Summary of HyperFast Silicon Data from FNAL test w. Quad ASIC

Sebastian White, CERN/UVa. March 25, 2019

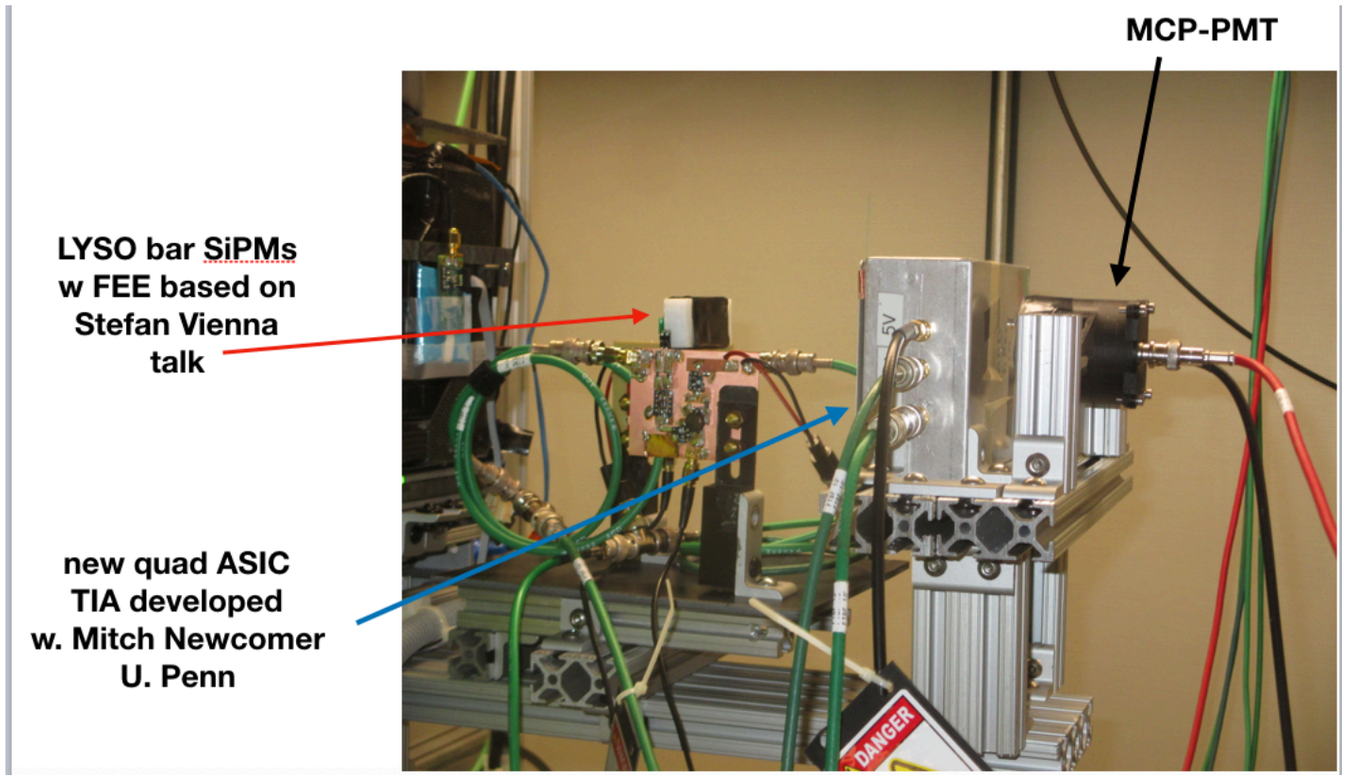
- **this was a 1-day parasitic beam test opportunity courtesy of Syracuse LHCb group**
- **beam was ~120 GeV protons**
- **probably not well focussed on our setup**
- **setup (from downstream):**

  -HPK R3809 11mm diam MCP-PMT,

  -64mm² HFS sensor w. Penn ASIC readout,

  -50mm*3mm*3mm LYSO w SiPM/each end&new FEE from UVa.

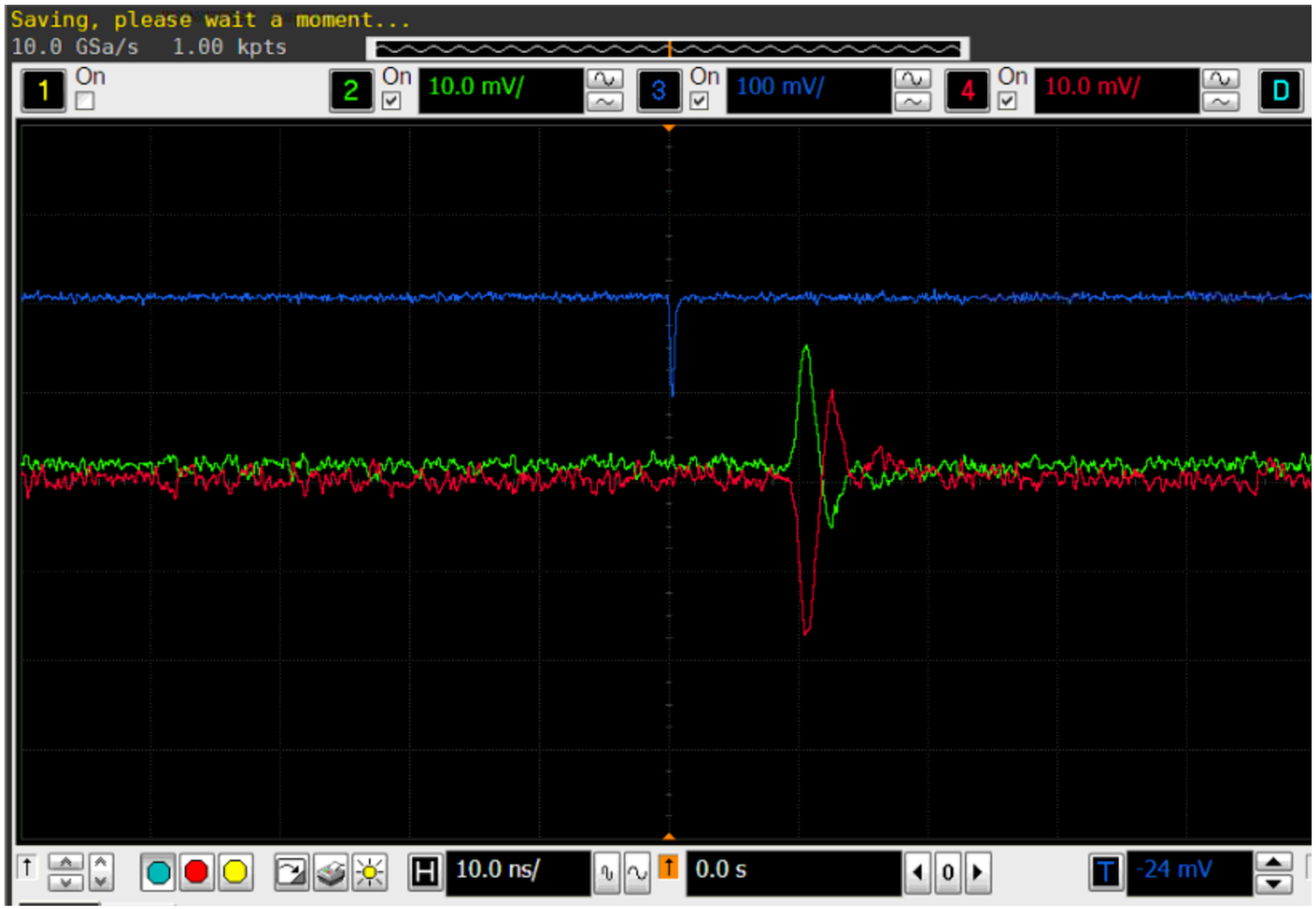
  (FEE clone of S.Grundacker presentation @Vienna)



MCP(blue trace) used as a trigger

independent of LHCb trigger&tracking

acceptable singles rate ->recorded ~400 good coincidences



HFS bias 1800V

I_{HFS}~400nA

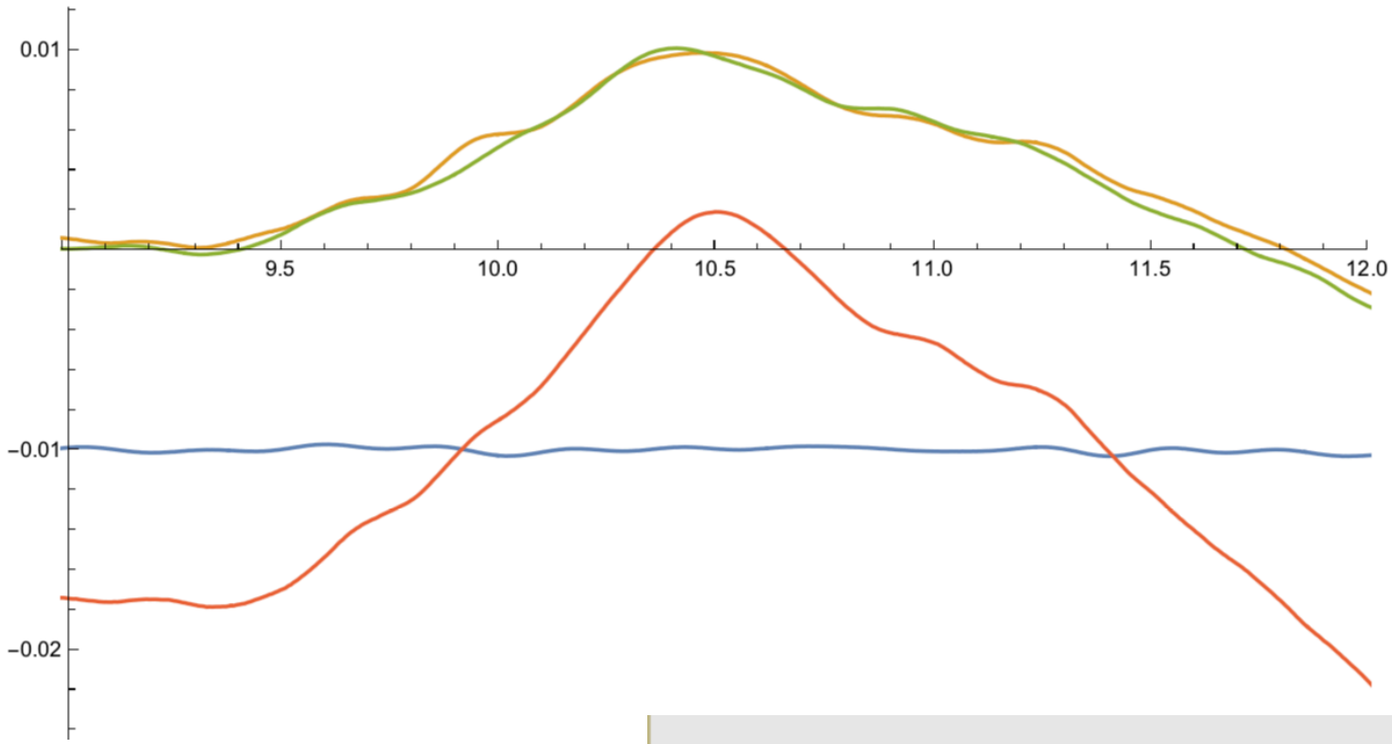
+'ve,-'ve out@10mV/div

signal (&noise) low compared to lab tests @ Penn
->amp had been switched from Hi->Lo gain @Penn?

this was first beam test of ASIC quad TIA
we would like another run in Hi gain mode
nevertheless good results (see below)

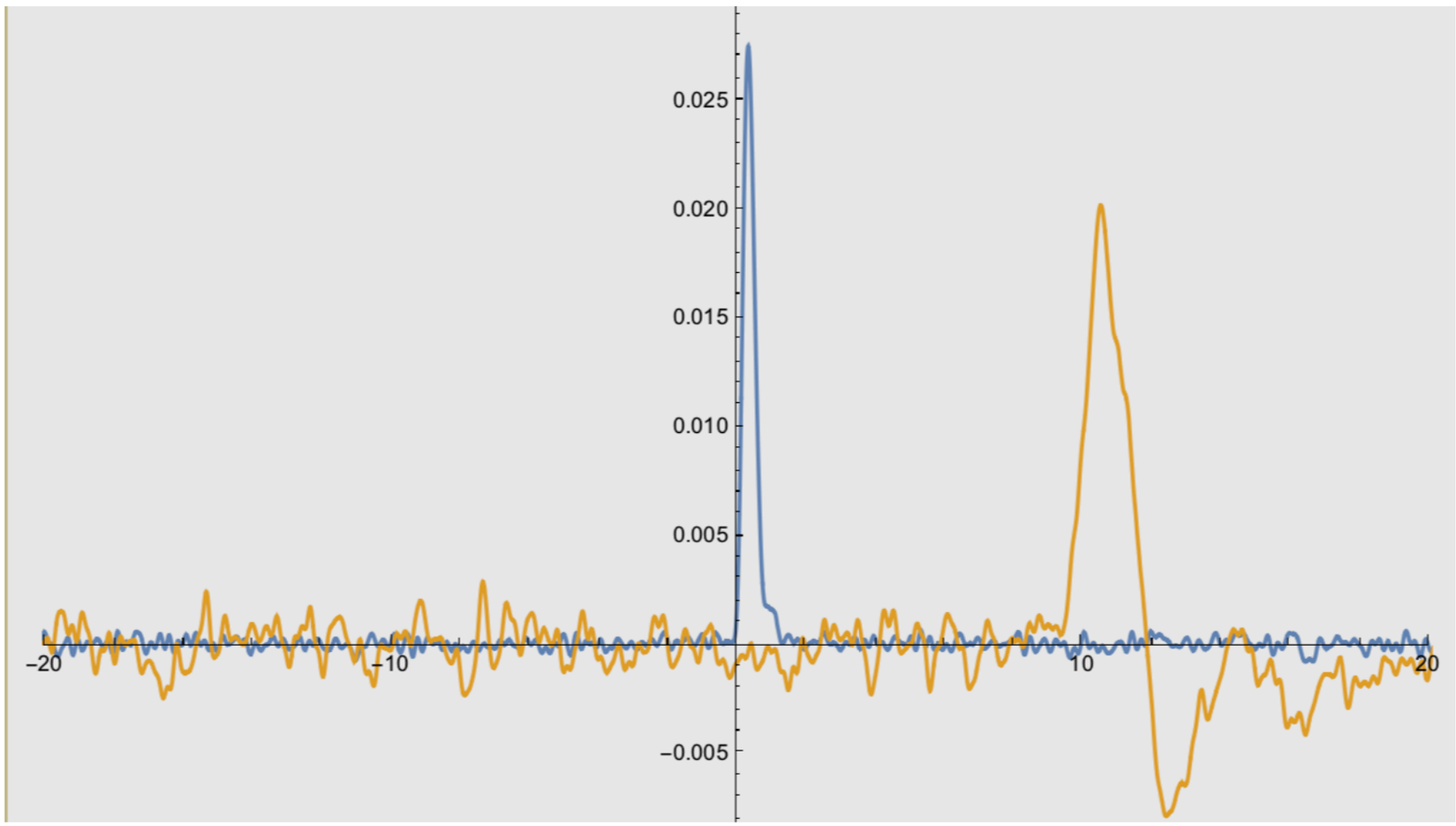
in what follows +'ve & -'ve difference, including 100 picosec offset and 20% Gain diff

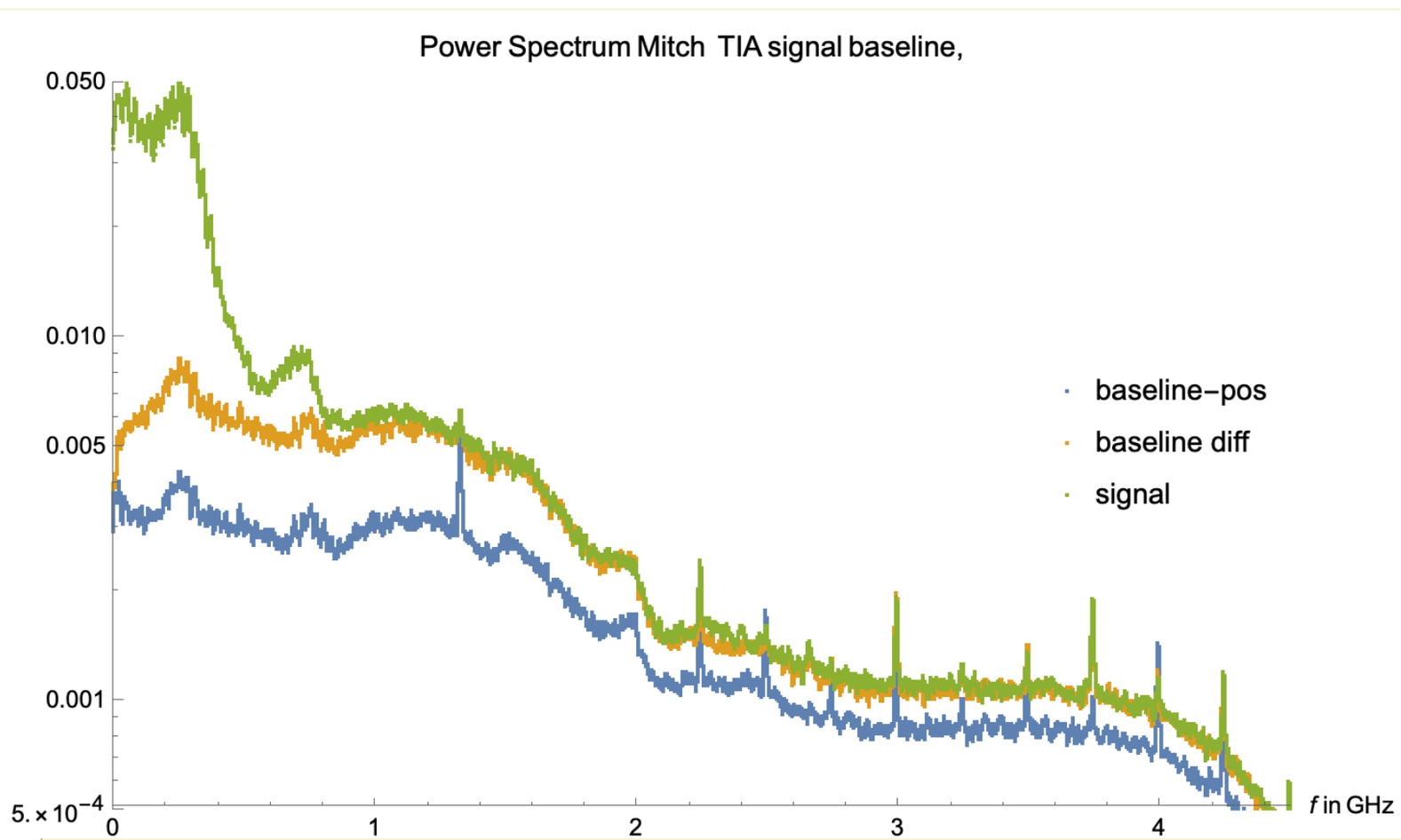
```
ListLinePlot[{Transpose[{time, 0.05 * mcp - 0.01}], Transpose[{time, ch1 + .018}], Transpose[{time - .1, -.8 * ch3}],
  Transpose[{Drop[time, 1], Drop[ch1, 1] - 0.8 * Drop[ch3, -1]}]}, PlotRange → {{9, 12}, Full}, ImageSize → Large]
```



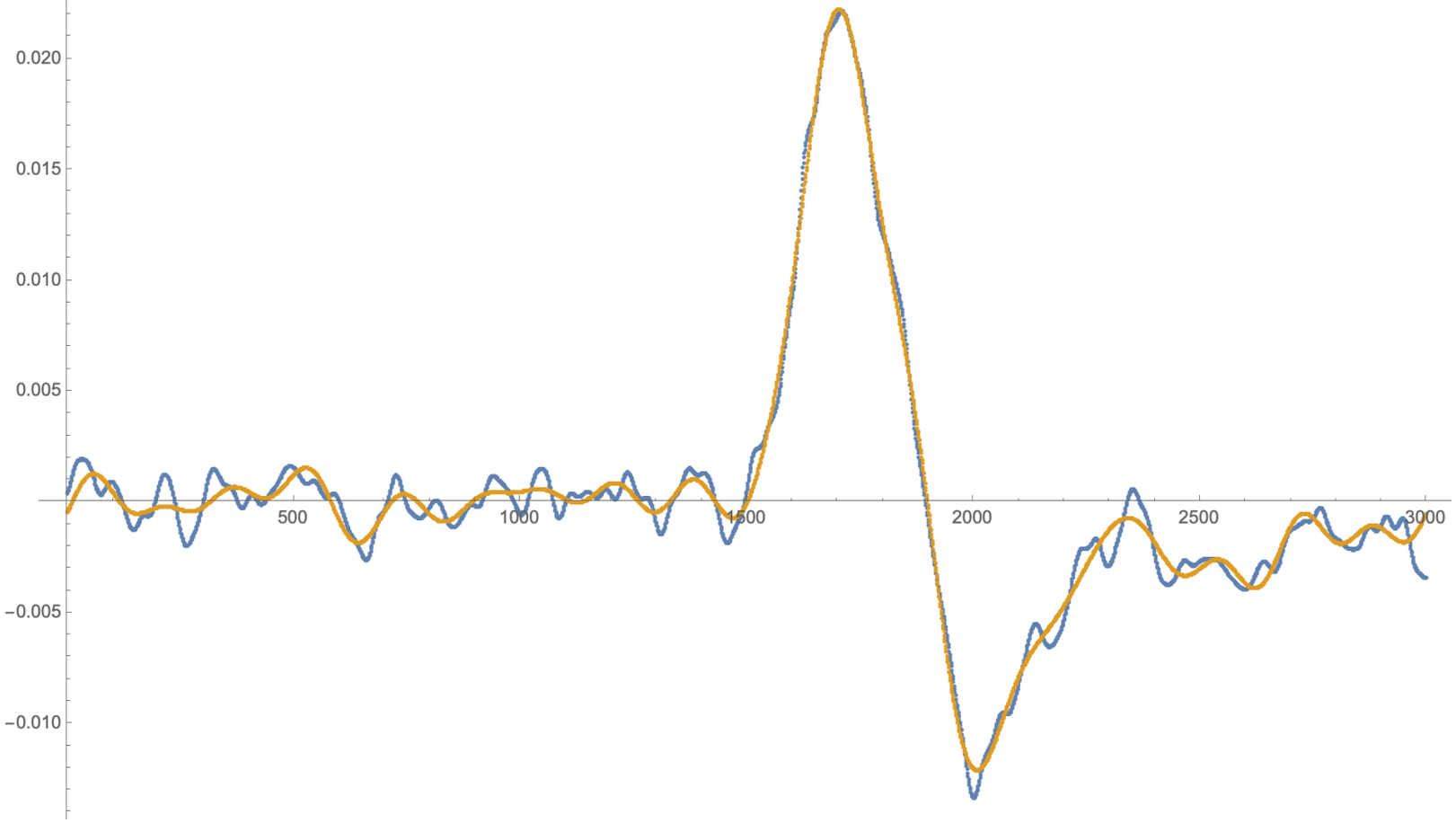
SNR of comb~ 19:1
t_{Rise}(20-80%)~ 0.65 ns

improve jitter
w . digitally applied
bandpass filter?
(scope BW=1GHz)

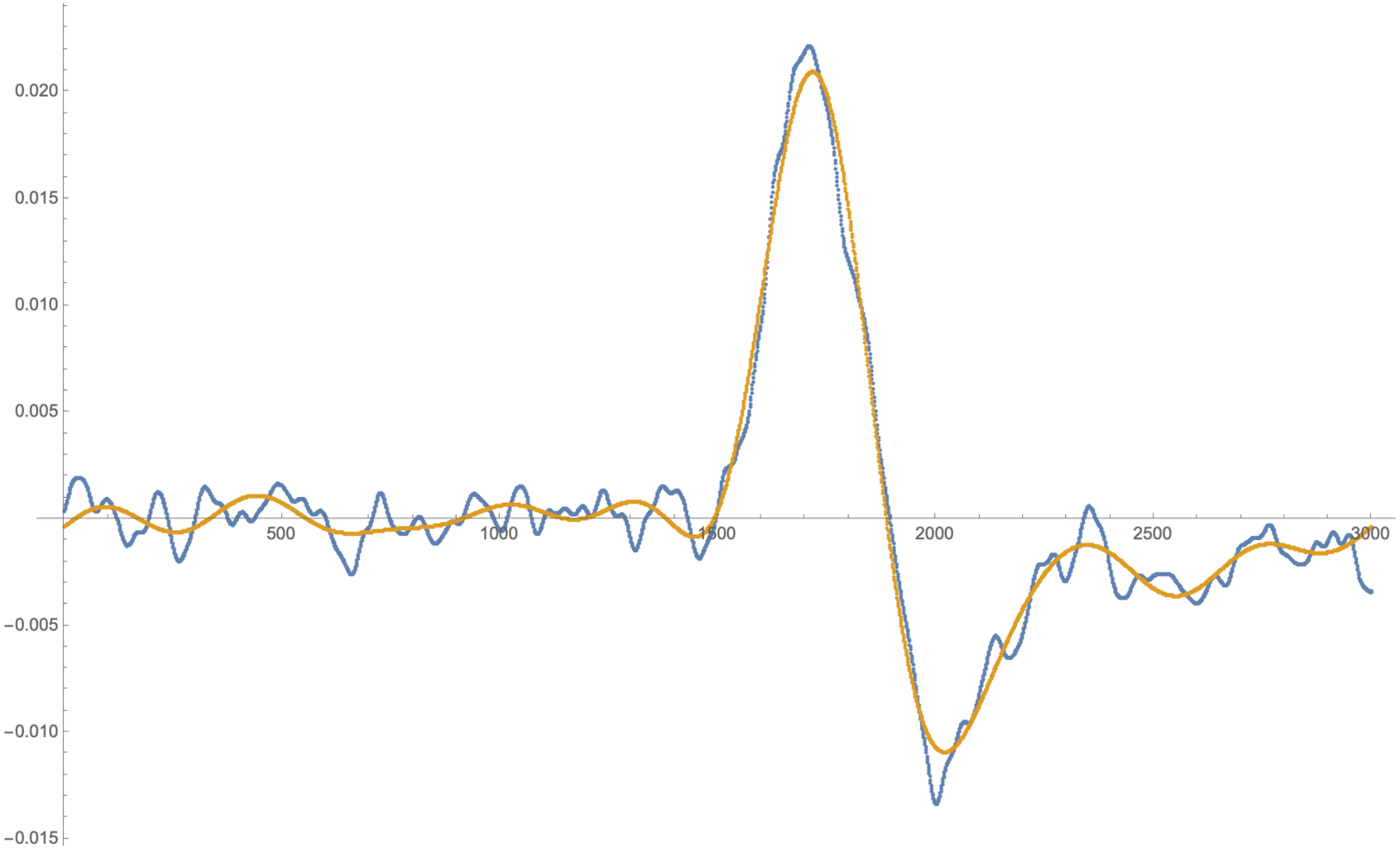



Power Spectrum Mitch TIA signal baseline,
0.050
0.010
0.005
0.001
5. × 10^−4
0
1
2
3
4
f in GHz
baseline−pos
baseline diff
signal

Power Spectrum Mitch TIA signal baseline,
0.05
0.04
0.03
0.02
0.01
1
2
3
4
f in GHz
baseline−pos
baseline diff
signal

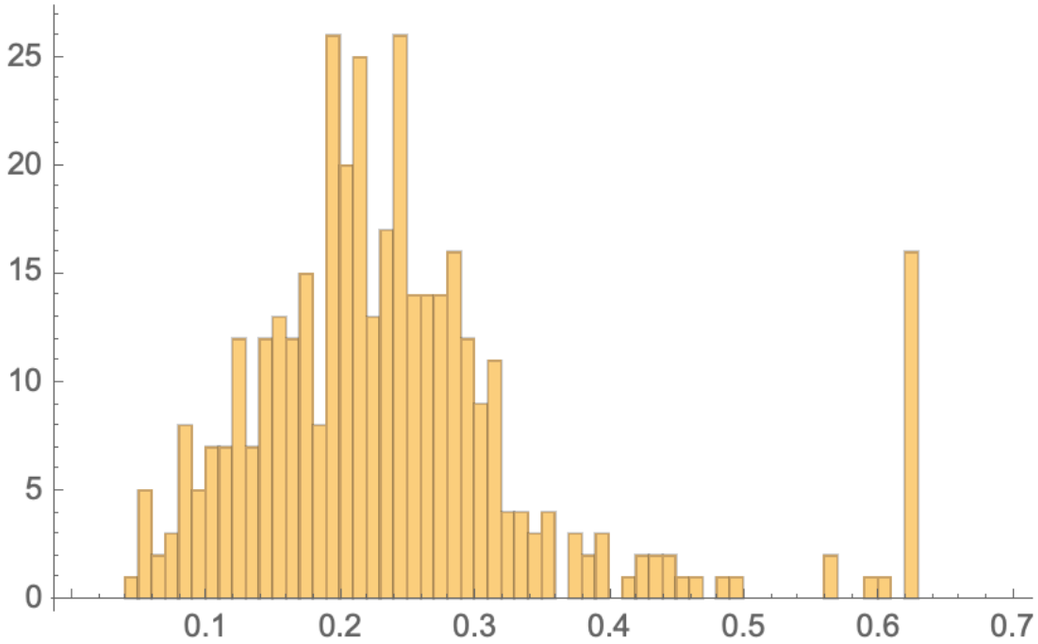


1GHz bandpass



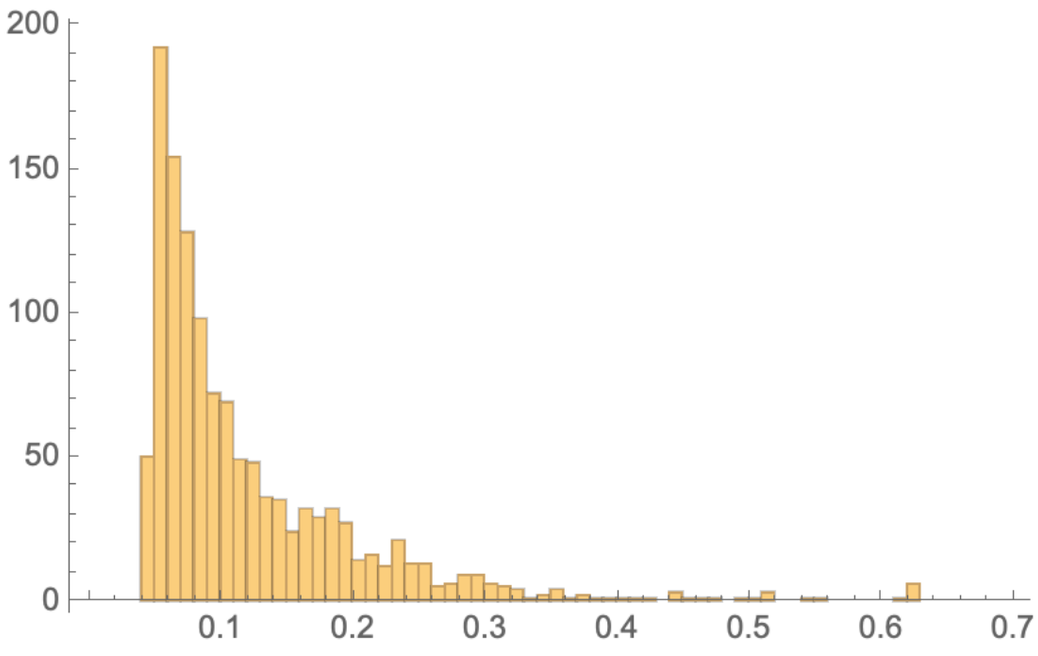
0.5 Ghz bandpass

MCP start time:
would have benefited from tracking to select hits in center of photocathode

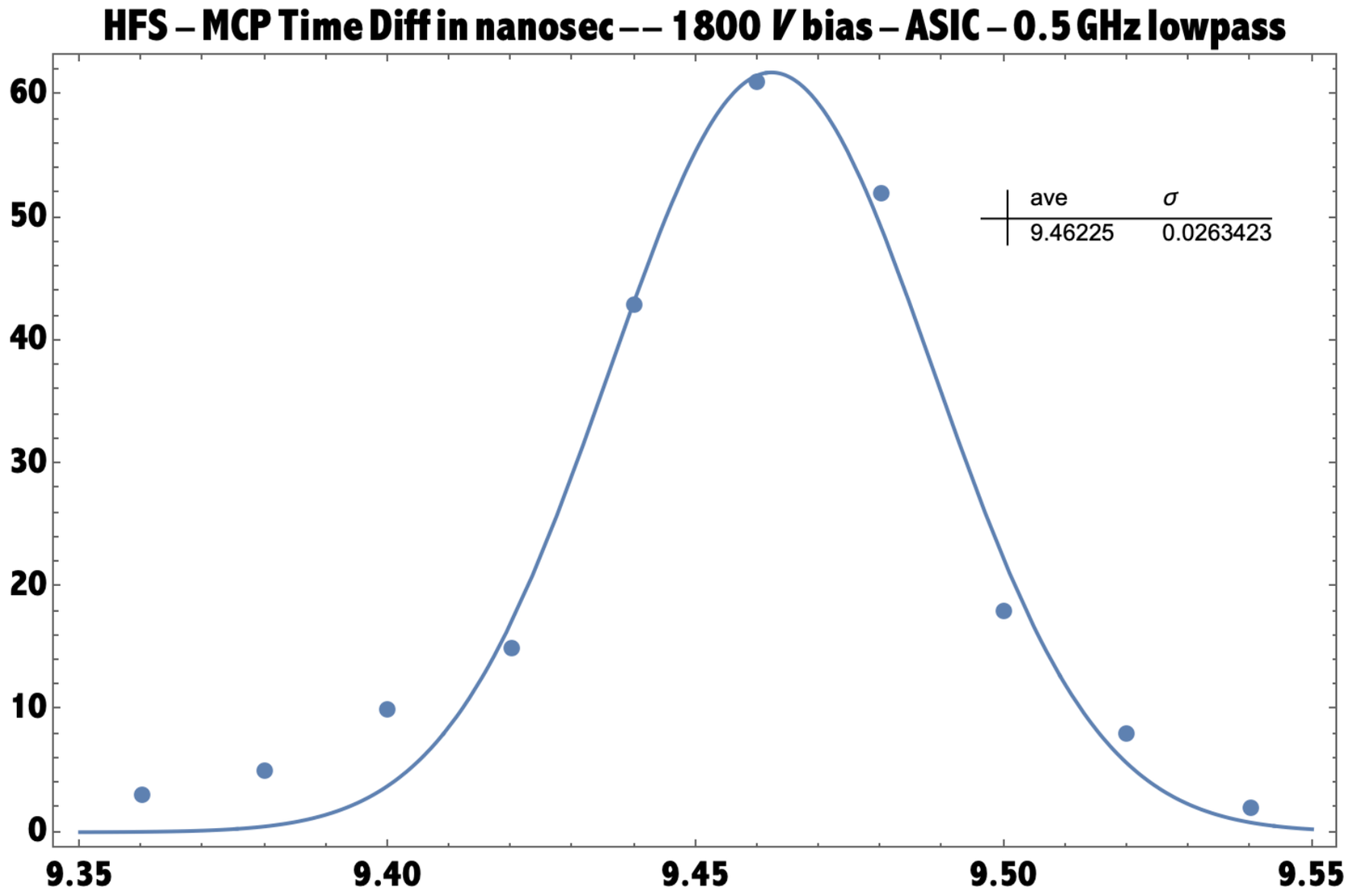


MCP peak pulse height (mV)

w HFS hit



w/o HFS hit



Summary:

- not a bad result for a 1 day testbeam campaign !
- in fact, it was a 3 hr. test I snuck in at the end of my CMS day job (Barrel Timing layer LYSO/SiPM)
- no evidence of significant CMRR in lo gain (Slide 4)-> follow up at Hi gain