

FCFD Variant Update

ASIC WG Monthly Update

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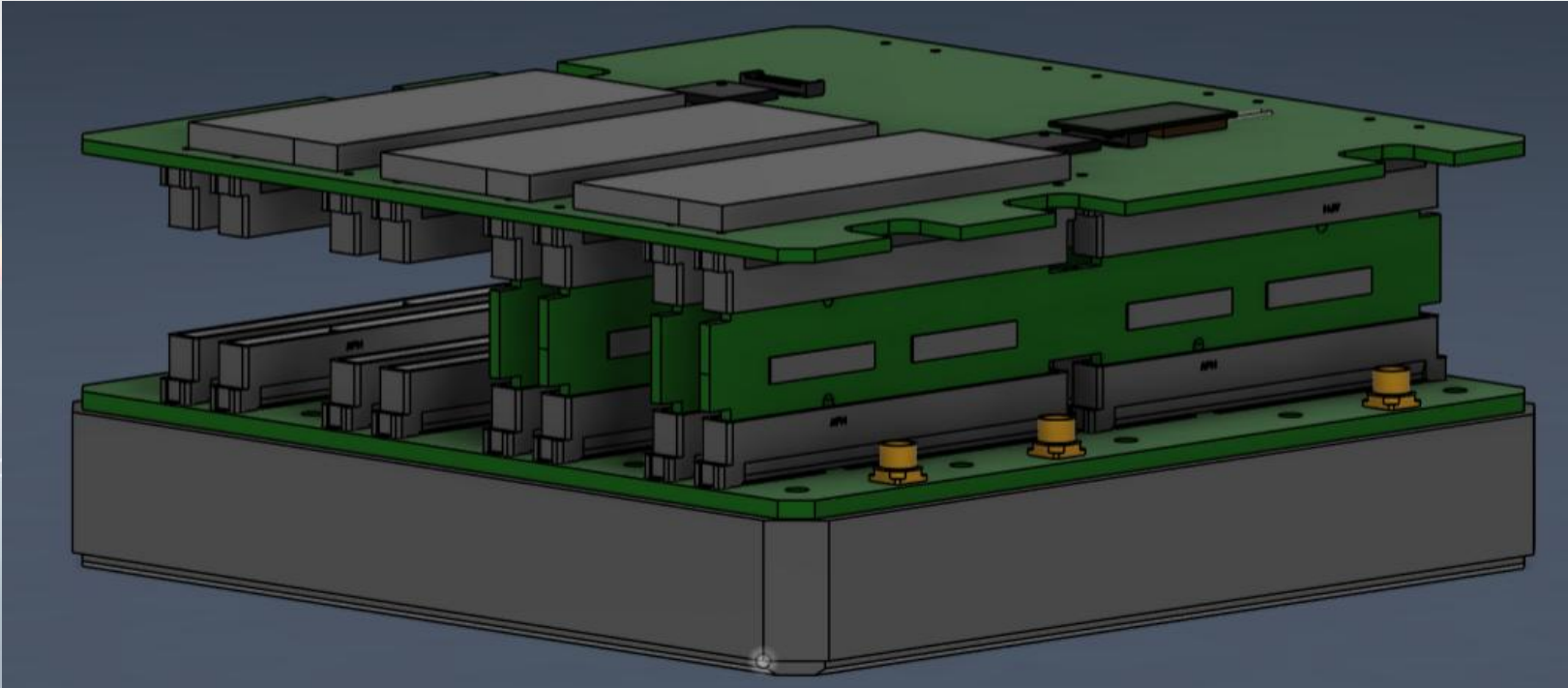
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Updates

- Met with FNAL + pfRICH and hpDIRC groups to discuss requirements
 - Hoping to meet during collab to discuss requirements document
- HRPPD testing restarts this month, mid-late July
- HRPPD V2s ordered June 17
- Planning to test with FCFDv1.2s to verify digital outputs since Variant won't be available for some time
- Preliminary mechanical envelope + mechanical/cooling design started
- Further analyzed timing data from preliminary run

Mechanical Envelope



Per HRPPD

- 8x FEBs
- 32x FCFD 32-ch
- 1 bridge/father card
- 3x bPOLs
- 1x IpGBT+VTRX+
- 68 HRPPDs in pfRICH
- 72 HRPPDs in hpDIRC

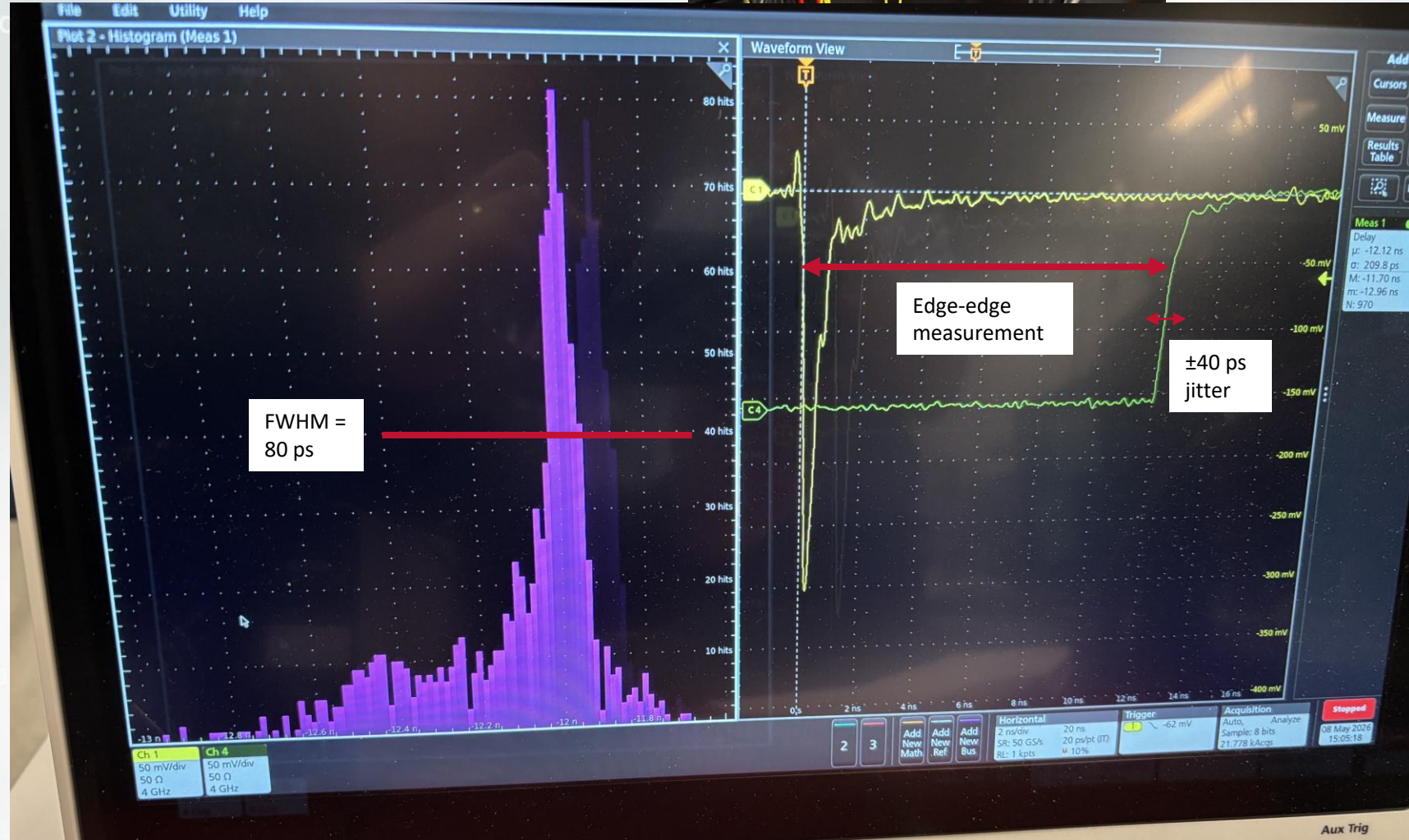
Laser Testing with HRPPD

Test setup:

- Yellow is photodiode measurement split from laser
- Green is CFD output of ASIC
- Histogram records response time difference of photodiode from CFD
- Laser was not exactly centered on pixel, diffused over area - Lead and tail ends could be small signals, noise, dark pulses

Results

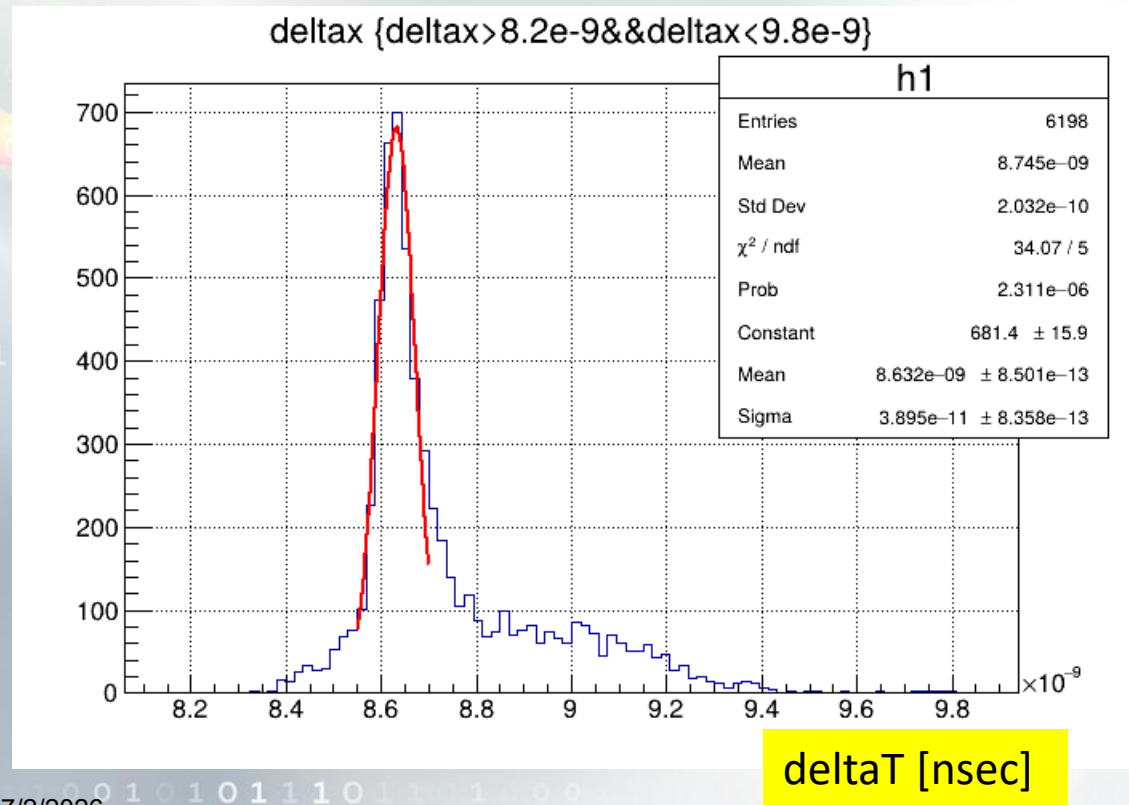
- FWHM = 80 ps
 - 6 bins above line
 - Each bin is 13.3 ps, 3 bins per division
 - Each division is 40 ps
- Std dev = ± 35 ps
- Seems promising as a first run but obviously much **more testing is required**
 - Need to assess gain and noise impacts



Timing Analysis

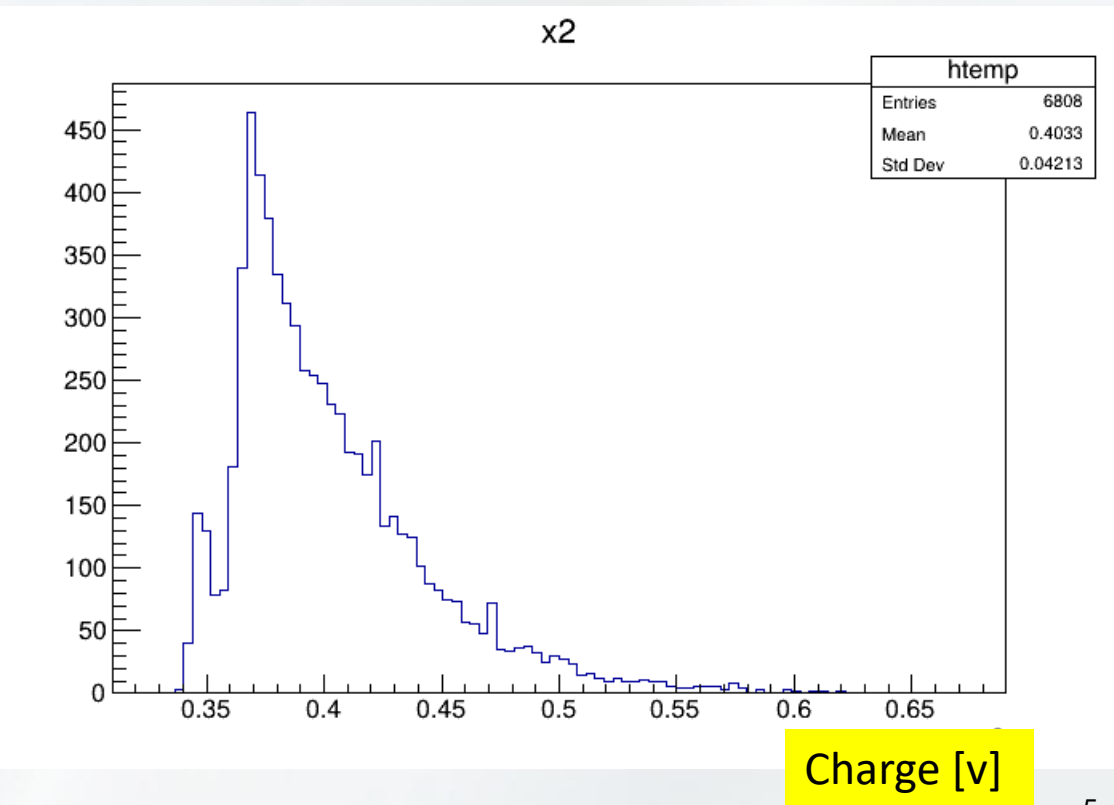
Timing resolution (sigma) distribution of CFD output

- Sigma = 38.95 ps
- Target = 40 ps



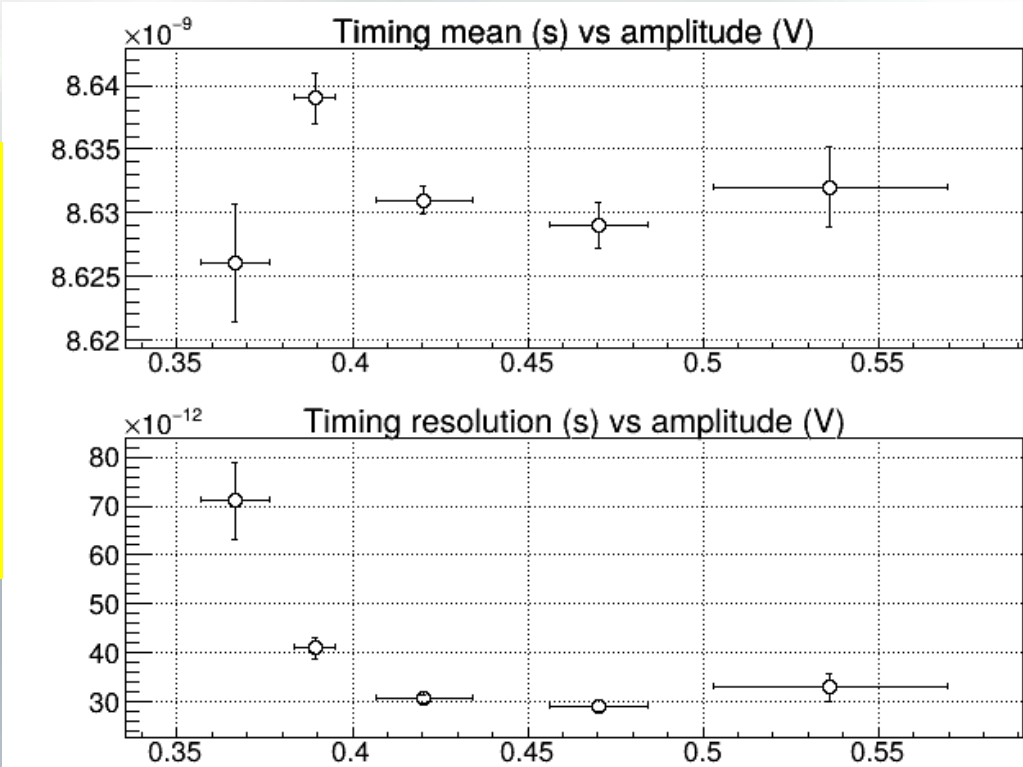
Peak voltage distribution of data

- Voltage equates to charge but not calculated
- Testing was run at few $\sim 10^5$ gain



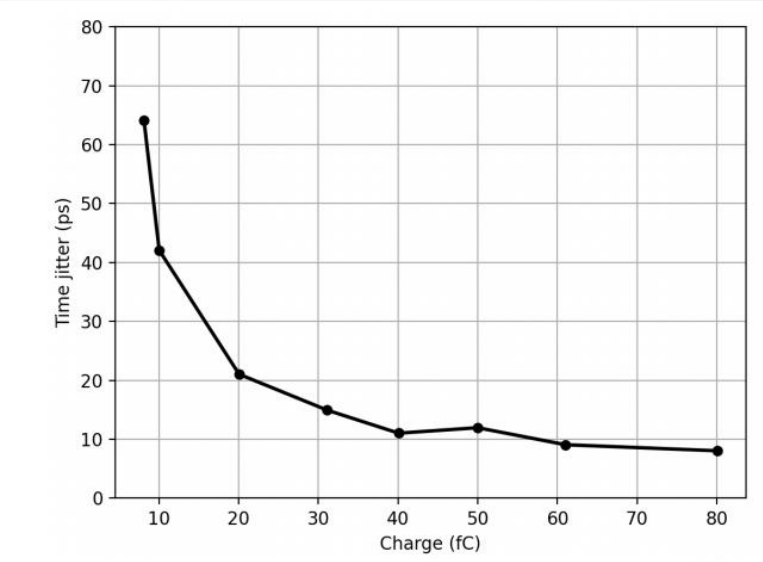
Timing Analysis

Top – mean time response @ different charges
 Bottom – time resolution (sigma) @ different charges



Time resolution of the FCFD tested with the AC-LGAD

- This is the plot directly from the 1st FCFD paper
 - “Design and performance of the Fermilab Constant Fraction Discriminator ASIC”



QUESTIONS?



Appendix