MTG FCI VisDA

Meteosat Third Generation is a meteorological spatial program funded by ESA

Development of the Visible Detector Assembly for the Flexible Combined Imager on MTG

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e2v technologies, Space Imaging

- e2v has been involved in many Solar Physics and Solar Weather satellites, Hinode (Solar-B), STEREO, SDO, IRIS and SUVI both in Europe and across the pond! We have also supplied many of Europe's Earth monitoring weather and atmospheric satellites such as Envisat, Sentinel-2, 3 and now 4 and 5. We have supplied detectors into OMI for NASA's Aura satellite and OMPS for NPOESS.
- Here we report our development of the Visible Detector Assembly for the Flexible Combined Imager on Meteosat Third Generation, MTG FCI VisDA. e2v has successfully passed the Preliminary Design Review for the detector and has demonstrated in silicon that the detector is latch-up free up to the maximum energy of our test facility, 67.7MeV/mg/cm^2.

**MTG is an ESA programme*

Image of a breadboard assembly

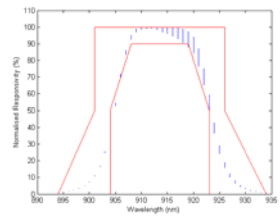
Description of the Detector
The Visible Detection Assembly of the Flexible Combined Imager

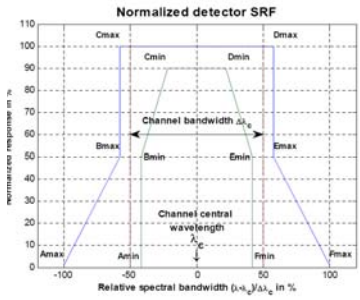
- The Visible Detection Assembly (VisDA) consists of 5 channels in a CMOS detector capable of working in snapshot mode at a frame rate of ~2.65kHz.
- The pixels are very large rhombus shapes separated by light shields to establish a very accurate control of the sensor MTF.
- Each channel has four pixel columns enabling the best pixel selection to be made with 3 redundant pixels.

Channels	λ ± Δλ (nm)	Pitch (µm)	Pixel (µm)
Vis 0.4	444 ± 30	46	90 x 108
Vis 0.5	510 ± 20	46	93 x 110
Vis 0.6	640 ± 25	23	38 x 48
Vis 0.8	865 ± 25	46	96 x 112
Vis 0.9	914 ± 10	46	96 x 112

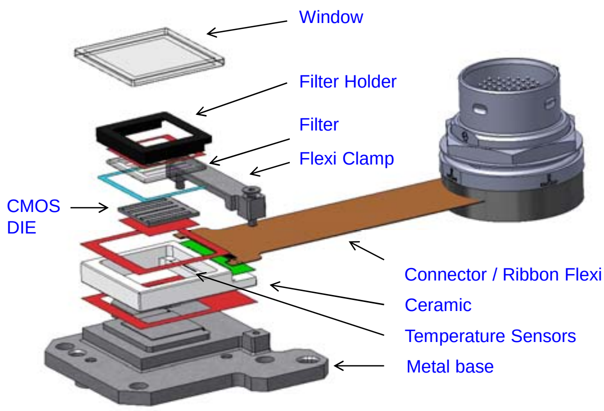
Description of the Assembly

- The assembly consists of 9 parts: metal base, temperature sensors. CMOS die, ceramic body, flexi clamp, connector ribbon sub-assembly, filter, filter holder and window.
- Of these, aside from the die, the most interesting part is the filter.
- The filter consists of a single glass substrate with individual bands patterned for each channel. Between the bands a black coating is applied to block the transmission of light and assist with suppression of stray light and optical cross-talk.
- The combination of the detector response and the filter response is required to confirm to the spectral template of the assembly.





Left: measurement of the first prototype with a standard ARC coating for Vis 0.9. Right: Thales' specification for the spectral template. Both figures are for the detector only.

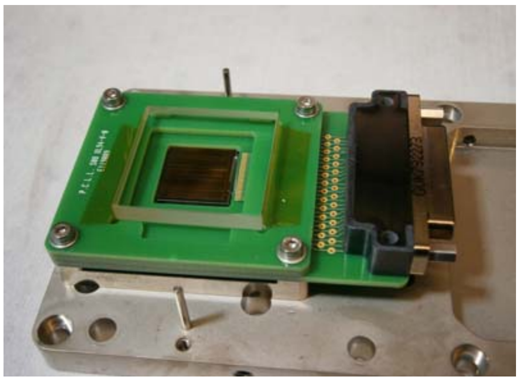


Irradiation of tests chips and prototypes

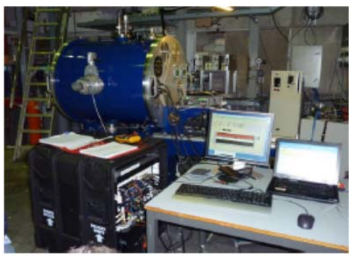
- The main specifications driving the CMOS design were linearity, temporal remanence (lag), blooming recovery and the optical requirements. Of these, linearity and pixel lag are sensitive to radiation.
- Test chips were fabricated to evaluate the best pixel design and to perform a gamma irradiation test campaign.
- The conclusions of the study were that the impact of 50krads of gamma radiation on the pixel CVF were negligible, dark current and noise increases (as expected) , there was a slight deterioration in lag of the larger pixels (which could be tolerated) and the linearity at high signal levels was almost unaffected.

- On a prototype assembly, the impact of heavy ions on the registers, sequencer and best pixel memory was a serious concern.
- A heavy ion radiation test campaign was carried out on the first prototypes of the VisDA assembly and has demonstrated that the device is latch-up free up to the maximum energy of our test facility, 67.7MeV/mg/cm^2.

- **Results from the test chip irradiation and prototype irradiation gave strong indications of meeting mission requirements throughout the planned life of the instrument.**



Above: A PCB package assembly for heavy ion irradiation tests
Below: Heavy ion test facility vacuum chamber at the Universitie Catholique Louvain



Completion of the programme

- Design, Test Equipment Development, Pre-Validation and Reliability and Dependability Analysis Phases are, or nearly, complete.
- Validation of the assembly is ongoing with a qualification of the engineering model lot planned to complete in 2016.
- Flight Model parts procurement has begun in conjunction with Engineering Model procurement. This enables some efficiencies. Assembly of the Flight Models will be in 2016.

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