TTU Update

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TB Program at T9 28 June - 5 July 2023

Run plan included following:

- Goals
  1. Measure the performance of the current SiPM's multi-hit capability in a short time window with high-frequency digitization
  2. Evaluate quartz fiber in Copper (4x4 mm2) matrix for em showers
- Detector
  1. Cherenkov/scintillation fibers of various lengths to SiPMs
  2. SiPMs from HPK and OnSemi with fast output
  3. CAEN DRS (DT5742 and V1742)
  4. CAEN FER-5200 (A5202 digitizer)
  5. 2 1x1 Scintillator counters for trigger
  6. MCP-PMT for good timing reference
  7. Tektronix scope 6 and 10 GHz
- Beams
  1. +5 and +3 GeV positrons

Preliminary Results on Different Fiber Lengths

Analyzing data with 40, 20, 10, and 0 cm fiber length differences

~20 cm/ns is the speed of light in quartz fibers

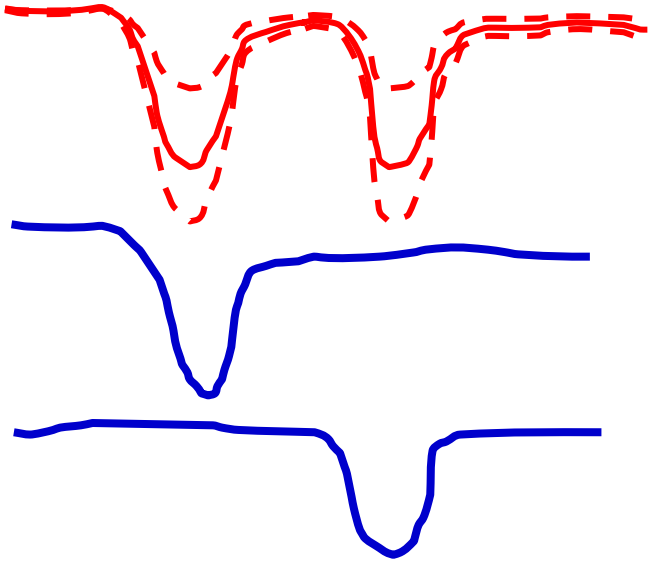
0.2 ns is the DRS time binning (5 GHz sampling rate)

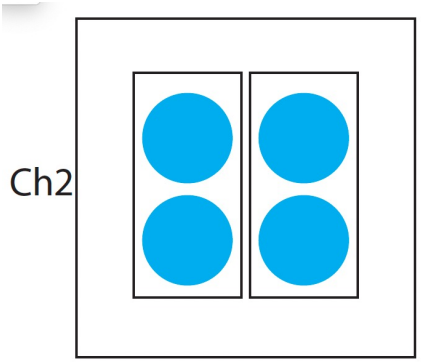
One amplifier on SiPM (Fast) (3 mm by 3 mm 20 um pitch)

We observe up to ~5 photons (1 photon = 2.6 mV)

Pulse width is ~1.4 ns

Limited number of events for shorter lengths…





Fiber Arrangement and Some TB Photos

Configuration for VME DRS Runs (July 4 2023)

Ch1 — DRS-Ch1 Fast / DRS-Ch9 Std
2 AMPS

Ch2 — DRS-Ch2 Fast / DRS-Ch10 Std
NO CHANGE - 20 CM

Ch3 — DRS-Ch3 Fast / DRS-Ch11 Std
NO CHANGE - 20 CM

Ch4 — DRS-Ch4 Fast / DRS-Ch12 Std
2 AMPS

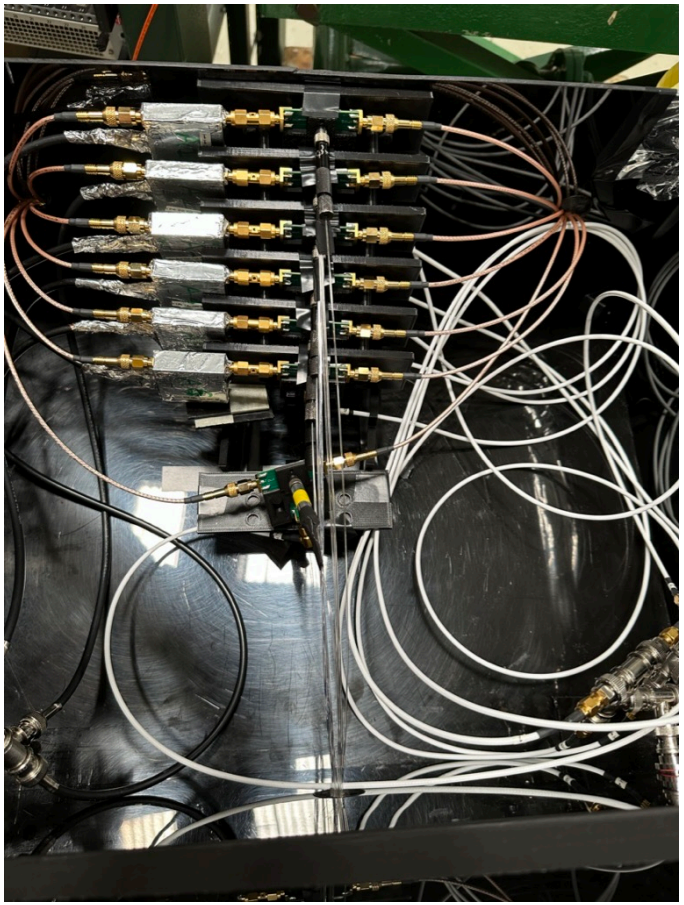
Ch5 — DRS-Ch5 Fast / DRS-Ch13 Std
2 PCF - No amp

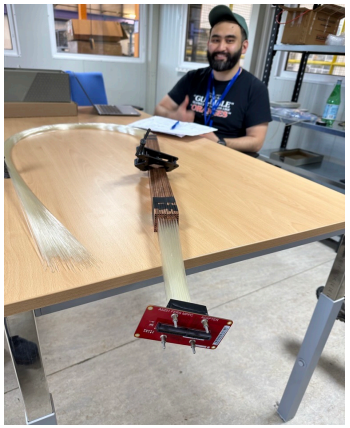
Ch6 — DRS-Ch6 Fast / DRS-Ch14 Std
NOTHING CONNECTED

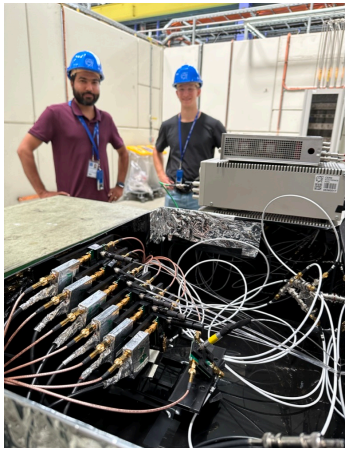
Ch7 — DRS-Ch7 Fast / DRS-Ch15 Std
4 Ce-doped Fibers - No amp

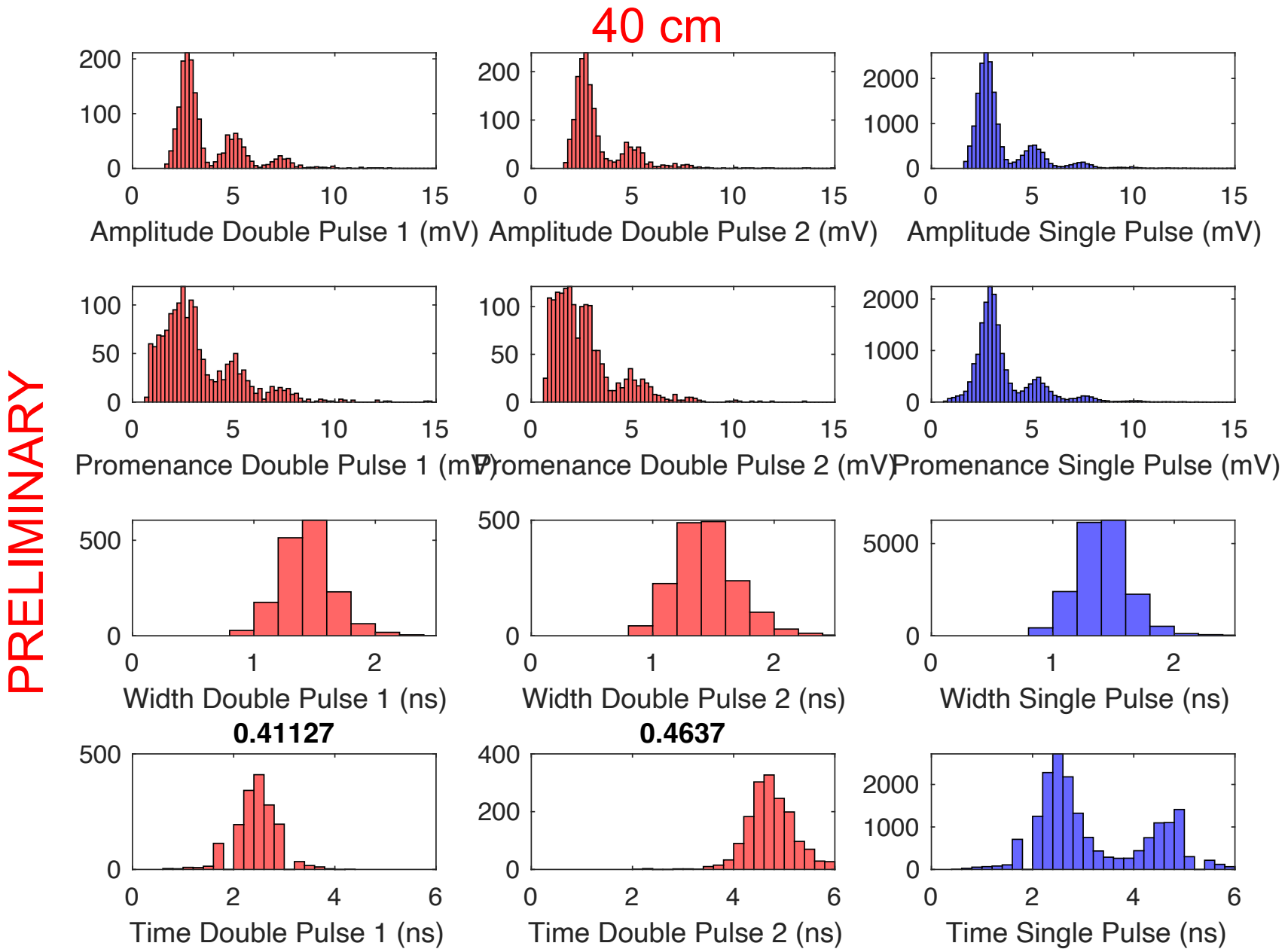
MCP / Trigger — DRS-Ch8 / DRS-Ch16

1	2	3	4
5	6	7	
Ce			

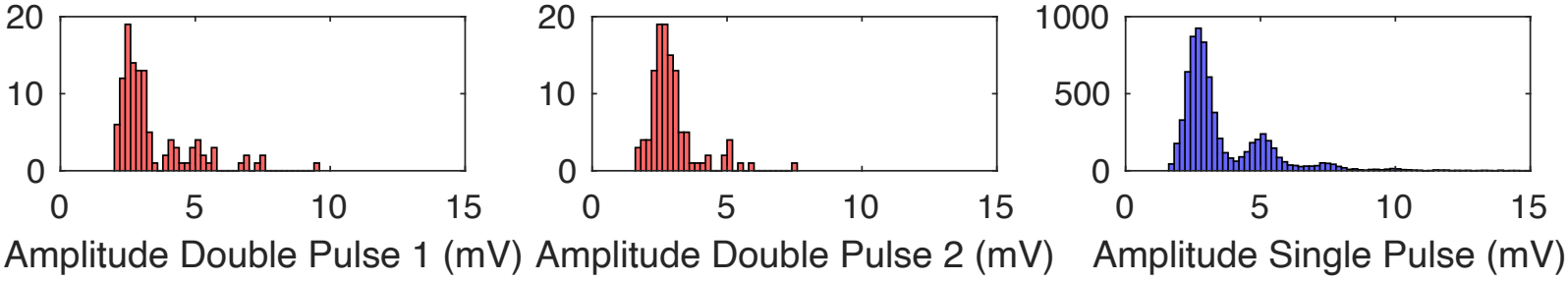


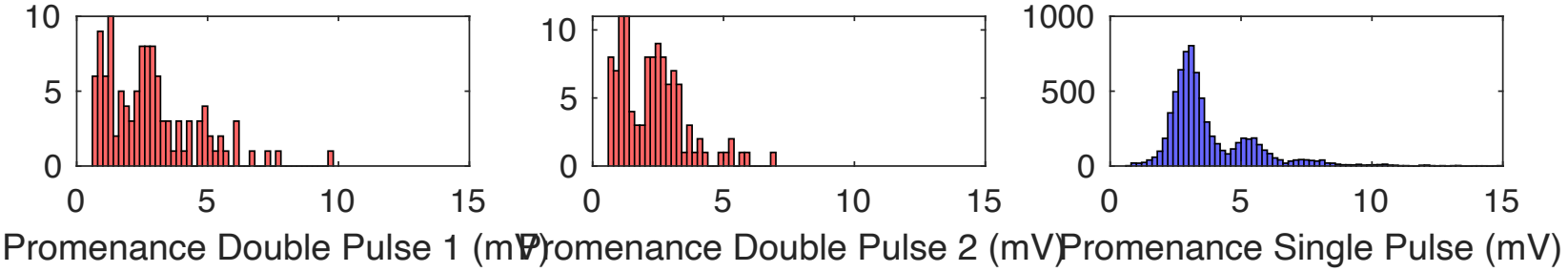




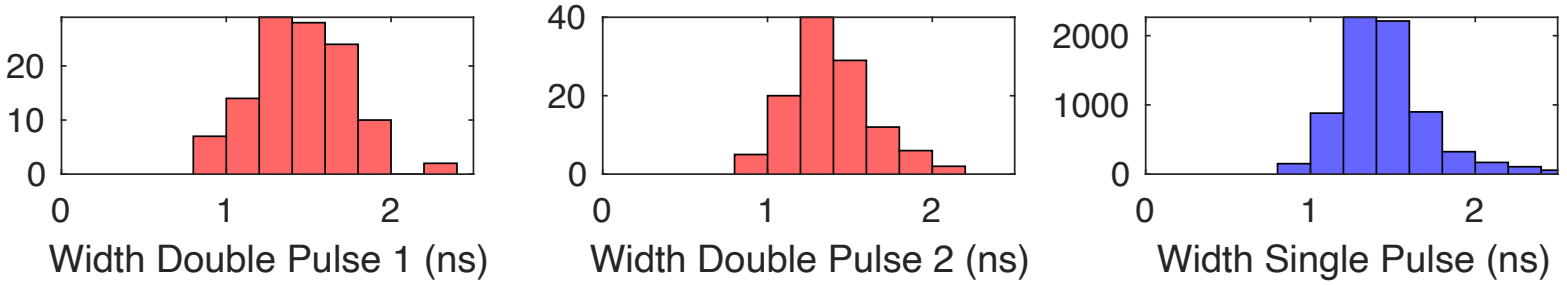

40 cm
PRELIMINARY
Amplitude Double Pulse 1 (mV)
Amplitude Double Pulse 2 (mV)
Amplitude Single Pulse (mV)
Promenance Double Pulse 1 (mV)
Promenance Double Pulse 2 (mV)
Promenance Single Pulse (mV)
Width Double Pulse 1 (ns)
Width Double Pulse 2 (ns)
Width Single Pulse (ns)
0.41127
0.4637
Time Double Pulse 1 (ns)
Time Double Pulse 2 (ns)
Time Single Pulse (ns)

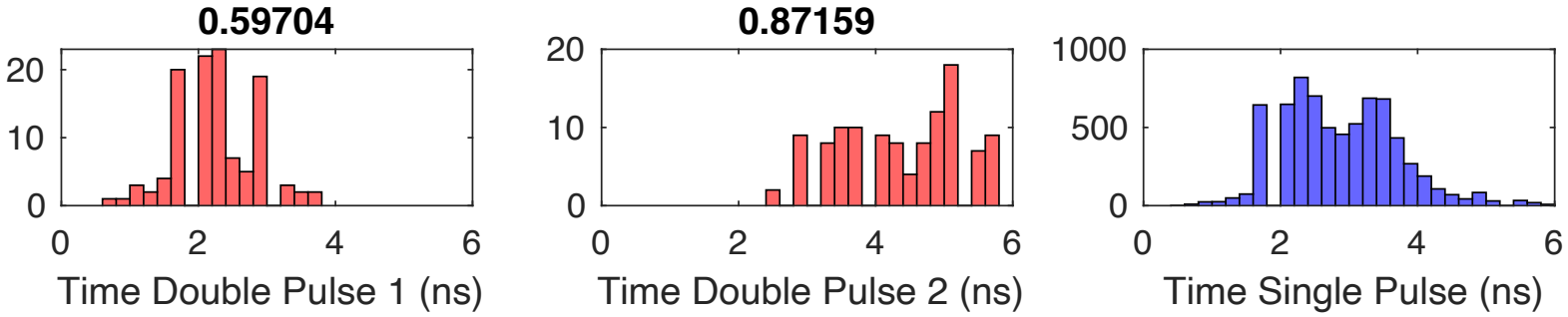
20 cm



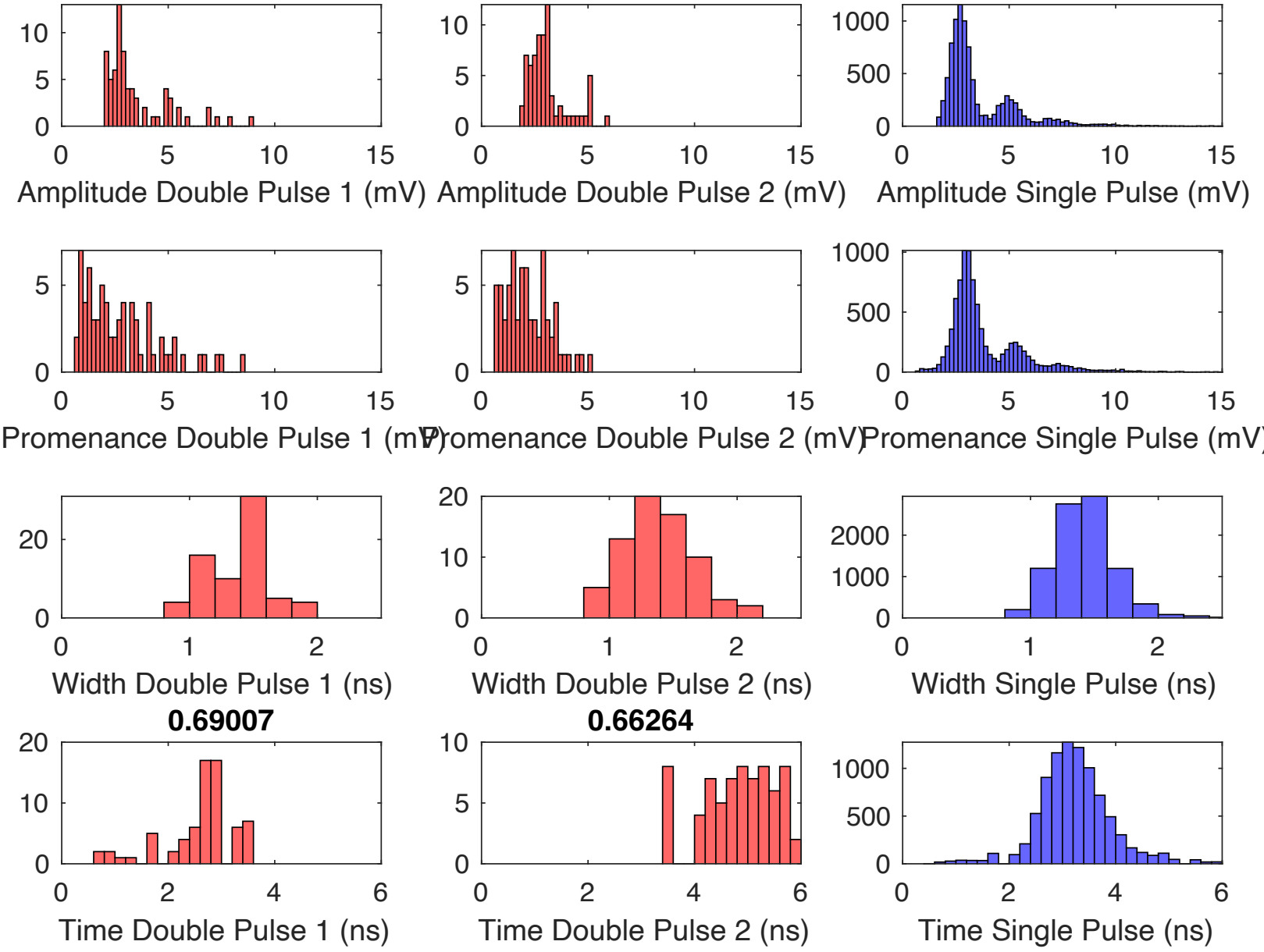


PRELIMINARY



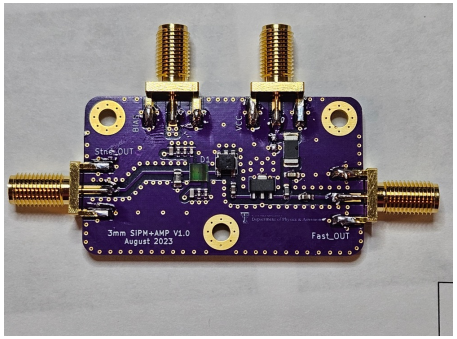


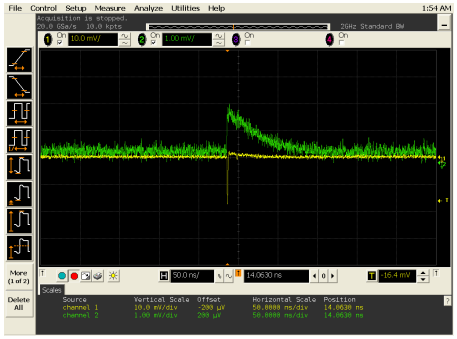
10 cm

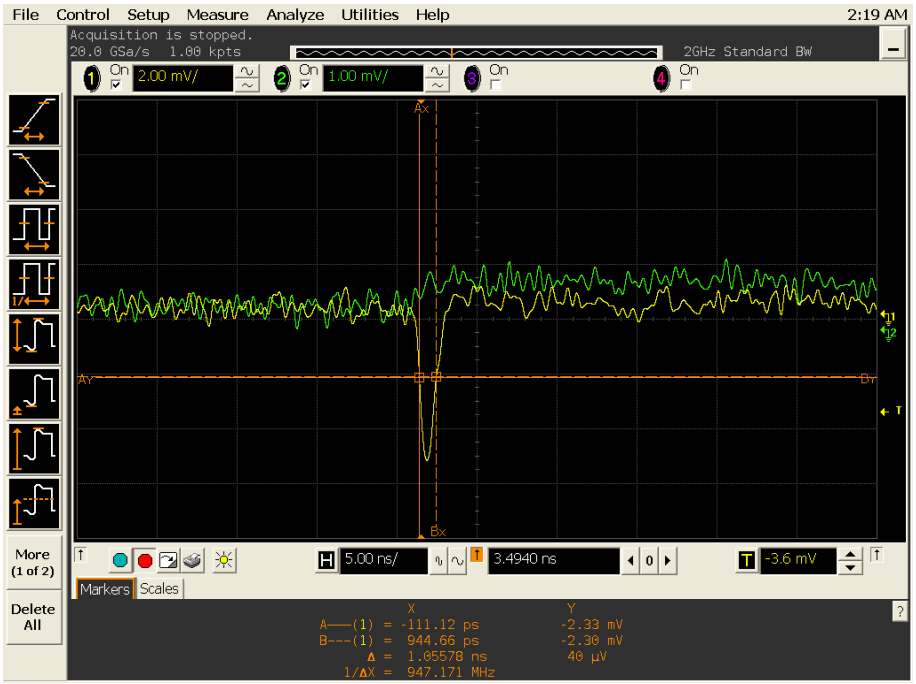

PRELIMINARY
Amplitude Double Pulse 1 (mV)
Amplitude Double Pulse 2 (mV)
Amplitude Single Pulse (mV)
Promenance Double Pulse 1 (mV)
Promenance Double Pulse 2 (mV)
Promenance Single Pulse (mV)
Width Double Pulse 1 (ns)
Width Double Pulse 2 (ns)
Width Single Pulse (ns)
0.69007
0.66264
Time Double Pulse 1 (ns)
Time Double Pulse 2 (ns)
Time Single Pulse (ns)

Developing SiPM Readout for a Future Prototype

- We started to develop custom readout chain for “fast output” OnSemi SiPMs
- The first prototype (3 mm by 3 mm) with a fast amplifier(3 GHz) works well
- We plan to scale up to 32-64 channels







Status

We had a successful beam test at T9 in June-July. We evaluated the timing resolution we may achieve with the existing instrumentation to establish a baseline. It looks like we have interesting data set and we are likely to produce a publication out of it

We will continue development of fast SiPM output readout

We expect DREAM module to arrive at TTU from CERN later this month for refurbishing