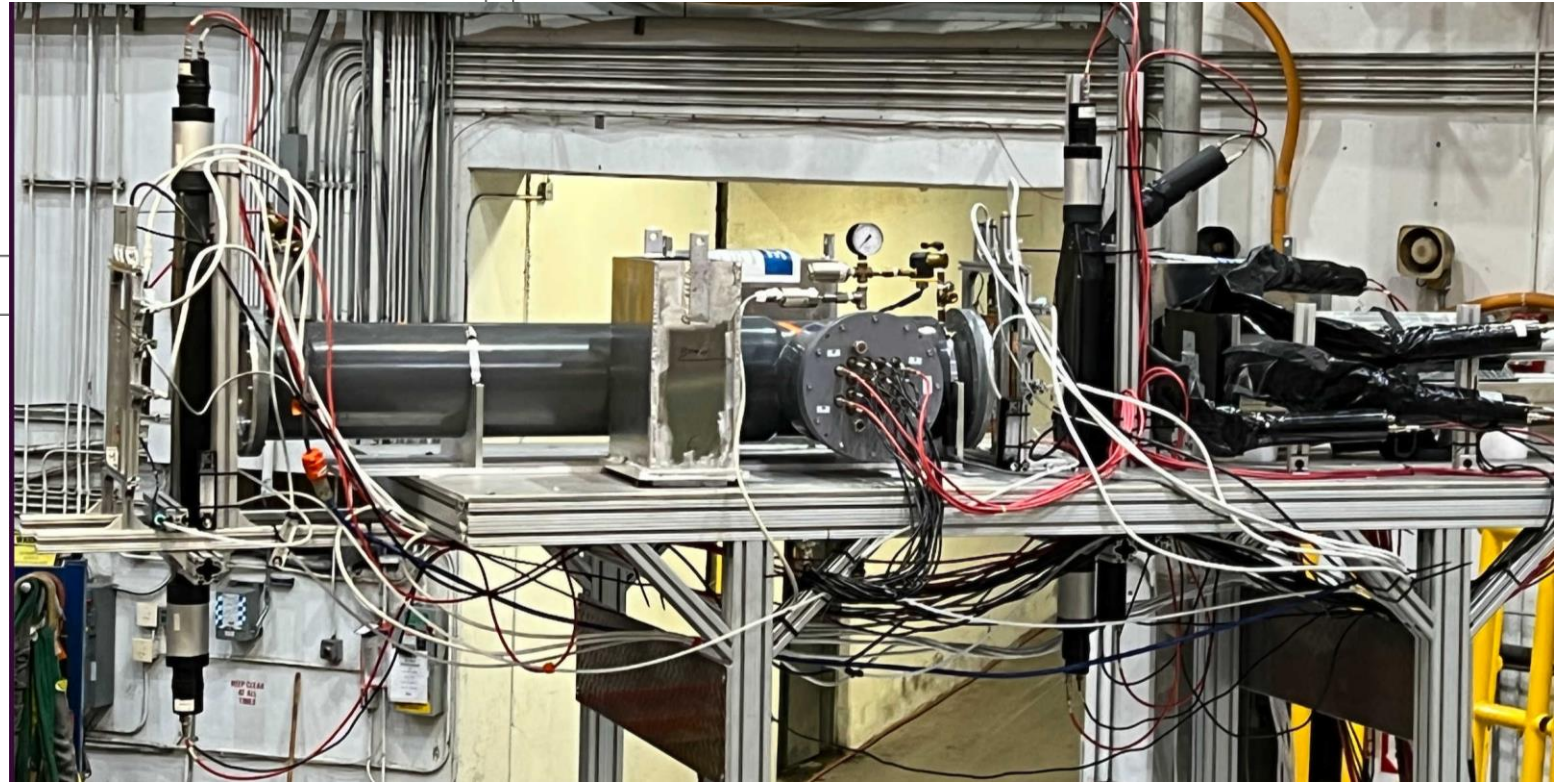
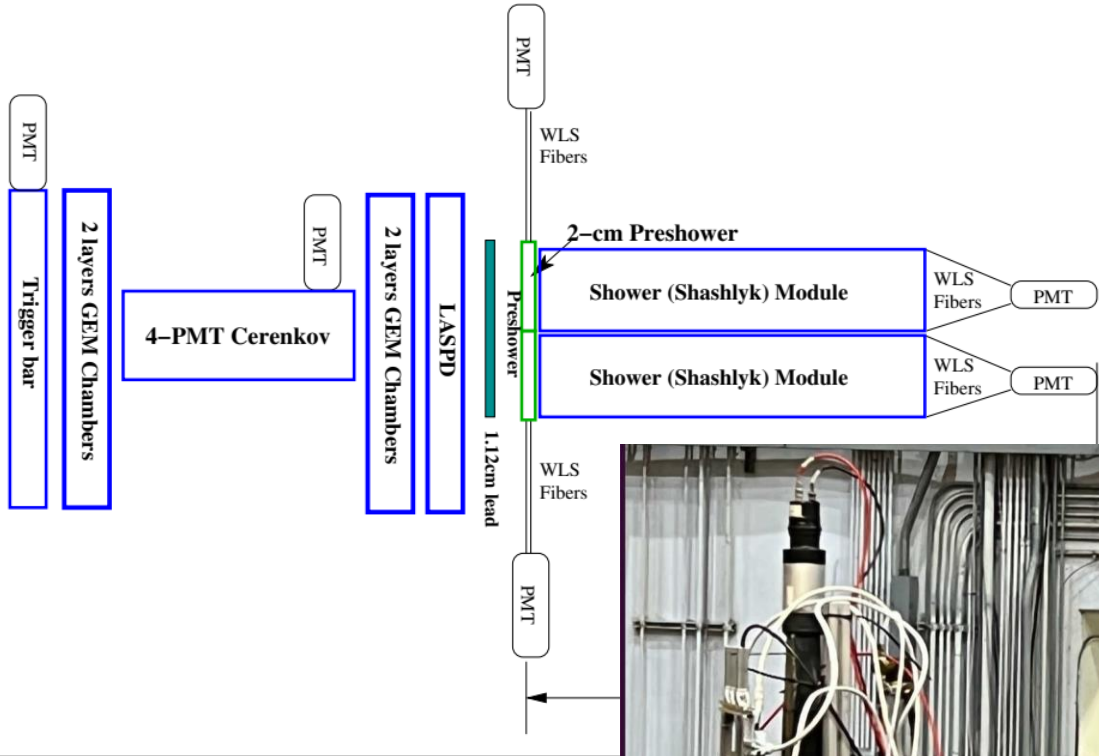


# Trigger Design for The High-Rate Beam Test in Hall C

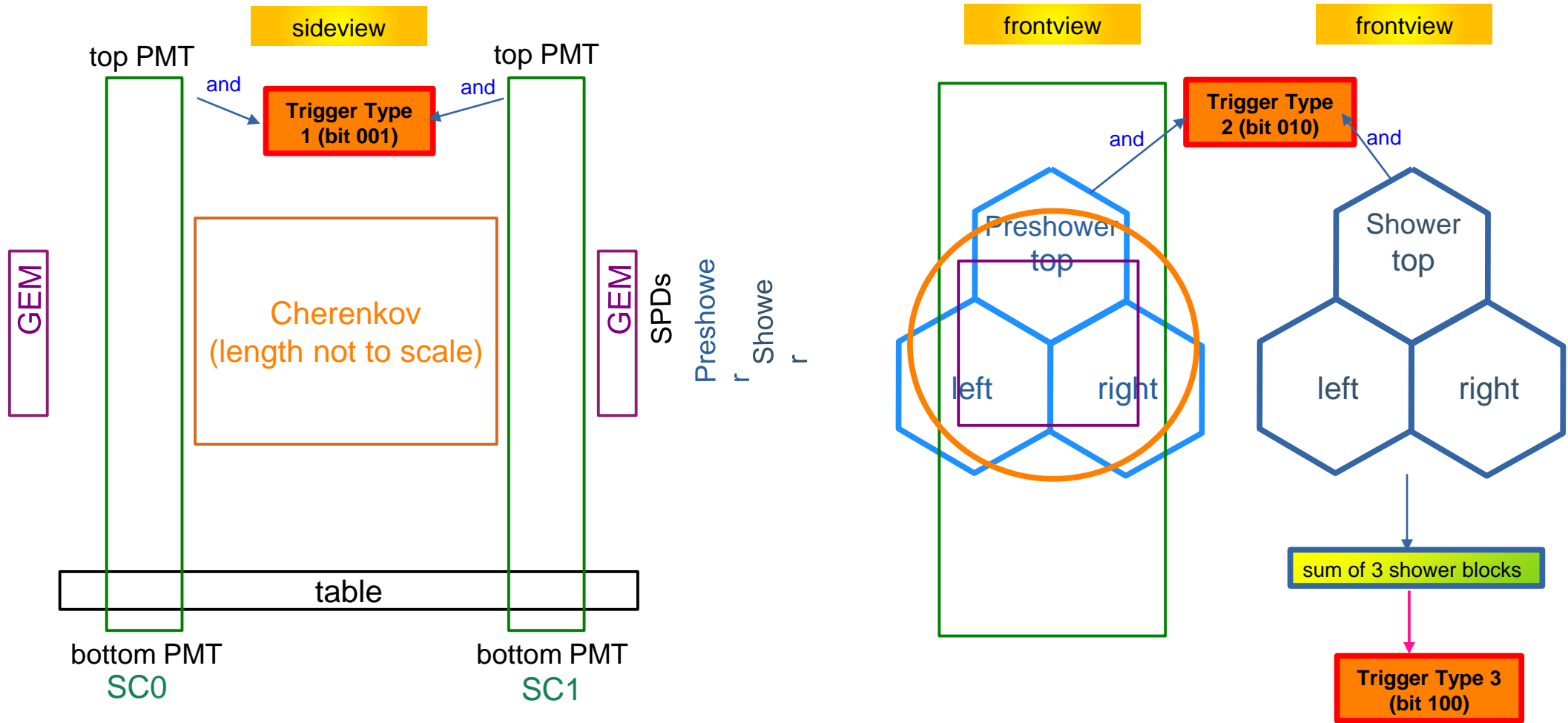
Jixie Zhang

# Proposed SoLID BeamTest Setup, 2022

Incoming  
Particles  
→

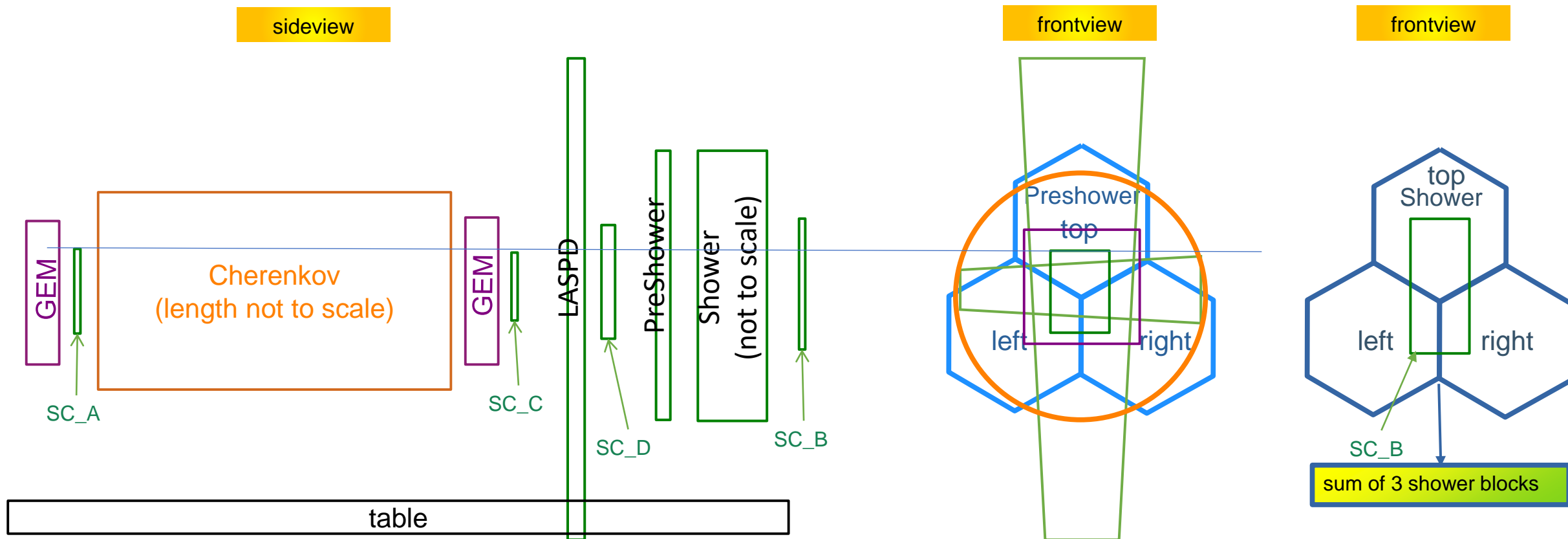


# Low rate trigger setup (Hall C beam-left 82.2 deg)



All discriminator threshold is around 18.2 mV

# High rate (current) detector layout (Hall C beam-right 7 deg)



## List of Detectors (From upstream to downstream):

**GEM\_00, GEM01;**

**SC\_A (5cm (x) x 7.5cm(y) x 1cm), Cherenkov;**

**GEM\_10, GEM\_11;**

**SC\_C (trapezoid shape: 3.5cm wide top side (at end tip, in hall y direction) and 5.5cm wide bottom side (connected to light guide), 18cm height (in hall x direction), 2cm thick);**

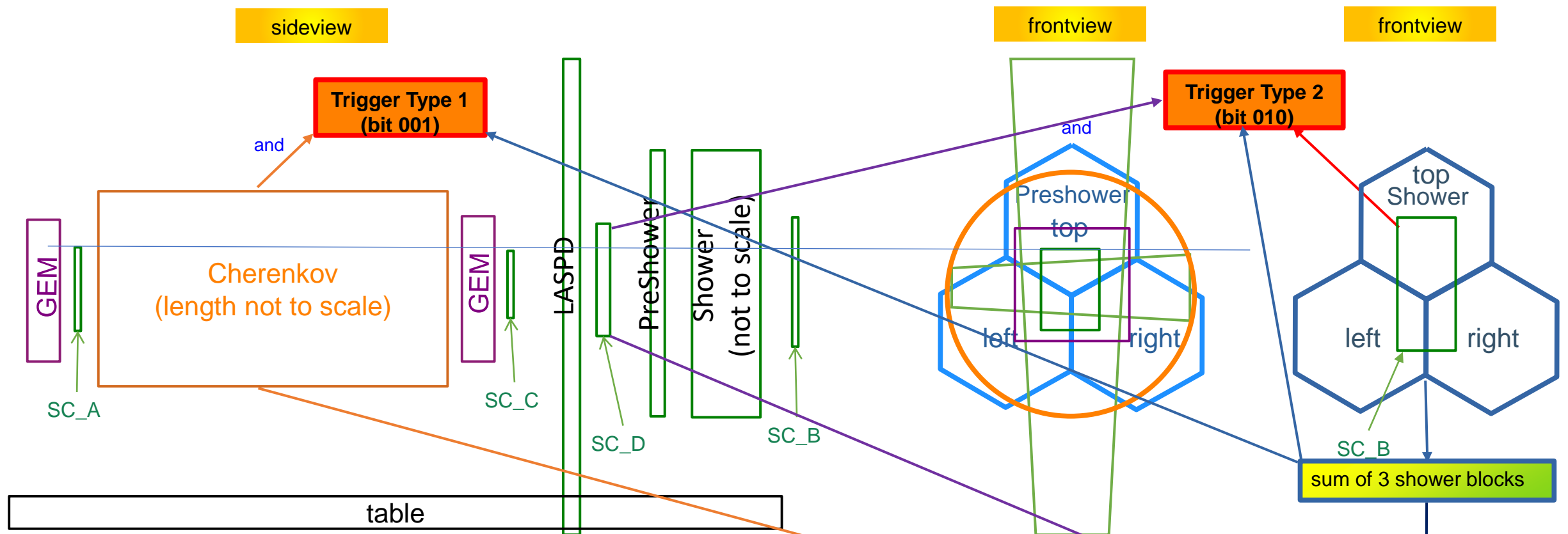
**LASPD, SC\_D (Kedi-6 preshower tile, 6.35cm side length hexagon, 2cm thick);**

**PreShower: Preshower\_T(SDU#2), Preshower\_left(SDU#1), Preshower\_right(THU#1);**

**Shower: Shower\_T(SDU#5), Shower\_L(SDU#4), Shower\_R(THU#4);**

**SC\_B: (5cm(x) x 10cm(y) x 1cm)**

# High rate (current) detector layout (Hall C beam-right 7 deg)



List of Detectors (From upstream to downstream):

GEM\_00, GEM01;

SC\_A (5cm (x) x 7.5cm(y) x 1cm), Cherenkov;

GEM\_10, GEM\_11;

SC\_C (trapezoid shape: 3.5cm wide top side (at end tip, in hall y direction) and 5.5cm wide bottom side (connected to light guide), 18cm height (in hall x direction), 2cm thick);

LASPD, SC\_D (Kedi-6 preshower tile, 6.35cm side length hexagon, 2cm thick);

PreShower: Preshower\_T(SDU#2), Preshower\_left(SDU#1), Preshower\_right(THU#1);

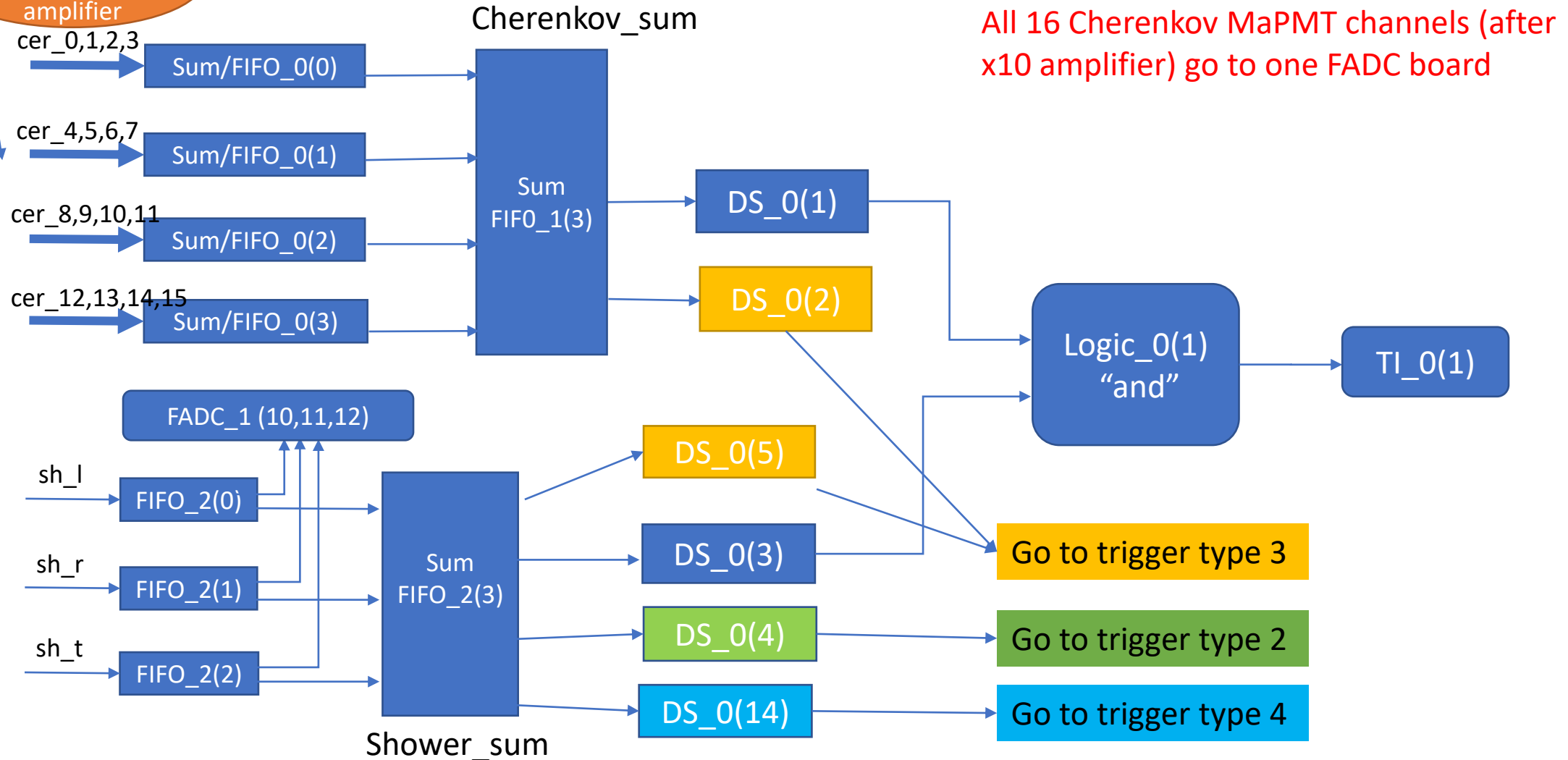
Shower: Shower\_T(SDU#5), Shower\_L(SDU#4), Shower\_R(THU#4);

SC\_B: (5cm(x) x 10cm(y) x 1cm)

Trigger Type 3 (bit 100)  
any 2 out of these 3 inputs

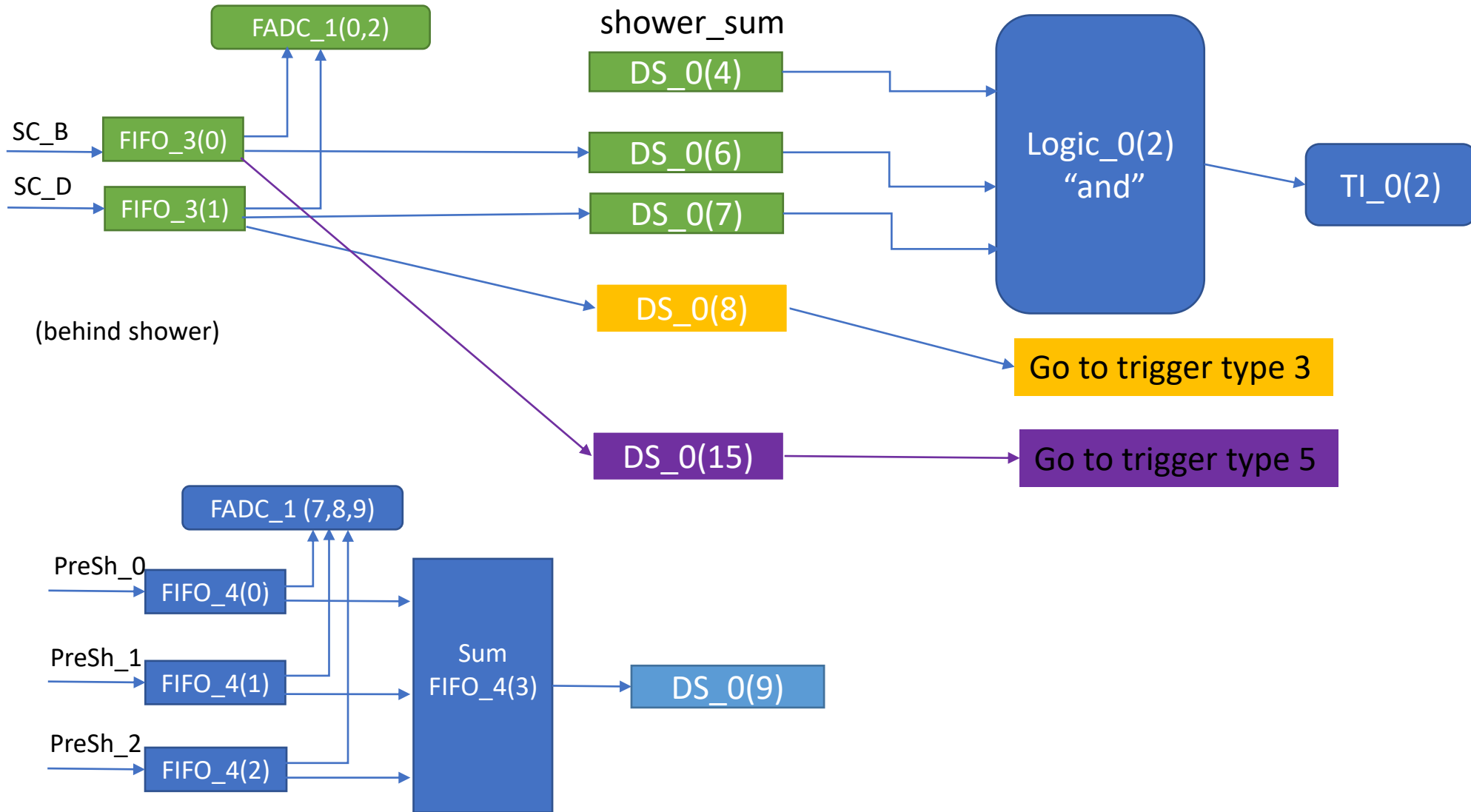
# High rate trigger type 1: primary electron trigger (sum\_cer & sum\_shower)

All inputs are after x10 amplifier

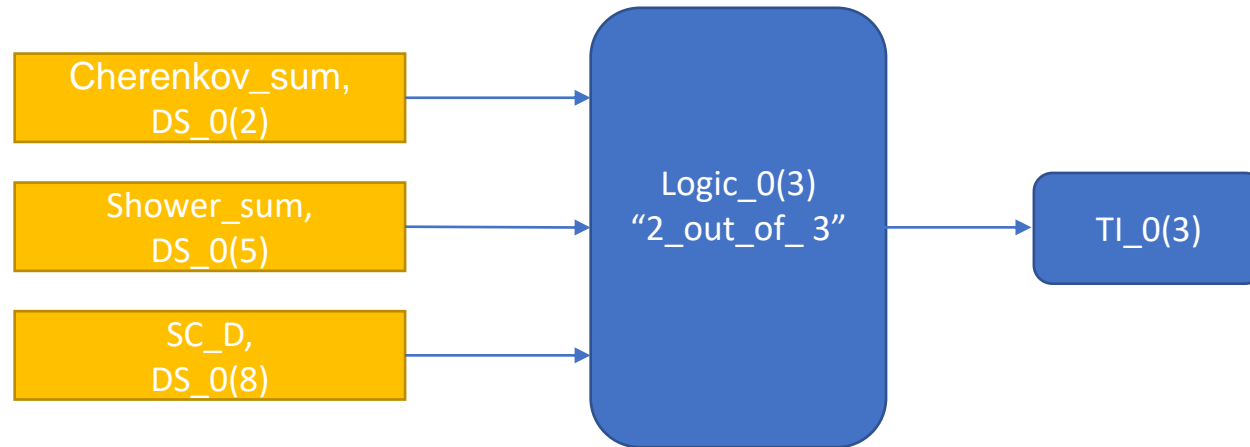


Separate each DSC channel for different threshold control to each trigger type

# High rate trigger type 2: pion trigger (scintillator & sum\_shower)

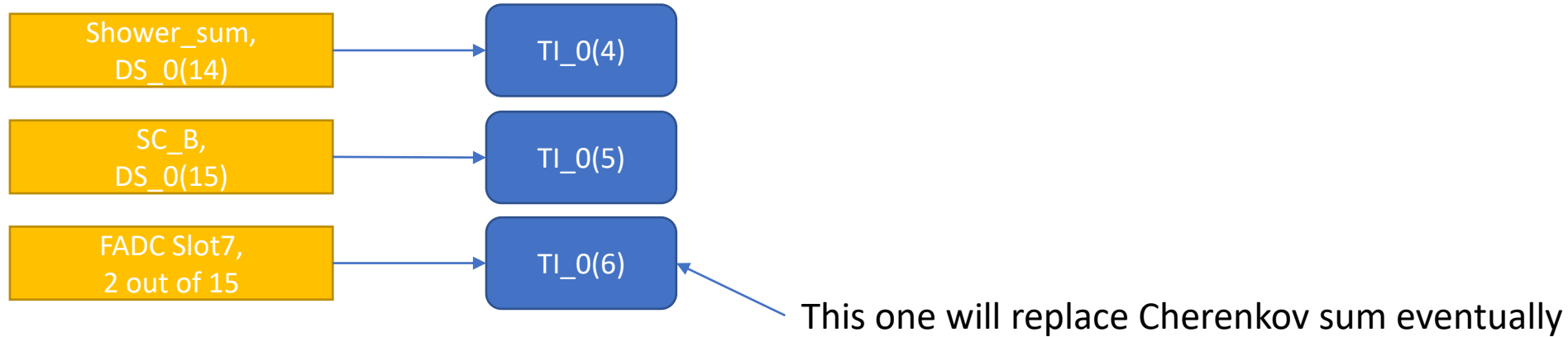


## High rate trigger type 3: efficiency trigger, any 2 out of 3 inputs



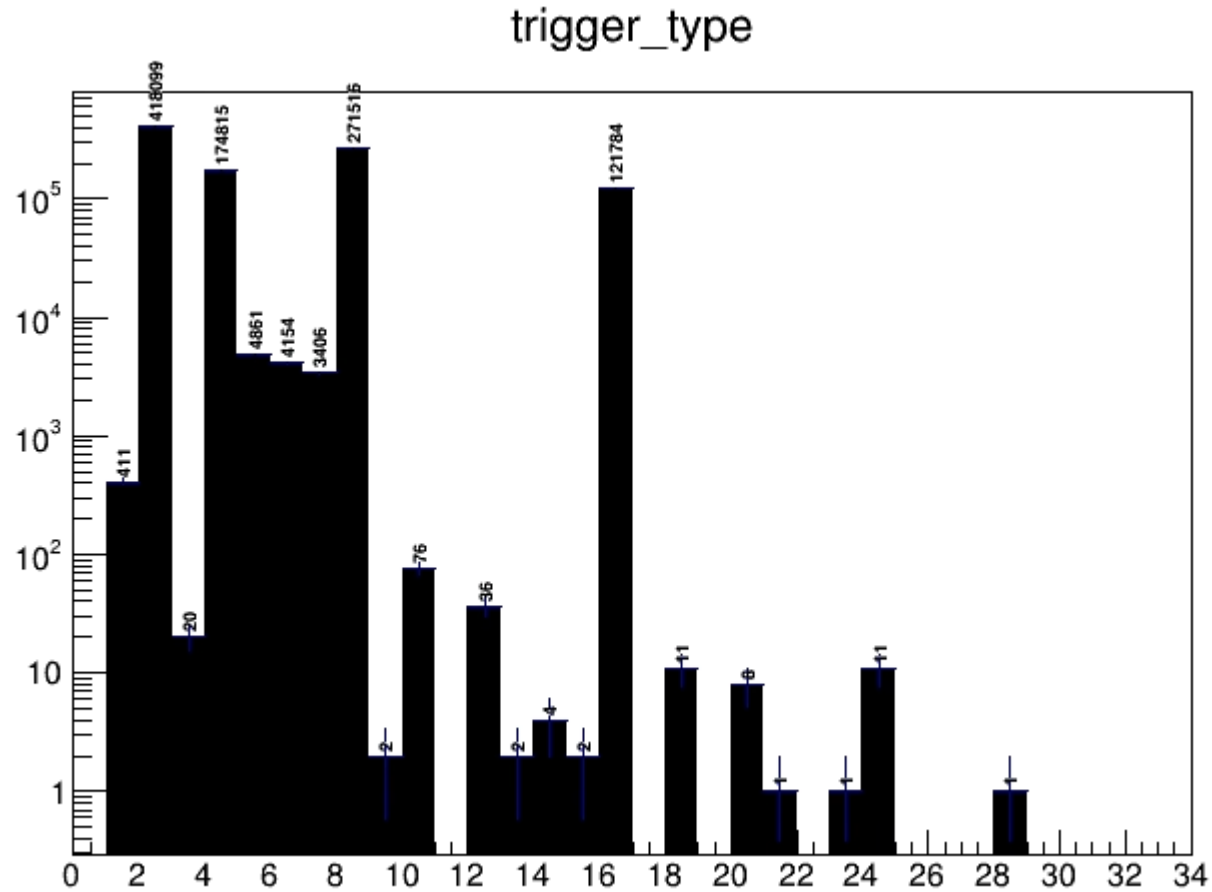


## High rate trigger type 4,5,6:



```
1 FADC250_SLOT 7
2
3 #Enable for FADC trigger, its ELC output (trigout) can feed to logic unit for further combination
4 # channel: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
5 FADC250_ADC_MASK 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 FADC250_TRG_MASK 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1
7 #delay for coincident with other signals
8 FADC250_ALLCH_DELAY 160 160 160 160 160 160 160 160 160 160 160 160 160 160 160
9 #determine the following PED when HVs are off
10 FADC250_ALLCH_PED 107 104 100 101 101 99 103 94 109 102 108 111 105 102 104 100
11 #stretches pulse width of channel over threshold in 4ns ticks
12 FADC250_TRG_WIDTH 5
13 #minimum number of 4ns clocks channel must be over threshold to count towards multiplicity for FADC
14 FADC250_TRG_MINTOT 3
15 #minimum number of channels triggered simultaneously for FADC to send trigger to SD
16 FADC250_TRG_MINMULT 2
17 #board Trigger Energy Threshold (TET), same for all 16 channels, for range=2V, 1 unit = 0.0488 mv
18 FADC250_ALLCH_TET 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40
19
```

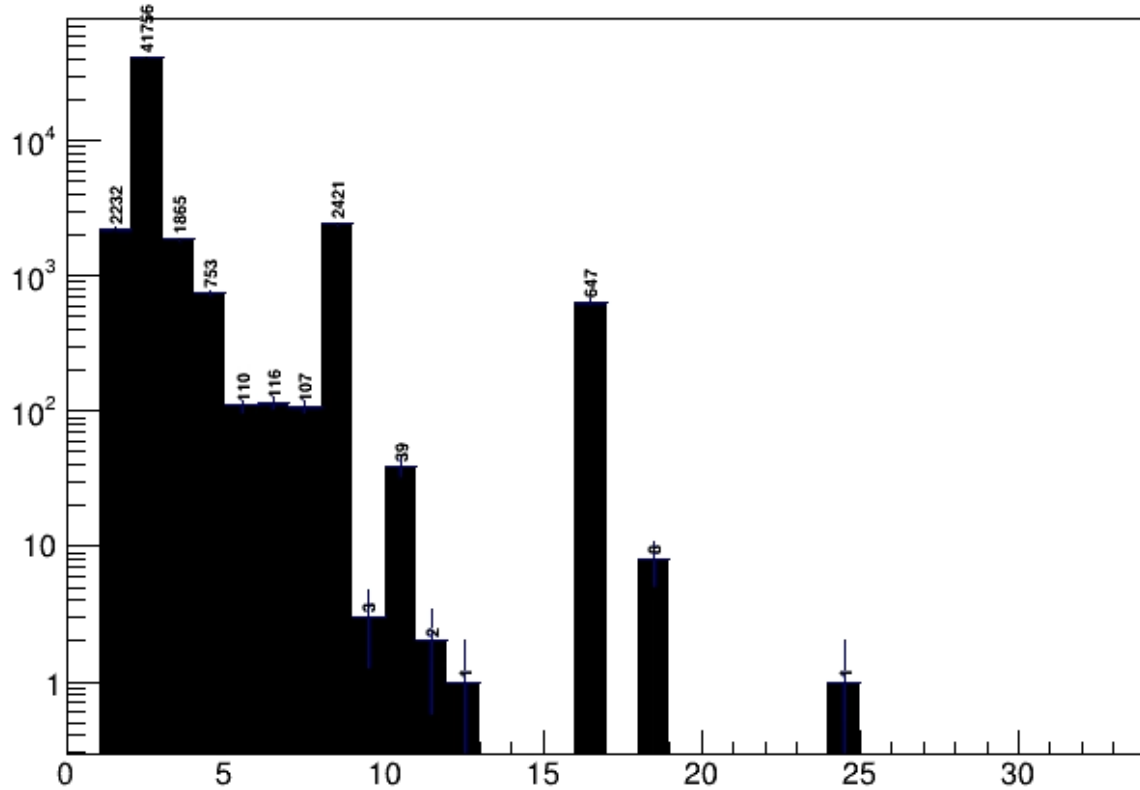
# trigger type without prescale



Threshold:  
Cer\_Sum(30mV),  
Shower\_Sum(10mV),  
SC\_D(Kedi6-Tile,10mV),  
SC\_B(downstream of Shower,10mV)

# trigger type after prescale factor for trigger bit 1-6: (0,0,5,3,3,0)

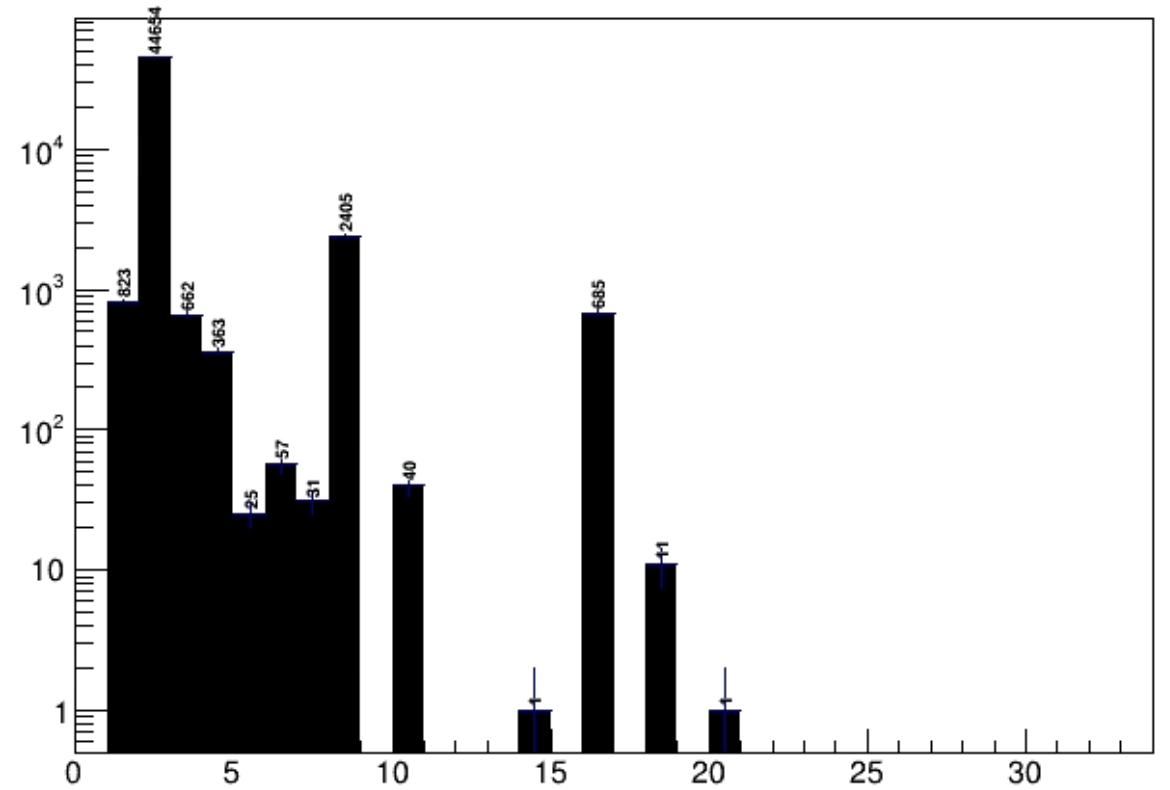
trigger\_type {Entry\$<100000}



Threshold:

Cer\_Sum(30mV),  
Shower\_Sum(10mV),  
SC\_D(Kedi6-Tile,10mV),  
SC\_B(downstream of Shower,10mV)

trigger\_type {Entry\$<100000}



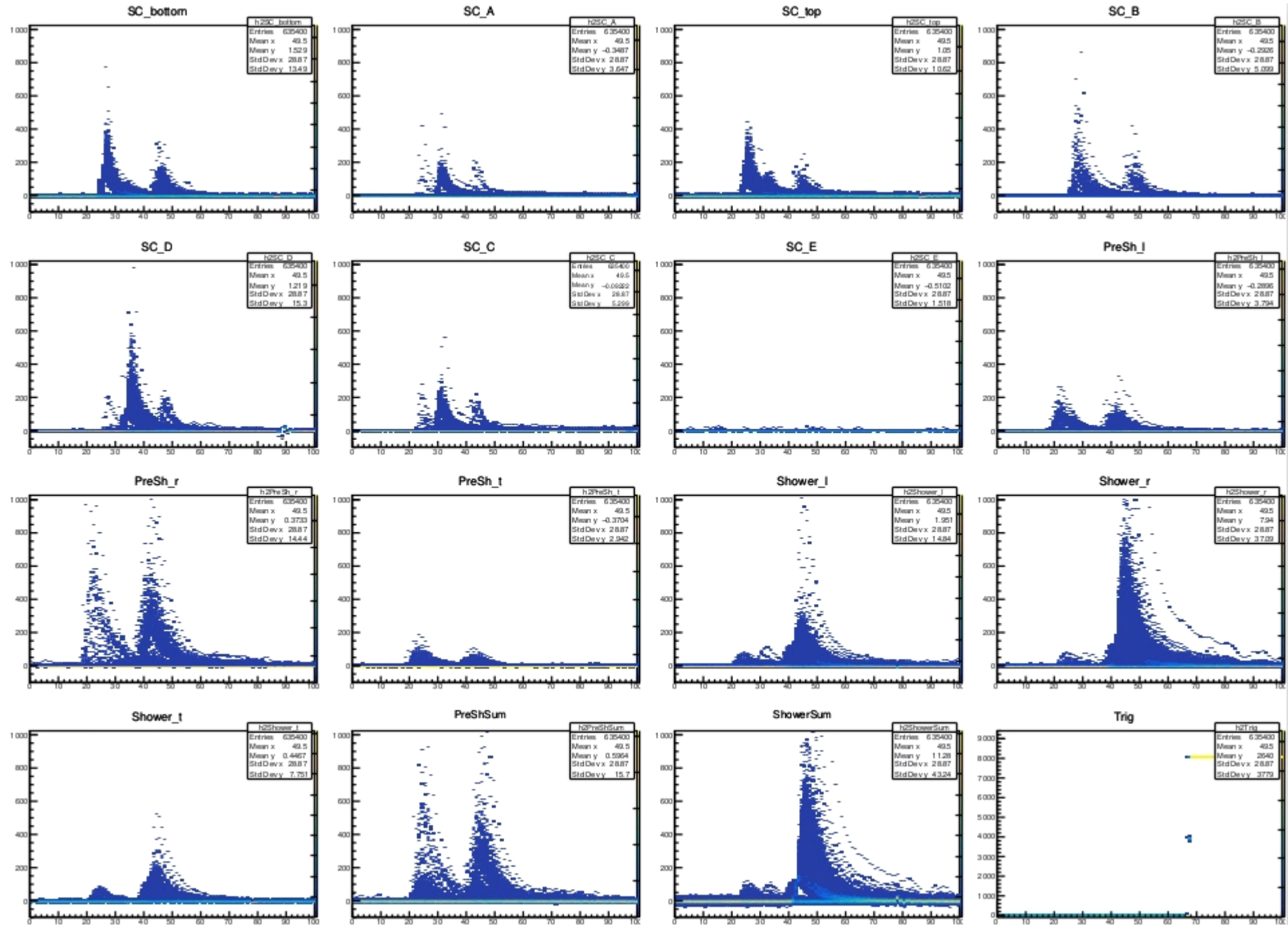
Threshold:

Cer\_Sum(100mV),  
Shower\_Sum(10mV),  
SC\_D(Kedi6-Tile,10mV),  
SC\_B(downstream of Shower,10mV)

Back up

# Cosmic 3

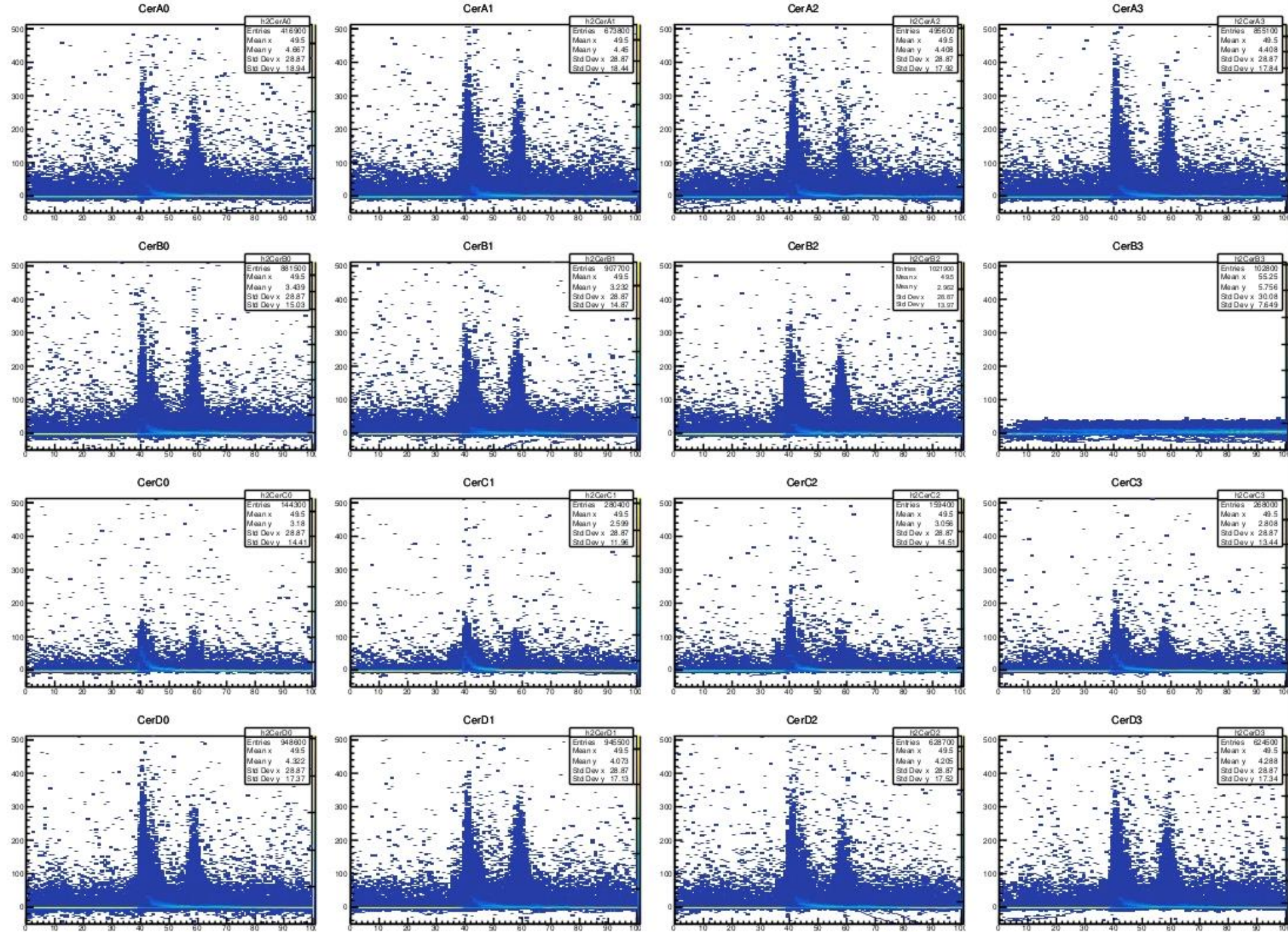
Check all detectors  
(not Cherenkov)





# Tune beam on Carbon Hole target

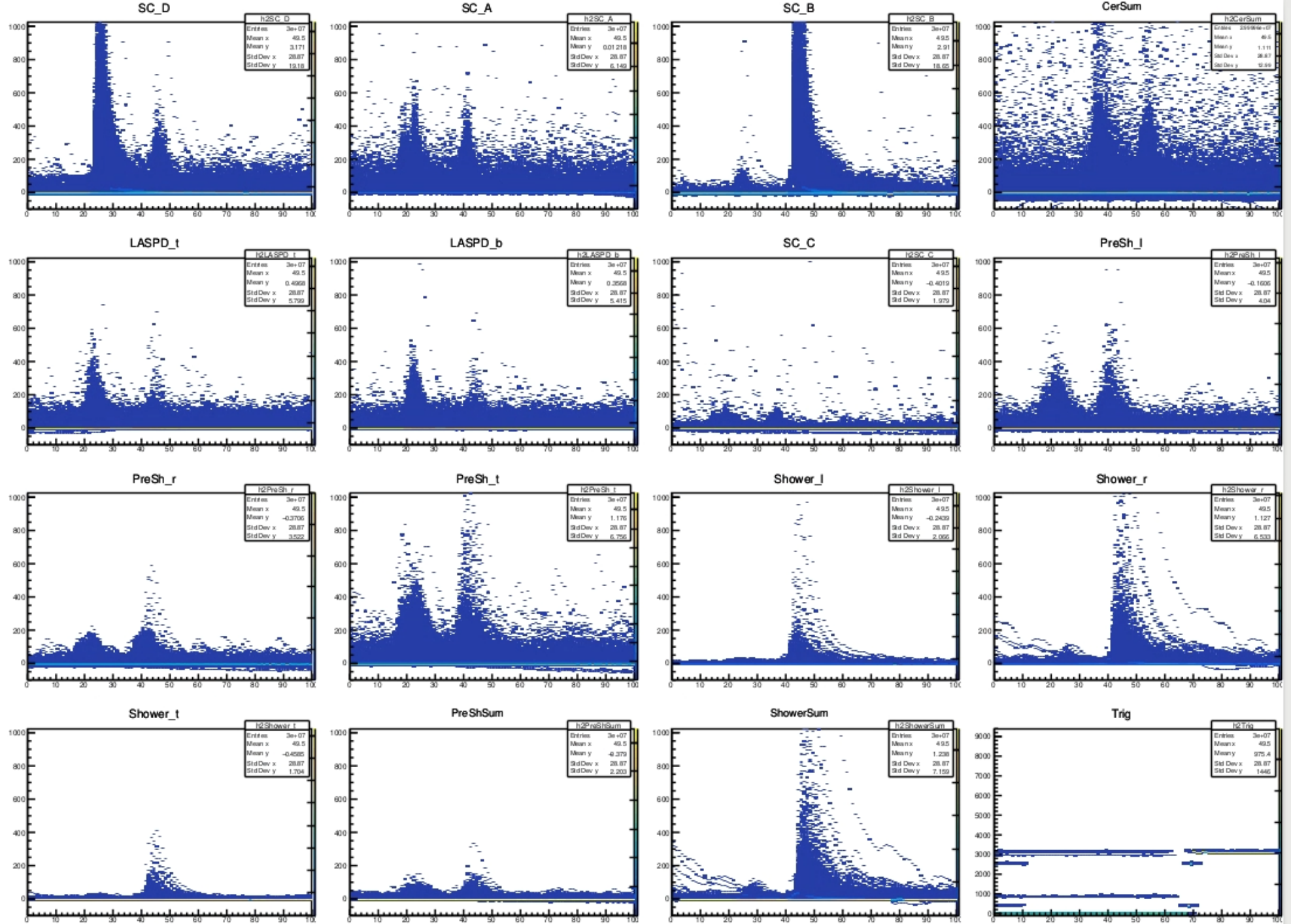
## Cherenkov





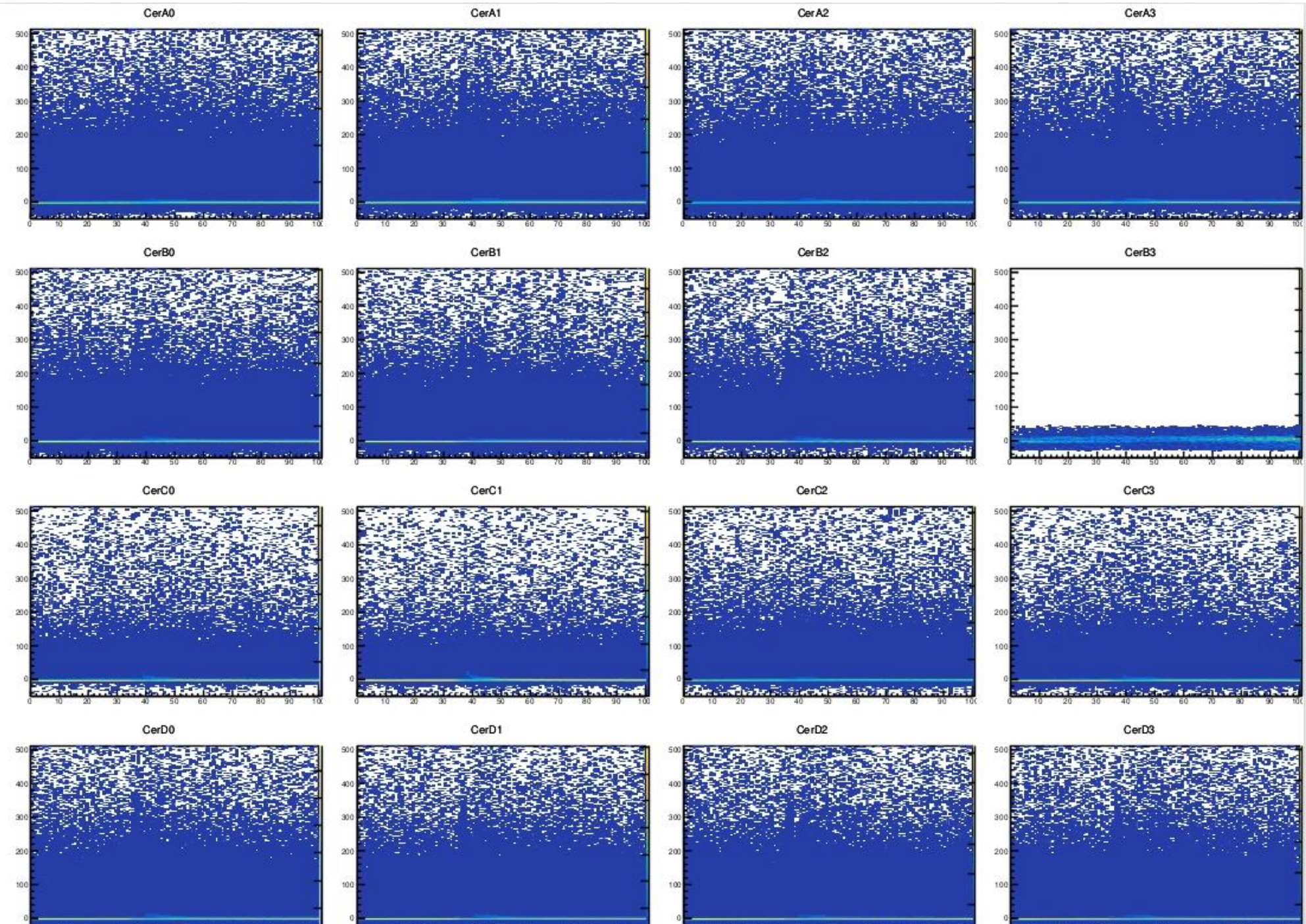
# Tune beam on Carbon Hole target

## SC PreShower Shower



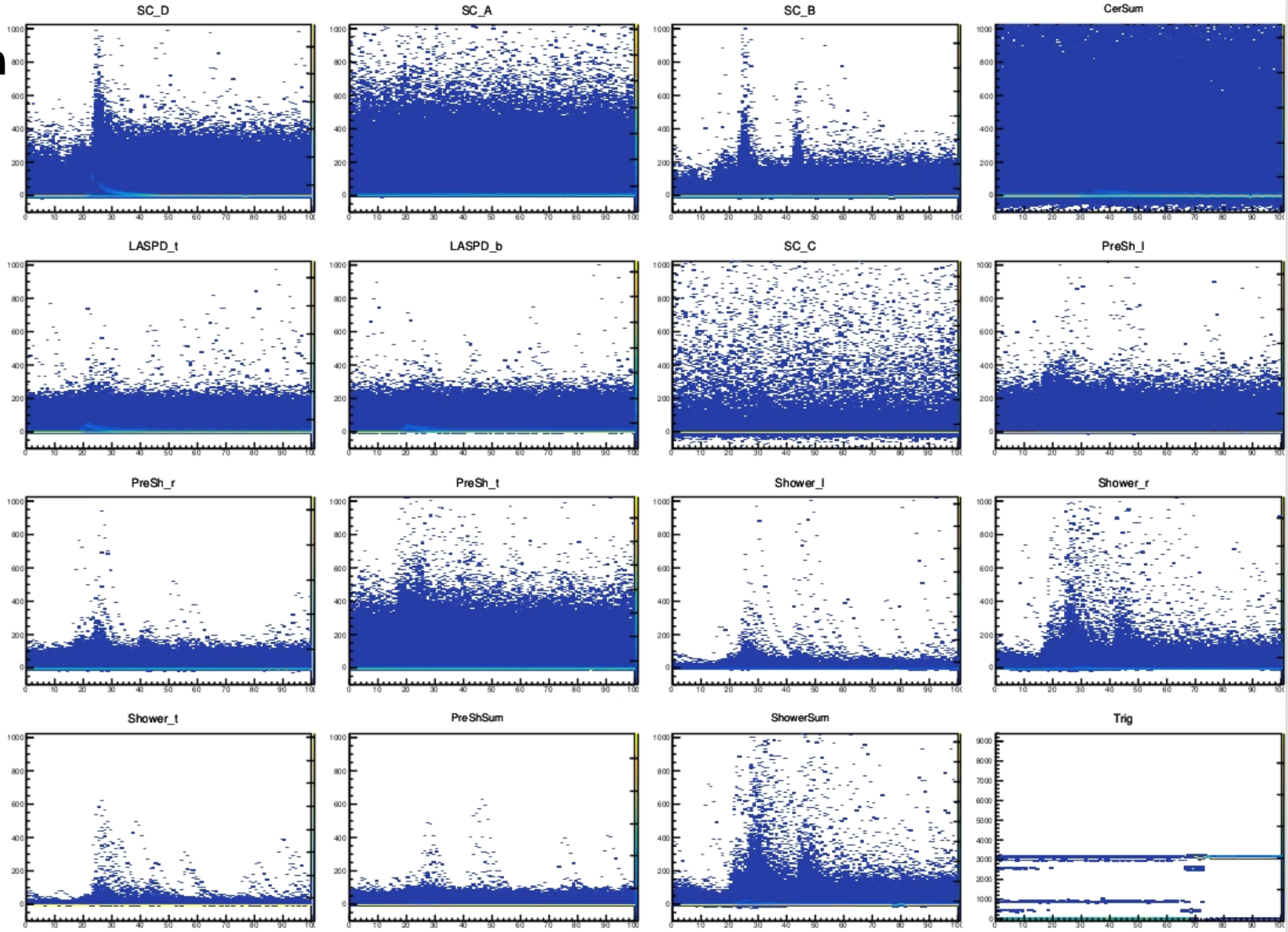


**2uA CW beam  
on  
Carbon hole.  
Beam scraped  
the beam pipe**





**2uA CW beam on  
Carbon hole.  
Beam scraped  
the beam pipe**



MODEL 740 QUAD BIPOLAR LINEAR FAN-IN/FAN-OUT

(Front Panel Description)

Standard #1 NIM Packaging  
in accordance with  
TID-20893

Four Linear Inputs; Accepts  
Up to  $\pm 2.5$  Volt Signal Levels;  
50 Ohm Impedance; Direct  
Coupled.

Four Linear Outputs; Each Capable  
of Delivering  $\pm 2.5$  Volts Across  
50 Ohm Load; Non-Inverting.

Test Point Provides Easy  
Monitoring of Output DC Offset.

Output DC Offset Control; 15-turn  
Screwdriver Adjustment, Variable  
Over  $\pm .5$  Volt Range.

Two Inverted Linear Outputs;  
Each Capable of Delivering  $\pm 2.5$   
Volts Across 50 Ohm Load.

Voltage and Current  
Requirements



CAEN N625

