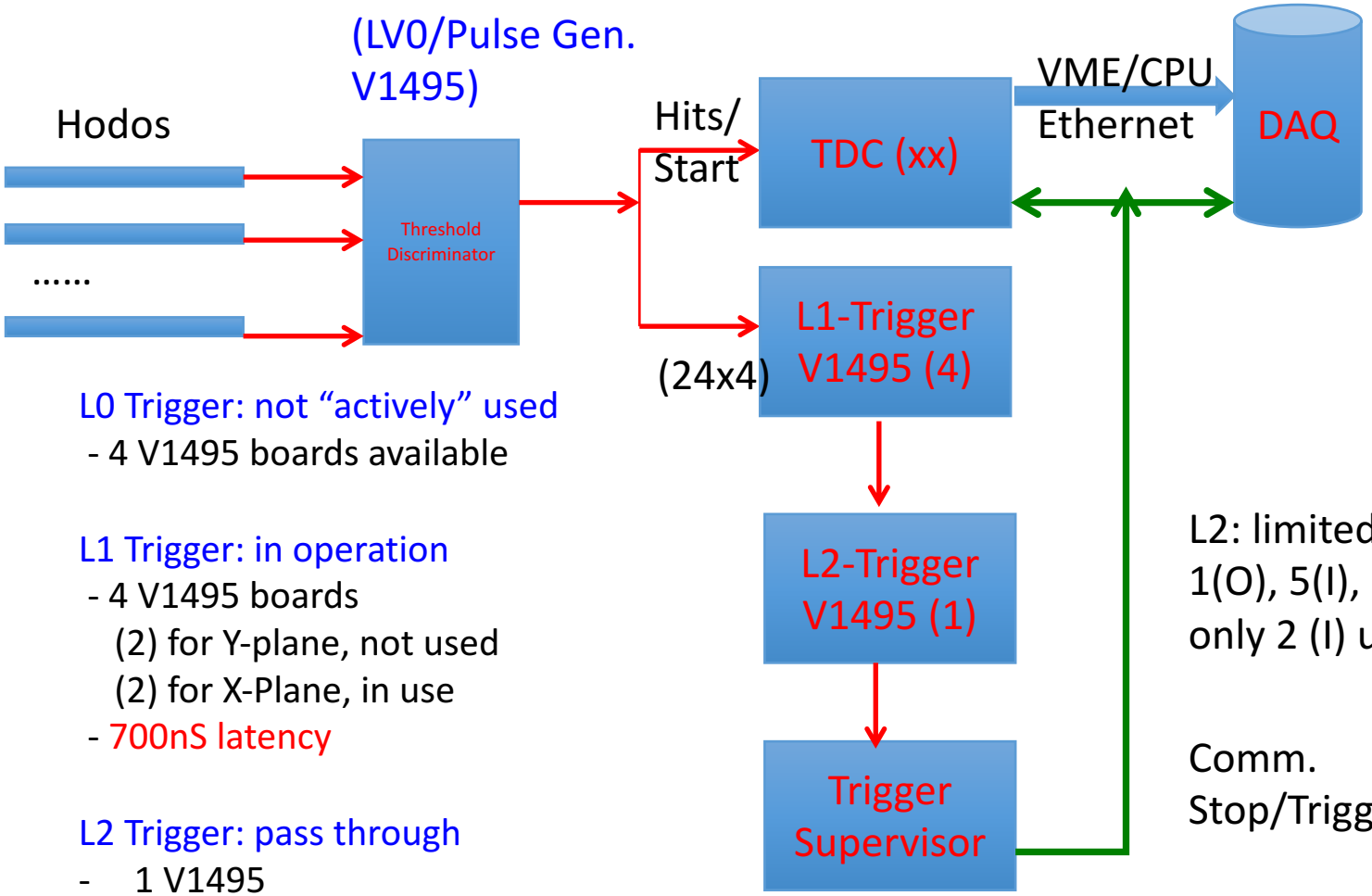
Dark Photon Trigger Upgrade

- Detector
  - Extruded scintillators
  - Y11 WLSF (two fibers per channel; d=1mm and 1.5mm)
  - Fermilab preamp readout, from one end only
  - SMA-Lemo patch panel
- Lemo cables from preamp to LeCroy 4413 discriminators
  - About 520 channels in total
  - To TDCs and V1495 boards
  -
- V1495 based trigger logic
  - LVL-1: determine muon road per quadrant
  - LVL-2: determine dimuon road from common vertex (within +/- 20cm or so)

E906 Trigger & DAQ System



L0 Trigger: not "actively" used
- 4 V1495 boards available

L1 Trigger: in operation
- 4 V1495 boards
  (2) for Y-plane, not used
  (2) for X-Plane, in use
- 700nS latency

L2 Trigger: pass through
- 1 V1495
- Could do simple look-up
- Trigger pattern

TS: Trigger Supervisor

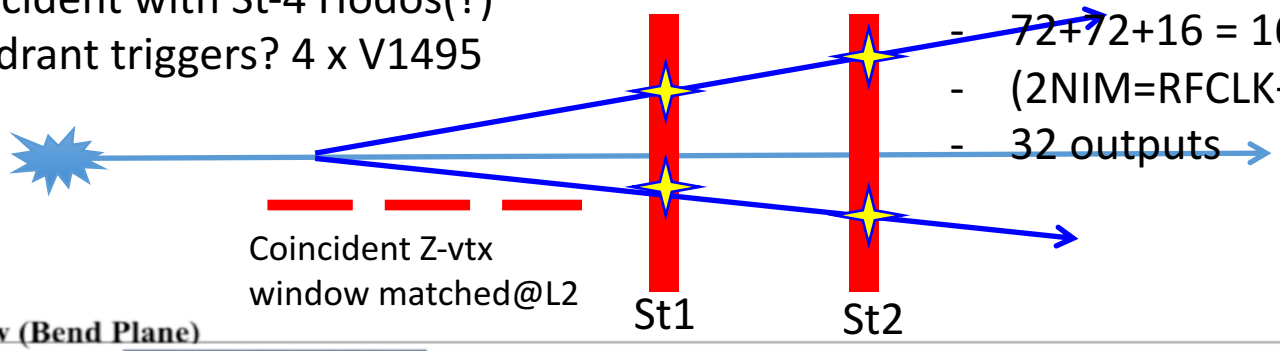
L2: limited I/O
1(O), 5(I), 32x
only 2 (I) used

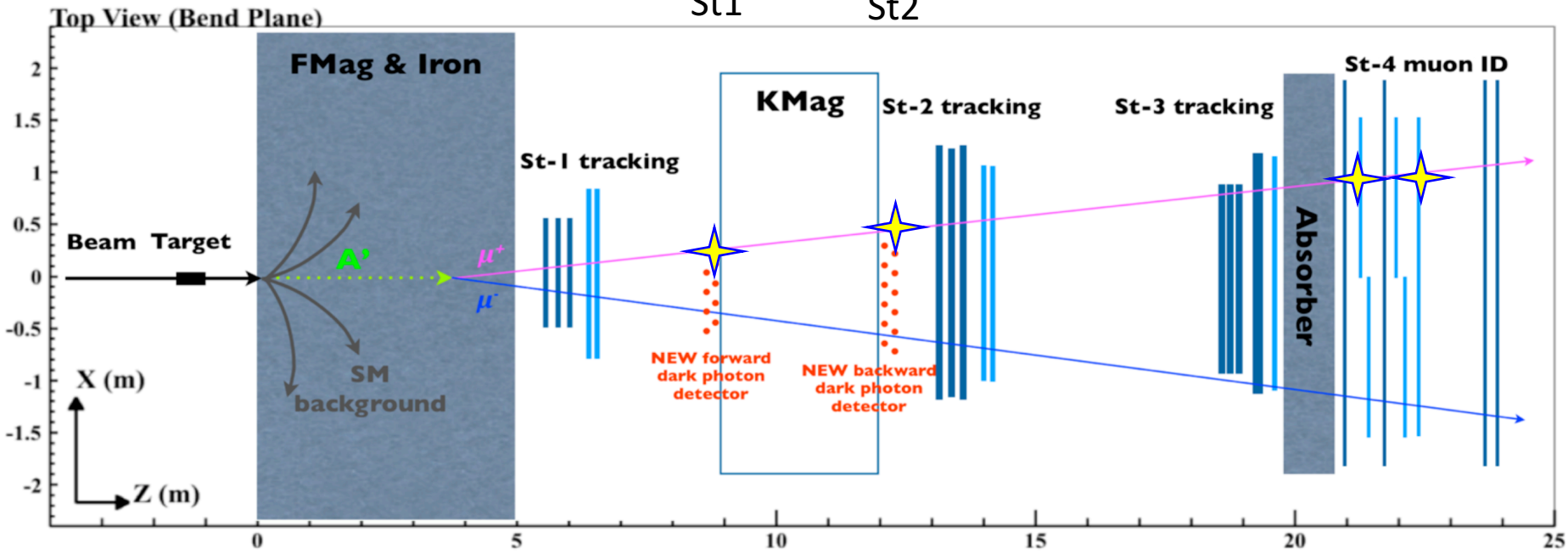
Comm.
Stop/Trigger

Low Mass Dark Photon Displayed Vertex Trigger

Y-Plane Trigger:
- No mass cut
- Displaced z-vertex
- Coincident with St-4 Hodos(?)
- Quadrant triggers? 4 x V1495

Y-channels per quadrant:
- 1x V1495
- 80(St1) + 50(St2) + 8x2 (St4-Y1,2) = 146
- 96+64 = 160 inputs possible
  - 72+72+16 = 160 (input possible)
    - (2NIM=RFCLK+ComSTOP)
    - 32 outputs





A New High-Granularity Displayed Dimuon Vertex Trigger

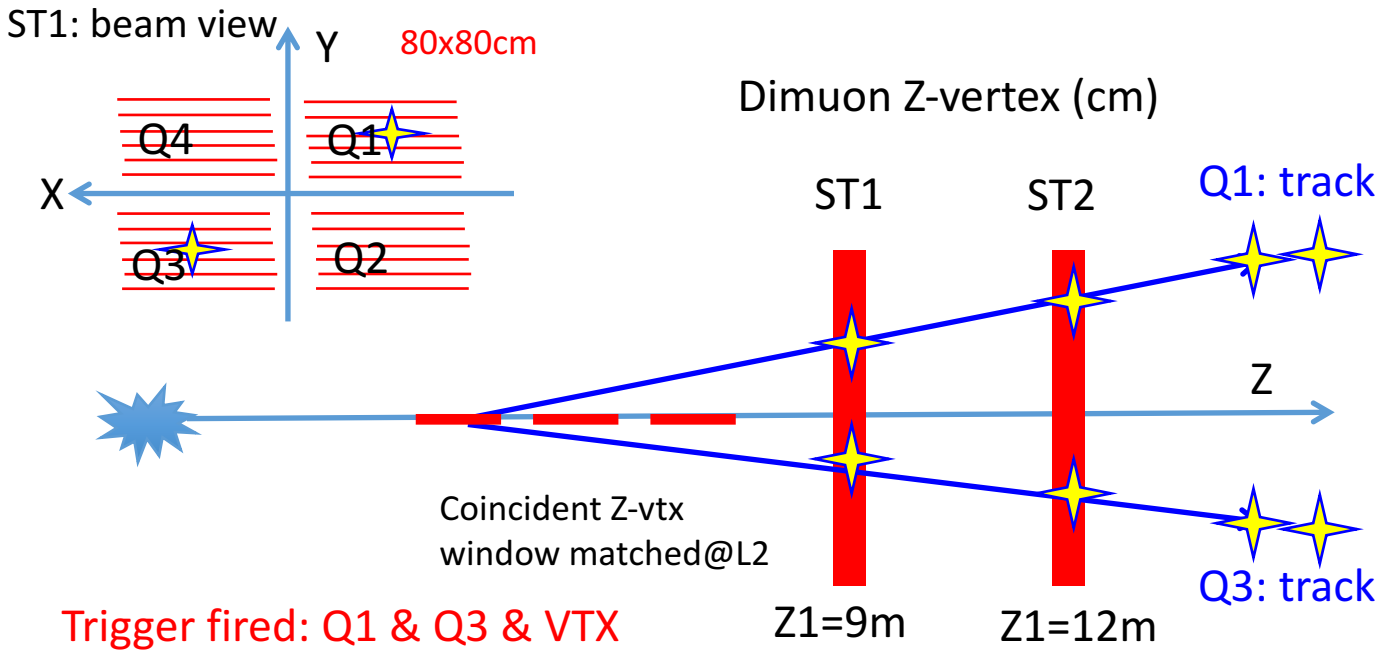
High rejection power, low rate, << 1 kHz(current E906 DAQ limit)

Y-Plane (non-bending) Trigger:

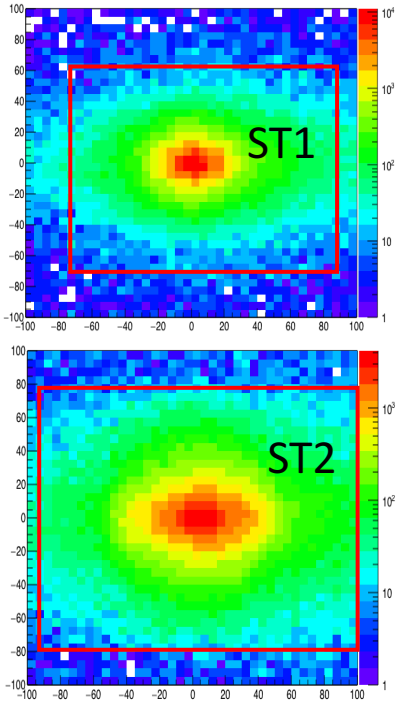
- A quadrant panel: 80cm x 80cm (100cmx100cm @ST-2)
  - ST1: 1cm x 1cm x 80 cm scintillating strips, SiPM readout
  - ST2: 2cm x 2 cm x 100 cm strips
- Straight line projection, σ_Z ~30cm
- Displaced z-vertex, mostly low mass < 3GeV

Y-channels per quadrant:

- 1x V1495
- 80(St1) + 50(St2) + 8x2 (St4-Y1,2) = 146
- 96+64 = 160 inputs possible
  (2NIM=RFCLK+ComSTOP)



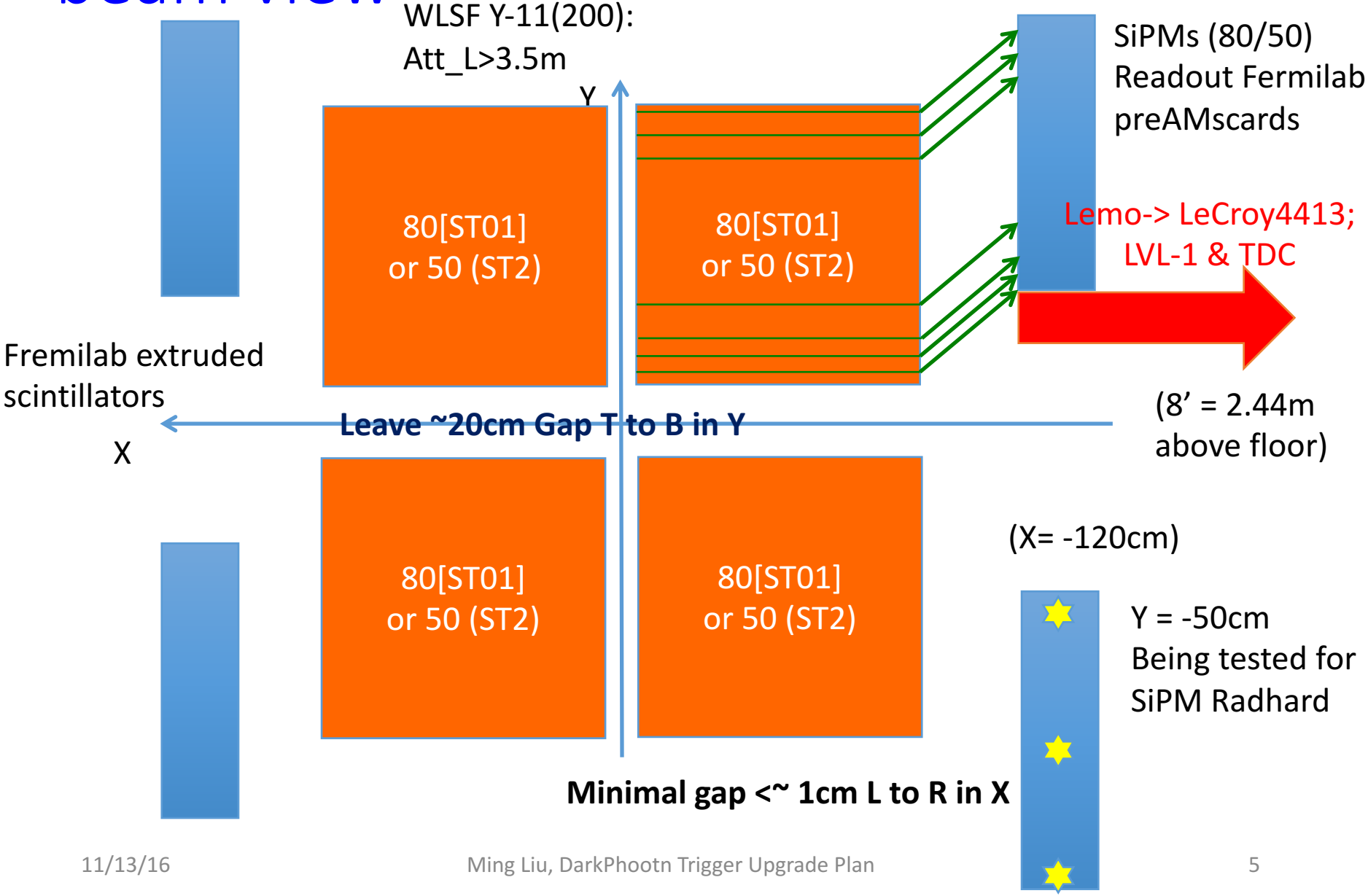
Trigger fired: Q1 & Q3 & VTX



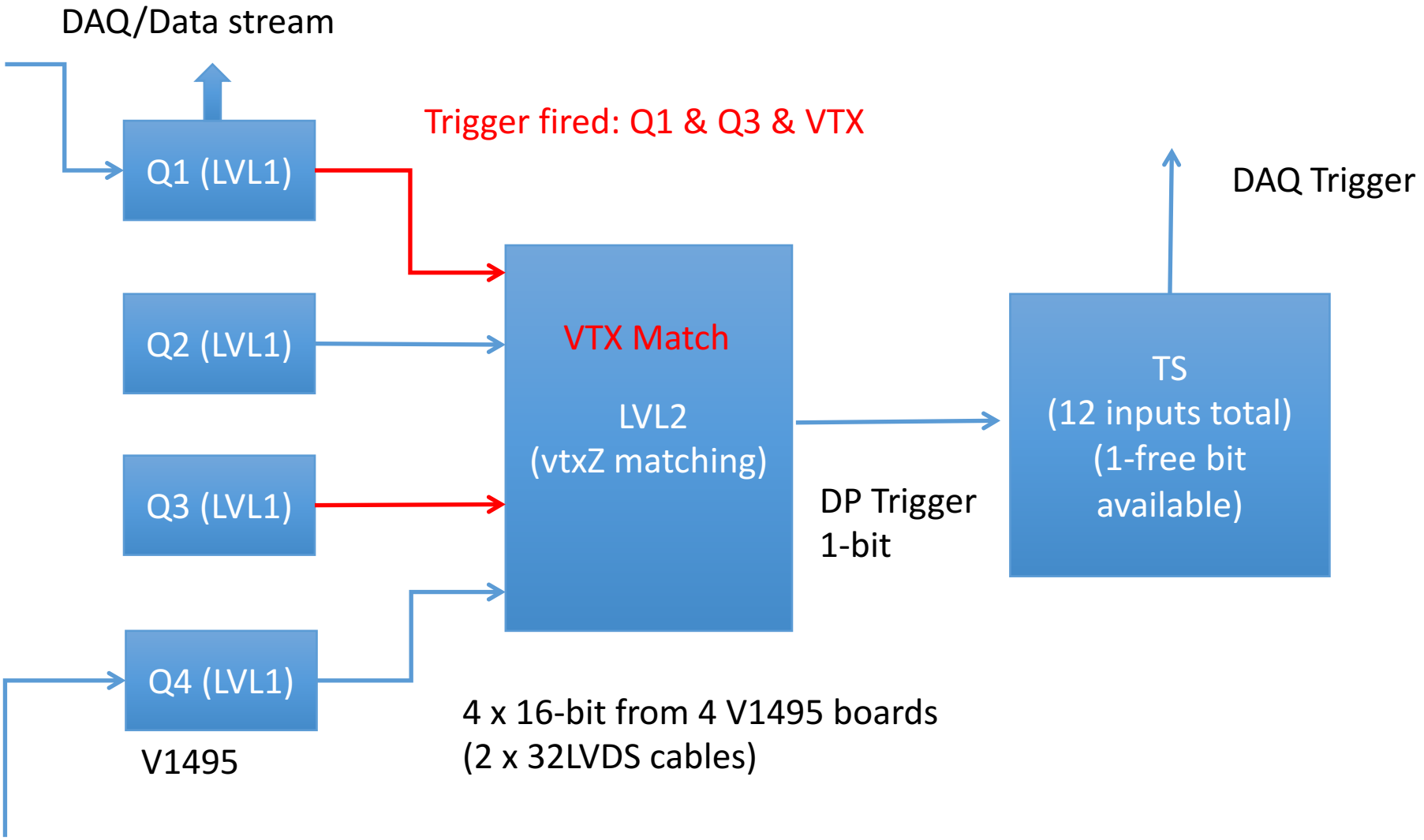
Trigger Detector Layout Schematics

beam view

http://kuraraypsf.jp/psf/ws.html

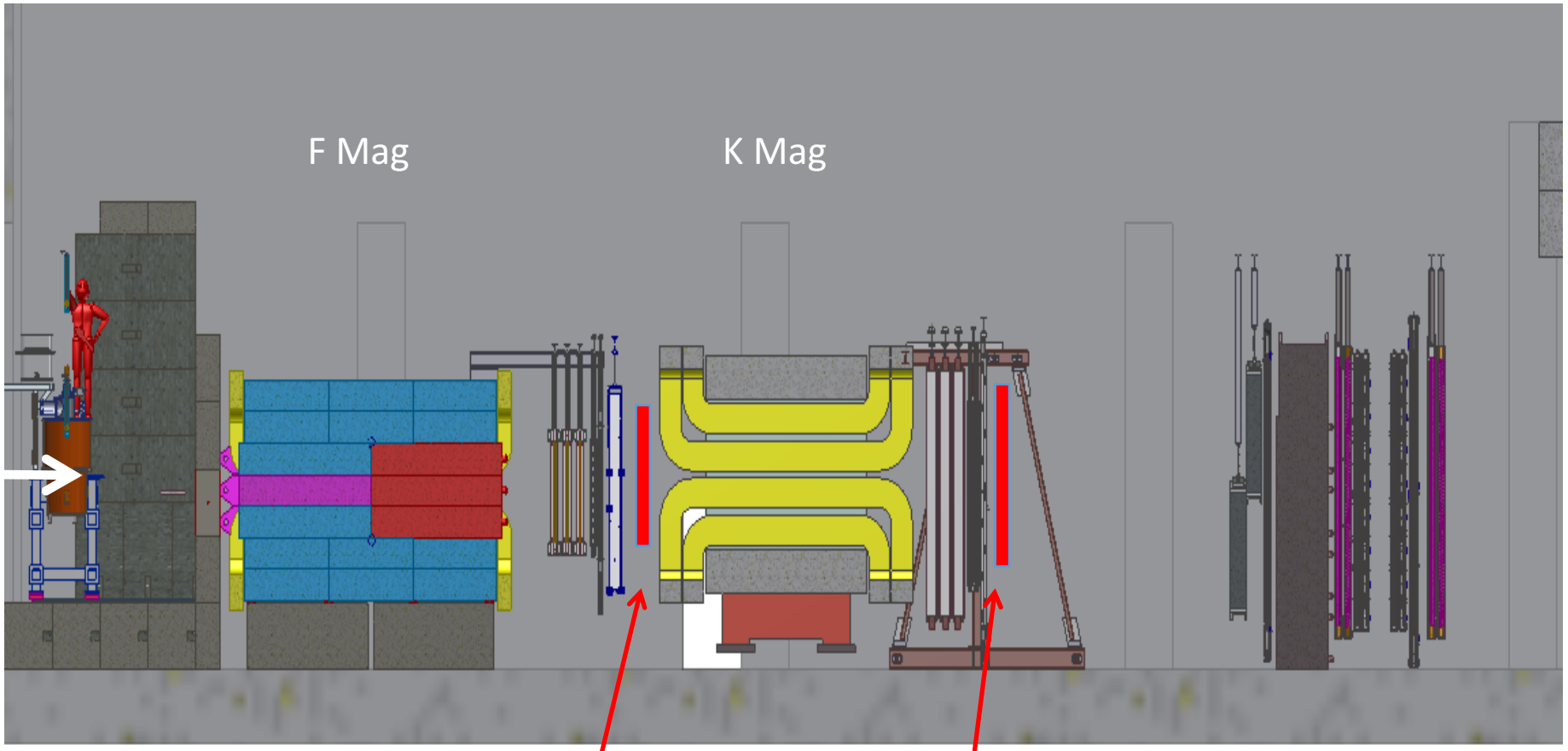


Displaced Dark Photon Trigger Logic



- Per quadrant $Q_{(1-4)}$: 80(ST1) + 50 (ST2) + 2x8(ST4-Y1/2) = 146, FANOUT ST4 Hodo
- Up to 72(ST1) + 72 (ST2) + 2x8(ST4Y1/2) = 160

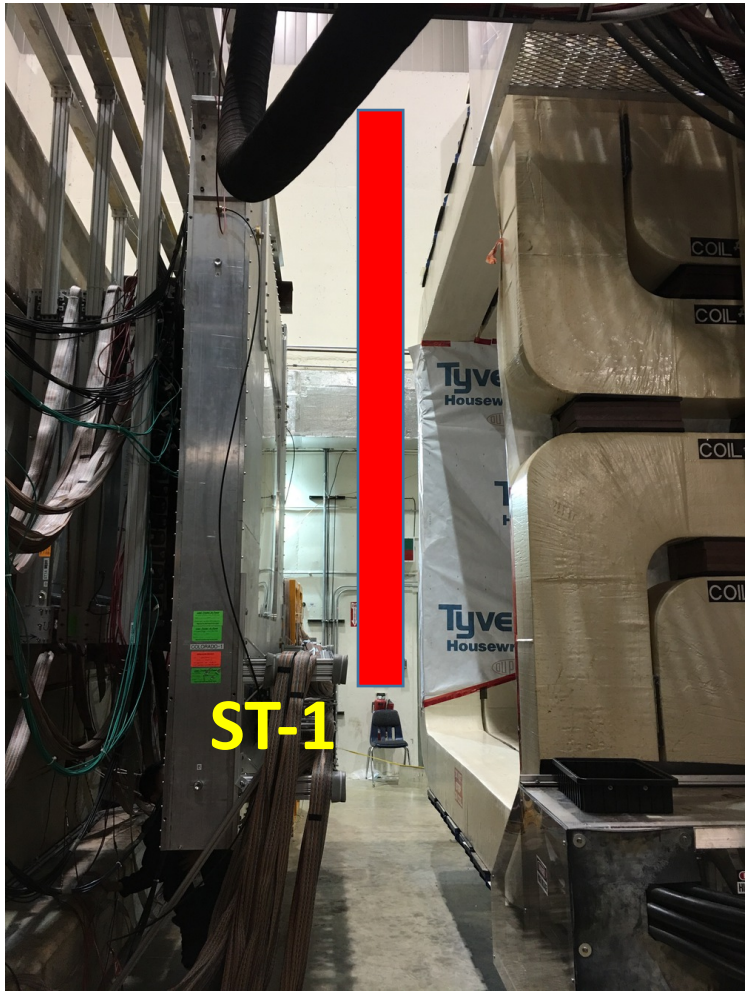
Side View of the Proposed Experimental Setup

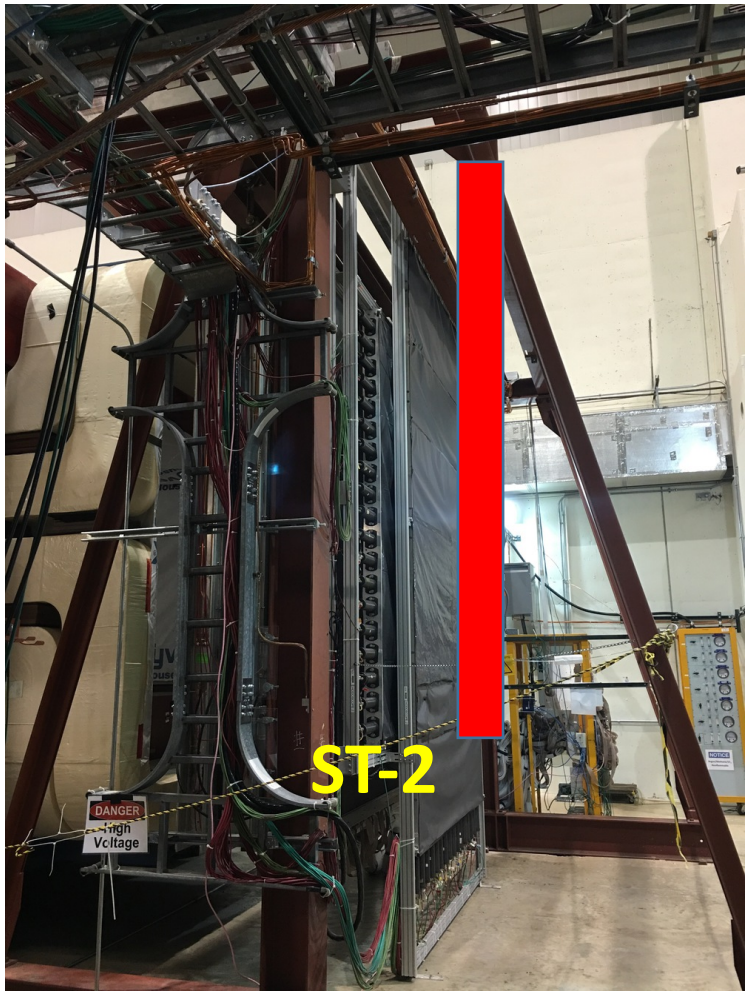


LDRD: St-1 trigger plane, 160 x 160 cm
Made of 4 1cm x 1cm x 80cm
scintillator planes

St-2 trigger plane, 200 cm x 200 cm
Made of 4 2cm x 2cm x 100cm
scintillator planes

Final Trigger Detector Installation Locations and Structures: TBD

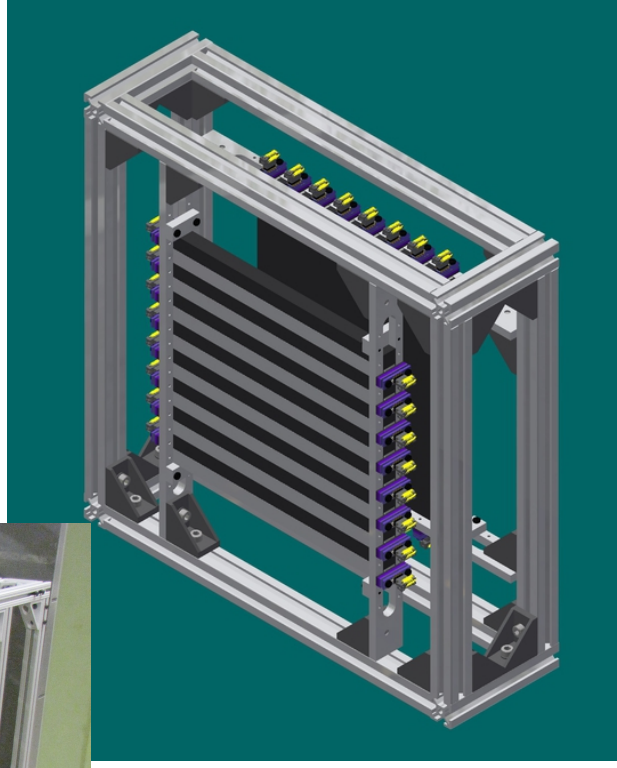


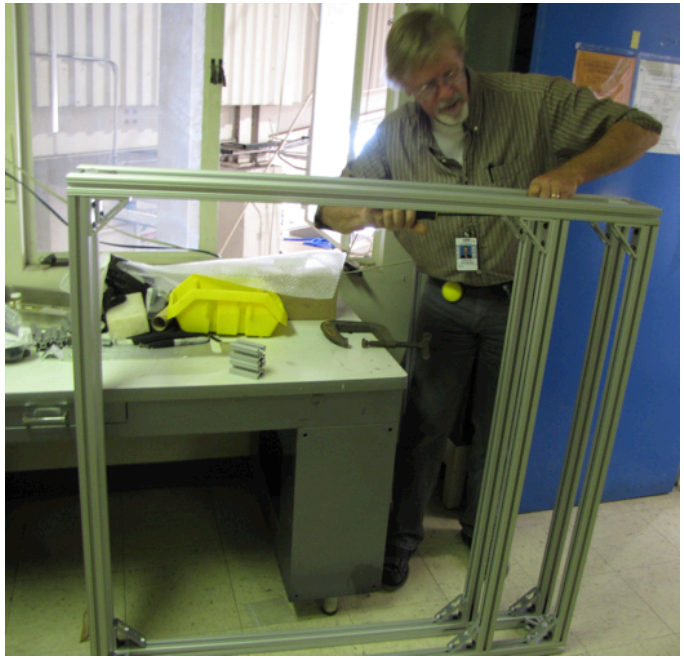


More pictures: https://p25ext.lanl.gov/darkphoton/images/hall/index.html

Frames and Installation

- 4 identical box per plane
- Two planes, St1 and St2





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