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FLOX-ROX User Interface - Kickoff

2017, UZH

A. Hueni (UZH)

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Agenda

- Einführung Remote Sensing
- Einsatz von Spectral Ground Data für Luft und Weltraum-gestützte Sensor und Produkt Validation
- FLOX-ROX Intro
- Goals
- Development Approach
- Praktische Demonstration eines Spectrometers

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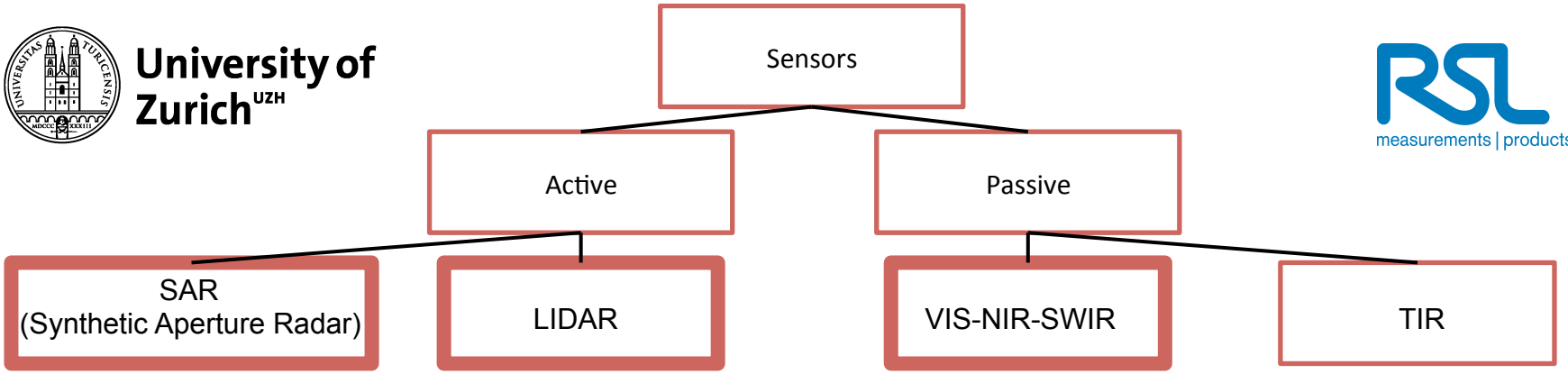
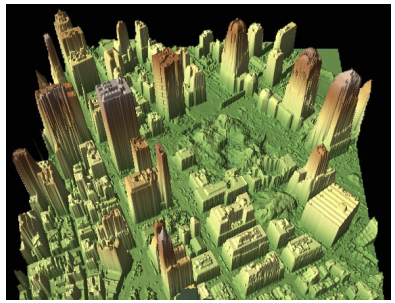


+ day & night & all weather
+ speed measurement possible
- processing difficult
- interpretation difficult
- only 1 layer (black/white)

The Pentagon
www.thespacereview.com/article/790/1

+ day & night
+ high precision
- weather dependent
- time intensive

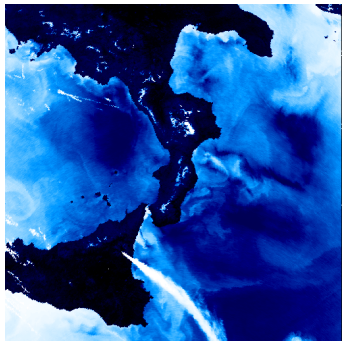


World Trade Centre: Ground zero
http://imaging.geocomm.com/gallery/wtc-lidar092701-overview.jpg

+ > 1 colour layer
+ easy interpretation
- weather dependent
- day only

www.globalsecurity.org/military/world/afghanistan/darunta.htm

+ > 1 colour layer
+ day & night
- temperature extraction difficult
- weather dependent



Mt Etna eruption
http://www.atsr.rl.ac.uk/images/sample/atsr-2/index.shtml

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Electromagnetic waves and the atmosphere

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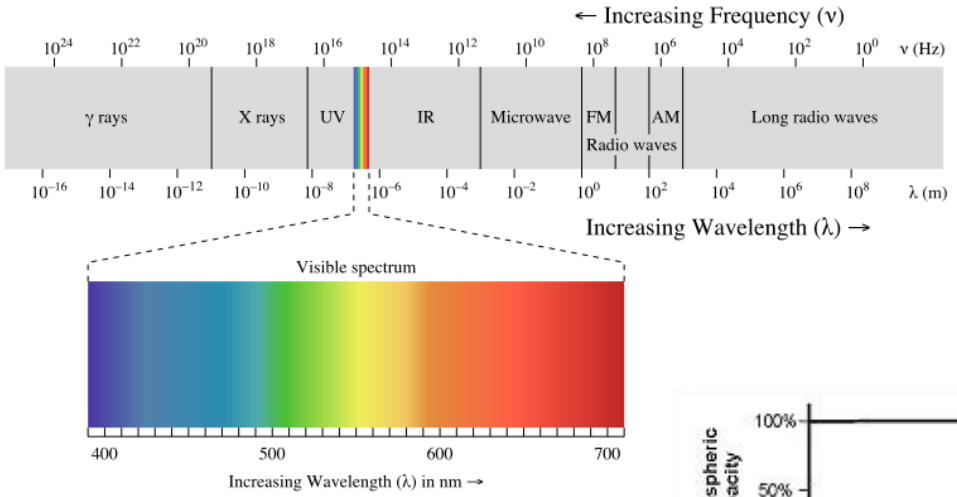

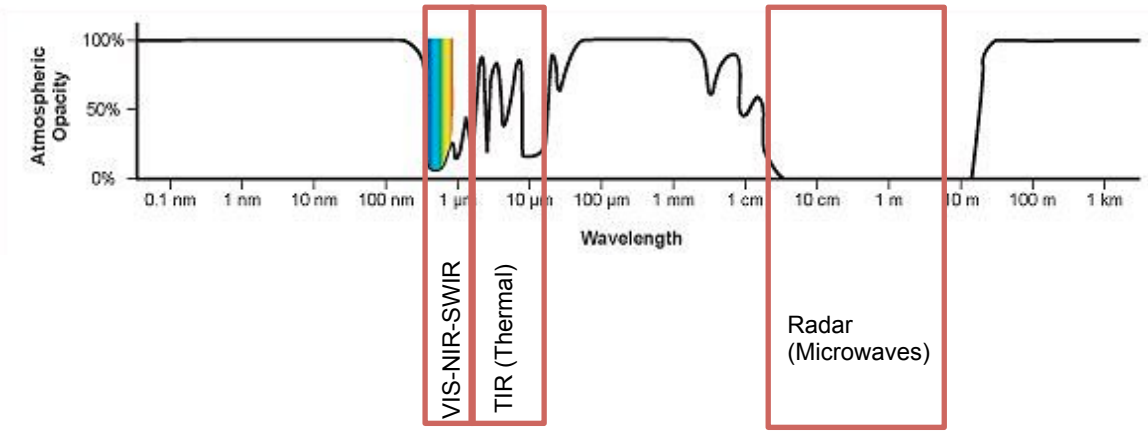

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Spectroradiometry

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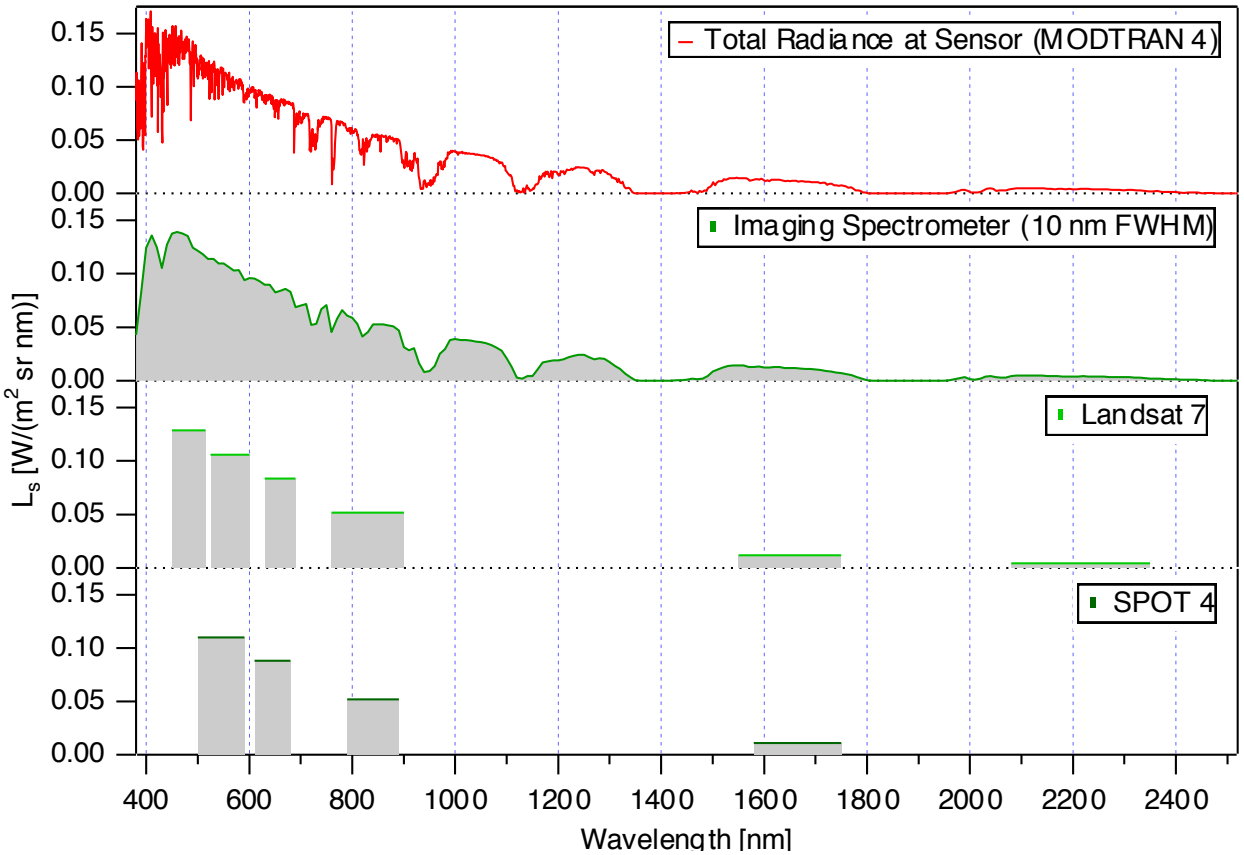

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Imaging Spectrometers

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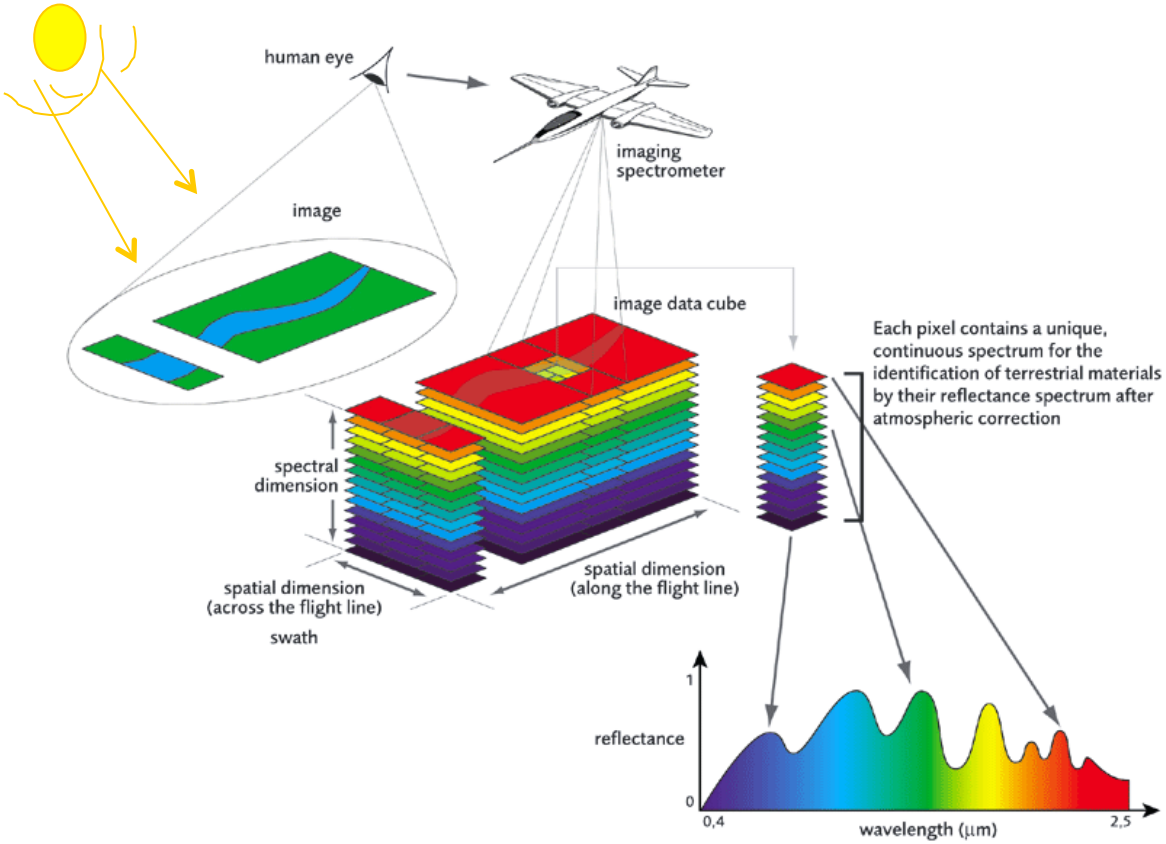
Visible Light:
400 – 700 nm

APEX:
380 – 2500 nm



Diffraction of light by prism

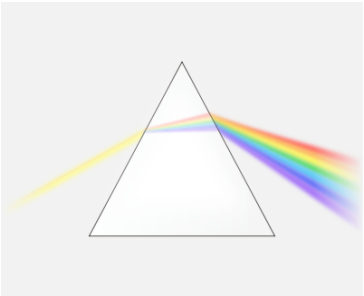


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Image Cube Example

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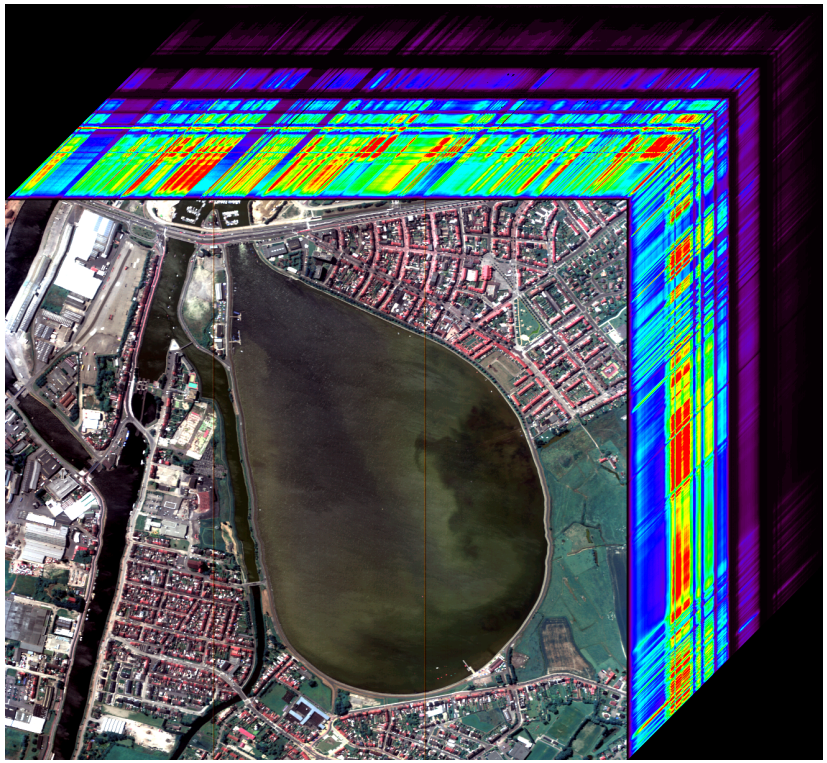

Image source: APEX Airborne Prism Experiment, 2009, Belgian Coast, processed by RSL, University of Zurich

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Spectral Analysis Basics

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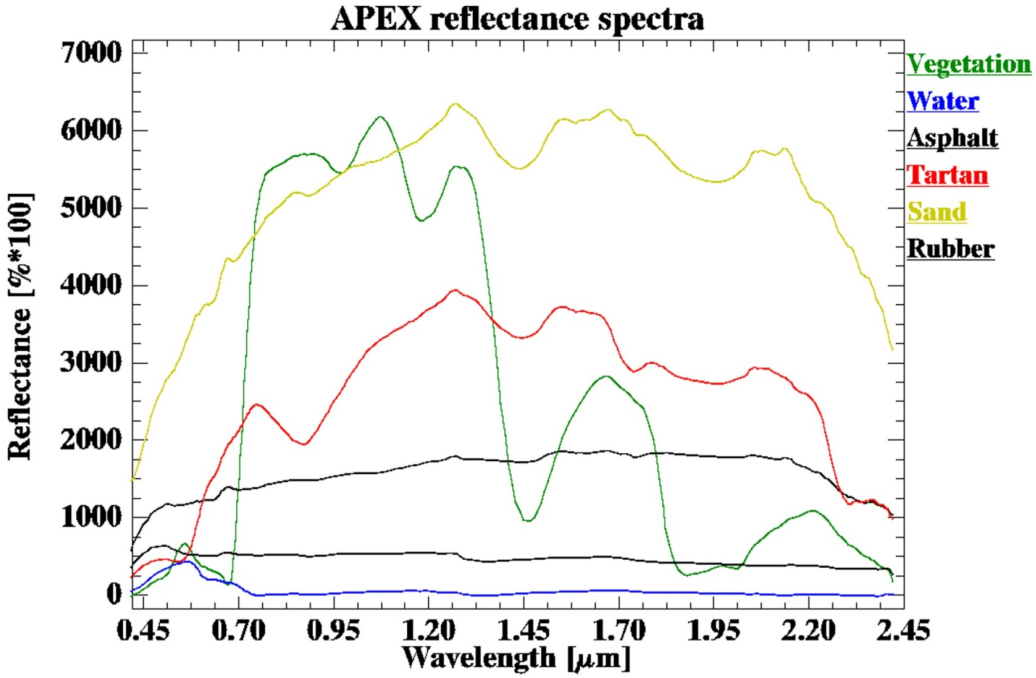

Assumption: Each material has a unique spectral signature, enabling its identification.

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Product Validation / Calibration

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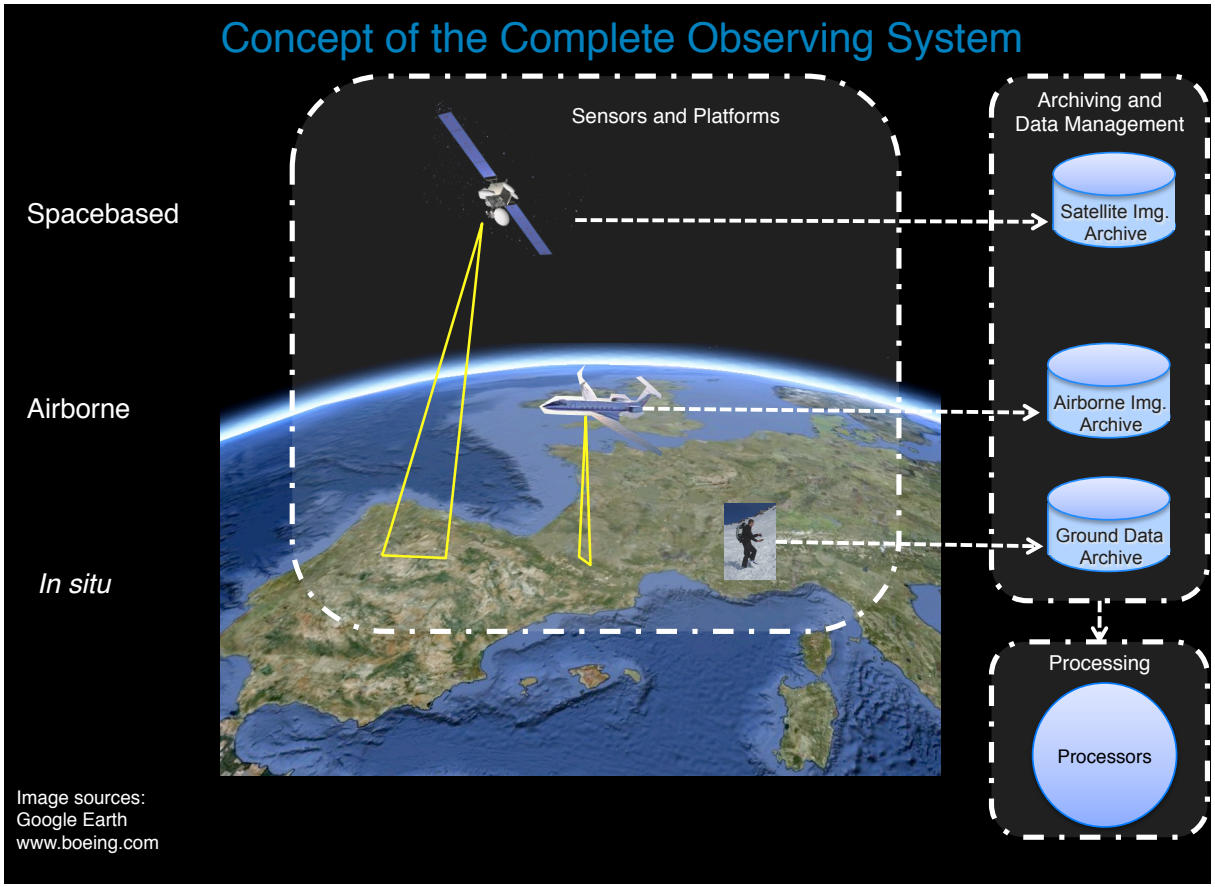

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Product Validation / Calibration

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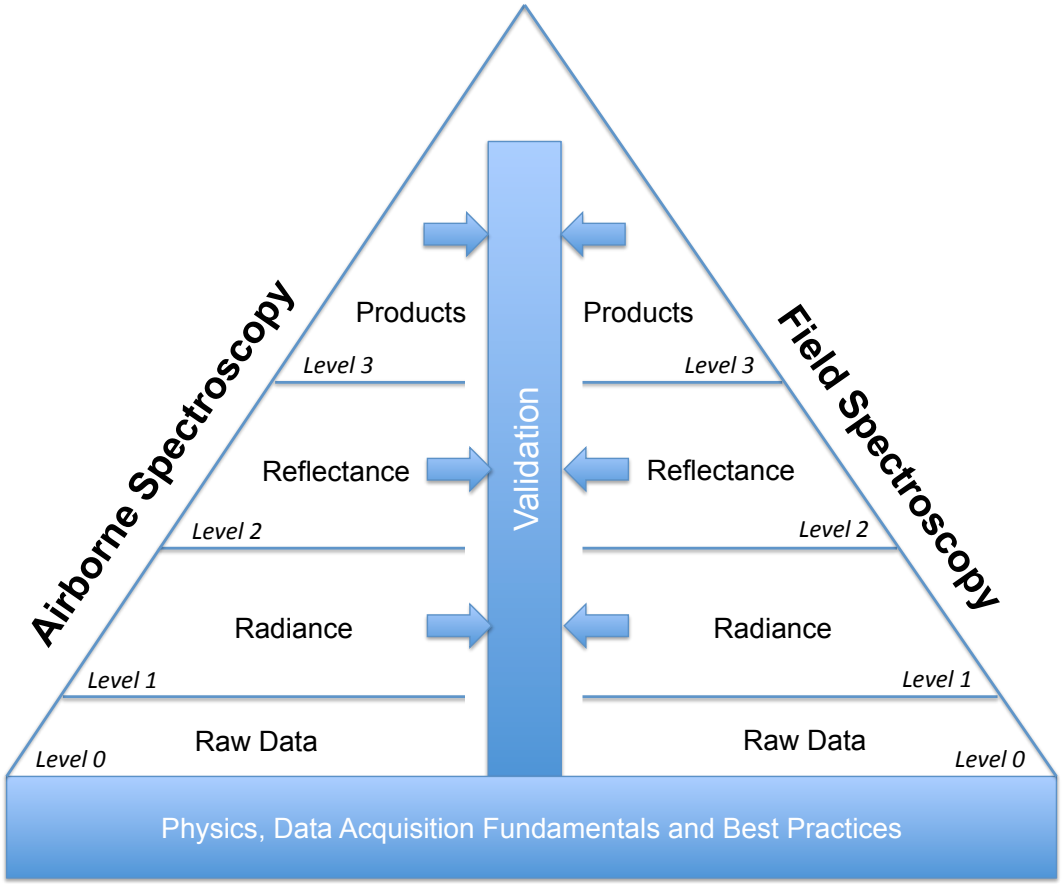

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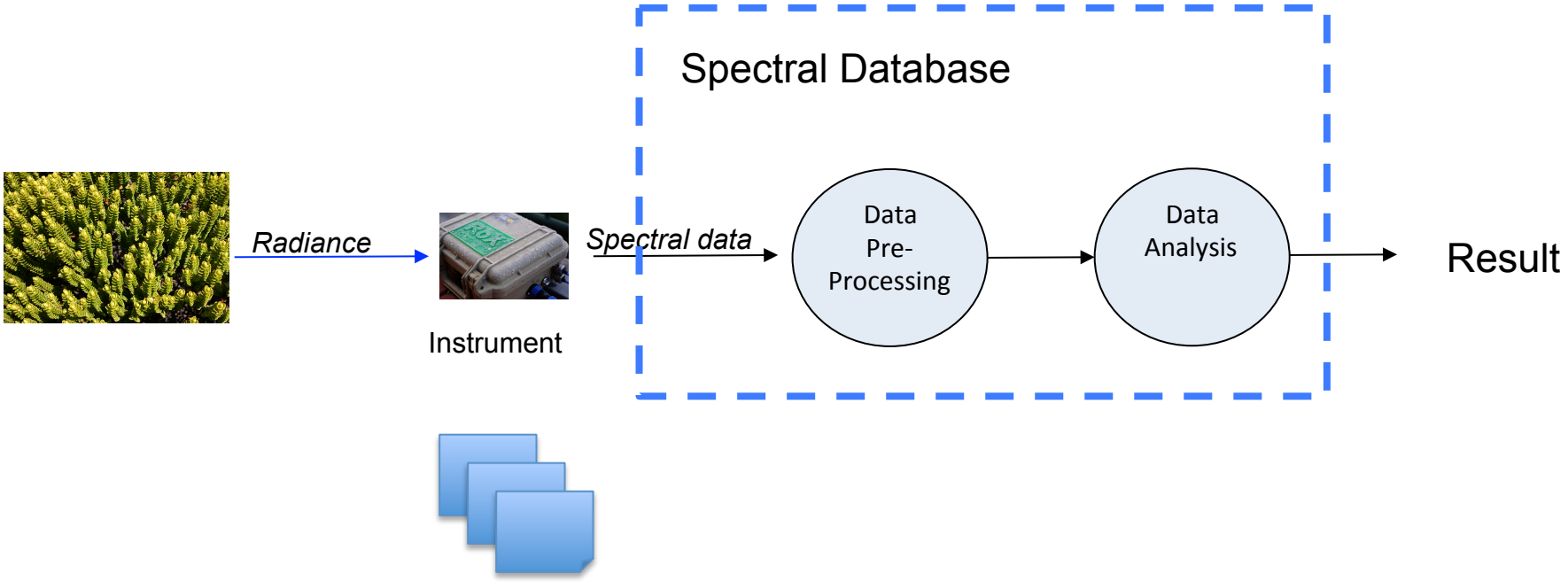
Data Flow Field Spectroscopy



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Field Spectroradiometer Demo

- Operating principles
- Collecting spectra
- Spectral data and metadata

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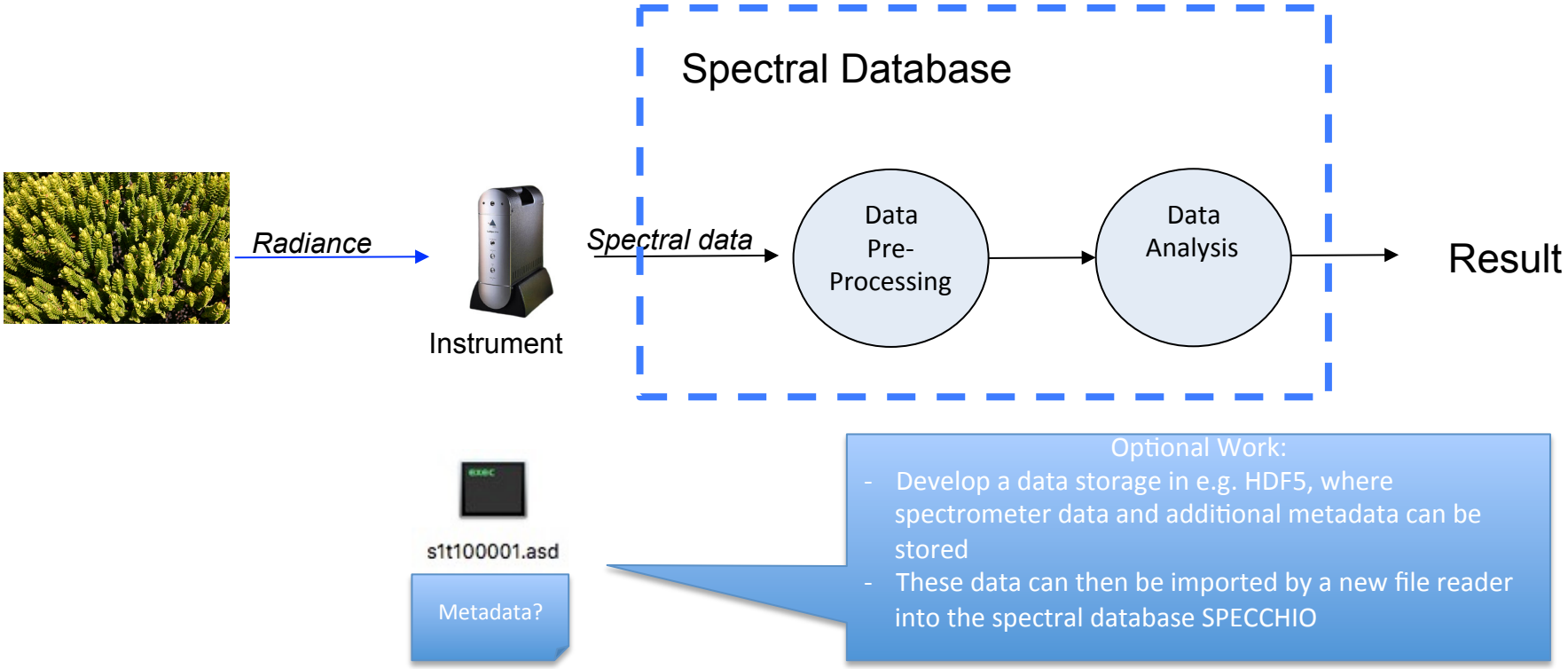
Data Flow Field Spectroscopy



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SPECCHIO Spectral Database

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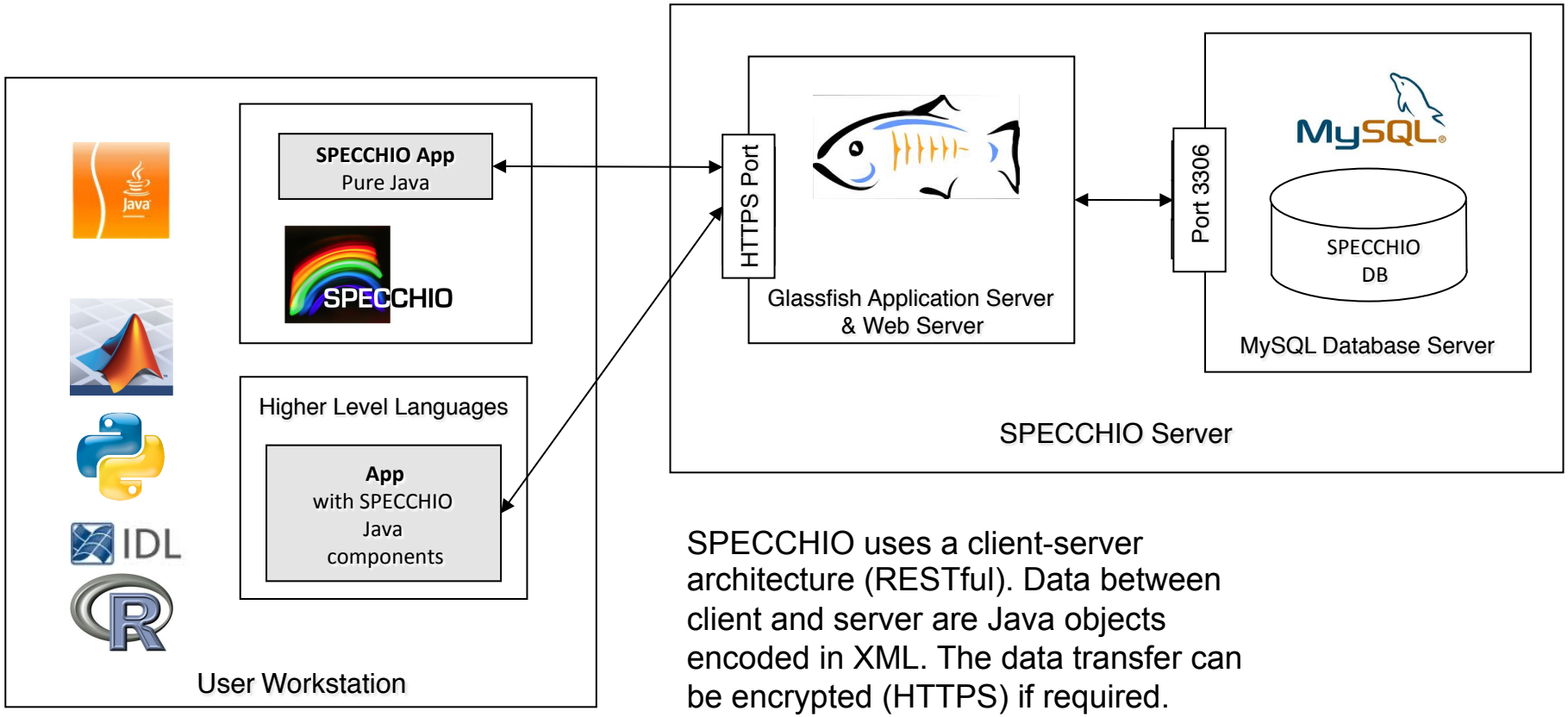

SPECCHIO uses a client-server architecture (RESTful). Data between client and server are Java objects encoded in XML. The data transfer can be encrypted (HTTPS) if required.

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RoX

Reflectance Box – System overview

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RoX instrument overview

Compact spectrometer for simple and automatic reflectance measurements, everywhere.

Based on the configurable FLAME spectrometer available in UV, VIS and NIR setup and various slit widths.

Upward and downward looking fibers for irradiance and reflectance measurements.

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System properties

- Small (Dimensions: 30 x 25 x 13 cm)
- Environment protected housing based on Pelicase
- Fully autonomous continous operation
- Automatic noise correction
- Low power consumption (10 W, 9-16 V)
- Years of data storage on SD card
- Day/Night switch for power saving

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Spectral characteristics

Typical VIS-NIR configuration

- 1024 pixels
- 400-1000 nm (other options possible)
- 3 nm FWHM (other options possible)
- 200 counts SNR (other options possible)

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Typical use scenarios

- Observation of canopy reflectance throughout the year
- Permanent measurements of water reflectance
- Characterization of spectral properties of snow

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Mobile use

- Irradiance/Radiance and Reflectance measurements with a tap of one button.
- Mounted on a boat
- Mounted on a car
- Mounted on a staff
- Optics stabilized to nadir using additional fiber gimbals
  - https://www.youtube.com/watch?v=4k2ofTJiOSM&t=4s

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Interfaces

On/Off button plus trigger button
Wired interface via USB (Virtual COM Port)
Wired interface via RS-232 (0 V – 3.3 V)
Wireless interface via Xbee up to 1km range

Optional interface via Xbee socket (Bluetooth, ZigBee)

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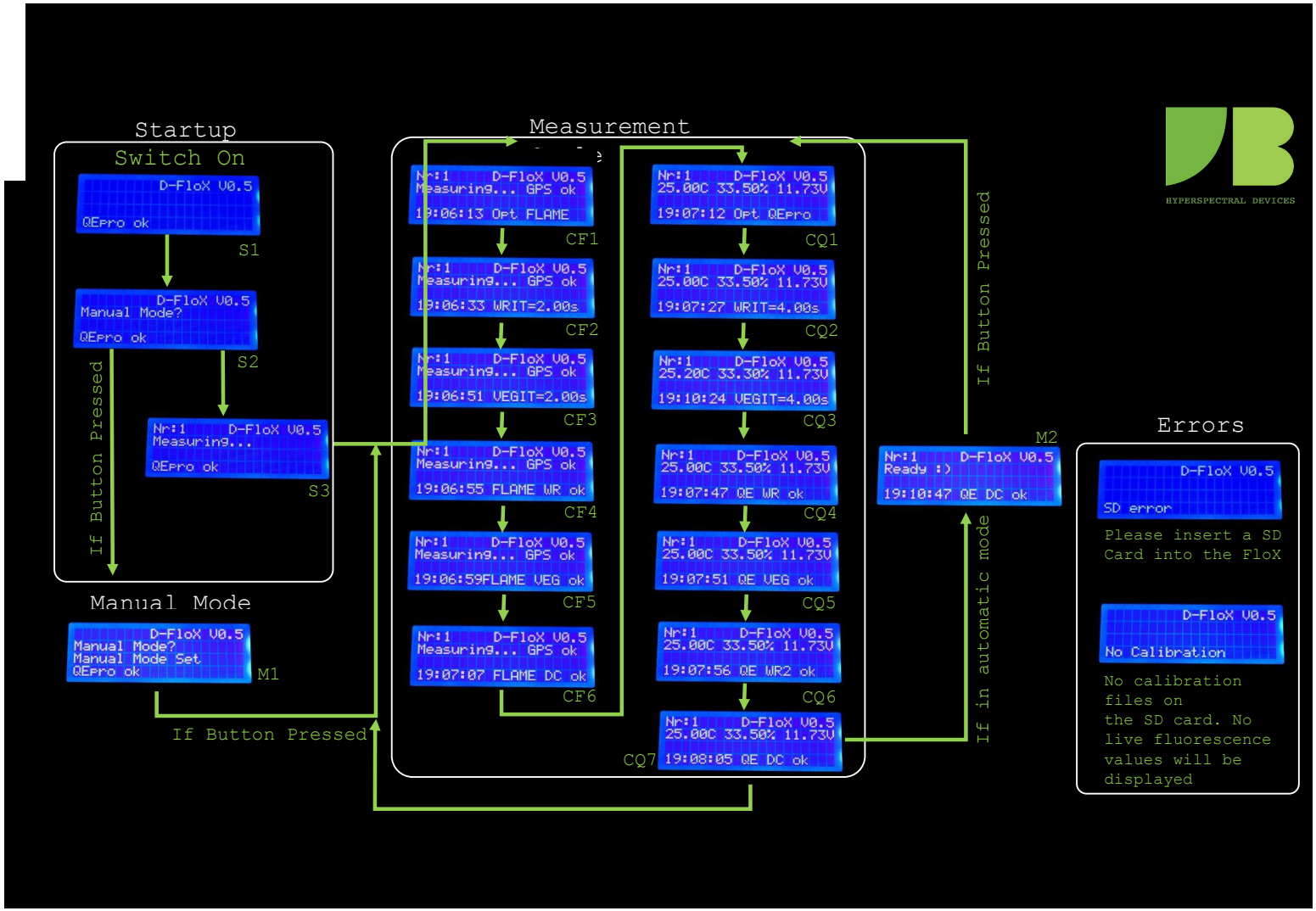
Protocol

Serial interface (TX/RX, 57600 Baud, NoParity)

ASCII command and reply

Operation


Startup
Switch On
D-FloX V0.5
QEpro ok
S1
D-FloX V0.5
Manual Mode?
QEpro ok
S2
If Button Pressed
Nr:1 D-FloX V0.5
Measuring...
QEpro ok
S3
Manual Mode
D-FloX V0.5
Manual Mode?
Manual Mode Set
QEpro ok
M1
If Button Pressed
Measurement
Nr:1 D-FloX V0.5
Measuring... GPS ok
19:06:13 Opt FLAME
CF1
Nr:1 D-FloX V0.5
Measuring... GPS ok
19:06:33 WRIT=2.00s
CF2
Nr:1 D-FloX V0.5
Measuring... GPS ok
19:06:51 VEGIT=2.00s
CF3
Nr:1 D-FloX V0.5
Measuring... GPS ok
19:06:55 FLAME WR ok
CF4
Nr:1 D-FloX V0.5
Measuring... GPS ok
19:06:59FLAME VEG ok
CF5
Nr:1 D-FloX V0.5
Measuring... GPS ok
19:07:07 FLAME DC ok
CF6
Nr:1 D-FloX V0.5
25.00C 33.50% 11.73V
19:07:12 Opt QEpro
CQ1
Nr:1 D-FloX V0.5
25.00C 33.50% 11.73V
19:07:27 WRIT=4.00s
CQ2
Nr:1 D-FloX V0.5
25.20C 33.30% 11.73V
19:10:24 VEGIT=4.00s
CQ3
Nr:1 D-FloX V0.5
25.00C 33.50% 11.73V
19:07:47 QE WR ok
CQ4
Nr:1 D-FloX V0.5
25.00C 33.50% 11.73V
19:07:51 QE VEG ok
CQ5
Nr:1 D-FloX V0.5
25.00C 33.50% 11.73V
19:07:56 QE WR2 ok
CQ6
Nr:1 D-FloX V0.5
25.00C 33.50% 11.73V
19:08:05 QE DC ok
CQ7
If Button Pressed
Nr:1 D-FloX V0.5
Ready :)
19:10:47 QE DC ok
M2
If in automatic mode
Errors
D-FloX V0.5
SD error
Please insert a SD Card into the FloX
D-FloX V0.5
No Calibration
No calibration files on the SD card. No live fluorescence values will be displayed
HYPERSPECTRAL DEVICES

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Graphical user interface

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Server data storage application

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Future developments

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Goals:

- Develop an application that provides a user interface for the FLOX/ROX system
- Ideally the app will work on mobile devices as well as on laptops -> Java?
- Wireless interface preferred
- App can display data stored on SD card of spectrometer
- App can show the status of the instrument (parameters and current data)
- App can save the raw files but also write them into a more generic format, e.g. HDF5 (these can then also be read into SPECCHIO at some point)

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Development Approach

- Learn the operating principle of a spectrometer and the resulting data and metadata (use the ASD spectrometer as example)
- Analyse how ASD and the FHNW software handles and displays the data
- Develop a concept for the FLOX/ROX (user interface and file format)
- Use available raw files to develop reading, display and file saving capability (available in the next few days …)
- Use actual test instrument to develop the interface (available in Sept)

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Questions