SoLID Cherenkov Hit and Occupancy

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Introduction

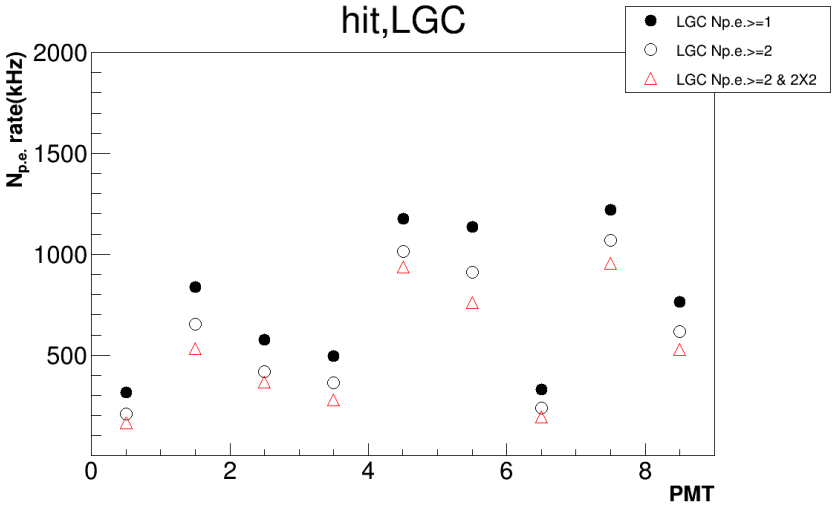
- Simulation setup ("Beam on target" with "hgc_moved")
  - "Beam on target", Shoot 11GeV electrons on target with full setup and use the general "QGSP_BERT_HP" physics list. (previous study suggested this gives higher background rate from individual particle source like eDIS and pions)
  - "hgc_moved", HGC adopted for longer endcap
  - LGC is the old one for shorter endcap (need update)
  - "SIDIS_He3_JLAB_VERSION_1.3/pass8" data used

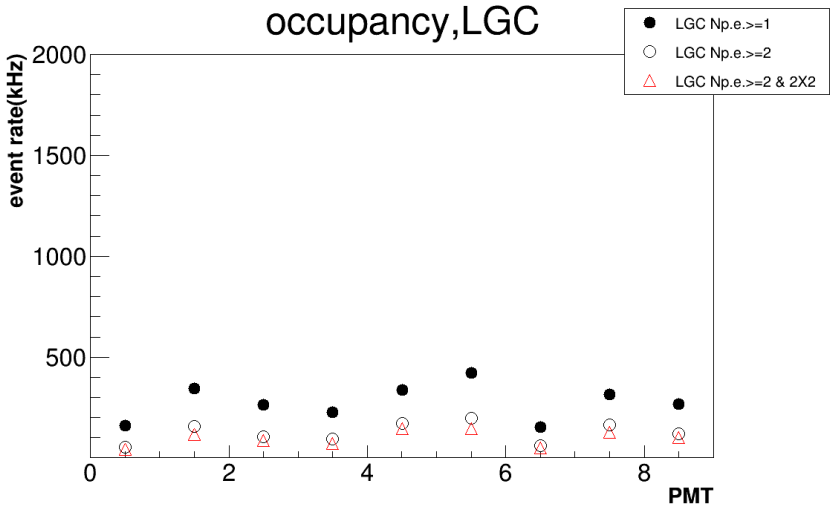
- assume every source particle is independent, so no time window for integration yet

"Hit", Np.e.*rate with threshold cut
"Occupancy", rate with threshold cut
Hit = Np.e. * occ

2x2 means at least 2 Np.e. in 2 PMTs

The result here is for SIDIS_He3
LGC rate is expected to be higher for Jpsi (~2X ?) and highest for PVDIS (~3X ?), even though the background type are different





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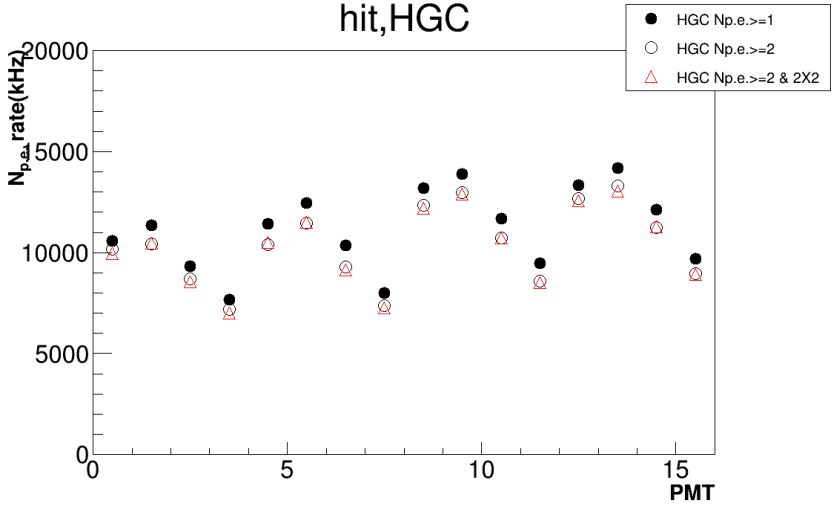
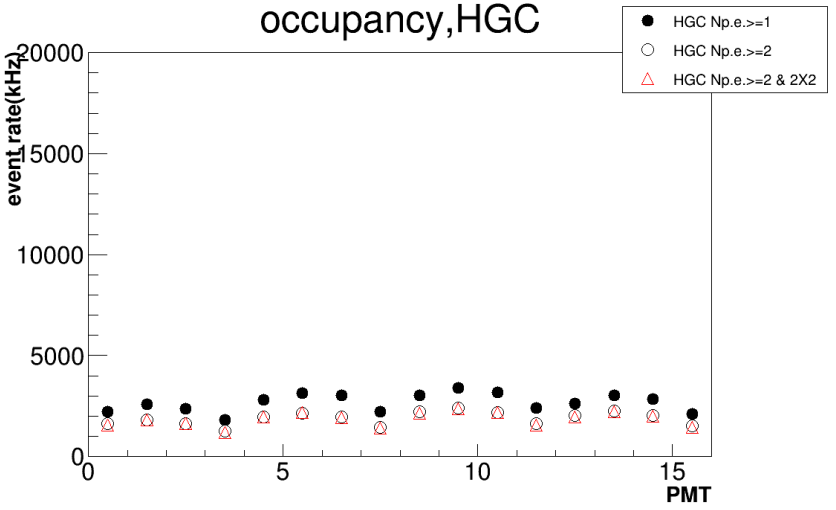
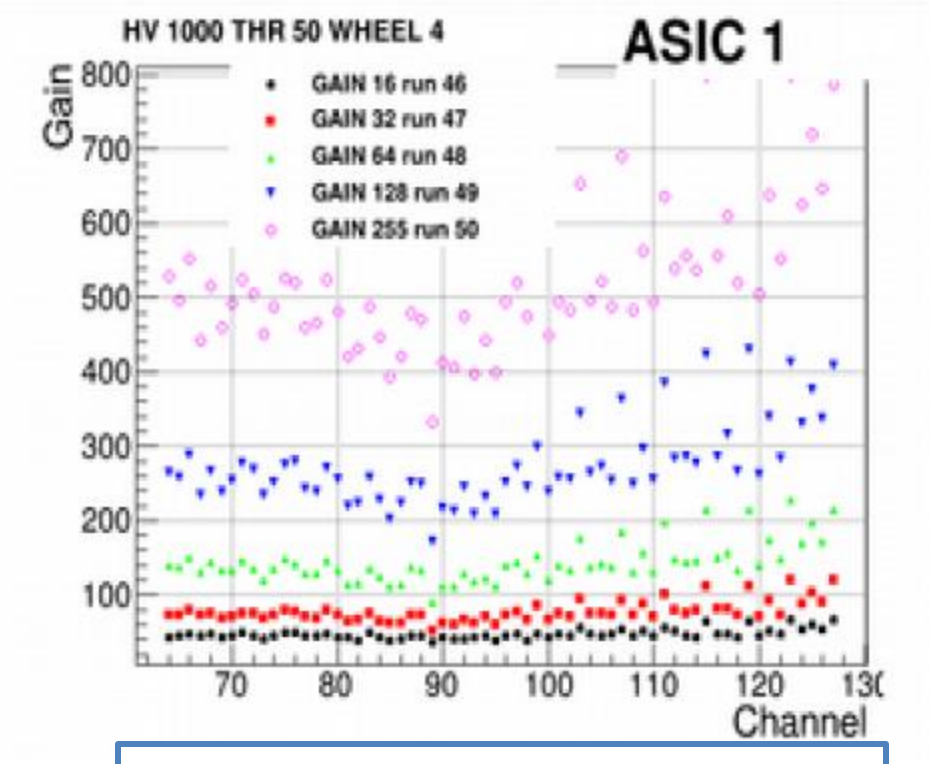




MAROC feature and MaPMT pixel gain variation

- Individual pixel amp, 0 to 4 with 8 bits resolution
- Common discrimination threshold DAC 10 bits
  - peaking time 15-25 ns for the fast channel and 60-100 for the slow one
- CLAS12 Trigger latency (8 μs) is too large for the use of the MAROC slow channel with charge measurement, so they use TDC in binary mode
- gain VS time? CLAS12 RICH hasn't seen significant gain reduction for ~1 year running



Gain of 64 pixels at various pixel amp

Figure 3: Anode uniformity (Example)

P1 → P8

73	71	68	66	71	68	80	76
83	78	76	75	81	82	91	88
80	77	79	77	82	92	94	95
74	73	77	72	82	91	96	100
68	69	73	77	80	87	92	97
57	64	73	76	76	81	87	91
57	60	60	68	66	71	84	79
52	56	51	62	58	57	69	62

P8 ↓ P64

TOP VIEW

SUPPLY VOLTAGE: -1000 V
LIGHT SOURCE: TUNGSTEN LAMP with BLUE FILTER (DC LIGHT)
SPOT ILLUMINATION (APERTURE SIZE): 6 mm square on each channel

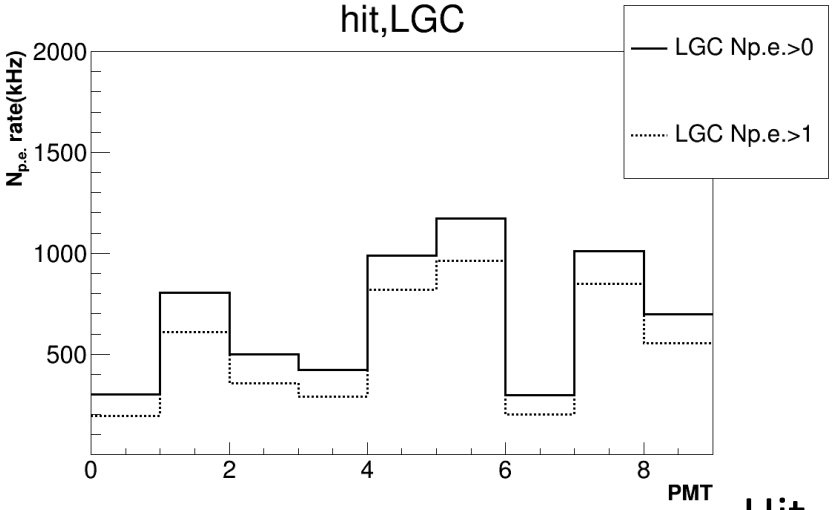
Catalog plot

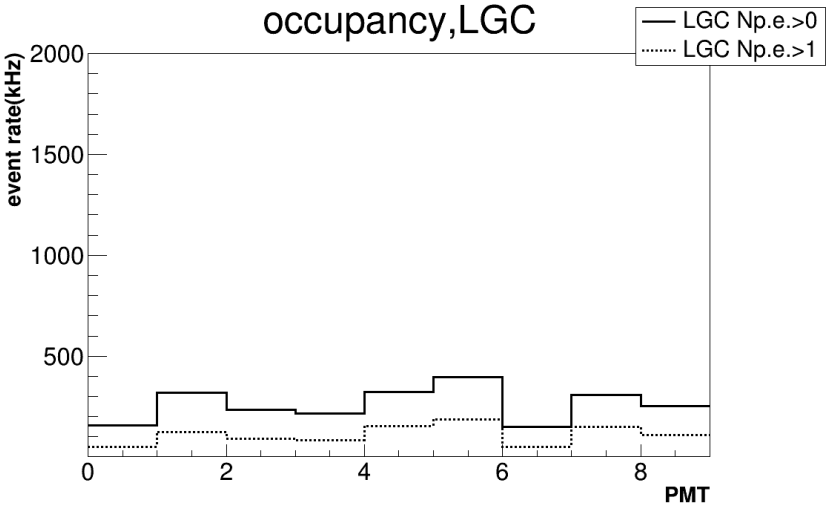
backup

"Beam on target" with "hgc_moved"

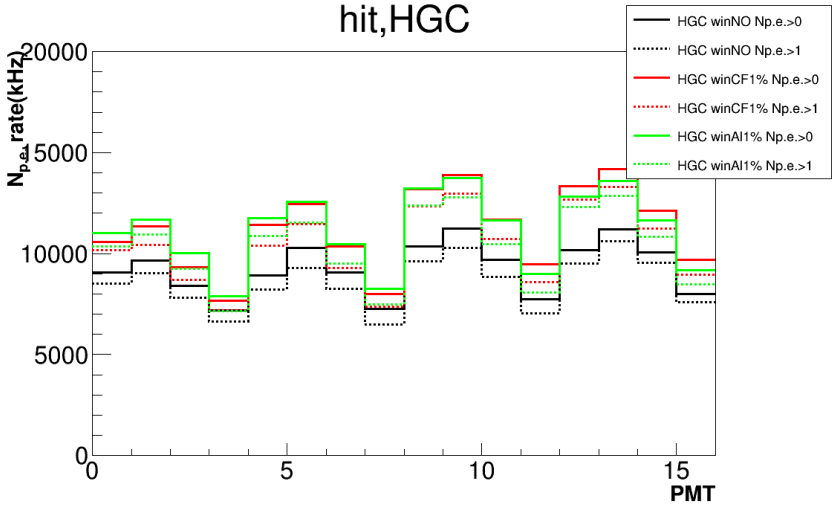
The result here is for SIDIS_He3
LGC rate is expected to be higher for Jpsi (~2X ?) and highest for PVDIS (~3X ?), even though the background type are different

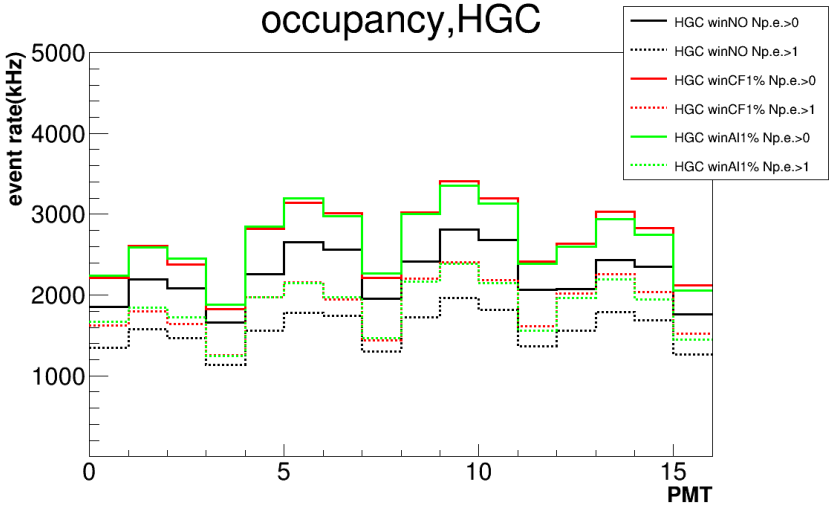
LGC and HGC hit and occ





Hit = Occ*Np.e.





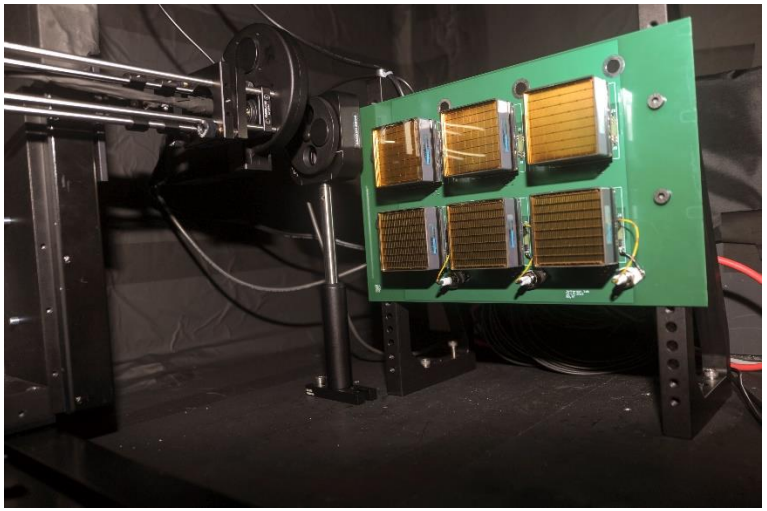
ADC Charge Measurement

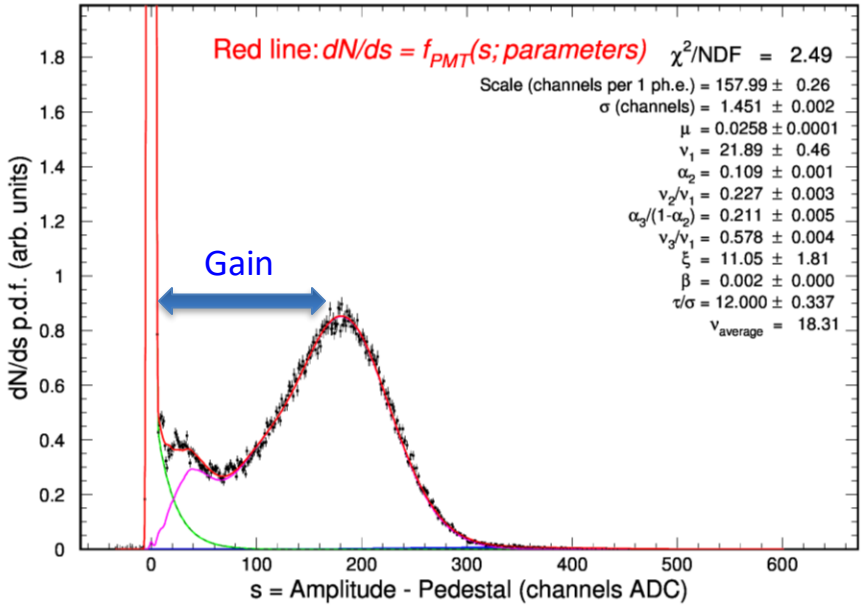
Multiplexed readout up to 50 kHz

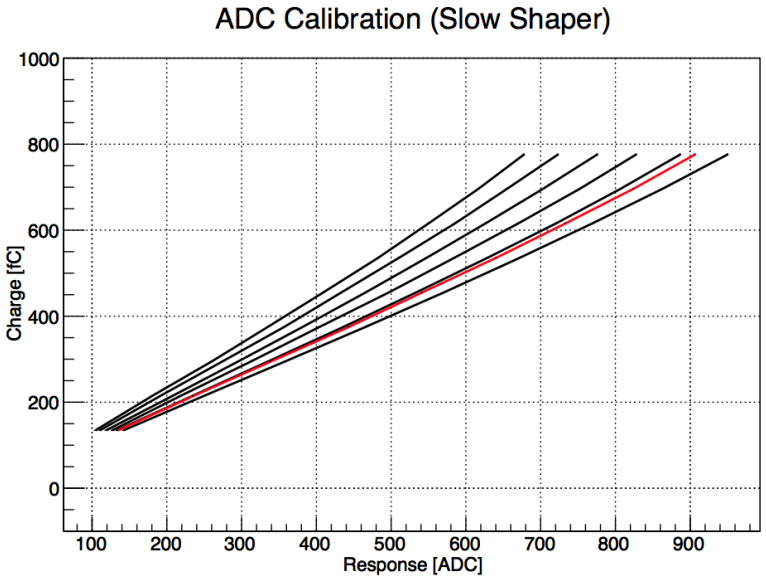
High resolution SPE spectrum

Viable for efficiency and gain monitors

In conjunction with timing, allows the study of PMT discharge and cross-talk

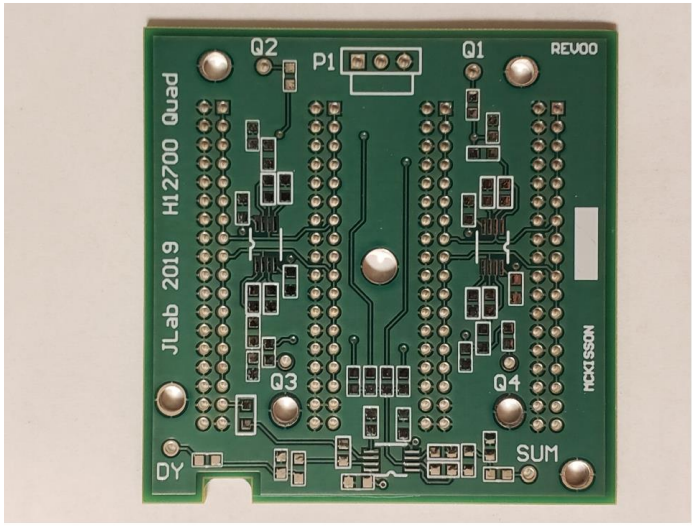




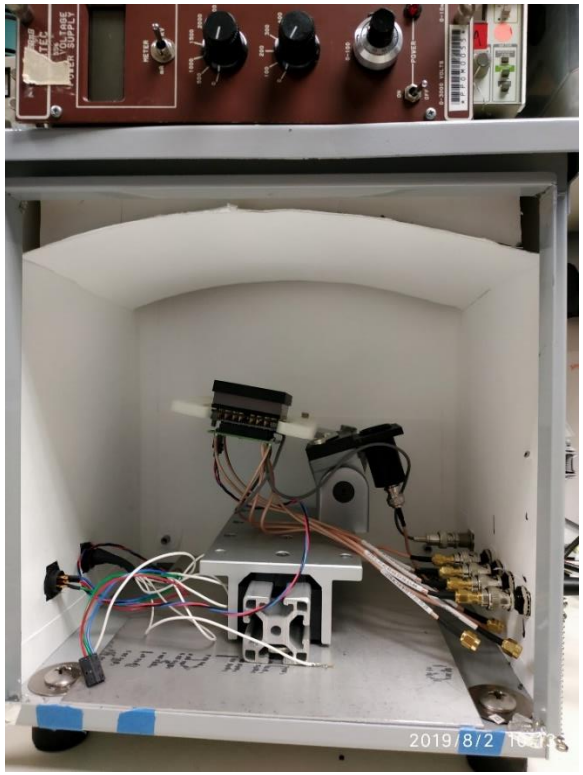


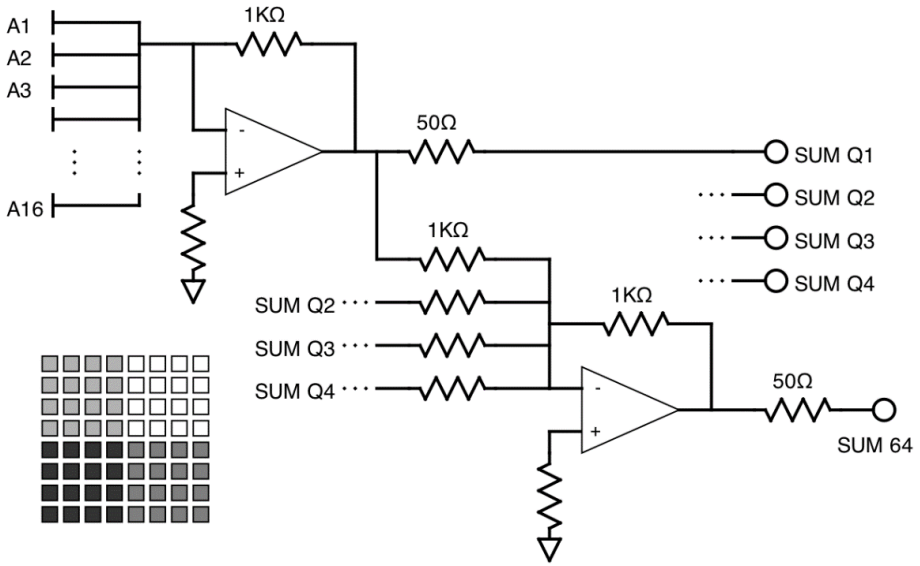
Simple Sum readout

- Jlab detector group helped design and build a preliminary sum board with 4 quad sum and 1 total sum, for both HGC and LGC
- Additional quad readout would increase DAQ cost to 3-4 times higher
- Plan to test it during preR&D



detector group test stand

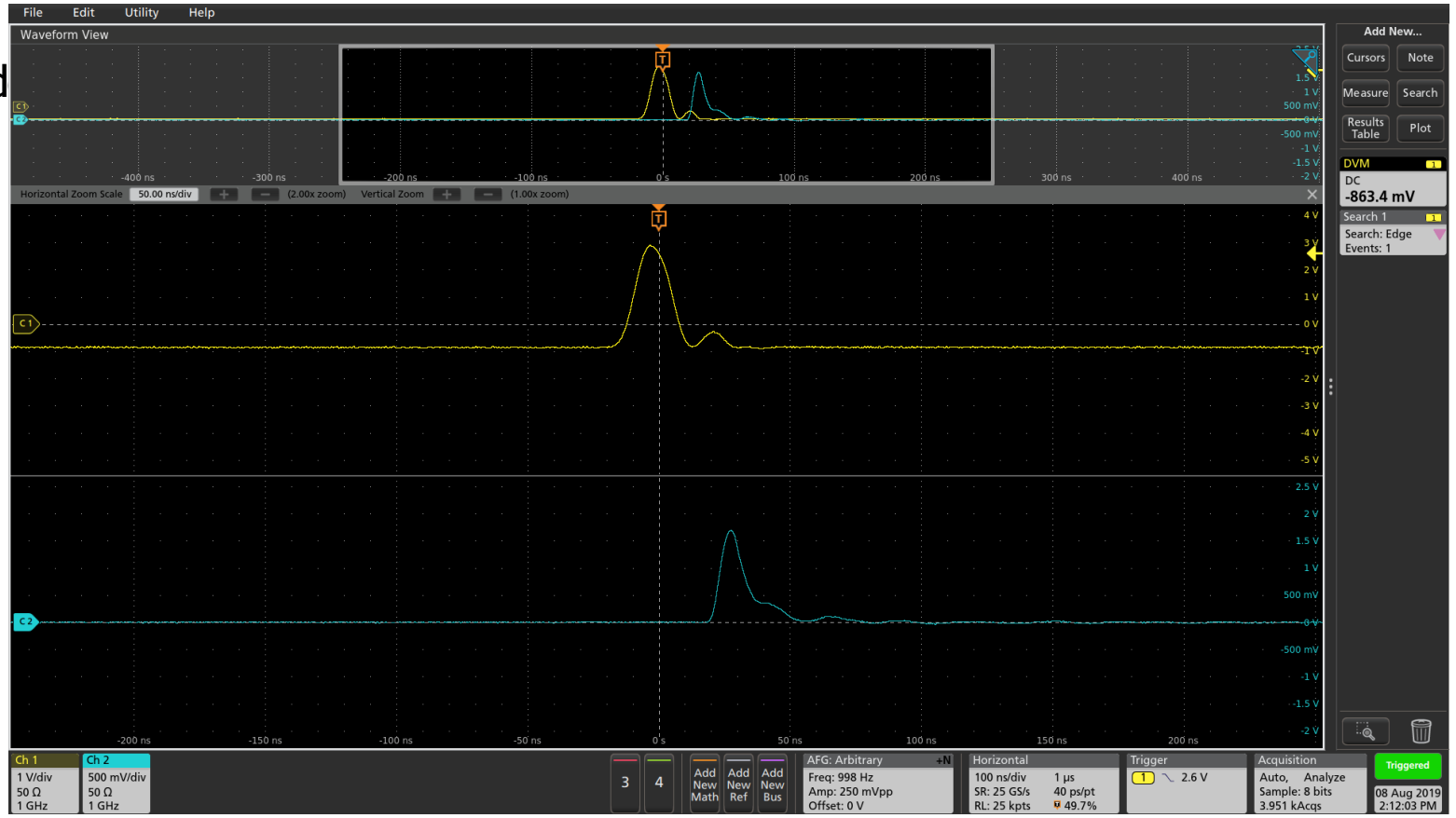




Simple Sum readout

- First look
  - Yellow is LED control voltage, blue is total sum signal

d



MAROC with analog readout

- Alternative/Upgrade readout solution with total sum and pixel information
- Based on CLAS12 RICH readout design
- Modify ASIC board and add a total sum board (design done by INFN Ferrara)
- MAROC would save 480 channel of HV and LV power source
- MAROC would need additional electronics and DAQ cost
- Plan to make a few boards and test during preR&D

MAROC test stand