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CNSRT@listserv.fnal.gov> **Cc:** DEYWIS MORENO <deymoreno@uan.edu.co>, Giovanni Franchi
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Subject: Re: [Electronics] DUNE PDS Consortium Electronics WG Meeting Thursday March 1 at 12PM CT

Dear all,

As preamble to the meeting, here are a few thoughts on establishing priorities related to the ganging question.

1. To make a convincing argument for R&D funding (from the US project) this year; to be credible in the LBNC review this summer; and to have a solid proposal for the TDR, we will need to relate whatever we propose to do in the next year to the PD system performance requirements.
2. The PD requirements are being revisited, but a change will require a proposal to the Collaboration that would need to be reviewed and approved, which will take some time. If we wait for that we may run into schedule credibility concerns, we should at the least address the following questions with the current requirements as a guide.
3. Currently available SiPMs are limited to sizes far below the spatial granularity justified by the physics (and by cost and other practical considerations), so some form of ganging is required.
4. Passive-ganging is the most straightforward and robust technical solution. It requires no additional active components in the LAr and requires the least time and funding to develop. So, a priority is to demonstrate how far this approach can be pushed and still meet the performance requirements.
 - a. For example, can the current configuration of 12 SiPMs used to read out the bars meet the requirements with passive ganging?
 - b. What is the maximum number of ARAPUCA cells that could use passive-ganging.
 - c. How dependent is the result on the specific SiPM? We could discuss optimization with the vendor(s).
 - d. (Harder) Can we characterize the impact on physics reach as a function of the ganging level?
5. Development of active-ganging to enable a higher ganging-level would need to be justified quantitatively (at some level) *a priori* in terms of passive-ganging failings with respect to achieving the performance requirements OR other considerations such as:
 - a. Reduced PDS impact on other systems (e.g. cable runs in the APA, feedthroughs).
 - b. Reduced overall PDS cost from reduced channel count (electronics, cables).
 - c. Enables higher efficiency photon collector that requires more SiPMs (e.g. ARAPUCA, WLS-coated SiPMs).
 - d. Enables higher performance if the summed signal is also amplified (and add-on to the summing justified separately).

- e. It is possible with identifiable personnel and funding resources to demonstrate a robust solution on the TDR timescale.
- 6. Both options will need to discuss robustness with respect to device/component failures e.g. how much PD capability do we lose in the case of SiPM or op-amp failure? That may become a direct tradeoff between cost and robustness. We will need to show that we have a way to estimate this.

There are likely plenty of other considerations, but these point to a near term priority for a definitive conclusion on passive ganging and quantifying the potential benefits of active-ganging. These will be powerful arguments for securing funding for an R&D program.

Just my two (hundred million) cents worth.

Bob