

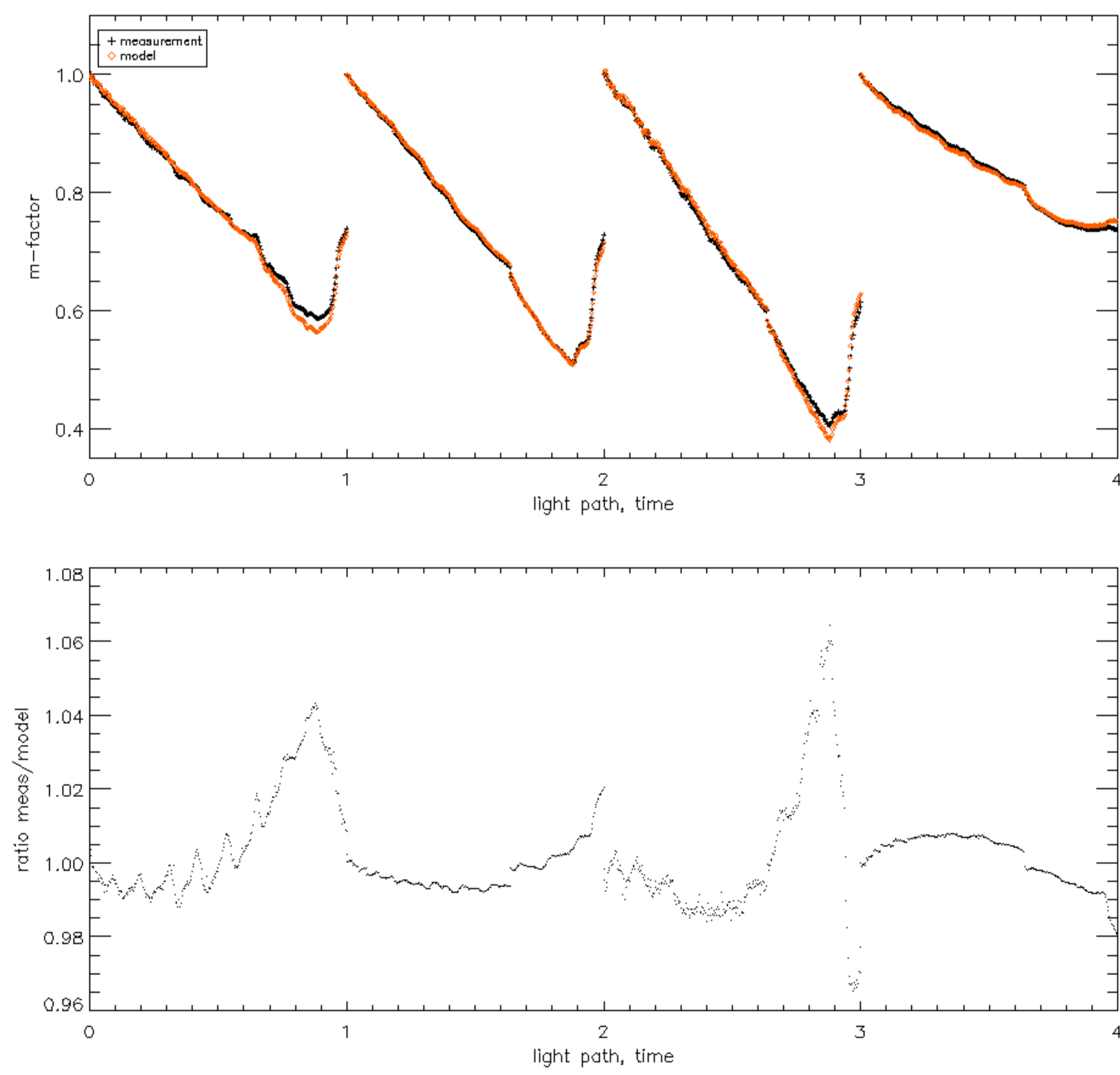
## Introduction

The SCIAMACHY Quality Working Group (SQWG) was founded in 2007 to improve the quality of the existing products and to implement retrievals of new data products. The SQWG consists of the experts from University of Bremen (lead), Belgian Institute for Space Aeronomy (BIRA), Remote Sensing Technology Institute at German Aerospace Center (IMF-DLR), Netherlands Institute for Space Research (SRON) and Royal Netherlands Meteorological Institute (KNMI).

Level 0-1 processing provides calibrated radiances. The calibration of the data is done with a combination of on-ground thermal vacuum measurements, on-ground ambient measurements (to correct for the different incidence angles of light) and in-flight measurements. Currently version 9 of the processor is implemented. The Level 1 products with the updates shown here will be released in 2017 after thoroughly testing the changes on the basis of retrieval results.

## Updated Degradation Correction

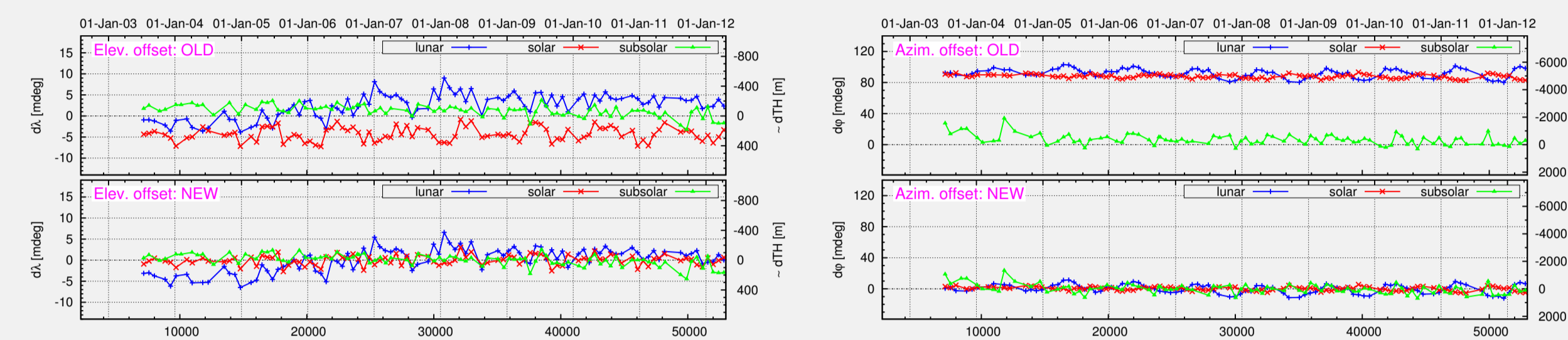
The degradation correction is based on a scan mirror model that fits the thickness of contaminant layers. The reflectivity of the mirror with the contaminant on top is calculated with the Fresnel equations. Regular monitoring measurements using the sun and the white light source with different light paths are used during processing to determine a degradation correction factor for the appropriate time and incidence angles on the mirrors. The scan mirror model was first implemented in Version 8 of the processor. In version 9 several improvements were added that lead to a better correction of the optical bench degradation. Together with the re-calculated polarisation and radiometric calibration data from on-ground measurements it is expected that the calibrated radiances will be improved over the whole mission life time.



**Figure 1:** Top: Measured and modeled degradation of SCIAMACHY at 350 nm for 4 different lightpaths: Subsolar, limb, extra mirror and diffuser, from left to right over 9 years of data. Bottom: Ratio of measured and modelled m-factors at 350 nm. (SRON)

## Better Pointing Correction

- Limb and occultation retrievals need very accurate pointing information for proper tangent heights.
- First update of mispointing parameters was already applied in 2007.
- IUP fitted new correction parameters by adjusting calculated solar and lunar positions to measured ones.
- For the first time, lunar measurements have been utilized for this purpose.
- New pointing correction parameters implemented in the initialisation file of the processor.

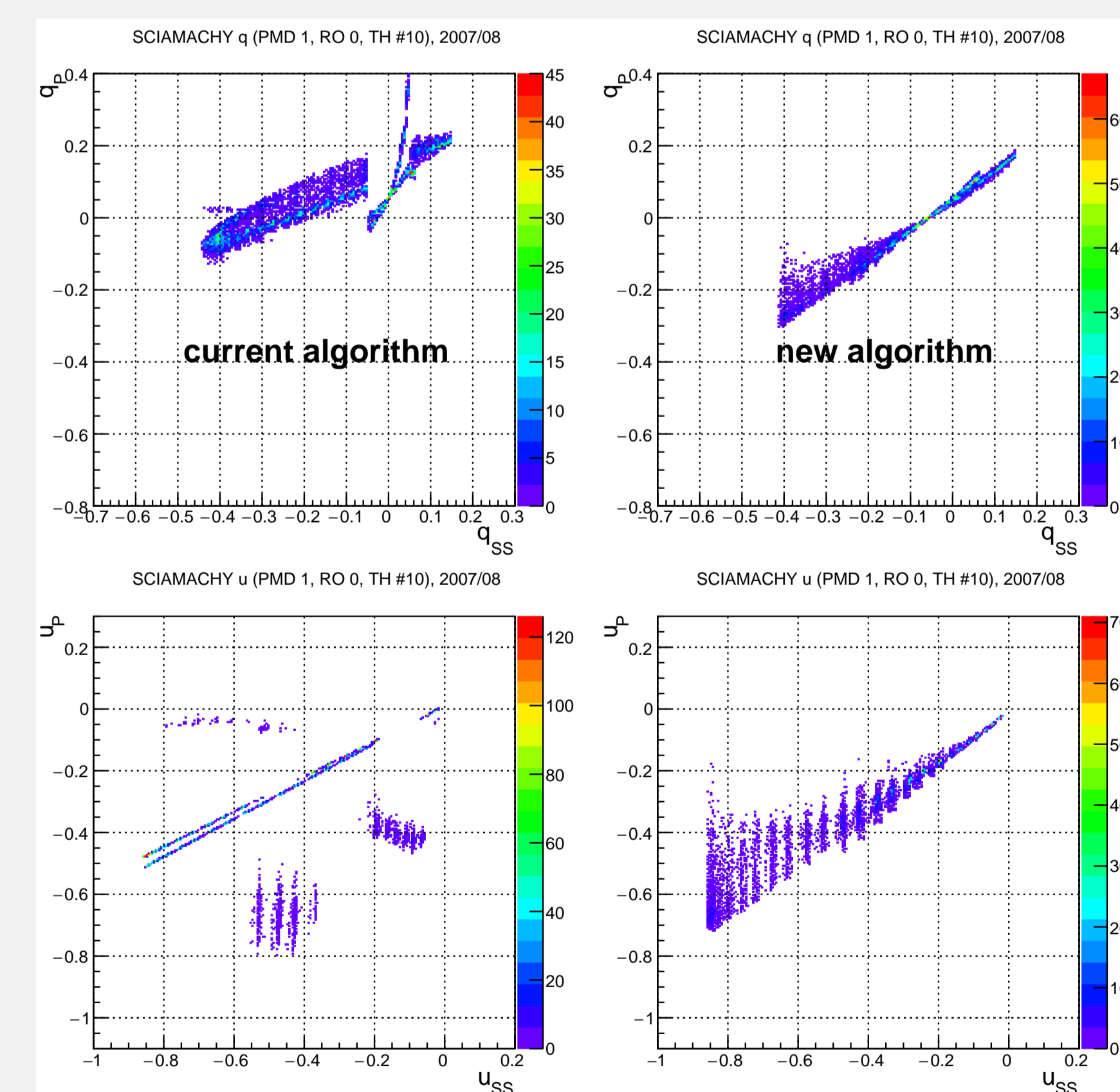


**Figure 2:** Elevation and azimuth angle offsets. OLD: Mispointing with the current processor. NEW: Remaining mispointing with the improved pointing parameters (IUP).

## Improved Polarisation Correction

The polarisation correction for V. 9 of the processor will be improved by implementing several additions and revisions to the polarisation correction:

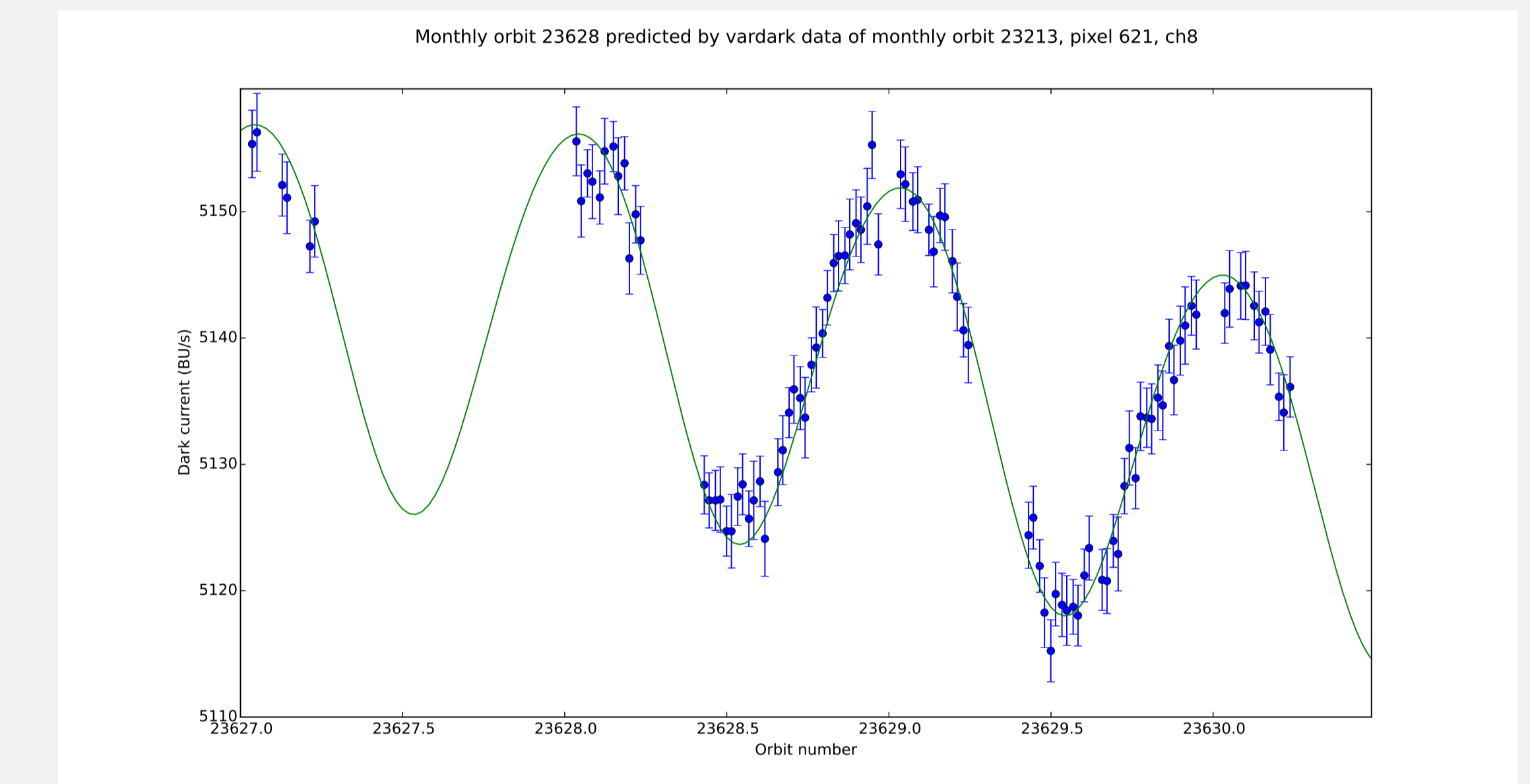
- Implementation of the CHEOPS correction already used in GOME-1 for a better correction in the UV
- Addition of a retarder matrix to the scan mirror model to consistently handle the phase shift that is caused by the OBM of SCIAMACHY
- Better handling of anomalous PMD data (spike filtering and electronic delays)
- Better handling of cases where U cannot be measured because of insufficient instrument sensitivity
- Complete Revision of the Limb polarisation calculation



**Figure 3:** Plot of determined Limb polarisation values  $q$  (top),  $u$  (bottom) vs single scattering values for the old (left) and new (right) algorithm (IUP).

## Improvements to SWIR Channel Calibration

- Bad Pixel Mask based on Individual Pixels:
  - 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 contains for channel 8 a float to characterise quality of pixels (0-1)
- Better Dark Correction
  - 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
- Spectral Calibration
  - Investigation based on Level 2 retrievals showed that the spectral calibration was not optimal
  - SRON derived new polynomial coefficients for the calibration of channel 8
  - For channel 6 (Methane) a new adaptive scheme for spectral calibration is investigated.



**Figure 4:** Prediction and measurement of the orbital variation of the dark signal in channel 8 (SRON).

## New Level 1 Product Format

- 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
  - The geolocation will be available for all pixels (the ENVISAT format required users to calculate the coordinates from the provided fine grid)

## Further Information

- EGU 2016 L2 Poster: Gretschan & SQWG: New Developments in the SCIAMACHY L2 Ground Processor
- Snel, R. C., and J. M. Krijger. "An improved scanner model for SCIAMACHY." Proc. Atmos. Sci. Conf., Barcelona, Spain, 2009.
- Bramstedt, K., et al. "Precise pointing knowledge for SCIAMACHY solar occultation measurements, Atmos." Meas. Tech 5.11: 2867-2880.
- Level 0-1c ATBD: [http://atmos.caf.dlr.de/sciamachy/documents/level\\_0\\_1b/scia01b\\_atbd\\_master.pdf](http://atmos.caf.dlr.de/sciamachy/documents/level_0_1b/scia01b_atbd_master.pdf) (will soon be updated for Version 9)
- Gottwald, Manfred, and Heinrich Bovensmann, eds. SCIAMACHY – Exploring the changing Earth's Atmosphere. Springer Science & Business Media, 2010.

