Action.M6.A8

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Action.M5.A15

Johannes Orphal, Dave Tobin, and Claude Camy-Peyret to prepare a list of what parameters from the MTG-IRS breadboard are needed. Consistency with other infrared sounders

Presentations by CCP and J. Orphal during the previous MAG meeting in Brussels 7-8 November 2018

Action.M6.A8

To merge the views of Claude Camy-Peyret and Johannes Orphal into a single list of desirable test data/parameters from the IRS Engineering Model (EM) as follow-up of M5.A15.

Action.M5.A15 (recall)

Response to the action

1) Data: provide a sample of interferograms (IGMs) when the breadboard is illuminated by a stable and homogeneous infrared source of known T and $\varepsilon(\sigma)$
2) Use: get an independent estimate (from the interested MAG members and with a NDA for industry confidentiality) of the radiometric noise and spectral responsivity
3) Option: Possibly check the spectral calibration if residual H_2O or CO_2 spectral signatures (absorbing between the source and the breadboard) are detected after Fourier transform of the IGM into spectra. Provide information on the test configuration
4) Preparation of the MAG members to use the L1 format

Action.M5.A15 (recall)

Some details

- Get a sample of the 160×160 interferograms (IGM) of the IRS instrument in the 2 bands (LWIR and MWIR) when fully illuminated by a homogeneous infrared source (if possible) for checking (from the user side) the radiometric noise and the spectral responsivity. Provide about (say) 256 IGMs to get a realistic noise estimate (gain of 16 over the noise of an individual IGM)
- If all pixels cannot be illuminated simultaneously provide the set of IGMs covering the different parts of the FPA with some redundancy to check consistency for common pixels

Action.M5.A15 (recall)

Some additional details

- Provide information on the breadboard test configuration
- Two different temperatures of the external calibration source would be needed (separated by about 25 K, D. Tobin is insisting on this aspect for assessing the basic linear response or spectral responsivity of the sensor)
- If the internal radiometric calibration target is already in place, also provide the set of corresponding views with the information on the BB source temperature and spectral emissivity
- If the spectral calibration device is in place, provide the corresponding set of IGMs for checking the instrument line shape (ILS) and its dependence with respect to the position of any individual pixel with respect to the interferometric axis
- The consistency with other sounders (IASI-NG, CrIS) is an issue for further studies

Action.M5.A15 (recall)

Slides from J. Orphal

Detector

Response and noise

- per pixel (-> detector homogeneity)
- spectral (e.g. cutoff)
- stability (in time, over cooling cycle, … local and global)

Non-linearity

- per pixel
- stability (in time, over cooling cycle, with variation scene - local and global)

„Scene“ variations

- global: level change on all pixels
- local: level change on observed pixel only or neighbouring pixels

Detector and optics

Imaging quality, PSF measurements

measurement of point source / edges in infinite on various FOV positions

cross-talk and ghosting in raw data and in spectral data after FFT

cross-talk spectral and spatial

ILS

measurements for various FOV positions and spectral bands

IFM

modulation efficiency and shear determination (independent of metrology / e.g. based or IR data)

Data

L0 processing, artifacts, added noise

spectral calibration

radiometric calibration

Action.M6.A15 (1/3)

Desirable test data/parameters from the IRS Engineering Model (EM)

- Sets of 160×160 interferograms (IGM) of the EM in the 2 bands (LWIR and MWIR) when illuminated by an IR source of known emissivity and at several blackbody (BB) temperatures (the corresponding information is to be attached to the data set)
- Provide about 256 IGMs (for each view i.e. warm and cold BB) to get a realistic noise estimate (gain of 16 over the noise of an individual IGM)
- Use at least two temperatures for the warm BB separated by 25 K (with at least one cold BB view)
- If spectral calibration sources are in place (narrow laser line in each band), provide the same set of IGM for assessing the ILS and its variation over the FPA
- It is assumed that the PRNU would have already been applied (to be discussed)

Action.M6.A15 (2/3)

More details

- The goal is not to duplicate (in a systematic manner) the analyses to be performed by industry and ESA
- Its is mainly to get an external assessment by concerned MAG scientists (with expertise in FTS L0 processing) of the expected performances of the PFM (through the EM in its current configuration)
- If the provided interferograms are “filtered and decimated” such that the corresponding spectral range is for the usable portion of the MTG-IRS spectra (two bands), then this is the minimum
- If it is also possible to get some samples of “unfiltered” data then that would also be very useful, so we can look for spectral artifacts in the “out of band” spectral regions, for example harmonics due to nonlinearity or interferometers double-pass features

Action.M6.A15 (3/3)

Additional comments

- Parameters to be derived: radiometric response, residual non-linearity, radiometric noise, spectral scale and ILS
- The volume of data is expected to be significant and the proper manner to transfer it is to be discussed
- The scientists potentially involved in this performance analysis are ready to sign a NDA, since the corresponding data is of an interim nature in the process of producing the final (proto-)flight model