

Drafting the «basic» paper

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A two-step analysis

Outcome of the 60% readiness review of the PDS

- The preliminary results of the Xe run are very promising
- It is likely that the Run II will be carried out in Xe-doping mode (10-20 ppm) **provided that the results are confirmed**
- This decision may have different impacts on the X-Arapuca:
 - (conservative) Use the baseline X-Arapuca
 - (more effective) Re-tune the dichroic filters to increase the light collection efficiency and fully benefit from the Xe doping
- Show the results to get feedbacks from the rest of the LAr community since they are quite unexpected

Tentative proposal

Perform a two step analysis corresponding to two different papers:

- A “basic” paper that ground the decision to run with Xe in Run II to be published by november 2020
- A more complete paper(s) to discuss the physics of Xe doping observed in ProtoDUNE

Basic paper

- Aimed at JINST as a regular article or a technical note
- Contain all the information of relevance for DUNE to support the Run II with the Xe doping
- Should provide information relevant to the whole LAr community:
 - Techniques for the doping (10-100 ppm) of large volume of liquid argon
 - Issues encountered (e.g. SF₆ contamination) and effectiveness of the solution
 - Xe doping as a nitrogen contamination recovery plan
 - Performance (see below)

Do we have what we need?

- Techniques for the doping (10-100 ppm) of large volume of liquid argon. **Yes**
 - Description of the X-Arapuca setup **Yes**
 - Description of the ProtoDUNE PDS and Xe injection **Yes**
- Issues encountered (e.g. SF₆ contamination) and effectiveness of the solution. **Yes**
- Xe doping as a nitrogen contamination recovery plan. **Yes with some caveats**
- Performance: see below

Performance

- Cosmic ray trigger: **OK** except for the events with low p.e. (not strictly needed for this paper but not well understood)
- Basic tools: waveform with and without deconvolution **OK**. We need to quote one single algorithm if we want to show a light spectrum. **Suggestion**: we do not understand some subtler issues as the reduction of the fast component the 150ns component, the fast component in quartz. So, the spectrum should be illustrative but we will postpone these analysis in a physics paper, maybe together with ProtoDUNE-DP
- Description of event selection in X-Arapuca **OK**, Arapuca **OK** and bars **in progress** (see Dante's talk today)
- **First main result**: ratio quartz/noquartz as a function of doping in the X-Arapuca **OK**
- **Second main result**: Uniformity of the Xe distribution in ProtoDUNE **in progress**
- **Third main result**: Xe doping up to 100 ppm does not deteriorate the charge reconstruction. **OK but we need to quantify this statement**

Draft of a TOC

- Introduction: advantages and opportunities of Ar-Xe mixtures for large volume LArTPCs and DUNE
- The PDS of ProtoDUNE-SP and the X-Arapuca telescope
- The Xe-doping run
- Analysis and Response of the X-Arapuca telescope. **Here we can put the first main result (ratio versus doping)**
- Analysis and response of the ProtoDUNE-SP PDS. Here we can put the second main result **(uniformity of Xe distribution)**
- The run with electric field: quality of the track. Here we can put the third main result **(compatibility of doping with TPC performance)**
- Conclusions and perspectives