



L1 Timing constraints and trigger protocol proposal in HERD beam test 2022

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L1 Timing constraints

CALO Items	latency/ns	PSD items	latency/ns
PMT transit	~50	PSD transit, beta-chip Electronics, Cable latency	~75
Front electronics	~25		
Alignment compensation	~10		
Back trigger logic	~80		
Cable latency	~20		
summary	~175		

- It's better that veto signal arrives within 75ns after the event hit

- Veto threshold should be adjustable to distinguish high-Z particle

- Logic: when an event is over threshold, there's a pulse

CALO PMT:

PMT transit FEE latency Alignment Back logic Cable

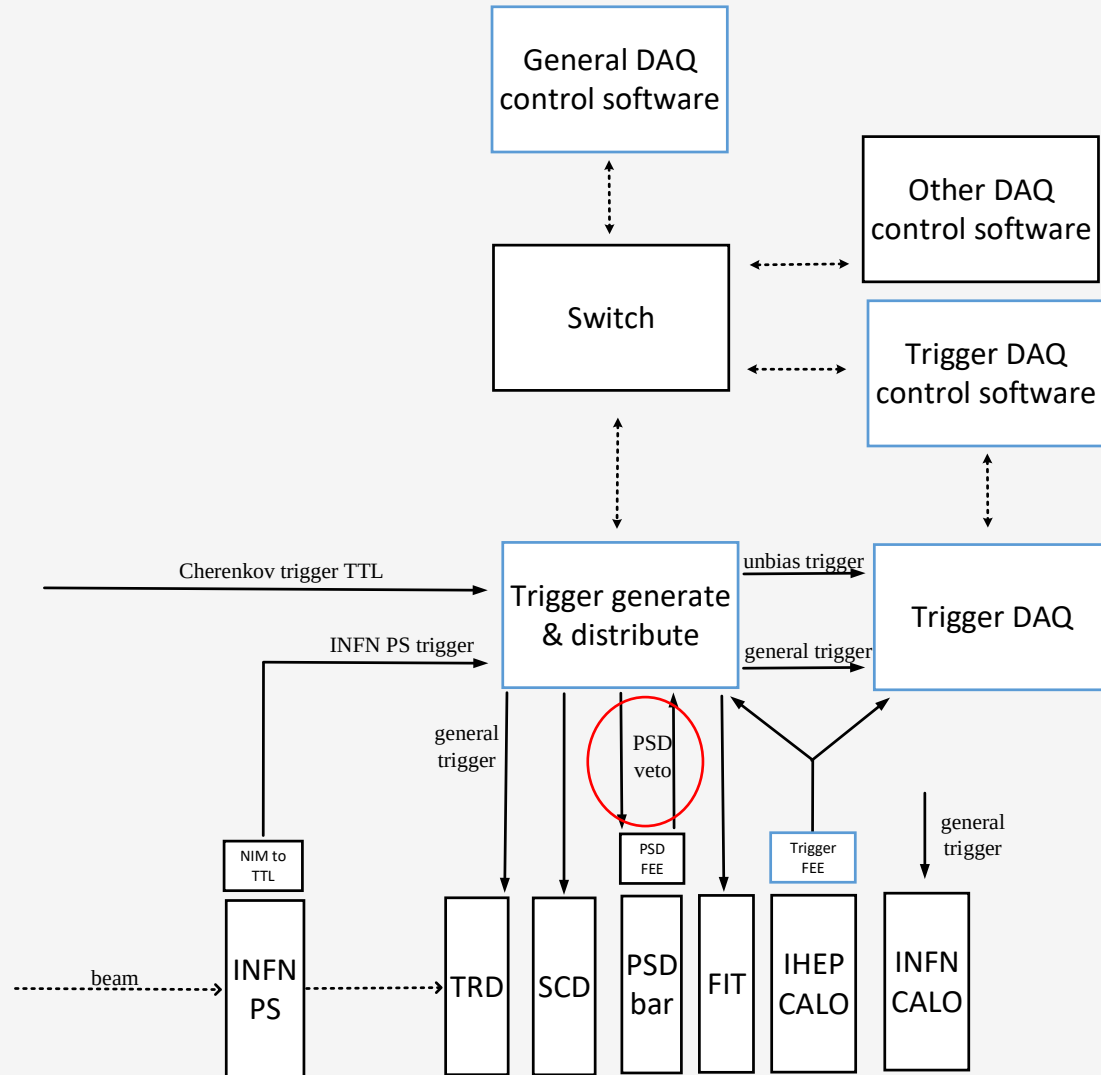


PSD:

transit Electronics cable

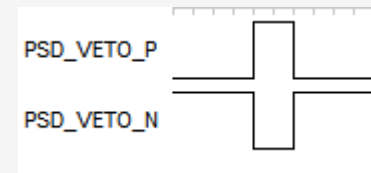
- Latency alignment: we need some extra beam time for PSD & CALO alignment

Trigger protocol proposal :MLVDS option



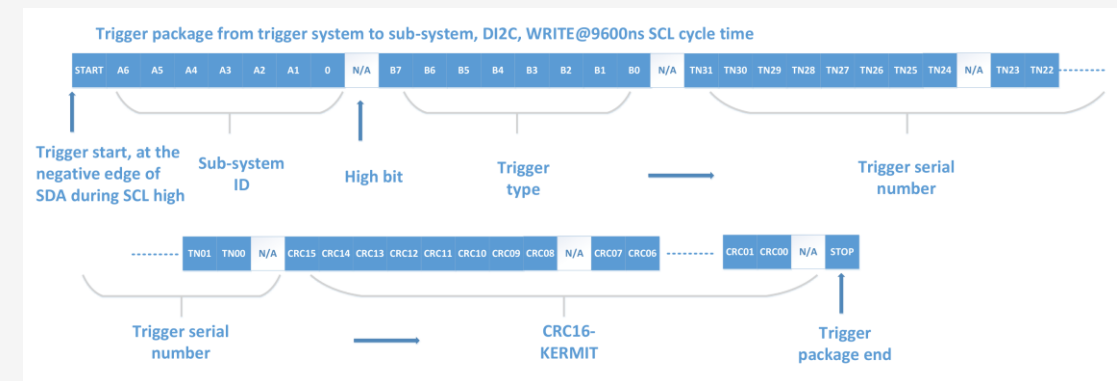
Veto from PSD FEE to master trigger

- MLVDS or LVDS, Pulse width=200ns



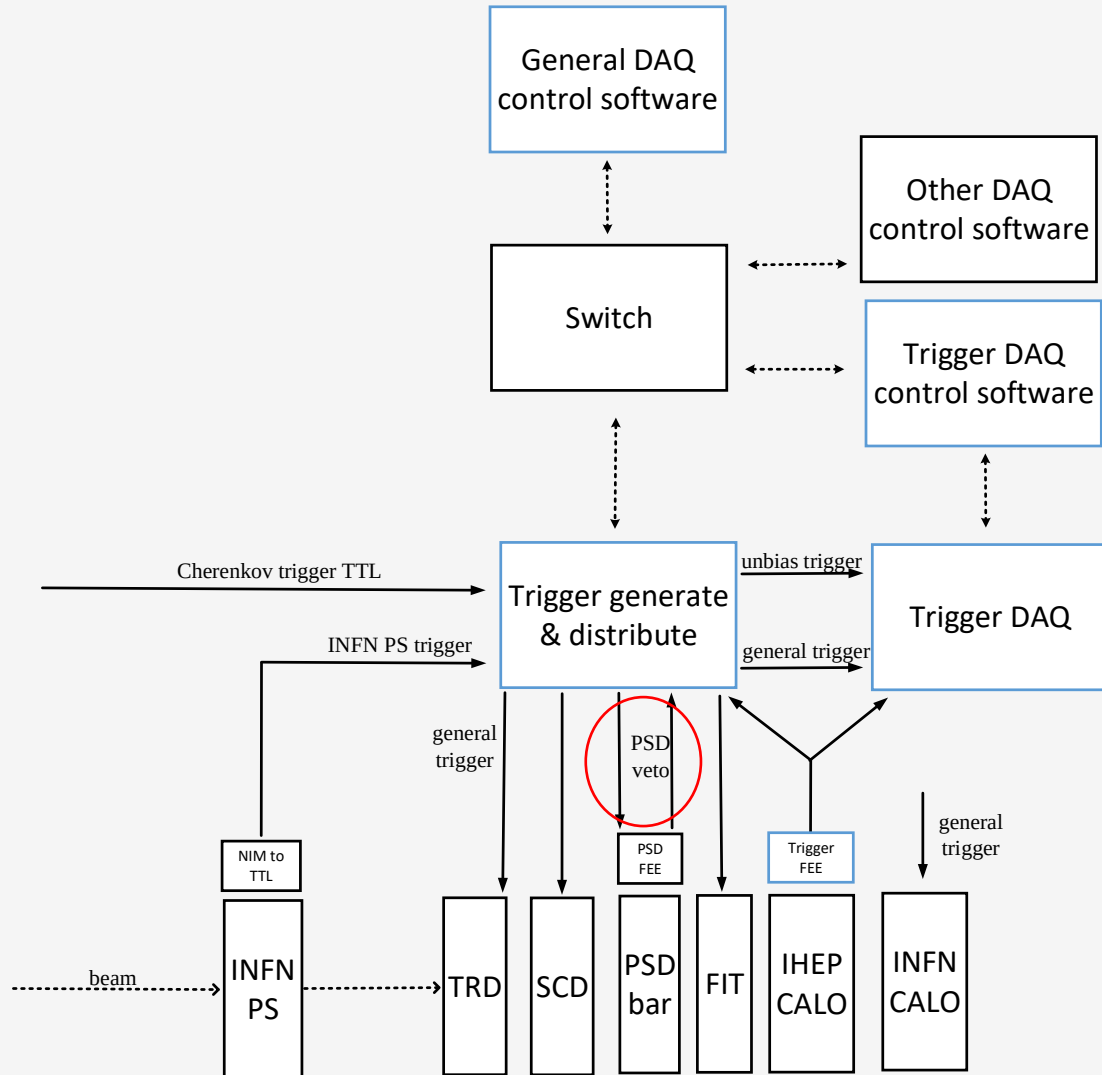
Master trigger to PSD DAQ

- DI2C, the same configuration as 2021 beam test



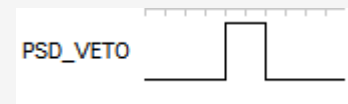
"Trigger synchronization reference design for HERD_2021_beamtest"
"HERD master DAQ example code and document"

Trigger protocol proposal: TTL option



Veto from PSD FEE to master trigger

- TTL Pulse width=200ns

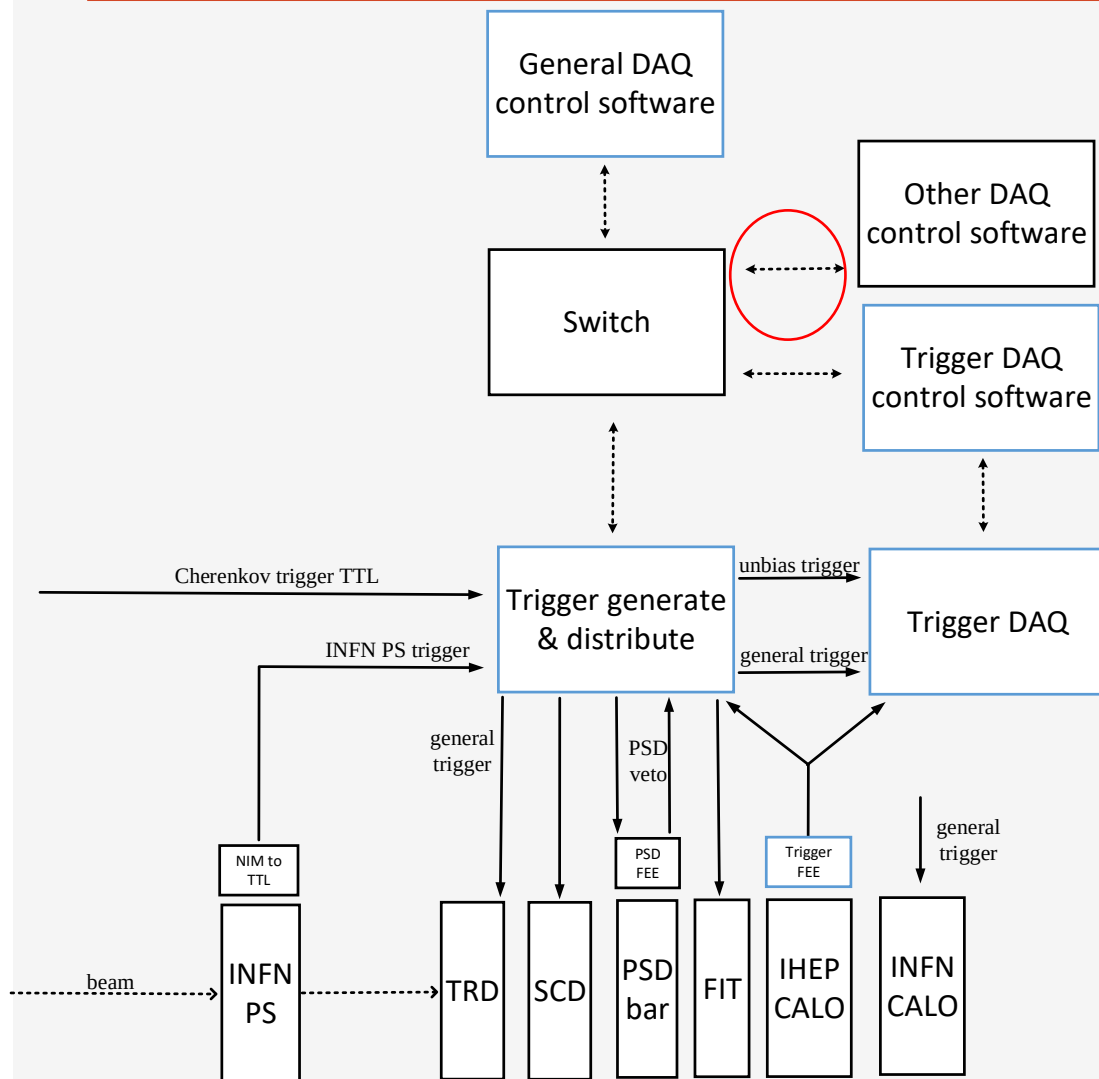


Master trigger to PSD DAQ

- TTL Pulse width=2us, the same as 2021 beamtest



DAQ protocol proposal



command to start or stop DAQ

- TCP command, the same as 2021beamtest
- `const char* start = "FF800008 <run number> <trigger type> EE000001 <unix time>";`
- `const char* stop = "FF800008 <run number> <trigger type> EE000000 <unix time>";`
- File name: `<sub detector>_<run number>_<trigger type>_<unix time>.root`
example: `PSD_RUN21_BEAM_20211009_121251.root`
- "BEAM" for the BEAM run, we use hex "0001" in the command
- "CAL" for the CAL runs, we use hex "0000" in the command