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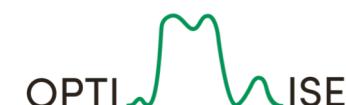
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# The Spectral Information System SPECCHIO V3.3 - Introduction

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cost  
EUROPEAN COOPERATION  
IN SCIENCE AND TECHNOLOGY





## Agenda

- Spectral Information Systems: Raison d'être
- Metadata
- Methods
  - SPECCHIO Architecture
  - Spectroscopy Lifecycle Support
- Results



## Spectral Information Systems: Raison d'être



Spectral Information Systems are systems for **building** and **providing spectral information**, utilising spectral databases as repositories for **spectral data** and associated **metadata**.



## Common Issues in Field Spectroscopy

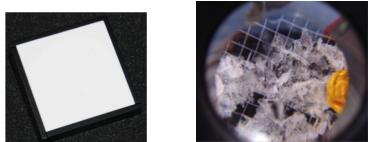
Where are my data files?



... and there are thousands of them: how to keep track?



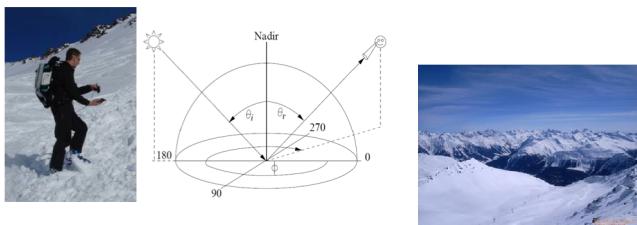
My instrument is not  
producing the truth?!?



Can someone else make use of my data?

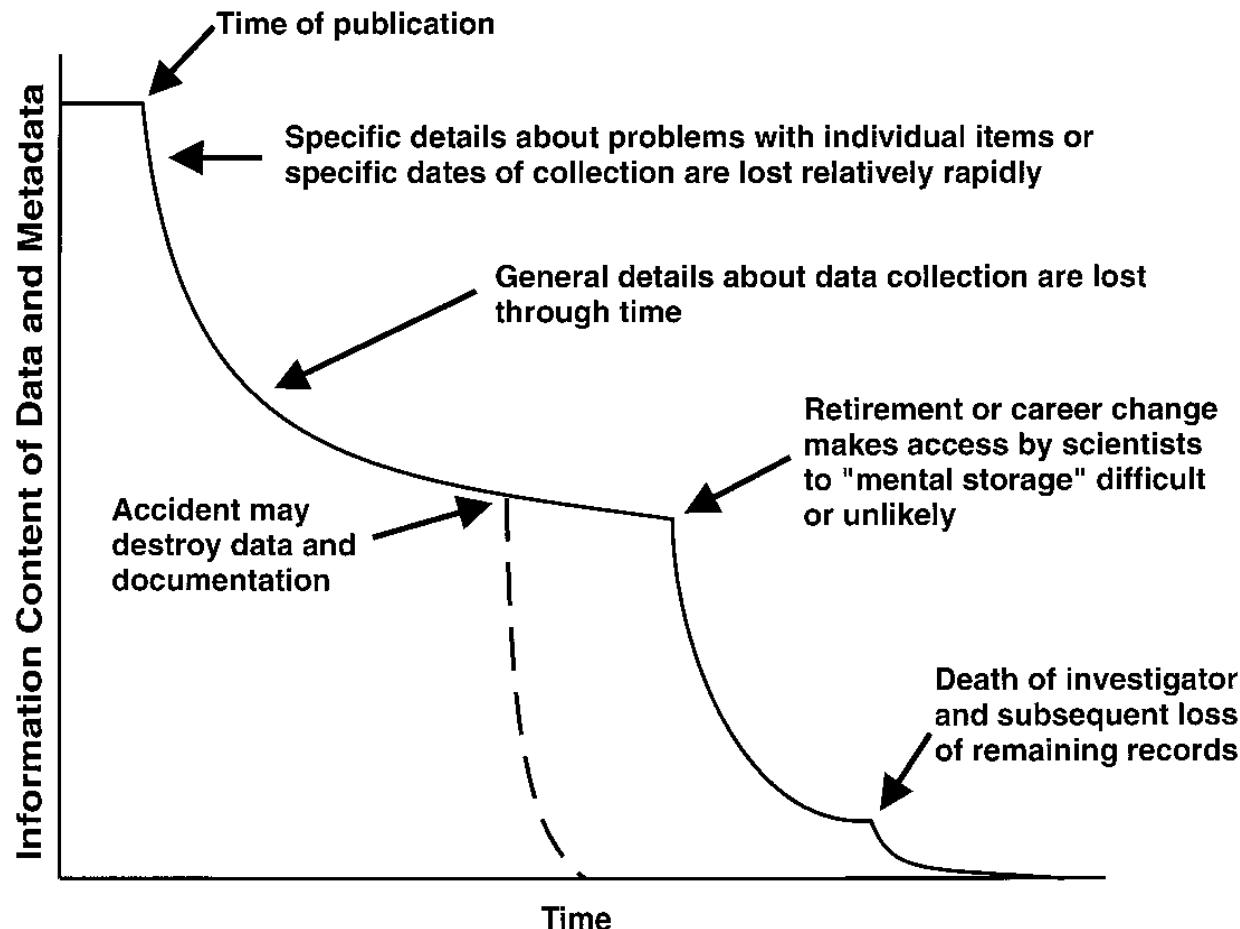


What were the sampling context and conditions?





## On the Importance of Metadata



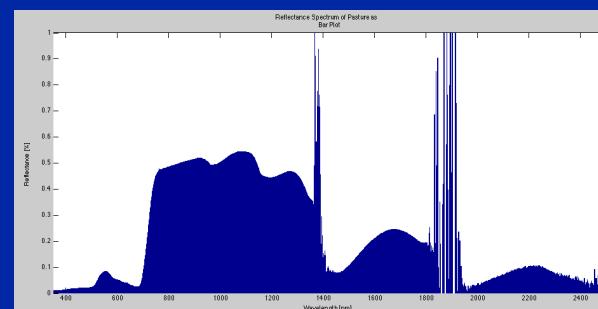
W. K. Michener, J. W. Brunt, J. J. Helly, T. B. Kirchner, and S. G. Stafford,  
"NONGEOSPATIAL METADATA FOR THE ECOLOGICAL SCIENCES," *Ecological Applications*, vol. 7, pp. 330–342, 1997.

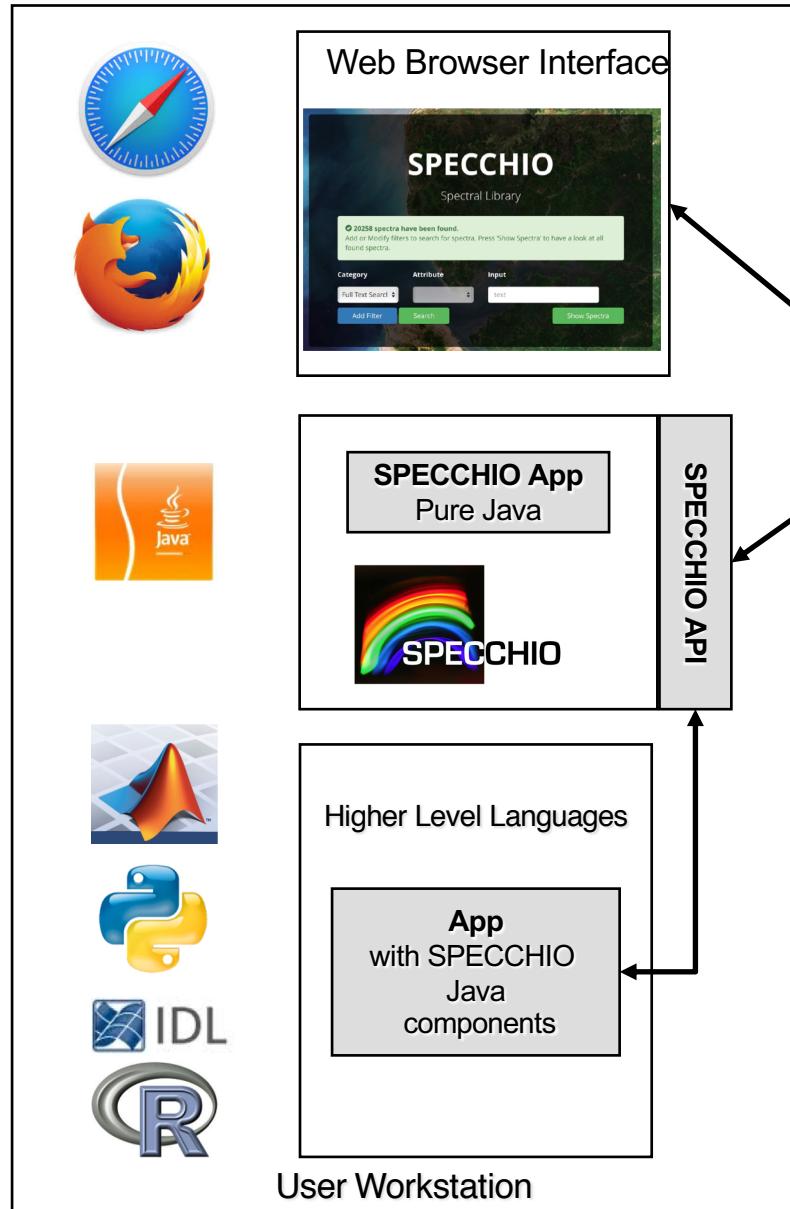


# Methods

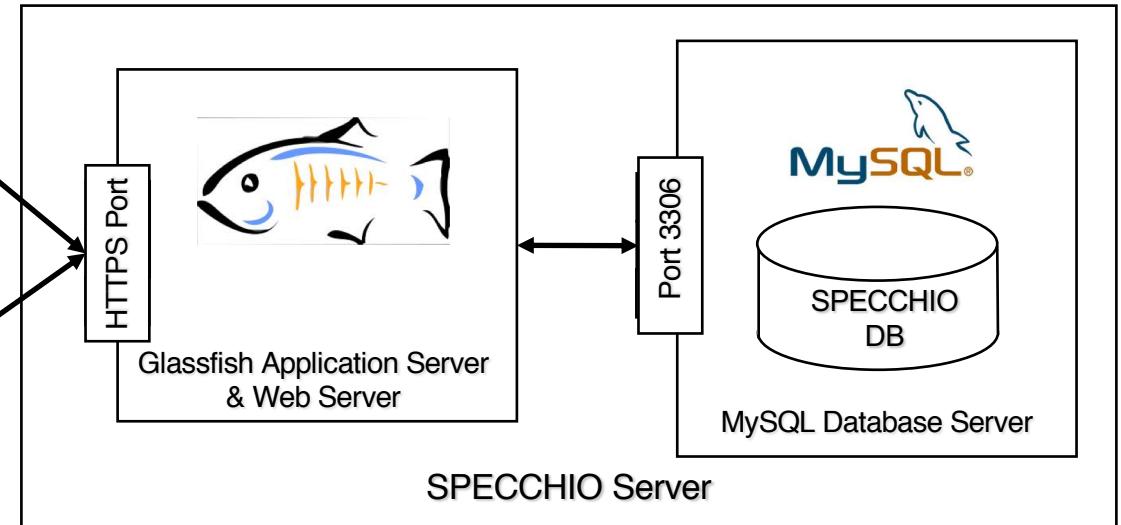
## SPECCHIO Spectral Information System

Metadata = Contextual Awareness



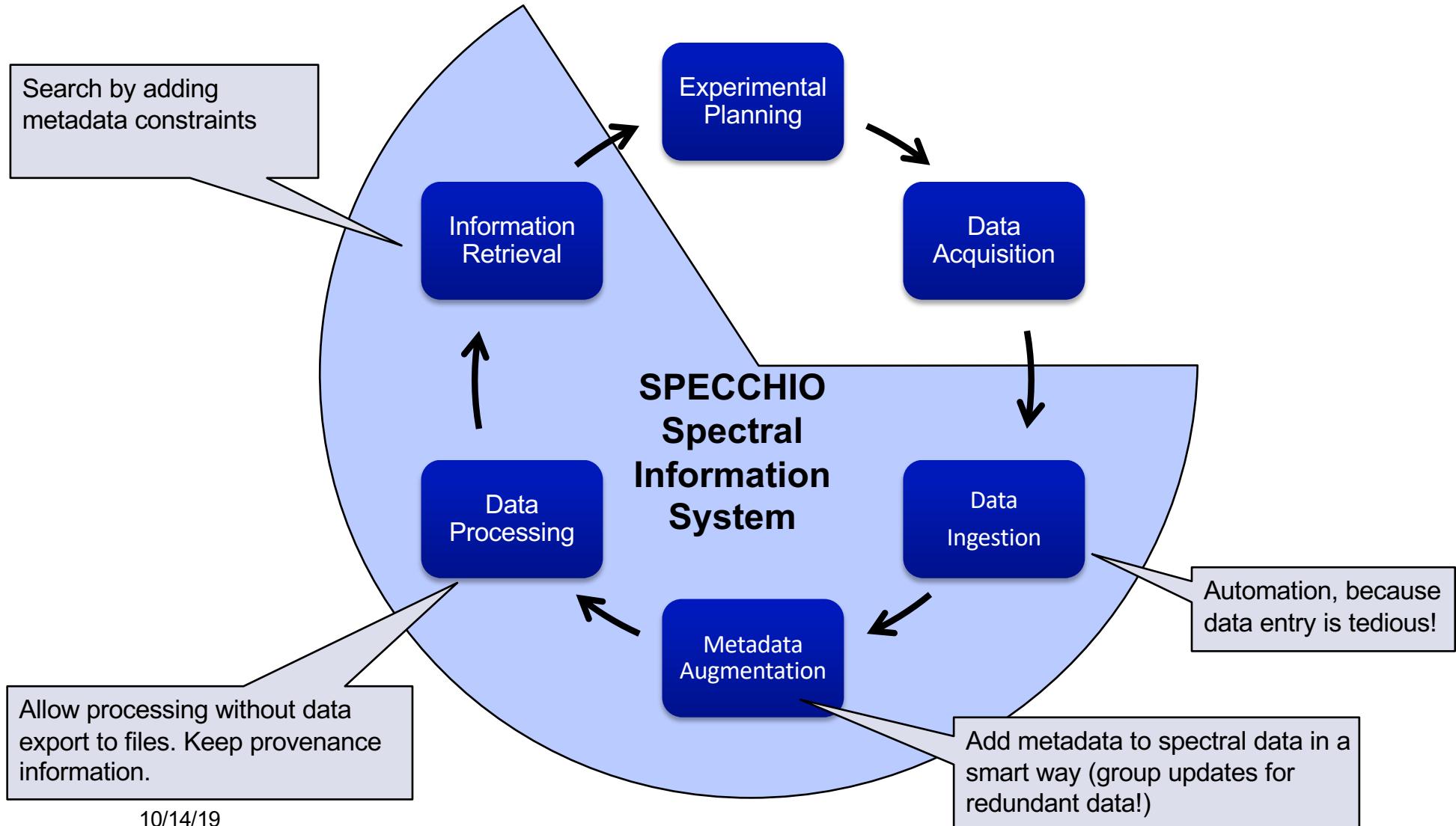


## Architecture – V3



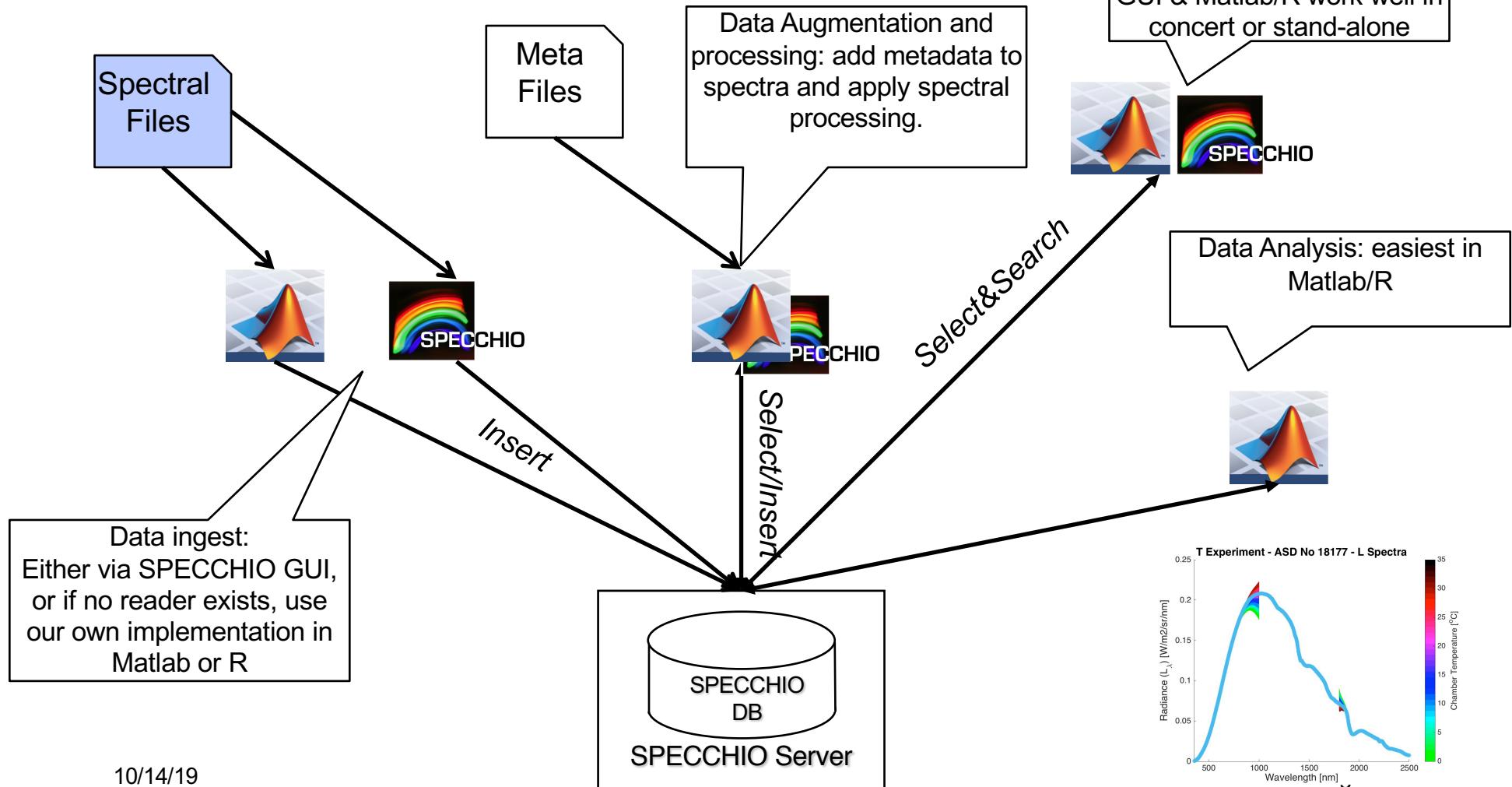
- Relational storage of spectral data and metadata
- Data sharing / Multiuser / Research Groups
- Open source/access components

## Spectroscopy Lifecycle Support





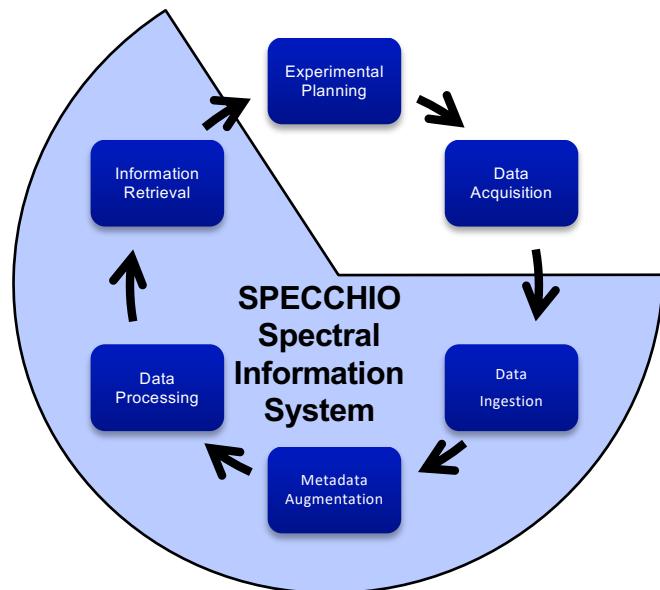
## Spend your research time analysing data instead of trying to find it on your file system.



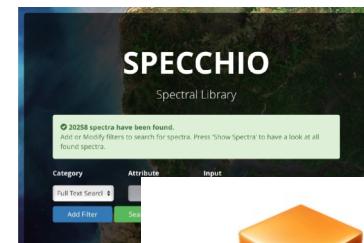


# Results

## Practical Use



## Installation/Availability



SPECCHIO-3.2.1.6-VM.ova



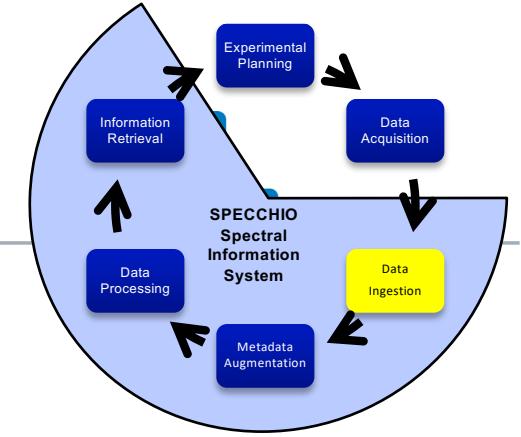
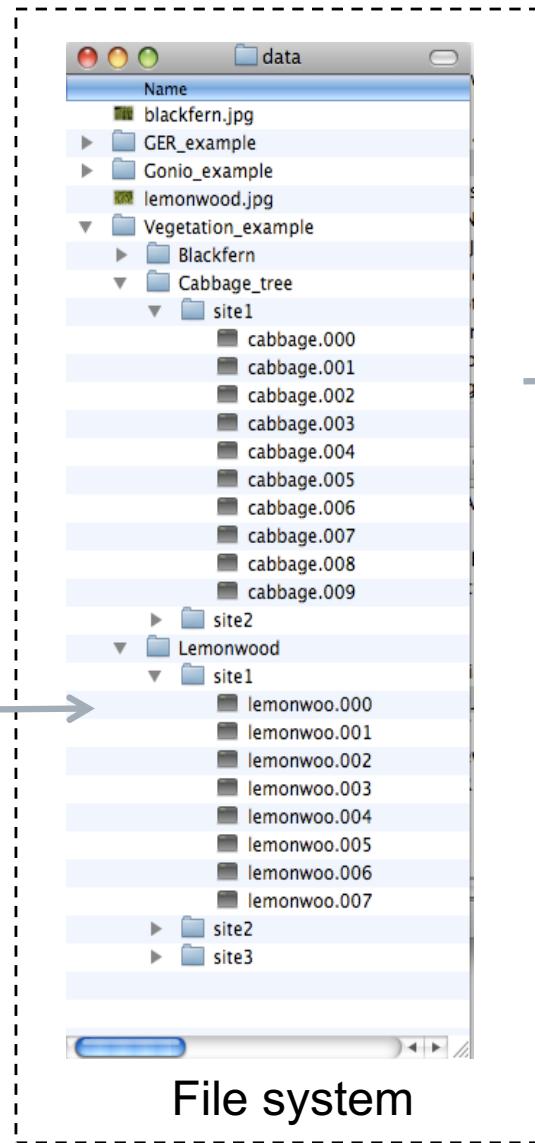
SPECCHIO



## Concepts - Data Input

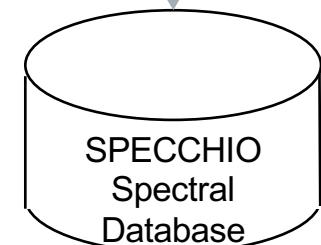


Spectral files  
&  
user defined structures



Intelligent  
data input  
process

Spectral data  
Automatically  
extracted  
metadata



SPECCHIO  
Spectral  
Database



# Metadata Augmentation

Metadata Editor V3

Campaign   Metadata

Altitude [m] 390.0  
Latitude [Degrees] 47.46471  
Longitude [Degrees] 8.31583  
Waypoint ID W6

Optics  
FOV [Degrees] 25

Pictures

Sampling Setup Picture

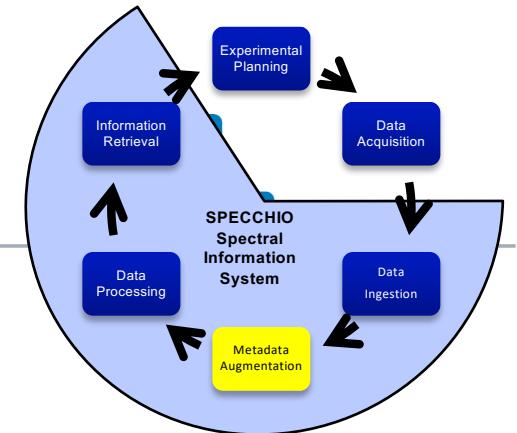
Target Picture

- Associated Campaigns
- Campaign Details
- Data Links
- Data Portal
- Environmental Conditions
- General
- Generic Target Properties
- Geochemistry
- Illumination
- Instrument
- Instrument Settings
- Instrumentation
- Keywords
- Location
- Names
- Optics
- PDFs
- Personnel
- Pictures
- Processing
- Sampling Geometry
- Sampling Scheme
- Scientific References
- Soil Parameters
- Vegetation Biophysical Variables

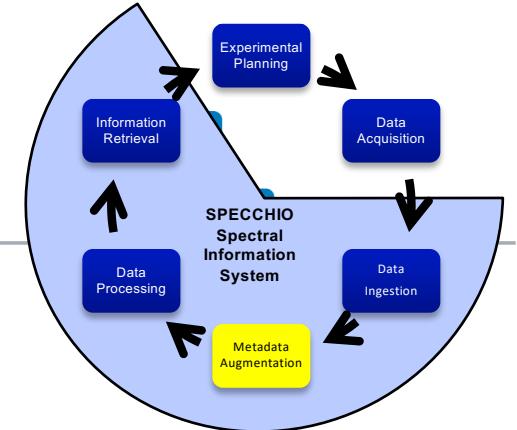
Select All

Select None

App. Domain: ---



- Group updates
- Conflict detection
- Application domain categories
- Automatic inserts:
  - Altitude
  - Measurement support
  - Solar angles
  - Goniometer Angles



## Metadata Augmentation from XLS

- Auto-matching to existing metadata in DB

Metadata Augmentation from Tabular Data

Order by: Sampling Date

REJECT

REGEX start   
REGEX end   
REGEX example: 15A.\*

Element - Column Auto-Matching

Matching File: Mappings of columns for Lolas Leafs.xls

Apply Auto-Matching

Assignment Details

Number of assignable columns: 12  
Number of assigned columns: 6

Matching Details

Number of spectra: 32  
Number of matches: 24

Spectrum ...	DB Value	Table Value
248	15A.001	15A
249	15A.002	15A
250	15A.003	15A
251	15A.004	15A
252	15B.001	15B
253	15B.002	15B
254	15B.003	15B
255	15B.004	15B
256	3A.001	3A
257	3A.002	3A
258	3A.003	3A
259	3A.004	3A
260	3B.001	
261	3B.002	
262	3B.003	
263	3B.004	

Matching & Element Assignment Control

Matching Column: NIL

General: Associated Campaigns

File Name: NIL

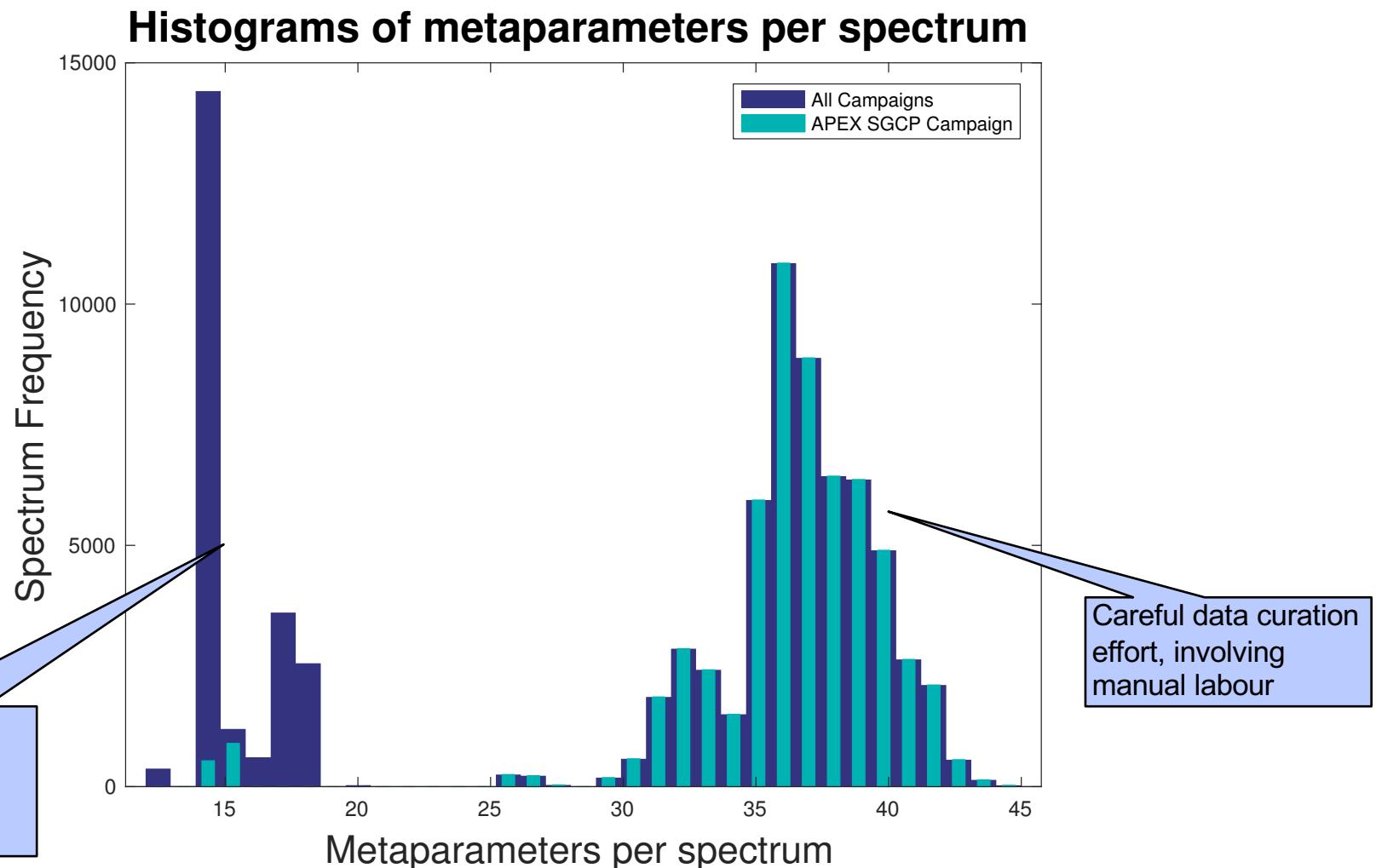
tree	spp	Neoxanthin
15A	peach	7.908
15B	peach	9.97
3A	peach	9.868
5A	peach	9.415
5B	peach	7.596
8B	peach	8.134

Refresh

Insert Selected Metadata

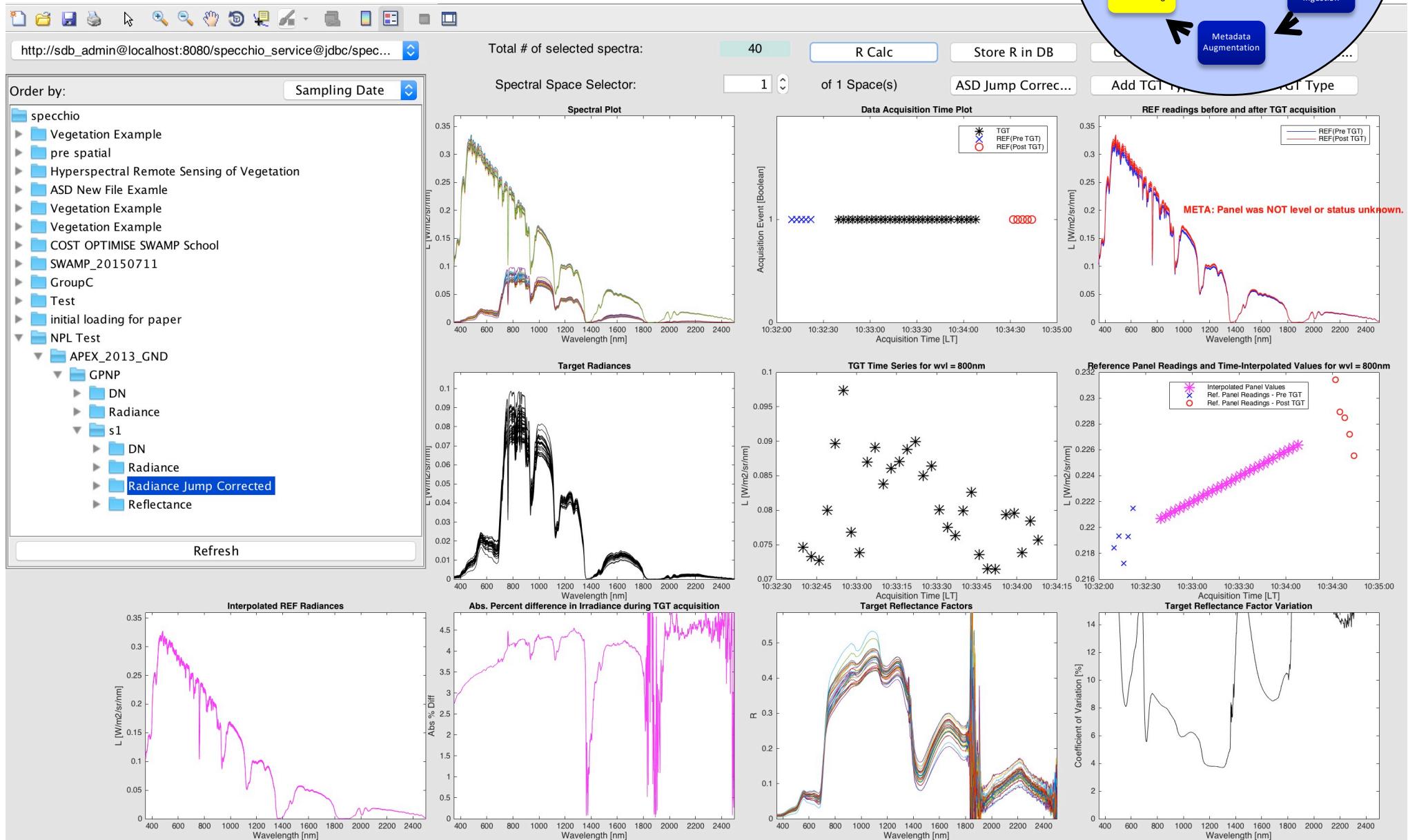


## Even with Automation, Metadata Entry takes Time!



# Spectral Processing: Reflectance Calculation

Interactive processing: jump-corrected radiances to reflectance factors using linear irradiance estimation. Reflectance factors are inserted into the SPECCHIO database, linking with all previously entered metadata





# Data Selection

## Interactive Query Building

Query Builder (V3)

Query conditions

Dry Weight	-	-
EPS	-	-
Height	-	-
Leaf Area	-	-
Lutein	0.001	- 5
Neoxanthin	-	-
Specific Leaf Area	-	-
Violaxanthin	1	- 4
Water Content	-	-
Wet Weight	-	-

Run Query

Matching Spectra

280, 281, 282, 283, 310, 311, 312, 313, 305, 306, 307, 308, 296, 297, 298, 299, 359, 360, 361, 362, 383, 384, 385, 386

Number of results

24

Show report File export Spectral Plot

Process Refl.Calc Publish Collection

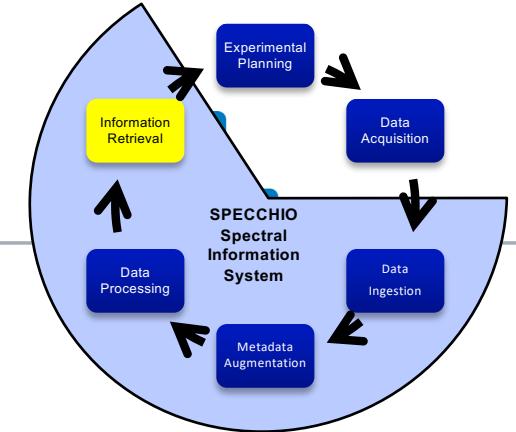
Splitting rules for file export and plotting:

Split spaces by sensor  
 Split spaces by sensor and unit  
 Split spaces by sensor, instrument, calibr\_no and unit

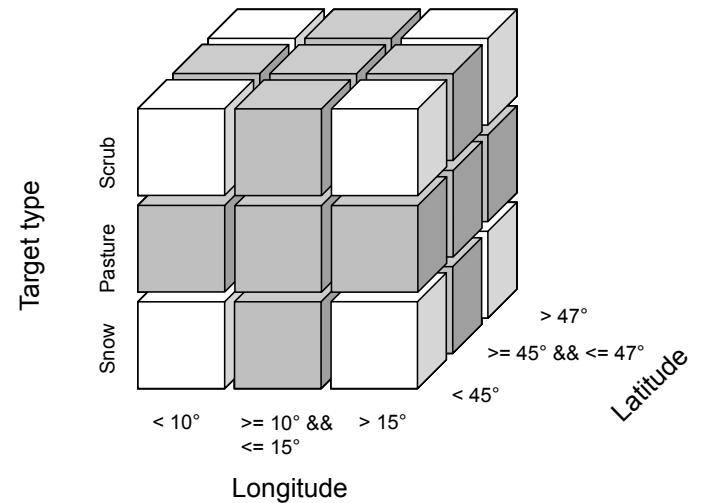
Autogenerated query code,  
for use in Matlab or R:

```
cond = EAVQueryConditionObject('eav', 'spectrum_x_eav', 'Lutein', 'double_val');
cond.setValue('0.001');
cond.setOperator('>=');
query.add_condition(cond);
```

```
cond = EAVQueryConditionObject('eav', 'spectrum_x_eav', 'Lutein', 'double_val');
cond.setValue('5.0');
cond.setOperator('<=');
```

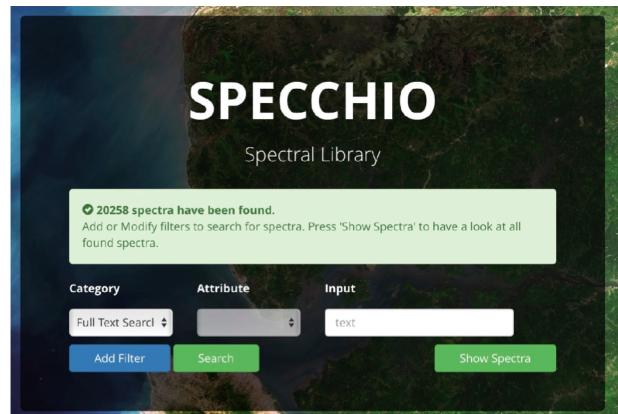


## Metadata space restrictions

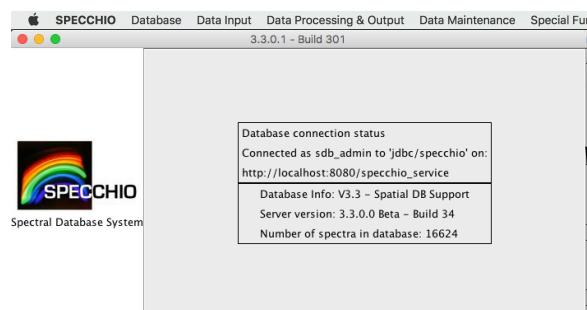
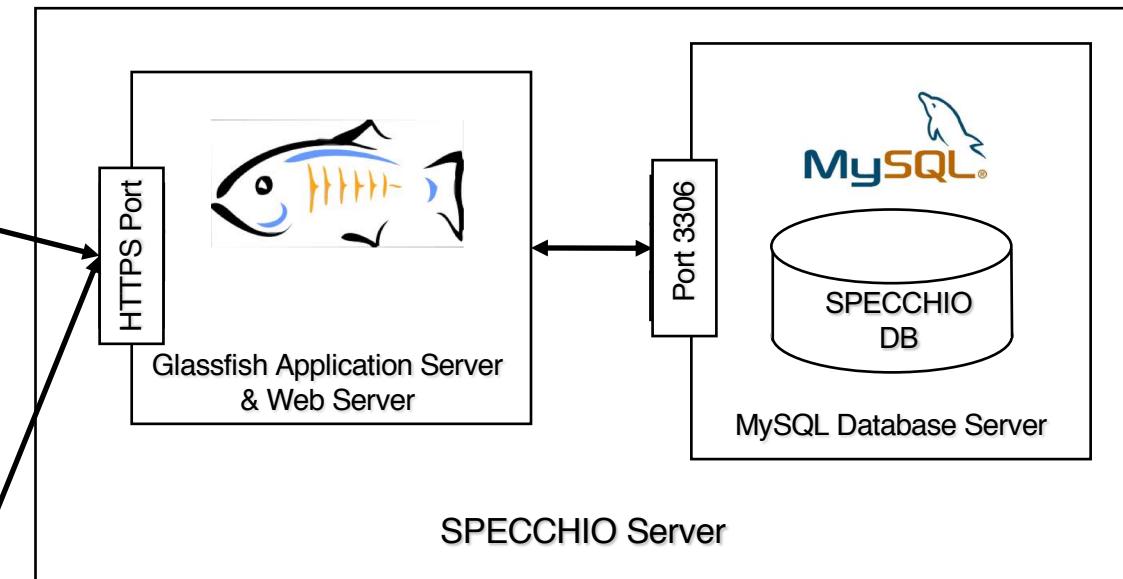




## Availability and Installation: Online System



Web Interface



Java Client

- Online multiuser DB for data sharing and testing of the system.
- OPTIMISE Training School data are available online



## Availability and Installation: Desktop Client

The screenshot shows the SPECCHIO desktop application interface. At the top, there's a menu bar with an Apple icon, followed by "SPECCHIO", "Database", "Data Input", "Data Processing & Output", "Data Maintenance", and "Special Fun". Below the menu is a toolbar with three colored circles (red, yellow, green). The main window title is "3.3.0.1 - Build 301". A central panel displays "Database connection status" with the message "Connected as sdb\_admin to 'jdbc/specchio' on: http://localhost:8080/specchio\_service". It also shows "Metadata Editor V3". On the left, a sidebar titled "Do conflict detection" lists sampling locations like "SG\_t1\_Grassland", "SG\_t2\_Grassland", etc., and categories such as "Reflectance" and "Radiance". The right side contains tabs for "Campaign" and "Metadata". Under "Campaign", it shows "Altitude [m] 390.0", "Latitude [Degrees] 47.46471", "Longitude [Degrees] 8.31583", and "Waypoint ID W6". Under "Metadata", there's a list of checked items including "Associated Campaigns", "Campaign Details", "Data Links", "Data Portal", "Environmental Conditions", "General", "Generic Target Properties", "Geochemistry", "Illumination", "Instrument", "Instrument Settings", "Instrumentation", "Keywords", "Location", "Names", "Optics", "PDFs", "Personnel", "Pictures", "Processing", "Sampling Geometry", "Sampling Scheme", "Scientific References", "Soil Parameters", and "Vegetation Biophysical Variables". Below these are sections for "Optics", "Pictures" (with a "Sampling Setup Picture" showing a person on a red clay tennis court), and "Target Picture" (a close-up of the court surface). At the bottom, there are buttons for "Select All" and "Select None", and a field for "App. Domain: ----".

Spectral Database System

10/14/19

- Java
- Runs on macOS, Linux, Windows, etc
- GUI
- Connection to any open access SPECCHIO database



SPECCHIO

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# Availability and Installation: SPECCHIO Virtual Machine

The screenshot displays three windows from a Mac OS X desktop environment:

- Finder:** Shows a folder structure for "SPECCHIO Software Update".
- Data Input & Output (Metadata Editor V3):** A window titled "3.2.1.6 - Build 243" showing a "Database connection status" panel and a "Metadata Editor V3" panel. The "Metadata Editor V3" panel contains fields for "Latitude [Degrees]" (-40.3848916666667) and "Longitude [Degrees]" (-175.621496666667), along with sections for "Names", "Optics", "PDFs", "Personnel", and "Pictures". It includes a "Target Picture" showing a close-up of a green leafy plant.
- Data Browser (V3):** A window titled "SPECCHIO-3.2.1-VM [Running]" showing a "Visualisations" tree view under "root". The tree includes "SPECCHIO Tutorial", "Vegetation\_example", "Blackfern", "Cabbage\_tree", and "Lemonwood". A "Matching Spectra" section lists numbers 1 through 17. Below it are buttons for "Show report", "File export", "Spectral Plot", "Process", "Rett.Calc", and "Publish Collection". A "Number of results" input field shows "17".
- SPECCHIO Web Interface - Mozilla Firefox:** A web browser window titled "SPECCHIO Web Interface - Mozilla Firefox" showing the "SPECCHIO Web Interface". The interface features a search bar with "blackfern" entered, a "Category" dropdown set to "Full Text Search", and a "Search" button. A message indicates "34 spectra have been found." Below the search area is a "Spectral Plot (Space no 0)" showing multiple colored lines representing spectral reflectance across a wavelength range from approximately 0.4 to 2.6 micrometers.

The desktop bar at the bottom shows the following open applications: SPECCHIO Web Int... (active), 3.2.1.6 - Build 243, Metadata Editor V3, Data Browser (V3), and Spectral Line Plot (Sp...).



# Availability and Installation: Open Source

All SPECCHIO code (client and server) is open source and can be found on GitHub:  
<https://github.com/SPECCHIODB/SPECCHIO>

SPECCHIO Spectral Information System <http://www.specchio.ch>

Add topics

Branch: SPECCHIO\_Master ▾ New pull request

Create new file Upload files Find file Clone or download ▾

File	Description	Time Ago
conf	Bug fixes in schema for MySQL 5.7	14 days ago
doc	V3.2.1.6	13 days ago
pkg	Bug fix for a metadata insert issue (e.g. in UTC computation)	2 days ago
src	Moving away from Campaign Factory abstraction.	7 days ago
web	Fixed the file sizes on the web page.	3 years ago
LICENCE.html	Added licensing information.	4 years ago
README	Add link to DC10 Project GitHub page.	2 years ago



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# Thank you for your attention!

For more information on the current version of SPECCHIO see: [www.specchio.ch](http://www.specchio.ch)

[https://twitter.com/SPECCHIO\\_DB](https://twitter.com/SPECCHIO_DB) 



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## SPECCHIO over Time – The only constant is change

2002		V0	RSL Internal	Bojinski, S., Schaepman, M., Schlaepfer, D. and Itten, K. (2002). "SPECCHIO: a Web-accessible database for the administration and storage of heterogeneous spectral data." <i>Photogrammetry and Remote Sensing</i> <b>57</b> : 204-211.
2006		V1	 Online DB	Hueni, A., Nieke, J., Schopfer, J., Kneubühler, M. and Itten, K. (2009). "The spectral database SPECCHIO for improved long term usability and data sharing." <i>Computers &amp; Geosciences</i> <b>35</b> (3): 557-565.
2009		V2	 Exchange More metadata	Hueni, A., Malthus, T., Kneubuehler, M., Schaepman, M., 2011. Data Exchange between distributed Spectral Databases. <i>Computers &amp; Geosciences</i> <b>37</b> , 861–873.
2012		V3	 Generic metadata	Hueni, A., Chisholm, L., Suarez, L., Ong, C. and Wyatt, M. (2012). Spectral Information System Development for Australia. <i>Geospatial Science Research Symposium</i> . Melbourne, Australia. <b>1328</b> : 1-11.
2015		V3.2	SPECCHIO Virtual Machine, SPECCHIO API public, Programming Courses	
2015		V3.2.1	Operational upgrades	Bertschi, S. and Hueni, A. (2017). Applied Spectral Databases - APEX Spectral Ground Control Point Handling. <i>10th EARSeL SIG Imaging Spectroscopy Workshop</i> . Zurich, CH.
2017		V3.3	Spatial database support	