



Readout-telescope interfaces

Amy Bender, Zeesh Ahmed

Previous work

The readout assessment started this conversation:

- Asked to look for challenges/limiting factors in each of the three readout technologies based on current information & LAT/SAT designs.
- [Systems Engineering - 2019 Readout Assessment](#)

Summary... Different challenges with each technology, but no obvious show stoppers. Main challenges:

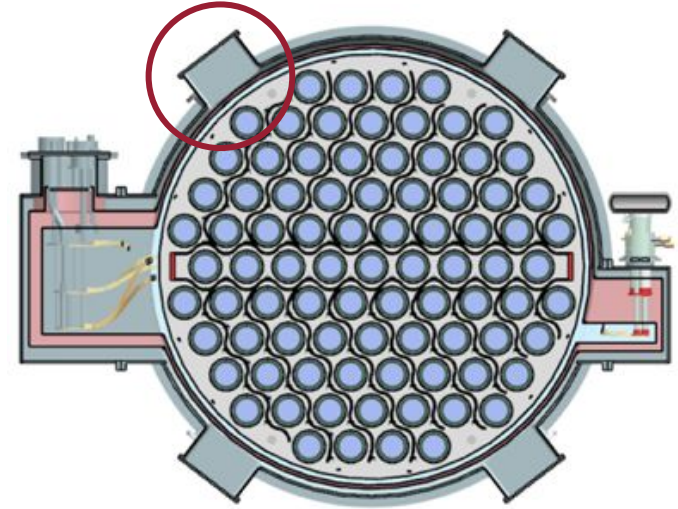
- fMUX: Sub-4K wiring parasitics
- TDM: Physical layout, detailed re-design to understand fit in cryostat and cabin
- uMUX: Systems demonstration

Next steps for systems engineering work:

- MUX numerology
- Detailed physical layout and sizing
- Cryo-engineering

Mechanical Interface Unknowns

- Volumes for readout electronics @ 300K (clearance & fit within telescope/mount)
 - readout crates & cable runs
 - How to do maintenance/swap boards in and out?
 - Whose responsibility is the flange for the wiring harnesses that attaches to the cryostat?
- Volumes/clearance & mounting @ 4K
 - Wire run lengths between different thermal stages (300 K - 100 mK)
 - Where will the heat sinks be?
 - What is the expected heat sink interface
- Number of optics tubes per telescope & number of detectors per optics tube.
 - Rhomboid arrays?
 - Potentially adjust to match mux numerology or vice versa?



Electrical Interface Unknowns

- Connection between cabling inside optics tube/detector module & telescope.
 - Where to connectorize? Filtered connectors?
 - Does readout impose constraints on these connections?
 - How will installation & connection work?
 - Will re-work be possible if we find a problem after installation?
- Power distribution to room temperatures components (readout crates, clocks, fans)
- Grounding scheme & connections throughout cryostat to site ground

Thermal

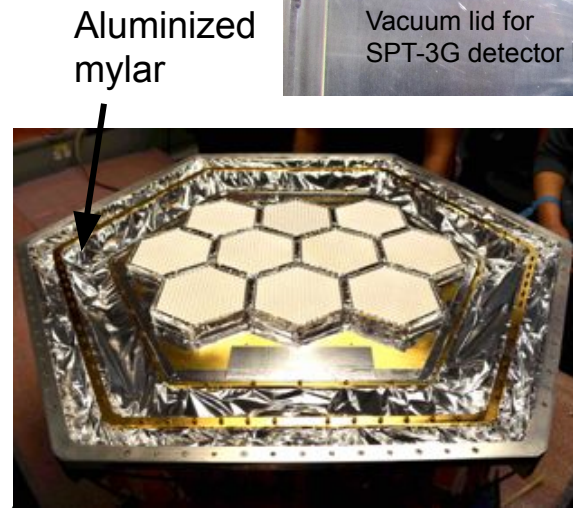
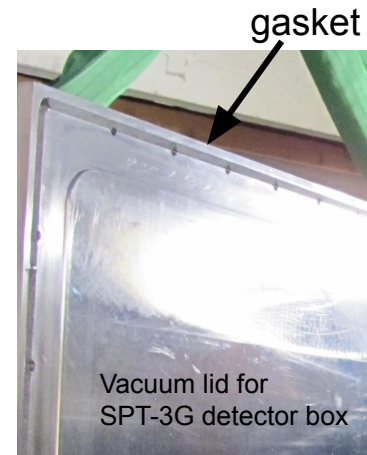
- Heat load budget for each thermal stage
 - Wiring loading
 - Any dissipative components?
 - Should we rebalance any marginal stages?
- Cooling room temperature electronics (are fans enough or do we need to get fancier?)
 - Site specific?
 - Stability requirements on general temperature of environment

Stage	Readout Budget Max	fMUX (68x)	TDM (60x)	uMUX (1000x)
0.1 K	200 μ W	13	51	15
1 K	12.5 mW	0.17	7	0.40
4 K	2 W	2.0	0.8	2.0
40 K	55 W	40	25	50

From readout assessment

Other

- RF shielding
 - Gasketing at flanges
 - Jiffy-pop aluminized mylar shielding
 - What are the cutoffs of the optics tubes?
- Magnetic shielding
 - Some will be part of mux package, but will we have a magnetic shield as part of the larger cryostat?



Peripherals?

- Clock (provided by DAQ)
- IRIG (provided by DAQ if necessary)
- Thermometry readout (whose WBS does this fall under?)
- What peripheral widgets are planned?
 - fiber for any peripheral widgets (provided by DAQ)
 - Need to coordinate to prevent potential contamination of readout
- e-rack space & configurations
- Global power distribution scheme (including any UPS)
- 'Earth' ground distribution

Suggested Meetings & Review Schedule

Need to find opportunity for discussing these items on a regular basis

- Joint meeting once a month?
- Task small sub-group with this role to have the conversations outside regular meetings and then report back to the separate groups?

Design review (?) of

- configuration of optics tubes & detector arrays within telescopes
- Cable routing
- Electronics placement inside & out