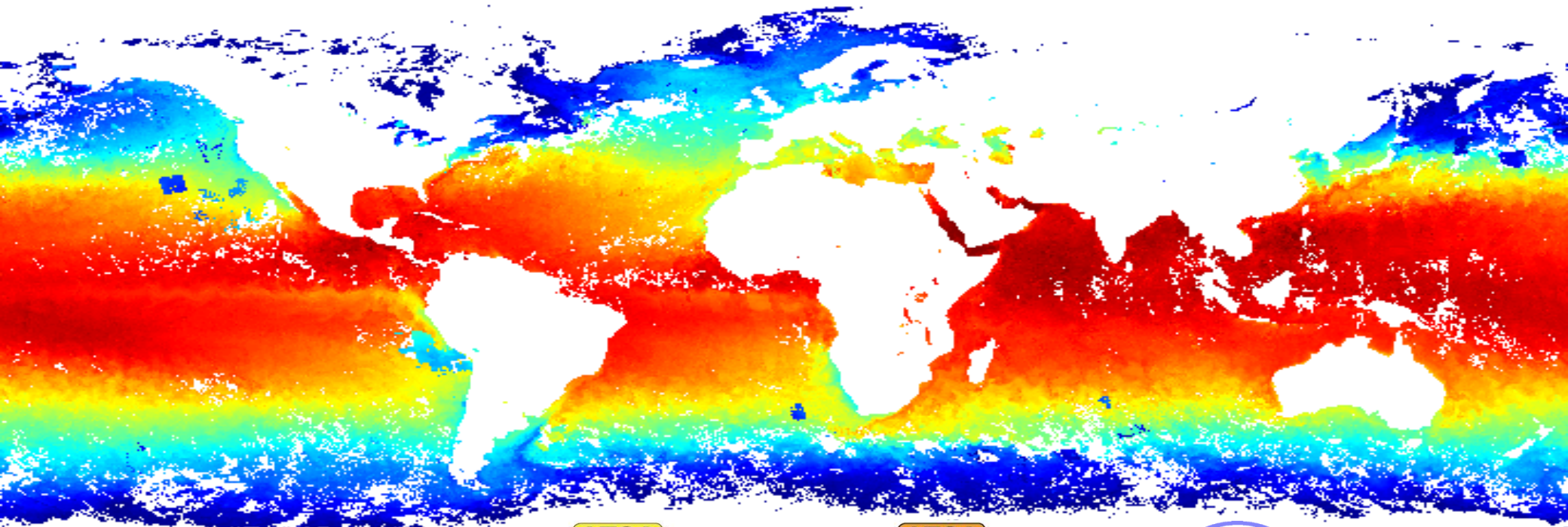




ATSR Pre-launch Characterisation

Graeme Mason
ESA / ESRIN

Formerly of University of Oxford and RAL





Why Perform Pre-launch Characterisation ?



- ATSR was designed from the outset to be an accurate, self-calibrating instrument for measuring infrared radiances.
- However, to be able to fully utilise the data from any instrument, its accuracy and performances need to be determined.
- As an infrared radiometer, the performances of ATSR depend strongly on the thermal balance and stability of key components such as the on-board calibration targets, optics and detectors.
- Therefore, the pre-launch characterisation programme was designed to determine the instrument's performance over a variety of thermal environments and operating conditions and to check for consistent performances at all positions around the conical scan – using sensors traceable to national standards.





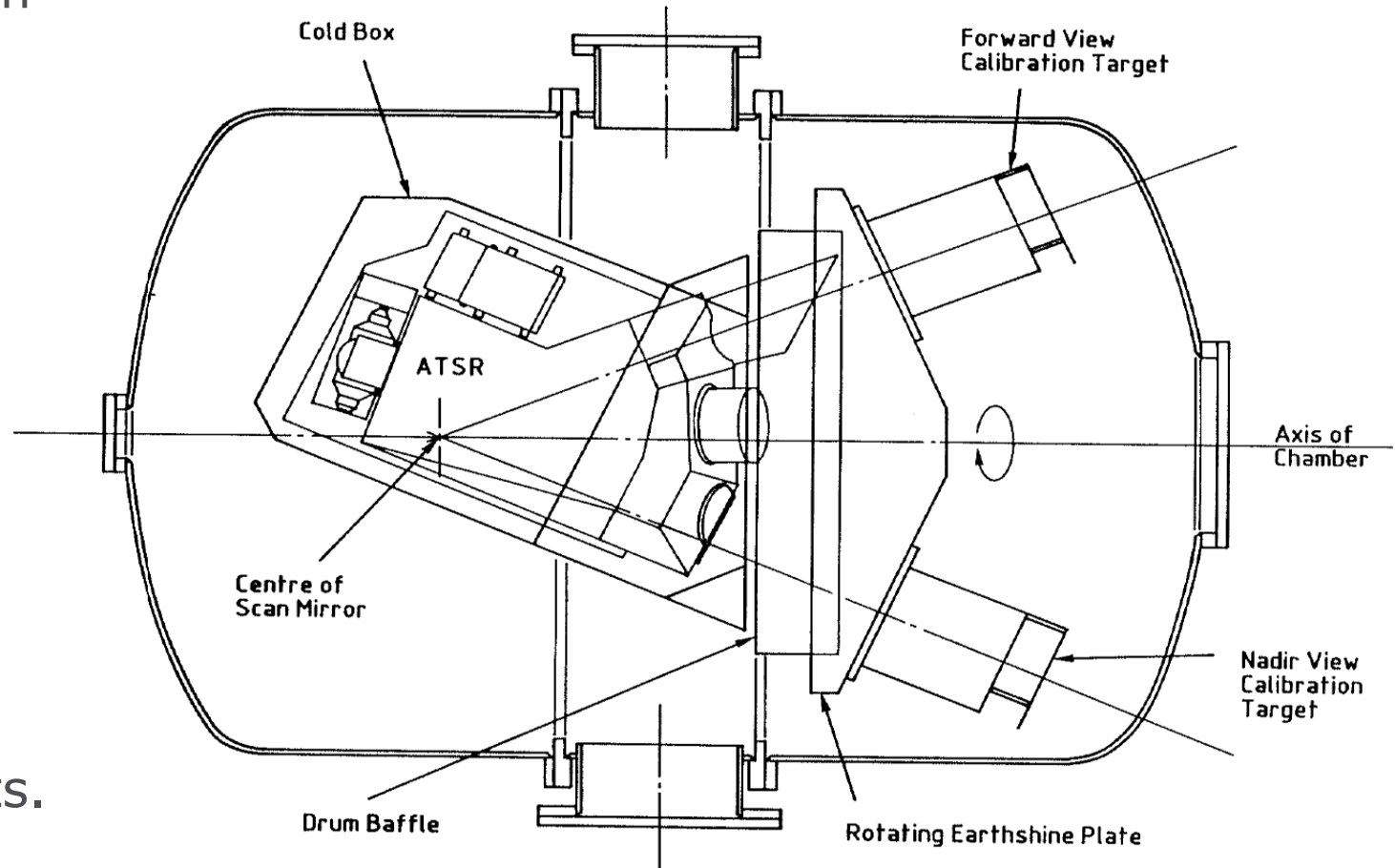
ATSR Pre-launch Characterisation Programme



- The ATSR pre-launch characterisation programme covered:
 - instrument functional check-out in vacuum;
 - determination of channel fields of view;
 - measurement of end-to-end radiometric noise performances;
 - determination of radiometric accuracy;
 - simulation of varying orbital thermal environments;
 - thermal vacuum temperature cycling.
- A dedicated test facility at the Department of Atmospheric, Oceanic and Planetary Physics at the University of Oxford was designed and built to perform these tests. ATSR was tested in May to July 1989.
- This facility was also used for ATSR-2, while the AATSR pre-launch calibration was performed at RAL. Facility now decommissioned.



- Outline diagram of thermal vacuum chamber showing ATSR instrument, thermal environment panels and set-up for radiometric calibration tests.

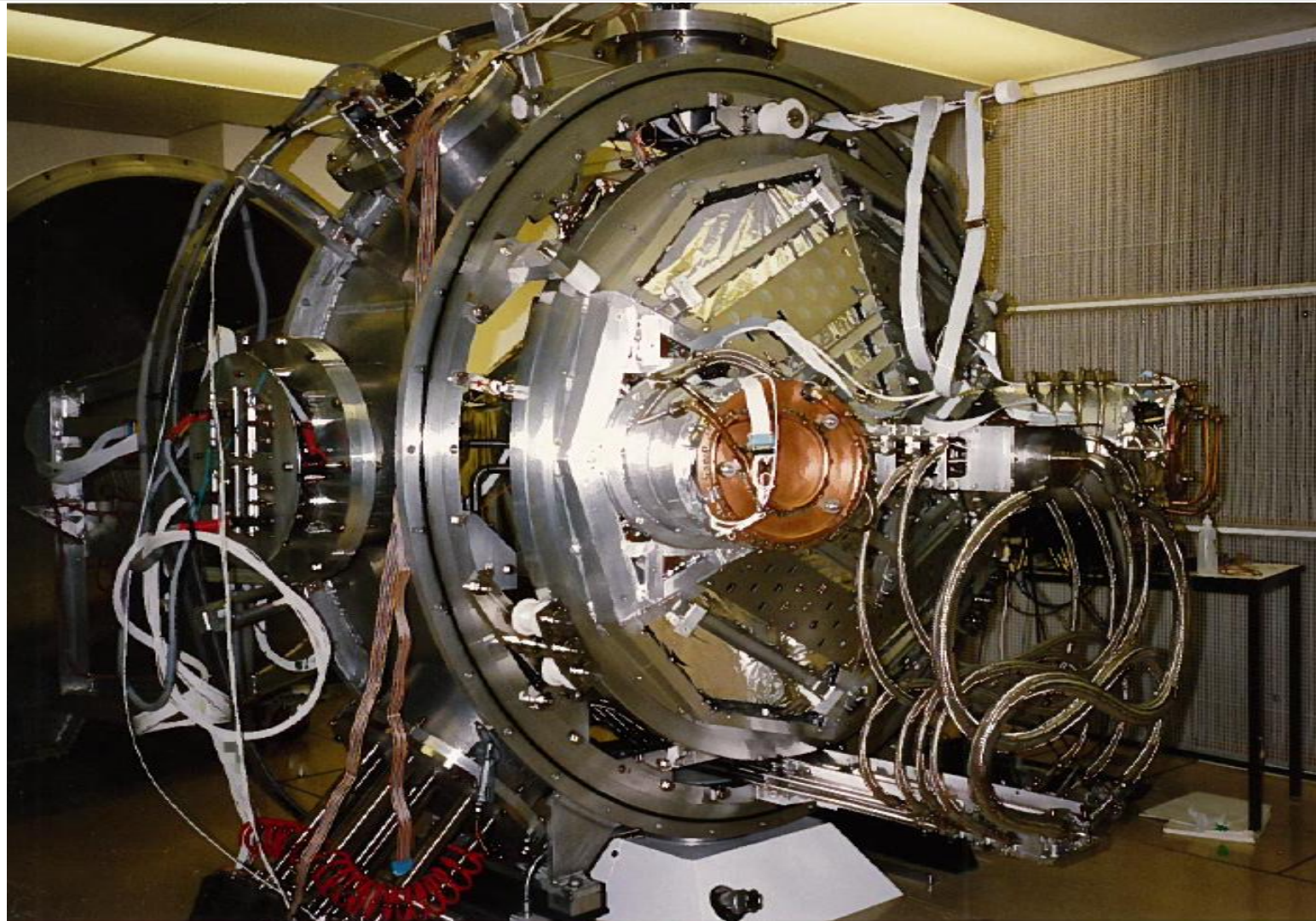




Oxford Test Facility



- External calibration targets, mounted on rotating 'earthshine plate'.





Oxford Test Facility



- Thermal environment panels surrounding the instrument.

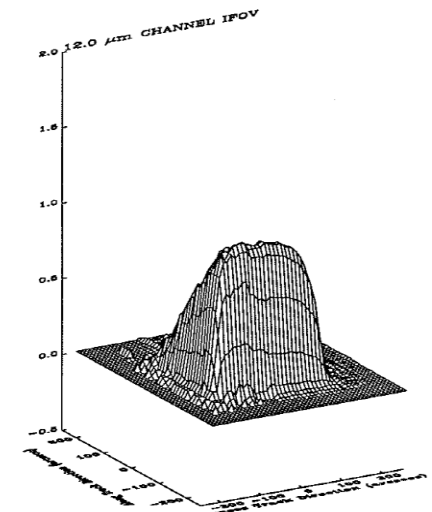
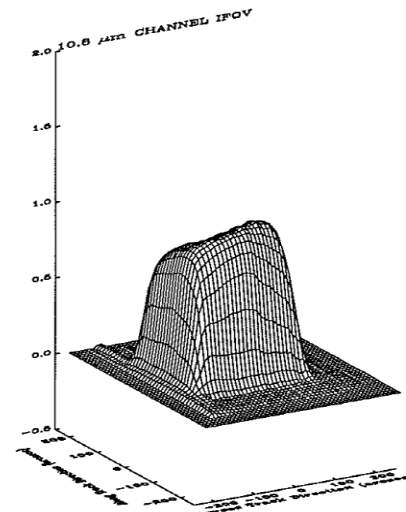
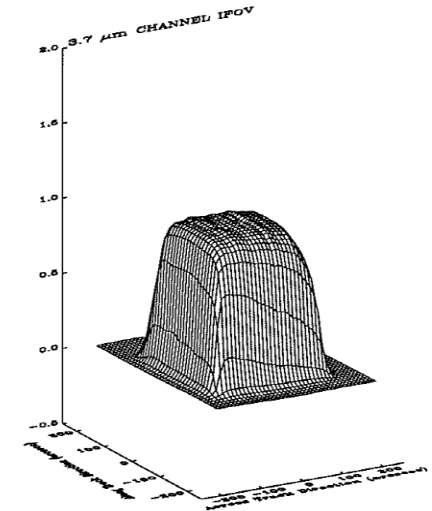
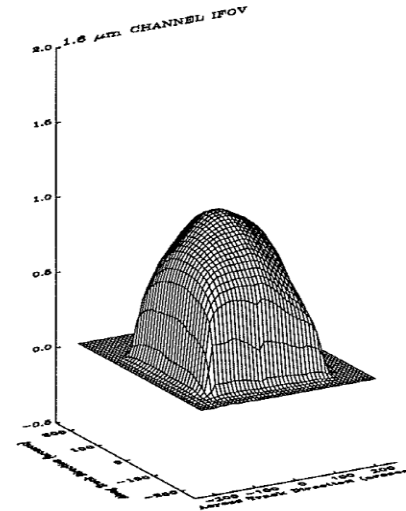
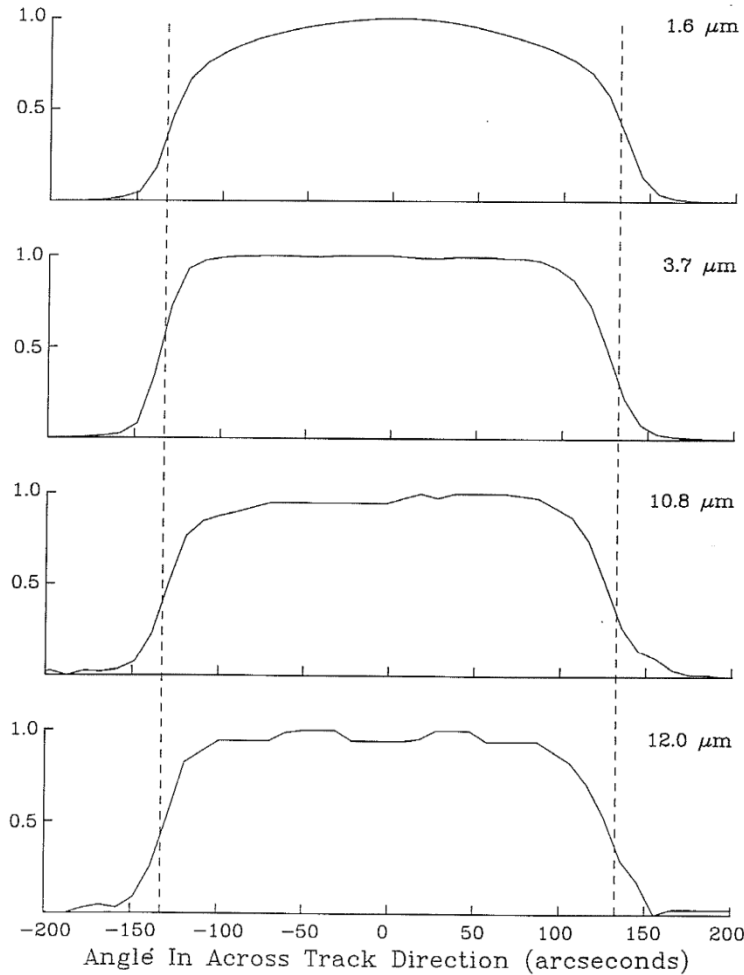




Field Of View Results



RELATIVE IFOVs IN THE ACROSS TRACK DIRECTION (BOL)

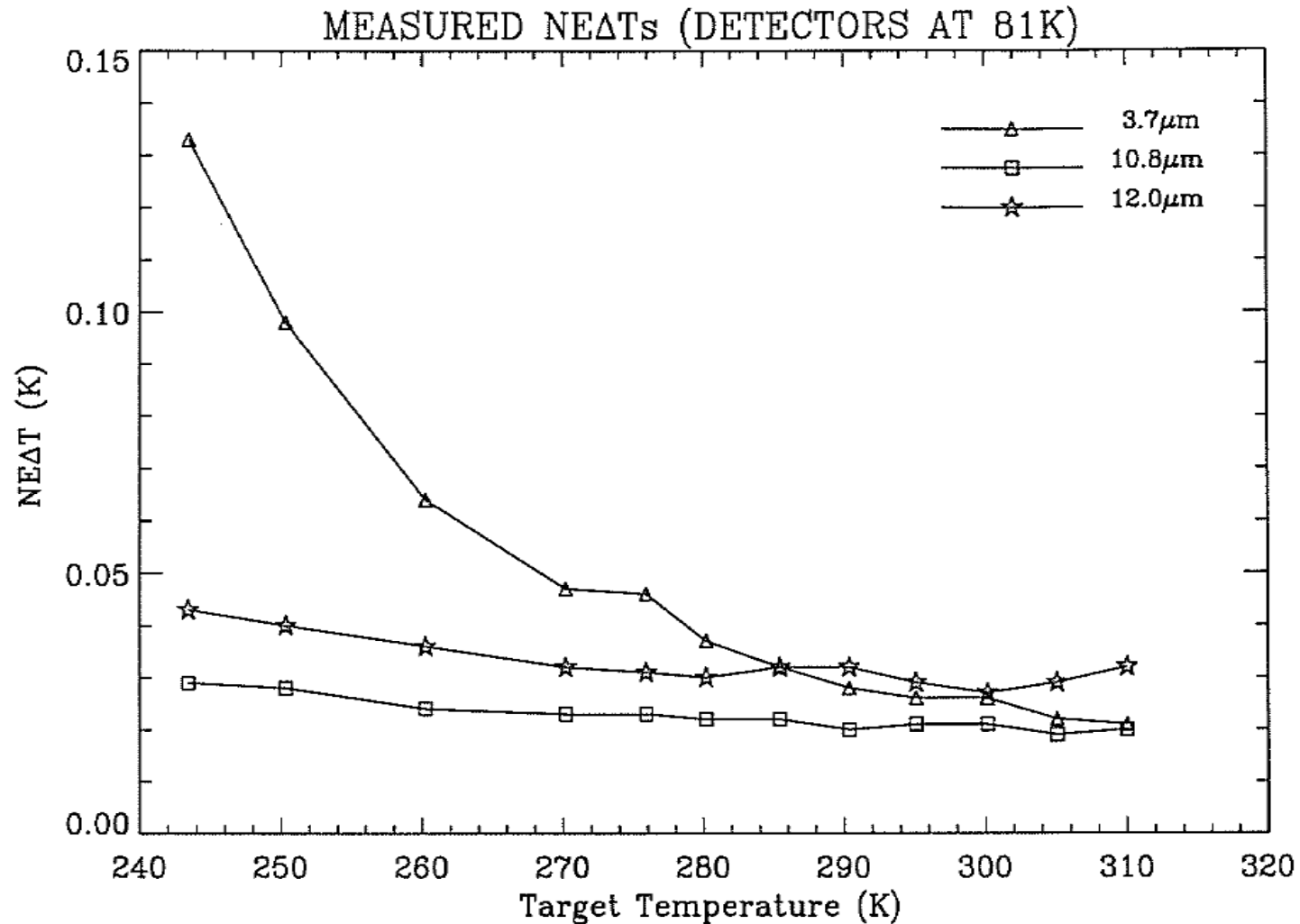




Radiometric Noise



- Radiometric noise measured viewing external targets, at all positions around the scan and at various thermal environments and detector temperatures.
- Very good NE Δ Ts: typically < 50 mK.

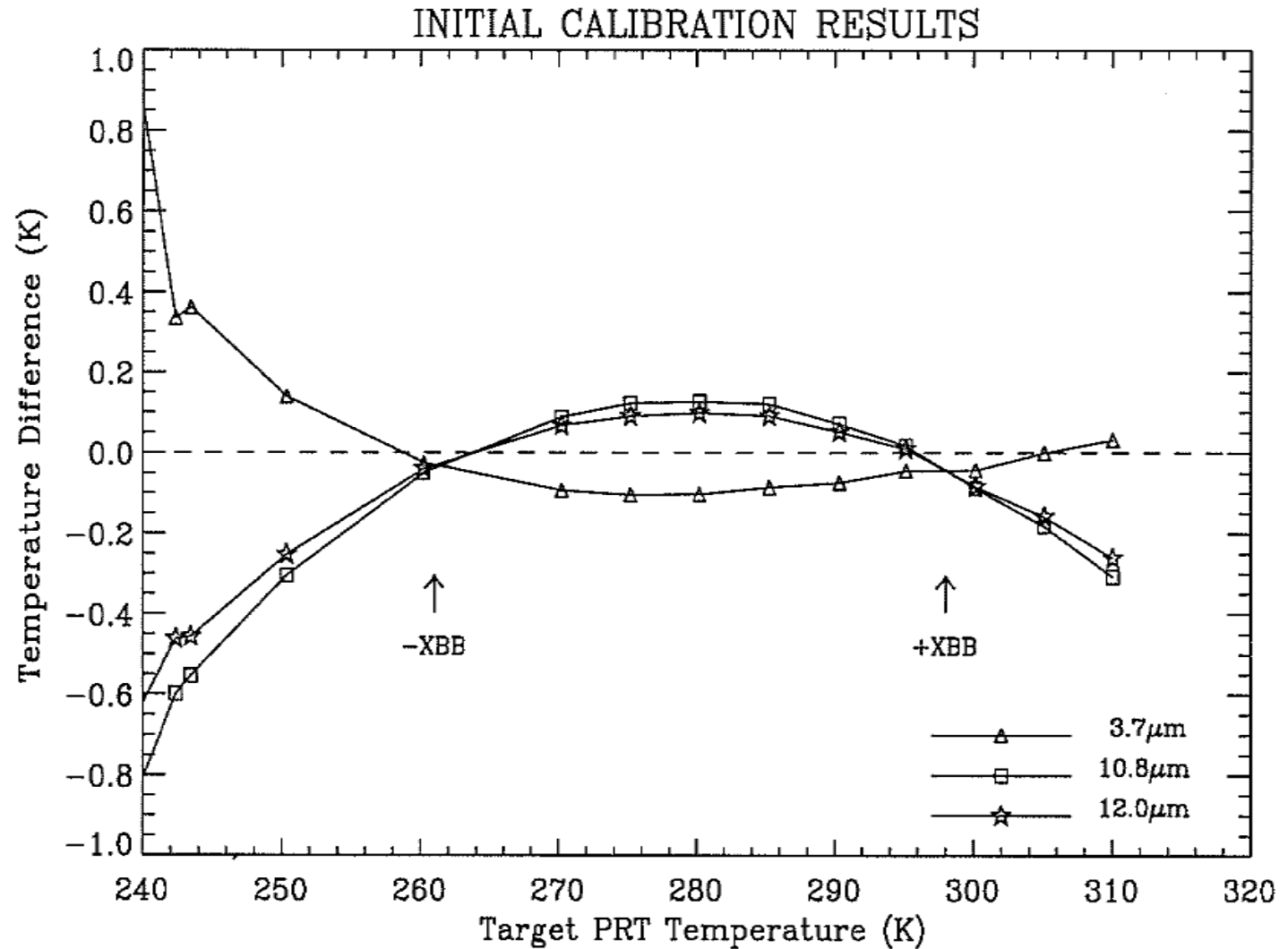




Radiometric Accuracy



- Initial calibration results showed non-linearity in all channels and small bias (30 to 40 mK) between on-board and external calibration targets.

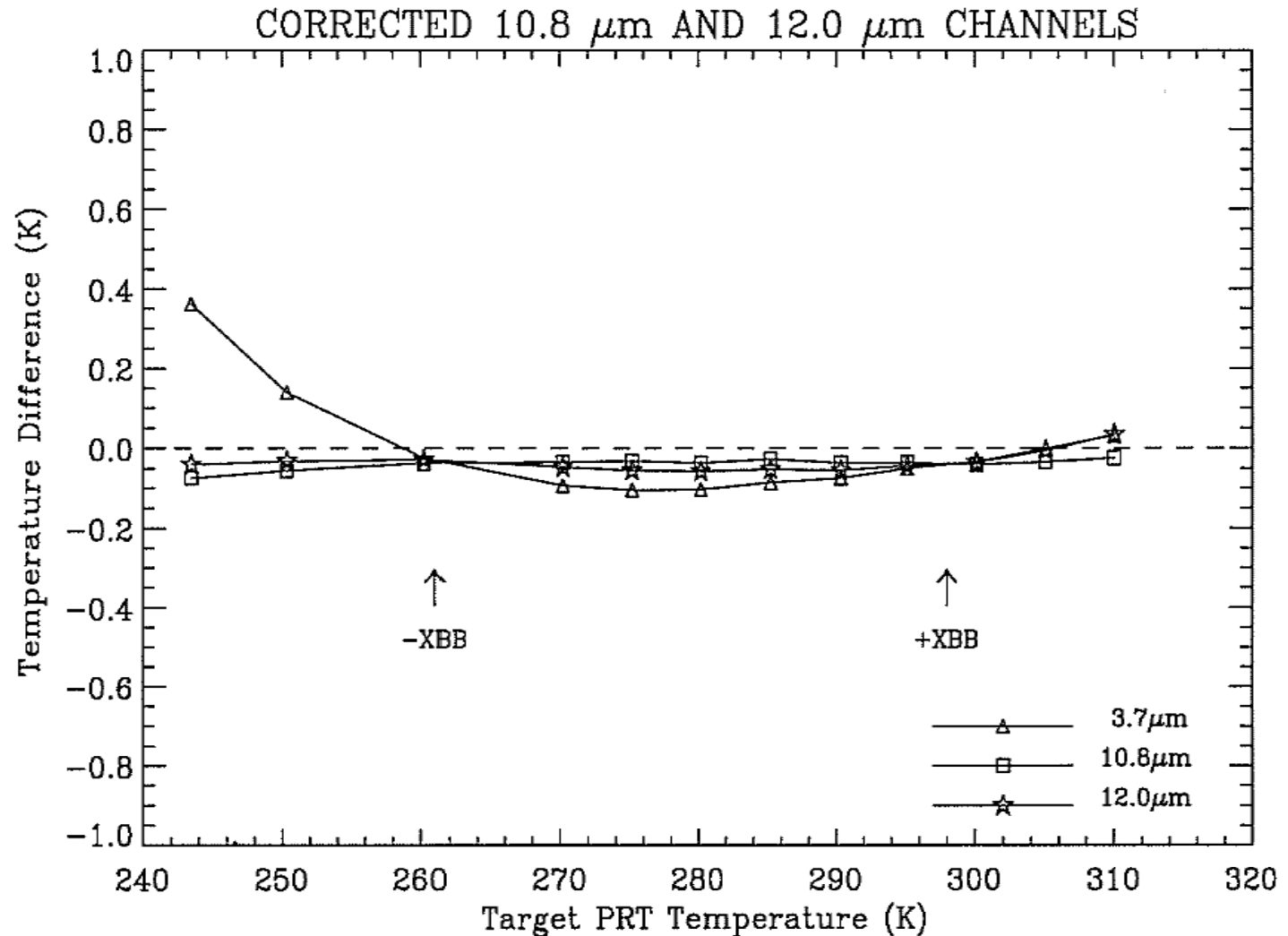




Radiometric Accuracy



- Non-linearities in 10.8 and 12.0 μm channels attributed to Auger recombination in HgCdTe detectors, and corrected.
- Good relative accuracy between all channels





Summary Of Results



- The ATSR pre-launch characterisation programme provided:
 - measurement of field of view of each channel;
 - determination of co-alignment between channels;
 - reference measurement of radiometric noise;
 - determination of radiometric accuracy;
 - corrections for non-linearity of 10.8 μm and 12.0 μm channels;
 - characterisation of small non-linearity of 3.7 μm channel;
 - confirmation of radiometric performances at different thermal environments, and on-board target and detector temperatures;
 - confirmation of no scan dependent biases;
 - confirmation of no out-of-field radiometric strays around the scan.
- These results confirmed ATSR to be an excellent radiometer and facilitated the subsequent exploitation of the in-orbit data.





Concluding Remarks



- Summary conclusions from ATSR pre-launch characterisation tests (September 1991):
 - “The test and calibration programme was an essential part of the ATSR development programme. Using the results from these tests, ATSR is shown to meet its radiometric performance requirements. ATSR should therefore fulfil its mission objectives and make significant contributions to climatological and oceanographic research.”
- The calibration approach and processes pioneered on ATSR over 20 years ago (and subsequently followed for ATSR-2 and AATSR) are now being promoted within the Quality Assurance Framework for Earth Observation (QA4EO) by CEOS and ESA as a template for all future radiometric Earth Observation missions.





Acknowledgements



- The ATSR pre-launch characterisation programme was the result of the efforts and contributions from many people – notably from RAL and the Met Office.
- However, with specific reference to the activities at Oxford University, particular mention should go to:
 - Jim Williamson;
 - Bob Watkins;
 - Steve Armitage;
 - David Corney;
 - Bill Taylor;
 - David Smith.



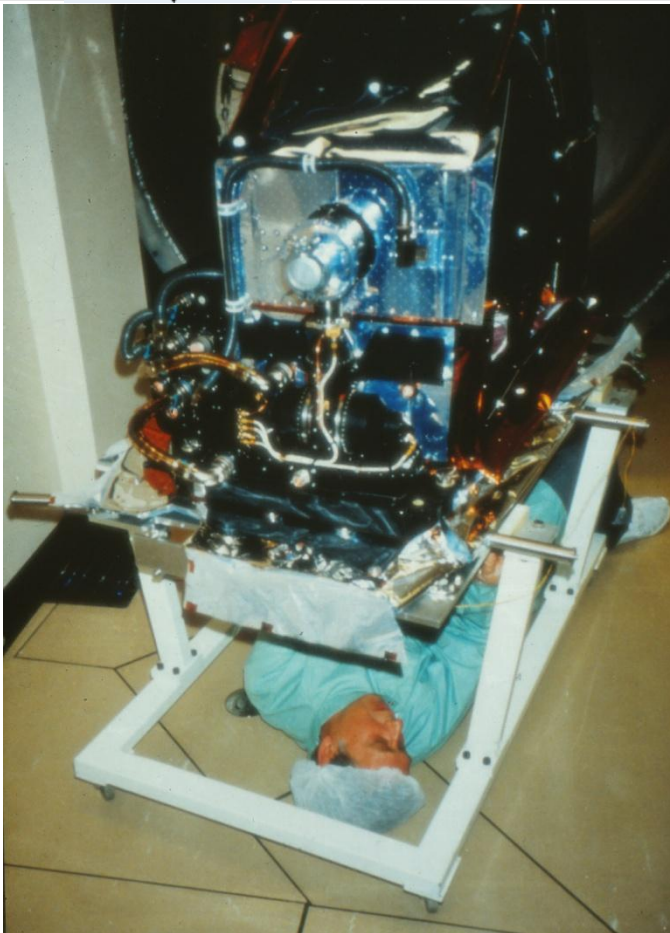


Rogues Gallery "Whatever happened to . . ."



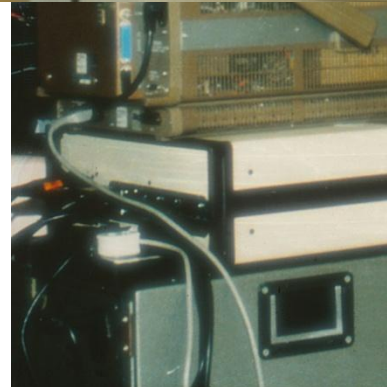
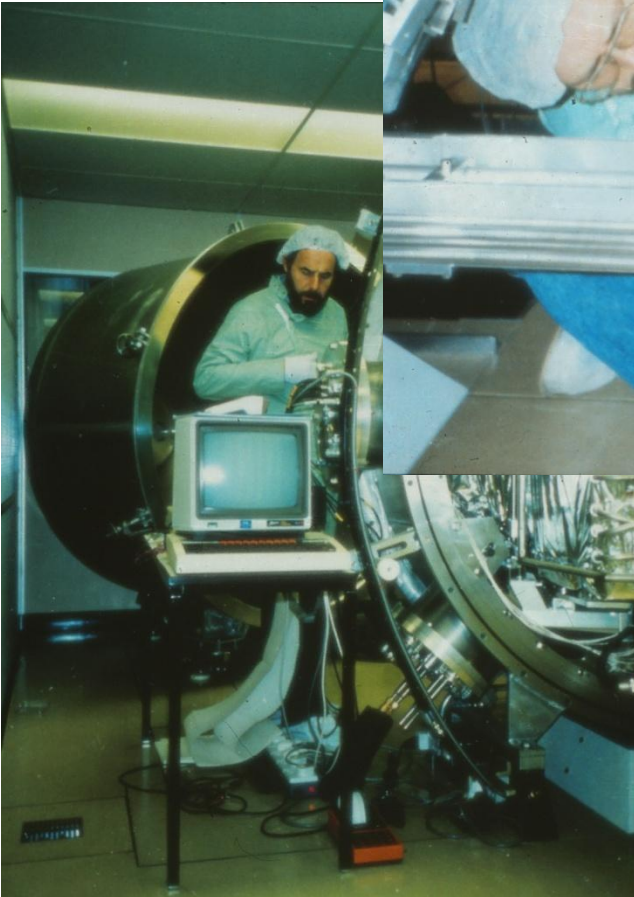


Rogues Gallery "Whatever happened to . . ."





Rogues Gallery "Whatever happened to . . ."



ATSR Special Event, RAL, 22 October 2009





Rogues Gallery "Whatever happened to . . ."

