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APEX Sensor and Data Calibration, Flight operations and Higher Level Processing

BRUHYP 2012

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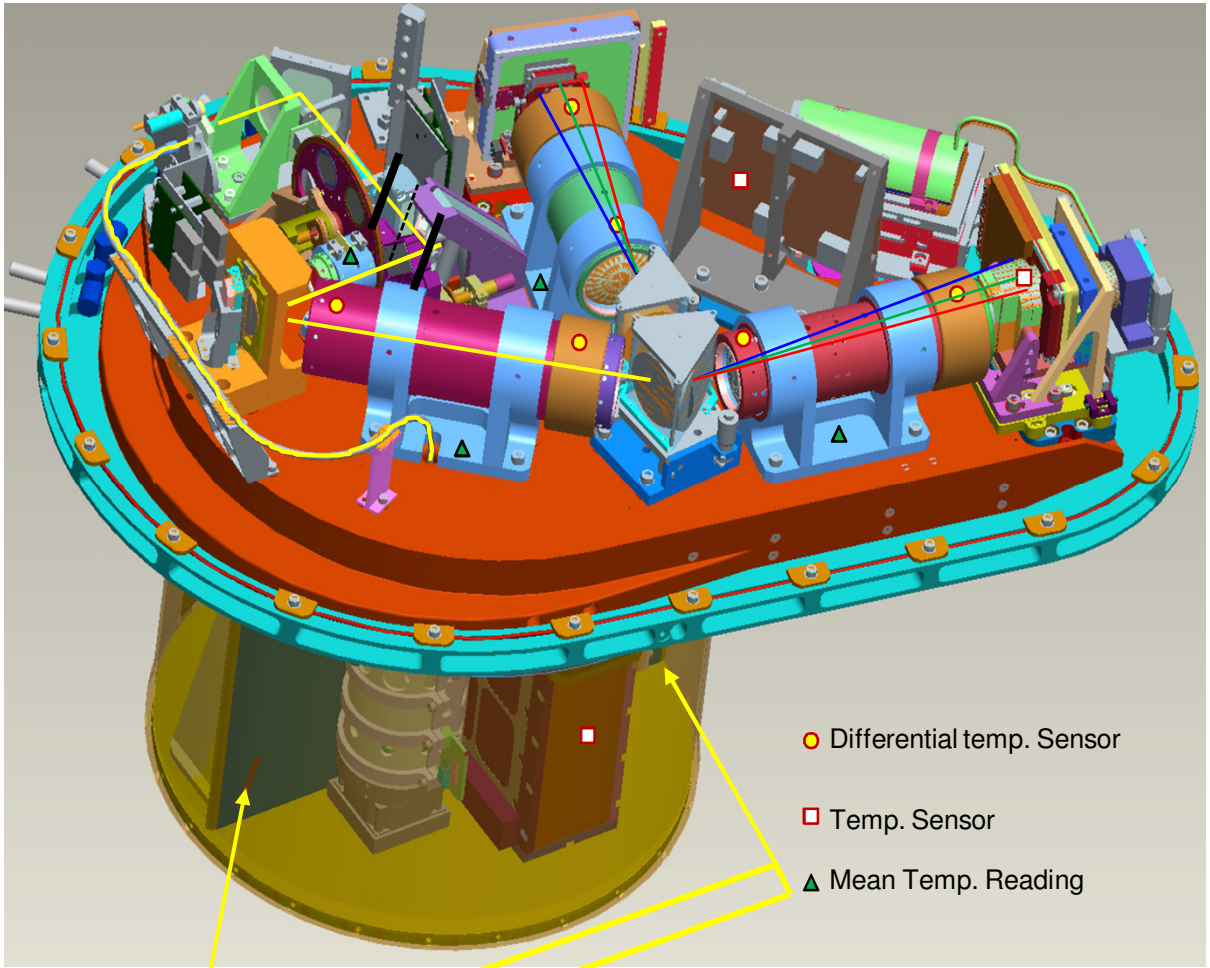
Content

- APEX System Overview & Calibration
- Data Calibration
- Known Issues

Optical Path during Image and IFC Aquisition



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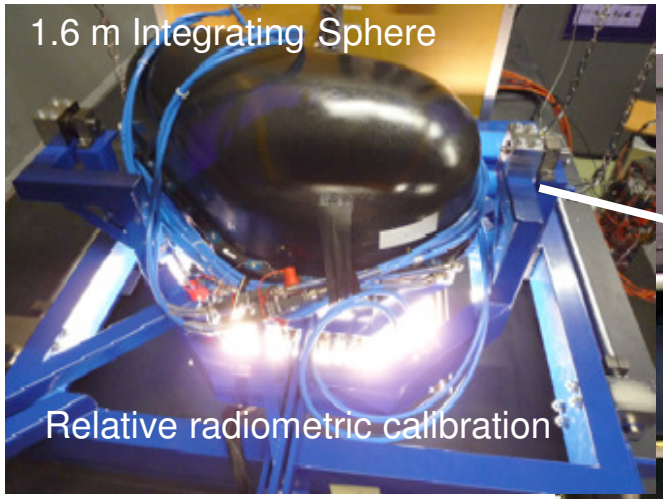
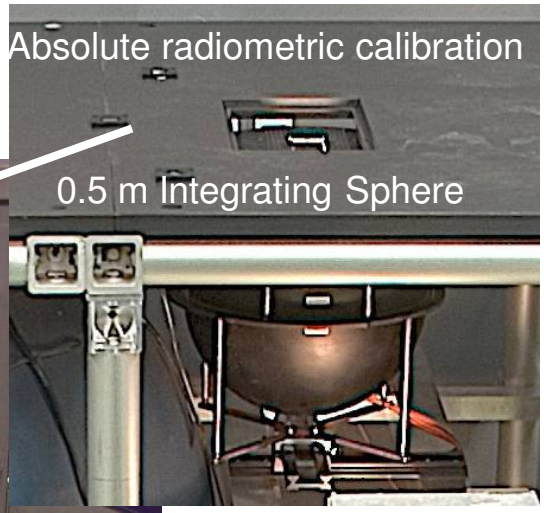
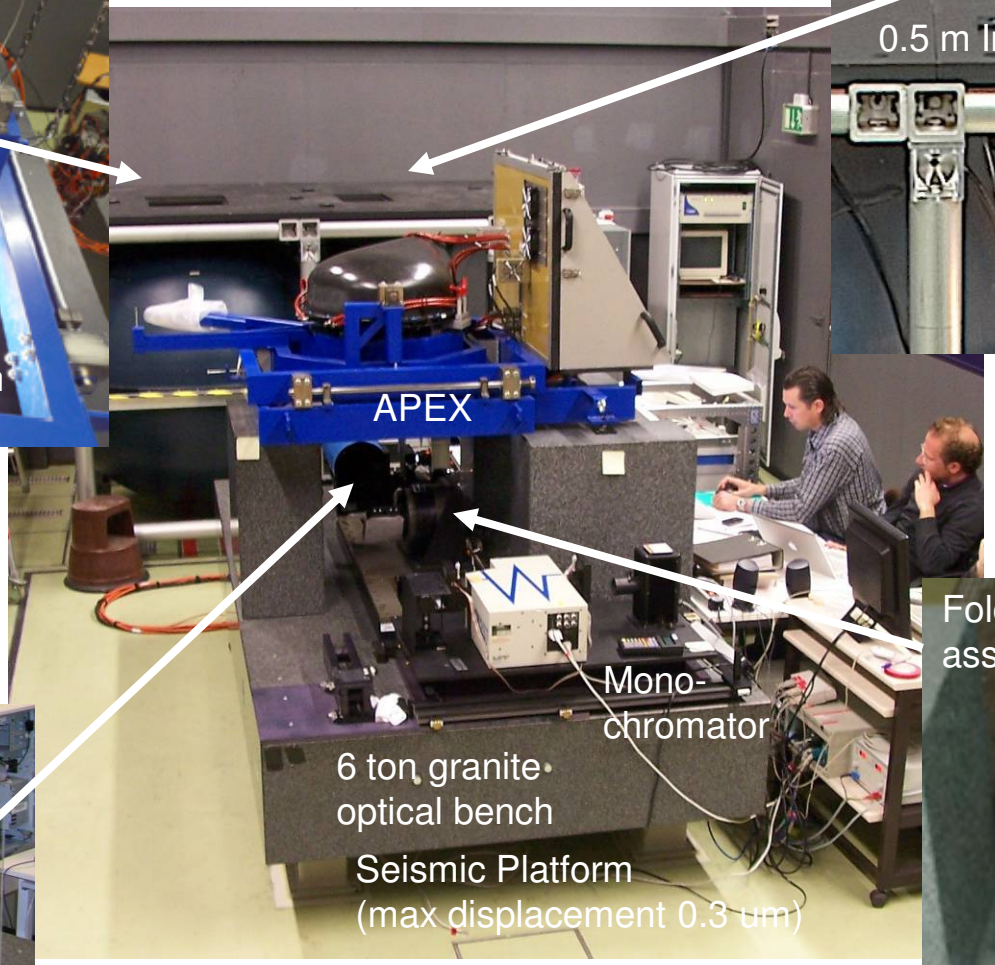
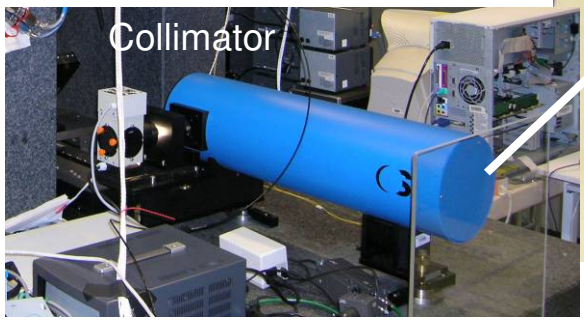
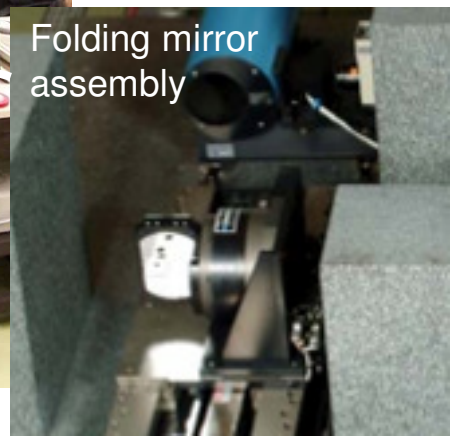
Calibration Home Base at DLR

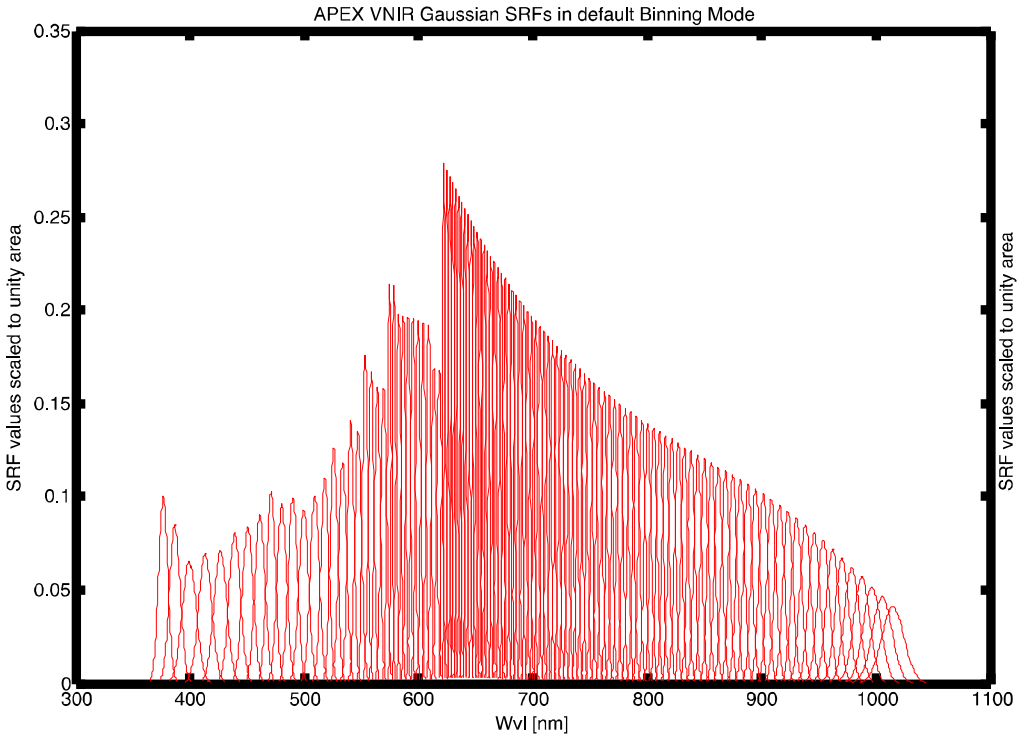


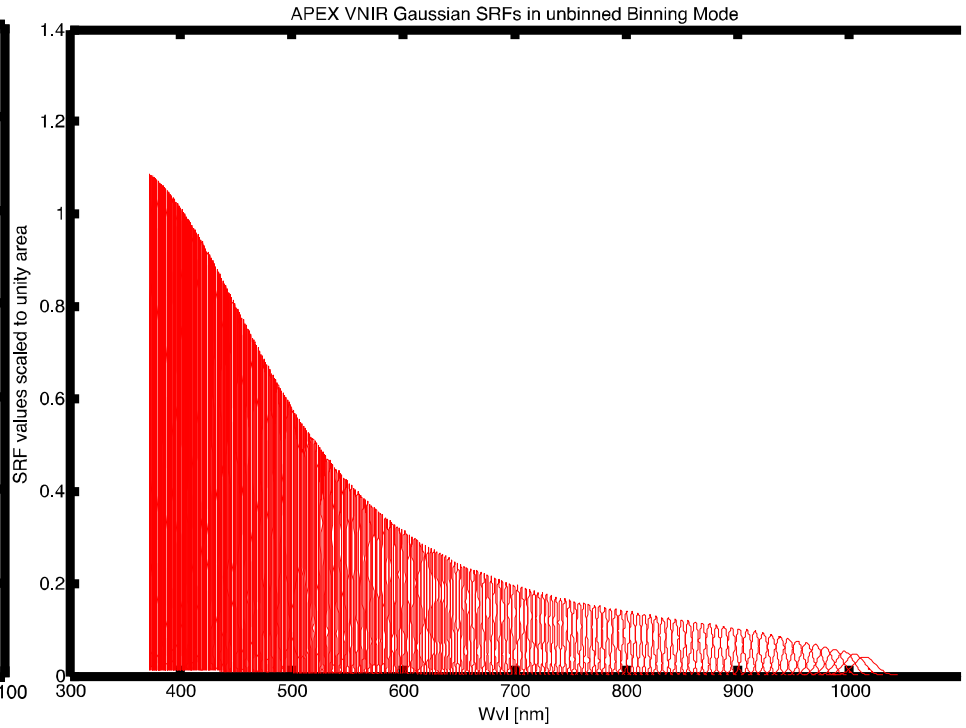




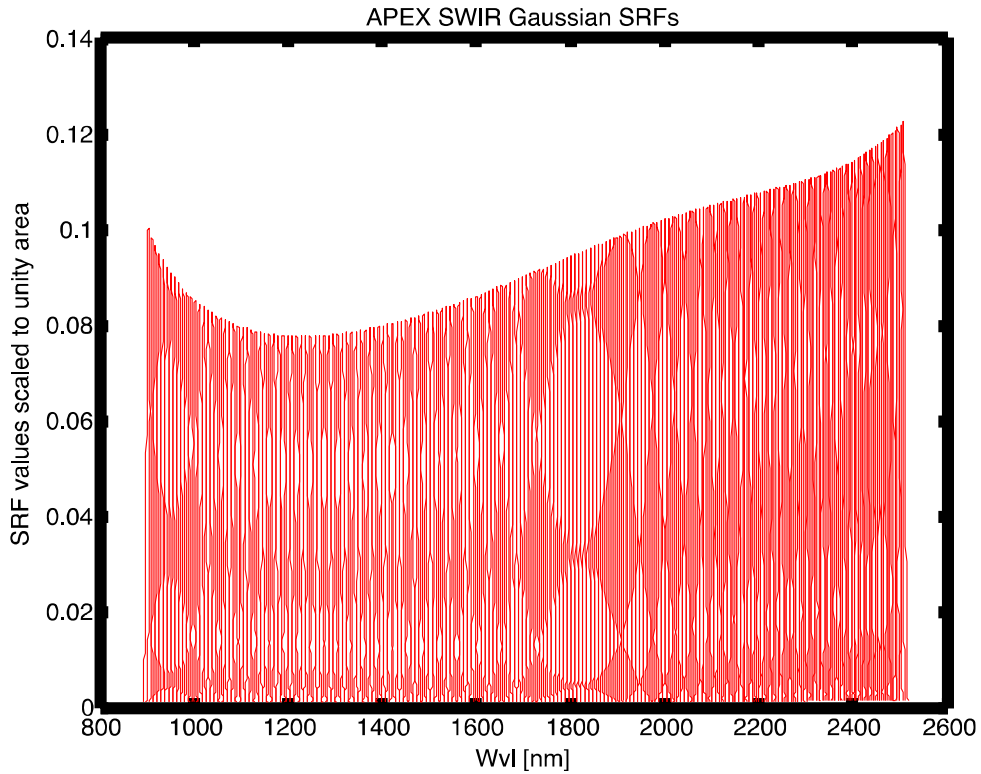




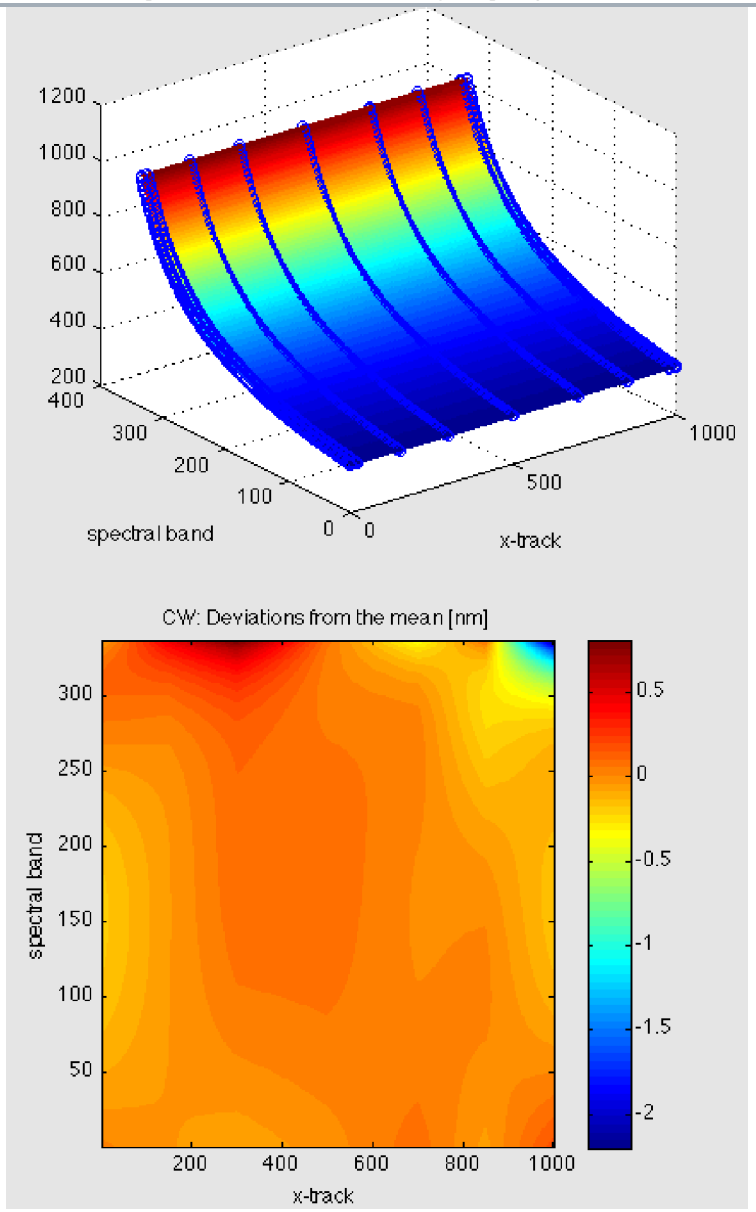


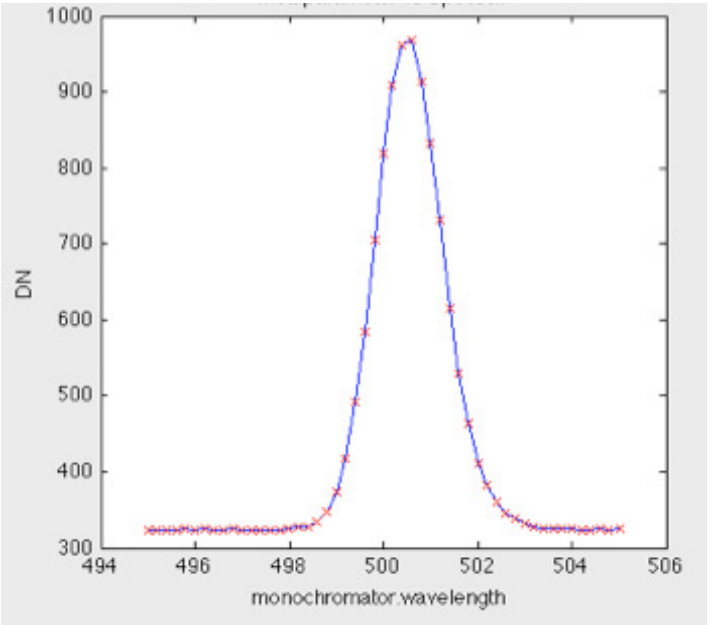


VNIR Properties (CCD, 14bit)	Default Binning	Unbinned
Spectral Range	375 – 1015nm	372 – 1015nm
Spectral Bands	115	335
SSI	2.5 – 14 nm	0.4 – 9 nm
FWHM	3 – 20 nm	0.9 – 20 nm



SWIR Properties (CMOS, 13bit)	
Spectral Range	902 – 2500 nm
Spectral Bands	198
SSI	5.8 – 9.7 nm
FWHM	7.7 – 12.1 nm

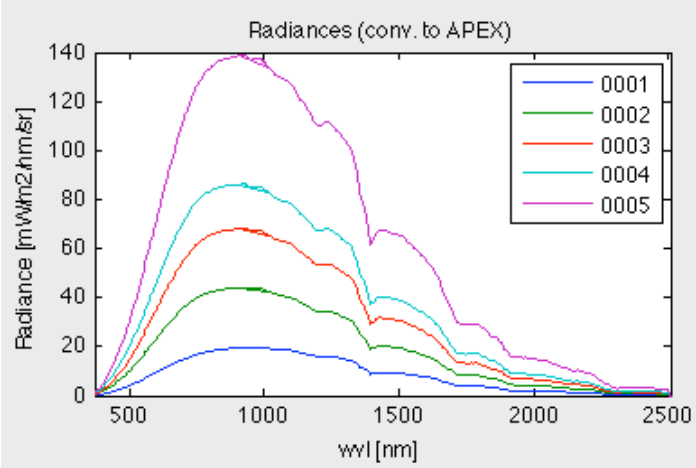


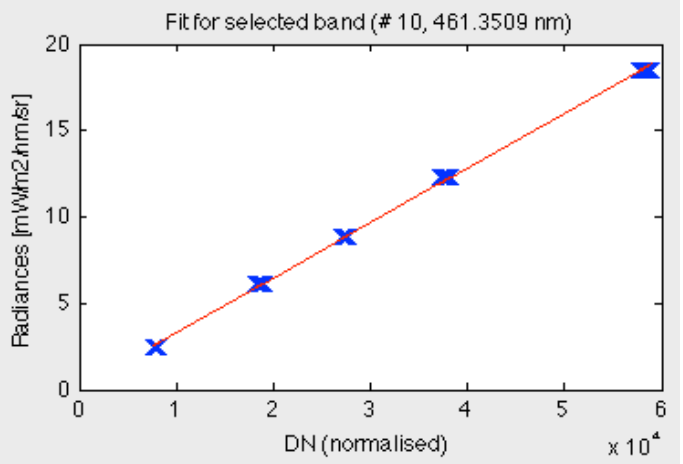


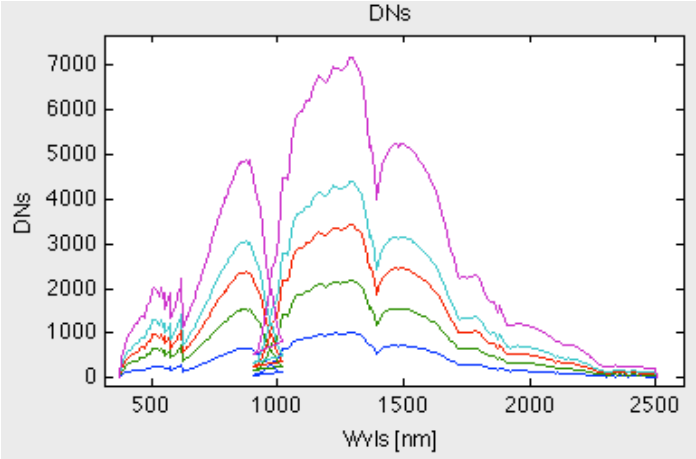
Centre Wavelength calibration of the VNIR: Inter/Extrapolation based on monochromator based SRF estimation.

Centre Wavelength deviation from the mean (VNIR): Inter/Extrapolation based on monochromator based SRF estimation.

Radiometric Calibration



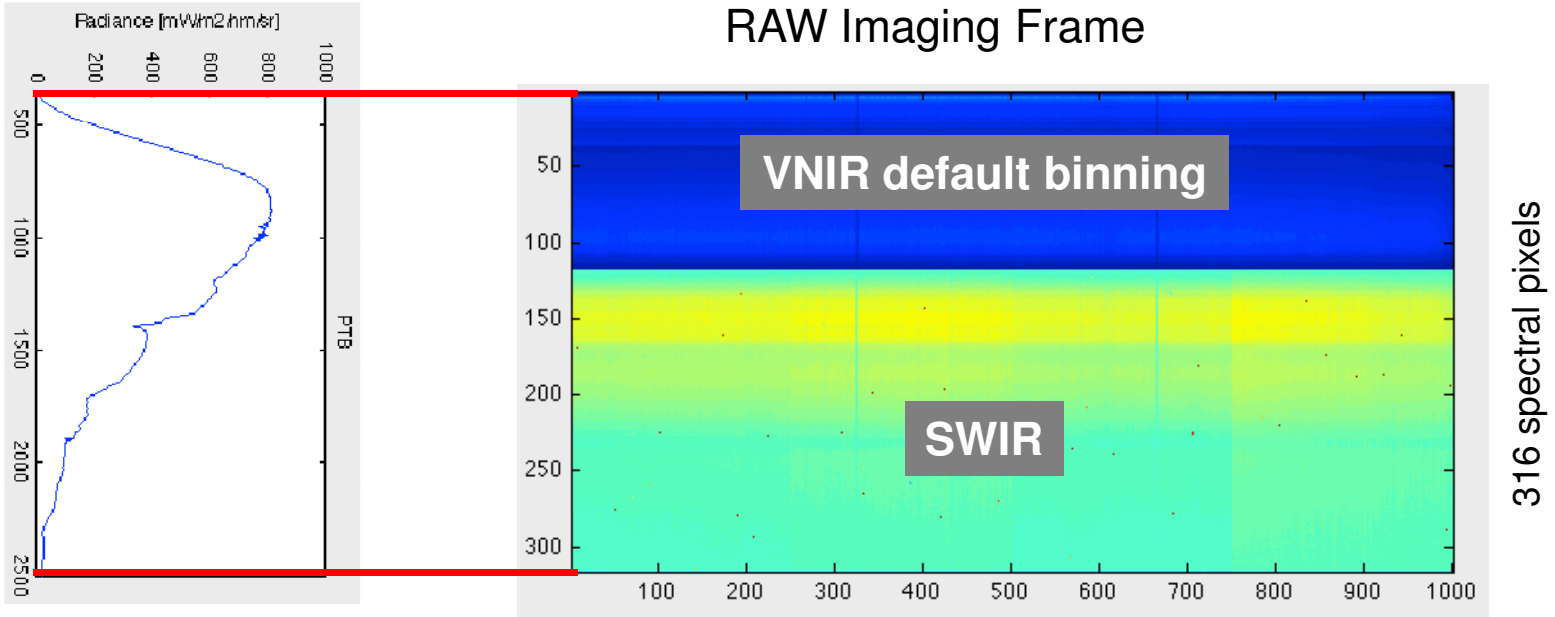




Radiometric calibration: linear fitting (gain+offset) of defined radiance levels versus observed DN's

APEX Instrument Performance

APEX Frame: Flat Fielding Example



VNIR/SWIR co-registration: < 0.5 pixels

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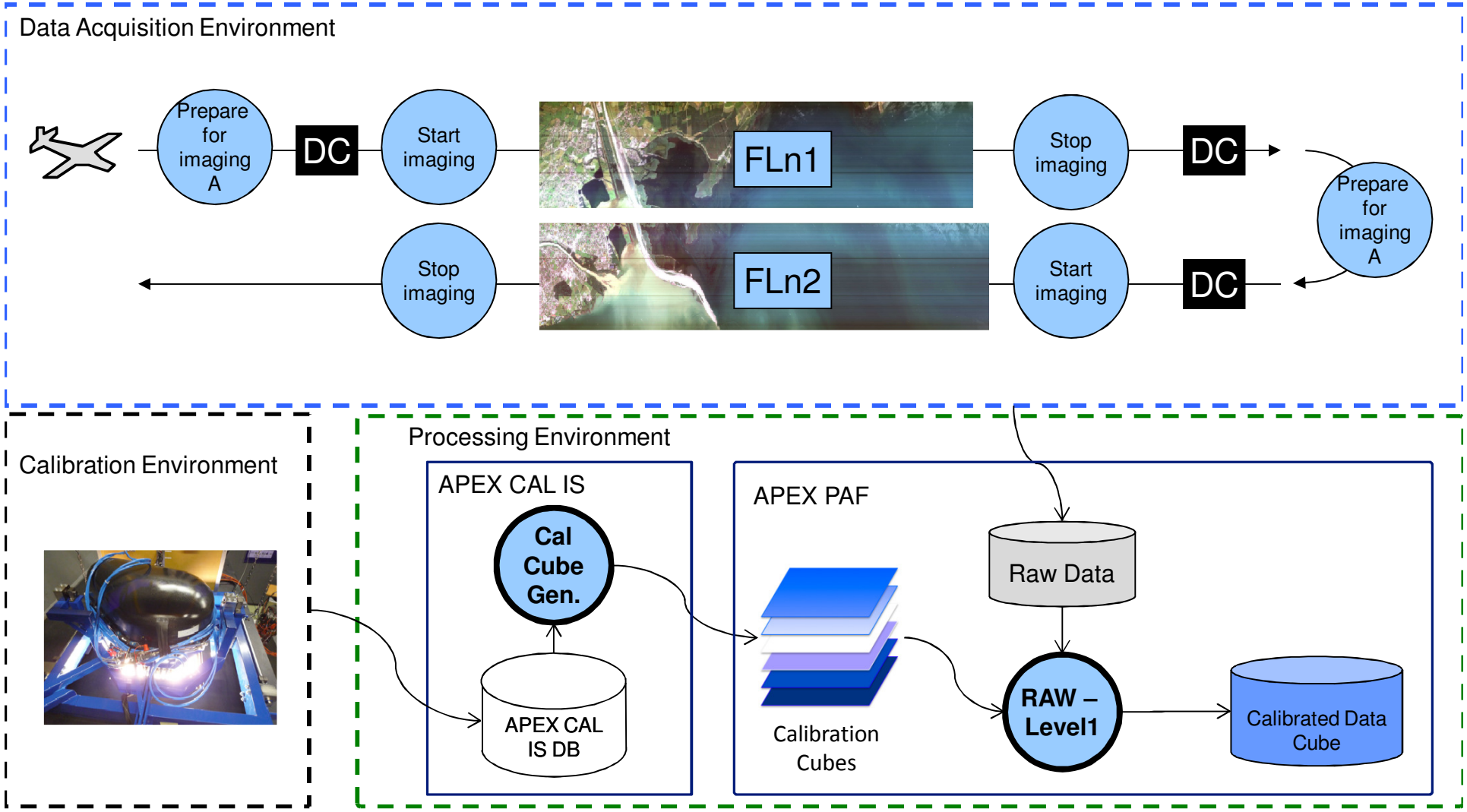
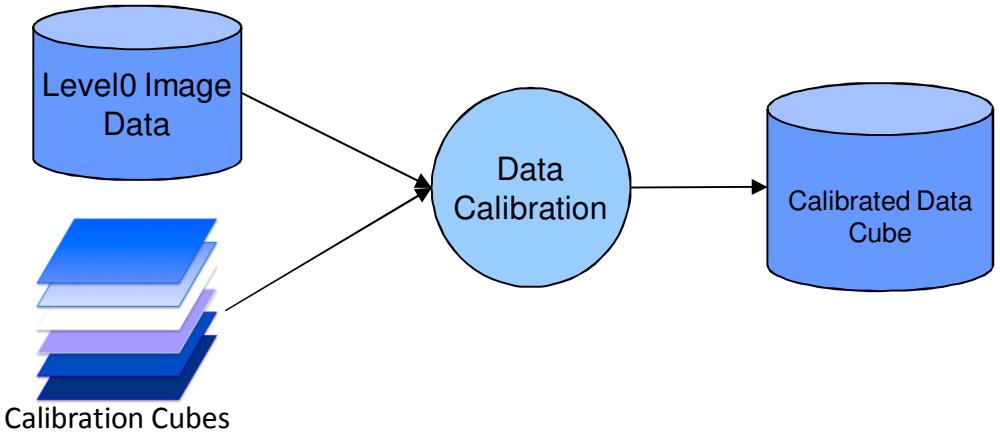
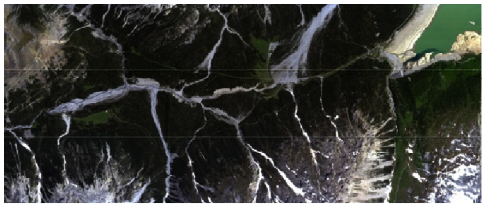
APEX Data Acquisition to Product Chain



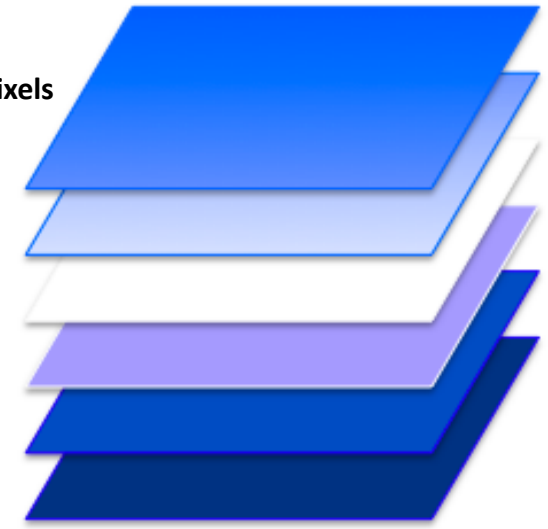
Level-0 to Level-1 Processing





Physical units [mW/m2/sr/nm]

Calibration Cube



Bad Pixels

Radiometric Gain

Radiometric Offset

Vignetting

Acrosstrack angles

FWHM

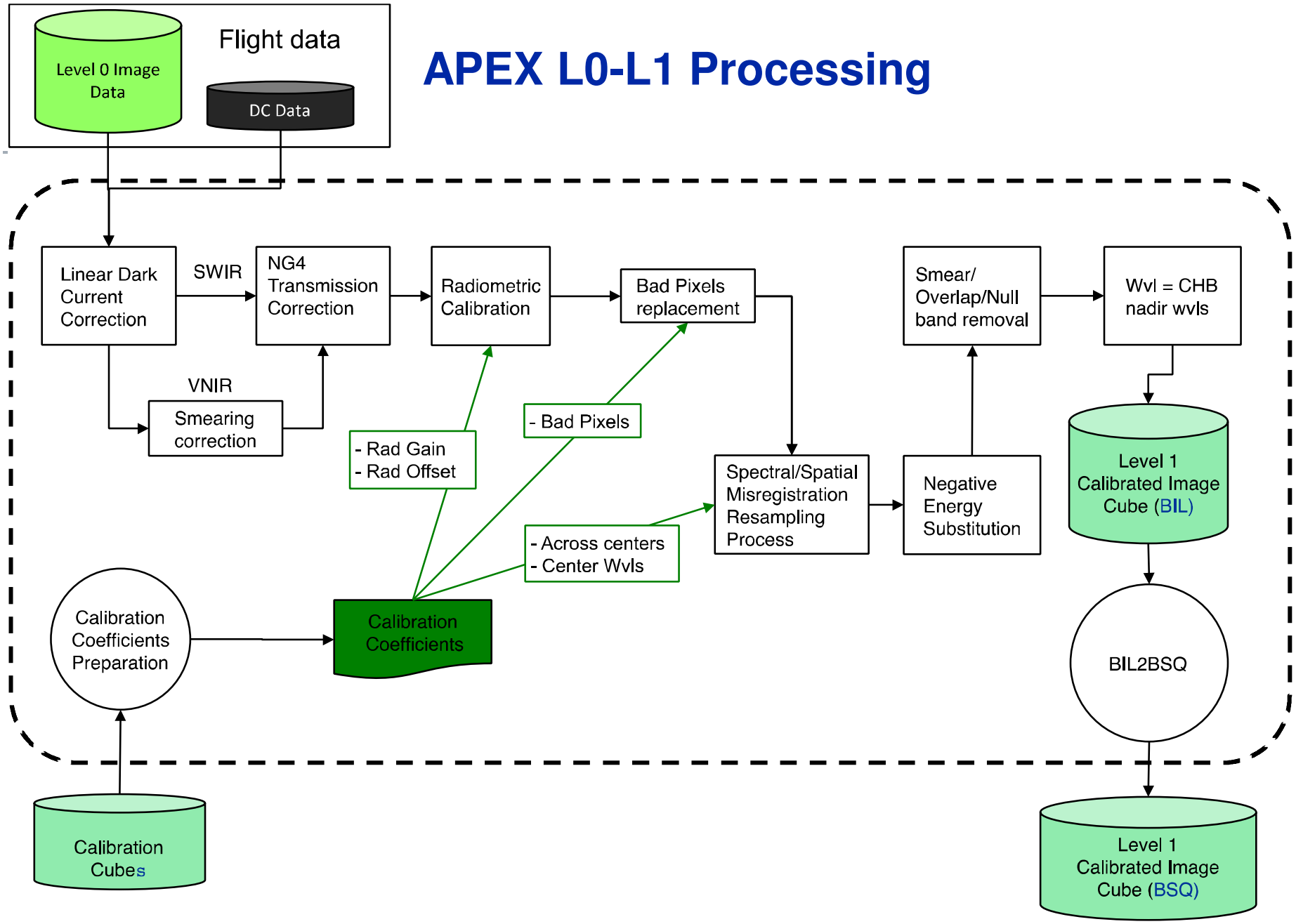
Centre Wavelengths

Wires and striping

Wires: glued to imaging slit.
Originally supposed to be used for geometric shift detection.
Interpolated during L1 processing (depending on processor version)

Striping caused due to imaging slit features.
Destriped in the PAF (depending on processor version).

APEX L0-L1 Processing



www.apex-esa.org/content/free-data-cubes

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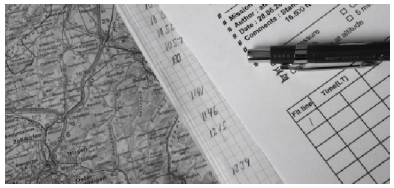
Known Issues

Greatest care is taken in processing APEX data sets to provide high accuracy spectroscopy data sets to the user community. However, APEX is an experimental system and some issues remain as artefacts in the data. These known issues are

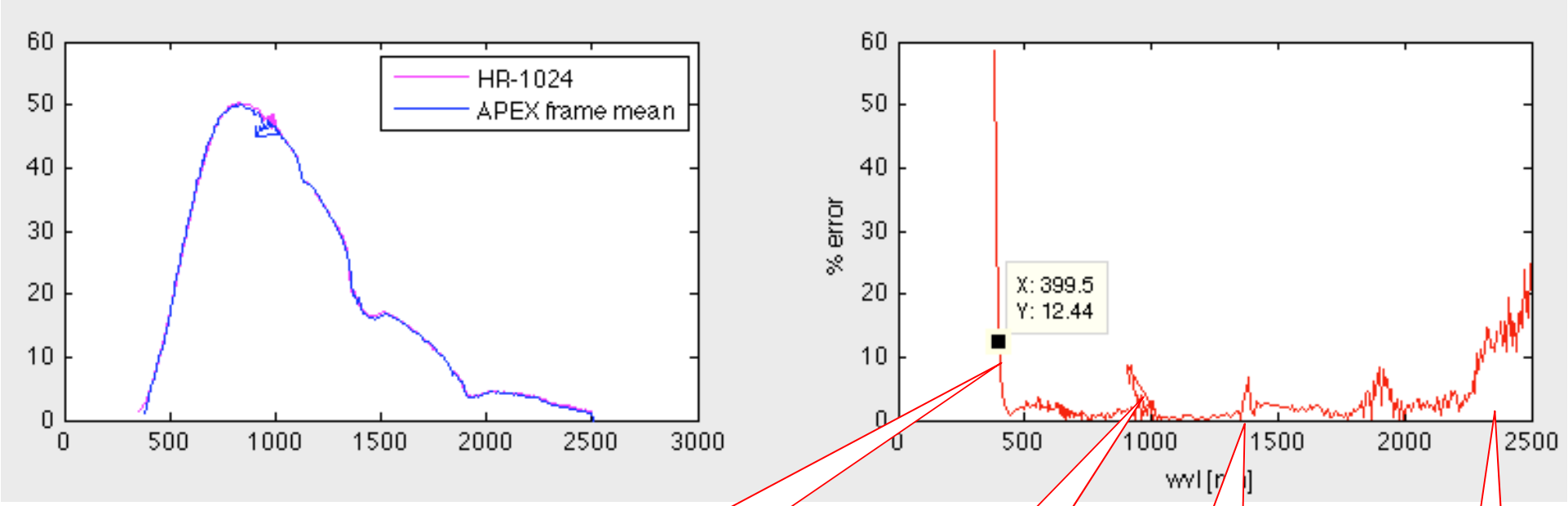


being addressed as part of the continuous improvement of the dedicated processing chain to provide even better data in the future. For a list of known issues please refer to the table provided below.

Residual along track striping	APEX is a pushbroom instrument and hence technologically prone to striping artefacts. Most of the striping is removed during radiometric calibration and destriping before atmospheric correction. However, some residual striping, occasionally at lower spatial frequency may appear.
Residual across track striping	Some minimal across track striping may be observed in a limited number of bands.
Interpolated wires	Wires were placed on the entry slit to observe spatial shifts. Depending on the geometric shifts apparent on the flight level of this data cube, some remaining wire residuals may exist. Some linear artefacts due to interpolation may exist. The across track wire positions are: 334-335 and 674-675, the interpolated region currently encompasses a buffer of 1 pixel around the wire positions. Pixels in the interpolated wire region should be treated with caution. Interpolated wire pixels are also contained in the interpolated bad pixel quality layer.
Image crispness	Spatial misregistration correction can lead to loss of information and according visual fuzziness due to spatial resampling.
Radiometric artefacts	Some radiometric miscalibrations are known to exist in the spectral band region 1020nm ±2 bands and spatial sample positions 319-324 as well as in the 1030nm region for all across-track positions. Pixels contained within the above mentioned spatial-spectral regions have been corrected for these artefacts but should be treated with care in this processing version.
Saturated pixels	A low number of pixels is affected by saturation due to high radiance reflected from very bright or specular objects in the scene. Spectral signatures of these pixels should be treated with caution. The saturated pixels are indicated in the supplied saturation quality layer.
Directional effects	The data are known to exhibit spectro-directional effects which have not yet been corrected for. These natural effects are known to affect information extraction routines in shaded and sloped areas of the imaged scene.
Low SWIR HCRF	Targets with very low reflectance characteristics in the SWIR may appear to bright due too yet to be compensated detector non-linearities.

Available on: www.apex-esa.org as part of the APEX Open Science Dataset description

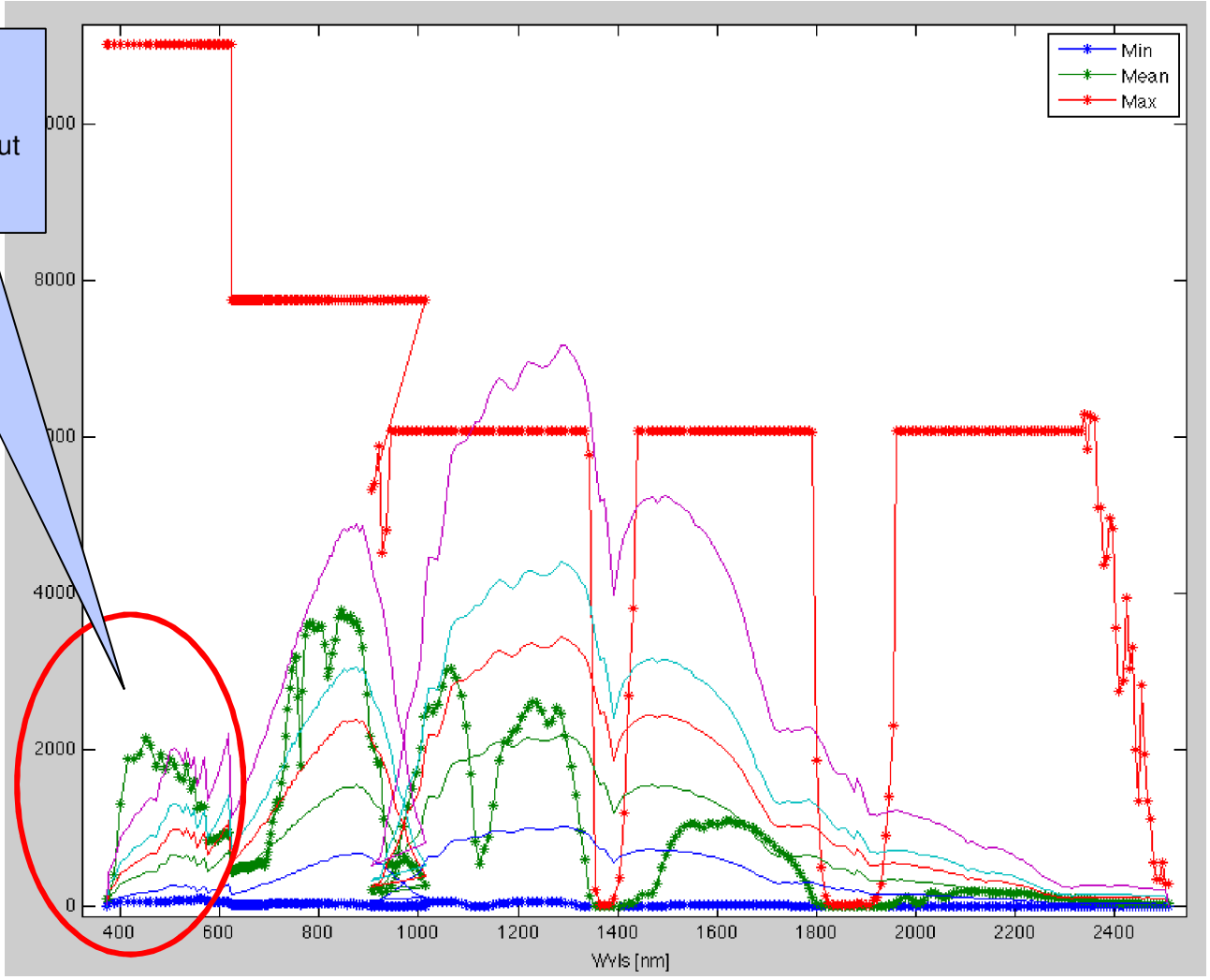
Radiometric Artefacts and Issues: 2012 Status



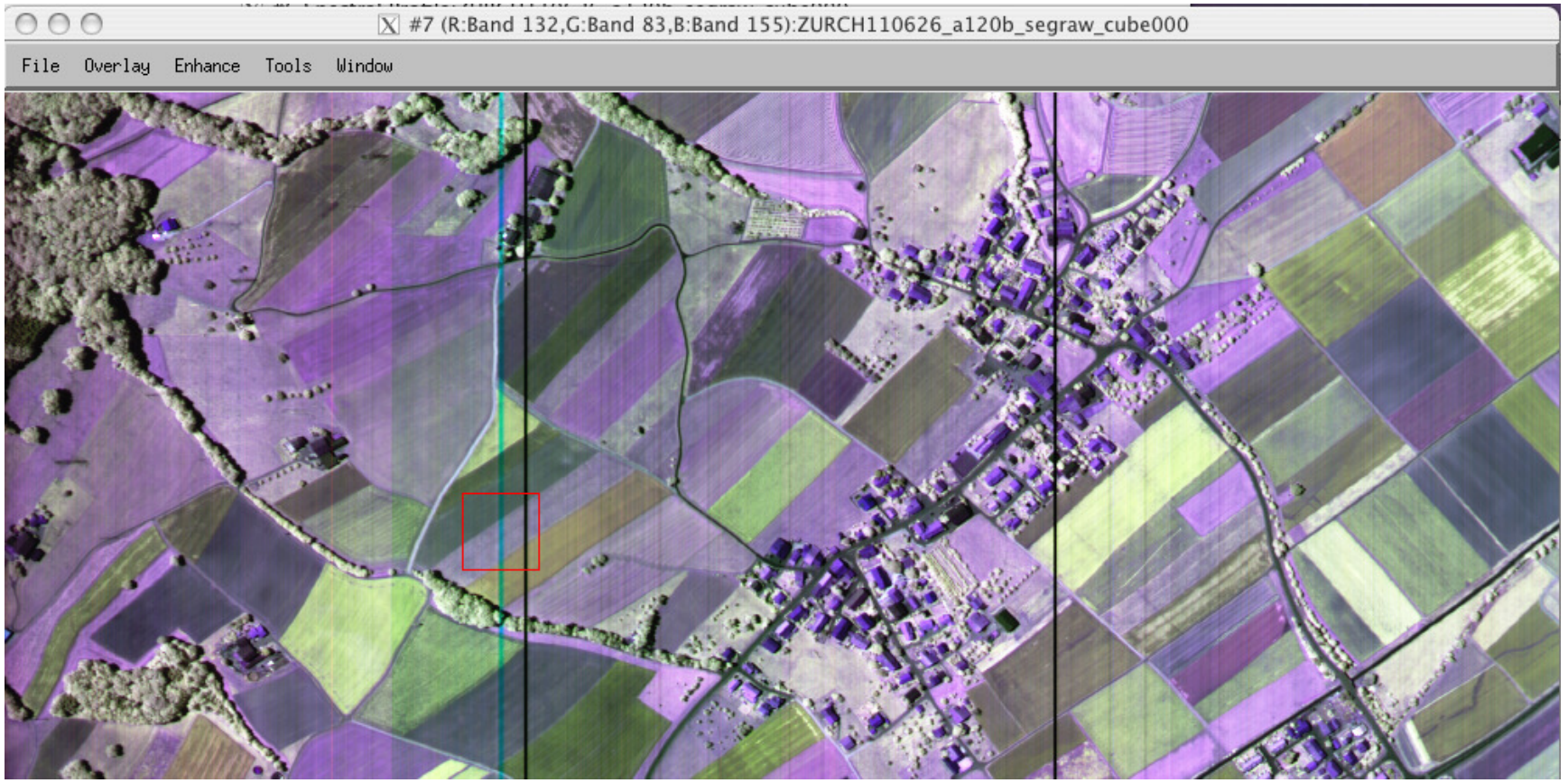
Estimated error is < 3% for most of the bands.

Restrictions of current default Rad Cal Setup

The majority of natural TGTs under solar illumination are brighter than CHB sphere (without saturating the VIS-NIR)



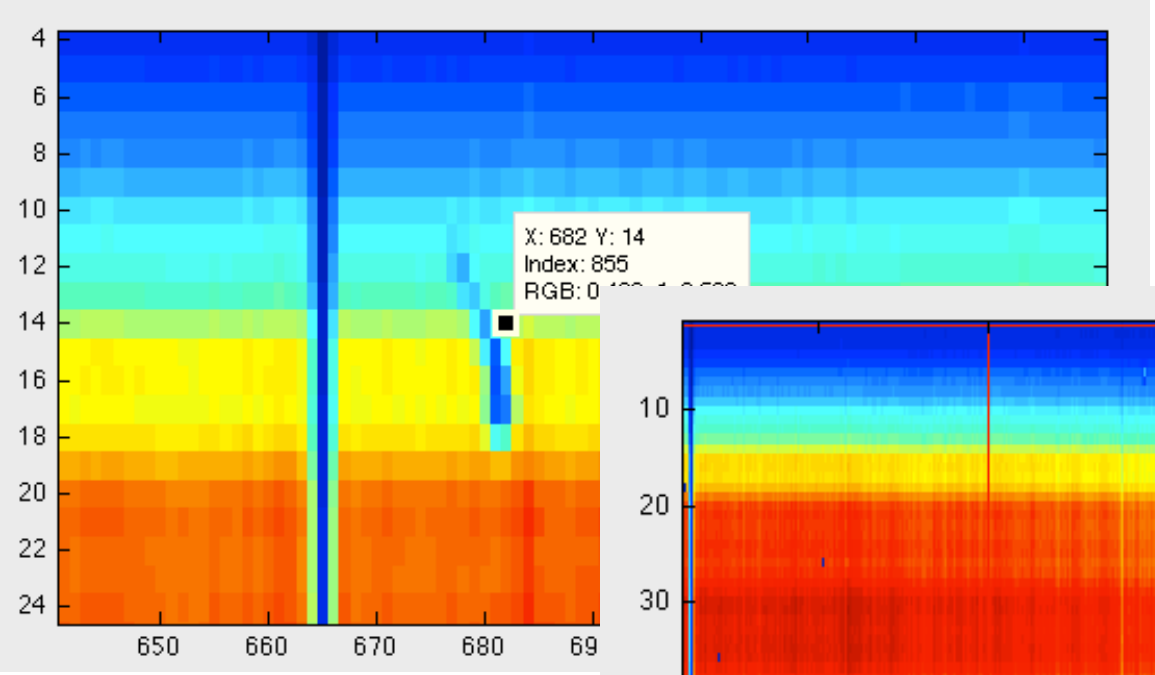
Radiometric Artefacts and Issues: 2012 Status



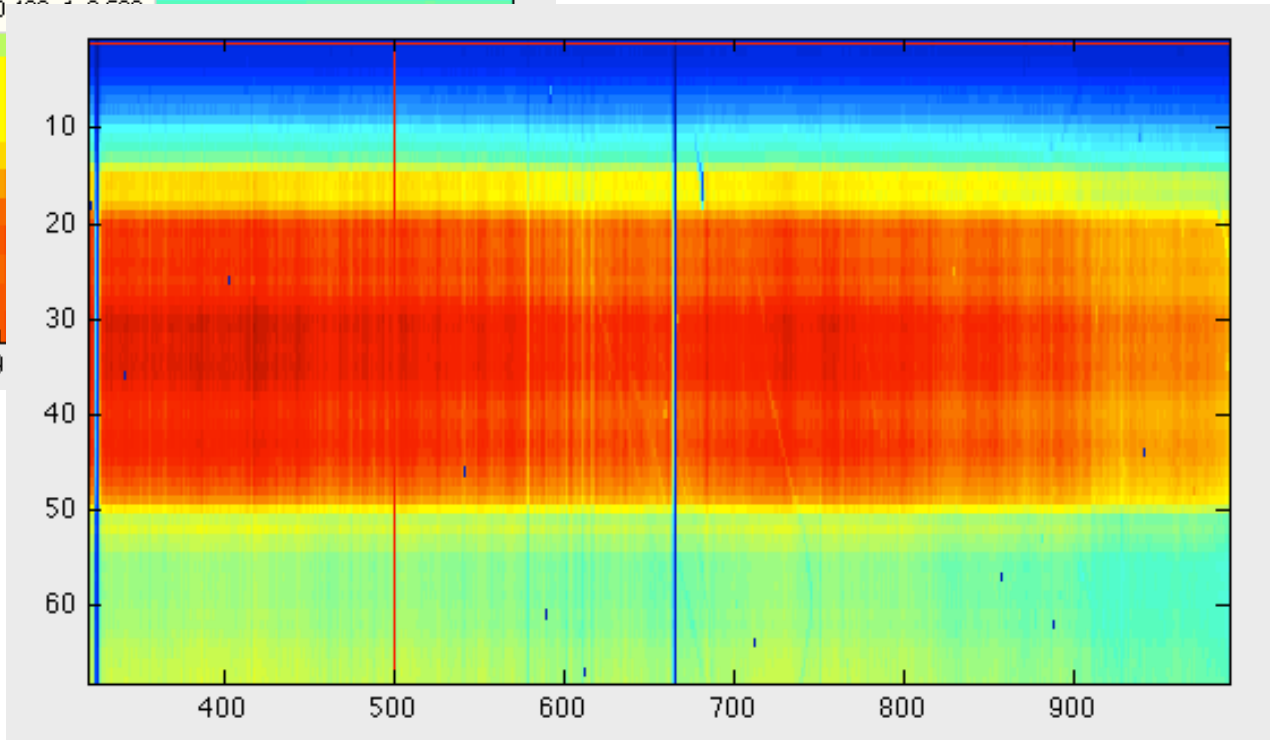
L0 image with red band set to 132 (~1030nm), showing the change in radiometry next to the wire.

Spatio-spectral anomaly

Spatio-spectral anomaly



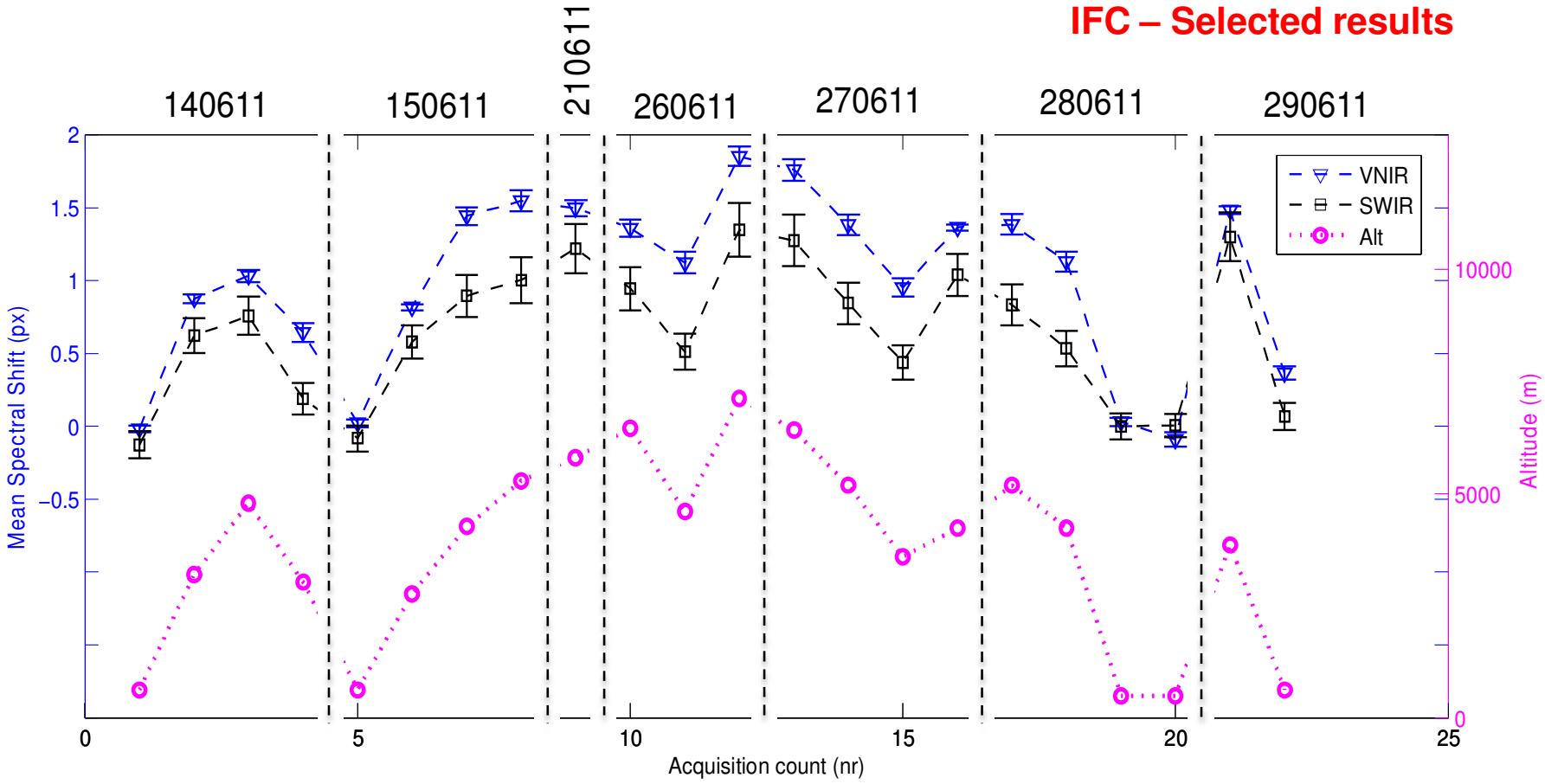
Smudge appears to react non-linear to light input.



Relative radiometric calibration frame

Spectral Artefacts – Spectral shifts

APEX campaign June 2011
IFC – Selected results



Analyzed spectral regions:
VNIR: λ_c = 629-656 nm; FWHM = 3.7 nm; SSI = 2.7 nm
SWIR: λ_c =1897-1969 nm; FWHM = 10 nm; SSI = 8 nm

Reference nominal spectral parameters:
calibration cubes 08/2011

Flight Operations and Higher Level Processing

- APEX Flight Operations
- APEX Processing and Archiving (PAF)
- Website

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APEX Team at VITO

Sindy Sterckx

Bart Michiels

Jan Biesemans

Walter Horsten

Kris Vanhoof

Dries Raymaekers

Bart Ooms

Bart Bomans

Johan Mijnendonckx

Tim Deroose

Ils Reusen

Stephen Kempenaers

Walter Debruyn

Dirk Fransaer

...

Kristin Vreys

Stefan Adriaensen

APEX Team

APEX 'Operations' Team based at VITO, Mol,B

Team tasks:

- Flight planning and preparation
- Aircraft and ATC planning and coordination
- Instrument Operations and handling
- APEX Processing and Archiving and Data dissemination
- Laboratory calibration together with RSL and generation of calibration parameters
- Website

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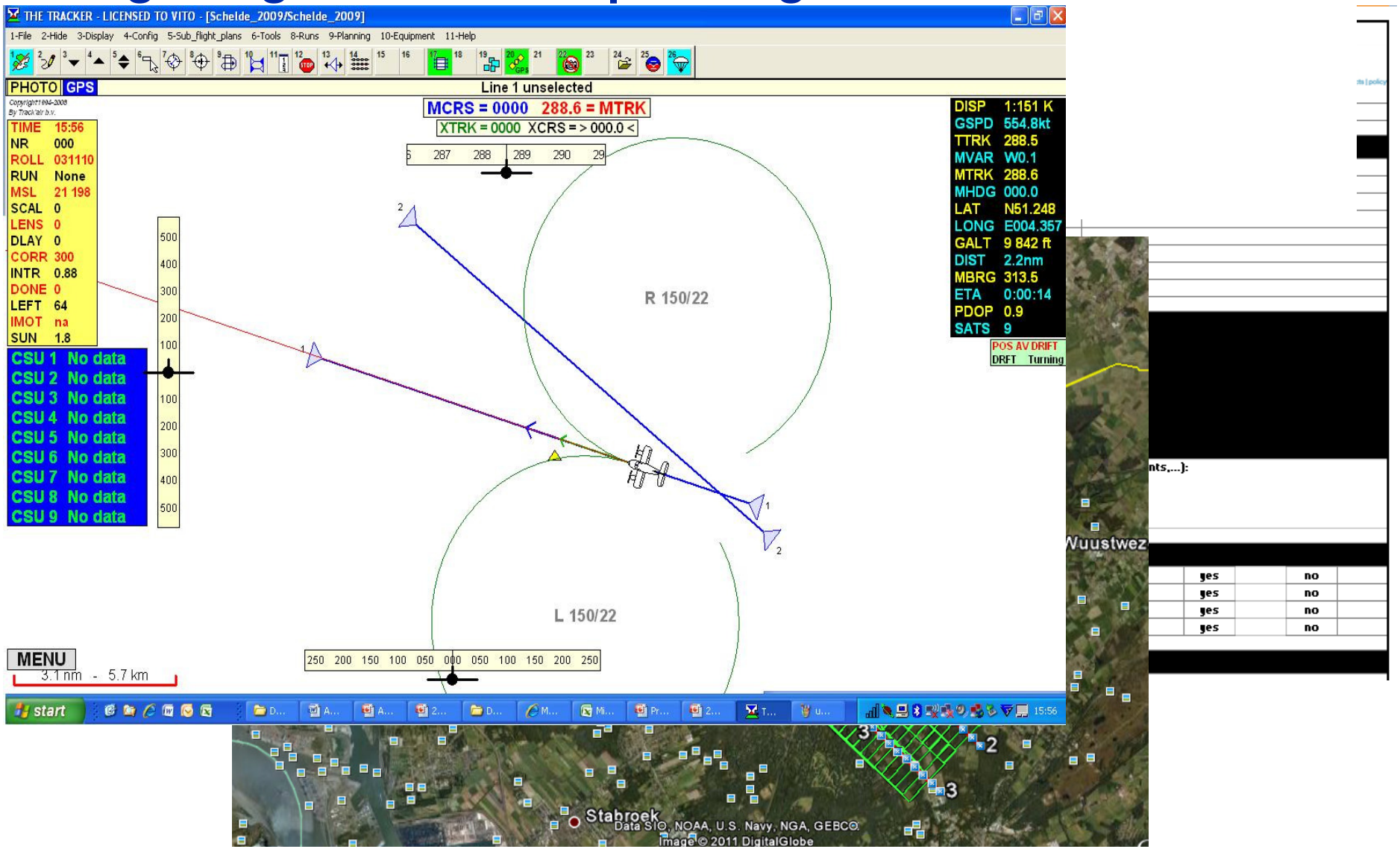
Flight organization and planning - Workflow



APEX Operations - aircraft installation

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APEX Operations - Aircraft

APEX is currently certified to fly on DLR's DO-228 aircraft (D-CFFUand D-CODE ongoing) and Skyvan of CAE Aviation → 3 aircraft available

Ongoing activities to certify APEX on several other platforms (CAE Aviation – Cessna; DLR Halo – Gulfstream; RUAG – DO-228NG; etc.).

Airworthiness certification costs per aircraft range from approx. 40 -100 kEUR depending on type and rules.

Export license rules apply for the operation of APEX in certain countries.

EUFAR – European Facility for Airborne Research (www.eufar.net) offers aircraft + APEX within a EC FP7 project → new opportunities end 2013…

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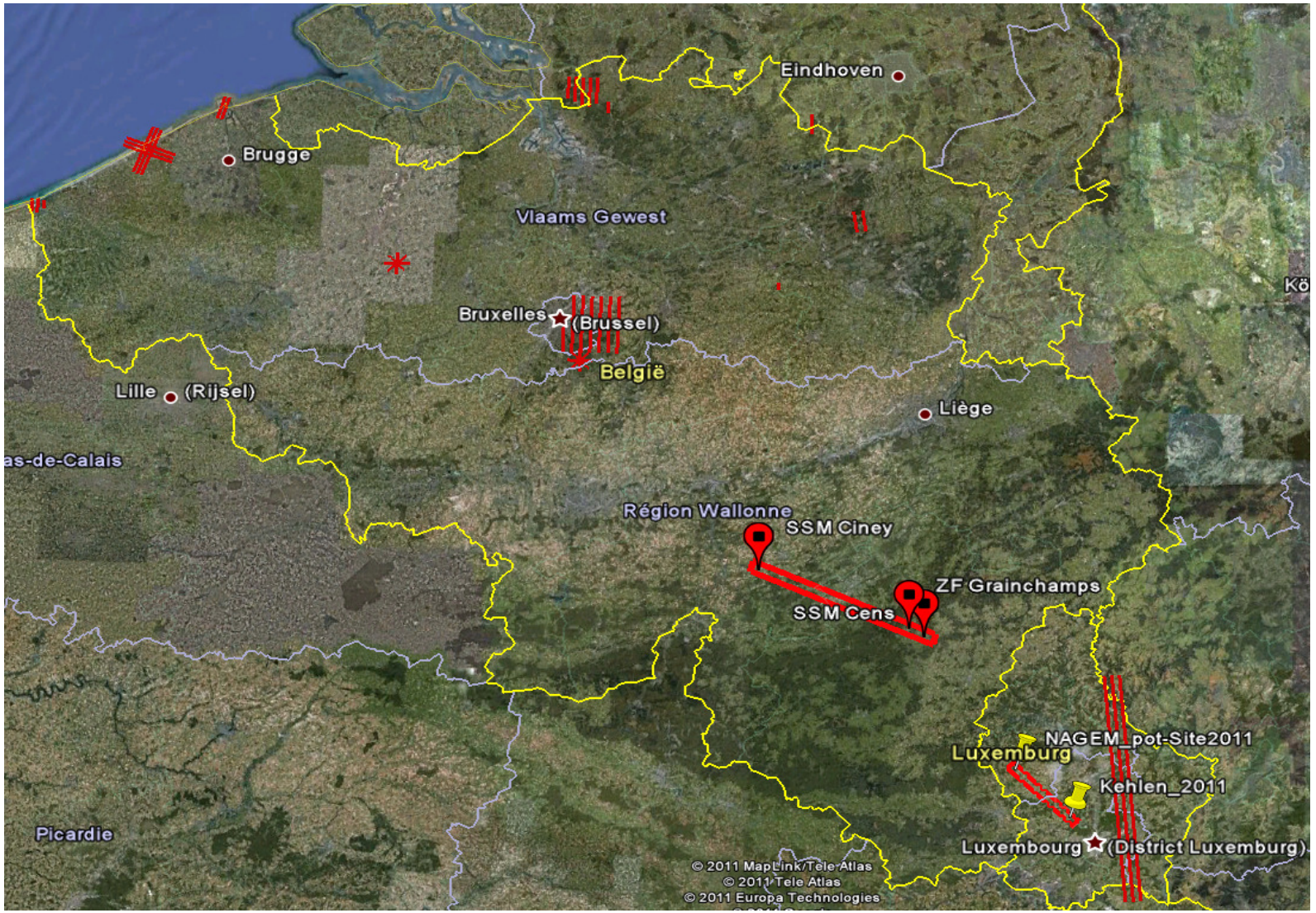
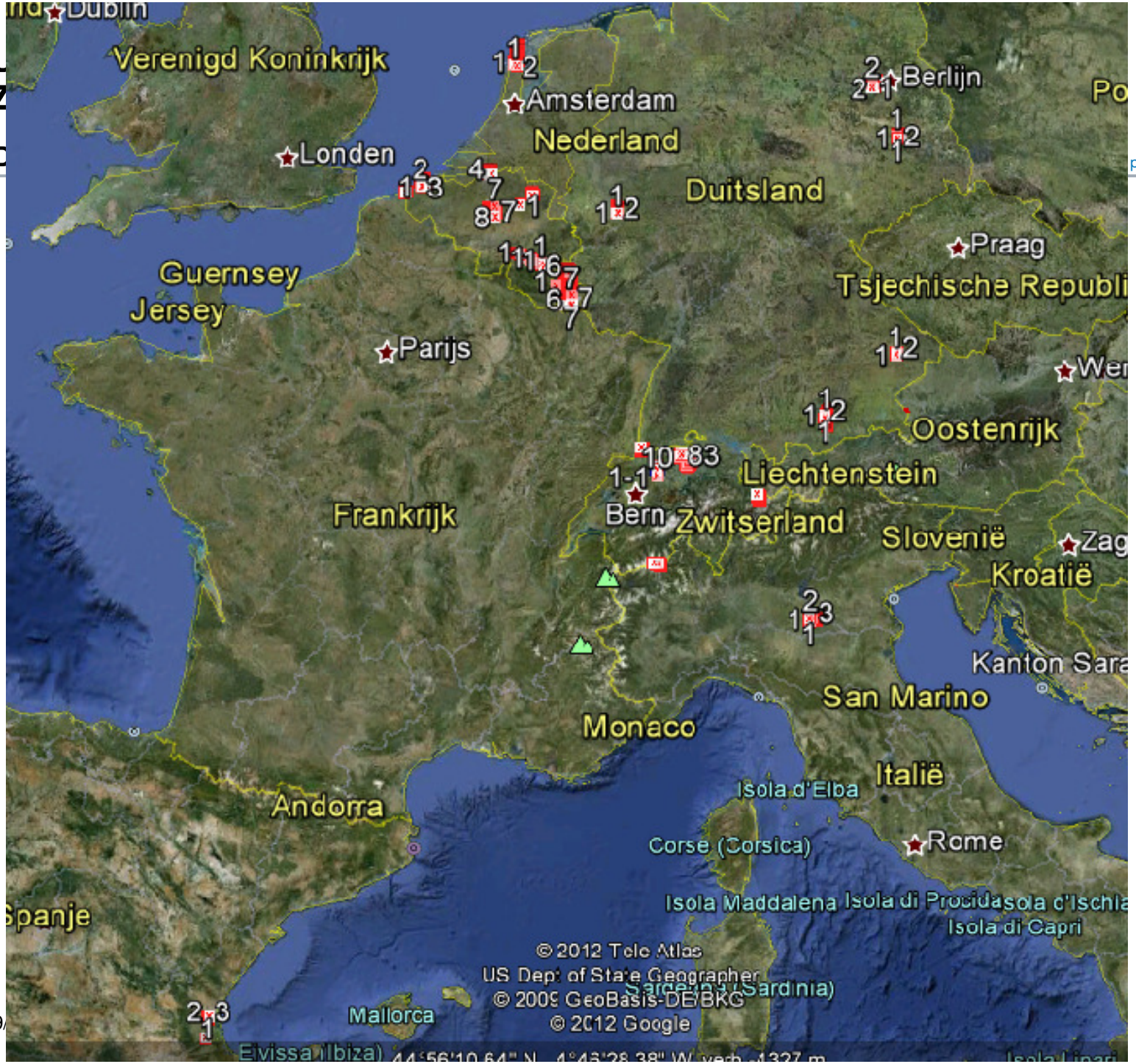
APEX flights 2011




Dublin
Verenigd Koninkrijk
Amsterdam
Nederland
Londen
Berlijn
Duitsland
Praag
Tsjechische Republi
Guernsey
Jersey
Parijs
Oostenrijk
Liechtenstein
Frankrijk
Bern
Zwitserland
Slovenië
Kroatië
Kanton Sara
San Marino
Monaco
Italië
Isola d'Elba
Andorra
Corse (Corsica)
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Spanje
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Isola di Capri
Mallorca
Eivissa (Ibiza)
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US Dept of State Geographer
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BUT… many (operational) constraints

Mostly group shoots (priorities!!)

Airspace restrictions

- Civil aviation
- Military aviation / exercises

understanding of user requirements

- Tidal / Timing restrictions (sun elevation)
- Flight orientation (sunglint)
- Specific areas in the flight lines / area
- Simultaneous ground campaigns (field spectra, reference targets, calibration)
- Pixel size, flight level, airspeed
- Terrain profile
- Coordinates projections and geodetic data

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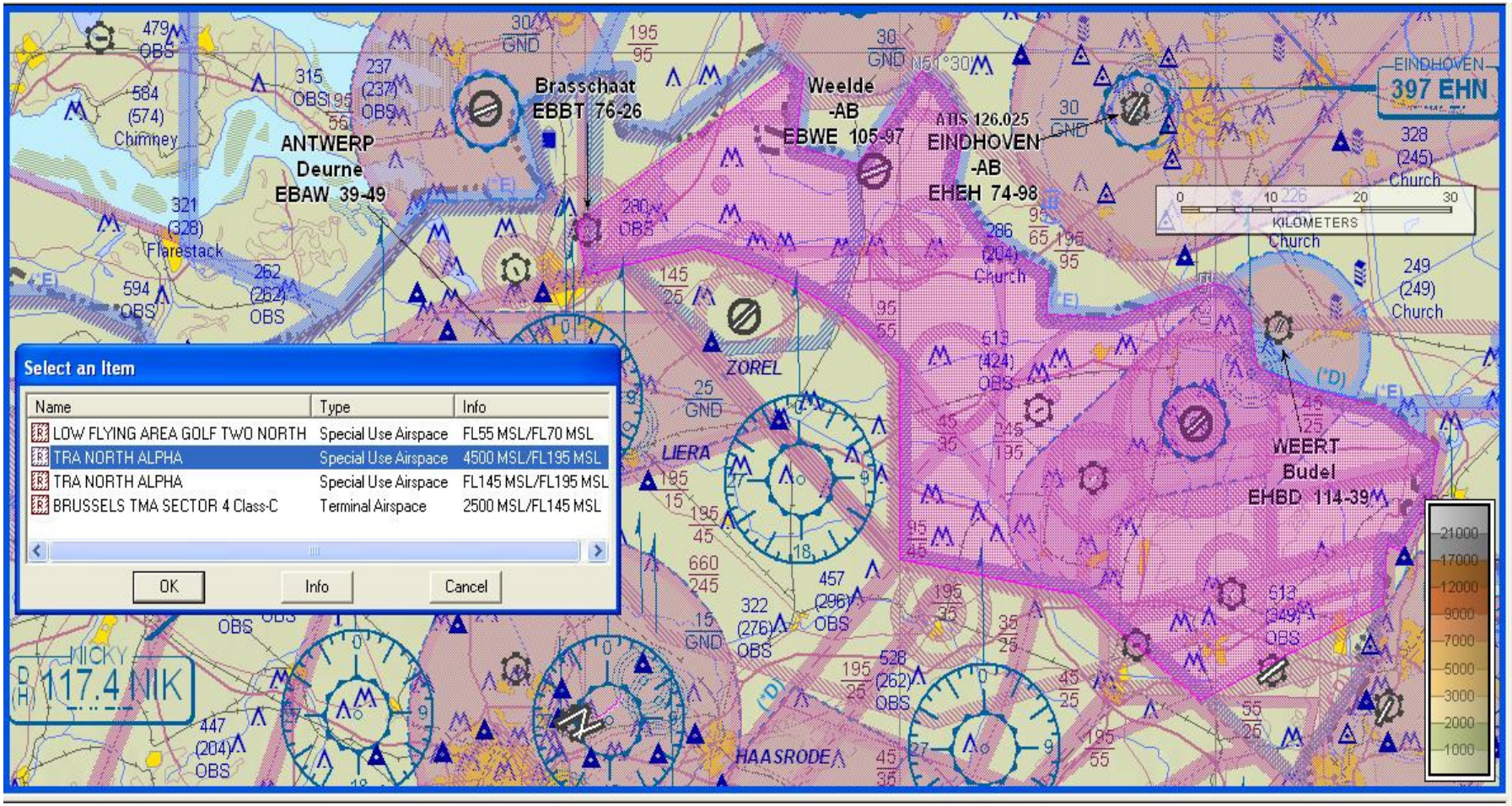
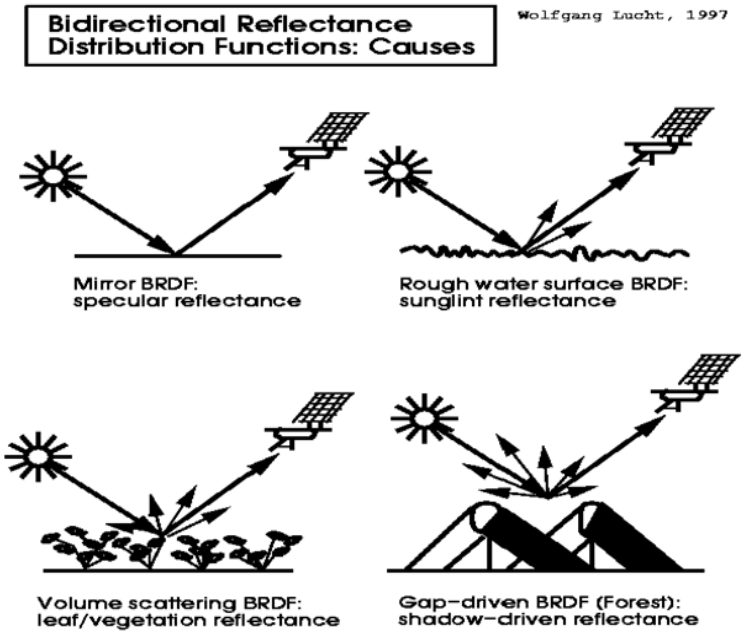
ATC restrictions

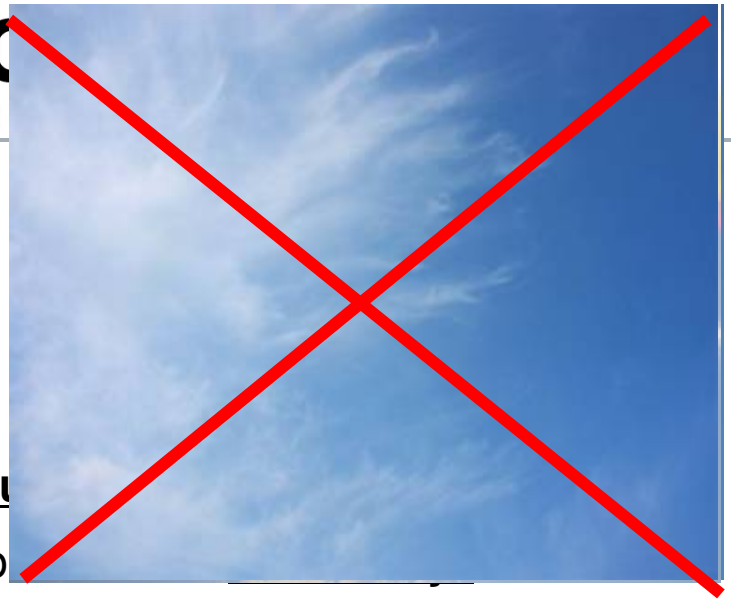


Flight line orientation

sunglint effects on water body



METEO



a. Probably **most important** but also **most u**
b. Most optical remote sensing techniques p **conditions**:
c. Acceptable (?) **1/8 Cumulus**
d. **No Cirrus** because of variable illumination conditions!
e. **Accurate and up to data meteo information is a must!** E.g. meteo websites, webcams, personnal contacts,...

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APEX Operations lead to....strange behaviour

APEX Processing and Archiving Facility (PAF)

VITO is in charge of operational level 0-1 (RSL development cfr Andy) processing and additional level 2-3 processing

APEX PAF disposes of dedicated hardware and supports all levels of processing (Level 0-3)

Hardware concept is based on VITO's processing experience and various instruments and activities (Pegasus, Medusa, AGIV, CASI, Hymap, AHS, etc.)

Middleware based concept supporting parallel computing approaches: Master/Worker and Task/Data decomposition

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Hardware: development + operational environment

MAIN	Rack 1 - Development	UPS
	Fibre Panel	
1	Development Node	1
1	Development Node	
1	Development Node	
1	Development Node	
1	Development Node	
1	WORKFLOW File Server 1	1
1	WORKFLOW File Server 2	1
1	WORKFLOW WORKER1	
1	WORKFLOW WORKER2	
1	WORKFLOW WORKER3	
1	WORKFLOW MASTER	1
1	File Server VTRAK	1
1	=SWITCH= DATA 1	
	=SWITCH= iSCSI 1	1
1	Development Node	1
	TAPE ROBOT LTO4 20 TB (RAW)	
1	VTRAK Development Test Data	1
1	VTRAK Hyperspectral Test Data	1
1	VTRAK Hyperspectral Test Data	1
1	VTRAK Development Test Data	1
1	VTRAK UNASSIGNED	1
19		12

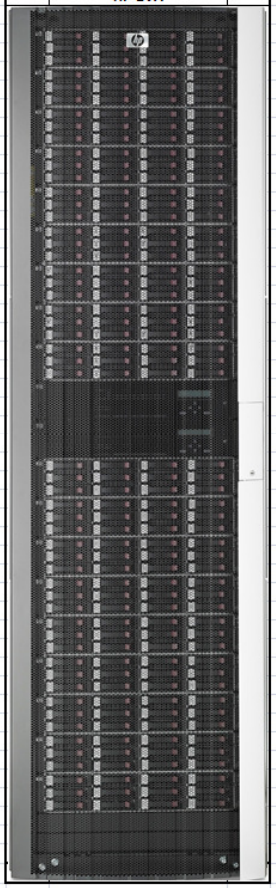
MAIN	Rack 2 - Development	UPS
	=SWITCH= DEVEL 1	1
1	File Server ARCHIEF 1	1
1	File Server ARCHIEF 2	1
1	MYSQL MASTER	1
1	MYSQL SLAVE	1
1	WEB	
1	WEBSERVICES	
1	FTP	
1	ORACLE	1
1	POSTGRES	1
2	KVM	
1	=SWITCH= DATA 2	
	=SWITCH= iSCSI 2	1
1	VTRAK Archive Airborne	1
1	VTRAK Archive Airborne	1
1	VTRAK Archive Airborne	1
1	VTRAK Archive Airborne	1
1	VTRAK Archive Airborne	1
1	VTRAK FTP	1
1	VTRAK Development Test Data	1
20		16

MAIN	Rack 3 - Development	UPS
	=SWITCH= DEVEL 2	1
1	Development Node	1
1	File Server VTRAK	1
1	Development Node	
1	WORKFLOW MASTER	
1	WORKFLOW MASTER	
1	WORKFLOW WORKER	
1	WORKFLOW WORKER	
1	WORKFLOW WORKER	
1	WORKFLOW WORKER	
1	WORKFLOW WORKER	
1	WORKFLOW WORKER	
1	WORKFLOW WORKER	
1	WORKFLOW WORKER	
1	=SWITCH= DATA 3	
	=SWITCH= iSCSI 3	1
1	VTRAK Development Test Data	1
1	VTRAK Development Test Data	1
1	VTRAK Development Test Data	1
17		7

MAIN	Rack 4 - Development	UPS
1	File Server VTRAK	
1	File Server VTRAK	
1	File Server VTRAK	
1	WORKFLOW WORKER	
1	WORKFLOW WORKER	
1	WORKFLOW WORKER	
1	WORKFLOW WORKER	
1	WORKFLOW WORKER	
1	WORKFLOW WORKER	
1	WORKFLOW WORKER	
	WORKFLOW File Server1	
	WORKFLOW File Server2	
	WORKFLOW File Server3	
1	=SWITCH= DATA 4	
	WORKFLOW File Server4	
	WORKFLOW File Server5	
	WORKFLOW WORKER	
	WORKFLOW WORKER	
12		0

MAIN	Rack 5 - Operational	UPS

HP EVA



Development Platform

Operational Platform

Total 172 cores on 19 machines

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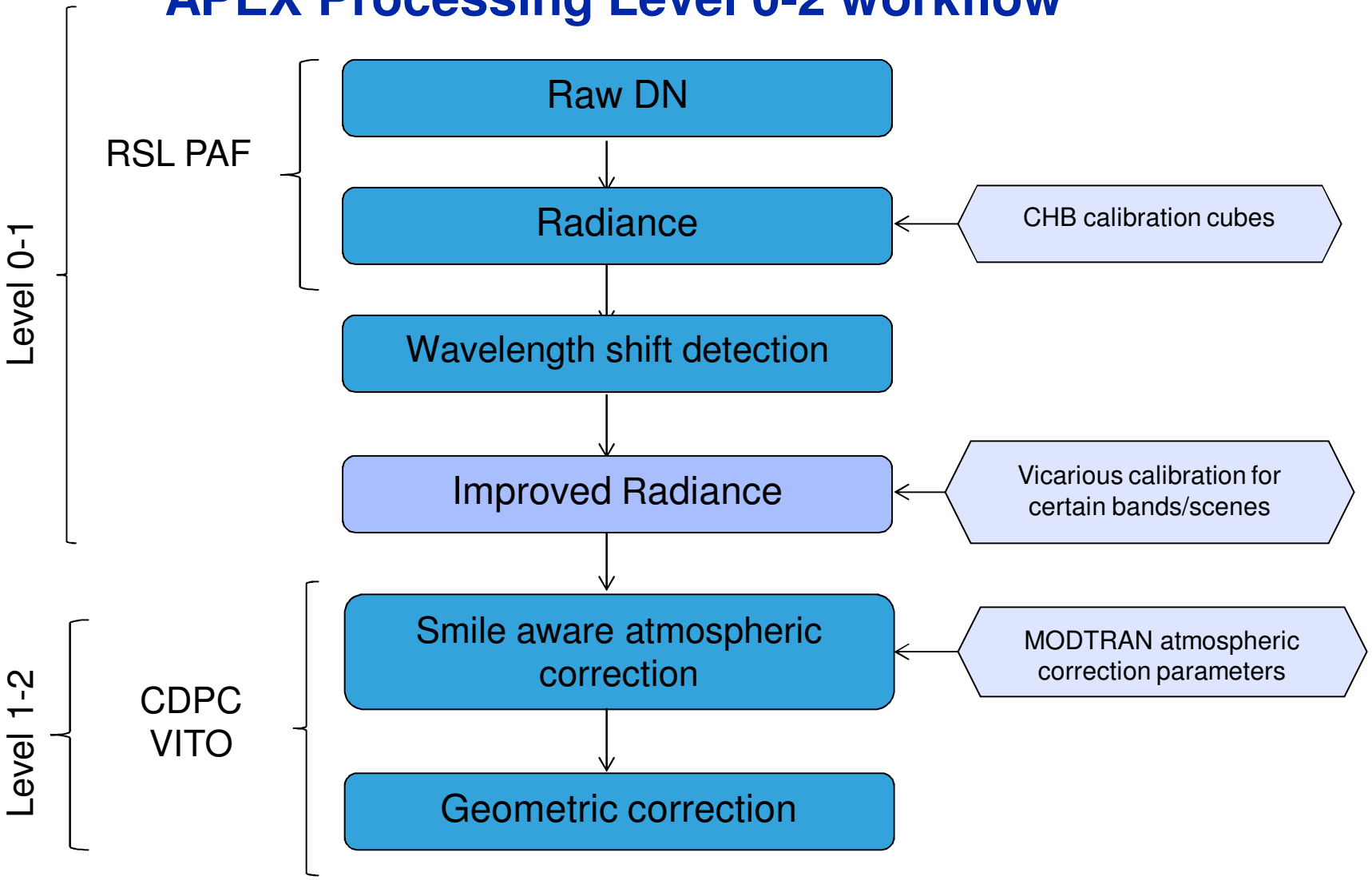
APEX Processing Level 0-2 workflow



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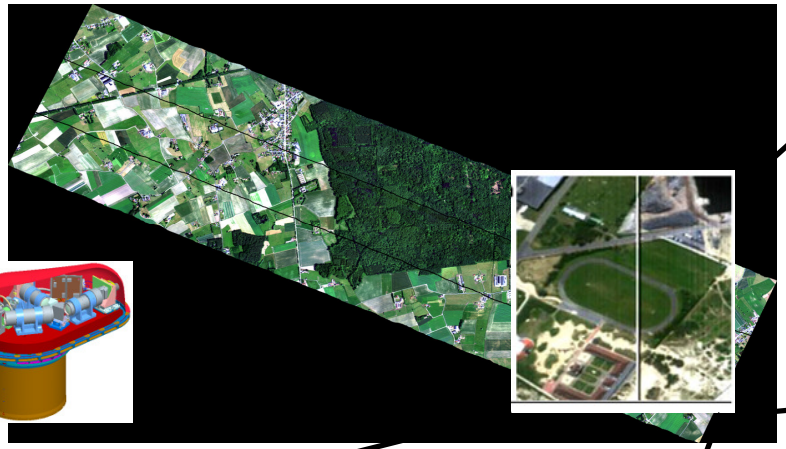
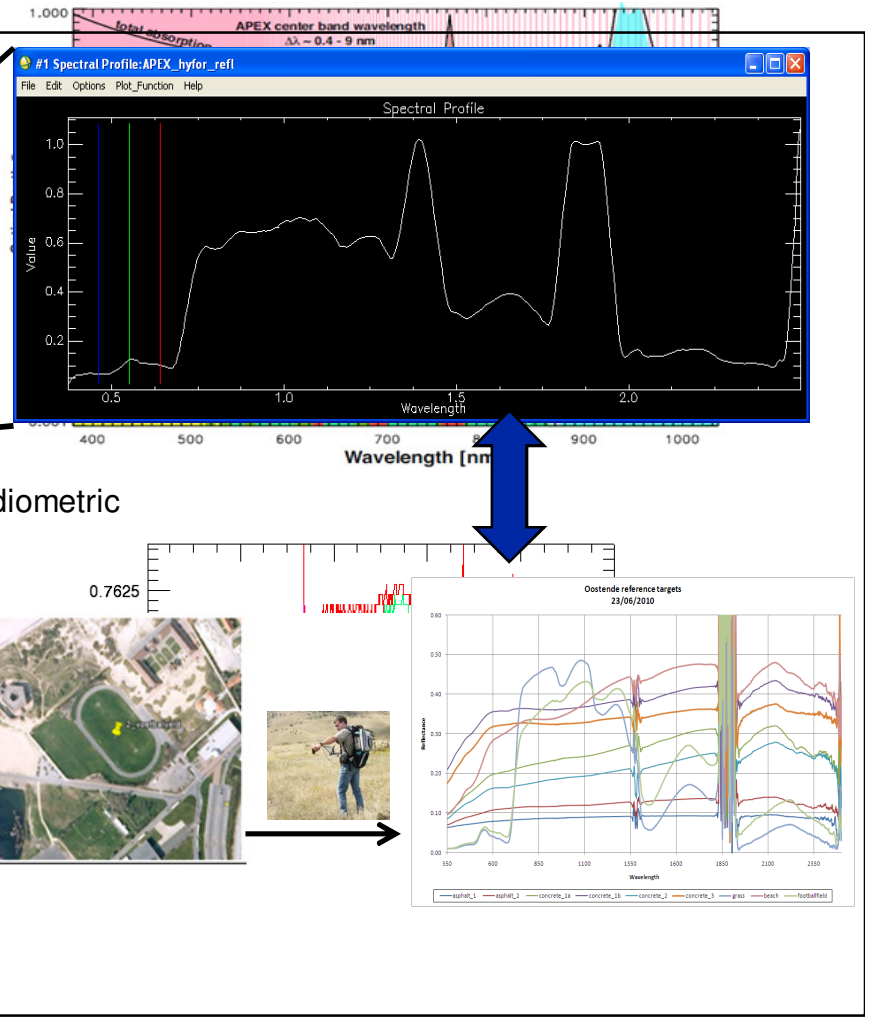
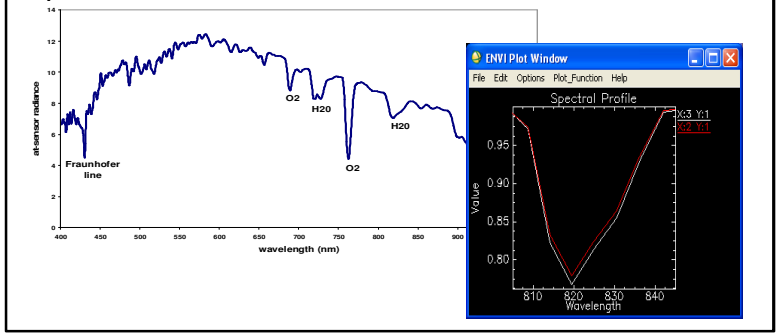
APEX Calibration: radiometric/spectral

Monitoring spectral and radiometric performance





Spectral



Boresight calibration...

Inputs:

Specific flight pattern

GPS/IMU processing (lever arms, dGPS,)

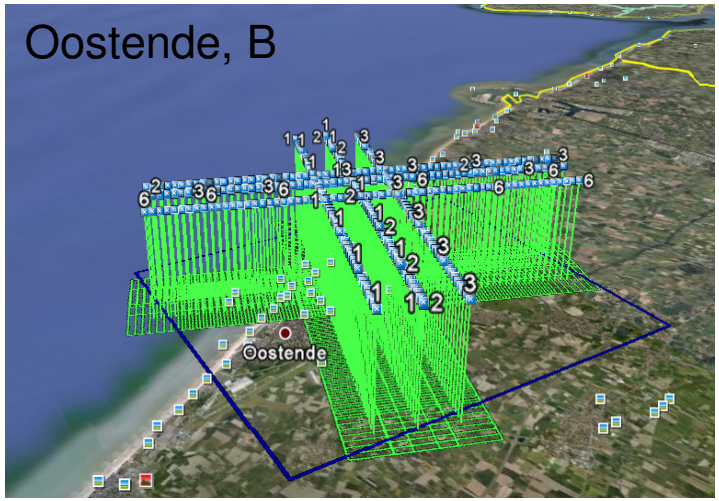
GCP selection

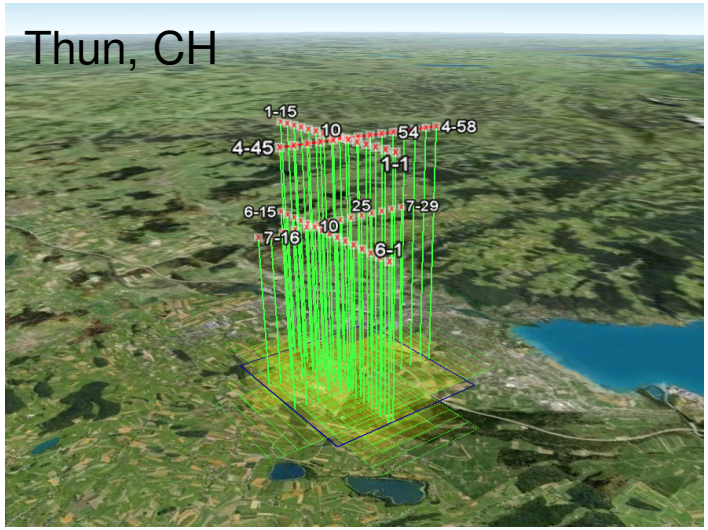
APEX sensor model (FOV, IFOV, CCD size,...)

↓

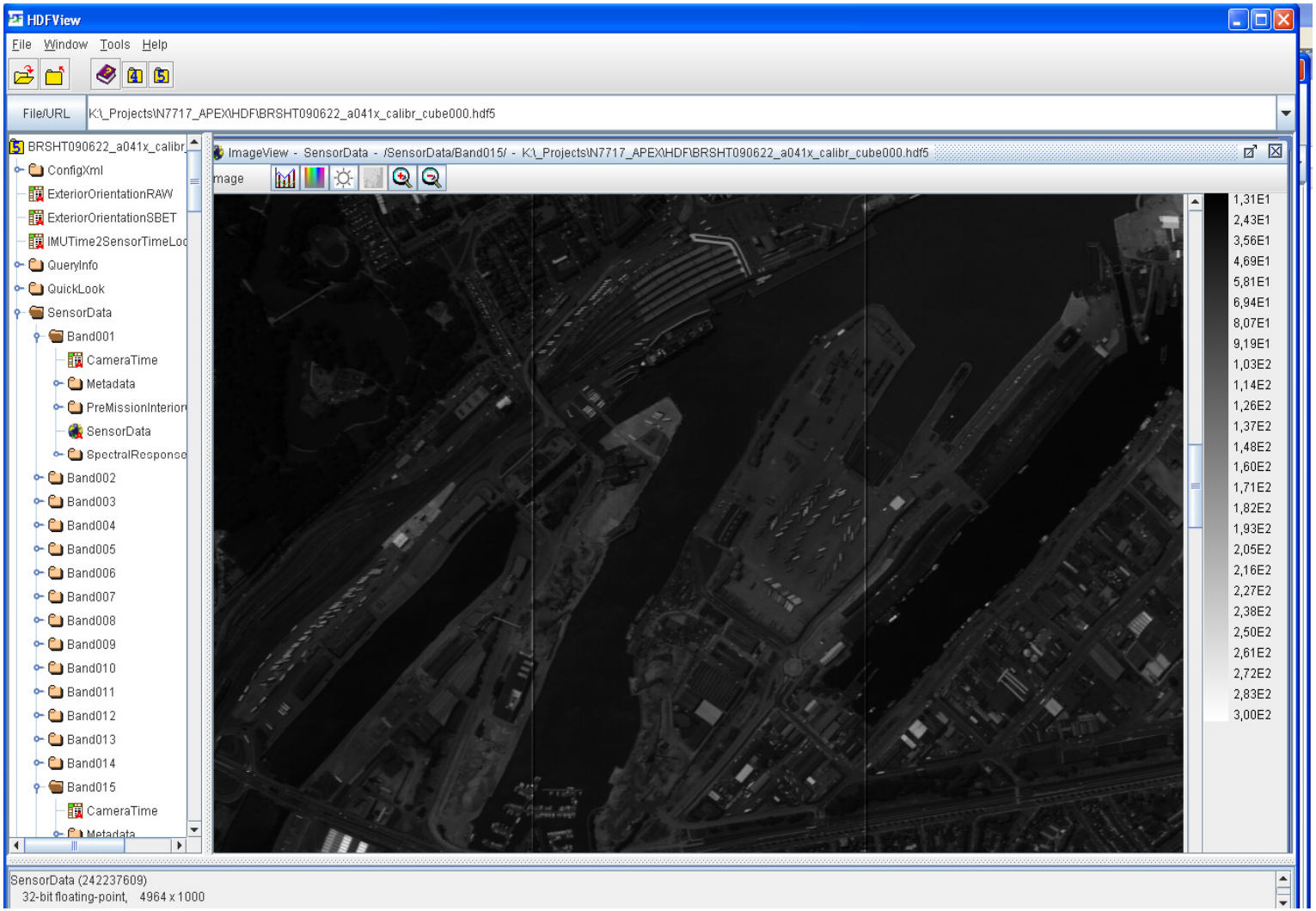
Residual boresight parameters

(+/-1 pixel accuracy)





APEX PAF - level 1 HDF5 product



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APEX PAF – level 1 - 2

APEX level 1 HDF5

APEX Level 2 PAF

GEO

- **Direct Georeferencing** (ortho production through forward projection): custom VITO software, for better interfacing with MODTRAN4.
- **Integration of Applanix POSPAC** for dGPS/IMU corrections.

ATMOS

- ***Smile aware atmos.correction module***
- **VITO has its own C++ implementation of the ATCOR4 model.** No pre-compiled LUTs needed, MODTRAN4 is used "on-the-fly": all 176 MODTRAN4 parameters become available for AC.
- **Water vapor determination (user or image)**
- **Visibility determination (user of image)**

RES

- All algorithms in an optimal workflow perform their work on the raw scene geometry and **image resampling** to a certain projection system and projection datum is done at the very end

***"Standard"* Level 2 product**

USER:
APEX level 2 HDF5: ftp, harddisk

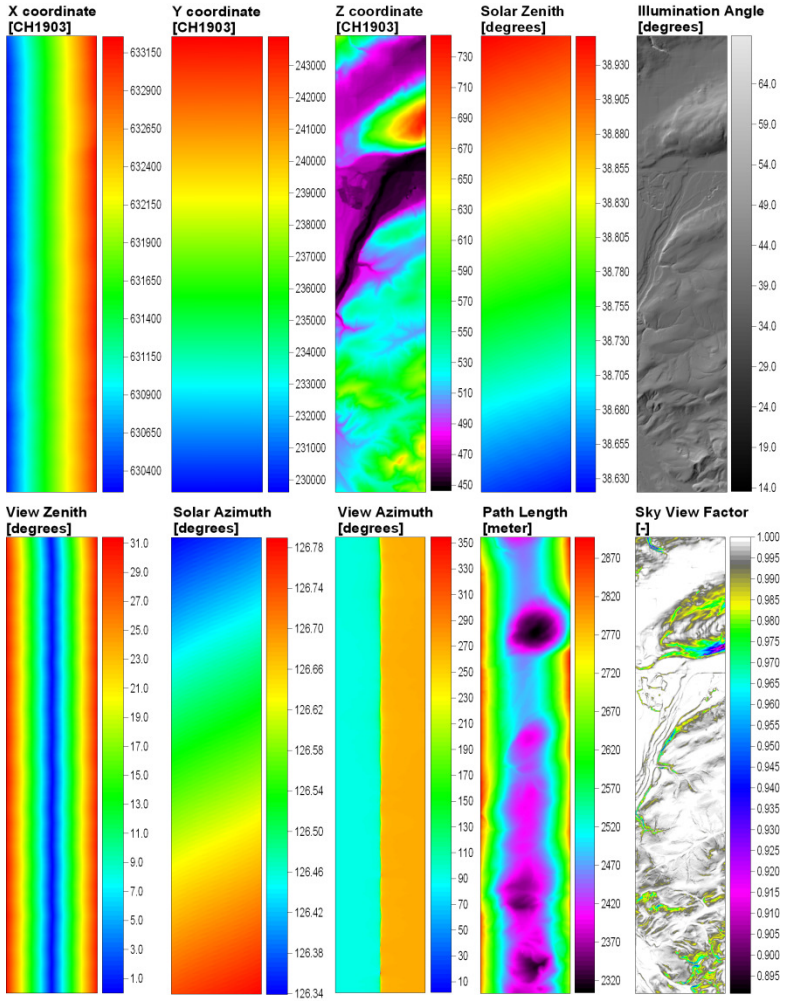
Algorithms Level1-Level2: Ortho-rectification

For:

- A better interfacing with Modtran4, and
- Given the requirement that all Level2 algorithms have to work on the raw sensor geometry and resampling has to be done at the very end of the workflow, and
- To support frame sensors, whiskbroom and pushbroom sensors

It was decided to develop an in-house C++ module.

This C++ module was fully validated against the Inpho OrthoVista package using UltracamD imagery and Parge using AHS data



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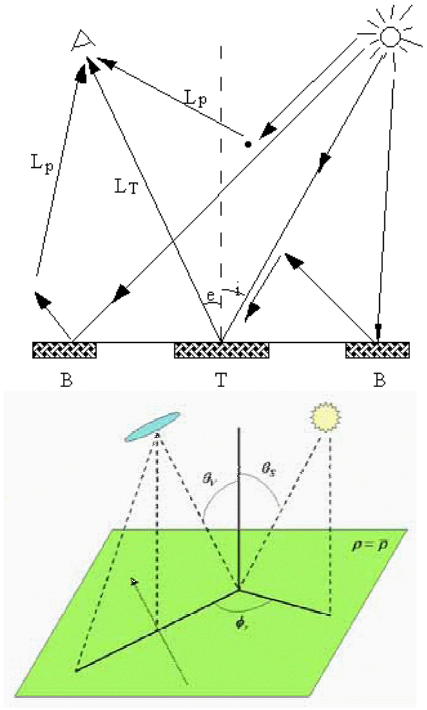
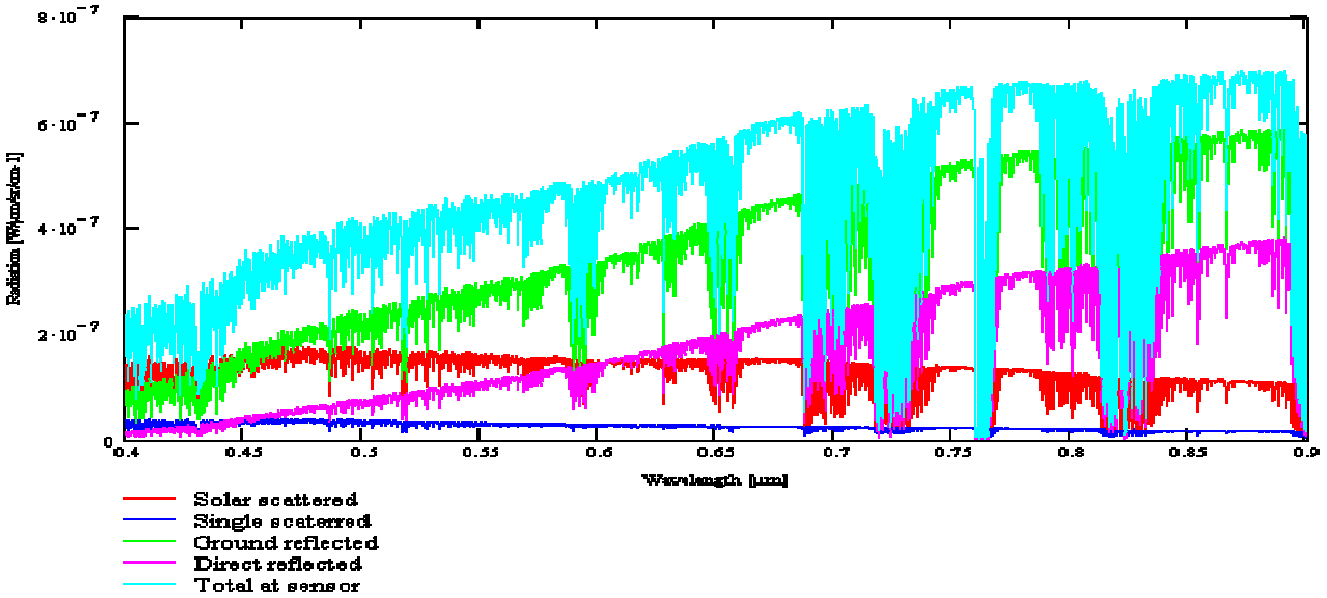
Algorithms Level1-Level2: On-the-fly configuration of MODTRAN4 (AFRL: US Air Force Research Laboratory)

Atmospheric Correction = Determining the at-target radiance (L_T) by correcting the measured at-sensor spectral radiance for the "path radiance" L_P (Haze) and "background radiance" (L_B). *L_P and L_T are influenced by*: earth-sun distance, solar incident angle (i), solar azimuth, sensor zenith angle (e), sensor viewing azimuth, atmospheric composition (water vapor, O_3, CO_2, CO, …) and cloud cover.



MODTRAN4 has 176 configurable parameters, as such, pre-calculated look-up tables (e.g. ATCOR 6D LUT) are non-generic → (a) An XML configuration file can be uploaded to fully customize the MODTRAN4 processing; (b) image based parameter estimation (water vapor, visibility, illumination geometry).



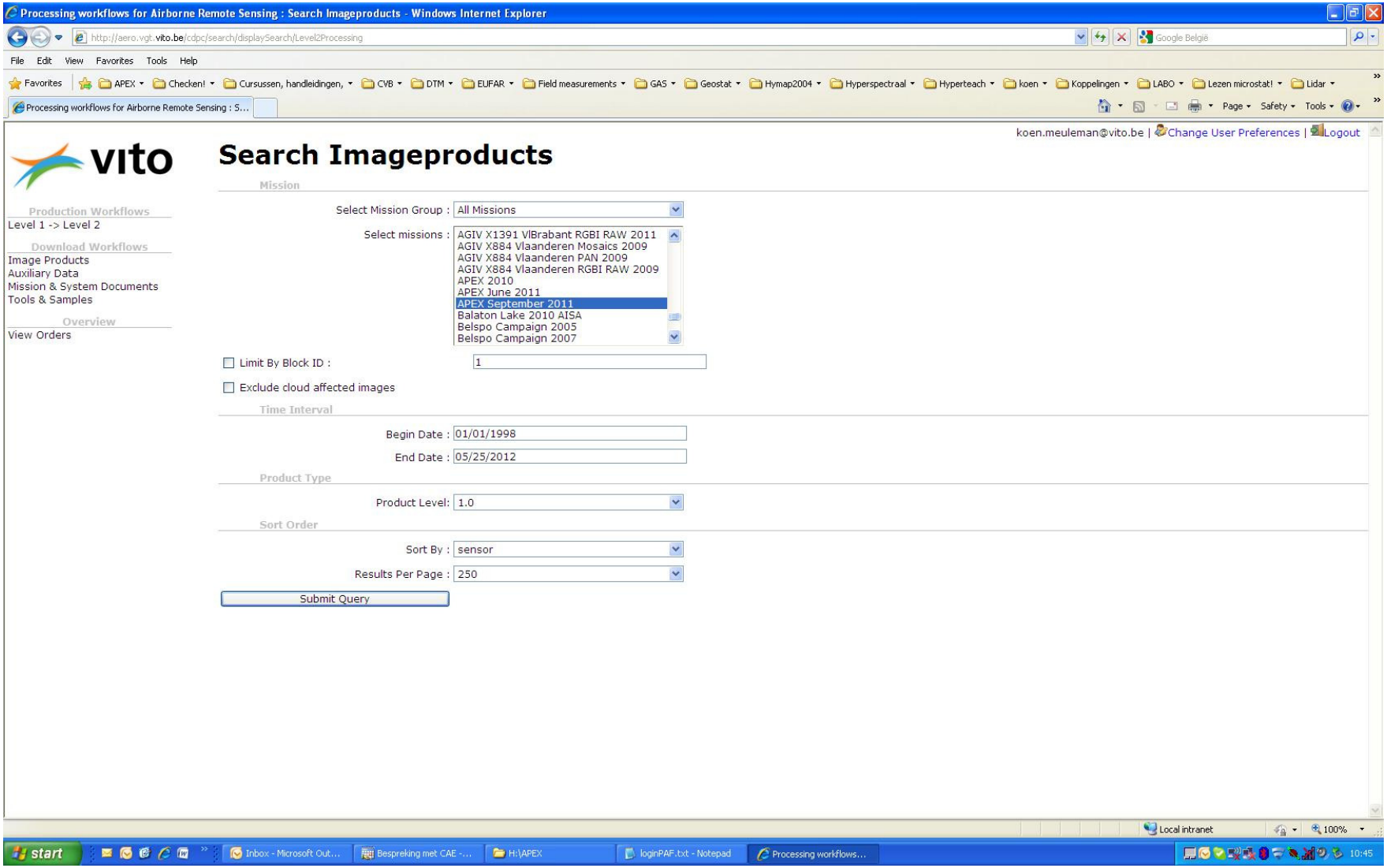

Processing workflows for Airborne Remote Sensing : Search Imageproducts - Windows Internet Explorer
http://aero.vgt.vito.be/cdpc/search/displaySearch/Level2Processing
File Edit View Favorites Tools Help
Processing workflows for Airborne Remote Sensing : S...
koen.meuleman@vito.be | Change User Preferences | Logout
vito
Search Imageproducts
Production Workflows
Level 1 -> Level 2
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Image Products
Auxiliary Data
Mission & System Documents
Tools & Samples
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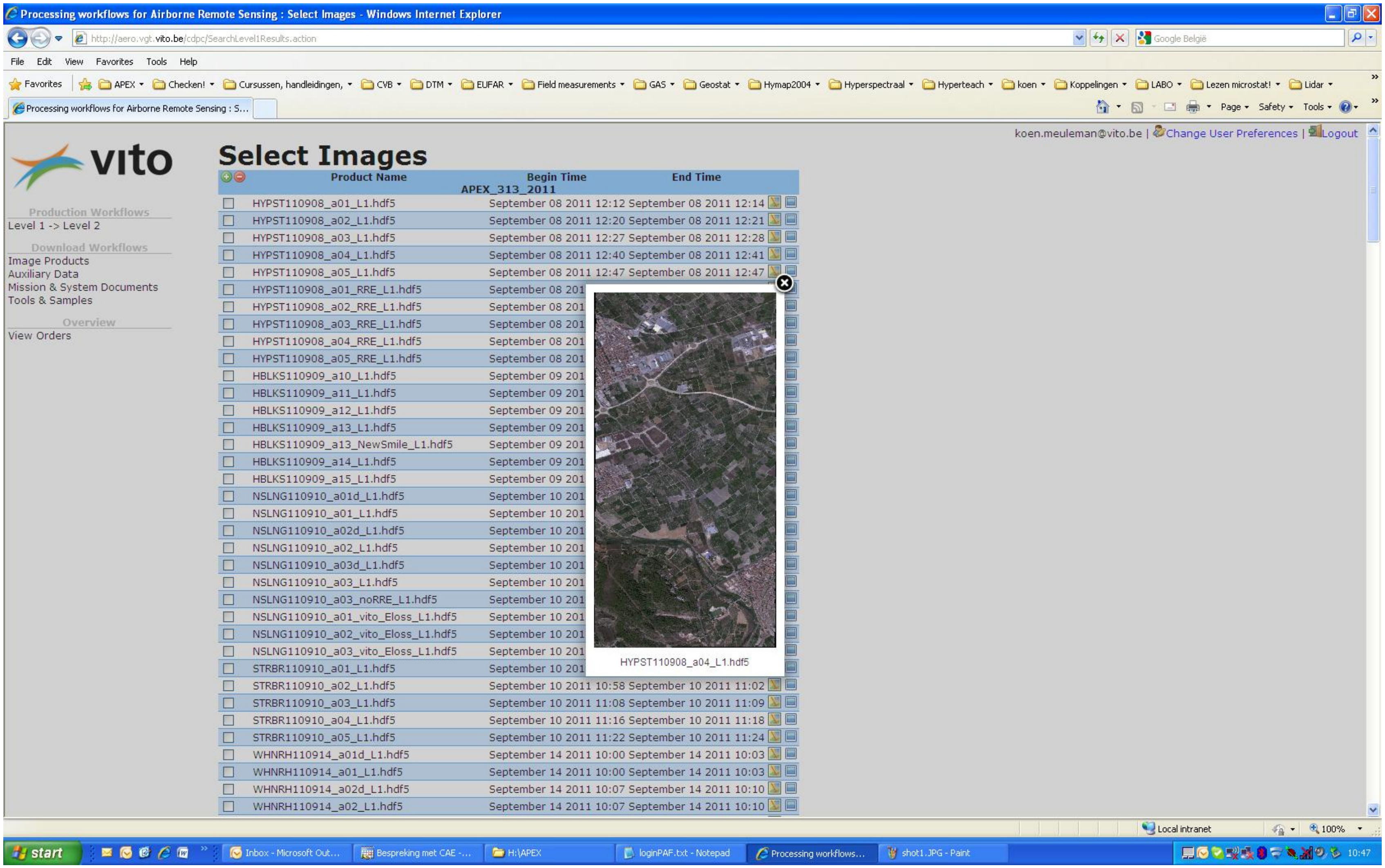
View Orders
Mission
Select Mission Group : All Missions
Select missions :
AGIV X1391 VlBrabant RGBI RAW 2011
AGIV X884 Vlaanderen Mosaics 2009
AGIV X884 Vlaanderen PAN 2009
AGIV X884 Vlaanderen RGBI RAW 2009
APEX 2010
APEX June 2011
APEX September 2011
Balaton Lake 2010 AISA
Belspo Campaign 2005
Belspo Campaign 2007
Limit By Block ID : 1
Exclude cloud affected images
Time Interval
Begin Date : 01/01/1998
End Date : 05/25/2012
Product Type
Product Level: 1.0
Sort Order
Sort By : sensor
Results Per Page : 250
Submit Query
Local intranet
100%
start
Inbox - Microsoft Out...
Bespreking met CAE -...
H:\APEX
loginPAF.txt - Notepad
Processing workflows...
10:45


Processing workflows for Airborne Remote Sensing : Select Images - Windows Internet Explorer
http://aero.vgt.vito.be/cdpc/SearchLevel1Results.action
File Edit View Favorites Tools Help
koen.meuleman@vito.be | Change User Preferences | Logout
vito
Production Workflows
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Download Workflows
Image Products
Auxiliary Data
Mission & System Documents
Tools & Samples
Overview
View Orders
Select Images
Product Name
Begin Time
End Time
APEX_313_2011
HYPST110908_a01_L1.hdf5 September 08 2011 12:12 September 08 2011 12:14
HYPST110908_a02_L1.hdf5 September 08 2011 12:20 September 08 2011 12:21
HYPST110908_a03_L1.hdf5 September 08 2011 12:27 September 08 2011 12:28
HYPST110908_a04_L1.hdf5 September 08 2011 12:40 September 08 2011 12:41
HYPST110908_a05_L1.hdf5 September 08 2011 12:47 September 08 2011 12:47
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HYPST110908_a03_RRE_L1.hdf5
HYPST110908_a04_RRE_L1.hdf5
HYPST110908_a05_RRE_L1.hdf5
HBLKS110909_a10_L1.hdf5
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NSLNG110910_a01_L1.hdf5
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NSLNG110910_a03_vito_Eloss_L1.hdf5
STRBR110910_a01_L1.hdf5
STRBR110910_a02_L1.hdf5 September 10 2011 10:58 September 10 2011 11:02
STRBR110910_a03_L1.hdf5 September 10 2011 11:08 September 10 2011 11:09
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STRBR110910_a05_L1.hdf5 September 10 2011 11:22 September 10 2011 11:24
WHNRH110914_a01d_L1.hdf5 September 14 2011 10:00 September 14 2011 10:03
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WHNRH110914_a02d_L1.hdf5 September 14 2011 10:07 September 14 2011 10:10
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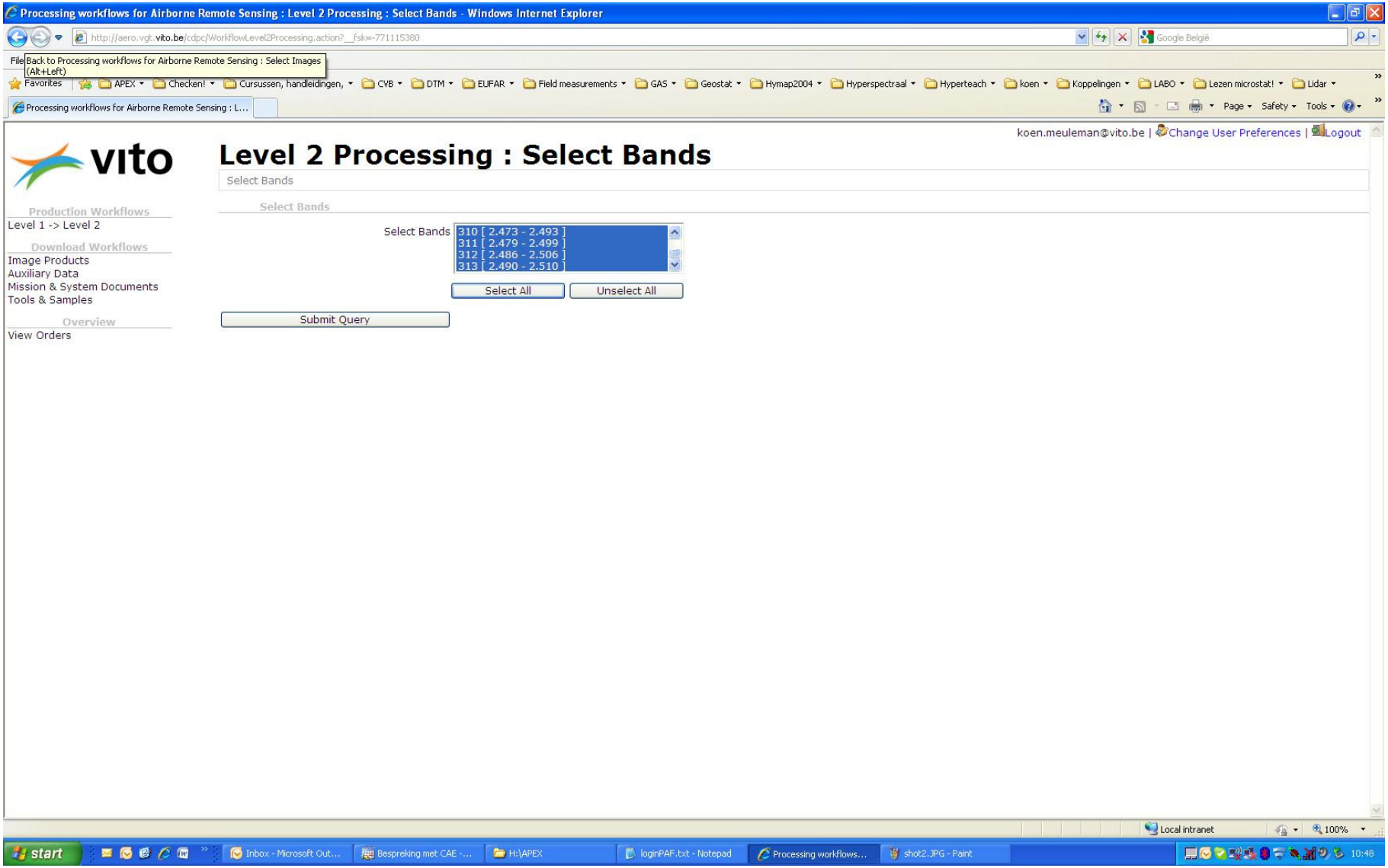
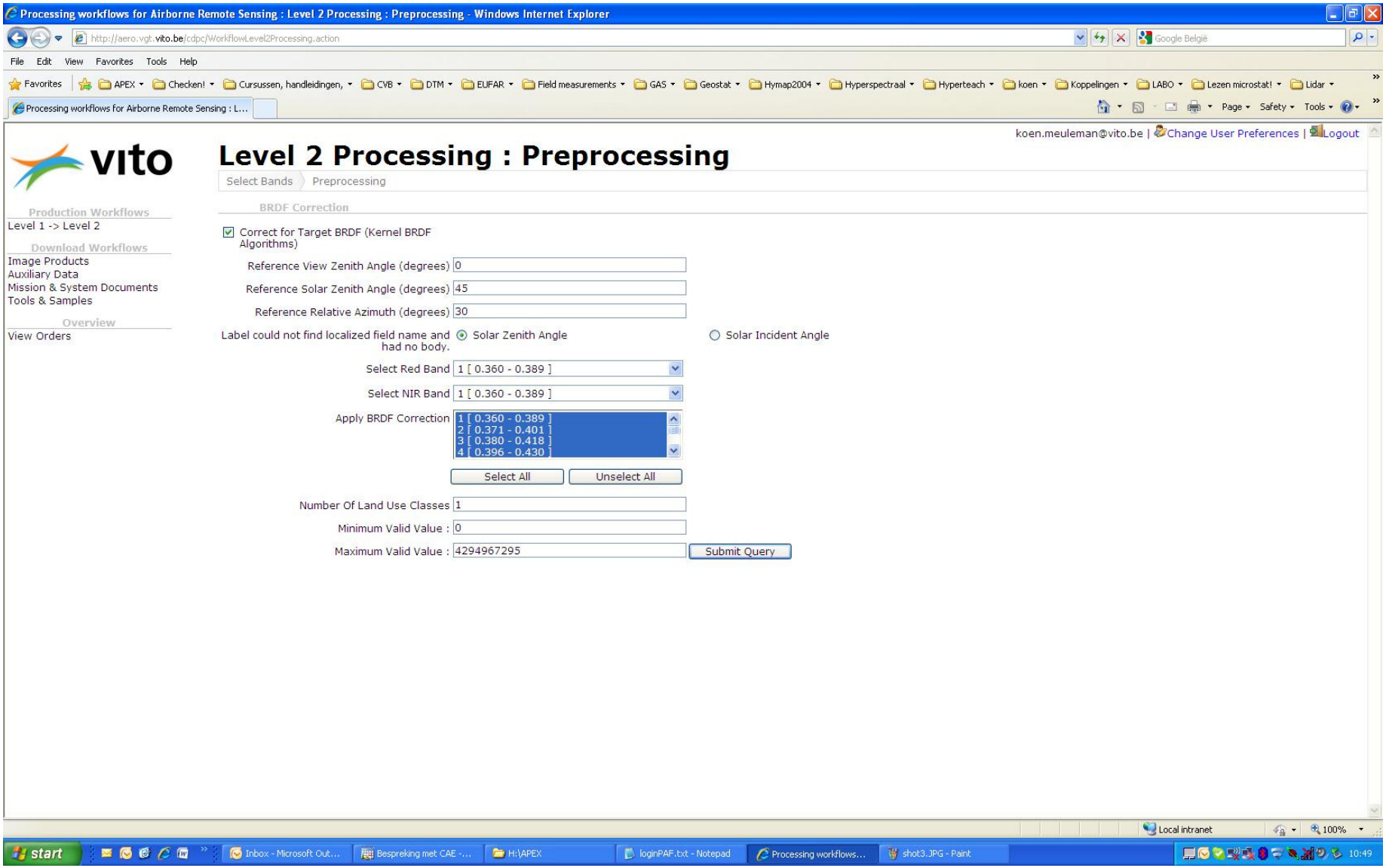
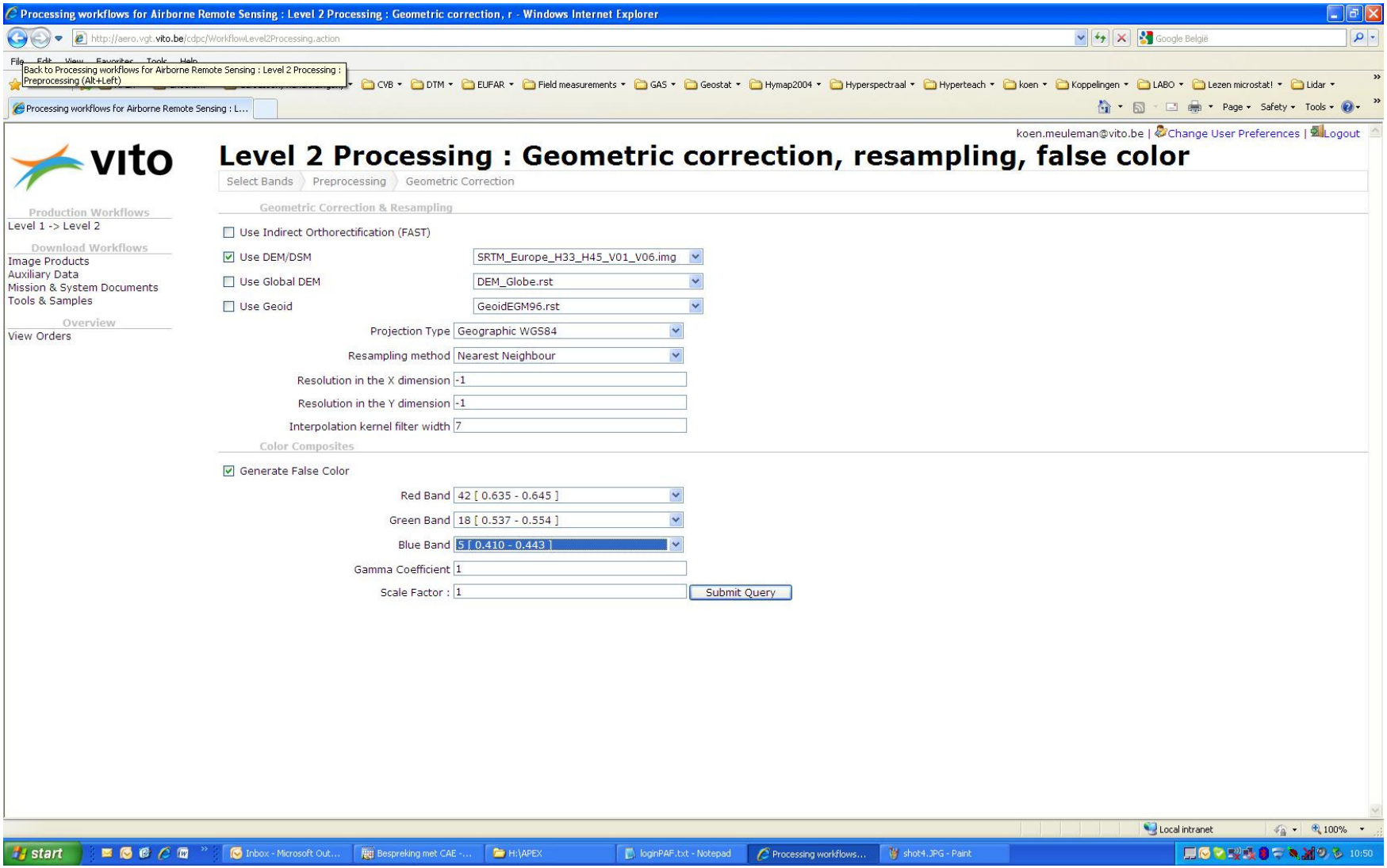
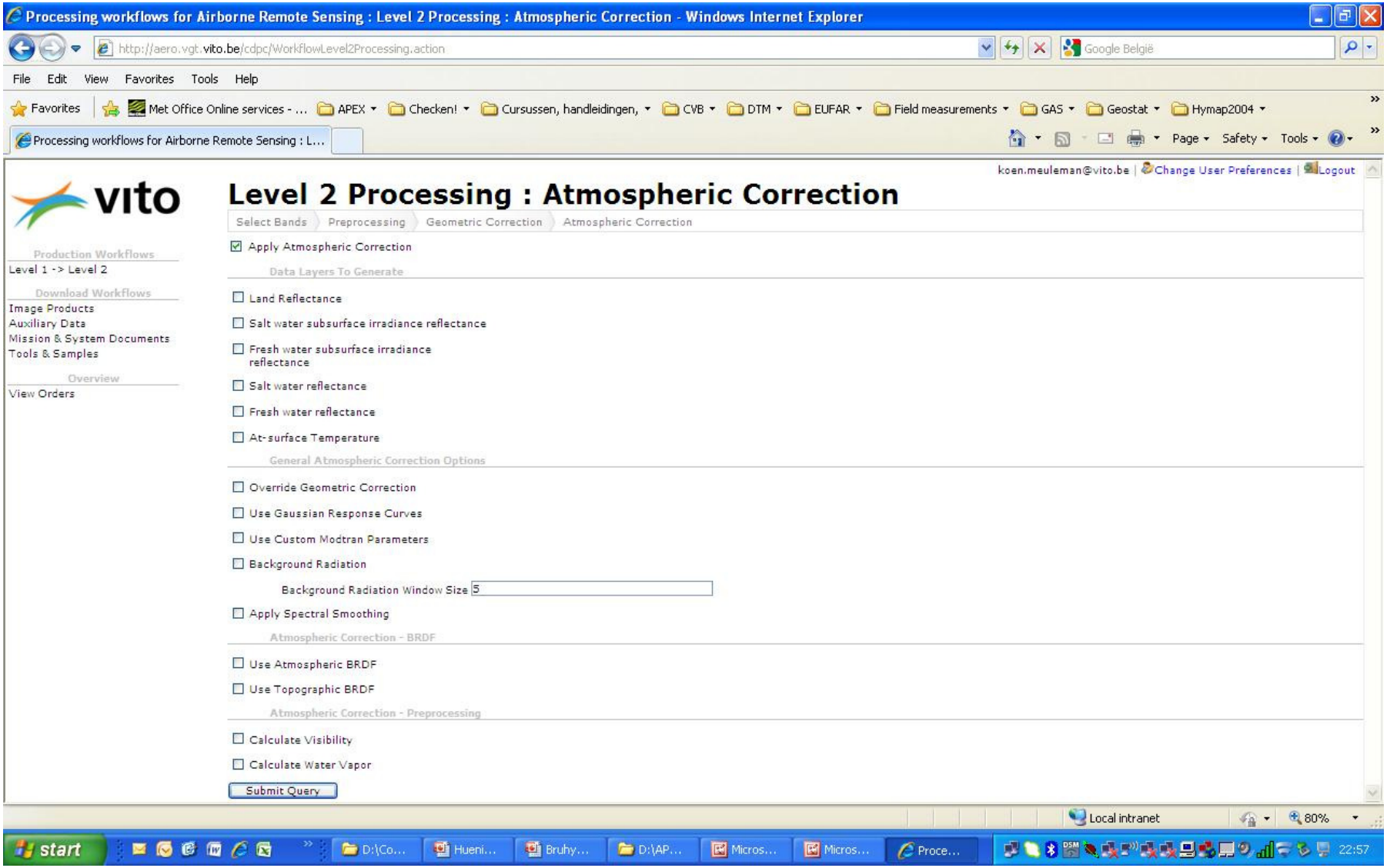
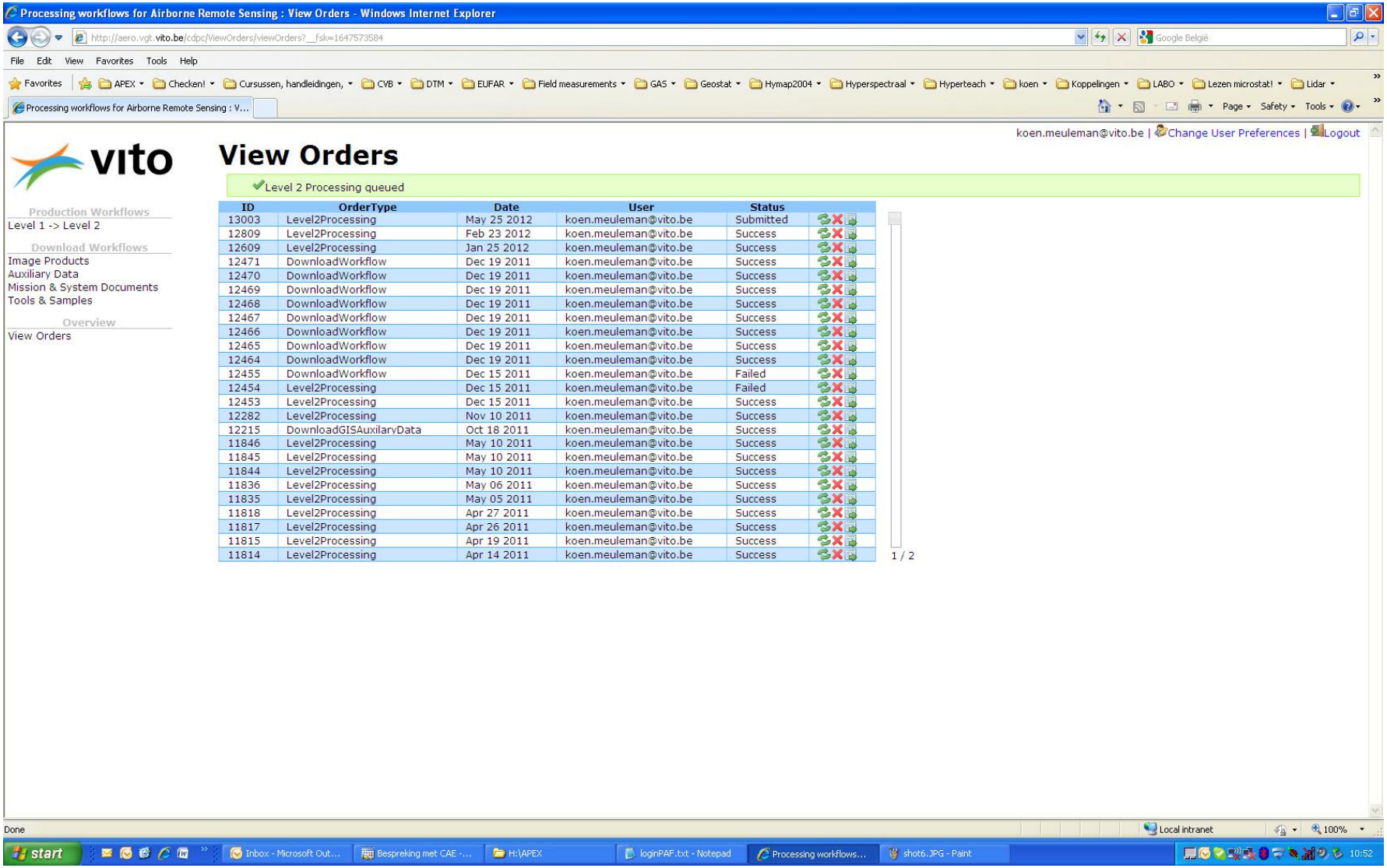

Processing workflows for Airborne Remote Sensing : Level 2 Processing : Select Bands - Windows Internet Explorer
Back to Processing workflows for Airborne Remote Sensing : Select Images (Alt+Left)
koen.meuleman@vito.be | Change User Preferences | Logout
Level 2 Processing : Select Bands
Select Bands
Production Workflows
Level 1 -> Level 2
Download Workflows
Image Products
Auxiliary Data
Mission & System Documents
Tools & Samples
Overview
View Orders
Select Bands
310 [2.473 - 2.493]
311 [2.479 - 2.499]
312 [2.486 - 2.506]
313 [2.490 - 2.510]
Select All
Unselect All
Submit Query


Processing workflows for Airborne Remote Sensing : Level 2 Processing : Preprocessing - Windows Internet Explorer
http://aero.vgt.vito.be/cdpc/WorkflowLevel2Processing.action
koen.meuleman@vito.be | Change User Preferences | Logout
vito
Level 2 Processing : Preprocessing
Select Bands
Preprocessing
Production Workflows
Level 1 -> Level 2
Download Workflows
Image Products
Auxiliary Data
Mission & System Documents
Tools & Samples
Overview
View Orders
BRDF Correction
Correct for Target BRDF (Kernel BRDF Algorithms)
Reference View Zenith Angle (degrees) 0
Reference Solar Zenith Angle (degrees) 45
Reference Relative Azimuth (degrees) 30
Label could not find localized field name and had no body.
Solar Zenith Angle
Solar Incident Angle
Select Red Band 1 [0.360 - 0.389]
Select NIR Band 1 [0.360 - 0.389]
Apply BRDF Correction
1 [0.360 - 0.389]
2 [0.371 - 0.401]
3 [0.380 - 0.418]
4 [0.396 - 0.430]
Select All
Unselect All
Number Of Land Use Classes 1
Minimum Valid Value : 0
Maximum Valid Value : 4294967295
Submit Query


Processing workflows for Airborne Remote Sensing : Level 2 Processing : Geometric correction, r - Windows Internet Explorer
http://aero.vgt.vito.be/cdpc/WorkflowLevel2Processing.action
Back to Processing workflows for Airborne Remote Sensing : Level 2 Processing : Preprocessing (Alt+Left)
koen.meuleman@vito.be | Change User Preferences | Logout
Level 2 Processing : Geometric correction, resampling, false color
Select Bands
Preprocessing
Geometric Correction
Production Workflows
Level 1 -> Level 2
Download Workflows
Image Products
Auxiliary Data
Mission & System Documents
Tools & Samples
Overview
View Orders
Geometric Correction & Resampling
Use Indirect Orthorectification (FAST)
Use DEM/DSM
SRTM_Europe_H33_H45_V01_V06.img
Use Global DEM
DEM_Globe.rst
Use Geoid
GeoidEGM96.rst
Projection Type
Geographic WGS84
Resampling method
Nearest Neighbour
Resolution in the X dimension
-1
Resolution in the Y dimension
-1
Interpolation kernel filter width
7
Color Composites
Generate False Color
Red Band
42 [0.635 - 0.645]
Green Band
18 [0.537 - 0.554]
Blue Band
5 [0.410 - 0.443]
Gamma Coefficient
1
Scale Factor :
1
Submit Query


Processing workflows for Airborne Remote Sensing : Level 2 Processing : Atmospheric Correction - Windows Internet Explorer
http://aero.vgt.vito.be/cdpc/WorkflowLevel2Processing.action
File Edit View Favorites Tools Help
Favorites
Met Office Online services - ...
APEX
Checken!
Cursussen, handleidingen,
CVB
DTM
EUFAR
Field measurements
GAS
Geostat
Hymap2004
Processing workflows for Airborne Remote Sensing : L...
Page Safety Tools
koen.meuleman@vito.be | Change User Preferences | Logout
vito
Level 2 Processing : Atmospheric Correction
Select Bands
Preprocessing
Geometric Correction
Atmospheric Correction
Production Workflows
Level 1 -> Level 2
Download Workflows
Image Products
Auxiliary Data
Mission & System Documents
Tools & Samples
Overview
View Orders
Apply Atmospheric Correction
Data Layers To Generate
Land Reflectance
Salt water subsurface irradiance reflectance
Fresh water subsurface irradiance reflectance
Salt water reflectance
Fresh water reflectance
At-surface Temperature
General Atmospheric Correction Options
Override Geometric Correction
Use Gaussian Response Curves
Use Custom Modtran Parameters
Background Radiation
Background Radiation Window Size 5
Apply Spectral Smoothing
Atmospheric Correction - BRDF
Use Atmospheric BRDF
Use Topographic BRDF
Atmospheric Correction - Preprocessing
Calculate Visibility
Calculate Water Vapor
Submit Query
Local intranet
80%
start
22:57



ID	OrderType	Date	User	Status
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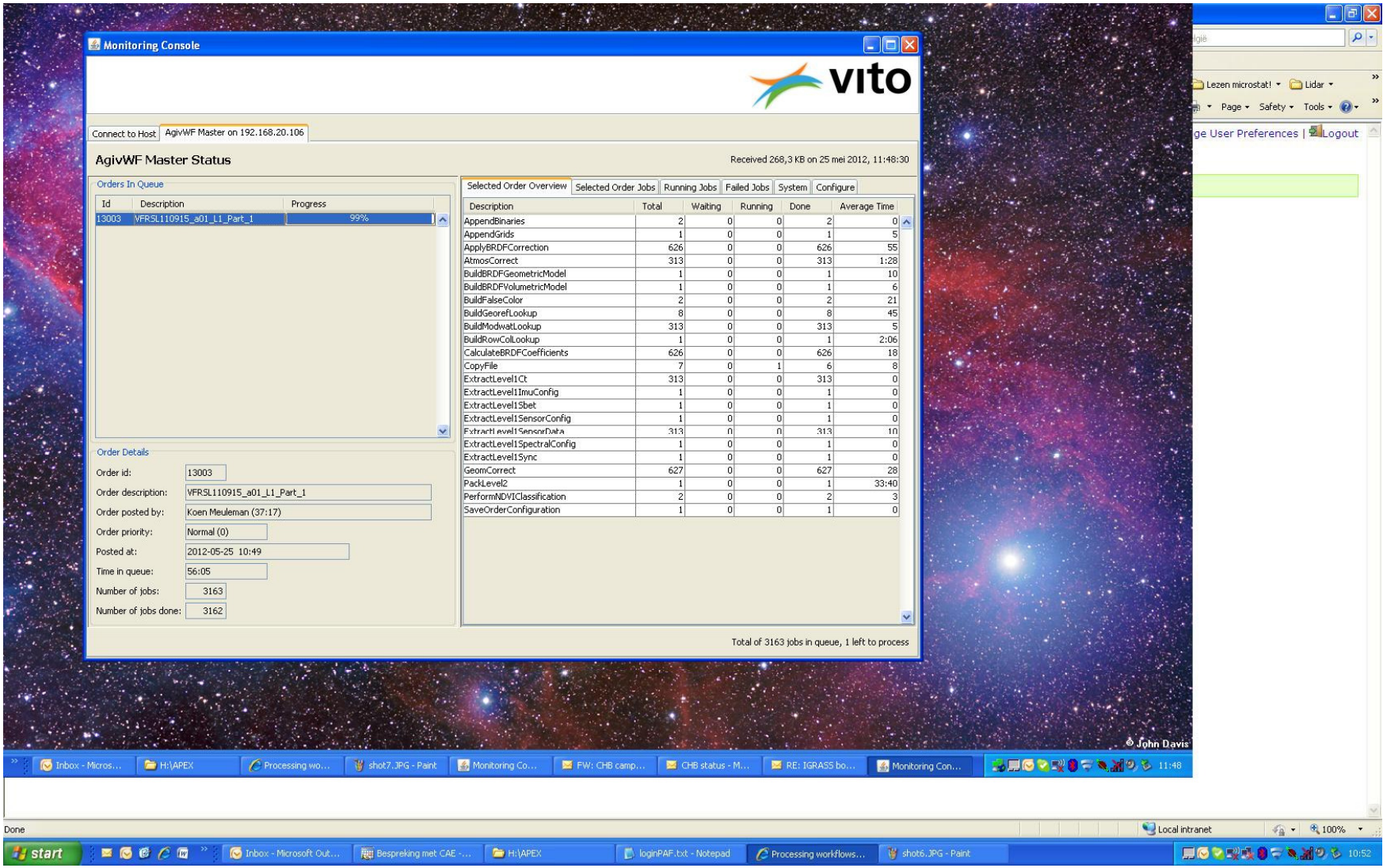
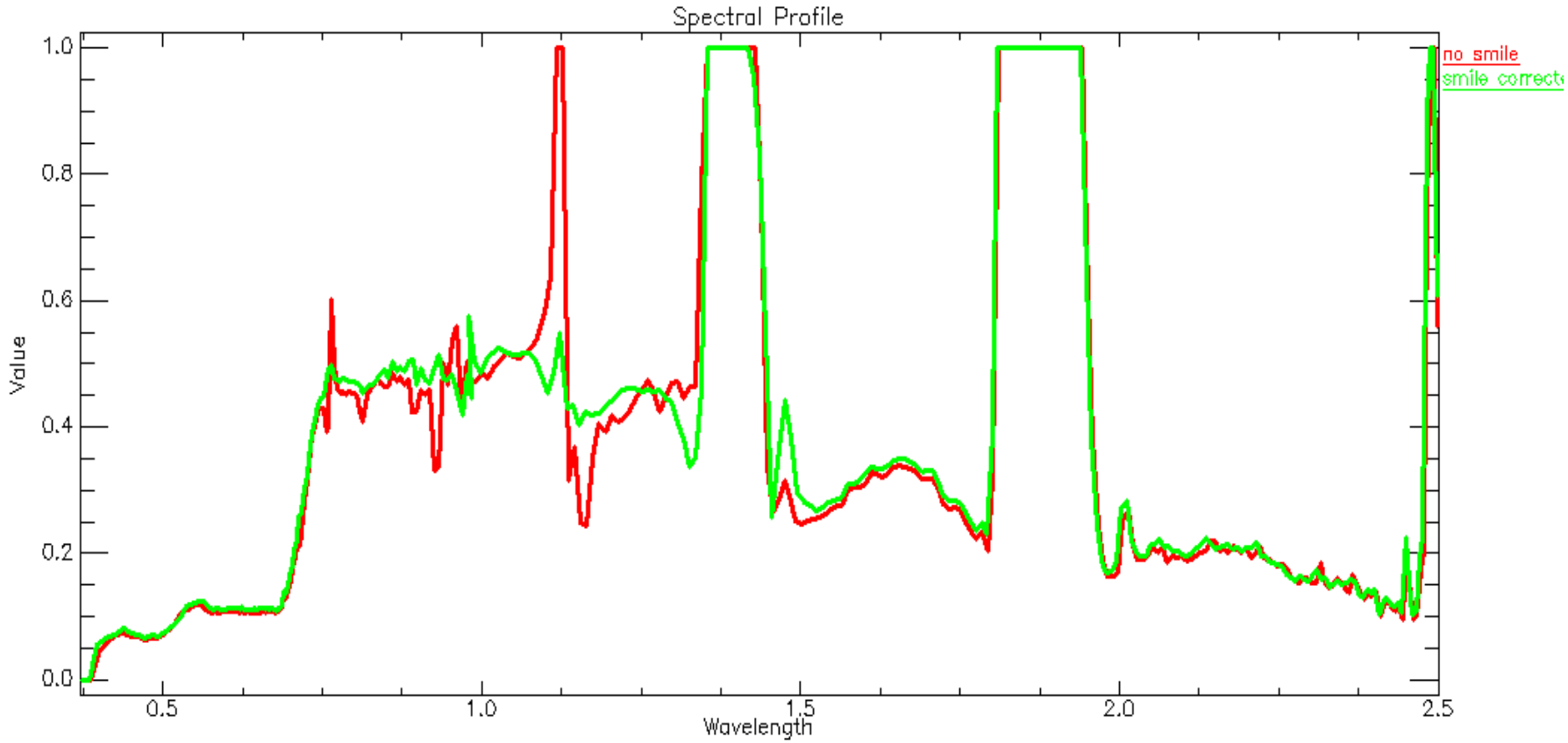
12809	Level2Processing	Feb 23 2012	koen.meuleman@vito.be	Success
12609	Level2Processing	Jan 25 2012	koen.meuleman@vito.be	Success
12471	DownloadWorkflow	Dec 19 2011	koen.meuleman@vito.be	Success
12470	DownloadWorkflow	Dec 19 2011	koen.meuleman@vito.be	Success
12469	DownloadWorkflow	Dec 19 2011	koen.meuleman@vito.be	Success
12468	DownloadWorkflow	Dec 19 2011	koen.meuleman@vito.be	Success
12467	DownloadWorkflow	Dec 19 2011	koen.meuleman@vito.be	Success
12466	DownloadWorkflow	Dec 19 2011	koen.meuleman@vito.be	Success
12465	DownloadWorkflow	Dec 19 2011	koen.meuleman@vito.be	Success
12464	DownloadWorkflow	Dec 19 2011	koen.meuleman@vito.be	Success
12455	DownloadWorkflow	Dec 15 2011	koen.meuleman@vito.be	Failed
12454	Level2Processing	Dec 15 2011	koen.meuleman@vito.be	Failed
12453	Level2Processing	Dec 15 2011	koen.meuleman@vito.be	Success
12282	Level2Processing	Nov 10 2011	koen.meuleman@vito.be	Success
12215	DownloadGISAuxilaryData	Oct 18 2011	koen.meuleman@vito.be	Success
11846	Level2Processing	May 10 2011	koen.meuleman@vito.be	Success
11845	Level2Processing	May 10 2011	koen.meuleman@vito.be	Success
11844	Level2Processing	May 10 2011	koen.meuleman@vito.be	Success
11836	Level2Processing	May 06 2011	koen.meuleman@vito.be	Success
11835	Level2Processing	May 05 2011	koen.meuleman@vito.be	Success
11818	Level2Processing	Apr 27 2011	koen.meuleman@vito.be	Success
11817	Level2Processing	Apr 26 2011	koen.meuleman@vito.be	Success
11815	Level2Processing	Apr 19 2011	koen.meuleman@vito.be	Success
11814	Level2Processing	Apr 14 2011	koen.meuleman@vito.be	Success


Monitoring Console
vito
Connect to Host
AgivWF Master on 192.168.20.106
AgivWF Master Status
Received 268,3 KB on 25 mei 2012, 11:48:30
Orders In Queue
Id
Description
Progress
13003
VFRSL110915_a01_L1_Part_1
99%
Selected Order Overview
Selected Order Jobs
Running Jobs
Failed Jobs
System
Configure
Description
Total
Waiting
Running
Done
Average Time
AppendBinaries 2 0 0 2 0
AppendGrids 1 0 0 1 5
ApplyBRDFCorrection 626 0 0 626 55
AtmosCorrect 313 0 0 313 1:28
BuildBRDFGeometricModel 1 0 0 1 10
BuildBRDFVolumetricModel 1 0 0 1 6
BuildFalseColor 2 0 0 2 21
BuildGeorefLookup 8 0 0 8 45
BuildModwatLookup 313 0 0 313 5
BuildRowColLookup 1 0 0 1 2:06
CalculateBRDFCoefficients 626 0 0 626 18
CopyFile 7 0 1 6 8
ExtractLevel1Ct 313 0 0 313 0
ExtractLevel1ImuConfig 1 0 0 1 0
ExtractLevel1Sbet 1 0 0 1 0
ExtractLevel1SensorConfig 1 0 0 1 0
ExtractLevel1SensorData 313 0 0 313 10
ExtractLevel1SpectralConfig 1 0 0 1 0
ExtractLevel1Sync 1 0 0 1 0
GeomCorrect 627 0 0 627 28
PackLevel2 1 0 0 1 33:40
PerformNDVIClassification 2 0 0 2 3
SaveOrderConfiguration 1 0 0 1 0
Order Details
Order id: 13003
Order description: VFRSL110915_a01_L1_Part_1
Order posted by: Koen Meuleman (37:17)
Order priority: Normal (0)
Posted at: 2012-05-25 10:49
Time in queue: 56:05
Number of jobs: 3163
Number of jobs done: 3162
Total of 3163 jobs in queue, 1 left to process
© John Davis
Done
Local intranet
100%
start

Data Volumes generated 2011

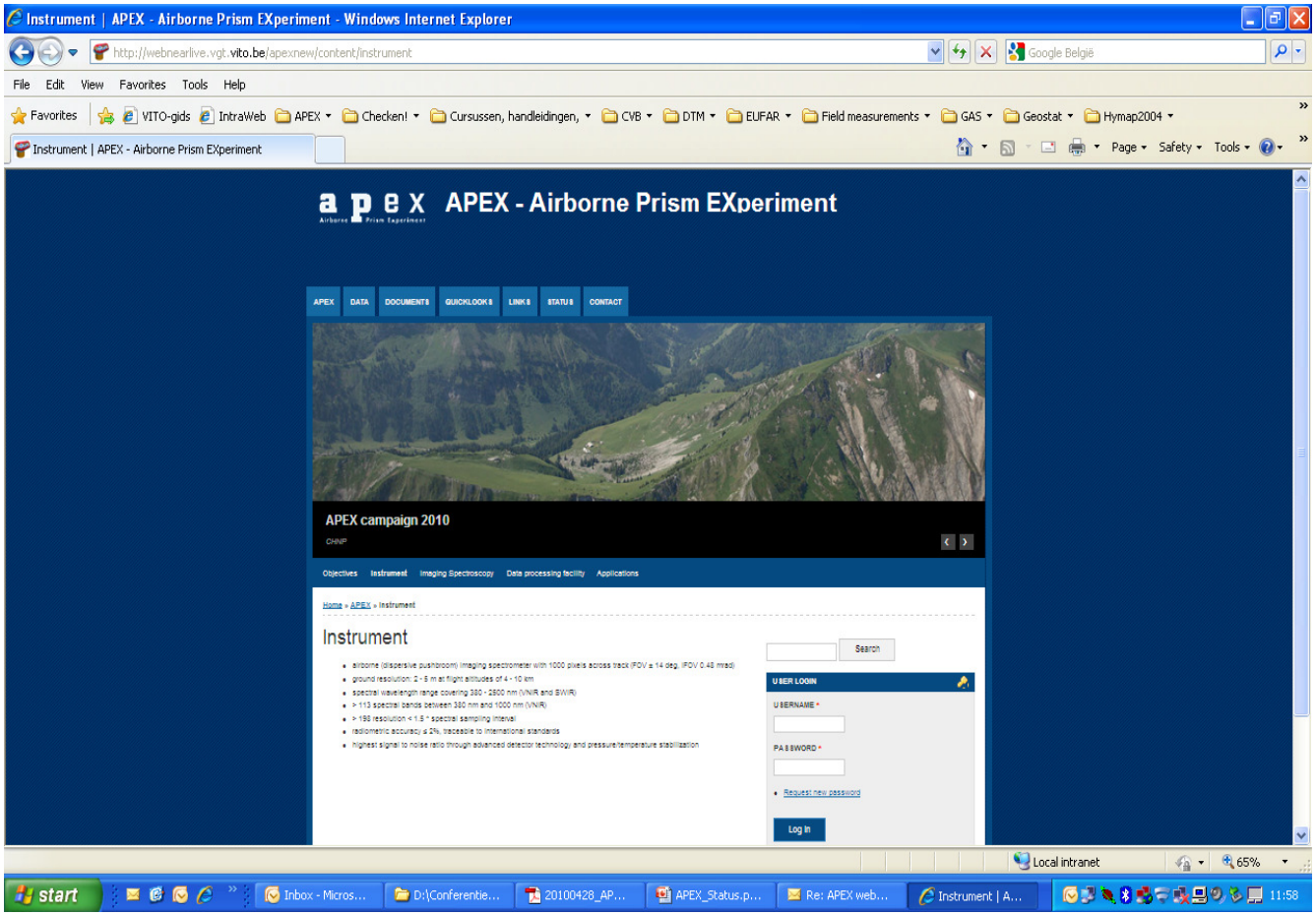
-	# flightlines	Raw image data (GB)	L1 HDF5 data (GB)	L2 data (GB)	SBET data (GB)	Intermediate (RSL-PAF) L0 and L1 data (GB)
June 2011	60	238.8	321.2	26.82	2.4	1900
Sept 2011	88	295.2	541.6	160.38	3	3300
Total	148	534	862.8	187.2	5.4	5200

Effect smile correction on final reflectance



APEX website

www.apex-esa.org



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APEX – Airborne Prism Experiment

Thank you for your attention!

www.apex-esa.org