ProtoDUNE DAQ Risk Register

General risks

Here are outlined some of the general risks to the experiment. These are not specific to the DAQ but we list for completeness. The impact of most of these risks is that it incurs a delay to the schedule.

- Availability of expert personnel
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- Delays in hardware supply chain or production
  - DAQ Hardware Schedule has adequate contingency
  - if needed, testing can proceed with prototype hardware
- Grounding
  - DAQ hardware will be on building ground – all connections to the detector will be through optical fibre
- Hardware failures
  - DAQ will provide spares at CERN and on-site expert support throughout running period
- External Interfaces
  - Detailed specs (physical links, connectors, protocols, information content)
  - Continuous interaction between sub-system leaders AND detailed work sessions with sub-system specialists
- Internal Interfaces
  - New timing system to be integrated with trigger and many endpoints
  - Detailed specs and regular meetings
  - Continuous integration testing!
- Resources
  - We are confident that the people and institutions that committed to the DAQ will deliver on their components
  - Sufficient effort will be needed @CERN to ensure smooth integration, commissioning, tuning, operation
- Delays to EHN1
  - Any delays to the readiness of EHN1 for DAQ installation and integration could seriously affect the schedule for APA testing.
  - Other areas at CERN are available which can be used for DAQ installation and testing, however installation followed by movement and installation is considered undesirable and has an associate risk itself.
- High noise affecting RCE compression
  - Effective compression relies on a reasonable signal-to-noise ratio. If this is too low the compression may become ineffectual.

    - Several compression schemes are being tested for both low and high noise scenarios. The overall data size could be compensated by reducing the inter-spill data taking, and reducing the drift margin (currently taking 2x drift time).
- New critical hardware components
    - Example: WIB - If the WIB is late it hampers our ability to test the front-end and prepare for APA testing. A mitigation is to use WIB-emulator where possible.

DAQ Specific Risks

These risks are specific to DAQ. In general, the risks are low, have contingency and/or can be solved by diverting manpower or funding.

- Backpressure
    - Extensive testing will be put in place to avoid backpressure where possible and monitor it should it happen. To restrict the effects of backpressure, buffers can be reset at the end of the spill cycle – ensuring that the system is always in same state at start of spill. A software trigger throttle will also be put in place to lower the trigger rate to compensate.
- Data Quality Monitoring
    - A lack of manpower actively working on this area exists.
    - The basic 35t monitoring software exists as a backup solution. Incorporating frameworks from other LAr experiments is also a possibility.
- Channel mapping
    - This must be established early to avoid mistakes in the data interpretation. It can lead to incomprehensible data, and is very difficult to fix on the spot. Appropriate use of labelling, database tracking, verification of channel mapping with pulse injection is essential.
- Merging of BI data fragment with PD may fail if PD nearline/prompt processing cannot sustain the delay due to end-of-cycle BI buffering.
    - BI data are always logged on the CERN logging system. Offline retrieval of information is painful but possible
- CPU/Storage/Network under-dimensioned
    - Additional *artdaq* processes can be configured, within reason
    - Full network not needed until all the detector units are installed in the cryostat
    - Apply more financial resources
- Immediate/urgent needs during commissioning to “get something working” lead to incoherent operation plan
    - Always a risk for downstream software components
    - Mitigating by…
        - Relying on solid, developed, scalable, flexible frameworks
        - Establishing system control/monitoring design with clear interfaces
        - Delivering working test system as template/guide for further development

        - Maintaining good communication across DAQ groups on needs and integration

- Difficulties in FragmentGenerator development
    - Assistance from *artdaq* team
- Integration issues with new features or new electronics
    - Support from *artdaq* team