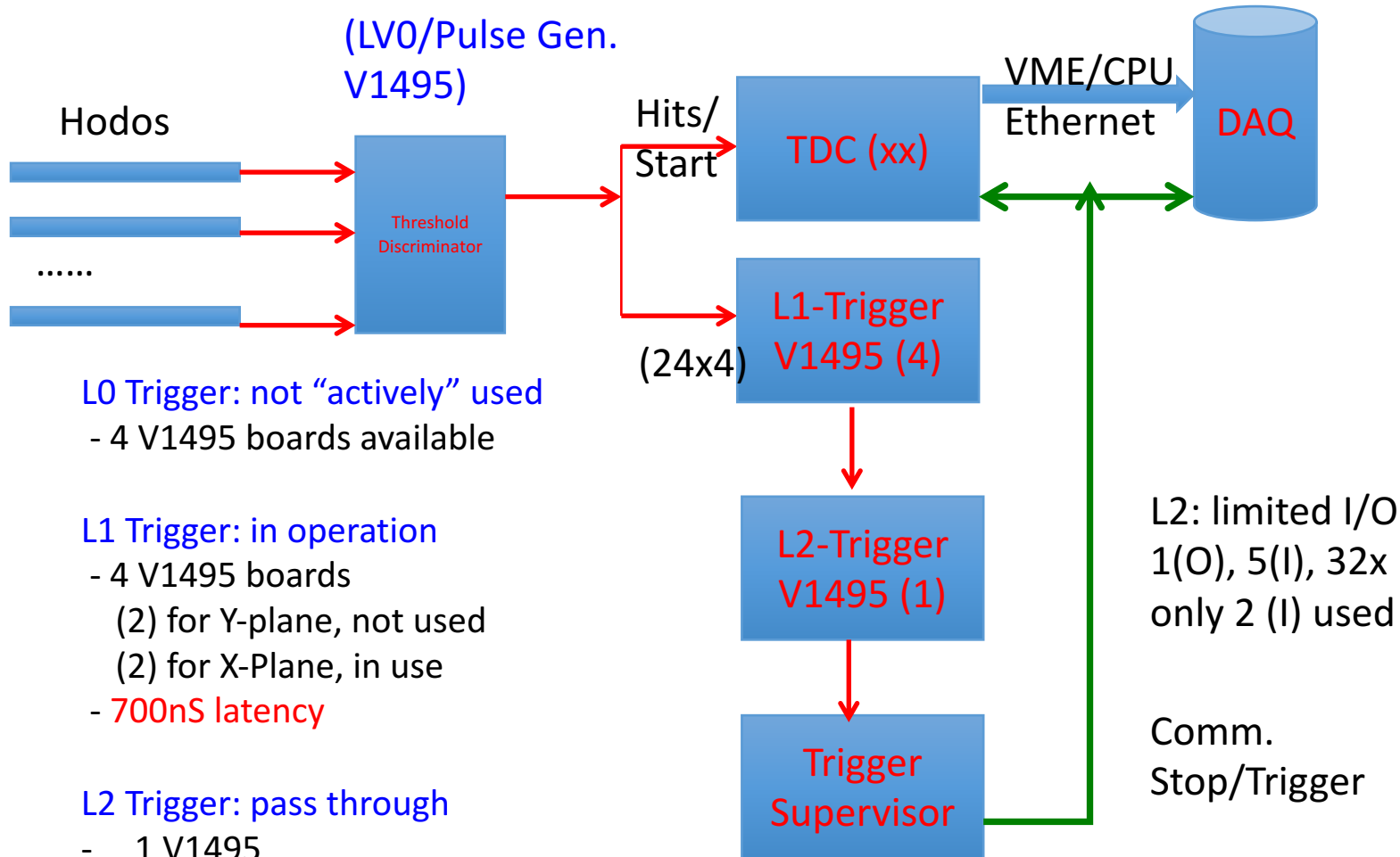


Dark Photon Trigger Upgrade

- Detector
 - Extruded scintillators
 - Y11 WLSF (two fibers per channel; $d=1\text{mm}$ 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 $\pm 20\text{cm}$ or so)

E906 Trigger & DAQ System



TS: Trigger Supervisor

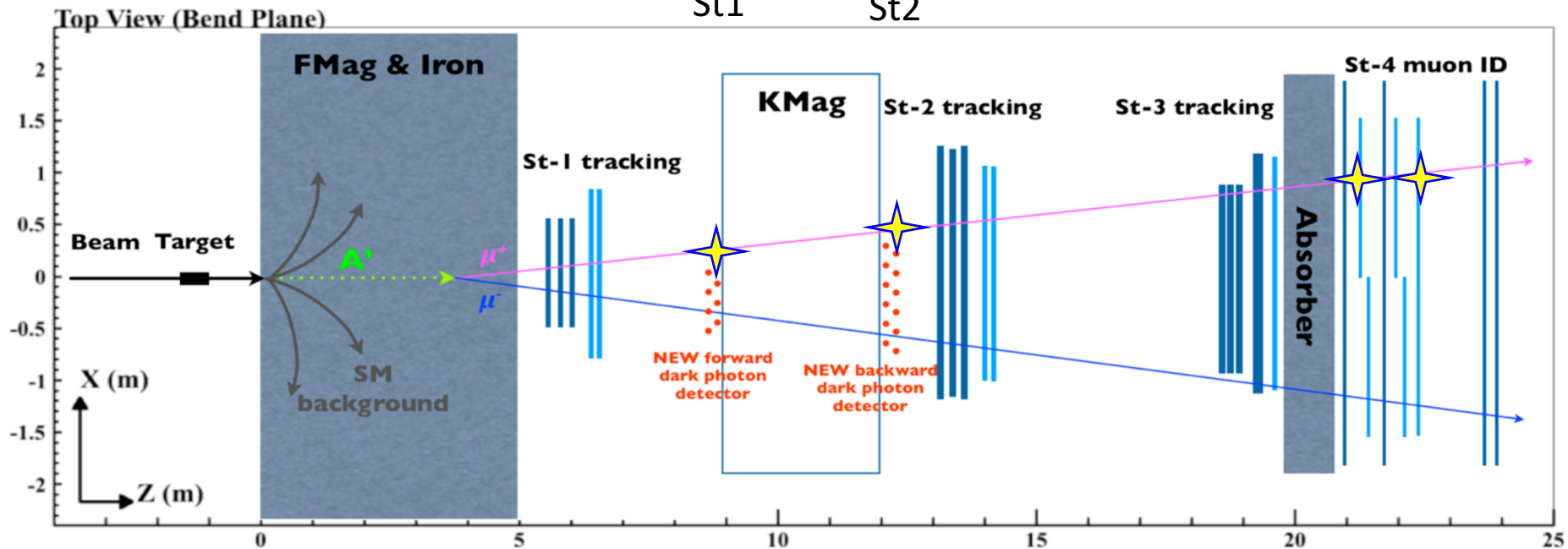
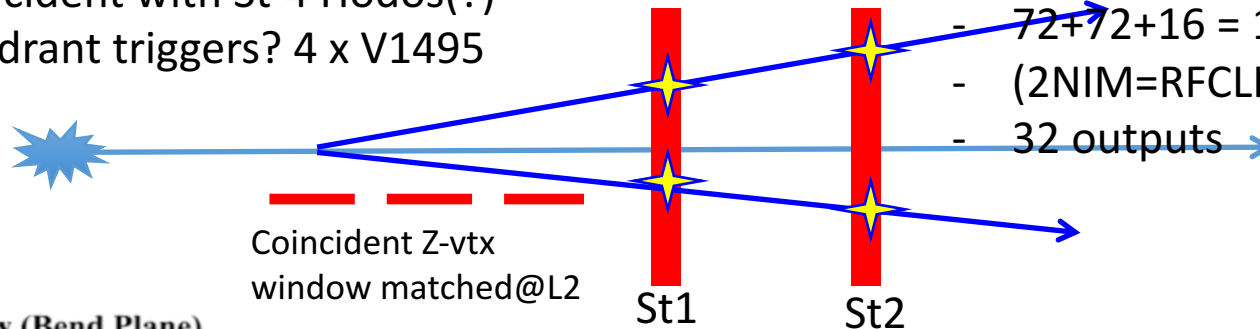
Low Mass Dark Photon Displayed Vertex Trigger

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
- $80(\text{St1}) + 50(\text{St2}) + 8 \times 2 (\text{St4-Y1,2}) = 146$
- $96 + 64 = 160$ inputs possible
- $72 + 72 + 16 = 160$ (input possible)
- $(2\text{NIM} = \text{RFCLK} + \text{ComSTOP})$
- 32 outputs



A New High-Granularity Displayed Dimuon Vertex Trigger

High rejection power, low rate, $\ll 1$ kHz (current E906 DAQ limit)

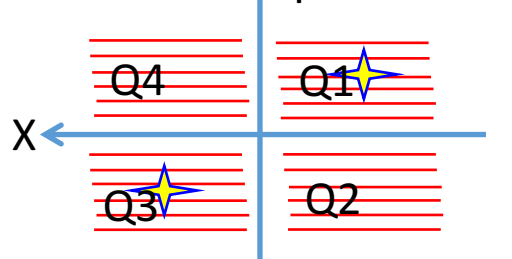
Y-Plane (non-bending) Trigger:

- A quadrant panel: 80cm x 80cm (100cm x 100cm @ 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, $\sigma_z \sim 30$ cm
- Displaced z-vertex, mostly low mass < 3 GeV

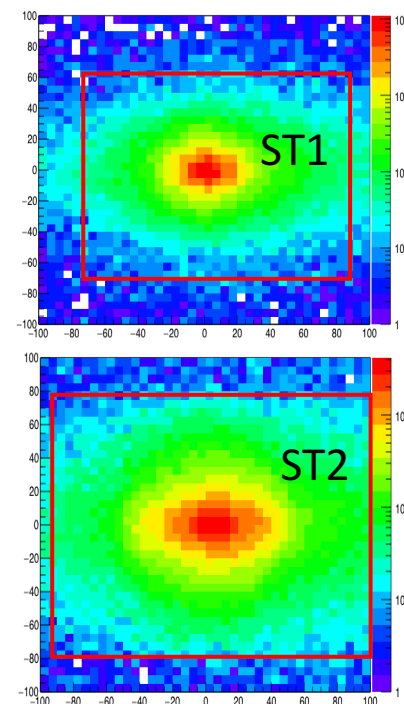
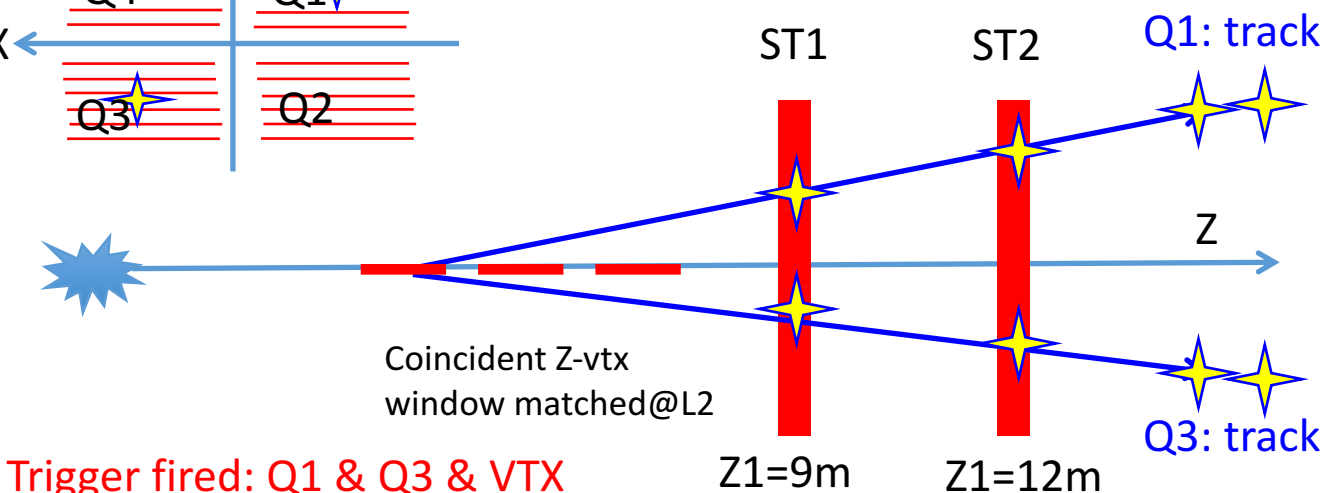
Y-channels per quadrant:

- 1x V1495
- $80(\text{St1}) + 50(\text{St2}) + 8 \times 2 (\text{St4-Y1,2}) = 146$
- $96 + 64 = 160$ inputs possible
($2\text{NIM} = \text{RFCLK} + \text{ComSTOP}$)

ST1: beam view



Dimuon Z-vertex (cm)

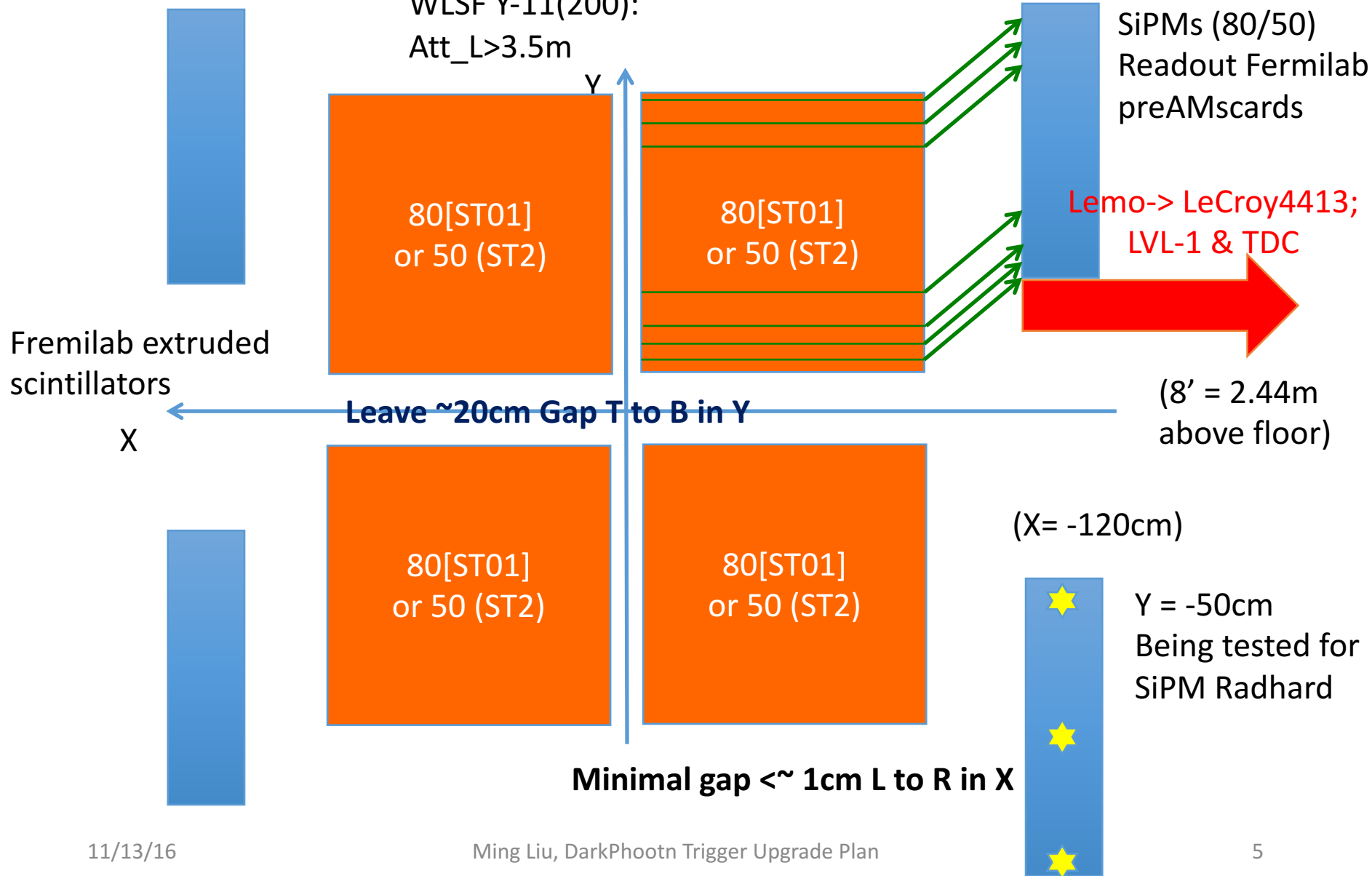


Trigger Detector Layout Schematics

beam view <http://kuraraypsf.jp/psf/ws.html>

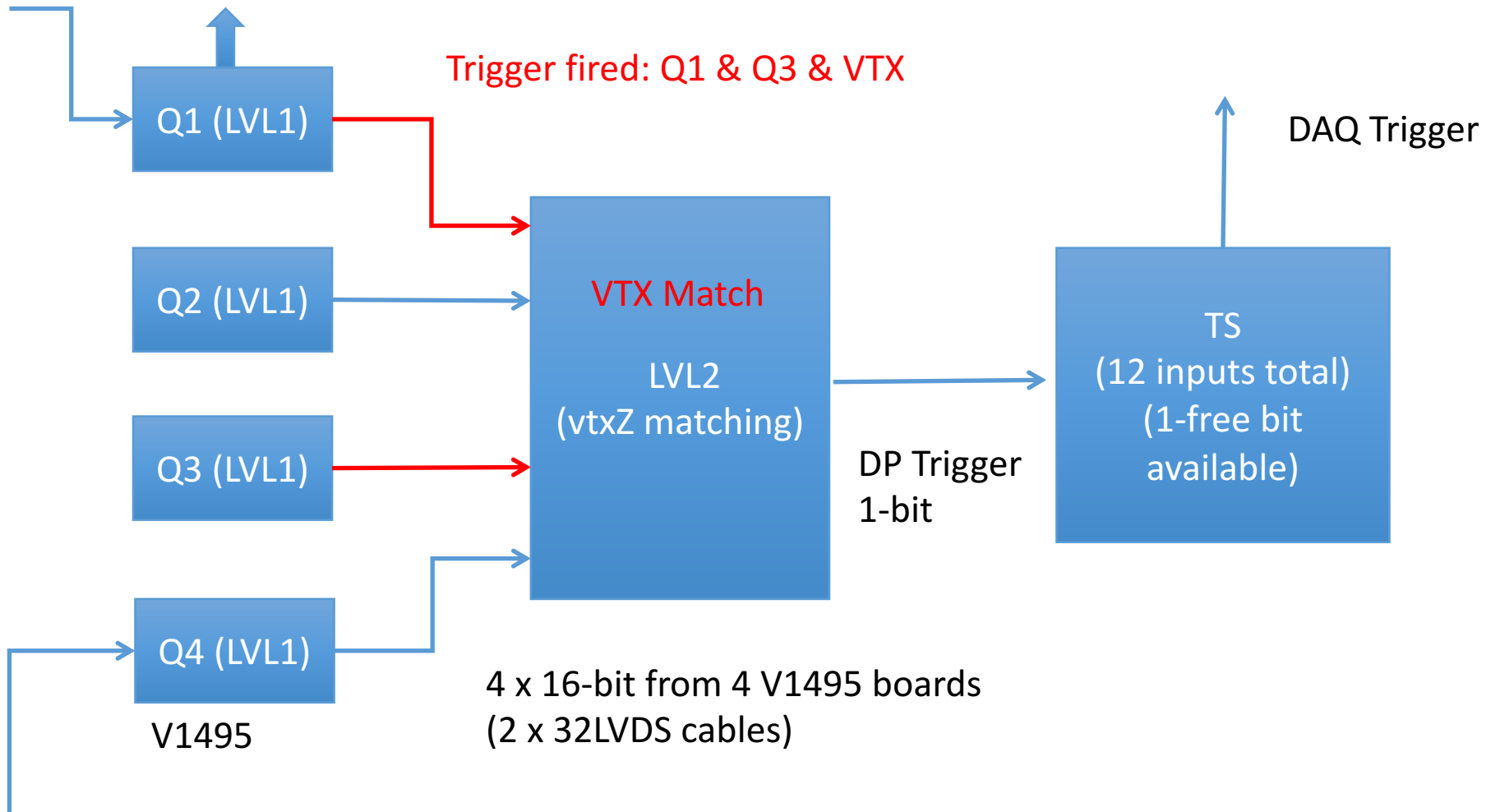
WLSF Y-11(200):

Att_L > 3.5m



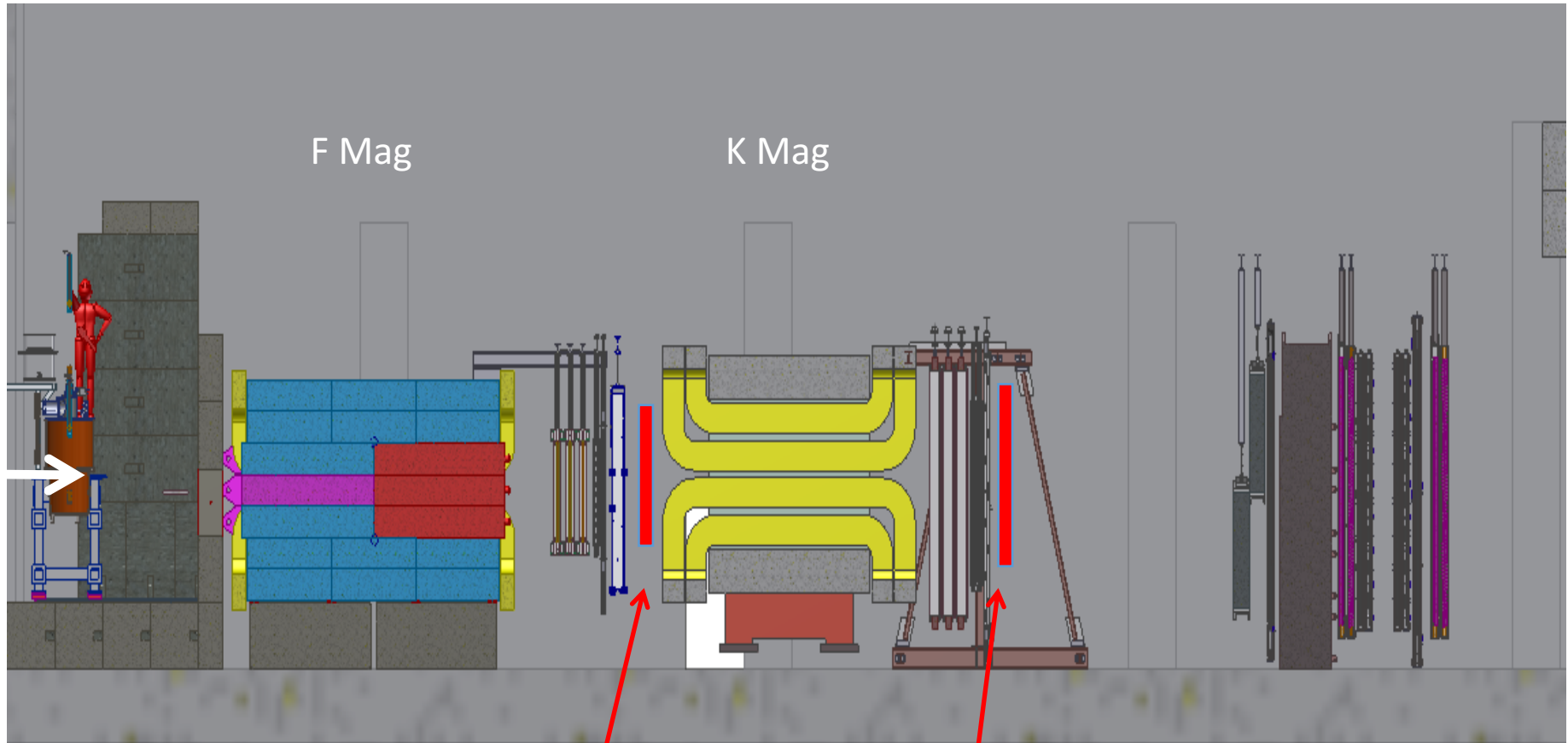
Displaced Dark Photon Trigger Logic

DAQ/Data stream



- Per quadrant $Q_{(1-4)}$: $80(ST1) + 50(ST2) + 2 \times 8(ST4-Y1/2) = 146$, FANOUT ST4 Hodo
- Up to $72(ST1) + 72(ST2) + 2 \times 8(ST4Y1/2) = 160$

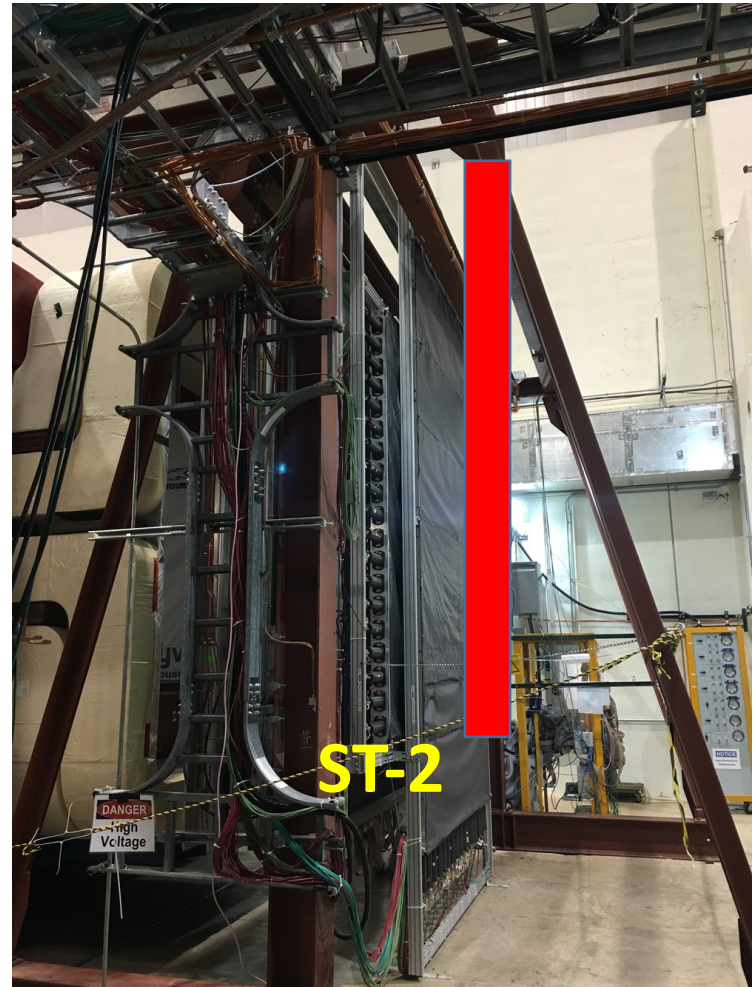
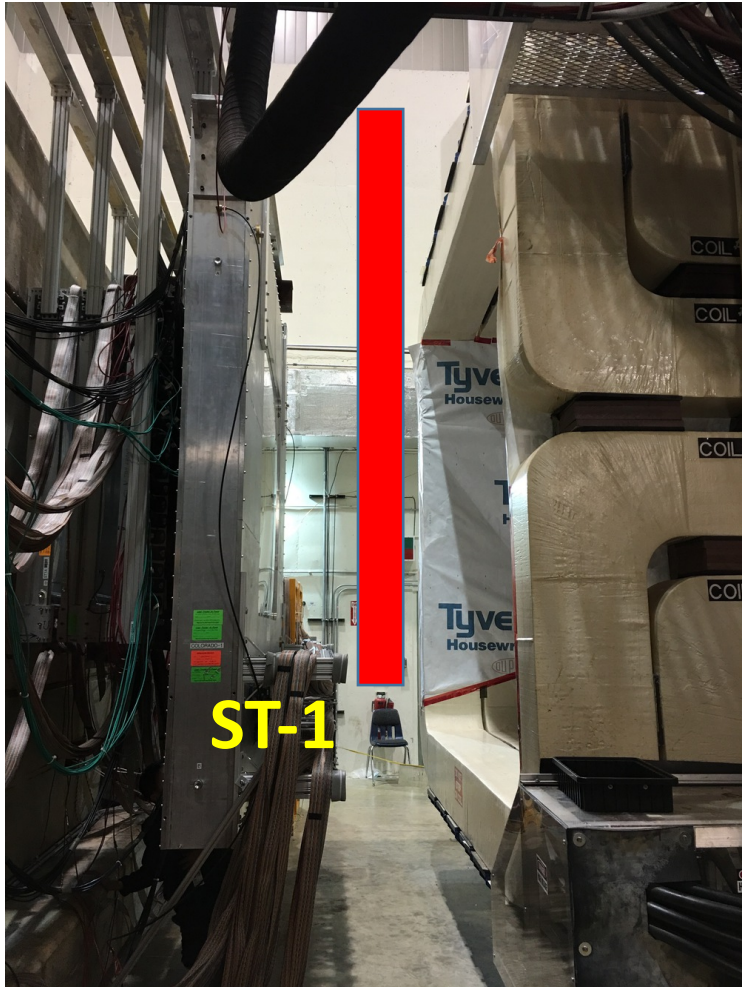
Side View of the Proposed Experimental Setup



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

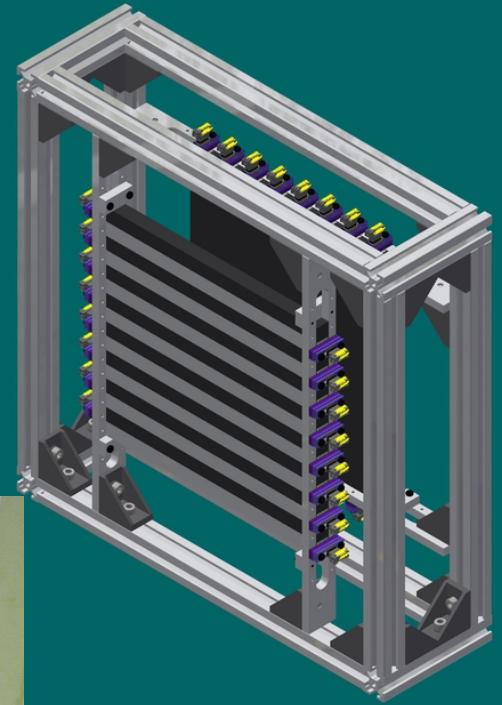
Final Trigger Detector Installation Locations and Structures: TBD



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

Frames and Installation

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



More pictures: <https://p25ext.lanl.gov/darkphoton/images/frames/index.html>