CIRRUS HD-OCT

Model 6000

Instructions for Use

ZEISS

Copyright

© 2024, Carl Zeiss Meditec, Inc., Dublin, CA

Trademarks

All ZEISS products mentioned herein are either registered trademarks or trademarks of Carl Zeiss Meditec, Inc. in the United States and/or other countries.

All other trademarks used in this document are the property of their respective owners.

Patents

www.zeiss.com/meditec/us/imprint/patents.html

Table of Contents

1 Safety and Certifications ... 11

1.1 Symbols and Labels ... 11

1.2 Definitions ... 12

1.3 Safety ... 12

1.3.1 Product Safety ... 12
1.3.2 Optical Safety and Contraindications ... 15
1.3.3 Electrical Safety ... 17
1.3.4 Printer and Peripherals Safety ... 17
1.3.5 Networking Safety ... 18
1.3.6 Record and Data Safety ... 19

1.4 Electromagnetic Compatibility (EMC) ... 20

1.4.1 Electromagnetic Emissions ... 21
1.4.2 Electromagnetic Immunity ... 21
1.4.3 Port Immunity Test Specifications ... 23

1.5 Operator Training and Equipment Maintenance ... 23

1.5.1 Operator Training ... 24
1.5.2 Equipment Maintenance ... 25
1.5.3 Notification of Serious Incident ... 26

1.6 RoHS Compliance ... 26

2 Introduction ... 27

2.1 Scope ... 27

2.1.1 Intended Use ... 27
2.1.2 Indications for Use ... 27
2.1.3 Essential Performance ... 27
2.1.4 Part of the Body ... 28
2.1.5 Application ... 28

2.2 Subject/Patient Profile ... 28

2.3 Operator Profile ... 29

2.3.1 Intended Demographic ... 29
2.3.2 Required Skills ... 29
2.3.3 Job Requirements (Operators) ... 29

2.4 Data Analyst Profile ... 30

2.4.1 Intended Demographic ... 30
2.4.2 Required Skills ... 30
2.4.3 Job Requirements (Analysts) ... 30

2.5 User Documentation ... 31

2.5.1 Purpose ... 31
2.5.2 Access ... 31
2.5.3 Organization ... 31
2.5.4 Conventions Used in This Document ... 31
2.5.5 Questions and Comments ... 32

2.6 Differences between OCTA and FA ... 32

2.7 CIRRUS HD-OCT Technology ... 33

3 System Overview ... 35

3.1 Hardware Overview ... 35

3.2 Software Overview ... 37

3.2.1 Screen Layout ... 38
3.2.2 Toolbar ... 38
3.2.3 Navigation ... 41
3.2.4 Basic Screens ... 42

4 Installation ... 45

4.1 Safety During Installation ... 45

4.2 About Changes to Hardware or Software ... 45

4.3 About Data Storage ... 45

4.4 Installing the Instrument ... 46

4.4.1 Embedded Windows License ... 47
4.4.2 Preparing to Install ... 47

4.5 Software and Document Media ... 48

4.6 Installing Review Station Software ... 48

4.6.1 Review Station Requirements ... 49
4.6.2 Review Station Performance ... 49
4.6.3 Install or Update Review Station Software ... 50

4.7 Update Instrument Software ... 51

4.8 Accessing User Documentation ... 52

5 Startup and Shutdown ... 55

5.1 Safety During Startup and Shutdown ... 55

5.2 System Startup ... 56

5.2.1 Turning on the Instrument ... 56
5.2.2 Logging In ... 57

5.3 Before Every Use ... 57

5.3.1 Safety During Preparation for Use ... 57
5.3.2 Prepare the Instrument for Use ... 57
5.3.3 Read and Understand Physician Instructions ... 58

5.4 System Shutdown ... 58

6 Configuring Software ... 59

6.1 About User Roles ... 59

6.2 System Administration ... 60

6.2.1 Log in as Admin ... 61
6.2.2 Configuring the Instrument or Review Station ... 61
6.2.3 Registering Licenses ... 63
6.2.4 Managing User Accounts ... 67
6.2.5 Export Log Files ... 70
6.2.6 Data Archiving and Retrieval ... 71
6.2.7 Windows 10 Cybersecurity and System Administration ... 74

6.3 Setting Preferences ... 95
6.3.1 Setting Archive/Synchronize Alerts ... 95
6.3.2 Configure DICOM Archiving ... 96
6.3.3 Setting the Default Patient Screen ... 97
6.3.4 Setting the Internet Protocol Version ... 98
6.3.5 Setting the Preventive Maintenance Schedule ... 98
6.4 Configuring Reports ... 99
6.4.1 Configuring Macular Thickness Reports ... 99
6.4.2 Configuring HD Image Reports ... 101
6.4.3 Configuring Guided Progression Reports ... 102
6.5 Customizing Settings ... 104
6.5.1 Customizing the Available Scans List ... 104
6.5.2 Set Preferred Analyses ... 105
6.5.3 Turn FastTrac™ On or OFF ... 106

7 Operation ... 109
7.1 Manage Patient Data ... 109
7.1.1 Managing Patient Categories ... 109
7.1.2 Patient Privacy ... 111
7.1.3 Merge Patient Records ... 111
7.1.4 Move Scan ... 112
7.1.5 Editing Patient Categories ... 112
7.1.6 Edit Patient Records ... 113
7.1.7 Print Patient Lists ... 114
7.1.8 Export Data ... 114
7.1.9 Import Data ... 131
7.2 Select the Patient ... 132
7.2.1 Finding an Existing Patient Record ... 133
7.2.2 Finding a Worklist Patient Record (DICOM) ... 133
7.2.3 Advanced Search ... 134
7.2.4 Adding a Patient ... 135
7.2.5 Viewing Today's Patients ... 136
7.3 Scan Types ... 136
7.4 Acquire Posterior Segment Overview ... 140
7.5 Acquisition Workflow ... 142
7.5.1 About Protocols ... 147
7.5.2 Position the Fixation Target ... 147
7.5.3 Manually Center B-Scans ... 148
7.5.4 Manually Enhance B-Scans ... 148
7.5.5 About FastTrac™ ... 149
7.5.6 About Auto Repeat ... 151
7.5.7 About Track to Prior ... 151
7.6 View Protocols ... 153
7.7 Acquire an Image Protocol ... 154
7.8 Acquire Posterior Segment Scans ... 155
7.8.1 Macular Cube Scans ... 156
7.8.2 Optic Disc Scans ... 160
7.8.3 HD Raster Scans ... 163

7.9 Acquire AngioPlex Scans ... 170
7.9.1 Acquire an OCT Angiography Scan ... 170
7.9.2 Check AngioPlex Cube Scan Quality ... 172
7.9.3 Acquire AngioPlex Montage Scans ... 174

7.10 Acquire Anterior Segment Scans ... 182
7.10.1 Attach External Lens ... 183
7.10.2 Acquire Anterior Segment Overview ... 185
7.10.3 Anterior Chamber Scans ... 187
7.10.4 Anterior Segment Cube ... 190
7.10.5 Anterior Segment 5-Line Raster Scans ... 194
7.10.6 HD Angle Scans ... 196
7.10.7 Wide Angle to Angle Scans ... 198
7.10.8 HD Cornea ... 201
7.10.9 Pachymetry ... 203

7.11 Acquisition Concepts, Tasks and Tools ... 205
7.11.1 Focus the Fundus Image ... 205
7.11.2 Adjusting B-Scan Images ... 207
7.11.3 About Fixation Targets ... 209
7.11.4 About Scan Patterns ... 210
7.11.5 About Image Position and Focus ... 211
7.11.6 About Auto Repeat ... 214
7.11.7 About FastTrac™ ... 214
7.11.8 About Track to Prior ... 217
7.11.9 About Cube Scans ... 220

7.12 Scan Acquisition Acceptance Criteria ... 225
7.12.1 Acceptance Criteria ... 225

8 Analyzing Exam Data and Creating Reports ... 231

8.1 About Analysis and Reports ... 231
8.1.1 Analysis Overview ... 234
8.1.2 About Reports ... 235

8.2 Posterior Segment Scan Analysis ... 236
8.2.1 Macular Analysis ... 236
8.2.2 Ganglion Cell Analysis ... 261
8.2.3 ONH Analysis ... 272
8.2.4 Advanced Visualization Analysis ... 286
8.2.5 3D Visualization Analysis ... 289
8.2.6 Combined (Macular and ONH) Analysis ... 293
8.2.7 En Face Analysis ... 304
8.2.8 Position the Fovea ... 308

8.3 Analyze Angiography Images ... 308
8.3.1 About Analysis Presets ... 309
8.3.2 About Angiography Registration ... 311
8.3.3 Verifying the Avascular Slab ... 314
8.3.4 Angiography Presets ... 315
8.3.5 Angiography Analysis Overview ... 318
8.3.6 Analyze an Angiography Image ... 320
8.3.7 Compare Angiography Images ... 322
8.3.8 Analyze Montage AngioPlex Images ... 325

8.4 Analyze Anterior Segment Scans ... 328

8.4.1 About Analyzing Anterior Segment Scans ... 329
8.4.2 About Central Corneal Thickness Measurement ... 330
8.4.3 About Angle Measurement ... 330
8.4.4 Analyze Anterior Chamber Scans ... 333
8.4.5 Analyze Anterior Segment Cube Scans ... 338
8.4.6 Analyze HD Angle Scans ... 340
8.4.7 Analyze HD Cornea Images ... 343
8.4.8 Analyze Pachymetry Scans ... 347
8.4.9 Analyze Wide Angle-to-Angle Scans ... 352
8.4.10 Analyze Anterior Segment 5-Line Raster Scans ... 354

8.5 Common Analysis Tasks and Tools ... 358

8.5.1 Manually Select a Scan ... 358
8.5.2 Edit Images ... 359
8.5.3 Reports Overview ... 373
8.5.4 Creating a Report ... 375
8.5.5 Navigating Cube Scans ... 376

9 Networking ... 383

9.1 Safety During Network Configuration ... 383

9.2 Network Capabilities ... 384

9.2.1 About Local Connections (Remote Desktop) ... 385
9.2.2 Select the Installation Mode ... 385

9.3 Network File Server Minimum Requirements ... 386

9.3.1 Additional Recommendations ... 386

9.4 Connect to a Networked Storage Device ... 386

9.4.1 NAS Requirements ... 387
9.4.2 Configure Networked Storage Device Connections ... 387
9.4.3 Setting Up a Network File Server (external NAS) ... 388
9.4.4 Enabling the Server Message Block Version 3 (SMB3) on the Synology NAS drive ... 388

9.5 Connect to a DICOM Gateway ... 390

9.5.1 Review Station Requirements ... 390
9.5.2 Configure DICOM Connections ... 390
9.5.3 DICOM Advanced Configuration ... 392
9.5.4 Enabling TLS and Exporting the KeyStore ... 393
9.5.5 Importing the FORUM KeyStore ... 394

9.6 Connecting Review Stations to Instrument Data Archives ... 395

9.6.1 Enabling the Server Message Block Version 3 (SMB3) on Review Station ... 395

9.7 Connecting to Printers ... 396

9.8 Database Selection ... 397

9.8.1 Select a Database ... 398
9.8.2 Copy a Database ... 398

10 Cleaning and Disinfection ... 401

10.1 Safety During Cleaning and Disinfection ... 401

10.2 Cleaning Agents ... 401

10.3 Cleaning Optical Components ... 402

10.3.1 Dust Cleaning ... 402

10.3.2 Brush Cleaning Method ... 403
10.3.3 Wipe Cleaning Method ... 403
10.3.4 Cleaning Heavy Contamination ... 404

10.4 Cleaning and Disinfecting the Chin Cup, Forehead Rest, and Breath Shield ... 404

10.5 Cleaning Peripherals and Table ... 404

11 Maintenance and Repair ... 405

11.1 Safety During Maintenance ... 405

11.2 Maintenance Schedule ... 405

11.2.1 Every Week (Before Use) ... 405
11.2.2 Every Month ... 405
11.2.3 Every 6 Months ... 406

11.3 Run the Verification Test ... 406

11.3.1 Verification Test Tool Overview ... 406
11.3.2 Install the Verification Test Tool ... 406
11.3.3 Run the Verification Test ... 407

11.4 Inspect, Clean or Replace the Fan Filter ... 410

11.5 Defragment the Disk Drives ... 411

11.6 Calibrate the Anterior Segment Lenses ... 412

12 Troubleshooting ... 415

12.1 Safety During Troubleshooting ... 415

12.2 Status Messages ... 417

12.3 System Startup Troubleshooting ... 418

12.4 Troubleshooting Instrument Power ... 419

12.5 Troubleshooting Connections ... 419

12.6 Troubleshooting Archive Management ... 421

12.7 Troubleshooting User Management ... 421

12.8 Troubleshooting Patient Management ... 422

12.9 Troubleshooting Scan Acquisition ... 422

12.9.1 Troubleshooting FastTrac ... 423

12.10 Troubleshooting Image Analysis ... 423

12.11 Troubleshooting Image Registration ... 423

13 Specifications ... 425

13.1 Imaging Specifications ... 425

13.1.1 OCT Imaging Specifications ... 425
13.1.2 Posterior Segment OCT Imaging Specifications ... 425
13.1.3 Anterior Segment OCT Imaging Specifications ... 425
13.1.4 Fundus Imaging Specifications ... 425
13.1.5 Iris Imaging Specifications ... 426
13.1.6 Imaging Properties ... 426

13.2 Mechanical Specifications ... 428

13.2.1 Physical Specifications ... 428
13.2.2 Computer Specifications ... 428

13.3 Electrical Specifications ... 428

13.4 Conditions for Use ... 428

13.5 Conditions for Storage ... 429

13.6 Conditions for Transport ... 429

14 Legal Notices ... 431

15 Accessories and User Replaceable Spare Parts ... 433

15.1 Accessories and User Replaceable Parts ... 433

15.2 Parts Orders ... 433

15.2.1 U.S. Domestic Parts Ordering ... 433
15.2.2 International Service Operations ... 433

15.3 Returning Defective Parts ... 434

15.4 Equipment Return Authorization ... 434

15.5 International Service Operations ... 434

15.6 Part Numbers ... 434

15.6.1 Power Cords ... 434
15.6.2 Cables ... 434
15.6.3 Cleaner ... 435
15.6.4 Kit, Test Eye ... 435
15.6.5 Miscellaneous Spare Parts ... 435

16 Decommissioning ... 437

16.1 Safety During Decommissioning ... 437

17 Packaging and Transport ... 439

17.1 Safety During Packaging and Transport ... 439

18 Disposal ... 441

18.1 Packaging Disposal ... 441

18.2 Device Disposal ... 441

A Reference Database 1 for Healthy Eyes Study–CIRRUS 400/4000/500/5000 ... 443

A.1 Purpose ... 443

A.2 Results in Image Analysis ... 444

A.3 Study Subjects ... 444

A.4 RDB Demographics ... 445

A.5 Data Collection ... 446

A.6 Image Selection ... 446

A.7 Data Analysis ... 447
A.7.1 Deriving Percentiles and Limits ... 447
A.8 Macular Images ... 447
A.8.1 Macular Thickness Parameters ... 448
A.8.2 Ganglion Cell Parameters ... 449
A.9 ONH Images ... 451
A.9.1 Examples ... 452
A.9.2 RNFL Parameters ... 452
A.9.3 ONH Parameters ... 454
A.10 Conclusions ... 456

B Reference Database 2 for Healthy Eyes Study–CIRRUS 6000 ... 457
B.1 Purpose ... 458
B.2 Results in Image Analysis ... 458
B.3 Study Subjects ... 458
B.4 Data Collection ... 462
B.5 Image Selection ... 462
B.6 Data Analysis ... 462
B.6.1 Deriving Percentiles and Limits ... 462
B.7 Macular Images ... 463
B.7.1 Macular Thickness Parameters ... 463
B.7.2 Ganglion Cell Parameters ... 464
B.8 ONH and RNFL Images ... 465
B.8.1 ONH Parameters ... 466
B.8.2 RNFL Parameters ... 466
B.8.3 ONH and RNFL Data ... 466
B.8.4 Examples ... 467
B.9 Analysis Application and Limitations ... 467
B.10 Conclusions ... 468

Glossary ... 469

Index ... 471

1 Safety and Certifications

Before using the CIRRUS™ HD-OCT, herein referred to as CIRRUS™ HD-OCT, you must fully understand potential safety hazards. Read the following safety warnings and cautions in their entirety before using the instrument. Additional warnings and cautions are found throughout the instructions for use.

Under normal conditions, the risk/benefits profile of the CIRRUS™ HD-OCT provides a high level of health and safety protection.

1.1 Symbols and Labels

Warning

Caution

Note

Must follow Instructions for Use

Electronic Manuals

Stand-by

Fuse

Direct Current

Type B Applied Parts

SN Serial Number

REF Catalog Number/Part Number

MODEL Model Number

Manufacturer

Authorized European Community Representative

CE Mark with identification number of DQS -- accredited Notified Body for compliance assessment to the European Union directives and regulations.

LR 96697 C US Certification mark of CSA – Nationally recognized test laboratory for US and Canada

Disposal of the Product within the E.U. Do not dispose via domestic waste disposal system or communal waste disposal facility.

Rx Only **CAUTION! Federal law (or United States) restricts this device to sale by or on the order of a licensed healthcare practitioner.**

1.2 Definitions

Warnings and **Cautions** are defined as follows:

⚠ WARNING!

Indicates hazards that, if not avoided, could cause the following:

> Severe injury or even death

The warning message names the possible consequences.

- ▶ These are actions that can be taken to prevent the hazard.

⚠ CAUTION!

Indicates hazards that, if not avoided, could result in the following:

> Minor or moderate injury

> Moderate damage to or impaired performance of equipment

The caution message names the possible consequences.

- ▶ These are actions that can be taken to prevent the hazard.

1.3 Safety

1.3.1 Product Safety

⚠ WARNING!

Non-compliance with system requirements laid out in standard IEC 60601–1

could result in compromised patient safety.

- ▶ The person or the responsible organization connecting additional devices or reconfiguring the system must evaluate the complete system to ensure compliance to the applicable IEC 60601–1 requirements.

⚠ WARNING!

Device proximity to flammable gases or vapors

may cause ignition.

- ▶ Do NOT use in the presence of flammable anesthetics, or oxidizing gases such as nitrous oxide and pure oxygen.

⚠ WARNING!

Opening Instrument Covers can lead to exposure to electrical and optical hazard.

- ▶ Do not open the instrument covers.
- ▶ Exceptions:
  - ⇨ You may remove the rear cover to access labels and connectors.

⚠ WARNING!

Motherboard Clock Battery replacement must be performed only by authorized ZEISS personnel.

Replacing the lithium battery with the wrong type or incorrectly can cause explosion and fire hazard.

- Only ZEISS authorized personnel are trained to replace the motherboard battery.

⚠ WARNING!

Using the Device adjacent to, or stacked with, other equipment

could impact device operation.

- If adjacent or stacked use is necessary, the equipment or system should be observed to verify normal operation in the configuration in which it will be used.

⚠ WARNING!

In case of an emergency

disconnect the appliance coupler.

- For the device, the most accessible power cord is the one that plugs into the bottom of the table.
- Do not position device so it is difficult to unplug power cord.

⚠ WARNING!

Use of the acquisition device, a printer, or the power table with an extension cord or a power strip (multiple portable socket outlet)

could cause electrical shock to the patient or operator.

- Do not use extension cords with the instrument.
- If you plug something other than an instrument into the Multiple Socket Outlet (MSO), the MSO may not have the designed level of safety.
- Do not use power strips with the instrument.
- Do not plug in any other equipment into the same wall outlet as the instrument.
- To avoid the risk of electric shock, this equipment must only be connected to a supply mains with protective earth.

⚠ CAUTION!

Patients who hold on to the instrument before or during tests

risk having their fingers pinched and possibly injured.

- Make sure that the patient is not holding on to the instrument before or during tests.

⚠ WARNING!

Installation or modification of devices and systems by unauthorized personnel can lead to the injury of patients and operators, as well as to property damage. Installation and modification requires special knowledge and skills.

- ▶ Have the installation performed only by persons authorized by ZEISS.
- ▶ Only have authorized personnel perform approved changes to the configuration of the instrument or the system.
- ▶ Have the instrument or review station installed in a secure location to safeguard from unauthorized access.

⚠ WARNING!

Use of accessories, transducers, and cables other than those specified or provided by the manufacturer of this equipment

could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation and potential safety hazards.

- ▶ Use only the accessories, transducers, and cables specified or provided by ZEISS.

⚠ CAUTION!

Using the instrument on an uneven or sloped surface or rolling the table in deep pile carpet or over objects on the floor such as power cords

could cause the table and/or instrument to tip, resulting in injury to operator or patient and damage to the instrument.

- ▶ Do not use the instrument on an uneven or sloped surface.
- ▶ Do not roll the table in deep pile carpet or over objects on the floor such as power cords.

⚠ CAUTION!

Using aerosols near or placing containers of liquid on or near the instrument

could damage the equipment. The instrument is not designed with any specific measures to protect against harmful ingress of water or other liquids (classified IPXO - ordinary equipment).

- ▶ Do not place containers of liquid, or use aerosols on or near the equipment.

⚠ CAUTION!

Using a non-approved or incorrectly connected device

could invalidate the system safety approval.

- ▶ Follow all indications in this user document to ensure that all connections are approved and correctly configured.

⚠ CAUTION!

Unauthorized modification or dismantling of the instrument or system components

could result in damage to the instrument or components or harm to the operator or other personnel.

- ▶ Only authorized ZEISS personnel are authorized to modify or dismantle the instrument or its components.

⚠ CAUTION!

Reconfiguring system components on the table, or adding non-system devices or components to the table, or replacing original system components with substitutes not approved by ZEISS

could result in failure of the table height adjustment mechanism, instability of the table, tipping and damage to the instrument, and injury to operator and patient.

- ▶ Do not reconfigure system components on the table, nor add non–system devices or components to the table, nor replace original system components with substitutes not approved by ZEISS.

⚠ CAUTION!

(United States) Federal law restricts this device for sale by, or on the order of, a licensed healthcare practitioner.

- ▶ Purchasing from an unlicensed healthcare practitioner is against (United States) Federal law.
- ▶ Purchasing from an unlicensed healthcare could result in a non-standard, incorrectly installed, and faulty instrument that could risk result accuracy and patient or operator safety.

1.3.2 Optical Safety and Contraindications

- ANSI Z80.36-2016. Light Hazard Protection for Ophthalmic Instruments

Classification

- Group 1 Instrument – Per ANSI Z80.36.2016
- Class 1 laser products – Per IEC 60825-1

Class 1 laser products are safe during use, including long-term direct intrabeam viewing, even when exposure occurs while using telescopic optics.

Contraindications

⚠ WARNING!

Device produces visual stimuli, including flickering light and flashing patterns, between 5 and 65 Hz

may adversely affect certain patients, although this effect is yet unproven.

- Medical professionals need to determine whether this device should be used for patients who may be photosensitive, including those with epilepsy.

⚠ WARNING!

Patient injection with photo–dynamic therapy (PDT) treatment drugs, such as Visudyne®

could lead to unintended exposure and uncontrolled treatment of neovascular vessels.

- Do not scan patients who have been injected with photo–dynamic therapy (PDT) treatment drugs, such as Visudyne®, in the previous 48 hours.

⚠ CAUTION!

Applicable Phototoxicity Statements (Ophthalmoscope Guidance - (Direct and Indirect) - Guidance for Industry; July 1998; FDA CDRH):

Because prolonged intense light exposure can damage the retina, the use of the device for ocular examination should not be unnecessarily prolonged.

- While no acute optical radiation hazards have been identified for direct or indirect ophthalmoscopes, it is recommended that the exposure time for the patient's eye be limited to the minimum time that is necessary for diagnosis.
- Infants, aphakes, and persons with diseased eyes will be at greater risk. The risk may also be increased if the person being examined has had any exposure with the same instrument or any other ophthalmic instrument using a visible light source during the previous 24 hours.
- This will apply particularly if the eye has been exposed to retinal photography.
- **Note:**This medical device has no user adjustable intensity settings for light incident on the retina, nor does it produce UV radiation or short–wavelength blue light.

1.3.3 Electrical Safety

Class I Equipment - Protection against electrical shock.

⚠ WARNING!

An ungrounded Device

could lead to electric shock.

- ▶ Do not remove or disable the ground pin.
- ▶ Only an authorized ZEISS service representative may service the instrument.
- ▶ Only an authorized ZEISS representative may install the instrument.

1.3.4 Printer and Peripherals Safety

⚠ WARNING!

Non-compliance with system requirements laid out in standard IEC 60601–1 for instruments externally connected to non-medical peripheral devices (i.e. printers, non-system storage devices, etc.)

compromises patient safety.

- ▶ If a non-medical peripheral device is located within 1.5 m from the patient, the usage of an isolation transformer is required.
- ▶ If the peripheral device is located outside the patient environment (beyond 1.5 m) and is connected to the instrument, a separation device must be used or there shall be no electrical connection between the non-medical peripheral device and the instrument.

⚠ WARNING!

Placing peripheral devices closer than 1.5 meters (4.9 feet) from the patient

could result in electrical shock to the patient and/or operator.

- ▶ Use a wireless configuration, if possible.
- ▶ Use an isolation transformer in the USB configuration.
- ▶ Ensure that patients cannot touch a peripheral device with any part of his or her body while being examined.
- ▶ Ensure the instrument operator does not attempt to touch the patient and a peripheral device at the same time.

⚠ WARNING!

Simultaneously touching a patient and a peripheral device

could compromise patient safety.

- ▶ The instrument operator must not touch the patient and a peripheral device simultaneously.

⚠ CAUTION!

Using peripheral devices not supplied or approved by ZEISS

could degrade the performance of the instrument and/or lead to corrupted diagnostic or therapeutic information and may cause safety hazards and void the instrument warranty.

- ▶ We strongly recommend you use peripheral devices supplied or approved by ZEISS, because they will have been tested to work safely with the instrument.
- ▶ Do not install any unapproved third party software on the instrument.

1.3.5 Networking Safety

⚠ CAUTION!

Internet connection of the Instrument

increases its vulnerability to serious security risks, including viruses and worms that could disable your system or adversely affect its performance and may void the instrument warranty.

- ▶ Only connect to the internet when it is absolutely necessary.
- ▶ Transfer data through internal networks.
- ▶ Ensure that all firewalls and internet security applications are up-to-date and running.

1.3.5.1 Unsupported Network Activities

NOTE

The user is responsible for system performance degradation or any other change or defect resulting from unsupported network activities.

ZEISS IS NOT RESPONSIBLE FOR SOFTWARE REPAIRS OR UPGRADES NECESSITATED BY THE ATTEMPTED PERFORMANCE OF THE FOLLOWING ACTIVITIES.

ZEISS does not support the following network activities, although they may be possible:

- Printing with a printer not approved by ZEISS for use with this instrument.

Refer to our website for the current list of approved hardware and software. If you want to use a third party device, seek technical support from the device manufacturer.

1.3.5.2 Networking Guidelines

CIRRUS™ HD-OCT provides IT–Network capabilities to allow data archiving and information sharing in the clinical environment and across medical facilities. Refer to the Networking section for specific details.

NOTE

Users are responsible for network setup and maintenance.

Users are responsible for installing and configuring all networking hardware and software.

ZEISS Technical Support is limited to testing instrument network connectivity.

- ZEISS Technical Support cannot troubleshoot or repair problems with network connectivity.
- Observe all guidelines in this document regarding instrument networking.

1.3.6 Record and Data Safety

1.3.6.1 Patient Record Deletion

⚠ CAUTION!

Deletion of a patient record

is permanent.

- Delete records with care!

⚠ CAUTION!

Merging incorrect patient records

can only be corrected using the **Move Scan** feature to separate the merged file.

- Be certain that you select the correct patient records to merge.

1.3.6.2 Prohibited Activities

⚠ CAUTION!

Attempting to carry out activities not specifically endorsed by ZEISS

may void your warranty and could result in damage to the instrument.

- ▶ Read the user documentation.
- ▶ Follow directions carefully.
- ▶ Do not make upgrades, or carry out repairs or modifications, without specific guidance and instruction from ZEISS or an authorized ZEISS represenative.

The following activities are prohibited using the CIRRUS™ HD-OCT instrument:

- Do not relocate the CIRRUS™ HD-OCT database to a network file server.
- Do not share CIRRUS™ HD-OCT folders with other computer systems via the network.
- Do not share the CIRRUS™ HD-OCT system printer on the network if the printer is connected to the USB port.

1.4 Electromagnetic Compatibility (EMC)

⚠ WARNING!

Installing or putting the device into service without regard to EMC information provided

may void your ZEISS instrument warranty, result in damage to the instrument and/or compromise safety for patients and operators.

- ▶ This instrument has special EMC precaution requirements and needs to be installed and put into service according to the EMC information provided herein.

⚠ CAUTION!

This instrument is intended for use in a professional healthcare facility environment.

Using the instrument in any other environment may void the warranty and compromises the safety of the patient and/or operator.

NOTE

The emissions characteristics of this equipment

make it suitable for use in industrial areas and hospitals (CISPR 11 Class A).

- ▶ If it is used in a residential environment, this equipment might not offer adequate protection to radio-frequency communication services.
- ▶ The user might need to take mitigation measures, such as relocating or re-orienting the equipment.

NOTE

Excessive electromagnetic events may temporary disable the instrument.

- ▶ If the instrument becomes disabled, reboot it.

Electromagnetic Emissions [▶ 21] and Electromagnetic Immunity [▶ 21] are required per IEC 60601-1-2:2014.

1.4.1 Electromagnetic Emissions

This instrument complies with the following emission requirements:

Phenomenon	Standard
Conducted and radiated RF emissions	Group 1 CISPR 11 Class A
Harmonic distortion	IEC 61000-3-2 Class A
Voltage fluctuations and flicker	IEC 61000-3-3: Complies

Table 1: Electromagnetic Emissions

1.4.2 Electromagnetic Immunity

This instrument complies with the following immunity requirements:

Phenomenon	Basic EMC standard or test method	Immunity test levels
Electrostatic Discharge	IEC 61000-4-2	± 8 kV contact ± 2 kV, ± 4 kV, ± 8 kV, ± 15 kV air
Radiated RF EM fields	IEC 61000-4-3	3 V/m 80 MHz – 2,7 GHz 80 % AM at 1 kHz
Proximity fields from RF wireless communications equipment	IEC 61000-4-3	See Port Immunity Test Specifications [▶ 23]
Rated power frequency magnetic fields	IEC 61000-4-8	30 A/m 50 Hz or 60 Hz
Electrical fast transients / bursts	IEC 61000-4-4	± 2 kV 100 kHz repetition frequency

Phenomenon	Basic EMC standard or test method	Immunity test levels
Surges line-to-line	IEC 61000-4-5	± 0,5 kV, ± 1 kV
Surges line-to-ground	IEC 61000-4-5	± 0,5 kV,± 1 kV, ± 2 kV
Conducted disturbances induced by RF fields	IEC 61000-4-6	3 V 0,15 MHz – 80 MHz 6 V in ISM bands between 0,15 MHz and 80 MHz 80 % AM at 1 kHz
Voltage dips, short interruptions, and voltage variations on power supply input lines	IEC 61000-4-11	0 % UT[1]; 0,5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0 % UT[1]; 1 cycle and 70 % UT[1]; 25/30 cycles Single phase: at 0°
Voltage Interruptions	IEC 61000-4-11	0 % UT[1]; 250/300 cycle

Table 2: Electomagnetic Immunity

[1]UT is the a.c. mains voltage prior to application of the test level.

1.4.3 Port Immunity Test Specifications

Test Frequency (MHz)	Band (MHz)	Service	Modulation	Maximum Power (W)	Distance (m)	Immunity Test Level (V/m)
385	380 - 390	TERTRA 400	Pulse 18 Hz	1.8	0.3	27
450	430 - 470	GMRS 460, FRS 460	FM ± 5 kHz deviation 1 kHz sine	2	0.3	28
710 745 780	704 - 787	LTE Band 13, 17	Pulse 217 Hz	0.2	0.3	9
810 870 930	800 - 960	GSM 800/900, TETRA 800, iDEN 820, CDMA 850, LTE Band 5	Pulse 18 Hz	2	0.3	28
1720 1845 1970	1700 - 1990	GSM 1800; CDMA 1900; GSM 1900; DECT; LTE Band 1,3,4,25; UMTS	Pulse 217 Hz	2	0.3	28
2450	2400 - 2570	Bluetooth, WLAN, 802.11 b/g/n, RFID 2450, LTE Band 7	Pulse 217 Hz	2	0.3	28
5240 5500 5785	5100 - 5800	WLAN 802.11 a/n	Pulse 217 Hz	0.2	0.3	9

Table 3: Test specifications for enclosure port immunity to RF wireless communications equipment.

1.5 Operator Training and Equipment Maintenance

NOTE

Expected Service Life

The expected service life of CIRRUS™ HD-OCT is 7 years.

1.5.1 Operator Training

⚠ WARNING!

Incorrect use of equipment

could result in damage to patients or equipment.

✓ Only personnel who have undergone appropriate training and instruction may use this device.

- ▶ Operating personnel must be appropriately trained and instructed.
- ▶ Operating personnel must read and understand the User Manual.
- ▶ The User Manual must be made available to operating personnel at all times.
- ▶ To facilitate access for all operating personnel: Request additional copies of user documentation as required from ZEISS.
- ▶ Specify the competencies for handling the device and state who is authorized for what tasks.
- ▶ Determine the reporting obligations for instrument error and/or damage and make them known.
- ▶ Regularly review the applicable legal regulations regarding accident prevention, health and safety in the country of use.

1.5.2 Equipment Maintenance

⚠ CAUTION!

Lack of regular safety inspections

could result in a decrease in device safety, increase in the possibility of device damage, and/or inaccurate results.

✓ Regular technical safety inspections must be carried out as specified for this device by any and all applicable national regulations.

✓ Equipment inspections may only be performed by ZEISS or ZEISS-qualified personnel.

▶ Comply with the specified maintenance intervals.

▶ Carry out all inspections fully.

▶ Minimally, local system inspections must include the following:

⇨ Availability of the Instructions for Use

⇨ Visual inspection of system and accessories for damage and legibility of labels

⇨ Current leakage test

⇨ Test of protective ground conductor

⇨ Function and wear test of brakes, if applicable

⇨ Function test of all switches, buttons, sockets and indicator lamps of the system

⚠ WARNING!

Making changes to equipment without first consulting your ZEISS Field Representative

could result in the equipment being Out of Compliance.

▶ Any additional equipment connected to medical electrical devices must demonstrably comply with the applicable IEC or ISO standards (e.g. IEC 60950 for data processing equipment).

▶ All configurations must meet the applicable requirements for medical systems, as specified in IEC 60601-1 standard.

▶ Anyone connecting additional equipment or modifying the configuration to a medical electrical device or system is a system configurer, and that individual is responsible for compliance of the complete system with the applicable standards such as IEC 60601-1 and other applicable collateral standards.

▶ Local legislation has priority over the above normative requirements.

1.5.3 Notification of Serious Incident

Any serious incident, affecting any person, that occurs in connection with the use of this medical device, must immediately be reported to the manufacturer or to the medical product distributor. In the European Union, the operator must report this serious incident to the responsible authorities in the applicable country.

Also immediately contact ZEISS to report any cybersecurity incident or security breach that occurs in connection with the use of this medical device.

1.6 RoHS Compliance

The product is RoHS-compliant according to Directive 2011/65/EU.

2 Introduction

2.1 Scope

2.1.1 Intended Use

The CIRRUS™ HD-OCT with retinal nerve fiber layer (RNFL), macula, optic nerve head and ganglion cell plus inner plexiform layer Reference Database (RDB) is intended for in-vivo viewing, axial cross-sectional, and three-dimensional imaging and measurement of anterior and posterior ocular structures.

2.1.2 Indications for Use

NOTE

CIRRUS™ HD-OCT is not intended as the sole diagnostic method for disease.

The CIRRUS™ HD-OCT is a non-contact, high resolution tomographic and biomicroscopic imaging device. It is indicated for in-vivo viewing, axial cross-sectional, and three-dimensional imaging and measurement of anterior and posterior ocular structures, including cornea, retina, retinal nerve fiber layer, ganglion cell plus inner plexiform layer, macula, and optic nerve head.

The CIRRUS™ HD-OCT Reference Database is a quantitative tool used for the comparison of retinal nerve fiber layer thickness, macular thickness, ganglion cell plus inner plexiform layer thickness, and optic nerve head measurements to a database of healthy subjects.

CIRRUS™ HD-OCT AngioPlex angiography is indicated as an aid in the visualization of vascular structures of the retina and choroid.

The CIRRUS™ HD-OCT is indicated for use as a diagnostic device to aid in the detection and management of ocular diseases including, but not limited to, macular holes, cystoid macular edema, diabetic retinopathy, age-related macular degeneration, and glaucoma.

2.1.3 Essential Performance

The CIRRUS™ HD-OCT is a retinal imaging device intended to be used as a non-contact, diagnostic imaging instrument for in vivo viewing, axial cross-sectional imaging, and three-dimensional imaging of ocular structures. No cases have been identified in which the product's failure to perform its intended clinical functions would result in unacceptable risk.

The main clinical performance of this instrument is to capture, display and store images to aid in the diagnosis and monitoring of diseases and disorders. Since there are no surgical or treatment

decisions made solely on data obtained by the instrument, it was determined that the instrument has no “essential performance” as defined in IEC 60601-1 standard.

2.1.4 Part of the Body

CIRRUS™ HD-OCT is designed for ocular structure and physically interacts with the patient's forehead and chin.

2.1.5 Application

The CIRRUS™ HD-OCT instrument is designed for continuous use, although it is expected that most sites operate the instrument for 10 hours or less per day, indoors, within a medical office or hospital setting that has clean air free of soot, vapors from adhesives, grease, or volatile organic chemicals.

CIRRUS™ HD-OCT is not a portable device. It is intended for placement in one location. However, there is no permanently installed infrastructure associated with the instrument, and it can be moved between locations following the applicable guidelines and warnings (see: Safety and Certifications [▸ 11]).

2.2 Subject/Patient Profile

NOTE

Patients must be able to sit upright and place their face in the chin and forehead rest of the instrument (with or without supplemental human or mechanical support).

The device may be used on all adults in need of diagnostic evaluation of the eye, including patients with the following disabilities or challenges:

- Wheelchair user
- Very low or not measurable visual acuity
- Fixation problems
- Postural problems
- Deafness
- Large body, but not those above 99th percentile based on anthropomorphic data

2.3 Operator Profile

2.3.1 Intended Demographic

Operators are adults with professional training or experience in the use of ophthalmic imaging equipment. Specific assumptions regarding the qualifications of individuals operating the instrument are given below:

- Opticians
- Ophthalmic Photographers
- Optometrists
- Ophthalmologists
- Medical Assistants
- Clinical Researchers
- Certified Medical Technician
- Nurse

2.3.2 Required Skills

- Knowledge of how to use the device to capture images
- Experience managing patients
- Experience with the Microsoft Windows operating system and applications based on it

2.3.3 Job Requirements (Operators)

Must be able to perform all of the following operations:

- Power on the unit and log on
- Enter, find, and modify patient identifying data
- Clean surfaces that contact patient
- Position patient with the device, including moving the patient, the device, the table height, and the patient's chair
- Select and acquire scan
- Review and save scan or try again
- Generate reports using available reporting protocols
- Review reports for completeness
- Output reports
- Archive data
- Turn off the unit

2.4 Data Analyst Profile

⚠ CAUTION!

Training and certification is required by governing bodies to interpret the analysis in the treatment of ophthalmic diseases or other eye–related medical issues.

The data created using this device is to be interpreted by clinicians or technicians with professional training in diagnostic interpretation of the images generated. Specific assumptions regarding the profiles of individuals who carry out data interpretation are given below. This guide contains information that will aid in the proper interpretation of the resultant data.

2.4.1 Intended Demographic

The **Data Analysts** are:

- Ophthalmologists
- Optometrists

2.4.2 Required Skills

- Knowledge of how to use an OCT device to capture images
- Experience with the Microsoft Windows operating system and applications based on it
- Be professionally trained in the physiology of the eye and its variations
- Experience managing patients
- Accurately identify ocular anomalies
- Be fully trained in the use of OCT equipment

2.4.3 Job Requirements (Analysts)

- Accurately identify ocular anomalies
- Have a history of correct diagnoses of eye disease or work solely within a research environment
- Be fully trained in the use of OCT equipment, and particularly, in the analyses that comprise the Review portion of the instrument software

2.5 User Documentation

2.5.1 Purpose

The user documentation that comes with your device is provided to ensure that all users operate and maintain it safely and successfully.

- Read all user documentation before starting and using the device
- Keep all user documentation where it is accessible at all times for all users
- Pass the user documentation on to the next owner of the device

2.5.2 Access

User documentation for your device is provided on the USB drive that came with the device as part of the Instrument Accessory Kit.

2.5.3 Organization

This User Manual has been written to provide a comprehensive overview of the Device and its software. It provides guidelines for successful:

- Clinical setup and workflow
- Data acquisition and acceptance
- Review and Interpretation of CIRRUS 6000 data

In addition, instructions and information are provided to ensure that data is safely managed and that the device is properly maintained.

2.5.4 Conventions Used in This Document

Certain types of information are specially marked in this document for better recognition.

- This is a list.
  - This is a second level list.

This is a cross-reference: Questions and comments [▶ 31].

This is `software code` or `program text`.

The name of software windows are capitalized. For example: Patient Screen

Names of menus, and buttons or other selectable items, are shown in **Bold**.

- **View** menu.
- **File > Save as**
- **My documents > Documents**

2.5.5 Questions and Comments

If you have questions or comments about this user documentation or the device, contact your ZEISS representative.

2.6 Differences between OCTA and FA

OCT angiography (OCTA) methods allow for 3-dimensional noninvasive microvascular visualization. These include phase-based (Doppler shift or variance) and intensity-based (speckle variance, decorrelation, and frequency filtering) techniques.

To image vascular flow, each B-scan in the scan pattern is repeated several times consecutively. OCTA uses adjacent b-scan image averaging to reduce noise and improve layer detail. For HD angiography the B-Scan images are repeated and averaged three times and for regular angiography twice. Comparisons of contrast on consecutive B-scans in the same location will reveal some areas with contrast change over time, and some areas with constant contrast. Temporal contrast change in a specific location is thought to be due to erythrocyte motion, and hence indicates a location of a vessel. Analysis of all B-scans along a cube allows for the mapping of the location of blood flow in three dimensions throughout the scanned area. Partial en face images of sections of the retina can be created by summing the flow signal between specific layers of interest, providing a simple visualization at multiple depths of interest.

The current gold standard method for imaging retinal vasculature is fluorescein angiography (FA). In spite of its great clinical value, this technique requires intravenous injection, is time consuming, requires a skilled photographer, and has possible side-effects such as nausea, vomiting, and rarely, an allergic anaphylactic reaction. Although OCTA cannot give information regarding leakage similar to FA (since the flow due to leakage is too slow to detect), it is capable of showing vascular abnormalities such as areas of ischemia, vessel tortuosity, microaneurysms, and changes associated with leakage. Furthermore, structural OCT cross sections and en face visualization can identify structural changes such as increased retinal thickness, sub-retinal fluids or cystic maculopathy which are clear signs of leakage.1Another advantage of OCTA is that the flow can be detected in three dimensions, so that depth information is available. In fluorescein imaging, all possible depths are combined into a single image.

2.7 CIRRUS HD-OCT Technology

The CIRRUS™ HD-OCT is a computerized instrument that acquires and analyzes cross-sectional and three-dimensional tomograms of the eye using spectral domain optical coherence tomography (SD-OCT).

In low-coherence interferometry, light is sent along two optical paths, one being the sample path (into the eye) and the other the reference path of the interferometer. The light source is an 840 nm superluminescent light emitting diode (SLD). Light returning from the sample and reference paths is combined and introduced to the detector, which is a spectrometer in SD-OCT. The spectrometer resolves the interference signals throughout the depth of each A-scan immediately by means of a Fourier transformation. This is possible because the spectrometer resolves the relative amplitudes and phases of the spectral components scattered back from all depths of each A-scan tissue sample, without varying the length of the reference path.

Different CIRRUS™ HD-OCT models use different technologies to create the image:

- All models include a CCD video camera to monitor the exterior eye and assist with scan alignment.
- **Model 6000** instruments include a Line Scanning Ophthalmoscope (LSO).

Empty page, for your notes

3 System Overview

3.1 Hardware Overview

NOTE

CIRRUS™ HD-OCT includes user-replaceable alkaline batteries in the mouse and keyboard.

CIRRUS™ HD-OCT also includes a lithium battery. Only a certified ZEISS Technician can replace the lithium battery.

- ▶ Dispose of alkaline batteries in accordance with local laws (see: Disposal [▸ 441]).

CIRRUS™ HD-OCT instrument includes the following integrated components:

- scan acquisition optics
- interferometer
- spectrometer
- system computer

In addition, the following external components are provided:

- monitor
- keyboard
- mouse
- *(optional)* printer
- *(optional)* wheelchair-accessible motorized table (adjusts to each patient's height)

Figure 1: CIRRUS™ HD-OCT System Hardware

1	Monitor	2	Connectors (USB, network, etc.) and labels under rear cover
3	USB Ports (2)	4	Mouse
5	Keyboard	6	Standby Switch
7	Motorized Patient Alignment Unit	8	Dual Chinrest with Automatic Right/Left Sensors
9	Imaging Aperture	10	Head Rest
11	Port for External Fixation Arm		

Instrument Table

If you would like to use CIRRUS™ HD-OCT with a table not provided by Carl Zeiss Meditec, then check the manufacturer specifications and instructions for the table to be used. Make sure that the table can accommodate the instrument, keyboard, mouse,

external hard drive or DVD drive, and printer, and it is configured similarly to the picture shown above. If not, the table is not fit for use with the instrument and its components.

⚠ WARNING!

Electrical hazard due to improper electrical connection

Improper electrical installation may cause an electric shock.

- ▶ Connect the device via an instrument table qualified by Carl Zeiss Meditec. If another table is used, the user is solely responsible for ensuring the electrical safety of the device.

⚠ CAUTION!

Mechanical hazard due to instability

Injury may be caused by falling parts.

- ▶ When selecting a suitable table, ensure that the combination of table and device is stable up to a tilt angle of 10°. The table must be designed for 4 times the weight of the device configuration.
- ▶ When using a mobile table, ensure that the casters have locking devices.

3.2 Software Overview

ZEISS pre-installs all software necessary to operate the CIRRUS™ HD-OCT. Software updates with installation instructions may be provided on USB flash disk.

CIRRUS™ HD-OCT software has the following screen types:

- Patient Screen
- Protocol and History Screen
- Acquire Screen
- Check Scan Quality Screen
- Analysis and Report Screen

3.2.1 Screen Layout

Pos.	Name	Explanation
1	Toolbar	Menus common to all screens
2	Work Area	Varies depending on mode and function
3	Navigation Bar	Status indicator and mode selection common to all screens

NOTE

Viewing a Patient in the Work Area

When using the application, if you are viewing a patient in the Work Area, the following Current Patient field information appears on the left side of the Toolbar:

- Name
- Medical Record Number
- Sex
- Date of Birth (DOB)

3.2.2 Toolbar

Each CIRRUS™ HD-OCT screen has context-specific menus and options.

3.2.2.1 Tools Menu

Option	Description
Live Fundus Overlay	Enables overlay display. If disabled, the bounding box is visible, but not the vertical and horizontal slice locations.
Colored OCT	Enables color OCT images display.
Inverted Gray scale for Raster	Changes black pixels to white and white to black on gray scale raster scans.
Live OCT Center Lines	Enables of a vertical center line display on OCT images.
Auto Repeat	Automatically adjusts the ocular lens and chinrest to the previous settings for the same patient, eye, and acquisition function.
Tracking	Enables FastTrac™ for all scans.
Print Configuration...	Sets the printout options for Macular Thickness, ONH, and (HD 5 Line) Raster, and Macula multi-slice parameters.
Scan Organizer	Sets show or hide available scans, or change scan order.
Export Audit Log File...	Exports the log file.
Change My Password...	Changes the current user's password.
Options	
Categories...	Creates, edits, or deletes categories for patient records and search.
Institution Edit...	Adds your organization's name and logo to reports.
Equipment Edit...	Creates a station name for the instrument, create DICOM AE Title, and view other equipment information.
Users...	Creates, edits, or deletes staff / users.
Select Database.. *(Review Station only)*	Switches to a different instrument database.

3.2.2.2 Records Menu

The **Records** menu is different for instruments that use **Native Archive** and **DICOM Archive.**

3.2.2.2.1 Records Menu (Native Archive)

Option	Description
Retrieve Archived Exams...	Retrieve selected exams from the archive.
Archive Now...	Archives all unarchived exams.
Clear Archived Exams	Clear exams to free additional disc space.
Archive Management:	Create archive locations and set default parameters.
Preferences...	

Option	Description
Archive/Synchronize	During instrument startup or shutdown, prompts you to archive exams and clear data.
DICOM Archive	Disable **Auto-Query** or **Auto-Archive**.
Display Options	Change display settings.
IPv4 / IPv6	Select Internet Protocol.
Search Worklist Patients ..	Opens the **Modality Worklist** to set parameters for patient search through DICOM Worklist server.
Import Exams...	Opens **Import Options**.
Export Exams..	Opens **Export Options**.
Print Patient list..	Print the patient list currently displayed.
Print Today's Patient list...	Prints the patient list in the Today's Patients.

3.2.2.2.2 Records Menu (DICOM Archive)

Option	Purpose
Clear Archived Exams	Clear exams to free additional disc space.
Preferences...	
Archive/Synchronize	During instrument startup or shutdown, prompts you to archive exams and clear data.
Reference Database	Selects which reference database is the default.
Display Options	Allows change to default setting.
DICOM Archive	Allows you to disable Auto–Query and/or Auto–Archive.
IPv4 / IPv6	Allows you to select Internet Protocol version.
DICOM Archive	Allows patient record archive through the DICOM server.
DICOM Retrieve	Allows patient records retrieval through the DICOM server.
Search Worklist Patients...	Opens the **Modality Worklist** to set parameters for patient search through DICOM Worklist server.
Import Exams...	Opens **Import Options**.
Export Exams..	Opens **Export Options**.
Print Patient list..	Print the patient list currently displayed.
Print Today's Patient list...	Prints the patient list in the Today's Patients.

3.2.2.3 Edit Menu

Option	Description
Patient Record	View or edit a patient's reccord.
Merge Two Patients...	Combines duplicate patient records.
Delete Patient	Delete selected patient record.
Move Scan..	Move a scan from one patient record to another patient record.

3.2.2.4 Help Menu

Option	Description
Keyboard Mouse Shortcuts	Displays a categorized listing of keyboard shortcut keys and mouse functions.
On-line Manual	Opens the User Manual PDF.
License Registration	Register a license.
View Licenses	Displays a list of CIRRUS™ HD-OCT licenses.
Service Support	Enables you to select the TeleService web link for remote online servicing of the instrument, and save a Log file for troubleshooting.
About	Displays the About dialog, which provides software version information.

3.2.3 Navigation

A navigation bar at the bottom of the screen shows the instrument status, queue status, scan status indicators, and navigation buttons.

3.2.3.1 Navigation Buttons

Button	Description
ID Patient	Opens ID Patient mode.
Protocols	Opens Protocol page.
Acquire	Opens scan acquisition (when patient is selected).
Analyze	Opens image analysis (when patient is selected).
Finish	Exits the current mode and opens the prior mode (from acquire or analyze mode).

3.2.3.2 Navigation Status

NOTE

Mouse over the status indicator and popup text will explain the current status.

Status (bottom left) displays a single green–yellow–red indicator along with a brief message about the instrument, hard drive, or NAS. For example:

■	**OK or normal:** The instrument is functioning normally.
■	**Warning:** The instrument is operational but one or more problems exist.
■	**Critical:** One or more serious problems exists that restricts use of the instrument.

For more information about status, refer to: Status Messages [▸ 417].

3.2.4 Basic Screens

Figure 2: Basic Screen Examples

Pos.	Name	Explanation
1	Patient ID Screen	Select or add a patient.
2	Protocol Screen	Displays the most popular scans for the selected protocol.
3	Acquire Screen	*(Instrument Only)* Acquire scans for the selected patient.

Pos.	Name	Explanation
4	Quality Check Screen	*(Instrument Only)* Assess the scan's quality and decide whether to save or retake the scan.
5	Analysis and Reports Screen	*(For saved scans)* Review, adjust, annotate, and assess scan results.

Empty page, for your notes

4 Installation

4.1 Safety During Installation

⚠ WARNING!

Unauthorized Installation could lead to the injury of patients and operators, as well as to property damage.

- Only ZEISS authorized personnel may install ZEISS products.

⚠ WARNING!

Incorrectly configured or installed hardware

could damage the instrument or injure patients or operators.

- Allow only trained ZEISS Meditec personnel to install the instrument and its components.
- Do not attempt to unpack the instrument or its components.
- Do not attempt to install the instrument or its components.
- Do not attempt to connect the instrument or its components.
- Do not attempt to setup or start the device.

⚠ WARNING!

An ungrounded Device

could lead to electric shock.

- Do not remove or disable the ground pin.
- Only an authorized ZEISS service representative may service the instrument.
- Only an authorized ZEISS representative may install the instrument.

4.2 About Changes to Hardware or Software

The CIRRUS™ HD-OCT is a medical device. The software and hardware were designed in accordance with U.S., European and other international medical device standards designed to protect clinicians, users and patients from potential harm caused by mechanical, diagnostic or therapeutic failures.

Read all safety information before installation and use. See: Safety and Certifications [▶ 11].

NOTE

Zeiss does not provide technical support for third party software.

4.3 About Data Storage

⚠ CAUTION!

We strongly recommend that a knowledgeable IT professional assists with network configuration when installing review software.

NOTE

You can export data from the Native archive in DICOM format.

- ▶ You **do not** need an additional license to export data in DICOM format.
- ▶ You **do** need an additional license to connect to **FORUM**.

The CIRRUS™ HD-OCT instrument saves data locally; however we recommended that you archive your data to a network file server or a network attached storage device (external hard drive).

NOTE

You can only view or use native archive dicom export on CIRRUS™ HD-OCT. You cannot open it on 3rd party DICOM readers.

In addition to the **Native** archive, you can purchase a license for FORUM that connects directly to a DICOM network which allows you to:

- Save your data to a DICOM-compatible system automatically.
- Archive your data on a DICOM-compatible system automatically.
- Connect all ZEISS instruments to a DICOM-compatible network.

The following table explains the differences between using the **Native** or **DICOM** data archiving.

	Native Archiving	DICOM Archiving
Export DICOM EPDF Reports	YES	YES
Access *DICOM Modality Worklist* (MWL)	YES	YES
Connect multiple ZEISS instru-ments	NO	YES
Access CIRRUS™ HD-OCT review software.	YES Instrument Review Software	YES Local Database Review Software through FORUM DICOM Archive (with either FORUM-Floating licensing or Node-locked licensing)

Table 4: Comparing Native and DICOM Archiving

4.4 Installing the Instrument

NOTE

Use extreme care when handling and transporting the instrument shipping boxes.

The instrument contains fragile optics that require precise alignment.

You are not responsible for initially installing CIRRUS™ HD-OCT hardware or software.

The CIRRUS™ HD-OCT arrives with its table(optional) and associated components on a pallet in a number of separate shipping boxes. Do *not* allow institution personnel to unpack or open any of these containers.

On arrival, the ZEISS Field Representative will carefully unpack and assemble all system components at the location you have selected for its placement.

When the instrument installation is complete, configure the software (see Configuring Software [▶ 59]).

4.4.1 Embedded Windows License

The CIRRUS™ HD-OCT instrument is issued with an embedded Windows® license. The Windows license number is on a label under the rear cover.

4.4.2 Preparing to Install

Install the CIRRUS™ HD-OCT instrument in an environment that meets the following requirements:

- no direct sunlight
- properly grounded, dedicated 15 A power source that meets all local electrical codes
- not connected to a power strip
- the device's ventilation openings are not blocked
- the device is not exposed to water or other liquids

Do not modify the instrument or use cables not provided by ZEISS.

The CIRRUS™ HD-OCT instrument arrives on a pallet with three boxes that contain all parts and accessories needed to assemble the instrument and table.

4.5 Software and Document Media

NOTE

Store the software installation media in a secure location and only using the media for installing software on the Cirrus.

USB storage devices can be a mechanism for malware transmission within an office environment if the device is connected to multiple computers. If reinstallation of the software is necessary, it is recommended running a full anti-malware scan on the USB storage device prior to installation of the software.

CIRRUS 6000 comes with a USB case that contains two flash drives.

USB Label	Content
SW	Software to install on the CIRRUS 6000 instrument and review stations.
UD	User Documentation.

4.6 Installing Review Station Software

NOTE

These instructions are provided only for installing CIRRUS 6000 Review software on a separate PC or laptop. Installing Review software on a separate PC or laptop will give you access to the Analysis/Review portion of the full CIRRUS 6000 application.

A Review Station is a laptop or PC that analysts can use to access, edit, and create reports for scans.

4.6.1 Review Station Requirements

NOTE

These instructions are provided for Review Station software installation *only*.

If you plan to run CIRRUS™ HD-OCT software on a Review Station, the laptop or PC must fulfill the following minimum system requirements.
NOTE! For the Review Station to function correctly, the Review Station software version must be the same version of software as the instrument.

	Minimum	Recommended
Operating System	■ Windows 10 ■ Windows 11 ■ Windows Server 2016 R2 ■ Windows Server 2019 with support for Remote Desktop Services.	
CPU	Core i5 family with AVX support	Core i7 family
RAM	16 GB	32 GB
HDD	500 GB	1 TB
Resolution	1920 x 1080 (only) Scale 100% Both display resolution and scale are in Display Settings for Windows.	

Table 5: System Requirements for stand-alone Review Stations

4.6.2 Review Station Performance

NOTE

All times are calculated based on an estimated network performance of 50% of theoretical.

▶ Actual performance for a typical clinical setting may differ and will depend on the actual network configuration.

Ethernet Rating	100 Base-T	1 GbE	10 GbE
Speed (MB/sec)	12	120	1200
Network Efficiency	0.5	0.5	0.5

Table 6: Review Station Performance

Scan Type	Approx. Scan Size (MB)	Time to Display (sec)
3x3 mm OCT Angiography	140	5
6x6/8x8/12x12 mm OCT Angiography	270	13

Table 7: Scan Display Performance

4.6.3 Install or Update Review Station Software

NOTE

If an error message appears

the software did not install successfully.

- Press the **Print Screen** button on your keyboard and save the error message to inform ZEISS Customer Support: 800–341–6968. Outside the U.S., contact your local Zeiss distributor.

NOTE

In the Remote Desktop Services environment, Review Software does not support the following functions:

- Adding, Editing, and Deleting a patient record
- Deleting Scans
- Importing Scans
- Adding users or user accounts to the review software
- Adding, Editing, and Deleting the Equipment data
- Adding, Editing, and Deleting the Institution data
- 3D visualization analysis

Prerequisite

☑ The Review Station fulfills the minimum system requirements for the Review Software (see: Review Station Requirements [▸ 49]).

☑ The installation media kit is available (see: Software and Document Media [▸ 48]).

Action

1. Insert the CIRRUS™ HD-OCT USB flash drive (SW) into the computer's USB port.
2. Navigate to the USB drive.
3. Double-click **Setup.exe**.
   ⇨ Installation takes a few moments to prepare before the installation wizard opens.
   ⇨ When preparation completes, the welcome page opens.
4. Click **Next**.
   ⇨ The license agreement page opens.
5. Read and accept the license agreement.

6. Click **Next**.
   ⇨ If you installing the review software for the first time, the mode selection window opens.
7. *(Initial installation only.)* If you archive exam data using the FORUM database environment, choose **Local Mode**.
   ⇨ For more information about FORUM, see: About Data Storage [▸ 45].
8. *(Initial installation only.)*If you do not, choose **Instrument Mode**.
9. Click **Next**.
   ⇨ (Local Mode) The **Remote Desktop Services** selection window opens.
10. (Local Mode) If you use **Remote Desktop Services**, check **Remote Desktop Services will be used**.
11. Click **Next**.
    ⇨ (Local Mode) The installation location window opens.
12. (Local Mode) To select a different location for the application installation, click **Browse** and navigate to the location for installation.
13. Click **Next**.
    ⇨ The review software installation takes a few minutes to complete. Progress bars indicate the progress as installation progresses.
    ⇨ When installation completes, the finish prompt opens.
14. Click **Finish**.
    ⇨ The CIRRUS™ HD-OCT shortcut appears on the computer's desktop.
15. To open the CIRRUS™ HD-OCT, double-click on the icon.
16. Remove the USB flash drive from the USB port and return it to the media kit.
17. Configure the Review Station: Configuring an Additional Instrument or Review Station.

Also see

🗎 About Data Storage [▸ 45]

4.7 Update Instrument Software

NOTE

If an error message appears

the software did not install successfully.

▶ Press the **Print Screen** button on your keyboard and save the error message to inform ZEISS Customer Support: 800–341–6968. Outside the U.S., contact your local Zeiss distributor.

Prerequisite

☑ The installation media kit is available (see: Software and Document Media).

Action

1. Insert the CIRRUS™ HD-OCT USB flash drive (SW) into the computer's USB port.
2. Navigate to the USB drive.
3. Double-click **Setup.exe**.
   ⇨ Installation takes a few moments to prepare before the installation wizard opens.
   ⇨ When preparation completes, the welcome page opens.
4. Click **Next**.
5. Read and accept the license agreement.
6. Click **Next**.
7. If you archive exam data using the FORUM database environment, choose **DICOM**.
   ⇨ For more information about FORUM, see: About Data Storage [▸ 45].
8. If you do not, choose **Native**.
9. Click **Next**.
   ⇨ Software installation takes a few minutes to complete. Progress bars indicate the progress as installation progresses.
   ⇨ When installation completes, the anterior segment calibration prompt opens.
10. Uncheck **Launch Anterior Segment Calibration Wizard now**.
11. Click **Next**.
12. Click **Finish**.
    ⇨ The CIRRUS™ HD-OCT shortcut appears on the computer's desktop.
13. Remove the USB flash drive from the USB port and return it to the media kit.

Also see

🗎 Calibrate the Anterior Segment Lenses [▸ 412]

4.8 Accessing User Documentation

The user document does not install automatically. You can copy user documents from documentation flash drive to your local drive and access the instructions from there.

Documents are available in multiple languages.

Prerequisite

☑ The media kit is available (see: Software and Document Media).

Action

1. Insert the document USB flash drive (UD) into the instrument's USB port.
2. Open Windows Explorer and navigate to USB flash drive flash drive files.
3. Copy the files locally or access directly from the drive.
4. When done, remove the USB flash drive from the USB port and return it to the media kit.

Empty page, for your notes

5 Startup and Shutdown

5.1 Safety During Startup and Shutdown

⚠ WARNING!

In case of an emergency

disconnect the appliance coupler.

- ▶ For the device, the most accessible power cord is the one that plugs into the bottom of the table.
- ▶ Do not position device so it is difficult to unplug power cord.

⚠ CAUTION!

Protect Patient Health Information (PHI)

to maintain patient confidentiality.

- ▶ Health care providers are responsible for protection of patient health information (PHI), both hardcopy and electronic.
- ▶ Use encryption when you export electronic data.

⚠ CAUTION!

Do Not Transport the Instrument Outside the Office

to retain the instrument warranty.

- ▶ Contact a ZEISS service technician to transport the instrument.
- ▶ If you attempt to transport the instrument without consulting a ZEISS service technician, the instrument warranties are void.

⚠ CAUTION!

Unauthorized modification or dismantling of the instrument or system components

could result in damage to the instrument or components, or harm to the operator or other personnel.

- ▶ Only authorized ZEISS personnel may make modifications to, or dismantle, the instrument or its components.

⚠ CAUTION!

Using aerosols near or placing containers of liquid on or near the instrument

could damage the equipment. The instrument is not designed with any specific measures to protect against harmful ingress of water or other liquids (classified IPXO - ordinary equipment).

- ▶ Do not place containers of liquid, or use aerosols on or near the equipment.

NOTE

Health care providers are responsibility for protecting patient health information (PHI), both hardcopy and electronic.

- ▶ We recommend using encryption when you export data.

5.2 System Startup

During system startup, CIRRUS™ HD-OCT checks the following:

- Database accessibility and integrity
- Instrument storage space
- Network storage space
- CIRRUS™ HD-OCT application installation
- Instrument connections

If any system checks fail or reports errors, refer to: System Startup Troubleshooting.

Also see

🗎 Cleaning and Disinfection [▶ 401]

5.2.1 Turning on the Instrument

NOTE

▶ Change the password provided immediately after logging in for the first time.

Action

1. Turn the switch (1) on.
2. Login to Windows. When logging in for the first time, use the following username and password and immediately change the password to a unique, secure password for your organization.
   - ⇨ **Initial Username:** `Zeiss`
   - ⇨ **Initial Password:** `November171846`

Result

✓ After a series of instrument checks, the CIRRUS™ HD-OCT opens automatically.

5.2.2 Logging In

After the system boots up and runs a series of system checks, the login screen opens. The login screen also appears when a user logs out.

NOTE

Passwords are case-sensitive.

An Administrator must add a user's name and password before that user can log in.

Action

To log in:

1. Double-click on the CIRRUS™ HD-OCT application icon .
   ⇨ The login screen opens.
2. Select your user name.
3. Type your password.

5.3 Before Every Use

5.3.1 Safety During Preparation for Use

⚠ CAUTION!

Improper operator training

could lead to poor scan quality, damage to system components, or inadvertent patient safety compromise.

- ▶ Train all operators fully.
- ▶ Ensure all personnel are familiar with the information contained in the Safety and Certifications chapter.
- ▶ Ensure that routine maintenance has been properly carried out in conformance with the Maintenance Schedules described in the Maintenance chapter.

⚠ CAUTION!

Neglecting to prompt the patient to move their head away from the chinrest and sit back on completion of Patient ID or Scanning could result in injury to the patient when the chinrest repositions itself.

- ▶ Before you click the **Finish** or **ID Patient** in the Acquire screen, always prompt the patient to sit back and move their head away from the chinrest.

5.3.2 Prepare the Instrument for Use

⚠ CAUTION!

Neglecting to disinfect device could lead to cross infection between patients.

- ▶ Refer to Cleaning and Disinfecting the Chin Cup, Forehead Rest, and Breath Shield [▶ 404] for more information.

NOTE

If a database, installation files, or instrument error occurs:

- ▶ Do not use the instrument.
- ▶ Contact your Zeiss representative.

NOTE

Make sure you archive scans frequently to ensure that there is enough storage space to acquire new scans.

Action

1. Wipe the chinrest and forehead rest with an alcohol pad and allow it to dry.
2. Turn on the instrument (see: System Startup).
3. Select the Patient [▸ 132].

5.3.3 Read and Understand Physician Instructions

For each patient scheduled for scans today:

Action

1. Carefully read all instructions from the officiating physician or researcher.
2. Ensure that you fully understand all instructions before starting the examination.

5.4 System Shutdown

Action

1. Click **Logout**.
   ⇨ If the system is set to archive data on shut down, an archive dialog opens.
2. If the archive dialog opens, select the appropriate archive action.
3. Click **Yes**.
   ⇨ A confirmation opens.
4. Click **Yes**.
   ⇨ The CIRRUS™ HD-OCT application closes.
5. Select **Windows Start > Shut Down**.
   ⇨ A confirmation opens.
6. Click **OK**.

Result

✓ The instrument turns off.

6 Configuring Software

6.1 About User Roles

These are the general roles of users (as opposed to specific types of users) in CIRRUS 6000. For user types and permissions in the software, see User Types [▸ 67].

NOTE

***If you login to the device using a Windows standard user account, and then login to the CIRRUS™ HD-OCT application, these settings will be restricted as the application is launched without Windows administrative privileges. Automatically start required services if any are stopped.**

	Operator	Administrator
Settings and Maintenance		
Configure equipment and institution settings*		X
Manage licenses	X	X
View instruction manual	X	X
View licenses	X	X
View software version information	X	X
Access ZEISS service link	X	X
Use Logfile collector	X	
Record screen, available if remote support is enabled	X	X
Diagnostics Package, available if remote support is enabled	X	X
DICOM Gateway Configuration*	X	X
Change Preferences (excluding DICOM TLS settings)	X	X
Change DICOM TLS settings*		X
Patient Records		
Edit patient records	X	
Merge or delete patients	X	
Clear Archived Exam	X	
DICOM Archive	X	
DICOM Retrieve	X	
Search Worklist Patient	X	
Native Archive Management	X	
Native Archive Retrieve	X	

	Operator	Administrator
Native Import	X	
Native Export	X	
Print Patient List	X	
Print Today Patient List	X	
Change Database (Review software only) *Restricted only in Review Station DICOM Mode	X	X
User Management		
Add or delete users		X
Acquire scans	X	
Review scans	X	
Select, edit and annotate scans	X	
Use review software installed on a separate computer	X	X
Reset other user's passwords		X
Change password security level		X
Reset your own password	X	X
Delete a local patient record	X	
Configure import and export settings	X	X
Configure network settings		X
Configure data backup	X	X
Restore data from a backup	X	X
Perform system maintenance		X

Table 8: User Roles

6.2 System Administration

Logging in as the System Administrator at the application level allows access to additional configuration, including:

- Managing User Accounts [▸ 67]
- Editing the Instrument Identifier [▸ 62]
- Editing Your Institution Information [▸ 61]

Refer to: User Names and Passwords [▸ 77] for Login information.

6.2.1 Log in as Admin

The admin can add users and access advanced settings; cannot acquire or analyze scans (see About User Roles [▸ 59]).

Action

1. In **User Name**, type `admin`.
2. Type the admin password. If this is the initial administrator login, use the default device password (0000). Immediately change this password.
3. Click **OK**.

Also see

🗎 Application Password Requirements [▸ 67]

6.2.2 Configuring the Instrument or Review Station

NOTE

Not available in DICOM Archive mode

This section describes how to configure settings on the CIRRUS 6000 instrument and review stations with your institution's information, users, and instrument identification.

6.2.2.1 About Assigning the Issuer of Patient ID

The **Issuer of Patient ID** field allows you to configure how your practice assigns patient IDs to new patients. Recommendations for configuring the Issuer of Patient ID:

- Set to the same **Issuer of Patient ID** value on every instrument in your practice.
- If you use an Electronic Medical Record (EMR) system, configure the **Issuer of Patient ID** to match the EMR system's patient ID value.

If you change the **Issuer of Patient ID**, the change will apply to future patient records; patient information already in the database does not change.

6.2.2.2 Editing Your Institution Information

We recommend that the administrator uniquely identifies your institution, office clinic, or hospital.

Prerequisite

☑ On the instrument, Log in as Admin.

Action

1. Select **Tools > Options > Institution Edit**.
2. *(Required)* For **Name**, type the name of your institution (between 1 and 64 characters including spaces).
   ⇨ Reports only display the first 24 characters of the institution name.

3. *(Required)* For **Issuer of Patient ID**, type your institution's patient identification settings (see: About Assigning the Issuer of Patient ID [▸ 61]).
4. To add a logo, click **Browse** and navigate to the file location. The file must be in `BMP` format; for best results, use a square image.
   ⇨ Your logo appears in the preview box. If your image is not square, it will stretch to fit. The proportion shown in the preview box shows how your logo will appear in reports.
5. Click **Save**.
6. Click **Close**.

NOTE **You must restart the software for the Institution Edit changes to appear in report headers.**

6.2.2.3 Editing the Instrument Identifier

You must create a unique name for each CIRRUS 6000 instrument and review station.

When configuring these settings, important instrument information displays, including:

- Model Number
- Sequence Number
- Serial Number
- Software Version
- ⊕DICOM AE Title (see: Connect to a DICOM Gateway [▸ 390]).

⊕ *Indicates optional features; license may be required.*

To edit instrument information:

Prerequisite

☑ On the instrument, Log in as Admin.

Action

1. Select **Tools > Options > Equipment Edit**.
2. For **Station Name**, type an instrument identifier that is meaningful to your institution.
3. If you have a license to connect to a DICOM Gateway, type the **DICOM AE Title** (see: Connect to a DICOM Gateway [▸ 390]).
4. Click **Save**.
5. Click **Close**.

6.2.3 Registering Licenses

NOTE

You will need your software Certificate Serial Number (shipped with your instrument) and optional feature licenses.

- ▶ If you cannot locate your software **Certificate Serial Number**, contact your ZEISS Representative to obtain this information.

NOTE

Register license(s) on instruments first, then on computers running review station software.

Some features of this instrument require licenses that you can purchase separately (see: About Licenses [▶ 63]).

All licenses you purchase with the instrument are already registered for you. If you purchase a license for optional features separately, you must register the license on each instrument and each computer running the review station software to enable the new features.

Before you register a license, ensure that you have the following information available:

- **Certificate Serial Number** (see the Software Product Certificate provided with your instrument)
- **Instrument Serial Number**

6.2.3.1 About Licenses

NOTE

Features described in this section are licensed separately and may not be available in all markets. Contact your local ZEISS distributer about feature availability.

Core License

The core license includes the features available without an additional license. When you view your installed licenses, both included and additionally purchased licenses are listed.

The core license includes software updates and features that were formerly licensed separately (now included).

License Name	Enables
4.0 Software Upgrade	*Core Upgrades*
6.0 Software Upgrade	■ **Macular Cube 512 x 128** ■ **Macular Cube 200 x 200** ■ **Optic Disc Cube 200 x 200** ■ **1 or 5 Line** ■ **HD 1 Line 100x** ■ **HD 5 Line**
6.0 Software Upgrade Plus Light	
CIRRUS 11.1 Core License	
CIRRUS 11.2 Core License	
Software Upgrade Plus	

License Name	Enables
	■ **HD Radial** ■ **HD 21 Line** ■ **HD Cross**
Instrument Review Software	Install software for analysis on separate (Review Station) computers
Advanced RPE Analysis	**Advanced RPE Analysis**
Anterior Segment Imaging	■ **Anterior Segment Cube** ■ **Anterior Segment 5 Line Raster** ■ **HD Angle**
Epithelial Thickness Mapping	Epithelial thickness measurement calculations for **Pachymetry**
Ganglion Cell Analysis	**Ganglion Cell OU**
Ganglion Cell Guided Progression Analysis	**Ganglion Cell Guided Progression**
Guided Progression Analysis	**Guided Progression Analysis**
Macular Reference Data	Associates study data to compare macular thickness to a reference range for healthy eyes for a patients' age
Macular Change Analysis	**Macular Change Analysis**
Macular Reports	Reports for analyses
ONH Reference Data	Associates study data to compare optic disc and RNFL measurements to a reference range for healthy eyes for a patients' age.
ONH and RNFL Analysis	**ONH/RNFL OU Analysis**
Reference Database 1	Associates images acquired originally on a CIRRUS 400/4000/500/5000 to compare macular thickness, ganglion cell thickness, optic disc, and RNFL measurements to a reference range for healthy eyes for a patients' age.
Reference Database 2	Associates images acquired originally on a CIRRUS 6000 to compare macular thickness, ganglion cell thickness, optic disc, and RNFL measurements to a reference range for healthy eyes for a patients' age.
RNFL Thickness Analysis and 3D Volume Rendering	**3D Visualization Analysis**
Segmentation Layer Editor	Macular cube segmentation editor for **Macular Thickness Analysis**, **Macular Thickness OU Analysis**, and **Advanced RPE Analysis**
Single Eye Summary Analysis	**Single Eye Summary**
Tracking	FastTrac feature

Some CIRRUS™ HD-OCT scans and analyses or features require separate licenses. Your instrument and review station list only the scans and analyses with an active license.

License Name	Enables
AngioPlex OCT Angiography	■ **Angiography 3x3 mm** ■ **Angiography 6x6 mm** ■ **HD Angiography 6x6 mm** ■ **Angiography 8x8 mm** ■ **HD Angiography 8x8 mm** ■ **Angiography 12x12 mm** ■ **Montage Angiography 6x6 mm** ■ **Montage Angiography 8x8 mm**

Table 9: Optional Instrument Licenses

Once you purchase and install a license, all related scans, analyses, and features activate for that instrument or review software.

To see what licenses are installed, see: Registering Licenses [▸ 63].

6.2.3.2 Register a License on an Instrument or Review Software

NOTE

In instrument mode the review station inherits the licensed features of the instrument it accesses.

You do not need to register a license on computers running review station software.

▶ In an environment with multiple instruments, features available to the review station may differ when accessing different instruments (if optional features are licensed differently on instruments).

Prerequisite

☑ Your device is connected to the internet.

☑ If registering the license on Review software, make sure it is in the Local or DICOM mode.

☑ The instrument licensing information is available.

Action

1. Select **Help > License Registration**.
2. Select the name of the license you are installing.
   ⇨ The **CZM License Registration Utility** opens displaying the prefix for your Certificate Serial Number, Feature to be Registered, and Node ID for the license you selected.
3. The prefix of the **Certificate Serial Number** is auto-populated. Type the rest of the **Certificate Serial Number**.
   You can find the Certificate Serial Number in your order details or order confirmation email.

4. Make a note of the **Node ID**.
   ⇨ You can leave the **CZM License Registration Utility** open. After you obtain the license key and security code from the ZEISS registration website, you need to return to the utility to complete registration.
5. Open a browser and go to the ZEISS registration website: https://activation.zeiss.com/med.
   ⇨ The licensing portal opens. Follow the instructions on the page.
6. Click **Register**.
   ⇨ The registration details page opens.
7. Type the **Certificate Serial Number** and click **Submit**.
8. Make a note of the **License Key** and **Security Code**.
9. Close the web browser and return to (or re-open) the **CZM License Registration Utility**.
10. In **License Key**, type the number you noted.
11. In **Security Code**, type the number you noted.
12. Click **Save**.
13. Log out.
14. Follow the steps above to register the license on instruments for which you purchased the optional features. If needed, register the license on computers running the Review software.

Result

✓ The registered licenses are enabled.

Also see

🗎 Log in as Admin [▸ 61]
🗎 View Licenses [▸ 66]

6.2.3.3 View Licenses

NOTE

Features described in this section are licensed separately and may not be available in all markets. Contact your local ZEISS distributer about feature availability.

Many types of scans, analyses and features that originally required a separate license are now included as standard features. The licenses for these features still appear in the license view, even if they are now included with the instrument.

Some features require licenses that you can purchase separately (see: About Licenses [▸ 63]). You can check which optional features are enabled on your instrument.

To view licenses:

Prerequisite

☑ On the CIRRUS™ HD-OCT instrument, login: Log In as Operator or Data Analyst or Log in as Admin [▶ 61].

Action

1. Select **Help > View Licenses**.
   ⇨ A dialog opens displaying the license list and status.

Also see

🗎 Register a License on an Instrument or Review Software [▶ 65]

6.2.4 Managing User Accounts

NOTE

Unsecured Logins

may result in unauthorized access or inaccurate record-keeping.

- ▶ Create individual user accounts for each staff member.
- ▶ Staff members should log out after every use.

CIRRUS 6000 saves the operator's user name for each scan acquired. The currently logged in user name displays in the top toolbar.

Analysis reports print the technician's name. To fit on the page, reports can only display the first 32 characters (including spaces)

6.2.4.1 User Types

	Operator	Referring Physician	Requesting Physician	Reading Physician
Ordering scans		x	x	
Reviewing scans				x
Acquiring scans	x			

6.2.4.2 Application Password Requirements

⚠ CAUTION!

Not having a complex password and infrequently changing passwords can lead to data vulnerability

For improved cybersecurity, users must:

- ▶ Change their default password immediately after initial use.
- ▶ Update their passwords frequently, at least once every three months.
- ▶ Provide a complex password that cannot be easily guessed.

Application Password Policy Level	Password Requirements
High	■ At least 15-characters long ■ No longer than 32 characters ■ Has at least one upper-case character ■ Has at least one lower-case character ■ Has at least one numeric character ■ The password is valid for a maximum of 60-days After three consecutive failed logon attempts within a 15-minute time period, the application locks the account and notifies the user. An administrator must reset the password to unlock the account. After reset, the number of failed attempts also resets to zero. When password is changed, the following applies ■ At least 8 characters in the new password must be different or at a different location than the previous password ■ The password is valid for at least 24 hours unless the admin has reset the user's password. ■ User cannot reuse an old password within five consecutive changes. ■ Reset password shall not be added to password history. This shall allow "0000" to always be valid for a password reset.
Medium	■ At least 8 characters long ■ No longer than 32 characters ■ Not a common use password such as `1234` `password` After 10 consecutive failed logon attempts, the application locks the account. The application will unlock the account after 60 seconds.

Also see

Changing Your Own Password [▶ 70]

6.2.4.3 Viewing User Accounts

NOTE **Only Administrators can complete this task.**

Prerequisite

☑ On the instrument, Log in as Admin.

Action

1. Select **Tools >Options > Users**.
   ⇨ The **Staff Registration** dialog opens listing the users already added to the system. If no users exist, the list is empty.

6.2.4.4 Adding a New User

NOTE **Only Administrators can complete this task.**

NOTE

First Name, Last Name and Password are case-sensitive.

Create a unique user account for each instrument operator who acquires scans and each clinician who analyzes scans.

When you add a new user, you must provide last name and first name. All other fields are optional.

To add a new user:

Prerequisite

☑ On the CIRRUS™ HD-OCT instrument, Log in as Admin [▸ 61].

Action

1. Select **Tools >Options > Users**.
   ⇨ The **Staff Registration** dialog opens listing the users already added to the system. If no users exist, the list is empty.
2. Click **New**.
   ⇨ The **New Staff** dialog opens.

3. For **Last Name**, type the user's last name
4. For **First Name**, type the user's first name.
5. If available, complete **Middle Name**, **Suffix**, **Prefix**, and **ID**.
6. For **Password**, type a temporary password for the user.
7. For **Verify Password**, retype the temporary password.
8. Check the user type (see User Types [▸ 67]). Make sure to check **Operator** for anyone using the instrument or review software.
9. Click **Save**.
10. Provide the user with the password and ask them to log in and reset their password.

6.2.4.5 Editing User Information and Password

NOTE

Only Administrators can complete this task.

NOTE

First Name, Last Name and Password are case-sensitive.

When you edit user information, you must provide at least one name (last name or first name). All other fields are optional.

To edit a user:

Prerequisite

☑ On the CIRRUS™ HD-OCT instrument, Log in as Admin [▸ 61].

Action

1. Select **Tools >Options > Users**.
   ⇨ The **Staff Registration** dialog opens.
2. Select the user you want to edit.
3. Click **Edit**.
   ⇨ The **Edit Staff** dialog opens.
4. Update the user's **Last Name**, **First Name**, **Middle Name**, **Suffix**, **Prefix**, and **ID** user type as required.
5. To reset their password, for **Password**, type a temporary password for the user and for **Verify Password**, retype the temporary password.
6. Click **Save**.
7. If you changed the user's password, provide the user with the new password and ask them to log in and set a different password.

6.2.4.6 Changing Your Own Password

To change your password:

Action

1. Click **Tools > Change Your Password**.
2. For **New password**, type a new password.
3. In **Re-enter Your New Password**, retype the new password.

Result

✓ Your password is now changed to the new password.

6.2.5 Export Log Files

NOTE

Save (export) audit log files regularly

to ensure events are tracked in case you encounter a data error.

CIRRUS 6000 records the following events and identifies them by date, time, and User ID:

- Log on / log off
- Display analysis data
- Create, modify, or delete data
- Import/export data from removable media
- Receive and transmit data from/to an external connection (network, for example)
- Remote service activity

The events are automatically recorded in (up to) 5 audit files of 5 Mb each. When the maximum limit for files and file size is reached, the device overwrites the existing files.

The default folder for the audit log files is:
`C:\ProgramData\Carl Zeiss Meditec\...\Logs`.

6.2.5.1 Export a Log File

NOTE

Only Administrators can complete this task.

To export a log file:

Prerequisite

☑ On the CIRRUS™ HD-OCT instrument, Log in as Admin [▸ 61].

Action

1. Select **Tools > Export Audit Log File**.
   ⇨ A browse dialog opens.
2. Navigate to the folder you want to store the audit log file.
3. Click **Save**.

Result

✓ The log is exported as a .zip file with the format: AuditLog_dd_mm_yyyy_hh_mm.

6.2.6 Data Archiving and Retrieval

NOTE

We recommond you use a single archive location.

Archives are proprietary only readable from the device on which they were created.

You cannot port archives to other instruments or to review stations.

Archiving data stores a backup of CIRRUS 6000 data. Data is archived to the **Current** location. For more information about adding storage to the network for archiving, refer to: Adding a Network Storage Device

Archives are automatically named following the format: **[ID Unique to the Instrument]-A-[YEAR][MONTH][DAY][HOUR][MINUTE][SEC].** For example: `123456789-A-20190730154623`

6.2.6.1 Setting Up an Archive

NOTE

Although Administrators and Operators can set up an archive, we recommend Administrators oversee this process.

To maintain consistency in your environment, have the Administrator set up a new archive.

The label for the new archive location has two parts:

- Automatically generated name (model number, serial number and archive sequence number)
- (optional) Customizable suffix

To set up an archive:

Prerequisite

☑ Logging In as Operator or Data Analyst.

☑ You know the name and location of the new archive: Adding a Network Storage Device

Action

1. Select **Records > Archive Management**.

   ⇨ The **Archive Locations** dialog opens.

2. Click **New**.

   ⇨ The **New Archive Location** dialog opens.

3. To identify this archive location by description, for **Description**, type your description (up to 85 characters).
4. Click **Browse**.
5. Navigate to the shared archive folder on the network file server.

6. Click **OK**.
7. Click **Save**.
8. Click **Close**.

6.2.6.2 Changing the Archive

To change the archive location:

Prerequisite

☑ Logging In as Operator or Data Analyst.

☑ You know the name of the new archive.

Action

1. Select **Records > Archive Management**.

   ⇨ The **Archive Locations** dialog opens listing all available archives.

2. Select name of the archive you want to use.
3. Click **Mark as Current**.
4. Click **Close**.

Result ✓ The archive location changed.

6.2.7 Windows 10 Cybersecurity and System Administration

NOTE

Only Administrators can complete this task.

This section contains detailed configuration information for system administrators. Only system administrators should make changes to these settings.

6.2.7.1 Settings to support cybersecurity and data protection

- It is recommended to install the instrument behind a firewall.
- Direct access to the internet is not recommended.
- All default passwords must be changed to more secure passwords on instruments.
- Schedule regular backups of the database, configuration, and calibration files.
- Review the current enhanced security settings.

CAUTION! Even though enhanced security settings are not required to operate the instrument properly, before making changes to these settings to match your organization's network environment, administrators must assess and have a cybersecurity solution geared for your organization to prevent potential data loss.

Also see

🗎 Turning on the Instrument [▶ 56]

6.2.7.2 Windows Patches and Updates

Automatic Windows updates are disabled. Windows patches and updates are communicated through a monthly newsletter to the SSC after they are tested and approved for use.

NOTE! For information on approved patches and updates, contact customer support or visit the website www.zeiss.com/cybersecurity.

6.2.7.2.1 Install the Windows Patches and Updates

ZEISS recommends updating devices to the latest approved patch to ensure continued cybersecurity. ZEISS-approved updates for installation on the CIRRUS™ HD-OCT are located in the software installation media, in the `Updates` folder.

Prerequisite ☑ You are logged in as an administrator.

Action

1. Open the `Updates` folder.
2. Double-click the file to manually install each update, starting with the Servicing Stack update.

Result ✓ Reboot the device for the changes to take effect.

NOTE **The installation process of all updates may take more than 60 minutes.**

6.2.7.3 Data Safety

⚠ CAUTION! **Protect Patient Health Information (PHI)**

to maintain patient confidentiality.

- ▶ Health care providers are responsible for protection of patient health information (PHI), both hardcopy and electronic.
- ▶ Use encryption when you export electronic data.

⚠ CAUTION! **Patient data on USB devices can become corrupted when inserting into computers for backup or transfer.**

- ▶ Make sure your USB devices are secured against malware/ viruses
- ▶ The use of anti-virus software on computers is recommended and is the responsibility of the user.

6.2.7.3.1 Auto-Lock

After 15 minutes of inactivity, the CIRRUS™ HD-OCT screen locks and the user must log in again.

6.2.7.3.2 Anti-Malware

When configuring anti-malware applications, ensure that updates and full system scans do not occur when data acquisition could be in progress. Windows Defender is configured and running on the CIRRUS™ HD-OCT. Definition files will be automatically downloaded and installed if the system has Internet access.

6.2.7.3.2.1 How to clean up the instrument if a malware infection occurs

If the instrument has been infected with malware, do the following to immediately to clean-up and restore the compromised device to its functional state to avoid further compromise reinfection of CIRRUS 6000.

Action

1. Disconnect the device from the network if connected.
   - ⇨ Confirm and record database backup location
   - ⇨ Confirm and record Institution Information
   - ⇨ Record the Network settings such as but not limited to
     IP Configuration and address
     Instrument Computer Name
     Mapped network drive paths and drive letters
     DICOM Settings (if any)

Issuer of Patient ID
Non-DICOM EMR settings (if any)
Printer configuration (if any)

⇨ Backup the calibration file C:\Program Files\CZM\CIRRUS HD-OCT\Config\ sdoctCalibrationValues.xml

2. Restart CIRRUS 6000.
3. During the boot up sequence, press `1` when prompted to recover the factory image.
4. Press `y` when prompted to continue.
   ⇨ The Acronis True Image will boot and automatically begin the factory restoration process.
5. After restore completes, restart the instruction again.
6. Restore the instrument's configuration data.
7. Restore the settings and files that were recorded and backed up during the steps above.

Also see

🗎 Configuring the Instrument or Review Station [▶ 61]
🗎 Data Archiving and Retrieval [▶ 71]
🗎 Import Data [▶ 131]

6.2.7.3.2.1.1 Steps to perform if malware infection has corrupted or encrypted data

Prerequisite

☑ You have an existing database backup to restore from.

☑ You have already performed the steps to clean-up and restore the device after a malware infection but the exam data has been corrupted / encrypted.

Action

1. To uninstall the device software, navigate to **Add or Remove** programs. Select the CIRRUS application and select uninstall. Follow the prompts to complete the process.
2. To delete the corrupted database, navigate to the location `E:\SDOCT\Database` and delete the file `ZDB.IB`.
3. Restart CIRRUS 6000.
4. Reinstall the device software.
5. Restore the exam data from the most recent backup.

Also see

🗎 Configuring the Instrument or Review Station [▶ 61]
🗎 Import Data [▶ 131]

6.2.7.3.3 User Names and Passwords

NOTE

Passwords for Tech Support users are unique for each system.

Zeiss instruments initially have three user names and passwords. Initial passwords are shown in the table below. Change the ZeissAdmin passwords before using the instrument.

User Name	Type	Password	Purpose
`Zeiss`	Administrator	`November171846` **NOTE! Change this password after initial use.**	Instrument User
`ZeissAdmin`	Administrator	`November171846` **NOTE! Change this password after initial use.**	Instrument Administration
`Tech Support`	Administrator	*<unique>*	Zeiss Technical Support

Table 10: Initial User Names and Passwords

NOTE

If you need Window admin privileges with UAC, then right-click the CIRRUS™ HD-OCT application and select Run as administrator to access admin settings.

For improved cybersecurity, all administrative passwords should be changed, a Windows standard user should be created. This will restrict administrative access.

Windows User types

Active Directory (AD): Active Directory is proprietary directory service developed by Microsoft for Windows domain networks. It provides benefits such as centralized resources and security administration, a single logon for access to global resources, and simplified resource location.

Standard User: A standard user is a user or operator with limited system access. Standard users can perform everyday tasks like running software, changing settings, and personalizing their desktop. They can't do complicated system tweaks, install apps, or run elevated commands. Standard users must also have administrator approval before installing any program. CIRRUS 6000 application does not require Administrator privileges anymore to run. This protects the OS from malicious users.

User Account Control (UAC): User Account Control is a security feature in Windows that ensures important system changes are only made with approval from an administrator. UAC reduces the

risk of malware by limiting the ability of malicious code to execute with administrator privileges. It requires every admin functionality to request for user permission.

6.2.7.3.3.1 Windows Password Requirements

All passwords must follow these rules:

- Must be at least eight characters long.
- Must contain at least three of the following:
  - European language uppercase characters (A through Z, with diacritic marks, Greek, and Cyrillic characters).
  - European language lowercase characters (A through Z, with diacritic marks, Greek, and Cyrillic characters).
  - Numbers (0 through 9).
  - Non-alphabetic characters (for example: !, $, #, %)
- Any unicode character alphabetic character, including Asian language unicode characters.

6.2.7.3.4 Windows Standard User Account

Create standard user accounts for users who will regularly access the device but will not perform administrative tasks. After you have created an account, make sure the automatic Windows login is disabled.

Switch users from a local user account

Action

1. Select **Start** > **Account name icon (or picture)** > **Sign out**.

Result

✓ Once you have successfully signed out, login with the desired user account.

NOTE

Using the Switch user button provided by Windows is not recommended.

The software application may not be suspended correctly and can freeze or crash.

6.2.7.3.5 Setting File Permissions for Standard Users

To run CIRRUS™ HD-OCT application as Standard User, the administartor has to ensure that the Users group is given Full Access Control to the CIRRUS™ HD-OCT database folder.

Installation Type	Database Location	Note
Instrument	E:\SDOCT	
Review Station in DICOM mode	C:\Users\Public\Cirrus Database\Database	This is the default location. If this has been set to a diffrent location, then make sure to configure permissions for that folder.

Table 11: Database folder locations

Prerequisite

☑ You are logged in as an administrator.

Action

1. In the Run dialog, type `gpedit.msc` and select **OK**.
2. Navigate to the File Explorer. Right-click the database folder, and then select **Properties**. Make sure the permissions for the Users group are set as shown:

3. If the Users group is not available, click **Add** to add the group.
4. Once the User's group is available, click **Edit**. Select **Allow** for each permission, and then click **Apply**.

Result

✓ Reboot the device for the changes to take effect.

6.2.7.3.6 Enabling the User Account Control through Windows

You can enable the UAC settings through the Windows Local Group Policy Editor.

Prerequisite

☑ You are logged in as an administrator.

Action

1. In the Run dialog, type `gpedit.msc` and select **OK**.
2. In the Local Group Policy Editor, navigate to **Computer Configuration > Windows Settings > Security Settings > Local Policies > Security Options.** Make the following policy changes:
   - ⇨ "User Account Control: Virtualize file and registry write failures to per-user locations" to "Enabled".
   - ⇨ "User Account Control: Run all administrators in Admin Approval Mode" to "Enabled".
   - ⇨ "User Account Control: Only elevate UIAccess applications that are installed in secure locations" to "Enabled".
   - ⇨ "User Account Control: Detect application installations and prompt for elevation" to "Enabled". "
   - ⇨ User Account Control: Behavior of the elevation prompt for standard users" to "Automatically deny elevation requests".
   - ⇨ "User Account Control: Behavior of the elevation prompt for administrators in Admin Approval Mode" to "Prompt for consent on the secure desktop"
   - ⇨ "User Account Control: Admin Approval Mode for the Built-in Administrator account" to "Enabled".

Result

✓ Reboot the device for the changes to take effect.

6.2.7.4 Networking

6.2.7.4.1 Network Controllers and IP Addressing

NOTE

This instrument is not compatible with networks using IPv4 addressing in the range of 192.168.52.0 to 192.168.52.254

This instrument contains two network controllers; Internal Network and External Network.

6.2.7.4.1.1 Internal Network

IMPORTANT NOTE! Network connections in the Windows Control Panel that are labeled Internal Network (DO NOT CHANGE) are reserved for device operation only. Modifying, altering or disabling these dedicated network connections will inadvertently cause disruptions in the device.

Internal Network is for instrument use only with the following assignments:

- Static IPv4 address: `192.168.52.100`
- Subnet mask: `255.255.255.0`

6.2.7.4.1.2 External Network

The External Network is for instrument connectivity and automatically picks up an IP address. Do not change the name of the network controller.

6.2.7.4.2 Network Ports

The network ports listed in this section are recommended for optimal instrument operation.

Service	TCP	UDP
CIRRUS™ HD-OCT Inter-instrument communication	80	69

Table 12: Internal (Computer to micro-controller communication)

Service	TCP	UDP
Remote file access SMB (Review software in instrument mode and NAS access)	445	
Printer communication outbound	9100	
Remote service HTTP	80	
DHCP		68
Windows Time Service NTP		123

Table 13: General

Service	TCP	UDP
DCS inbound/outbound	7778	7716-7719

Table 14: Zeiss Smart Service (ZSS)

Service	TCP	UDP
HTTP communication to FORUM outbound	8080	
HTTPS TLS communication to FORUM outbound	8181	
DICOM communication with ZEISS FORUM inbound	11112	
DICOM communication with ZEISS FORUM outbound	11119	
DICOM communication with ZEISS FORUM user configurable outbound	2762	
Forum to device auto-discovery inbound	24500- 24504	
mDNS (Auto-discovery for instruments inbound) **NOTE! mDNS traffic should not go to the internet from Hospital/Clinic firewall**		5353

Table 15: EMR and FORUM

6.2.7.5 Configuring Enhanced Security

Enhanced security settings are not required to operate the instrument properly; however, they are strongly recommended for enhanced protection. You can also change these settings individually to match your network environment.

6.2.7.5.1 Disabling Enhanced Security Settings

You can change individual settings per your institution's requirements or you can disable these settings using the *Disable Enhanced Security* command.

Prerequisite

☑ You are logged in as an administrator.

Action

1. Locate and run the `Disable_Enhanced_Security` script as an administrator by right-clicking on it and selecting **Run as Administrator**.
2. When the process completes, you are presented with a list of services and firewall rules that have been changed.

Result

✓ Reboot the device for the changes to take effect.

6.2.7.5.2 Enabling Enhanced Security Settings

If there were changes to individual settings or if all enhanced security settings were disabled, you can re-enable all of these settings using the *Enable Enhanced Security* command.

Prerequisite

☑ You are logged in as an administrator.

Action

1. Locate and run the `Enable_Enhanced_Security` script as an Administrator by right-clicking on it and selecting **Run as Administrator**.
2. When the process completes, you are presented with a list of services and firewall rules that have been changed.
3. See Enhanced Security Group Policy [▸ 86] for a list of Group Policy settings.
   ⇨ If desired, locate and configure `Minimum password length` to meet your institution's requirements (enhanced security default: 8 characters).

Result

✓ Reboot the device for the changes to take effect.

NOTE

If the device is connected to an AD domain,

Group Policy is configured by the domain administrator.

6.2.7.5.3 Enhanced Security Windows Firewall Rules

Enhanced security disables the following Windows firewall rules:

Disabled Firewall Rules

`AllJoyn Router (TCP-In)`
`AllJoyn Router (TCP-Out)`
`AllJoyn Router (UDP-In)`
`AllJoyn Router (UDP-Out)`

Disabled Firewall Rules
Cast to Device functionality (qWave-TCP-In) Cast to Device functionality (qWave-TCP-Out) Cast to Device functionality (qWave-UDP-In) Cast to Device functionality (qWave-UDP-Out) Cast to Device SSDP Discovery (UDP-In) Cast to Device streaming server (HTTP-Streaming-In) Cast to Device streaming server (RTCP-Streaming-In) Cast to Device streaming server (RTP-Streaming-Out) Cast to Device streaming server (RTSP-Streaming-In) Cast to Device UPnP Events (TCP-In) Cortana Delivery Optimization (TCP-In) Delivery Optimization (UDP-In) DIAL protocol server (HTTP-In) Microsoft.AccountsControl Microsoft.LockApp Microsoft.Windows.ContentDeliveryManager Microsoft.Windows.ParentalControls Microsoft.Windows.Apprep Network Discovery (WSD Events-In) Proximity sharing over TCP (TCP sharing-In) Proximity sharing over TCP (TCP sharing-Out) Remote Assistance (DCOM-In) Remote Assistance (PNRP-In) Remote Assistance (RA Server TCP-In) Remote Assistance (SSDP TCP-In) Remote Assistance (SSDP UDP-In) Remote Assistance (TCP-In) SmartScreen Windows.ShellExperience Windows Spotlight Wireless Display (TCP-In) Wireless Display (TCP-Out) Wireless Display (UDP-Out) Wireless Display Infrastructure Back Channel (TCP-In)

6.2.7.5.4 Enhanced Security Services

Enhanced security disables the following services:

Disabled Security Services
AllJoyn Router Service Application Layer Gateway Service Bluetooth Handsfree Service Bluetooth Support Service BranchCache Connected Devices Platform Service Connected User Experiences and Telenetry Downloaded Maps Manager Fax Function Discovery Resource Publication Geolocation Service HomeGroup Listener HomeGroup Provider Infrared Monitor Service Internet Connection Sharing (ICS) Microsoft iSCSI Initiator Service Microsoft Storage Spaces SMP Microsoft Windows SMS Router Service Network Connection Broker Phone Service Program Compatibility Assistant Service Quality Windows Audio Video Experience Retail Demo Service Shell Hardware Detection Telephony Touch Keyboard and Handwriting Panel Service Windows Camera Frame Server Windows Event Collector Windows Image Acquisition (WIA) Windows Insider Service Windows Media Player Network Sharing Service Windows Mobile Hotspot Service Work Folders Xbox Live Auth Manager Xbox Live Game Save Xbox Live Networking Service

6.2.7.5.5 Enhanced Security Group Policy

Policy	Setting
Access Credential Manager as a trusted caller	No One
Access this computer from the network	Administrators
Account lockout duration	60 minute(s)
Account lockout threshold	30 invalid logon attempt(s)
Accounts: Administrator account status	Disabled
Accounts: Guest account status	
Accounts: Limit local account use of blank passwords to console logon only	Enabled
Accounts: Rename administrator account	LocalAdmin
Accounts: Rename guest account	Not Used
Act as part of the operating system	No One
Adjust memory quotas for a process	Administrators, Local Service, Network Service
Allow all trusted apps to install	Disabled
Allow Basic authentication	
Allow Cortana	
Allow indexing of encrypted files	
Allow log on locally	Administrators, Users
Allow Microsoft accounts to be optional	Enabled
Allow Telemetry	Enabled 0 - Off (Enterprise Only)
Allow unencrypted traffic	Disabled
Allow user control over installs	
Allow users to connect remotely by using Remote Desktop Services	
Allow Windows to automatically connect to suggested open hotspots, to networks shared by contacts, and to hotspots offering paid services	
Always install with elevated privileges	
Always prompt for password upon connection	Enabled
Apply UAC restrictions to local accounts on network logons	

Policy	Setting
Audit Policy: Account Logon: Credential Validation	Success and Failure
Audit Policy: Account Management: Other Account Management Events	
Audit Policy: Account Management: Security Group Management	
Audit Policy: Account Management: User Account Management	
Audit Policy: Detailed Tracking: Process Creation	Success
Audit Policy: Logon-Logoff: Account Lockout	
Audit Policy: Logon-Logoff: Logoff	
Audit Policy: Logon-Logoff: Logon	Success and Failure
Audit Policy: Logon-Logoff: Special Logon	Success
Audit Policy: Object Access: Removable Storage	Success and Failure
Audit Policy: Policy Change: Audit Policy Change	
Audit Policy: Policy Change: Authentication Policy Change	Success
Audit Policy: Privilege Use: Sensitive Privilege Use	Success and Failure
Audit Policy: System: IPsec Driver	
Audit Policy: System: Other System Events	
Audit Policy: System: Security State Change	Success
Audit Policy: System: Security System Extension	Success and Failure
Audit Policy: System: System Integrity	
Audit: Audit the access of global system objects	Disabled
Audit: Audit the use of Backup and Restore privilege	Enabled
Audit: Force audit policy subcategory settings (Windows Vista or later) to override audit policy category settings	
Audit: Shut down system immediately if unable to log security audits	Disabled
Back up files and directories	Administrators
Boot-Start Driver Initialization Policy Choose the boot-start drivers that can be initialized	Enabled Good, unknown and bad but critical
Change the system time	LOCAL SERVICE, Administrators
Configure Automatic Updates	Disabled
Configure Offer Remote Assistance	

Policy	Setting
Configure registry policy processing Do not apply during periodic background processing Process even if the Group Policy objects have not changed	Enabled TRUE TRUE
Configure Solicited Remote Assistance Maximum ticket time (units) Maximum ticket time (value) Method for sending email invitations Permit remote control of this computer	Enabled Hours 1 Simple MAPI Allow helpers to remotely control the computer Enabled
Configure Windows SmartScreen	Disabled
Create a pagefile	Administrators
Create a token object	No One
Create global objects	Administrators, SERVICE, LOCAL SERVICE, NETWORK SERVICE
Create permanent shared objects	No One
Create symbolic links	Administrators
Debug programs	
Default behavior for AutoRun Default AutoRun Behavior	Enabled Do not execute any autorun commands
Deny access to this computer from the network	NT AUTHORITY \Local Account,GUESTS
Deny log on locally	GUESTS
Deny log on through Remote Desktop Services	NT AUTHORITY \Local Account,GUESTS
Detect compatibility issues for applications and drivers	Enabled
Devices: Allow undock without having to log on	
Disallow Digest authentication	
Disallow WinRM from storing RunAs credentials	
Do not allow drive redirection	
Do not allow passwords to be saved	
Do not display network selection UI	

Policy	Setting
Do not enumerate connected users on domain-joined computers	
Do not preserve zone information in file attachments	Disabled
Domain member: Digitally encrypt or sign secure channel data (always)	Enabled
Domain member: Digitally encrypt secure channel data (when possible)	
Domain member: Digitally sign secure channel data (when possible)	
Domain member: Disable machine account password changes	Disabled
Domain member: Maximum machine account password age	30 day(s)
Domain member: Require strong (Windows 2000 or later) session key	Enabled
Enable computer and user accounts to be trusted for delegation	No One
Enable insecure guest logons	Disabled
Enable local admin password management	Enabled
Enable RPC Endpoint Mapper Client Authentication	
Enable screen saver	
Enforce password history	24 password(s)
Enumerate administrator accounts on elevation	Disabled
Enumerate local users on domain-joined computers	
Force shutdown from a remote system	Administrators
Generate security audits	Local Service, Network Service
Hardened UNC Paths Hardened UNC Paths: Hardened UNC Paths: = *\NETLOGON" RequireMutualAuthentication = 1 RequireIntegrity = 1	Enabled
Impersonate a client after authentication	Administrators, SERVICE, Local Service, Network Service
Include command line in process creation events	Enabled
Increase scheduling priority	Administrators
Interactive Logon: Do not display last user name	Disabled
Interactive logon: Machine account lockout threshold	10 invalid logon attempts
Interactive logon: Machine inactivity limit	900 seconds

Policy	Setting
Interactive logon: Number of previous logons to cache (in case domain controller is not available)	10 logon(s)
Interactive logon: Prompt user to change password before expiration	5 day(s)
Interactive logon: Require Domain Controller authentication to unlock workstation	Disabled
Interactive logon: Require smart card	
Interactive logon: Smart card removal behavior	No Action
Load and unload device drivers	Administrators
Lock pages in memory	No One
Manage auditing and security log	Administrators
Maximum password age	60 days
Microsoft network client: Digitally sign communications (if server agrees)	Enabled
Microsoft network client: Send unencrypted password to third-party SMB servers	Disabled
Microsoft network server: Amount of idle time required before suspending session	15 minute(s)
Microsoft network server: Digitally sign communications (if client agrees)	Enabled
Microsoft network server: Server SPN target name validation level	Accept if provided by client
Minimize the number of simultaneous connections to the Internet or a Windows Domain	Disabled
Minimum password age	1 day(s)
Minimum password length	7 character(s)
Minimum PIN length Minimum PIN length	Enabled 6
Modify an object label	No one
Modify firmware environment values	Administrators
MSS: (AutoAdminLogon) Enable Automatic Logon (not recommended)	Disabled
MSS: (DisableIPSourceRouting IPv6) IP source routing protection level (protects against packet spoofing) DisableIPSourceRoutingIPv6	Enabled Highest protec-tion, source routing is completely disabled
MSS: (DisableIPSourceRouting) IP source routing protection level (protects against packet spoofing) DisableIPSourceRouting	
MSS: (EnableICMPRedirect) Allow ICMP redirects to override OSPF generated routes	Disabled

Policy	Setting
MSS: (NoNameReleaseOnDemand) Allow the computer to ignore NetBIOS name release requests except from WINS servers	Enabled
Network access: Allow anonymous SID/Name translation	Disabled
Network access: Do not allow anonymous enumeration of SAM accounts	Enabled
Network access: Do not allow anonymous enumeration of SAM accounts and shares	
Network access: Let Everyone permissions apply to anonymous users	Disabled
Network access: Restrict anonymous access to Named Pipes and Shares	Enabled
Network access: Sharing and security model for local accounts	Classic - local users authen-ticate as themselves
Network security: Allow Local System to use computer identity for NTLM	Enabled
Network security: Allow LocalSystem NULL session fallback	Disabled
Network Security: Allow PKU2U authentication requests to this computer to use online identities	
Network Security: Configure encryption types allowed for Kerberos	RC4\AES128\AES256\Future types
Network security: LAN Manager authentication level	Send NTLMv2 response only. Refuse LM & NTLM
Network security: Do not store LAN Manager hash value on next password change	Enabled
Network security: Force logoff when logon hours expire	Disabled
Network security: LDAP client signing requirements	Negotiate signing
Network security: Minimum session security for NTLM SSP based (including secure RPC) clients	Require NTLMv2 session security, Require 128-bit encryption
Network security: Minimum session security for NTLM SSP based (including secure RPC) servers	
No auto-restart with logged on users for scheduled automatic updates installa-tions	Enabled
Notify antivirus programs when opening attachments	
Password must meet complexity requirements	
Password protect the screen saver	
Perform volume maintenance tasks	Administrators

Policy	Setting
Prevent enabling lock screen camera	Enabled
Prevent enabling lock screen slide show	Disabled
Prevent the usage of OneDrive for file storage	Enabled
Profile single process	Administrators
Recovery console: Allow automatic administrative logon	Disabled
Recovery console: Allow floppy copy and access to all drives and all folders	
Replace a process level token	Local Service, Network Service
Require a Password When a Computer Wakes (On Battery)	Enabled
Require a Password When a Computer Wakes (Plugged In)	
Require secure RPC communication	
Reset account lockout counter after	60 minute(s)
Restrictions for Unauthenticated RPC clients RPC Runtime Unauthenticated Client Restriction to Apply:	Enabled Authenticated
Restore files and directories	Administrators
Screen saver timeout Policy = Settings =	Enabled Seconds 900
Set client connection encryption level Encryption Level	Enabled High Level
Shutdown: Allow system to be shut down without having to log on	Enabled
Shutdown: Clear virtual memory pagefile	Disabled
Sign-in last interactive user automatically after a system-initiated restart	
Specify the maximum log file size (KB) (Application Log) Maximum Log Size (KB)	Enabled 32768
Specify the maximum log file size (KB) (Security Log) Maximum Log Size (KB)	Enabled 196608
Specify the maximum log file size (KB) (System Log) Maximum Log Size (KB)	Enabled 32768
Store passwords using reversible encryption	Disabled
System cryptography: Use FIPS compliant algorithms for encryption, hashing, and signing	
System objects: Require case insensitivity for non-Windows subsystems	Enabled
System objects: Strengthen default permissions of internal system objects (e.g. Symbolic Links)	

Policy	Setting
System settings: Use Certificate Rules on Windows Executables for Software Restriction Policies	Disabled
Take ownership of files or other objects	Administrators
Turn off access to the Store	Enabled
Turn off app notifications on the lock screen	
Turn off Automatic Download and Install of updates	
Turn off Autoplay Turn off Autoplay on	Enabled All drives
Turn off Autoplay for non-volume devices	Enabled
Turn off Data Execution Prevention for Explorer	Disabled
Turn off downloading of print drivers over HTTP	
Turn off heap termination on corruption	
Turn off Internet download for Web publishing and online ordering wizards	Enabled
Turn off Microsoft consumer experiences	
Turn off Password Manager	Disabled
Turn off printing over HTTP	
Turn off the offer to update to the latest version of Windows	Enabled
Turn off toast notifications on the lock screen	
Turn off Windows Update device driver searching	
Turn on PIN sign-in	Disabled
Turn on PowerShell Script Block Logging Log script block invocation start / stop events:	Enabled TRUE
Untrusted Font Blocking Mitigation Options	Enabled Block untrusted fonts and log events
Use a hardware security device	Enabled
Use enhanced anti-spoofing when available	
User Account Control: Admin Approval Mode for the Built-in Administrator account	
User Account Control: Allow UIAccess applications to prompt for elevation without using the secure desktop	Disabled
User Account Control: Behavior of the elevation prompt for administrators in Admin Approval Mode	Elevate without prompting

Policy	Setting
User Account Control: Behavior of the elevation prompt for standard users	Prompt for credentials
User Account Control: Detect application installations and prompt for elevation	Enabled
User Account Control: Only elevate executables that are signed and validated	Disabled
User Account Control: Only elevate UIAccess applications that are installed in secure locations	Enabled
User Account Control: Run all administrators in Admin Approval Mode	Disabled
User Account Control: Switch to the secure desktop when prompting for elevation	
User Account Control: Virtualize file and registry write failures to per-user locations	Enabled
WDigest Authentication (disabling may require KB2871997)	Disabled
Windows Firewall: Domain: Apply local connection security rules	Yes
Windows Firewall: Domain: Apply local firewall rules	
Windows Firewall: Domain: Display a notification	No
Windows Firewall: Domain: Inbound connections Inbound Connections	Enabled Block
Windows Firewall: Domain: Logging: Log dropped packets	Yes
Windows Firewall: Domain: Logging: Log successful connections	
Windows Firewall: Domain: Logging: Name	%SYSTEMROOT%\System32\logfiles\firewall\domainfw.log
Windows Firewall: Domain: Logging: Size limit (KB)	16384 KB
Windows Firewall: Domain: Outbound connections	Allow
Windows Firewall: Private: Apply local connection security rules	Yes
Windows Firewall: Private: Apply local firewall rules	
Windows Firewall: Private: Display a notification	No
Windows Firewall: Private: Inbound connections Inbound Connections	Enabled Block
Windows Firewall: Private: Logging: Log dropped packets	Yes
Windows Firewall: Private: Logging: Log successful connections	

Policy	Setting
Windows Firewall: Private: Logging: Name	`%SYSTEMROOT%\System32\logfiles\firewall\privatefw.log`
Windows Firewall: Private: Logging: Size limit (KB)	`16384 KB`
Windows Firewall: Private: Outbound connections	`Allow`
Windows Firewall: Public: Apply local connection security rules	`Yes`
Windows Firewall: Public: Apply local firewall rules	
Windows Firewall: Public: Display a notification	`No`
Windows Firewall: Public: Inbound connections Inbound Connections	`Enabled` `Block`
Windows Firewall: Public: Logging: Log dropped packets	`Yes`
Windows Firewall: Public: Logging: Log successful connections	
Windows Firewall: Public: Logging: Name	`%SYSTEMROOT%\System32\logfiles\firewall\publicfw.log`
Windows Firewall: Public: Logging: Size limit (KB)	`16384 KB`
Windows Firewall: Public: Outbound connections	`Allow`

Table 16: Enhanced Security Group Policy

6.3 Setting Preferences

6.3.1 Setting Archive/Synchronize Alerts

CIRRUS 6000 allows you to set an alert to remind you to archive data at start up and/or shutdown.

NOTE

If no archive preference is selected

The hard drive will become full. Indicators are:

Yellow - hard drive is nearly full.

Red - hard drive is full; you cannot scan patients or review data until the current data is archived.

▶ Select **Records > Archive Now** to immediately archive exams.

To set archive alerts:

Prerequisite

☑ Logging In as Operator or Data Analyst.

Action

1. Select **Records > Preferences**.
2. Select the **Archive/Synchronize** tab.

3. To alert the operator of un-archived data each time the instrument starts up, select **Startup** .
4. To alert the operator of un-archived data each time the instrument shuts down, select **Shutdown**.
5. Click **OK**.

6.3.2 Configure DICOM Archiving

If your system is not running DICOM Archive, only one option appears on the **DICOM Archive** tab (to enable it).

To set DICOM options:

Prerequisite

☑ Logging In as Operator or Data Analyst.

☑ **NOTE! Ensure to archive all data prior to enabling this setting.**

Action

1. Select **Records > Preferences**.
2. Select the **DICOM Archive** tab.
3. Check **Enable Auto-Query/Retrieve**.
   ⇨ Additional options display.

4. To automatically delete data stored locally when you exit **Analysis**, check **Purge Archived Data for Current Patient after Finishing Analysis**.
5. To delete data stored locally when you shut down the application, check **Purge Archived Data for all Patients at Shutdown**.
6. To enable exporting image files in a standard DICOM format, check **Send OP and OPT IODs During Archive (Except After Saving)** and select either:
   Send Without Prompt to disable prompt for eCIRRUS™ HD-OCTxport, or
   Prompt Before Sending to enable prompt for export.
7. To enable automatic archiving of newly acquired exams or a modified analysis, check **Enable Auto-Archive**.
8. Click **OK**.

6.3.3 Setting the Default Patient Screen

To set the default patient screen:

Prerequisite

☑ Logging In as Operator or Data Analyst.

Action

1. Select **Records > Preferences**.
2. Select the **Display Options** tab.

3. To set the patient screen to start with Find Existing Patients, choose **Find Existing Patients**.

4. To set the patient screen to start with Today's Patients, choose **Today's Patients**.
5. Click **OK**.

6.3.4 Setting the Internet Protocol Version

CIRRUS 6000 instruments work on networks that support Internet Protocol version 6, as well as version 4. CIRRUS 6000 Review Software works *only* on version 4. The default setting is IPv4.

NOTE

Choosing the Incorrect Network Protocol

will result in no network connectivity.

▶ Consult your IT professional before selecting.

To set the internet protocol version you use:

Prerequisite

☑ Logging In as Operator or Data Analyst.

Action

1. Select **Records > Preferences**.
2. Select the **IPv4 / IPv6** tab.

3. Select the internet protocol version your facility uses.
4. Click **OK**.

6.3.5 Setting the Preventive Maintenance Schedule

Two weeks prior to the scheduled date, the instrument begins to displays a reminder (at startup) that maintenance is due.

CIRRUS 6000 instruments require regular maintenance. The frequency of this maintenance depends on how much your institution uses the instrument.

To set the maintenance schedule reminder:

Prerequisite

☑ Logging In as Operator or Data Analyst.

Action

1. Select **Records > Preferences**.
2. Select the **Preventive Maintenance** tab.

3. Check **Enable**.
4. For **Phone Number**, type your local maintenance representative's phone number.
5. Click **OK**.

6.4 Configuring Reports

Some types of analysis offer custom options for the printed reports. The reports you can configure are:

- Macular Thickness Report [▸ 99]
- ONH Report
- HD Image Report [▸ 101]
- Guided Progression Reports [▸ 102]

6.4.1 Configuring Macular Thickness Reports

There are three types of reports for the Macular Thickness analysis [▸ 236]:

- Macula Thickness Report
- Macula Multi-Slice Report
- Macula Radial Report

You can choose whether to include one, two or all three types of **Macula Thickness** reports.

Report	Settings
Macula Thickness Report	None

Report	Settings
Macula Multi-Slice Report 	Includes images of the central fast B-scan and adjacent B-scans on a series of pages, each showing a set of Macula slices. You can set which slices to print, the number of scans to print per region and the spacing between the scans (which determines the number of page the report produces). For each region, set: ■ number of scans ■ spaces between scans **Central Region** the central 1 mm (1000 µm) of the cube (the equivalent of 500 µm above and 500 µm below the central B-scan) **Mid–Regions** the next 1.0 mm above and below the Central Region. **Outer Regions** the 1.5 mm of area above and below the Mid Regions. **Print all Scans** check or uncheck **OCT tomogram per page**1 or 4
Macula Radial Report	Produces a radial line report; six B-scans at meridians of: ■ 0 degrees ■ 30 ■ 60 ■ 90 ■ 120 ■ 150 (right eye) or 300 x 330 (left eye).

Report	Settings
	If you select **Macula Multi-Slice**, complete additional settings for this report on the **Macula MultiSlice parameters** tab. **NOTE! If the radial pattern position causes a portion of a lines to extend outside the boundary, no OCT data appears.**

To configure macular thickness reports:

Prerequisite

☑ Log in as Operator or Data Analyst.

Action

1. Select **Tools** > **Print Configuration**.
   ⇨ The **Printout Configuration** dialog opens.
2. Select the **MTA Print Options** tab.
3. To set report to the default, click **Reset to Default**.
4. To set report to Macular Multi Slice, check **Macula Multi Slice**, click **OK** and select the **Macula MultiSlice parameters** tab.

   ⇨ Type the number of scans for each section or to omit scans for the region, type 0.
   ⇨ Type the number of spaces between scans for each region.
   ⇨ To print all scans, check **Print all scans**.
   ⇨ Select whether to print 1 or 4 *OCT tomograms* per page.
5. To set report to Macular Radial, check **Macula Radial** .
6. Click **OK**.

Result

✓ Macular thickness analysis reports now include your new selection(s).

6.4.2 Configuring HD Image Reports

The **HD Image** report includes:

- Fundus image showing the placement of the line scans
- thumbnails of the scan lines
- single larger image of the selected scan line (for HD Cross: middle vertical and horizontal images)

You can customize the **HD Image** report to print all lines (multiple pages) or only the selected line (single page).

To configure HD Image reports:

Prerequisite

☑ Log in as Operator or Data Analyst.

Action

1. Select **Tools** > **Print Configuration**.
   ⇨ The **Printout Configuration** dialog opens.
2. Select the **Raster Print Options** tab.
3. To include only the line selected, choose **Print Selected Line**.
4. To include all lines, choose **Print All Lines**.
5. Click **OK**.

6.4.3 Configuring Guided Progression Reports

You can set the Guided Progression reports as 1-page or 2-page reports. If you set 1-page reports, you can set whether the page shows the summary or just the latest scan.

No Selection	Summary	Latest Scan

Table 17: Options for 1-Page Guided Progression Reports

Page 1	Page 2
Summary 	
Latest Scan 	

Table 18: Options for Multi-Page Guided Progression Reports

To configure Guided Progression reports:

Prerequisite

☑ Log in as Operator or Data Analyst.

Action

1. Select **Tools** > **Print Configuration**.
   ⇨ The **Printout Configuration** dialog opens.
2. Select the **GPA Print Options** tab.
3. To generate guided progression as a one-page report, choose **Print Single Page** and select **Summary** or **Latest Scan Only**.

4. To generate guided progression as multi-page report , choose **Print All Pages** and select whether the first page includes **Summary** or **Latest Scan Only**.
5. Click **OK**.

6.5 Customizing Settings

6.5.1 Customizing the Available Scans List

NOTE

You must organize scans using the CIRRUS™ HD-OCT instrument.

Since review stations do not acquire scans, you cannot organize scan types from a review station.

NOTE

Your instrument might show a different list of scan types.

The types of scans that are available on the instrument depends on the licenses that you purchased for the instrument. Refer to: About Licenses [▸ 63].

You can change the list of scan types that appears at the top of the Acquire screen to make it easier for the instrument operator to find the type of scan(s) that your site uses most frequently. You can:

- Hide some types of scans from the list
- Re-organize the list

Prerequisite

☑ Log In as Operator or Data Analyst

☑ View Today's Patients Screen

Action

1. Select **Tools** > **Scan Organizer**.
   ⇨ The scan organizer opens showing the full list of scans types available for the instrument.

2. Under **Available Scans**, select the scan type(s) that you want the instrument to display and click ⇨.
   ⇨ The scans appear under **Visible Scans**.

3. To hide a scan from the list select the scan type under **Visible Scans** and click ⇦.
4. To move a scan higher on the list, select the scan type under **Visible Scans** and click ⇧.
5. To move a scan lower on the list, select the scan type under **Visible Scans** and click ⇩.

Result

✓ The new list you created under **Visible Scans** now appears when an operator acquires scans.

6.5.2 Set Preferred Analyses

NOTE

Your instrument might show a different list of scans and analyses.

The types of scans and analyses available depends on the licenses installed the instrument or review station. See: About Licenses [▸ 63].

You can customize the preferred analyses to use for a particular type of scan.

For example, if you:

1. Set **Macular Change Analysis** as the preferred analysis for **Macular Cube 512 x 128** scan.
2. Select a patient with **Macular Cube 512 x 128** scans acquired during two different visits and click **Analyze**.

   Macular Change Analysis opens automatically, showing the patient's macular cube images from both visits for change comparison.

You can set a preferred analyses for (up to) five types of scans.

CIRRUS 6000 uses the first applicable preferred analyses for the selected scan.

To set the preferred analysis for a type of scan:

Prerequisite

☑ Log In as Operator or Data Analyst

☑ View Today's Patients Screen

Action

1. Select **Records > Preferences.**

   ⇨ The **Preferences** dialog opens.

2. Select the **Preferred Analysis** tab.

3. For the first available **Select Scan Type**, choose the scan you want to associate with a preferred analysis.
   ⇨ The scan organizer shows the full list of scans types available for the instrument.
4. For **Select Preferred Analysis**, choose the analysis you want to associate to the scan.
5. To set additional preferred analyses, repeat the steps above. You can associate up to five scans with a preferred analysis.
6. Click **OK**.

Result

✓ When you analyze a scan, CIRRUS 6000 opens the first available scan specified in the preferred analysis list.

6.5.3 Turn FastTrac™ On or OFF

FastTrac™ performs two functions (see About FastTrac™ [▸ 149]):

- When acquiring an OCT scan, **FastTrac™** tracks the position of the eye to minimize the effects of eye motion.
- **FastTrac™** also tracks an OCT scan to OCT scan acquired from a previous visit.

Before using the **FastTrac™** feature the first time, make sure you complete the Performance Verification Check.

Auto Repeat automatically reuses chinrest settings from an earlier scan for the same patient and same type of scan for the same eye (see About Auto Repeat [▸ 151]).

To enable FastTrac™:

Prerequisite

☑ Tracking is off (unchecked).

Action

1. Select **Tools** > **Auto Repeat**.
   ⇨ **Auto Repeat** is checked.
2. Select **Tools** > **Tracking**.
   ⇨ **Tracking** is checked.
   ⇨ The **Capture** button displays a green border for scans that can use **FastTrac™.**
3. If this is the first time **FastTrac™** is enabled on the instrument, complete the Performance Verification Check.

To disable FastTrac™:

Prerequisite

☑ Tracking is on (checked).

Action

1. Select **Tools** > **Tracking**.
   ⇨ **Tracking** is unchecked.

Empty page, for your notes

7 Operation

7.1 Manage Patient Data

7.1.1 Managing Patient Categories

NOTE

Not available in DICOM Archive mode

You can create custom categories for patient records. Then you can use categories to identify a group of patients that fit into your category (or combination of categories) using Advanced Search [▸ 134].

7.1.1.1 About Patient Categories

Some institutions create patient categories to apply to their patients. Your institution can create custom categories that are helpful to your clinicians. Your administrator can add new categories, edit them or delete them.

For example, an institution could create categories to distinguish the patient's age group like this:

- `Child (under 12)`
- `Teen (12-19)`
- `Adult 20-45`
- `Adult 45-60`
- `Adult 60-80`
- `Adult 80+`

Classification categories can help when a patient is diagnosed with a specific problem.

You can apply categories to a patient's record when you create it, then change or delete categories that no longer apply.

7.1.1.2 Adding a Category

To add a category:

Prerequisite

☑ Log in as Operator or Data Analyst.

Action

1. Select **Tools > Options > Categories**.
   ⇨ The Category Registration dialog opens listing existing categories in alphabetical order.

2. Click **New**.
   ⇨ The Category Edit dialog opens.

3. For **Name**, type a name for the category (up to 64-characters).
4. Click **Save**.
5. (Optional) For **Description**, type a description (up to 64-characters).

7.1.1.3 Editing a Category

NOTE **You cannot edit categories created by another institution.**

To edit a category:

Prerequisite ☑ Log in as Operator or Data Analyst.

Action

1. Select **Tools > Options > Categories**.
   ⇨ The Category Registration dialog opens listing existing categories in alphabetical order.
2. Select a category.
3. Click **Edit**.
   ⇨ The **Category Edit** dialog opens.
4. Update the category information.
5. Click **Save**.

7.1.1.4 Deleting a Category

NOTE **You cannot edit categories created by another institution.**

To delete a category:

Prerequisite ☑ Logging In as Operator or Data Analyst

Action

1. Select **Tools > Options > Categories**.
   ⇨ The Category Registration dialog opens listing existing categories in alphabetical order.
2. Select a category.
3. Click **Delete** .
   ⇨ A confirmation opens.
4. Click **OK**.

7.1.2 Patient Privacy

NOTE

Obscuring Patient Identities

leads to better security. The unique Patient ID is created when you export with this option, referred to as the **Obscured ID**.

▶ In order to search on a patient with an Obscured ID, enter the ID into the **Obscured ID** field of **Advanced Search** (see Advanced Search [▸ 134]).

⇨ Users who wish to obtain additional medical information about an anonymous patient must contact the originating clinic.

The device gives you the choice to export exam data (Export Data [▸ 114]) without information that could identify the patient. Upon import, anonymous or "obscured" patient records appear in the patient list with the originating institution name in the last name field and a unique Patient ID generated during export. You have the further option to export:

- the complete date of birth
- the month and year of birth
- the year of birth

7.1.3 Merge Patient Records

If a single patient is identified twice with two different ID numbers, you can merge the records.

To Merge Patient Records:

Prerequisite ☑ Logging In as Operator or Data Analyst.

Action

1. Select **Edit > Merge Patients**.
   ⇨ The **Merge Patient** dialog opens.

2. Select the first record to merge.
3. Press **<Ctrl>** and select the second record to merge.
4. Click **Merge Patients**.

Result

✓ The patient records are now combined.

7.1.4 Move Scan

If a scan was acquired using an incorrect patient record, you can move the scan data to the correct patient using **Move Scan**.

Prerequisite

☑ Logging In as Operator or Data Analyst.

☑ A scan is selected in analyze mode.

Action

1. Select **Edit > Move Scan**.

⇨ The Move Scan window opens.

2. Click **Search** to find and select the patient scan.
3. Select **Move** to move the scan into the correct patient record.

7.1.5 Editing Patient Categories

To edit a patient record:

Prerequisite ☑ Logging In as Operator or Data Analyst.

Action

1. Select the Patient [▸ 132].
2. Select **Edit > Patient Record**.

3. Select the **Add/Remove Categories** tab.
4. To add a category, select the category from the left panel and click **Add** .
5. To remove a category, select the categories from the right panel and click **Remove**.
6. Click **Update**.
7. Click **Close**.

7.1.6 Edit Patient Records

The Edit Patient option is reached from **Edit > Patient Record.**

You must have selected a patient to edit for this option to be available. On selection, the **Patient Edit** screen appears. Follow the instructions in Adding a Patient [▸ 135] to fill in or change the **Patient Edit** fields.

7.1.7 Print Patient Lists

Found in **Records > Print Patient Lists**, this option generates a report that includes all patients listed on the Patient screen in alphabetical order:

- Name
- Data of Birth
- Patient ID

The report can be viewed, saved or printed as described in Standard Print Options.

7.1.8 Export Data

You can export data several ways:

- Export in Native format
- Export in XML format
- Export in Native and XML format
- Export in IMG

Using these Export Formats:

- Export to Zip Format (for Native, XML, Native + XML, and IMG)
- Research Export (tree structure)

You can export data to:

- A USB flash drive
- A folder on the instrument's hard drive
- Another CIRRUS™ HD-OCT instrument

7.1.8.1 About XML Data Export

XML Export you choose where to save the data and CIRRUS™ HD-OCT saves in a single XML file using patient and scan information to name the file as follows:

<Last Name>_<First Name>_<Middle Name>_<Patient ID>_<Date of Birth>_<Gender>_<Scan Type>_<Scan Date and Time>_<Eye>_<Export Date and Time>.xml

For example:
`Wilson_Gordon_Matthew_46673598_1981-02-07_Pachymetry_2019-06-10093523_OU_201 90712115204.xml`

XML Export the following analysis types:

- Guided Progression Analysis
- Macular Change Analysis
- Anterior Chamber Analysis
- HD Angle Analysis
- Wide Angle to Angle Analysis

- Pachymetry Analysis
- HD Cornea Analysis

In addition to the analysis specific information, some XML data is the same for all types, including:

- Export Data
- Patient Data
- Visit Data
- General Scan Data

Field Name	Description
EXPORT_DATE_TIME	Date and time of export.
EXPORT_USER	User (account name) for the person who exported the file.
EXPORT_HOST	Host name of the system that created the export file.
EXPORT_INSTRUMENT_SERIAL_NUMBER	Serial number of the instrument.
EXPORT_VERSION	XML Export version and XML Schema.

Table 19: Export Data

Field Name	Description
FIRST_NAME	Patient name information.
LAST_NAME	
MIDDLE_NAMES	
NAME_PREFIX	
NAME_SUFFIX	
PATIENT_ID_ISSUER	Issuer of patient ID.
PATIENT_ID	Patient ID.
BIRTH_DATE	Patient’s Birth Date (yyyy-mm-dd or yyyy-mm).
GENDER	Patient’s Sex (Male, Female, Other, Unknown).
CATEGORY	Patient Category..
CATEGORY_NAME	The name of the category
OBSCURITY LEVEL	How much patient identification information is obscured (if applicable).
OBSCURITY ID	Obscured ID (if applicable).
ID SPHERICAL EQUIV-ALENT	Patient spherical equivalent.
REFERENCE DATA	Patient reference database type (if applicable).

Field Name	Description
OTHER PATIENT IDS	Patient Other ID (if applicable).
ORIGINAL PATIENT ID	Patient ID (blank if obscured) .

Table 20: Patient Data

Field Name	Description
VISIT_DATE	Scan date (yyyy-mm-dd)
STUDY_ID	User or equipment-generated ID.
REFERRING PHYSICIAN	Patient's primary referring physician.
REQUESTING PHYSICIAN	Physician who requested the scan (attending physician).
PROTOCOL	Scan protocol.
CREATION DATE	Study information (if applicable)
ACCESSION NUMBER	
STUDY INSTANCE UID	
UID SERIES Series level information.	

Table 21: Visit Data

Field Name	Description
SITE	Site name.
DATE TIME	The date and time of scan(yyyy-mm-ddThh:mm:ss).
PROTOCOL	Scan protocol.
SCAN LENGTH	Scan length (in mm).
SCAN DEPTH	Scan depth.
SCAN TYPE	Scan type.
Z MOTOR POSITION Z	Motor position information.
FIXATION POSITION X	Fixation target position information.
FIXATION POSITION Y	
SCAN SCALING FACTOR X	Zoom information.
SCAN SCALING FACTOR Y	
POLARIZATION SLIDER	Polarization Slider.
CHINREST LOCATION X	Chinrest adjustment information.
CHINREST LOCATION Y	

Field Name	Description
CHINREST LOCATION Z	
OCULAR LENS POSITION	Ocular lens position.
NOISE	Noise.
SATURATION	Saturation.
SIGNAL STRENGTH	Scan signal strength (0-10).
EYE TRACKING	Eye tracking.
FIXATION TARGET	Fixation target.
FIXATION BLINK RATE	Fixation blink rate.
SCAN PATTERN OFFSET X	Scan pattern adjustment information.
SCAN PATTERN OFFSET Y	
COMMENT	Scan comment.
OPERATORNAME	Username of the operator who acquired the scan.
SERIES INSTANCE UID	Series Instance unique id.

Table 22: General Scan Data

7.1.8.1.1 Macular Scans

7.1.8.1.1.1 Macular Thickness Analysis XML Export Values

Figure 3: XML Export: Macular Thickness Analysis

1	LAST_NAME	2	FIRST_NAME
3	PATIENT_ID	4	GENDER
5	BIRTH_DATE	6	VISIT_DATE
7	PROTOCOL	8	DATE_TIME
9	SITE	10	OPERATORNAME
11	SIGNALSTRENGTH	12	FOVEA_Y
13	FOVEA_X	14	ILMRPECENTRAL
15	ILMRPEVOLUME	16	ILMRPEAVERAGE
17	Z_CENTER	18	Z_OUTERSUPERIOR
19	Z_INNERSUPERIOR	20	Z_INNERRIGHT
21	Z_OUTERRIGHT	22	Z_INNERINFERIOR
23	Z_OUTERINFERIOR	24	Z_INNERLEFT
25	Z_OUTERLEFT		

7.1.8.1.1.2 Macular Change Analysis XML Export Values

Figure 4: XML Export: Macular Change

1	DATE_TIME	2	REGISTRATION
3	Z_CENTER	4	Z_INNERSUPERIOR
5	Z_INNERRIGHT	6	Z_INNERINFERIOR
7	Z_INNERLEFT	8	Z_OUTERSUPERIOR
9	Z_OUTERRIGHT	10	Z_OUTERINFERIOR
11	Z_OUTERLEFT	12	FOVEA_X,Y

7.1.8.1.1.3 Advanced RPE Anaylsis XML Export Values

Figure 5: Advanced Export

1	DATE_TIME	5	VOLUME_OF_RPEELEVATIONSFIVEMMCIRCLE
2	AREA_OF_RPEELEVATIONSTHREEMMCIRCLE	6	AREA_OF_SUBRPE_ILLUMINATION
3	AREA_OF_RPEELEVATIONSFIVEMMCIRCLE	7	CLOSEST_DISTANCE_TO_FOVEA
4	VOLUME_OF_RPEELEVATIONSTHREEMMCIRCLE		

7.1.8.1.1.4 Ganglion Cell OU Analysis XML Export Values

Figure 6: Ganglion Cell OU Advanced Export

1	SITE	2	GC_AVERAGE
3	GC_MINIMUM	4	GC_TEMPSUP

5	GC_SUP	6	GC_NASSUP
7	GC_NASINF	8	GC_INF
9	GC_TEMPINF		

7.1.8.1.1.5 Ganglion Cell Guided Progression XML Export Values

Figure 7: XML Export : Guided Progression Analysis

1	DATE_TIME	2	SERIAL_NUMBER
3	SIGNAL_STRENGTH	4	OVERALL_THICKNESS
5	SUPERIOR_THICKNESS	6	INFERIOR_THICKNESS

7.1.8.1.2 ONH and RNFL Scans

7.1.8.1.2.1 ONH and RNFL OU Analysis XML Export Values

Figure 8: XML Export: ONH / RNFL OU

1	AVERAGETHICKNESS	2	SYMMETRY
3	RIMAREA	4	DISCAREA
5	AVERAGE_CD_RATIO	6	VERTICAL_CD_RATIO
7	CUPVOLUME	8	ONHCENTER_X,Y
9	QUADRANT_S	10	QUADRANT_N
11	QUADRANT_I	12	QUADRANT_T
13	CLOCKHOUR–1–12		

7.1.8.1.3 Angiography Scans

7.1.8.1.3.1 Angiography Analysis XML Export Values

- FOVEA_LOCATION {X,Y}
- CENTRALSUBFIELDTHICKNESS
  - ILMRPE
  - ILMRPEFIT
  - RPERPEFIT
- CUBEVOLUME
  - ILMRPE
  - ILMRPEFIT
  - RPERPEFIT
- CUBEAVGTHICKNESS
  - ILMRPE

  - ILMRPEFIT
  - RPERPEFIT
- FOVEA_LOCATION {X,Y}

7.1.8.1.4 Anterior Segment Scans

7.1.8.1.4.1 Anterior Chamber Analysis XML Export Values

Figure 9: XML Export: Anterior Chamber Analysis

1	HD_LASTEDITED	2	SIGNAL_STRENGTH
3	SCAN_LENGTH	4	SCAN_ANGLE
5	SCAN_SPACING	6	CALIPER_MEASUREMENT
7	ANNOTATION_MEASUREMENT	8	CCT
9	ATA	10	CLR
11	ACD	12	LEFTANGLE
13	RIGHTANGLE	14	CHAMBER_AREA

7.1.8.1.4.2 HD Angle Analysis XML Export Values

Figure 10: XML Export : HD Angle Analysis

1	HD_LASTEDITED	2	SIGNAL_STRENGTH
3	SCAN_LENGTH	4	SCAN_ANGLE
5	SCAN_SPACING	6	CALIPER_MEASUREMENT ■ DECIMAL_PLACES
7	ANNOTATION_MEASUREMENT ■ ANNOTATION_TEXT	8	IC_Angle ■ A0D500 ■ Distance ■ A0D750 ■ Distance ■ TISA500 ■ Space Area ■ TISA750 ■ Space Area ■ SSA ■ LOCATION – Nasal = Left eye, left angle or right eye, right angle – Temporal = Left eye, right angle or right eye, left angle
9	ANGLE		

7.1.8.1.4.3 HD Cornea Analysis XML Export Values

Figure 11: XML Export : HD Cornea Analysis

1	HD_LASTEDITED	2	SIGNAL_STRENGTH
3	SCAN_LENGTH	4	SCAN_ANGLE
5	CALIPER_MEASUREMENT	6	ANNOTATION_MEASUREMENT
7	STROMA_TOOL_DISTANCE		

7.1.8.1.4.4 Wide Angle to Angle Analysis XML Export Values

Figure 12: XML Export: Wide Angle to Angle Analysis

1	HD_LASTEDITED	2	SIGNAL_STRENGTH
3	SCAN_LENGTH	4	SCAN_ANGLE

5	SCAN_SPACING	6	CALIPER_MEASUREMENT ■ DECIMAL_PLACES
7	ANNOTATION_MEASUREMENT ■ ANNOTATION_TEXT	8	IC_LEFT ■ A0D500 ■ Distance ■ A0D750 ■ Distance ■ TISA500 ■ Space Area ■ TISA750 ■ Space Area ■ SSA ■ LOCATION – Nasal = Left eye, left angle or right eye, right angle – Temporal = Left eye, right angle or right eye, left angle
9	IC_RIGHT ■ A0D500 ■ Distance ■ A0D750 ■ Distance ■ TISA500 ■ Space Area ■ TISA750 ■ Space Area ■ SSA ■ LOCATION – Nasal = Left eye, left angle or right eye, right angle – Temporal = Left eye, right angle or right eye, left angle	10	LEFTANGLE
11	RIGHTANGLE		

7.1.8.1.4.5 Pachymetry and Epithelial Thickness Analysis XML Export Values

Figure 13: XML Export: Pachymetry Analysis

1	SUBFIELD_OD ■ SUBMAXDATA ■ SUBMEANDATA ■ SUBMINDATA ■ EPITHELIALSUBMAXDATA ■ EPITHELIALSUBMEANDATA	2	SUBFIELD_OS ■ SUBMAXDATA ■ SUBMEANDATA ■ SUBMINDATA ■ EPITHELIALSUBMAXDATA ■ EPITHELIALSUBMEANDATA

7.1.8.2 Data Export Options

Figure 14: Data Export

Export Type	Description
Export and XML	Exports patient data in both its **Native** format and **XML** format simultaneously. ■ Maximum of 100 exams per export ■ **Export to Zip Format** not recommended
XML Export	Exports patient data formatted as an XML file with values of OCT Angiograpaphy and the Cube reports, including: ■ Patient Identifiers (or tokens if patient identification is omitted) ■ Study Identifiers ■ Scan Information including: – OD or OS – Scan Type, Scan identifiers, and instrument identifiers – Tracking details including fixation data over time (if available)
Export	Exports patient data in its existing format.

7.1.8.3 Exporting Data

NOTE

Creating a zip file takes extra time to compress.

Do not try to export a large numbers of patient exams into a single zip file.

NOTE

Always create a new folder when exporting zip files

If you export zip files to a folder that has existing files from previous exports, the new zip file will combine the newly exported records with the existing files (excluding existing zip files).

Tip: You can save time by using the same folder to export patient data.

If you export to the same folder as a prior export, you can choose to update the prior export or overwrite all data.

NOTE! If an export process is interrupted, you can restart the export. If you use the same folder, the export will continue.

Prerequisite

☑ Removable media is inserted (If saving to removable media such as a USB flash drive)

☑ Target system login is successful (If the target system requires a password for access).

☑ Log in as Operator or Data Analyst.

Action

1. Select **Records > Export Exams**.

   ⇨ The **Export Exams** dialog opens showing the last export path. (On first export, **Path** is empty.)

2. To change the export destination, click **Browse** and navigate to the desired location.
3. To create a new folder for the exported files, click **Make New Folder**.
4. Click **OK**.

   ⇨ **Path** displays the new path.
5. To hide patient identifying information (as for a clinical trials) check **Omit Patient Identifiers** and select an option. For more information, refer to: Patient Identifying Information Omission Options [▸ 130].
6. To find the exams for a patient, type the patient's last name, ID or select a category. You can also select a time interval to limit the search results.

7. Click **Search**.
   ⇨ For additional search options, refer to Advanced Search [▶ 134].
8. Under **Results**, click on the records to export.
   Click **Select All** in the Patient Export window to select all patients in the list.
   Press **Ctrl** while clicking on each record to select multiple records.
   In the Exam Export window, you may export individual scans for the patient you selected in the Patient Export window.
   Press **Ctrl** and click on each scan to select multiple scans.
9. To export the data compressed into one zip file, check **Export to Zip**.
10. Select an **Export Option** (see: Data Export Options [▶ 128]).
    ⇨ Export status appears at bottom. Export Manager will be open and visible if the Export Exams window is closed.
    ⇨ If you are exporting to a folder used in a prior export, a prompt opens.

7.1.8.4 Patient Identifying Information Omission Options

NOTE

You cannot edit or merge patient information in data imported with identifying information omitted.

NOTE

System-generated patient identifiers do not change.

Patient identifiers are generated when you want to obscure the patient's *name*, *day*, and *month* of birth.

Option	Description
Omit: ■ Patient Name	■ Replaces patient's **Last Name** with the institution name. ■ Replaces patient's **First Name** and **Patient ID** with a unique 17-character number. **NOTE! The unique number is the date and time (to the thousandth of a second) that the patient record was originally created. Example: 20070609081320226.**
Omit: ■ Patient Name ■ *Day* of birthday	In addition: ■ Replaces the day of birth with **1**. For example, the birthday `10/22/1995` becomes `10/1/1995`.

Option	Description
	NOTE! For patients over 80 years old, the year of birth changes to <current year> minus 80. For example, the birthday `10/22/1920` becomes `10/22/1941`.
Omit: ■ Patient Name ■ *Day* of birthday ■ *Month* of birthday	Generates a unique identifier for the patient (does not correlate to the patient name or birthday).

Table 23: Identifier Omission Options

7.1.9 Import Data

7.1.9.1 Data Integrity of Imported Records

For all imported patient records, it is possible to import new scan data and update patient data, including obscured patient records. If during import the device encounters information associated with a patient that was already imported, the device does the following:

- Imports all scan data (exams) not previously imported, but never deletes nor overwrites any scan data already imported.
- Updates patient data only if it was created on a later date than the data already imported. This action prevents overwriting of newer patient data with older data.

7.1.9.2 Importing Data

NOTE

ZIP files containing a large number of patients a great deal of time to uncompress on import.

When importing data, you do not need to uncompress the `ZIP` file prior to importing it; all data will be imported.

Prerequisite

☑ Removable media is inserted (If saving to removable media such as a USB flash drive)

☑ Target system login is successful (If the target system requires a password for access).

☑ To import data from databases prior to software version 9.0, you must first convert the export data to version 9.5.2 or later.

NOTE

Directly importing data prior to software version 9.0 is not supported in version 11.6 or later.

▶ Call ZEISS Customer Support for assistance.

☑ Log in as Operator or Data Analyst.

Action

1. Select **Records > Import Exams**.
   ⇨ The **Import** dialog opens.
2. Navigate to the exams to import.
3. To import specific exams, select the **Exam Import** tab.

4. To import by patient identifiers, select the **Patient Import** tab.

5. Click on the patients to import.
   To select multiple patients, **Ctrl-click**.
   To select all patients in the list, click **Select All**.
6. Click **Import**.

Result

✓ The records are imported into your current database.

7.2 Select the Patient

Scanning and analysis are disabled until you identify a patient. The ID Patient screen will list any currently retrieved patients. This is the default screen that appears following system start and login. You can identify a patient using any of the three tabs provided, or you

can query archived data to display a list of patients scheduled for exams. If your institution connects to a DICOM system, you can also search a DICOM archive.

To display the complete list of patients in the current database, click **Search**.

7.2.1 Finding an Existing Patient Record

Simple search uses the patient's last name or ID to locate their record. If you leave the name and ID fields blank and click Search, the result lists all patients. If you want to search using other criteria or narrow the results further, see: Advanced Search [▶ 134].

To find a patient record:

Prerequisite

☑ Log in as Operator or Data Analyst.

Action

1. Select the **Find Existing Patient** tab.
2. Type the patient's **Last Name** or **Patient ID**.
3. Click **Search**.
   ⇨ The **Results** list displays the patient (or list of patients that have the same last name).
4. Select the patient's record.

7.2.2 Finding a Worklist Patient Record (DICOM)

NOTE

Edit patient records in your EMR system (if used).

Changes made directly on the instrument do not get synchronized into the EMR database.

▶ If you are connected to an EMR , always delete or edit patient records directly in the EMR system. If you make changes directly on the instrument, the changes will only appear in the instrument's database and not the EMR database.

Modality Worklist allows you to search a DICOM EMR archive.

A **Broad Query** allows searches using the following parameters:

- **Date Range:** Search for patients scheduled for an exam within a selected range. To search for all dates, check **All Dates**.
- **AE Title:** Search for patients scheduled for a scan using a particular instrument's AE Title.
- **Modality:**
  - IOD
  - OP
  - OPT
  - OPT IOD
  - OP IOD

A **Patient Based Query** allows searches using the following parameters:

- **First Name**
- **Last Name**
- **Patient ID**
- **Accession Number** (Determined from the Analysis screen when the mouse cursor is over an exam date in the upper left corner)
- **Requested Procedure ID**

You can set a preference that automatically searches the DICOM archive for patients scheduled for a scan today (see Enabling Automatic Worklist Search (DICOM)).

Prerequisite

☑ Log in as Operator or Data Analyst.

Action

1. Select **Records > Search Worklist Patients**.
2. To use broad search parameters, select **Broad Query** and indicate what parameter(s) you want the search to include.
3. To use patient information parameters, select **Patient Based Query** and indicate what parameter(s) you want the search to include.
4. Click **Search**.
   ⇨ The list populates with all patient records that fit the parameters you indicated.
5. To view more information about a patient, select the patient and click **Details**.
   ⇨ A dialog opens showing more details of the patient's record.
6. To add patient records to your instrument database, select the patient(s), and click **Save**.
7. Click **Close**.

Result

✓ The patients you added are now listed in the **View Today's Patients** tab.

7.2.3 Advanced Search

To search an archive (or database) for a patient using additional criteria:

Prerequisite

☑ Log in as Operator or Data Analyst.

Action

1. Select the **Find Existing Patient** tab.
2. Click **Advanced Search**.
3. Fill in the known criteria for the patient you are searching for.
4. Click **Search**.
   ⇨ **Search Preview** opens.

5. To select a patient, click on the patient's name. Current patient information appears on the left side of the Toolbar.
6. To select the whole list of patients, check **Select All**.
7. Click **OK**.

7.2.4 Adding a Patient

NOTE

If you include refractive error information in the patient's record, it can save time when you acquire the scans.

When you add a new patient, you can enter the refractive error. The CIRRUS 6000 uses this information to determine the scan focus.

Each patient must have a unique patient ID for CIRRUS 6000 to save acquired images in their record. Your institution can use its own patient ID numbering system or have the system generate unique patient ID numbers.

Patient ID numbers that CIRRUS 6000 generates start with `CZMI`.

To add a patient:

Prerequisite

☑ Log in as Operator or Data Analyst.

Action

1. Select the **Add New Patient** tab.
2. Type the patient's **Last Name** and **First Name**.
3. If applicable, type the patient's **Middle Name** and Suffix (Jr., Sr., etc.) or Prefix (Mr., Ms., Mrs., etc.).
4. Type the patient's **Date of Birth**.
5. Select the patient’s **Gender**.
6. To have CIRRUS 6000 create a **Patient ID**, click **Generate ID**.
7. To use your own numbering system, type a unique **Patient ID** number. **NOTE! To fit on the page, reports only show the first 23 characters of the patient ID (including spaces).**
8. To save the patient's refractive error, type the diopters for **Spherical Equiv. OD** and **Spherical Equiv. OS**.
9. To add comments to the patient's record, click **More**, type the comments, and click **Done**.
10. To apply categories to the new patient, select the **Add/ Remove Categories** tab and choose the applicable categories. For more information about categories, see: Managing Patient Categories [▸ 109].
11. Click **Save**.
12. To add another new patient, click **New Patient**.
13. Click **Close**.

7.2.5 Viewing Today's Patients

The **View Today's Patients** tab lists:

- Patients added today (Adding a Patient [▸ 135])
- Patients that were scanned earlier today
- DICOM patients scheduled for a scan today.

To view today's patients:

Prerequisite

☑ Log in as Operator or Data Analyst.

Action

1. Select the **View Today's Patients** tab.
2. To refresh this list, click **Refresh List**.
   ⇨ Synchronizes with the electronic medical record system and updates the list. Pressing **Refresh List** will update the main patient list after the importing patient data from another CIRRUS 6000.
3. Select a patient's name.
   ⇨ **Current Patient** information appears on the left side of the Toolbar.
4. To acquire a scan for this patient, click **Acquire**.

7.3 Scan Types

CIRRUS™ HD-OCT software provides a variety of scan types for in-depth analysis of ocular features and possible abnormalities. The three categories of scan types are:

- **Posterior Segment Scans**
- **OCT Angiography Scans**
- **Anterior Segment Scans**

Symbols for Scans and Analyses

The following lists include CIRRUS™ HD-OCT scans and analyses using the following symbols:

⊕ *Indicates optional features; license may be required.*

Requires (or best with) image of both eyes.

Requires (or best with) both **Macular Cube** and **Optic Disc Cube** images.

Macular

Scan Pattern	Scan	Analyses
	512 x 128 200 x 200	■ Macular Thickness ■ Macular Thickness OU ■ Macular Change ■ Advanced RPE ■ Wellness Exam

Scan Pattern	Scan	Analyses
		■ Panomap ■ Advanced Visualization ■ En Face ■ 3D Visualization ■ Ganglion Cell OU ■ Ganglion Cell Guided Progression ■ Single Eye Summary

Table 24: Macular Cube Scans

Optic Disc

Scan Pattern	Scan	Analyses
	200 x 200	■ ONH/RNFL OU ■ Guided Progression Analysis ■ Advanced Visualization ■ En Face ■ 3D Visualization ■ Wellness Exam ■ Panomap ■ Single Eye Summary

Table 25: Optic Disc Cube Scans

HD Raster (Including Smart Scans)

Scan Pattern	Scan	Analyses
	HD 1 Line 100X	High Definition Images
	HD 5 Line	
	HD Radial	
	HD 21 Line	

Scan Pattern	Scan	Analyses
	HD Cross	

Table 26: HD Raster Scans (Includes Smart HD Scans)

AngioPlex

Scan Pattern	Scan	Analyses
	3mm x 3mm ⊕	■ Angiography ■ Angiography Two Visit Comparison ■ En Face
	HD 6mm x 6mm ⊕ 6mm x 6mm ⊕	
	HD 8mm x 8mm ⊕ 8mm x 8mm ⊕	
	12mm x 12mm ⊕	

Table 27: Angiography Scans

AngioPlex Montage

Scan Pattern	Scan	Analyses
	6mm x 6mm ⊕	Montage Angiography
	8mm x 8mm ⊕	

Table 28: AngioPlex Montage Scans

Many anterior segment scans are optional (see: About Licenses [▸ 63]).

Scan Pattern	External Lens	Scan	Analysis
Anterior Segment Scans			
	-	Anterior Segment Cube	■ Anterior Segment Analysis ■ 3D Visualization
	-	Anterior Segment 5 Line Raster	High Definition Images
	-	HD Angle	HD Angle Analysis
		Anterior Chamber ⊕	Anterior Chamber Analysis
		Wide Angle-to-Angle ⊕	Wide Angle-to-Angle Analysis
		HD Cornea ⊕	HD Cornea Analysis
		Pachymetry ⊕	Pachymetry Analysis

Table 29: Anterior Segment Scans

7.4 Acquire Posterior Segment Overview

Figure 15: Acquire Screen

#	Symbol	Name	Explanation
1		Protocols	Selects a protocol (see: About Protocols [▶ 147]).
2		Scan Selector	Selects OD scan type.
3			Selects OS scan type.
4		Iris Viewport	Displays the live image of the iris.
		Pupil Target	Indicates the pupil center alignment.
		Brightness and Contrast	Opens brightness and contrast adjustment controls.
		Reset	Resets your adjustments of the iris image.
		Chinrest Controls	Circular controls adjust the patient chinrest up, down, right or left. Left arrow moves chinrest toward patient. Right arrow moves chinrest toward device.

#	Symbol	Name	Explanation
5		B-scans	Displays the live B-scan images.
		Enhance	Button automatically adjusts polarization of the live B-scan images. Arrows adjust polarization manually.
		Center	Button automatically centers the live B-scan images. Arrows adjust centering manually.
6		*Identifies Selected Prior Scan*	Replicates the settings of a prior scan (to compare same scans of the same eye using the same settings).
		Fundus Viewport	Displays the live image and scan pattern.
		Fixation Target	Displays the location of the fixation target.
		Auto Focus	Automatically focuses the live scan.
		Manual focus	Focus slider or arrows adjust focus manually.
		Transparency	Controls the opacity of the overlay.
		Reset Scan Pattern	Returns the scan pattern to its default position.
		Reset Fixation Target	Returns the fixation target to the center.
		EDI	Inverts the OCT signal profile so the strong part of the signal is at the bottom of the B-scan.

#	Symbol	Name	Explanation
7	Optimize	**Optimize**	Automatically centers and enhances the B-scan.
	Capture	**Capture**	Captures the scan.
		FastTrac	Indicates whether FastTrac is on or off.
		Help	Displays tips for acquiring the best scan.
		Track to Prior	Sets tracking to align and track the scan at the same location on the retina as the selected prior scan. **NOTE! Tracking to prior automatically enables FastTrac.**

7.5 Acquisition Workflow

The following workflow represents the typical acquisition capture sequence using CIRRUS™ HD-OCT:

⚠ CAUTION!

Neglecting to prompt the patient to move their head away from the chinrest and sit back on completion of Patient ID or Scanning could result in injury to the patient when the chinrest repositions itself.

- Before you click the **Finish** or **ID Patient** in the Acquire screen, always prompt the patient to sit back and move their head away from the chinrest.

⚠ CAUTION!

Patients who hold on to the instrument before or during tests

risk having their fingers pinched and possibly injured.

- Make sure that the patient is not holding on to the instrument before or during tests.

⚠ WARNING!

Tipping the device may result in injury.

- Do not allow the patient to lean on the device, its parts, or the table as a support to stand up.

Prepare the patient and device

NOTE

You do not need to dilate the patient's eye(s) for scans using this instrument.

Pupil size differences can cause variability in how the OCT beam enters the eye that can influence results for a series of repeated followup scans.

The minimum pupil size for the CIRRUS™ HD-OCT is 2 mm, which can usually be achieved with dimmed lights and without dilation. **For optimal repeatability, image the patient the same way at every visit.**

1. Instruct the patient to sit back.
2. Cleaning and Disinfecting the Chin Cup, Forehead Rest, and Breath Shield [▶ 404]

3. If applicable, Attach External Lens [▶ 183].

4. Select the Patient [▶ 132] (1)

5. Click **Acquire** (2) to open the acquire screen.

6. In the scan list for the eye you want to scan, click the scan type.
7. Ask the patient to place their chin on the left chin cup (marked blue) to scan the right eye or the right chin cup (marked white) to scan the left eye.

Find the pupil and focus the image in the iris viewport

1. Adjust the chinrest height to align the canthus marker with the patient's eye.

2. Click to adjust the brightness, contrast, and illumination. Lowering the illumination may increase pupil size.
3. Align the scan per respective scan guidelines using the screen X-Y and Z controls, keyboard arrow keys, or mouse scroll wheel.

4. Adjust the patient position to find the iris and pupil. **NOTE! For patients with opacities, try clicking slightly off-center of the pupil.**

5. Instruct the patient to fixate on the center of the fixation target. **NOTE! For scans that require an external lens, the fixation target is blurry.**

Make adjustments for optimal fundus and B-scan images NOTE! This applies to only Posterior Segment and Angiography scans.

1. Click **Auto Focus**. Instruct patient to move with the chinrest, fixate on the target and to not blink while this function runs. Adjust manually if necessary (Focus the Fundus Image [▸ 205]). Proper focus can increase the signal for the OCT scans and improve ability to track.
2. Press F9 to toggle between color and grayscale images.
3. Click **Optimize** to center and enhance the B-scan images. Adjust manually if necessary (Manually Center B-Scans [▸ 148] and Manually Enhance B-Scans [▸ 148])
4. For best results, position the B-scan approximately 100 µm below the top of the of the image area before capturing the image.
5. To sharpen the fundus image, mouse over the fundus image and click on the wand that appears in the upper right corner to perform auto brightness and contrast.

For steps specific to a scan acquisition refer to the respective acquisition task:

- Acquire Posterior Segment Scans [▸ 155]
  - Acquire an HD Raster Scan [▸ 166]
- Acquire Anterior Segment Scans [▸ 182]
  - Acquire an Anterior Segment Cube Scan [▸ 191]
  - Acquire a Pachymetry Scan [▸ 203]
  - Acquire a Wide Angle to Angle Scan [▸ 198]
  - Acquire an Anterior Chamber Scan [▸ 188]
  - Acquire an Anterior Segment 5-Line Raster Scan [▸ 194]
  - Acquire an Anterior Segment Cube Scan [▸ 191]
  - Acquire an HD Angle Scan [▸ 196]
  - Acquire an HD Cornea Scan [▸ 201]

Capture the image

1. Instruct patient to open eyes wide just before capture to minimize eyelash interference.
2. On the Acquire screen, click **Capture**.
3. If tracking is on [▸ 150], you can tell the patient to blink naturally during the scan.
4. If tracking is off, remind the patient to avoid blinking and to focus on the target until the capture is completed.
5. During subsequent steps, monitor: 1) the patient's head to ensure they maintain contact with the headrest and, 2) the position of the red scan circle in the pupil to ensure it remains within the pupil.

Review the captured scan, then save or try again.

1. On the Review screen, evaluate the B-scan quality and the Signal Strength (6 or greater). Check that the OCT B-scans are approximately centered in the windows without missing data.
2. If scan quality, position, or eye movements are unacceptable, click Try Again to retake the scan.
3. Click **Save**.

Also see

- Select the Patient [▸ 132]
- Turn FastTrac™ On [▸ 150]
- Check HD Raster Scan Quality [▸ 168]

7.5.1 About Protocols

A **Protocol** is a group of suggested scans for a particular purpose. You can access protocols at the top of any **Acquire** page.

The protocol list only displays scans with an active license for the instrument (see: About Licenses [▸ 63]).

⊕ *Indicates optional features; license may be required.*

The Protocol page lists a patient's scan history, shows what scans are available for each protocol, and allows you to select a protocol for acquisition.

7.5.2 Position the Fixation Target

NOTE

If the image is too close to the upper boundary, it could reflect a mirror image or appear inverted.

▶ Center or adjust the image until the mirror image is eliminated and image inversion is corrected.

CIRRUS™ HD-OCT has fixation target locations. You can select a fixation target for the patient to fix their gaze during scan acquisition. Select a fixation target that makes it easiest to obtain a good-quality scan of the area of interest.

When you click the fundus image, the nearest of the fixation targets is selected.

For the best results, center the area of interest in the live fundus view to scan the deepest part of the bowl of the retina and help keep the image centered vertically.

To select a different fixation target location:

Prerequisite

☑ You are acquiring a scan and have reached this step.

Action

1. Click on the fundus image where you want the fixation target to move (area of interest).

2. Instruct the patient to follow the fixation target and focus their gaze on the target in its new location.

   ⇨ A different area of the retina is centered in the fundus image.

3. To reset the fixation target back to the center, click **Reset Fixation Target** .
4. To adjust the scan pattern to match the fixation target (area of interest), see: Customize Raster Scan Patterns (Drag) [▶ 164].
5. Return to the Acquisition Workflow to capture and save the scan.

7.5.3 Manually Center B-Scans

You can also manually adjust B-scan centering and quality. Center the image first so you can see image enhancements better.

Prerequisite

☑ You are acquiring a scan and want to manually center B-Scans.

Action

1. In the B-Scan panel, locate the control arrows below that adjust **Centering**.

2. To move the B-scan image up, click the **Up** arrow.
3. To move the B-scan image down, click the **Down** arrow.
4. Return to the Acquisition Workflow to capture and save the scan.

7.5.4 Manually Enhance B-Scans

Prerequisite

☑ You are acquiring a scan and want to manually adjust polarization to enhance B-Scans.

Action

1. In the B-Scan panel, locate the control arrows below to adjust **Enhancement**.

2. To increase polarization for the B-scan image, click the **Up** arrow.
3. To decrease polarization for the B-scan image, click the **Down** arrow.
4. Return to the Acquisition Workflow to capture and save the scan.

7.5.5 About FastTrac™

NOTE

FastTrac™ does not work properly for certain anatomical features.

If a patient exhibits any of the following features that impede FastTrac™, turn off FastTrac™ before capturing scans:

- strongly tilted or curved retinas
- high myopia
- media opacities
- small pupils

NOTE

For optic disc scans, *Monitor Z Position* is off.

***Monitor Z Position* setting does not work properly for certain anatomical features:**

If a patient exhibits features that impede alignment of the B-scan, turn off *Monitor Z Position*. These features include:

- high myopia
- posterior staphylomas

Advantages of using **FastTrac™** retinal tracking include:

- **Minimizing effects of eye movements:** FastTrac™ automatically detects a patient's eye movement in real time, then minimizes its effect before you capture a scan.
- **Tracking only if tissue is vertically centered: FastTrac™** monitors whether B-scans are vertically centered and stops tracking if it detects that some or all of the tissue is outside the B-scan window.
- **Faster retakes:** because **FastTrac™** tracks eye motion, retaking a scan only re-captures the areas impacted by movement.
- **More accurate alignment:** by *registering* anatomical features of the eye, CIRRUS™ HD-OCT allows you to repeat a patient's scan precisely (see About Macular Scan Registration [▶ 246]).
- **Faster follow-up scans:** when a patient returns for follow-up visit, CIRRUS™ HD-OCT positions the instrument in the same location as the last scan.
- **Better change analysis:** accurate alignment for a series of scans over time facilitates better accuracy in assessing the progression of pathology.

Some patient anatomy or pathology can inhibit tracking. You can turn off tracking at any time.

Use **FastTrac™** with **Track to Prior** to reuse the FastTrac settings from previous scans.

7.5.5.1 Turn FastTrac™ On

FastTrac™ works best when the fundus image is properly focused, illumination is uniform, and the blood vessels are sharp. While a tracked scan processes, the patient can remain focused on the fixation target and blink normally. Blinking increases tear film, which can improve signal quality.

If **FastTrac™** is interrupted during processing, the progress bar turns red and stops.

Prerequisite

☑ To enable FastTrac™, select **Tools** and enable **Auto Repeat** and **Tracking**.

☑ You are acquiring a scan and reached the step: *turn on FastTrac™*.

Action

1. To turn on FastTrac, click . The button turns green to indicate that FastTrac is on.
2. If the **Capture** button has a red border, **FastTrac™** is not ready.
   Ensure the B-Scans are centered.
3. If illumination is not uniform across the fundus image, ensure that the pupil is centered and the iris and pupil are in focus.
4. If a **FastTrac™** scan does not process successfully, try turning off the **Monitor Z Position** setting.
5. To turn of the **Monitor Z Position** setting, click the **Fine Adjustment** icon (2) and uncheck **Monitor Z Position** .

   ⇨ **Fine Adjustment** opens the **OCT Tomogram** settings.

   ⇨ A **FastTrac™** progress indicator opens after capture. It can take a few moments to complete FastTrac processing. The patient's first scans using **FastTrac™** takes a little longer to process, but subsequent scans are faster and more accurate.
6. If the **OCT image centered** indicator is red, recenter the image and try the scan again.
7. If the **Other factors for tracking OK** indicator is red, check that the iris and fundus image are adjusted properly and try the scan again.
8. To stop a scan during processing, click **Cancel**.

9. When FastTrac is interrupted, the progress bars turn red and processing stops. Click Cancel to return to the Acquire Screen to make adjustments to center the scan, focus the fundus or iris images, or turn off FastTrac for a non-tracked scan.
10. Return to the Acquisition Workflow to capture and save the scan.

Also see

Turn FastTrac™ On or OFF [▶ 106]

7.5.6 About Auto Repeat

NOTE

Auto Repeat only works for scans acquired on a prior day.

When you enable **Auto Repeat**, CIRRUS™ HD-OCT automatically repeats the settings to match the patient's most recent scan.

Advantages of using **Auto Repeat** include:

- You can easily repeat the patient's earlier scans in a folow-up visit.
- The patient can remain in position between scans.

With **Auto Repeat** enabled:

1. Select the patient and the type of scan to acquire.
2. The instrument detects whether the patient already acquired that type of scan for the same eye in a past visit.
3. If the instrument finds one (or more), it selects the most recent scan and matches all of the settings used for that scan.

The instrument:

- Adjusts the ocular lens the same way
- Moves the chinrest into the same place
- Adjusts the scan pattern the same way (if applicable)
- Places the fixation target in the same place
- Adjusts to match all enhancements, positioning, focus, brightness, contrast and illumination settings
- Displays the scan pattern and the fundus image from the prior scan

The date and time of the most recent scan (with its settings reused for this scan) appears on the acquisition screen .

7.5.7 About Track to Prior

If you want to use tracking for a follow-up scan and the prior scan was acquired without FastTrac, you can track using**Track to Prior**.

Track to Prior allows you to select a patient's earlier scan and CIRRUS™ HD-OCT automatically adjusts to the same settings.

If the patient will likely return for the same followup series of scans, set up the initial scans using **Track to Prior**.

CIRRUS™ HD-OCT retains these settings so you can reuse them to capture followup scans more efficiently. You can use this feature for earlier scans that did not have **Track to Prior** turned on, but for optimal results, turn on the feature for the initial scans also.

With **Track to Prior** enabled:

1. Select the patient and the type of scan to acquire.
2. Turn on **Track to Prior** .

3. Select the **Prior Scan** linkand choose the scan to repeat.

The instrument automatically:

- Adjusts the ocular lens the same way
- Moves the chinrest into the same place
- Adjusts the scan pattern the same way (if applicable)
- Places the fixation target in the same place
- Adjusts to match all enhancements, positioning, focus, brightness, contrast and illumination settings
- Displays the scan pattern and the fundus image from the prior scan

Track to Prior ON	Track to Prior OFF

Table 30: **Track to Prior** Settings

7.5.7.1 Track to a Prior Scan

Track to Prior allows you to reuse all the setting from an earlier scan for the same patient (see About Track to Prior [▸ 151]).

To track to a prior scan:

Prerequisite

☑ You are acquiring a scan and reached the step: *track to a prior scan*.

Action

1. Click **Track to Prior** .
   ⇨ The**Track to Prior** icon turns green.
2. To select a prior scan and reuse its settings, click **Please select prior scan** (2).
   ⇨ A scan selection dialog opens.
3. Select the scan you want to repeat.
   ⇨ The instrument moves into place and sets the same adjustments as the prior scan. This process might take a few moments. The fundus image and scan pattern from the prior scan overlay the live fundus image.
4. Align the live fundus view with the fundus overlay from the prior scan.
5. Click on the scan pattern (3) and drag it into position.
6. To view the live fundus image with the fixation target or overlays better, adjust the overlay **Transparency** (4).
7. Return to the Acquisition Workflow to capture and save the scan.

7.6 View Protocols

Access the **Protocols** page to see a list of the patient's prior scans, view which scans are available in each protocol, and select a protocol for acquisition.

To view protocols:

Prerequisite ☑ Logging In as Operator or Data Analyst.

Action

1. Select the Patient [▸ 132].
2. Click **Protocols**.
3. Select a **Protocol** and click **Acquire**.

Result

✓ The **Acquire** screen opens with the protocol scans selected.

7.7 Acquire an Image Protocol

This procedure describes how to use the Protocol feature to filter the scan list for a particular purpose. For instructions on acquiring a scan, refer to acquisition instructions for the type of scan you are acquiring.

The **Protocol** list filters the scans for a particular purpose, but there might be more scans listed than you need to acquire.

To acquire an image protocol:

Action

1. Select the Patient [▸ 132].
2. Prepare the Patient
3. Click **Acquire**.

4. Select a **Protocol**.

   ⇨ The scan lists filters the scans to show only scans for the selected protocol.

5. Acquire the scans you need for analysis (see acquisition instructions for each type of scan).

7.8 Acquire Posterior Segment Scans

Tip: To see details better in high-resolution images, switch to grayscale (see: View Color or Grayscale Image [▶ 367]).

Posterior segment scans provide detailed views of the patient's retinal micro-structure.

- Macular Cube Scans [▶ 156] provide a three-dimensional image of the macula.
- Optic Disc Scans [▶ 160] provide a three-dimensional image of the optic nerve head.
- HD raster scans [▶ 163] offer a variety of different patterns that provide two-dimensional details focused on specific areas or structures.
- Angiography [▶ 170] scans provide visualization and measurement of vascular structures of the retina and choroid.

7.8.1 Macular Cube Scans

Macular scans generate a cube of data through a 6 mm square grid with a central horizontal HD B-scan.

Figure 16: Macular Scan Pattern

The **Macular Cube** scan pattern has a square that indicates the scan area and the lines cross in the center where you align the fovea.

You can also place the yellow circle over the optic disc, and the fovea is centered within 1 mm for most patients.

Tip: If it is difficult to center or see the fovea (extreme edema, cataract, or floaters impede the view), center the circle on the optic disc instead.

You can use macular scans to analyze:

- Macular layer thicknesses
- Macular change
- Ganglions cells / IPL
- RPE elevation details
- A 3-dimensional view of the macula

Scans	Horizontal Lines	A-Scans / Line	Description
200 x 200	200	200	Provides higher resolution vertically, but lower resolution along each horizontal line.
512 x 128	128	512	Provides higher resolution along each horizontal line, but lower resolution vertically.

Table 31: Macular Cube Scans

7.8.1.1 Acquire a Macular Cube Scan

Figure 17: Macular Cube Scan

To acquire a macular cube scan:

Action

1. Select the Patient [▸ 132].
2. Prepare the Patient

3. Under the appropriate eye (OD or OS), select **Macular Cube 512x128** or **Macular Cube 200x200**.

4. Align and Focus the Iris Image [▸ 211].

5. Ask the patient to hold their gaze steady and click **Auto Focus**.
   ⇨ The chinrest moves into place as the CIRRUS 6000 automatically corrects for the patient's refraction error and balances fundus brightness and contrast.

6. To change the position of the scan or fixation target, see: Select an Internal Fixation Target.

7. To manually focus the image, see: Focus the Fundus Image [▸ 205].

8. To manually adjust brightness or contrast, click brightness and contrast adjustment tool.

9. Click **Optimize**.
   ⇨ CIRRUS 6000 automatically centers and optimizes B-Scan settings. You can fine-tune these settings manually.
10. To fine-tune B-Scan image quality and centering, see: Manually Enhance B-Scans [▸ 148].
11. To use automatic eye tracking, Turn FastTrac™ On [▸ 150]. **NOTE! Once you turn FastTrac on, do not make further scan adjustments. If you need to make additional adjustments, turn off FastTrac, make adjustments, and turn FastTrac on again.**
12. Ask the patient to blink, then open their eyes wide.

13. Click **Capture**.
    ⇨ The **Quality Check** screen opens.
14. Check Macular Cube Scan Quality [▸ 158].

7.8.1.2 Check Macular Cube Scan Quality

When you save a macular cube scan, you can add a **Smart HD Scan** for the image. The **Smart HD Scan** you save is the high-definition image that doctors can select when they analyze the scan.

For the **Smart HD Scan** , you can use the fovea location that CIRRUS™ HD-OCT detects automatically or you can select any other cube slice by navigating the cube data (see: Navigate Cube Layers Manually [▸ 223]).

1	Iris Image	2	Signal Strength Fundus Image Rating Tracking Tracked to Prior
3	Fundus Image	4	B-Scan Images
5	Fundus Overlay	6	Fundus Overlay Transparency
7	Try Again	8	Save

To check Macular Cube scan quality:

Prerequisite

☑ Acquire a Macular Cube Scan [▸ 156]

Action

1. Ensure that the target is centered on the pupil.
2. Ensure that light intensity is uniform across the image.
3. To view a full-screen version of an image, double-click on the image.

4. If **FastTrac** is on, ensure that **Tracked during scan** is green (successful) and the **Fundus Image** rating is 6 or higher.
   ⇨ A rating of 6 or higher is needed to reuse the scan settings in the future (see: About Track to Prior [▸ 151]).

5. If this scan is tracked to a prior scan, ensure that it tracked scan successfully. (**Tracked to prior** is marked green.)
6. If the fundus scan has an overlay, adjust the transparency of the overlay.
7. Ensure that the fundus image is sharp and clear with good visibility of the branching blood vessels.
8. Ensure that the color density is the same across the image.
9. Ensure that there are few or no artifacts cast shadows on the OCT scan.
10. Ensure that the scan is complete in all windows (no missing data).

11. If the scan is not acceptable, click **Try Again** and retake the scan.
12. To select a slice for the **Smart HD** scan, navigate through the slices until you find the slice you want to use (see to: Navigate Cube Layers Manually [▸ 223]) and click **Save and Add Smart HD Scan**.

13. To save the scan without an HD image, click **Save**.

7.8.2 Optic Disc Scans

Optic Disc scans capture an image of the ONH. These scans generate a cube of data through a 6 mm square grid with a central horizontal HD B-scan.

The fixation target is offset to center the optic nerve in the scan. Concentric rings shown in the viewport help you align the optic disc.

Figure 18: Optic Disc Scan Pattern

You can use ONH Cube Scans to:

- Measure RNFL thickness
- Observe RNFL progression
- Measure ONH parameters

Optic Disc Cube Scan	Horizontal Lines	A-Scans per Line
200 x 200	200	200

Table 32: ONH Cube Scan

7.8.2.1 Acquire an Optic Disc Cube Scan

NOTE

You can select a different fixation target, but consider using a fixation target near the center.

Optic disc detection works best when the optic disc is close to the center of the image.

To acquire an optic disc cube scan:

Action

1. Select the Patient [▸ 132].
2. Prepare the Patient
3. Under the appropriate eye (OD or OS), select **Optic Disc Cube 200x200** .
4. Align and Focus the Iris Image [▸ 211].

5. Ask the patient to hold their gaze steady and click **Auto Focus**.
   ⇨ The chinrest moves into place as the CIRRUS 6000 automatically corrects for the patient's refraction error and balances fundus brightness and contrast.
6. To manually focus the image, see: Focus the Fundus Image [▸ 205].

7. To change the position of the scan or fixation target, see: Select an Internal Fixation Target.
8. Click **Optimize**.
   ⇨ CIRRUS 6000 automatically centers and optimizes B-Scan settings. You can fine-tune these settings manually.
9. To fine-tune B-Scan image quality and centering, see: Manually Enhance B-Scans [▸ 148].
10. To adjust the brightness or contrast of a b-scan image, see: Edit Images (Hover Over) [▸ 362]

11. To use automatic eye tracking, Turn FastTrac™ On [▸ 150].
    NOTE! Once you turn FastTrac on, do not make further scan adjustments. If you need to make additional adjustments, turn off FastTrac, make adjustments, and turn FastTrac on again.
12. Ask the patient to blink, then open their eyes wide.
13. Click **Capture**.
    ⇨ The **Quality Check** screen opens.

7.8.2.2 Check Optic Disc Cube Scan Quality

To check optic disc scan quality:

Prerequisite

☑ Acquire Data (Scan).

Action

1. Ensure that the target is centered on the pupil.
2. To view a sequence of cube slices as a movie, use the movie controls.

3. Ensure that light intensity is uniform across the image.
4. To view a full-screen version of an image, double-click on the image.
5. Ensure that the fundus image focus is sharp and clear with good visibility of the branching blood vessels and that the lighting is uniform across the image.
6. Ensure that the scan overlaying the Fundus image is centered over the area to be analyzed.
7. Ensure that the scan is complete in all windows (no missing data).
8. If the scan is not acceptable, click **Try Again** and retake the scan.

9. Click **Save**.

7.8.3 HD Raster Scans

Different scan patterns help you spotlight an area of interest. You can reposition, stretch, and rotate patterns to capture the size and shape of the area you want to spotlight.
NOTE! The CIRRUS 6000 raster scans are indicated only for qualitative use and are for visualization only.

Pattern	B-Scans	Adjustments
	HD 5-Line Raster Scan **Averaging per line:** 5 **A-scans per B-scan:** 1024	■ **Length:** 3mm, 6mm or 9mm ■ **Placement:** Any fundus location ■ **Rotation:** -89° to 90° ■ **Spacing:** 0 to 0.4mm (in increments of 0.025 mm)
	HD 1-Line Raster Scan **Averaging per line:** 100 **A-scans:** 1024	■ **Length:** 3mm, 6mm, 9mm or 12mm ■ **Placement:** Any fundus location ■ **Rotation:** -89° to 90°
	HD 21-Line Raster Scan **Averaging per line:** 8 **A-scans:** 1024	■ **Length:** 3mm, 6mm or 9mm ■ **Placement:** Any fundus location ■ **Rotation:** -89° to 90° ■ **Spacing:** 0 to 0.4mm (in increments of 0.025 mm)
	HD Cross (5 horizontal & 5 vertical lines) **Averaging per line:** 8 **A-scans:** 1024	■ **Length:** 3mm or 6mm ■ **Placement:** Any fundus location ■ **Rotation:** -89° to 90° ■ **Spacing:** 0 to 1.5mm (in increments of 0.025 mm) between lines
	HD Radial Scan (12 radial lines) **Averaging per line:** 8 **A-scans:** 1024	■ **Length:** 3mm or 6mm ■ **Placement:** Any fundus location

Table 33: Posterior Segment HD Scan Types and Patterns

7.8.3.1 About Enhanced Depth Imaging

CIRRUS™ HD-OCT optimizes the signal in the top portion of the scan, which is the best option for most types of scans. However; for some types of **Raster Scans**, you might want to optimize a different area of the scan.

Enhanced Depth Imaging (EDI) improves image quality at the bottom of B-scans.

7.8.3.2 Adjusting HD Raster Scan Patterns

Scan patterns overlay the fundus image when you are preparing to acquire a scan. Most types of scans allow you to relocate the scan pattern within the live fundus preview.

Scan patterns help you center or place the scan in the location that obtains the best image of a particular area of interest for the patient's eye.

7.8.3.2.1 Customize Raster Scan Patterns (Drag)

You can rotate, stretch, or shrink scan patterns-- or create a custom scan pattern-- so you acquire the optimal area for each patient's eyes.

	Original	Adjustment Example 1	Adjustment Example 2
Adjust Line Length			
Rotate Scan Pattern			
Adjust Line Spacing			

You can customize scan patterns by dragging, pulling, or rotating the scan pattern that overlays the fundus image. The line length, spacing between lines, and rotation angle displays to show the measurements.

Figure 19: Adjust Scan Pattern Overlaying the Fundus Image

You can also click **Custom** to open the **Custom Scan Pattern** tool and change the measurements numerically.

Adjustments apply to all lines. For example, if you are acquiring a 5-Line raster scan and you rotate the scan pattern, all five lines rotate as a block. You cannot rotate each line independently.

If you increase the distance between lines, the spacing between all lines increases. You cannot change the distance between particular lines of the scan pattern.

To adjust the scan pattern:

Prerequisite

☑ You are acquiring a scan and reached the step: *Customize a Raster Scan Pattern*.

Action

1. Mouse over the scan pattern that overlays the fundus image.
   ⇨ A set of blue adjustment bars and magenta rotation tools for the scan pattern open and the mouse pointer becomes a hand icon.

2. To lengthen the lines, drag a horizontal adjustment bar out.
3. To shorten the lines, drag a horizontal adjustment bar in.
4. To increase the spacing between lines, drag a vertical adjustment bar out.
5. To decrease the spacing between lines, drag a vertical adjustment bar in.
6. To rotate the scan pattern, drag a rotation tool to a different angle.

7. To reset the scan pattern to its original settings, click **Reset Scan Pattern**.
8. Complete the remaining steps of the acquire procedure.

7.8.3.2.2 Customize Raster Scan Patterns (Numeric)

To adjust the scan pattern using the Custom tool:

Prerequisite

☑ You are acquiring a scan and reached the step: *Customize a Raster Scan Pattern*.

1. Click **Custom**.

Action

   ⇨ The **Custom Scan Pattern** tool opens.
2. To rotate the scan pattern: for **Rotation**, type a value between 0 (horizontal) and 360 that corresponds with the rotation angle you want to set.
   Values entered from 91 to 269 are automatically transposed 180 degrees to correspond with scan direction.
3. To change the line length: for **Length**, select the value you want to set.
   ⇨ Depending on the scan, you can select 3, 6, or 9 mm.
4. To change the spacing between lines: for **Spacing**, select an available value.
   ⇨ Depending on the scan, you can select a value between 0.00 and 1.25 mm in increments of 0.025 mm.

5. To reset the scan pattern to its original settings, click **Reset**.

6. Click **Close**.
7. Complete the remaining steps of the acquire procedure.

7.8.3.3 Acquire an HD Raster Scan

NOTE

Make sure that the B-scan images are not too high in the viewport.

- ▶ If a B-scan image is too high, it can reflect a mirror image that makes the image appear inverted.

If this is a followup visit and you want to replicate the settings of an earlier scan, refer to: Repeating a Prior Scan (Track to Prior).

You can switch from a **5-Line HD Raster** scan to a **1-Line HD Raster** scan using the toggle button.

Tip: For HD 5-Line and HD 1-Line scans, position the scan pattern before you toggle between 1-Line and 5-Line.

To acquire an HD raster scan:

Action

1. Select the Patient [▶ 132].
2. Prepare the Patient
3. Choose an **HD Raster** scan pattern (see: About HD Raster Scans).

4. Under the appropriate eye (OD or OS), select **HD 1 Line 100x**, **HD 21 Line**, **HD Radial**, **HD Cross**, or **HD Raster (1 or 5 Line)**.

5. Align and Focus the Iris Image [▶ 211].
6. To adjust the scan pattern, refer to: Adjusting HD Raster Scan Patterns [▶ 164]

7. If you selected **HD Raster (1 or 5 Line)**, click **Toggle** to switch between the 1-Line pattern and the 5-Line pattern.
   ⇨ If you adjust the 1-Line Raster scan pattern, the toggle button becomes disabled.

8. To enable EDI, check EDI.
   ⇨ EDI optimizes the signal in the lower portion of the scan.

9. Ask the patient to hold their gaze steady and click **Auto Focus**.
   ⇨ The chinrest moves into place as the CIRRUS 6000 automatically corrects for the patient's refraction error and balances fundus brightness and contrast.
10. To manually focus the image, see: Focus the Fundus Image [▸ 205].

11. Click **Optimize**.
    ⇨ CIRRUS 6000 automatically centers and optimizes B-Scan settings. You can fine-tune these settings manually.
12. To fine-tune B-Scan image quality and centering, see: Manually Enhance B-Scans [▸ 148].
13. Ensure that the live Iris, Fundus, and B-scan images are all properly focused and aligned.
14. Ask the patient to blink, then open their eyes wide.

15. Click **Capture**.
    ⇨ The **Quality Check** screen opens.
16. Check HD Raster Scan Quality [▸ 168]

7.8.3.4 Check HD Raster Scan Quality

Tip: To see more detail in high-resolution images, switch to black-and-white mode (hover over the image and click the color button:

Figure 20: Quality Check for HD Raster 21-Line

To check HD Raster scan quality:

Prerequisite

☑ Acquire an HD Raster Scan [▸ 166]

1. Ensure that the target is centered on the pupil.
   ⇨ *The green arrow shows the iris target placed over the pupil.*

Action

2. Ensure that the **Signal Strength** is 6 or higher.

3. If **FastTrac** is on, ensure that **Tracked during scan** is green (successful) and the **Fundus Image** rating is 6 or higher.
   ⇨ A rating of 6 or higher is needed to reuse the scan settings in the future (see: About Track to Prior [▸ 151]).

4. Ensure that the fundus image focus is sharp and clear with good visibility of the branching blood vessels and that the lighting is uniform across the image.

   ⇨ *The green arrow shows a good-quality fundus image.*

5. To view a full-screen version of an image, double-click on the image.

6. To adjust the brightness or contrast of the fundus image, hover over the fundus image and select the **Brightness** or **Contrast** tool (see:Edit Images (Hover Over) [▸ 362]).

7. Ensure that the B-scan(s) are centered.

   ⇨ *The green arrows show a centered B-scan.*

8. If the scan is not acceptable, click **Try Again** and retake the scan.

   ⇨ See: Acquire an HD Raster Scan [▸ 166]

9. Click **Save**.

7.9 Acquire AngioPlex Scans

AngioPlex OCT Angiography scans capture high quality images of the retinal and choroidal vasculature.

High-definition (HD) 6x6 mm and 8x8 mm scans provide very high quality images, and the 12x12 mm scan offers the widest field of view in a single scan.

There are three types of **AngioPlex** scans:

- **AngioPlex Macular** scans acquire a cube of data centered on the fovea.
- **AngioPlex ONH** scans acquire a cube of data centered on the optic nerve head.
- **AngioPlex Montage** scans acquire multiple images from different areas and merge them into one larger, combined image.

AngioPlex	AngioPlex ONH	AngioPlex Montage

Table 34: AngioPlex Scans

To image vascular flow, each AngioPlex scans acquire repeated, consecutive B-scans, then compares them. Erythrocyte motion shows areas of contrast changes over time in a particular location, which indicates the location of a vessel.

7.9.1 Acquire an OCT Angiography Scan

NOTE

AngioPlex OCT Angiography is not a substitute for fluorescein angiography.

- ▶ Vascular findings with fluorescein angiography may be absent or poorly defined with OCT angiography.
- ▶ OCT angiography does not feature leakage, staining, and pooling.

For the best results, acquire **OCT Angiography** scans with FastTrac turned **on** (see About FastTrac™ [▶ 214]).

You can choose from the following **OCT Angiography** scan sizes:

- 3x3 mm
- 6x6 mm
- HD 6x6 mm
- 8x8 mm
- HD 8x8 mm
- 12x12 mm

To acquire an OCT angiography cube scan:

Action

1. Select the Patient [▸ 132].
2. Prepare the Patient
3. Scan Types (if needed).
4. Align and Focus the Iris Image [▸ 211].

5. Ask the patient to hold their gaze steady and click **Auto Focus**.
   ⇨ The chinrest moves into place as the CIRRUS 6000 automatically corrects for the patient's refraction error and balances fundus brightness and contrast.
6. To manually focus the image, see: Focus the Fundus Image [▸ 205].

7. To change the position of the scan or fixation target, see: Select an Internal Fixation Target.

8. Click **Optimize**.
   ⇨ CIRRUS 6000 automatically centers and optimizes B-Scan settings. You can fine-tune these settings manually.
   ⇨ **NOTE! Auto-centering moves the OCT B-scan higher in the imaging window to maximize signal strength.**
9. Confirm that the B-scan remains within the imaging window approximately 100 µm below the top of the scan.
   ⇨ If tracking is on, the B-scan might shift upwards.
10. If the B-scan shifts upwards, reposition the B-scan to approximately 100 µm below the top.
11. To fine-tune B-Scan image quality and centering, see: Manually Enhance B-Scans [▸ 208].

12. Turn FastTrac™ On [▸ 216]. **NOTE! Once you turn FastTrac on, you cannot make further scan adjustments. If you need to make additional adjustments, turn off FastTrac, make adjustments, and turn FastTrac on again.**
13. Ask the patient to blink, then open their eyes wide.

14. Click **Capture**.
    ⇨ The **Quality Check** screen opens.
15. Ask the patient to sit back.
16. Check AngioPlex Cube Scan Quality [▸ 172]

7.9.2 Check AngioPlex Cube Scan Quality

To check angiography cube scan quality:

Prerequisite

☑ Acquire an OCT Angiography Scan [▸ 170]

1. Ensure that the target is centered on the pupil.

Action

2. Ensure that the **Signal Strength** is 6 or higher.
3. Ensure that light intensity is uniform across the image.
4. Ensure that the fundus image is sharp and clear with good visibility of the branching blood vessels.
5. If the fundus scan has an overlay, adjust the transparency of the overlay.

6. To adjust the brightness or contrast of the fundus image, hover over the fundus image and select the **Brightness** or **Contrast** tool (see:Edit Images (Hover Over) [▸ 362]).
7. Ensure that there are few or no artifacts cast shadows on the OCT scan.
8. Ensure that there are few or no saccades in the area to be analyzed.
   Saccades appear as discontinuities of the blood vessels (horizontal shifts of the vessel):
9. Ensure that the scan is complete in all windows (no missing data).
10. Scan passes: RPE Acceptance Criteria [▸ 226].
    Retina is not too low in the scan, which impacts sub-RPE slice detection.
11. Scan passes: Signal Quality Acceptance Criteria [▸ 226].
    Signal strength is 6 or higher; shadows and dark spots exhibit floaters or disease.
12. Scan passes: Decorrelation Tails Acceptance Criteria [▸ 227].
    Scan shows accurate motion, no decorrelation tails, no vasculature in the RPE layer, and superficial and deep retinal layers look appropriately different.

13. Scan passes: Segmentation Acceptance Criteria [228].
    Presence or absence of flow appears in layers as appropriate.

14. If the scan is not acceptable, click **Try Again** and retake the scan.

15. Click **Save**.

7.9.3 Acquire AngioPlex Montage Scans

AngioPlex Montage scans take a series of scans of an eye from different positions and fixation locations, then joins them together showing larger area of the retina.

Figure 21: AngioPlex Montage

You can acquire all scans in the sequence or skip of the scans that you do not want to include in the montage.

6 x 6 mm Montage		8 x 8 mm Montage	
	This scan acquires six images at different positions (four different fixation targets) in the following sequence: 1. Superior Nasal (SN) 2. Superior (S) 3. Superior Temporal (ST) 4. Inferior Temporal (IT) 5. Inferior (I) 6. Inferior Nasal (IN)		This scan acquires five images at different positions (five different fixation targets) in the following sequence: 1. Central (C) 2. Superior Nasal (SN) 3. Superior Temporal (ST) 4. Inferior Temporal (IT) 5. Inferior Nasal (IN)

Table 35: **Montage AngioPlex** Scans

7.9.3.1 Acquire Montage Overview

Figure 22: Acquire AngioPlex Montage Overview

#	Symbol	Name	Explanation
1		Protocols	Selects a protocol (see: About Protocols [▸ 147]).
2		Scan Selector	Selects OD scan type.
3			Selects OS scan type.
4		Iris Viewport	Displays the live image of the iris.
		Pupil Target	Indicates the pupil center alignment.
		Brightness and Contrast	Opens brightness and contrast adjustment controls.
		Reset	Resets your adjustments of the iris image.
		Chinrest Controls	Circular controls adjust the patient chinrest up, down, right or left. Left arrow moves chinrest toward patient. Right arrow moves chinrest toward device.

#	Symbol	Name	Explanation
5		B-scans	Displays the live B-scan images.
		Enhance	Button automatically adjusts polarization of the live B-scan images. Arrows adjust polarization manually.
		Center	Button automatically centers the live B-scan images. Arrows adjust centering manually.
6		*Identifies Selected Prior Scan*	Replicates the settings of a prior scan (to compare same scans of the same eye using the same settings).
		Fundus Viewport	Displays the live image and scan pattern.
		Fixation Target	Displays the location of the fixation target.
		Auto Focus	Automatically focuses the live scan.
		Manual focus	Focus slider or arrows adjust focus manually.
		Transparency	Controls the opacity of the overlay.
		Reset Scan Pattern	Returns the scan pattern to its default position.
		Reset Fixation Target	Returns the fixation target to the center.
		EDI	Inverts the OCT signal profile so the strong part of the signal is at the bottom of the B-scan.

#	Symbol	Name	Explanation
7		**Optimize**	Automatically centers and enhances the B-scan.
		Capture	Captures the scan.
		FastTrac	Indicates whether FastTrac is on or off.
		Help	Displays tips for acquiring the best scan.
		Track to Prior	Sets tracking to align and track the scan at the same location on the retina as the selected prior scan. **NOTE! Tracking to prior automatically enables FastTrac.**
8		Scan Positions (6mm x 6mm)	Preset positions for each of the five component scans that are stitched together to create a 14 mm x 10 mm montage.
		Scan Positions (8mm x 8mm)	Preset positions for both component scans that are stitched together to create a 14 mm x 14 mm montage.
		Selected Scan Position	Indicates which scan will be acquired next (outlined in blue).
		Acquired Scan	Indicates which scans were already acquired.
		Scan Not Yet Acquired	Indicates scans they are not yet acquired.
		Retake Scan	Allows you to retake a component scan while acquiring the montage series.
		Done	Ends the montage series before all component scans are acquired.

7.9.3.2 Acquire a Montage AngioPlex Scan

Montage AngioPlex scans increase the Field of View (FOV) by combining scans to form a montage image. Montage images provide high-resolution vascular imaging over a larger region of the retina.

When you acquire a **Montage AngioPlex** scan, you first acquire each component scan in the series, then check the quality of all component scans that make up the montage image at the same time.

To acquire a montage AngioPlex scan:

Action

1. Select the Patient [▸ 132].
2. Prepare the Patient
3. Under the appropriate eye (OD or OS), select **Montage Angiography 8x8 mm** or **Montage Angiography 6x6 mm**.

4. Align and Focus the Iris Image [▸ 211].

5. To change the position of the scan or fixation target, see: Select an Internal Fixation Target.
   ⇨ The fixation target might look blurry or out of fucus.

6. Ask the patient to hold their gaze steady and click **Auto Focus**.
   ⇨ The chinrest moves into place as the CIRRUS 6000 automatically corrects for the patient's refraction error and balances fundus brightness and contrast.
7. To manually focus the image, see: Focus the Fundus Image [▸ 205].

8. Click **Optimize**.
   ⇨ CIRRUS 6000 automatically centers and optimizes B-Scan settings. You can fine-tune these settings manually.
9. To fine-tune B-Scan image quality and centering, see: Manually Enhance B-Scans [▸ 208].

10. To use automatic eye tracking, Turn FastTrac™ On [▸ 216].
    NOTE! Once you turn FastTrac on, do not make further scan adjustments. If you need to make additional adjustments, turn off FastTrac, make adjustments, and turn FastTrac on again.
11. Ask the patient to blink, then open their eyes wide.

12. Click **Capture**.
    ⇨ The instrument advances to the next image in the montage series (outlined in blue).

13. To acquire the next image in the series, repeat steps **5** - **13** above.
14. To select a different image in the series, click on the position of the image you want to capture, (the box becomes outlined in blue) and repeat steps **5** - **13** above.

15. To skip the remaining scans or finish the montage prior to acquiring all scans, click **Done**.
16. After the final scan of the series, ask the patient to sit back.
    ⇨ The **Quality Check** screen opens.
17. Check Montage AngioPlex Scan Quality [▶ 180].

7.9.3.3 Quality Check Screen (Montage)

Figure 23: Angiography Montage Quality Check Overview

#	Symbol	Name	Explanation
1		Iris Image	Displays the iris image.
2		Fundus Image	Displays the fundus image (montage or individual image).
3		Scroll Images	Navigates through the individual images that make up the montage.
		Individual Image Positions	Selects an individual image position: ■ **SN** - Superior Nasal ■ **S** - Superior (Center)

#	Symbol	Name	Explanation
			■ **ST** - Superior Temporal ■ **IN** - Inferior Nasal ■ **I** - Inferior (Center) ■ **IT** - Inferior Temporal
4		Angiography Image	Displays the angiography image (montage or individual image).
5		Selected for retake	Indicates which scan(s) will be retaken.
	Retake selected	**Retake selected**	Returns to the acquire screen to the re-scan the selected image position (without saving).
6	Save All	**Save All**	Saves the montage image and all individual images that make up the montage.
7		**Signal Strength**	Indicates the overall image signal strength.
8		**Fundus Image**	Indicates the overall fundus image signal strength.
9		B-Scan	Displays the B-scan of an individual image
10		Movie Controls	Scrolls through the cube as a movie.
		Movie Slider	Scrolls through the cube movie faster.
11		**Transparency**	Controls the opacity of the overlay.

7.9.3.4 Check Montage AngioPlex Scan Quality

To check Montage AngioPlex scan quality:

Prerequisite

☑ Acquire AngioPlex Montage Scans [▸ 174]

Action

1. Ensure that the target is centered on the pupil.
2. Ensure that the **Signal Strength** is 6 or higher.
3. Ensure that light intensity is uniform across the image.

4. Ensure that the fundus image is sharp and clear with good visibility of the branching blood vessels.
5. If the fundus scan has an overlay, adjust the transparency of the overlay.

6. To adjust the brightness or contrast of the fundus image, hover over the fundus image and select the **Brightness** or **Contrast** tool (see:Edit Images (Hover Over) [▸ 362]).

Figure 24: Saccades

7. Ensure that there are few or no saccades in the area to be analyzed.
   Saccades appear as discontinuities of the blood vessels (horizontal shifts of the vessel):
8. Ensure that the scan is complete in all windows (no missing data).
9. Ensure that the scan passes all acceptance criteria (refer to the *Instructions for Use*).

10. If the scan is not acceptable, click **Try Again** and retake the scan.

11. Click **Save**.

7.10 Acquire Anterior Segment Scans

NOTE

Features described in this section are licensed separately and may not be available in all markets. Contact your local ZEISS distributer about feature availability.

NOTE

Ensure that the patient is not wearing contact lenses for Anterior Segment scans.

Anterior segment measurements are not valid for patients wearing contact lenses.

NOTE

B-scan adjustment works differently for anterior segment scans.

Enhance and **Center** adjustment tools are not available.

- ▶ Adjust the chinrest to center images vertically.
- ▶ Shift + mouse scroll wheel does not bring the scan into the acquisition window.

CIRRUS™ HD-OCT images and measures structures in the anterior segment.

For some anterior segment scans, you must fist attach an external lens (see: Attach External Lens [▶ 183]). There are two different external lenses. Use the correct lens for the type of scan you are acquiring.

When you install an external lens or select an anterior segment scan:

- LSO illumination of the retina turns off
- Iris illumination dims (to avoid causing pupillary constriction)
- The internal lens clicks into position
- The internal fixation target centers
- The patient sees the green fixation target against a black background and with a (blurred) red flashing scan pattern.

CIRRUS™ HD-OCT software corrects the bean scanning geometry and refraction on the corneal surfaces for some anterior scan types. For these scans, you can view the raw image or corrected image during analysis. Corrected scans are:

- Anterior Chamber
- Wide Angle-to-Angle
- HD Cornea
- HD Angle
- Pachymetry

If this is a followup visit and you want to replicate the settings of an earlier scan, refer to: Repeating a Prior Scan (Track to Prior).

Also see

- Anterior Chamber Scans [▸ 187]
- HD Angle Scans [▸ 196]
- Wide Angle to Angle Scans [▸ 198]
- Anterior Segment 5-Line Raster Scans [▸ 194]
- About Licenses [▸ 63]

7.10.1 Attach External Lens

There are two external lenses. Use the appropriate lens for the type of scan.

Scans	Lens	Symbol	Label
■ Anterior Chamber ■ Wide Angle to Angle			ANTERIOR CHAMBER
■ HD Cornea ■ Pachymetry			CORNEA

Table 36: External Lens Identification

To attach an external lens:

Action

1. Install the external lens onto the instrument lens mount.
   ⇨ The instrument detects the lens, adjusts lens position, and displays the scans appropriate for the lens.

7.10.2 Acquire Anterior Segment Overview

For descriptions of the common acquire buttons and features, see: Acquire Posterior Segment Overview [▸ 140]

Figure 25: Acquire Anterior Chamber Scan Overview

#	Symbol	Name	Explanation
1		Protocols	Selects a protocol (see: About Protocols [▸ 147]).
2	Macular Cube 512x128 Optic Disc Cube 200x200 Angiography 3x3 mm Angiography 6x6 mm Angiography 8x8 mm	Scan Selector	Selects OD scan type.
3			Selects OS scan type.
4		Iris Viewport	Displays the live image of the iris.
		Brightness and Contrast	Opens brightness and contrast adjustment controls.
		Reset	Resets your adjustments of the iris image.
		Customize Scan Pattern	For scan patterns that adjust, set numeric values for line length, spaces between lines, etc..
		Chinrest Controls	Circular controls adjust the patient chinrest up, down, right or left. Left arrow moves chinrest toward patient. Right arrow moves chinrest toward device.

#	Symbol	Name	Explanation
5	**B-Scan**		
		B-Scan	Live display of alignment.
6	**Capture**		
	Prior Scan: Please select prior scan	*Identifies Selected Prior Scan*	Replicates the settings of a prior scan (to compare same scans of the same eye using the same settings).
		Capture	Captures the scan.

7.10.3 Anterior Chamber Scans

The **Anterior Chamber** scan generates a wide field, speckle-reduced raster scan of the front of the eye that is higher contrast than the **Anterior Segment 5 Line Raster** scan. It produces 20 B-scans, each comprised of 1024 A-scans.

By allowing the source and mirror images to overlap, the CIRRUS™ HD-OCT shows a scan depth of 5.8mm. **NOTE! In the overlap region (indicated by blue overlay), there is less detail.**

The scan pattern is a single, horizontal line that you can rotate from -89° to 90°. You cannot lengthen or shorten the line or reposition it higher or lower.

You can enhance the image manually before you capture the scan.

Figure 26: Acquire Anterior Chamber Scan

Analysis Considerations

For analysis, CIRRUS™ HD-OCT software adjusts the scan to account for beam scanning geometry and refraction on the corneal surfaces. For accurate results, center the scan on the corneal vertex, which generates a strong central reflection line on the live OCT image. Typically the corneal vertex is just to the nasal side of the pupil center.

Make sure you align the image for an **Anterior Chamber** scan correctly:

Incorrect Alignment	Correct Alignment
Cornea and Iris are too close.	
Cornea and Mirror Cornea are too close.	
Image is not centered.	

Table 37: Aligning the Anterior Chamber Image

The analysis available for this scan is: Analyze Anterior Chamber Scans [▸ 333].

7.10.3.1 Acquire an Anterior Chamber Scan

Prerequisite

☑ Perform the Acquisition Workflow [▸ 142].

Action

1. Attach the **Anterior Chamber** lens (Attach External Lens [▸ 183]).

2. If the anterior chamber is tilted, instruct the patient to shift their gaze slightly (eft or right as needed) until the anterior chamber is horizontal.

3. Use the chinrest controls to center and adjust the image:

   ⇨ Move the chinrest up or down as needed (1).
   ⇨ Move the chinrest right or left as needed (1).
   ⇨ Move the chinrest closer or further away as needed (2).

4. Adjust the image so that the cornea and iris are separated (cornea and iris are not too close or touching).

5. If the mirror image is turned on, align the image:

   ⇨ The cornea and mirror cornea image are separated properly (mirror image is not too close to the cornea).

6. Ask the patient to blink, then open their eyes wide.
7. Click **Capture**.
   ⇨ The **Quality Check** screen opens.
8. Ask the patient to sit back.
9. Check Anterior Segment Cube Scan Quality [▸ 192].

7.10.3.2 Check Anterior Chamber Scan Quality

To check anterior chamber cube scan quality:

Prerequisite

☑ Acquire an Anterior Chamber Scan [▸ 188].

Action

1. Ensure that the target is centered on the pupil.
   ⇨ *The green arrow shows the iris target placed over the pupil.*
2. To view a full-screen version of an image, double-click on the image.
3. If the scan is not acceptable, click **Try Again** and retake the scan.
4. Click **Save**.

7.10.4 Anterior Segment Cube

The live iris image displays the position of the **Anterior Segment Cube 512x128** scan pattern.

When you acquire an anterior cube scan, the cornea appears flat in the display. The instrument focuses the OCT beam onto the anterior segment and scans in an arc to allow the curved cornea to

better fit into the 2 mm scan depth. The cornea appears with the expected curvature during review and analysis. Moved slightly away from center to avoid corneal reflection.

The OCT B-scan images display:

- the horizontal scan lines of the selected cube slice (1).
- the vertical scan lines of the selected cube slice (2).
- the top horizontal cube slice (3) .
- the bottom horizontal cube slice (4) .

Figure 27: Example of incorrect alignment showing corneal reflection causing bright artifact

7.10.4.1 Acquire an Anterior Segment Cube Scan

Action

1. Select the Patient [▸ 132].
2. Prepare the Patient

3. Select the **Anterior Segment Cube 512 x 128** scan for the appropriate eye.
   ⇨ The instrument moves into place.

4. Instruct the patient to lean forward and fixate on the center of the fixation target.
5. Align and Focus the Iris Image [▸ 211].

6. Use the chinrest controls to center and align the cornea. Make sure the cornea is between the gray bars outside the center B-scan.
7. Center the scan between the gray bars in the middle B-scan (slightly off center to avoid corneal reflection).
   ⇨ If the patient's cornea is completely centered, a strong reflection from the anterior cornea can produce unwanted bright artifacts.
   ⇨ A strong vertical central reflection line on the B-scan indicates the scan is centered properly on the corneal vertex.
8. If the corneal reflection causes a bright artifact, adjust the chinrest slightly to offset the image.
9. Ask the patient to blink, then open their eyes wide.

10. Click **Capture**.
    ⇨ The **Quality Check** screen opens.
11. Ask the patient to sit back.
12. Check Anterior Segment Cube Scan Quality [▸ 192].

7.10.4.2 Check Anterior Segment Cube Scan Quality

NOTE

Always check scan quality before saving a scan.

Good quality scans are essential for accurate disease diagnosis.

▶ If you are not sure of the image quality, retake the scan.

A cube pattern with slice navigators below the iris image allows you to sequence through cube slices.

To check anterior chamber cube scan quality:

Prerequisite

☑ Acquire an Anterior Chamber Scan [▸ 188]

Action

1. Ensure that the target is centered on the pupil.
2. To view a full-screen version of an image, double-click on the image.
3. To navigate through the cube data, move the cyan or magenta navigation lines (see: Navigate Cube Layers Manually [▸ 223]).
4. To view a sequence of cube slices as a movie, use the movie controls.

5. If the scan is not acceptable, click **Try Again** and retake the scan.

6. Click **Save**.

7.10.5 Anterior Segment 5-Line Raster Scans

The live iris image displays the position of the five-line scan pattern. You can move or rotate this pattern as needed. The B-scans correspond to the 5 scan lines.

Figure 28: Acquire Anterior Segment 5 Line Raster Scan (Cornea)

7.10.5.1 Acquire an Anterior Segment 5-Line Raster Scan

Prerequisite

☑ Perform the Acquisition Workflow [▸ 142].

Action

1. Select the **Anterior Segment 5-Line Raster** scan for the appropriate eye.

   ⇨ The instrument moves into place.

2. Use the chinrest controls to center and align the cornea. Make sure the cornea is between the gray bars outside the center B-scan.

3. To enhance image contrast and brightness, click **Adjust**.
4. Ask the patient to blink, then open their eyes wide.
5. Click **Capture**.
   ⇨ The **Quality Check** screen opens.
6. Ask the patient to sit back.
7. Check HD Angle Scan Quality [▸ 198].

7.10.5.2 Check Anterior Segment 5-Line Raster Scan Quality

Prerequisite

☑ Acquire an Anterior Segment 5-Line Raster Scan [▸ 194].

Action

1. Ensure that the target is centered on the pupil.
2. To view a full-screen version of an image, double-click on the image.

3. To view a full-screen version of an image, double-click on the image.
4. Ensure that the cornea image is clear and you can see the layers of the cornea.
5. Ensure that light intensity is uniform across the image.
6. Ensure that the patient's eyelashes did not interfere with the image
7. If the scan is not acceptable, click **Try Again** and retake the scan.
8. Click **Save**.

7.10.6 HD Angle Scans

The **HD Angle** scan gives the highest resolution and greatest detail of one iridocorneal angle and provides the most accurate measurements.

Figure 29: Acquire HD Angle Scan

- To view both angles and the iris shape in one image: Wide Angle to Angle Scans [▸ 198].
- To view five slices of the angle in one image: Anterior Segment 5-Line Raster Scans [▸ 194].

7.10.6.1 Acquire an HD Angle Scan

Because there is no visible internal fixation target for the patient to view, the external fixation target can help the patient fixate.

To acquire an HD Angle scan:

Prerequisite

☑ Install and position the external fixation target.

☑ Perform the Acquisition Workflow [▸ 142].

Action

1. Click the edge of the iris where the angle you want to capture is located.

2. Adjust the chinrest controls until the angle (corneoscleral junction) is low in the B-scan viewport and the scan pattern is still in the middle of the iris (vertically).
   ⇨ Center the B-scan in the lower quadrant of the viewport to maximze the view of the cornea.
   ⇨ A strong vertical central reflection line on the B-scan indicates the scan is centered on the corneal vertex.

3. If the angle recess in the B-scan appears shadowed by the sclera, move the scan slightly along the limbus to minimize the effect, or ask the patient to look slightly to the left or right as needed.
4. Ask the patient to blink, then open their eyes wide.
5. Click **Capture**.
   ⇨ The **Quality Check** screen opens.
6. Ask the patient to sit back.
7. Check HD Angle Scan Quality [▸ 198].

Also see

🗎 Align and Focus the Iris Image [▸ 211]

7.10.6.2 Check HD Angle Scan Quality

Prerequisite

☑ Acquire an HD Angle Scan [▸ 196].

Action

1. Ensure that the target is centered on the pupil.
2. To view a full-screen version of an image, double-click on the image.
3. Ensure that the angle, the iris and scleral spur are visible and clear.
4. Ensure that no shadows impede the angle view.
5. If the scan is not acceptable, click **Try Again** and retake the scan.
6. Click **Save**.

7.10.7 Wide Angle to Angle Scans

Wide Angle to Angle scans highlights both 0 and 180 degree iridocorneal angles.

Figure 30: Acquire a Wide Angle to Angle Scan

7.10.7.1 Acquire a Wide Angle to Angle Scan

You can change the rotation of the **Wide Angle to Angle** scan, but you cannot resize or move the scan pattern to a different location on the iris.

Prerequisite

☑ Perform the Acquisition Workflow [▸ 142].

Action

1. Attach the **Anterior Chamber** lens (Attach External Lens [▸ 183]).

2. Select the **Wide Angle to Angle** scan for the left or right eye.
   ⇨ The instrument moves into place.
3. Instruct the patient to lean forward and fixate on the center of the fixation target.
   ⇨ The fixation target might look blurry or out of focus.
4. Click the center of the pupil.
   ⇨ **NOTE! The iris appears slightly out of focus when correctly aligned.**

5. Adjust the chinrest until the anterior plane is straight and the iris is very low in the view.
   ⇨ The green arrow shows proper alignment.
6. If the anterior chamber appears tilted, instruct the patient to shift their gaze slight left or right (as needed) until the anterior chamber appears horizontal.

7. Adjust the chinrest until both iridocorneal angles (1) and iris (2) are visible.
   ⇨ The entire cornea does not appear in the image.
   ⇨ A strong vertical central reflection line on the B-scan indicates the scan is centered on the corneal vertex.
8. To rotate the scan pattern , click and drag the *rotation corner* of the cyan line to rotate that scan pattern into position.
   ⇨ You can adjust the scan pattern from –89 to 90 degrees.
   ⇨ **NOTE! Rotation can reduce the field to 14.0 mm vertically.**
9. Ask the patient to blink, then open their eyes wide.
10. Click **Capture**.
    ⇨ The **Quality Check** screen opens.
11. Ask the patient to sit back.
12. Check Wide Angle to Angle Scan Quality [▸ 200]

7.10.7.2 Check Wide Angle to Angle Scan Quality

NOTE

Always check scan quality before saving a scan.

Good quality scans are essential for accurate disease diagnosis.

▶ If you are not sure of the image quality, retake the scan.

To check wide angle to angle scan quality:

Prerequisite

☑ Acquire a Wide Angle to Angle Scan [▸ 198].

Action

1. Ensure that the target is centered on the pupil.
2. Ensure that both angles are in view.
3. To view a full-screen version of an image, double-click on the image.
4. Ensure that light intensity is uniform across the image.
5. If the scan is not acceptable, click **Try Again** and retake the scan.
6. If the scan is acceptable, click **Save**.

7.10.8 HD Cornea

Figure 31: Acquire HD Cornea Scan

The HD Cornea scan is a straight line across the center of the eye. You can rotate the line to scan the cornea in a different direction.

7.10.8.1 Acquire an HD Cornea Scan

NOTE **This scan does not appear as a selection until you install the external lens.**

When you acquire **HD Cornea** scans, center the live iris image and align the cornea between the guidelines in the B-scan image.

Prerequisite

☑ Perform the Acquisition Workflow [▸ 142].

Action

1. Use the chinrest controls to center and align the cornea between the red guidelines in the B-scan viewport.

2. Ask the patient to blink, then open their eyes wide.
3. Click **Capture**.
   ⇨ The **Quality Check** screen opens.
4. Ask the patient to sit back.
5. Check HD Cornea Scan Quality [▸ 202].

Also see

🗎 About Image Position and Focus [▸ 211]

7.10.8.2 Check HD Cornea Scan Quality

NOTE

Always check scan quality before saving a scan.

Good quality scans are essential for accurate disease diagnosis.

▶ If you are not sure of the image quality, retake the scan.

Prerequisite

☑ Acquire HD Cornea Scans.

Action

1. Ensure that the target is centered on the pupil.

2. Ensure that the corneal image is clear and you can see its layers.
3. Ensure that the posterior and anterior surfaces are well-defined.
4. Ensure that there are no motion artifacts or corneal reflections on the central cornea (especially where measurements are needed).
5. Ensure that light intensity is uniform across the image.
6. Ensure that the patient's eyelashes did not interfere with the image.
7. If the scan is not acceptable, click **Try Again** and retake the scan.
8. Click **Save**.

7.10.9 Pachymetry

Pachymetry scans consist of 24 radial scan lines with a scan depth of 2.0 mm that generate a color-coded thickness map of the cornea. The scan uses 24 B-scans, each composed of 1024 A scans.

Figure 32: Acquire Pachymetry Scan

7.10.9.1 Acquire a Pachymetry Scan

NOTE

This scan does not appear as a selection until you install the external lens.

CIRRUS™ HD-OCT automatically corrects **Pachymetry** scans for beam scan geometry and refraction on the corneal surfaces. These corrections work best when the corneal vertex is properly centered between the two red guidelines in the **Temporal / Nasal** B-Scan.

Figure 33: Temporal / Nasal B-scan

Prerequisite

☑ Perform the Acquisition Workflow [▸ 142].

☑ The patient is not wearing contact lenses.

☑ The patient's eyelashes are not impeding the images.

Action

1. Instruct the patient to lean forward and fixate on the center of the fixation target.

   ⇨ The fixation target might look blurry or out of focus.

2. Use the arrow keys to adjust the **Superior / Inferior** B-scan until you see the corneal reflex in the **Temporal- Nasal** B-scan.

3. To make fine adjustments, click **Ctrl** + arrow keys.
4. To adjust the brightness or contrast of a b-scan image, see: Edit Images (Hover Over) [▸ 362]
5. To enhance image contrast and brightness, click **Adjust**.
6. Ask the patient to blink, then open their eyes wide.
7. Click **Capture**.
   ⇨ The **Quality Check** screen opens.
8. Ask the patient to sit back.
9. Check Pachymetry Scan Quality [▸ 204].

7.10.9.2 Check Pachymetry Scan Quality

NOTE

Always check scan quality before saving a scan.

Good quality scans are essential for accurate disease diagnosis.

▶ If you are not sure of the image quality, retake the scan.

Pachymetry scans do not show signal strength to indicate scan quality. Instead, an **Image Quality** indicator detects whether the scan quality is acceptable.

Acceptable Image	Low Quality Image Detected
Green	**Yellow**

Table 38: Pachymetry Image Quality Indicator

CIRRUS™ HD-OCT **Image Quality** indicator detects:

- Poor scan quality:
  - Patient blinked or partially blinked
  - Patient eyelid or eyelash interference

  - Scan contrast too low
- Scan not centered:
  - Scan misaligned
  - Scan not centered
- Excessive motion during scan

To check Pachymetry scan quality:

Prerequisite

☑ Acquire a Pachymetry Scan [▸ 203].

Action

1. Click on the iris image and use the mouse scroll wheel to select a radial scan line.

2. To view a full-screen version of an image, double-click on the image.
3. Check the image quality for each line.
4. To view the series of lines using the B-scans, click on the B-scan and use mouse scrolling to view the lines.

5. To view a sequence of the radial scan lines, use the movie controls.

6. If **Image Quality** is green, click **Save**.
7. If **Image Quality** is yellow, click **Try Again** and ensure that the lens is clean (see: Cleaning Optical Components [▸ 402]) , the scan is properly centered, and retake the scan: Acquire a Pachymetry Scan [▸ 203].

7.11 Acquisition Concepts, Tasks and Tools

7.11.1 Focus the Fundus Image

Tip: If a patient has floaters that obscure parts of the scan, ask the patient to shift their eyes several times prior to the scan to move floaters.

The fundus image is properly focused when the image is sharp and clear and the branching blood vessels are visible.

Macular cube scans have an alignment tool that you can place over the optic disc to help position followup scans more accurately--especially when a patient's fovea is difficult to locate.

For optic disc scans, the alignment tool is turned on and centered on the scan pattern.

Tip: If the patient's record includes their refractive error, Auto Focus adjusts accordingly-focusing the fixation target and optimizing fundus image brightness.

Auto Focus

Auto Focus automatically optimizes several settings:

- Adjusts focus to compensate for the patient’s refractive error
- Adjusts fundus image brightness and contrast

If the patient's refractive error is not saved in their record, you can help the patient see the fixation target more clearly by manually setting the correction.

Tip: If a patient has corneal opacities, realign the pupil to minimize effects.

For patients with unsteady fixation you can also set **Rapid Refresh View**.

To focus the fundus image:

Prerequisite

☑ You are acquiring a scan and reached the step: *Focus the Fundus Image*.

1. Click **Auto Focus** and ask the patient to hold their gaze and head steady while the instrument moves into place.

Action

2. Ensure that the iris target is still centered on the pupil.

3. If the patient cannot see the fixation target clearly, click the left arrow to compensate for myopic corrections or the right arrow to compensate for hyperopic corrections.
4. If the fundus image is not sharp and clear, manually adjust the focus.
5. Ensure the fundus is illuminated uniformly (no dark corners on the overlay).

6. If the fundus image is too dark, click **Fine Adjustment**.
   ⇨ The **Fundus Image** adjustment tool opens.

7. Click **Auto B/C**.
8. If needed, manually adjust image brightness and contrast sliders separately.
9. Click **Close**.

10. To discard your adjustments and return to the default settings, click **Reset**.

11. To increase the screen refresh rate, right-click on the image and select **Rapid Refresh View**.
12. Complete the remaining steps of the acquire procedure.

7.11.2 Adjusting B-Scan Images

For **Posterior Segment** scans and **Angiography** scans, an **Optimize** button automatically adjusts the B-scan(s) as follows:

1. Centers the image.
2. moves the B-scan higher to maximize signal strength. (Angiography Cube only)
3. Optimizes image quality (polarization).

7.11.2.1 Automatically Optimize B-Scans

NOTE

If tracking is turned on, the B-scan may shift upwards.

▶ If necessary, move the B-scan image down manually.

Tip: Press F9 to toggle between color and grayscale images.

For best results, position the B-scan approximately 100 µm below the top of the of the image area before capturing the image.

To adjust B-scans automatically:

Action

1. Instruct the patient to hold their gaze steady and do not blink.
2. Click **Optimize**.
   ⇨ The B-scan images are centered and polarization is optimized.
   ⇨
3. Confirm that the B-scan is:
   Visible in the imaging window
   Approximately 100 µm below the top of the scan.
4. To adjust image centering and polarization manually, refer to: Manually Enhance B-Scans [▶ 208].
5. Complete the remaining steps of the acquire procedure.

7.11.2.2 Manually Center B-Scans

Tip: Center the image first so you can see image enhancements better.

Optimize automatically centers the B-scan image, then optimizes image quality (polarization). You can also manually adjust B-scan centering and quality.

To manually center B-scans:

Prerequisite

☑ You are acquiring a scan and reached the step: *Manually Center or Enhance B-Scans*.

Action

1. In the B-Scan panel, locate the control arrows that adjust **Centering**.
2. To move the B-scan image up, click the **Up** arrow.
3. To move the B-scan image down, click the **Down** arrow.
4. Complete the remaining steps of the acquire procedure.

7.11.2.3 Manually Enhance B-Scans

Optimize automatically centers the B-scan image, then optimizes image quality (polarization). You can also manually adjust B-scan centering and quality.

To manually enhance B-scans:

Prerequisite

☑ You are acquiring a scan and reached the step: *Manually Center or Enhance B-Scans*.

Action

1. In the B-Scan panel, locate the control arrows to adjust **Enhancement**.
2. To increase polarization for the B-scan image, click the **Up** arrow.
3. To decrease polarization for the B-scan image, click the **Down** arrow.
4. Complete the remaining steps of the acquire procedure.

7.11.3 About Fixation Targets

CIRRUS 6000 has 21 fixation target locations. You can select a fixation target for the patient to fix their gaze during scan acquisition. Select a fixation target that makes it easiest to obtain a good-quality scan of the area of interest.

When you click on the fundus image, the nearest of the 21 fixation targets is selected.

Figure 34: Fixation Targets

7.11.3.1 Position the Fixation Target

NOTE

If the image is too close to the upper boundary, it could reflect a mirror image or appear inverted.

▶ Center or adjust the image until the mirror image is eliminated and image inversion is corrected.

Tip: Center the area of interest to scan the deepest part of the bowl of the retina and help keep the image centered vertically.

For the best results, center the area of interest in the live fundus view. You might need to:

- Select a different fixation target to redirect the patient's gaze.
- Move or rotate the scan pattern closer to the area of interest.

To select a different fixation target location:

Prerequisite

☑ You are acquiring a scan and reached the step: *Position the Fixation Target*.

Action

1. Click on the fundus image where you want the fixation target to move (area of interest).
2. Instruct the patient to follow the fixation target and focus their gaze on the target in its new location.
   ⇨ A different area of the retina is centered in the fundus image.

3. To reset the fixation target back to the center, click **Reset Fixation Target**.
4. To adjust the scan pattern to match the fixation target (area of interest), see: Customize Raster Scan Patterns (Drag) [▶ 164].
5. Complete the remaining steps of the acquire procedure.

7.11.4 About Scan Patterns

Scan patterns overlay the fundus image when you are preparing to acquire a scan. Most types of scans allow you to relocate the scan pattern within the live fundus preview.

Scan patterns help you center or place the scan in the location that obtains the best image of a particular area of interest for the patient's eye.

7.11.4.1 Position the Scan Pattern

If you want to capture a different area of the retina, you can move the scan pattern to acquire the optimal area for a patient's eye.

To move the scan pattern:

Prerequisite

☑ You are acquiring a scan and reached the step: *Reposition the Scan Pattern*.

Action

1. Mouse over the scan pattern that overlays the fundus image.
   ⇨ The mouse pointer becomes a finger pointing icon.
2. Click on the scan pattern and drag it to the location you want to capture.

3. To reset the scan pattern (and all other adjustments), click **Reset**.
4. Complete the remaining steps of the acquire procedure.

7.11.5 About Image Position and Focus

Once the patient's eye is aligned with the alignment mark on the instrument, use the chinrest controls to center and focus the iris image and B-scan images as needed. You might need to make a few adjustments before the image is both aligned and focused properly. The following table explains how the controls move the chinrest.

Buttons	Chinrest Movement	
	1	Moves chinrest up.
	2	Moves chinrest down.
	3	Moves chinrest left.
	4	Moves chinrest right.
	5	Moves chinrest up and to the left.
	6	Moves chinrest up and to the right.
	7	Moves chinrest down and to the left.
	8	Moves chinrest down and to the right.
	9	Moves chinrest away from the acquisition head.
	10	Moves chinrest toward the acquisition head.

Table 39: Chinrest Adjustments (Image Centering)

7.11.5.1 Align and Focus the Iris Image

Tip: For patients with opacities, try clicking slightly off-center of the pupil.

Proper alignment of the patient eye to the external marker is crucial to obtaining a good quality scan.

Improper Alignment	Proper Alignment
Eye **is not** aligned with the instrument marker.	Eye **is** aligned with the instrument marker.

Table 40: Alignment

To align the iris image:

Prerequisite

☑ You are acquiring a scan and reached the step: *Align the Iris*.

Action

1. Ensure that the patient's eye aligns with the marker on the CIRRUS™ HD-OCT external surface.

2. Click on the center of the pupil (1).
   ⇨ The red target appears over the center of the pupil and chinrest automatically moves into position to center the iris in the viewport.

NOTE

If you reposition the iris manually, the chinrest moves as you make adjustments.

▶ Instruct the patient to:

⇨ Keep their chin down

⇨ Keep their teeth together

⇨ Place their forehead against the forehead rest

⇨ Move along with the chinrest

3. To adjust the image position manually, click on center of the pupil again (1) and move the chinrest controls (2) up, down, right, and left as needed to position the iris in the viewport.

4. Focus the iris image by moving the chinrest forward or back as needed (3).

5. To reset the chinrest position, click **Reset** (4).

6. Click **Brightness / Contrast** (5).
   ⇨ The adjustment panel opens.
7. To increase contrast, slide the contrast adjustment (6) up.
8. To decrease contrast, slide the contrast adjustment (6) down.
9. To brighten the image, slide the brightness adjustment (7) up.
10. To dim the image, slide the brightness adjustment (7) down.

11. To restore the default contrast and brightness, click **Reset** (8).
12. Complete the remaining steps of the acquire procedure.

7.11.6 About Auto Repeat

NOTE

Auto Repeat only works for scans acquired on a prior day.

When you enable **Auto Repeat**, CIRRUS™ HD-OCT automatically repeats the settings to match the patient's most recent scan.

Advantages of using **Auto Repeat** include:

- You can easily repeat the patient's earlier scans in a folow-up visit.
- The patient can remain in position between scans.

With **Auto Repeat** enabled:

1. Select the patient and the type of scan to acquire.
2. The instrument detects whether the patient already acquired that type of scan for the same eye in a past visit.
3. If the instrument finds one (or more), it selects the most recent scan and matches all of the settings used for that scan.

The instrument:

- Adjusts the ocular lens the same way
- Moves the chinrest into the same place
- Adjusts the scan pattern the same way (if applicable)
- Places the fixation target in the same place
- Adjusts to match all enhancements, positioning, focus, brightness, contrast and illumination settings
- Displays the scan pattern and the fundus image from the prior scan

The date and time of the most recent scan (with its settings reused for this scan) appears on the acquisition screen .

7.11.7 About FastTrac™

NOTE

FastTrac™ does not work properly for certain anatomical features.

If a patient exhibits features that impede FastTrac™, turn off FastTrac™ before capturing a scans. These features include:

- ▶ strongly tilted or curved retinas
- ▶ high myopia
- ▶ media opacities
- ▶ small pupils

NOTE

For optic disc scans, *Monitor Z Position* is off.

***Monitor Z Position* setting does not work properly for certain anatomical features:**

If a patient exhibits features that impede alignment of the B-scan, turn off *Monitor Z Position*. These features include:

- high myopia
- posterior staphylomas

CIRRUS™ HD-OCT FastTrac™ improves scans by:

- **Minimizing effects of eye movements:** FastTrac™ automatically detects a patient's eye movement in real time, then minimizes its effect before you capture a scan.
- **Tracking only if tissue is vertically centered: FastTrac™** monitors whether B-scans are vertically centered and stops tracking if it detects that some or all of the tissue is outside the B-scan window.

The patient's first scans using **FastTrac™** takes a little longer to process, but subsequent scans are faster and more accurate (see Turn FastTrac™ On or OFF [▶ 106] and Turn FastTrac™ On [▶ 216]).

Advantages of using **FastTrac™** retinal tracking include:

- **Faster retakes:** because **FastTrac™** tracks eye motion, retaking a scan only re-captures the areas impacted by movement.
- **More accurate alignment:** by *registering* anatomical features of the eye, CIRRUS™ HD-OCT allows you to repeat a patient's scan precisely (see About Macular Scan Registration [▶ 246]).
- **Faster follow-up scans:** when a patient returns for follow-up visit, CIRRUS™ HD-OCT positions the instrument in the same location as the last scan.
- **Better change analysis:** accurate alignment for a series of scans over time facilitates better accuracy in assessing the progression of pathology.

Some patient anatomy or pathology can inhibit tracking. When tracking is on, you can turn it off for a particular scan (as needed). When acquiring a scan, click green tracking to button turn tracking off (the button becomes gray).

FastTrac™ Enabled	FastTrac™ Turned ON	FastTrac™ Turned OFF
 Auto Repeat and **Tracking** are checked.		

Table 41: **FastTrac™** Settings

You can further simplify re-taking a series of scans for a patient when you use **FastTrac™** with **Track to Prior** to create a series of matched images over time (see About Track to Prior [▸ 217]).

7.11.7.1 Turn FastTrac™ On

FastTrac™ works best with when the fundus image is properly focused, illumination is uniform, and the blood vessels are sharp. While a tracked scan processes, the patient can remain focused on the fixation target and blink normally. Blinking increases tear film, which can improve signal quality.

If **FastTrac™** is interrupted during processing, the progress bar turns red and stops.

To turn FastTrac™ on:

Prerequisite

☑ **FastTrac™** is enabled (Turn FastTrac™ On or OFF [▸ 106]).

☑ You are acquiring a scan and reached the step: *turn on FastTrac™*.

Action

1. Click **FastTrac™** (1) .
2. If the **Capture** button has a red border, **FastTrac™** is not ready.
   Ensure the B-Scans are centered.

3. If illumination is not uniform across the fundus image, ensure that the pupil is centered and the iris and pupil are in focus.
4. If a **FastTrac™** scan does not process successfully, try turning off the **Monitor Z Position** setting.

5. To turn of the **Monitor Z Position** setting, click the **Fine Adjustment** icon (2) and uncheck **Monitor Z Position** .
   ⇨ **Fine Adjustment** opens the **OCT Tomogram** settings.

   ⇨ A **FastTrac™** progress indicator opens after capture. It can take a few moments to complete FastTrac processingl
6. If the **OCT image centered** indicator is red, recenter the image and try the scan again.
7. If the **Other factors for tracking OK** indicator is red, check that the iris and fundus image are adjusted properly and try the scan again.
8. To stop a scan during processing, click **Cancel**.
9. Complete the remaining steps of the acquire procedure.

To turn FastTrac™ off:

Prerequisite

☑ FastTrac™ is enabled (Turn FastTrac™ On or OFF [▸ 106]).

☑ You are acquiring a scan and reached the step: *turn off FastTrac™*.

Action

1. Click FastTrac.
   ⇨ The icon turns gray.
2. Complete the remaining steps of the acquire procedure.

7.11.8 About Track to Prior

If you want to use tracking for a follow-up scan and the prior scan was acquired without FastTrac, you can track using**Track to Prior**.

Track to Prior allows you to select a patient's earlier scan and CIRRUS™ HD-OCT automatically adjusts to the same settings.

If the patient will likely return for the same followup series of scans, set up the initial scans using **Track to Prior**.

CIRRUS™ HD-OCT retains these settings so you can reuse them to capture followup scans more efficiently. You can use this feature for earlier scans that did not have **Track to Prior** turned on, but for optimal results, turn on the feature for the initial scans also.

With **Track to Prior** enabled:

1. Select the patient and the type of scan to acquire.
2. Turn on **Track to Prior**.

3. Select the **Prior Scan** linkand choose the scan to repeat.

The instrument automatically:

- Adjusts the ocular lens the same way
- Moves the chinrest into the same place
- Adjusts the scan pattern the same way (if applicable)
- Places the fixation target in the same place
- Adjusts to match all enhancements, positioning, focus, brightness, contrast and illumination settings
- Displays the scan pattern and the fundus image from the prior scan

Track to Prior ON	Track to Prior OFF

Table 42: **Track to Prior** Settings

7.11.8.1 Track to a Prior Scan

Track to Prior allows you to reuse all the setting from an earlier scan for the same patient (see About Track to Prior [▸ 217]).

To track to a prior scan:

Prerequisite

☑ You are acquiring a scan and reached the step: *track to a prior scan*.

Action

1. Click **Track to Prior** (1) .
   ⇨ The**Track to Prior** icon turns green.
2. To select a prior scan to reuse its settings, click **Please select prior scan** (2).
   ⇨ A scan selection dialog opens.
3. Choose the scan you want to repeat and click.
   ⇨ The instrument moves into place and sets the same adjustments as the prior scan. This process might take a few moments. The fundus image and scan pattern from the prior scan overlay the live fundus image.
4. Align the live fundus view with the fundus overlay from the prior scan.
5. Click on the scan pattern (3) and drag it into position.
6. To view the live fundus image with the fixation target or overlays better, adjust the overlay **Transparency** (4).
7. Complete the remaining steps of the acquire procedure.

7.11.9 About Cube Scans

Cube scans stack and align consecutive axial-scans (A-scans) side by side to produce a two-dimensional B-scan. Consecutive B-scans align to produce a 3D cross-section of the retina.

1	En Face Scan Plane	**Yellow box** indicates the scan area.	
		Click and drag **cyan or magenta triangle** to move through the scan slices.	
		The number beside the line indicates which slice of the cube is in view.	

2	Slow B-Scan Plane	Reformatted, vertically parallel A-scans acquired in successive line scans. These slices are acquired more slowly; one per line of horizontal A-scans.	
3	Fast B-Scan Plane	Slices parallel to the front of the cube; each line of A-scans is acquired quickly .	

You can quickly navigate through the slices of either plane. Simply move the corresponding line displayed on the fundus image and the B-scan image moves accordingly. The slice number helps you know which area of the cube is selected.

CIRRUS™ HD-OCT displays scan images as follows:

- Horizontal scans:
  - left of scan equals the left of scan display
  - right of scan equals right of scan display
- Vertical scans
  - bottom of scan equals left of scan display
  - top of scan equals right of scan display
- Diagonal scans in 5 Line Raster
  - left takes precedence over bottom
  - left of scan equals left of scan display
  - right of scan equals right of scan display

Cube Analysis

Because cube scans contain this volume of information, there is are additional types of analyses available only for cube scans:

Analysis	Description
3D Visualization	Shows a 3-dimensional image of the data. You can navigate through the 3D slices, adjust settings, and animate a series to save as a movie (see: 3D Visualization Analysis [▸ 289]).

Analysis	Description
En Face 	
Advanced Visualization	

Analysis	Description

Table 43: Additional Visual Cube Scans

7.11.9.1 Navigate Cube Layers Manually

To ensure that the image shows the area of interest clearly for analysis, you can scroll through the B-scans to check individual layers to make sure the area is captured in the image.

By dragging the layer line to each area of interest, you can quickly scan the cube layers.

Tip: You can also navigate through layers by clicking the B-scan you want to navigate and scrolling the mouse.

Prerequisite

☑ You are acquiring, checking quality or analyzing a scan and reach the step: *navigate cube data*.

Action

1. Click on the magenta triangle and move the line to the right or left to view different slices.
2. Click on the cyan triangle and move the line up or down to view different slices.
3. Complete the remaining steps of the acquire procedure.

7.11.9.2 Navigate Through Cube Slices as a Movie

Action

1. Use to view a movie of the fast B-scans or sequence through them one image at a time.

   ⇨

2. Complete the remaining steps of the acquire procedure.

   ⇨

You can view the scan as a movie that begins at the top of the B-Scan slice and moves down through the tissue in 51 µm increments. You can stop the movie, reverse or advance the movie frame by frame.

NOTE! The default frame rate for scan movies is 51 µm/sec.

To view the image as a movie:

Prerequisite

☑ You reach the scan analysis step: *Edit an Image*.

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. Click **Play Movie**.

   ⇨ The movie controls open.

2. To start the movie, click the **play button (1)**.
3. To stop the movie, click the **pause button (2)**.
4. To move backward one frame, click the **previous button (3)**.
5. To move forward one frame, click the **next button (4)**.
6. To decrease movie speed, move the slider toward **Slow (5)**.
7. To increase movie speed, move the slider toward **Fast (6)**.
8. To close the movie controls, click **Close (7)**.
9. Complete the remaining steps of the acquire procedure.

7.12 Scan Acquisition Acceptance Criteria

7.12.1 Acceptance Criteria

FastTrac minimizes, but does not completely eliminate, the possibility of saccades.

For cube scans, the operator should review the OCT fundus image to ensure there are minimal saccades and no saccades through the area of interest (macula, for example).

A saccade can be detected by discontinuities in the appearance of the blood vessels (for example, a horizontal shift of the vessel at a specific location). Example: Saccades During the course of a scan with FastTrac, the individual B-scans in a cube may be acquired at different positions in the Z-direction (for example, tissue varies in vertical position in the B-Scan window from B-Scan to B-Scan).

CIRRUS corrects for this motion when assembling the data for analysis. However, the OCT fundus image can have artifacts from gradations in the intensity of each B-Scan.

These gradations appear as horizontal lines or bands in the OCT fundus image, as shown in the OCT fundus image banding example below. As long as there are no saccades, scans with OCT fundus images like these should be acceptable for analysis and the operator is advised to save them.

Consider all these possibilities before accepting OCT Angiography scans for further analysis.

Also see

- Signal Quality Acceptance Criteria [▸ 226]
- Decorrelation Tails Acceptance Criteria [▸ 227]
- Segmentation Acceptance Criteria [▸ 228]

RPE Acceptance Criteria [▶ 226]

7.12.1.1 RPE Acceptance Criteria

Test	Pass	Fail	Explanation
Retina Position	Retina is in an appropriate position in the scan	Retina is too low in the scan Example of retina position too low: .	If the retinal tissue is captured too low in the axial FOV of the scan, there will not be enough contrast to detect sub-RPE illumination.

Table 44: RPE Acceptance

7.12.1.2 Signal Quality Acceptance Criteria

CIRRUS 6000 OCT Angiography (AngioPLEX™) is more sensitive to signal quality than structural OCT imaging.

Test	Pass	Fail	Explanation
Signal Strength	6 or higher	Less than 5	Low signal strength causes poor scan quality and can affect interpretation of the images.
Shadows	Shadows exhibit floaters or disease ■ **Floater**: dark area appears in different locations in multiple scans (compare the flow en face and structural en face image). ■ **Possible disease**: Angiography image is dark, but the B-scan and the structural en face image are normal.	Dark spots, dark or blurry scans	OCT Angiography sensitivity sometimes show dark spots resulting from poor local signal, not capillary dropout. Poor signal quality appears throughout the image; the B-scan also looks dark or blurry.

Table 45: Signal Quality Acceptance

Enface Flow Image	Enface Structural Image	B-Scan	Explanation
			■ Blue arrow shows a floater ■ Red arrow shows possible impaired capillary flow: – Good signal in the structural en face and the B-scan

Enface Flow Image	Enface Structural Image	B-Scan	Explanation
			– B-scan and en face images show a decreased signal in the same area

Table 46: Example: Signal Criteria Example: Angio 6mmx6mm

7.12.1.3 Decorrelation Tails Acceptance Criteria

Bright shadows of more superficial vessels that appear in posterior layers are decorrelation tails. Decorrelation tails result from light that passes through moving blood cells and returns to be detected. **NOTE! Artifacts such as decorrelation tails cause false signals in layers posterior to vessels.**

Test	Pass	Fail	Explanation
Bright	No Decorrelation Tails; signal detected shows accurate motion. ■ **DRL** has a different characteristic appearance than the **SRL**. ■ RPE not showing vasculature	Decorrelation Tails Appear ■ **DRL** has the same characteristic appearance as the **SRL**. ■ Vessels appear exactly the same shape as a layer superior to it. ■ RPE shows vasculature (exactly the same shape as a superior layer)	Inaccurately detected motion causes a weaker signal to appear below the original signal. Because the effect is correlated with the brightness of the reflecting layer, decorrelation tails may seem to disappear within the outer nuclear layer, but appear strongly in the brightly-reflecting RPE.

Table 47: Decorrelation Tails Acceptance

Layer	Enface	B-Scan	Explanation
SRL			The larger vessels that appear similar in SRL and DRL are decorrelation tails and not present in the DRL.
DRL			DRL en face does not include the larger vessels; they appear due to the decorrelation tails.
Above RPE			RPE enface does not normally have vessels; vasculature appears due to decorrelation tails.

Table 48: Decorrelation Tails Example: Normal Eye

7.12.1.4 Segmentation Acceptance Criteria

Test	Pass	Fail	Explanation
Flow Detection	Appropriate presence or absence of flow in the layers of interest.	Unexpected presence or absence of flow in the layers of interest.	Segmentation errors can result in incorrect visualization of flow. Boundary lines that determine a particular enface image appear as pink dotted lines overlying the B-scan.

Table 49: Segmentation Acceptance

EnFace	B-Scan	Explanation
		■ Boundary lines that determine the enface image appear as pink dotted lines overlying the B-scan. ■ En face image shows a bright area not associated with pathological flow. ■ Bright area in the B-scan shows that segmentation pushed below the hyper-reflective retinal pigment epithelium. (Any signal detected here is likely due to decorrelation tails from the inner retinal vascu-lature). ■ B-scan shows that the segmen-tation is not correctly passing through the outer retinal layer expected to be free of signal (horizontal blue line location)

Table 50: Segmentation Criteria Example: Angio 6mmx6mm

Empty page, for your notes

8 Analyzing Exam Data and Creating Reports

Using the Analysis and Report screens, you can view, group, characterize, measure, annotate, and adjust scanned data in multiple ways and save the adjusted scans and create reports.

8.1 About Analysis and Reports

Scan Pattern	Scan	Analyses
	512 x 128 200 x 200	■ Macular Thickness ■ Macular Thickness OU ■ Macular Change ■ Advanced RPE ■ Wellness Exam ■ Panomap ■ Advanced Visualization ■ En Face ■ 3D Visualization ■ Ganglion Cell OU ■ Ganglion Cell Guided Progression ■ Single Eye Summary

Table 51: Macular Cube Scans

Scan Pattern	Scan	Horizontal Lines	A-Scans/line	Analyses
	200 x 200	200	200	■ ONH/RNFL OU ■ Guided Progression Analysis ■ Advanced Visualization ■ En Face ■ 3D Visualization ■ Wellness Exam ■ Panomap ■ Single Eye Summary

Table 52: Optic Disc Cube Scans

Scan Pattern	Scan	Analyses
	HD 1 Line 100X	High Definition Images

Scan Pattern	Scan	Analyses
	HD 5 Line	
	HD Radial	
	HD 21 Line	
	HD Cross	
	3mm x 3mm ⊕	■ Angiography ■ Angiography Two Visit Comparison ■ En Face
	HD 6mm x 6mm ⊕ 6mm x 6mm ⊕	
	HD 8mm x 8mm ⊕ 8mm x 8mm ⊕	
	12mm x 12mm ⊕	
	6mm x 6mm ⊕	Montage Angiography

Scan Pattern	Scan	Analyses
	8mm x 8mm ⊕	

Table 53: HD Raster Scans (Includes Smart HD Scans)

Many anterior segment scans are optional (see: About Licenses [▸ 63]).

Scan Pattern	External Lens	Scan	Analysis
Anterior Segment Scans			
	-	Anterior Segment Cube	■ Anterior Segment Analysis ■ 3D Visualization
	-	Anterior Segment 5 Line Raster	High Definition Images
	-	HD Angle	HD Angle Analysis
		Anterior Chamber ⊕	Anterior Chamber Analysis
		Wide Angle-to-Angle ⊕	Wide Angle-to-Angle Analysis
		HD Cornea ⊕	HD Cornea Analysis
		Pachymetry ⊕	Pachymetry Analysis

Table 54: Anterior Segment Scans

Requires (or best with) image of both eyes.

Requires (or best with) both **Macular Cube** and **Optic Disc Cube** images.

⊕ *Indicates optional features; license may be required.*

You can set a preferred analysis for scans (see: Set Preferred Analyses [▸ 105]).

8.1.1 Analysis Overview

This section describes elements common to the analysis screens.

Figure 35: Analysis Screens

1	**Information Bar**		
	Hopkins, Anita 026 Female 2/16/1939	Patient Information	Displays the patient's name, gender, and date of birth.
	OD OS	OD / OS Indicator	Indicates which eye is selected. If the patient's other eye does not have a comparable scan to select, it's is grayed out.
	OD OS		
2	**Print Tools** (See: Printing Reports)		
		Save	Saves the printed report with any changes you made.
		Export	Exports the analysis with any changes you made.
		Print	Prints the analysis with any changes you made.
		Delete	Deletes the report.
3	**Scan Selection**		
	8/13/2018 8/10/2018 8/9/2018	Scan Date	Selects the date of the scan to analyze.
		OD Scans	Selects a scan of the patient's right eye.
	Macular Thickness Analysis Macular Thickness OU Analysis 3D Visualization En Face Analysis	Analysis / Report Selection	Allows you to select the type of analysis you want to view.

			This list varies depending on the type of scan (see About Licenses [▶ 63].)
4	*Varies*	Scan Tools	Displays information about the scan and tools to make adjustments (varies depending on the type of scan and analysis).
5	*Varies*	Viewports	Displays in the viewport(s) vary depending on the type of scan and analysis.

Table 55: Posterior Segment Scans (Macula and Optic Nerve Head) Overview

8.1.2 About Reports

CIRRUS™ HD-OCT allows you to generate color reports that you can print or export. Some information on the reports is truncated to fit the page. For example, although a patient identification number can have as many as 32 characters, only the first 23 characters (including spaces) print on the report. Truncated fields are:

	Possible Characters	Characters on Reports
Patient ID	32	23
Technician Name	64	32
Institution Name	36	24

You can customize reports (refer to: Configuring Reports [▶ 99]).

Exporting Reports

You can export a report to DICOM (if configured) or export data into one of the following file formats:

- PDF
- BMP
- GIF
- JPEG
- PNG
- TIFF
- EMF
- WMF

For XML export details, see: About XML Data Export [▶ 114].

8.2 Posterior Segment Scan Analysis

8.2.1 Macular Analysis

8.2.1.1 Analyze Macular Thickness

NOTE

Good scan quality (strong signal strength) is essential for accurate comparisons to a reference database for healthy eyes.

- ▶ Scans with low signal strength may not compare to the reference database for healthy eyes as accurately as higher quality scans.

Macular Thickness Analysis allows you to:

- View a retinal thickness map overlaying the fundus image and identify the fovea location.
- Edit and measure the layers and their boundaries.
- View high-resolution B-scans.
- Compare the patient's thickness and volume measurements to a reference range for healthy eyes for their age.
- Scroll through automatically-detected ILM - RPE three-dimensional thickness maps.
- Navigate color-coded thickness maps of the cube slices and identified layers.

Macular Thickness Analysis uses a reference database of healthy eyes to determine how a patient's macular thickness compares to the reference range for healthy eyes of their age.

Macular Thickness Analysis is available for the following scans:

- Macular Cube 512x128
- Macular Cube 200x200

To study a series of scans and analyze macular thickness change over time, see: Analyze Macular Change [▶ 246].

For a more detailed examination of RPE elevation and sub-RPE illumination, see: Advanced RPE Analysis [▶ 256].

You can also view and navigate through the slices of any cube scan as a three-dimensional image (see: 3D Visualization Analysis [▶ 289]).

Also see

- Reference Database 2 for Healthy Eyes Study–CIRRUS 6000 [▶ 457]
- Reference Database 1 for Healthy Eyes Study–CIRRUS 400/4000/500/5000 [▶ 443]

8.2.1.1.1 Interpreting Macular Thickness Parameters

NOTE

Reference Database 1 – CIRRUS 400/4000/500/5000

The reference range for healthy eyes represent the general population.

However, when interpreting data, keep the following study limitations in mind (especially for 1% and 99%):

- Subjects:
  - ⇨ Ages 18-84
  - ⇨ Refractive errors –12.00 D to +8.00 D
- Age ranges with fewest subjects:
  - ⇨ 3 subjects over 80.
  - ⇨ 28 subjects aged (70-79).

NOTE

Reference Database 1 – CIRRUS 400/4000/500/5000

The reference range for healthy eyes limits are adjusted by age groups only (unless noted).

Other differences might occur for some measurements; however, the reference range for healthy eyes does not adjust for these factors, such as:

- Image Signal Strength
- Ethnicity
- Axial Length
- Refraction
- Optic Disc Area

NOTE

Reference Database 2 – CIRRUS 6000

The reference range for healthy eyes represent the general population.

However, when interpreting data, keep the following study limitations in mind (especially for 1% and 99%):

- Subjects:
  - ⇨ Ages 18-88
  - ⇨ Refractive errors –8.00 D to +3.00 D range with Astigmatism less than -2D
- Age ranges with fewest subjects:
  - ⇨ 17 subjects age 80-89

⇨ Any patient over 88 years old will be compared as if they were 88 years old.

NOTE

Reference Database 2 – CIRRUS 6000

Reference range limits for healthy eyes were adjusted only by age for Macular Thickness and Ganglion Cell Thickness. ONH parameters and RNFL thickness were adjusted for both age and optic disc size. Other factors might influence measurements; however, the reference range for healthy eyes does not adjust for these factors, such as:

- Gender
- Axial Length
- Image Signal Strength
- Ethnicity
- Refraction

Color coding and measurements help you determine how a patient's macular thickness compares to the reference range for healthy eyes for their age.

Color Code	Study Population Comparison
	The thickest 1% of measurements fall in the light red area. Measurements in light red are considered above reference limits *(light red > 99%, above reference limits)*.
	The thickest 5% of measurements fall within overlapping 95% confidence intervals of the 95% and 99% reference limits or above.
	The thickest 5% of measurements fall in the light yellow area or above. *(95% < light yellow ≤99%, borderline above reference limits).*
	90% of measurements fall in the green area *(5% ≤ green and ≤95%)*.
	The thinnest 5% of measurements fall in the yellow area or below *(1% ≤ yellow <5%, borderline below reference limits).*
	The thinnest 5% of measurements fall within overlapping 95% Confidence intervals of the 1% and 5% reference limits or below.
	The thinnest 1% of measurements fall in the red area. Measurements in red are considered below reference limits. *(red <1%, below reference limits).*

The ETDRS grid shows the patients' average macular thickness measurement for each sector of the grid.

The following examples compare a patient's measurements to subjects of the same age that are representative of the general population.

Analysis	Interpretation
	ETDRS Grid ■ All sectors are **green**, which indicates that all measurements are within the middle 90% of the reference database for healthy eyes.
	ETDRS Grid ■ Five sectors are **green**, which indicates that their measurements are within the middle 90% of the reference database for healthy eyes. ■ Four sectors are **red**, which indicates that their average macular thickness measurements are within the 1% of the reference database for healthy eyes.
	ETDRS Grid ■ Seven sectors are **green**, which indicates that their measurements are within the middle 90% of the reference database for healthy eyes. ■ Two sectors are **yellow**, which indicates that their average macular thickness measurements are within 5% of the reference database for healthy eyes.
	Macular Thickness Table Combining the ETDRS Grid information with additional parameters in the table provides data you can use to inform your assessment.

Studies that included a diverse population to determine the reference range for healthy eyes.

Also see

Reference Database 1 for Healthy Eyes Study–CIRRUS 400/4000/500/5000 [▸ 443]

Reference Database 2 for Healthy Eyes Study–CIRRUS 6000 [▸ 457]

8.2.1.1.2 Macular Thickness Analysis

Figure 36: Macular Thickness Analysis Overview

#	Symbol	Explanation
1	**Toolbar** Displays information about the scan and tools to make adjustments	
2		Fundus image showing scan area and cube navigation lines.
	Overlay ILM - RPE	Selects which overlay to display over the fundus image.
3	**Thickness Measurements and Reference Data Comparisons**	Shows overall average macular thickness in nine sectors. ■ central circle (radius = 500 micrometers; diameter =1 mm) ■ superior sectors ■ nasal sectors ■ temporal sectors ■ inferior sectors. Color coding shows how this patient's scan compares to the reference range for healthy eyes for their age.
	Central Subfield Thickness µm / Cube Volume mm³ / Cube Avg Thickness µm ILM - RPE 478 11.0 305	Color coding shows how this patient's scan compares to the reference range for healthy eyes for their age. Calculations shows the central thickness, volume, and average thickness..
4	Fovea: 99, 102	Fovea Finder Automatically identifies the fovea and shows the surface of the area for the individual thickness measurements in the grid and table.
5		Slice through cube side to side relative to LSO fundus image

#	Symbol	Explanation
		Slice through cube top to bottom relative to LSO fundus image
6	**3D Surface Maps (interactive)**	ILM - RPE Map Shows the thickness between the ILM and RPEas a color-coded three-dimensional surface.
		ILM Map Shows the Anterior Layer (ILM) as a color-coded three-dimensional surface.
		RPE Map Shows the Posterior Layer (RPE) as a color-coded three-dimensional surface.

Also see

- Macular Thickness Parameters [▸ 448]

8.2.1.1.3 Analyzing Macular Thickness and Macular Thickness OU

CIRRUS™ HD-OCT automatically traces retinal layers and calculates their thickness. You can adjust these layer boundaries, if needed. See (Editing Segmentation Results [▸ 244]).

If CIRRUS™ HD-OCT cannot detect the fovea, the measurement circles and calculations are based on the center of the 6 mm square.

High-Definition Images

You can view high–definition images and double-click for a full–screen view.

- You cannot navigate through the high-definition image using the slice navigators. If you move the slice navigators, the image changes back to the standard resolution.
- The **ETDRS Grid** does not change positions for the high-definition image.

Macular Thickness Analysis is available for the following scans:

- Macular Cube 512x128
- Macular Cube 200x200

To analyze macular thickness:

Prerequisite

☑ The patient has at least one 512x128 Macular Cube scan that is centered at the macula: (Acquire a Macular Cube Scan [▸ 156]).

Action

1. Select the patient and click **Analyze**.
2. Select a **Macular Cube** scan and select **Macular Thickness Analysis**.
   ⇨ The analysis opens.
3. To show or hide the layer indicators, click **Show/Hide Layers** .
4. To edit the layer boundaries, refer to: Editing Layer Boundaries [▸ 244].
5. To change the overlay for the fundus image, select a different overlay (or none).
6. To export all images, click **Advanced Export** .
7. To add a caliper, click **Caliper** .
   ⇨ A caliper measurement appears over the image. You can move, stretch, and rotate calipers. You can add (up to) ten.
8. To delete a measurement or annotation, select it and click **Delete** .
9. To return the current slices to their default central positions, click .

10. To reposition the fovea, for **Overlay**, select **ETDRS position**. Select and drag the fovea overlay to the correct position.
    ⇨ The data recalculates according to the new fovea position.

11. To place the navigators in the center of the grid, click .
    ⇨ The slice navigation lines move to the center of the grid.
12. To set the center of the grid to the position of the slice navigators, click .
13. To reset the grid to its original position, click .
14. To show or hide the high-resolution image, click **HD** .
    ⇨ The image toggles between the original resolution and high resolution versions.
15. To edit an image, right-click to access the edit menu (see: About Image Editing [▸ 359]).
16. To view a full-screen image, double-click on the image.
17. To print, save, or export a report, see: Creating a Report [▸ 375].

Also see

🗎 Editing Images Using the Menu [▸ 360]

8.2.1.1.4 Export Thickness Map Values

You can save the ILM-RPE thickness map data as comma–delimited values in a .csv file. The .csv file saves the fast B-scans as rows starting at the top and slow B-scans as columns starting at the far left.

You can open and view .csv files in Microsoft Excel Matlab, or other applications that accept the file .csv file type. Select this button to

To export thickness map values:

Prerequisite

☑ Logged in to review station (or instrument).

☑ The scan report or analysis is open.

Action

1. Click **Export Data** .
   ⇨ The navigation dialog opens.
2. Navigate to the folder where you want to save the file.
3. Click **OK**.

8.2.1.1.5 Editing Segmentation Results

An option to view all layers identified for the scan is enabled by selecting **Show All Layers**. The green colored lines delineate the other layers identified, in addition to the selected inner and outer boundaries.

Use the slice navigators on the B-scan and en face images to position and view layer details. Use the corresponding slider bar on the B-scan to adjust layer location.

- **Top B-scan viewport:** Fast B-scan
- **Bottom B-scan view:** Slow B-scan

NOTE

You can drag any portion(s) of the boundary lines, but you cannot cross the top and bottom boundaries of a layer.

Blue line indicates the top layer.

Red line indicates the bottom layer.

CIRRUS™ HD-OCT automatically calculates **Macular Thickness** layer boundaries. Sometimes a patient's retinal structure has anomalies or pathology that causes algorithms to trace the boundaries inaccurately.

To edit layers:

Prerequisite

☑ Logged in to review station (or instrument): Logging In as Operator or Data Analyst.

☑ Analyze Macular Thickness [▶ 236]

Action

1. Select the layer or preset that you want to edit.
2. Click **Edit Segmentation Results** .
   ⇨ The Edit Segmentation window opens.

3. To adjust the top layer, click and hold the blue (upper) line, then drag it into place to create a new boundary.
4. To adjust the bottom layer, click and hold the red (lower) line, then drag it into place to create a new boundary.
   ⇨ The new segmentation location blends with the automatic segmentation and appears continuous.
5. To copy these changes to the next slice, click **Copy Next** .

6. To copy these changes to the previous slice, click **Copy Previous**.
7. To view the next layer, click **Next**.
8. To view the previous layer, click **Previous**.
9. To show the vertical B-scan below the horizontal B-scan, check **Show Vertical B-Scan**.
10. Click **Done**.

Also see

About Analysis Presets [▶ 309]

8.2.1.1.6 Create a Macular Thickness Report

Macula Thickness Reports

There are three different types of reports for macular thickness analysis. To set which reports to include and customize their settings, see: Configuring Macular Thickness Reports [▶ 99].

Macula Thickness Report (One Eye, Both Eyes)	Macula Multi-Slice Report	Macula Radial Report

To create a macular thickness report, see: Creating a Report [▶ 375]

8.2.1.2 Analyze Macular Change

When you have two or more macular scans for the same patient taken at different times, you can compare scans together to analyze macular changes. The **Macular Change** analysis compares two of the patients macular cube scans taken at different times.

By comparing each of the patient's scans to the reference range for healthy eyes and combining this information into one analysis, you can easily see how the patient's measurements have changed over time, which sectors changed, and how much change occurred between the images captured at the first visit and the followup visit.

Macular Change Analysis is available for the following scans:

- Macular Cube 512x128
- Macular Cube 200x200

An optional license provides progression analysis that compares a series of scans over time (see: About Licenses [▸ 63]).

8.2.1.2.1 About Macular Scan Registration

Figure 37: Unregistered Areas (Black Border)

When you compare a patient's scan to an earlier scan (of the same type), CIRRUS™ HD-OCT automatically aligns, or *registers*, the scans together. Registration synchronizes anatomical structures and corrects differences in rotation, which can occur if the patient is situated slightly differently for the two scans.

If areas in the current image do not overlap with the earlier image, those areas are not included in the registered pair; they appear as black borders along the edge of the fundus image and are not included in the b-scan image.

8.2.1.2.1.1 Automatic Scan Registration

There are two different methods for automatically registering scans, **R2** and **R1**.

CIRRUS™ HD-OCT's primary (preferred) registration method is **R2**.

However, if **R2** cannot adequately register the images, the instrument attempts **R1** registration.

Analyses and reports that use scan registration inform you of which method was applied.

Method	Order	Description
R2	Primary	■ Aligns scans using the blood vessels identified in the en face images of both scans. ■ For guided progression analyses, uses translation and rotation to align the follow-up scan(s) to the baseline scan
R1	Secondary	■ Aligns scans using the center of the optic disc of both scans. ■ R1 does not include rotation. ■ R1 might cause additional variability at the super-pixel level, which can affect change detection in a thickness map.

Table 56: Registration Types

If you want to override automatic registration, you can register scans manually or select a different set of scans to register together. (See: Manually Register Macular Images [▸ 252]).

8.2.1.2.1.2 No Registration

If automatic registration was not successful and no manual registration was applied yet, the scans will display **No Registration**. To register the scans, refer to: Manually Register Macular Images [▸ 252].

8.2.1.2.1.3 Manual Registration

When you manually register images, you set (up to five) corresponding points between two images. When you identify the same structure or feature in both images, click that structure in the first image, then the second image.

For example, use a blood vessel bifurcation or a bend in a blood vessel as a point to mark. A matching set of marks indicates corresponding features. Different colored marks indicate the next feature you mark in each image.

Figure 38: Registration Mark Pairing

After you register two images, the second image might display irregular black borders. These borders indicate areas that are not present in both images.

8.2.1.2.2 Macular Change Analysis

Figure 39: Macular Change Analysis Overview

#	Symbol	Explanation
1	**Toolbar** Displays information about the scan and tools to make adjustments	
2		Macular Thickness Map Shows ILM-RPE thickness maps.
3		Fundus image with ETDRS grid position displayed. To reposition the ETDRS grid, select **Overlay > ETDRS position** and adjust the center or drag the lines.
		Sets the overlay transparency level.
4		Shows the difference in measurements between the two images for each section of the ETDRS grid.
5		Horizontal B-Scan: slice through cube side to side relative to LSO fundus image.

8.2.1.2.3 Analyzing Macular Change

Macular Change Analysis is available for the following scans:

- Macular Cube 512x128 (2 or more)
- Macular Cube 200x200 (2 or more)

To analyze macular change:

Prerequisite

☑ The patient has at least one 512x128 Macular Cube scan that is centered at the macula: (Acquire a Macular Cube Scan [▸ 156]).

Action

1. Select the patient and click **Analyze**.
2. Select a **Macular Cube** scan and select **Macular Change Analysis**
3. To synchronize the navigation and zoom action between the selected scans, click . Click to disable synchronization.
4. To show or hide the layer indicators, click **Show/Hide Layers** .
5. To see how the images are matched together for comparison, click **Review Registration** (see: Review Scan Registration [▸ 250]).
6. To set the center of the grid to the position of the slice navigators, click .
7. To reset the grid to its original position, click .
8. To manually register the images, select **Manual** (see:Manually Register Macular Images [▸ 252]).
9. To change the color of the ETDRS grid and measurements, click **Color** and select a color (or create a custom color).
10. To show or hide the high-resolution image, click **HD** .
    ⇨ The image toggles between the original resolution and high resolution versions.
11. To edit an image, right-click to access the edit menu (see: About Image Editing [▸ 359]).
12. To view a full-screen image, double-click on the image.
13. To print, save, or export a report, see: Creating a Report [▸ 375].

Also see

🗎 Editing Images Using the Menu [▸ 360]

8.2.1.2.4 Changing Thickness Colors

If automatic registration was not successful and no manual registration was applied yet, the scans will display **No Registration**. To register the scans, refer to: Manually Register AngioPlex Images [▸ 313].

8.2.1.2.5 Review Scan Registration

With **Macular Change** analysis, you can review and fine-tune registration if automatic registration does not suit your needs.

8.2.1.2.5.1 Review Registration Overview

Figure 40: Review Registration Overview

Pos.	Symbol	Explanation
1		Fundus image of the earlier (baseline) exam(s).
2		En face image for the followup exam. Black borders incidate areas that do not correspond between the two images.
3		Image slider to adjust the registration overlay view: ■ slide left to view image 1, ■ slide right to view image 2.

Pos.	Symbol	Explanation
4		Overlays both exam images.
5	Manual Registration	Opens Manual Registration.
6	Cancel	Exit registration review and return to analysis.

8.2.1.2.5.2 Manually Register Macular Images

With **Macular Change** analysis, you can review and fine-tune registration if automatic registration does not suit your needs.

Matched Marks

To adjust registration manually:

Prerequisite

☑ You have a comparison analysis open and you want to change the registration.

Action

1. For **Registration**, select **Manual**.
   ⇨ The registration review tool opens.

2. Identify a feature that appears in both images, like a blood vessel bifurcation or a bend in a blood vessel.
3. Mark the feature in both images.

4. Identify and mark additional identifiable features in other regions of the pair of images (between 3 and 5 marks in each image).

5. To change the transparency of Image 1 or Image 2, move the transparency slider right or left.
6. To view the manually-adjusted overlay, click **Review Registration**.
7. To return to the original registration, click **Reset**.
8. Click **OK**.

Result

✓ The **Registration succeeded** message and a green flag appears.

8.2.1.3 Analyze HD Images

HD Images Analysis is available for the following scans:

- HD 1 Line 100X
- HD 5 Line
- HD Radial
- HD 21 Line
- HD Cross

8.2.1.3.1 HD Images Analysis

Figure 41: HD Images Analysis Overview

#	Symbol	Explanation
1	**Toolbar** Displays information about the scan and tools to make adjustments	
2		Horizontal B-Scan: slice through cube side to side relative to LSO fundus image.
3		Vertical B-scan: slice through cube top to bottom relative to LSO fundus image.
4		Image area showing the scan pattern with customization adjustments (if applicable)
5		Thumbnails of the B-scans; cyan and magenta outlined thumbnails are selected for enlarged view

8.2.1.3.2 Analyzing HD Images

HD Images Analysis is available for the following scans:

- HD 1 Line 100X
- HD 5 Line
- HD Radial
- HD 21 Line
- HD Cross

To analyze HD images:

Prerequisite

☑ The patient has at least one 512x128 Macular Cube scan that is centered at the macula: (Acquire a Macular Cube Scan [▸ 156]).

Action

1. Select the patient and click **Analyze**.
2. Select a **Macular Cube** scan and select **Macular Thickness Analysis**.
3. Click for greyscale, or click for reverse greyscale, or click for color. The button toggles between the three color settings.
4. Click , then click and drag on the image to draw a linear measurement.
   ⇨ A caliper measurement appears over the image. You can move, stretch, and rotate calipers. You can add (up to) ten.
5. To delete a caliper, click **Delete** .
6. To view a different part of the HD image, select a different thumbnail.
7. To edit an image, right-click to access the edit menu (see: About Image Editing [▸ 359]).
8. To view a full-screen image, double-click on the image.
9. To print, save, or export a report, see: Creating a Report [▸ 375].

Also see

🗎 Editing Images Using the Menu [▸ 360]

8.2.1.4 Advanced RPE Analysis

The **Advanced RPE Analysis** allows you to compare the current scan to a prior scan and automatically measure drusen and geographic atrophy. You can examine disturbances in the RPE to identify and measure RPE elevations and sub–RPE illumination.

By showing the RPE in greater detail, **Advanced RPE Analysis** can help in managing age–related macular degeneration-- even in advanced forms that exhibit RPE atrophy.

When you select a scan for **Advanced RPE Analysis**, CIRRUS™ HD-OCT automatically opens the latest prior scan for the same patient (same eye, same scan). If the patient has multiple scans taken over time, you can choose another scan for the comparison.

This analysis has two different screens:

- Screen 1: shows RPE elevation and the sub–RPE illumination results separately as en face images
- Screen 2: shows combined the RPE Elevation Map and the sub–RPE illumination segmentation images with calculated values.

Advanced RPE Analysis is available for the following scans:

- Macular Cube 200x200
- Macular Cube 512x128

8.2.1.4.1 Advanced RPE Analysis - Screen 1

Figure 42: Advanced RPE Analysis - Screen 1 Overview

#	Symbol	Explanation
1	**Toolbar** Displays information about the scan and tools to make adjustments	
2		Toggles between the first and second screen of the analysis.
3		Overlaid with the RPE Elevation Map for both scans.
		The yellow box indicates the area included in the scan.
		A pair of circles centered on the fovea (at 3mm and 5mm)
		Navigates cube slices horizontally (cyan line) and vertically (magenta line) and shows the slice number currently selected.
		Increases or decreases the transparency of the RPE elevation map overlay.
4	**Sub-RPE Slab Toolbar**	Toggles between the first and second screen of the analysis.

#	Symbol	Explanation
		Opens editor for Sub-RPE Illumination segments.
		Toggles visibility of the illumination of the Sub-RPE segment.
5		Displays the horizontal topogram showing RPE elevation segments.
6		Displays the sub-RPE illumination layer.
		Indicates the location of the fovea A red line connects the fovea to the closest Sub-RPE Illumination location-showing the distance (in mm).
	30 %	Increases or decreases the visibility of the sub-RPE illumination layer.

8.2.1.4.2 Advanced RPE Analysis - Screen 2

Figure 43: Advanced RPE Analysis - Screen 2 Overview

#	Symbol	Explanation
1	**Toolbar** Displays information about the scan and tools to make adjustments	
2		Shows the data and differences in area and volume for the 3mm and 5mm circles.
3		Shows the data and differences in area and the closest to the fovea.

8.2.1.4.3 Analyzing RPE (Advanced Analysis)

NOTE

Some characteristics can affect RPE elevation measurements, including presence, size, and extent of:

geographic atrophy

choroidal neovascularization

extensive epiretinal membrane

vitreomacular traction

NOTE

The minimum RPE elevation for calculations is 19.5 µm.

This analysis typically compares a patient's current scan to a prior scan from a series of scans taken over time. However, you can use some features of this analysis for a single patient scan.

Prerequisite

☑ The patient has at least one 512x128 Macular Cube scan that is centered at the macula: (Acquire a Macular Cube Scan [▸ 156]).

Action

1. Select the patient and click **Analyze**.
2. Select a **Macular Cube** scan and select **Advanced RPE Analysis**.
   ⇨ If the patient had the same macular cube scan of the same eye taken during earlier visits, CIRRUS™ HD-OCT automatically loads the most recent prior scan for comparison.
3. To hide or show the circles around the fovea, click .
4. If the patient exhibits characteristics that affect elevation, review the individual B-scans to determine where RPE elevation overlaps.
5. Check RPE elevation borders (black and purple lines) in the horizontal tomogram to ensure that retinal segments are accurate.
6. To edit an image, right-click to access the edit menu (see: About Image Editing [▸ 359]).
7. To view a full-screen image, double-click on the image.
8. To print, save, or export a report, see: Creating a Report [▸ 375].

Also see

🗎 Editing Images Using the Menu [▸ 360]

8.2.1.4.3.1 Editing Sub-RPE Illumination Segments

To edit the Sub RPE illumination boundaries:

Prerequisite

☑ An **Advanced RPE** analysis is open.

Action

1. Click **Edit Illumination** .
   ⇨ The Sub-RPE Illumination boundary editor opens showing the sub–RPE illumination areas.

2. To draw fine details or outlines, select the **Pencil** , click in the image and draw a fine detail or the outline of a larger shape.
3. To fill the outline of a shape, select **Floodfill** and click inside the shape.
4. To delete fine details or outlines, select the **Knife** , click in the image and draw a fine detail or the outline of a larger shape.
5. To remove a large area, select the **Eraser** and click inside the shape drawn with the **Knife**.
6. To revert to the original (unedited) image, click **Reset** .
7. Click **Apply**.

8.2.2 Ganglion Cell Analysis

8.2.2.1 Analyze Ganglion Cell OU

Ganglion Cell OU Analysis measures the thicknesses of the ganglion cell layer and inner plexiform layer (GCL + IPL layers) using data from the scan patterns.

CIRRUS™ HD-OCT compares thickness information to a reference database for healthy eyes gathered for their age.

Ganglion Cell OU Analysis is available for the following scans:

- Macular Cube 512x128
- Macular Cube 200x200

8.2.2.1.1 Interpreting Ganglion Cell Results

NOTE

Reference Database 1 – CIRRUS 400/4000/500/5000

The reference range for healthy eyes represent the general population.

However, when interpreting data, keep the following study limitations in mind (especially for 1% and 99%):

- Subjects:
  - ⇨ Ages 18-84
  - ⇨ Refractive errors –12.00 D to +8.00 D
- Age ranges with fewest subjects:
  - ⇨ 3 subjects over 80.
  - ⇨ 28 subjects aged (70-79).

NOTE

Reference Database 1 – CIRRUS 400/4000/500/5000

The reference range for healthy eyes limits are adjusted by age groups only (unless noted).

Other differences might occur for some measurements; however, the reference range for healthy eyes does not adjust for these factors, such as:

- Image Signal Strength
- Ethnicity
- Axial Length
- Refraction
- Optic Disc Area

NOTE

Reference Database 2 – CIRRUS 6000

The reference range for healthy eyes represent the general population.

However, when interpreting data, keep the following study limitations in mind (especially for 1% and 99%):

- Subjects:
  - ⇨ Ages 18-88
  - ⇨ Refractive errors –8.00 D to +3.00 D range with Astigmatism less than -2D
- Age ranges with fewest subjects:
  - ⇨ 17 subjects age 80-89

⇨ Any patient over 88 years old will be compared as if they were 88 years old.

NOTE

Reference Database 2 – CIRRUS 6000

Reference range limits for healthy eyes were adjusted only by age for Macular Thickness and Ganglion Cell Thickness. ONH parameters and RNFL thickness were adjusted for both age and optic disc size. Other factors might influence measurements; however, the reference range for healthy eyes does not adjust for these factors, such as:

- Gender
- Axial Length
- Image Signal Strength
- Ethnicity
- Refraction

To establish reference values, the images were analyzed using a (proprietary) segmentation algorithm that identifies the thickness of the combined ganglion cell and inner plexiform layers.

Figure 44: GCL + IPL Thickness Grid

Average GCL + IPL thickness sectors:

- 60° segments of an elliptical annulus
- inner minor axis radius of 0.5 mm
- outer minor axis radius of 2.0 mm
- stretched by 20% in the horizontal direction i.e. the inner radius should be 0.5mm vertically x 0.6mm horizontally and the outer radius should be 2mm vertically x 2.4mm horizontally

CIRRUS™ HD-OCT compares the patient's measurements to the reference range for healthy eyes for their age. Different colors indicate the distribution percentiles of reference range for healthy eyes.

Color Code	Study Population Comparison
	The thickest 5% of measurements fall in the white area. Measurements in white are considered above reference limits *(white > 95%, above reference limits)*.
	90% of measurements fall in the green area *(5% ≤ green and ≤95%)*.
	The thinnest 5% of measurements fall in the yellow area or below *(1% ≤ yellow <5%, borderline below reference limits).*
	The thinnest 5% of measurements fall within overlapping 95% Confidence Intervals of the 1% and 5% reference limits or below.
	The thinnest 1% of measurements fall in the red area. Measurements in red are considered below reference limits. *(red <1%, below reference limits).*

Table 57: Color Key for GCL + IPL Thickness Comparison to the reference range for healthy eyes

Analysis	Interpretation
Ganglion Cell OU 	**OD:** **Deviation map** - shows areas within 5% of the reference limit range of healthy eyes (yellow) and areas within 1% of the reference limit range of healthy eyes (red) **Table** - average = 80. The value is *within the middle 90% of the reference database* (green) **Grid** - 1 sector is *within the middle 90% of the reference database* (green) 2 sectors are *within the thinnest 1% of the reference database* (58 and 68) 3 sectors are *within the thickest 5% of the reference database* (91, 92, and 94) **OS:** **Deviation map** - shows areas within 5% of the reference limit range of healthy eyes (yellow) and areas within 1% of the reference limit range of healthy eyes (red) **Table** - average = 78. The value is *within the middle 90% of the reference database* (green) **Grid** - 1 sector is *within the middle 90% of the reference database* (green) 2 sectors are *within the thinnest 1% of the reference database* (59 and 61)

Analysis	Interpretation
	3 sectors are *within the thickest 5% of the reference database* (90, 92, and 96)
Average GCL+IPL thickness	Average GCL+IPL thickness is the average of the 6 ganglion cell thickness sectors. In the example image, *the sum of the 6 sectors is 402; the average is 67.*

Table 58: Interpreting Ganglion Cell Thickness Results for the reference range for healthy eyes

Also see

- Reference Database 1 for Healthy Eyes Study–CIRRUS 400/4000/500/5000 [▸ 443]
- Reference Database 2 for Healthy Eyes Study–CIRRUS 6000 [▸ 457]

8.2.2.1.2 Ganglion Cell OU Analysis

Figure 45: Ganglion Cell OU Analysis Overview

#	Symbol	Explanation
1	**Toolbar** Displays information about the scan and tools to make adjustments	
2	Deviation Map	Compares GCL + IPL thickness to reference data. ■ red indicates thinner than all but 1% of reference range for healthy eyes ■ yellow indicates thinner than all but 5% of reference range for healthy eyes
3		Shows thickness measurements of the GCL + IPL in the 6 mm x 6 mm cube with an elliptical annulus centered about the fovea.
4	Horizontal B-Scan: slice through cube side to side relative to LSO fundus image.	Slice through cube: ■ purple line indicates the inner boundary of the ganglion cell layer (outer boundary of the retinal nerve fiber layer) ■ yellow line indicates the outer boundary of the inner plexiform layer
	Vertical B-scan: slice through cube top to bottom relative to LSO fundus image.	
5		Shows average GCL+IPL layer thickness with color-coded comparison to the reference range for healthy eyes for the patient's age.
6		GCL + IPL Thickness grid [▶ 261]

8.2.2.1.3 Analyzing Ganglion Cell OU

To analyze the ganglion cell layer for both eyes:

Prerequisite

☑ The patient has at least one 512x128 Macular Cube scan that is centered at the macula: (Acquire a Macular Cube Scan [▸ 156]).

Action

1. Select the patient and click **Analyze**.
2. Select a **Macular Cube** scan and select **Ganglion Cell OU Analysis**.
3. To reposition the center of the thickness map on the fovea, click and drag the circles to a different location on the thickness map.
4. To export all images, click **Advanced Export** .
5. To show or hide the layer indicators, click **Show/Hide Layers** .
6. To return the current slices to their default central positions, click .
7. To place the navigators in the center of the grid, click .
   ⇨ The slice navigation lines move to the center of the grid.
8. To reset the grid to its original position, click .
9. To set the center of the grid to the position of the slice navigators, click .
10. To show or hide the high-resolution image, click **HD** .
    ⇨ The image toggles between the original resolution and high resolution versions.
11. To edit an image, right-click to access the edit menu (see: About Image Editing [▸ 359]).
12. To view a full-screen image, double-click on the image.
13. To print, save, or export a report, see: Creating a Report [▸ 375].
14. If you want to use a different scan, manually select it (Manually Select a Scan [▸ 358]).

Also see

🗎 Editing Images Using the Menu [▸ 360]

8.2.2.2 Ganglion Cell Guided Progression

NOTE

Guided Progression Analysis (GPA) is one component of a comprehensive clinical assessment of glaucoma progression. Apply GPA results in context of the patient

GPA reports statistically significant change for one eye, which may or may not be clinically significant.

- ▶ Rate of loss, locations of the detected loss, age of the patient, stage of the disease, and other clinical factors should be evaluated for clinical decisions.
- ▶ To confirm that GCL/IPL loss is clinically significant, correlate your results with other clinical tests such as perimetry and IOP.

This analysis helps you follow changes to the GCL/IPL thickness.

This analysis compares 3-8 exams for changes to thickness measurements over time and determines whether significant changes have occurred.

This analysis is available for the following scans:

- Macular Cube 512 x 128
- Macular Cube 200 x 200

8.2.2.2.1 Guided Progressive Analysis (GPA) Scan Selection

GPA automatically selects the appropriate scans from the most recent 8 visits. The automatic selection algorithm looks for scans with the highest signal strength from each previous visit. Scans with signal strength of 5 or lower will not be loaded automatically, although you may load them using the manual tool if necessary. CIRRUS™ HD-OCT automatically establishes the first two qualifying exams as the Baselines.

Use the Guided Progression Analysis - Manual Selection to override the automatic GPA selections. You can select from a list of eligible scans in place of automatically selected scans. If you use the manual selection, then the report would indicates that choice.

- The first Baseline scan is indicated by the letter B.
- Scans to be included in the analysis are indicated by green checkmarks (✔).
- Scans that are not selected for the current analysis do not have any mark next to the scan.
- You can click an unchecked scan to include it. The green checkmark toggles with each selection.

8.2.2.2.1.1 Changing the Baseline Image

The Baseline image will always be the oldest image in the GPA sequence. Any images older than the Baseline image will not be included in the GPA.

Action

1. Select Guided Progression Analysis - Manual Selection.
2. Select the desired scan for the Baseline.
3. Click Set as Baseline.
   ⇨ The letter B will indicate the Baseline exam.

The exam you selected will be the first Baseline and the next qualified exam will be the second Baseline. The second Baseline exam is not indicated by a letter B. It will only be indicated by a green checkmark. GPA will recalculate all follow up exam comparisons based on the new Baseline.

NOTE

Baselines can be from the same day, but should be separated by at least a day.

However, if the Baselines are separated by too great of a time period, change may have occurred between Baselines, which would make it more difficult to detect loss.

8.2.2.2.1.2 Including Scans

The Baseline image will always be the oldest image in the GPA sequence. Any images older than the Baseline image will not be included in the GPA.

Action

1. Select Guided Progression Analysis - Manual Selection.
2. Click the scan to include.
3. Repeat to include additional scans.
   ⇨ A green checkmark will appear next to the selected scan.
4. If you find a scan unacceptable, you can delete the scan or exclude it. You may not permanently exclude scans from Guided Progression Analysis.
5. When exam selection is complete, click Next to exit the selection screen. Continue to the GPA analysis.

The GPA exam selections made during this process are set as the new default exams for the patient. Subsequent use of GPA using the automatic exam selection option will use these exams and will automatically select any new exams completed after the last manually selected exam. Should you have more than 8 eligible exam dates, the first Follow-up (exam 3) will be removed from the list and replaced with the most recent exam.

NOTE

If you use GPA Manual Selection for a standalone device, then the device will remember the scan selection the next time you run GPA for the current scan on the same device. If

you use GPA Manual selection for a device that is connected to FORUM, then you must repeat the manual selection as the selection is not saved by default.

8.2.2.2.2 Interpreting Ganglion Cell Guided Progression Results

NOTE

Features described in this section are licensed separately and may not be available in all markets. Contact your local ZEISS distributer about feature availability.

Tip: Choose a baseline pair of images from a period when treatment stabilized changes.

Guided Progression allows you to analyze information from 3 to 8 exams. Guided Progression includes a chronological display of thickness maps and thickness change maps, average thickness graphs representing rate of change, and thickness profiles comparing the current exam to the baseline exams. The analysis shows how a patient's measurements change over time by comparing images acquired in a series of visits. It works by establishing a baseline for the patient using images from two visits, then displays the difference between the baseline and each subsequent image.

CIRRUS™ HD-OCT detects changes from the patient's baseline to display progression. Using a good baseline pair established (with more similar images) is important for a more accurate depiction of progression.

#	Analysis	Interpretation
1	Scan Information	Date & Time of acquisition. Serial Number of the instrument that acquired the image. Registration type and signal strength. Average thickness.
2	GCL + IPL Thickness Maps	Shows how the ganglion cell layer thickness changed over time. In this example, R2 registration was successful for all images. Signal strength is good for each image (6 or higher). Scans look similar.
3	GCL + IPL Thickness Change Maps	Statistically significant changes are highlighted with yellow, red, or purple.

#	Analysis	Interpretation
		Red indicates likely decrease (it has changed relative to the two Baselines, and furthermore, the same region on the previous exam had also changed by more than the expected test-retest variability). Yellow indicates possible decrease (It has changed relative to the two Baselines, but an additional scan is required to confirm that the change is likely) Purple indicates possible increase (indicates an increase in thickness relative to the two Baselines). For “Likely Decrease,” “Possible Decrease,” or “Possible Increase,” to be reported, at least 20 adjacent superpixels must show significant change. In this example, change maps show progression over time starting with the 4th image.
4	**Graph Series** 	The graphical plots will show a rate of change, 95% confidence limits around that rate of change whenever at least 4 exams that span a minimum of 2 years are loaded. If there are fewer than 4 scans loaded, or if there is less than two years between the first baseline and the current scan, no rate of change analysis will be provided. In this example, the graph series indicates a ● possible decrease starting with the 4th image progressing to ● likely decrease.
5	**Summary** 	Unchecked indicates no decrease or increase detected. ✓ Red indicates Likely Decrease (progressive decrease detected and confirmed by consecutive follow–up exams). ✓ Yellow indicates Possible Decrease (progressive decrease detected once.) ✓ Purple indicates Possible Increase. In this example, the summary indicates a likely decrease for both; detected statically-significant change in measurements.

Table 59: Ganglion Cell Guided Progression Interpretation Examples

Ensuring Accurate Results

Guided progression analysis works best when:

- **Good registration**: images are registered properly (see: About Macular Scan Registration [▸ 246]).
- **Strong signal**: signal strength is 6 or higher for each image.
- **Good baseline**: baseline images with fewest detected changes

8.2.2.2.3 Analyzing Ganglion Cell Change Progression

You can customize **Guided Progression** reports.

To analyze ganglion cell progression:

Prerequisite

☑ You are logged in (review station or instrument): Login.

☑ The patient has at least three 512x128 Macular Cube scans that is centered at the macula.

Action

1. Select the patient and click **Analyze**.
2. Select a **Macular Cube** scan and select **Guided Progression.**
   ⇨ The analysis opens.

3. Ensure that the signal strength is 6 or higher for each image.
4. Ensure scans are registered properly; if needed, manually register the scans.
5. To use a different scan, manually select it (Manually Select a Scan [▸ 358]).
6. Check the progression series:
   ⇨ Evaluate the rate of decrease, locations of the detected decrease, age of the patient, stage of the disease, and other clinical factors to make clinical decisions.
   ⇨ Correlate these results with other clinical tests (perimetry, IOP) to confirm whether GCL+IPL loss is clinically significant.
7. Check the **GCL+IPL Summary**.

8. If the **GCL+IPL Summary** indicates **Possible decrease**, consider recommending additional follow–up visits to confirm change.
9. To edit an image, right-click to access the edit menu (see: About Image Editing [▸ 359]).
10. To view a full-screen image, double-click on the image.
11. To print, save, or export a report, see: Creating a Report [▸ 375].

Also see

- Manually Register Macular Images [▸ 252]
- Configuring Guided Progression Reports [▸ 102]
- Editing Images Using the Menu [▸ 360]

8.2.3 ONH Analysis

8.2.3.1 Interpreting ONH Results

NOTE

Reference Database 1 – CIRRUS 400/4000/500/5000

The reference range for healthy eyes represent the general population.

However, when interpreting data, keep the following study limitations in mind (especially for 1% and 99%):

- Subjects:
  - ⇨ Ages 18-84
  - ⇨ Refractive errors –12.00 D to +8.00 D
- Age ranges with fewest subjects:
  - ⇨ 3 subjects over 80.
  - ⇨ 28 subjects aged (70-79).

NOTE

Reference Database 1 – CIRRUS 400/4000/500/5000

The reference range for healthy eyes limits are adjusted by age groups only (unless noted).

Other differences might occur for some measurements; however, the reference range for healthy eyes does not adjust for these factors, such as:

- Image Signal Strength
- Ethnicity
- Axial Length
- Refraction
- Optic Disc Area

NOTE

Reference Database 2 – CIRRUS 6000

The reference range for healthy eyes represent the general population.

However, when interpreting data, keep the following study limitations in mind (especially for 1% and 99%):

- Subjects:
  - ⇨ Ages 18-88
  - ⇨ Refractive errors –8.00 D to +3.00 D range with Astigmatism less than -2D
- Age ranges with fewest subjects:
  - ⇨ 17 subjects age 80-89

⇨ Any patient over 88 years old will be compared as if they were 88 years old.

NOTE

Reference Database 2 – CIRRUS 6000

Reference range limits for healthy eyes were adjusted only by age for Macular Thickness and Ganglion Cell Thickness. ONH parameters and RNFL thickness were adjusted for both age and optic disc size. Other factors might influence measurements; however, the reference range for healthy eyes does not adjust for these factors, such as:

- Gender
- Axial Length
- Image Signal Strength
- Ethnicity
- Refraction

CIRRUS™ HD-OCT compares the patient's ONH parameters to the reference data for healthy eyes. Different colors indicate the distribution percentiles of the reference data healthy eyes.

The reference range limits are adjusted by age and disc area.

Color	Interpretation
	No comparison In the CIRRUS 4000 and 5000 reference database, possible reasons include: ■ disc area is larger than 2.5 mm^2 ■ disc area is smaller than 1.33 mm^2 ■ average cup-to-disc ratio is below 0.25 ■ vertical cup-to-disc ratio is below 0.25 In the CIRRUS 6000 reference database, possible reasons include: ■ average cup-to-disc ratio is below 0.25 ■ vertical cup-to-disc ratio is below 0.25 ■ The model used to fit the reference data is not applicable for small cup to disc ratios.
	Largest/thickest 5% of measurements of the database sample.
	90% of measurements of the database sample fall into green.
	Smallest/thinnest 5% of the sample database.
	Smallest/thinnest 5% of measurements fall within overlapping 95% Confidence Intervals of the 1% and 5% reference limits or below.
	Smallest/thinnest 1% of measurements of the database sample.

Table 60: Color Key for ONH Comparison (Rim Area and Neuroretinal Rim Thickness) to the reference database for healthy eyes

Color	Interpretation
	No comparison In the CIRRUS 4000 and 5000 reference database, possible reasons include: ■ disc area is larger than 2.5 mm^2 ■ disc area is smaller than 1.33 mm^2 ■ average cup-to-disc ratio is below 0.25 ■ vertical cup-to-disc ratio is below 0.25 In the CIRRUS 6000 reference database, possible reasons include: ■ average cup-to-disc ratio is below 0.25 ■ vertical cup-to-disc ratio is below 0.25 ■ The model used to fit the reference data is not applicable for small cup to disc ratios.
	Smallest 5% of measurements of the database sample.
	90% of measurements of the database sample fall into green.
	Largest 5% of the sample database.
	Largest 5% of measurements fall within overlapping 95% Confidence Intervals of the 95% and 99% reference limits or above.
	Largest 1% of measurements of the database sample.

Table 61: Color Key for ONH Comparison (Average & Vertical Cup-to-Disc Ratio and Cup Volume) to the reference database for healthy eyes

Also see

ONH Parameters [▸ 454]
About Licenses [▸ 63]

8.2.3.2 Interpreting RNFL Results

CIRRUS™ HD-OCT compares the patient's RNFL Thickness to the reference database for healthy eyes gathered for their age.

Color	Interpretation
	Thickest 5% of measurements of the database sample.
	90% of measurements of the database sample fall into green.
	Thinnest 5% of the sample database.
	Thinnest 5% of measurements fall within overlapping 95% Confidence Intervals of the 1% and 5% reference limits or below.
	Thinnest 1% of measurements of the database sample.

Table 62: Color Key for the RNFL reference database for healthy eyes

Shape	Indication
	Quadrants (Superior, Nasal, Temporal, Inferior)
	Clock Hours

Table 63: Shape Key for the RNFL reference database for healthy eyes

Analysis	Interpretation
Thickness Map	Two examples of thickness maps; interpreted as: ■ blue and green = thinner areas ■ yellow and red = thicker areas ■ solid blue circle = optic disc
Deviation from Reference Map	Two examples that show: Red and yellow areas shows where this scan has areas that are thinner than the reference range for healthy eyes. Thinner regions do not necessary indicate pathological loss of RNFL. Red and yellow areas can also appear for: ■ Strongly myopic or hyperopic eyes (which may have a different distribution of measured RNFL thickness values) ■ Split-bundle anatomy ■ A very tilted RNFL bundle
Quadrant Average (more detailed comparison)	Right Eye ■ Superior quadrant average is **86 µm** and **Borderline Thin** ■ Nasal quadrant average is **45 µm** and **Borderline Thin** ■ Inferior quadrant average is **81 µm** and **Thin** ■ Temporal quadrant average is **79 µm** and **Healthy** Left Eye ■ Superior quadrant average is **77 µm** and **Thin** ■ Temporal quadrant average is **70 µm** and **Healthy** ■ Inferior quadrant average is **50 µm** and **Thin** ■ Nasal quadrant average is **45 µm** and **Borderline Thin**
Clock Hour Average (most detailed comparison)	Shows the measurement for each clock hour and indicates whether the measurement is within 90% of reference limits of healthy eyes (green), within 5% of reference limits of healthy eyes (yellow) or within 1% of reference limits of healthy eyes (red).

Analysis	Interpretation
RNFL Table	Symmetry shows the correlation coefficient (converted to a percentage) that results from comparing the OD profile (256 points) with the OS profile (256 points). When the symmetry is close to 100%, the two eyes have similar profiles. Symmetry value decreases with the dissimilarity between the two eyes.
TSNIT Thickness Chart	Displays thickness at each A-scan location along the selected circle (you can select different positions to calculate).

Also see

- Reference Database 2 for Healthy Eyes Study–CIRRUS 6000 [▸ 457]
- Reference Database 1 for Healthy Eyes Study–CIRRUS 400/4000/500/5000 [▸ 443]

8.2.3.3 Analyze ONH/RNFL OU

ONH/RNFL OU Analysis is only available for **Optic Disc Cube** 200 x 200 scans.

You can also view and navigate through the slices of any cube scan as a three-dimensional image (see: 3D Visualization Analysis [▸ 289]).

8.2.3.3.1 About Advanced Export

Advanced Export produces two types of plain text files: DAT and TXT.

DAT Files

DAT files contain comma–delimited values that applications such as Excel or Matlab can read.

There is a DAT file for each A-scan thickness with rows (fast B-scans) and columns (slow B-scans). The first row is top fast B-scan; the first column is the left slow B-scan.

TXT Files

These files save patient information, exam information, and values (temporal to superior, superior to nasal, nasal to inferior, and inferior to temporal). Values are:

- Neuro–retinal rim thickness values at 180 points (2° each)
- RNFL thickness values at 256 points (1.41° each)

8.2.3.3.2 ONH/RNFL OU Analysis

You can customize the **ONH and RNFL Thickness** report. For customization information, see: Configuring ONH Reports.

Figure 46: ONH and RNFL Thickness Analysis Overview

#	Symbol	Explanation
1	**Toolbar** Displays information about the scan and tools to make adjustments	
	Transparency 50 %	Sets the overlay transparency level.
2		**Deviation Map**
		RNFL (Purple outer) calculation circle. **Interaction:** Move the RNFL calculation circle to recalculate: ■ **Deviation Map** ■ **Optic Disc** measurements Black (middle) Circle: Optic Disc Outline Red (inner) Circle: Optic Cup Outline
	Rotation Indicators	Cyan dots on the optic disc and optic cup indicate the direction of rotation. When you change the angle of the ONH spoke, the cyan dots move to the corresponding angle selected.

#	Symbol	Explanation
3	Reference Range Comparison 	Displays measurements with color-coded comparison to the reference range for the patient's age.
4	Quadrant Averages 	Shows the RNFL thickness for each eye in four quadrants (Superior, Nasal, Temporal, Inferior)
	RNFL Thickness Chart 	Displays thickness profiles. ■ TSNIT
5	RNFL Clock Hours 	Shows the measurement for each clock hour and indicates whether the measurement is within 90% of the reference limit range of healthy eyes (green), within 5% of the reference limit range of healthy eyes (yellow) or within 1% of the reference limit range of healthy eyes (red).
6	 	RNFL thickness map.
7	 	Vertical B-scan: slice through cube top to bottom relative to LSO fundus image.
8		Horizontal B-Scan: slice through cube side to side relative to LSO fundus image. RNFL circle scan extracted along 3.46 mm diameter Calculation Circle
9	Angle Indicator	Shows the angle of the ONH spoke.

#	Symbol	Explanation
	Rotation Tool	Changes the angle of the ONH spoke.

8.2.3.3.3 Analyzing ONH and RNFL

The **ONH and RNFL OU Analysis** uses two kinds of thickness measurements:

- RNFL grid

  When you move the RNFL grid, the thickness maps, deviation maps, and ONH calculations update automatically.

- Super-pixels

  A total of 50 x 50 (2500) super-pixels are analyzed (optic disc excluded).

RNFL Thickness Maps report thickness by showing blue or green for thinner areas and yellow or red for thicker areas (the optic disc appears solid blue).

Deviation Maps compare the reference range for healthy eyes for the patient's age and show yellow and red areas that are thinner than 95% and 99% of the (age and optic disc size-adjusted) population, respectively.

Interpretation Considerations

For some patients, deviation maps can show decrease due to reasons other than pathology. such as:

- The patient has strongly myopic or hyperopic eyes
- The patient has split-bundle anatomy
- The patient has a tilted RNFL bundle pattern

If the patient's temporal RNFL that is very thin or absent, the maps might show thickened RNFL.

CIRRUS™ HD-OCT compares the RNFL thickness and symmetry of the scan(s) with the reference range for healthy eyes for the patient's age.

To analyze ONH and RNFL OU:

Prerequisite

☑ You are logged in (review station or instrument): Login.

☑ The patient has at least one optic disc cube scan per eye.

Action

1. Select the patient and click **Analyze**.
2. Select an **Optic Disc Cube** scan and select **ONH and RNFL OU Analysis**.
3. To set the center of the grid to the position of the slice navigators, click .
4. To show or hide the radial control over the fundus image, click **Radial** .
5. To show or hide the layer indicators, click **Show/Hide Layers** .
6. To reposition the optic disc and cup over the fovea, click and drag the circles into place.

7. To rotate the angle of the ONH spoke, click **Up** or **Down**.

8. To export all images, click **Advanced Export** .
9. To use a different scan, manually select it (Manually Select a Scan [▸ 358]).
10. To edit an image, right-click to access the edit menu (see: About Image Editing [▸ 359]).
11. To view a full-screen image, double-click on the image.
12. To print, save, or export a report, see: Creating a Report [▸ 375].

Also see

- Reference Database 2 for Healthy Eyes Study–CIRRUS 6000 [▸ 457]
- Reference Database 1 for Healthy Eyes Study–CIRRUS 400/4000/500/5000 [▸ 443]
- Acquire an Optic Disc Cube Scan [▸ 160]

Editing Images Using the Menu [360]

8.2.3.4 ONH Guided Progression

NOTE

Guided Progression Analysis (GPA) is one component of a comprehensive clinical assessment of glaucoma progression. Apply GPA results in context of the patient

GPA reports statistically significant change for one eye, which may or may not be clinically significant.

- Rate of loss, locations of the detected loss, age of the patient, stage of the disease, and other clinical factors should be evaluated for clinical decisions.
- To confirm that ONH loss is clinically significant, correlate your results with other clinical tests such as perimetry and IOP.

This analysis helps you follow changes to the optic nerve head.

Guided Progression Analysis includes features to follow changes to the optic nerve head:

- A graphical plot of the average cup-to-disc ratio as a function of patient age using the same layout as the graphical plots of RNFL average thickness measurements versus patient age. This graphical plot is available on a second page of the analysis screen. You may access this page by selecting the ONH toggle button.
- The GPA summary box has been expanded to include a colored checkmark whenever “Possible Loss”, “Likely Loss”, or “Possible Increase” has been detected using the Average Cup-to-Disc Ratio (ACDR). Note that ACDR increases as the thickness of RNFL decreases. Therefore, ”Possible Loss” of RNFL is indicated by an increase in ACDR, and thus ”Possible Loss” is checked when an there is an increase in ACDR observed (that exceeds the expected variability of ACDR).
- The RNFL thickness maps that are displayed as a function of time include a mask to indicate the location of the cup and disc boundaries. This display is similar to what is seen on the ONH & RNFL OU Analysis.

NOTE

Some plot points may be missing from the graph if exams selected span beyond 15 years.

- Make sure to select exams within a 15 year range to see the guided progression.

This analysis compares 3-8 exams for changes to thickness measurements over time and determines whether significant changes have occurred.

This analysis is available for the following scans:

- Optic Disc Cube 200 x 200

8.2.3.4.1 Guided Progressive Analysis (GPA) Scan Selection

GPA automatically selects the appropriate scans from the most recent 8 visits. The automatic selection algorithm looks for scans with the highest signal strength from each previous visit. Scans with signal strength of 5 or lower will not be loaded automatically, although you may load them using the manual tool if necessary. CIRRUS™ HD-OCT automatically establishes the first two qualifying exams as the Baselines.

Use the Guided Progression Analysis - Manual Selection to override the automatic GPA selections. You can select from a list of eligible scans in place of automatically selected scans. If you use the manual selection, then the report would indicates that choice.

- The first Baseline scan is indicated by the letter B.
- Scans to be included in the analysis are indicated by green checkmarks (✔).
- Scans that are not selected for the current analysis do not have any mark next to the scan.
- You can click an unchecked scan to include it. The green checkmark toggles with each selection.

8.2.3.4.1.1 Changing the Baseline Image

The Baseline image will always be the oldest image in the GPA sequence. Any images older than the Baseline image will not be included in the GPA.

Action

1. Select Guided Progression Analysis - Manual Selection.
2. Select the desired scan for the Baseline.
3. Click Set as Baseline.
   ⇨ The letter B will indicate the Baseline exam.

The exam you selected will be the first Baseline and the next qualified exam will be the second Baseline. The second Baseline exam is not indicated by a letter B. It will only be indicated by a green checkmark. GPA will recalculate all follow up exam comparisons based on the new Baseline.

NOTE

Baselines can be from the same day, but should be separated by at least a day.

However, if the Baselines are separated by too great of a time period, change may have occurred between Baselines, which would make it more difficult to detect loss.

8.2.3.4.1.2 Including Scans

The Baseline image will always be the oldest image in the GPA sequence. Any images older than the Baseline image will not be included in the GPA.

Action

1. Select Guided Progression Analysis - Manual Selection.
2. Click the scan to include.
3. Repeat to include additional scans.
   ⇨ A green checkmark will appear next to the selected scan.
4. If you find a scan unacceptable, you can delete the scan or exclude it. You may not permanently exclude scans from Guided Progression Analysis.
5. When exam selection is complete, click Next to exit the selection screen. Continue to the GPA analysis.

The GPA exam selections made during this process are set as the new default exams for the patient. Subsequent use of GPA using the automatic exam selection option will use these exams and will automatically select any new exams completed after the last manually selected exam. Should you have more than 8 eligible exam dates, the first Follow-up (exam 3) will be removed from the list and replaced with the most recent exam.

NOTE

If you use GPA Manual Selection for a standalone device, then the device will remember the scan selection the next time you run GPA for the current scan on the same device. If you use GPA Manual selection for a device that is connected to FORUM, then you must repeat the manual selection as the selection is not saved by default.

8.2.3.4.2 ONH Guided Progression Analysis Overview

Figure 47: ONH Guided Progression Analysis Overview

#	Symbol	Explanation
1	**Scan Information** 	Date & Time of acquisition. Serial Number of the instrument that acquired the image. Registration type and signal strength. Average thickness.
2	RFNL Thickness Maps 	Shows a series of RNFL thickness maps over time.
3	RNFL Thickness Change Maps 	Statistically significant changes are highlighted with yellow, red, or purple. Red indicates likely decrease (it has changed relative to the two Baselines, and furthermore, the same region on the previous exam had also changed by more than the expected test-retest variability). Yellow indicates possible decrease (It has changed relative to the two Baselines, but an additional scan is required to confirm that the change is likely) Purple indicates possible increase (indicates an increase in thickness relative to the two Baselines). For “Likely Decrease,” “Possible Decrease,” or “Possible Increase,” to be reported, at least 20 adjacent superpixels must show significant change. The red circle on the fundus image represents the measurement area for the charts and graphs.
4		The graphical plots will show a rate of change, 95% confidence limits around that rate of change whenever at least 4 exams that span a minimum of 2 years are loaded. If there are fewer than 4 scans loaded, or if there is less than two years between the first baseline and the current scan, no rate of change analysis will be provided.

#	Symbol	Explanation
7	RNFL Thickness Profile	Plots RNFL thickness values in the red measurement area centered on the optic disc. ■ **B1:** First baseline scan measurements. ■ **B2:** Second baseline scan measurements. ■ **C:** (Blue line) the most recent scan. The RNFL Thickness Profile identifies moderate focal thinning (at least 14 adjacent A-scans showing significant change) by comparing changes over multiple visits to test–retest variability. This value was chosen to allow the TSNIT profile to be sensitive to defects of 20° or more. red shading indicates likely decrease. yellow shading indicates possible decrease. purple shading indicates possible increase.
8	Summary	Unchecked indicates no decrease or increase detected. ✓ Red indicates Likely Decrease (progressive decrease detected and confirmed by consecutive follow–up exams). ✓ Yellow indicates Possible Decrease (progressive decrease detected once.) ✓ Purple indicates Possible Increase (improvement).
9	Progression Setting	Selects either: ■ ONH: graphs the Average Cup–to–Disc Ratio per patient's age ■ RNFL: graphs the RNFL thickness per patient's age

Also see

ONH Guided Progression [▸ 281]

8.2.3.4.3 Analyzing RNFL Change Progression

You can customize **Guided Progression** reports. For customization information, see: Configuring Guided Progression Reports [▸ 102].

To analyze RNFL progression:

Prerequisite

☑ The patient has at least three optic disc cube scan (Acquire an Optic Disc Cube Scan [▸ 160]).

Action

1. Select the patient and click **Analyze**.
2. Select an **Optic Disc Cube** scan and select **Guided Progression Analysis**.

3. Ensure that the signal strength is 6 or higher for each image.
4. Ensure scans are registered properly; if needed, manually register the scans.

5. To use a different scan, manually select it (Manually Select a Scan [▸ 358]).
6. To view optic nerve measurements, select **ONH**.
7. To view retinal nerve fiber layer measurements, select **RNFL**.
8. Check the baseline scans to ensure consistent results for:
   RNFL Thickness profiles
   Average RNFL Thickness graphs
   RNFL thickness maps
9. Check the progression series:
   ⇨ Evaluate the rate of decrease, locations of the detected decrease, age of the patient, stage of the disease, and other clinical factors to make clinical decisions.
   ⇨ Correlate these results with other clinical tests (perimetry, IOP) to confirm that RNFL loss is clinically significant.
10. Check the **Summary**.

11. To edit an image, right-click to access the edit menu (see: About Image Editing [▸ 359]).
12. To view a full-screen image, double-click on the image.
13. To print, save, or export a report, see: Creating a Report [▸ 375].

Also see

🗎 Editing Images Using the Menu [▸ 360]

8.2.4 Advanced Visualization Analysis

Advanced Visualization Analysis is available for the following scans:

- Macular Cube 512x128
- Macular Cube 200x200
- Optic Disc Cube 200 x 200

8.2.4.1 Advanced Visualization Analysis

Figure 48: Advanced Visualization Overview

#	Symbol	Explanation
1	**Toolbar** Displays information about the scan and tools to make adjustments	
2		Fundus image showing scan area and cube navigation lines.
	Overlay ILM - RPE	Selects which overlay to display over the fundus image.
	Transparency 50 %	Sets the overlay transparency level.
3	Front plane navigator	Shows cross–section of the cube front.

#	Symbol	Explanation
4	Side plane navigator 	Shows cross–section of the cube side.
5	Top Plane Navigator 	Shows cross–section of the cube top. ■ None (default) ■ Slice ■ OCT Fundus ■ Slab ■ ILM – RPE ■ ILM – RPEfit ■ RPE – RPEfit **Interaction:** When you select Slab, the dashed lines depict slab thickness in all three planes. ■ To adjust the slab, drag the posterior line of the front or side plane by its handle. ■ To reposition the slab, drag the anterior line handle and move both lines of the slab together.The image shows an average signal intensity value for each A-scan location through the depth of the slab. For ILM, RPE, and RPEfit (variations of the slab), you view the slab thickness relative to the layer.

8.2.4.2 Analyzing Advanced Visualization

Action

1. To edit an image, right-click to access the edit menu (see: About Image Editing [▸ 359]).
2. To view a full-screen image, double-click on the image.
3. To print, save, or export a report, see: Creating a Report [▸ 375].

Also see

- Editing Images Using the Menu [▸ 360]

8.2.5 3D Visualization Analysis

3D Visualization Analysis is available for the following scans:

- Macular Cube 512x128
- Macular Cube 200x200
- Optic Disc Cube 200 x 200

8.2.5.1 3D Visualization Analysis

Figure 49: Optic Disc Cube 3D Visualization Overview

Pos.	Symbol	Name	Explanation
1	**View Settings**	Brightness	increases or reduces image brightness.
		Contrast	increases or reduces image contrast.
		Threshold	**Threshold** removes darker tissue in the image.

Pos.	Symbol	Name	Explanation
		Transparency	■ **Use Same Transparency for all Pixels** equalizes transparency allowing you to see through darker tissue better. ■ **Transparency** reduces or increases the transparency for all pixels by the same percentage
		Intensity	■ **Apply intensity filter** adjusts intensity settings. ■ **Intensity Value** sets the grayscale intensity range. ■ **Intensity Range** limits the intensity range.
		Lighting	■ **Lighting** changes the external light source (decreases the internal light of the cube). ■ **Surface Light Weight** changes the intensity of light on the surface of the image. ■ **Gradient Step Size**
		Save / Apply	■ **Save As Global** saves your settings for all subsequent exams. ■ **Apply Global** restores previous global settings. ■ **Apply Defaults** restores the default settings.
	Show Settings 	Fundus	check to include the top / bottom fundus images.
		Resolution	shows images in normal or high resolution.
		Surface	check to include surface(s)
		Volume	check to include volume(s)
		Box	check to show a box around the cube.
		Clip Selector	selects the whole cube or a particular area of the cube to view
2		Clip Surfaces	selects which plane of tissue to clip or cut away.
		Lighting	enables exterior lighting.

Pos.	Symbol	Name	Explanation
		Light Direction Adjust	adjusts the light direction.
		Grayscale Mode	shows color or grayscale image.
3		Animation Editor	■ **Timeline** selects a particular point in the animation. ■ **Save snapshot** defines the length of animation. ■ plays or pauses playback. ■ stops playback. ■ **Save** saves the animation in CIRRUS™ HD-OCT-specific format. ■ **Load** plays a previously-saved animation. ■ **Save as Movie** saves an animation in a standard movie format. ■ **Close** exits the animation editor.
4		AutoRecord	■ **AutoRecord Keyframes** starts recording snapshots automatically at specific intervals ■ **Stop AutoRecord** finishes recording the animation ■ **Clear AutoRecording** starts a new animation. ■ **PlayEdit AutoRecording** play backs, allows you to edit, and saves the recording. ■ **Close** exits AutoRecord.
5		A-Scan Adjustments	■ **Width** manually adjusts the red sphere position. ■ **Height** manually adjusts the blue sphere position. ■ **A-Scan** manually adjusts the green sphere position.
6		Mouse Rotates	mouse movement rotates the image.
		Mouse Translates	mouse movement translates the image.

Pos.	Symbol	Name	Explanation
		Zoom	zooms in or out.
7		Straighten Volume Data	■ **Auto Straighten** automatically corrects the image tilt. ■ **Reset to Zero** resets corrections ■ **Units** sets **Degrees** or **Radians**. **Straighten X** straightens the image along the X axis. ■ **Straighten Y** straightens the image along the Y axis.
8		Transparent Surfaces	Check the view individual layers as transparent surfaces and adjusts transparency level. **NOTE! Transparent surfaces have lower resolution.**
9		Reset	**Reset** returns the image to its default settings.
10		Signal Strength	Indicates scan quality level; more green indicates a higher quality scan.
		Track	
11		3D Image	■ White lines show cube boundaries ■ Red, Green, and Blue lines show the slice planes. ■ Drag sphere along the line of the same color to change the slice.

8.2.5.2 Analyzing 3D Visualization

Action

1. Click **Analyze**.
2. Select a cube scan.
3. Select **3D Visualization**.
   ⇨ The 3D Visualization Analysis opens. The cube boundaries are shown with white lines. Labels indicate the Nasal (N), Superior (S), Temporal (T), and Inferior (I) sides of the cube.
4. To define the slice plane, drag the (red, green, or blue) sphere along the matching line.
5. To zoom in or out, scroll the mouse.
6. To adjust brightness, contrast, threshold and transparency, click **View Settings**.
7. To display settings, click **Show Settings > Show...**

8. To show or hide the cube boundary lines, and show or hide the view from the top or bottom of the box, click **Show Settings** and check the appropriate settings.
9. To select the whole cube or one of the four niches of the cube, select **Clip Selector** .
10. To adjust the light direction, move the red and green spheres left to right.
11. To toggle between color and grayscale, click **Grayscale Mode**.
12. To save a recorded animation, click **Save** or **Save as Movie.**
13. To close animation, click **Close**.
14. To record a movie in AVI format, click **Record**, make edits that you want to record, and click **Record** again.
15. To play back a movie, click **Play**, navigate to the folder with the movie file and click **Open**.
16. To start recording, click **AutoRecord Keyframes**.
17. To finish recording the animation, click **Stop AutoRecord**.
18. To play back, edit, and save, click **Play/Edit AutoRecording**.
19. To start a new animation, click **Clear AutoRecording** .
20. Click **Close**.
21. To capture an image of the screen, click **Take Snapshot**.
    ⇨ You can save the image as a BMP, JPG, or PNG file.
22. To automatically correct a tilted retina, click **Auto Straighten**.
23. To manually correct the retina angle, adjust the sliders, numbers, or arrows.
24. Check whether to view ILM, RNFL, or RPE as transparent surfaces.
    ⇨ Transparent surfaces cause the image to have lower resolution.
25. Use the sliders to adjust the transparency level.
26. To return to the original image settings, click **Reset**.

8.2.6 Combined (Macular and ONH) Analysis

8.2.6.1 Single Eye Summary Analysis

When you select the **Single Eye Summary** analysis for any macular cube or optic disc scan, CIRRUS™ HD-OCT automatically selects the best companion scan to complete the analysis. For example, if you select a macular cube scan, the system selects the optic disc scan from the same day to include in the analysis.

If you want to select a different companion scan, select **Single Eye Summary - Manual Selection**.

Single Eye Summary Analysis is available for the following scans:

Either: ■ Macular Cube 512x128 ■ Macular Cube 200x200	+	Optic Disc Cube 200 x 200

Figure 50: Single Eye Summary Analysis Overview

#	Symbol	Explanation
1	**Toolbar** Displays information about the scan and tools to make adjustments	
2		Macular Thickness Map Shows ILM-RPE thickness maps.
3		**Deviation Map**
		RNFL (Purple outer) calculation circle. **Interaction:** Move the RNFL calculation circle to recalculate: ■ **Deviation Map** ■ **Optic Disc** measurements Black (middle) Circle: Optic Disc Outline

#	Symbol	Explanation
		Red (inner) Circle: Optic Cup Outline
	Rotation Indicators	Cyan dots on the optic disc and optic cup indicate the direction of rotation. When you change the angle of the ONH spoke, the cyan dots move to the corresponding angle selected.
4		Fovea Finder Automatically identifies the fovea and shows the surface of the area for the individual thickness measurements in the grid and table.
5	Measurements Table	Displays measurements with color-coded comparison to the reference range for healthy eyes for the patient's age.
6		RNFL thickness map.
7		**Neuro-Retinal Rim Thickness** Graph **RNFL Thickness** Graph Displays thickness at each A-scan location along the selected circle **Interaction:** Recalculate according to position if you: ■ Move the blue line right or left. ■ Toggle the lines to display OD, OS, or OU.
8	Macular Thickness Information	Shows overall average macular thickness in nine sectors. ■ central circle (radius = 500 micrometers; diameter =1 mm) ■ superior sectors ■ nasal sectors ■ temporal sectors ■ inferior sectors. Macular Thickness Parameters [▸ 237].
9		Macular Cube B-Scan

#	Symbol	Explanation
10		4 mm B-Scan extracted from radial spoke
		Rotation Angle Allows you to change the angle of rotation for the optic nerve head spoke. **Interaction:** Changing rotation changes: ■ B-scan view ■ Cyan dots along the optic disc outline. ■ Cyan dots along the optic cup outline.

Also see

- Reference Database 1 for Healthy Eyes Study–CIRRUS 400/4000/500/5000 [▸ 443]
- Reference Database 2 for Healthy Eyes Study–CIRRUS 6000 [▸ 457]

8.2.6.1.1 Analyzing a Single Eye Summary

Interactivity provided for this analysis includes:

- Navigate through the OCT B-scans (macula and ONH).
- Toggle between Macula B-scans in the same window.
- Toggle between the Macula Cube B-scans and HD Cross Hair scans in the same window.
- Reset fovea location, which will update the data table and the ETDRS grid thickness measurements.
- Reset peripapillary RNFL circle location, which updates the RNFL and ONH analysis.
- Turn on and off the segmentation lines.
- Turn on and off the disc and cup boundaries and fovea indicator.

To analyze macular thickness and optic disc of the same eye:

Prerequisite

☑ The patient has at least one 512x128 Macular Cube scan that is centered at the macula: (Acquire a Macular Cube Scan [▸ 156]).

Action

1. Select the patient and click **Analyze**.
2. Select a **Macular Cube** or **Optic Disc** scan and select **Single Eye Summary**.
3. To export all images, click **Advanced Export** .
4. To show or hide the circle guides overlaying the fundus image, click **Show/Hide Circles**.

5. To show or hide the high-resolution image, click **HD** .
   ⇨ The image toggles between the original resolution and high resolution versions.
6. To return the current slices to their default central positions, click .
7. To place the navigators in the center of the grid, click .
   ⇨ The slice navigation lines move to the center of the grid.
8. To reset the grid to its original position, click .
9. To set the center of the grid to the position of the slice navigators, click .
10. To reposition the optic disc and cup over the fovea, click and drag the circles into place.
11. To rotate the angle of the ONH spoke, click **Up** or **Down**.
12. To edit an image, right-click to access the edit menu (see: About Image Editing [▸ 359]).
13. To view a full-screen image, double-click on the image.
14. To print, save, or export a report, see: Creating a Report [▸ 375].

Also see

🗎 Editing Images Using the Menu [▸ 360]

8.2.6.2 Panomap Analysis

The **PanoMap** analysis combines information from the Macular Thickness analysis, RNFL and ONH analysis, and Ganglion Cell OU analysis to provide an integrated, wide-field perspective for comprehensive analysis.

PanoMap Analysis is available for the following scans:

Either: ■ Macular Cube 512x128 ■ Macular Cube 200x200	+	Optic Disc Cube 200 x 200

Figure 51: PanoMap Analysis Overview

#	Symbol	Explanation
1		Macula and RNFL Thickness Map Shows thickness maps.
	Transparency 50 %	Sets the overlay transparency level.
	Overlay ILM - RPE	Selects which overlay to display over the fundus image. ■ ONH/RNFL thickness map for the optic disc cube and macular cube scans (default) ■ GCL+IPL lthickness map for the macular cube scan ■ ILM-RPE layer thickness map for the macular cube scan
3	Reference Range Comparison Disc Area 2.11 mm² Rim Area 0.99 mm² Average C/D Ratio 0.73 Vertical C/D Ratio 0.67 Cup Volume 0.369 mm³ Average RNFL Thickness 80 µm Superior RNFL Thickness 87 µm Inferior RNFL Thickness 122 µm	Displays measurements with color-coded comparison to the reference range for the patient's age.
4		Compares Ganglion Cell and RNFL thickness to the reference range for the patient's age. ■ **Red** indicates thinner than 99% of the (age-adjusted) normal reference population. ■ **Yellow** indicates thinner than 95% of the (age-adjusted) normal reference population.
5	⚠ OD µm OS µm Average GCL + IPL Thickness 67 72	Shows average GCL+IPL layer thickness with color-coded comparison to the reference range for healthy eyes for the patient's age.
6		GCL + IPL Thickness grid [▶ 261]

#	Symbol	Explanation
7		**Neuro-Retinal Rim Thickness** Graph **RNFL Thickness** Graph Displays thickness at each A-scan location along the selected circle **Interaction:** Recalculate according to position if you: ■ Move the blue line right or left. ■ Toggle the lines to display OD, OS, or OU.
8	Macular Thickness Information 	Shows overall average macular thickness in nine sectors. ■ central circle (radius = 500 micrometers; diameter =1 mm) ■ superior sectors ■ nasal sectors ■ temporal sectors ■ inferior sectors. Macular Thickness Parameters [▸ 237].

Also see

- Reference Database 2 for Healthy Eyes Study–CIRRUS 6000 [▸ 457]
- Reference Database 1 for Healthy Eyes Study–CIRRUS 400/4000/500/5000 [▸ 443]

8.2.6.2.1 Analyzing a PanoMap

To analyze a panomap:

Prerequisite

☑ The patient has at least one Macular Cube scan that is centered at the macula: (Acquire a Macular Cube Scan [▸ 156]).

☑ The patient has at least one optic disc cube scan (Acquire an Optic Disc Cube Scan [▸ 160])

Action

1. Select the patient and click **Analyze**.
2. Under OD or OS, select a **Macular Cube** scan and select **PanoMap**.
   ⇨ The **PanoMap** analysis opens showing the selected macular cube scan and the most recent optic disc cube scan.

3. To change the overlay for the fundus image, select a different overlay (or none).
4. To adjust the overly transparency, slide the adjustment tool to the right or left.
5. If you want to use a different scan, manually select it (Manually Select a Scan [▸ 358]).
6. Analyze the macular thickness and RNFL maps, charts and graphs. For more information, see: Interpreting Macular Thickness Parameters [▸ 237] and Interpreting RNFL Results.
7. To edit an image, right-click to access the edit menu (see: About Image Editing [▸ 359]).
8. To view a full-screen image, double-click on the image.
9. To print, save, or export a report, see: Creating a Report [▸ 375].

Also see

- Acquire a Macular Cube Scan [▸ 156]
- Editing Images Using the Menu [▸ 360]

8.2.6.3 Wellness Exam Overview

NOTE

This report is intended to provide an eye health summary of both eyes for the patient.

▶ Acquire both macular and optic disc cube scans for each eye to provide a complete wellness report.

The **Wellness Exam** combines macular and optic disc image information to provide an integrated, easy-to-read, patient-focused report.

This analysis requires at least **one macular** and **one optic disc** image for the **same patient**, **same eye**, acquired the **same day**.

This analysis is available for the following scans:

Macular Cube Scan: 512x128* or 200x200 *512x128 is the default	+	Optic Disc Cube Scan: 200 x 200

You can select this analysis for any macular or optic disc cube scan. When you select a scan and the **Wellness Exam**, CIRRUS™ HD-OCT automatically finds the most recent companion scans needed for this report.

For example, if you select a patient's OD macular cube 200x200 image, CIRRUS™ HD-OCT finds the following companion images to use in the report:

- OD optic disc cube
- OS macular cube
- OS optic disc cube

Figure 52: Wellness Exam Overview

#	Symbol	Explanation
1		B-Scan Images Shows OD and OS B-scans of the macula.
		Cube Navigation Sliders Slides up and down to navigate through the slices.

#	Symbol	Explanation
3		Compares Ganglion Cell and RNFL thickness to the reference range for healthy eyes for the patient's age. ■ red indicates thinner than 99% of the (age-adjusted) reference population. ■ yellow indicates thinner than 95% of the (age-adjusted) reference population.
4	Quadrant Averages 	Shows the RNFL thickness for each eye in four quadrants (Superior, Nasal, Temporal, Inferior)
	RNFL Thickness Chart 	Displays thickness profiles. Right-click toggles the display orientation: ■ TSNIT ■ NSTIN
5		Shows average macular thickness in nine sectors. ■ central circle (radius = 500 micrometers; diameter =1 mm) ■ superior sectors ■ nasal sectors ■ temporal sectors ■ inferior sectors. Macular Thickness Parameters [▸ 237].
6	**Scan Information** OD/OS Macula Scan OS Macula Scan OD Optic Disc Scan OS Optic Disc Scan 	■ Signal strength (out of 10) ■ Date and time the scan was captured ■ Scan type and size.

Also see

- Reference Database 2 for Healthy Eyes Study–CIRRUS 6000 [▸ 457]

Reference Database 1 for Healthy Eyes Study–CIRRUS 400/4000/500/5000 [▸ 443]

8.2.6.3.1 Creating a Wellness Exam Report

Prerequisite

☑ The patient has at least one Macular Cube scan that is centered at the macula: (Acquire a Macular Cube Scan [▸ 156]).

☑ (Optional) The patient has at least one optic disc cube scan (Acquire an Optic Disc Cube Scan [▸ 160]).

Action

1. Select the patient and click **Analyze**.
2. Under OD or OS, select a **Macular Cube** or **Optic Disc Cube** scan and select **Wellness Exam**.
   ⇨ The **Wellness Exam** opens showing the selected macular cube scan and the most recent optic disc cube scan (for both eyes, if available).

3. If you want to use a different scan, manually select it (Manually Select a Scan [▸ 358]).
4. To view a full-screen image, double-click on the image.

5. To navigate through slices, slide the slice navigator up, down, right and left as needed.
   ⇨ The slice number updates as you move the slider.
6. To show or hide the high-resolution image, click **HD** .
   ⇨ The image toggles between the original resolution and high resolution versions.
7. To return the current slices to their default central positions, click .

8. To center the navigators to the middle of the ONH, click **Center ONH** .
   ⇨ The slice navigation lines move to the center of the grid.
9. Analyze the ganglion cell and RNFL maps, charts and graphs. For more information, see: Interpreting Ganglion Cell Results [▸ 261] and Interpreting RNFL Results.
10. To print, save, or export a report, see: Creating a Report [▸ 375].

Also see

🗎 Acquire a Macular Cube Scan [▸ 156]

8.2.7 En Face Analysis

En-face Analysis (facing forward) is the same perspective as the fundus image-- looking directly into the eye.

En Face Analysis is available for the following scans:

- Macular Cube 512x128
- Macular Cube 200x200
- Optic Disc Cube 200 x 200
- Angiography 3mm x 3mm
- Angiography 6mm x6mm
- Angiography 8mm x 8mm
- Angiography 12mm x 12mm
- HD Angiography 6mm x6mm
- HD Angiography 8mm x 8mm

8.2.7.1 En face Presets

You can click on the preset to overlay the en face image and adjust its transparency.

Figure 53: En Face Presets and Boundaries

#	Slab	Features		Example
		Boundary	Boundary	
1		**Thickness Map** Displays a color-coded slab of thicknesses ranging from 0 (black) to 500 (white). Each color bar is 25 micrometers (µm).		
2		**Fundus** Displays the structural view of the retina.		
3		**VRI** Highlights disorders of the VRI such as epiretinal membranes (ERM) and vitreomacular traction (VMT). ■ Bright areas may indicate vitreous attachments. ■ Variations in the background intensity may indicate macular pucker.		
		ILM + 133 µm	ILM - 33 µm	
4		**Mid-Retina** Highlights fluid and exudates occurring from the Inner Nuclear Layer to the Outer Nuclear Layer. Follows contours that are fractions of the distance between ILM and RPE. Follows the RPE contour and is elevated slightly to put it at the level of the IS/OS – Ellipsoid Zone.		
		Central 1/3 of retinal thickness based on the ILM and RPE layers		
5		**IS/OS Ellipsoid** Highlights disruptions to the IS/OS – Ellipsoid Zone (shown as dark areas). Follows the RPE contour and is elevated slightly to put it at the level of the IS/OS – Ellipsoid Zone.		

#	Slab	Features		Example
		Boundary	Boundary	
		RPE + 39 µm	RPE + 9 µm	
6		**Choroid** Highlights choroidal vasculature - below the RPE-Fit, (approximately Haller's Layer), deep in the choroid. ■ Dark areas indicate vessels. ■ Bright areas may indicate RPE disturbance (such as GA). *Choroid thickness can vary; borders may need adjustment.*		
		RPE Fit - 72 µm	RPE-Fit - 128 µm	
7		**Minimum Intensity** Shows patterns of minimum scan intensity in the retina to help identify areas of fluid or other disruptions (see: About Minimum Intensity Projection (Min-IP)). ■ Dark areas may indicate fluid build-up. ■ Bright areas may indicate disruption of the retina.		
		90% ILM + 10% RPE	RPE	

8.2.7.2 En Face Analysis

Figure 54: En Face Analysis Overview

#	Symbol	Name	Explanation
1	**Toolbar**		
2	*varies*	Selected Preset	Displays the preset slab selected from the thumbnails.
3	*varies*	B-Scan	Displays the B-scan
		Adjustment Tools	**Offset**: Adjusts the boundary line up or down. **Thickness**: Adjust the space between the two boundary lines. **Hide Lines**: Hides or shows the boundary lines.
4	*varies*	Preset Selector	Selects the Preset.

8.2.7.3 Analyzing En Face Images

Prerequisite

☑ The patient has a scan that provides En Face Analysis.

☑ You are logged in (review station or instrument): Login.

Action

1. Select the patient and click **Analyze**.
2. Select a scan that provides En Face Analysis, and select **En Face Analysis**.
   ⇨ The analysis opens.

3. Select a preset (see: En face Presets [▸ 305]).
4. To edit or adjust the image, hover over the image and select an adjustment tool (refer to: Edit Images (Hover Over) [▸ 362].
5. To view a full-screen image, double-click on the image.
6. To print, save, or export a report, see: Creating a Report [▸ 375].

8.2.8 Position the Fovea

CIRRUS™ HD-OCT software identifies reduced reflectivity below the retina to detect the fovea automatically for the following analyses:

- Analyze Macular Thickness [▸ 236]
- Analyze Macular Change [▸ 246]
- Analyze Ganglion Cell OU [▸ 261]
- Advanced RPE Analysis [▸ 256]

If the algorithm could not detect the fovea location or if the fovea was detected inaccurately, you can manually reposition the fovea. When you manually reposition the fovea, the data tables and ETDRS thickness measurements update accordingly.

The set of tools that help you position the fovea include:

#	Symbol	Name	Explanation
		Snap to Center	Moves the slice navigators to the center of the 6x6 mm square.
		Snap to ETDRS Grid center	Moves the slice navigators to the ETDRS Grid center position.
		Reset ETDRS Grid	Moves the ETDRS Grid back to the CIRRUS-calculated fovea center location.
		Center ETDRS Grid	Moves the ETDRS Grid to center on the slice navigator position.

8.3 Analyze Angiography Images

NOTE

12x12 cubes and 12 mm raster scan the resolution has changed compared to the case of the A-scan size of 2.0 mm.

Using the sum projection, weaker details of the images are enhanced. Specifically, by mathematical definition of the sum projection, with the sum projection the slower flow is enhanced and therefore smaller capillaries are more visible.

Before analyzing an Angiography image, re-assess scan quality, segmentation errors, and decorrelation tails.

Artifacts causing decrease in signal intensity, such as media opacities, dryness, may appear as capillary non-perfusion/ischemia. If artifacts occur, retake the scan to achieve better image quality. To note, intraretinal fluid may also block the OCT signal and appear as capillary non-perfusion/ischemia and should be analyzed accordingly.

Angiography Analysis is available for the following scans:

- Angiography 3mm x 3mm
- Angiography 6mm x 6mm
- Angiography 8mm x 8mm
- HD Angiography 6mm x 6mm
- HD Angiography 8mm x 8mm
- Angiography 12mm x 12mm

⊕ *Indicates optional features; license may be required.*

8.3.1 About Analysis Presets

Tip: If CIRRUS™ HD-OCT does not detect segments successfully, you can use the layer segmentation editor to set layer boundaries (see: Edit Layer Boundaries).

Some analyses have preset slab views that highlight different features or locations. You can also create your own custom presets.

Presets provide a calculated slab location as a starting point. However, since exact layer location can vary by patient anatomy and pathology, you can drag these segmentation lines to adjust layers more precisely.

You can make additional image adjustments (such as brightness and contrast) and save the adjusted images.

Presets are available for the following analyses:

- Analyze Angiography Images
- Compare Angiography Images [▶ 322]
- Analyze ONH Angiography Images
- Compare ONH Angiography Images
- Analyze En Face Images

8.3.1.1 Organize AngioPlex Presets

Not all AngioPlex presets appear in AngioPlex analysis. You can choose which presets to hide and which to display (including your own custom presets) by organizing the thumbnails.

To organize presets:

Prerequisite

☑ You are analyzing an AngioPlex image and you want to organize the presets.

Action

1. Click to open the **Thumbnail Organizer** .
   ⇨ Some thumbnails are displayed and others are hidden.
2. Move the presets you want to display under **Displayed Thumbnails**.
3. Move the presets you want to hide under **Hidden Thumbnails**.
4. To change to order of the presets, drag a displayed thumbnail to a new position.

Result

✓ The thumbnails you set for display appear for AngioPlex analysis in the same order.

8.3.1.2 Offset Preset Layer Boundaries

Editing layers allows you to fine-tune layer boundaries. If a patient's retinal structure has anomalies or if the patient's retinal pathology causes CIRRUS 6000 algorithms to trace the boundaries inaccurately, you might need to adjust layer boundaries.

NOTE! You can also left-click on the pink triangle and drag the layer boundary line into place.

You can drag any portion(s) of the boundary lines, but you cannot cross the upper and lower boundaries.

To offset layer boundaries:

Prerequisite

☑ An angiography cube scan is open: Analyze Angiography Images [▶ 308].

Action

1. Under **Segmentation Lines**, check **Show**.

   ⇨ Dashed lines indicating the top and bottom layers overlay the B-scan image.
2. To adjust the top layer, change the **Offset** number for **Top**.

3. To adjust the bottom layer, change the **Offset** number for **Bottom**.
4. Complete the analysis.

8.3.1.3 Custom Presets

There are two blank presets for you to create and reuse your own slab presets. There are two different types of custom presets:

Custom Scan Presets

You can create one or two custom presets to define your own boundaries and segmentation lines to use for the scan you are analyzing.

Custom Global Presets

You can also create one or two custom presets to define your own boundaries and segmentation lines to use for all **Angiography Analyses**. You can use custom presets to choose an inner boundary and an outer boundary, and then shift them to visualize the vasculature between existing presets.

You can step through the scan and drag segmentation lines to offset the outer and inner boundaries. However, you cannot use segmentation lines when images are overlaid with a thickness map.

8.3.2 About Angiography Registration

When you compare a patient's scan to an earlier scan (of the same type), CIRRUS™ HD-OCT automatically aligns, or *registers*, the scans together. Registration synchronizes anatomical structures and corrects differences in rotation, which can occur if the patient is situated slightly differently for the two scans.

Figure 55: Unregistered Areas (Black Border)

8.3.2.1 Automatic Scan Registration

There are two different methods for automatically registering scans, **R2** and **R1**.

CIRRUS 6000's primary (preferred) registration method is **R2**.

However, if **R2** cannot adequately register the images, the instrument attempts **R1** registration.

Analyses and reports that use scan registration inform you of which method was applied.

Method	Order	Description
R2	Primary	■ Aligns scans using the blood vessels identified in the en face images of both scans. ■ For guided progression analyses, uses translation and rotation to align the follow-up scan(s) to the baseline scan
R1	Secondary	■ Aligns scans using the center of the optic disc of both scans. ■ R1 does not include rotation. ■ R1 might cause additional variability at the super-pixel level, which can affect change detection in a thickness map.

Table 64: Registration Types

If you want to override automatic registration, you can register scans manually or select a different set of scans to register together. (See: Manually Register AngioPlex Images [▸ 313]).

8.3.2.2 No Registration

If automatic registration was not successful and no manual registration was applied yet, the scans will display **No Registration**. To register the scans, refer to: Manually Register AngioPlex Images [▸ 313].

8.3.2.3 Manual Registration

When you manually register images, you set (up to five) corresponding points between two images. When you identify the same structure or feature in both images, click that structure in the first image, then the second image.

For example, use a blood vessel bifurcation or a bend in a blood vessel as a point to mark. A matching set of marks indicates corresponding features. Different marks indicate the next features you mark (see: Manually Register AngioPlex Images [▸ 313]).

Figure 56: Registration Mark Pairing

After you register two images, the second image might display irregular black borders. These borders indicate areas that are not present in both images.

8.3.2.4 Manually Register AngioPlex Images

Matched Marks

To adjust registration manually:

Prerequisite

☑ You have a comparison analysis open and you want to change the registration.

Action

1. For **Registration**, select **Manual**.

⇨ The registration review tool opens.

2. Identify a feature that appears in both images, like a blood vessel bifurcation or a bend in a blood vessel.

3. Mark the feature in each image.

4. Identify and mark additional identifiable features in other regions of the pair of images (between 3 and 5 marks in each image).
5. To change the transparency of Image 1 or Image 2, move the transparency slider right or left.
6. To view the manually-adjusted overlay, click **Review Registration**.
7. To return to the original registration, click **Reset**.
8. Click **OK**.

Result

✓ The **Registration succeeded** message and a green flag appear.

8.3.3 Verifying the Avascular Slab

Reviewing the Avascular Layer

NOTE

The Avascular slab was constructed with the goal of bounding the parts of the retina that are expected to have no vasculature in normal anatomy. There are many situations

for which there may appear to be bright patches or areas in this image that are not necessarily due to pathology. These are listed below.

Examine the segmentation, flow, and intensity of B-scans carefully for abnormal-appearing vasculature in the Avascular slab.

- Errors in segmentation may cause there to be apparent vasculature. This is particularly common in the presence of geographic atrophy. Bright areas below the Bruch's Membrane are common in the presence of geographic atrophy due to the fact that the highly scattering RPE is missing. When this happens, the RPE segmentation can frequently fall into the choroidal areas and be irregular.
- Because the layers in between the ILM and RPE are estimated rather than segmented, they may incorrectly include bright areas that could contain decorrelation tails or even actual vasculature.
- The brightness and contrast of the avascular layer is enhanced in order to assist in visualizing any potential abnormal vasculature, but this can also tend to emphasize both noise and weak decorrelation tail signals.
- Exudates or migrated RPE may cause there to be artifacts in different layers. This should be uncommon in the outer retina, but it can occur.
- The segmentation, flow, and intensity of B-scans should be examined carefully if there is abnormal-appearing vasculature in the Avascular slab.

8.3.4 Angiography Presets

The following slabs are calculated based on Legacy Segmentation. Legacy Segmentation is based on true detection of two layers: ILM and RPE. All other Legacy layers are computed from the two

detected layers and are estimated rather than segmented. For example, for Legacy Segmentation, the Outer Plexiform Layer (OPL) is defined as OPL = RPE-fit – 110 µm.

Figure 57: Angiography Analysis Presets and Boundaries

#	Slab	Features		Example
		Top Boundary	Bottom Boundary	
1		**VRI** Highlights disorders of the VRI such as epiretinal membranes (ERM) and vitreomacular traction (VMT). ■ Bright areas may indicate vitreous attachments. ■ Variations in the background intensity may indicate macular pucker.		
		ILM - 300 µm	ILM	
2		**RPE - RPE Fit** Uses the summation of pixel values as the default.		
		RPE	RPE Fit	
3		**Retina Depth Encoded** A color encoded slab with different colors representing different layers. ■ Red: Superficial ■ Green: Deep ■ Blue: Asascular		

#	Slab	Features		Example
		Top Boundary	Bottom Boundary	
4		**Sub-RPE** Uses a Pixel option that displays the maximum pixel value for each A-scan.		
		RPE + 29 µm	RPE + 49 µm	
5		**Superficial** Displays the superficial retinal layer slab with the ILM layer segmented in the same manner as structural images. The IPL is approximate.		
		ILM	IPL	
6		**Choriocapillaris** Displays a uniform thickness of 20 microns.		
		RPE fit + 29 µm	RPE fit + 49 µm	
7		**Deep** Displays the deep retina layer slab.		
		IPL	OPL	
8		**Choroid** Displays the (estimated) Bruch's Membrane (BM).		
		RPE fit + 64 µm	RPE fit + 115 µm	
9		**Avascular** Displays parts of the retina that normally do not have vasculature. You can adjust brightness and contrast to help visualize potential abnormal vasculature, but these adjustments could also emphasize noise and weak decorrelation tail signals.		
		OPL	RPE fit - 70 µm	
10		**Retina** Illustrates vasculature of the entire retina. The lower boundary is offset by 70 µm to minimize the contribution of the hyper-reflective RPE.		
		ILM	RPE fit – 70µm	

#	Slab	Features		Example
		Top Boundary	Bottom Boundary	
11		**ORCC** Outer Retina-to-ChorioCapillaris		
		OPL	RPE fit + 38 µm	
12		**Whole Eye** Illustrates the vasculature of entire posterior segment, including vitreous, retina and choroid.		

- ILM = *Inner Limiting Membrane*
- IPL = *Inner Plexiform Layer* `IPL = ILM + 70% * (Thickness of ILM - Thickness of OPL)`
- DRL = *Deep Retinal Layer*
- IS/OS = *Inner Segment / Outer Segment* `IS/OS = RPEfit - 70 µm`
- OPL = *Outer Plexiform Layer*`OPL = RPE-fit - 110 µm`
- RPE = *Retinal Pigment Epithelium*
- VRI = *VitreoRetinal Interface*

8.3.5 Angiography Analysis Overview

Figure 58: Angiography Analysis Overview

#	Symbol	Explanation
1	**Tools and Indicators**	
		Navigates to the prior preset

#	Symbol	Explanation
		Rearranges, hides, or shows presets.
		Green indicates the scan was acquired with FastTrac **on**.
		Exports images and thickness values.
		Signal Strength 6 or higher indicates acceptable scan quality; 10/10 represents the best scan quality
		Turns on or off the watermark.
2	AngioPlex Image 	Displays the angiography image for the slab.
3		Displays the structure image for the slab.
4		B-Scan
5		Overlay Tools (AngioPlex and Structure images) **Thickness Map:** shows or hides the thickness map over AngioPlex® or Structure image (or both). **Transparency:** increases or deceases transparency of the thickness map overlaying the image. **Fundus Image:** shows or hides the fundus image over both AngioPlex® and Structure images. Slice Navigators: shows or hides the cyan (fast B-scans) and magenta (slow B-scans) over both AngioPlex® and Structure images.
7	Presets	Preset slabs (see:Angiography Presets).
8		B-Scan Settings

#	Symbol	Explanation
		B-Scan Flow shows or hides an overlay depicting blood flow on the B-scan image: ■ **1 color**: shows all aspects of the flow in light red. ■ **2 color**: light red shows flow data above the RPE; green shows flow data below the RPE. **Segmentation Lines:** **Show:** shows or hides the dashed magenta layer lines of the selected slab over the B-scan image. **Edit:** opens segmentation editing.
9	Slab Boundaries Reference: Top: ILM, Offset: 0 Reference: Bottom: IPL, Offset: 0	Shows the top and bottom boundaries for the selected slab preset.

8.3.6 Analyze an Angiography Image

You can edit the AngioPlex, Structure, and B-scan images individually. To access the editing tools, right click on the image you want to edit.

NOTE! You can use the toolbar arrows to navigate through the presets. The left arrow selects the prior preset. The right arrow selects the next preset.

To analyze an angiography image:

Prerequisite

☑ The patient has at least one angiography scan: (Acquire an OCT Angiography Scan [▸ 170]).

Action

1. Select the patient and click **Analyze**.
2. Under OD or OS, select a **Angiography** scan and select **Angiography Analysis**.
   ⇨ The analysis opens.

3. Select a preset (About Analysis Presets [▶ 309]).
   ⇨ The selected slab opens in **Slab**, **Structure**, and **B-scan** views.
4. To view a full-screen image, double-click on the image.
5. To overlay the B-scan image with flow data, check **Show** under **B-Scan Flow** .
   ⇨ Select **1 color** to show all flow data in red or select **2 color** to show areas above the RPE in light red and below the RPE in green.
6. To show the layer segmentation lines over the B-scan image: under **Segmentation Lines** , check **Show**.
   ⇨ Dashed magenta lines show the layer boundaries over the B-scan.
7. To adjust a layer boundary, refer to: Offset Preset Layer Boundaries [▶ 310].
   ⇨ The **AngioPlex** and **Structure** images update to match the adjusted layer boundary.
8. To remove image artifacts such as decorrelation tails, check **Remove Projections**.
9. To adjust image brightness or contrast, right-click on the image and select **Brightness/Contrast**.
10. To show a color image, right-click on the image and select **Color**.
11. To hide the image, right-click on the image and select **Hide**.
12. To exit any editing mode and save the changes, right-click on the image and select **Normal**.
13. To show the thickness map over the angiography image, check **AngioPlex**.
14. To show the thickness map over the structure image, check **Structure**.
    ⇨ **NOTE! You cannot use segmentation lines on an image showing a thickness map.**
15. To adjust the transparency of the thickness map(s), increase or decrease **Transparency**.
16. To show the fundus image over the AngioPlex and Structure images, check **Fundus Image**.
17. To turn on slice navigators that allow you to navigate the cube layers, check **Slice Navigators**. See: Navigate Cube Layers Manually [▶ 223].
    ⇨ Cyan (fast B-scans) and magenta (slow B-scans) navigators show over both AngioPlex and Structure images.
18. To return the current slices to their default central positions, click .

19. To center the navigators to the middle of the ONH, click **Center ONH** .
    ⇨ The slice navigation lines move to the center of the grid.
20. To edit or adjust the image, hover over the image and select an adjustment tool (refer to: Edit Images (Hover Over) [▸ 362].
21. To view a full-screen image, double-click on the image.
22. To print, save, or export a report, see: Creating a Report [▸ 375].

8.3.7 Compare Angiography Images

8.3.7.1 Angiography Two-Visit Comparison

The **Angiography Two-Visit Comparison** analysis allows you to compare two of a patient's Angiography scans to visualize changes in retinal vasculature.

This analysis is available for the following scans:

- Angiography 3mm x 3mm
- Angiography 6mm x6mm
- Angiography 8mm x 8mm
- HD Angiography 6mm x6mm
- HD Angiography 8mm x 8mm
- Angiography 12mm x 12mm

8.3.7.1.1 Angiography Two-Visit Comparison Overview

Figure 59: Angiography Two-Visit Comparison Analysis Overview

#	Symbol	Explanation
1	**Tools and Indicators**	
	Preset Slabs VRI	Selects the slab to view.
		Green indicates the scan was acquired with FastTrac **on**.
		Signal Strength 6 or higher indicates acceptable scan quality; 10/10 represents the best scan quality
	Prior Scan and Selected Scan	Indicates the **Date** and **Time** each image was acquired.
	Registration Automatic Manual None Automatic	Indicates whether images are aligned to each other.
	Advanced Export 	Exports images and thickness values.
2		Prior Images Shows the slab and the structure for the earlier image.
3		Selected Images

#	Symbol	Explanation
		Shows the slab and the structure for the selected image.
6	**Overlays**	AngioPlexCheck to overlay thickness maps. StructureCheck to overlay thickness maps. TransparencyAdjusts overlay transparency. Remove ProjectionsCheck to remove projections. WatermarkCheck to add a watermark to images Slice Navigators Shows or hides slice navigators on slab and structure images. Check **Fundus Image** to overlay fundus image (instead of thickness maps). B-Scan Flow Shows or hides an overlay depicting blood flow on the B-scan image: ■ **1 color**: shows all aspects of the flow in light red. ■ **2 color**: – light red shows flow data above the RPE. – green shows flow data below the RPE. Segmentation Lines Shows or hides magenta lines that indicate top and bottom layers of slabs.

⊕ *Indicates optional features; license may be required.*

8.3.7.1.2 Compare Images from Two Visits (Angiography)

To compare images from two visits (Angiography):

Prerequisite

☑ You are logged in (review station or instrument): Login.

☑ The patient has at least one angiography scan: (Acquire an OCT Angiography Scan [▸ 170]).

Action

1. Select the patient and click **Analyze**.
2. Under OD or OS, select a **Angiography** scan and select **2 Visit Comparison**.
   ⇨ The analysis opens.
3. Select a preset (About Analysis Presets [▸ 309]).
   ⇨ The selected slab opens in **Slab**, **Structure**, and **B-scan** views.
4. To view a full-screen image, double-click on the image.
5. To overlay the B-scan image with flow data, check **Show** under **B-Scan Flow** .
   ⇨ Select **1 color** to show all flow data in red or select **2 color** to show areas above the RPE in light red and below the RPE in green.

6. To show the layer segmentation lines over the B-scan image: under **Segmentation Lines** , check **Show**.
   ⇨ Dashed magenta lines show the layer boundaries over the B-scan.
7. To adjust a layer boundary, refer to: Offset Preset Layer Boundaries [▸ 310].
   ⇨ The **AngioPlex** and **Structure** images update to match the adjusted layer boundary.
8. To remove image artifacts such as decorrelation tails, check **Remove Projections**.
9. To show the thickness map over the angiography image, check **AngioPlex**.
10. To show the thickness map over the structure image, check **Structure**.
    ⇨ **NOTE! You cannot use segmentation lines on an image showing a thickness map.**
11. To adjust the transparency of the thickness map(s), increase or decrease **Transparency**.
12. To show the fundus image over the AngioPlex and Structure images, check **Fundus Image**.
13. To turn on slice navigators that allow you to navigate the cube layers, check **Slice Navigators**. See: Navigate Cube Layers Manually [▸ 223].
    ⇨ Cyan (fast B-scans) and magenta (slow B-scans) navigators show over both AngioPlex and Structure images.
14. To print, save, or export a report, see: Creating a Report [▸ 375].

8.3.8 Analyze Montage AngioPlex Images

Wide-field montage images increase the Field of View (FOV) to produce high-resolution vascular imaging over a larger region of the retina.

Montage Angiography Analysis is available for the following scans:

- Montage AngioPlex 6x6mm
- Montage AngioPlex 8x8mm

8.3.8.1 Montage AngioPlex Analysis

Figure 60: Montage Angiography Analysis Overview

#	Symbol	Name	Explanation
1	**Toolbar**		
		Toggle	Toggles between showing the **AngioPlex** and **Structure** image.
		Angio	Shows or hides the **AngioPlex** image.
		Structure	Shows or hides the **Structure** image.
		Both	Shows both the**AngioPlex** and **Structure** images.
		Watermark	Turns on or off the watermark.
		Advanced Export	Exports maps of the ILM layer to RPE layer thickness values.
2		AngioPlex Image	Displays the **AngioPlex** image of the selected slab.
3		Structure Image	Displays the **Structure** image of the selected slab.

#	Symbol	Name	Explanation
4		Scan Positions	Shows the positions of the individual images that make up the montage. Select a position to view its thumbnail.
5	Selected Image	Blue outline indicates selected image.	
6	Selected Presets	Outlined in blue.	
7	Presets	Preset slabs (see:Angiography Presets).	
8		Thumbnail	Thumbnail of the individual image.
9		Slab Boundaries	Shows the top and bottom boundaries for the selected slab preset.

8.3.8.2 Analyze an Angiography Montage Image

To analyze a montage image:

Prerequisite

☑ You are logged in (review station or instrument): Login.

☑ The patient has at least one montage angiography scan (Acquire AngioPlex Montage Scans [▸ 174]).

Action

1. Under OD or OS, select a **Montage** scan and select **Montage Angio Analysis**.
   ⇨ The **Montage Angio Analysis** opens.
2. Select a preset (About Analysis Presets [▸ 309]).
   ⇨ The selected slab opens in **AngioPlex** and**Structure** views.

Reference	Offset
Top: ILM	0
Bottom: IPL	0

3. To view the boundaries of the selected slab, refer to the table.
4. To view a full-screen image, double-click on the image.

5. To switch the positions of the AngioPlex and Structure images, click the arrows toggle.

6. To view the AngioPlex image only, click **Angio**.

7. To view the Structure image only, click **Structure**.

8. To view both AngioPlex and Structure images, click **Both**.

9. To export all montage images, click **Export**.

10. To view a thumbnail of an individual image from the montage, click on the position of the image.
    ⇨ The thumbnail under the selector shows the image of the selected position.
11. To analyze an individual image that makes up the montage, expand the montage, select the image and analysis you want to use.
12. To edit or adjust the image, hover over the image and select an adjustment tool (refer to: Edit Images (Hover Over) [▸ 362].
13. To view a full-screen image, double-click on the image.
14. To print, save, or export a report, see: Creating a Report [▸ 375].

8.4 Analyze Anterior Segment Scans

Typical Applications	Anterior Chamber	Anterior Segment Cube	5-Line Raster	HD Angle	Wide Angle to Angle	HD Cornea	Pachymetry
Measure Iridocorneal Angles	X Most accurate angle measurement	-	X	X Highest resolution and greatest detail of individual angle	X Both angles in one image	-	-
Measure additional angles	X	-	-	-	-	-	-
Measure anterior chamber depth, angle-to-angle distance	X	-	-	-	-	-	-
Measure angle-to-angle distance	X				X		
Measure lens vault	X						
Measure corneal thickness	X	X	X			X	X
Measure central corneal thickness	X	X				X	X
Measure angle to angle distance	X				X		
Navigate through slices horizontally and vertically	-	X	-	-	-	-	-
Measure corneal tissue and anterior segment structures below the cornea (vertically)			X			X	

Typical Applications	Anterior Chamber	Anterior Segment Cube	5-Line Raster	HD Angle	Wide Angle to Angle	HD Cornea	Pachymetry
View a color-coded thickness map of the cornea *with detailed thickness measurement data*	-	-	-	-	-	-	X
View color-coded thickness map of the corneal epithelium *with detailed thickness measurement data*							X

8.4.1 About Analyzing Anterior Segment Scans

Anterior segment reports do not include customization or additional options.

Many anterior segment scans are optional (see: About Licenses [▸ 63]).

Scan Pattern	External Lens	Scan	Details	Analysis
Anterior Segment Scans				
	-	**Anterior Segment Cube** ■ Creates a 3D image ■ **B-Scans:** 128 ■ **A-Scans:** 512 ■ **HD B-Scans:** 2 ■ **A-Scans per HD B-Scan:** 1024	■ Creates a 3D image ■ **Scan Depth:** 2mm ■ **Scan Depth:** 2mm	■ Anterior Segment Analysis ■ 3D Visualization
	-	**Anterior Segment 5 Line Raster**	View images of the anterior chamber angle and cornea. ■ Five parallel horizontal lines 0.25mm apart (1mm width total). ■ **Length:** 3.0mm (fixed)	High Definition Images
	-	**HD Angle** ■ **Averaging per line:** 20 ■ **A-Scans:** 1024	Angle measurements for one iridocorneal angle ■ **Scan Depth:** 2.9mm ■ **Length:** 6.0mm ■ **Adjustments:** -89 to 90°	HD Angle Analysis

Scan Pattern	External Lens	Scan	Details	Analysis
		Anterior Chamber ■ **Averaging per line:** 20 ■ **A-Scans:** 1024	■ **Scan Depth:** 5.8mm ■ **Length:** 15.5mm (rotation may reduce to 14.0mm) ■ **Adjustments:** -89 to 90°	Anterior Chamber Analysis
		Wide Angle-to-Angle ■ **Averaging per line:** 20 ■ **A-Scans:** 1024	Angle measurements for a both iridocorneal angles (0° and 180°) ■ **Scan Depth:**2.9mm ■ **Length:** 15.5mm (rotation may reduce to 14.0mm) ■ **Adjustments:** -89 to 90°	Wide Angle-to-Angle Analysis
		HD Cornea ■ **Averaging per line:** 20 ■ **A-Scans:** 1024	Shows a wider field of view (than 5-Line). ■ **Scan Depth:** 2.0mm ■ **Length:** 9.0mm ■ **Adjustments:** -89 to 90°.	HD Cornea Analysis
		Pachymetry ■ **B-Scans:** 24 (radial) ■ **A-Scans:** 1024	Measure corneal thickness, epithelial thickness, and view a color-coded thickness map of the cornea. ■ **Scan Depth:**2.0mm ■ **Diameter** 9.0mm	Pachymetry Analysis

Table 65: Anterior Segment Scans

8.4.2 About Central Corneal Thickness Measurement

Some conditions make it more difficult to obtain an image that measures Central Corneal Thickness (CCT) accurately, including:

- Patient wearing contact lenses (obscuring the junction of contact lenses and the corneal surface).
- Patient with poor visual acuity (cannot maintain fixation).
- Patient with intraocular lenses, corneal abrasions or corneal opacities that cause excessive corneal reflection.
- Have the patient remove contact lenses.
- Use **HD Cornea** and **Anterior Chamber** scans to measure CCT more easily.

8.4.3 About Angle Measurement

There are two types of tools that measure angles: **Angle** tools and **IC Angle** tools.

Angle Tools

Left Angle tool ( ) and **Right Angle** tool ( ) allow you to place three points over an image and measure the angle.

When you place an angle tool, place the intersection at the scleral spur and the other two points at the corneal endothelium and iris. CIRRUS™ HD-OCT calculates the angle.

IC Angle Tools

IC Left Angle tool ( ) and **IC Right Angle** tool ( ) allow you to place multiple points over an image to measure additional aspects of the angle.

	AOD500	Angle Opening Distance at 500 mm (Distance between 1 and 2)
	AOD750	Angle Opening Distance of 750mm (Distance between 3 and 4)
	TISA500	Trabecular Iris Space Area 500 (mm^2) (Area of the polygon that joins points 1, 2, 5, and 6)
	TISA750	Trabecular Iris Space Area 750 (mm^2) Area of the polygon that joins points 1, 2, 5, and 1, 3, 4, 2.
	SSA	Scleral Spur Angle: (Angle formed by 1, 5, and 2)

8.4.4 Analyze Anterior Chamber Scans

Anterior Chamber analysis is only available for Anterior Chamber Cube Scans [▶ 187], which produce a 512 x 128 image 20 B-scans comprised of 1024 A-scans across the center of the eye at the depth of 5.8 mm.

Using this analysis you can measure:

- anterior chamber depth
- central corneal thickness
- left or right angles
- corneal tissues
- anterior chamber structures

You can also view and navigate through the slices of any cube scan as a three-dimensional image (see: 3D Visualization Analysis [▶ 289]).

8.4.4.1 Anterior Chamber Depth Tool

NOTE

You can place the Anterior Chamber Depth Tool in any position on the image.

Although this tool is designed to facilitate routine measurements, you can place the endpoints in other locations to measure different structures.

When you place the **Anterior Chamber Depth Tool** , the cornea caliper automatically positions itself to the cornea aligned to the anterior and posterior (corneal vertex) surfaces.

You can drag the caliper along the cornea to adjust its position. Once you drag the endpoints into each angle and the base line to the anterior surface of the crystalline lens, CIRRUS™ HD-OCT automatically calculates and displays measurements for:

- corneal thickness
- angle-to-angle distance

- anterior chamber depth
- lens vault

NOTE! For eyes with aphakia or pseudophakia, drag the base line to the pupillary plane.

8.4.4.2 Anterior Chamber Analysis

Figure 61: Anterior Chamber Analysis Overview

#	Symbol	Name	Explanation
1		Iris Image	Shows the scan pattern over the iris image and indicates the rotation direction set during acquisition.
2		Angle Measurements	(See: About Angle Measurement [▸ 330]).
3		Mirror Image Preview	Shows a thumbnail image with the corneal mirror image.
2	**Toolbar**		
		Raw / Processed Image	Toggles between the raw acquired image and the processed (corrected) image.
		Show / Hide Mirror Images	Shows or hides the corneal mirror image.
		Show / Hide Layers	Overlays lines to indicate: ■ **Green**: anterior cornea ■ **Red**: posterior cornea ■ **Magenta**: residual stromal line
		Anterior Depth Tool	(See: Anterior Chamber Depth Tool [▸ 333]).
		Annotate Image	Adds your notes onto the image.

#	Symbol	Name	Explanation
		Right Angle Measurement Tool	(See: About Angle Measurement [▶ 330]).
		Left Angle Measurement Tool	
		Caliper	Adds a measurement line.
		Delete	Deletes an angle or caliper measurement line.
5		B-Scan	(See: Anterior Chamber Depth Tool [▶ 333]).

8.4.4.3 Analyzing Anterior Chamber Scans

NOTE

The Anterior Chamber Angle measurements are not intended as a substitute for gonioscopy, which is the current reference standard for evaluating the anterior chamber angle configuration.

During gonioscopy the operator can dynamically view the mirror/prism to examine full extent of the angle.

The **Anterior Chamber Depth** analyzes a single location.

NOTE

The Anterior Chamber scan uses a full axial field of view to display both the true image data and an inverted mirror artifact.

Even if you hide the mirror image, distinct bars remain where the mirror intersect the image.

To see these parts of the cornea, use the HD Cornea scan.

When you place the **Anterior Chamber Depth**, CIRRUS™ HD-OCT displays the measurements over the image and in the summary table.

Prerequisite

☑ The patient has at least one Anterior Chamber scan: (Anterior Chamber Scans [▶ 187])

Action

1. Select the patient and click **Analyze**.
2. Under OD or OS, select an **Anterior Chamber** scan and select **Anterior Chamber Analysis**.
   ⇨ The **Anterior Chamber** analysis opens.

3. To view the raw (unprocessed) image, click **Raw / Processed Image** .

4. To view the mirror image, click **Show / Hide Mirror** .

   ⇨ The mirror image appears on the image.

5. To show the layer lines for cornea anterior and posterior surfaces and the residual stromal line, click **Hide / Show Layers** .

   ⇨ Layer lines indicate: **Green**: anterior cornea; **Red**: posterior cornea; **Magenta**: residual stromal line.

6. Click the **Anterior Chamber Depth** tool.

⇨ The tool opens with the corneal caliper aligned to the top and bottom surfaces of the cornea at the posterior vertex.

7. To adjust the corneal caliper, drag the caliper along the cornea.
8. Drag the base line to the anterior surface of the crystalline lens. **NOTE! For eyes with aphakia or pseudophakia, drag the base line to the pupillary plane.**

   ⇨ CIRRUS™ HD-OCT calculates and displays the anterior chamber depth and lens vault.
9. Drag the endpoints of the base line into each angle.

   ⇨ CIRRUS™ HD-OCT calculates and displays the angle-to-angle distance.
10. To add a text annotation to the image, click **Annotate** and type text.

    ⇨ You can change the color and size of the text or move it somewhere else in the image (see: Add Annotations to Images [▸ 369]).

11. To place an angle measurement, click (right or left) **Angle Tool** and place the intersection at the scleral spur and the other two points at the corneal endothelium and iris.

    ⇨ CIRRUS™ HD-OCT calculates the angle.
12. To add a caliper, click **Caliper** .

    ⇨ A caliper measurement appears over the image. You can move, stretch, and rotate calipers. You can add (up to) ten.
13. To delete a measurement or annotation, select it and click **Delete** .
14. To edit or adjust the image, hover over the image and select an adjustment tool (refer to: Edit Images (Hover Over) [▸ 362].
15. To view a full-screen image, double-click on the image.
16. To print, save, or export a report, see: Creating a Report [▸ 375].

8.4.5 Analyze Anterior Segment Cube Scans

The **Anterior Segment Analysis** is the only analysis available for the Anterior Segment Cube [▸ 190] scan.

The **Fast B-scan** displays above the **Slow B-scan**.

8.4.5.1 Anterior Segment Cube Analysis

Figure 62: Anterior Segment Cube Overview

#	Symbol	Name	Explanation
1		Iris	Displays the iris, scan area (yellow square) and scan pattern placement.
2	**Toolbar**		
3		Horizontal B-Scan	
		Vertical B-scan	

8.4.5.2 Analyzing Anterior Segment Cube Scans

Prerequisite

☑ The patient has at least one Anterior Segment Cube scan: (Anterior Segment Cube [▸ 190]).

☑ You are logged in (review station or instrument): Login.

Action

1. Select the patient and click **Analyze**.
2. Under OD or OS, select an **Anterior Segment Cube** scan and select **Anterior Segment Cube Analysis**

⇨ The **Anterior Segment Cube** analysis opens.

3. To add a caliper, click **Caliper** .

⇨ A caliper measurement appears over the image. You can move, stretch, and rotate calipers. You can add (up to) ten.

4. To lock the length of the caliper, right-click on the caliper to open its settings, check **Lock Length** and click **Accept**.

5. To delete a caliper, click **Delete** .

6. To navigate through the vertical slices of the cube, click on the magenta triangle and drag the line right or left.

⇨ The current slice number changes dynamically as you navigate through slices.

7. To navigate through the horizontal slices of the cube, click on the cyan triangle and drag the line up or down.

⇨ The current slice number changes dynamically as you navigate through slices.

8. To return the current slices to their default central positions, click .
9. To show or hide the high-resolution image, click **HD** .
   ⇨ The image toggles between the original resolution and high resolution versions.
10. To open movie tools, right-click on the image and select **Movie**.
    ⇨ The movie player opens and automatically scrolls through the slices. For more information about these controls, refer to: Navigate Through Cube Slices as a Movie [▸ 380].
11. To edit an image, right-click to access the edit menu (see: About Image Editing [▸ 359]).
12. To view a full-screen image, double-click on the image.
13. To print, save, or export a report, see: Creating a Report [▸ 375].

Also see

🗎 Editing Images Using the Menu [▸ 360]

8.4.6 Analyze HD Angle Scans

NOTE

Features described in this section are licensed separately and may not be available in all markets. Contact your local ZEISS distributer about feature availability.

8.4.6.1 HD Angle Analysis

Figure 63: HD Angle Analysis Overview

Pos.	Symbol	Name	Explanation
1		Iris Image	Shows the scan pattern over the iris image and indicates the rotation direction set during acquisition.
2	IC Measurements | Value AOD500 | 0.30 mm AOD750 | 0.44 mm TISA500 | 0.15 mm² TISA750 | 0.24 mm² SSA | 30.96° Angle Measurements | Value Angle 1 | 45°	Angle Measurements	(See: About Angle Measurement [▸ 330]
3	**Toolbar**		
		Dewarp	Shows the curvature-adjusted image or the original (flat) image.
		Annotate Image	Adds your notes onto the image.
		IC Angle Measurement Tool	(See: About Angle Measurement [▸ 330]).
		Angle Measurement Tool	
		Caliper	Adds a measurement line.
		Delete	Deletes an angle or caliper measurement line.
4		Angle Image	Editing Options: ■ View Images in Full-Screen Mode [▸ 364] ■ Adjust Image Brightness [▸ 365] ■ Adjust Image Contrast [▸ 366] ■ Zoom In and Out [▸ 370]

Pos.	Symbol	Name	Explanation
			■ Save Edited Images [▶ 373] ■ Reset Edited Images [▶ 371]

8.4.6.2 Analyze an HD Angle Scan

Editing available for the **HD Angle** images:

- View Color or Grayscale Image [▶ 367]
- Adjust Image Brightness [▶ 365]
- Adjust Image Contrast [▶ 366]

Prerequisite

☑ The patient has at least one HD Angle scan: (HD Angle Scans [▶ 196])

Action

1. Select the patient and click **Analyze**.
2. Under OD or OS, select an **HD Angle** scan and select **HD Angle Analysis**.
   ⇨ The **HD Angle** analysis opens.

3. To view the raw (unprocessed) image, click **Raw / Processed Image** .
4. To add a text annotation to the image, click **Annotate** and type text.
   ⇨ You can change the color and size of the text or move it somewhere else in the image (see: Add Annotations to Images [▶ 369]).

5. To place an angle measurement, click (right or left) **Angle Tool** and place the intersection at the scleral spur and the other two points at the corneal endothelium and iris.
   ⇨ CIRRUS™ HD-OCT calculates the angle.

6. To place an iridocorneal angle measurement, click (right or left) **IC Angle Tool**, drag the trapezoid into position over the angle you want to measure and adjust the points to touch the corneal endothelium and iris.
   ⇨ CIRRUS™ HD-OCT calculates the measurements (see: About Angle Measurement [▸ 330]).
7. To add a caliper, click **Caliper** .
8. To delete a measurement or annotation, select it and click **Delete** .
9. To edit or adjust the image, hover over the image and select an adjustment tool (refer to: Edit Images (Hover Over) [▸ 362].
10. To view a full-screen image, double-click on the image.
11. To print, save, or export a report, see: Creating a Report [▸ 375].

Also see

🗎 HD Angle Scans [▸ 196]

8.4.7 Analyze HD Cornea Images

The **HD Cornea** scan helps you analyze the residual stromal bed on post-LASIK patients.

When acquiring the scan, the operator can rotate the scan pattern, but not change its length or central position.

8.4.7.1 HD Cornea Analysis Overview

Figure 64: HD Cornea Analysis Overview

#	Symbol	Name	Explanation
1		Iris Image	Shows the scan pattern over the iris image and indicates the rotation direction set during acquisition.
2	**Toolbar**		
		Raw / Processed Image	Toggles between the raw acquired image and the processed (corrected) image.
		Annotate Image	Adds your notes onto the image.
		Show / Hide Layers	Overlays lines to indicate: ■ **Green**: anterior cornea ■ **Red**: posterior cornea ■ **Magenta**: residual stromal line
		Cornea Caliper	Adds a measurement line across the cornea that snaps to the anterior and posterior corneal surfaces and slides along the corneal contour.
		Caliper	Adds a measurement line.
		Delete Measurement	Deletes a measurement line added with the caliper tool.
3		Cornea Image	Corneal layer lines show: ■ **Green**: anterior corneal surface ■ **Magenta**: adjustable residual stromal line (RSL) ■ **Red**: posterior corneal surface.

8.4.7.2 Analyze an HD Cornea Scan

HD Cornea Analysis is only available for HD Cornea Scans.

NOTE! You can also move the pink line by typing a different value for "Stromal Tool Distance."

Editing available for the **HD Cornea** images:

- View Color or Grayscale Image [▸ 367]
- Adjust Image Brightness [▸ 365]
- Adjust Image Contrast [▸ 366]

To analyze an HD Cornea scan:

Prerequisite

☑ The patient has at least one HD Cornea scan: (Acquire HD Cornea Scans)

Action

1. Select the patient and click **Analyze**.
2. Under OD or OS, select an **HD Cornea** scan and select **HD Cornea Analysis**.
   ⇨ The **HD Cornea Analysis** opens.

3. To view the raw (unprocessed) image, click **Raw / Processed Image** .
   ⇨ You cannot add measurement calipers to the raw (unprocessed) image.
4. To add a text annotation to the image, click **Annotate** and type text.
   ⇨ You can change the color and size of the text or move it somewhere else in the image (see: Add Annotations to Images [▸ 369]).
5. To show or hide the green, pink and red layer indicators, click **Show/Hide Layers**.

6. To adjust the residual stromal bed indicator (pink line) move the slider (right of the image) up or down.
7. To add a corneal thickness measurement, click **Corneal Caliper** .

   ⇨ A **Corneal Caliper** with an internal marker appears over the image. You can add (up to) ten.

8. To reposition the **Corneal Caliper**, select and drag it along the cornea.

   ⇨ CIRRUS™ HD-OCT automatically detects the corneal surfaces and measures the thickness dynamically as you move the caliper along the cornea.

9. To move the internal measurement mark, click on it and drag it up or down.

   ⇨ CIRRUS™ HD-OCT automatically measures (and displays) the following information:
   —Horizontal distance from the center of the scan.
   —Distance between the anterior corneal surface and the demarcation line.
   —Distance between the demarcation line and the posterior corneal surface.
   —Total corneal thickness.

10. To add a caliper, click **Caliper** .

    ⇨ A caliper measurement appears over the image. You can move, stretch, and rotate calipers. You can add (up to) ten.

11. To lock the length of the caliper, right-click on the caliper to open its settings, check **Lock Length** and click **Accept**.
12. To delete a measurement or annotation, select it and click **Delete** .
13. To edit or adjust the image, hover over the image and select an adjustment tool (refer to: Edit Images (Hover Over) [▸ 362].

14. To view a full-screen image, double-click on the image.
15. To print, save, or export a report, see: Creating a Report [▶ 375].

8.4.8 Analyze Pachymetry Scans

Pachymetry Analysis uses the 24 radial scan lines of the Pachymetry scan to display a color-coded map of the cornea allowing you to measure corneal thickness variation.

Before analyzing Pachymetry images, assess scan quality and check for segmentation errors in all B-scans to help confirm measurements. Eyes with pathology are more susceptible to artifacts and segmentation errors. Outer sectors of peripheral cornea are susceptible to artifacts from low signal, high tear meniscus, eyelid, or eyelashes. Errors in segmentation may cause incorrect pachymetry and/or epithelial thickness values. If artifacts occur, retake the scan to achieve better image quality.

8.4.8.1 Pachymetry Analysis

Figure 65: Pachymetry Analyses

1	Pachymetry Maps	2	Epithelial Thickness Maps
3	All Maps	4	OD or OS

Figure 66: Pachymetry Analysis Overview

#	Symbol	Name	Explanation
1		View Selection	Changes the view of the scan: ■ **Pachymetry Map** ■ **Epithelial Thickness Map** ■ **All Maps** ■ **OD Images** ■ **OS Images**
2		Show / Hide Overlays	Shows or hides the grid and numbers.
3		Color Scale	Sets the color coding options (right-click on the color scale): ■ **Standard** (default): Shows a constant thickness for red at 750 mm and blue at 350 mm. ■ **Auto:** Adjusts the maximum and minimum thickness values to the thickness variation for the selected scan. ■ **Custom**: Opens a custom color scale tool for you to set your own color coding. Your selection applies to both scans and is saved with the analysis.

#	Symbol	Name	Explanation
		Pachymetry Map	Shows the corneal thickness of any area on the map and allows you to mark thickness points on the map (for reports). **NOTE! Towards the periphery of the cornea, the data may have lower signal and the boundaries of the surfaces may be difficult to detect. If the algorithm has low confidence in a region, that region does not appear on the map.**
		Epithelial Thickness Map	Shows a map of the epithelial thickness with a grid centered on the corneal vertex *(the intersection of the visual axis with the corneal surface)*. Epithelial thickness measurements may aid in the detection of early keratoconus. This may be factored into refractive and intraocular surgery decisions due to epithelial thickness' association with corneal power. **X** indicates the vertex. Grid ring diameters: ■ Central ring: 2 mm ■ Inner ring: 5 mm ■ Third ring: 7 mm ■ Outer ring: 9 mm Thickness measurements for each sector display inside the sector. **NOTE! Towards the periphery of the cornea, the data may have lower signal and the boundaries of the surfaces may be difficult to detect. If the algorithm has low confidence in a region, that region does not appear on the map.**
		OD Images OS Images	Shows all 24 B-scan images for the **Pachymetry** scan.
4		Vertex	Shows the location of the corneal vertex.
5		Minimum Corneal Thickness	shows the location of minimum corneal thickness.
6	Cornea Thickness Table 		Provides details of the corneal thickness within annular ranges. For each ring of the grid, the table displays: **Range** = inner and outer diameters of the annular region. **Min** = minimum thickness. **Avg** = average thickness. **Max** = maximum thickness. **S-I** = *average value in the Superior (S) sector - average value in the Inferior (I) sector*

Range (mm)	Min. (µm)	Avg. (µm)	Max. (µm)	S-I (µm)	SN-IT (µm)
0.0-2.0	541	545	553	-	-
2.0-5.0	543	564	598	12	19
5.0-7.0	555	594	661	34	31

Minimum Thickness (µm)	541	Y Min (µm)	-277
Pachy Min-Median (µm)	-20	Central Corneal Thickness (µm)	542

#	Symbol	Name	Explanation
			SN-IT = *average value in the Superior Nasal (SN) sector - average value in the Inferior Temporal (IT) sector*.
	Epithelial Thickness Table		Provides details of the epithelial thickness within annular ranges. **Range** =inner and outer diameters of the annular region. **Min** = minimum thickness. **Avg** = average thickness. **Max** = maximum thickness. **S-I** = *average value in the Superior (S) sector - average value in the Inferior (I) sector* **SN-IT** = *average value in the Superior Nasal (SN) sector - average value in the Inferior Temporal (IT) sector*.

Range (mm)	Min. (µm)	Avg. (µm)	Max. (µm)	S-I (µm)	SN-IT (µm)
0.0-2.0	49	51	54	-	-
2.0-5.0	44	51	55	-6	-2
5.0-7.0	40	49	60	-5	0
7.0-9.0	38	47	59	-7	0

Minimum Thickness (µm)	37	Y Min (mm)	-0.3
Epithelial Min-Median (µm)	-6	Central Epithelial Thickness (µm)	51

8.4.8.2 Analyzing Pachymetry

Pachymetry analysis displays a color-coded map showing corneal thickness variation.

Data tables below the Epithelial maps show minimum, average, and maximum thickness measurements (in micrometers) for the four radial zones.

Zone range is defined in millimeters away from the center of the map:

- **Central ring (1):** diameter corresponds to 2 mm
- **Second ring (2):** diameter corresponds to 5 mm
- **Third ring (3):** diameter corresponds to 7 mm
- **Fourth ring (4):** diameter corresponds to 9 mm

The grid centers on the corneal vertex (white "X") at the intersection of the visual axis with the corneal surface.

S-I values: `average value of Superior (S) - average value of Inferior (I) at the same distance`

SN-IT values: `average value of SN - average value of IT at the same distance`

To analyze pachymetry:

Prerequisite

☑ You are logged in (review station or instrument): Login.

☑ The patient has at least one pachymetry scan: (Acquire a Pachymetry Scan [▸ 203])

Action

1. Select the patient and click **Analyze**.
2. Under OD or OS, select a **Pachymetry** scan and select **Pachymetry Analysis**.
   ⇨ The analysis opens showing the corneal thickness map and details table. White areas indicate peripheral regions with low signal that were not quantified for the map.
3. To view the thickness (in micrometers) and location (relative to the center of the map) of any point on the map, hover over the point.
4. To mark a point on the map, click on the point.
   ⇨ The point's location, thickness and map coordinates are marked for reports.
5. To delete a marked location, right-click on the marked point and check **Clear User Selection**.
6. To show all three values of per sector, (Min, Max, Avg.), right-click a point on the map and uncheck **Show Mean Only**.
7. To hide all data values on a map, right-click a point on the map and check **Hide Data**.
8. To view epithelial thickness maps, select **View** > **Epithelial Thickness Map**.
9. To view both the pachymetry and epithelial thickness maps, select **View** > **All Maps**.
   ⇨ A **green** line indicates the anterior surface of the cornea. *(No line indicates that he algorithm has low confidence in the posterior surface of the cornea and did not calculate the value.)*
   ⇨ A **red** line indicates the posterior surface of the cornea.
   ⇨ A **yellow** line indicates the Bowman’s Layer.
10. To view all 24 thumbnail scans that make up a pachymetry map, select **View** > **OS** or **View** > **OD**.
11. To view a full-screen image, double-click on the image.
12. To print, save, or export a report, see: Creating a Report [▸ 375].

8.4.9 Analyze Wide Angle-to-Angle Scans

NOTE

Features described in this section are licensed separately and may not be available in all markets. Contact your local ZEISS distributer about feature availability.

8.4.9.1 Wide Angle-to-Angle Analysis

Figure 67: Wide Angle to Angle Analysis Overview

#	Symbol	Name	Explanation
1		Iris Image	Shows the scan pattern over the iris image and indicates the rotation direction set during acquisition.
2	**Toolbar**		
		Annotate Image	Adds your notes onto the image.
		Right Angle Measurement Tool	(See: About Angle Measurement [▸ 330]).
		Left Angle Measurement Tool	
		Caliper	Adds a measurement line.
		Delete	Deletes an angle or caliper measurement line.
		Right IC Angle	Adds a (trapezoid-shaped) Iridocorneal angle tool onto the image to help determine angle measurements.
		Left IC Angle	

#	Symbol	Name	Explanation
			Adjust the shape to fit the structures in the image: ■ angle opening distance ■ trabecular iris space area ■ sclera spur angle
3			

8.4.9.2 Analyzing Wide Angle-to-Angle Scans

To analyze Wide Angle to Angle scans:

Prerequisite

☑ The patient has at least one Wide Angle to Angle scan: (Wide Angle to Angle Scans [▸ 198])

☑ You are logged in (review station or instrument): Login.

Action

1. Select the patient and click **Analyze**.
2. Select an **Wide Angle to Angle** scan and select **Wide Angle to Angle Analysis**.
   ⇨ The **HD Angle** analysis opens.

3. To add a text annotation to the image, click **Annotate** and type text.
   ⇨ You can change the color and size of the text or move it somewhere else in the image (see: Add Annotations to Images [▸ 369]).

4. To place an angle measurement, click (right or left) **Angle Tool** and place the intersection at the scleral spur and the other two points at the corneal endothelium and iris.
   ⇨ CIRRUS™ HD-OCT calculates the angle.

5. To place an iridocorneal angle measurement, click (right or left) **IC Angle Tool**, drag the trapezoid into position over the angle you want to measure and adjust the points to touch the corneal endothelium and iris.
   ⇨ CIRRUS™ HD-OCT calculates the measurements (see: About Angle Measurement [▸ 330]).
6. To delete a measurement or annotation, select it and click **Delete** .
7. To edit or adjust the image, hover over the image and select an adjustment tool (refer to: Edit Images (Hover Over) [▸ 362].
8. To view a full-screen image, double-click on the image.
9. To print, save, or export a report, see: Creating a Report [▸ 375].

8.4.10 Analyze Anterior Segment 5-Line Raster Scans

NOTE

Features described in this section are licensed separately and may not be available in all markets. Contact your local ZEISS distributer about feature availability.

You can use the **Anterior Segment 5 Line Raster** scan to create images of the cornea or the iridocorneal angle. Since this analysis is the same for all HD scans, there are no angle measurement tools available for this scan.

To measure angles, use one the following scans and their custom analysis tools:

- HD Angle [▸ 340] for the most accurate measurements of an angle
- Wide Angle to Angle [▸ 352] to view and measure both irido-corneal angles of an eye

To analyze a high-definition cornea cube scan that has 1024 A-scans and 20 B-scans, refer to:HD Cornea [▸ 343].

8.4.10.1 Anterior HD 5-Line Raster Analysis

You can use the **Anterior Segment 5 Line Raster** scan to create images of the cornea or the iridocorneal angle. Since this analysis is the same for all HD scans, there are no angle measurement tools available for this scan. To measure angles, use one the following scans and their custom analysis tools:

- HD Angle [▸ 340] for the most accurate measurements of an angle
- Wide Angle to Angle [▸ 352] to view and measure both irido-corneal angle angles

of an eye

Figure 68: Anterior HD Image Analysis Overview (Cornea)

#	Symbol	Explanation
1	**Toolbar** Displays information about the scan and tools to make adjustments	

#	Symbol	Name	Explanation
		Caliper	Adds a measurement line.
		Delete Measurement	Deletes a measurement line added with the caliper tool.
2	**Cornea**	Iris Image	Shows the scan pattern over the iris image and indicates the length, line spacing, and rotation direction set. For **Angle**, offset to capture the angle.
	Angle		

#	Symbol	Name	Explanation
3	**Cornea** **Angle** 	B-scan Selection Panel	Shows the B-scan slices and allows you to select a slice to display.
4	**Cornea** **Angle** 	B-scan	Shows a larger view of the selected B-scan. The number inside the TSNIT square (lower left) corresponds to the B-scan slice number in the selection panel.

8.4.10.2 Analyzing Anterior Segment 5-Line Raster Images

You can use the **Anterior Segment 5 Line Raster** scan to create images of the cornea or the iridocorneal angle. Since this analysis is the same for all HD scans, there are no angle measurement tools available for this scan. To measure angles, use one the following scans and their custom analysis tools:

- HD Angle [▸ 340] for the most accurate measurements of an angle
- Wide Angle to Angle [▸ 352] to view and measure both irido-corneal angle angles

of an eye

Prerequisite

☑ You are logged in (review station or instrument): Login.

☑ The patient has at least one **Anterior Segment 5-Line Raster** scan of the cornea or angle: (Acquire HD Cornea Scans)

Action

1. Under OD or OS, select an **Anterior Segment 5-Line Raster** scan.
   ⇨ The **HD Images** analysis opens.
2. To display a different B-scan, select a different image from the selection panel.
   ⇨ The B-scan you selected displays.
3. To exit any editing mode and save the changes, right-click on the image and select **Normal**.
4. To reset an image to default settings, **Normal**
5. To zoom in our out, right-click on the image and select **Zoom**.
   Unzoom returns the image to the original size.
   Rectangle selects a rectangular zoom area.
   Continuous allows you to zoom in or out (click and drag).
6. To pan a zoomed image, right-click on the image, select **Pan** , and drag to image to view a different part of the image.
7. To view a full-screen image, double-click on the image.

8. To save an image, right-click on the image, select **Save image as...**, select a file type, name, and path for the image.
9. To show or hide the navigator lines, right-click on the image and select **Hide Slice Navigator**.
10. To adjust image brightness or contrast, right-click on the image and select **Brightness/Contrast**.
11. To show a color image, right-click on the image and select **Color**.
12. To print, save, or export a report, see: Creating a Report [▸ 375].

8.5 Common Analysis Tasks and Tools

8.5.1 Manually Select a Scan

Some analyses automatically select a companion scan for the most comprehensive information. You can choose a different scan instead. For example, if CIRRUS™ HD-OCT selects a scan that does not have good signal strength or is not centered properly, you can select a different scan for the analysis.

This feature is available for the following analyses:

- Analyze Macular Change [▸ 246]
- Analyze Ganglion Cell OU [▸ 261]
- Advanced RPE Analysis [▸ 256]
- Analyze ONH/RNFL OU [▸ 276]
- Analyze Single Eye Summaries
- Analyze PanoMap
- Wellness Exam
- Compare Angiography Images [▸ 322]

To manually select a different scan:

Prerequisite

☑ You are using an analysis listed above and you want to select a different scan.

Action

1. Under OD or OS, select a scan for an analysis in the list above.
2. Click the same analysis with an suffix: **– Manual Selection**.
   ⇨ A dialog opens listing scans you can use for comparison (two examples shown).

3. Click the scan you want to use.
4. Click **Close**.

8.5.2 Edit Images

8.5.2.1 About Image Editing

During image analysis, you can view and edit images. There are two different ways to access editing tools:

- Right-click to select from a menu
- Hover over the image to open editing icons.

Editing tool access depends on the type of analysis you are using.

Access Type	Analyses
Hover	■ Angiography ■ Compare Angiography ■ ONH Angiography ■ Compare ONH Angiography ■ Montage AngioPlex ■ En Face ■ Anterior Chamber ■ HD Angle ■ HD Cornea ■ Wide Angle to Angle
	■ Macular Thickness ■ Macular Change ■ Ganglion Cell OU ■ Guided Progression: Ganglion Cell

Access Type	Analyses
	■ Advanced RPE Analysis ■ ONH Guided Progression ■ ONH/RNFL OU ■ HD Images ■ Same Eye Summary ■ Panomap ■ Wellness Exam ■ Advanced Visual Analysis ■ Anterior Segment ■ Pachymetry ■ Anterior Segment 5-Line Raster

The following image shows how the same editing functions access correlates.

Figure 69: Menu and Toolbar Buttons

8.5.2.2 Editing Images Using the Menu

This method of accessing image editing tools applies to the following analyses:

- Macular Thickness
- Macular Change

- Ganglion Cell OU
- Guided Progression: Ganglion Cell
- Advanced RPE Analysis
- ONH Guided Progression
- ONH/RNFL OU
- HD Images
- Same Eye Summary
- Panomap
- Wellness Exam
- Advanced Visual Analysis
- Anterior Segment
- Pachymetry
- Anterior Segment 5-Line Raster

To edit images using the menu:

Prerequisite

☑ You are logged in (review station or instrument): Login.

☑ You reach the scan analysis step: *Edit an Image*.

Action

1. To view a full-screen image, double-click on the image.
2. To adjust image brightness or contrast, right-click on the image and select **Brightness/Contrast**.
3. To show a color image, right-click on the image and select **Color**.
4. To hide the image, right-click on the image and select **Hide**.
5. To exit any editing mode and save the changes, right-click on the image and select **Normal**.
6. To pan a zoomed image, right-click on the image, select **Pan** , and drag to image to view a different part of the image.
7. To reset an image to default settings, **Normal**
8. To zoom in our out, right-click on the image and select **Zoom**.
   Unzoom returns the image to the original size.
   Rectangle selects a rectangular zoom area.
   Continuous allows you to zoom in or out (click and drag).
9. To save an image, right-click on the image, select **Save image as...**, select a file type, name, and path for the image.

8.5.2.3 Edit Images (Hover Over)

NOTE

The image editing tools vary depending on the type of analysis.

- ▶ Refer to a particular analysis to see which editing tools you can use for its images.

This method of accessing image editing tools applies to the following analyses:

- Angiography
- Compare Angiography
- ONH Angiograpju
- Compare ONH Angiograpju
- Montage AngioPlex
- En Face
- Anterior Chamber
- HD Angle
- HD Cornea
- Wide Angle to Angle

You can adjust and edit most images in an analysis viewport. Right-click on an image to open the editing toolbar.

Tool	Reference	Tool	Reference
	Adjust Image Contrast [▶ 366]		Export a Movie [▶ 372]
	Adjust Image Brightness [▶ 365]		View Images in Full-Screen Mode [▶ 364]
	Zoom In and Out [▶ 370]		Reset Edited Images [▶ 371]

Tool	Reference	Tool	Reference
	Adjust Image Transparency [▸ 367]		Hide / Show Toolbar [▸ 364]
	View the Images as a Movie [▸ 371]		Add Freeform Shapes to Images [▸ 368]
	View Color or Grayscale Image [▸ 367] (toggles):		Add Circles to Images [▸ 368]
	Copy Edited Images [▸ 372]		Add Calipers to Images [▸ 370]
	Save Edited Images [▸ 373]		Add Annotations to Images [▸ 369]
			Remove Shapes, Tools and Annotations [▸ 371]

Table 66: Image Editing Tools

8.5.2.3.1 Open Image Editing Tools

NOTE

Not all image tools are available for all images.

Image tools vary by type of image.

You can adjust, edit, annotate, export and save most images in the viewport. Each image has its own toolbar that opens when you right-click on the image.

To open the image editing tool:

Prerequisite

☑ You are logged in (review station or instrument): Login.

☑ You reach the scan analysis step: *Edit an Image*.

Action

1. Click on the image that you want to edit.

   ⇨ Adjustments open at the top right side and annotations open at the bottom.

8.5.2.3.2 Hide / Show Toolbar

To hide or show the image editing toolbar:

Prerequisite

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. To hide the toolbar, click **Hide Toolbar**.

   ⇨ The toolbar collapses.

2. To show the toolbar, click **Show Toolbar**.

   ⇨ The toolbar expands.

3. Complete the analysis.

8.5.2.3.3 View Images in Full-Screen Mode

Tip: You can also click Esc to close full-screen mode.

To view an image in full-screen mode, you can either double-click on the image or click on the full-screen icon.

To view an image in full-screen mode:

Prerequisite

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

1. Click **Full-Screen**.

Action

⇨ The image opens in full-screen mode.

2. Click **Close**.
3. Complete the analysis.

8.5.2.3.4 Adjust Image Brightness

To adjust image brightness:

Prerequisite

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

1. Click **Brightness**.

Action

⇨ An adjustment slider opens below the **Brightness** icon.

2. To increase image brightness, slide the marker up.

⇨ The image lightens.

⇨ The brightness level also appears as a number from **0** (lowest brightness level) to **255** (highest brightness level).

3. To decrease image brightness, slide the marker down.
   ⇨ The image dims.
4. Save Edited Images [▸ 373].

8.5.2.3.5 Adjust Image Contrast

To adjust image contrast:

Prerequisite

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

1. Click **Contrast**.

Action

⇨ An adjustment slider opens below the contrast icon.

2. To increase image contrast, slide the marker up.
   ⇨ Image contrast increases.

3. To decrease image contrast, slide the marker down.
   ⇨ Image contrast decreases.
4. Save Edited Images [▸ 373].

8.5.2.3.6 Adjust Image Transparency

To adjust image transparency:

Prerequisite

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. Click **Transparency** .

⇨ An adjustment slider opens below the transparency icon.

2. To increase image transparency, slide the marker down.
   ⇨ The image becomes more transparent.

3. To decrease image transparency, slide the marker up.
   ⇨ The image becomes less transparent.
4. Save Edited Images [▸ 373].

8.5.2.3.7 View Color or Grayscale Image

The image toggles among three color options:

Option	Example
Color	
Grayscale	
Reverse Grayscale	

Table 67: View Color Options

To toggle color settings:

Prerequisite

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. To toggle among a color, grayscale image, and reverse grayscale, click **Color**.
2. Click **Save** ( ).
3. Complete the analysis.

8.5.2.3.8 Add Circles to Images

When you add a circle to an image, CIRRUS™ HD-OCT automatically calculates the perimeter and area of the circle.

To add a circle to an image:

Prerequisite

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. Click **Add Circle**.
   ⇨ A circle annotation appears in the center of the image.
   ⇨ The area and diameter of the circle are displayed.
2. To make the circle larger or smaller, click on a corner and drag the corner in or out.
   ⇨ The area and diameter of the circle update.
3. To move a circle, click on the middle of the circle and drag it to a new location.
4. Save Edited Images [▸ 373].

8.5.2.3.9 Add Freeform Shapes to Images

When you create a free-form shape on an image, CIRRUS™ HD-OCT automatically calculates the perimeter and area of the shape.

To draw a free-form shape on an image:

Prerequisite

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. Click **Free-Form Shape**.
2. Click on the image where you want the shape to start and drag in any direction to draw a freeform shape.
3. Continue to draw the shape and complete the shape by returning to the starting point.
   NOTE! You do not end exactly at the starting point. The shape automatically closes.
   ⇨ The area and perimeter of the shape are displayed.
4. To move a freeform shape, click on the middle of the shape and drag it to a new location.

5. To delete a freeform shape, click on the shape to select it and click **Delete**.
6. Save Edited Images [▸ 373].

8.5.2.3.10 Add Annotations to Images

In each annotation, you can enter up to 32 characters, including spaces. You can change the size and color for each annotation individually. You can also add an arrow to any annotation.

To add annotations to images:

Prerequisite

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. Click **Annotations**.
   ⇨ The annotation tool appears in the image.

2. Type your annotation.
3. To move the text, click to select it and drag it to a new location on the image.
4. To edit the text, click to select the text and type .
5. To start a new line in an annotation, click **Enter**, then**OK**.

6. To customize the text, double-click an existing text annotation on the image.
   ⇨ **Annotations Settings** open.

7. To add an arrow, check **Show Arrow**.
8. To change the text color, click on the **Text Color** pallette and select a color.
9. To change the size of the text, slide **Text Size** to the right to enlarge or left to shrink the text.
   ⇨ The annotation displays the new size, color and arrow (if selected).
10. To resize an arrow, click on the arrow tip and drag it in to make the arrow smaller or out to make the arrow larger.
11. Save Edited Images [▸ 373].

8.5.2.3.11 Add Calipers to Images

NOTE

For some analyses, calipers detect and measure a particular structure.

For example, **HD Cornea Analysis** adds a caliper that detects and measures the cornea, so you can move it along the cornea, but not to other areas of the image.

You can add up to ten calipers on an image or B-Scans. Calipers add a line that measures microns (µm).

To add calipers to images:

Prerequisite

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. Click the **Caliper**.
   ⇨ A caliper tool appears in the image.

2. To move a caliper, click on the middle of the caliper and drag it to a new location.
3. To change the direction of the caliper, click on an end and drag to rotate it.
4. To shorten or lengthen a caliper, click on and end and drag it in or out.
5. To move the measure callout, click on the number and drag it to another location.
6. Save Edited Images [▸ 373].

8.5.2.3.12 Zoom In and Out

To zoom in:

Prerequisite

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. Click **Zoom In**.
   ⇨ The image zooms in.
2. To zoom in again, click **Zoom In** again.
   ⇨ The image zooms in further.

To zoom out:

Action

1. Click **Zoom Out**.
   ⇨ The image returns to its original dimensions.
2. Save Edited Images [▸ 373].
3. Complete the analysis.

8.5.2.3.13 Remove Shapes, Tools and Annotations

You can remove measurements, shapes, and annotations individually. To undo all editing and reset the image, see: Reset Edited Images [▸ 371]

To remove an item from an image:

Prerequisite ☑ Editing tools are open: Open Image Editing Tools [▸ 363].

1. Select a shape or annotation added to the image.

Action

2. Click **Delete**.
   ⇨ The item is removed from the image.
3. Save Edited Images [▸ 373].

8.5.2.3.14 Reset Edited Images

When you reset an image, all editing and adjustments are removed from the image and the image returns to its last saved state.

To reset an image:

Prerequisite ☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. Click **Reset**.
2. Save Edited Images [▸ 373].

8.5.2.3.15 View the Images as a Movie

You can view the scan as a movie that begins at the top of the B-Scan slice and moves down through the tissue in 51 µm increments. You can stop the movie, reverse or advance the movie frame by frame.

NOTE! The default frame rate for scan movies is 51 µm/sec.

To view the image as a movie:

Prerequisite

☑ You reach the scan analysis step: *Edit an Image*.

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. Click **Play Movie**.
   ⇨ The movie controls open.

2. To start the movie, click the **play button (1)**.
3. To stop the movie, click the **pause button (2)**.
4. To move backward one frame, click the **previous button (3)**.
5. To move forward one frame, click the **next button (4)**.
6. To decrease movie speed, move the slider toward **Slow (5)**.
7. To increase movie speed, move the slider toward **Fast (6)**.
8. To close the movie controls, click **Close (7)**.

8.5.2.3.16 Export a Movie

Movies are available for En Face, B-scan, and Angiography images. You can export a movie as an avi file type.

To export a movie:

Prerequisite

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. Click **Export Movie**.
2. Navigate to the location you want to save the movie file.
3. Click **OK**.
   ⇨ A dialog with a progress bar opens.
4. Click **Save**.

Result

✓ The movie takes a few moments to save.

8.5.2.3.17 Copy Edited Images

You can copy an image or an edited image onto the clipboard, then paste it into a separate document or image file.

To add copy an image to the clipboard:

Prerequisite

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. Click **Copy**.
   ⇨ The image or edited image is saved to the clipboard.

2. To paste the image into a document or image, open the file and select **Paste** or **CTRL+V**.
   ⇨ The image is pasted into the file.
3. Complete the analysis.

8.5.2.3.18 Save Edited Images

After you complete adjustments and edits, save the changes.

To save an edited image:

Prerequisite ☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. Click **Save**.
2. Complete the analysis.

8.5.3 Reports Overview

Figure 70: Reports Overview

Pos.	Name	Explanation
1	**Header**	
	Name:	Patient name
	ID:	Patient identification number
	DOB:	Patient date of birth
	Gender:	Patient gender

Pos.	Name	Explanation
	Technician:	Instrument operator name
	OD / **OS**	Patient eye(s) included in the report
	Exam Date:	Date the scan was acquired.
	Exam Time:	Time the scan was acquired.
	Serial Number:	Serial number of the instrument that acquired the scan.
	Signal Strength:	The signal strength of the scan.
	Institution Name:	The name of your institution.
	ZEISS logo	
2	*Report Name*	The type of analysis used to create the report.
	Scan Type	The type of scan used for the analysis.
3	**OD** / **OS**	Indicates which eye(s) is included in the report.
4	*Report Content*	The content varies by scan and analysis type.
5	**Footer**	
	Comments:	Field to add written comments on the printed report.
	Analysis Edited:	The date and time the analysis was edited.
	Doctor's Signature	Field to sign the printed report.
	ZEISS Software and copyright information	
	Page *x* of *x*	Page number and total number of pages of the report.

8.5.4 Creating a Report

You can create a report to print, save or export. You can access report features from any analysis screen. The cross-sections and/or surface maps currently displayed in the analysis are included in the report.

To create a report:

Prerequisite

☑ You are logged in (review station or instrument): Login.

☑ Open and edit an analysis.

Action

1. Click **Print**.
   ⇨ The print menu expands.
2. To print a report without preview, select **Print**.
   ⇨ The report prints on the default printer.
3. To see a preview of the report (all pages), select **Print Preview...**.
   ⇨ A preview opens showing all pages of the report. You can zoom, pan, print, or save the report from the preview toolbar.
4. To save a PDF report, click select **Save as PDF...**.
5. To save a high-definition report, select **Save as HD PDF...**.

6. To save the report in another format, select **Print Preview...**, click **Save**, and select a file format.
7. To export the report to DICOM, select **Export to DICOM**.
8. To export as XML, select **XML Export**.

8.5.5 Navigating Cube Scans

Cube scans stack and align consecutive axial-scans (A-scans) side by side to produce a two-dimensional B-scan. Consecutive B-scans align to produce a 3D cross-section of the retina.

1	En Face Scan Plane	**Yellow box** indicates the scan area.	
		Click and drag **cyan or magenta triangle** to move through the scan slices.	
		The number beside the line indicates which slice of the cube is in view.	

2	Slow B-Scan Plane	Reformatted, vertically parallel A-scans acquired in successive line scans. These slices are acquired more slowly; one per line of horizontal A-scans.	
3	Fast B-Scan Plane	Slices parallel to the front of the cube; each line of A-scans is acquired quickly .	

You can quickly navigate through the slices of either plane. Simply move the corresponding line displayed on the fundus image and the B-scan image moves accordingly. The slice number helps you know which area of the cube is selected.

CIRRUS™ HD-OCT displays scan images as follows:

- Horizontal scans:
  - left of scan equals the left of scan display
  - right of scan equals right of scan display
- Vertical scans
  - bottom of scan equals left of scan display
  - top of scan equals right of scan display
- Diagonal scans in 5 Line Raster
  - left takes precedence over bottom
  - left of scan equals left of scan display
  - right of scan equals right of scan display

Cube Analysis

Because cube scans contain this volume of information, there is are additional types of analyses available only for cube scans:

Analysis	Description
3D Visualization	Shows a 3-dimensional image of the data. You can navigate through the 3D slices, adjust settings, and animate a series to save as a movie (see: 3D Visualization Analysis [▸ 289]).

Analysis	Description
En Face 	
Advanced Visualization	

Analysis	Description

Table 68: Additional Visual Cube Scans

8.5.5.1 Navigate Cube Layers Manually

Tip: You can also navigate through layers by clicking the B-scan you want to navigate and scrolling the mouse.

You can drag the vertical and horizontal slice lines to scroll through the image cube. The current slice number displays on the opposite side of the arrow you use to select and drag the line.

Prerequisite

☑ You are acquiring, checking quality or analyzing a scan and reach the step: *navigate cube data*.

Action

1. To navigate through the vertical slices of the cube, click on the magenta triangle and drag the line right or left.

   ⇨ The current slice number changes dynamically as you navigate through slices.

2. To navigate through the horizontal slices of the cube, click on the cyan triangle and drag the line up or down.

   ⇨ The current slice number changes dynamically as you navigate through slices.

3. Complete the remaining steps of the acquire procedure.

8.5.5.2 Navigate Through Cube Slices as a Movie

Action

1. Use to view a movie of the fast B-scans or sequence through them one image at a time.

   ⇨

2. Complete the remaining steps of the acquire procedure.

   ⇨

You can view the scan as a movie that begins at the top of the B-Scan slice and moves down through the tissue in 51 µm increments. You can stop the movie, reverse or advance the movie frame by frame.

NOTE! The default frame rate for scan movies is 51 µm/sec.

To view the image as a movie:

Prerequisite

☑ You reach the scan analysis step: *Edit an Image*.

☑ Editing tools are open: Open Image Editing Tools [▸ 363].

Action

1. Click **Play Movie**.
   ⇨ The movie controls open.

2. To start the movie, click the **play button (1)**.
3. To stop the movie, click the **pause button (2)**.
4. To move backward one frame, click the **previous button (3)**.
5. To move forward one frame, click the **next button (4)**.
6. To decrease movie speed, move the slider toward **Slow (5)**.
7. To increase movie speed, move the slider toward **Fast (6)**.
8. To close the movie controls, click **Close (7)**.
9. Complete the remaining steps of the acquire procedure.

Empty page, for your notes

9 Networking

9.1 Safety During Network Configuration

⚠ WARNING!

Use of a power strip

may cause an electric shock.

- To avoid the risk of electric shock, this equipment must only be connected to a supply mains with protective earth.

⚠ WARNING!

Connecting the NAS device Directly to the instrument using a shielded network patch cable

could cause electrical shock to the patient and/or operator.

- Use a network patch cable with an unshielded RJ–45 connector to connect the NAS device directly to the instrument.

⚠ CAUTION!

Not archiving data daily increases the risk of data loss.

- We strongly recommend that you archive daily to a network archive location (a network file server or network attached storage device). If you do not archive at all, paper records are the only way to retain patient information in case of system hard drive malfunction.

⚠ CAUTION!

Connecting the instrument to the Internet

increases its vulnerability to serious security risks, including viruses and worms that could disable your system or adversely affect its performance and may void the instrument warranty.

- Transfer data through internal networks.
- Ensure that all firewalls and internet security applications are up-to-date and running.
- Connecting the device to the internet or transferring data via USB devices may result in compromised patient privacy and expose the network to malware.

⚠ CAUTION!

It is strongly recommended that you allow a knowledgeable IT professional to assist you with network configuration and software installation.

⚠ CAUTION!

Installation of any unapproved software, including drivers

could degrade the performance of the instrument and/or lead to corrupted diagnostic or therapeutic information and may void the instrument warranty.

When connected to the Internet, the instrument may be vulnerable to serious security risks, including viruses and worms that could disable your system or adversely affect its performance.

Internet connectivity enables third-party software, software drivers and updates to be downloaded to your system, either automatically or intentionally.

- ▶ Do not download or install any unapproved software or drivers.

NOTE

ZEISS does not provide technical support for the use of third party hardware or software.

NOTE

Users are responsible for network setup and maintenance.

Users are responsible for installing and configuring all networking hardware and software.

ZEISS Technical Support is limited to testing instrument network connectivity.

- ▶ ZEISS Technical Support cannot troubleshoot or repair problems with network connectivity.
- ▶ Observe all guidelines in this document regarding instrument networking.

NOTE

Do not perform a virus scan while acquiring exam data.

NOTE

These instructions assume that a TCP/IP network is already installed in your institution. If you are unsure of your network status or if you want to set up a network, consult a networking professional.

9.2 Network Capabilities

The CIRRUS 6000 is designed for network data transfer. Software supports the following networks and network activities:

- Windows networks
- Creating user accounts
- Networking via a local area network or intranet
- Archiving to and retrieving from a network file server
- ⊕DICOM gateway connection

⊕ *Indicates optional features; license may be required.*

9.2.1 About Local Connections (Remote Desktop)

NOTE

Only Administrators can complete this task.

To connect locally, use Remote Desktop. If you need help using Remote Desktop, ask your institution's local IT personnel or consult the documentation for Remote Desktop.

9.2.2 Select the Installation Mode

Your CZMI Representative installs your CIRRUS 6000

- Software is installed correctly.
- Software is configured properly for your network.
- Archiving is configured.
- Software connects to your archive.

9.2.2.1 Installation Modes

	Stand-alone	Native	DICOM/FORUM
Typical Use	Very small office (not recommended).	Most practices.	Archiving CIRRUS 6000 raw data to FORUM Archive & Viewer.
ZEISS Instrument Connections	None	Connects instruments to review stations.	None.
Data Storage	CIRRUS 6000 internal storage.		Can be stored locally. When connected to FORUM, CIRRUS 6000 internal data is archived to FORUM and no longer stored locally.
Storage Limit	CIRRUS 6000 internal drive limit. When the instrument's internal drive is full, the oldest data is archived and cleared to make room for new data.		External storage device (any size; expandible). When the instrument's internal drive does not become full.
Data exchange	DICOM MWL and EPDF compatible.		DICOM MWL, EPDF, and Raw data compatible using FORUM, integrates with other DICOM-compatible systems.
Additional Storage Requirements	None (provided the CIRRUS 6000).		■ DICOM/FORUM License. ■ DICOM-compatible storage or EMR system.

Table 69: Mode Comparison

9.3 Network File Server Minimum Requirements

Using a Network File Server is recommended in offices that have a local area network and want to archive data to a network storage location.

The network file server must meet the following minimum requirements:

- 256 MB RAM
- Windows, Unix or Linux server operating system. (You can use SAMBA with Unix and Linux file servers).
- NTFS drive partition(s) for CIRRUS 6000 data.
- 250 GB available disk space for data storage
- Tape backup unit
- BaseT network connection

9.3.1 Additional Recommendations

In addition to the minimum requirements listed above, we recommend the following for the network file server:

- A mirrored RAID array for data storage—strongly recommended.
- An uninterruptible power supply (UPS)—strongly recommended.
- 1000 BaseT network connection.
- Removable backup drive with capacity of at least 250 GB.

9.4 Connect to a Networked Storage Device

You can archive your data using **Network Attached Storage** (NAS).

You can use one, multiple or mirrored NAS devices to back up your data.

When you use two or more NAS devices concurrently, you must also use a switch or router that is connected to the network or directly to the instrument.

9.4.1 NAS Requirements

To use a NAS device for archiving your data, the NAS device must meet the following minimum requirements:

- **1000Base Ethernet capable**: For safety reasons, do not connect the NAS directly to the instrument.
- **Network patch cord:** for direct connection to the instrument, UTP CAT5e cord with an unshielded RJ-45 connector.
- **Compliance:** The NAS device you select must comply with local requirements.
  - In Europe, CE approval is required
  - In North America, UL, CSA, or equivalent and FCC approval is required.

9.4.2 Configure Networked Storage Device Connections

Most NAS devices have a default name on the network. We recommend that you retain the default name for the NAS device. Workgroup Name Must Match the CIRRUS HD-OCT Workgroup Name:

Some NAS devices automatically map the NAS device to a drive letter on the instrument.

To configure NAS connections:

Prerequisite

☑ The NAS device is on and initialization is complete (see manufacturer's instructions)

Action

1. Start up CIRRUS™ HD-OCT (see: System Startup [▸ 56]).
2. Note the name of the NAS.
3. Open **Windows Explorer** and navigate to **This PC**.

4. Ensure the NAS device appears in your network.
5. If necessary, map a drive for the NAS device. Refer to the Windows documentation or online help for instructions on mapping a public drive.

9.4.3 Setting Up a Network File Server (external NAS)

To ensure access to the shared folder on the Network File Server, create a new user account on the server. This can be any user name and password, however check with your IT Administrator to ensure it corresponds to any naming conventions that may be in use.

Action

- ▶ On the designated Network File Server, create a folder with a unique name for a dedicated archive folder.
- ▶ Make it a shared folder.
- ▶ On the instrument select **Records > Archive Management > Archive Locations > New Archive Location**.

- ▶ Type the path of the Network File Server.
  For the external NAS supplied with the instrument, the path is `\\kilinas\archives`.

9.4.4 Enabling the Server Message Block Version 3 (SMB3) on the Synology NAS drive

The settings to enforce encryption between CIRRUS™ HD-OCT and the NAS drive should be set on the NAS drive.

NOTE

The Synology NAS drive has the default administrator password `November171846`.

Change this default password immediately.

Prerequisite

- ☑ You are logged in as an administrator.
- ☑ To confirm that the connection to the NAS drive is encrypted, make changes on the NAS drive, map a drive letter if it does not already exist.
- ☑ Run the following PowerShell command as an administrator `Get-SmbConnection | Select-Object -Property Encrypted`
  NOTE! This command assumes that only one drive letter is mapped for the current user.

Action

1. Open the Control Panel App.
2. Select **File Services**.

3. Select **Enable SMB service**.

4. Select **Advanced Settings** and set the following options and values:
   - ⇨ Maximum SMB protocol = `SMB3`
   - ⇨ Minimum SMB protocol = `SMB2 and Large MTU`
   - ⇨ Transport encryption mode = `Force`

Result

✓ Reboot the device for the changes to take effect.

9.5 Connect to a DICOM Gateway

NOTE

This section is intended for an IT or DICOM network administrator.

For assistance:

- ▶ In the U.S., call Zeiss at 800-341-6968.
- ▶ Outside the U.S., contact your local CZM distributor

DICOM Gateway allows you to connect CIRRUS™ HD-OCT instruments to other patient scheduling, record management, and storage applications such as:

- DICOM-compatible EMR or patient management system
- DICOM archive, such as a PACS server

9.5.1 Review Station Requirements

Review stations must meet the minimum requirements listed in this section for DICOM Gateway connections.

Also see

🗎 Review Station Requirements [▶ 49]

9.5.1.1 Computer Requirements

To use the DICOM Gateway, your review station must meet the following minimum system requirements:

Requirement	Minimum and Recommendations
CPU	2.0 GHz **Recommend:** Intel Quad Core
Available Disk Space	20 GB
Memory (RAM)	4 GB **Recommend:**8 GB
USB Port	1 (required for installation)
Network Card (TCP/IP Protocol)	100 MB
Screen Resolution	1024 x 768 pixels

Table 70: Review Station Requirements for DICOM Connection

9.5.2 Configure DICOM Connections

NOTE

ZEISS FORUM application enables you to use AutoConnect.

Each instrument and review station connected to the DICOM network must have a unique Application Entity (AE) title registered with your DICOM system.

To configure DICOM connections:

Prerequisite

☑ On the instrument, Log in as Admin.

☑ **AE Titles** are registered in the DICOM system

Action

1. From the Windows desktop, navigate to **C: \ Program Files \ Carl Zeiss Meditec \ DICOM Gateway**.
2. Double-click **Configuration Tool.**
   ⇨ The **DICOM Gateway** tool opens.

3. Select the **General** tab.
4. For **IP Address** , set to: `127.0.0.1` *(instruments and Review Stations)*.
5. For **AE Title**, type the **DICOM Gateway** title registered in the DICOM system.
6. For **DICOM Port**, type the local port number for DICOM Gateway (e.g., FORUM).
7. For **Host Name**, type the server address.
8. Click **AutoConnect**.

   ⇨ If multiple FORUM servers are discovered, a selection dialog opens.

   ⇨ If only one FORUM server is discovered, the DICOM-registered **AE Title**,**Host Name**, and **Port** for the **MWL Provider**and **Storage Provider** populate automatically.

9. If the **Storage Provider**, **Storage Commitment Provider**, and **Retrieve Provider** are the same, check **Same as Storage Provider**.
10. If the **Storage Provider**, **Storage Commitment Provider**, and **Retrieve Provider** are the different, type the DICOM-registered **AE Title**,**Host Name**, and **Port** for the providers.
11. Click **Save and Test**.
    ⇨ When the network testing is complete, a green indicator confirms success.
12. For advanced configuration options, refer to: DICOM Advanced Configuration [▸ 392].
13. To view a detailed list of the connection testing, select the **Test Details** tab.

    ⇨ A detailed list of connection testing opens.
14. If indicators are not red, confirm the connection data and click **Save and Test**
15. If the connections are not working properly, refer to: Troubleshooting Connections [▸ 419].
16. Click **OK**.

9.5.3 DICOM Advanced Configuration

NOTE

Not all systems use Extended Negotiation.

Make sure you use the correct settings for your system. Setting **Enable DICOM Extended Negotiation**:

- **Uncheck** for United States Veterans Administration's VistA™
- **Check** for FORUM

The recommended default values for the **Advanced** tab are listed in the table below.

Setting	Value
Maximum Query Responses	100
Timeouts	
Maximum Association Idle Time	30
DIMSE RSP Timeout	20
Network Timeout	20
Enable DICOM Extended Negotiation	Checked
Allow Local AETitle Edit (if Review Stations are included in the network)	Checked

Table 71: Recommend Values for Advanced Configuration for Connections

You can adjust these values as needed to optimize performance or allow for slower network connections.

To configure DICOM advanced configuration settings:

Prerequisite

☑ Log in to the computer.

Action

1. From the Windows desktop, navigate to **C:\ Program Files > Carl Zeiss Meditec > DICOM Gateway**.
2. Double-click **Configuration Tool.**
   ⇨ The **DICOM Gateway** tool opens.

3. Make adjustments as needed to accommodate your network's response time.
4. Click **OK**.

9.5.4 Enabling TLS and Exporting the KeyStore

Enable TLS to secure the communication between the device and the DICOM FORUM server throughout the network using transfer layer security (TLS). For the TLS communication to be initiated

between the two entities, you must export the keystore certificate from the device and import it into the FORUM truststore and vice-versa.

Prerequisite

☑ You have access to KeyStore Explorer.

☑ You have access to an existing DICOM FORUM truststore.

☑ You have enabled the folder sharing across network to allow your application to communicate with a FORUM server located on a different device within the same network.

Action

1. On the CIRRUS 6000 device, go to **Records > Preferences**.
2. Open the **DICOM TLS** tab.
3. Select the **TLS Security** box. The application automatically creates a keystore and truststore certificates.
4. Use **Change Password** in the **Keystore** and **Truststore** sections to change the default password.
   The default password for both keystore and truststore is `changeit`. If you delete a keystore or create a new one this will always be the default password unless changed.
5. In the **KeyStore** section, select **Export** to export the device KeyStore as a certificate `(*.CER)` file. Preferably, export the file to `C:\ProgramData\Carl Zeiss Meditec \Certificates\KeyStore`, and provide a descriptive name such as `Cirrus6000-10780_keystore.cer`.
6. Enter the password when prompted.
7. In the **Preferences** window, open the **DICOM Archive** tab, and select **DICOM Configuration**.
   ⇨ The **DICOM Gateway** window opens.
8. Enter the FORUM server connection details.
   NOTE! You can change your instrument's AE Title, for example "Cirrus6000-10780". Also TLS uses port 2762 to connect the instrument to the FORUM server.
9. Select **Save and Test** to check for connection errors.
10. Select **OK** to save and close the window.

Result

✓ Now the keystore certificate is available and ready to be imported into the FORUM truststore.

9.5.5 Importing the FORUM KeyStore

Prerequisite

☑ You have exported the FORUM keystore certificate `forum-backend.cer` file from the FORUM truststore.

Action

1. On the CIRRUS 6000 device, go to **Records > Preferences**.
2. Open the **DICOM TLS** tab.
3. In the **TrustStore** section, select **Manage** to open
4. Select **Import**.

5. Go to the location of the FORUM keystore certificate file `forumbackend.cer`.
6. In the **Import TrustStore Certifcate** window, enter the **Certificate Name** and **TrustStore Password**.
   The default password for both keystore and truststore is `changeit`.
   ⇨ **NOTE! When configuring this for the first time, the "Enter network credentials" window may open. Enter the FORUM server credentials to gain access before importing the certificate.**
7. Select **OK** to save and close the window.

9.6 Connecting Review Stations to Instrument Data Archives

NOTE

Some IT departments only allow computer administrators to map network drives.

If your computer does not allow you to map network drives, contact your institution's IT representative to request that a computer administrator map this drive for you.

When a review station connects to one or more CIRRUS™ HD-OCT instruments, a reviewer can access patient scans. After an operator saves a patient's scans, a doctor can view, compare, annotate, edit them from their review station computer on the same networks.

This procedure describes how map a network drive using the Windows control panel. When you map a network drive from the review station to the instrument, the review station retains this connection for future access.

Prerequisite

☑ The instrument 's data folder is shared: (Setting Up a Network File Server (external NAS) [▸ 388]).

☑ Review software is installed on the review station: (Installing Review Station Software [▸ 48]).

☑ The review station is on the same network as the instrument: (Networking [▸ 383]).

☑ You have administrator rights to the review station.

Action

▶ Map a network drive to the instrument's shared folder on the network. Refer to the Windows documentation or online help for instructions on mapping a drive.

9.6.1 Enabling the Server Message Block Version 3 (SMB3) on Review Station

The settings to enforce SMB encryption in the review station.

Prerequisite

☑ You are logged in as an administrator.

Action

1. Run the following PowerShell command as an administrator
   `Set-SmbServerConfiguration -EncryptData $true -Confirm:$false`
   NOTE! This -Confirm:$false flag bypasses the confirmation dialog that would otherwise appear.
2. To verify encryption is set, run the following PowerShell command as an administrator
   `Get-SmbServerConfiguration | Format-List EncryptData`

Result

✓ Reboot the device for the changes to take effect.

9.7 Connecting to Printers

⚠ WARNING!

Adding peripheral equipment

may result in noncompliance with the safety requirements of IEC 60601-1.

- ▶ You are responsible for ensuring that the system meets the safety requirements of IEC60601-1.
- ▶ Place any AC-powered, non-medical device peripherals at least 1.5 m away from the device and connect them to a separation device, or else use an isolation transformer.

⚠ WARNING!

Placing peripheral devices closer than 1.5 meters (4.9 feet) from the patient

could result in electrical shock to the patient and/or operator.

- ▶ Use a wireless configuration, if possible.
- ▶ Use an isolation transformer in the USB configuration.
- ▶ Ensure that patients cannot touch a peripheral device with any part of his or her body while being examined.
- ▶ Ensure the instrument operator does not attempt to touch the patient and a peripheral device at the same time.

⚠ WARNING!

Powering peripherals directly through a wall socket

could result in electrical shock to the patient and/or examiner.

- ▶ When using a printer in the USB configuration, always power the printer through an isolation transformer. Some ZEISS equipment comes with an isolation transformer that may be used by plugging into a special power strip provided with the equipment. Talk to your ZEISS Service Representative to determine if this is true for your equipment.
- ▶ If you are not sure, plug all peripherals (such as a printer), into an isolation transformer. This requires a special power cable. In North America, the required cable has an IEC–320–14

connector on one end and a NEMA S–15R connector on the other end. This cable is included in the accessory kit shipped with the instrument.

⚠ WARNING!

Use of the acquisition device, a printer, or the power table with an extension cord or a power strip (multiple portable socket outlet)

could cause electrical shock to the patient or operator.

- ▶ Do not use extension cords with the instrument.
- ▶ If you plug something other than an instrument into the Multiple Socket Outlet (MSO), the MSO may not have the designed level of safety.
- ▶ Do not use power strips with the instrument.
- ▶ Do not plug in any other equipment into the same wall outlet as the instrument.
- ▶ To avoid the risk of electric shock, this equipment must only be connected to a supply mains with protective earth.

This section provides generic requirements and recommendations for printers. Use high-end graphic printers that support postscript processing. Specific configuration instructions vary by printer. Refer to the printer manufacturer's instructions. If you use a third-party device, seek technical support from the device manufacturer. Repairs necessitated by the attempt to use a non-approved device are not covered under warranty.

Local Area Network Connection	Use any of the following connection methods: ■ Connect both the instrument and the printer to the local area network ■ Connect instrument and printer with the network (Ethernet) cable ■ Connect the printer to a network switch/router/hub connected to the instrument **NOTE! Use the same kind of network cable. Do not use an RJ-45 crossover cable to connect the printer to the instrument.**
Direct Connection (USB) **NOT RECOMMENDED**	General steps for USB connection: 1. Install the ZEISS approved printer drivers on the instrument (if needed). 2. Connect the printer power cord plug **to an isolation transformer**. 3. Connect the printer to the instrument using a USB cable. 4. Power on the printer.

9.8 Database Selection

Like CIRRUS 6000 instruments, Review Stations typically have a designated primary database. When data is imported, it is placed into this database. The option **Database Selection** is available on

Review Stations for this purpose. For more information about connecting review stations with instruments, see Networking [▶ 383].

Operators and Administrators can select the working database. However, it is recommended that the Administrators oversee databases to ensure that patient data is kept cohesive and transparent within the institutional environment.

9.8.1 Select a Database

Action

1. From the Toolbar, select **Tools > Options > Select Database**, and an Explorer window appears.
2. Navigate to the location of the database of interest. Database files have an "**.ib**" extension. For example: **C:\SSOCT \Database\ZDB.ib** is a valid CIRRUS 6000 database.
3. Click **Open**.
4. Restart the software.

9.8.2 Copy a Database

Action

1. From the review station desktop, click the Windows Explorer icon from the Desktop.
2. Navigate to `C:\Program Files\CZM\CIRRUS HD-OCT \Database`.

3. Select **ZDB.ib**. This file is the software database. **Do not modify this database.** It is empty and intended to be copied as a database template for the database you will use to store patient data.
4. Right-click and select **Copy**.

5. Navigate to the location where you want your database to reside, preferable in an empty folder. Note where on the system you are storing the database, because you will periodically need it.
6. Right-click and select **Paste**.
7. Right-click the copied database and select **Properties**.
8. In the **General** tab, uncheck the **Read-only** attribute and then select **Apply > OK**.
9. Launch the CIRRUS 6000 application software.
10. During startup, the Equipment Edit dialog box will appear.
    - ⇨ Enter information in the **Station Name** field (if needed).
    - ⇨ Enter information in the **DICOM AE Title** field (if needed). This information should match the AE Title assigned in the DICOM Gateway.
    - ⇨ Enter the model number in the **Model Number** field. The model number is the first set of numbers *before* the dash and after the **SN** box on the **Instrument Serial Number** label.
    - ⇨ Enter the sequence number in the **Sequence Number** field. The sequence number is the second set of numbers *after* the dash and after the **SN** box on the **Instrument Serial Number** label.
    - ⇨ Select **Save**.
11. Log in using the **Admin** user and then create the CIRRUS 6000 **Operator** user. Refer to the CIRRUS™ HD-OCT Instructions for Use for Managing User Accounts [▸ 67].
12. Log out of the CIRRUS™ HD-OCT application software.

Empty page, for your notes

10 Cleaning and Disinfection

10.1 Safety During Cleaning and Disinfection

⚠ CAUTION!

Improper care and cleaning of optical components

could lead to coating failure.

Contaminants on the optical surfaces increase scatter off the surface and absorb light energy.

- ▶ Do not use alcohol prep wipes to clean lenses or optical surfaces.
- ▶ Wipe gently and carefully to avoid scratching the instrument and auxiliary lenses.

⚠ CAUTION!

Cleaning lenses too frequently

can damage optic surfaces.

- ▶ Clean optics only when necessary.
- ▶ Keep the protective cover on your device when not in use.

⚠ CAUTION!

Using aerosols near or placing containers of liquid on or near the instrument

could damage the equipment. The instrument is not designed with any specific measures to protect against harmful ingress of water or other liquids (classified IPXO - ordinary equipment).

- ▶ Do not place containers of liquid, or use aerosols on or near the equipment.

10.2 Cleaning Agents

Item	Explanation
Latex Finger Cots and Gloves	Solvents are harsh to the skin; wear protection.
Optics Cleaning Tissue	Soft, absorbent, lint-free lens tissue is best.
Swabs	Cotton swabs with wooden handles or polyester swabs with polypropylene handles are best.
Blower	Filtered dry nitrogen blown through an antistatic nozzle is best. Canned dusters also work. Bulb-type blowers and brushes must be kept clean to prevent recontamination.
Mild Soap	Neutral soap, 1% in water. Avoid perfumed, alkali, or colored soaps. Several drops of green soap (available at a pharmacy) per 100 cc of distilled water is acceptable.
Distilled water, 70% isopropyl alcohol in water, mild, ammonia-free glass cleaner, or alcohol wipes	For cleaning instrument covers, chinrest, and forehead rest

Item	Explanation
Acetone	Spectroscopic grade.
Hemostats	For holding lens tissue.
Bright Light	For inspection.

10.3 Cleaning Optical Components

⚠ WARNING!

Cleaning of optical surfaces frequently poses an increased risk of damage to the optical surfaces if hard particles are present on the surface and too much pressure is applied.

▶ Follow the cleaning procedure as described in this section.

Tips for handling optical components:

- Always wear gloves as oil on your fingertips can sometimes damage the coating on optics. Leaving the fingerprint on an optical surface for a long time, can leave a permanent stain.
- Never touch the optical surface with your fingertips, even while wearing gloves, always handle optics by the edges.
- Avoid using metal, wooden, bamboo, or plastic tools to handle optics to minimize the chance of damaging the optic.
- Always place an optic on a clean soft surface as a hard or dirty tabletop can scratch the optical surface.
- Never store unwrapped optics together in a box or bag, as contact between the optics will cause damage.
- Never blow on the optic with your mouth to prevent saliva contamination. Saliva particles will often stain the surface.

10.3.1 Dust Cleaning

Static electricity can bind dust tightly onto optics. Blowing removes some dirt; use a wet alcohol swab to remove the remainder. Acetone dries the optic quicky, which helps eliminate streaks.

Action

1. Blow off dust.
2. If any dust remains, twist lens tissue around a swab, soak in alcohol, and wipe the optic in one direction with a gentle figure-eight motion.
3. Repeat as necessary.
4. Repeat the steps above, using acetone.

10.3.2 Brush Cleaning Method

NOTE

Edges on mounted optics

are often hard to reach.

- ▶ Wrap a lens tissue around a swab.
- ▶ Soak the covered swab in acetone.
- ▶ Brush around the edge of the lens and then across the middle using a continuous figure-eight stroke.
- ▶ Repeat if necessary.

Use this technique to clean small lenses. Hold a folded lens tissue with a hemostat to brush the surface clean.

Action

1. Fold a lens tissue about as wide as the lens. Do not touch the area of the tissue that will contact the lens.
2. Using hemostats, hold the tissue near the fold.
3. While holding the optic, using tweezers if necessary, blow off any dust.
4. Soak the tissue with acetone.
5. Brush the fold in the tissue across the surface of the optic using light pressure.
6. Repeat as necessary until the optic is clean, using a new lens tissue with each wipe.

10.3.3 Wipe Cleaning Method

Use this technique to clean very dirty lenses and mirrors.

Action

1. Blow off dust.
2. Fold a lens tissue as with the brush method.
3. Apply acetone to the tissue.
4. Holding the lens tissue in your hand with the fold near the tip of your fingers, apply uniform pressure while gently wiping across the surface of the optic.
5. Repeat as necessary until the optic is clean, using a new lens tissue with each wipe.

10.3.4 Cleaning Heavy Contamination

NOTE

Always clean fingerprints, oil, and water spots from lens and optics immediately.

Skin acids can permanently damage optical coatings. Solvents can redistribute dirt and oil.

- ▶ Use soap or other wetting agent to clean the optical surfaces.
- ▶ Use water to remove the soap.
- ▶ Use alcohol to remove the water.
- ▶ Use acetone to speed drying and eliminate streaks.

Use this technique to clean fingerprints, oil, or water spots.

Action

1. Blow off dust.
2. Using a soap-saturated lens tissue placed around a swab, wipe the optic gently in a figure-eight motion.
3. Repeat as necessary.
4. Repeat this procedure with distilled water.
5. Repeat again with alcohol.
6. Repeat once more with acetone.

10.4 Cleaning and Disinfecting the Chin Cup, Forehead Rest, and Breath Shield

⚠ WARNING!

Strong solvents such as Acetone or Methyl Alcohol will damage the chin cup and forehead rest.

- ▶ Use a gentler disinfectant such as isopropyl alcohol.

Prerequisite

☑ Use protective gloves before cleaning.

Action

1. Clean the chin cup and forehead rest with 70% isopropyl alcohol. Let it air dry completely before use.
2. If applicable, wipe down the breath shield with 70% Isopropyl Alcohol. Let it air dry completely before use.
3. If disinfectant contacts the ocular lens during cleaning, gently wipe the lens (see: Wipe Cleaning Method [▸ 403]).

10.5 Cleaning Peripherals and Table

⚠ CAUTION!

Do not use any cleaning agent on the screen.

Action

1. Wipe the monitor with a soft, non-linting cloth.
2. Regularly dust or wipe down the table.

11 Maintenance and Repair

NOTE

Expected Service Life

The expected service life of CIRRUS™ HD-OCT is 7 years.

11.1 Safety During Maintenance

⚠ CAUTION!

Unauthorized modification or dismantling of the instrument or system components

could result in damage to the instrument or components, or harm to the operator or other personnel.

- ▶ Only authorized ZEISS personnel may make modifications to, or dismantle, the instrument or its components.

Before performing cleaning or maintenance, refer to: Safety [▸ 12].

⚠ WARNING!

Motherboard Clock Battery replacement must be performed only by authorized ZEISS personnel.

Replacing the lithium battery with the wrong type or incorrectly can cause explosion and fire hazard.

- ▶ Only ZEISS authorized personnel are trained to replace the motherboard battery.

11.2 Maintenance Schedule

Periodically inspect the CIRRUS 6000 system to ensure that:

- The system is well maintained and free of dust
- Wiring is intact and connected.
- Optics are clean (see: Cleaning and Disinfection [▸ 401]).

The frequency of these inspections depends on the frequency of use and the environmental conditions where the system resides.

11.2.1 Every Week (Before Use)

Component	Activity	Time required
Scan Alignment	Performance Verification Check	2 minutes

11.2.2 Every Month

Component	Activity	Time required
Instrument Computer	Defragment the Disk Drives [▸ 411]	(Varies)

11.2.3 Every 6 Months

Component	Activity	Time required
Fan Filter	Inspect, Clean or Replace the Fan Filter [▸ 410]	2 minutes

11.3 Run the Verification Test

11.3.1 Verification Test Tool Overview

Figure 71: Verification Test Tool

1	Thumbscrews	2	Peg mounts
3	Thumbscrew mounts	4	Ocular lens housing

11.3.2 Install the Verification Test Tool

Install the **Verification Test Tool** before you Run the Verification Test [▸ 407].

Do not drop the **Verification Test Tool**; hold the test tool in place until you tighten the thumbscrews.

To install the Verification Test Tool:

Action

1. Install the **Verification Test Tool** on the face of the ocular lens housing.

2. Align the short pegs with holes on upper left and lower right.
3. Align the thumbscrews with holes on the upper right and lower left.
4. Tighten the thumbscrews with your fingers.

11.3.3 Run the Verification Test

NOTE

You do not need to make adjustments for image appearance or signal strength.

You can adjust brightness and contrast in the **Analyze** step.

NOTE

You cannot edit or delete the Performance Verification patient record.

NOTE

If a performance verification check fails, the data acquired since the last successful check may not be reliable.

Evaluating this test is somewhat subjective. The examples provided are guidelines. Note that:

- The alignment target defines a stringent range of tolerance.
- There is only a two or three-pixel difference between **PASS** and **FAIL**.

Before confirming that a test **FAILED**:

- Switch between 0% and 100% transparency multiple times to confirm navigation line alignment (see steps below).
- Remove and reinstall the **Verification Test Tool** to make sure it is seated properly and rerun the test.

To verify performance:

Prerequisite

☑ The **Verification Test Tool** is installed (Install the Verification Test Tool [▸ 406]).

☑ The **Patient** window is open (Select the Patient [▸ 132]).

Action

1. Select the patient: **Performance Verification** and click **Acquire**.

   ⇨ The **Acquire** screen opens.

2. Select **Macular Cube 200x200** and click **Auto Focus**.

3. Click **Capture**.

   ⇨ The **Select Eye** dialog opens.

4. Select either **OD** or **OS**.
5. Click **Save**.

6. Click **Finish**.
   ⇨ The **Patient** page opens.
7. Select the patient: **Performance Verification** and click **Analyze**.
   ⇨ The **Analysis** screen opens.

8. Select the scan saved in the steps above.
9. For **Overlay**, choose **OCT Fundus**.
10. Set **Transparency** to **0%**.
11. Double-click on the fundus image.
    ⇨ The fundus image opens in full-screen mode.

12. Drag the horizontal and vertical navigation lines to center them directly over the alignment target (white crossed lines) in the center of the circle.
13. Exit full-screen mode.
14. Set **Transparency** to **100%**.
    ⇨ The circles fade and the fundus image panel is black showing only the alignment target and navigation lines.
15. Double-click on the fundus image.
    ⇨ The fundus image opens in full-screen mode.

16. If both the horizontal and vertical navigation lines are centered on the alignment target or are touching the alignment target, the verification test **PASSES**.

17. If either the horizontal and vertical navigation lines are in the black (above, below, to the right or left of the alignment target), the verification test **FAILS**.
18. If the test **FAILS**, contact Zeiss customer service.
    ⇨ In the U.S., call 800–341–6968.
    ⇨ Outside the U.S., contact your local Zeiss distributor.
19. If you are not sure of the results, remove the verification test tool and repeat the test.
20. Click **Finish**.

11.4 Inspect, Clean or Replace the Fan Filter

Inspect the fan filter at least twice a year to determine if it needs cleaning or replacement.

To check or replace the fan filter:

Action

▶ Press the snap connector (1) and gently pull the cover back (2).

- If the filter (3) does not need replacement, gently clean the filter with water or alcohol and wipe dry with a clean, soft cloth.
- If the filter (3) needs replacement, remove and discard the old fan filter.
- Install the new fan filter (3) in the fan cover (2).
- Carefully install the fan cover (2) and snap the connector (1) into place.

11.5 Defragment the Disk Drives

NOTE

Hard disk defragmentation usually requires several hours to complete

- We recommend that you start defragmentation at the end of the day and let the process run overnight.

This procedure explains how to determine whether a drive needs defragmentation and now to defragment it.

If defragmentation does not complete by the time you need to use the instrument, stop defragmentation and start again when the instrument will not be in use for several hours.

When you clear archived exams regularly, the database and system performance degrade over time. Defragment the drives to maintain peak performance.

The CIRRUS™ HD-OCT might be segmented into several drives. For example, an instrument could have the disk drives:

- **D:**
- **E:**

Check each drive and defragment all drives that require it.

To defragment the computer:

Prerequisite

☑ The instrument is not needed for several hours (overnight recommended).

Action

- ▶ Exit the CIRRUS™ HD-OCT software (Log Out).
- ▶ From Windows, select **Search** and type `Defrag`.
- ▶ Open the app **Defragment and Optimize Drives**.
  - ⇨ The Windows **Optimize Drives** tool opens.
- ▶ Select the first disk drive.
- ▶ Click **Analyze**.
  - ⇨ The app analyzes the disk to determine whether it requires optimization.
- ▶ If the analysis recommends optimization, click **Optimize**.
  - ⇨ This process takes several hours. Do not use the system during the optimization process.
- ▶ Repeat these steps for each remaining disk drive and optimize as needed.

11.6 Calibrate the Anterior Segment Lenses

NOTE

Do not touch the Calibration Tool, External Lens, or instrument while the calibration is in progress.

To calibrate the anterior segment lenses:

Action

1. In Windows, navigate to the **Carl Zeiss Meditec** folder.
2. Double-click the **Anterior Segment Module Calibration Wizard** file.
   - ⇨ The calibration wizard opens.

3. Click **Next**.
   - ⇨ Hardware initializes and the calibration tool installation dialog opens.

4. Click **Next**.
   ⇨ The lens selection dialog opens.

5. Select **Internal Lens.**
6. Click **Next**.
   ⇨ Lens calibration starts. When calibration is complete, a confirmation opens.

7. If your instrument does not have an **Anterior Segment** license, click **Finish** and exit calibration.

8. If your instrument has an **Anterior Segment** license, install the **Anterior Chamber** lens (see: Attach External Lens [▸ 183]).
9. Click **Next**.
   ⇨ Lens calibration starts. When calibration is complete, a confirmation opens.

10. Install the **Cornea** lens (see: Attach External Lens [▸ 183]).
11. Click **Next**.
    ⇨ Lens calibration starts. When calibration is complete, a confirmation opens.

12. Click **Exit**.

12 Troubleshooting

12.1 Safety During Troubleshooting

⚠ WARNING!

Opening Instrument Covers can lead to exposure to electrical and optical hazard.

- ▶ Do not open the instrument covers.
- ▶ Exceptions:
  - ⇨ You may remove the rear cover to access labels and connectors.

⚠ CAUTION!

Reconfiguring system components on the table, or adding non-system devices or components to the table, or replacing original system components with substitutes not approved by ZEISS

could result in failure of the table height adjustment mechanism, instability of the table, tipping and damage to the instrument, and injury to operator and patient.

- ▶ Do not reconfigure system components on the table, nor add non–system devices or components to the table, nor replace original system components with substitutes not approved by ZEISS.

⚠ CAUTION!

Improper care and cleaning of optical components

could lead to coating failure.

Contaminants on the optical surfaces increase scatter off the surface and absorb light energy.

- ▶ Do not use alcohol prep wipes to clean lenses or optical surfaces.
- ▶ Wipe gently and carefully to avoid scratching the instrument and auxiliary lenses.

⚠ CAUTION!

Attempting to carry out activities not specifically endorsed by ZEISS

may void your warranty and could result in damage to the instrument.

- ▶ Read the user documentation.
- ▶ Follow directions carefully.
- ▶ Do not make upgrades, or carry out repairs or modifications, without specific guidance and instruction from ZEISS or an authorized ZEISS representative.

⚠ CAUTION!

Using a non-approved or incorrectly connected device

could invalidate the system safety approval.

- ▶ Follow all indications in this user document to ensure that all connections are approved and correctly configured.

NOTE

Report Serious Incidents

- ▶ Any serious incident, affecting any person, that occurs in connection with the use of this medical device, must immediately be reported to the manufacturer or to the medical product distributor. In the European Union, the operator must report this serious incident to the responsible authorities in the applicable country.

12.2 Status Messages

NOTE **Qualification recommendation for these solutions: Local IT.**

Instrument Status

Message / Fault	Cause	Solution
■	The instrument is ready for use.	N/A
■ Critical Storage	Not enough storage space for patient data.	▶ Archive patient data or add an external storage device. ▶ Turn instrument power off and then on. ▶ If the problem persists, contact ZEISS customer service.

Hard Drive Status

Message / Fault	Cause	Solution
■	Adequate free data storage space	N/A
■ Low disk space	Hard drive space is low at startup.	▶ You can continue to use the instrument software. ▶ Free some space on the hard drive soon.
■ Critically low hard drive space.	Not enough hard drive space to acquire or analyze patient data. You cannot **Acquire** or **Analyze** data.	▶ Create additional hard disk space by deleting unused, saved exams. ▶ Save the exams to an external storage unit or an additional NAS. ▶ Shut down and restart the software to enable the **Acquire** button. ▶ If using a Review Station and you only plan to review one or two scans, you can temporarily change the storage requirements. *Result* ✓ When you have adequate space on the hard drive, status changes to green.

Network Archive Status

Message / Fault	Cause	Solution
■	Network available with adequate storage for data.	N/A
■ Low network disk space	Low network disk space for data storage, or network unavailable.	▶ Verify the network connection. ▶ When connected, change the database location. *(You can use the database temporarily.)*
■ Critically low archive storage space.	Not enough free space on the archive to save additional patient data.	▶ Save the exams locally and consider attaching to an additional archive storage space.

12.3 System Startup Troubleshooting

Figure 72: System Startup Results Example

Fault	Cause	Solution
⊗ **Database**	The system cannot access patient records success-fully.	You cannot log in or use the instrument. *Action* ▶ Call ZEISS customer service: In the U.S., call 800-341-6968. Outside the U.S., contact your local CZM distributor.
⊗ **Instrument Storage Space**	The CIRRUS™ HD-OCT instrument storage is low or full.	▶ Clear archived exams. ▶ To bypass the error and login, click **Continue**. ⇨ You might not be able to archive additional data

Fault	Cause	Solution
Network Storage Space	Network archive storage space is low or full.	▶ Click **Details** for more information. Correct the failure reported in details. If free space is critically low, you may need to clear archived exams or add storage before you acquire new scans. ▶ If prompted, shutdown to archive exams data. ▶ To bypass the error and login, click **Continue**.
Installation Files	Critical system software files are not available or were altered.	▶ Click **Details** and note system check details. ▶ Call ZEISS customer service: In the U.S., call 800-341-6968. Outside the U.S., contact your local CZM distributor.
Instrument	Checks the connectivity of the instrument hardware with the system computer.	
Fail	Instrument startup failure.	

Table 72: Startup Check Failure (Operator)

12.4 Troubleshooting Instrument Power

Fault / Indicator	Cause	Solution
The instrument will not turn on.	General power outage.	▶ Ensure that there is not a localized power outage in your office or a general power outage in your neighborhood.
	Power cord is not attached to the instrument.	▶ Ensure that the power cord is properly plugged into the instrument.
	The table's power cord is not plugged into the wall outlet.	▶ Ensure that the power cord is properly plugged into the wall outlet.

Table 73: Troubleshooting Instrument Power

12.5 Troubleshooting Connections

Fault / Indicator	Cause	Solution
Review station does not connect to the network.	The internet protocol version is set incorrectly.	▶ Set the internet protocol version correctly (see: Setting the Internet Protocol Version [▷ 98]).
Connection to the current database failed. Do you want to specify another database?	The database service is not turned on.	▶ Open Windows **Task Manager**. ▶ Select **Services**. ▶ Start the service: `Interbase 2020`.

Fault / Indicator	Cause	Solution
	Firewall rules are configured incorrectly.	Ensure that the following **Windows Firewall** rules are enabled for **Public**, **Private** and **Domain** network profiles: ■ `Interbase Server` ■ `File and Printer Sharing (SMB-In)` ■ `File and Printer Sharing (Edho Request-ICMPv4-In)` ■ `File and Printer Sharing (Edho Request-ICMPv6 -In)`
	Server Port 3051 needed for instrument and review station communication is not available, blocked or already in use.	▶ Contact an IT professional to assist you to make port 3051 available (both the review station and instrument). ▶ Assign a different port for communication on both review station and instrument. To change the port, use a text edit (like Notepad) to open the file: `C:\WINDOWS\system32\drivers\etc\services` (no file extension) and find the line that starts: `czm_db`.
	TCP/IP filtering is blocking the port.	▶ Turn off TCP/IP filtering: From the Windows desktop, open **Control Panel > Network Connections**, right-click **Local Area Connection** and select **Properties**. ▶ Select the **General** tab, select **Internet Protocol (TCP/IP)**, click **Properties**, and click **Advanced**. ▶ Select the **Options** tab, select **TCP/IP filtering** and click **Properties**.
		▶ Add **port 3051** to the list of permitted ports.
	User is unable to access the database folder on the review software	▶ Makes sure if the correct permissions have been given to the user. See Setting File Permissions for Standard Users [▷ 78]
Failure to load scanned data. Unable to open DICOM File for Retrieval.	Network drive not mapped properly or inadequate permissions for the network drive.	▶ On the review station, map a drive to the archive and set shared permissions.
Frequent connection timeouts.	The network drive map uses the name of the storage computer.	▶ Remap the drive using the IP address instead of the computer name.
	Slow or weak network connection.	▶ Increase timeout values (see: DICOM Advanced Configuration [▷ 392]).

Fault / Indicator	Cause	Solution
	LAN adapter setting is disabled.	▶ From the Windows desktop, open **Control Panel > Network and Internet >Network and Sharing Center**. ▶ Click **Change adapter settings.** ▶ Right-click **Local Area Connection** and select **Properties**.
DICOM connection status indicator is red	Connection information is set incorrectly.	▶ Set the internet protocol version correctly (see: Setting the Internet Protocol Version [▶ 98]).
	Connect test failed.	
United States Veterans Administration's VistA™ is not connecting properly.	**DICOM Extended Negotiation** is enabled.	▶ Uncheck **DICOM Extended Negotiation** (see: DICOM Advanced Configuration [▶ 392]).
FORUM is not connecting properly.	**DICOM Extended Negotiation** is disabled.	▶ Check **DICOM Extended Negotiation** (see: DICOM Advanced Configuration [▶ 392]).
During DICOM configuration, **AE Title** and **DICOM Port** fields are not editable.	**Allow Local AETitle Edit** is disabled.	▶ Check **Allow Local AETitle Edit** (see: DICOM Advanced Configuration [▶ 392]).
Worklist records searches timeout or message: " exceeds the configured maximum"	The **Maximum Query Response** is too low for the network.	▶ Use additional search criteria to return faster, narrower search results. ▶ Increase **Maximum Query Response** value (see: DICOM Advanced Configuration [▶ 392]).
FORUM/DICOM is not automatically connecting.	Auto-query is disabled.	▶ Enable auto-query (see: Configure DICOM Archiving [▶ 96]).

12.6 Troubleshooting Archive Management

Fault / Indicator	Cause	Solution
Cannot set an archive location.	You are using a review station in **Instrument** mode.	▶ Use a CIRRUS™ HD-OCT instrument or review station set to DICOM mode to set up an archive.

12.7 Troubleshooting User Management

Fault / Indicator	Cause	Solution
Cannot add a user.	You are logged in as an operator or analyst.	▶ Log in as Admin [▶ 61].
Cannot delete a user.	The user is assigned to one or more existing patient scans.	▶ Retain the inactive user to keep their association to existing scans.

12.8 Troubleshooting Patient Management

Fault / Indicator	Cause	Solution
Cannot open the scan organizer.	You are using a review station.	▶ Use a CIRRUS™ HD-OCT instrument to organize scans.

12.9 Troubleshooting Scan Acquisition

Fault / Indicator	Cause	Solution
Cannot obtain a complete image.	The patient's eyelid is obstructing the image.	▶ Elevate the patient's eyelid during scan acquisition (see:).
Image has breaks or saccades.	The patient is moving their eyes during the scan or blinking excessively.	▶ Turn FastTrac™ On [▸ 150].
Poor image quality and blurry B-scan.	Weak signal strength.	▶ Re-take the scan.
FastTrac stalls or does not complete.	The image is too high or too low.	▶ Center the B-scan image (see: Adjusting B-Scan Images [▸ 207]).
	The iris target is not centered on the pupil.	▶ Align and Focus the Iris Image [▸ 211].
	The fundus image is not focused.	▶ Focus the Fundus Image [▸ 205].
	The patient's pathology or anatomical features make it difficult to center all B-scans.	▶ Turn off **Z position monitoring** (see:).
	The patient is not fixating properly during the scan.	▶ Ask the patient to try to move and blink less frequently during the scan.
	The patient is blinking or moving too much during the scan.	
Cannot center all of the B-scans at the same time.	The patient's pathology or anatomical features make it difficult to center all B-scans.	▶ Turn off **Z position monitoring** (see:).
Cannot turn on FastTrac.	FastTrac is disabled.	▶ Enable FastTrac (see: Turn FastTrac™ On or OFF [▸ 106]).
HD image appears inverted.	The B-scan image is too high in the viewport (creating a reflection).	▶ Center the B-scan image (see: Adjusting B-Scan Images [▸ 207]).
Fundus image is partially or completely obscured.	The B-scan is too low in the viewport; light is not passing directly through the center of the pupil.	

12.9.1 Troubleshooting FastTrac

Fault / Indicator	Cause	Solution
The image is not centered properly (too high or too low).	For patients with certain pathologies or anatomical features, it may be difficult to ensure centering across all B-scans in a cube.	▶ Use the up and down arrows to center the image.
		▶ Cancel the scan. ▶ Turn off the monitoring of the Z position. ▶ Re-scan with FastTrac.
FastTrac stalls or cannot successfully track using FastTrac.	The iris image is not aligned properly	▶ Adjust the position in the Iris viewport.
	The fundus image is not focused properly.	▶ Manually adjust the focus.
	Fixating problems.	▶ Ensure that the patient is fixating in the same position throughout scan acquisition.
	Excessive blinking or moving.	▶ Ensure that the patient remains still and blinks less frequently throughout scan acquisition.

12.10 Troubleshooting Image Analysis

Fault / Indicator	Cause	Solution
Fovea Not Found	The system's automatic fovea location algorithm could not detect the Fovea.	▶ Manually position the Fovea.
The Fovea location was not detected properly.	The systems' automatic fovea location algorithm detected a depression in the reflectivity around the ILM that is not related to the fovea.	
	The patient's fovea is very far from the center.	

Table 74: Troubleshooting Posterior Segment Image Analysis

12.11 Troubleshooting Image Registration

Success or failure of registration is based on a cross-correlation metric computed from the two images after registration. A threshold for this metric concludes whether registration failed or succeeded.

Fault / Indicator	Cause	Solution
Red Flag Registration Failed Message	Weak signal strength	▶ If another image is available, select another image for comparison. ▶ To register the images, see: Manually Register AngioPlex Images [▸ 313]. ▶ To proceed without registering the images, select **No Registration**.
	Poor alignment	
	Opacities	
	Differences between the scan areas	
	Differences in retinal anatomy between the images.	

13 Specifications

13.1 Imaging Specifications

13.1.1 OCT Imaging Specifications

	CIRRUS 6000
Methodology	Spectral domain OCT
Optical source	Superluminescent diode (SLD), 840 nm
Optical power	Nominal 1200 +/– 300 µW at cornea
Maximum Scan speed	100k A-scans/sec

13.1.2 Posterior Segment OCT Imaging Specifications

	CIRRUS 6000
A-scan depth	2.9 mm for 12 mm 1 line 100x Raster, Angio HD 8x8, Angio 8x8 and 12x12 2.0 mm for all other scans
Axial resolution	5 µm
Transverse resolution	12 µm

13.1.3 Anterior Segment OCT Imaging Specifications

Scan	A-Scan Depth	Axial resolution	Transverse resolution
Anterior Segment Cube 512x128	2.0 mm, 1024 points	5 µm	<20 µm
Anterior Segment 5 Line Raster			
HD Cornea			<25 µm
Pachymetry			
HD Angle	2.9 mm, 1024 points		<20 µm
Wide Angle-to-Angle			<45 µm
Anterior Chamber	5.8 mm, 2048 points		

13.1.4 Fundus Imaging Specifications

	CIRRUS 6000
Methodology	Line scanning

	CIRRUS 6000
	ophthalmoscope
Live fundus image	During alignment and during OCT scan
Optical source	Superluminescent diode (SLD), 750 nm
Optical power	< 1.5 mW at the cornea
Field of view	36 degrees W x 30 degrees H
Frame rate	> 20 Hz
Transverse resolution	25 µm (in tissue)

13.1.5 Iris Imaging Specifications

	CIRRUS 6000
Sensor Resolution	1280 x 1024
Live iris image	During alignment

13.1.6 Imaging Properties

The following tables lists the optical properties of the four light sources incorporated into the CIRRUS™ HD-OCT instrument:

OCT	
Source	Super-luminescent diode (SLD)
Wavelength	840 nm Wavelength range: 795 nm – 885 nm (10 dB bandwidth, approximate Gaussian intensity distribution)
Scan Angle	10° minimum, 42° maximum
Operating Beam Power	0.9 to 1.5 mW at cornea

LSO	
Source	SLD, lensed to illuminate a line subtending 30°
Center Wavelength	750 nm Wavelength range: 740 nm – 760 nm (3 dB bandwidth, approximate Gaussian intensity distribution)
Scan Angle	36° horizontal scan of the 30° vertical line
Operating Beam Power	0.9 to 1.1 mW at cornea

Iris View	
Source	Infrared LED
Wavelength	700 nm Wavelength range: 678 nm – 722 nm (45 nm 3 dB bandwidth, approximate Gaussian intensity distribution)
Radiance	260 mW/cm^2/sr

Internal Fixation		
Optical Source	Green LED	
Wavelength	523 nm Wavelength range: (Approximate Gaussian intensity distribution) 	x-Axis = wavelength λ (nm) y-Axis = Relative intensity % 1=Blue 2=Green
Luminance	0.31 lumens/cm^2/sr	

External Fixation		
Optional Source	Red LED	
Wavelength	627 nm Wavelength range: 604 nm – 650 nm (45 nm 3dB width, approximate Gaussian intensity distribution) 	x-Axis = wavelength λ (nm) y-Axis = Relative radiant intensity
Radiance	0.64 mW/cm^2/sr	

Based on an analysis of relevant laser and ophthalmic standards, all CIRRUS™ HD-OCT light sources together comprise a safe instrument, for which the standards prescribe no warnings or limitations on viewing the light sources beyond the label “Class 1 laser product.” The analysis includes consideration of the spatial distribution of intensities of the light sources on the cornea and retina during scanning to determine the hazard classification of the product.

13.2 Mechanical Specifications

13.2.1 Physical Specifications

	CIRRUS 6000
Weight	35 kg (77 lbs) *(without monitor)*
Dimensions	62.2L x 42.5W x 49.4H (cm) *(without monitor)*
Input devices	keyboard mouse
Fixation	Internal, external
Internal Fixation (focus adjustment)	-20D to +20D (diopters)

13.2.2 Computer Specifications

	CIRRUS 6000
Processor	i7 Intel® processor (7th gen)
Internal storage	2 TB
USB ports	6
Monitor	22” Widescreen HD
Operating system (Instrument)	Windows 10
Operating system (Review Station)	Review Station Requirements [▸ 49]
Maximum Review Station connections per device	10

Table 75: Computer Specifications

13.3 Electrical Specifications

Rating	CIRRUS 6000
Electrical (230V) Electrical (115V)	Single Phase, 220/240V~ systems:50–60 Hz, 3.15A Line and Neutral are fused. Single Phase, 100/120V~ systems:50–60Hz, 5A Line and Neutral are fused.
Fuse	N/A

13.4 Conditions for Use

	CIRRUS 6000
Temperature	+10° C to +35° C
Relative humidity	30% to 75% *(excluding condensation)*

	CIRRUS 6000
Atmospheric pressure	700 hPa to 1060 hPa
Altitude (above sea level)	Up to 3000m
Room Lighting	Standard indoor office fluorescent lamp environment; not to be used in direct sunlight or near a window.

13.5 Conditions for Storage

	CIRRUS 6000
Temperature	–40–+70°C
Relative humidity	10–95% *(excluding condensation)*
Atmospheric pressure	500–1060 hPa

13.6 Conditions for Transport

	CIRRUS 6000
Temperature	–10–+55°C
Relative humidity	10–95% *(excluding condensation)*
Atmospheric pressure	700–1060 hPa

Empty page, for your notes

14 Legal Notices

Software Copyright

The software program (“Software”) included with your CIRRUS™ HD-OCT is a proprietary product of Zeiss and in certain instances contains material proprietary to Microsoft Corporation and other third party licensors, suppliers and vendors. These proprietary products are protected by copyright laws and international treaty. You must treat the Software like any other copyrighted material. Copyright ©2024 Carl Zeiss Meditec, Inc. All rights reserved.

End User Software License Agreement

Upon initial configuration of your CIRRUS™ HD-OCT, you will be presented with an End User Software License Agreement (the “EULA”), which you must accept in order to use the Software. The EULA is a legal contract between You and Carl Zeiss Meditec, Inc., which governs Your use of the Software. If you do not agree with the terms and conditions of the EULA and do not agree to be bound by the EULA, do not use the Software. If You have any questions concerning the EULA, contact Carl Zeiss Meditec, Inc., Attention: Customer Service, 5300 Central Parkway, Dublin, CA 94568. Telephone 800–341–6968.

Acknowledgment

You acknowledge that you have read all the provisions in this Chapter, including End User Software License Agreement, understand them, and agree to be bound by their terms and conditions.

Empty page, for your notes

15 Accessories and User Replaceable Spare Parts

This section contains parts lists and associated information for the device. It also contains instructions for ordering parts and returning defective parts.

NOTE

The procedure for returning defective parts from International operations differs somewhat from that for U.S. domestic operations

These differences are noted in the instructions.

- Please follow the instructions carefully.

15.1 Accessories and User Replaceable Parts

⚠ WARNING!

Using parts that are not authorized by ZEISS

may compromise device safety during operation.

- Use only accessories authorized by ZEISS.
- In the U.S., call 800–341–6968. Outside the U.S., contact your local Zeiss distributor. You can find the ZEISS contact partner for your country on our website: www.zeiss.com.

15.2 Parts Orders

15.2.1 U.S. Domestic Parts Ordering

Spare parts may be ordered as needed following established parts ordering procedures. Parts needed overnight may be ordered by phone from the Parts Department. The cost of shipping parts for next day delivery is very high and should be used only in emergencies. The Parts Department phone number is:

- 1-800-341-6968 (domestic toll-free)
- 1-925-557-4843 (domestic)
- 1-925-557-4652 (domestic fax)

15.2.2 International Service Operations

Customers are billed for shipping charges, including any customs fees required.

For International Service Operations, please use the ordering procedures that have been established for your area of operations, and which meet the requirements of the Carl Zeiss Meditec International Parts Department.

15.3 Returning Defective Parts

The return of defective parts is a very important part of ZEISS' responsibility to its customers and helps us to:

Action

- ▶ Evaluate returned parts to assist in root cause analysis.
- ▶ Rebuild and return them to service stock, so they are available in the future as needed.

15.4 Equipment Return Authorization

Authorization must be obtained from Carl Zeiss Meditec before equipment is returned for repair. A Return Material Authorization (RMA) number is required on each return shipment to Carl Zeiss Meditec. The procedure for obtaining an RMA number varies, depending on your area of operation. Use the procedure that has been established by Carl Zeiss Meditec for your area of operations.

15.5 International Service Operations

Customers are billed for shipping charges, including any customs fees required.

For International Service Operations, please use the ordering procedures that have been established for your area of operations, and which meet the requirements of the Carl Zeiss Meditec International Parts Department.

15.6 Part Numbers

NOTE

Part numbers are subject to change

- ▶ When ordering, confirm all part numbers with your ZEISS Representative.

15.6.1 Power Cords

Designation	Specification	Part Number
Power Cord IEC 320	1 m/39 Inch	0000001217033
Power Cord IEC 320 to NEMA	.3 m/12 In	2660021115973

15.6.2 Cables

Designation	Length	Part Number
Ethernet CAT5E Shielded	14 ft.	2660021121819
Cable, USB MA-MB	6 ft.	2660021116418

15.6.3 Cleaner

Designation	Specification	Part Number
Alcohol Wipes	-	2660100006566
Camera Lens Cleaner	-	2660100007672
Camera Lens Wipes	-	2660100007673

15.6.4 Kit, Test Eye

Designation	Specification	Part Number
The Kit includes: ■ Verification Test Tool ■ Fixation Device ■ Occluding Sleeve for Fixation Device ■ Red Fixation Lamp	-	2660021161047

15.6.5 Miscellaneous Spare Parts

Description	Specification	Part Number
Anterior Chamber Lens	-	2660021158406
Anterior Segment Calibration Tool	-	2660021150088
Instrument Dust Cover	-	2660021174524
Cornea Lens	-	2660021158407
Fan Filter	-	2660021161991
Fixation Device	(External)	2660021149361
Fixation Lamp	Red	3013509052000
Occluding Sleeve for Fixation Device	-	3197519005000
Ocular Lens Cover	-	2660021124008
Verification Test Tool	-	2660021160365

Empty page, for your notes

16 Decommissioning

16.1 Safety During Decommissioning

⚠ CAUTION!

Attempting to decommission your system

may result in damaged equipment and danger to personnel.

- ▶ Never attempt to decommission a ZEISS system or device. Only ZEISS approved field service representatives are qualified to safely decommission your system.
- ▶ Contact your ZEISS Representative to set up an appointment for system/device decommissioning.

Empty page, for your notes

17 Packaging and Transport

17.1 Safety During Packaging and Transport

⚠ CAUTION!

Packaging and transport by non-ZEISS personnel

could result in damage, loss, or non-compliance within the country of transit.

- ▶ Allow only change to Zeiss approved representative to prepare the instrument and associated components for transport.
- ▶ Allow only ZEISS-approved personnel to transport the instrument and associated components.

Empty page, for your notes

18 Disposal

18.1 Packaging Disposal

- Keep instrument packing material in the event of a relocation or repair.
- If you want to dispose of the packing material: Dispose of packing material by sending it for recycling through an acknowledged collection system.

18.2 Device Disposal

The device contains electronic components with integrated batteries.

- Dispose of the device and integrated batteries correctly, in accordance with national legislation.

The device specified on the delivery note must not be disposed of via household waste or communal disposal companies according to the applicable EU guidelines valid at the time the device was placed on the market.

For more information about the disposal of the device, please contact the ZEISS contact partner in your country.

If you want to sell the device or its components: Inform the purchaser that they must dispose of the device according to the regulations valid at that time.

Empty page, for your notes

Attachment A Reference Database 1 for Healthy Eyes Study–CIRRUS 400/4000/500/5000

Data was collected and analyzed for this study to establish reference range limits for healthy eyes by regression analysis for the 1st, 5th, 95th, and the 99th percentiles for structural measurements which included: macular thickness, ganglion cell thickness, the retinal nerve fiber layer (RNFL) thickness, and optic nerve head (ONH) parameters (rim, cup, and cup-to-disc ratios).

NOTE

Reference Database 1 – CIRRUS 400/4000/500/5000

The reference range for healthy eyes represent the general population.

However, when interpreting data, keep the following study limitations in mind (especially for 1% and 99%):

- Subjects:
  - ⇨ Ages 18-84
  - ⇨ Refractive errors –12.00 D to +8.00 D
- Age ranges with fewest subjects:
  - ⇨ 3 subjects over 80.
  - ⇨ 28 subjects aged (70-79).

NOTE

Reference Database 1 – CIRRUS 400/4000/500/5000

The reference range for healthy eyes limits are adjusted by age groups only (unless noted).

Other differences might occur for some measurements; however, the reference range for healthy eyes does not adjust for these factors, such as:

- Image Signal Strength
- Ethnicity
- Axial Length
- Refraction
- Optic Disc Area

This document explains how reference ranges for healthy eyes were determined for the general population.

A.1 Purpose

The purpose of this study was to establish reference ranges for healthy eyes for:

- **Macular Thickness** (macular images)
- **RNFL Thickness** (ONH images)

- **Ganglion Cell Thickness** (macular images)
  NOTE! the actual layers measured are both the ganglion cell layer and inner plexiform layer
- **ONH Features** (ONH images)

A.2 Results in Image Analysis

CIRRUS™ HD-OCT analyses compare a patient's results to the reference ranges for health eyes and depict the results visually in different ways.

Table	Chart

⚠	Central Subfield Thickness µm	Cube Volume mm³	Cube Avg Thickness µm
ILM - RPE	478	11.0	305

Table 76: Examples of RDB data incorporated into the analysis pages for Macular Thickness.

Chart	Grid	Maps

Table 77: Examples of RDB data incorporated into the analysis pages for RNFL Thickness.

Also see

Interpreting Macular Thickness Parameters [▸ 237]
Interpreting Ganglion Cell Results [▸ 261]
Interpreting ONH Results [▸ 272]

A.3 Study Subjects

The following table describes the selection criteria for subjects of this study.

Inclusion Criteria	Exclusion Criteria
■ 18 years or older. ■ Willing to make the required study visits.	**Ophthalmic** ■ Best corrected visual acuity in either eye worse than 20/40. ■ Refractive error (spherical equivalent) outside -12.00 D to +8.00 D range. ■ Glaucoma or glaucoma suspect diagnosis in either eye. ■ Presence or history of ocular hypertension (IOP ≥ 22 mm Hg) in either eye.

Inclusion Criteria	Exclusion Criteria
■ Willing to give consent and follow study instructions. ■ Normal and valid Humphrey 24-2 SITA standard visual field in both eyes.	■ Occludable angle or history of angle closure in either eye. ■ Presence or history of disc hemorrhage in either eye. ■ RNFL defect in either eye. ■ Amblyopia in either eye. ■ Previous laser or incisional surgery. ■ Active infection in anterior or posterior segments. ■ Evidence of diabetic retinopathy, diabetic macular edema, or other vitreo-retinal disease.
	Systemic ■ History of diabetes, leukemia, AIDS, uncontrolled systemic hypertension, dementia or multiple sclerosis. ■ Life-threatening or debilitating disease. ■ Current or recent use of an agent with photosensitizing properties *(Visudyne®, ciprofloxacin, Bactrim®, doxycycline, etc.)*.

Table 78: Inclusion and Exclusion Criteria

Subject Medical History

Investigators took medical and ophthalmic histories and conducted an ophthalmic examination on each subject prior to enrollment, which included:

- Distance visual acuity.
- Humphrey 24-2 SITA perimetry (standard threshold test).
- Goldmann applanation tonometry.
- Keratometry.
- Axial length measurement using an IOLMaster.
- Slit lamp examination of the anterior segment of both eyes.
- Gonioscopy.
- Dilated ophthalmoscopic examination, bilaterally.
- Fundus and stereodisc photography of the maculas and the optic nerves of both eyes.
- Corneal thickness measurement using ultrasound pachymetry.

A.4 RDB Demographics

NOTE

For the study, subjects were categorized into age groups. Image analyses compare a patient's measurements to subjects of the same age (not age group).

For the study, subjects were divided into age groups as follows:

Group	Age Range	Gender Diversity		Ethnic Diversity
1	18-29	**Macula & Ganglion Cell Study** ■ 133 Male ■ 149 Female ■ Median age: 46.6	**RNFL & ONH Study** ■ 134 Male ■ 150 Female ■ Median age: 46.5	■ 43% Caucasian ■ 24% Asian ■ 18% African American ■ 12% Hispanic ■ 1% Indian ■ 2% mixed ethnicity
2	30-39			
3	40-49			
4	50-59			
5	60-69			
6	70-84			
Observations: ■ *0 subjects under 19 years old*. ■ *28 subjects between 70 and 79 years old*. ■ *3 subjects 80 and older*.				

Table 79: Demographic summary, subjects with any valid scans

A.5 Data Collection

CIRRUS™ HD-OCT operators obtained the following images from each subject:

Subjects	Scan Type	# of Scans	Eyes
284	Optic Disc Cube 200x200	3	OD & OS
	Macular Cube 200x200	3	
	Macular Cube 512x128	1	

Table 80: CIRRUS™ HD-OCTStudy Images

All 284 subjects qualified for the **RNFL** study.

282 subject eyes qualified for the **Macula**, **Ganglion Cell**, and **ONH** study.

A.6 Image Selection

Investigator reviewed each image to determine:

- Poor quality images to exclude, such as images with:
  - Signal strength of 5 or lower.
  - Saccade(s) within the central 80% of the image (due to excessive eye motion during image acquisition).
  - Data loss greater than 10% at the edge of the scan area.
  - Floaters obscuring the macular area (macular images).
  - Floaters obscuring the measurements of ONH image.
- The best quality image for each eye.

A.7 Data Analysis

By defining the reference range for healthy eyes, CIRRUS™ HD-OCT image analysis can compare a patient's measurements to determine whether a patient's measurements are within the reference range for healthy eyes for their age.

The subject's **age** is a clinically important factor for determining the reference ranges for healthy eyes.

Regression model analyses estimated the limits of thickness parameters adjusted by age.

A.7.1 Deriving Percentiles and Limits

The following table provides the formulas that derived the reference range limits:

Purpose	Formula
Derive residuals for fitted regression model (each eye).	`Residual = Obs(age0) - ET(age0)`
Established estimated 1%, 5%, 95% and 99% limits for a normal subject with an age of age0. *Empirical distribution of the residual estimated the percentiles.*	`ET(age0) + NL(100xα %) < Obs(age0)`
■ `ET(age0)` = *the estimated expected mean reading* ■ `Obs(age0)` = *the measured or observed reading* ■ `NL(100xα %)` = *the normative limit of the residuals*	

A.8 Macular Images

Measurement	Parameters	Analyses
Macular Thickness	■ Macular thickness ■ Average macular thickness ■ Average volume (ILM-RPE)	■ Macular Thickness ■ Macular Change ■ Panomap ■ Single Eye Summary ■ Wellness Report
Ganglion Cell Thickness	■ Ganglion cell thickness	■ Ganglion Cell OU ■ Panomap ■ Wellness Exam

Table 81: Macular Thickness and Ganglion Cell Thickness Parameters and Analyses with RDB Data

Also see

Wellness Exam Overview [▶ 300]
Panomap Analysis [▶ 297]
Single Eye Summary Analysis [▶ 293]
Analyze Macular Thickness [▶ 236]
Analyze Macular Change [▶ 246]
Analyze Ganglion Cell OU [▶ 261]

A.8.1 Macular Thickness Parameters

Figure 73: Early Treatment Diabetic Retinopathy Study (ETDRS) Grid

The reference range for healthy eyes for macular thickness provides the basis to compare a patient's macular thickness to the reference range for healthy eyes for their age.

The reference range for healthy eyes apply to the following measurements:

- **Macular Thickness:** Average thickness for the ILM - RPE tissue layer for each sector of the ETDRS grid.
- **Average Thickness:** Overall average thickness for the ILM - RPE tissue layer over the entire scanned area.
- **Volume:**Overall average volume for the combined ILM - RPE tissue layers over the entire scanned area.

A.8.1.1 Examples

Macular Thickness Analysis	PanoMap

A.8.1.2 Factors That Affect the Reference Ranges

A.8.1.2.1 Effect of Age

Central Subfield	Key: ■ *X-axis (horizontal) = Age in years* ■ *Y-axis (vertical) = Central Retinal Thickness (µm)* ■ *Line = Fitted regression line*

Average Thickness (all ETDRS subfields)	Key: ■ *X-axis (horizontal) = Age in years* ■ *Y-axis (vertical) = Average Retinal Thickness (µm)* ■ *Line = Fitted regression line*
Average Volume (all ETDRS subfields)	Key: ■ *X-axis (horizontal) = Age in years* ■ *Y-axis (vertical) = Average Retinal Volume (mm^3)* ■ *Line = Fitted regression line*

A.8.2 Ganglion Cell Parameters

The **Ganglion Cell** reference ranges provide the reference data for the thickness of the ganglion cell and the inner plexiform layer in healthy subjects ages 19 to 84.

A.8.2.1 Ganglion Cell Data

Parameter	Mean	Std	Min	Max
Average GCL + IPL Thickness	84.7	7.1	67.7	104.2
Sector 1	82.9	6.3	68.0	102.0
Sector 2	86.4	7.9	67.0	113.0
Sector 3	86.8	8.3	65.0	112.0
Sector 4	85.3	9.0	62.0	111.0
Sector 5	83.2	7.8	62.0	109.0

Parameter	Mean	Std	Min	Max
Sector 6	83.8	6.5	68.0	106.0
Minimum Average Axial Thickness	82.1	6.9	53.2	101.8

Table 82: Ganglion Cell Data

A.8.2.2 Factors That Affect the Reference Ranges for Healthy Eyes

The reference ranges for healthy eyes are adjusted by age. Factors that influenced ganglion cell reference range limits for some parameters included:

- Age (12% variability)
- Image Signal Strength (4% variability).
- Refractive error and axial length (< 2% variability)

A.8.2.2.1 Effect of Age

Key:

- *X-axis (horizontal) = Age in years*
- *Y-axis (vertical) = Ganglion Cell Average Thickness (µm)*
- *Line = Fitted regression line*

A.8.2.2.2 Effect of Ethnicity

Descent	Mean	Std
European	84.1	7.8
Hispanic	88.8	6.4
African	86.3	7.8
Asian	89.4	7.2

Observations:

- *There are differences among different ethnic groups in GCL + IPL thickness.*
  The mean difference in the average thickness between any two race groups is within 4.3 mm.
- *Subjects of European Descent have* **thinner** *GCL + IPL thickness (on average).*
- *Subjects of Hispanic and Chinese descent have* **thicker** *GCL + IPL thickness (p < 0.001).*

A.8.2.2.3 Effect of Axial Length and Refractive Error

Key

- *X-axis (horizontal) = Age in years*
- *Y-axis (vertical) = Average Ganglion Cell Thickness (microns)*
- *Line = Fitted regression line*

Observations:
GCL + IPL thickness decreases slightly with axial length (less than 2% of the total variability of the ganglion cell parameters).

A.9 ONH Images

Measurement	Parameters	Analyses
RNFL Thickness	■ Average RNFL Thickness ■ Superior RNFL Thickness ■ Inferior RNFL Thickness ■ RNFL Quadrants (TSNIT) ■ RNFL Clock Hours ■ RNFL Symmetry	■ ONH/RNFL OU ■ Panomap ■ Single Eye Summary ■ Wellness Report
ONH Features	■ Rim Area (mm^2) ■ Disc Area (mm^2) ■ Average Cup-to-Disc Ratio ■ Vertical Cup-to-Disc Ratio ■ Cup Volume (mm^3)	■ ONH/RNFL OU ■ Panomap ■ Single Eye Summary ■ Wellness Report

Table 83: RNFL thickness and ONH Parameters and Analyses with RDB Data

Also see

ONH/RNFL OU Analysis [▸ 277]
Panomap Analysis [▸ 297]
Wellness Exam Overview [▸ 300]
Single Eye Summary Analysis [▸ 293]
Analyze ONH/RNFL OU [▸ 276]

A.9.1 Examples

ONH and RNFL OU

A.9.2 RNFL Parameters

This study determined the reference ranges for the following the retinal nerve fiber layer (RNFL) parameters in healthy subjects ages 19 to 84:

- Average RNFL Thickness
- Superior RNFL Thickness
- Inferior RNFL Thickness
- RNFL Thickness for Quadrants (TSNIT)
- RNFL Thickness for Clock Hours
- Temporal RNFL Thickness
- Nasal RNFL Thickness

A.9.2.1 Factors That Affect the Reference Ranges

A.9.2.1.1 Effect of Age

Superior Quadrant Average	Key: ■ *X-axis (horizontal) = Age in years* ■ *Y-axis (vertical) = RNFL Thickness (µm)* ■ *Line = Fitted regression line*

Inferior Quadrant

Average

Key:

- *X-axis (horizontal) = Age in years*
- *Y-axis (vertical) = Average RNFL Thickness (µm)*
- *Line = Fitted regression line*

A.9.2.1.2 Effect of Ethnicity

Ethnicity [1] [2] [3]	RNFL Thickness
Caucasian	Thinner mean average thickness, superior quadrant average, and inferior quadrant average.
Asian	Thinner mean nasal quadrant average and thicker temporal quadrant average.

Observations:

- *The mean difference in the average thickness between any two race groups is within 6 µm.*
- *People of Asian descent have thinner mean nasal quadrant average and thicker temporal quadrant average.*
- *The largest difference in the RNFL thickness between two race groups is for the temporal quadrant average between Asian and African American, with a difference of 16 µm.*

[1] Artes, Crabb: *Estimating normative limits of Heidelberg Retina Tomograph optic disc rim area with quantile regression,* Invest Ophthalmol Vis Sci. 2010 Jan;51(1):335-61

[2] Knight, Oakley, Durbin, Callan, Budenz: *Cirrus Normative Database Study Group: Effect of Ethnicity, Age, and Axial Length on Optic Nerve Head Parameters Measured by Cirrus™ HD-OCT*, ARVO abstract 2010.

[3] Spaeth, Henderer, Steinmann: *The disc damage likelihood scale: its use in the diagnosis and management of glaucoma*, Highlights Ophthalmol 31: 4-16, 2003.

A.9.3 ONH Parameters

NOTE

These ONH parameters are adjusted for age and optic disc area.

▶ Refer to: Factors That Affect the Reference Ranges [▸ 455].

The data originally collected for the database was analyzed again to create the reference ranges for the following ONH parameters:

- Rim Area (mm^2)
- Average Cup-to-Disc Ratio
- Vertical Cup-to-Disc Ratio
- Cup Volume (mm^3)

NOTE! Cup-to-Disc Ratios ≤ 0.25 were excluded as the model used to fit the reference data is not applicable for small cup to disc ratios.

Additional Image Analysis Criteria

All three scans for each subject were reviewed again after processing with the optic nerve head analysis algorithm to ensure that:

- no floaters impacted the optic nerve head region
- optic nerve head data was within the axial field-of-view

In three instances, it was necessary to select a different scan for one eye to obtain acceptable results for both ONH and RNFL.

A.9.3.1 Quantile Regression Data Analysis

Because the subject's **age** and **disc size** are both clinically important factors for determining the reference ranges for healthy eyes, we used quantile regression to determine limits for ONH parameters.

Quantile regression fits slope and offset independently for each limit [4].

Cup-to-Disc Ratios ≤ 0.25 were excluded prior to quantile regression.

A.9.3.2 ONH Parameter Data

Parameter	Average	Standard Deviation	Minimum	Maximum
Rim Area (mm^2)	1.311	0.218	0.720	2.272
Average Cup-to-Disc Ratio	0.458	0.173	0.071	0.812
Vertical Cup-to-Disc Ratio	0.435	0.166	0.058	0.762

[4] Artes, Crabb: *Estimating normative limits of Heidelberg Retina Tomograph optic disc rim area with quantile regression,* Invest Ophthalmol Vis Sci. 2010 Jan;51(1):335-61

Parameter	Average	Standard Deviation	Minimum	Maximum
Cup Volume (mm^3)	0.137	0.134	0.000	0.796
Observations: ■ *11 subjects (less than 5%) had discs larger than 2.5 mm^2.* ■ *11 subjects (less than 5%) had discs smaller than 1.3 mm^2.* ■ *Disc area did not depend on age.*				

Table 84: ONH Parameter Data [5]

In earlier studies, researchers measured the disc's vertical diameter with a slit-lamp and classified the discs as small, medium, and large [6].

In this study we measured disc area, which considers all meridians. The classifications for disc area are:

- **Smallest ⅓:** < 1.58 mm^2
- **Medium ⅓:** 1.58 mm^2 to 1.88 mm^2
- **Largest ⅓:** > 1.88 mm^2

A.9.3.3 Factors That Affect the Reference Ranges

This study found that optic disc area had the greatest effect on the ONH parameters.

- **Disc Area:** as much as 40% of variability for some parameters
- **Age:** no more than 5% of variability for ONH parameters
- **All Other Factors:** (refractive error, axial length, etc.) no more than 7% of variability for ONH parameters

A.9.3.3.1 Effect of Age

Measurement	Slope	R^2	p
Rim Area	-0.002 mm^2 / year	0.033	0.002
Average Cup-to-Disc Ratio	+0.002 / year	0.032	0.002
Vertical Cup-to-Disc Ratio	+0.002 / year	0.041	0.001
Observations : ■ *Average and Vertical Cup-to-Disc Ratios slowly increase with age.* ■ *Rim Area slowly decreases with age.* ■ *Disc area does not change with age (p>0.05).*			

[5] Knight, Oakley, Durbin, Callan, Budenz: *Cirrus Normative Database Study Group: Effect of Ethnicity, Age, and Axial Length on Optic Nerve Head Parameters Measured by Cirrus™ HD-OCT*, ARVO abstract 2010.

[6] Spaeth, Henderer, Steinmann: *The disc damage likelihood scale: its use in the diagnosis and management of glaucoma*, Highlights Ophthalmol 31: 4-16, 2003.

A.9.3.3.2 Effect of Ethnicity

Observations:

- *Subjects of African descent had the largest discs on average* (1.93 ± 0.33 mm^2).
- *Subjects of European descent had the smallest discs on average* (1.68 ± 0.30 mm^2).
- *Rim Area show no significant difference among different ethnic groups.*

A.9.3.3.3 Effect of Optic Disc Area

Observations:

- *Most disc areas are between 1.3 mm^2 and 2.5 mm^2*.
- *All parameters increase with disc size.*

A.10 Conclusions

Doctors can use the reference ranges for healthy eyes to compare a patient's measurements to the general population.

Attachment B Reference Database 2 for Healthy Eyes Study–CIRRUS 6000

Data was collected and analyzed for this study to establish reference range limits for healthy eyes by regression analysis for the 1st, 5th, 95th, and the 99th percentiles for structural measurements which included: macular thickness, ganglion cell thickness, the retinal nerve fiber layer (RNFL) thickness, and optic nerve head (ONH) parameters (rim, cup, and cup-to-disc ratios).

NOTE

Reference Database 2 – CIRRUS 6000

The reference range for healthy eyes represent the general population.

However, when interpreting data, keep the following study limitations in mind (especially for 1% and 99%):

- Subjects:
  - ⇨ Ages 18-88
  - ⇨ Refractive errors –8.00 D to +3.00 D range with Astigmatism less than -2D
- Age ranges with fewest subjects:
  - ⇨ 17 subjects age 80-89

⇨ Any patient over 88 years old will be compared as if they were 88 years old.

NOTE

Reference Database 2 – CIRRUS 6000

Reference range limits for healthy eyes were adjusted only by age for Macular Thickness and Ganglion Cell Thickness. ONH parameters and RNFL thickness were adjusted for both age and optic disc size. Other factors might influence measurements; however, the reference range for healthy eyes does not adjust for these factors, such as:

- Gender
- Axial Length
- Image Signal Strength
- Ethnicity
- Refraction

This document explains how reference ranges for healthy eyes were determined for the general population.

B.1 Purpose

The purpose of this study was to establish reference ranges for healthy eyes for:

- **Macular Thickness** (macular images)
- **RNFL Thickness** (ONH images)
- **Ganglion Cell Thickness** (macular images)
  NOTE! the actual layers measured are both the ganglion cell layer and inner plexiform layer
- **ONH Features** (ONH images)

B.2 Results in Image Analysis

CIRRUS™ HD-OCT analyses compare a patient's results to the reference ranges for health eyes and depict the results visually in different ways.

Table				Chart
⚠	Central Subfield Thickness µm	Cube Volume mm³	Cube Avg Thickness µm	
ILM - RPE	478	11.0	305	

Table 85: Examples of RDB data incorporated into the analysis pages for Macular Thickness.

Chart	Grid	Maps

Table 86: Examples of RDB data incorporated into the analysis pages for RNFL Thickness.

Also see

- Interpreting Macular Thickness Parameters [▸ 237]
- Interpreting Ganglion Cell Results [▸ 261]
- Interpreting ONH Results [▸ 272]

B.3 Study Subjects

The following table describes the selection criteria for subjects of this study.

Inclusion Criteria	Exclusion Criteria
■ 18 years or older. ■ Able and willing to make the required study visits. ■ Able and willing to give consent and follow study instructions. ■ Able and willing to complete ophthalmic imaging.	**Ophthalmic** ■ Best corrected visual acuity worse than 20/40 on a Snellen or on a Snellen equivalent acuity chart in either eye. ■ Refractive error outside: Sphere: −8.00D to +3.00D range, Astigmatism greater than -2D ■ Glaucoma or glaucoma suspect diagnosis in either eye, including: Suspicious glaucomatous optic nerve appearance IOP > 21 mm Hg in either eye History of unreliable/abnormal HFA 24-2 sita standard threshold visual field ■ Any clinically significant vitreal, retinal, optic nerve or choroidal disease. Small drusen are acceptable in subjects. ■ Dense media opacity inhibiting adequate visualization of the retina. ■ History of ocular surgery (previous uncomplicated cataract and/or refractive surgery is acceptable). ■ Any active infection of anterior or posterior segments. ■ Current use of ocular medication (topical lubricants, treatment for dry eyes and/or ocular allergies are acceptable)
	Systemic ■ History of diabetes, leukemia, AIDS, dementia or multiple sclerosis. ■ A life threatening or debilitating disease. ■ Current or recent (within the past 14 days) use of an agent with photosensitizing properties by any route (e.g., Visudyne) ■ Concomitant use of hydroxychloroquine and chloroquine.

Subject Medical History

Investigators took medical and ophthalmic histories and conducted an ophthalmic examination on each subject prior or during enrollment which included the below.

The following qualifying procedures were completed:

1. Best corrected visual acuity
2. Manifest refraction
3. Axial length measurement
4. Intraocular pressure measurement
5. Slit lamp examination of the anterior segment.
6. Grading of the lens
7. Ophthalmoscopic evaluation and/or fundus photographs of the macula and ONH

NOTE

For the study, subjects were categorized into age groups. Image analyses compare a patient's measurements to subjects of the same age (not age group)

Factor Level	Summary
N (subjects)	870
Age (years)	

Factor Level	Summary
Mean(SD)	53.6 (15.1)
Median	56.0
Min, Max	[18.0, 88.0]
Age (by sampling categories)	
Age 18-49	247/870 (28.4%)
Age 50-88	623/870 (71.6%)
Age (by decade)	
Age 18-29	87/870 (10.0%)
Age 30-39	83/870 (9.5%)
Age 40-49	77/870 (8.9%)
Age 50-59	275/870 (31.6%)
Age 60-69	237/870 (27.2%)
Age 70 and older	111/870 (12.8%)
Gender n (%)	
Female	511/870 (58.7%)
Male	359/870 (41.3%)
Race n (%)	
Caucasian/White	474/870 (54.5%)
Black/African American	168/870 (19.3%)
Asian	160/870 (18.4%)
American.Ind/AK.Native	4/870 (0.5%)
Hawaiian/Pac.Islander	2/870 (0.2%)
Other	41/870 (4.7%)
Declines to State	21/870 (2.4%)
Ethnicity n (%)	
Not Hispanic or Latino	742/870 (85.3%)
Hispanic or Latino	105/870 (12.1%)
Declines to State	23/870 (2.6%)
Study Eye n (%)	
OD	438/870 (50.3%)
OS	432/870 (49.7%)
Observations: ■ 0 subjects under 18 years old ■ 17 subjects 80 and older	

Table 87: Demographic summary, subjects with any valid scans

Reported Race (Other)	Count
Asian, Native Hawaiian/ Pacific Islander	1
Caucasian/ White, American Indian/ Alaskan Native	3
Caucasian/ White, American Indian/ Alaskan Native, Black/ African American	2
Caucasian/ White, Asian	6
Caucasian/ White, Asian, Native Hawaiian/ Pacific Islander	2
Caucasian/ White, Black/ African American	4
Caucasian/ White, Native Hawaiian/ Pacific Islander	2
Central American	1
Ethiopian	1

Reported Race (Other)	Count
Hispanic	2
Latino	1
Mexican	12
Portuguese	3
Puerto Rican	1
TOTAL	41

Table 88: Details of Race (other) responses, subjects with any valid scans

Factor Level	Summary
N (subjects)	870
MRSE	
Mean(SD)	-0.8 (2.0)
Median	-0.25
Min, Max	[-7.75, 3.0]
Cylinder	
Mean(SD)	-0.6 (0.5)
Median	-0.5
Min, Max	[-2.0, 0.0]
BCVA	
20/15	21/870 (2.4%)
20/20	761/870 (87.5%)
20/25	74/870 (8.5%)
20/30	13/870 (1.5%)
20/40	1/870 (0.1%)
BCVA (logMAR[1])	
Mean(SD)	0.01 (0.04)
Median	0.00
Min, Max	[-0.12, 0.30]
IOP (mmHg)	
Mean(SD)	14.5 (3.1)
Median	14.0
Min, Max	[6.0, 21.0]
Axial Length (mm)	
Mean(SD)	24.1 (1.1)
Median	24.0
Min, Max	[21.2, 28.4]
ONH, Horizontal C/D	
Mean(SD)	0.334 (0.121)
Median	0.30
Min, Max	[0.10, 0.80]
ONH, Vertical C/D	
Mean(SD)	0.336 (0.122)
Median	0.30
Min, Max	[0.10, 0.70]
1 – Converted from Snellen score using: `logMAR = log10(SNELLEN/20)`.	

Table 89: Summary of Ophthalmologic Evaluation, subjects with any valid scans

B.4 Data Collection

CIRRUS™ HD-OCT operators obtained the following images from each subject:

- Macular Cube 512x128 Scan
- Macular Cube 200x200 scan
- Optic Disc Cube 200x200 Scan

The study device procedures were as follows:

- Qualified eyes were scanned with the CIRRUS™ HD-OCT in all subjects.
- The operator reviewed all scans as soon as they were taken to make sure they were of acceptable quality, according to the scan qualification criteria described below

	Macular Cube 200x200	Macular Cube 512x128	Optic Disc Cube 200x200
Acceptable Scans	826	831	854

Table 90: Qualified scans, by scan type

B.5 Image Selection

Images were required to be sharp and clear, well-centered and without missing data, and have a signal strength of 6 or greater.

B.6 Data Analysis

By defining a reference range for healthy eyes, CIRRUS™ HD-OCT image analysis can compare a patient's measurements to determine whether a patient's measurements are within the reference range for healthy eyes for their age.

The subject's **age and disc size** are clinically important factors for determining the reference range for healthy eyes. Regression model analyses estimated the limits of thickness parameters adjusted by age for macular and ganglion cell parameters and adjusted by age and disc size for RNFL and ONH parameters.

B.6.1 Deriving Percentiles and Limits

The following conditional quantile regression model is used to derive the reference range limits:

$$Q_Y\ (\tau|x) = \alpha+\beta x$$

where

- Y = CIRRUS™ HD-OCT parameter
- x = subject’s age and/or categorical disc size.
- τ = 0.01, 0.05, 0.50, 0.95, and 0.99.

B.7 Macular Images

Measurement	Parameters	Analyses
Macular Thickness	■ Macular thickness ■ Average macular thickness ■ Central Subfield Thickness ■ Retinal Volume Cube (mm^2)	■ Macular Thickness ■ Macular Change ■ Panomap ■ Single Eye Summary ■ Wellness Report
Ganglion Cell Thickness	■ Ganglion cell thickness ■ Average Ganglion cell thickness	■ Ganglion Cell OU ■ Panomap ■ Wellness Report

Table 91: Macular Thickness and Ganglion Cell Thickness Parameters and Analyses with RDB Data

Also see

Analyze Macular Thickness [▸ 236]
Analyze Macular Change [▸ 246]
Wellness Exam Overview [▸ 300]
Single Eye Summary Analysis [▸ 293]

B.7.1 Macular Thickness Parameters

Figure 74: Early Treatment Diabetic Retinopathy Study (ETDRS) Grid

The reference range for healthy eyes for macular thickness provides the basis to compare a patient's macular thickness to the reference range for healthy eyes for their age.

The reference range for healthy eyes apply to the following measurements:

- **Macular Thickness:** Average thickness for the ILM - RPE tissue layer for each sector of the ETDRS grid.
- **Average Thickness:** Overall average thickness for the ILM - RPE tissue layer over the entire scanned area.
- **Volume:**Overall average volume for the combined ILM - RPE tissue layers over the entire scanned area.

B.7.1.1 Macular thickness data

Type Variable	n	Mean (SD)	95% CI	Min	Max
Macular Thickness					
Central Subfield (µm)	826	257.31 (22.61)	[255.77, 258.86]	189.00	323.00
Inner Superior (µm)	826	321.48 (15.64)	[320.41, 322.54]	270.00	369.00
Inner Temporal (µm)	826	309.13 (15.46)	[308.07, 310.19]	257.00	352.00
Inner Inferior (µm)	826	317.33 (15.81)	[316.25, 318.41]	268.00	365.00

Type Variable	n	Mean (SD)	95% CI	Min	Max
Inner Nasal (µm)	826	323.78 (16.88)	[322.63, 324.94]	269.00	381.00
Outer Temporal (µm)	826	259.51 (12.27)	[258.68, 260.35]	220.00	304.00
Outer Superior (µm)	826	276.81 (13.29)	[275.91, 277.72]	231.00	327.00
Outer Nasal (µm)	826	294.16 (15.37)	[293.11, 295.21]	246.00	342.00
Outer Inferior (µm)	826	265.16 (13.46)	[264.24, 266.08]	223.00	320.00
Average Cube Thickness (µm)	826	278.32 (12.55)	[277.46, 279.18]	237.00	319.00
Volume Cube (mm3)	826	10.02 (0.45)	[9.99, 10.05]	8.50	11.50

Table 92: Summary of variables, Macular Cube 200x200

B.7.1.2 Examples

Macular Thickness Analysis

B.7.2 Ganglion Cell Parameters

The **Ganglion Cell** reference range for healthy eyes provide reference data for the thickness of the ganglion cell and the inner plexiform layer in healthy subjects ages 18 to 88.

The reference range for healthy eyes apply to the following measurements:

- **Ganglion Cell Thickness:** Average thickness for the combined GCL-IPL tissue layers for each sector of the ETDRS grid.
- **Average Thickness:** Overall average thickness for the combined GCL-IPL tissue layers over the entire scanned area.

B.7.2.1 Ganglion Cell Data

Type Variable	n	Mean (SD)	95% CI	Min	Max
Ganglion Cell Thickness					
Average Thickness (µm)	826	80.46 (6.36)	[80.02, 80.89]	61.00	100.00
Temporal Superior (µm)	826	79.60 (6.25)	[79.17, 80.03]	60.00	100.00
Superior (µm)	826	80.98 (6.73)	[80.52, 81.44]	59.00	102.00
Nasal Superior (µm)	826	82.16 (7.12)	[81.68, 82.65]	58.00	100.00
Nasal Inferior (µm)	826	80.49 (7.13)	[80.00, 80.97]	59.00	99.00
Inferior (µm)	826	78.84 (6.83)	[78.37, 79.30]	58.00	100.00
Temporal Inferior (µm)	826	80.71 (6.36)	[80.28, 81.15]	61.00	103.00

Table 93: Summary of variables, Macular Cube 200x200

B.8 ONH and RNFL Images

NOTE! These parameters are adjusted for age and optic disc area.

Measurement	Parameters	Analyses
RNFL Thickness	■ RNFL Summary Parameters: – Average RNFL Thickness – Temporal Average RNFL Thickness – Superior Average RNFL Thickness – Nasal Average RNFL Thickness – Inferior Average RNFL Thickness – Inter-eye symmetry (RNFL) – Clock hour parameters – TSNIT Profiles – Neuro-Retinal Rim – RNFL Thickness – RNFL Deviation Map	■ ONH/RNFL OU ■ Panomap ■ Single Eye Summary ■ Wellness Report
ONH Features	■ Rim Area (mm^2) ■ Average Cup-to-Disc Ratio ■ Vertical Cup-to-Disc Ratio ■ Cup Volume (mm^3)	■ ONH/RNFL OU ■ Panomap ■ Single Eye Summary

Table 94: RNFL thickness and ONH Parameters and Analyses with RDB Data

Also see

Analyze ONH/RNFL OU [▸ 276]

B.8.1 ONH Parameters

The data originally collected for the database was analyzed to create the reference ranges for the following ONH parameters:

- Rim Area (mm^2)
- Average Cup to Disc Ratio (square root of cup area over disc area)
- Vertical Cup to Disc Ratio (cup height over disc height)
- Cup Volume (mm^3)

B.8.2 RNFL Parameters

This study determined the reference range for healthy eyes for the following the retinal nerve fiber layer (RNFL) parameters in healthy subjects ages 18 to 88:

- Average RNFL Thickness
- Temporal Average RNFL Thickness
- Superior Average RNFL Thickness
- Nasal Average RNFL Thickness
- Inferior Average RNFL Thickness
- Inter-eye symmetry (RNFL)
- Clock hour parameters
- TSNIT Profiles
- Neuro-Retinal Rim
- RNFL Thickness
- RNFL Deviation Map

B.8.3 ONH and RNFL Data

Type Variable	n	Mean (SD)	95% CI	Min	Max
ONH					
Rim Area (mm^2)	854	1.30 (0.23)	[1.28, 1.31]	0.74	2.21
Average Cup/Disc Ratio	854	0.46 (0.17)	[0.45, 0.47]	0.06	0.74
Vertical C/D Ratio	854	0.44 (0.16)	[0.43, 0.45]	0.05	0.75
Cup Volume (mm^3)	854	0.13 (0.12)	[0.12, 0.14]	0.00	0.70
RNFL Thickness					
Average RNFL Thickness (µm)	854	93.19 (9.28)	[92.57, 93.81]	69.00	126.00
Temporal (µm)	854	64.04 (11.53)	[63.26, 64.81]	40.00	120.00
Superior (µm)	854	115.05 (15.92)	[113.98, 116.12]	72.00	162.00
Nasal (µm)	854	72.35 (11.54)	[71.58, 73.13]	41.00	115.00
Inferior (µm)	854	121.37 (16.08)	[120.29, 122.45]	72.00	188.00
Clock hour 1 (µm)	854	105.56 (23.11)	[104.01, 107.11]	51.00	185.00
Clock hour 2 (µm)	854	88.60 (18.10)	[87.39, 89.82]	43.00	160.00
Clock hour 3 (µm)	854	60.73 (10.53)	[60.02, 61.44]	38.00	103.00
Clock hour 4 (µm)	854	67.78 (13.79)	[66.85, 68.70]	37.00	129.00

Type Variable	n	Mean (SD)	95% CI	Min	Max
Clock hour 5 (µm)	854	100.12 (22.53)	[98.60, 101.63]	49.00	193.00
Clock hour 6 (µm)	854	133.29 (26.17)	[131.53, 135.05]	45.00	229.00
Clock hour 7 (µm)	854	130.69 (22.99)	[129.15, 132.23]	60.00	197.00
Clock hour 8 (µm)	854	64.11 (15.16)	[63.10, 65.13]	32.00	151.00
Clock hour 9 (µm)	854	51.09 (8.87)	[50.50, 51.69]	32.00	99.00
Clock hour 10 (µm)	854	76.89 (15.44)	[75.86, 77.93]	43.00	135.00
Clock hour 11 (µm)	854	123.18 (22.28)	[121.68, 124.68]	45.00	186.00
Clock hour 12 (µm)	854	116.41 (26.43)	[114.64, 118.19]	51.00	205.00
RNFL Symmetry (%)[1]	725	0.88 (0.07)	[0.87, 0.88]	0.48	0.98
1- Note RNFL symmetry values are calculated from both eyes and was not included if only one eye was scanned.					

Table 95: Summary of variables, Optic Disc Cube 200x200

NOTE

Cup-to-Disc Ratios ≤ 0.25 were excluded as the model used to fit the reference data is not applicable for small cup to disc ratios.

B.8.4 Examples

ONH and RNFL OU

B.9 Analysis Application and Limitations

In the CIRRUS 6000 reference database, the Average C/D Ratio will have a grey background when the ratio is below 0.25. The Vertical C/D Ratio will also have a grey background when it is less than 0.25. The model used to fit the reference data is not applicable for small cup to disc ratios.

OU Analysis

A patient can have different disc areas for each eye, which applies a different reference range for healthy eyes to each. OU analysis takes the OD and OS disc areas and averages these values to determine the corresponding OU disc area category.

Observation

Disc area did not depend on age.

In studies, researchers classified disc sizes as small, medium, and large [7] [8] [9]. In this study we measured disc area, which considers all meridians. The categories for disc area are:

- one third of subjects had Disc Area values less than 1.57 mm^2
- one third of subjects had Disc Area values between 1.57 and 1.88 mm^2
- one third of subjects had Disc Area values larger than 1.88 mm^2.

B.10 Conclusions

Doctors can use the reference ranges for healthy eyes to compare a patient's measurements to the general population.

[7] Rao, Harsha B Laxmana et al. “Clinical measurement and categorization of optic disc in glaucoma patients.” Indian journal of ophthalmology vol. 57,5 (2009): 361-4. doi:10.4103/0301-4738.55075

[8] Jonas JB, Papastathopoulos K. Ophthalmoscopic measurement of the optic disc. Ophthalmology. 1995 Jul;102(7):1102-6. doi: 10.1016/s0161-6420(95)30905-0. PMID: 9121759

[9] Savini, G., et al. "Correlation between retinal nerve fibre layer thickness and optic nerve head size: an optical coherence tomography study." British journal of Ophthalmology 89.4 (2005): 489-492.

Glossary

anterior segment

the front third of the eye that includes the structures in front of the vitreous humour: the cornea, iris, ciliary body, and lens.

Certificate Serial Number

a unique SERIAL NUMBER used in the license registration process. CZM includes a Software Product Certificate with software that requires license registration.

corneoscleral junction

the margin of the cornea overlapped by the sclera

DICOM

Digital Imaging and Communications in Medicine. A standard for data management, including a file format specification and a network communication protocol.

EDI

Enhanced Depth Imaging

EMR

Any electronic medical records system, including FORUM, whether DICOM-compatible or not

ERM

Epiretinal membrane - a fibrocellular tissue found on the inner surface of the retina.

ETDRS grid

macular grid used to measure area and proximity of macular edema to the macular center (fovea) and aids in evaluating the changes in vision in patients with diabetic retinopathy.

FastTrac

FastTrac monitors retina movement and automatically compensates for detected motion

FORUM

A software product for managing, archiving, and viewing patient data, images, and reports from computerized diagnostic instruments or documentation systems.

ILM

The internal limiting membrane forms the innermost boundary of the retina between the retina and the vitreous body, formed by astrocytes and the end feet of Müller cells.

IOD

Information Object Definitions

IOP

Intraocular Pressure

iridocorneal angle

the acute angle between the iris and the cornea at the periphery of the anterior chamber of the eye.

NAS

Network Attached Storage: a device for allowing multiple users remote access to large amounts of data.

Node ID

an internal alphanumeric identifier unique to each CZM instrument computer.

OP

Ophthalmic Photography

OPT

Ophthalmic Tomography

OPT IOD

DICOM standard format for archiving and transferring OCT images as black and white images

Optic Nerve Head (ONH)

The circular area in the back of the inside of the eye where the optic nerve connects to the retina.

Retinal Nerve Fiber Layer

RNFL

Review Station

A separate networked computer, laptop or PC (often in the doctor's office) with ZEISS instrument software installed to access patient data and images from the instrument for analysis.

RPE

Retinal Pigment Epithelium: the pigmented cell layer just outside the neurosensory retina that nourishes retinal visual cells, and is firmly attached to the underlying choroid and overlying retinal visual cells.

scleral spurs

a protrusion of the sclera into the anterior chamber; the origin of the longitudinal fibres of the ciliary muscle attached anteriorly to the trabecular meshwork.

SD-OCT

Special Domain Optical Coherence Tomography: a form of non-invasive, low-coherence interferometry that produces high-resolution tomograms without contacting the eye

VMT

Vitreomacular traction - a disorder of the vitreo-retinal interface.

VRI

Vitreo Retinal Interface - a complex composite structure connecting the vitreous cortex and the inner retina.

XML

eXtensible Markup Language is a self-descriptive markup language designed to store and transport data

Index

Numerical

1 Line Scan
About 137, 231
200 x 200 Macular Scans
About 156
200 x 200 Optic Disc Scans
About 160
21 Line Scan
About 137, 232
3D Visualization Analysis
About 289
5 Line Scan
About 137, 232
512 x 128 Macular Scans
About 156

A

About 41
Acquiring Scans..... 142
Auto Repeat..... 151, 214
Cube Scans 220, 376
FastTrac 149, 215
Fixation Targets..... 147, 209
Image Focus / Position 211
Patient Categories 109
Protocols..... 147
Scan Patterns 210
User Roles 59
XML Export 114
Acceptance Criteria
Sub-RPE 226
Accessories 433
Accounts, User
Add New 69
Edit 69
Manage..... 67
View..... 68
Acquire
HD 1-Line Raster Scan 163
HD 21-Line Raster Scan 163
HD 5-Line Raster Scan 163
HD Angle Scan 196
HD Cornea Scan 201
HD Cross Raster Scan 163
HD Radial Raster Scan 163
HD Raster Scans 163
Macular Cube Scans 156
Montage AngioPlex..... 174
OCT AngioPlex 171
Optic DIsc Cube Scans 160
Pachymetry Scan 203
Wide Angle to Angle Scan.....198, 353
Acquire Button 41
Acquire Screen
Overview..... 140
Acquiring Scans, About..... 142
Add
New Patient 135
User Account..... 69
Add a Category..... 109
Adjust Scan Patterns 164
Adjusting Instrument Height 35
Administrator
Login..... 60
Administrator Login 60
Advanced RPE Analysis
About..... 257
Select a Different Scan..... 358

XML Export 120
Advanced Visualization
Overview..... 287
Advanced Visualization Analysis
About 286
Align Scans (Registration)..... 246, 311
Angiography 311
Macular Change..... 246
Altitude
Conditions for Use 429
Analysis
Customize List..... 105
Edit Images 363
Analyst
Add New 69
View 68
Analyst Profile
Demographic 30
Occupational Skills 30
Analyze
Anterior Chamber 335
Anteriror 5-Line Raster 357
HD Angle Scan 342
HD Cornea Scan 345
Pachymetry 350
Wide Angle to Angle Scan..... 352
Analyze Button 41
Angio Montage
Quality Check..... 179
Angiography
Register License..... 63
Registration..... 311
View License Status..... 66
Angiography Analysis
About 309
Overview..... 318
XML Export 122
Angiography Change Analysis
Select a Different Scan..... 358
Angiography Cube Scans
About..... 170
Angiography Montage
Acquire Overview 175
Analysis Overview..... 326
Angiography Scans
About..... 138, 000, 000
Angiography Two-Visit Comparison
Overview..... 323
Angiography Two-Visit Comparison Analysis
About..... 322
Angiography, OCT
Acquire 171
Acquire Montage 174
Angle Scan
Analyze 342
Annotation
Delete 371
Annotations
Adding Calipers 256, 370, 372
Adding Circles 368
Adding Freeform Shape..... 369
Adding Text..... 369
ANSI Z80.36-2016 15
Anterior Chamber
Acquire Overview 187
Analysis 335
Analysis Overview..... 334
Check Scan Quality..... 190

Depth Tool 333
XML Export 123
Anterior Chamber Cube Scan
Check Quality 193
Anterior Chamber Scan
Acquire, Overview 185
Anterior Segment Analysis
About 329
Anterior Segment Scan
5-Line Raster Analysis 357
Anterior Chamber Analysis 335
HD Angle Analysis 342
HD Angle, Acquire 196
HD Cornea, Acquire 201
HD Cornea, Analyze 345
Pachymetry 203
Pachymetry Analysis 350
Pachymetry, Acquire 203
Wide Angle to Angle, Acquire ... 198, 353
Wide Angle to Angle, Analyze ... 352
Anterior Segment Scans
About 139, 233, 330
Anteriror 5-Line Raster 357
Aperture 36
Archive
Changing 73
New Setup 71
Atmospheric Pressure
Conditions for Use 429
Audit Log, Export 39
Auto Repeat 39
About 151, 214
Avascular Layer Preset 317

B

Band (MHz) 23
Bluetooth 23
BMP file 62
BMP Report 235
Brightness
Adjust 365
B-Scans
Center and Enhance Manually 148, 207, 208
Button
Acquire 41
Analyze 41
Anterior Chamber Depth 333
Done 177
Finish 41
ID Patient 41
Native 128
Native + XML 128
Protocols 41
Refresh List 136
XML 128

C

Caliper
Delete 371
Calipers, Add to Image 256, 370, 372
Categories 39
About 109
Adding 109
Changing 113
Deleting 111
Editing 110
Caution Symbol 11
Cautions

Definition 12
Prohibited Activities..... 20
Center B-Scans Manually 148, 207, 208
Center Lines, Live..... 39
Central Region, ETDRS grid 100
Change
Categories..... 113
Change Analysis
Macular, Overview 248
Change Archives 73
Change My Password 39
Check Quality
Anterior Chamber Cube Scan 193
Anterior Chamber Scan 190
HD Angle Scan 198
HD Cornea Scan 195, 202
Macular Cube Scan 158
Wide Angle to Angle Scan..... 200
Chinrest
Controls 211
Location..... 36
Choose Fixation Target Location 147, 209
Choriorcaplillaris Layer Preset..... 317
Choroid Layer Preset..... 306, 317
Circle
Delete 371
Circles, Add to Image 368
Classification
Optical 15
Cleaning
Agents 401
Chin cup and forehead rest 404
Front window lens 404
Peripherals 404
Table..... 404
Close
Image Editing Tool 363
Color Image 367
Color OCT 39
Comments, Submitting 32
Comparing Scans, Alignment 246, 311
Macular Change 246
Compliance
IEC 61000-4 21
Computer, Instrument..... 35
Configuration Settings
Instrument Identifeir..... 62
Configure
Reports 99
Connect
DICOM Storage or Records..... 390
Printer 397
USB 36
Connection
Testing 390
Copyright, Softwre..... 431
Cornea Scan
Acquire 201
Analyze 345
Check Quality 202
Corneal Thickness Map 349
Cross Scan
About.....138, 232
CSA Certification Symbol 11
CSV Filie..... 243
Cube Scans
About.....220, 376
Macular Scans 156
Optic Disc Scans 160
Custom Presets

Creating 309
Customize
Analysis List..... 105
Guided Progression Report..... 102
HD Image Report 101
Macular Thickness Report..... 99
Scan List..... 104

D

Data Management
Integrity of imported records..... 131
Log Files..... 70
Patient Privacy..... 111
Data Storage
About 46
Database
Select..... 398
Database, Select 39
Decorrelation Tails 227
DECT 23
Delete
Category 111
Image Editing..... 371
Device Warranty
Voiding 20
DICOM
Automatically Search Worklist ... 96
Configure Connections..... 390
Gateway Connection..... 390
DICOM Archive Records Menu..... 40
DICOM Export 235
DICOM/FORUM 46
Dimensions and Weight..... 428
Direct Current Symbol..... 11
Disposal
Batteries..... 441
Electronics..... 441
Packing material..... 441
Distance, Wireless..... 23
Done Button 177
DRL Slab 317

E

EC Rep Symbol..... 11
EDI
About..... 163
Edit
Auto Repeat 39
Categories..... 110
Change My Password 39
Delete 69
Export Audit Log File 39
Institution Name..... 39
Layers, Angiography Presets 310
Layers, Macular Thickness 244
User Account..... 69
Edit Images
Add Circles 368
Add Freeform Shape..... 369
Adding Calipers 256, 370, 372
Adding Text..... 369
Adjust Brightness 365
Adjust Transparency 367
Full-screen Image 365
Hide / Show Toolbar..... 364
Reset (Remove All Edits) 371
Save Edits and Adjustments..... 373
View Color or Grayscale 367
Zoom In / Out..... 370
Electrical Specifications 428
Electromagnetic Compatibility (EMC) ... 21

Electromagnetic Emissions 21
Electromagnetic Immunity 21
EMF Report..... 235
EMR 390
Import from an EMR 133
Patient record management..... 133
En Face Analysis
About 304
Overview..... 307
End User Software License Agreement 431
Enhance B-Scans Manually..... 148, 207, 208
Environmental Conditions
For storage..... 429
For transport..... 429
For use..... 428, 429
Epithelial Thickness
Map 349
Equipment Return Authorization..... 434
ERM 316
Export
Audit Log files..... 71
Exam Data 129
Log File 71
Native and XML Export 128
Native Export 128
Thickness Map Values 243
XML..... 114
XML Export..... 128
Export Audit Log File 39
External Fxation..... 36
Eye Motion Detection (FastTrac) 215

F

FastTrac
About 149, 215
Enable / Disable..... 39, 106
Troubleshooting 423
Turn ON / OFF 150, 216
Features
Auto Repeat 151, 214
EDI 163
Track to Prior.....151, 217
File Server Requirements 386
Files
AVI..... 372
CSV 243
IB 398
ZIP..... 129
Filies
BMP 62
Find Today's Patients 136
Finish Button..... 41
Fixation Target
About.....147, 209
External..... 36
Select 147, 209
Freeform Shape
Add to Image 369
Delete 371
Fullscreen
Image Editing 365
Fundus Layer Preset 305
Fuse Symbol..... 11

G

Ganglion Cell
Guided Progression 267
Ganglion Cell Analysis
Select a Different Scan..... 358
Ganglion Cell Guided Progression
XML Export 121

Ganglion Cell OU Analysis
About 261
XML Export 120
GIF Report 235
GMRS 23
GPA Print Options 102
Gray
FastTrac Button 216
Track to Prior Button 152, 218
Grayscale Image 367
Green
FastTrac Button 216
Track to Prior Button 152, 218
Green Status 42
GSM 23
Guided Progression
ONH, Overview 284
Guided Progression Analysis
Ganglion Cell 267
ONH 281
Guided Progression Report
Customizing 102

H

Hardware 428
Installation Requirements 47
Hardware Overview 47
HD 1 Line Scan
About 137, 231
HD 1-Line Raster Scan
Acquire 166
Adjust Scan Pattern 164
Analysis Overview 255
Analyze 256
Check Quality 168
HD 21 Line Scan
About 137, 232
HD 21-Line Raster Scan
Acquire 166
Adjust Scan Pattern 164
Analysis Overview 255
Analyze 256
Check Quality 168
HD 5 Line Scan
About 137, 232
HD 5-Line Raster Scan
Acquire 166
Adjust Scan Pattern 164
Analysis Overview 255
Analyze 256
Check Quality 168
HD Angle
Analyze 342
Register License 63
View License Status 66
HD Angle Analysis
XML Export 124
HD Angle Scan
Acquire 196
Check Quality 198
HD Cornea
Register License 63
View License Status 66
HD Cornea Analysis
XML Export 125
HD Cornea Scan
Acquire 201
Analyze 345
Check Quality 195, 202
HD Cross Raster Scan
Acquire 166

Adjust Scan Pattern 164
Analysis Overview 255
Analyze 256
Check Quality 168
HD Cross Scan
About 138, 232
HD Image Report
Customizing 101
HD Images Analysis
About 254, 255
HD Radial Raster Scan
Acquire 166
Adjust Scan Pattern 164
Analysis Overview 255
Analyze 256
Check Quality 168
HD Radial Scan
About 137, 232
HD Raster Scans
About 163
Adjust Scan Pattern 164
Enhancing Depth 163
Head Rest 36
Height Adjustment 35
Hide
Image Edit Toolbar 364
Presets 309
Hide Scans 104
Humidity
Conditions for Use 428

I

IB File 398
ID Patient Button 41
ID, User
Editing 69
ILM 317, 318
Image
Aperture 36
Specifications 425
Image Color Options 367
Image Edit
Close 363
Open 363
Import
Exam Data 131
Imported Records 131
Installation
Hardware 47
Institution Name
Report Character Limit 235
Instrument ID, Editing 62
Instrument Information
Model, Sequence, Serial Number 62
Instrument Licenses 65
Instrument Software
Installation Instructions 52
Intended Demographic 29, 30
Intended Use 27
Interferometer 35
IPL 317
IS/OS Layer Preset 305

J

JPEG Report 235

K

Keyboard Shortcuts 41

L

LAN Connection, Printer 397
LASIK, Post 343

Layers
Edit Macular 244
Layers (Angiography Presets), Edit 310
License Agreement 431
License Registration 41
Licenses
About 65
Instrument Registration 63
Registering 63
Viewing Active Licenses..... 66
Lighting
Conditions for Use 429
Line, Add to Image 256, 370, 372
Live Fundus Overlay 39
Log File, Export..... 39, 71
Log Files 70
Logging In 57
Login
Administrator 60
LTE 23

M

Macula Thickness Report 99
Macular Change
Analysis Overview 248
Macular Change Analysis
About 246, 249
Registering Scans 246
Select a Different Scan 358
XML Export 119
Macular Cube Scan
About 136, 231
Check Quality..... 158
Macular Registration
Overview..... 251
Macular Scans
About..... 156
Macular Thickness
Analyzing 241
Edit Layer Boundaries 244
Overview 240
Macular Thickness Analysis
XML Export 118
Macular Thickness Report
Customizing 99
Maintenance Schedule..... 98
Manual Registration
About.....247, 312
Manual Selections..... 358
Manufacturer Symbol 11
Maximum Power 23
Measurement Circle, Add to Image..... 368
Measurement Line, Add to Image 256, 364, 370, 372
Menu
Records 40
Tools 39
Mid-Region, ETDRS grid 100
Mid-Retina Layer Preset 305
Minimum Requirements, Review Station 49
Min-IP Layer Preset 306
Modality Worklist Server
Configure Connection 390
Model Number 62
Model Number Symbol 11
Modulation..... 23
Monitor 36
Monitor Z Position 150, 217
Montage

Scan Positions 177
Montage Angio
Quality Check 179
Montage Angio Scans
About 170
Montage Angiography
Register License 63
View License Status 66
Montage Angiography Analysis
About 325
Montage, OCT Angiography
Acquire 174
Motion Detection, Eye 149, 215
Mouse 36
Move Caliper 370
Movie
Export 372
View 224, 371, 380
MTA Print Options 99
Multi-Slice Report, Macula 99

N

Name, Obsecure 130
Name, User
Add New 69
Edit 69
View 68
NAS
Connecting 386
Native + XML Button 128
Native Archive
About 46
Native Archive Records Menu 39
Native Button 128
Navigation Bar 38
Status Area 417
Network
Guidelines 19
Network Attached Storage 386
Networking 384
Prohibited Activity 20
New Archive 71
Note Symbol 11
Notes, Add to Image 369
Notification of Serious Incident 26

O

Obscured Patient Records 111
Obsuring Patient Identification 130
OCT Angiography
Acquire 171
Acquire Montage 174
Decorrelation Tails 227
Segmentation Errors 228
Signal Quality 226
Slab selection 314
On Switch 36
ONH
Guided Progression 281
Guided Progression Overview 284
OU Analysis, Overview 277
ONH (see Optic Disc) 160
ONH and RNFL Analysis
Select a Different Scan 358
ONH and RNFL OU Analysis
XML Export 122
ONH Angiography
Register License 63
View License Status 66
ONH Angiography Cube Scans
About 170

ONH/RNFL OU Analysis
About 276
Online Manual 41
Open
Image Editing Tool 363
Operator
Add New 69
Edit 69
View 68
Operator Information
Intended Demographic..... 29, 30
OPL 317
Optic Disc Cube Scan
About 137, 231
Optic Disc Scans
About 160
Optical Safety
ANSI Z80.36-2016 15
Classification 15
Optical Source 425
Optional Features
See Licenses 66
ORCC Layer Preset 318
Organize Presets 309
Organize Scans 39
Out Regions, ETDRS grid 100
Overview
Acquire 140
Acquire Angiography Montage . 175
Acquire Anterior Segment 185
Advanced Visualization 287
Angiography Analysis 318
Angiography Montage Analysis . 326
Angiography Two- Visit Comparison..... 323
Anterior Chamber Analysis 334
En Face Analysis 307
HD Image Analysis..... 255
Macular Change Analysis..... 248
Macular Thickness 240
ONH and RNFL Thickness 277
ONH Guided Progression..... 284
Pachymetry Analysis 347
PanoMap 298
Single Eye Summary 294
System Hardware 36
Verification Test Tool..... 406

P

Pachymetry 203, 350
Acquire 203
Analysis Overview..... 347
Register License..... 63
View License Status 66
Pachymetry Analysis
XML Export 127
PACS
Configure Connection 390
PACS Servers, Connecting 390
Panomap
Overview 298
Select a Different Scan..... 358
Panomap Analysis
About..... 297
Part Number Symbol 11
Parts
Ordering, US 433
Ording, International 433, 434
Replaceable 433
Returning defective 434
Passwords
Changing 69

Logging In 57
Requirements 78
Patient
Preparation 143
Privacy 111
Record deletion 19
Record merge 19
Patient Categories
About 109
Managing 109
Patient ID
Assigning 62
Report Character Limit 235
Patient Privacy
Obscured Records 111
Patient Record
Change Categories 113
Patient record management 133
Patient Records
Obsure Name 130
Patient Screen
Setting Default 97, 98
Patient/Subject Profile 28
Patients
Adding a New Patient 135
Alignment 36
Today's patients 136
PDF Report 235
Physician
Add New 69
Edit 69
Instructions 58
View 68
PNG Report 235
Posterior Segment Scans
HD Raster, About 163
Post-LASIK Scan 343
Power
Optical 425
Switch 36
Power Down, System 58
powerup, system 56
Preferences
Default Patient Screen 97, 98
DICOM Worklist 96
Patient Categories 109, 110
Preventive Maintenance Schedule 98
Preferred Analysis, Customizing 105
Prepare Patient 143
Prepare to Scan
Prepare Instrument 58
Understand Physician Instructions 58
Preset Layers, Edit 310
Presets
About 309
Create Custom 309
Organize 309
Printer 35, 397
Prohibited Activities 20
Protocols 147
About 147
Using 154
View 154
Protocols Button 41

Q

Questions, Submitting 32

R

R1 and R2 Scan Registration 246, 311

Radial Report, Macula 99
Radial Scan
About 137, 232
Raster Print Options 101
Raster Scans
Enhancing Depth 163
RDE Layer Preset 316
Rearrange Presets 309
Records
Obscured patient 111
Records Menu 40
Red Status 42
Refresh List Button 136
Register Licenses
Instrument 63
Register Scans
Angiography 311
Automatic 246, 311
Macular Change 246
Manually 247, 312
No Registration 247, 250, 312
Registering a License 63
Registration
Categories 110
Macular, Overview 251
Registration, Manual 250, 252
Remote Desktop Services 51
Repeat, Automatic 39
Reports
About 235
Configuring 99
Edit Images 363
Guided Progression, Customizing 102
HD Image, Customizing 101
Macular Thickness, Customizing . 99
Requirements
File Server 386
Reset
Maintenance Reminder 98
Reset Image Edits 371
Residual Stromal Bed 343
Retake
Montage Scan 177
Quality Check 180
Retina Layer Preset
Angiography 317
Reverse Grayscale Image 367
Review Software
Installation Instructions 50
Review Station
Connect to Instrument Data 395
System Requirements 49
Review Types 231
Review/Results Screen
Save to .csv 243
RNFL
Analysis, Overview 277
Roles, User 59
Rotate Caliper 370
RPE 317, 318
RPE Layer Preset 316

S

Safety
Cleaning the Instrument 401
Electrical 17
Installation 47
Instrument Use 58
Networking 18
Optical 15

Patient Data 111
Records and Data 20
Troubleshooting 417
Safety Symbols 11
Satus Area 417
Save Edits 373
Scan
Acceptance Criteria 226
Anterior Chamber , Acquire Screen 185
Anterior Chamber Cube, Check Quality 193
Anterior Chamber, Analyze 335
Anterior Chamber, Check Quality 190
Anteriror 5-Line Raster, Analyze 357
HD Angle, Acquire 196
HD Angle, Analyze 342
HD Angle, Check Quality 198
HD Cornea, Acquire 201
HD Cornea, Analyze 345
HD Cornea, Check Quality 195, 202
Macular Cube, Check Quality 158
Pachymetry, About..... 203
Pachymetry, Acquire 203
Pachymetry, Analyze 350
Wide Angle to Angle, Acquire ... 198, 353
Wide Angle to Angle, Analyze... 352
Wide Angle to Angle, Check Quality 200
Scan Organizer 39
Scan Patterns
About 210
Anterior Segment..... 139, 233, 330
Scan Positions, Montage..... 177
Scans
Acquiring, About..... 142
Angiography 138, 170, 000, 000
Anterior Segment..... 139, 233, 330
Cube Scans, About 220, 376
Customize List 104
Export Movie..... 372
Macular Scans 156
Maximum Speed 425
Movie..... 224, 371, 380
Optic Disc Scans 160
Preferred Analysis..... 105
Registering 246, 311
Types 136
Schedule, Intrument Maintenance..... 98
Security, Passwords..... 78
Segmentation Errors 228
Segmentation Layers, Edit..... 244
Select
Database 398
Select a Different Scan 358
Select a Patient
Add a New Patient 135
Today's Patients 136
Select Database 39
Select Fixation Target Location.....147, 209
Sensors 36
Sequence Number 62
Serial Number 62
Serial Number Symbol..... 11
Service Support..... 41
Settings
Default Patient Screen 97, 98
DICOM Worklist 96

Patient Categories 109, 110
Preventive Maintenance Schedule 98
User Accounts 67
Shape
Freeform, Add 369
Shape, Freeform
Delete 371
Show
Image Edit Toolbar 364
Presets 309
Signal Quality 226
Single Eye Summary
Overview 294
Select a Different Scan 358
Single Eye Summary Analysis
About 294
Software
Copyright 431
License Agreement 431
Software Version 62
Specifications
Dimensions and weight 428
Electrical 428
Environmental Conditions 428, 429
Hardware 428
Imaging 425
Operation 428
Transport and Storage 429
Spectrometer 35
Spotlight Scans
HD 163
Staff
Add New 69
Edit 69
View 68
Stand-by Symbol 11
Status 42
Green 42
Red 42
Yellow 42
Status, Licenses 66
Stromal Bed 343
Sub-RPE Acceptance 226
Sub-RPE Layer Preset 317
Superficial Layer Preset 317
Symbols and Labels 11
System Requirements, Review Station .. 49

T

Table
Cleaning 404
Technician
Report Character Limit 235
TERTRA 23
Test Connections 390
Test Frequency 23
Text, Add to Image 369
Thickness Map
Corneal 349
Epithelial 349
Exporting Values as CSV 243
Thickness Map Layer Preset 305
TIFF Report 235
Today's Patients 136
Toolbar 38
Image Edit, Hide / Show 364
Toolbar Access
Category Registration 109
Tools Menu 39
Track to Prior
About 151, 217

Using 152, 218
Transparency
Adjust 367
Troubleshooting
FastTrac 423
Truncated Fields, Reports..... 235
Turn Off Power..... 58
turn on power 56
Type B Applied Parts Symbol..... 11

U

USB
Connect Printer 397
Connectors 36
Ports 36
Use
Preparing for..... 58
User
Accounts, Managing 67
Add New 69
Edit 69
View 68
User Documentation
About 31
User Roles..... 59
Users
Username..... 57

V

Verification Test Tool
Overview..... 406
Version, Software 62
View
Protocols..... 154
User Account 68
Viewport
Edit Images 363
Visibile Scans Customizing 104
VMT 316
VRI Layer Preset
Angiography 316
En Face 305

W

Warning Symbol 11
Warnings
Definition 12
EMC Emissions 21
Hardware Installation and Setup. 47
Waste Disposal Symbol 11
Wellness Exam
About..... 300
Select a Different Scan..... 358
Whole Eye Preset
Angiography 318
Wide Angle to Angle
Register License..... 63
View License Status 66
XML Export 125
Wide Angle to Angle Scan
Acquire 198, 353
Analyze 352
Analyze Overview 352
Check Quality 200
Wireless
Communication..... 23
Specifications 23
WLAN..... 23
WMF Report 235

X

XML Export

About 114, 128
Advanced RPE Analysis..... 120
Angiography Analysis..... 122
Anterior Chamber Analysis 123
Ganglion Cell Guided Progression 121
Ganglion Cell OU Analysis 120
HD Angle Analysis..... 124
HD Cornea Analysis..... 125
Macular Change Analysis 119
Macular Thickness Analysis..... 118
ONH and RNFL OU Analysis..... 122
Pachymetry Analysis..... 127
Wide Angle to Angle Analysis.... 125

Y

Yellow Status..... 42

Z

ZIP File..... 129
Zoom In / Out
Adjusting 370

Carl Zeiss Meditec, Inc.
5300 Central Parkway
Dublin, CA 94568
USA
Toll Free: 1-800-341-6968
Phone: 1–925–557–4100
Fax: 1-925-557-4101
Internet: https://www.zeiss.com/med
E-Mail: info.meditec@zeiss.com

2660021178037 Rev. C EN-US
Release Date (YYYY-MM-DD): 2024-05-24
Software Version: 11.7

Specifications subject to change without notice.