SNEWS Input to DUNE FD Trigger

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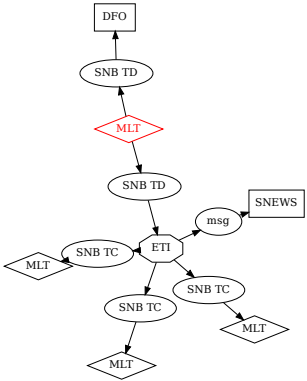
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Topics

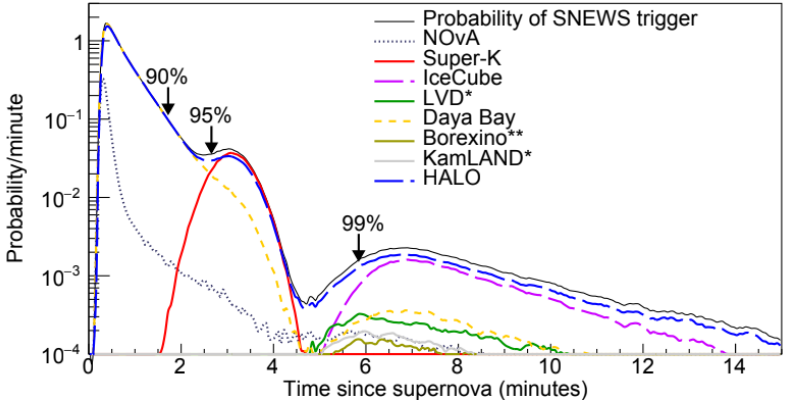
- Reminder of nominal DUNE SNB self-trigger and readout
- Latency for SNEWS as trigger source
- Scenario for delayed SNB trigger candidates
- Limitations on delayed trigger rate

Nominal DUNE DAQ SNB self-trigger and readout

1. **Trigger**: **MLT** produces **SNB TD**.
   - Rate $\approx 1/\text{month}$ with latency $\ll 10s$.
   - Send **SNB TD** to **Dataflow** and to **ETI**.
2. **Dataflow** receives **SNB TD** from **MLT**,
   - Initiates streaming from **Readout** to **Offline**.
   - Streaming 100 seconds of 4xHD data out to 100 Gbps requires > 10 hours.
3. **ETI** receives **SNB TD** from **MLT**
   - Convert to **SNB TC**, send to other **MLT**s.
   - Convert to **SNEWS** input message, send to **SNEWS** server.



SNEWS: SNB-to-alert latency



(Matt Strait via Alec Habig)

SNEWS itself is fast but must wait $> \mathcal{O}(\text{minute})$ for experiments to report in.

- The current DUNE DAQ design can not meaningfully ingest SNEWS alerts.
- **So, what might we change?**

How may DUNE benefit from SNEWS input?

Basic idea:

*Augment the nominal SNB self-trigger with another SNB self-trigger that is "**lower threshold, higher rate, lower purity**" and apply **post-hoc veto** in the **absence of subsequent SNEWS alert**.*

- Allows catching "marginal" SNB that SNEWS reports but that DUNE would otherwise miss.
- Requires augmenting the design for **Trigger**, **Dataflow** and **Readout** and **Offline** to support **canceling a previously initiated SNB stream**.

New SNB Trigger elements

ETI will send a new TC to MLTs:

snb-snews produced on receipt of a SNEWS alert.

MLTs will provide these TDs:

snb-high the nominal, self-triggered SNB TD, tuned to mean rate of 1/mo.

snb-low a new "low threshold", self-triggered SNB TD, exclusive of **snb-high**, with some faster mean rate $> 1/\mathrm{mo}$.

snb-low-confirm formed when **snb-snews** TC received w/in XXX minutes of raising **snb-low**.

snb-low-cancel formed if XXX minutes pass with not **snb-snews**.

All new TDs accepted by Dataflow.

- Only **snb-high** TD will be sent to ETI (as usual).

Reactions to snb-* TDs

snb-high **Dataflow initiates dump and stream** with **Readout**.

snb-low **Dataflow initiates dump** with **Readout**.

snb-low-confirm **Dataflow initiates stream** with **Readout**.

snb-low-cancel **Dataflow terminates stream** with **Readout**.

- Usual "okay to cleanup dump" notifications in there somehow.
- The **stream** is between **Readout** and **Offline** in the DAQ design[1]. And so, **Offline** also requires some notice of a "cancel" so it may clean up.
- **Readout** must be robust against stream termination in any case, so **Readout** should need no design changes to accommodate stream termination.

[1] Streaming was in the draft of the DAQ System Design doc. Could simply stream to DAQ output buffer disk and then only inform Offline to pick up files if stream not intentionally terminated.

How low (threshold) do we go?

"Probably SSD endurance sets the limit", Alec Habig.

- Today SSD's have something like $\mathcal{O}(1000\times)$ write endurance.
  - according to random Google Search results.
- Nominal DAQ SSD capacity allows 4 SNB dumps.
- Assume 4000 dumps over 10 year service life.
  - Giovanna, "SSDs spec'ed for 3 writes per day for 5 years".
- $\Rightarrow$ **snb-low rate** limited to $\lessapprox 1$ per day.

Some SSDs will fail due to 1/mo **snb-high** dumps. Ongoing replacement should be expected in any case. Frequent **snb-low** dumps will require higher replacement rate.

Dynamic impact on DAQ due to 1/day SNB dumps

Essentially, every **snb-low** will be followed by an **snb-low-cancel**.

- But not before a full dump to SSD is complete.

Can tune “XXX minutes” delay before **snb-low-cancel**/**snb-low-confirm**.

- Unconfirmed **snb-low** dumps need never leave the SSDs.
- Confirmed **snb-low** dumps will be **far more rare** than **snb-high**!

Summary

- DUNE DAQ (as-is) can not meaningfully accept SNEWS input.
- We may exploit SNEWS with new “low-threshold” SNB self-trigger to kick-off SNB dump followed by an ACK/VETO based on receiving a SNEWS alert (or not).
- Minor extension to DAQ design required in Trigger and Dataflow.
- Maximum 1/day mean “low-threshold” SNB dump rate, driven by SSD endurance and guesses at reasonable service life.
- Addition resource burdens are confined to the SSDs.

TBD: threshold and rate expectations from SNB physics and background.