Overall Status of UVIT Project

S N Tandon

UVIT-PMB Meeting , June 8, 2012

Context in ASTROSAT

- ASTROSAT observes in multi wavelengths
- Four X-ray telescopes and UVIT are co-aligned and observe simultaneously
- UVIT images in ~ 28' field with a spatial resolution < 1.8" FWHM

  in three channels:

  Far Ultraviolet (FUV)   : 130-180 nm

  Near UltraViolet (NUV) : 200-300 nm

  Visible (VIS)   : 320-550 nm

Specifications

- Spatial resolution   < 1.8"
- field   ~ 28'
- Timing accuracy/resolution   ~ 5 ms
- Simultaneous imaging in 3 Channels
- Sensitivity: mag 20 in FUV in 200 s
- Selection of band with filters in wheels
 and slit-less spectroscopy with ~ 100 res.
- Off-axis attenuation at 45 deg. by   > 10^9

Collaborating Institutions

Indian Institute of Astrophysics, Bengaluru

Inter University Centre for A&A, Pune

Tata Institute of Fundamental Research
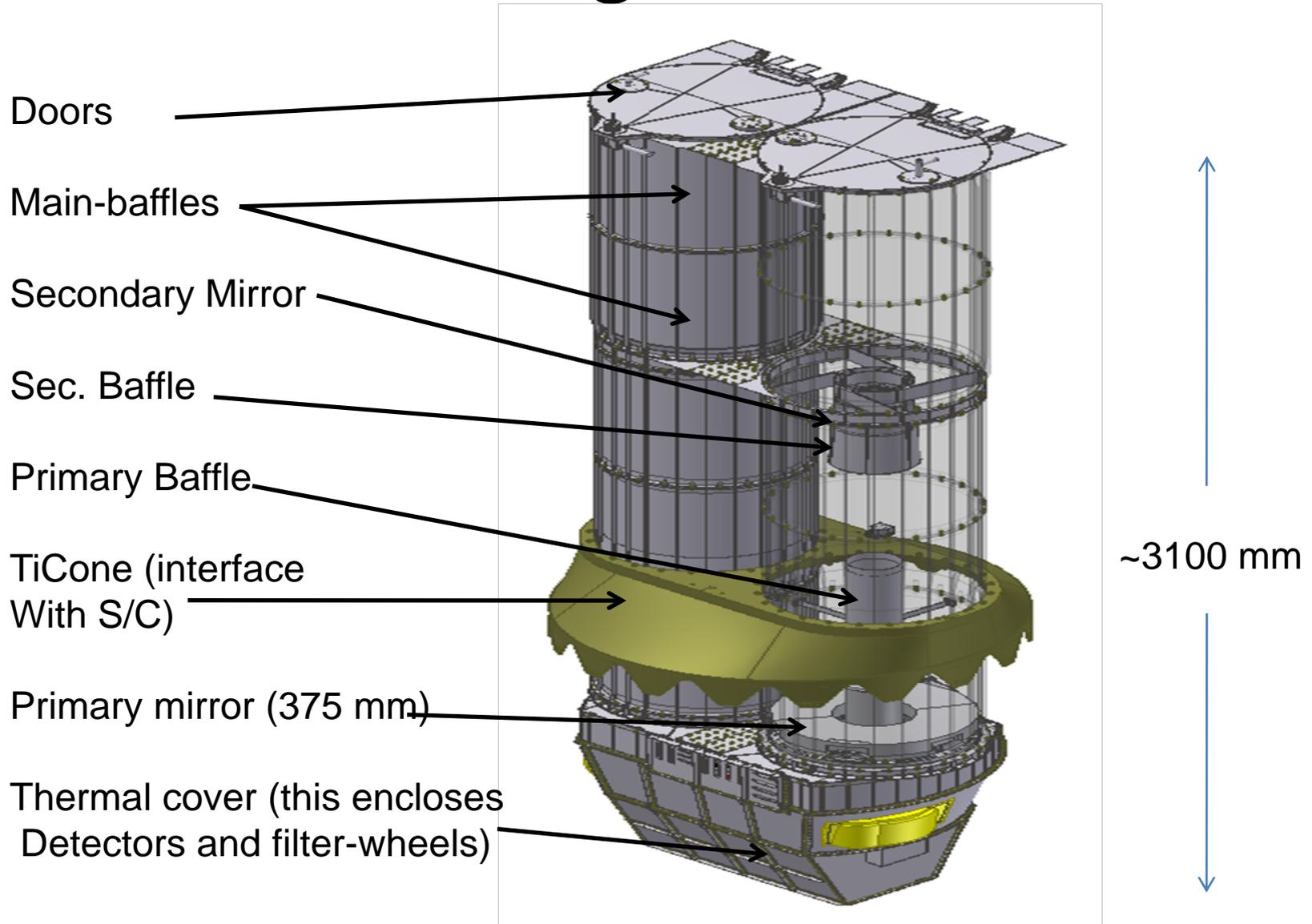
ISAC, LEOS, and IISU from ISRO

AND Canadian Space Agency, Canada
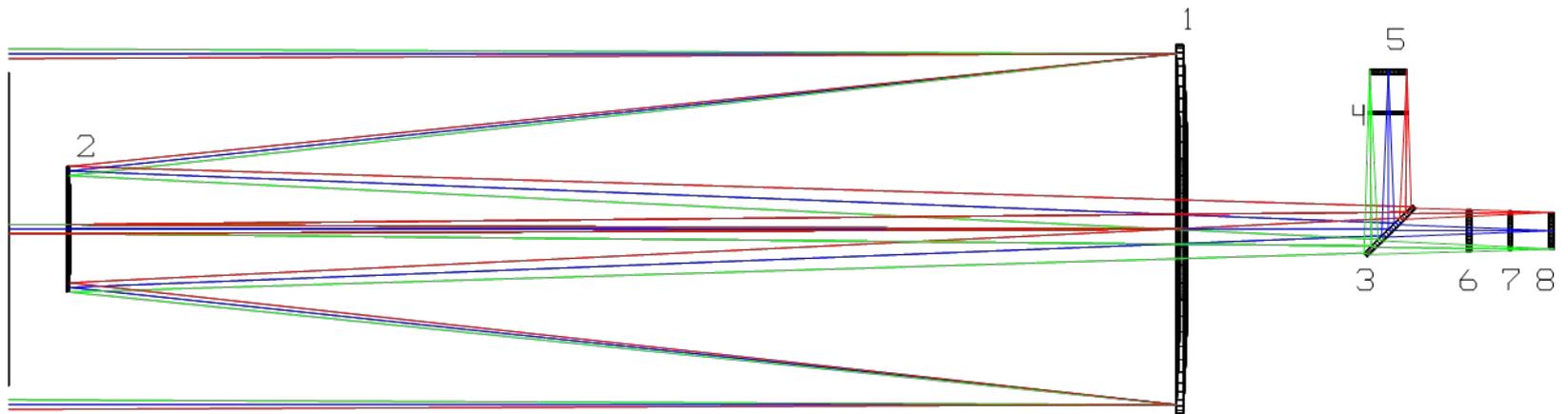
Some Industrial Partners:

Cades, Bengaluru; Brahmos, Trivandrum;

Photek and MSSL, UK;   I T Globe, USA

Configuration

Doors

Main-baffles

Secondary Mirror

Sec. Baffle

Primary Baffle

TiCone (interface
With S/C)

Primary mirror (375 mm)

Thermal cover (this encloses
 Detectors and filter-wheels)

~3100 mm

Optics

1- PRIMARY MIRROR
2- SECONDARY MIRROR
3- BEAM SPLITTER
4- NUV FILTER
5- NUV DETECTOR WINDOW
6- VIS CORRECTOR
7- VIS FILTER
8- VIS DETECTOR WINDOW

Status- EM

- Engineering Model

Qualified in the beginning of year 2011 for Vibrations and Thermo-vacuum,

with 1 set of: qualified mirrors/ detector/ filter-wheel in NUV/VIS telescope ; and the rest as dummy to simulate mass and rigidity
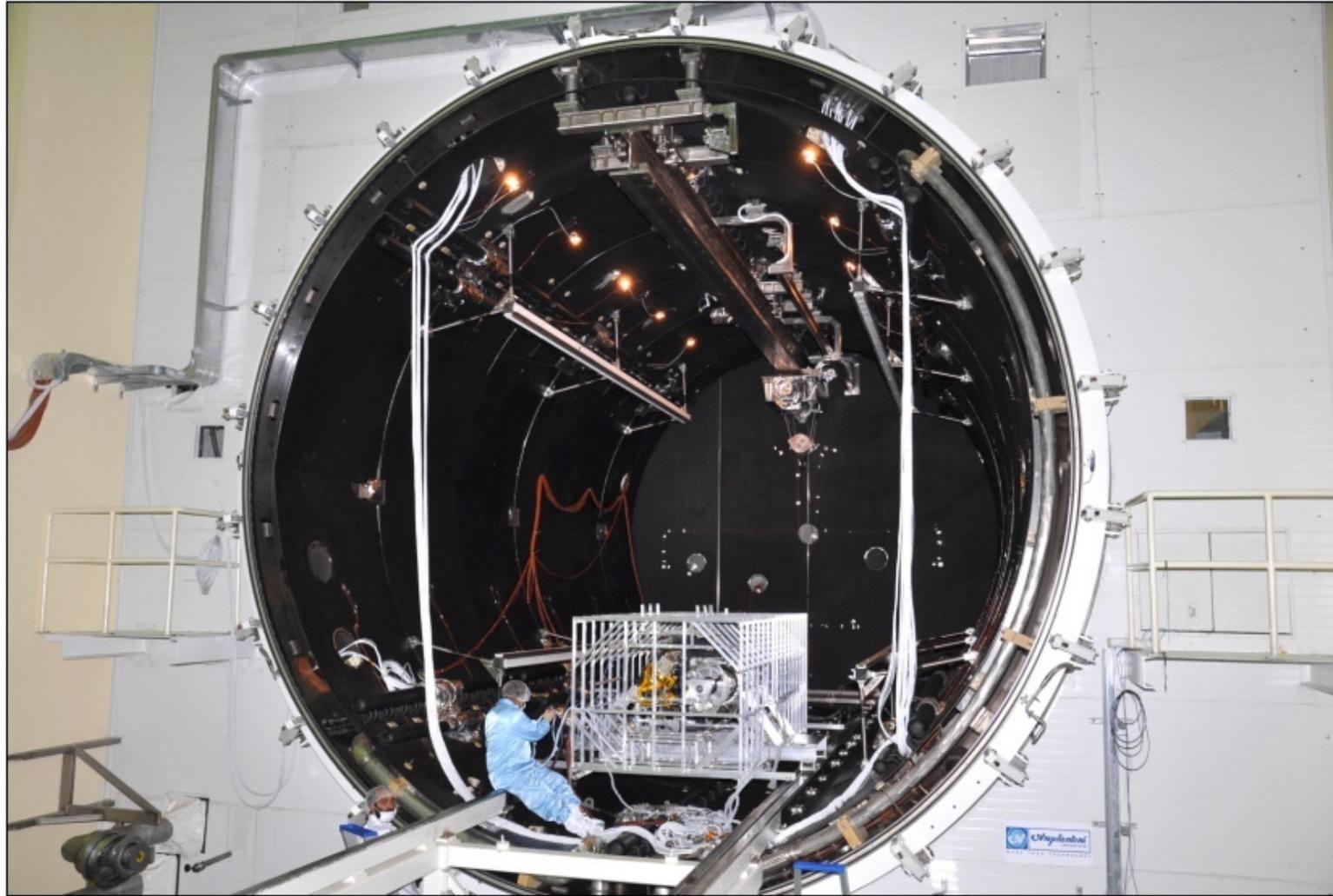
Some modifications recommended for the FM

Major modifications in the Doors

Picture of vibration Test of EM

Pictureb of Thermo-vac test of EM at ISITE, ISAC

Critical Design Review

- Critical design review held on June 17-18, 2011

- Analysis and checks done as per the recommendations, and any recommended modifications implemented for the FM

- This review cleared the way for assembly of the FM.

Flight Model (FM): Components

- In the first part of the year 2011

Qualified mirrors for NUV/VIS were *delivered by LEOS, ISRO*

The filters were calibrated at IIA, CREST

Qualified Filter wheel drives were *delivered by IISU, ISRO*

All the parts of the structure were ready with black coating (*by ISAC*), cleaning/baking, and mounting of heaters (*by ISAC*)

Flight … Components

- Qualified and Calibrated detectors were ready

    Optimisation of High Voltages and flat field done at Calgary

    Quantum efficiency done at CREST, IIA
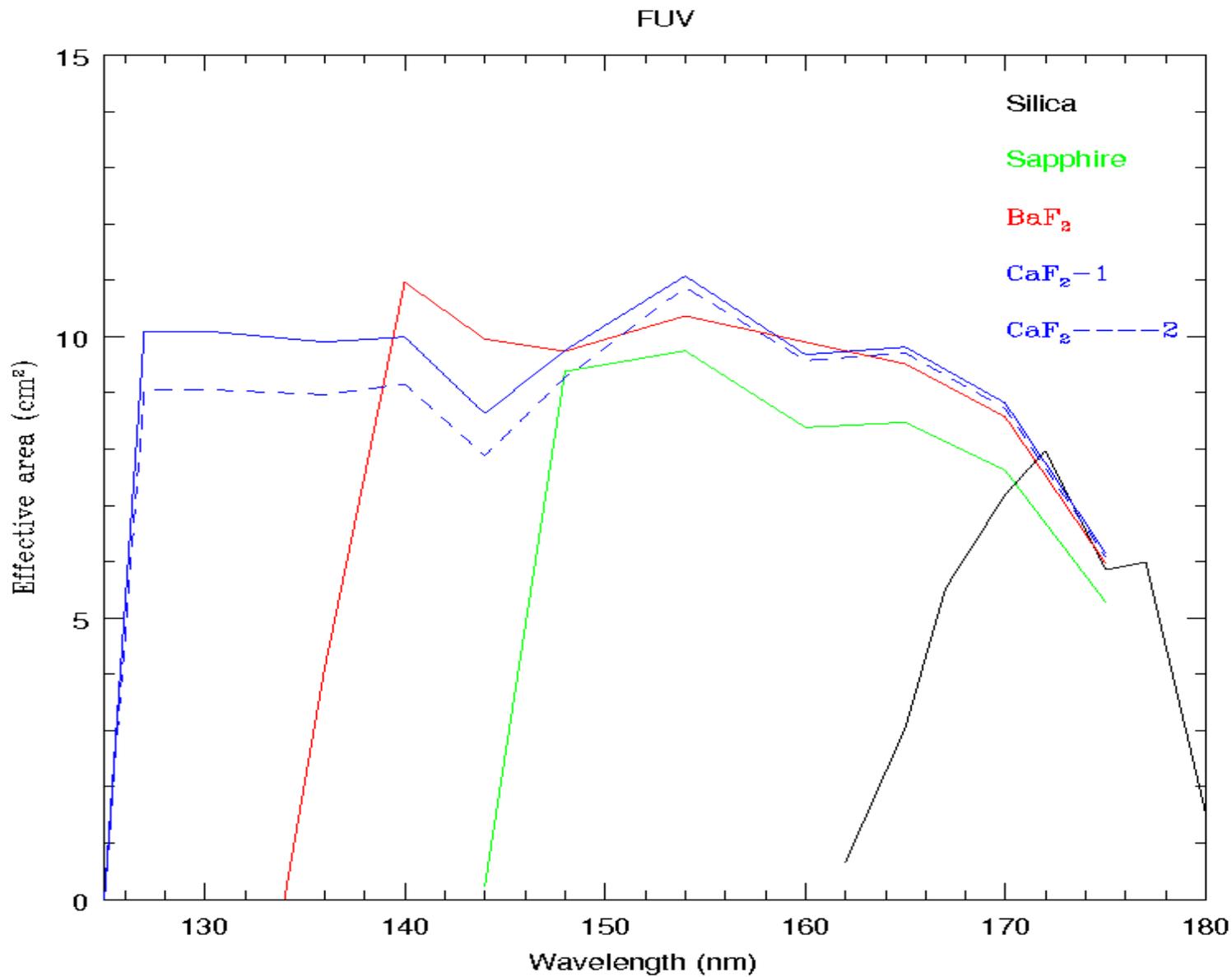
    Data on distortion taken at Calgary & IIA

Distortion in the Detectors
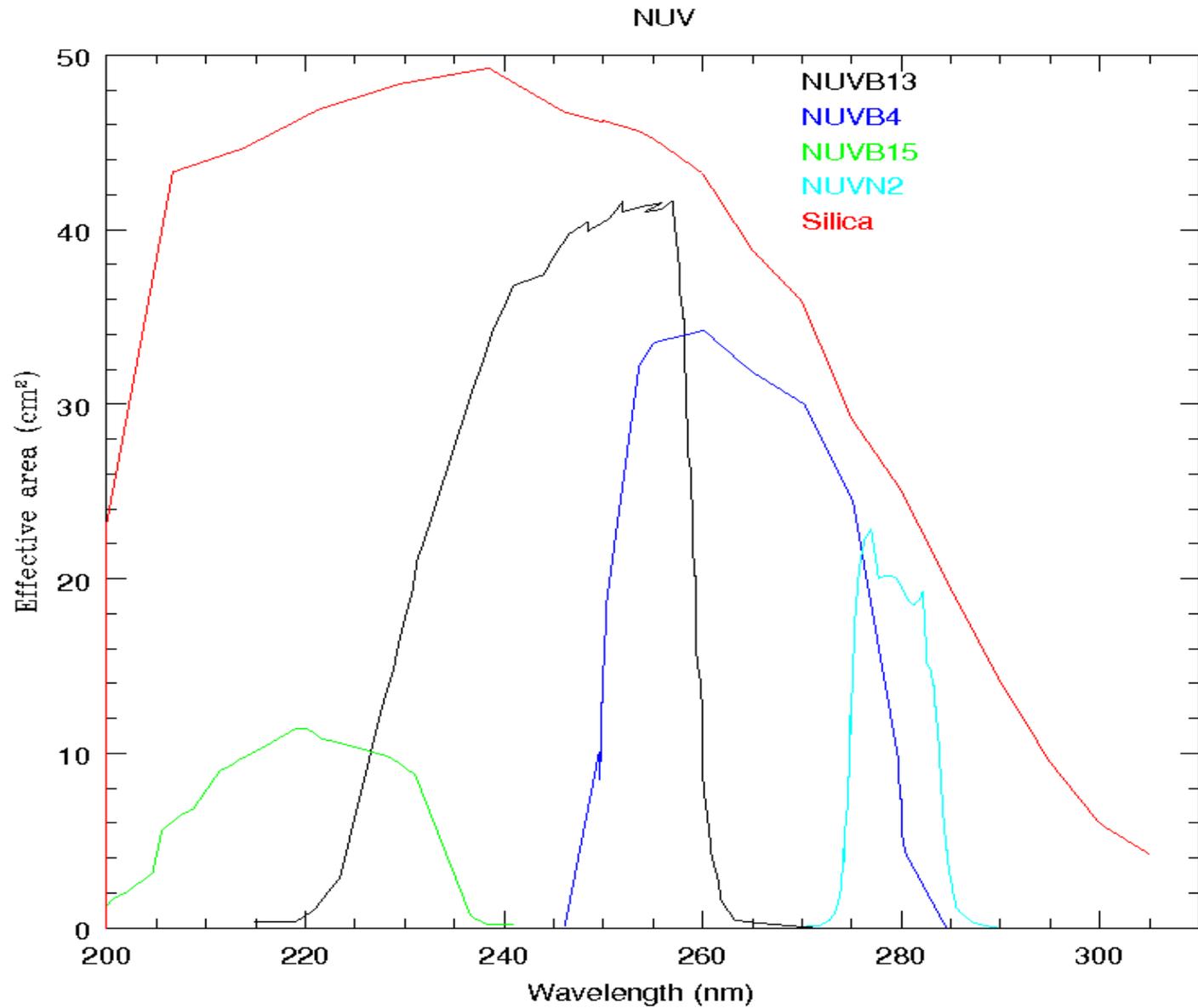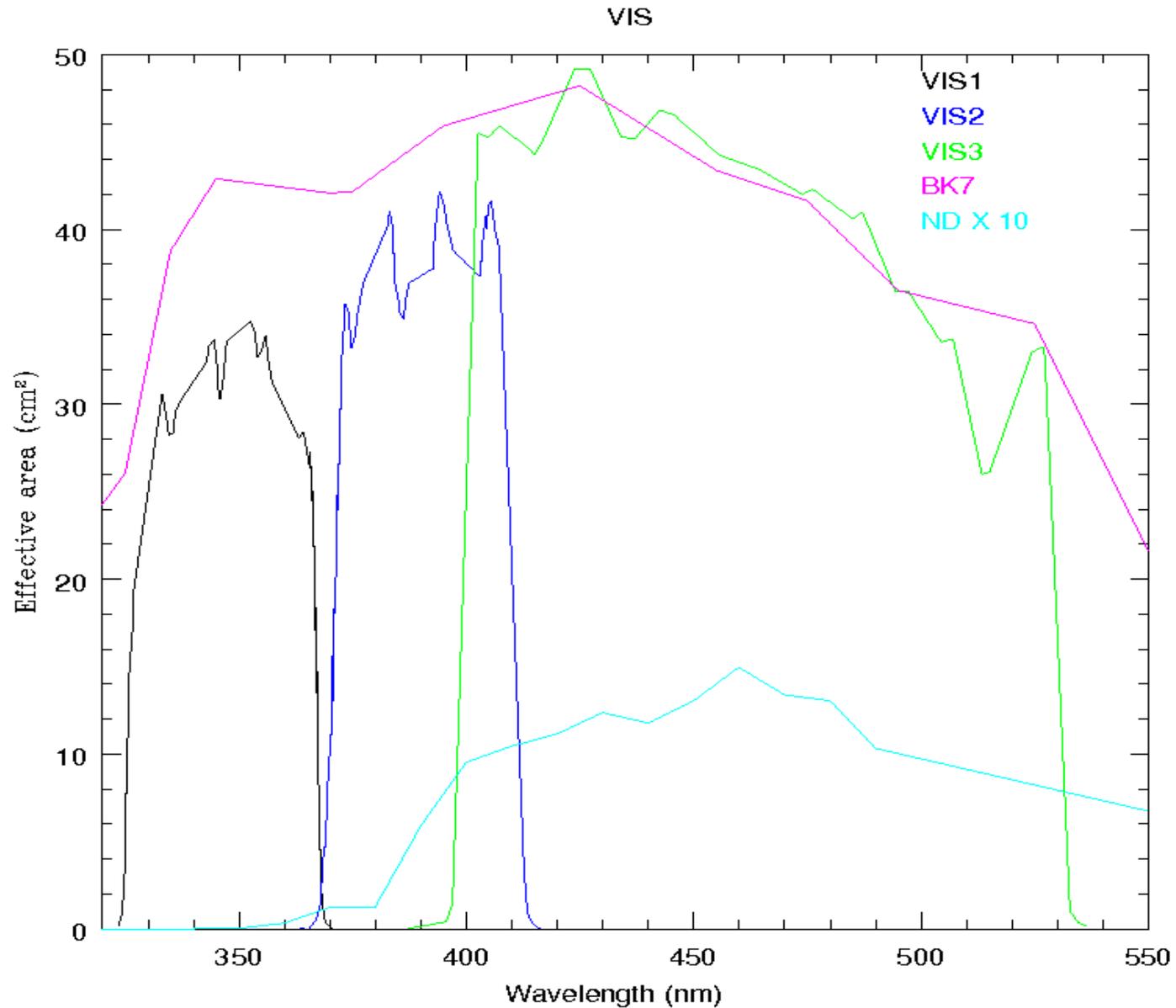
DETECTOR

Window

MCP

Fibre
taper
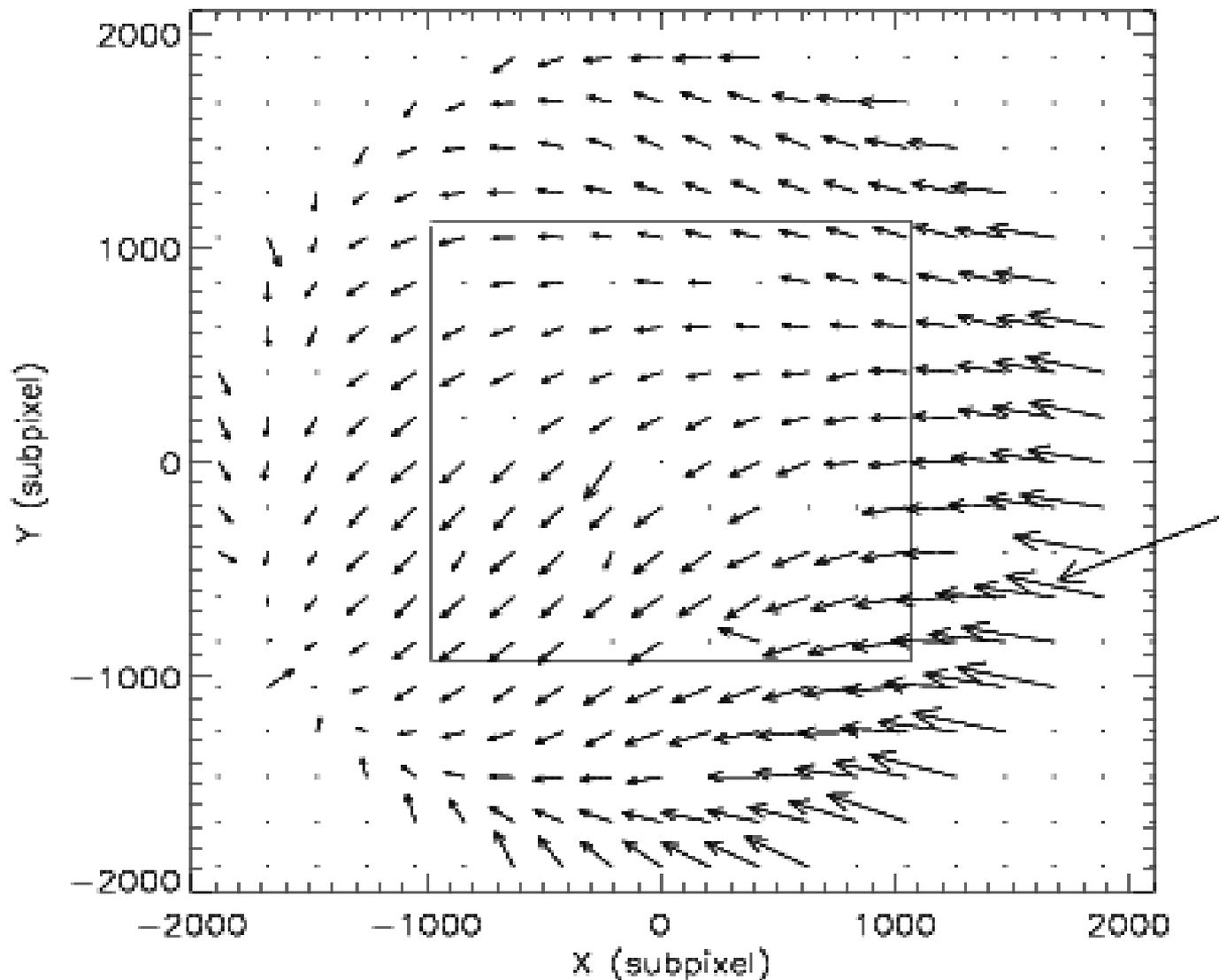
CMOS
Imager
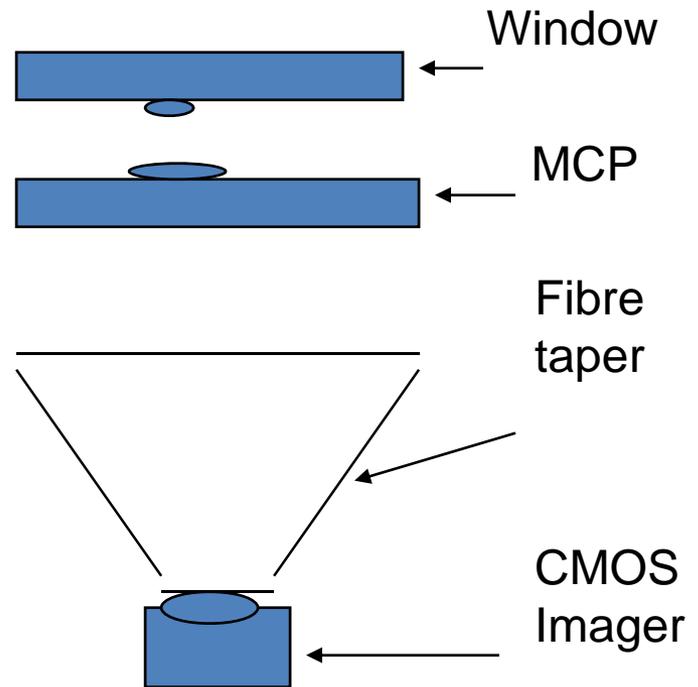
Estimated Effective Areas

Estimated …

Estimated …

NUV/VIS Telescope: Assembly/testing

- Assembly of the NUV/VIS telescope :

  June 2011   to January 2012

  Wavefront measures indicate FWHM < 1"

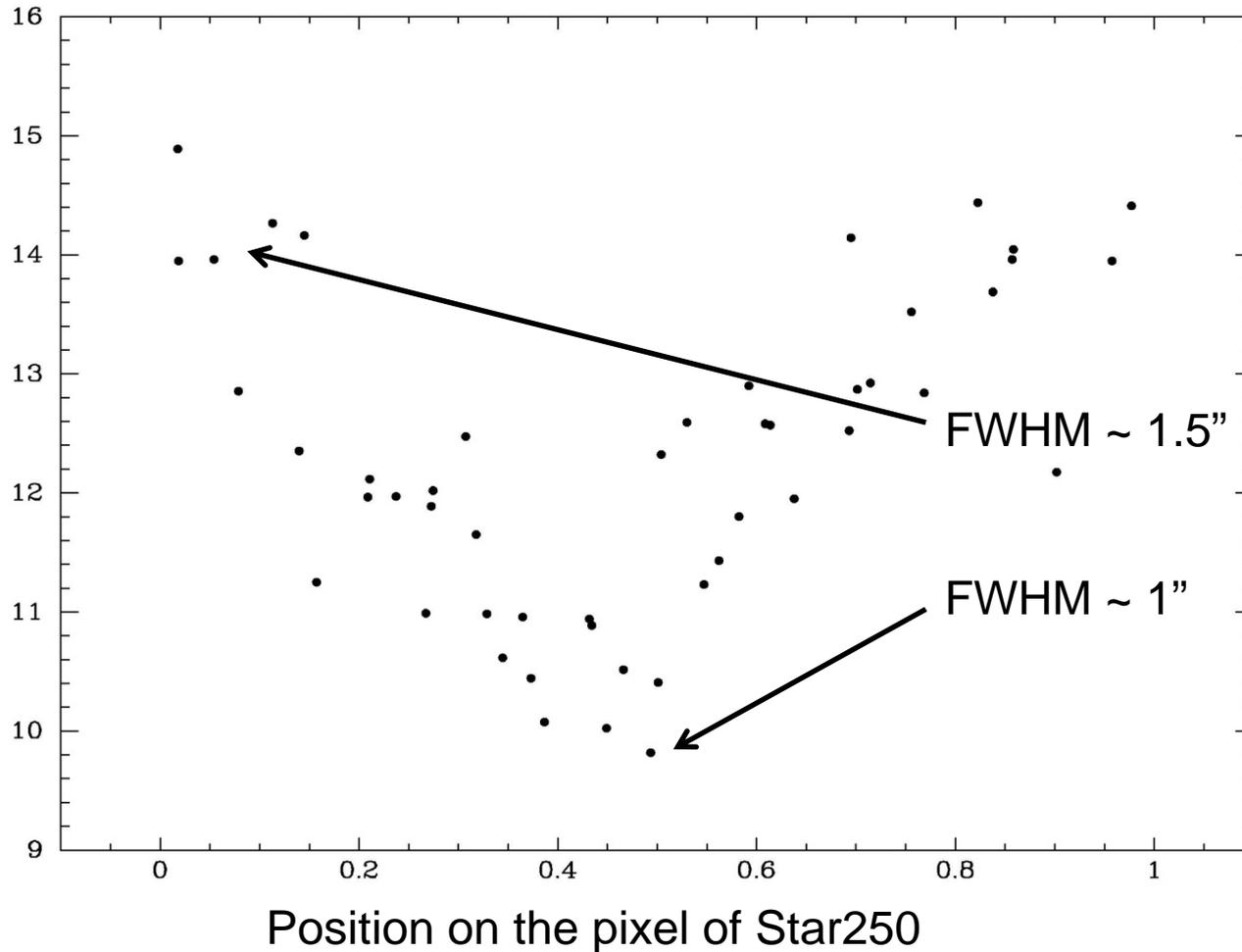- Tests on the telescope

  February 2012 to March 2012

  Thermal shift of focus 0.020 mm/C

  Baffles restrict vision of the detectors and do not lead to vignetting

NUV/VIS ...testing

- Alignment of centres of the two fields with axis of the telescope < 30"

- PSF with beam of a collimator <1.3" FWHM,

for all filters, except one

the filter for 200-230 nm gives PSF ~ 1.7" FWHM

Image Size (FWHM) Variation

FWHM ~ 1.5"

FWHM ~ 1"

Position on the pixel of Star250

FUV Telescope: Assembly/testing

- Assembly of the telescope :

  March 2012 to May 2012

  Wavefront measures indicate FWHM < 1"

  Thermal shift of focus 0.035 mm/C

- Tests on the telescope – to be done

  June 2012

PSF for FUV on Axis (150 nm)

PSF for FUV …

$y = 14.84x^2 + 44.56x + 46.97$

FWHM

~ 1.5"

~ 1.3"

FWHM

PH Position

- Series1
- Poly. (Series1)

Image Size in Orbit

DETECTOR

Photo cathode

Image

Photo e, 1" rms

Photons, 2.5" rms
3.5" = 1 pixel

Window

MCP

Fibre taper

CMOS Imager
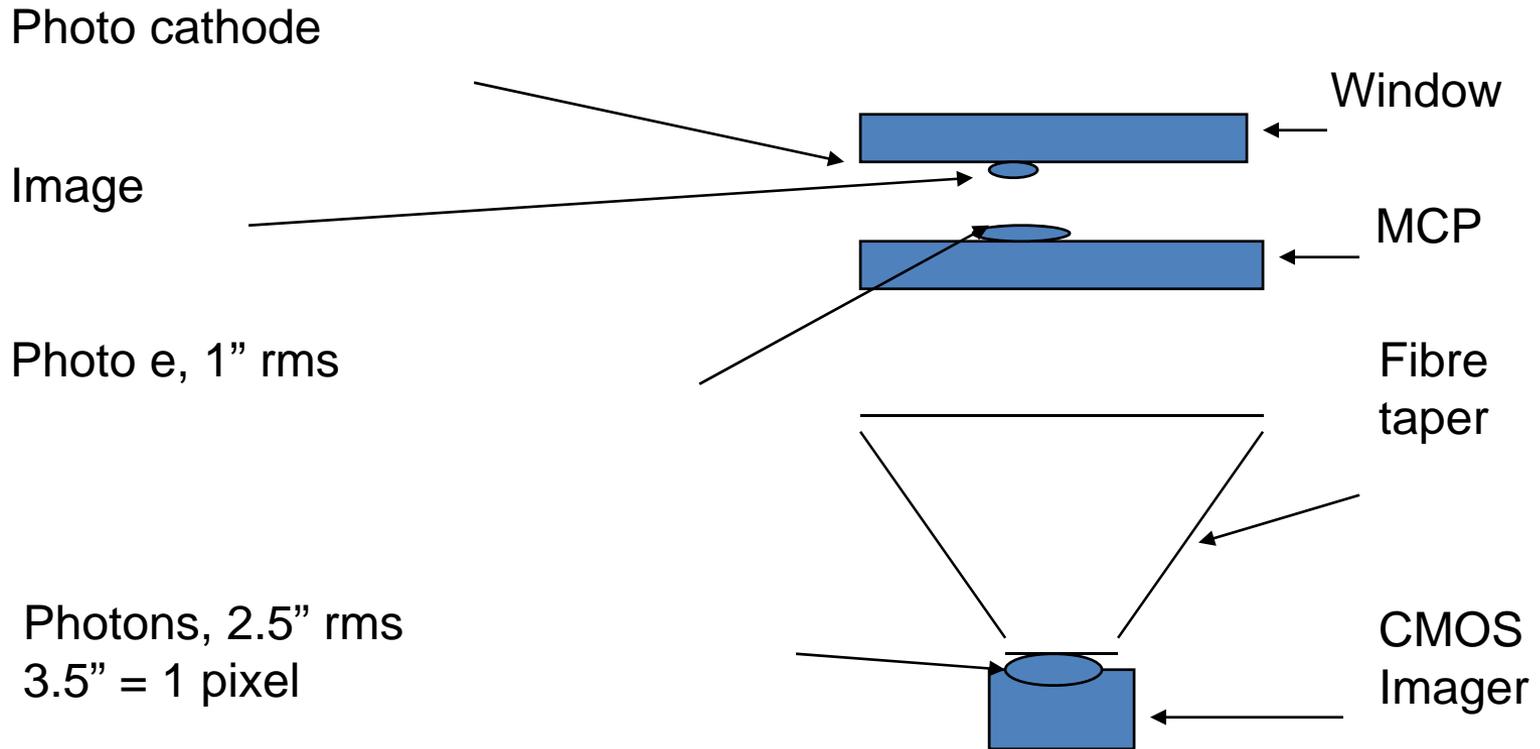
Image size …

- Thermal effect on focus: small
- Drift of Satellite (<~ 0.5"/s) and long exposure imagees:

  short exposures taken

  shift-add algorithm used

  shift obtained from stellar images in Visible to an accuracy < 0.1"
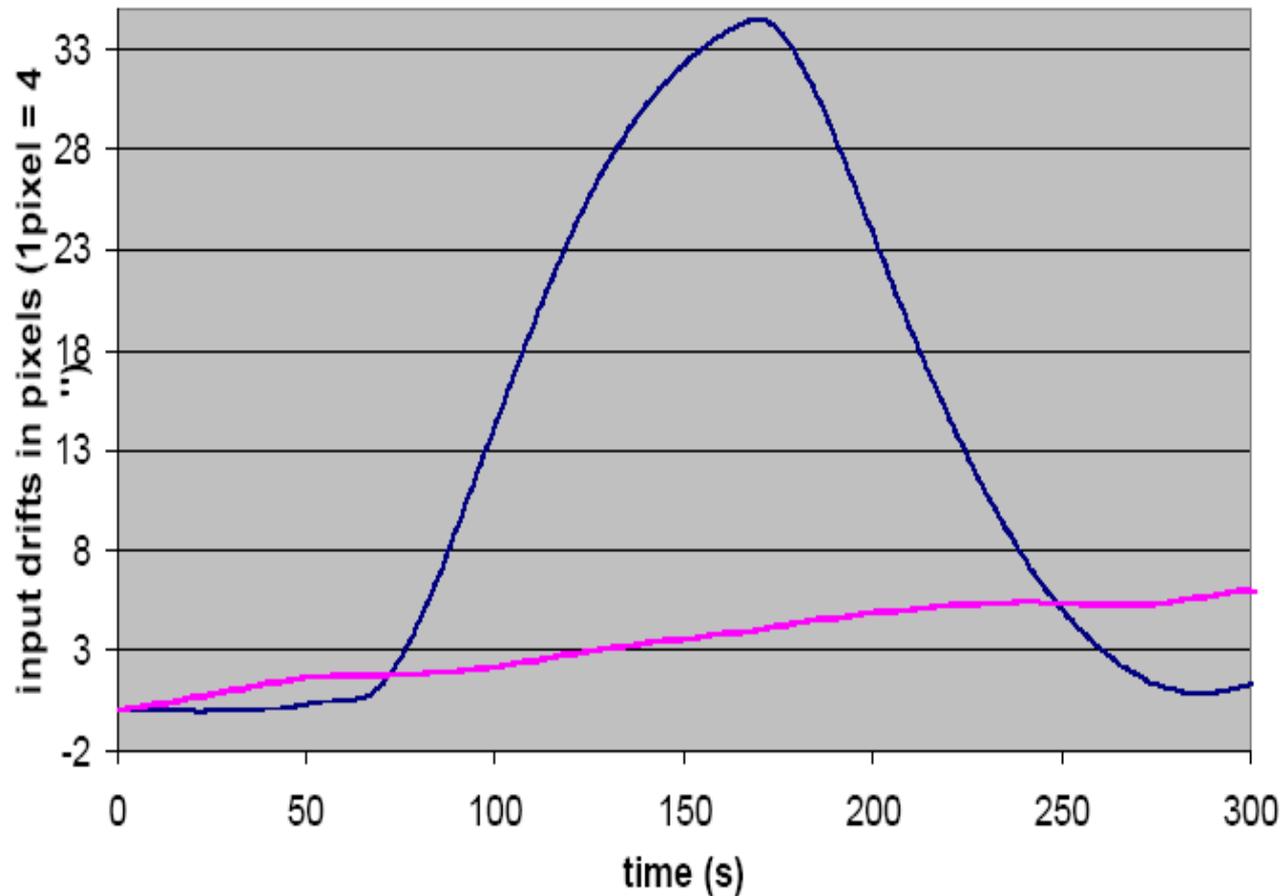
Drift of Satellite

period 2_input drifts
thin-blue : pitch ; thick-red : yaw

period2_errors_pitch
thin-blue: raw errors ; thich-red: errors with polynomial fit
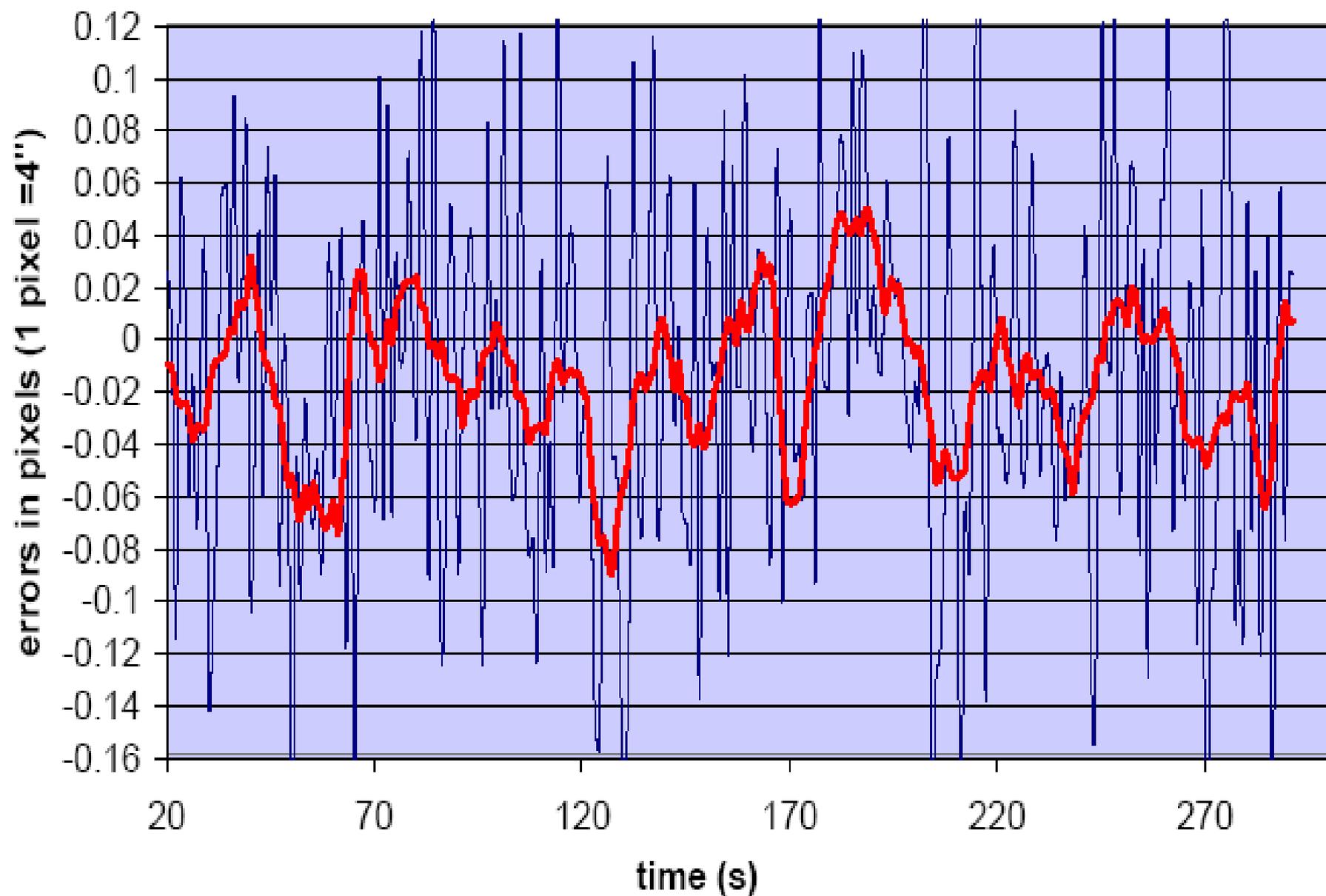
Contaminations

- FUV (130-180 nm) very sensitive to any molecular contaminations

- Monitoring of possible contamination in the laboratory and during all stages of assembly/testing/storage/transport , through witness samples.

- So far no significant contamination seen

Contaminations

Further work on the hardware

- Testing of the FUV telescope
- Assembly of the two telescopes on Ti Cone, and recording data on the alignments
- Mounting of the main baffles and the doors
- Wiring of the thermal elements, and routing of all the cables
- Mounting of the thermal cover

Ready for transport to ISAC by End of July

At ISAC

- Environmental Tests
- Mechanical Integration with S/C
- Electrical Integration with S/C, and tests
- Integration of the other payloads with S/C
- Electrical Tests of full S/C
- Environmental test of the S/C
- …

Ground Segments

- Calibrations in orbit: Draft on key details of observations available, software s to generate the data-base are to be assembled/written.

- Data analysis pipeline: being done by SAC,ISRO in collaboration with UVIT

- Documents to help Proposals: documents and softwares under preparation

- Data processing Centre for UVIT: requirements
 of the hardware available

Acknowledgements

- Support from ASROSAT Project Team, and many centres of ISRO in implementation/tests

- Many committees constituted by ISRO have helped at different stages of design/test

- Very generous support has been received from all sections of IIA: management, administration, academic and technical staff.

    Guidance and support of the PMB-UVIT has been of critical importance to the project.

THANKS