

TD spreadsheet - rationale and more
“MKID - Multiplexing factor”
“MKID - Noise (low, white)”
“MKID - Crosstalk”

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Spreadsheet - https://docs.google.com/spreadsheets/d/101ncyzfDAHrTF9O0rTPRGbX6dqut_WdfVA7-2ck9qGQ/edit#gid=0
Evaluation guidance - https://cmb-s4.org/CMB-S4workshops/images/2017_11_30_CMBS4_TDCcombinedNovember.pdf

MKID - Multiplexing factor

Short description: 'Increasing multiplexing factor to level needed for S4 (readout system, frequency, and detector quality dependent)'

	Evaluation/ Status	Rationale
Baseline	routinely > x128, up to x1000 demonstrated	MKID multiplexing factors have been demonstrated up to x1000 on-sky (McHugh 2012) and x4000 in lab (van Rantwijk 2016) on a single pair of coax lines and routinely over x128 in many readout systems including BLAST (Gordon 2016), ROACH2-based in-lab systems, NIKA/NIKA2 (Bourrion 2016). This x1000 should meet the requirement for CMB-S4. There needs to be some implementation (interface, deployment software) done. In addition to the currently fielded NIKA2 instrument, a number of mm-wave instruments, such as MUSCAT, Toltec, SuperSpec, all scheduled for deployment in FY18/19 with ROACH2 readout hardware, will be valuable field demonstrations of the performance in this area. The multiplexing factor for a given system is dependent on resonance frequency, detector Q, desired spacing and more but the demonstrated systems give a good baseline for a range of these parameters.
TD Goal	Baseline	Multiplexing factor of x1000 has been demonstrated (S4 technology book 2017).
Cost reduction [k\$]	0	Baseline demonstrated; no R&D cost required. Estimated cost is \$25,000 per readout system with a x1000 multiplexing factor. Cost reduction compared to TES could be calculated instead of as compared to the technology's own baseline.
Schedule	1	Baseline demonstrated; will not affect schedule
Science Stat	1	Baseline demonstrated; will not affect
Science Sys	1	Baseline demonstrated
Target Completion Date	N/A	Baseline demonstrated
Estimated Investment	0	Baseline demonstrated; no R&D cost required
Likelihood of Success	5	Baseline demonstrated

MKID - Noise (low, white)

Short description: 'What's the readout's contribution to the total noise'

	Evaluation/ Status	Rationale
Baseline	Readout noise is subdominant to KID white noise.	Depending on the number of tones, the amplifier noise or the ADC (van Rantwijk 2016 , Gordon 2016) is the dominant readout noise source. It is routinely subdominant to the KID white noise. How far it is suppressed depends on the exact readout system and detectors but it is typically below <10%. This has been measured in-lab as it requires a large bandwidth to see the amplifier noise.
TD Goal	Baseline	Demonstrated
Cost reduction [k\$]	0	Baseline demonstrated; no R&D cost required
Schedule	1	Baseline demonstrated; will not affect schedule
Science Stat	1	Baseline demonstrated; will not affect
Science Sys	1	Baseline demonstrated; should not affect systematics
Target Completion Date	N/A	Baseline demonstrated
Estimated Investment	0	Baseline demonstrated; no R&D cost required
Likelihood of Success	5	Baseline demonstrated

MKID - Crosstalk

Short description: 'between MKID (optical or readout?)'

	Evaluation/ Status	Rationale
Baseline	-20 dB	Crosstalk comes from multiple sources including from optical signals and from the readout. Optical crosstalk is heavily dependent on the optical coupling scheme. Approximately 10 linewidths are needed to achieve a crosstalk level of -25dB (Bisigelloa 2016). Electrical/readout crosstalk: The SpaceKIDs project demonstrated that, with appropriate design, interpixel cross-talk originating from parasitic EM coupling can be reduced to below the -30 dB level (Bisigelloa 2016). Optical crosstalk: In-lab measurements of total crosstalk (readout and optical) show <-20 dB with horn coupling (McCarrick 2017) at an effective 90 K load and negligible CMB experiment-like loading. In addition, interpixel optical cross-talk can be effectively reduced with the addition of a stray-light absorbing layer (Yates 2017), that also doubles as a cosmic ray mitigation layer (D'Addabbo 2014).
TD Goal	Baseline	<.3% (or -25 dB) is cited as a requirement in (Dober 2017). There is no number given in the S4 technology book as far as I can tell.
Cost reduction [k\$]	0	Baseline demonstrated; no R&D cost required
Schedule	1	Baseline demonstrated; will not affect schedule
Science Stat	1	Baseline demonstrated; will not affect
Science Sys	1	Baseline demonstrated -20 dB; going lower would only help
Target Completion Date	N/A	Baseline demonstrated
Estimated Investment	0	Baseline demonstrated; no R&D cost required
Likelihood of Success	5	Baseline demonstrated