VISTA: Infra-red Camera and potential Surveys

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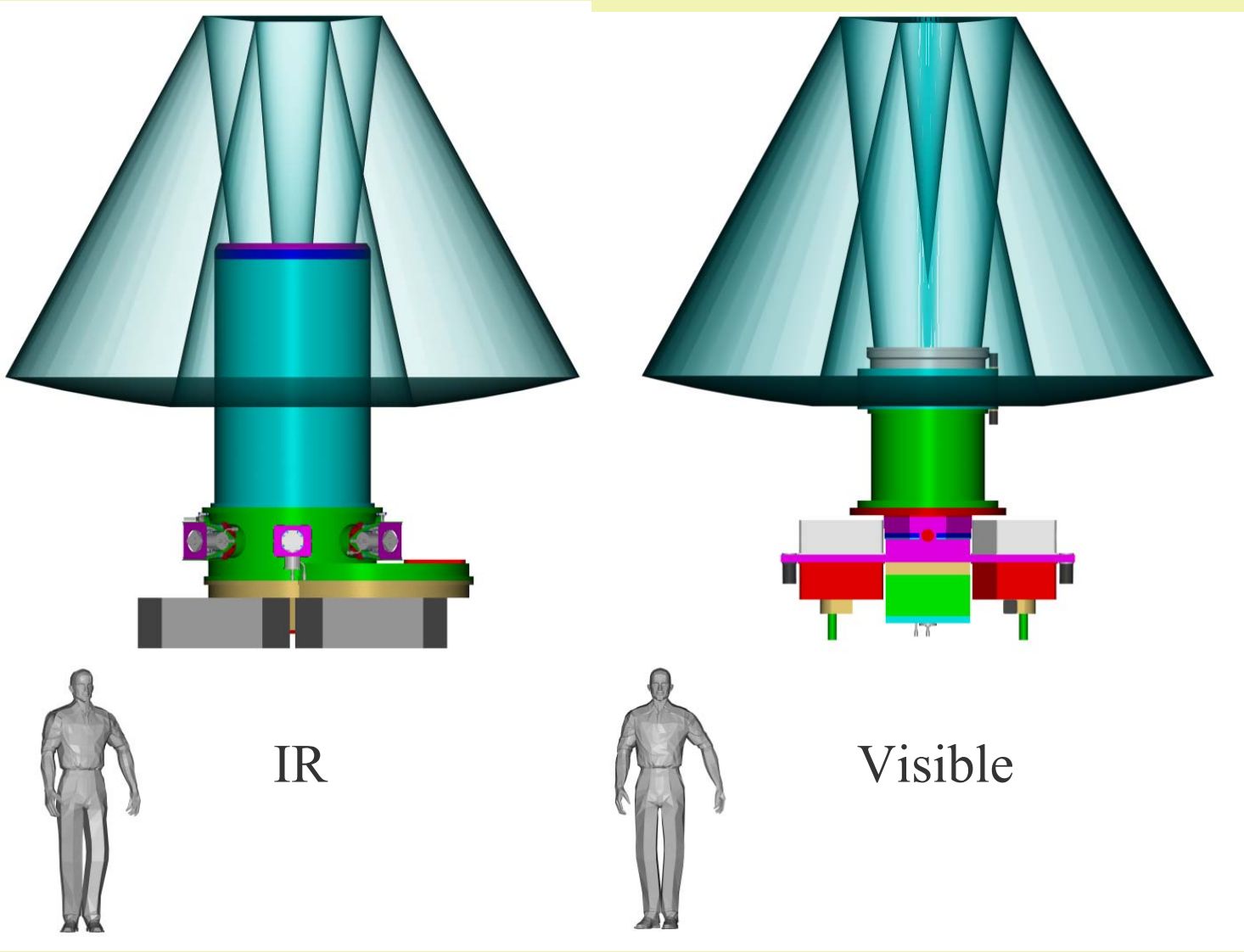
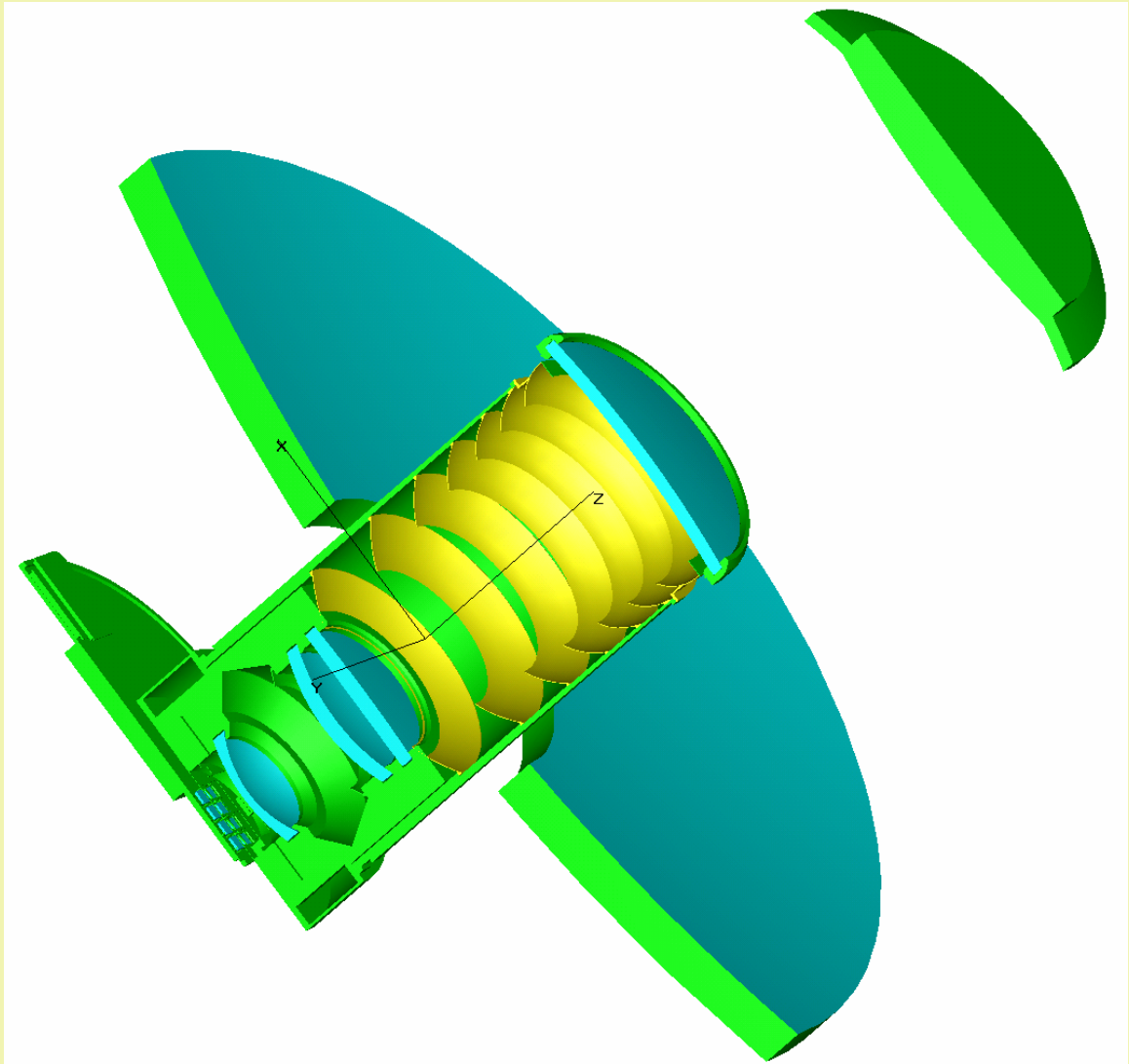
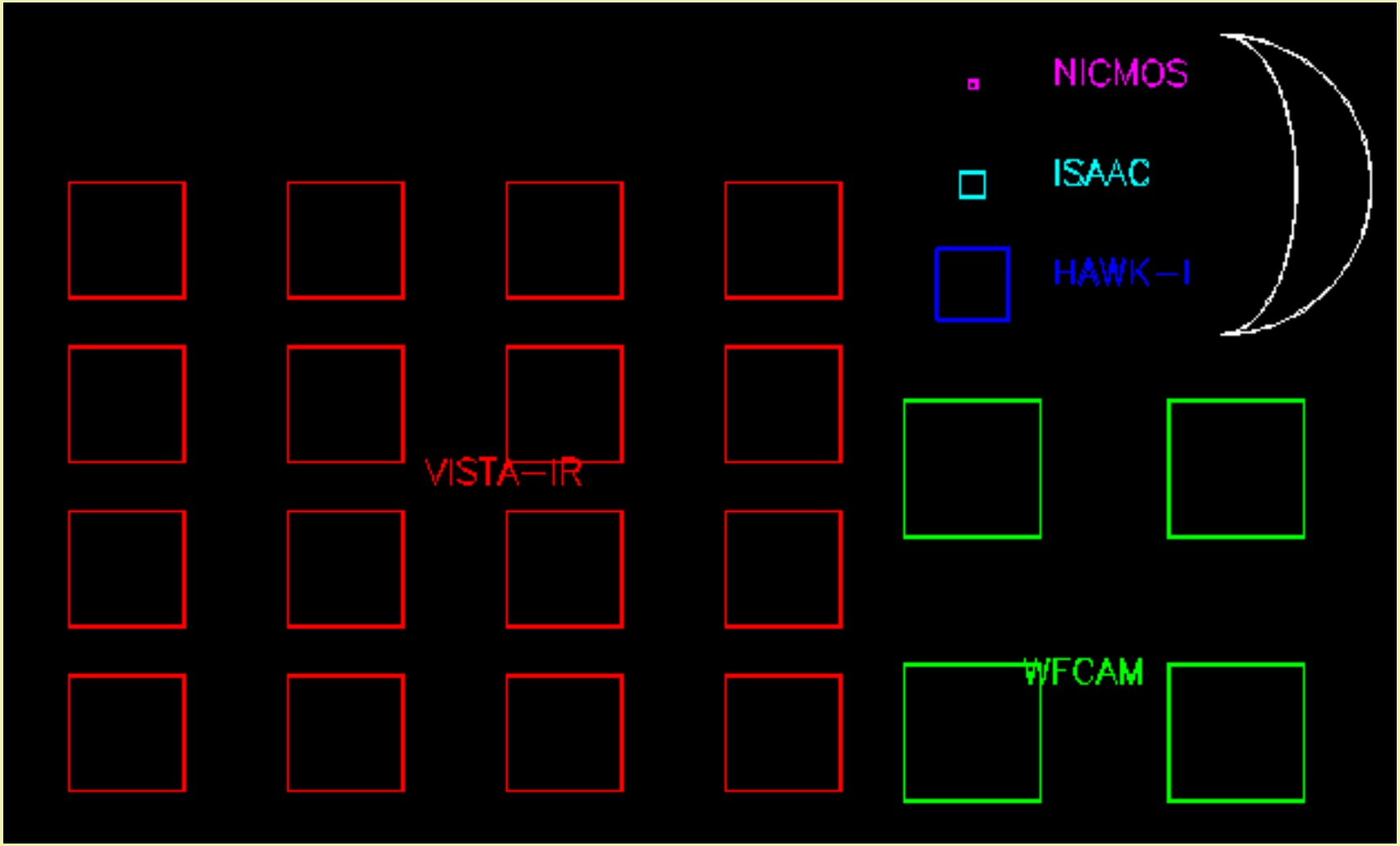

IR
Visible

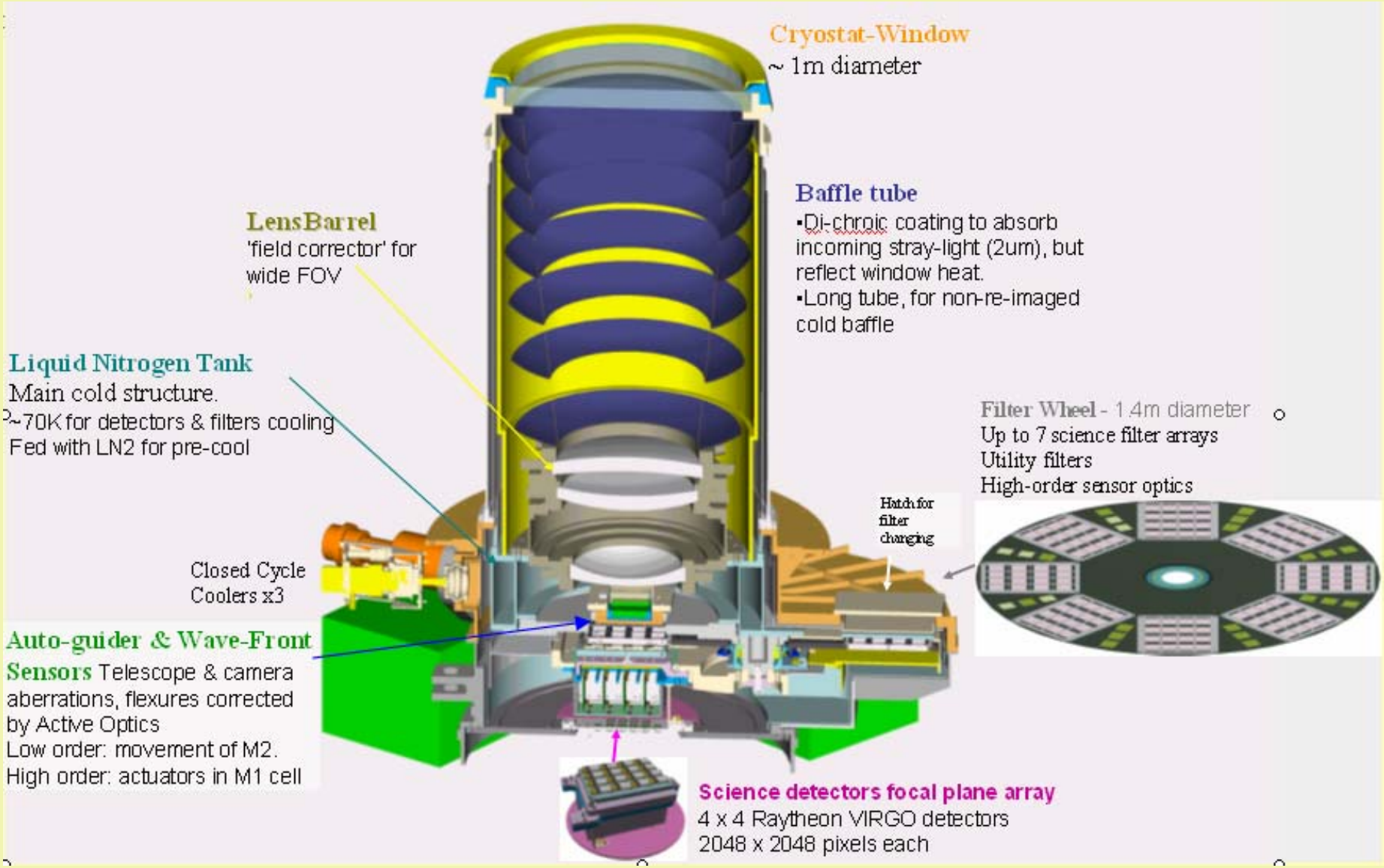
VISTA IR optical layout



IR camera field sizes:



IR Camera cross-section



VISTA IR Camera consortium : RAL, UKATC, Univ. Durham

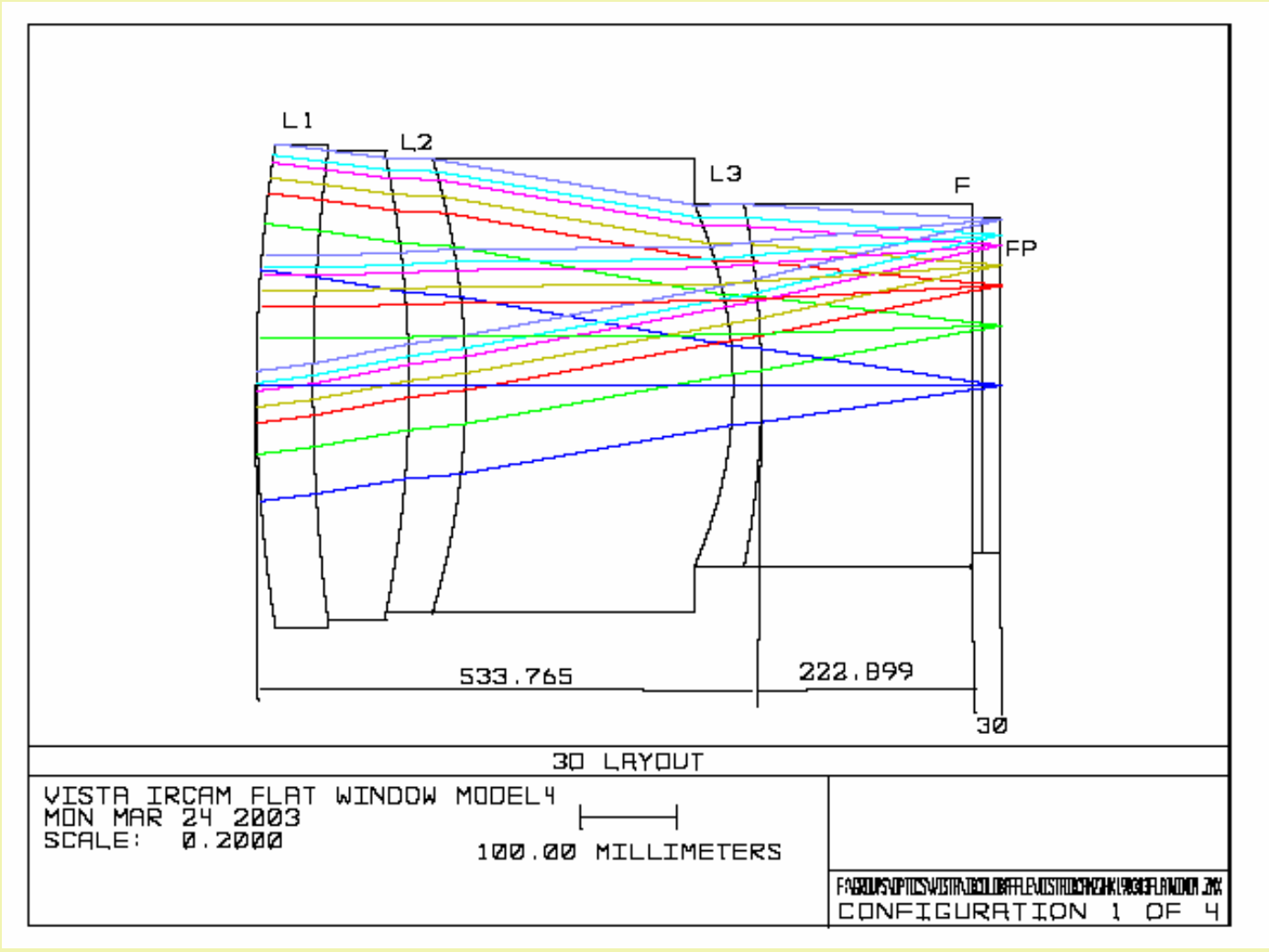
IR Camera

- RAL : Cryostat, coolers, controllers, AIT .
  Kim Ward (PM), Martin Caldwell (Sys. Engineer), Gavin Dalton (Camera scientist), Martin Whalley (cryo) et al

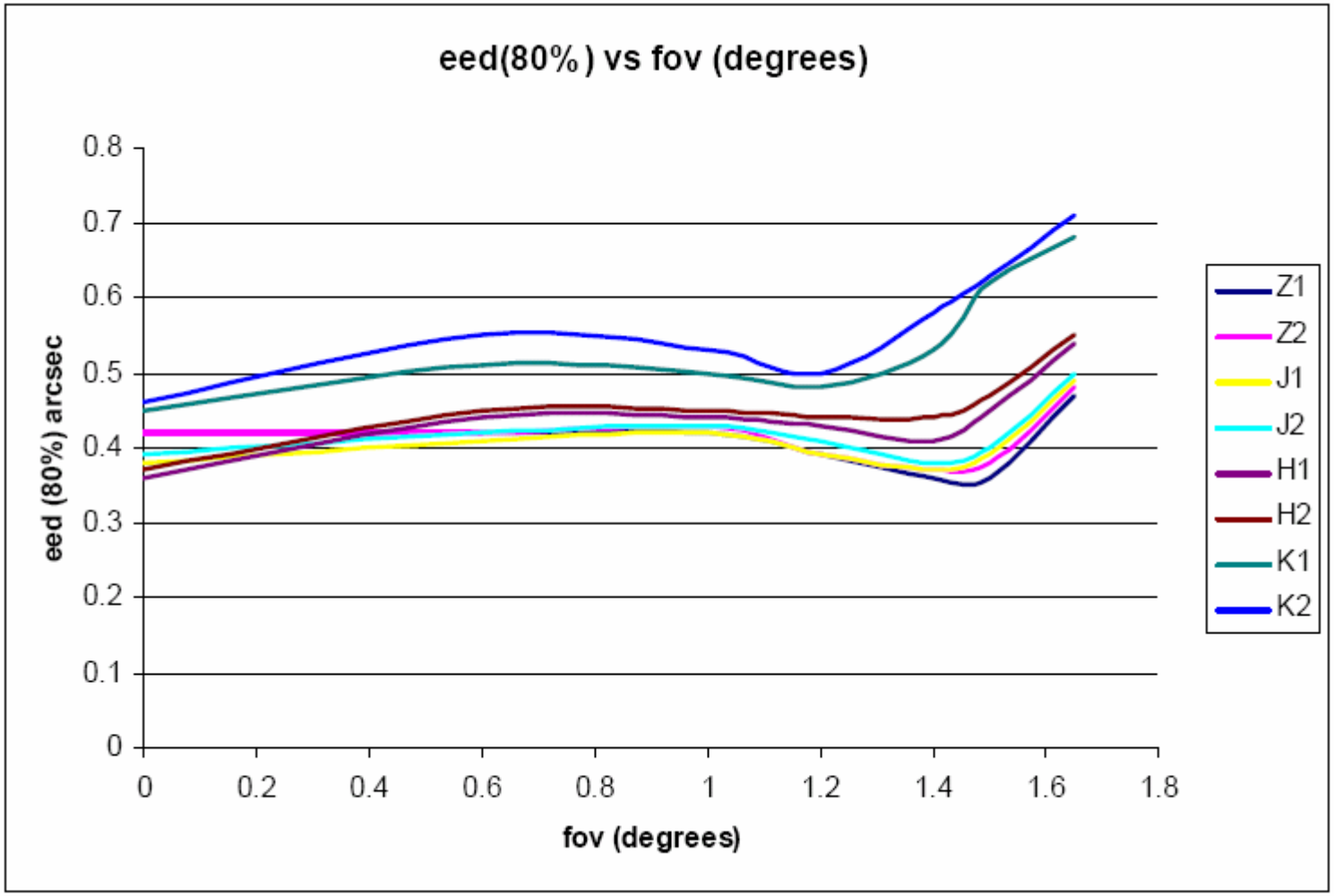
- UKATC: Lens barrel, filter wheel, detector tests.
  Mel Strachan, Angus Gallie, Naidu Bezawada, Steven Todd, Steven Beard et al.

- UoD : guiders and wavefront sensors.
  Paul Clark, Nigel Dipper et al.

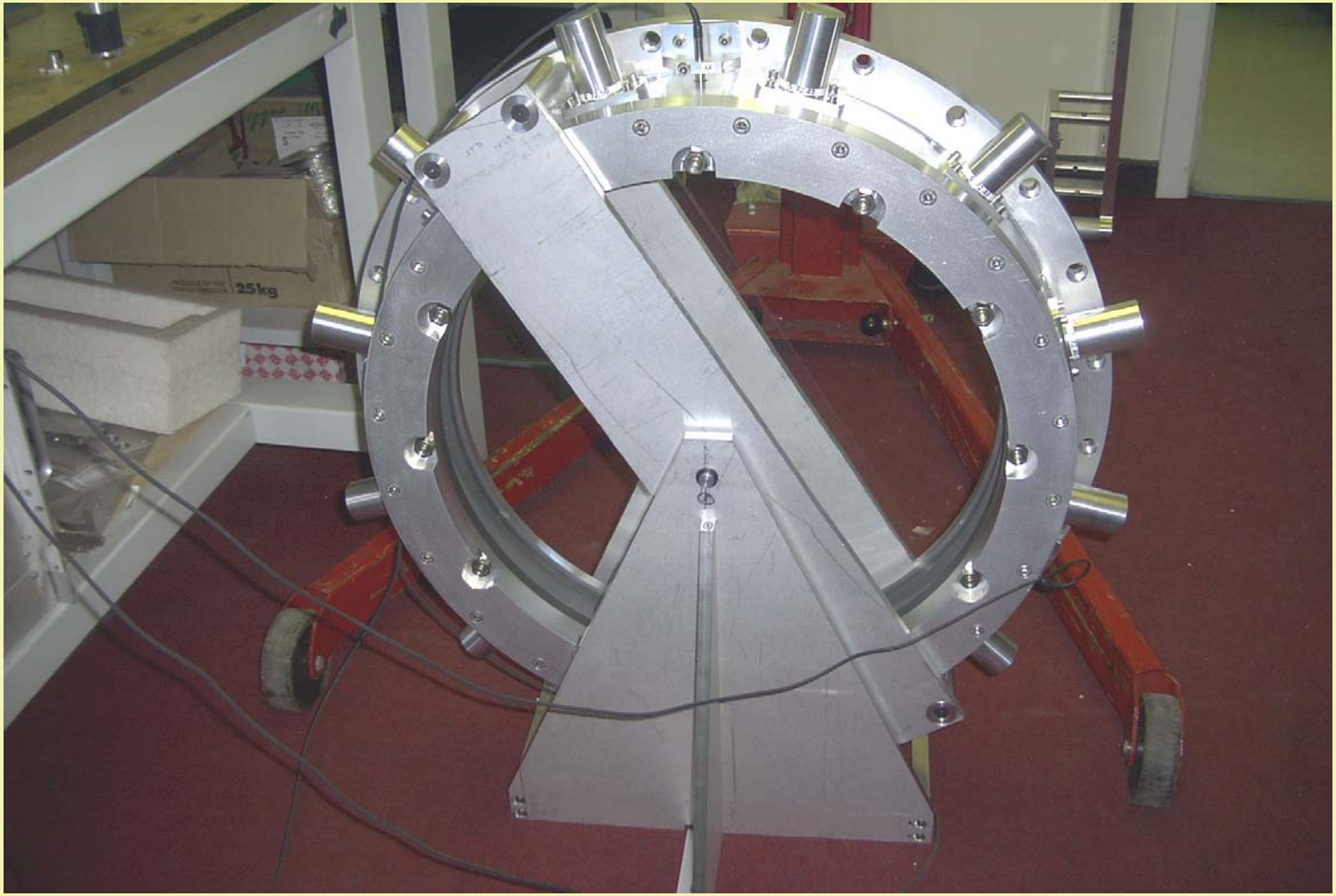
IR camera corrector lenses



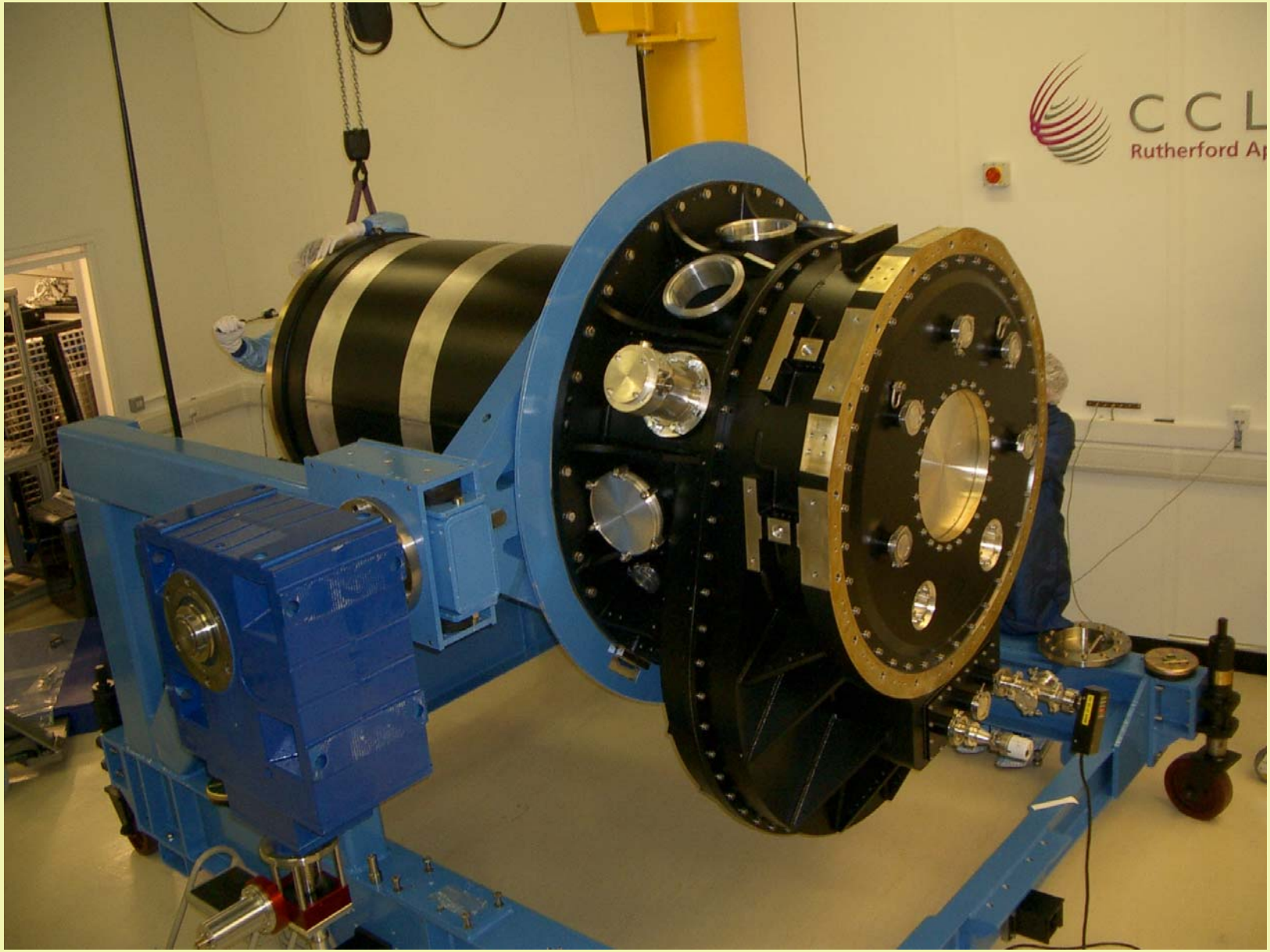
80% encircled energy diameter

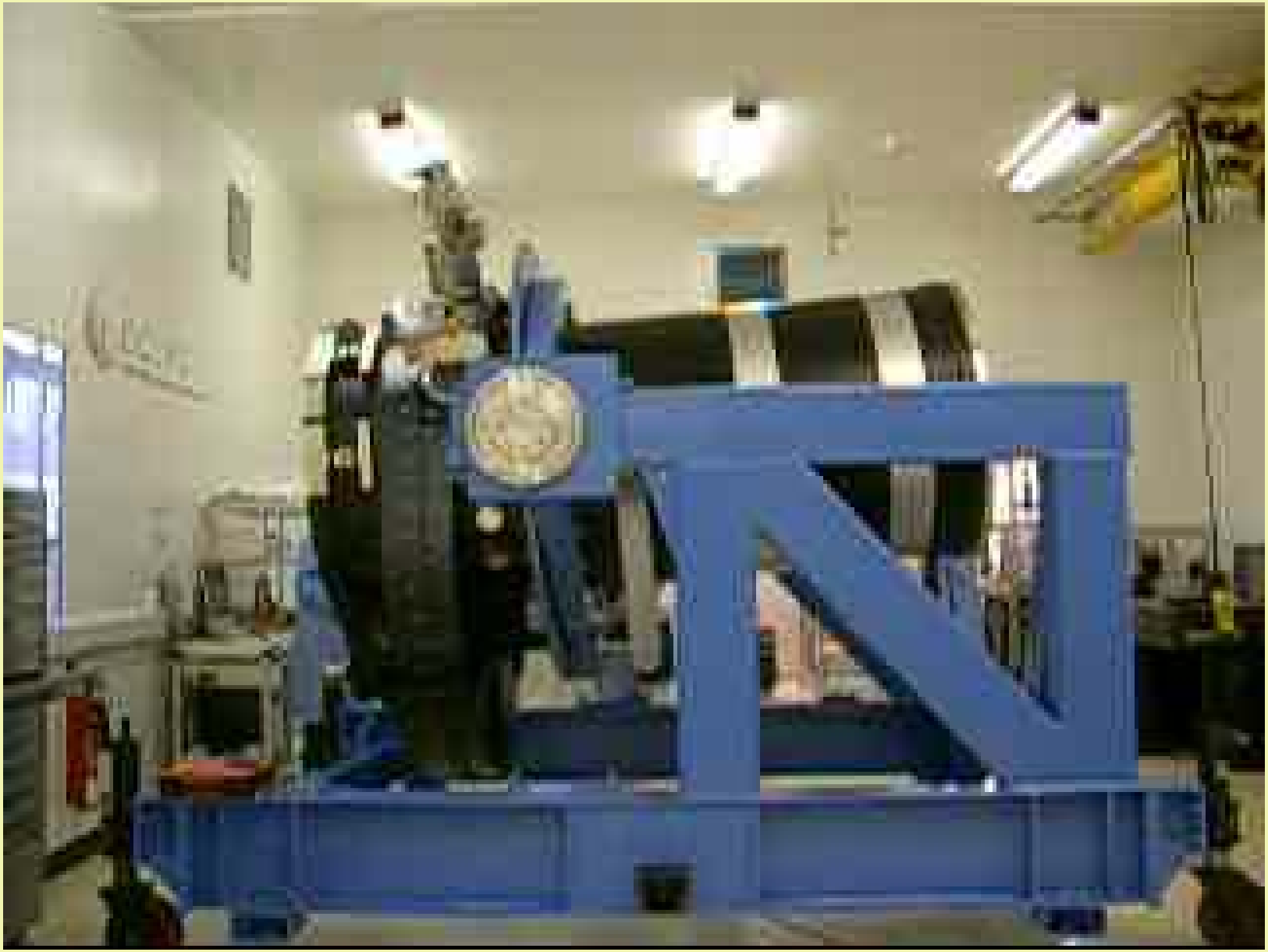


Dummy lens + mount at UKATC

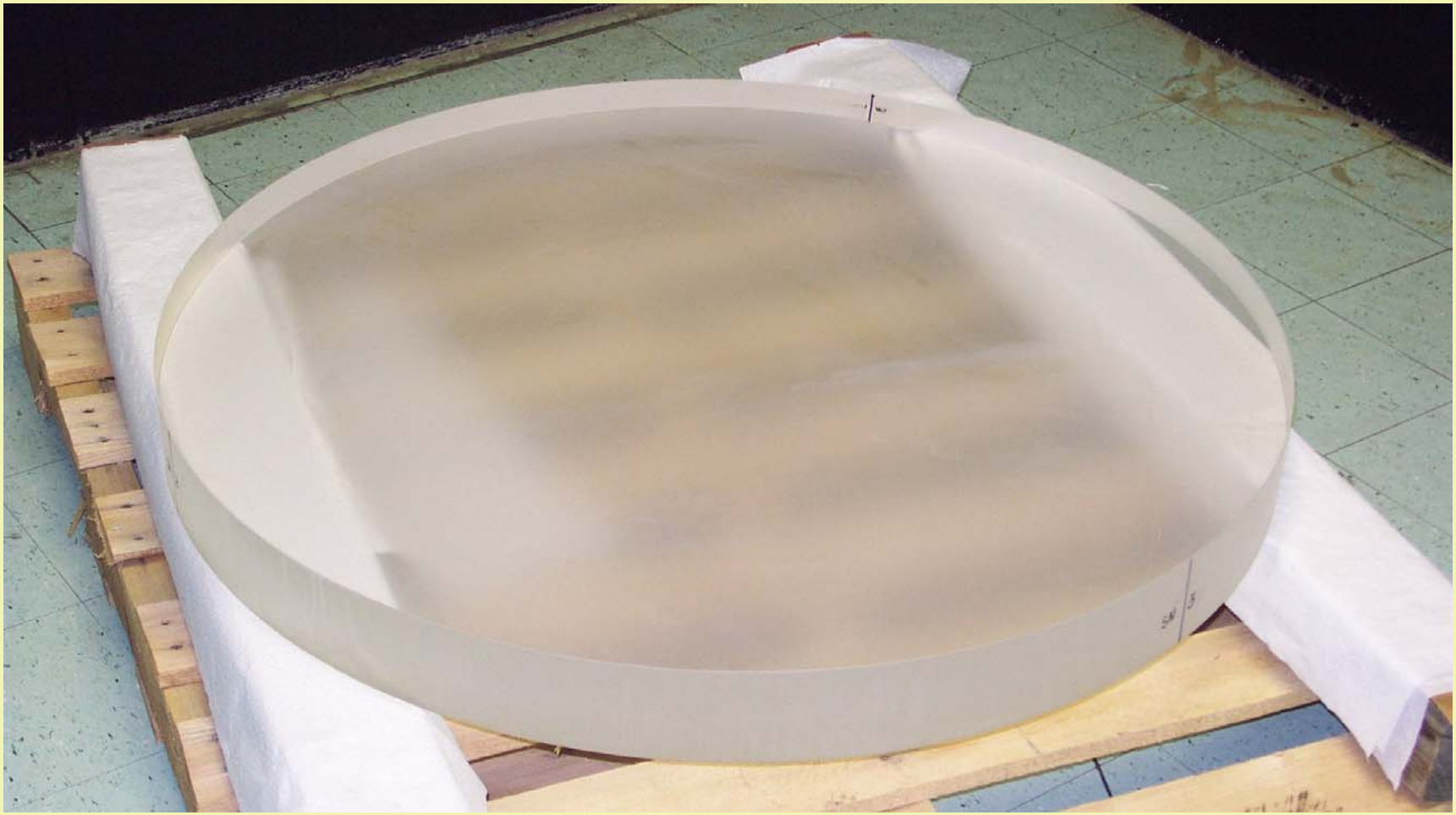


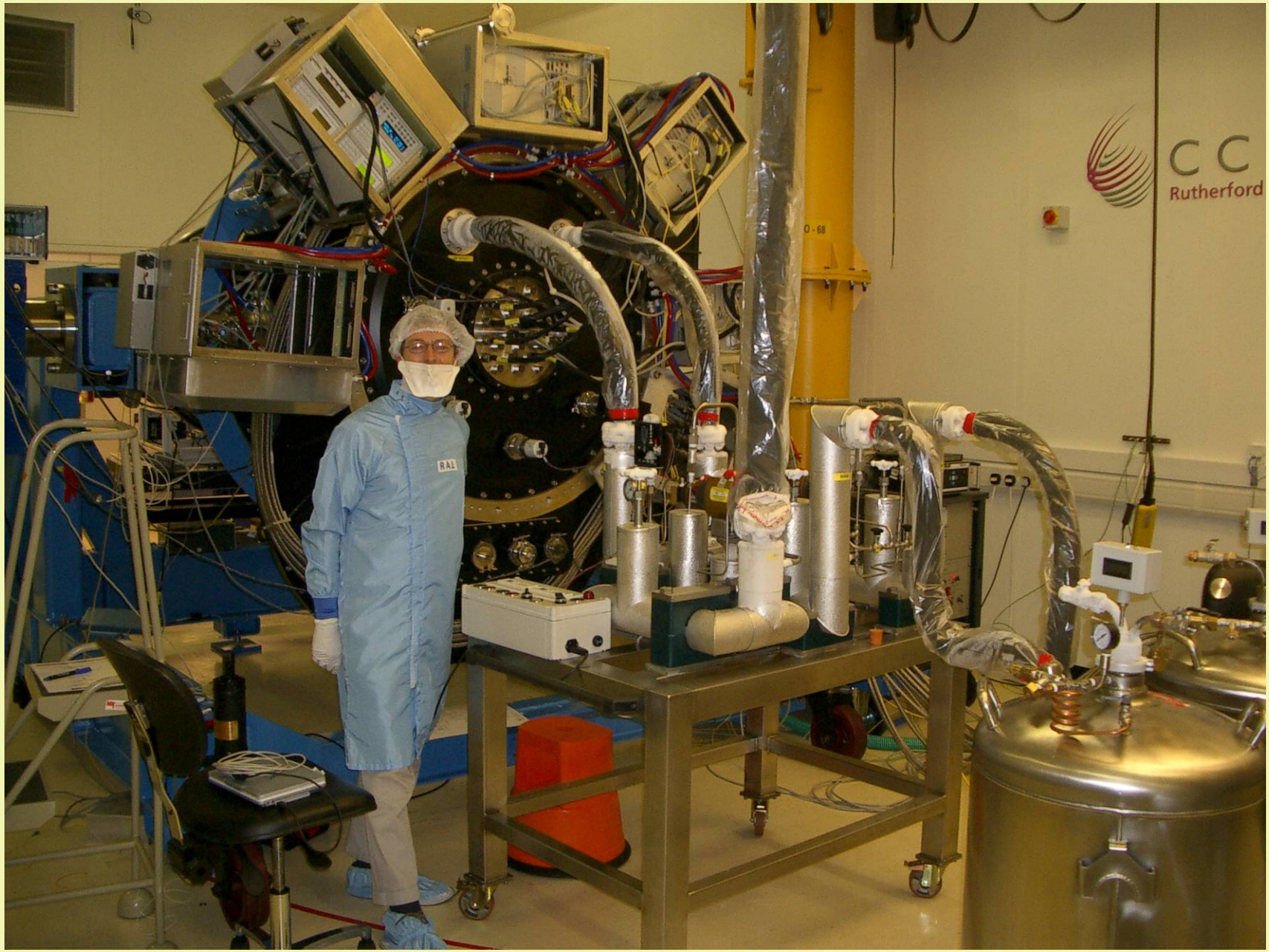
Cryostat and trolley at RAL



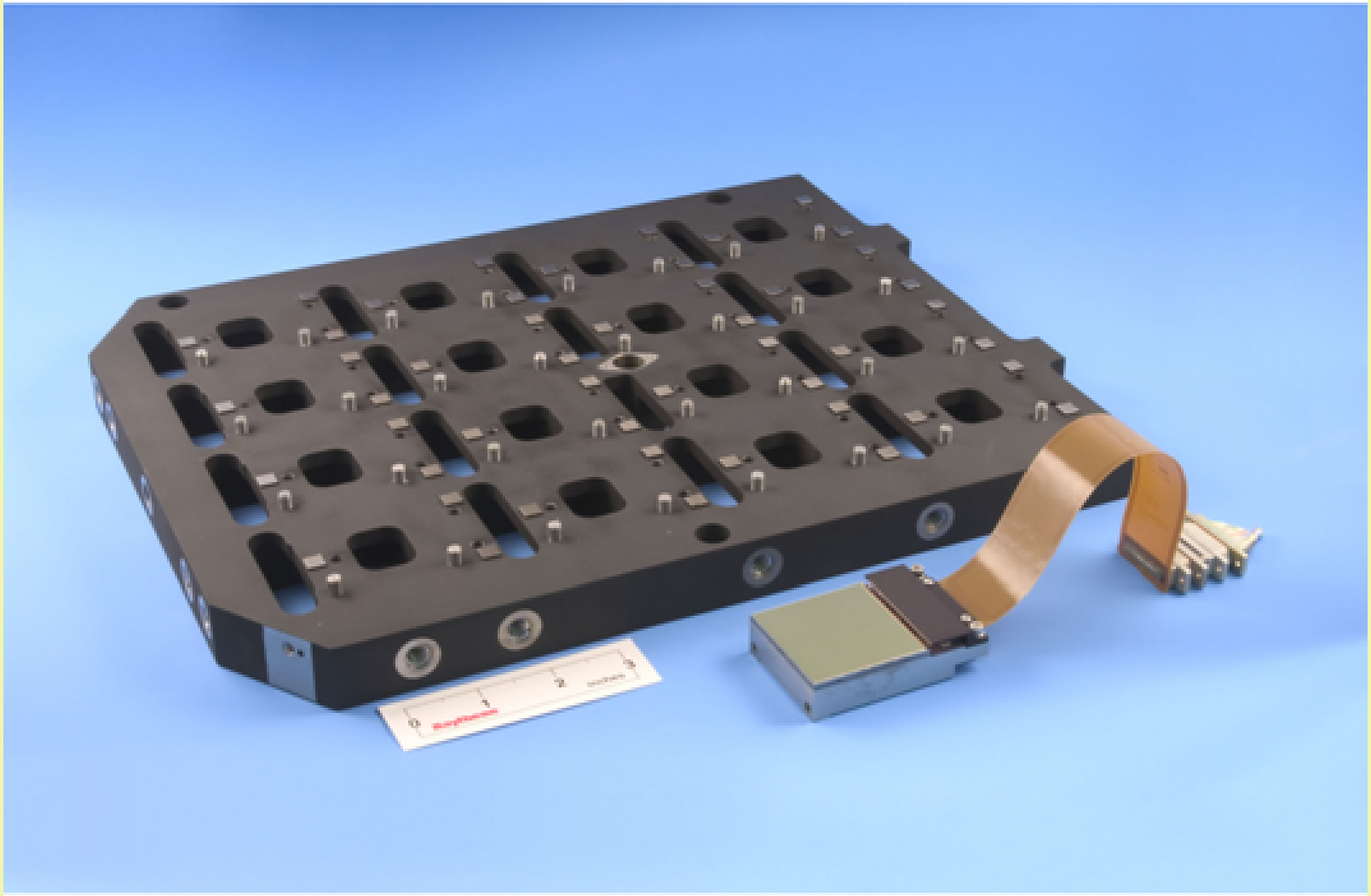


Infrasil window blank – 95cm




RAL
Rutherford

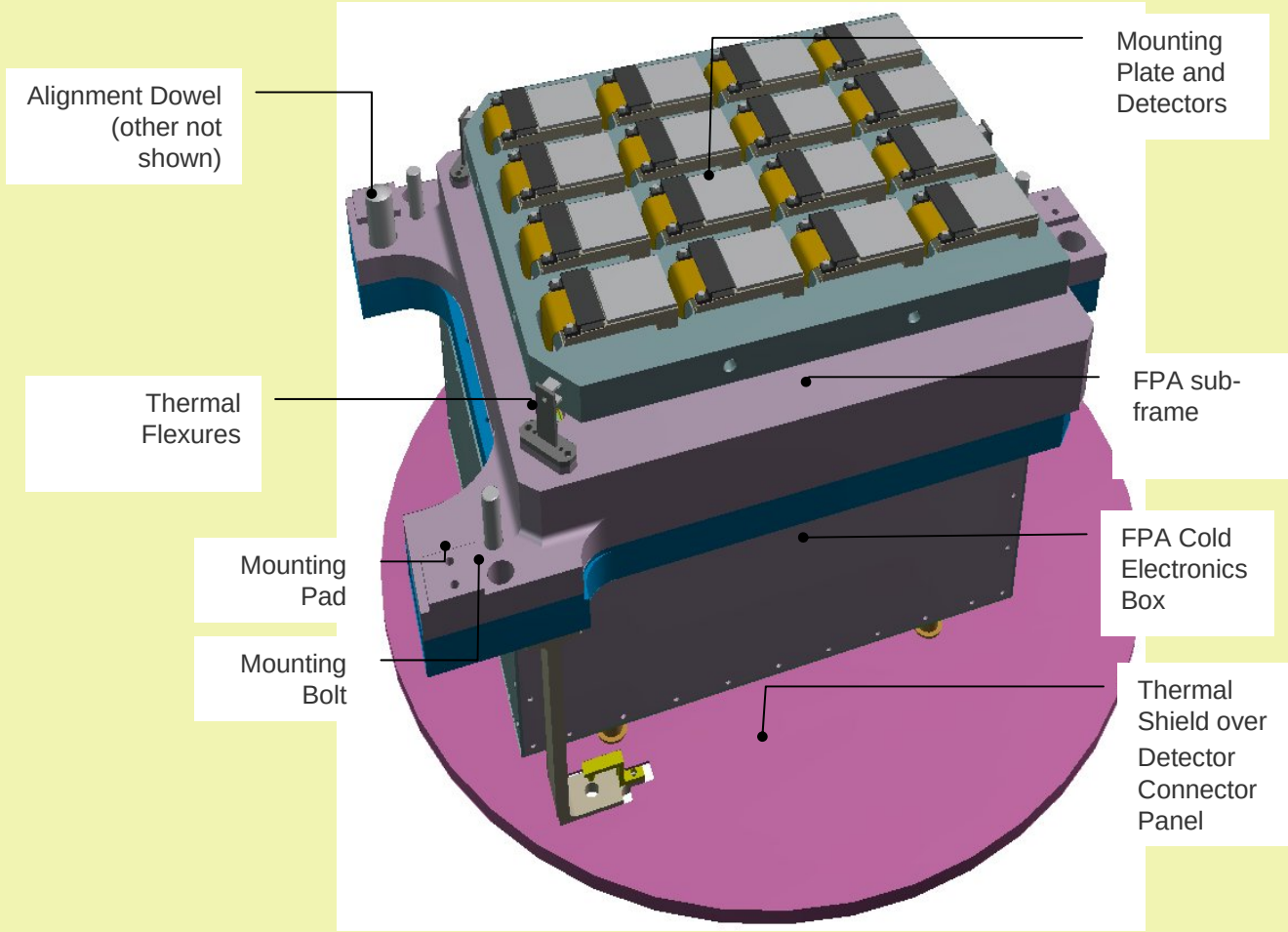
Detector Mounting Plate



VISTA Mounting Plate, with Module - 3/17/05

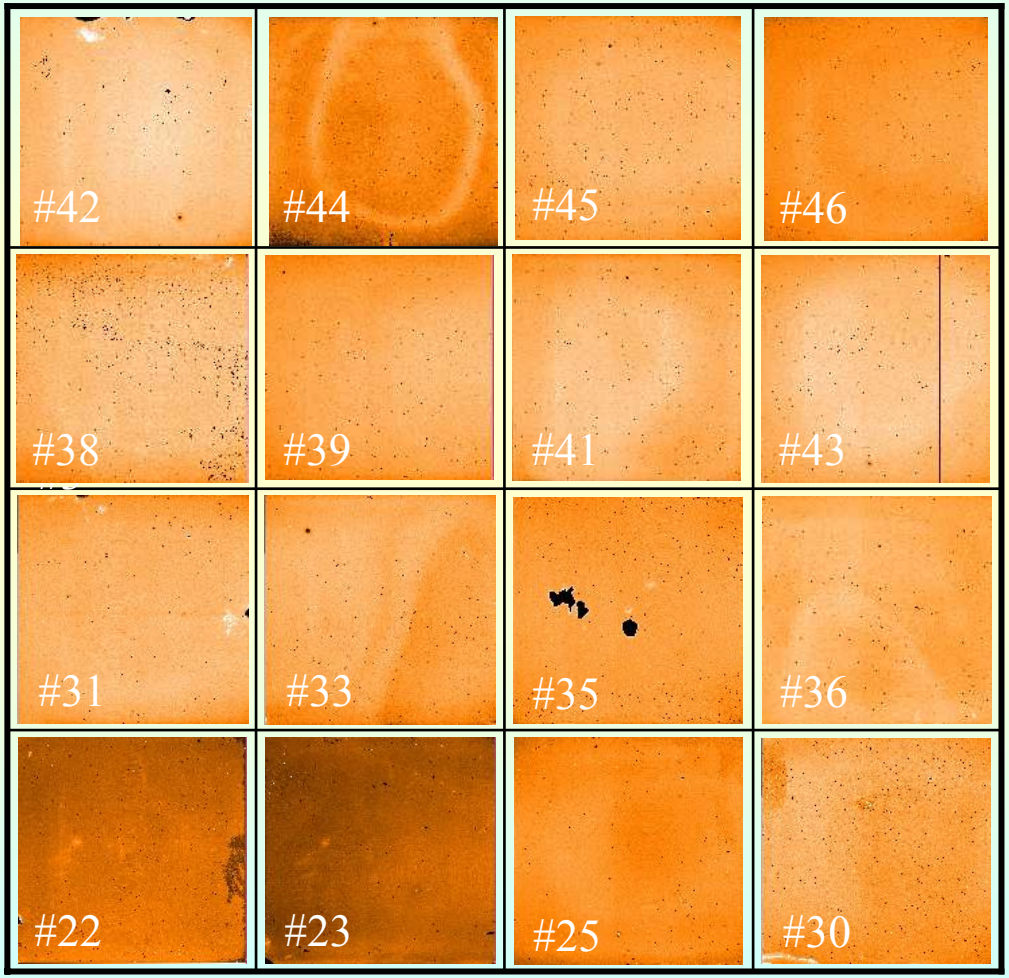
05-03-146

Focal Plane Assembly



Final 16 Detectors – Status Bitmaps

IR Camera

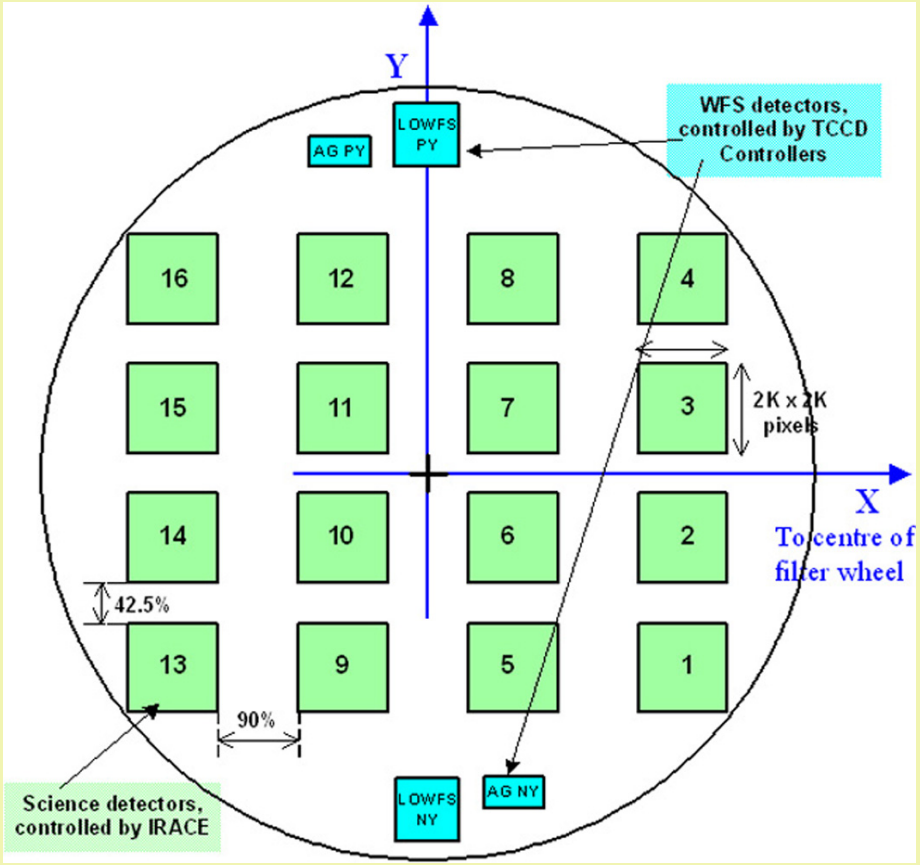


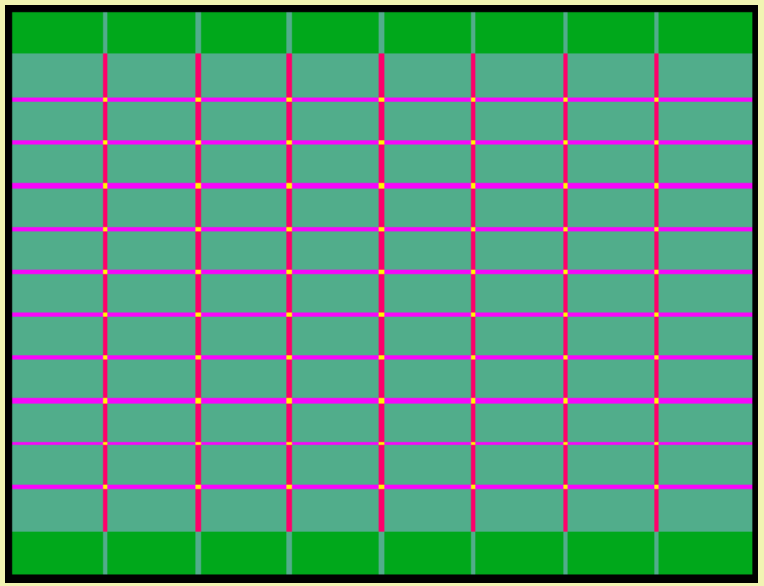
- Early detectors QE ~ 70% (unstable AR coatings on them)
- Robust coating from Module 25
- Large area defects on Module 35
- Dark relaxed on couple of detectors
- Column / row defects on couple
- 3 spares

IR focal plane:

- **16 arrays, 67 Mpix = 0.60 deg^2 = 2150 arcmin^2 on-pixels , 0.34 arcsec/pix.**

  - 6 offset pawprints gives 1.5 x 1.0 deg^2 `tile' , every pixel covered by $\geq$ 2 pawprints.





Observing mode(s):

- Just one basic mode: imaging, within 0.85 – 2.4 μm

- Filters: wheel can accommodate 7 science + 1 opaque filters .
  Y, J, H, Ks procured.
  Z and 1.19 μm narrowband (Ly-α z=8.8) in progress.
  One spare slot at present.

- Various combinations of tiling, jittering, microstepping – all by offsetting whole telescope.

- High observing efficiency:
  - Active optics runs "concurrently", minimal overhead.
  - Fast readout and telescope movement -
    Typical minute: 6 x (10 sec integrate + 1 sec readout), coadd + save, 3 sec jitter move, 1 sec guider lock, repeat .

VISTA operations:

- Operations: By ESO - All queue-scheduled service observing - match to range of observing conditions.

- At least 75% of time for large-scale ESO-public surveys, time allocated by specialised ESO Panel(s) + OPC. No guaranteed time .

- Call for Proposals in late 2005 ?

- Survey Planning Tool in development to handle tiling sky, guide/aO star preselection, bright star avoidance. Schedule `linkage' between OBs under discussion.

Design Reference Programme (example only, ~ 400 clear nights)

Survey name	Area (deg^2)	Y	J	H	K_s	Clear nights
		(Vega, 5σ)				(exc. overheads)
Very deep	15		23.8	22.5	22.0	55
Deep	100		22.8	21.5	21.0	57
Wide (high-b)	3000	22.0	21.2*	20.0	19.5	100
Wide (plane + MCs)	1500	21.5	20.5*	19.5	19.0	45
Atlas (Goal)	20000		20.2		18.2	150

Matching visible data important…

- Almost all VISTA projects require *some* visible data
  (some only z' ; many desire 4 or 5 visible bands).

- 2MASS was well matched to Schmidt plates ,
  WFCAM LAS is matched to SDSS ...
  limited existing CCD surveys in Southern hemisphere.

- VST very important for visible data - public surveys selected,
  (KIDS, Atlas, VPHAS/UVEX; Census.), details TBC soon.

VST : 2.6 m ,
Cass f/5.5 .

OmegaCam:
1 x 1 deg^2,
0.21 arcsec/pix

Possible survey regions: (I) deep.

- Ultradeep: COSMOS field (1.4 x 1.4 deg^2);
  - Widest HST field (600 1-orbit ACS pointings).
  - Extensive multiwavelength data; z < 3 galaxy population.
  - May be `scooped' by WFCAM-UDS, but COSMOS is bigger, has HST and complementary in RA.
- V. deep: Spitzer SWIRE fields (24 deg^2 from S).
  - 2 Southern, 1 equatorial. 2dFGRS-like volume at z > 1.
  - VST "Census" has "secondary" ranking – TBC.
  - VST-16 cf COMBO-17 planned in GTO time.
  - 5-10% of Spitzer sources fainter than realistic optical limits.
  - VISTA: Ks ~ 21.5 – 22 should detect all non-weird Spitzer sources, gives photo-z's and restframe optical.
- Deep: two CFHLS-Wide (if public) + South Ecliptic Pole (deepest Astro-F, WISE ?). No VST pending.

Possible survey regions (II) Wide.

- Wide: (1500 deg^2): VST-KIDS , approx 2dF areas .
  - KIDS is core VST survey. ~ Sloan + 2 mag, CFH-Wide – 1 mag.
  - NIR for improved photo-z's, stellar masses, z > 7 quasars, brown dwarfs, high-z clusters.
  - 10 mins / VISTA band ~ 250 nights; half WFCAM-LAS area at ~ 1.3 mag deeper.
- Galactic plane:
  - VST VPHAS is core public survey: r, i, Hα.
- Atlas:
  - VST ATLAS (4500 deg^2) is core public survey.
  - Australian "Skymapper" 1.3m will do 20,000 deg^2 , 5 epochs.
  - WISE, IRIS probably full-sky ; strong motivation for VISTA hemisphere survey. VISTA J, Ks ~ 2MASS + 3 mag.
  - Full hemisphere in Y,J,H,Ks may be prohibitive: do J, Ks hemisphere or 4 bands without mid-latitudes ?

Summary:

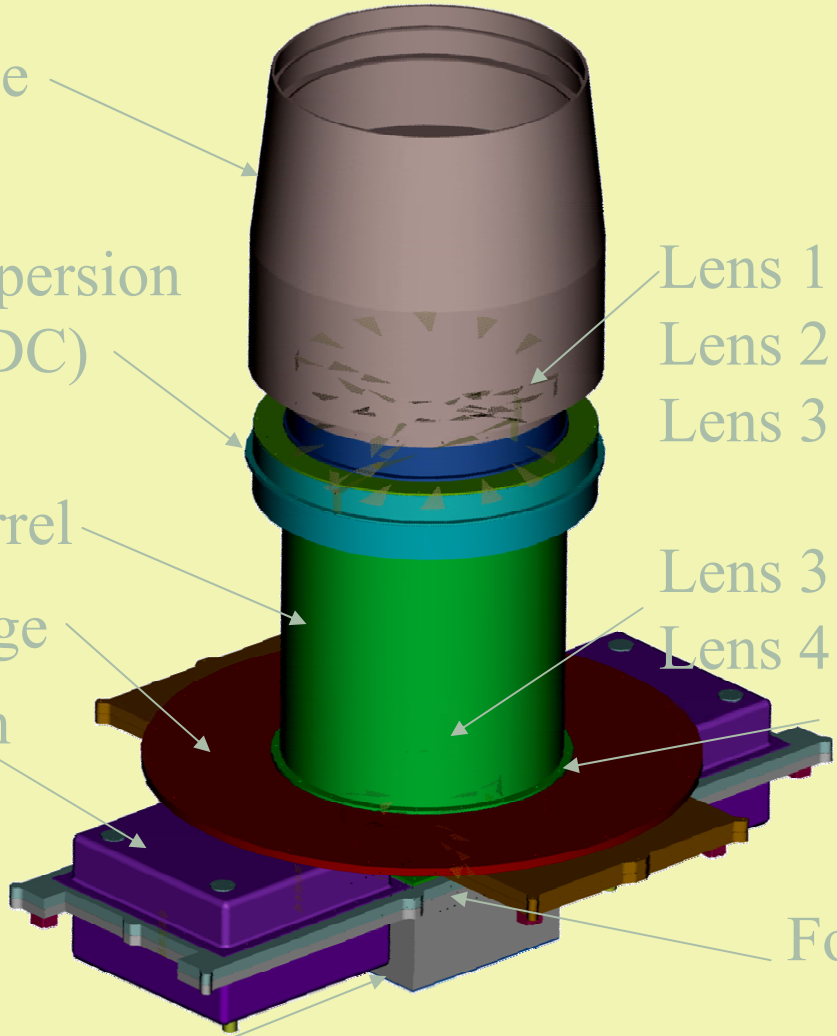
- VISTA is on track for commissioning in 2nd half 2006.
  Need to make plans soon.

- Will be world's leading facility for wide-area near-IR surveys,
  (few deg^2 to hemisphere), maybe until SNAP ~ 2014.
  Optimistically 5 – 8 x WFCAM rate due to wider field,
  full-time, better QE + weather.

- Deluge of mid-IR / far-IR / submm / SZ surveys coming
  soon - incl. Spitzer, Astro-F, WISE, Herschel, APEX,
  SCUBA-2, S. Pole : VISTA is highly complementary .

- Matching visible data is very important. Medium term: VST.
  Longer term: ideally go deeper in i + z than VST ;
  e.g. proposed VISTA Visible camera "DarkCam".

The *darkCAM* instrument



Visible Camera: