



Royal Observatory Belgium

Functional Design Document

[Digisun NextGen]

[15/04/2015]

Contents

[Digisun NextGen].....	1
Contents.....	2
Document History.....	4
Publication.....	4
References.....	4
Introduction.....	5
Scope.....	5
Definitions.....	5
Figures.....	6
Overview Functional Requirements.....	7
Prerequisites.....	7
Pillars for development.....	8
Functional Requirements.....	9
Workflows.....	9
Digisun workflow.....	10
Login at start of the application.....	15
Usage of statuses indicating progress.....	15
Calibration before Analysis.....	17
Other changes.....	17
Scanning of drawings.....	17
Analysis of drawings (and images).....	18
Calibration.....	18
Analysis.....	18
Drawing Status.....	19
Saving information to database.....	19
Export to various formats.....	20
From Digisun to Digisun NextGen.....	20
Data Structures.....	20
Database as-is.....	20
Database to-be.....	24
User Interface.....	29

The menu bar.....	30
The icon bar.....	30
The control section.....	30
Calibration section.....	30
Analysis section.....	31
Drawing section.....	31
The working section.....	32
Groups section.....	32
Image section.....	33
The status bar.....	34
Configuration.....	35
Risks / Issues.....	35
Security.....	36
Performance.....	36
Constraints and limitations.....	36
Appendix.....	37
Appendix A: Q & A.....	37
Appendix B: Trains of thought.....	37
Appendix C: Types of drawings.....	38
Type: USET.....	38
Type: USET41.....	39
Type: USET77.....	39

Document History

Name	Type	Description	Date	Version
Vincent Malisse	creation	Document setup and outline	15/04/2015	V0.1
Vincent Malisse	Update	Update to document Started workflow diagrams	08/06/2015	V0.2
Vincent Malisse	Update	Added database table definitions	10/08/2015	V0.3
Vincent Malisse	Update	Added chapters Risks/Issues, Security, Performance and Constraints and Limitations. Several changes throughout the document.	02/09/2015	V0.4
Vincent Malisse	Update	Document check, small changes.	07/09/2015	V0.5
Vincent Malisse	Update	Added tables for allowing users to “save” surface calculation work.	11/09/2015	V0.6
Vincent Malisse Olivier Lemaitre	Final version before publication	Removed placeholders. Clarified open questions	30/09/2015	V1.0

Publication

This document is for ORB/ROB personnel only.

References

Reference	Description	Version
Workflow.vsd	Document containing the workflow diagrams	/
Database.vsd	Document containing database table definitions	/
UI Mockup (folder)	A mockup of the UI.	/

Introduction

Scope

This document will describe all required functionality for the new version of Digisun.

To avoid confusion the name of the new version of Digisun (or at least the project of rewriting the old version) should be distinguishable.

Some propositions:

- Digisun NextGen
- Digisun 2.0
- Digisun++
- Digisun Web
- SunAnalyzer

In this document Digisun NextGen will be used, the definitive name should be chosen BEFORE development starts.

Definitions

Term	Description
ASCII	American Standard Code for Information Interchange (https://en.wikipedia.org/wiki/ASCII)
DPI	Dots Per Inch
FITS	Flexible Image Transport System (https://en.wikipedia.org/wiki/FITS)
ISES	International Space Environment Service (http://www.spaceweather.org/)
JPG	Or JPEG, Joint Photographic Experts Group (https://en.wikipedia.org/wiki/JPEG)
PNG	Portable Network Graphics (https://en.wikipedia.org/wiki/Portable_Network_Graphics)
(G)UI	(Graphical) User Interface (https://en.wikipedia.org/wiki/Graphical_user_interface)
USET	Uccle Solar Equatorial Table (http://sidc.oma.be/uset/)
USSPS	Ursigram SunSPotS (http://www.spaceweather.org/ISES/code/od/ussps.html)

Figures

Id	Description
Figure 1	The basic workflow of the current Digisun application.
Figure 2	Drill down of the calibration and analyze processes of the basic workflow of the current Digisun application.
Figure 3	Digisun NextGen workflow
Figure C1	Drawing type USET
Figure C2	Drawing type USET41
Figure C3	Drawing type USET77
Figure 4	UI mockup – screenshot
Figure 5	The menu bar
Figure 6	The icon bar
Figure 7	Control section – Calibration
Figure 8	Control section – Analysis
Figure 9	Control section – Drawing
Figure 10	Working section – Groups
Figure 11	Working section – Image

Overview Functional Requirements

Following is a high level list of functionality required for Digisun NextGen.

In the paragraph “Functional Requirements” each of the following items will be discussed in detail.

- Workflows
- Scanning of drawings
- Analysis of drawings (and images)
- Saving information to database
- Export to various formats
- From Digisun to Digisun NextGen
- Data Structures
- User Interface
- Configuration
- Risks/Issues
- Security
- Performance
- Constraints and limitations

Prerequisites

- Client
 - Internet connection
 - Internet Explorer, Firefox, Safari or Chrome
- Server
 - Sufficient hardware
 - Processing power
 - Memory
 - Disk space
- Database

Note: Client and Server can potentially be the same machine. Data storage could also be another machine, but will not be discussed.

Pillars for development

Following are the pillars (maximum 5) to which development of the Digisun NextGen should comply.

These are keywords for developers to help them in the application logic.

1. Usability

This pillar indicates that the application at all-time should be easy to use and follow intuitive user actions. Some examples:

- a. The user should always know where to find actions, how the workflow of the application works and what he should do (and what the application does).
- b. The user should not have to do actions or execute workflows that are difficult and/or time consuming.
- c. The user will be able to work with a responsive UI.

Keywords: avoid too many clicks, the user knows when and where the data is saved, guidance text where necessary, good and logical user design using text, color and icons where appropriate.

2. Accessibility

This pillar indicates the accessibility of the application for users.

- a. The application will also be available outside ROB for all (ROB?) users.

Note: This question has not been answered, but is not important for describing the functionality. However, this should be answered before development starts. It is still an open question in Appendix A: Q&A

- b. The application can be easily ported to other institutes.

Functional Requirements

Workflows

See next page. First the current workflow is discussed, then the new workflow.

Digisun workflow

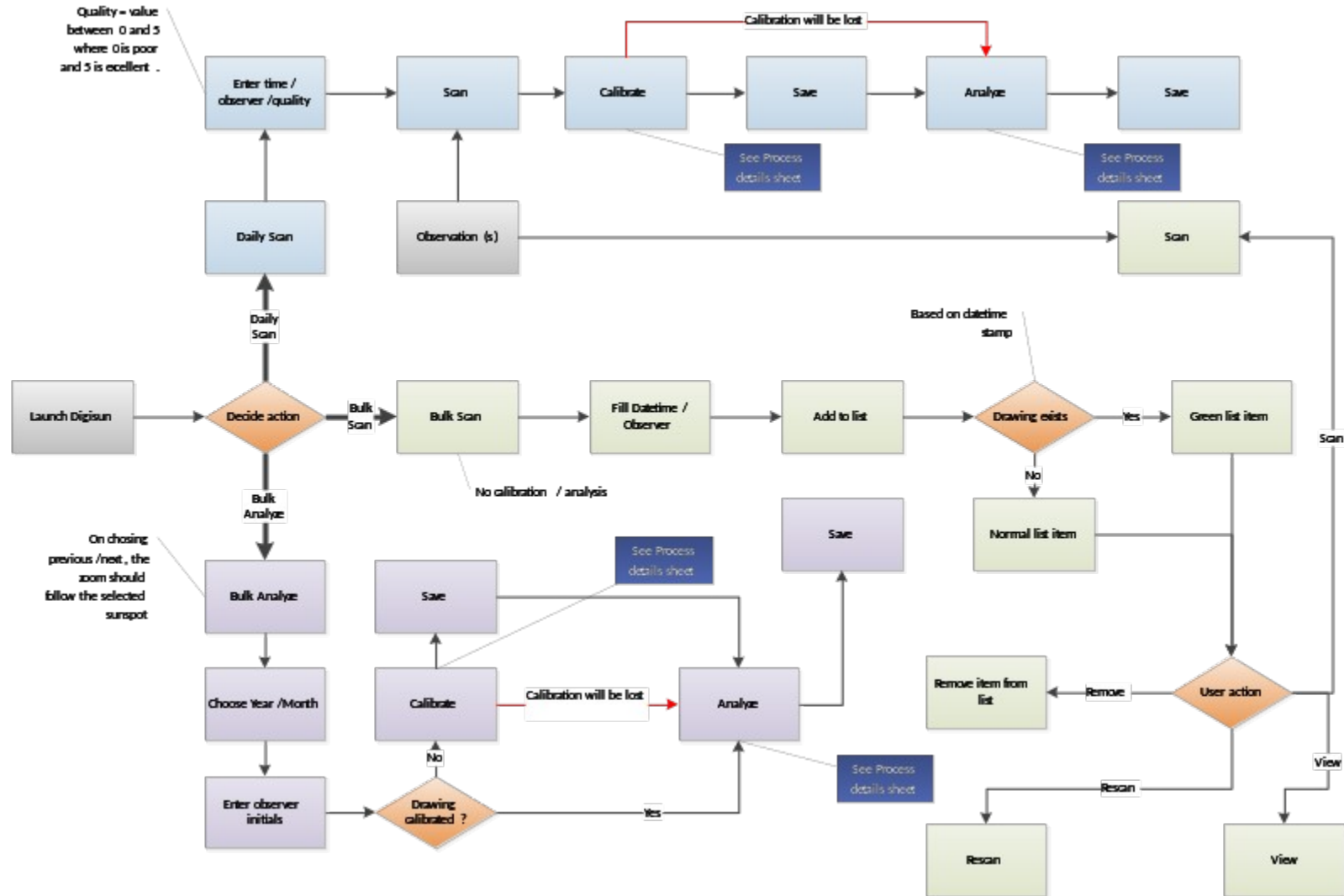


Figure 1: Current Digisun workflow

Basically, in the current digisun, there are three different workflows :

1. **Daily Scan**

This feature is used daily to scan and analyze a single drawing just made. It is used the most often. Basic flaws here include the saving mechanism and the possibly loss of calibration when forgetting to save.

2. **Bulk Scan**

This feature is used to scan in multiple drawings one after the other. It does not allow calibration or analysis. It can also be used to rescan an existing image.

3. **Bulk Analyze**

This feature is used to analyze multiple drawings (after they were already scanned and added to the database). This feature also allows Surface Calculation (currently only in DEV) of sunspot groups.

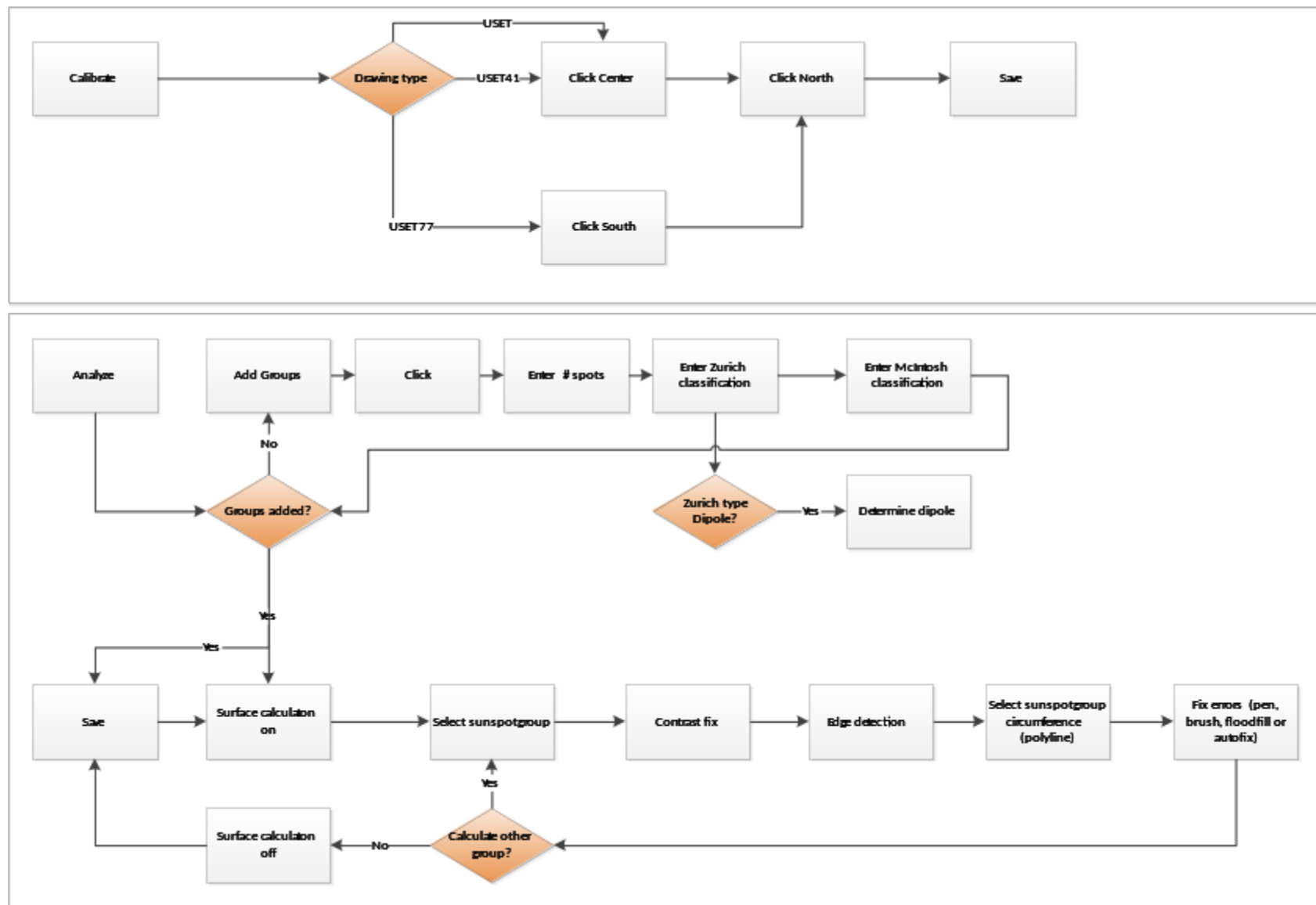


Figure 2: Zoom-in on the Calibration and Analyze processes.

Calibration is done by clicking 2 points. For USET and USET41 drawing types this is the center and the north of the solar disc. For USET77 drawing types this is the south and the north of the solar disc.

Analysis is done by defining the features of the sunspot groups on the solar disc. The location is saved by clicking on the group's estimated center. The number of spots, Zurich's - and McIntosh classifications are defined. In case the Zurich classification implies a dipole, the dipole direction can be defined. A helper grid is available to help distinguish between different group classifications.

In addition, in Bulk analyze only at this time, the surface of the sunspot group can be determined. This is done by switching this feature "on" (press the button) and following the "wizard" to prepare the drawing with the necessary parameters. Then a polyline can be drawn to determine the area that includes the sunspot group. A popup allows the user to "fix" any scan errors, missing penumbras, ... When all sunspot groups are calculated the wizard can be exited and the data written back to the original screen. The user must press save to save the values to database.

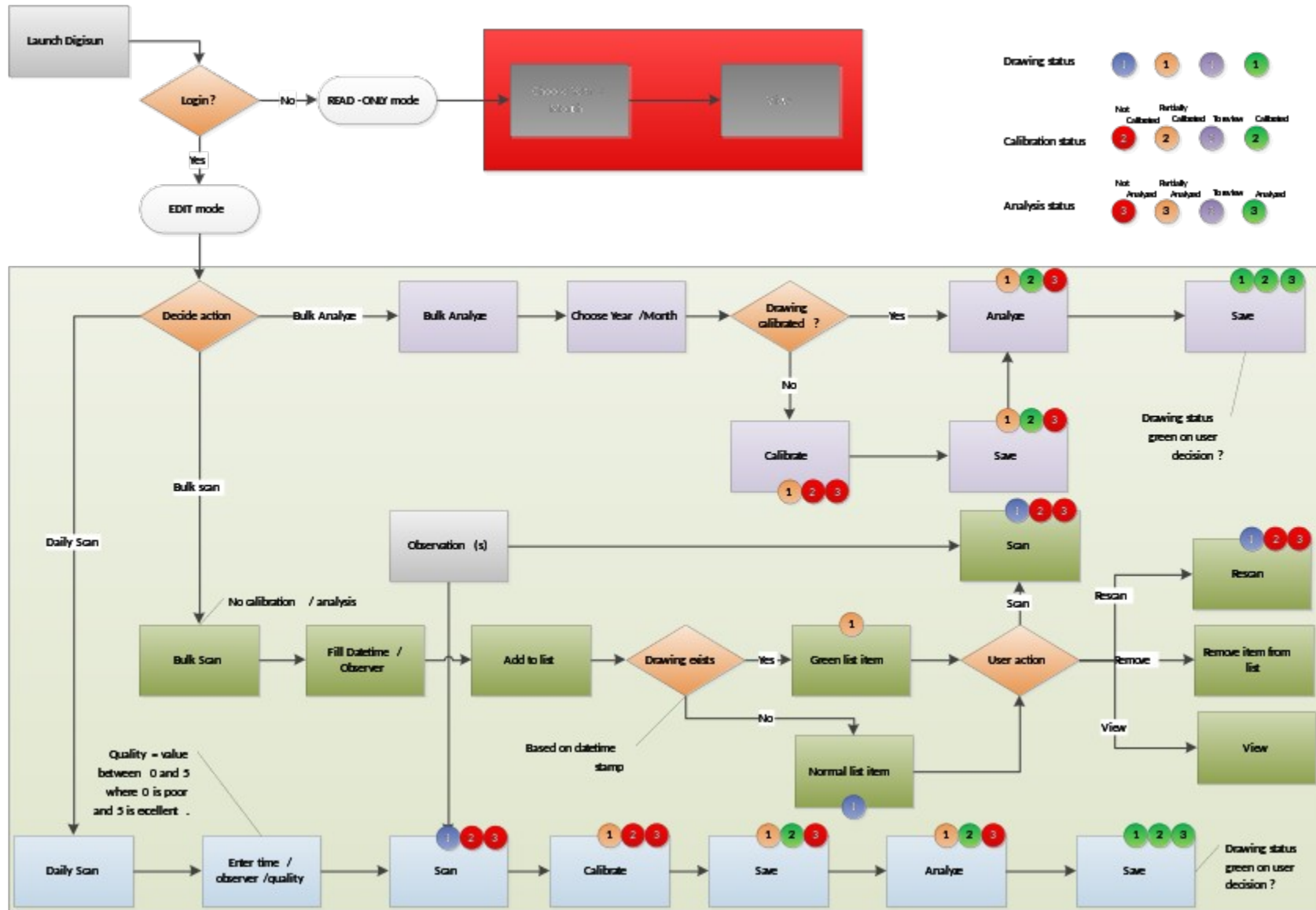


Figure 3: Digisun NextGen Workflow

There are several distinctive differences in this workflow compared to the current Digisun workflow.

1. Login at start of the application.
2. Usage of statuses indicating progress.
3. Calibration before Analysis
4. Other changes

Login at start of the application

The login will be more thorough (username/password) and 100% unique. This will allow a user to clearly identify the person who made the analysis of a drawing. It will also prevent a non-user to modify the data willingly or unwillingly. Not logging in, still makes the application usable, but only in a read-only mode. When a web-based tool is preferred, the login remains active until the end of the session or if the application is closed. Logging out is also always possible. This feature will also allow saving the history on drawings, indicating who worked on it and when. Keeping the changes per user will become too complex.

Usage of statuses indicating progress

There are three types of statuses.

1. Calibration status
2. Analysis status
3. Overall status

Each of these types has following status options

1. New
2. Work In Progress
3. To Review
4. Finished

These statuses are at all times visible for a drawing and are indicated by colors and icons.

The colors are:

- New = blue (#FF3333FF),
- work in progress = orange (FFFF6600),
- to review = purple (FF6600AA),
- finished = green (FF009933).

The icon set is the following:

Calibration



Analysis



Overall



Possible status combinations are:

Calibration status	Analysis status	Overall status
new	new	new
work in progress	new	work in progress
finished	new	work in progress
finished	work in progress	work in progress
finished	to review	to review
finished	finished	finished
to review	new	to review
to review	work in progress	to review
to review	to review	to review
to review	finished	to review

Not possible are:

new	work in progress
new	to review
new	finished
work in progress	work in progress
work in progress	to review
work in progress	finished

The statuses will change as follows: “new” When nothing has been done for that type of progress, “work in progress” when something has been filled in and “finished”/”to review” is set manually. The overall status is set automatically. The “to review” status is a way for indicating the drawing has not been finished (and often there is some form of problem). The statuses allow a user to quickly see if work still needs to be done.

Note that a drawing status might be “summarized” in the bulk scan list eg. Indicating if the set still needs work. Clicking on the year, the month list can have an equal summary status.

Calibration before Analysis

In normal circumstances the calibration must be done before the analysis can start, with the exception for “to review”, but even in that case all “calibration data” must be present before continuing. In the case of a “rescan” the old data is still saved to database, but marked “invalid”. The old data is reused to fill in the new data, but the user will have to correct and/or verify the data in order to set the status back to “finished”.

Other changes

- Saving is done when the user clicks the “next” button.

Scanning of drawings

Digisun Nextgen should allow the user to scan a drawing from within the application. This might be a problem as some sort of interface needs to be foreseen to allow plugins, since other institutions do not have the same scanner. A necessary and easy workaround to avoid any failure on the plugin system is to allow users to scan images OUTSIDE Digisun NextGen and import them. Additionally, the application should allow for various image formats (jpg, bmp, tiff, png, ...) and properties (dpi, image size, color table, compression, etc...)

Some sort of quality score is given to the image based on:

- Type of file (jpg, png, tiff, ...)
- Scan resolution (dpi)
- Manual quality score (seeing quality, pencil thickness, ...)
- (optional) scanner type
- (optional) Paper format

Analysis of drawings (and images)

Calibration

Today's Digisun calibration consists of determining the center of the solar disc as well as its radius, by clicking on the center of the disc with the mouse and again on the north side of disc edge. This could result in somewhat inaccurate calibration when not done right or when the circle on the scan template was not exactly round.

Digisun NexGen could calibrate the image by placing a circle, possibly partly automatically detected, on top of the drawing and using that information for the calibration. In addition, this automated detection needs "cleaning" of the image which could also be used for further analysis of the drawing and could therefore be seen as an additional calibration. Indicating the north remains a mandatory step in the calibration process in order to gauge each drawing from an angular point of view (a drawing could be slightly misplaced on the scanner and therefore have a slight angle). This indication should also be shown as a small cross or dot in a different color so the user can always check where the North has been set. An overlay set "calibrations" could be added to the menu (cfr the current overlay menu) that will show all markers for the calibration (center, circle, north)

Practically this would mean that the calibration necessary for the surface calculation in the current situation is moved to the Calibration phase of the workflow.

All properties concerning calibration should be checked for validity.

Additionally, the user should give a quality score from 1-5 (poor quality – high quality)

Analysis

Analysis can only be done when the calibration has been done. This should be checked. Upon entering the analysis the user should enter the number of groups and this will create an empty user control for each group allowing the user to fill in the necessary data. By entering the number of groups, the application can more easily follow the status and adjust accordingly. Of course the number of groups value can be changed. Lowering the number of groups should be done by removing the corresponding group (which will automatically change the number). Increasing the group number will add empty groups at the end of the list.

Analysis consists of identifying the sunspot groups and assigning properties to them:

- McIntosh classification
 - Zurich class
 - p-values
 - c-values
- (Mount Wilson classifications?)
- Location
 - Coordinates
 - Quadrant
- Bipolar
- Surface
- Additional features ? (penumbras, ...)

All sunspot properties should be easy to see and modifiable by the user and the user should be able to easily navigate between them. Visual aids are added to indicate what the user is working on (eg. Indication overlay for where the sunspot is on the drawing, what the “measured” area is, etc...

All properties concerning analysis should be checked for validity and regularly saved so the user can continue his/her work when closing and reopening the application. This includes the “cuts” when selecting a sunspot group for surface calculation, since these parts of the drawing are changed by “painting”.

Note: The cuts will receive the following filename: [\[drawingfilename\]_\[sunspotgroupnumber\]](#).
[\[extension\]](#)

Drawing Status

This status is set to “new” when the drawing is added to the database. If the user is calibrating or analyzing this drawing the status is set to “work in progress”. When a user is unable to finish due to lack of time eg, this status is kept. If the user needs additional information (eg help from another observer) the status is set to “to review”. If the user is satisfied with the information he can “close” the drawing, preferably locking the data (which can be unlocked with a specific action or by a superuser eg.)

Note: The “to review” status implies that more than one user can work on drawings. Advice is to save ALL users that have worked on a drawing.

Saving information to database

By definition all RAW information should be saved to database. Images can be stored on disc with the path saved in database. Possibly multiple image versions can co-exist (eg calibrated files and or masks next to the raw scanned image).

Any links between data is by use of primary/foreign keys and by use of a single sequence column. (no concatenated keys, no datetime stamps, no strings, ...)

Export to various formats

A special export module will take care of generating any export needed. This could be ASCII reports in various formats (Leroy, USPPS, ...) and with different extensions. This could be excel files or pdf reports or even images with overlays or a combination of all above. To be defined as the need arises. Immediate exports are Leroy and USSPS.

Another export to be done is towards other SIDC products (SIDC main page, previweb, ...) and could possibly be through a web service, a data copy (from database to database) or through intermediary files.

From Digisun to Digisun NextGen

Some thought should be given to how the current data and functionality will be in Digisun NextGen. At minimum, a tool must be provided to port the data from one database structure to another.

Data Structures

Database as-is

The database on development: USET_DEV is defined as follows:

Note:

- The record count is indicational
- Tables marked with '*' are not used for digisun

Name	Type	Primary Key	NOT NULL	Description
------	------	-------------	----------	-------------

Activities * (12 records)				
Id	INT(10)	X	X	
DateTime	DATETIME			
UserName	VARCHAR(255)			
Action	TEXT			

Area * (103 records)				
Id	INT(10)	X	X	
DateTime	DATETIME			
TypeOf Drawing	VARCHAR(50)			
Number	INT(11)			

Calibrations (20792 records)				
Id	INT(10)	X	X	
DateTime	DATETIME		X	
TypeOfDrawing	VARCHAR(50)		X	
NorthX	DOUBLE		X	X coordinate of the North calibration point
NorthY	DOUBLE		X	Y coordinate of the North calibration point
CenterX	DOUBLE		X	X coordinate of the Center calibration point
CenterY	DOUBLE		X	Y coordinate of the Center calibration point
Radius	DOUBLE			Radius in pixels

Cameras * (32854 records)				
Id	INT(10)		X	
Obs_id	MEDIUMINT(8)	X	X	
Last_upd_time	DATETIME			
filepath	VARCHAR(60)			
filename	VARCHAR(60)		X	
SIMPLE	CHAR(1)			
BITPIX	TINYINT(3)		X	
NAXIS	SMALLINT(5)			
NAXIS1	SMALLINT(5)			
NAXIS2	SMALLINT(5)			
BUNIT	VARCHAR(18)			
BSCALE	TINYINT(3)			
BZERO	TINYINT(3)			
ORIGIN	VARCHAR(18)			
TELESCOP	VARCHAR(18)			
INSTRUME	VARCHAR(18)			
EXPTIME	FLOAT			
OBJECT	VARCHAR(18)			
DATE_OBS	DATE			
TIME	TIME			
DATE	DATE			
QUALITY	FLOAT			
METHODE	VARCHAR(15)			
CAMERA	VARCHAR(30)			
COMMENT	VARCHAR(100)			

Drawings (22586 records)				
Id	INT(10)	X	X	
DateTime	DATETIME		X	timestamp of the drawing
TypeOfDrawing	VARCHAR(50)		X	
Quality	VARCHAR(100)		X	A quality indicator
Observer	VARCHAR(100)		X	Who made the observation
CarringtonRotation	INT(11)		X	Rotation number of the Carrington rotation
JulianDate	(DOUBLE)		X	Julian date of the drawing
Calibrated	TINYINT(1)		X	Is the drawing calibrated
Analyzed	TINYINT(1)		X	Is the drawing analyzed
GroupCount	INT(11)		X	How many sunspot groups are there on the drawing.
SpotCount	INT(11)		X	How many sunspots are there on the drawing.
Wolf	INT(11)		X	Wolf number of the observation
AngleP	DOUBLE		X	Correction angle P
AngleB	DOUBLE		X	Correction angle B
AngleL	DOUBLE		X	Correction angle L
AngleScan	DOUBLE		X	
Path	TEXT		X	Name of the scanned image
Operator	VARCHAR(255)			Person who logged in and scanned the drawing

Groups (84087 records)				
Id	INT(10)	X	X	
DateTime	DATETIME		X	
TypeOfDrawing	VARCHAR(50)		X	
Number	INT(11)		X	Number of groups
Latitude	DOUBLE			Latitude of the group
Longitude	DOUBLE			Longitude of the group
McIntosh	VARCHAR(3)		X	McIntosh type
Zurich	VARCHAR(1)		X	Zurich type
Spots	INT(11)		X	Number of spots in the group
Dipole1Lat	DOUBLE		X	Latitude of point 1 of the dipole
Dipole1Long	DOUBLE		X	Longitude of point 1 of the dipole
Dipole2Lat	DOUBLE		X	Latitude of point 2 of the dipole
Dipole2Long	DOUBLE		X	Longitude of point 2 of the dipole
DipoleDefined	TINYINT(1)		X	1 or 0
Surface	DOUBLE			Surface in Msh

Observers (62 records)				
Id	INT(10)	X	X	
Namecode	VARCHAR(255)		X	
Typeofdrawing	VARCHAR(255)		X	
Leroynamecode	VARCHAR(1)			
Lastname	VARCHAR(255)			
firstname	VARCHAR(255)			

Note: Is the table "qualities" used?

Qualities (12 records)				
Id	INT(10)	X	X	
value	VARCHAR(255)		X	
Typeofdrawing	VARCHAR(255)		X	

Technical_logs (387 records)				
Id	BIGINT(20)	X	X	
Logdts	DATETIME		X	Datetime of the log
Logtype	TEXT		X	WARNING, INFORMATION, ERROR
Logaction	TEXT		X	USER or SYSTEM
Logseverity	TEXT		X	LOW, MEDIUM, HIGH
Logapplication	TEXT		X	application and/or module that made the log
Logmachine	TEXT		X	Machine that created the log
logmessage	TEXT		X	The logmessage

Technical_settings (20 records)				
Id	INT(10)	X	X	
Usetkey	TEXT		X	Name of the setting
Usetvalue	TEXT		X	Value of the setting
Owner	TEXT			Used for overriding settings
Module	TEXT			Application name that uses the setting
description	TEXT		X	Description of the setting

Database to-be

There was a specific request to make no changes to the database, however, to accommodate the new features for Digisun NextGen, some database changes are required.

A small (incomplete) list of desired changes are:

- Save the raw coordinates for clicks, sunspot groups, dipole indications, etc ...
- Remove any unused tables
- Add information for the statuses and history information

Note: Changes marked in blue

Name	Type	Primary Key	NOT NULL	Description
Calibrations				
Id	INT(10)	X	X	
DateTime	DATETIME		X	
TypeOfDrawing	VARCHAR(10)		X	
NorthX	DOUBLE		X	X coordinate of the North calibration point
NorthY	DOUBLE		X	Y coordinate of the North calibration point
CenterX	DOUBLE		X	X coordinate of the Center calibration point
CenterY	DOUBLE		X	Y coordinate of the Center calibration point
Radius	DOUBLE		X	Radius in pixels
contrasttreshold	INT(10)		X	Number between -1 and 255. -1 means the gradientfilter has been used. A number between 0-255 equals the threshold value and implies the "bitflipfilter"
Quality	INT(10)		X	Quality of the drawing between 1 and 5
Version	INT(10)		X	Version of the calibration
Active	VARCHAR(1)		X	T/F indicating if this is the last version
Udts	DATETIME			Update datetimestamp
PersonId	INT(10)		X	Id of the person who made the update

Drawings				
Id	INT(10)	X	X	
DateTime	DATETIME		X	timestamp of the drawing
TypeOfDrawing	VARCHAR(10)		X	
Quality	INT(10)		X	A quality indicator based on manual score, image type, scan resolution, etc...
PersonId	INT(10)		X	Who made the observation
CarringtonRotation	INT(10)		X	Rotation number of the Carrington rotation
JulianDate	(DOUBLE)		X	Julian date of the drawing
CalibrationStatus	VARCHAR(20)		X	NEW, WORK IN PROGRESS, TO REVIEW, FINISHED
AnalysisStatus	VARCHAR(20)		X	NEW, WORK IN PROGRESS, TO REVIEW, FINISHED
OverallStatus	VARCHAR(20)		X	NEW, WORK IN PROGRESS, TO REVIEW, FINISHED
GroupCount	INT(10)		X	How many sunspot groups are there on the drawing.
SpotCount	INT(10)		X	How many sunspots are there on the drawing.
Wolf	INT(10)		X	Wolf number of the observation
AngleP	DOUBLE		X	Correction angle P
AngleB	DOUBLE		X	Correction angle B
AngleL	DOUBLE		X	Correction angle L
AngleScan	DOUBLE		X	
Path	TEXT		X	Name of the scanned image
Operator	INT(10)		X	Person who logged in and scanned the drawing (links to person table)
CalibrationId	INT(10)			Links to the calibration table.
Version	INT(10)		X	Version of the analysis
Active	VARCHAR(1)		X	T/F indicating if this is the last version
Udts	DATETIME			Update datetimestamp
PersonId	INT(10)		X	Id of the person who made the update

Groups				
Id	INT(10)	X	X	
DateTime	DATETIME		X	
TypeOfDrawing	VARCHAR(10)		X	
Number	INT(10)		X	Number the group (order)
Latitude	DOUBLE			Latitude of the group
Longitude	DOUBLE			Longitude of the group
X	DOUBLE			X-coordinate of the group
Y	DOUBLE			Y-coordinate of the group
McIntosh	VARCHAR(3)		X	McIntosh type
Zurich	VARCHAR(1)		X	Zurich type
Spots	INT(10)		X	Number of spots in the group
Dipole1Lat	DOUBLE		X	Latitude of point 1 of the dipole
Dipole1Long	DOUBLE		X	Longitude of point 1 of the dipole
Dipole2Lat	DOUBLE		X	Latitude of point 2 of the dipole
Dipole2Long	DOUBLE		X	Longitude of point 2 of the dipole
DipoleDefined	TINYINT(1)		X	1 or 0
Dipole1X	DOUBLE		X	X-coordinate of point 1 of the dipole
Dipole1Y	DOUBLE		X	Y-coordinate of point 1 of the dipole
Dipole2X	DOUBLE		X	X-coordinate of point 2 of the dipole
Dipole2Y	DOUBLE		X	Y-coordinate of point 2 of the dipole
Surface	DOUBLE			Surface in Msh
DrawingsId	INT(10)		X	Links to the drawings table
Version	INT(10)		X	Version of the analysis
Active	VARCHAR(1)		X	T/F indicating if this is the last version
Udts	DATETIME			Update datetimestamp
PersonId	INT(10)		X	Id of the person who made the update

Person				
Id	BIGINT(20)	X	X	
Lastname	TEXT		X	
Firstname	TEXT		X	
Login	TEXT		X	
Password	TEXT		X	Hashed (password+salt)
Salt	TEXT		X	Used in the hashed password (https://en.wikipedia.org/wiki/Salt_(cryptography)))
Email	TEXT			The email address of the person
Phone	TEXT			The phone number of the person
NameCode	TEXT		X	
LeroyNameCode	Varchar(1)			

SurfacePolygon				
Id	BIGINT(20)	X	X	
X	INT(10)		X	X-coordinate of the point
Y	INT(10)		X	Y-coordinate of the point
GroupsId	INT(10)		X	Links to the groups table
This table keeps the polygon data for the surface calculation. With this, the polygon can be redrawn as an overlay and can also easily be redone.				

SurfaceCut				
Id	BIGINT(20)	X	X	
X	INT(10)		X	X-coordinate of the top, left corner
Y	INT(10)		X	Y-coordinate of the top, left corner
Path	TEXT		X	Filename of the cut.
Since the user paints on the part to improve the surface calculation, the “cut” is saved. With this information the “cut” can be replaced as an overlay.				

Technical_logs				
Id	BIGINT(20)	X	X	
LogDts	DATETIME		X	Datetime of the log
LogType	TEXT		X	WARNING, INFORMATION, ERROR
LogAction	TEXT		X	USER or SYSTEM
LogSeverity	TEXT		X	LOW, MEDIUM, HIGH
LogApplication	TEXT		X	application and/or module that made the log
LogMachine	TEXT		X	Machine that created the log
LogMessage	TEXT		X	The logmessage

Technical_settings				
Id	INT(10)	X	X	
UsetKey	TEXT		X	Name of the setting
UsetValue	TEXT		X	Value of the setting
Owner	TEXT			Used for overriding settings
Module	TEXT			Application name that uses the setting
Description	TEXT		X	Description of the setting

Technical_lists				
Id	INT(10)	X	X	
ListName	TEXT		X	Name of the list (groups items together)
ItemText	TEXT		X	Text to show in the list
ItemValue	TEXT		X	Associated code or value
SortOrder	INT(10)		X	The order in which the item should appear.
Remark: This table can hold list values like: <ul style="list-style-type: none"> • Yes / no • True / false • NEW / WORK IN PROGRESS / TO REVIEW / FINISHED • Axx,Bxi,Bxo,Cai,Cao,...,Fhi,Fho,Fkc,Fki,Fko,Hax,Hhx,Hkx,Hrx,Hsx,Xxx • A,B,C,D,E,F,G,H,J,X • ... 				

ussps				
Id	INT(10)	X	X	
IIIII	Varchar(5)		X	
DDHHH	Varchar(5)		X	
aaabc	Varchar(5)		X	
ddAAA	Varchar(5)		X	
QXXYY	Varchar(5)		X	
fghii	Varchar(5)		X	
drawingsId	INT(10)		X	Links to the drawings table
groupsid	INT(10)		X	Links to the groups table
version	INT(10)		X	Version of the analysis
active	VARCHAR(1)		X	T/F indicating if this is the last version
udts	DATETIME			Update datetimestamp
An sdts : sent datetimestamp could be added (or pdts : published datetimestamp), though this thought could be extended into adding a “message” table that holds the exports of reports (Leroy, ussps, ...)				

User Interface

Note: The User Interface analysis does not take in account any mobile devices.

An example of how the user interface could look like:

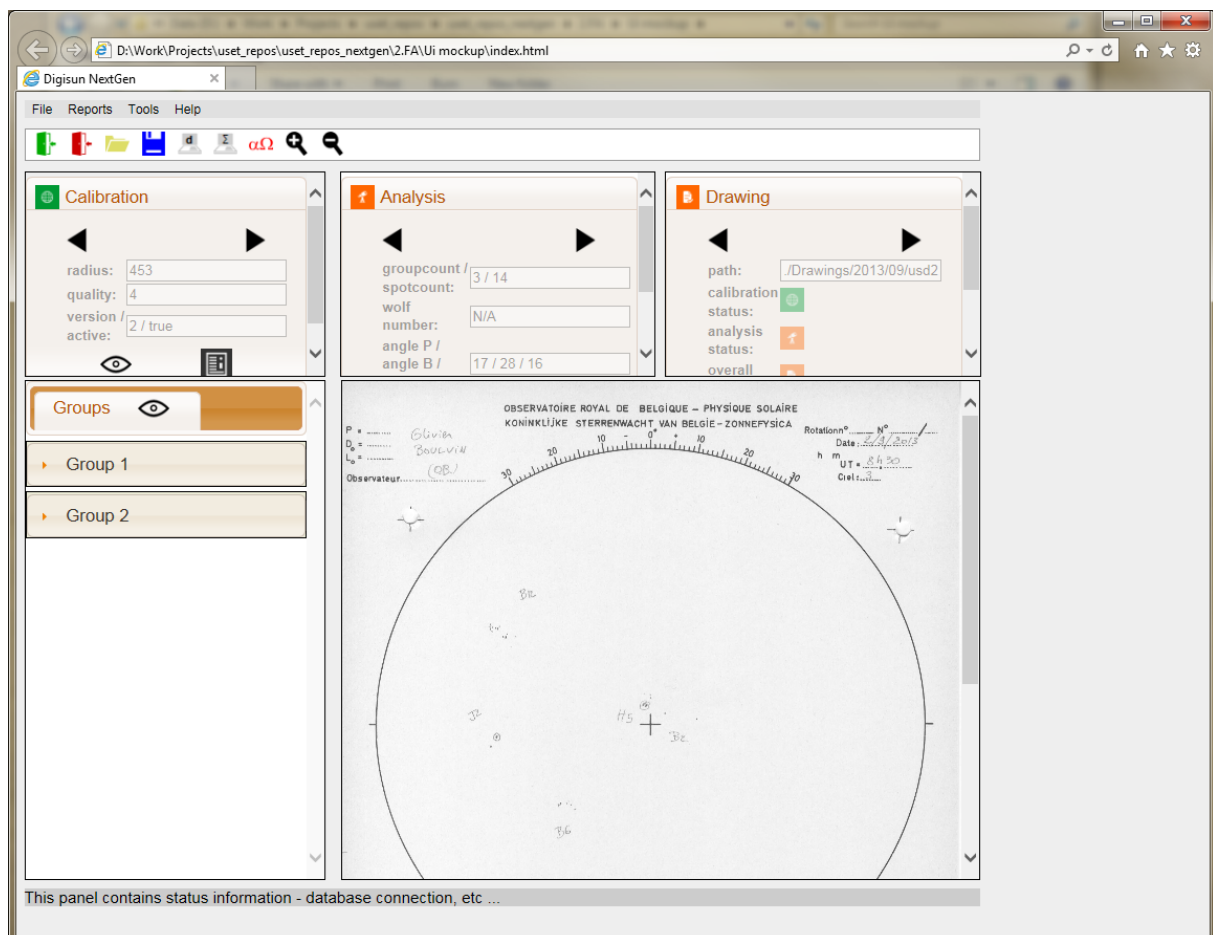


Figure 4: UI mockup screenshot

Note: This screenshot is from a mockup prototype and does not resemble the final product. Its goal is to show a possible look and feel.

There are several things to note before explaining the different sections of the screenshot.

1. This is just one page, there will be other pages as well, but this prototype is only for the purpose of showing a look and feel. Some of the options or buttons might not even make sense.
2. There is a lot of information on one screen. Too much for any user to handle in an adequate manner. Much of it can be intelligently hidden/shown, but the culprit here is the main drawing (that takes up a lot of space), but also the fact that a large part is taken up by the browser itself. The mere fact that the application is web-based has implications.

One of those implications is that you can develop against certain screen resolutions (the mockup currently has one fixed width of 960 pixels) or you can try to dynamically adapt the layout depending on the resolution, but both methods will require a significant development time in order for it to work properly (on all screens and all browsers). That is outside the scope of the mockup.

3. The choice of using a web-based tool has some implications on the design and usage of the tool. The most notable is sending data up and down the wire to update information on the screen. It is harder to react to keyboard interactions, ...
4. The look and feel can still be tailored more towards development. Functionality like menu options and buttons are an example and do not resemble real actions.
5. The mockup prototype can be tested, but is not a working product. It should also not evolve towards a working product.
6. Note that user can close browsers, use the back/forward buttons, favorites, ... which is to be taken in account when designing other pages and the interaction between them. (in the final product)

The menu bar

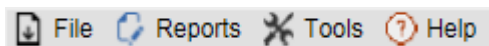


Figure 5 : The menu bar

This section works like a classic windows menu, with drop down menus allowing a user to select an action.

The icon bar



Figure 6 : The icon bar

This section works like a classic windows taskbar (not a ribbon). It is a shortcut for the most-used menu based actions.

The control section

This section gives the user an overview of the progress, the metadata on the drawing, etc... It consists of three subsections.

Calibration section

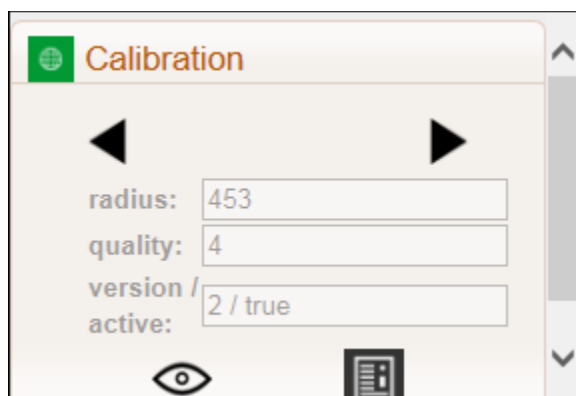


Figure 7 : Control section - Calibration

This section is a dropdown in order to avoid making the page to « crowded » with information. It contains information on the **calibration** of the drawing. An icon shows the calibration status, even if the panel is collapsed. The eye icon is a button, allowing to enable(👁) / disable(🚫) the visualization for the calibration. This visualization would be : The center point, the circle (center point + radius) and the indication for the North. The edit button (📄) shows a popup with more information and allows a user to edit information.

Analysis section

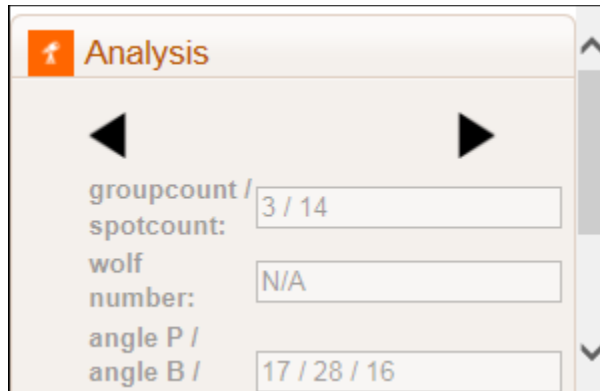


Figure 8 : Control section - Analysis

This section is a dropdown in order to avoid making the page to « crowded » with information. It contains information on the **analysis** of the drawing. An icon shows the analysis status, even if the panel is collapsed. The edit button (📄) shows a popup with more information and allows a user to edit information.

Drawing section

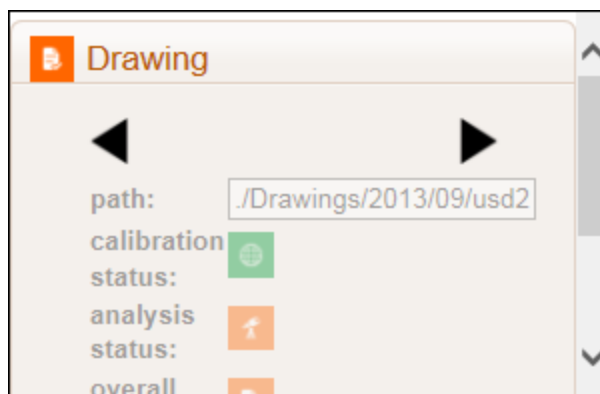


Figure 9 : Control section - Drawing

This section is a dropdown in order to avoid making the page to « crowded » with information. It contains information on the **metadata** of the drawing. An icon shows the drawing (overall) status, even if the panel is collapsed. The edit button (📄) shows a popup with more information and allows a user to edit information.

The working section

This section will be the main focus of the user. It consists of two subsection containing a list of groups and the drawing. Clicking on a group « header » expands/collapses the information.

Groups section

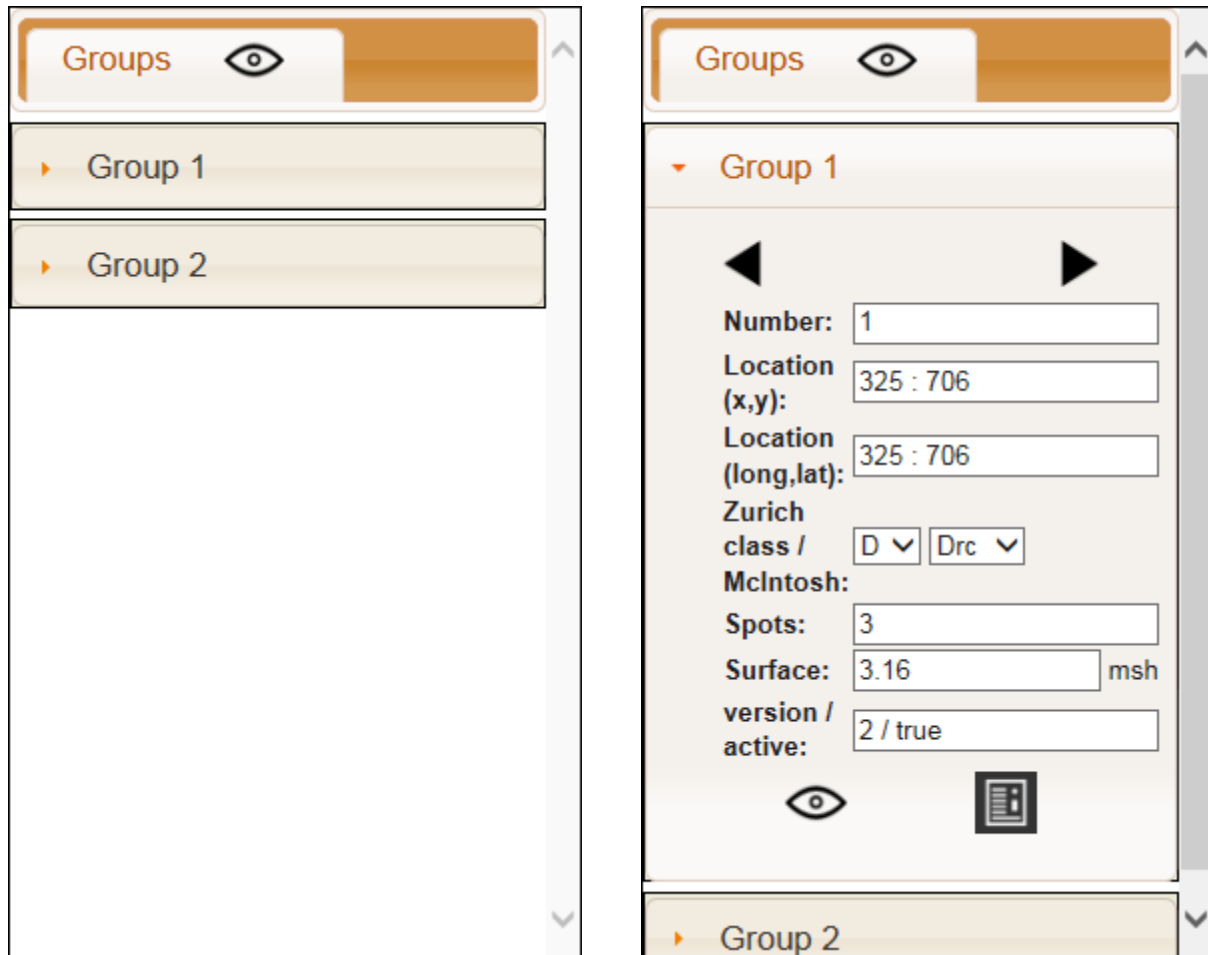


Figure 10: Working section - groups






The groups section contains all information by group. An eye button allows the user to enable() / disable() the visualization for that group. (location, dipole, ...) The eye button on top allows a user to enable() / disable() the visualization for all groups. The edit button () shows a popup with more information and allows a user to edit information.

Image section

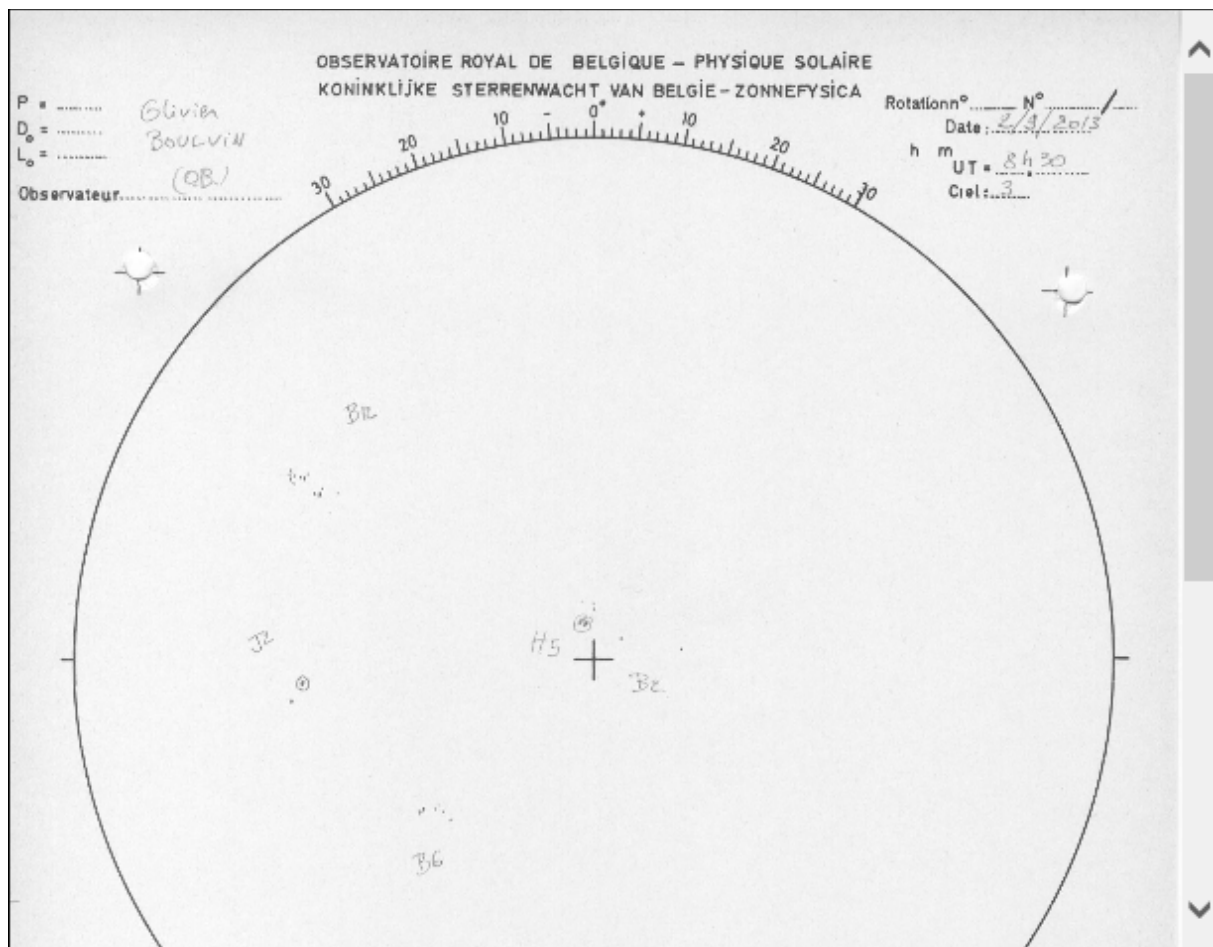


Figure 11: Working section - image

This section shows the drawing. The final product should allow image manipulation and drawing of overlay information (group location, dipole, calibration information, ...)

Possible overlays on the drawing are:

- Sunspot group
 - Location
 - Surface polygon
 - Surface cut overlay

For the last two, the user could get a popup with a list of groups with radiobuttons to select for each group if they want the polygon indication or the cut overlay.
- Dipole indication
- Small/large grid
- Circle, centerpoint and north.

The status bar

This panel contains status information - database connection, etc ...

The status bar at the bottom allows for some additional information like Copywrite, database connection information, etc... Alternatively this could be added to a dialog on the about popup in the help menu.

Configuration

In the current Digisun following parameters are set:

Key	Value	Description
drawingtype	USET	Type of drawing
drawingpath	N:	Contains the path to the drawing repository.
drawingtemppath	drwtemp	Contains the path to a temporary working directory.
webserver		
leroypath	Reports/Leroy	Path used for leroy reports.
bulkscanlist	bulkscan.lst	Name of the file that contains the list for the bulkscan.
cannytreshholdintensity	80	Treshold value for the solar edge detection.
accumulatortreshhold	220	Treshold value for the solar edge detection.
resolution	5.0	Resolution value for the solar edge detection
minimumdistance	500.0	the minimum distance between the centers of the different detected circles.
minimumradius	500	The minimum radius of the detected circels
maximumradius	0	The maximum radius of the detected circles (0 = infinity)
contrastfixtreshhold	225	The treshold of each RGB value that flips the pixel to black or white.
solardiameter	1392684000	The solar radius in meters.
scandpi	150	The DPI of the scan.
scanhorizontallines	1170	
scanhorizontal_a3	297	
scanverticallines	1700	
scanvertical_a3	420	
scanformat	JPG	Can be any of the following: BMP, TIFF, GIF, PNG, JPG.

For Digisun NextGen the following settings should be changed.

Key	Value	Description
scandpi	300	The DPI of the scan.
scanformat	PNG	Can be any of the following: BMP, TIFF, GIF, PNG, JPG.

Risks / Issues

id	Risk/Issue	Solution (proposal)
1	SQL injection	Use parametrized queries, use data validation.
2	Unauthorized usage.	Firewalls, logins, ...
3	Changing from one version to the other	Run both versions in parallel for a while to make sure nothing breaks and results come out the same.

Security

Security is fairly simple by using a login. If no valid login has been given the user is allowed to read the data, but no changes are to be made. With a valid login, the user can edit any information. Changed information is saved with history.

There is no concept of roles defined, allowing some users to have more rights than others.

User logins consist of a username/password combination. Passwords are saved in the database as a salted hash value. ([https://en.wikipedia.org/wiki/Salt_\(cryptography\)](https://en.wikipedia.org/wiki/Salt_(cryptography)))

Performance

To increase performance perception for the user, many of the actions will take place on the client side. Client-server traffic will be limited to avoid unnecessarily sending data up and down the wire.

Constraints and limitations

Realistically only a limited set of browsers will be supported:

- IE 10 and 11 and the new Edge browser
- Chrome Version 44 and above
- Firefox version 37 and above
- Safari version 8.0 and above

Mobile devices will not be supported.

Appendix

Appendix A: Q & A

Id	Date	Question	Answer
001	15/04/2015	What should the project name be?	Digisun NextGen is OK for now.
002	10/06/2015	Should there be support for mobile devices and to what extent?	No request for this has been made.
003	10/06/2015	The “observer” context seems somewhat awkward (the late login, etc...). Wouldn't it be better to have a login at starting digisun?	Login at startup is desired.
004	10/08/2015	Operator/Observer. Advice would be to create a person table with better and cleaner information and link the observer/operator to that table.	Create the person table
005	28/08/2015	Can a user (or anyone) use the tool from outside ROB ?	Mail Olivier L: 31/08/2015 This is a tough one in my opinion, because it raises a lot of questions. Will this tool be available for all our observers (others stations than USET) for example? In that case, will we be offering this service and storing all the data ourselves? Or will the product be offered without database infrastructure, like a Almost Ready to Work product that you have to care for your own database, etc...?
006		“For USET77 drawing types this is the south and the north of the solar disc.” How is the center determined in that case?	

Appendix B: Trains of thought

This appendix gives some brainstorming ideas which might become useful in the future.

- Should images from scanned drawings and images from the camera be used in a mixed way in the future (overlays, switching between images, etc ...)
- Can SPoCA be re-used for image analysis ?

Appendix C: Types of drawings

Drawings have different sets of parameters to take into account. Some properties are different even between the same types of drawings like eg. The pixelformat.

Type: USET

OBSERVATOIRE ROYAL DE BELGIQUE - PHYSIQUE SOLAIRE
KONINKLIJKE STERRENWACHT VAN BELGIE - ZONNEFYSICA

P =
D_o =
L_o =

Rotationn° N°
Date : 22/06/2009
h m UT = 06h15
Ciel : 3

Observateur : A. J. E. G. E. N.

NW SW NE SE

B l T n N°

NOMBRE DE TACHES : 6
NOMBRE DE GROUPES : 2
NOMBRE DE WOLF : 26

Figure C1: Drawing type: USET

This type of drawing has a size of : width: 1110 x height: 1416.

It has a small cross in the center and therefore the “center click” is used for calibration (see workflows). This template is still in use today.

Type: USET41

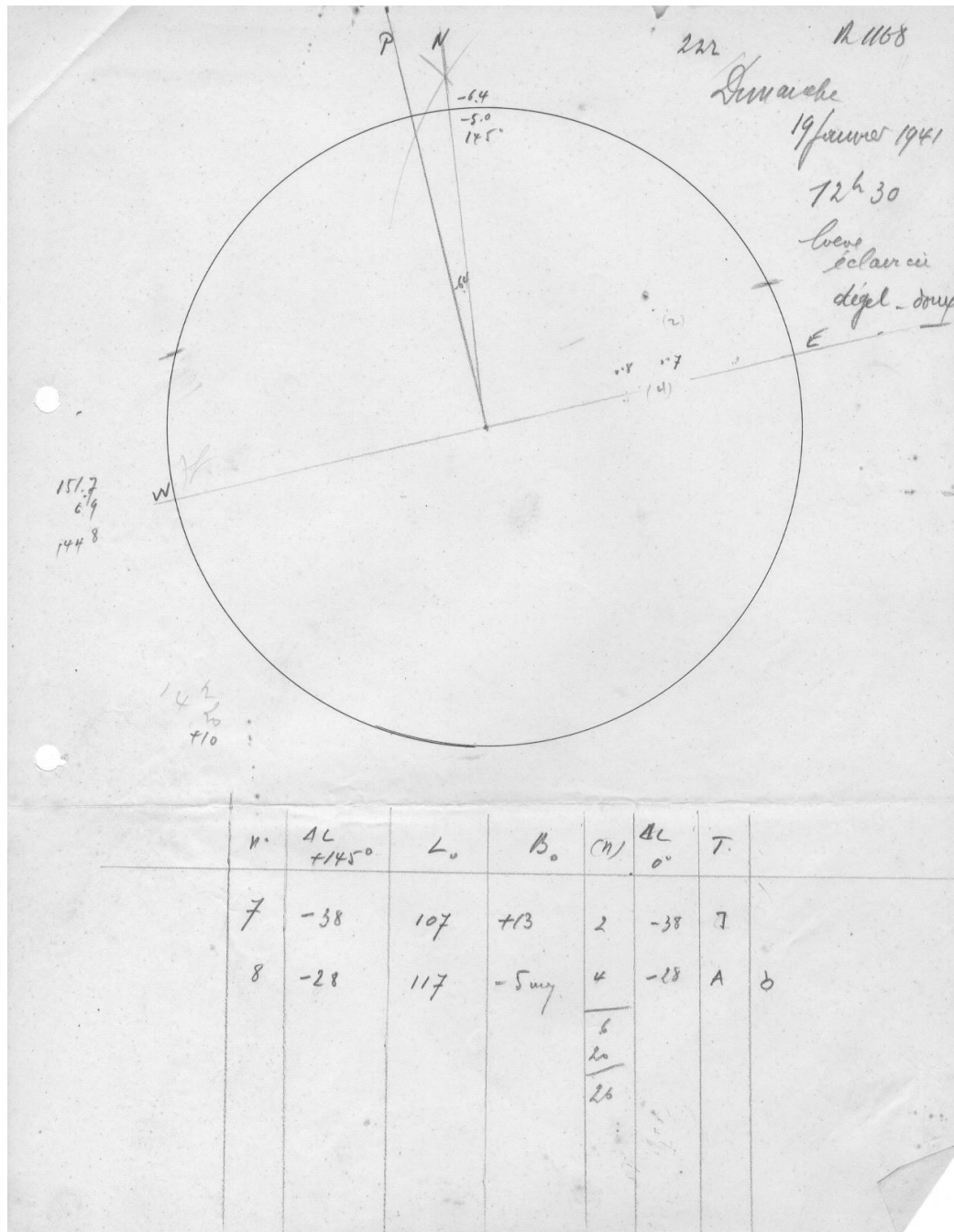


Figure C2: Drawing type: USET41

This type of drawing has a size of: width: 1269 x height: 1669.

It has a center indication and therefore the "center click" is used for calibration (see workflows). This template is no more in use today.

Type: USET77

OBSERVATOIRE ROYAL DE BELGIQUE - PHYSIQUE SOLAIRE

Rotation n° 11549 N° 11549/116
Date : 25-8-77
h m TU = 0844 Ciel : 2

P =
D₀ =
L₀ =
Observateur : CE

NW	SW	NE	SE	B	L	T	n	N°	B	L	T	n	N°
NOMBRE DE TACHES													
NOMBRE DE GROUPES													
NOMBRE DE WOLF													

Figure C3: Drawing type: USET77

This type of drawing has a size of: width: 1110 x height: 1416.

It has no center indication and therefore the “south click” is used for calibration (see workflows). This template is no more in use today.