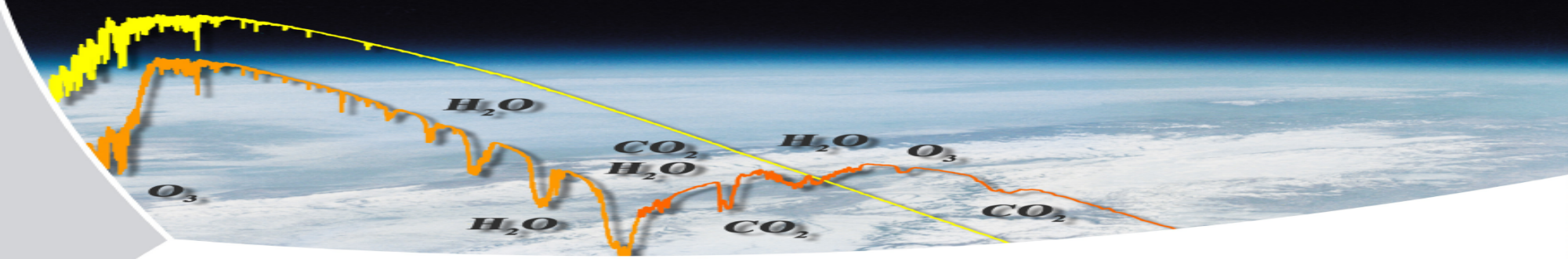


Baseline Status/Operational Products

G. Lichtenberg & QWG

Remote Sensing Technology Institute ATP

24.11.2015

Overview

Level 1 Verification Method

- All new algorithms need to be verified
- For Level 1 this is done with dedicated test methods and data
- If a reference is available, the operational implementation results are compared to reference results
- If no reference is available, a specifically designed test is done to ensure proper functionality

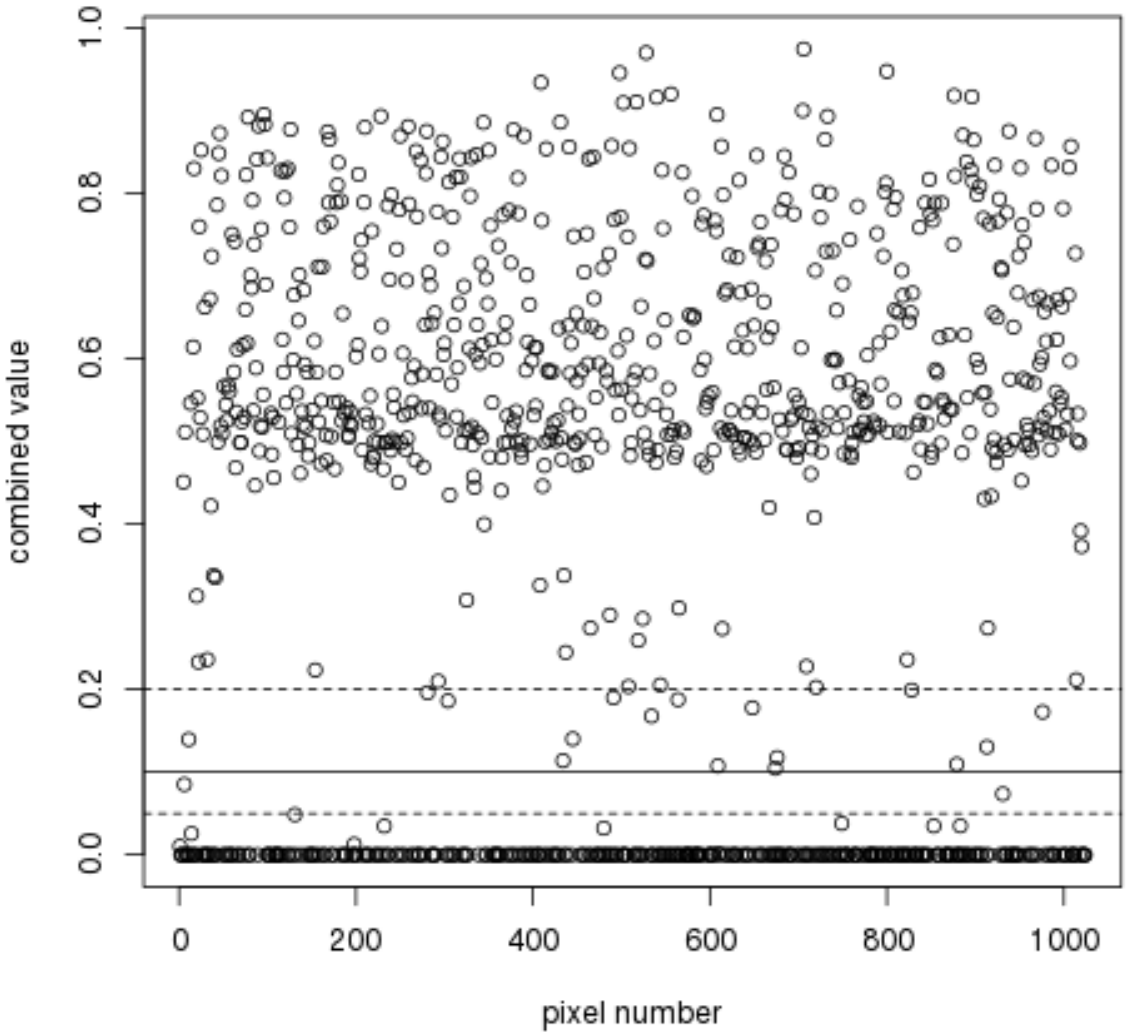
WP2160: Individual Pixel Characterisation (I)

- Motivation:
  - The old mask had only channel wide thresholds
  - This led to potentially useful pixels to be thrown away
  - The new algorithm analyses each pixel individually over time to decide if it still useful
- Mask was delivered by SRON
- Mask contains for channel 8 a float to characterise quality of pixels (0-1)

WP2160: Individual Pixel Characterisation (II)

- Algorithm uses this mask was implemented in the following way:
  - The original file of SRON is directly used (i.e. no DB in processor)
  - An additional config parameter was added to L0-1 processor to switch on and off the SRON mask
  - The threshold to mark a pixel as bad can be changed in the configuration
  - The threshold for marking a pixel as bad is currently set to 0.1 (this works well with SRON CO retrieval but would have to be tested for SGP retrieval)
- Verification Test Targets:
  - New flags for channel 8 are evaluated correctly
  - Flags for channel 1-7 remain unchanged
  - Thresholds different than 0.1 are processed correctly (0.2 and 0.05 were tested)
- The data from the SRON DB were extracted with hdf5 tools and compared to processor results
- All tests were successful

WP2160: Individual Pixel Characterisation (III)



WP2220: Dark Calibration (I)

- Motivation:
  - The spectral signature of CO is very small compared to the overall background
  - Therefore the offset correction must be very accurate
  - The new dark algorithm developed by SRON introduces a new correction of the dark dependency over the orbit with improved accuracy
- Data base reading and application implemented
- Test Targets
  - Channel 8 Dark signal/error for (Earth) are correctly calculated
  - Channel 8 Dark signal/error for (Sun) are correctly calculated
  - Dark signal/error for other channels remains unchanged

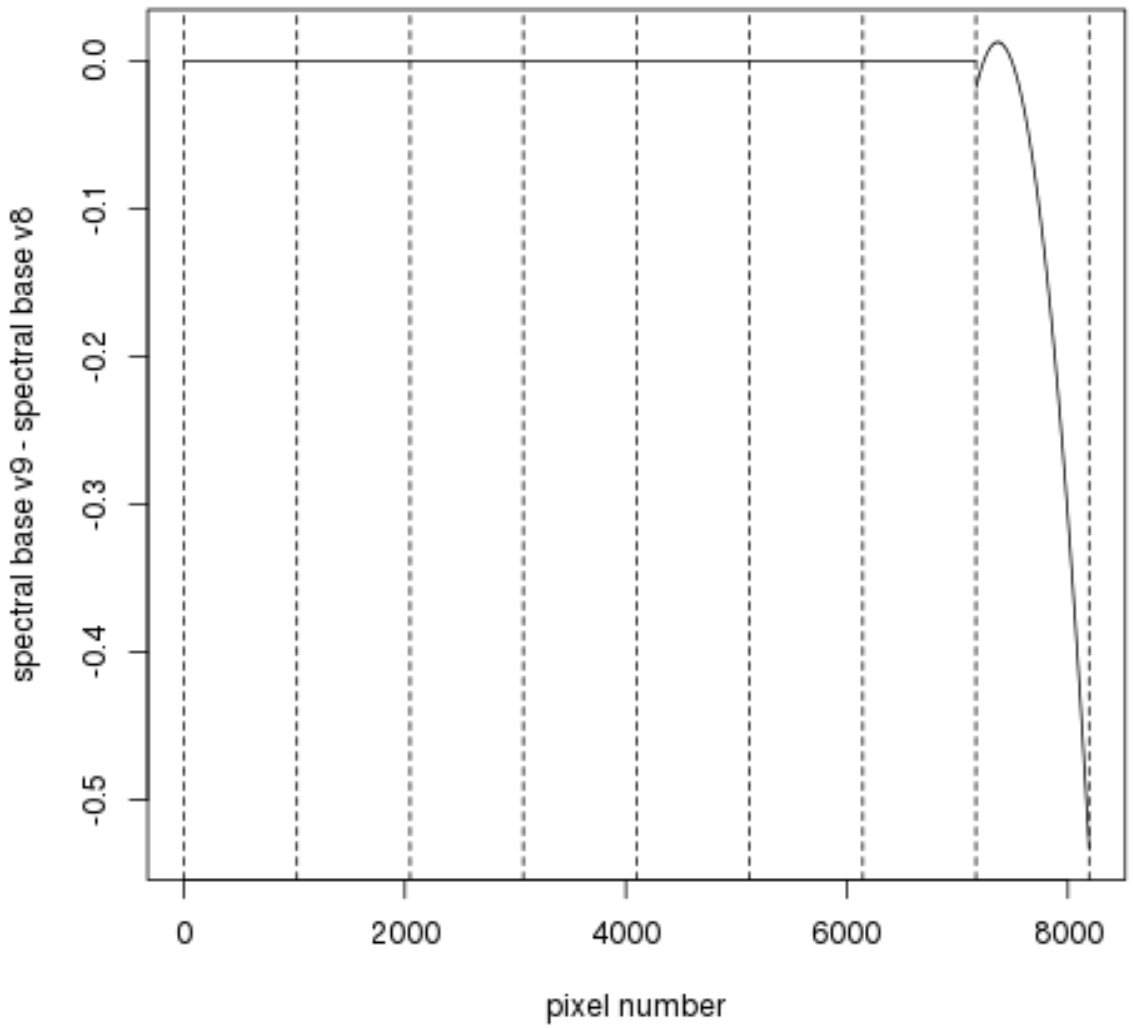
WP2220: Dark Calibration (II)

- Verification:
  - Calculate the darks “manually” from the SRON DB values
  - Compare to processor values
  - Check that all other dark values are unchanged by switching SRON darks on and off and compare
  - Maximum relative difference found 1.134e-10 (signal), 2.637e-06 (error), i.e. are below the threshold
  - All other channels showed identical values for SRON darks on/off
- Update February:
  - List of corrupt darks in the SRON DB
  - Replace corrupt darks with nearest neighbour in time in the DB *before* processing
- Testing was successful

WP 2250: Spectral Calibration Channel 8 (II)

- Motivation
  - Investigation based on Level 2 retrievals showed that the spectral calibration was not optimal
  - SRON derived new polynomial coefficients for the calibration
- Implementation complete:
  - Original key data base wavelength was exchanged with one calculated from SRON
  - No algorithm changes needed
- Test Targets:
  - Wavelength of channel 8 are set correctly
  - Wavelength of other channels are unchanged
- Verification done by manual implementation of wavelength polynom calculation and comparison with processor result
- Maximum relative difference found 3.315e-08 (reason: single precision of saved baseline wavelngth)

WP 2250: Spectral Calibration Channel 8 (II)

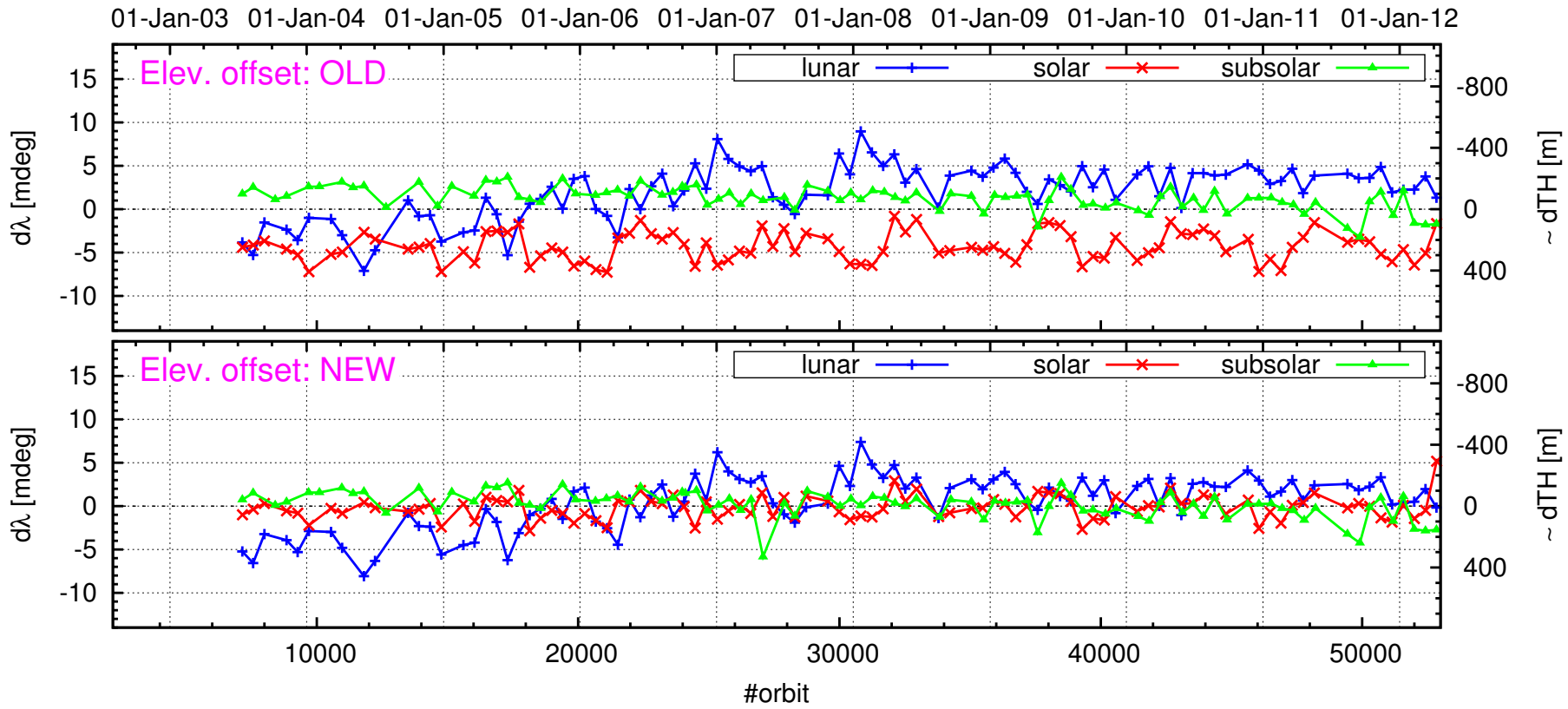


WP2270: Improve Pointing (I)

- Motivation:
  - The limb retrieval needs very accurate pointing information
  - The pointing was already improved in the past
  - IUP derived new correction parameters from solar and lunar positions
- New pointing correction parameters implemented in the initialisation file of processor
- Verification:
  - Test target: Compare processor geolocation values with those of IUP model
  - Result: Difference is within 30 cm

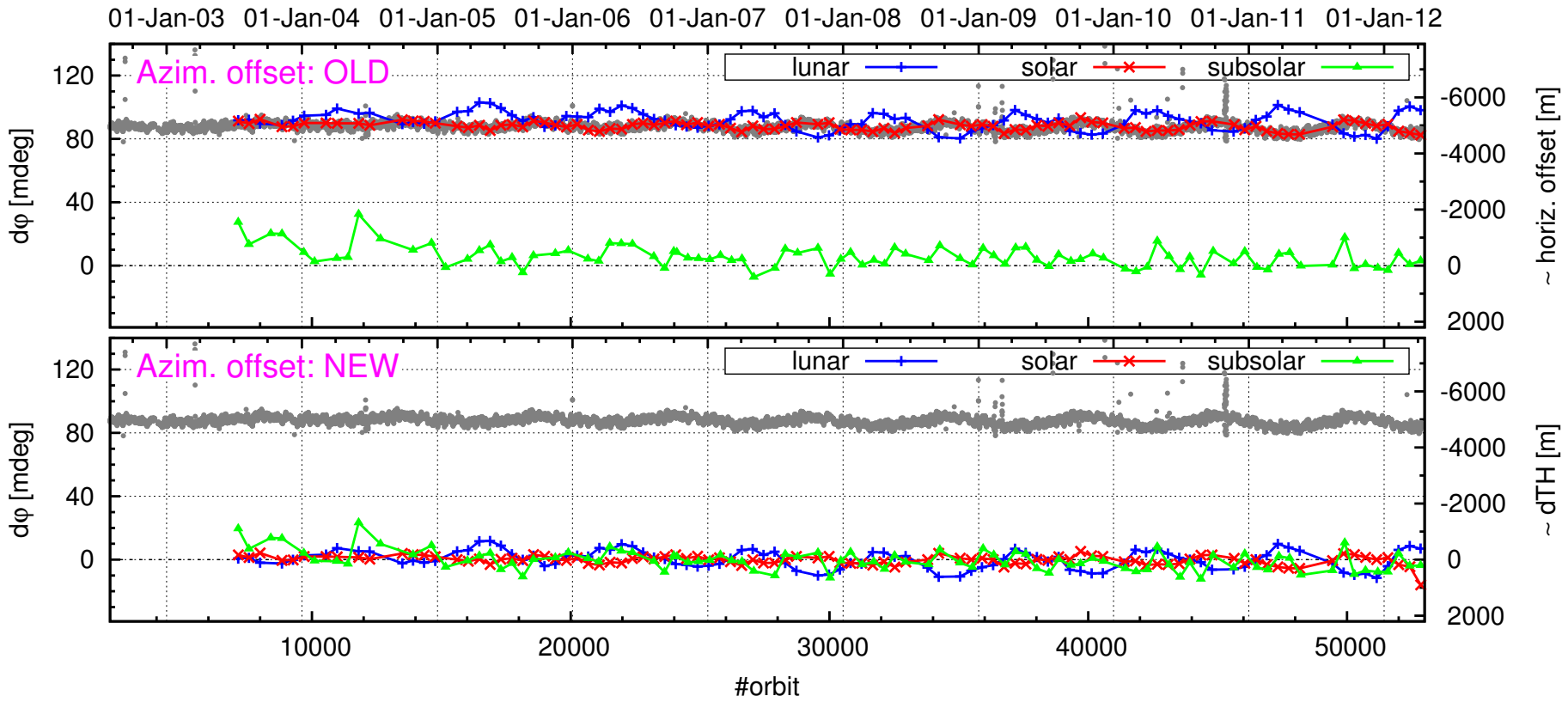
WP2270: Improve Pointing (II)

Elevation offset



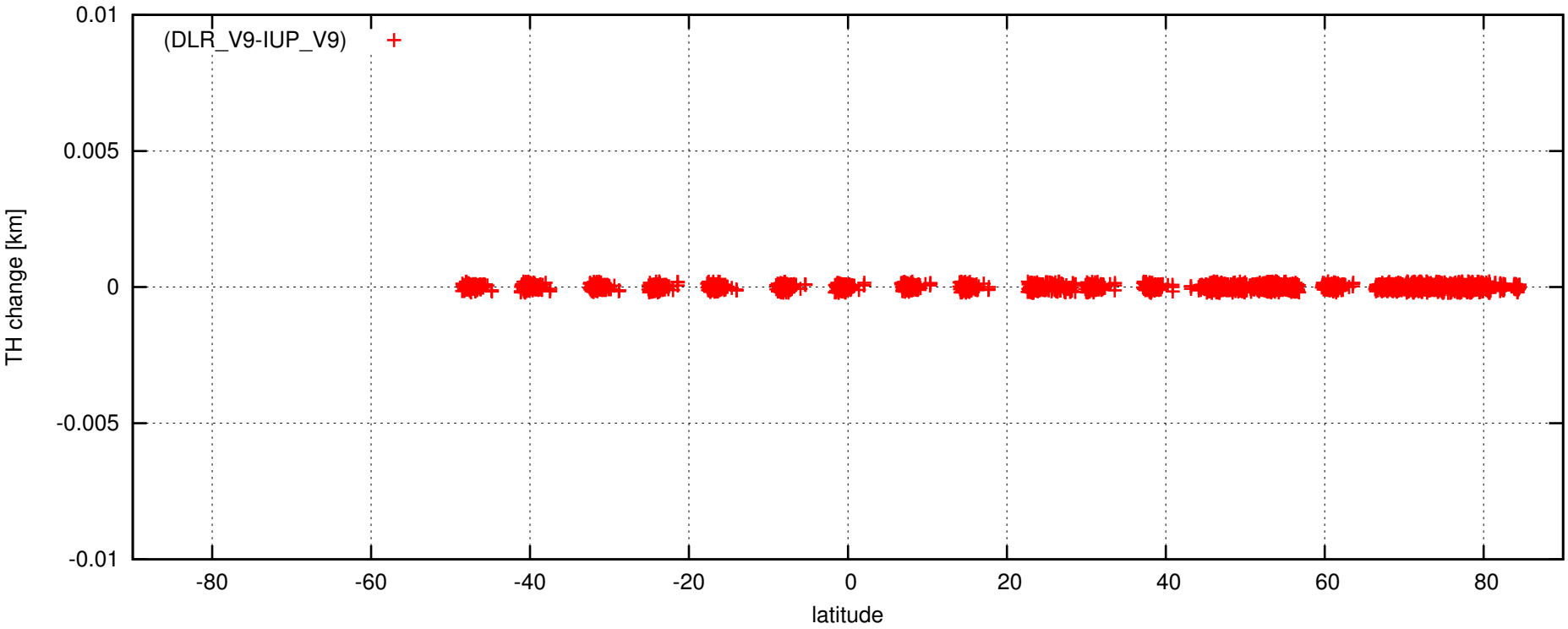
WP2270: Improve Pointing (III)

Azimuth offset



WP2270: Improve Pointing (IV)

Implementation vs Reference



WP2120: Improve ESM Diffuser Reference

- Motivation:
  - The ESM diffuser sun spectra show seasonally varying spectral features
  - Since the Earth radiances are measured with the mirrors they do not exhibit these features
  - In reflectances the features might hamper or degrade Level 2 retrieval results
- SRON analysed a large set of measured solar spectra over the lifetime of SCIAMACHY
- From this analysis a new set of ESM calibration data and trends over time for the spectral features was derived
- The corrections are incorporated into the updated scan mirror model and the residual m-factor correction and will be implemented there

WP2140: Improve Degradation Correction

- Updated degradation module from SRON that has an improved correction (especially OBM degradation)
- Implementation: Replace existing module with updated module from IUP (to align m-factor calculation with degradation correction)
- Verification:
  - Use test data established during initial model implementation for Version 8.0
  - Results: are currently derived

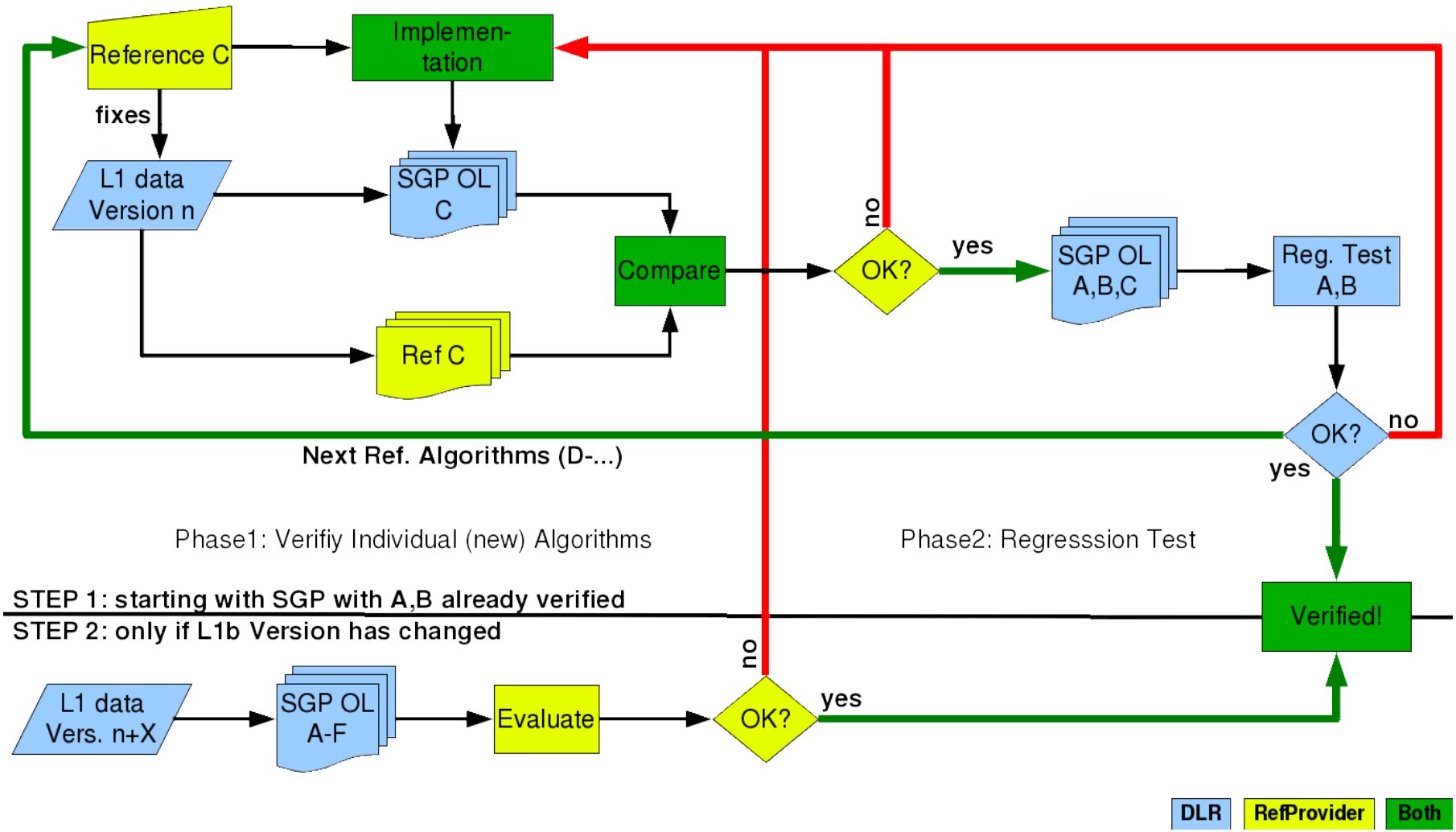
WP2150: Improve Polarisation Key Data

- Key data are input files for processor
- No algorithm changes needed, reading routines stay unchanged
- The new key data (together with the scan mirror model) deliver better correction factors
- The number of unphysical result is lower
- Note: The polarisation correction algorithms will be further improved in phase 2

Level 2 Verification (I)

- The *implementation* for algorithms is started by doing a quick prototype implementation at DLR
  - The prototype implementation is done to clarify gaps in the documentation
  - The prototype implementation is then transferred to the operational processor
- The Level 2 *verification* is done in two steps:
  - **Step 1:** Test individual *new* algorithms using the current, operational Level *1* products against the results of the reference provider
  - **Step 2:** Test *all* algorithms using the new Level 1 version and compare with the results from the previous verification step or operational product for algorithms that were not changed
  - In this way the impact of Level 1 changes on Level 2 can be separated from the implementation details of the Level 2 algorithms
  - It also decouples Level 1 development from Level 2 development
- Test data are several hundred orbits distributed over the whole mission

Level 2 Verification (II)



Level 2 Improvements - Tropospheric BrO

- see presentation C. Lerot

New Product Formats (I)

- Both products, Level 1 and Level 2 will be transferred from the current ENVISAT format to netCDF V4 format
- Guidelines:
  - Product structure will be as far as possible similar to those developed for Sentinels (SCIAMACHY is more complicated though)
  - All information in the current product will also be in the new products
  - Level 1 will *additionally* contain all relevant operations information for LTDP

New Product Formats (II)

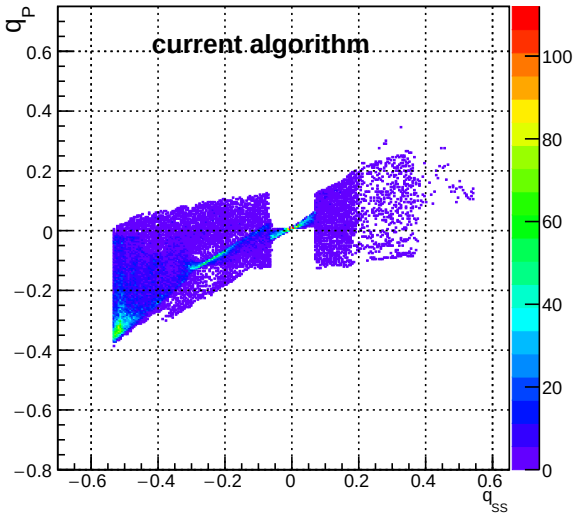
- A draft specification was send to the QWG in December 2015
- For Level 2 a sample product was distributed
- Tools (scial1c) and the operational chain will be adjusted for the new format in the coming months
- Note: Verification will be done with the old formats to ease the transition period
- The new format content will be checked against the old format content to ensure proper transfer

WP2260: Improve Polarisation Correction (I)

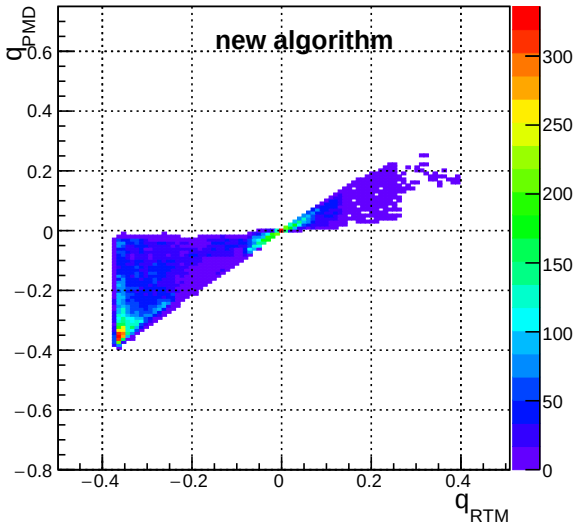
- Several improvements planned, implementation pending on MTR outcome
- Improvements require larger re-structuring of the algorithms
- Implementation of first part, the GOME-CHEOPS algorithm finished
- Verification:
  - Comparison of correction values with test cases developed for GOME
  - Verification is on-going

WP2260: Improve Polarisation Correction (II)

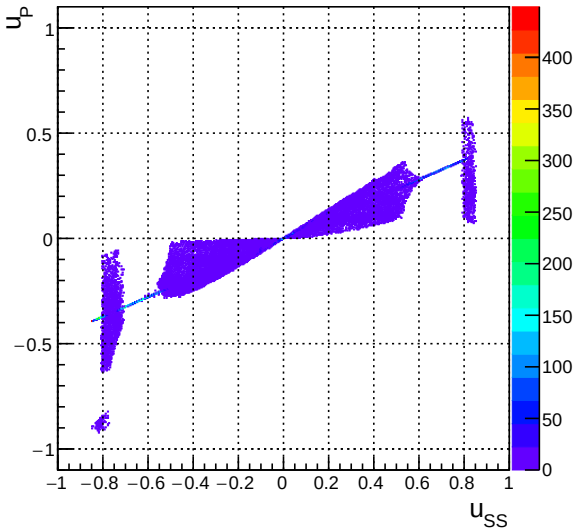
SCIAMACHY q (PMD 1, RO 0), 2007/08



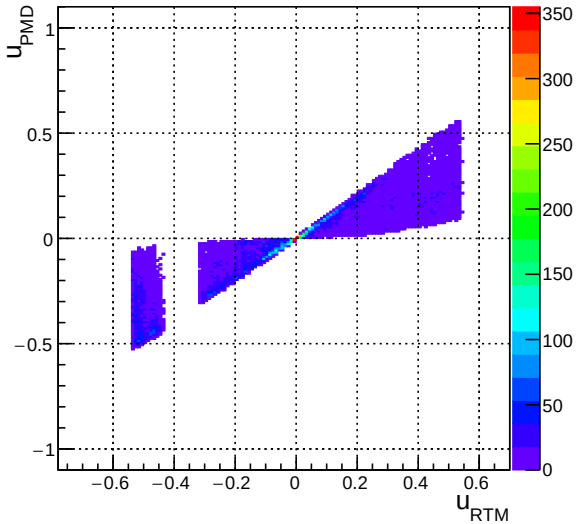
SCIAMACHY q (PMD 1, RO 0), 2007/08



SCIAMACHY u (PMD 1, RO 0), 2007/08



SCIAMACHY u (PMD 1, RO 0), 2007/08



WP2240: Investigate/Improve spectral calibration channel 6+

- The new algorithm was implemented for Sentinel-4 and Sentinel-5
- Implementation needs
  - ISRF from SCIAMACHY
  - clean solar spectrum interpolated for bad pixels
  - test if it improves Level 2 products
- Impact on *operational* products: minimal, since they have their own wavelength correction algorithms
- However, for a good Level 1 calibration is useful for future possible products
- Implementation for the next version of the processor is likely

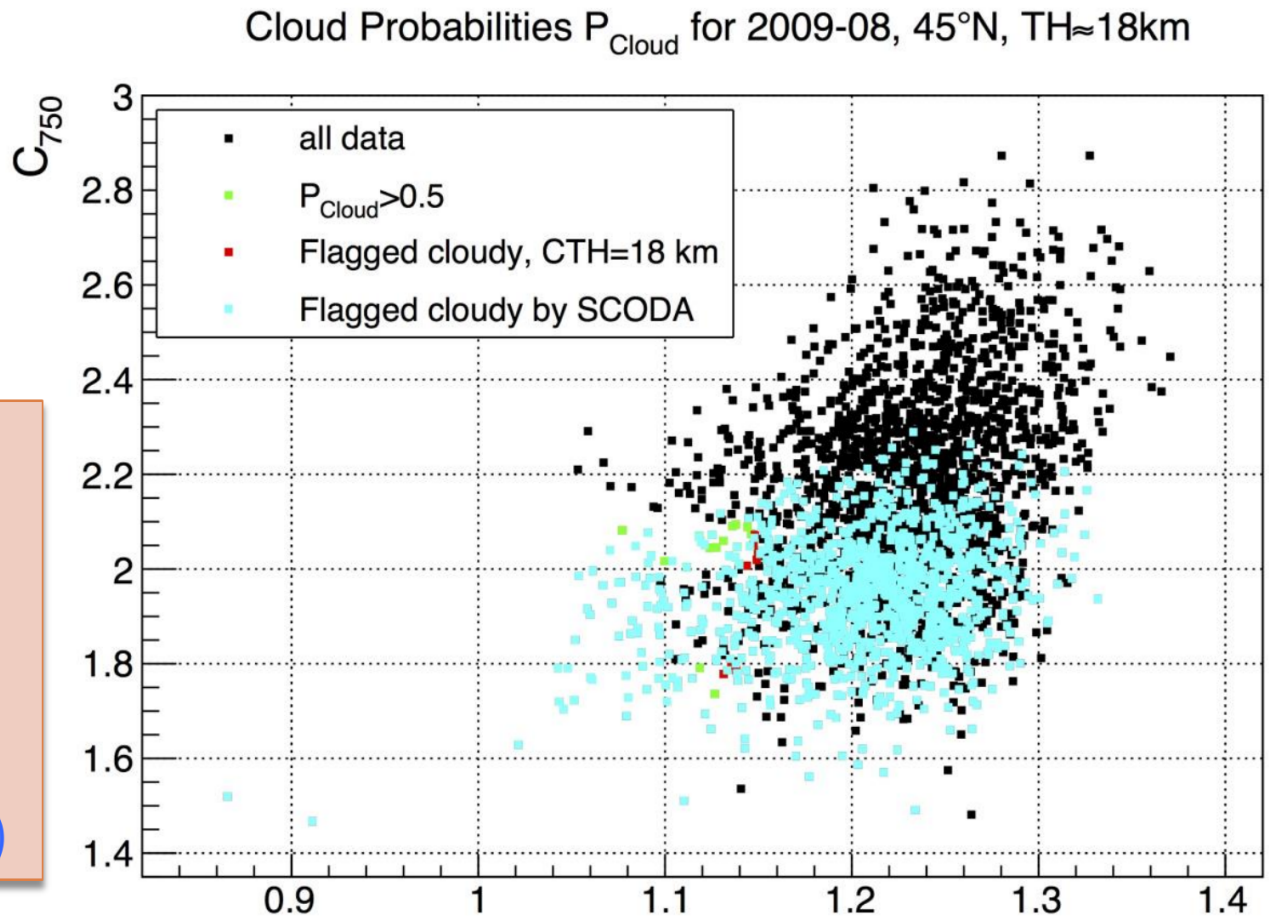
Level 2 Improvements - Limb Cloud Detection

- The exisiting Limb cloud detection was re-designed by IUP, because the current algorithm can confuse aersols and clouds
- Changes
  - Better wavelength regions to separate clouds and aerosols
  - No ratioing of tangent heights
  - The identification/detection threshold is now set in dependence of latitude, season, altitude and and aerosol background conditions
- ATBD was delivered in January, analysis for operational implementation has started

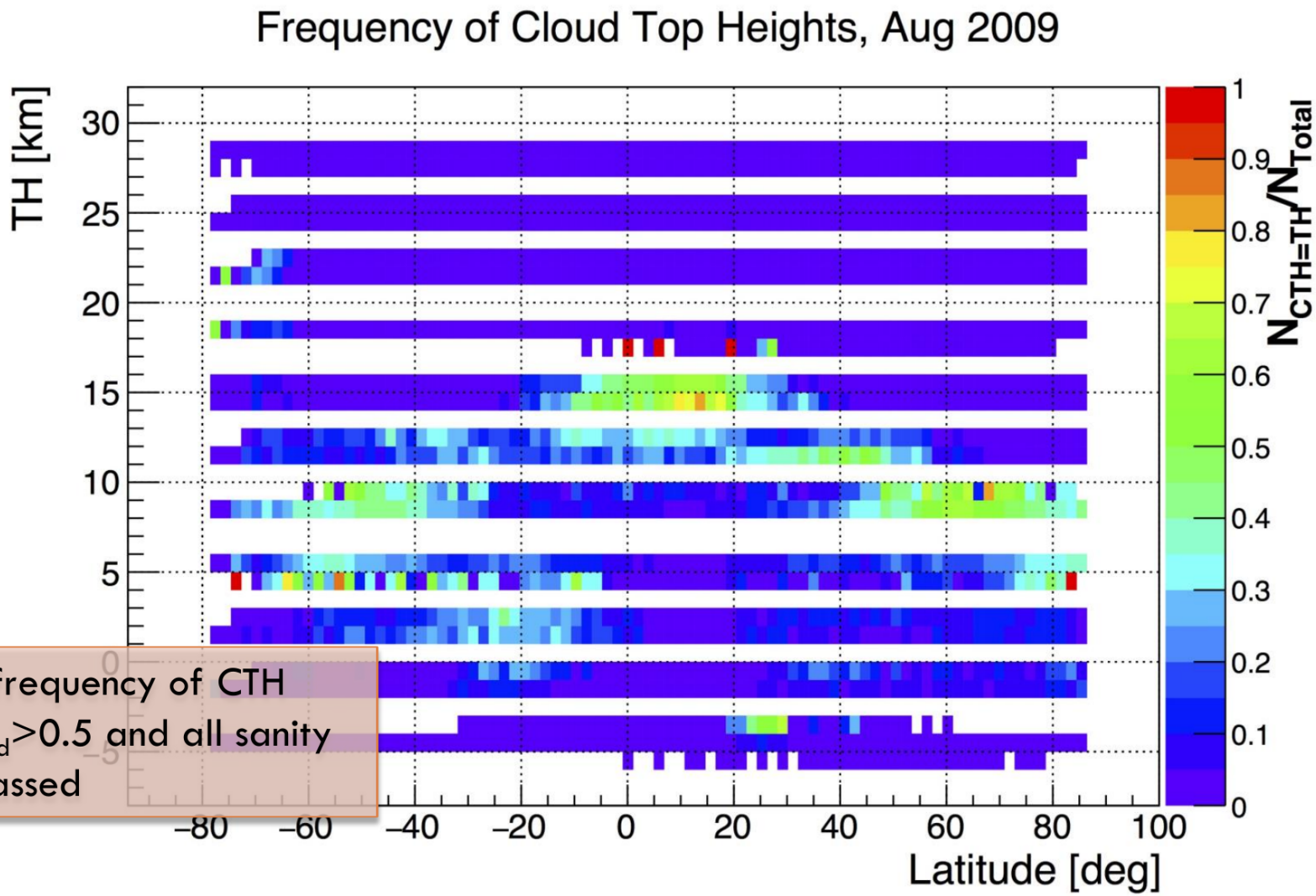
Limb Clouds - Volcanic Aerosol

30N-60N, 18 km

- All data (2871)
- P_{Cloud}>0.5 (61)
- Flagged as cloud, CTH=18km (16)
- Flagged as cloud by SCODA (1112)



Backup Limb Clouds - Altitudes



Relative frequency of CTH with P_{Cloud}>0.5 and all sanity checks passed

Backup Limb Polarisation(I)