Corner Raft Conceptual Design

Kirk Arndt, Ian Shipsey
Purdue University

LSST Camera Workshop

SLAC

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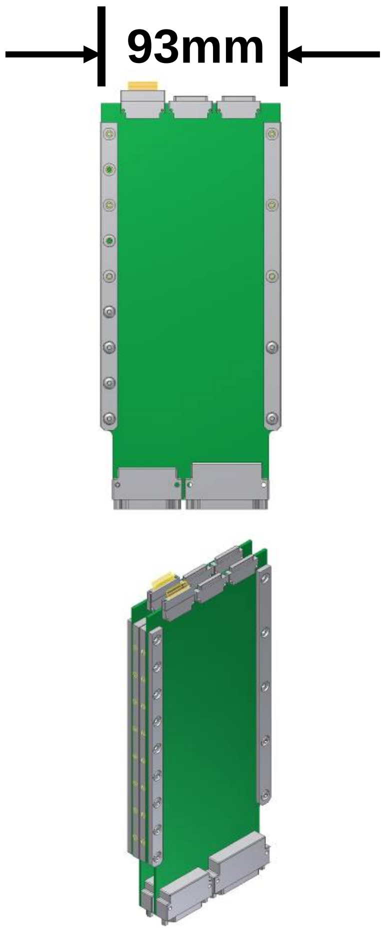
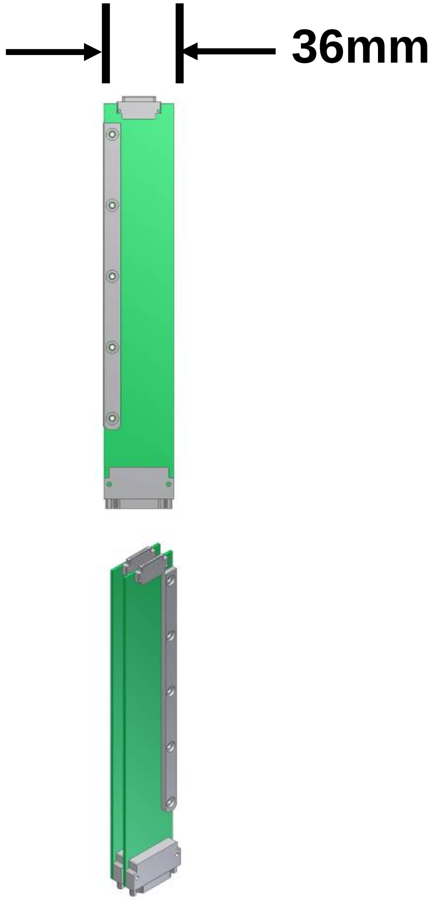
WFS FEE Board Package



Science Raft
Double Rail
Board Pair



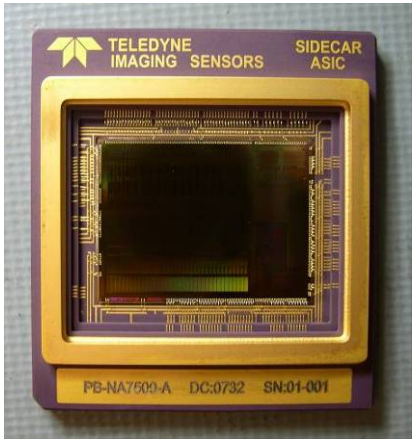
Corner Raft
Single Rail
Board Pair
~1/3 area of Science Raft FEE board

- **Each board for a Wave Front Sensor is the same (206mm) length and ~1/3 the width of a board for the Science Rafts.**
- **The single rail has 1/2 the thermal contact with the cage, but 1/3 the heat load, compared to a Science Raft double rail board pair.**
- **A WFS FEE board pair has 2x51-pin low-profile Micro-D connectors (compared to 2x69-pin and 2x51-pin standard profile Micro-D connectors on a Science Raft board pair).**

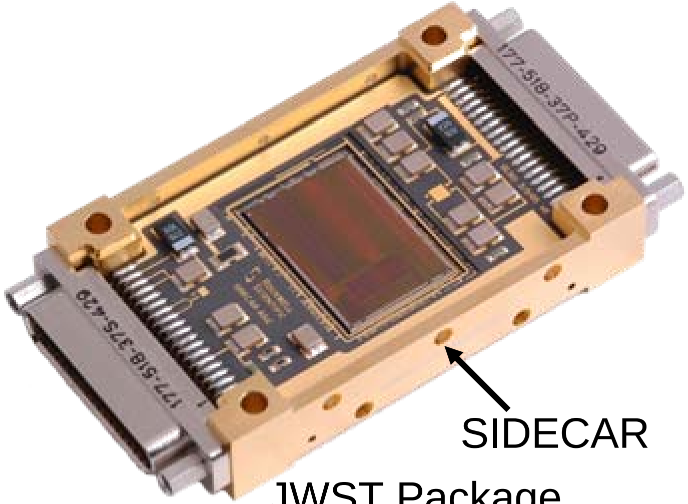
Guider SIDECAR ASIC Package

from Don Figer, RIT

- **SIDECAR ASIC interfaces directly to analog readout circuits**
- **Low power, high performance**
- **Integrated circuit contains microprocessor, bias generators, clocks, plus 36 input video channels, 36 parallel ADCs (12 bit /10 MHz, 16 bit /500 kHz)**
- **SIDECAR is being used for three JWST instruments (4 port readout, 11 mW)**
- **SIDECAR is key to Hubble Space Telescope ACS Repair – operates CCDs**



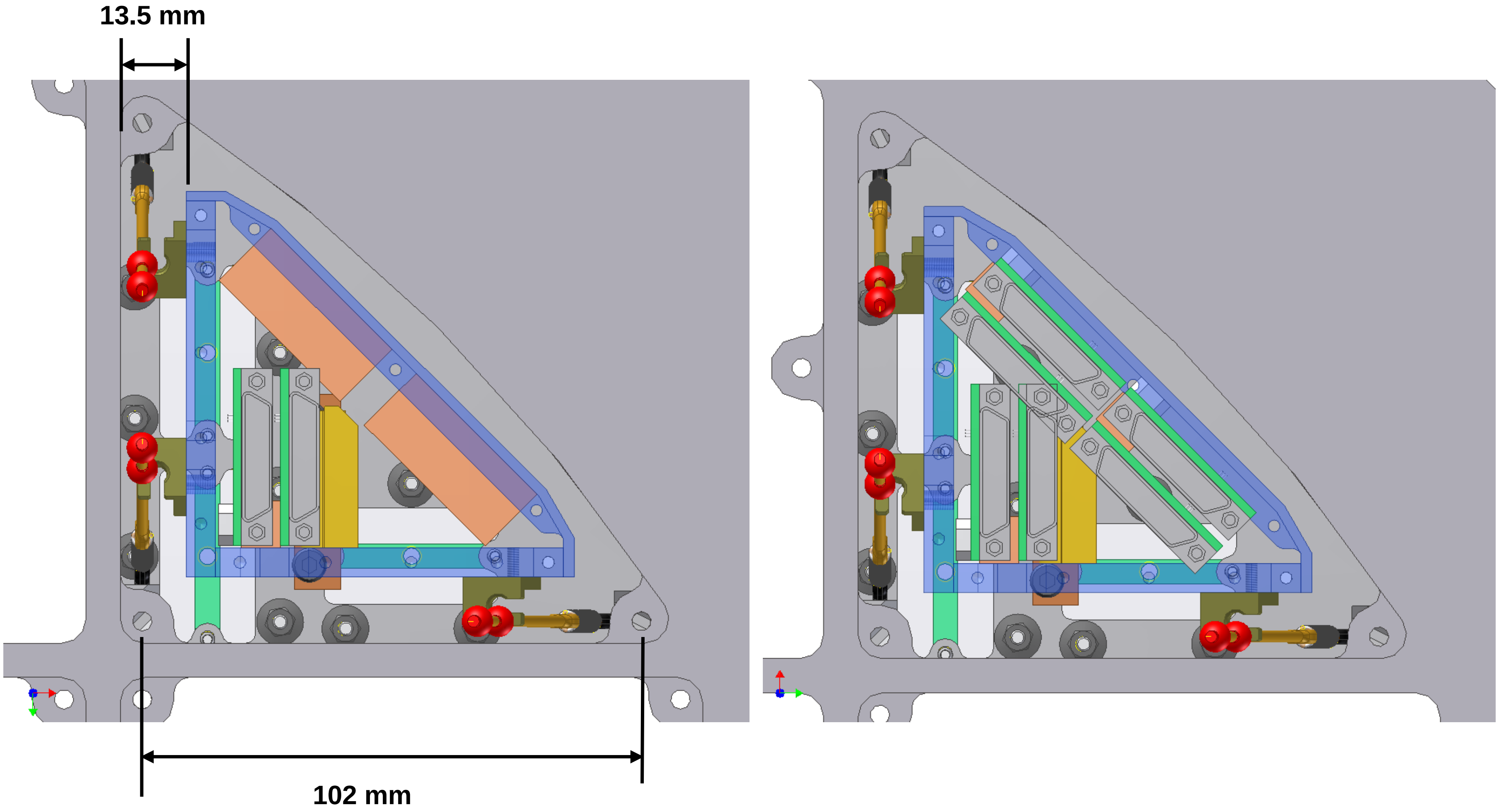
HST Package (3.5×3.5 cm)
Does not show hermetically sealed lid over ASIC



JWST Package
(does not show protective package lid)

Estimated <u>37mm x 15mm x 100mm</u> size of JWST package is the size of the Guide sensor FEE clearance volumes in the CAD model shown in following slides

Corner Raft Tower in GRID – Summer 2008



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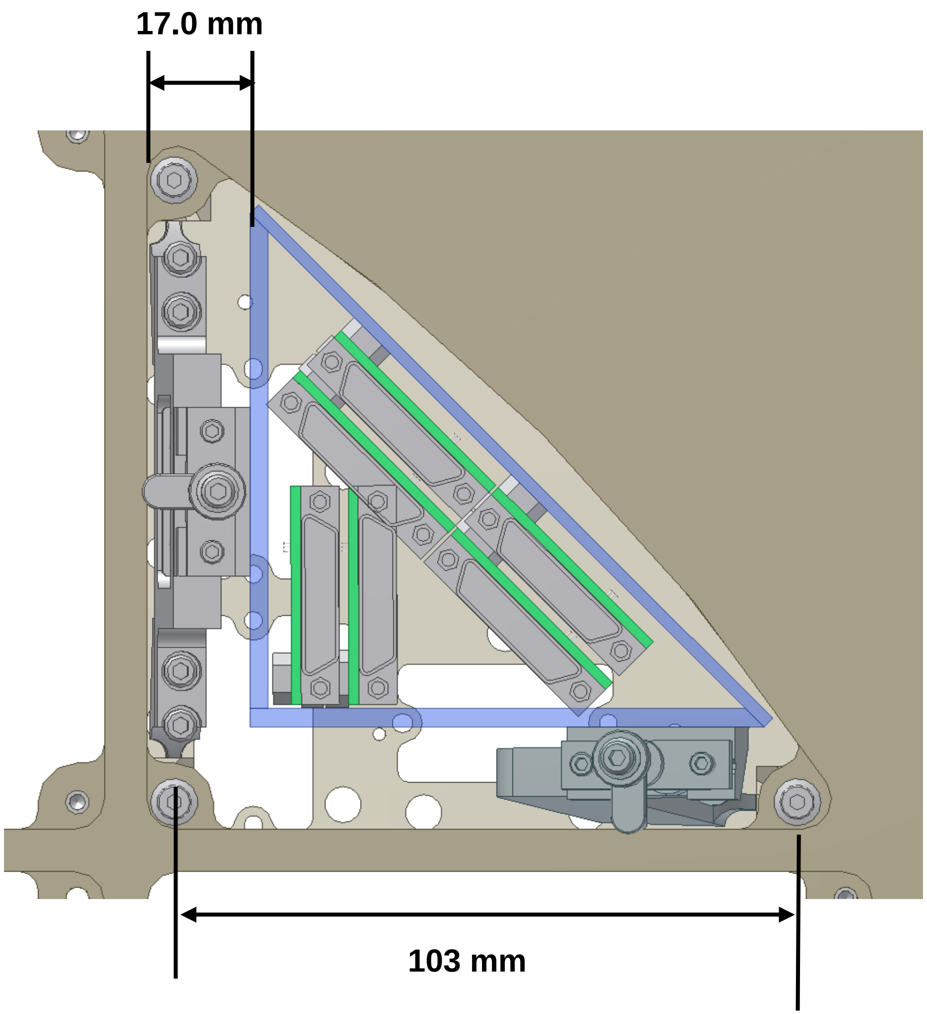
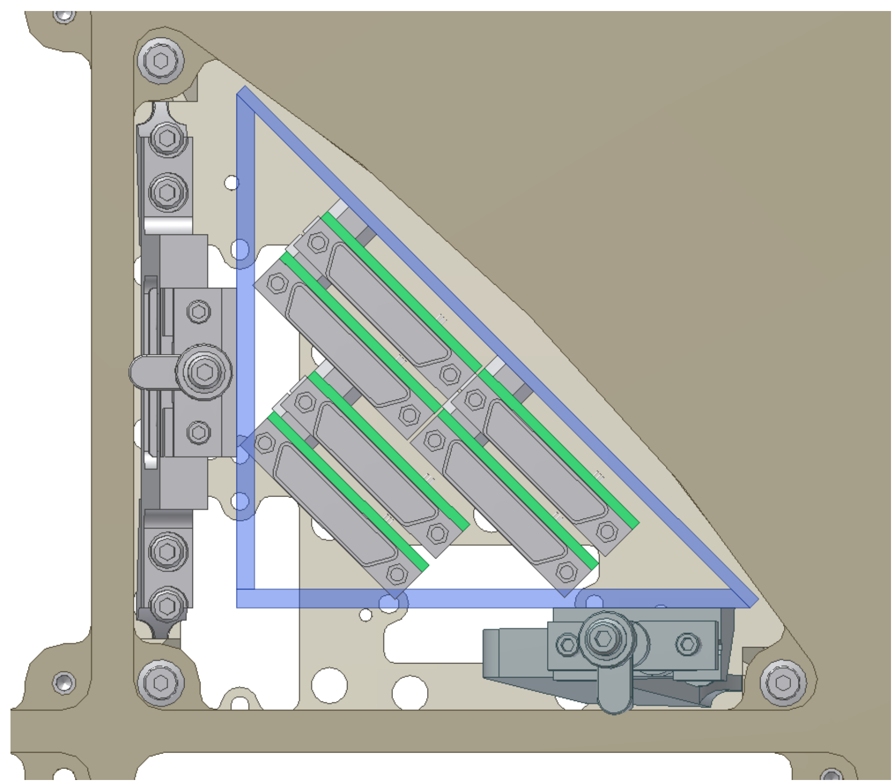
Corner with new GRID and Raft hold-downs

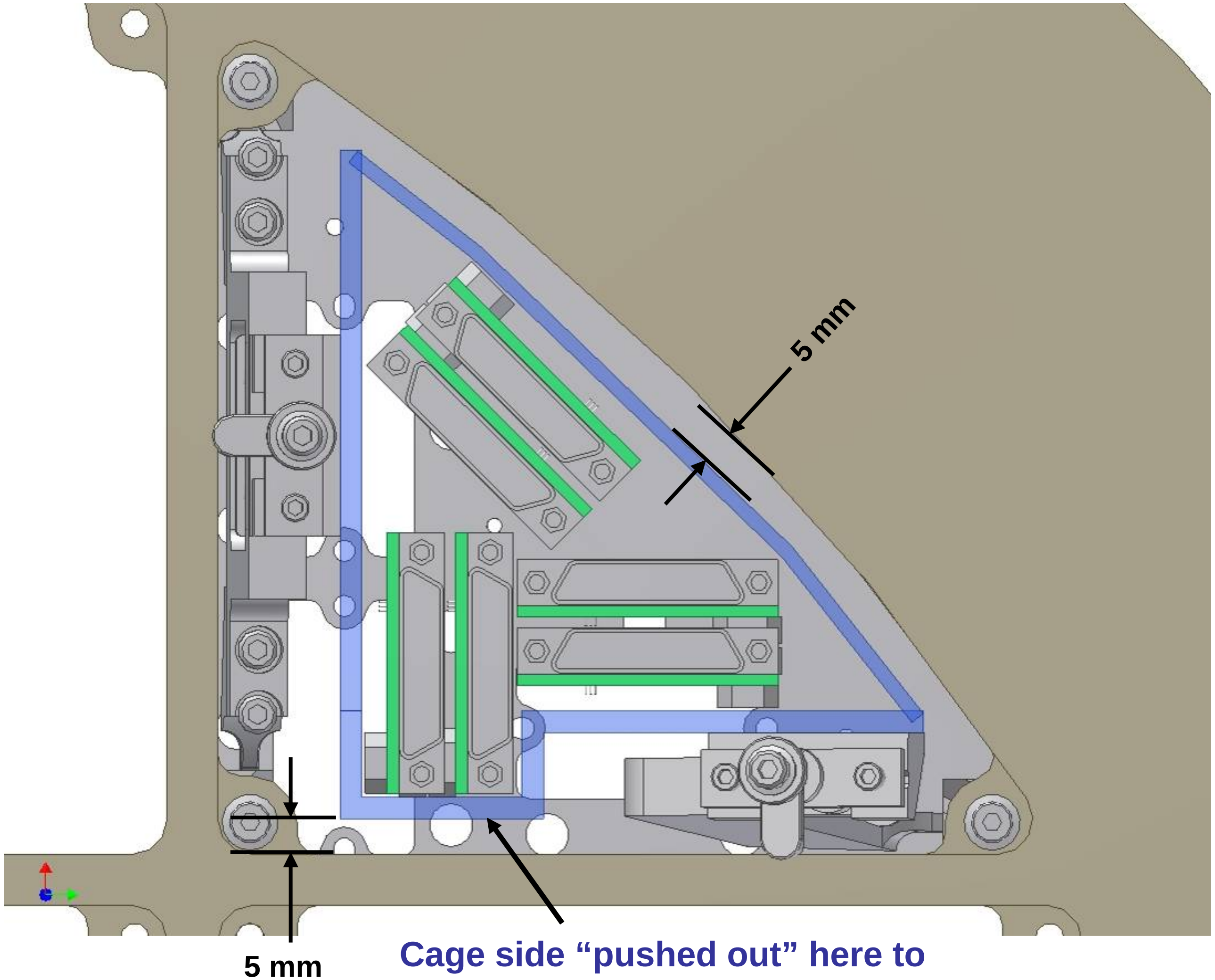
Large Synoptic Survey Telescope

same spacing between cage and Grid bay walls as in Science Raft/Towers for new raft hold-downs





New Corner cage and FEE layout in GRID



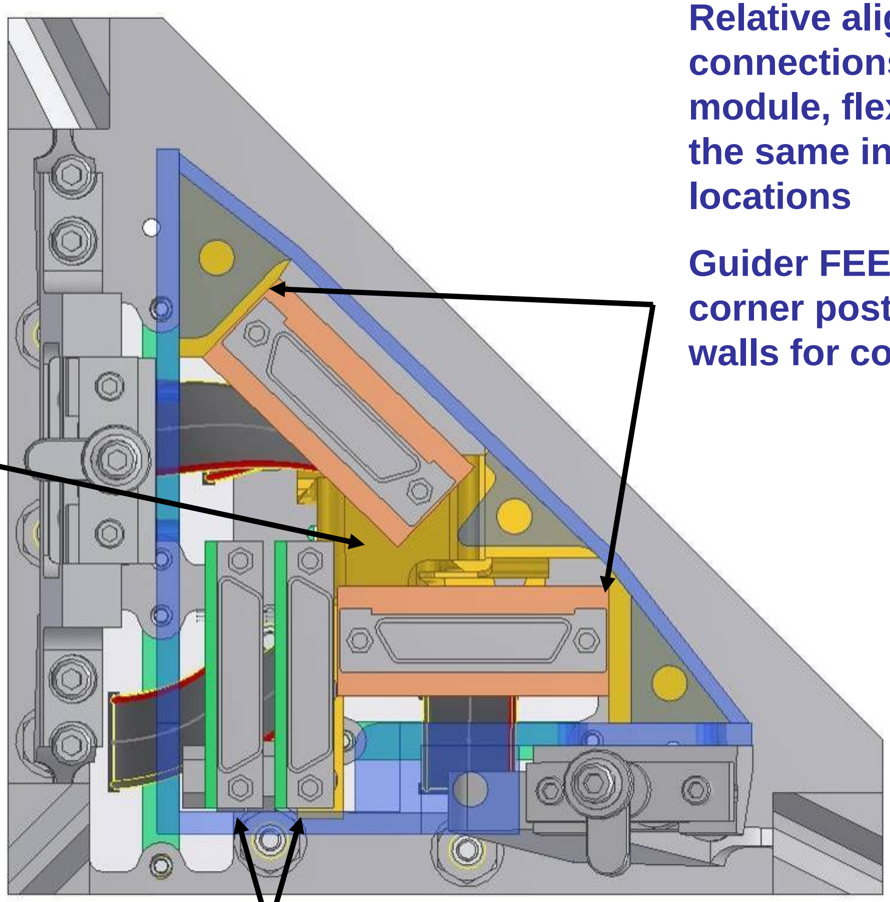
Cage side "pushed out" here to fit 3 board pairs inside cage with minimum 5mm clearance in GRID Corner bays

end view of new Corner Raft/Tower

Relative alignment of connections between sensor module, flex cable and FEE is the same in both Guide sensor locations

Guider FEE in contact with corner posts fastened to cage walls for cooling

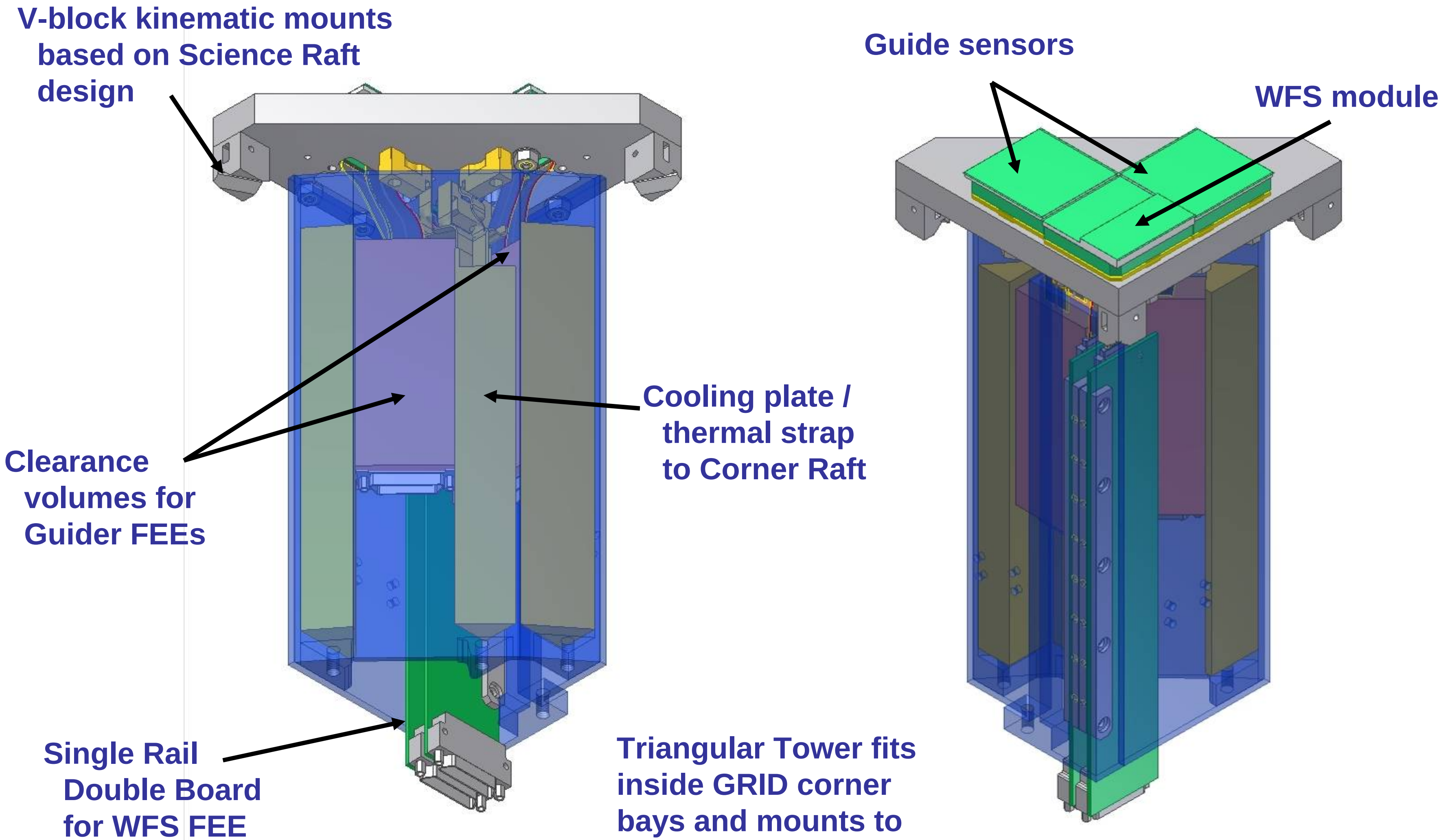
Thermal straps to Corner Raft (cooling plate fastened to cage wall on hypotenuse side)



Single Rail Board Pair for WFS

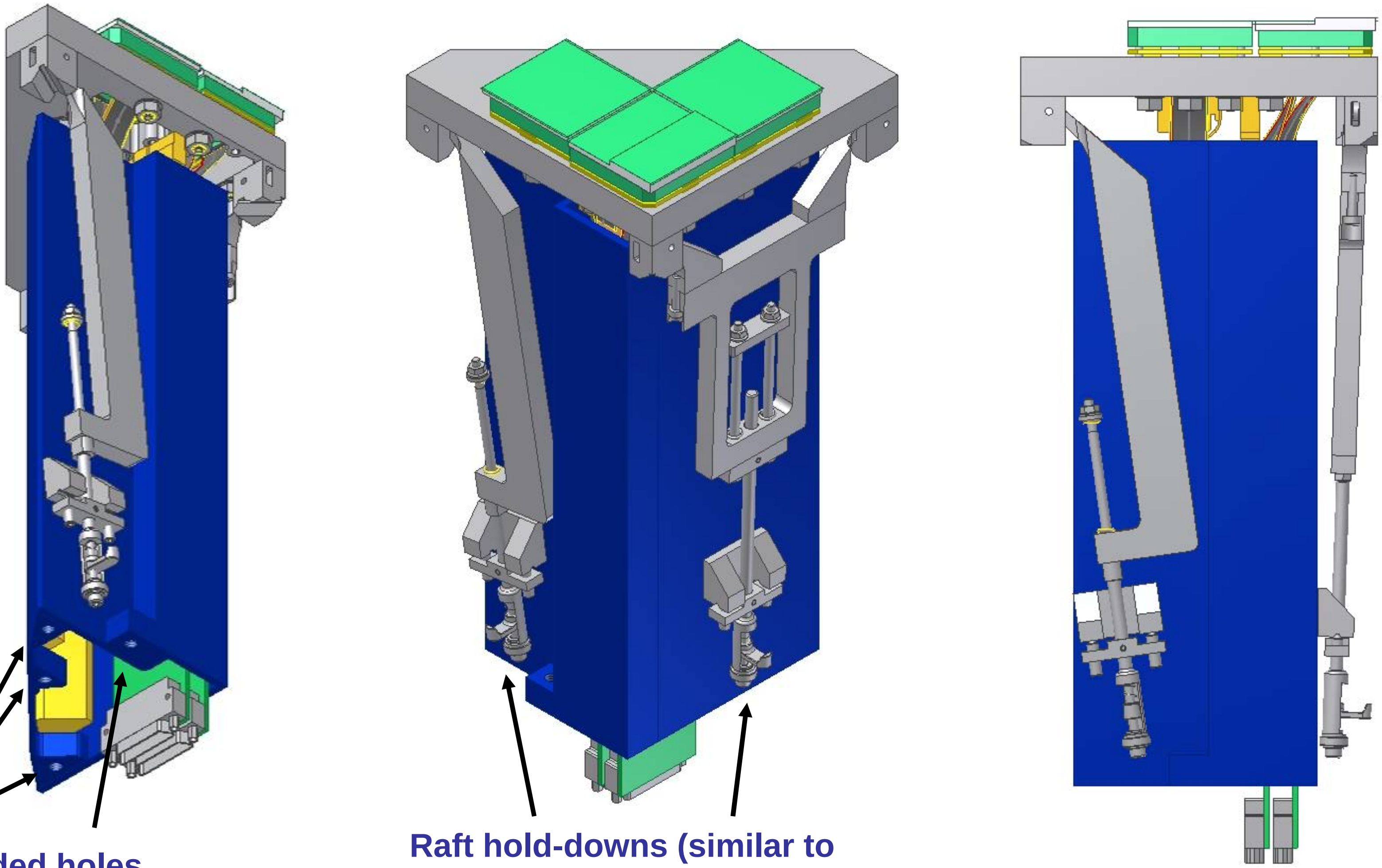
Heat of WFS FEE conducted through single rail to cage wall

Corner Raft Tower concept



Triangular Tower fits inside GRID corner bays and mounts to Cryoplate

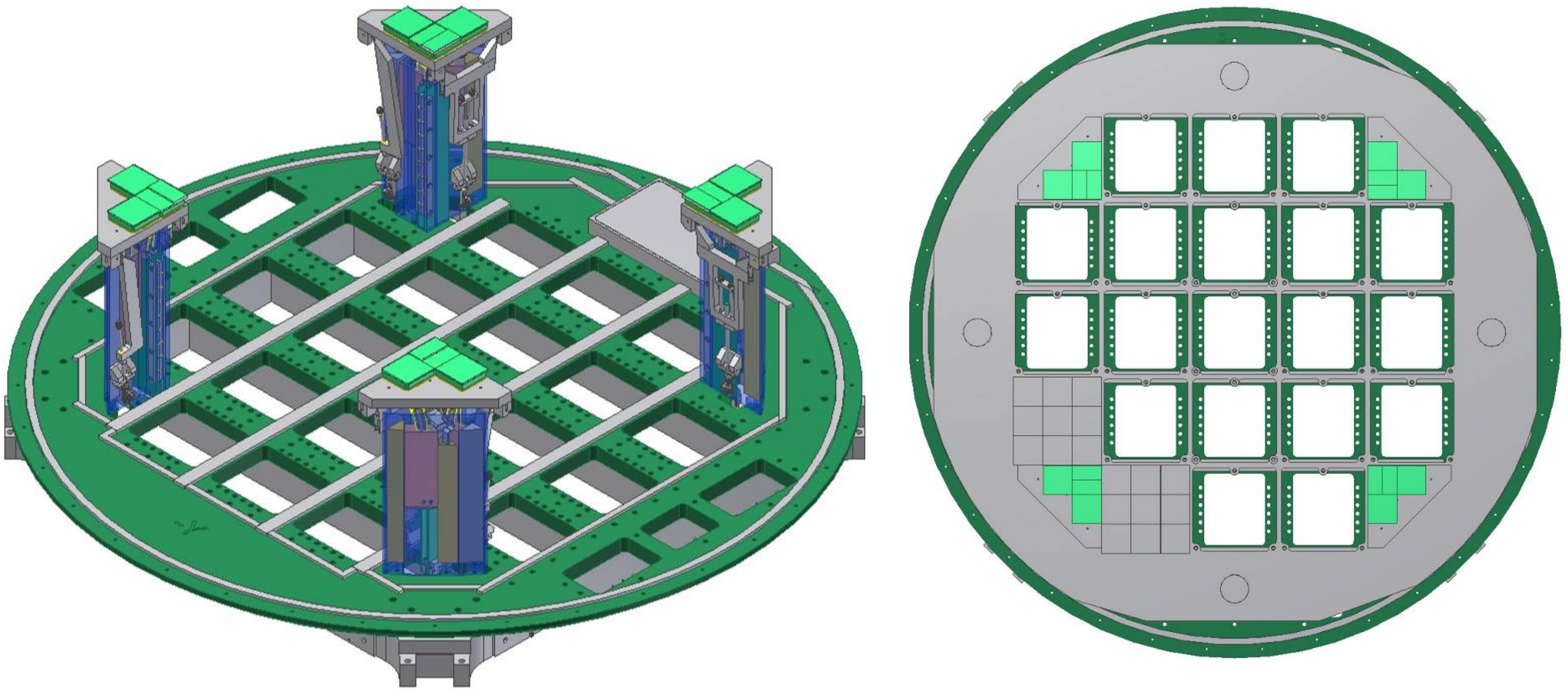
Cage exterior details / Corner Raft hold downs



Threaded holes for fastening to cryoplate

Raft hold-downs (similar to new design for Science Rafts)

Corner Raft/Towers in GRID/Cryoplate

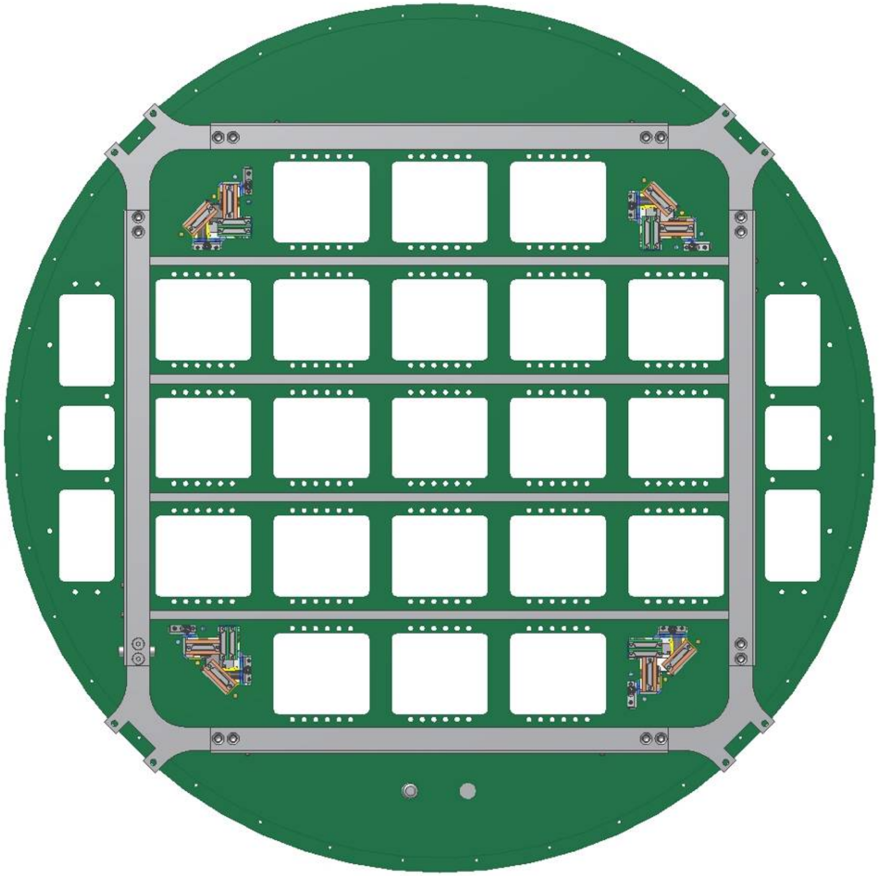


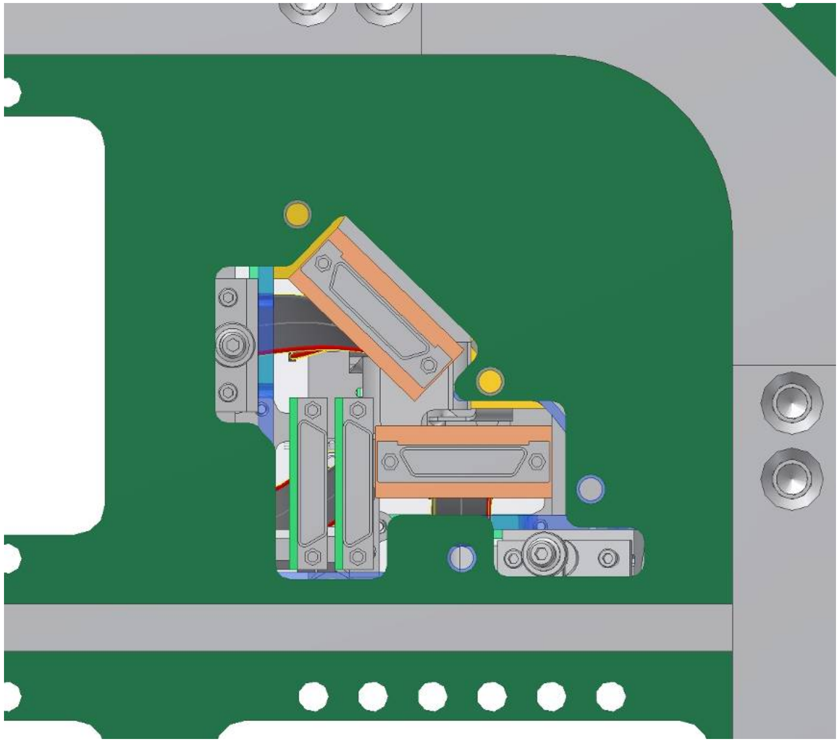
A single Corner Raft-Tower design in all corners of GRID/Cryoplate

→ Corner Raft-Towers are interchangeable

→ Sensor, FEE and raft-hold-down orientation w.r.t. GRID/Cryoplate/Camera are rotated 4x 90 degrees

view through openings in Cryoplate





Items for Mechanical Development

- Assembly sequence
- Tool for insertion into the GRID (temporarily fastened to FEE cage)
- Mechanical analysis
  - Refine raft hold-down mechanism
  - Raft-to-Tower interface detail (prior to insertion into the GRID)
- Thermal analysis
  - Match delta T of science raft-to-cryoplate
  - Temperature stability – fluctuations due to varying power of Guider electronics?
- Accuracy/stability needed for sensors with respect to focal plane
  - Height location accuracy of each sensor compared to science focal plane?
  - Need for co-planarity of the 8 guide sensors?
  - X-Y-Theta position accuracy and stability?
  - Required offset from focal plane for WFS: +/- 1 mm or ?
  - Required parallelism of one split surface with respect to the other for WFS?
  - Required parallelism of each WFS with respect to the science focal plane?
- Electronics form factor and schematic
  - What FEE connectors are needed? Number of pins?
  - What FEE-to-BEE cables and cable folding scheme are needed?
  - How are Guider signals ganged in BE to reduce number of Cryostat feedthroughs needed

Backup slides

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Draft Development schedule

Large Synoptic Survey Telescope

Task	Start Date	Duration	Sensors
Conceptual mechanical design finalized	Nov-08	*milestone*	
Mechanical and Thermal analysis	Dec-08	3 months	
Sensor/Raft/Grid/Cryoplate interface definitions	Feb-09	*milestone*	
Mechanical prototype construction	Mar-09	3 months	
Electrical grade components	Nov-08	7 months	mini-OTA
integration w/ mech prototype and testing	May-09	6 months	
2nd version mechanical prototype	Oct-09	6 months	
system integration and testing	May-10	6 months	CCD from prototype order (unlikely), mOTA or engineering grade CCD, prototype CMOS
Final version prototype	Oct-10	6 months	
system integration and testing	May-11	6 months	prototype WFS format CCD, prototype CMOS

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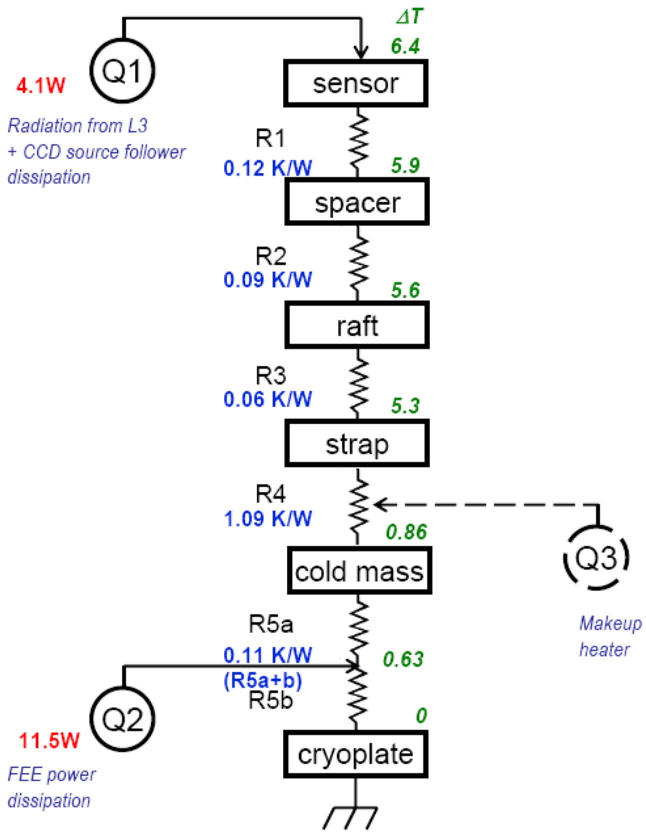
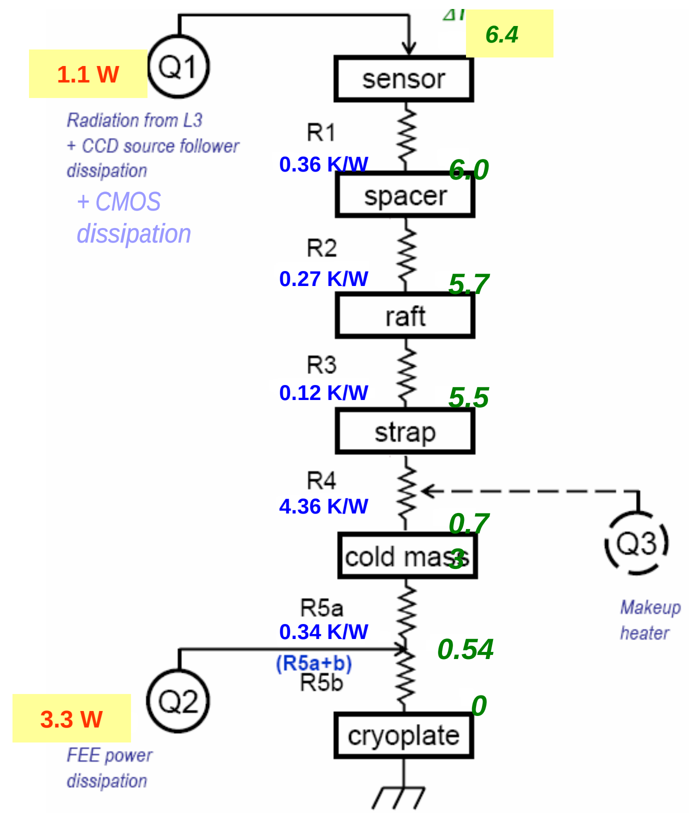
Simplified Thermal Models

1-D model (electrical analog) for first-order calculation of thermal gradients

- Ignore lateral heat flows
- Rn = bulk + interface thermal impedance of component
- Tower cold mass = cooling plates + housing sidewalls
- Strategy: make R4 dominant, keep R5 minimum
- Makeup heater may be necessary to compensate for time variation of L3 and cryoplate temperatures, and for controlled warm-up



Science Raft Tower



Corner Raft Tower