WEAVE

Instrument Concept

Gavin Dalton (RALSpace/Oxford)

RIA CAHA/ORM 23/3/12

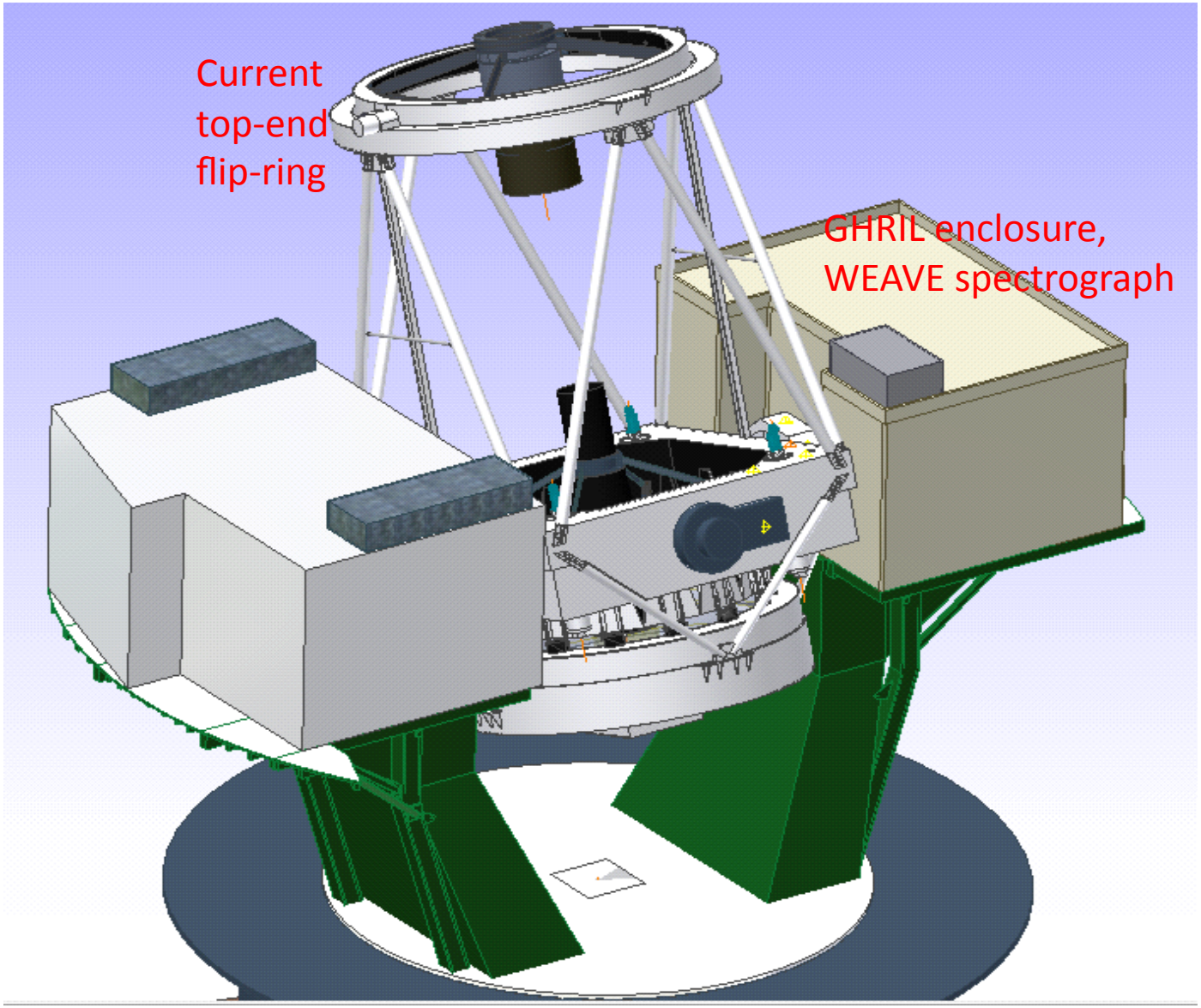
Background

- Community discussion meetings in early 2010
  - (see Marc's talk from yesterday)
  - Very strong case for wide-field MOS
  - Summarised in Balcells et al. 2010 (SPIE)
  - Objective to develop a powerful but realistic instrument for the next phase of the WHT.
- Instrument consortium phase A KO July 2010 timeline for key 'visibility' proposals in Jan 2011.
  - UK: Top ranked wide field MOS proposal (vs BIGBOSS, Subaru-PFS, 4MOST, MOONS, VXDS …)
  - NL: Key ranking in overall strategic plan (decadal survey).
- Critical strategic decisions on ING long term plan happening now.

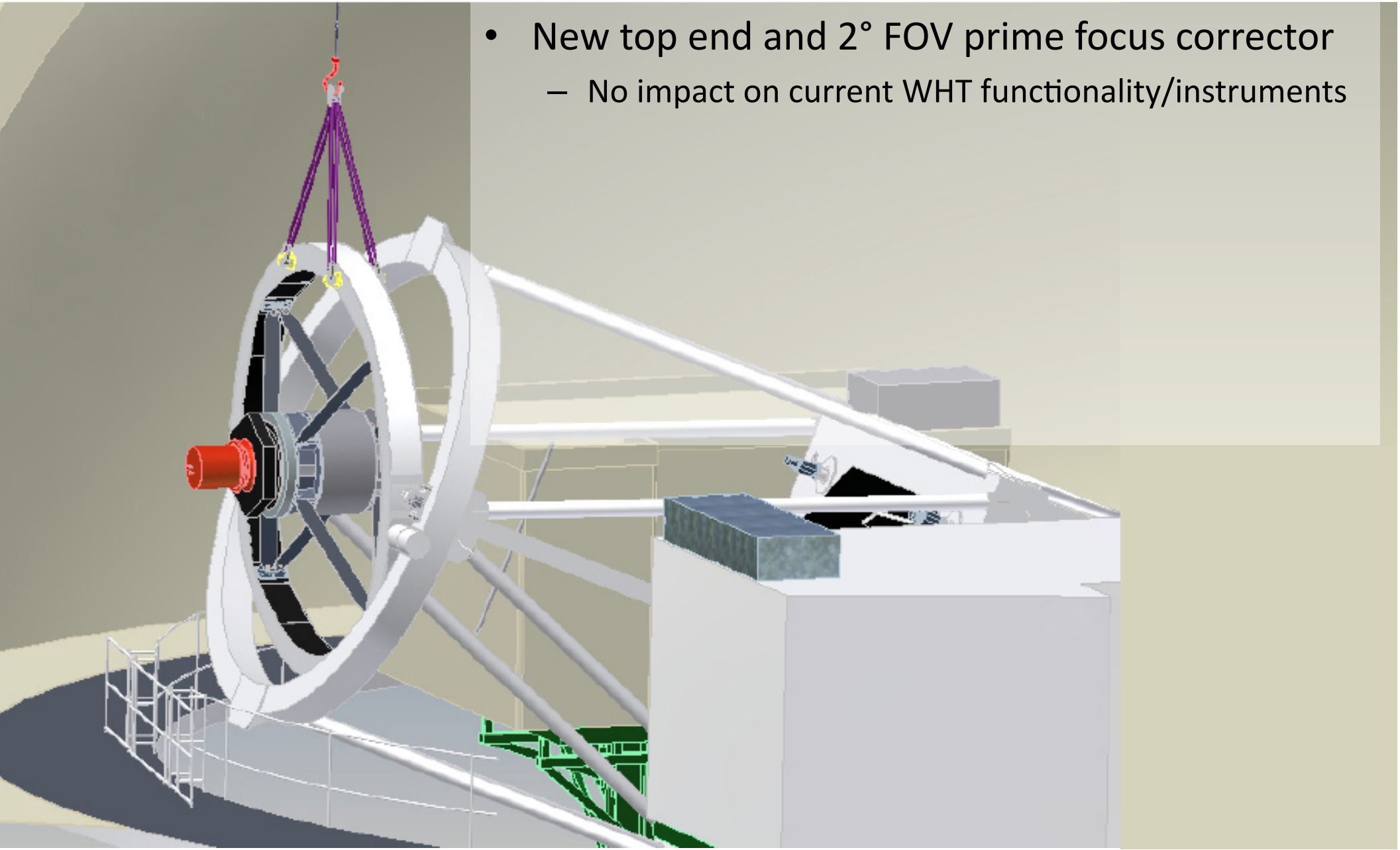
Phase B timeline

- KO September 22-23/9 2011
- Science requirements closed-out Dec 2011
  - See Scott's talk next…
  - Flow down to subsystem specifications and instrument design.
  - Ongoing development of science cases and survey planning once requirements fixed.
- Preliminary Design Review Jan/Feb 2012.
  - Stage-gate for funding.

General Layout of WHT



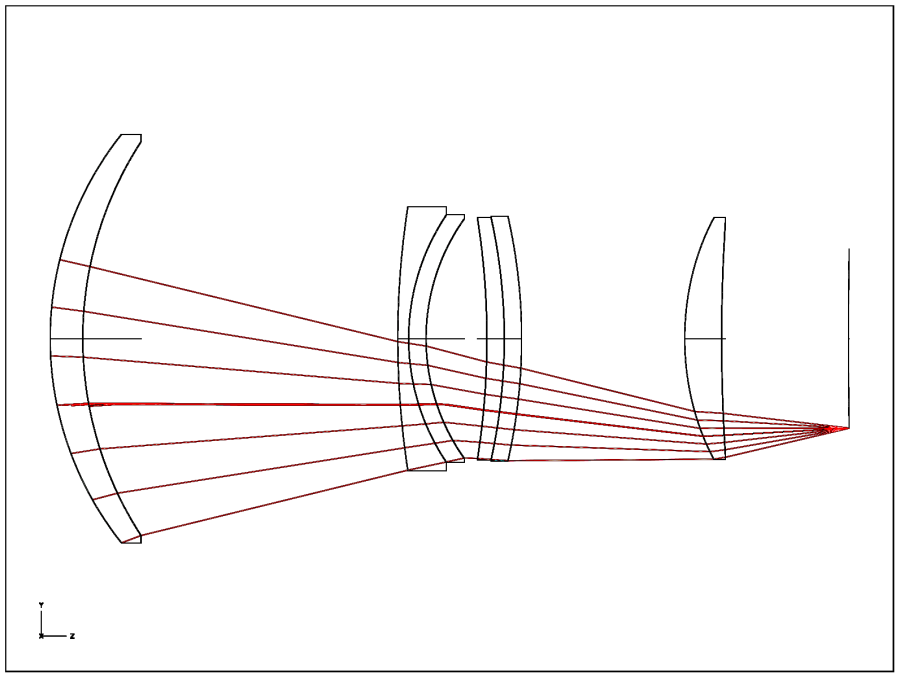
Instrument Overview

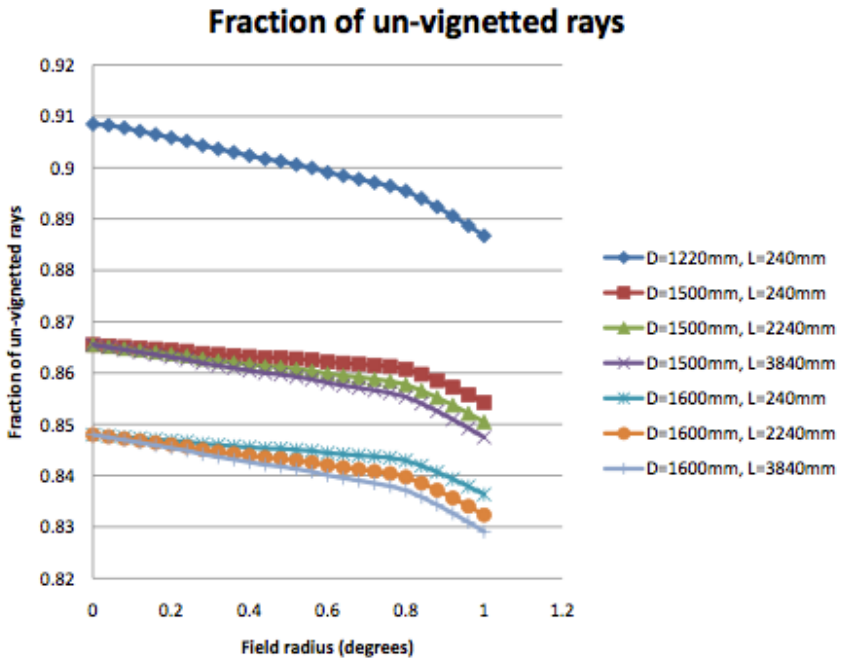


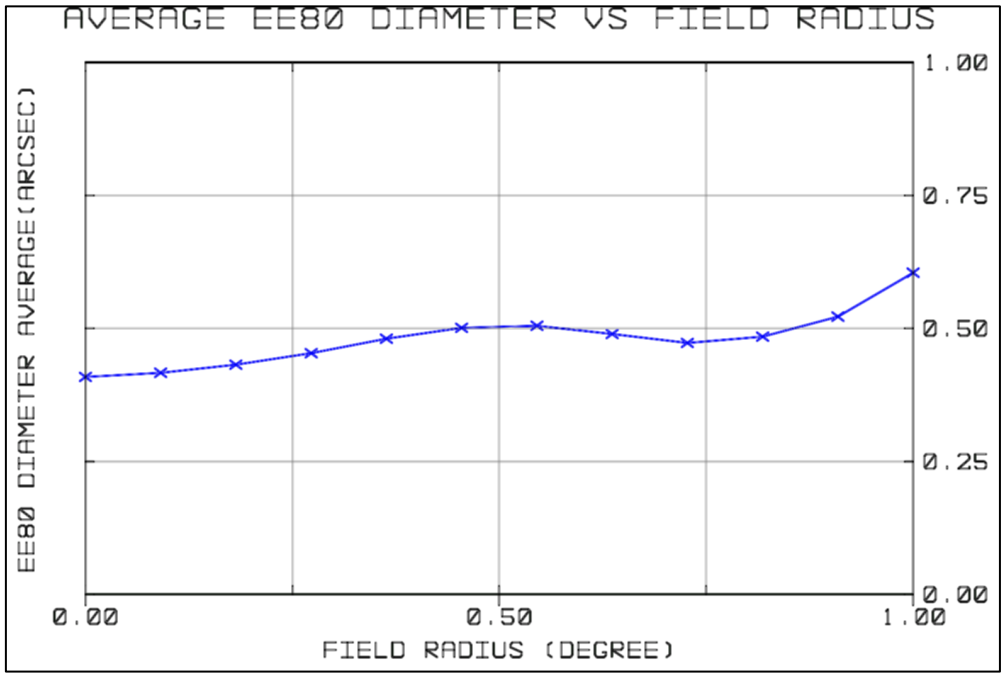
- New top end and 2° FOV prime focus corrector
  - No impact on current WHT functionality/instruments

Prime Focus Corrector

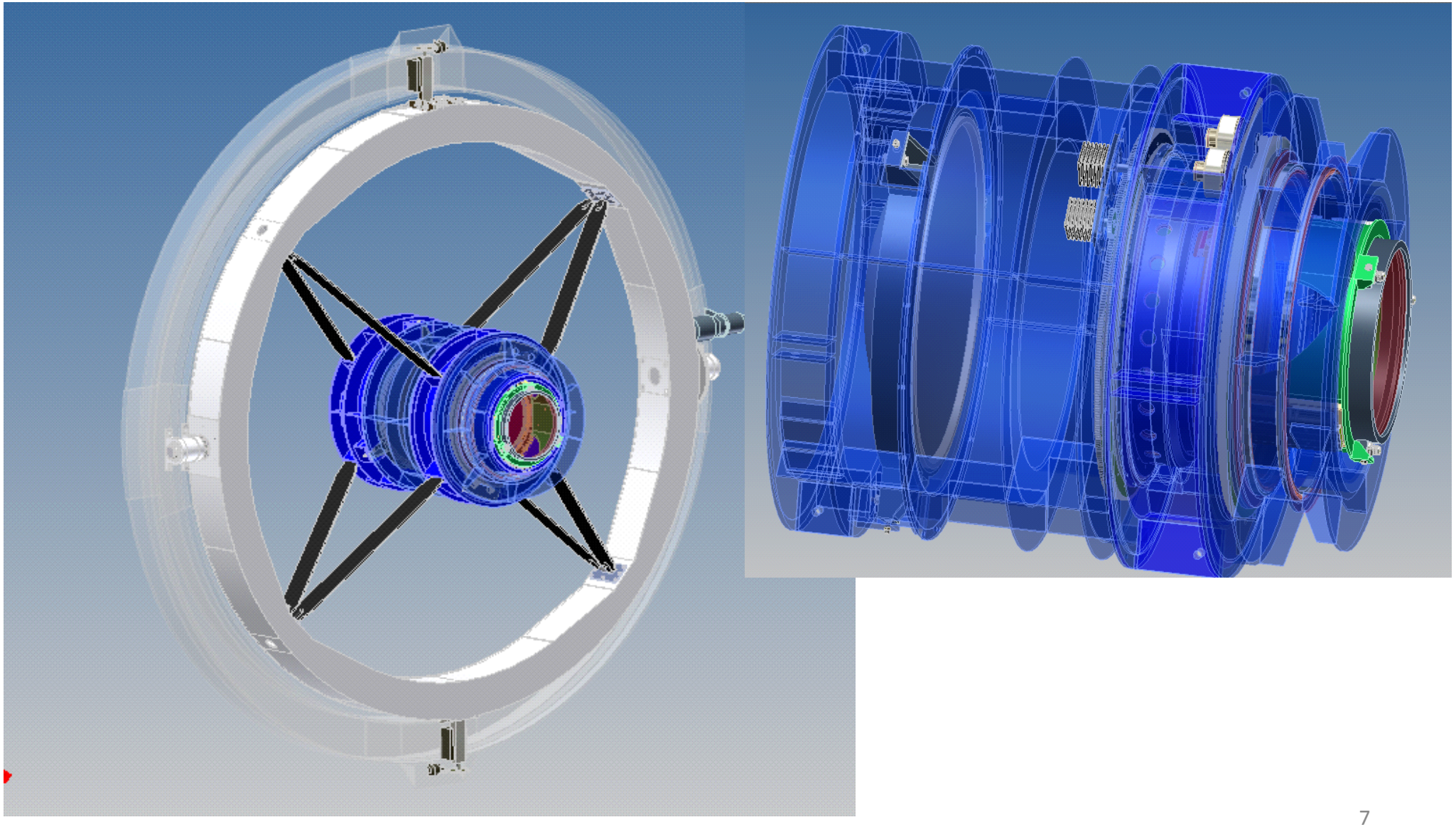
- 2 degree diameter field of view (f/2.7)
- 940mm first lens
- 290mm back focal distance
- Counter-rotating ADC
- Polychromatic image quality degrades by only 0.1” at 55 degrees ZD with ADC.
- Flat focal plane with tolerable non-telecentricity



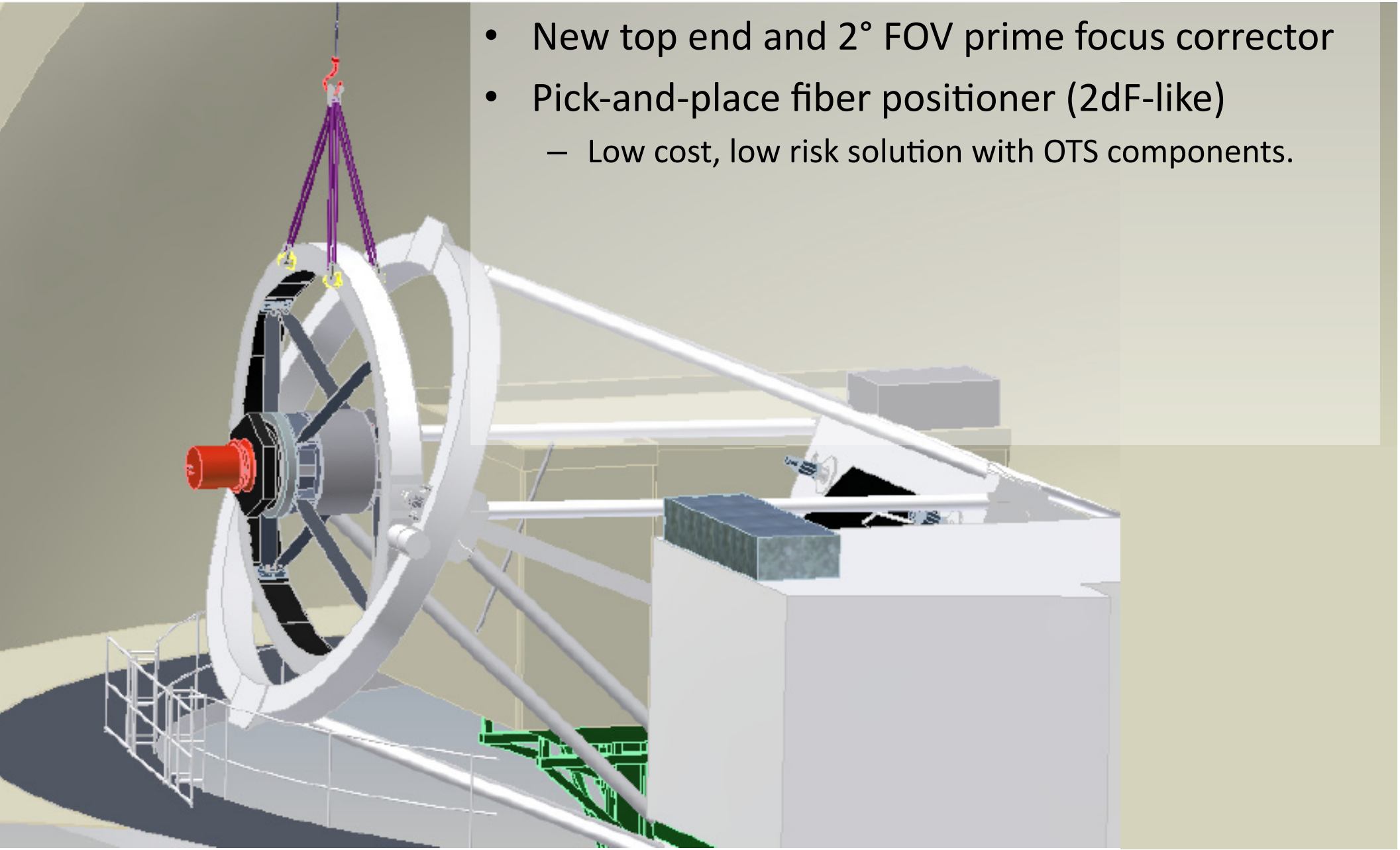




Prime Focus Corrector & ADC



Instrument Overview



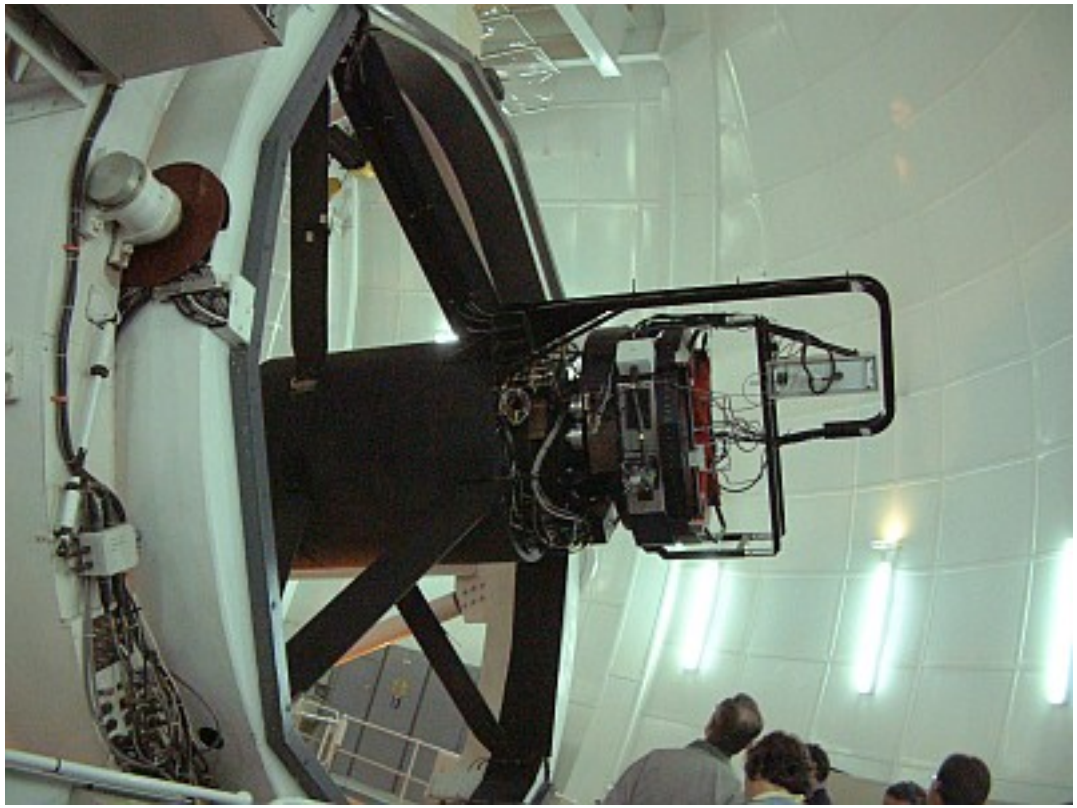
- New top end and 2° FOV prime focus corrector
- Pick-and-place fiber positioner (2dF-like)
  - Low cost, low risk solution with OTS components.

Positioner

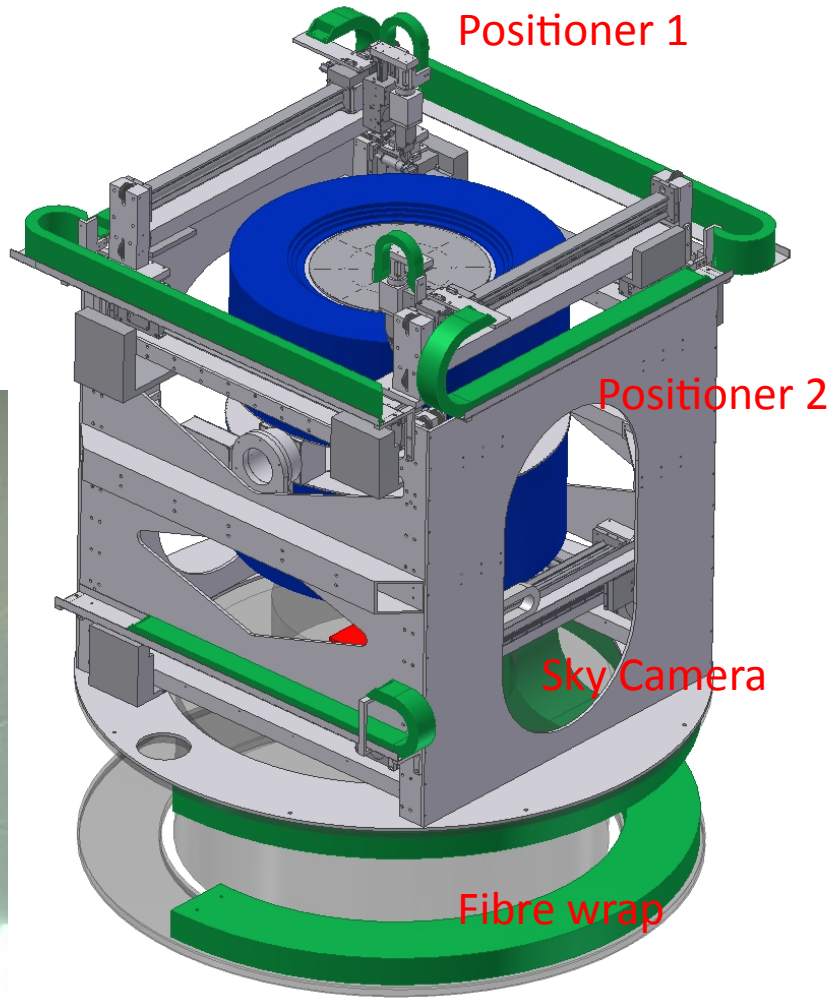
Total positioner mass
~600kg (including anti-vibration counterweights)

Obstruction diameter
~1.5m

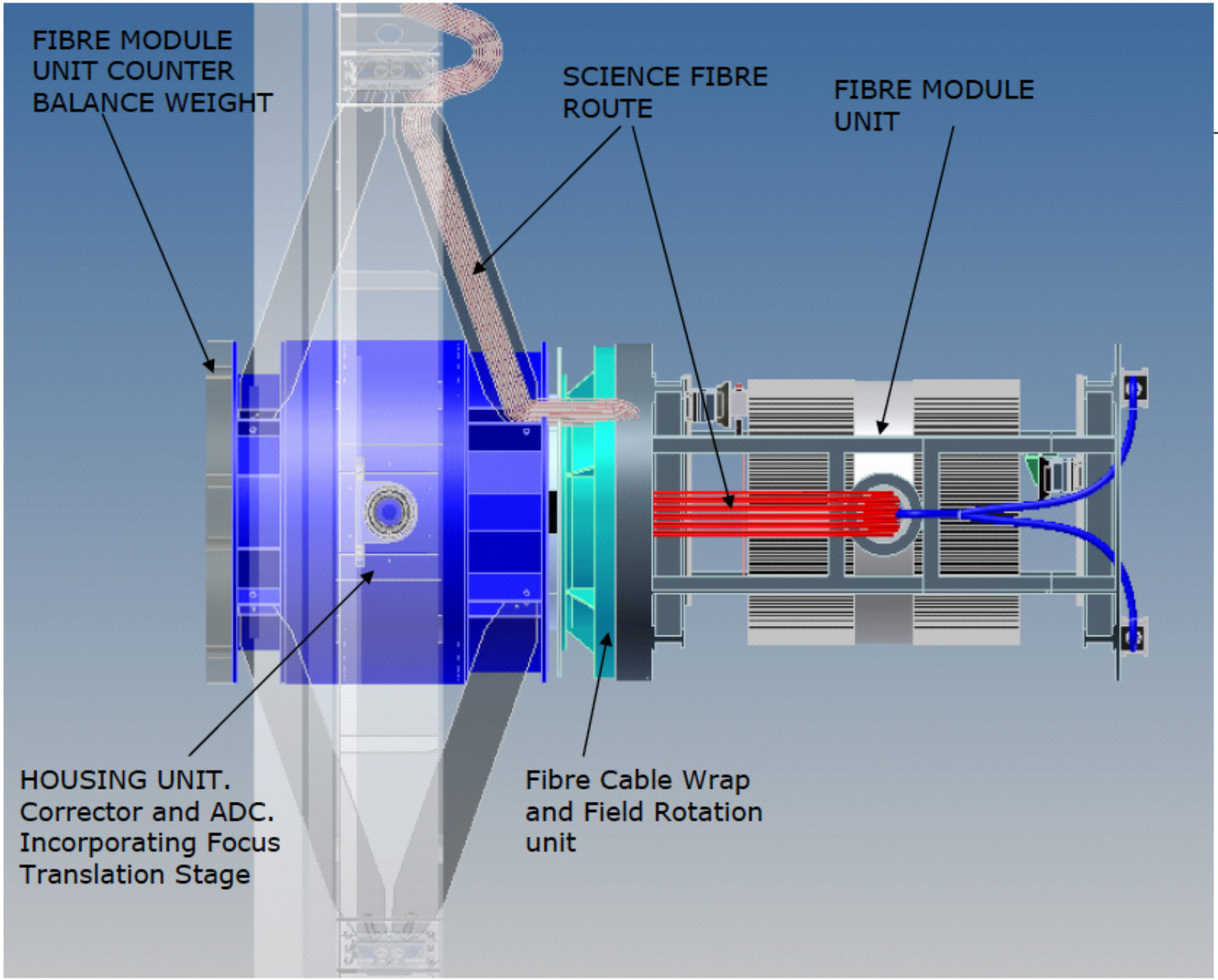
Tumbler clears corrector by
~30mm



Fits inside the available vertical space envelope… (just clears the crane gantry)



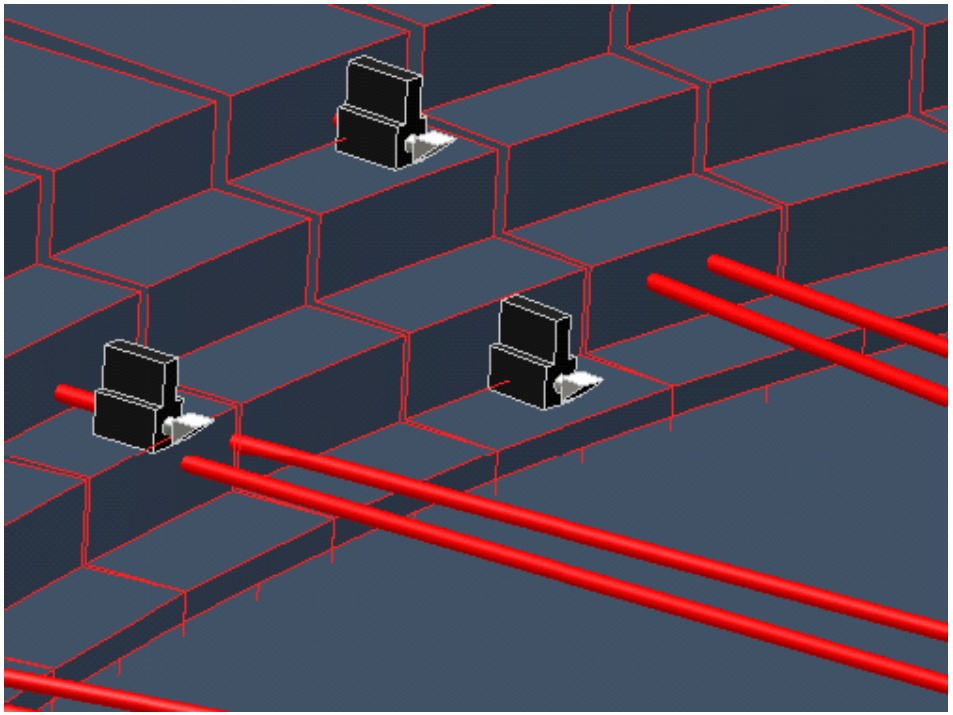
CENTRE SECTION

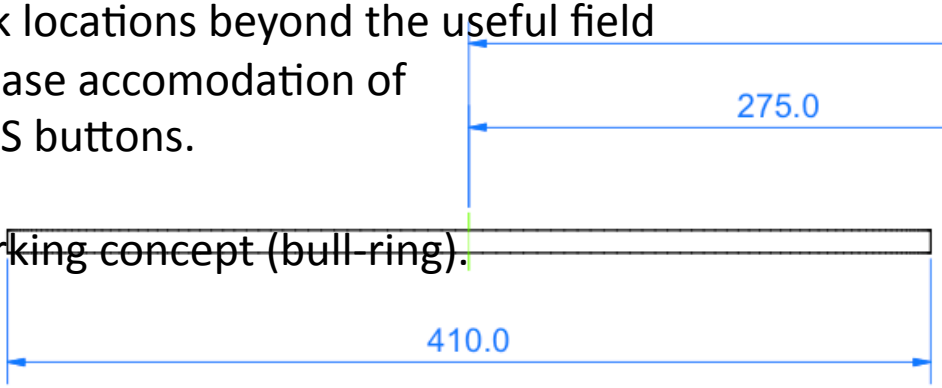


Retractor Concept

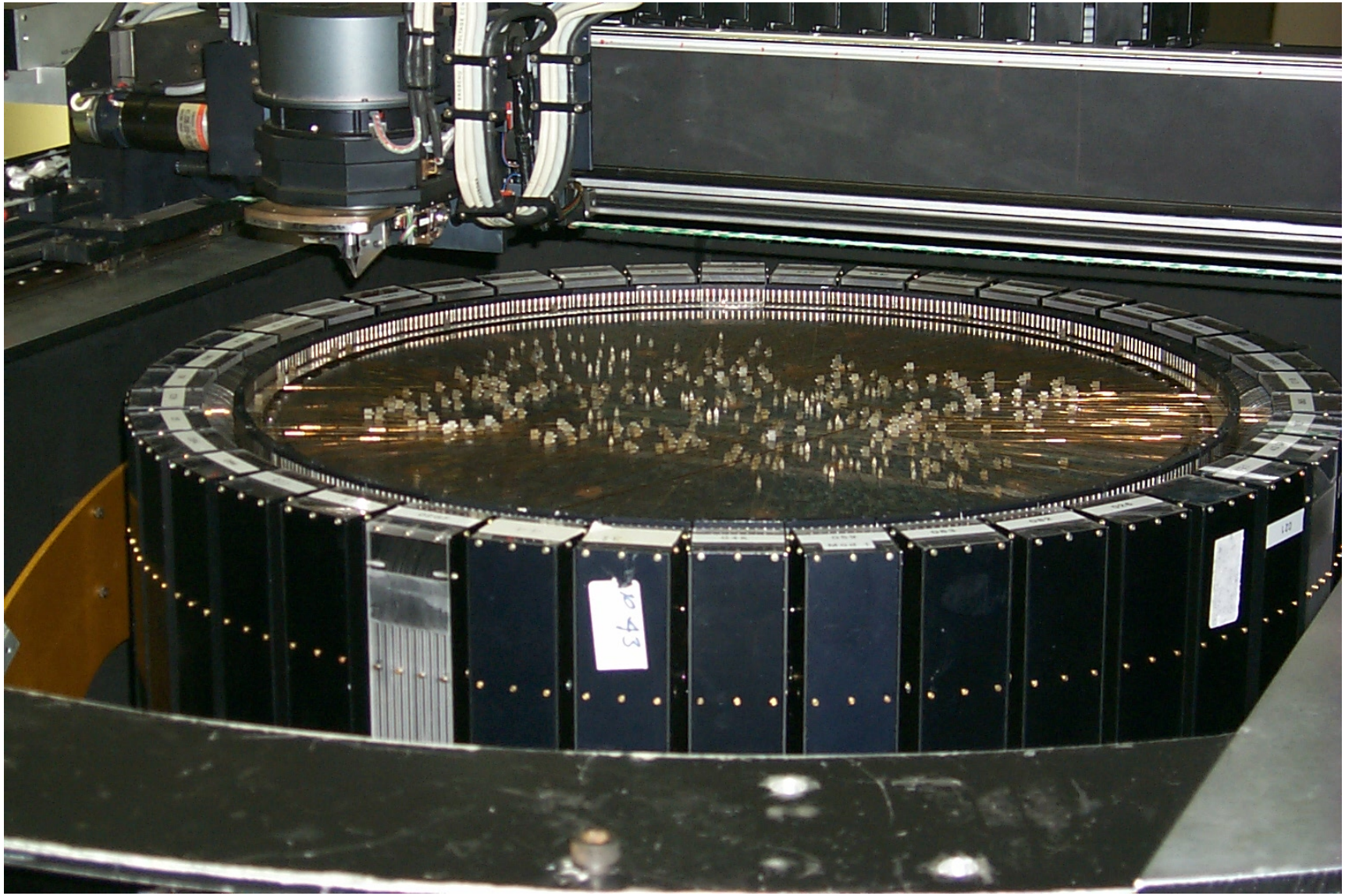
Push park locations beyond the useful field edge to ease accomodation of 1000 MOS buttons.

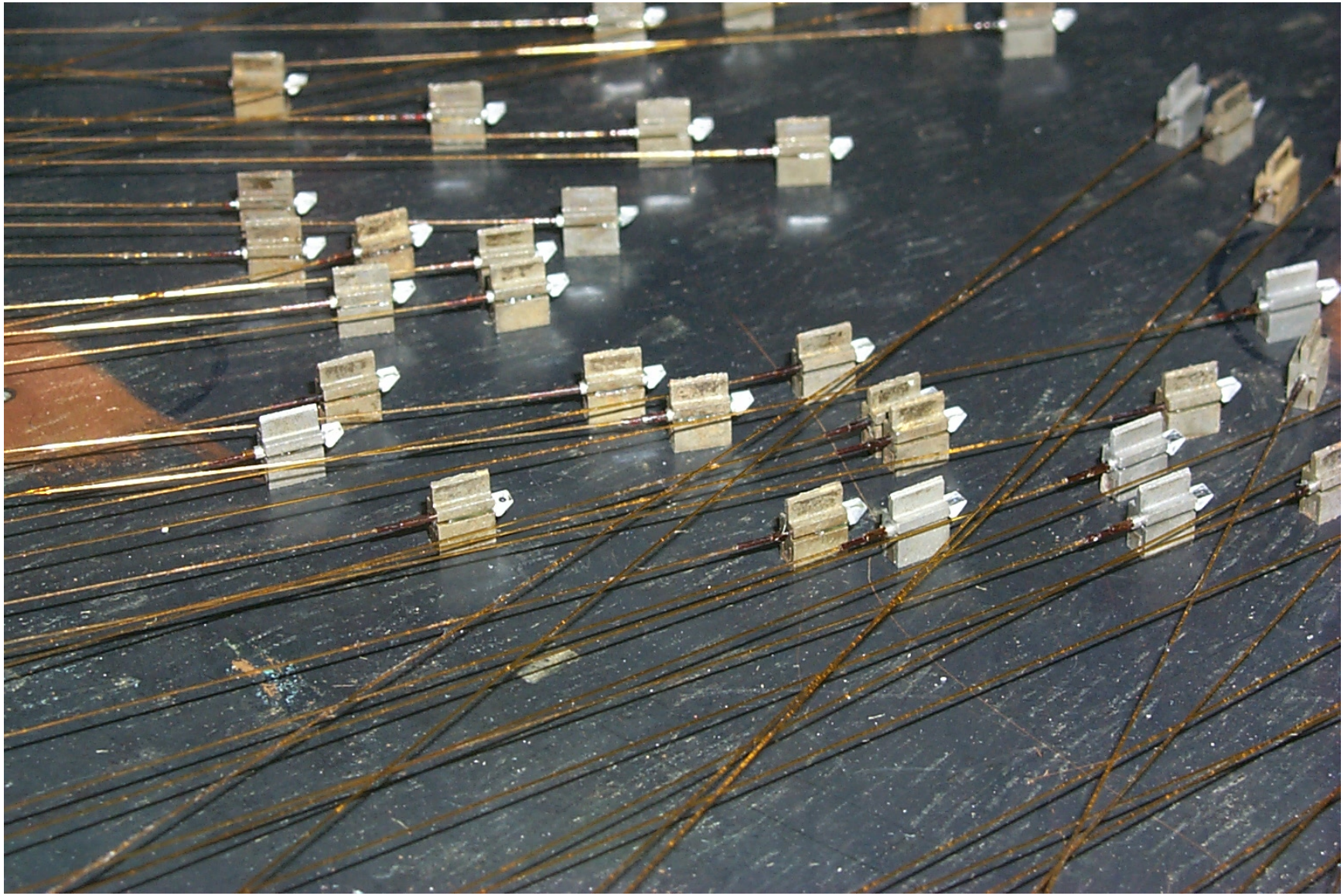
Triple-parking concept (bull-ring).





Positioner concept similar to AF2/2dF, but all COTS components…





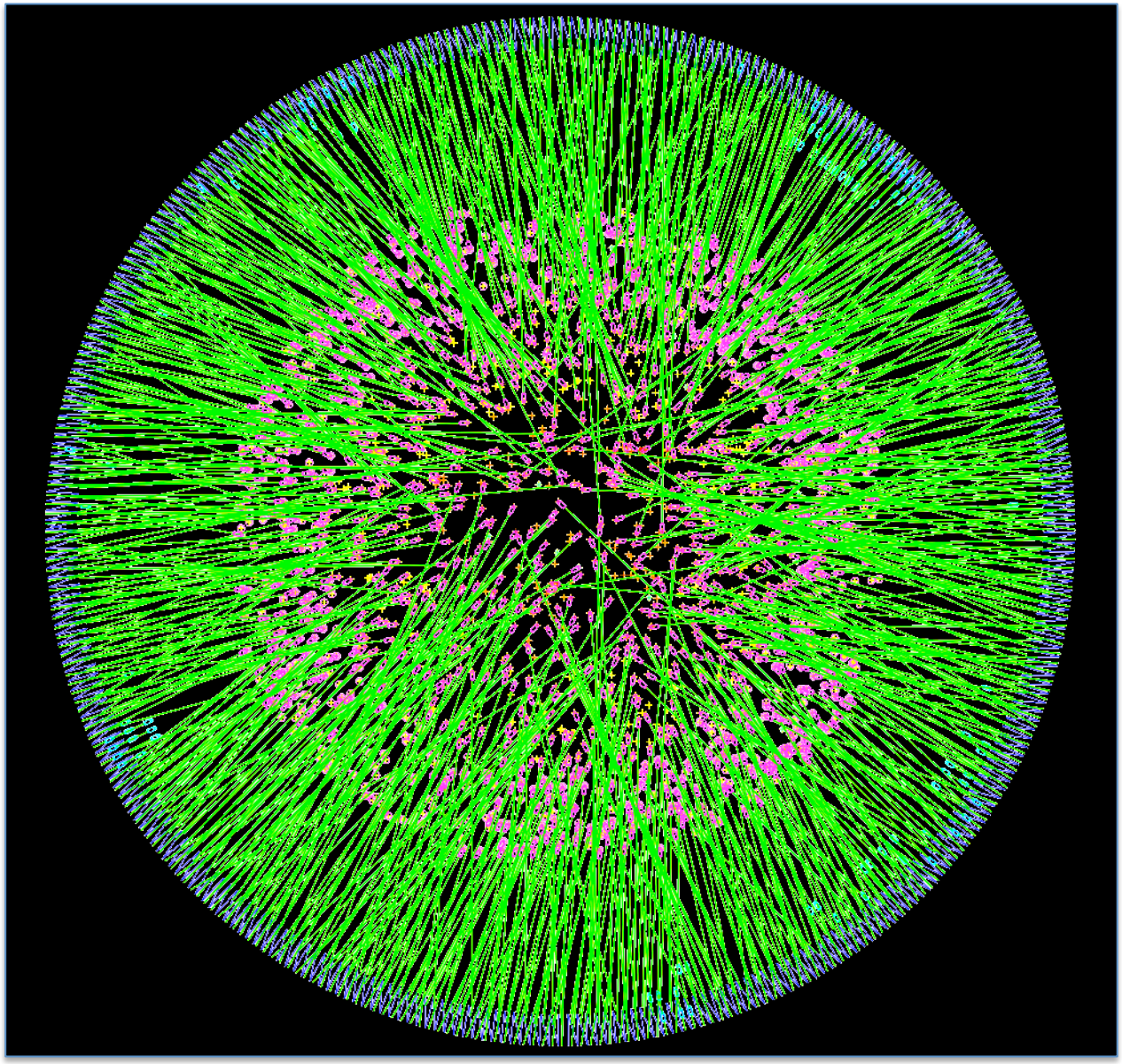
FIELD SIMULATION

Random target distribution, oversampled (1800 targets)

970 targets allocated

8300 fibre crossings

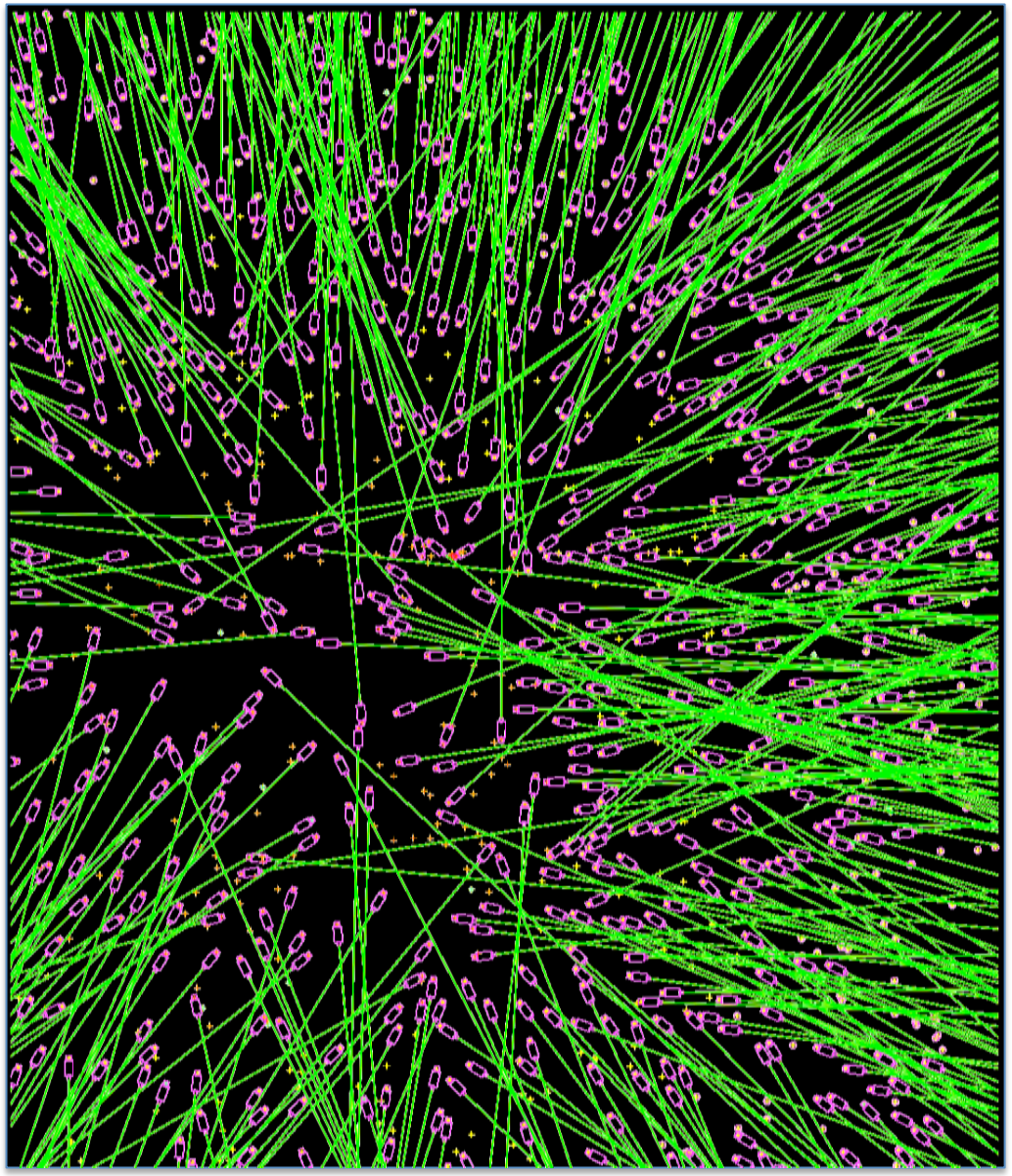
Reconfiguration simulations imply ~1600 moves to reconfigure…, but some optimisation still to be done…



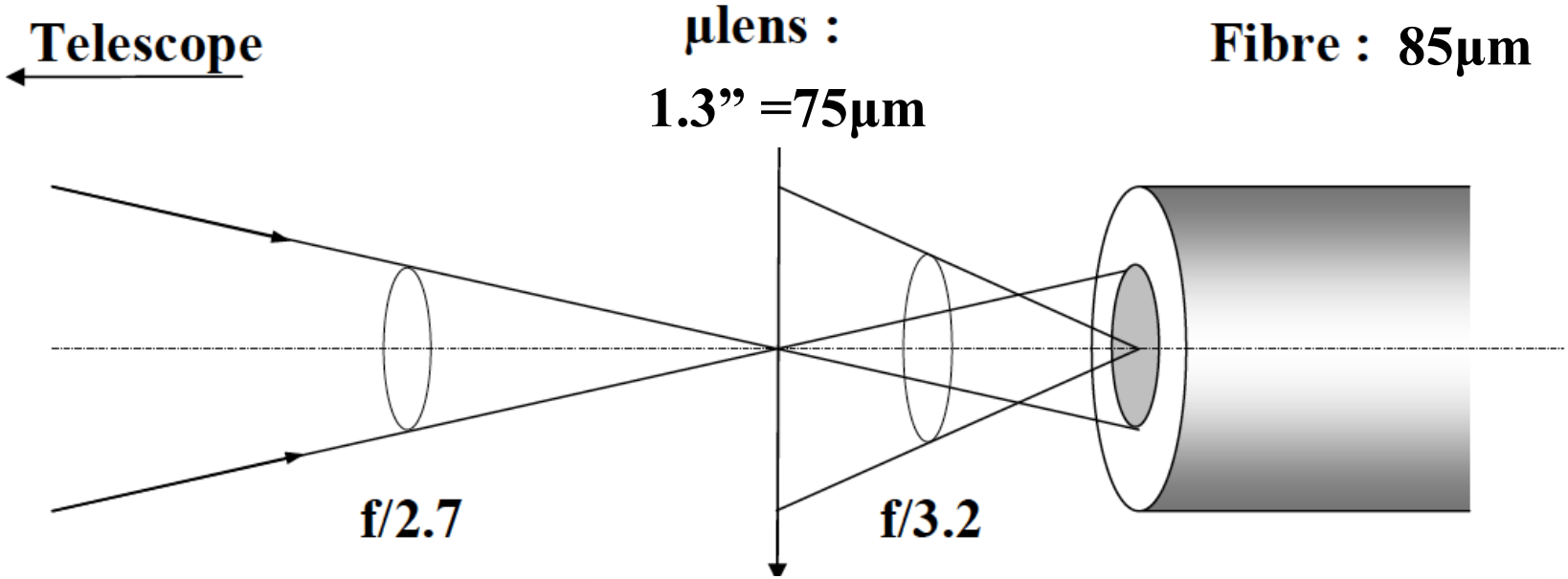
Simulations will be used for considering impacts of any suggested design changes on the overall survey efficiencies.

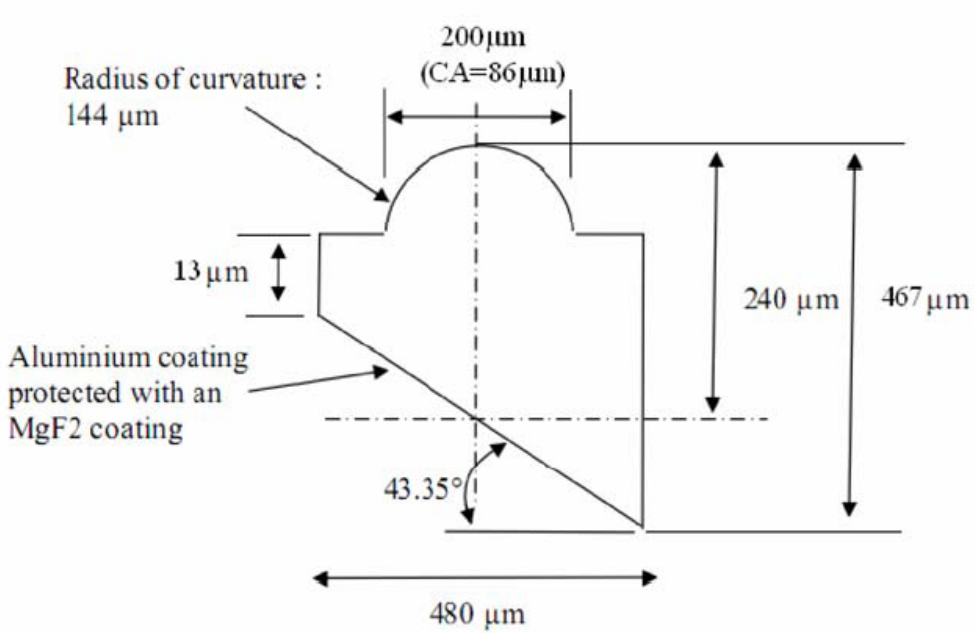
Realistic button and retractor geometries

Algorithm developed for 2dF surveys. Fully implemented simulated annealing algorithm now available for WEAVE.



Button Input Geometry





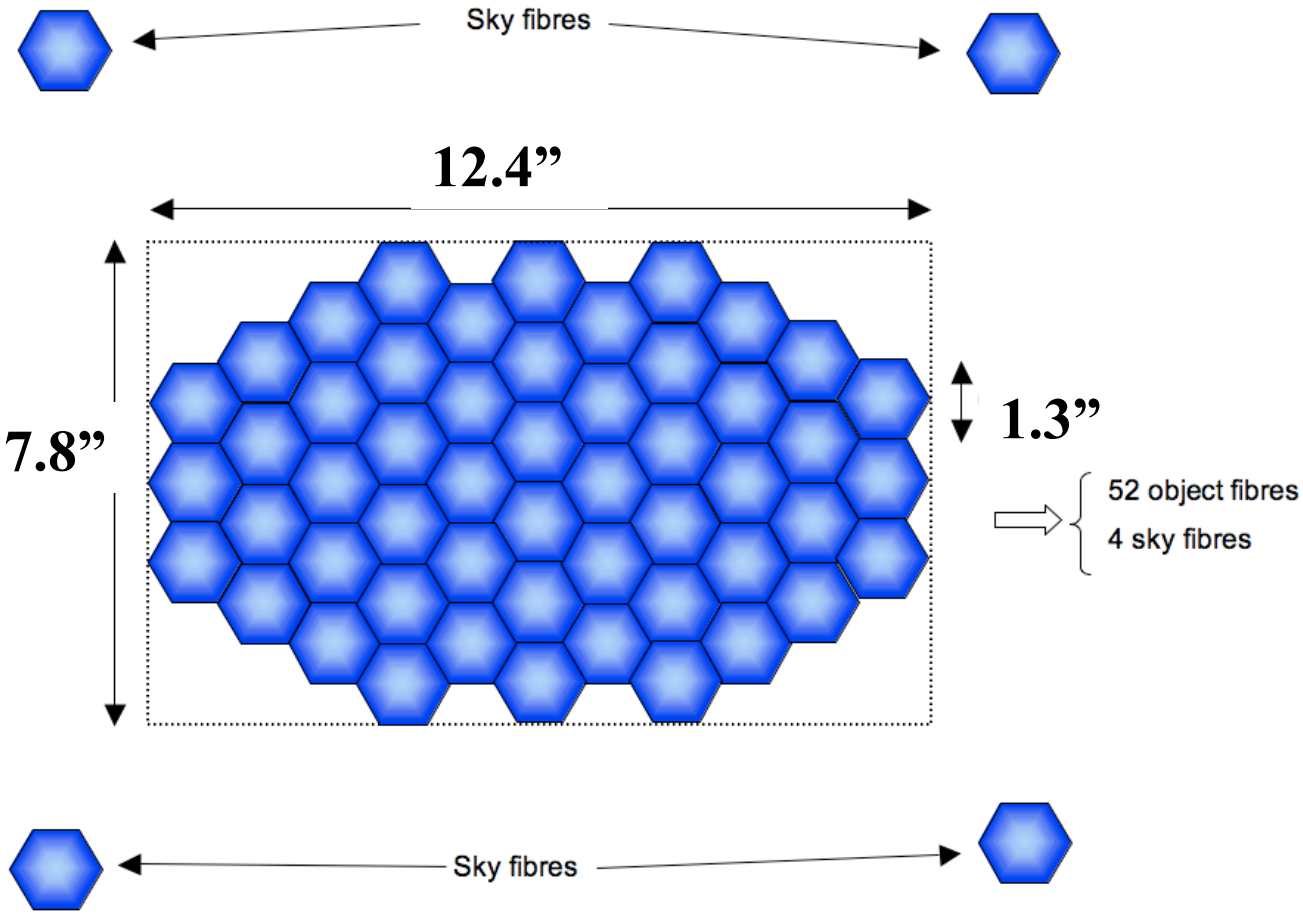
WEAVE IFUs

- Use the full available slit length of the spectrograph.
- 20-30 small field IFUs, same fibre size as MOS
- 50-30 fibres/unit, e.g.

- Large single-field IFU uses full slit length in a single IFU located at 90° tumbler position

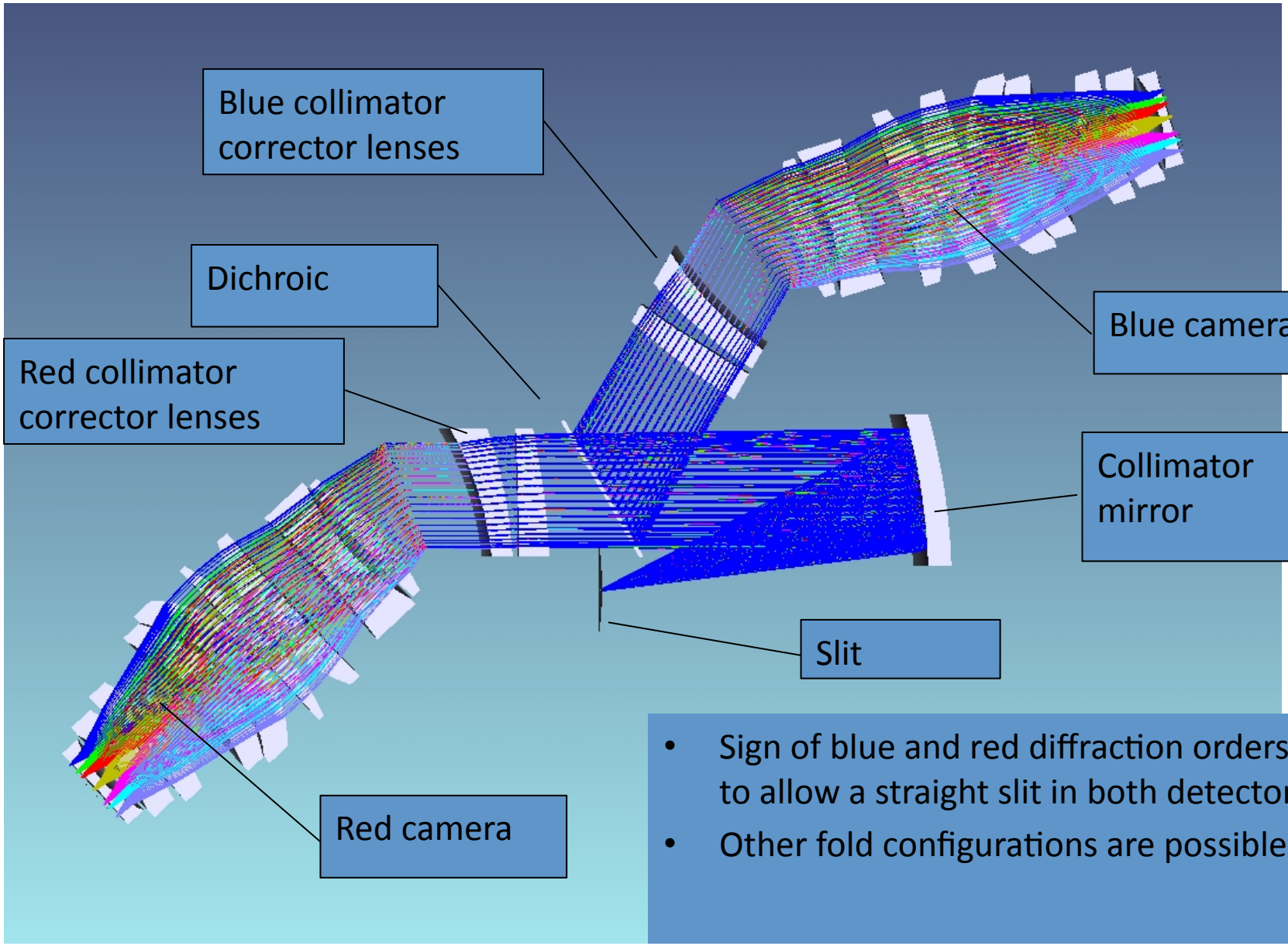
IFUs stored on one MOS field plate, at the cost of a small number of MOS science fibres.

Physical size of IFU unit still governed by 57µm/" plate scale, so still only a few mm button size.



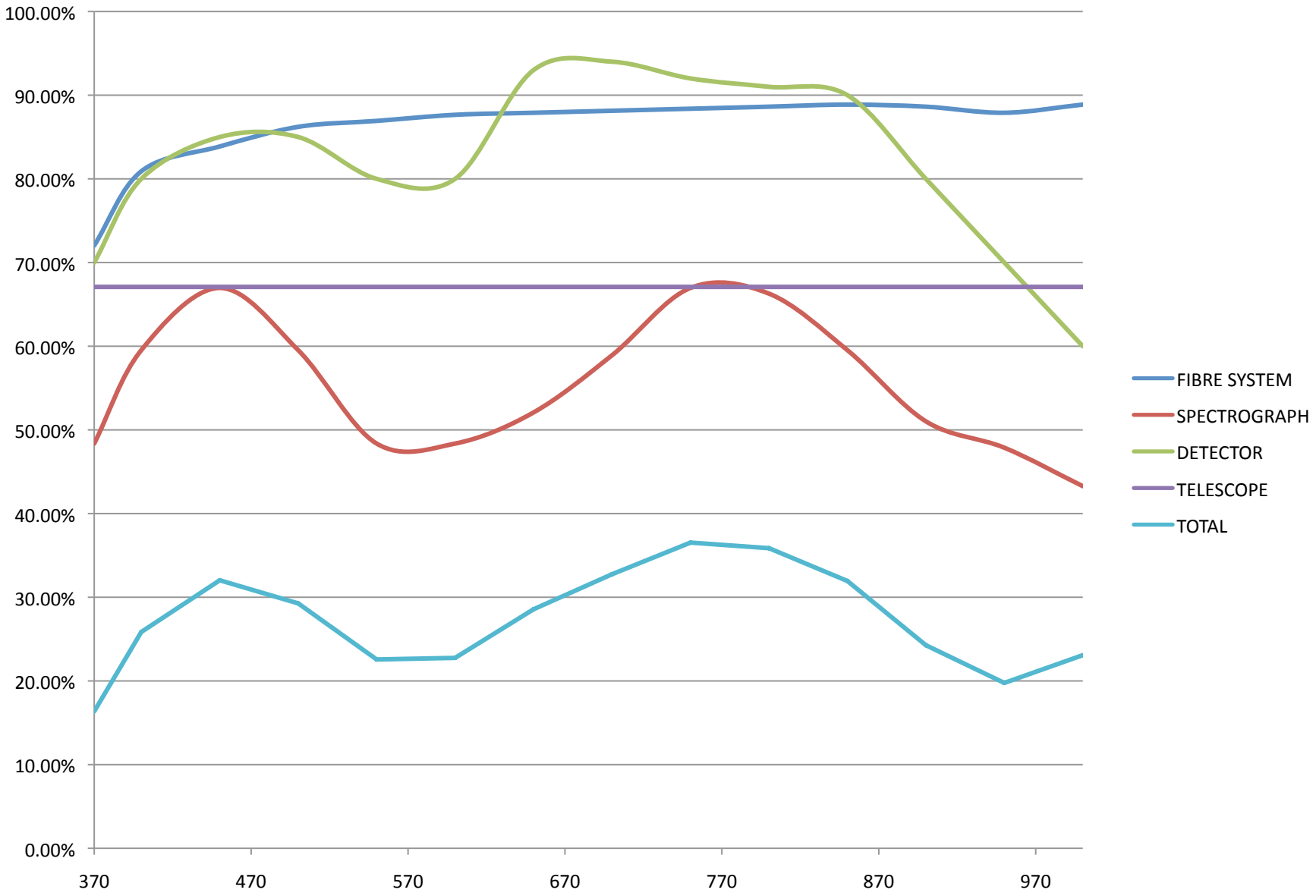
Dual-Beam Spectrograph Early Design (RAL/ASTRON)

f/3.0 input, f/1.75 camera, 180mm beam diameter.
2x8kx3k e2V CCDs in each camera.

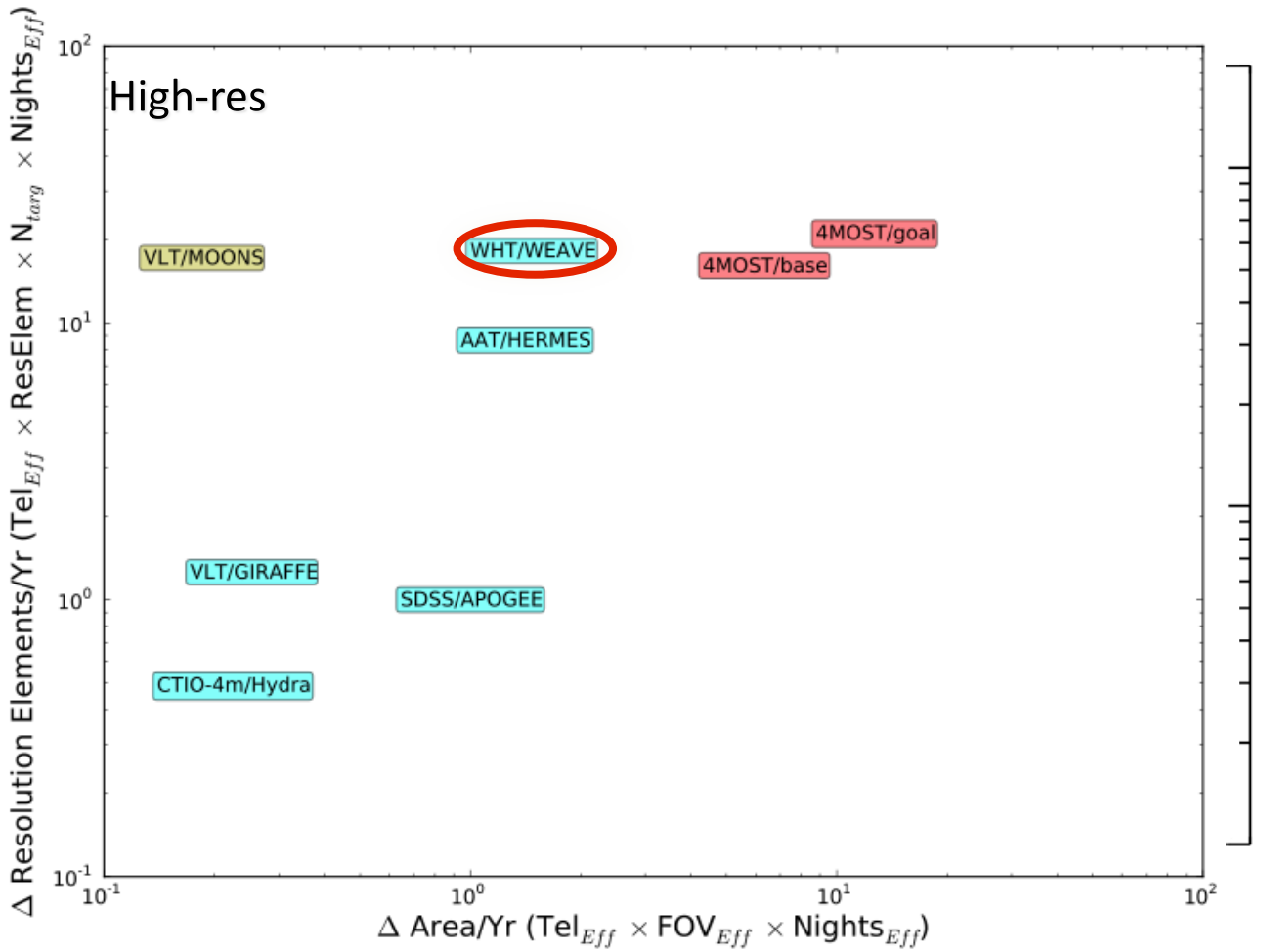


- Sign of blue and red diffraction orders matched to allow a straight slit in both detectors
- Other fold configurations are possible

WEAVE throughput

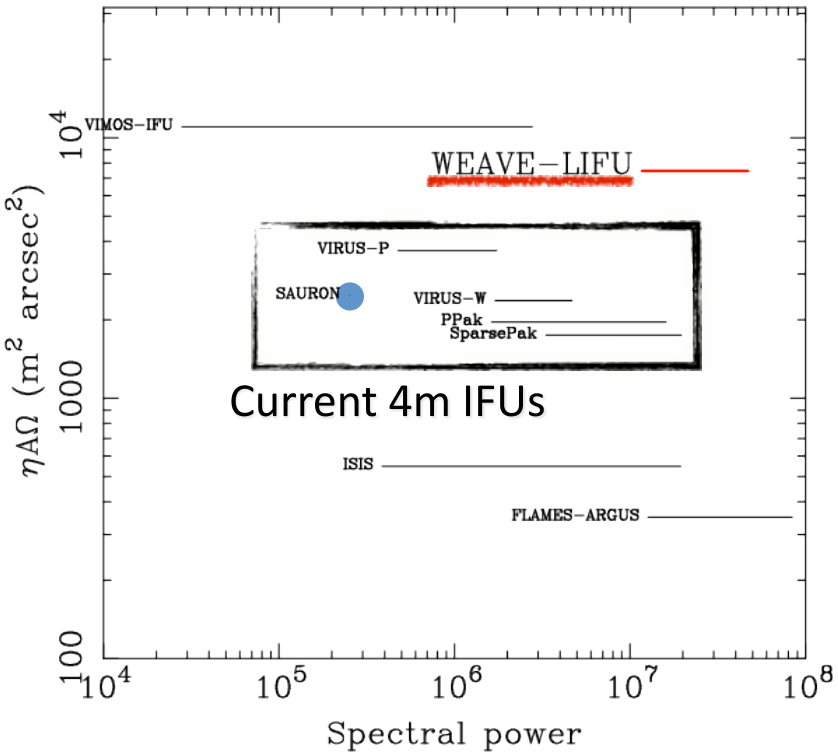


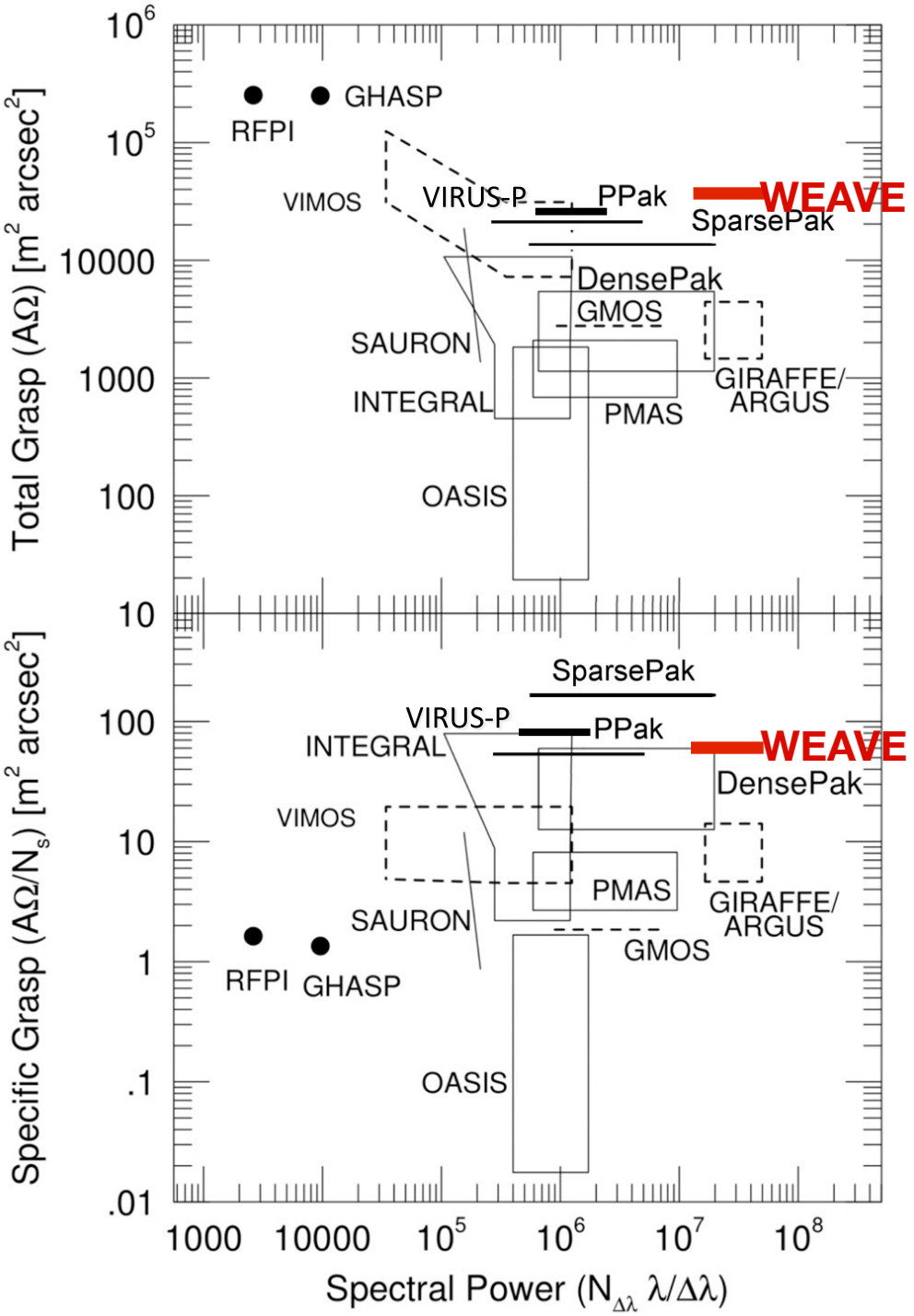
WEAVE as a survey instrument



IFU r

Effiency-corrected étendue





WEAVE TIMELINE

- PDR/Corrector FDR Feb 2013
- Goal is to complete construction and be on-sky for science in early 2017.

- 5 years of operations 1.3×10^7 spectra!