

Cold Elec. in Milano: updates and plans

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Electronics WG Meeting

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Requirements?

- Design of the amplifier for FBK SiPMs presented at the general meeting:
<https://indico.fnal.gov/event/21445/session/18/contribution/185/material/slides/0.pdf>
- The numbers we have in mind now... to be discussed and/or corrected!

Parameter	Number	Note
S/N ratio	> 4-5 (which?)	With 48x 6x6 mm ² SiPM Also depends on SiPM overvoltage: trying to obtain the largest margin here
Amplifier noise	0.4 nV/√Hz	Measured at 77 K
Bandwidth	> 3.5 MHz (risetime < 100 ns)	To ≈ match performance of Gustavo's amp Is there a strong requirement on timing?
Power supplies	Now +3V / -1V	The THS4531 works with Vcc-Vee=5V maximum The outputs in our design sit around 1 V, so +3V/-1V is symmetric Can be modified to work with a single supply (e.g. +5V).
Output voltage range	≈ same as power supplies	Opamp is almost rail to rail. Should be adjusted to match DAPHNE/SSP input stage (assuming no intermediate stages are used) → This, combined with dynamic range, will define the gain of the amplifier
Output lines	Differential, 100 ohm, CAT6	From conversation with Gustavo months ago, is this still up to date?
Dynamic range	1-2000 p.e.	Fixed; from F. Terranova's slides (24 sep 2019)
Amplifier gain	?	Will be constrained by dynamic range + output voltage range
Power consumption	Now 2.5 mW On area ≈ 1 cm ² → 0.025 mW/mm ²	< 0.1 mW/mm ² to avoid bubbling in LAr (source: Deywis's mail referring to https://lbne2-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=2415) Depends on area, i.e. PCB layout; there should be margin

Next steps

- We are developing the cryogenic amplifier optimized for the FBK NUV-HD-Cryo. Four sensors already in Milano Bicocca and Bologna, although not optimized for DUNE, yet.
- In the next six months, we will have NUV-HD-Cryo from FBK and HWB from Hamamatsu developed for DUNE (see F. Terranova's talk at the Collaboration meeting) to validate the amplifier design and perform systematic comparisons.
- We'd like to test the entire chain (48 SiPM → cold amplifier → warm electronics) with the SSP already in use in Milano and with the DAPHNE board.
We hope to perform systematic comparisons between the full chain based on FBK and Hamamatsu sensors + DAPHNE (and SSP) board as soon as DAPHNE will be available.

Thanks!