WFCAM

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“Lets make a widefield IR imager for UKIRT”

Someone at JAC circa 1998

Why?

- New large 2kx2k IR detectors were anticipated
- Optical surveys using the Schmidts, and Sloan DSD were very successful
- Surveys would be a good use of 4m telescopes in the era of 8m facilities
- 2MASS not deep enough to ensure IR targets for spectroscopy on 8m telescopes
- Big science potential for large surveys beyond mag 15

Requirements

- Four 2kx2k H-2 HgCdTe detectors spaced at 90%
- 0.93 degree field of view diameter
- Z-K band
- High bandwidth autoguider (20-100Hz)

The fundamental challenge

UKIRT was an f/36 telescope, with typical fields of view of a few arcminutes

compared to

f/1-3 of Schmidt systems and prime foci

approval

- Conceptual Design Review in Aug 1999
- WFCAM project approved by PPARC in Nov
  - Total cost of £4.34 M
  - 29.7 DSY
  - Completion date December 2002

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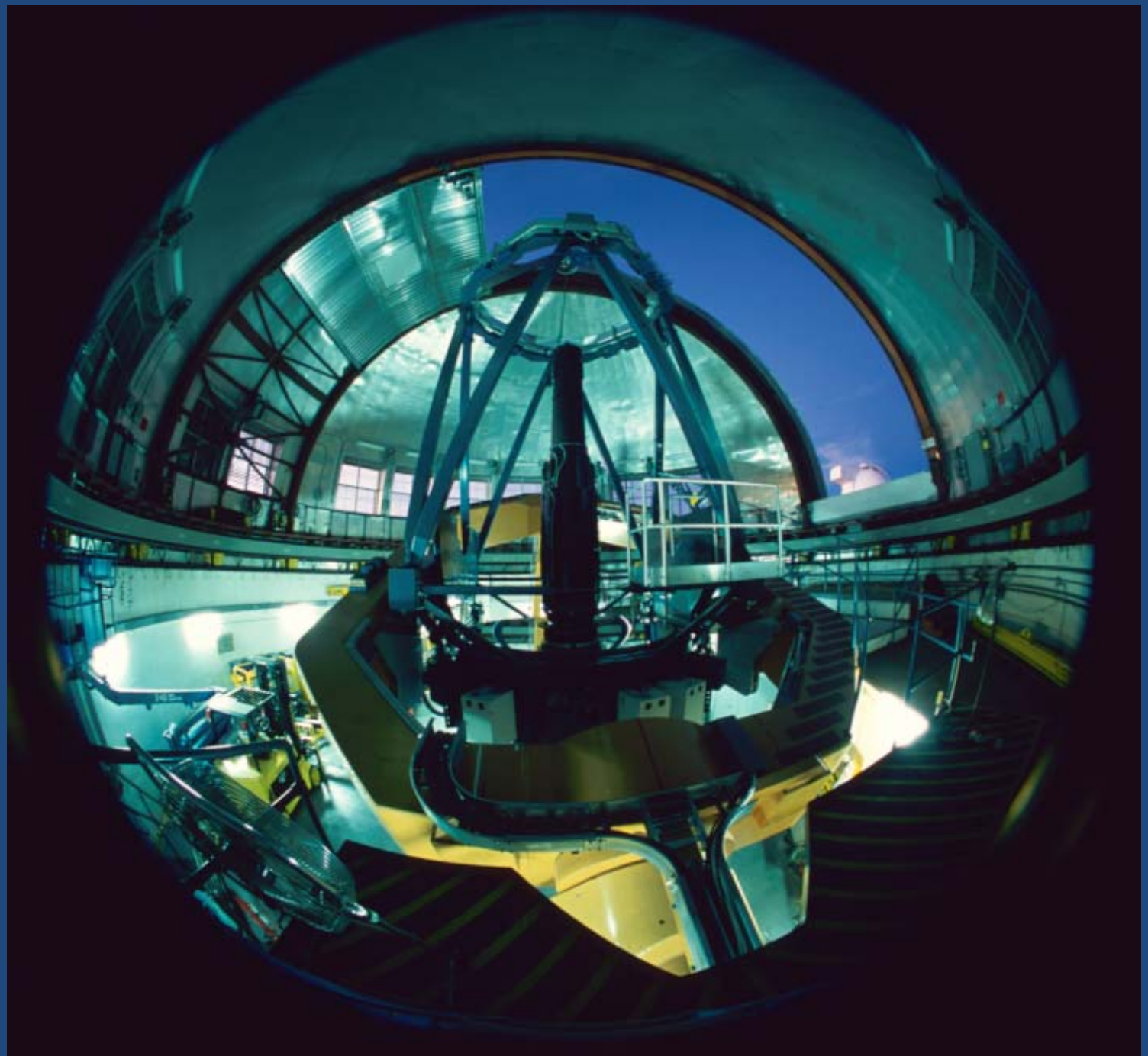
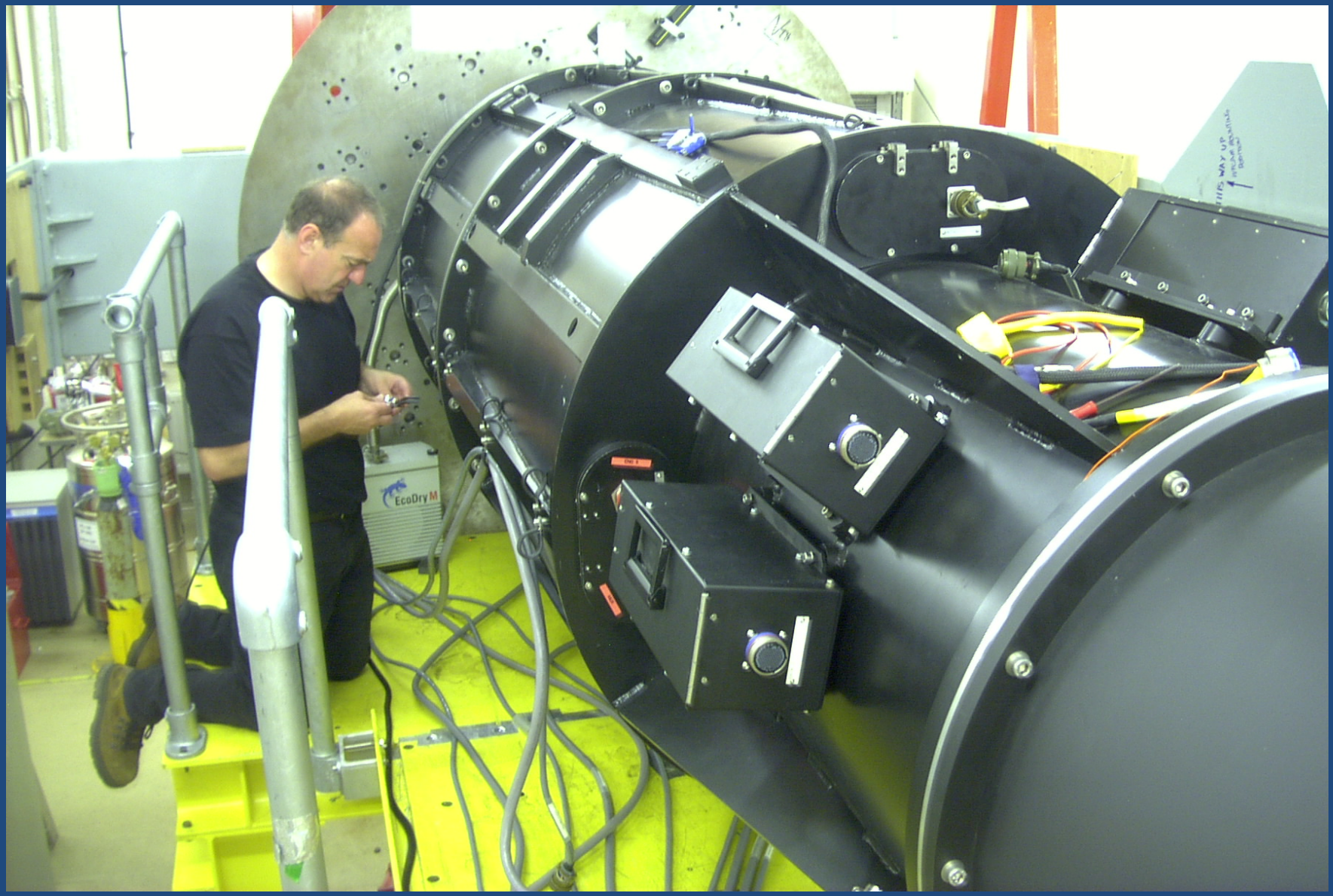
Shipped June 2004

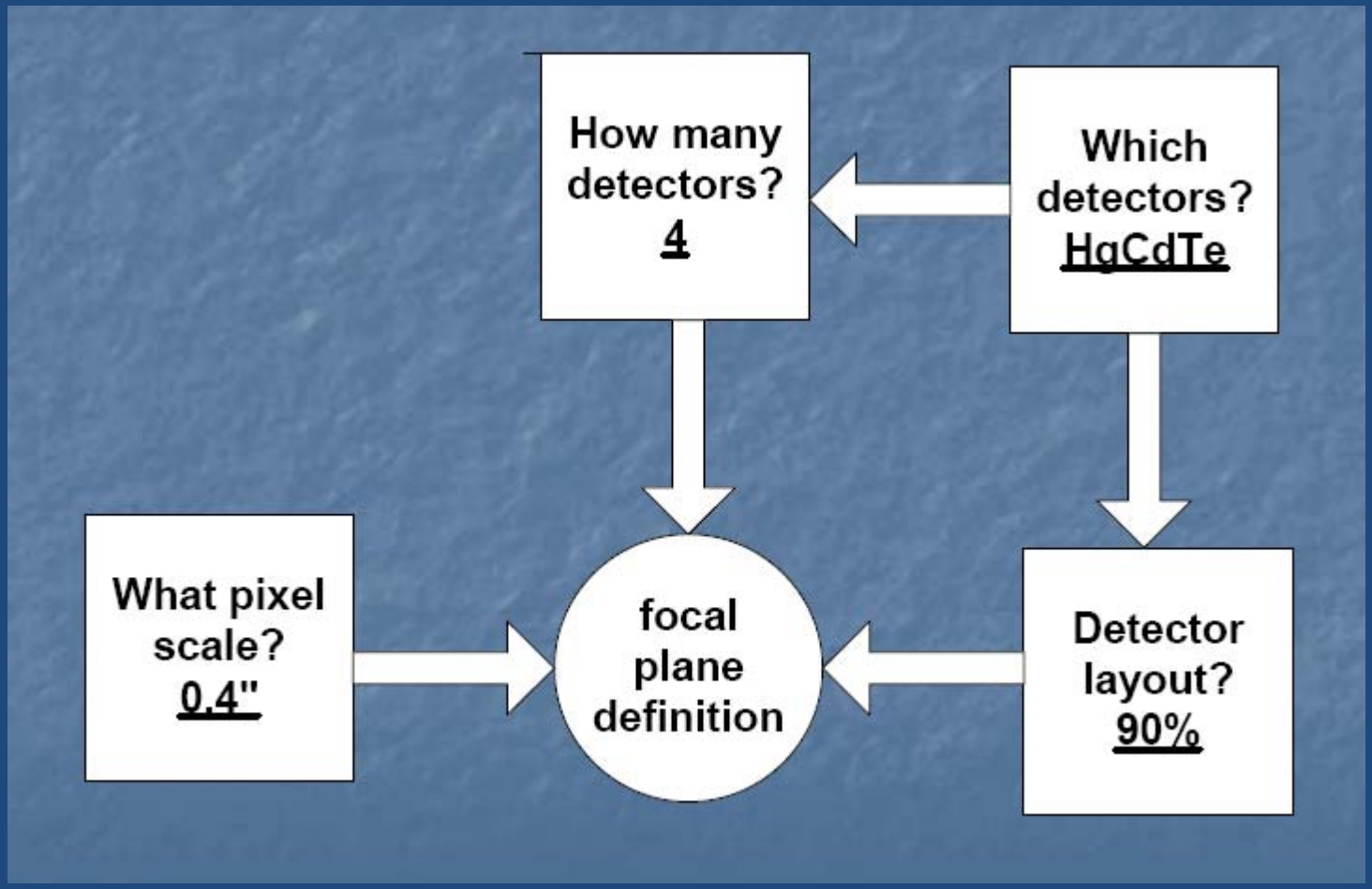


About WFCAM



1. Why is there a sparse focal plane with the coarse pixel scale of 0.4” per pixel?

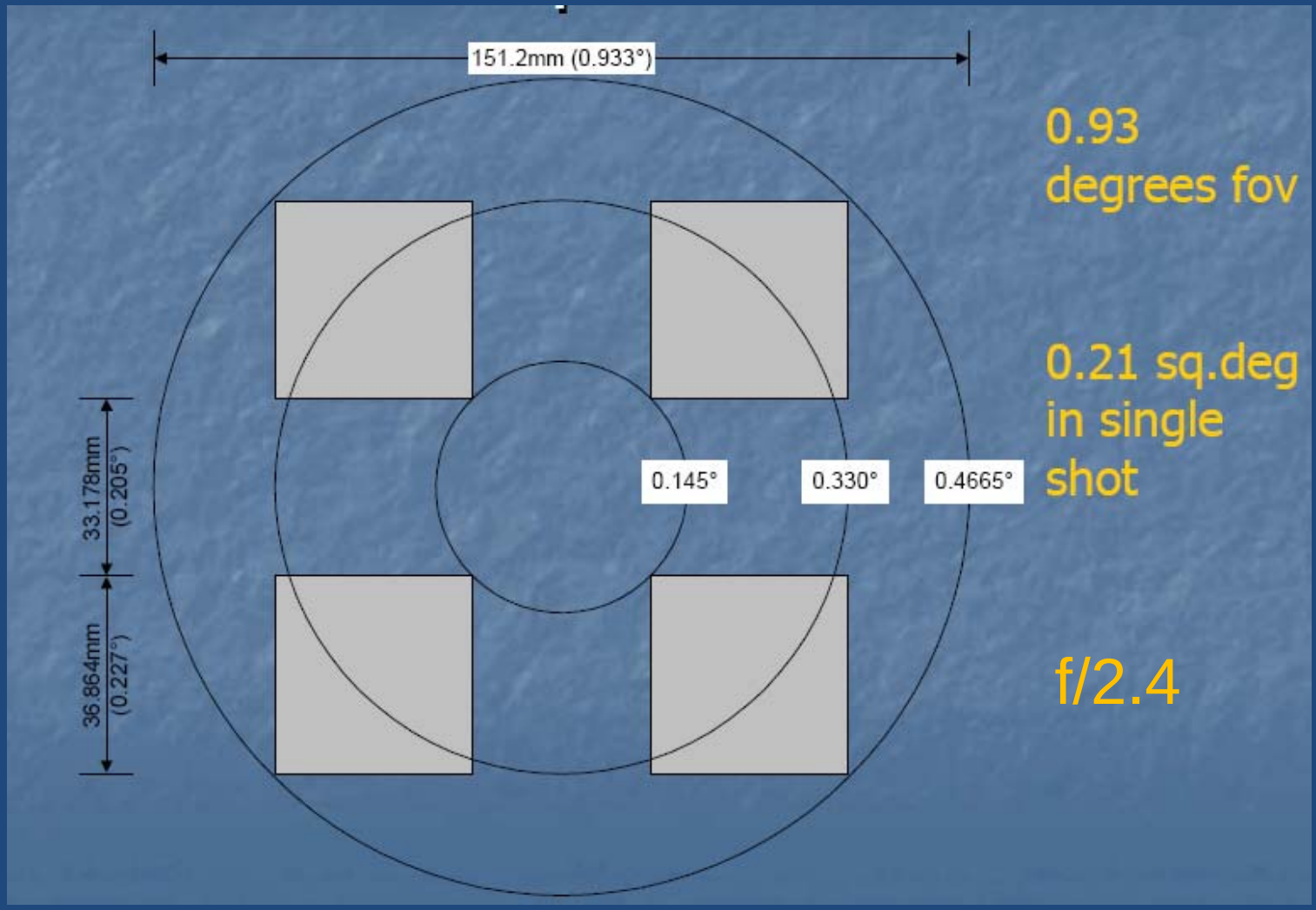
Focal plane definition



Detector number limited -> undersampling

2. Why is it above the primary mirror?

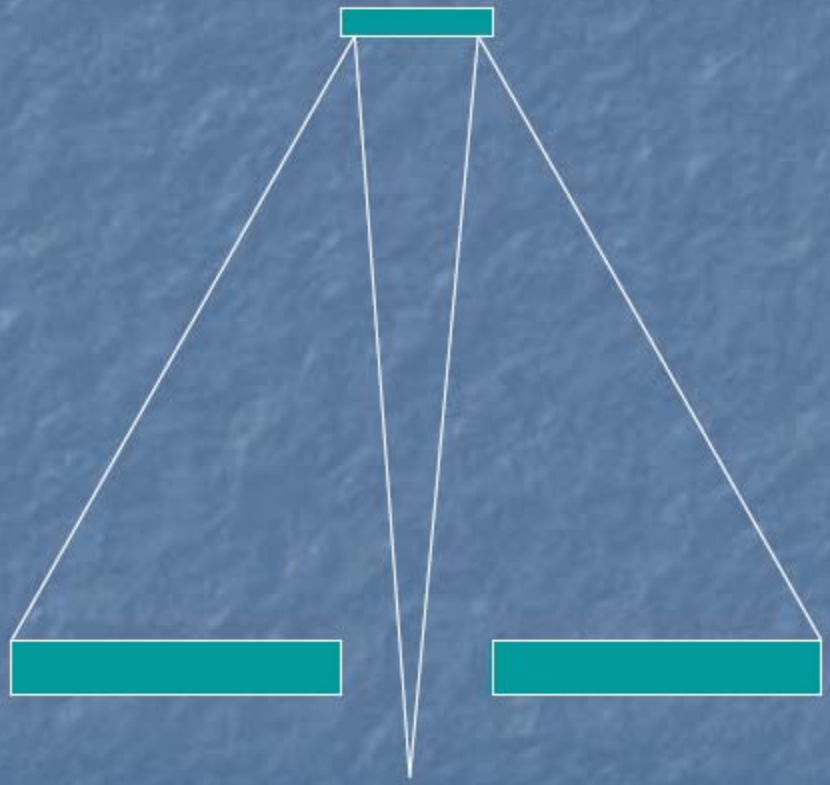
Tough field requirement



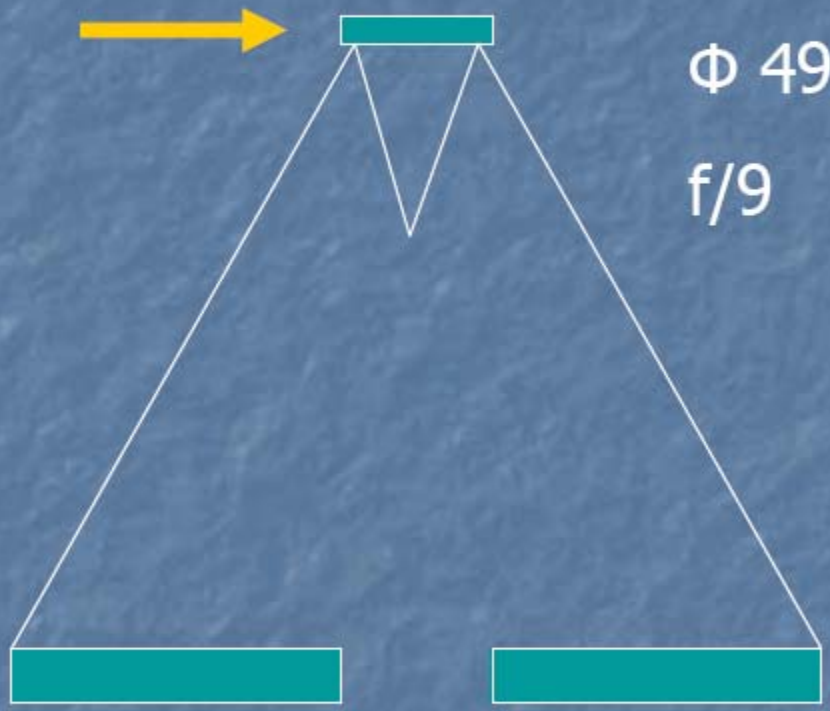
A few of the considerations

- 0.93 deg = 2.2m at f/36
- Kept normal IR instrument requirement of an internal cold pupil image/stop
- Large refractive optics allowed only one IR material – fused silica
- Optical power for re-imaging needed to be reflective
- 1 year of conceptual design
- Dozens of designs tried

start with UKIRT f/36



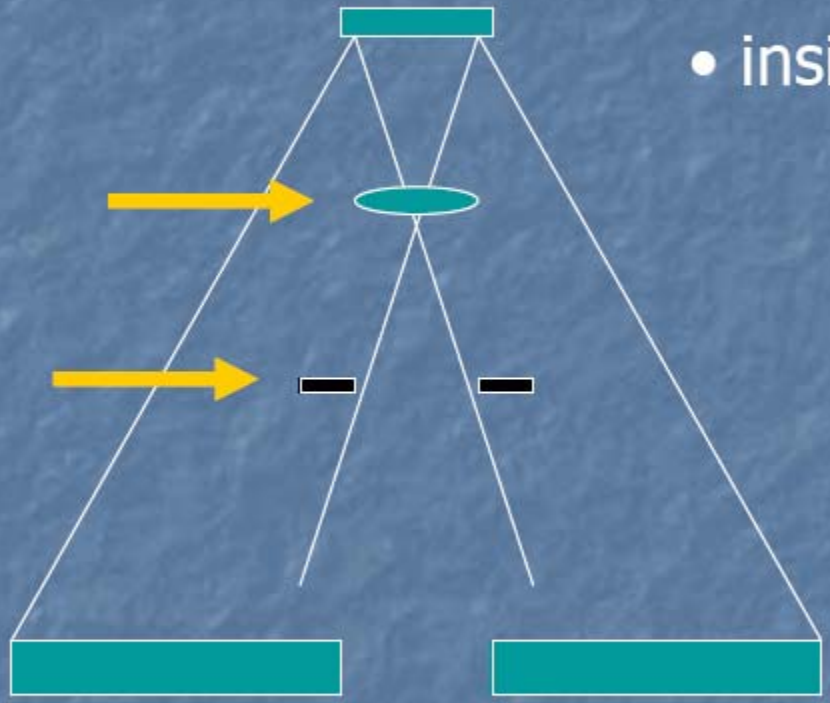
add new M2



Φ 496 mm

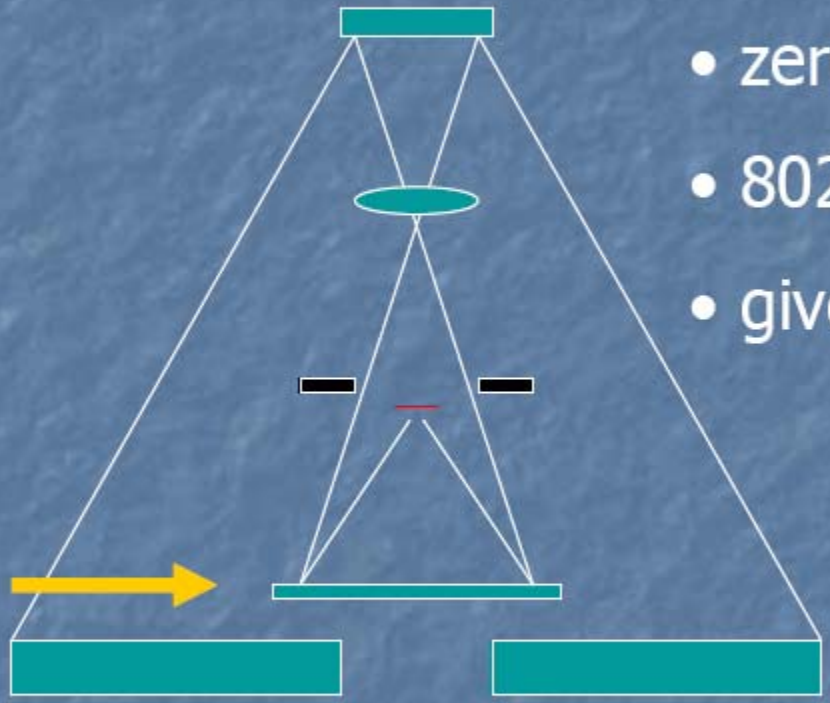
f/9

need cold pupil stop



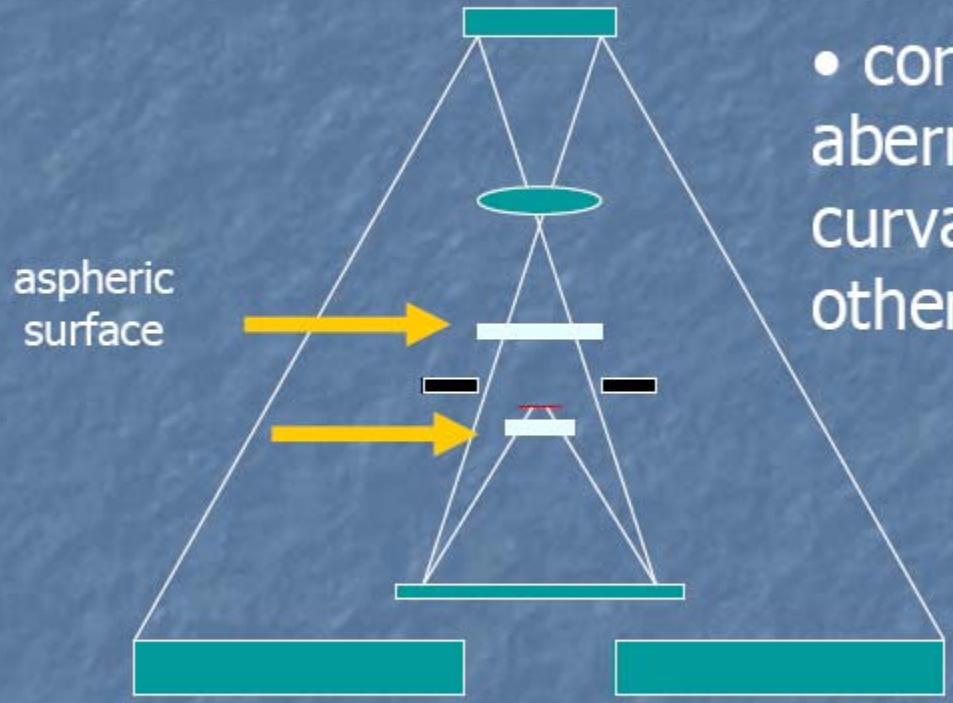
- inside cryostat

ellipsoidal tertiary mirror



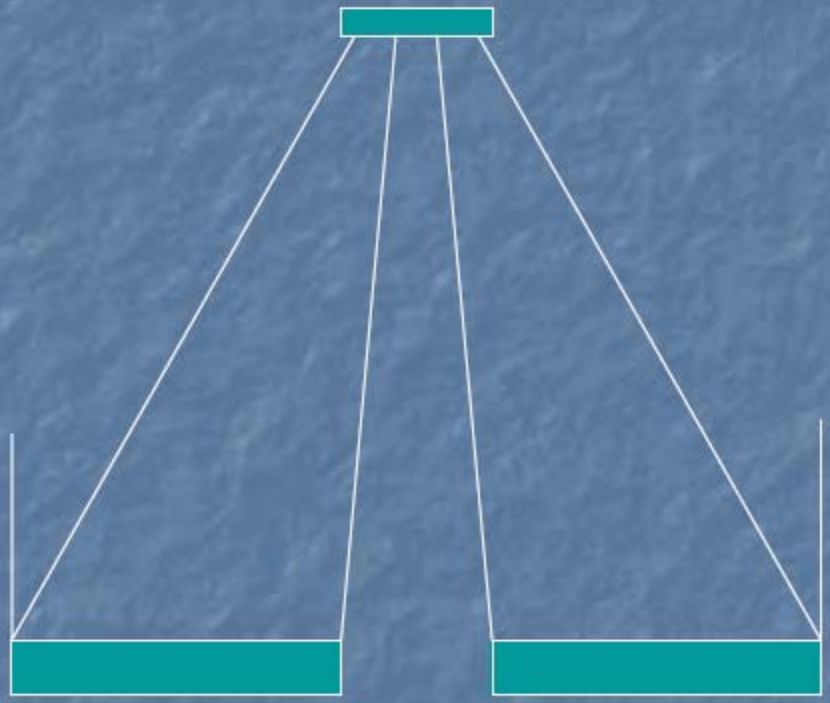
- zerodur, cryogenic
- 802 mm
- gives f/2.4

+ aberration correction



- corrects spherical aberration, field curvature and other aberrations

instrument fits shadow cone



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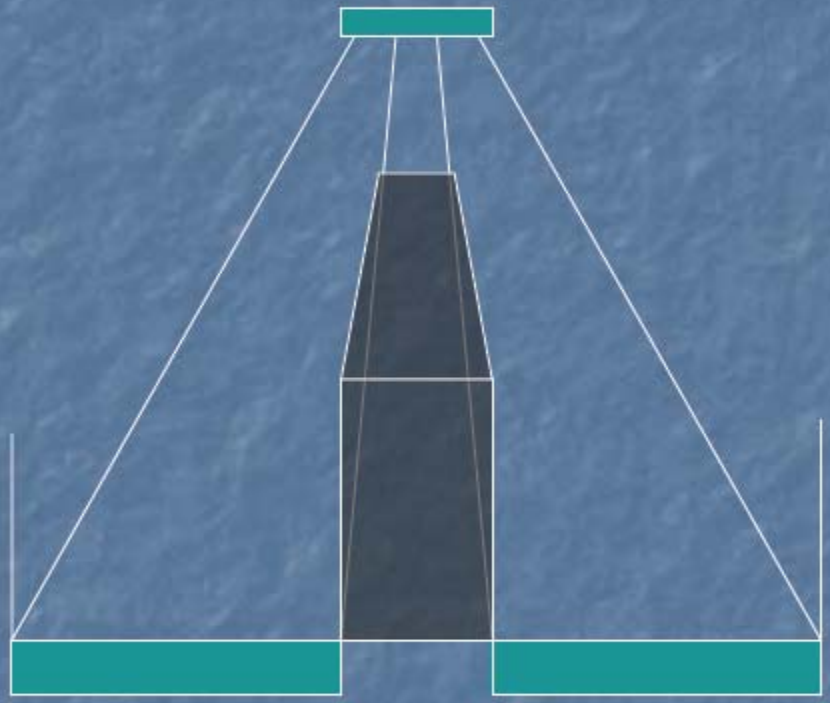
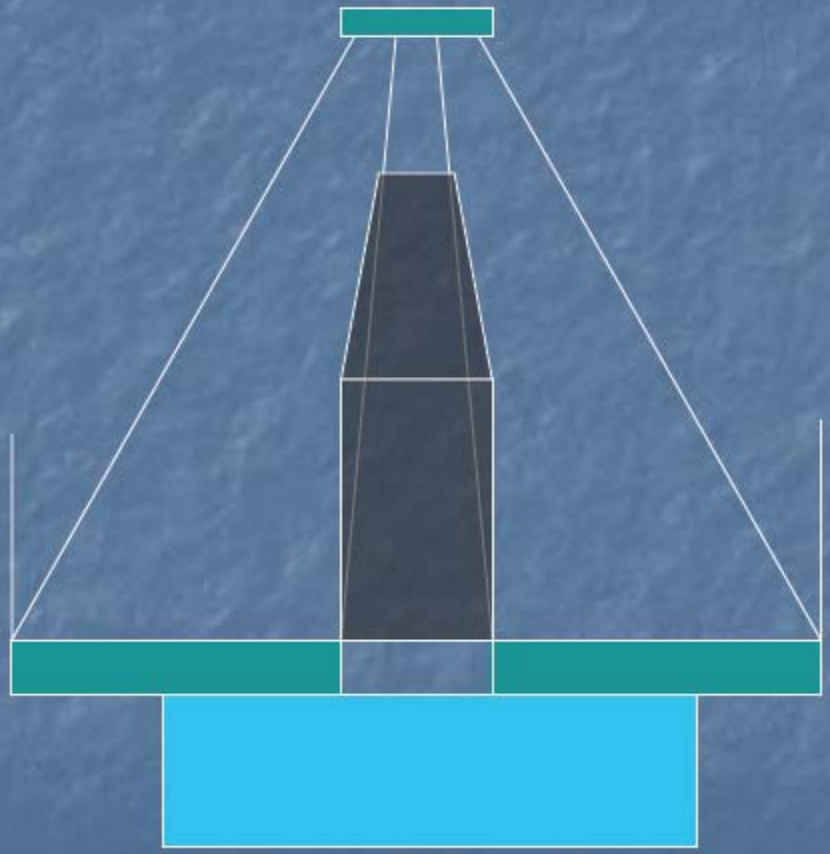
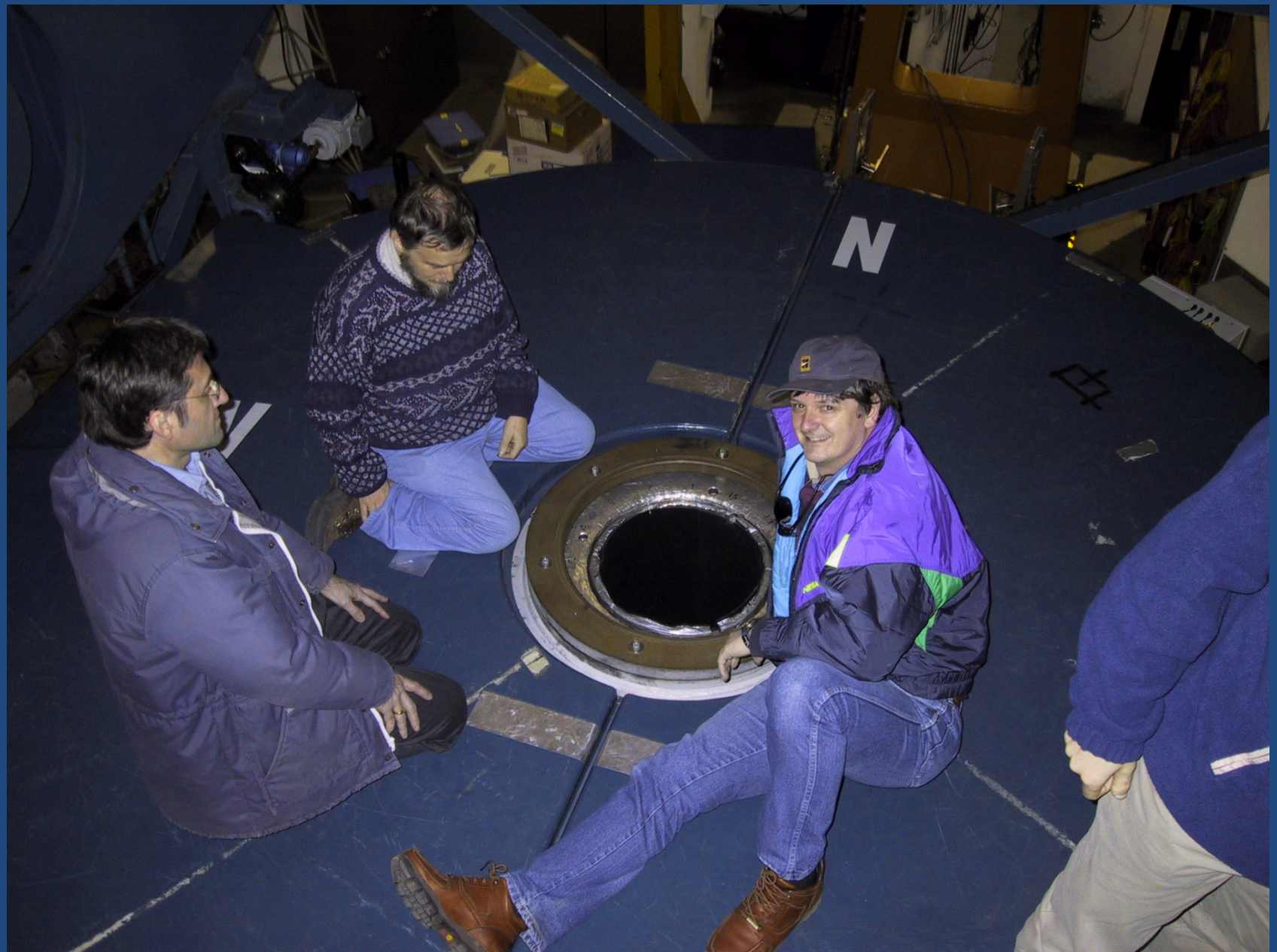


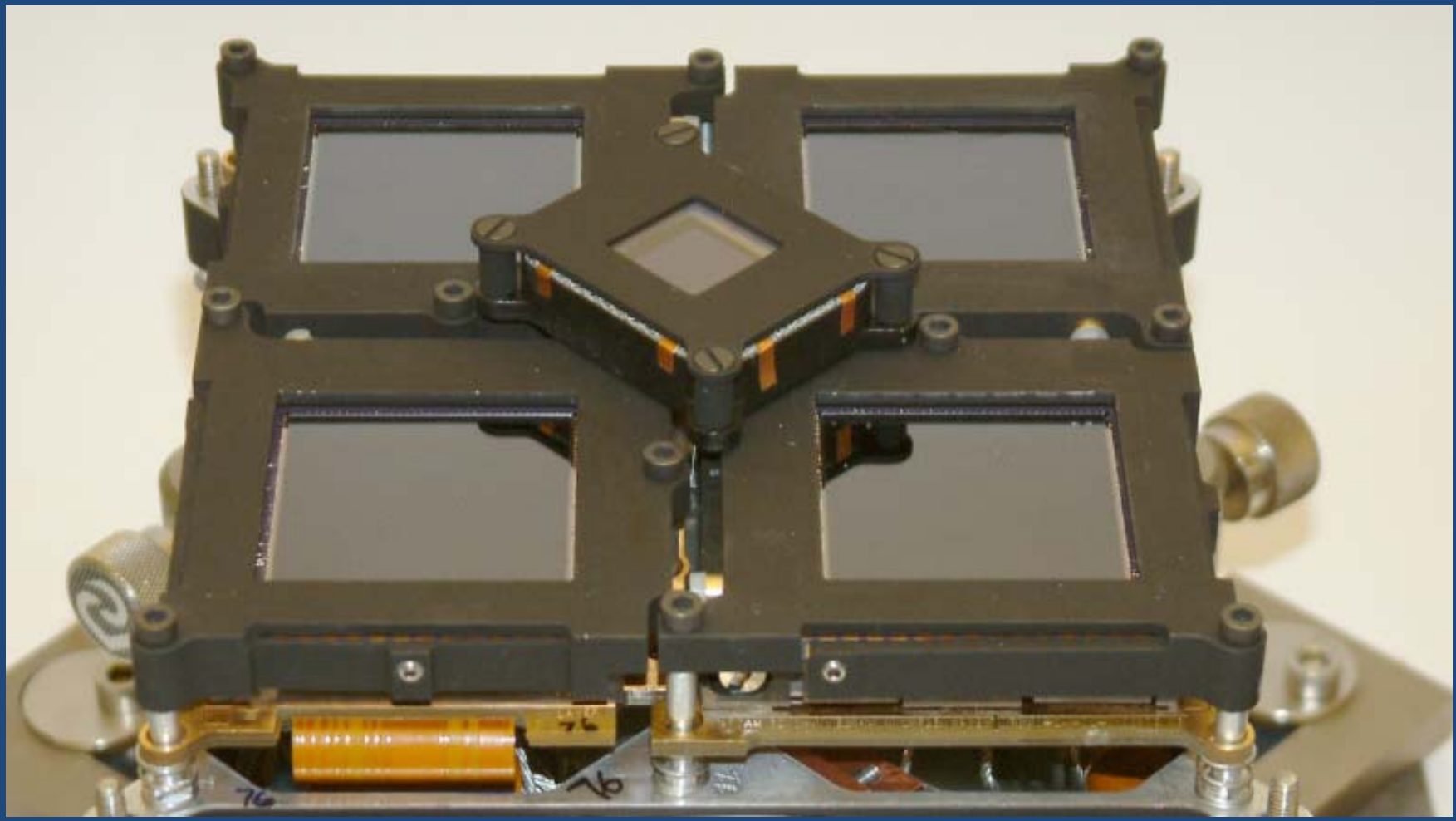
cass instruments unaffected



Uncertain interface

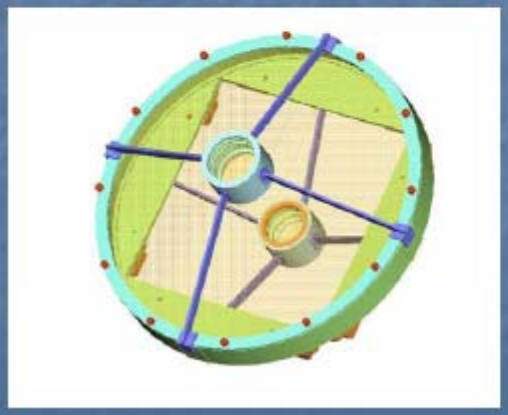


3. Why is the autoguider CCD rotated 45 degrees ?



Autoguider challenge

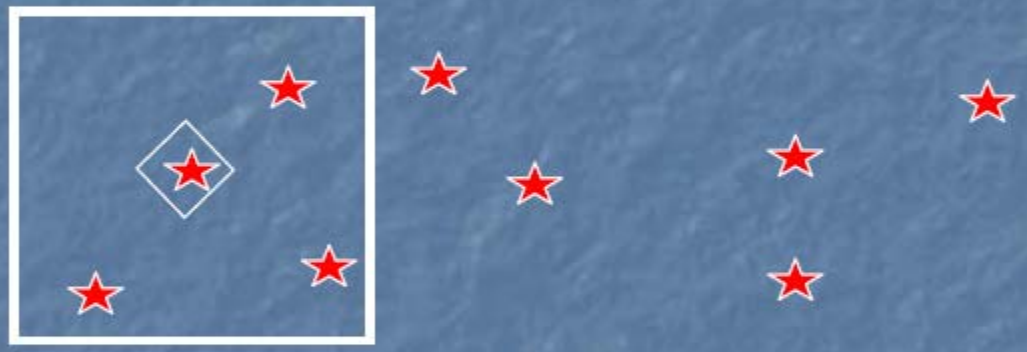
- The only sensible place for the autoguider CCD turned out to be the focal plane itself, but
  - CCD had to be above the IR detectors (no space)
    - Required extra central lens at field lens to raise focus
  - Had to ensure no EM interference
    - CCD enclosed in conductive housing with conducting window
  - CCD and its housing needed to be constrained in size to not vignette IR detectors



Field lens with autoguider optics

Rotated CCD gave more space

WFCAM features - autoguiding



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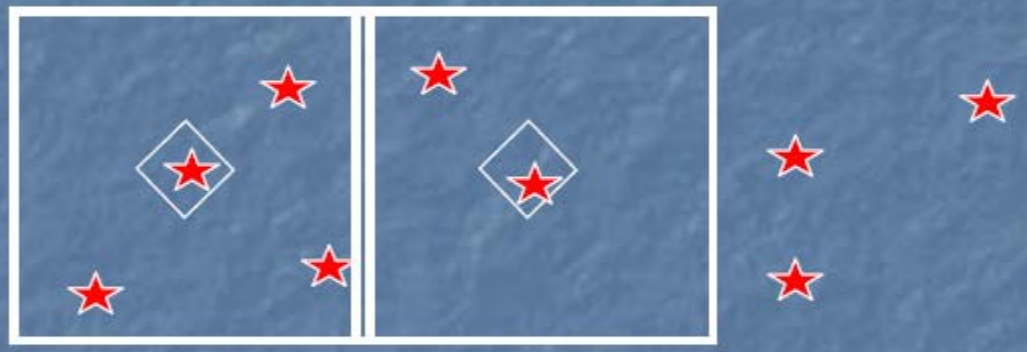

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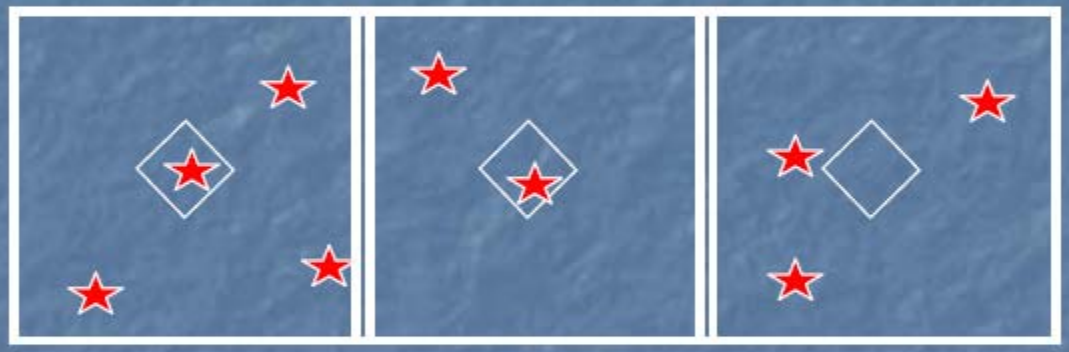

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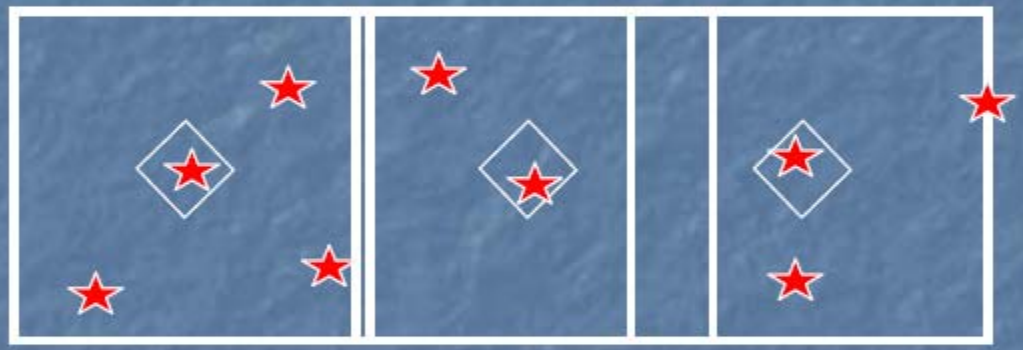
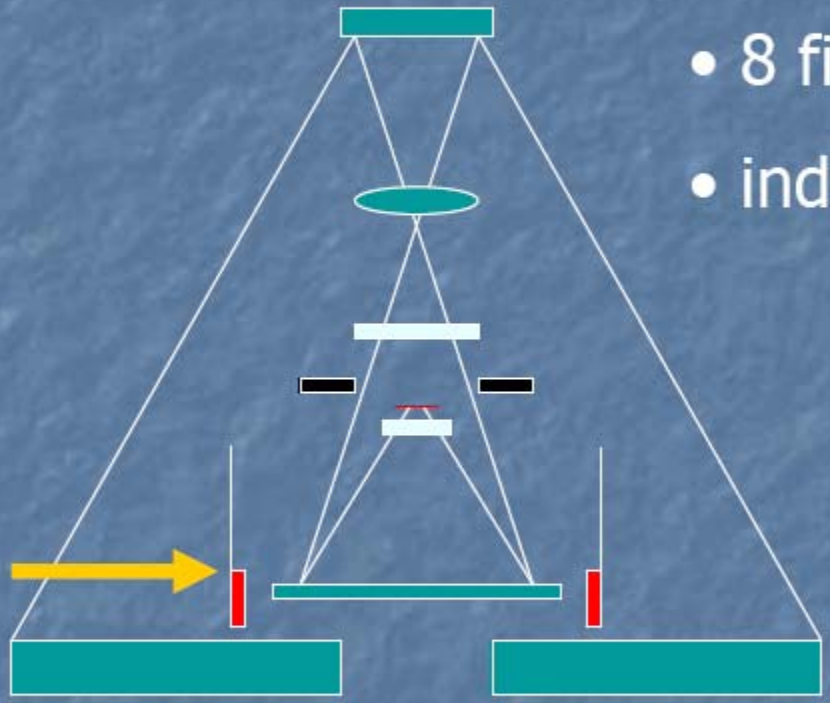


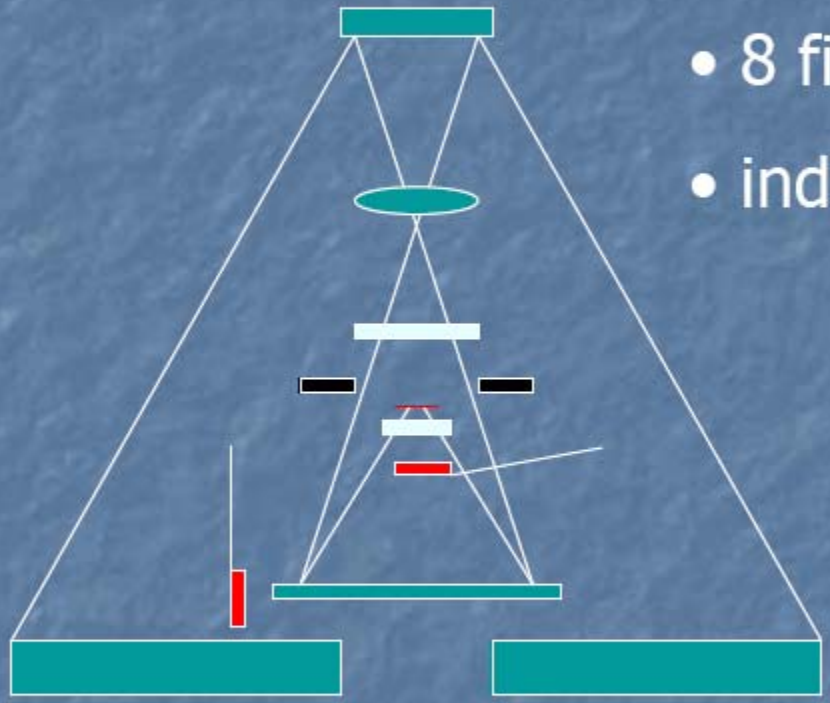
4. Why is there a capacity of only 7 filters

filter paddles



- 8 filter paddles
- individual motors

filter paddles



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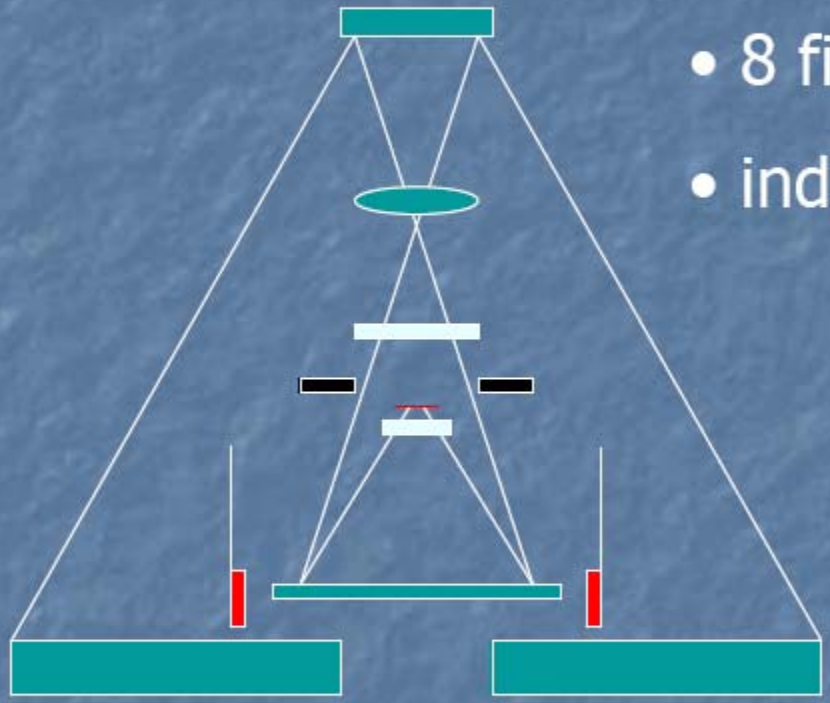

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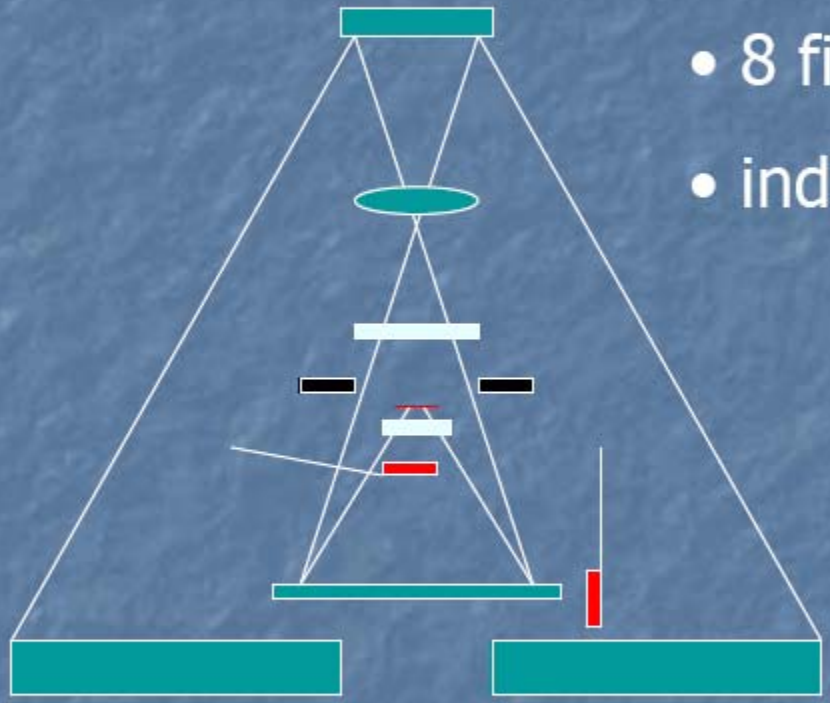

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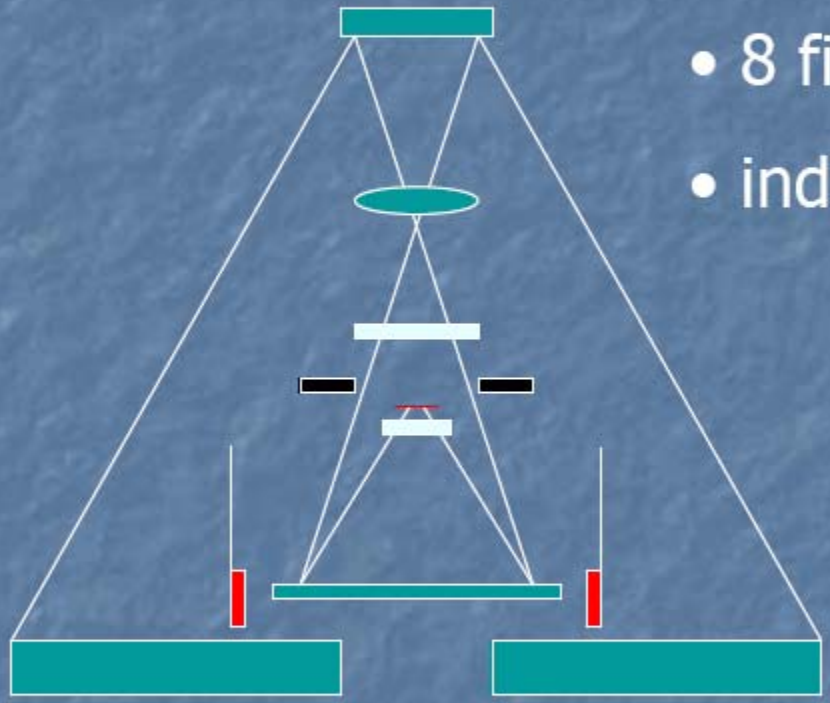

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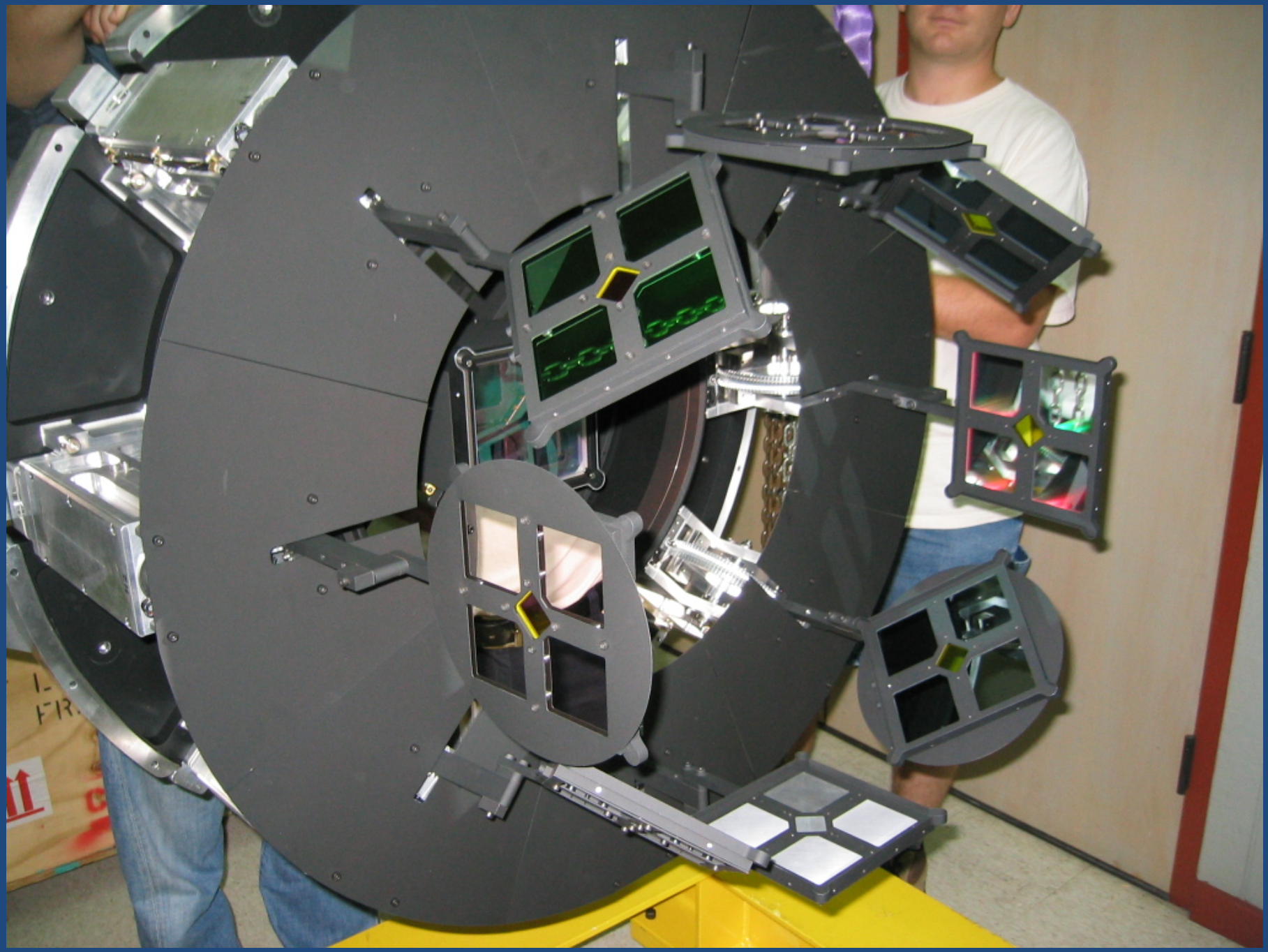
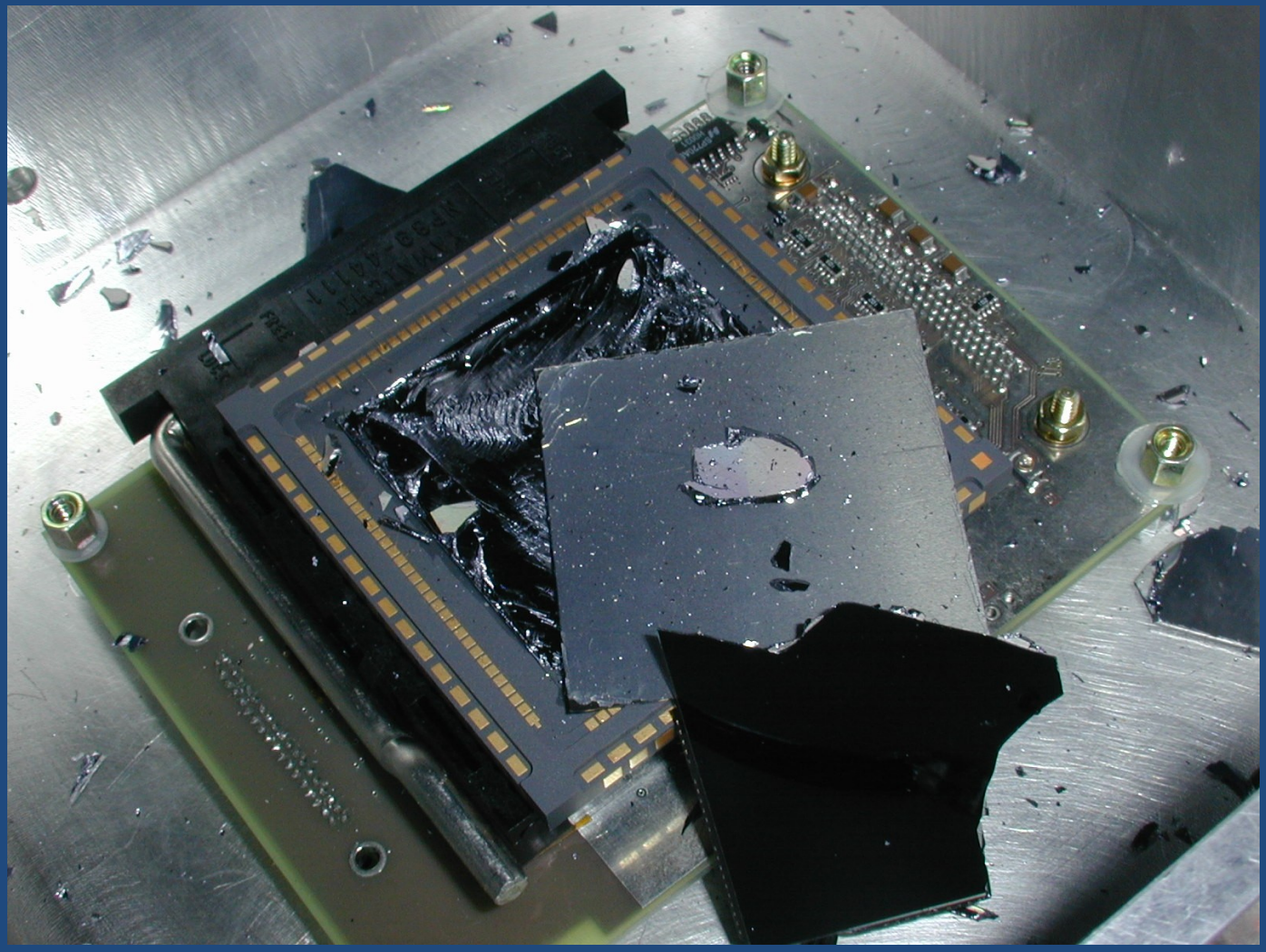
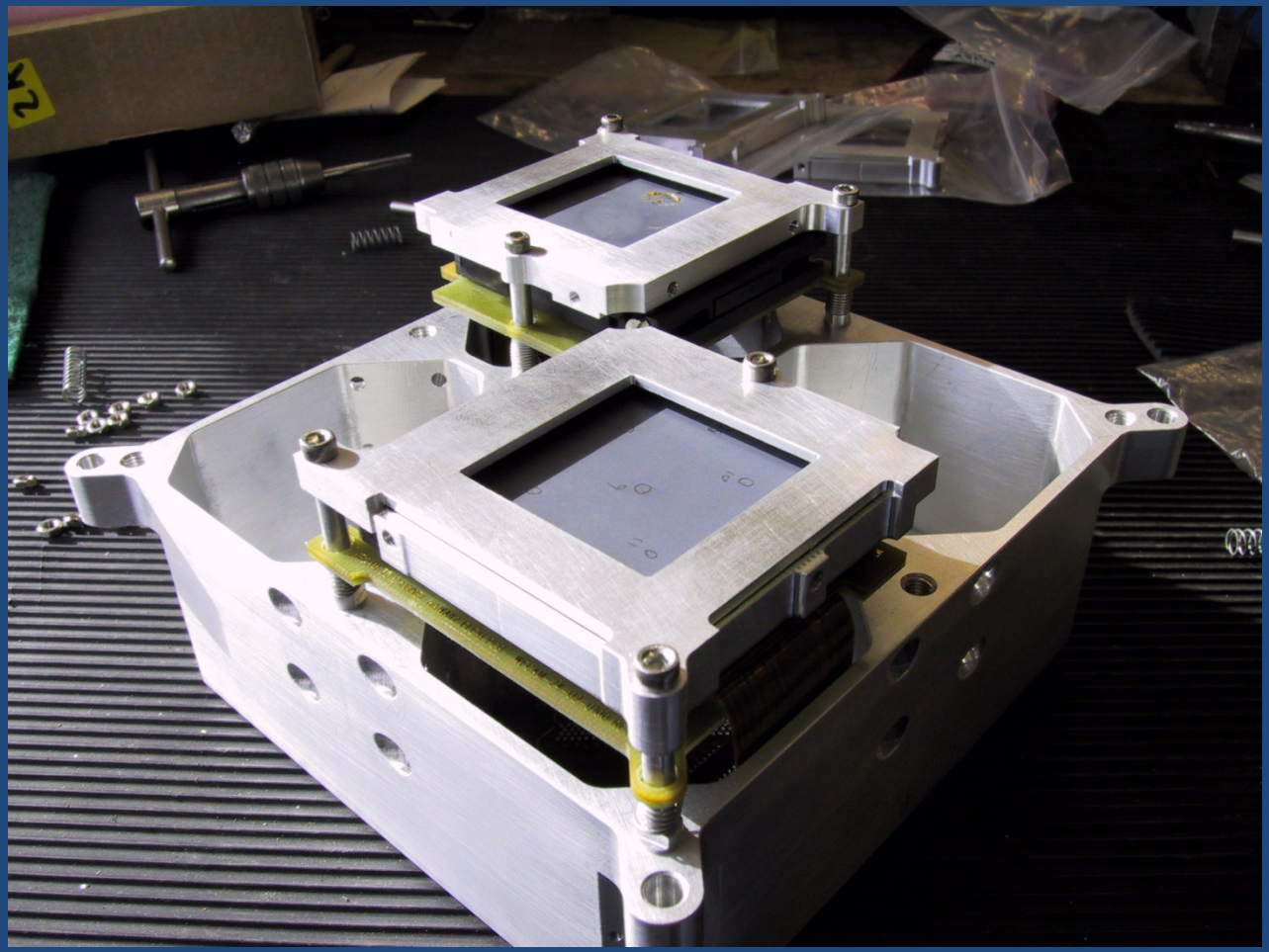


Some other challenges…

Exploding detectors

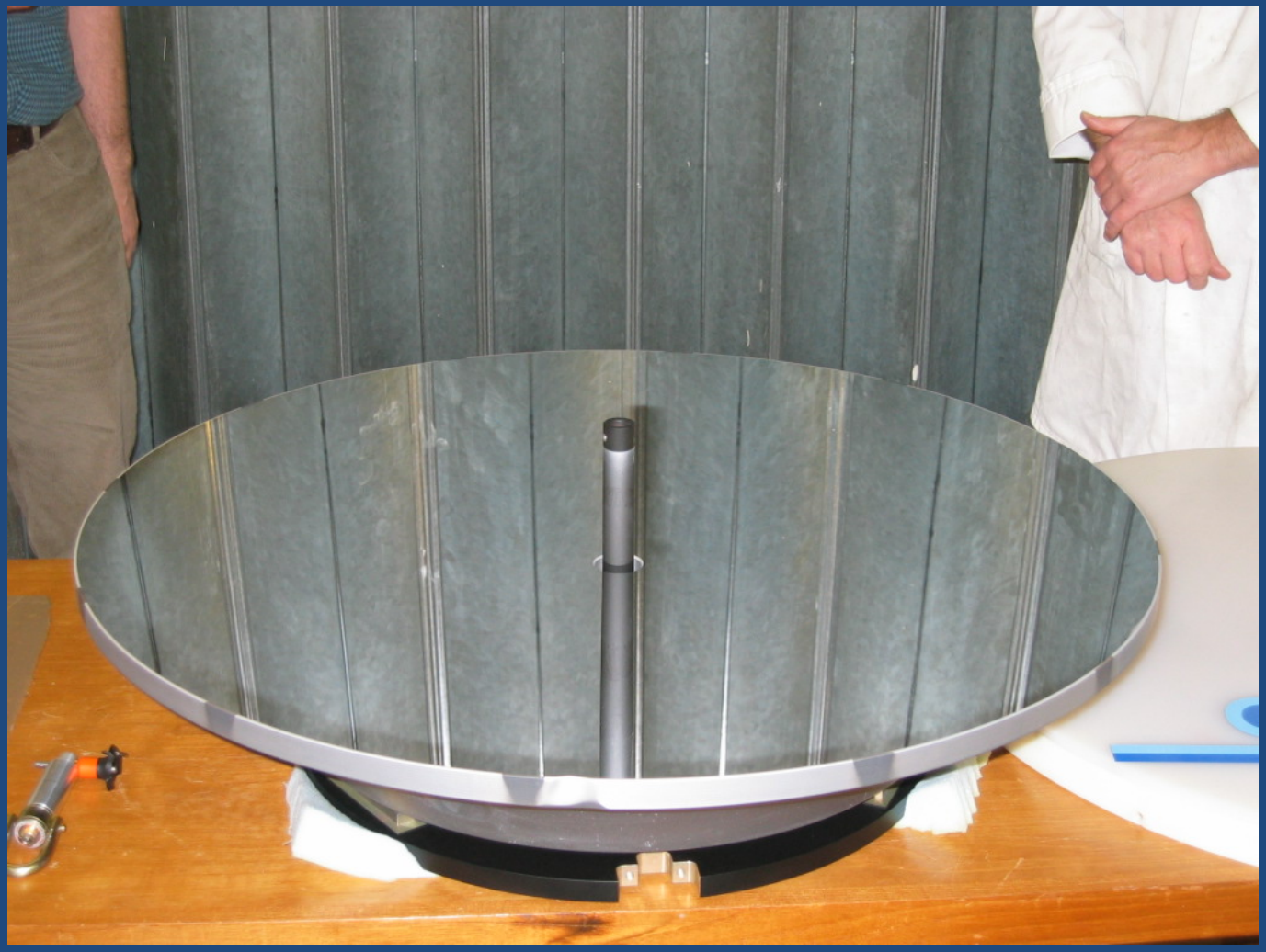


Coplanar adjustment of H-2 detectors

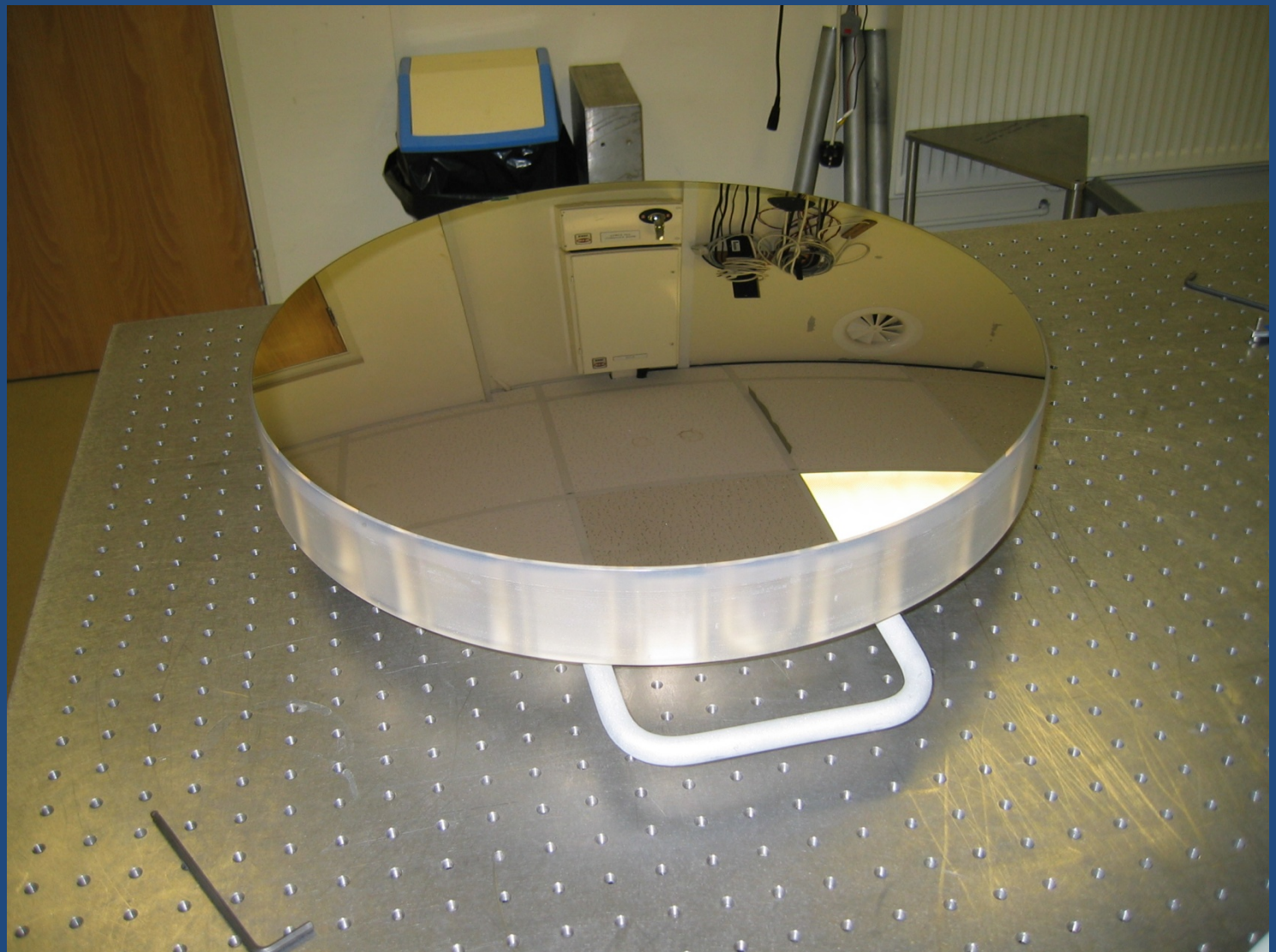


Safe handling at the telescope

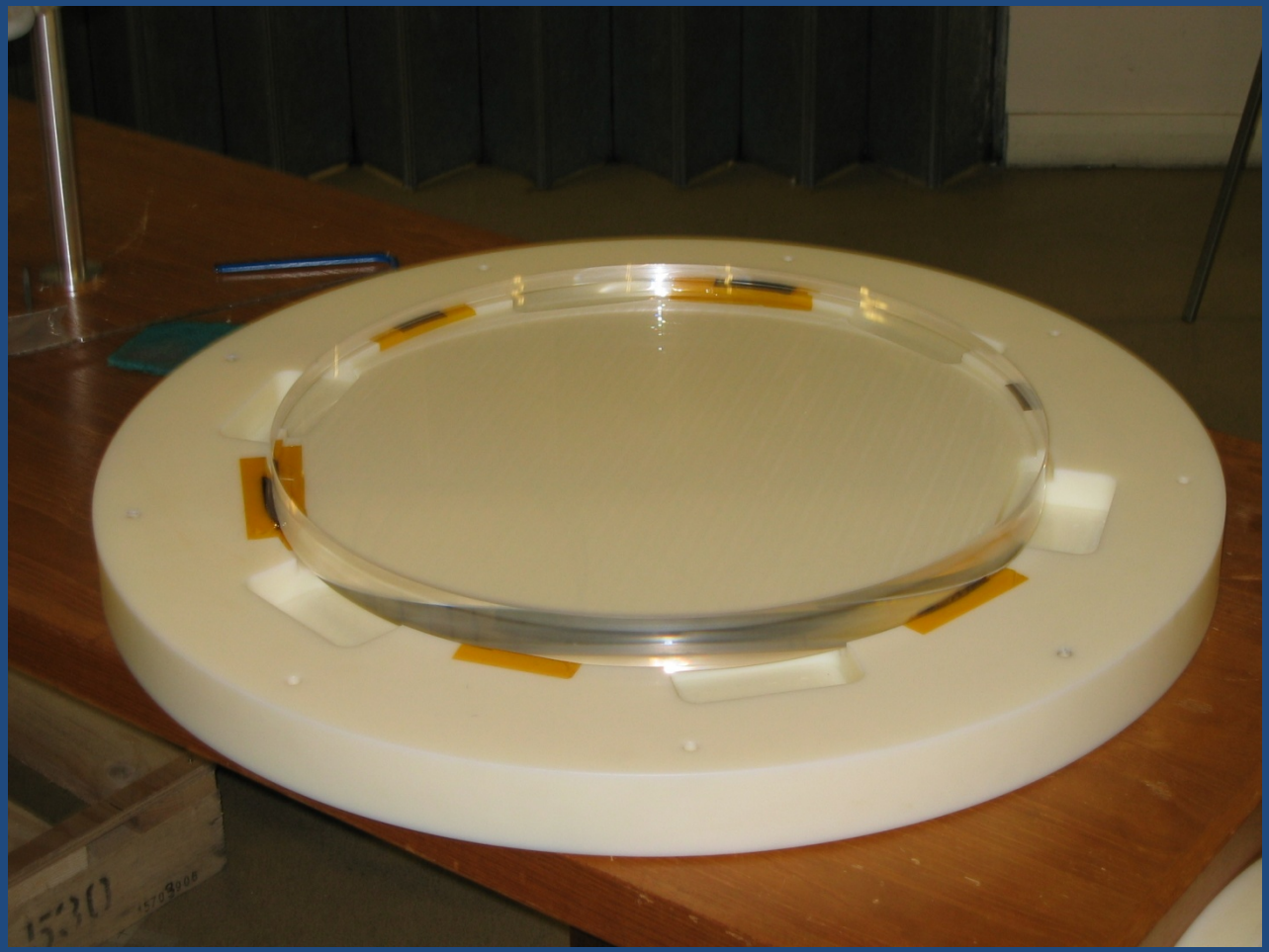
802 mm cryogenic tertiary



New lightweight secondary mirror



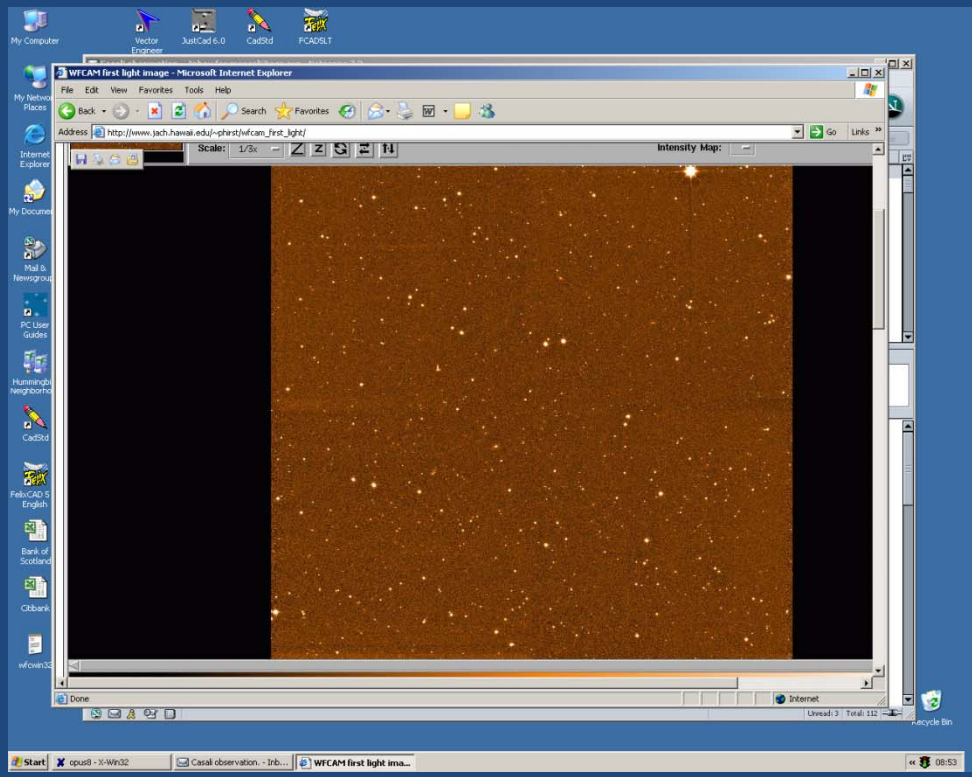
large window

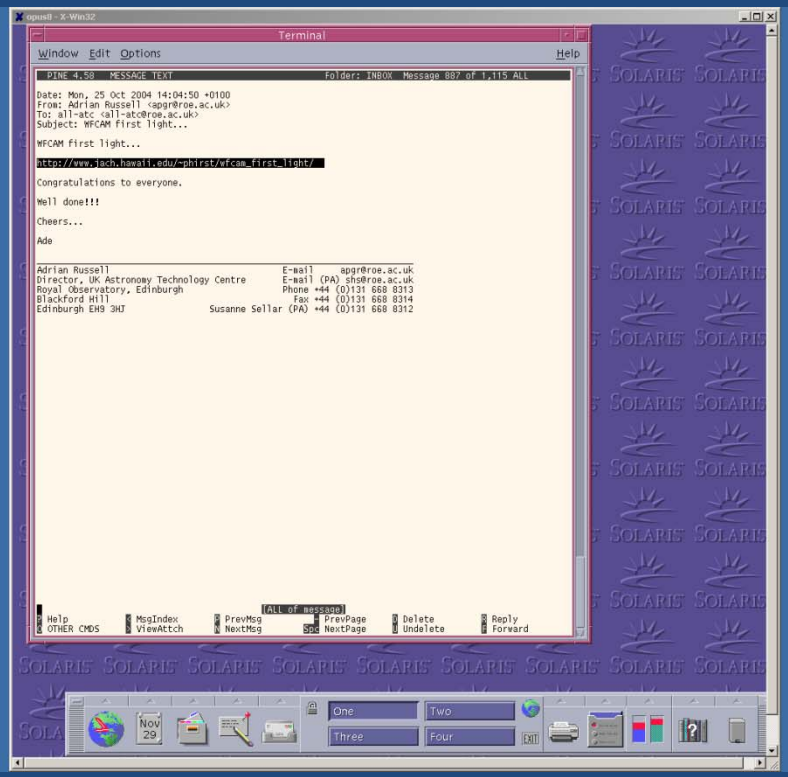


Highly aspheric correct plate

Failing disc drives

First light





…and the stars are round!

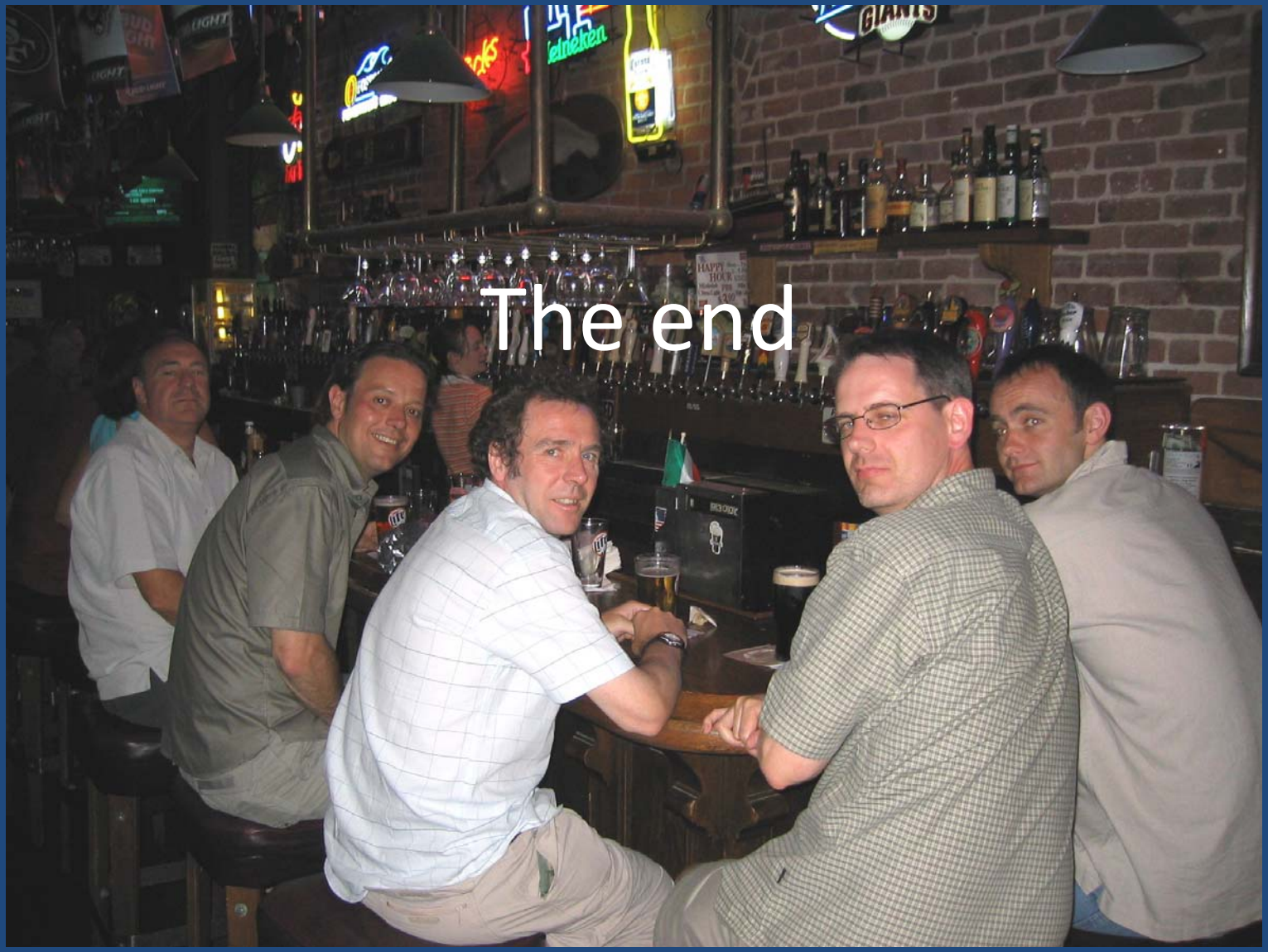
4 sets of thanks

Thanks to PPARC (RIP) for funding an ambitious and risky instrument!

Thanks to the ATC team of engineers for taking (most of) the fear out of WFCAM design and construction!

Thanks to all the JAC staff who have streamlined WFCAM operations over the last 4 years and ensured efficient and successful operations

Thanks to the Cambridge and Edinburgh WFA groups for ensuring the science data output.


The end