

Overview of ProtoDUNE Data Reconstruction and Analysis (DRA) Status

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ProtoDUNE-SP Data Exploitation Readiness Review

Introduction

- The ProtoDUNE-SP DRA group is actively engaged in development of software and analysis tools in preparation for the ProtoDUNE data taking and analysis.
- The DRA group is leading efforts on 4 interconnected topics

DRA
G. Christodoulou,
T. Yang

**Data quality
monitoring**
B. Baller

**TPC and PD
reconstruction**
L. Whitehead

**Detector
Calibration**
M. Mooney

**Physics
Analysis**
S. Bordoni

Documents and Presentations

- Two documents
 - Overview of Data Readiness Status - [DUNE-doc-8145](#)
 - Raw data decoding, DQM, detector calibration, analysis plans
 - Overview of reconstruction software - [DUNE-doc-8127](#)
 - Details of reconstruction tools
- 3 presentations at this review
 - Overview of Analysis Plans - Stefania Bordoni
 - protoDUNE-SP Data Quality Monitoring - Maxim Potekhin
 - Overview protoDUNE-SP Reconstruction Performance - Leigh Whitehead

Data Quality Monitoring (DQM)

- Leader: Bruce Baller
- Goals
 - Monitor detector performance
 - Provide good run list, bad channel list, detector performance measurements
- Infrastructure development - Maxim Potekhin
- Payload development
 - Lifetime - Bruce Baller
 - Signal-to-noise ratio - Bruce Baller
 - TPC monitoring - Tom Junk, David Adams
 - Event display - David Adams
- More details in Maxim and Stefania's talks and [DUNE-doc-8145](#).

Reconstruction

- Leader: Leigh Whitehead
- Goals
 - Provide reconstruction tools for data calibration and physics analysis
 - Optimize existing algorithms to meet ProtoDUNE requirements
- Reconstruction chain
 - Raw data decoding: Tom Junk, Jingbo Wang
 - Data preparation: David Adams, Xin Qian
 - LineCluster/TrajCluster: Bruce Baller
 - PMA: Leigh Whitehead
 - Pandora: Steve Green
 - Wire-Cell: Xin Qian
 - Calorimetry: Tingjun Yang
 - Photon detector reconstruction: Alex Himmel
- More details in Leigh's talk and [DUNE-doc-8127](#)

Detector Calibration

- Leader: Mike Mooney
- Goals
 - Remove electronics nonlinearity and variations in detector response
 - Determine energy scale
- Calibration chain
 - Noise level measurement - Mike Mooney
 - Electronics calibrations - Mike Mooney
 - Space charge effect calibration - Mike Mooney
 - CRT-TPC matching - Arbin Timilsina
 - Calibrations with cosmic ray muons - Ajib Paudel
 - Calibrations with ^{39}Ar - Mike Mooney
 - Calibrations with Michel electrons - Aidan Reynolds
- More details in Stefania's talk and [DUNE-doc-8145](#)

Physics Analysis

- Leader: Stefania Bordoni
- Short-term goals to provide useful information for DUNE TDR
- Long-term goals to measure cross-sections and π^0 mass etc.
- Contact person between DRA and beamline instrumentation groups: Pablo Fernandez
- More details in Stefania's talk and [DUNE-doc-8145](#)

Some Review Questions

- Is the proposed scope of the ProtoDUNE-SP data analysis program aligned with the needs of the DUNE project? Are the proposed timescales for ProtoDUNE data analysis consistent with their exploitation by the DUNE project and its design efforts?
 - We have short-term plans to provide information on detector performance and calibration to be included in DUNE TDR. We have long-term plans to make more sophisticated measurements.
- Do the algorithms that have been developed or are planned for development, meet the needs of the planned scope of the ProtoDUNE-SP program?
 - See Leigh's talk and [DUNE-doc-8127](#).

- Does the data quality monitoring system, in terms of both underlying the infrastructure and the routines/payloads for assessing detector performance, meet the requirements and have appropriate scope to fulfill the needs of the ProtoDUNE-SP program? Are the infrastructure, visualization layers, and analysis routines on track for detector commissioning and beam running?
 - See Maxim and Stefania's talks and [DUNE-doc-8145](#).
- Do the software tools for calibrating the detector meet the requirements and have appropriate scope for the ProtoDUNE-SP program. Are these efforts on track for detector commissioning and beam running?
 - See Stefania's talk and [DUNE-doc-8145](#).

- Do the software tools for assessing detector performance meet the requirements and have appropriate scope for the ProtoDUNE-SP program. Are these efforts on track for detector commissioning and beam running?
- We have been developing tools to measure the electron lifetime, pedestal RMS, signal-to-noise ratio, etc. in the DQM group. See Stefania's talk and [DUNE-doc-8145](#).