

Snowmass TDAQ (IF04): Rewakening

Darin Acosta (Rice), Wes Ketchum (FNAL), and
Stephanie Majewski (Oregon)

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TDAQ Challenges

Next generation of detectors places many challenges on Trigger and DAQ

- Large data throughput
- High reliability and performance in extreme environments
- Fast timing and precise synchronization, even across large distances

We should consider advances on many possible lines

- Novel improvements on existing technologies and techniques
- Exploring and advancing emerging technologies
- Integration of TDAQ requirements, capabilities, and possibilities, into R&D efforts across instrumentation frontier and future detector design

Who we are (in case you forgot)

- Darin Acosta
 - Rice University, Department of Physics
 - CMS experiment, Level-1 muon trigger, Trigger co-coordinator
- Wes Ketchum
 - Fermilab, Scientific Computing Division
 - MicroBooNE, SBN, and DUNE experiments, LArTPC DAQ and *artdaq* framework
- Stephanie Majewski
 - University of Oregon, Department of Physics
 - ATLAS experiment, HL-LHC TDAQ upgrade (Global Trigger and EF Tracking)

Where we left off

We had around 30 LOIs reference TDAQ (IF04) covering wide range of topics

- Data links and readout
- Real-time processing hardware
- Triggering techniques/algorithms
- AI/ML applications to TDAQ
- Experiment/detector-specific DAQ needs (often novel/challenging!)

Additionally some good discussion on related and different topics in workshop prior to LOI submissions

- See summary minutes
<https://docs.google.com/document/d/17Bqt2NUEWjjmTtOYp6YqVAGdYD4JhHc3SiSpWtKm4M4/edit?usp=sharing>

Looking ahead to white papers

Many LOIs indicated plans to work towards a white paper

Additionally, there are many common trends, and so great opportunity for common white papers to facilitate broader community input

We also anticipate/hope during the 'break' that there may be new ideas/perspectives that could be contributed

Our first 'reawakening' priority is to support plans for white papers from the TDAQ community

Possible Common White Papers

“Artificial Intelligence and Machine Learning in Trigger and DAQ”

- Big and popular topic, so depending on community feedback consider split to two white papers? e.g. “AI/ML at the edge” and “AI/ML in High-level triggers, event-filtering, and detector control”
- Work closely with IF07 (especially on the former) and computing frontier (especially on the latter)

“Innovating Trigger and DAQ for the next generation of detectors”

- Include TDAQ architecture and infrastructure (e.g. streaming DAQ), fast computation on heterogeneous computing, fast timing, trigger-aware ASIC development (work with IF07)
- Natural place for ideas not specific to AI/ML (e.g. fast tracking triggers, fast spectral analysis), and a way to tie-in needs of future experiments

“Readout technologies for future detectors”

- Include wireless readout, rad-hard links, multiplexed high-speed readout (with IF07)

Next steps and contact

Plan for a general TDAQ meeting (target: 19 Oct @ 2pm CT / 12pm PT) to welcome everyone back and hear status and plans

- Discuss community white papers, and organize those efforts (e.g. identify editors, facilitate meetings, etc.)
- Hear plans and status on white papers, based on both existing LOIs and new ideas

Make sure you're signed up to get updates!

- Snowmass wiki: <https://snowmass21.org/instrumentation/trigger>
- Email list: SNOWMASS-IF-04-TDAQ@FNAL.GOV
- Slack channel #if04-tdaq (at snowmass2021.slack.com)

Backup