# First beam test for MERIT

Particle detectors

# Preparations

- Uncertainty of the real time between main trigger (~1 ms) and beam suggested some actions.
  - An empty signal could mean either that the acquisition interval (~100 microseconds) did not include the beam or that a detector is malfunctioning.
  - To rule out malfunctioning a wide time span must be scanned by using different oscilloscope delays.
- This, in combination with not fully satisfying knowledge of detector response (“How much signal for different bias voltage?”), made it preferrable to use a second interface to the LeCroy scope only, in order to quickly change oscilloscope parameters. Also, the LeCroy can acquire signals of several ms length while having sufficiently high sampling rate which should identify the trigger-to-beam time interval in one single run – hence not having to dedicate several bunches to finding the trigger.


LeCroy GUI: *ScopeExplorer*

# Obstacle I

- Two hours before start of beam test, the connection to the LeCroy was lost. While still pingable, neither LabView or ScopeExplorer could communicate with the oscilloscope. The reason for this is not fully understood. A plausible explanation is that the scope operations and settings preceding the loss required too much net traffic or too much processor capacity and caused a freezing.

- The communication was not recovered until a manual restart could be made during this week's TT2a access. No apparent reasons for the communication loss could be found.

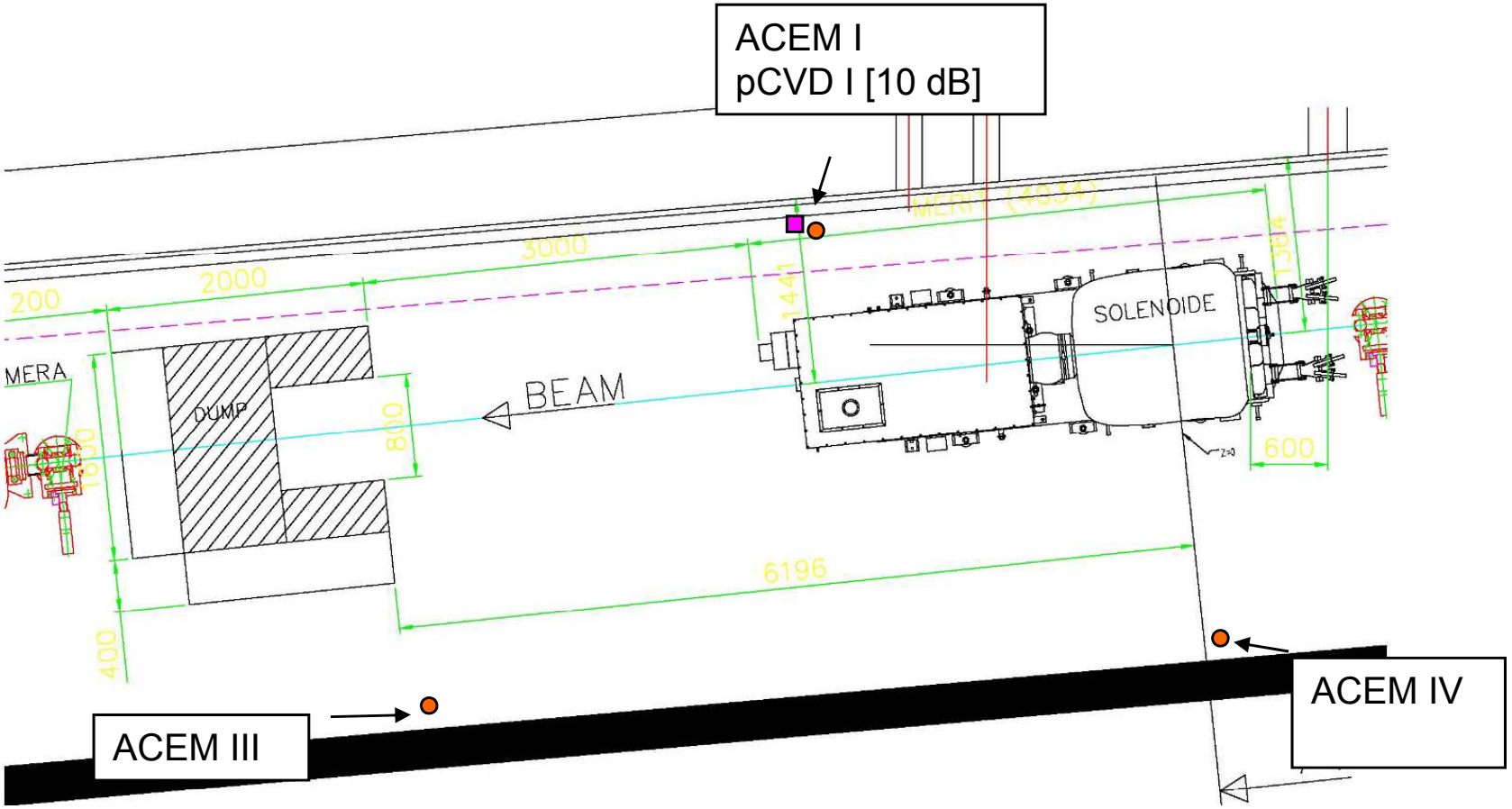
- With the LeCroy lost, the LabView interface had to be modified to use only the Tektronix oscilloscope with a maximum acquisition time of 200 μs.

- The major drawback with this was that the LeCroy was connected to the detectors placed on positions with high particle flux (three diamonds and the ACEM behind the dump), leaving us with the low flux detectors and only one diamond.

# Obstacle II

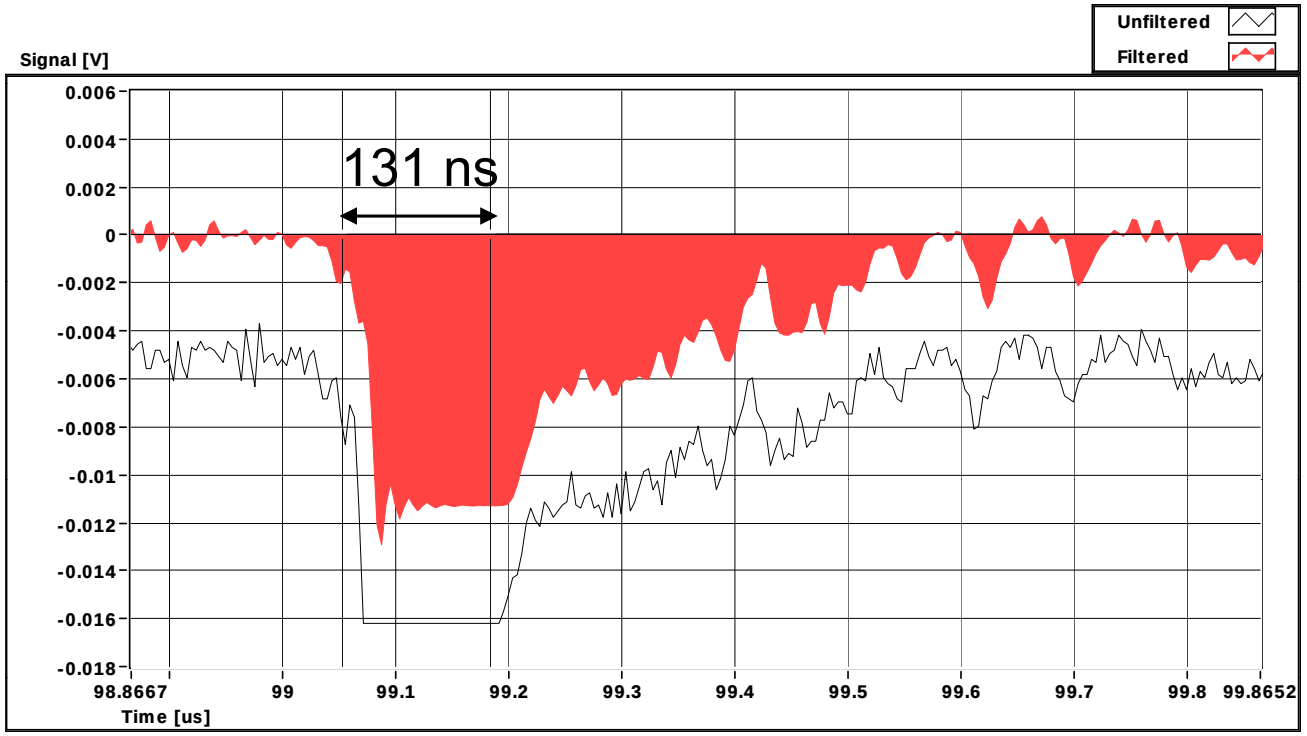
- First runs were without beam to verify triggering of systems. This worked fine.
- When starting running beam, the particle detectors did not receive any trigger, causing some confusion and mild panic.
- 4 bunches later it was discovered that a trigger cable had been unplugged. When reconnecting this, the PD-trigger returned and data from the final three bunches could be extracted. The feared millisecond offset between the trigger and the beam did not occur. (Beam arrived less than 1 microsecond before trigger.)

# Active detectors



# Results

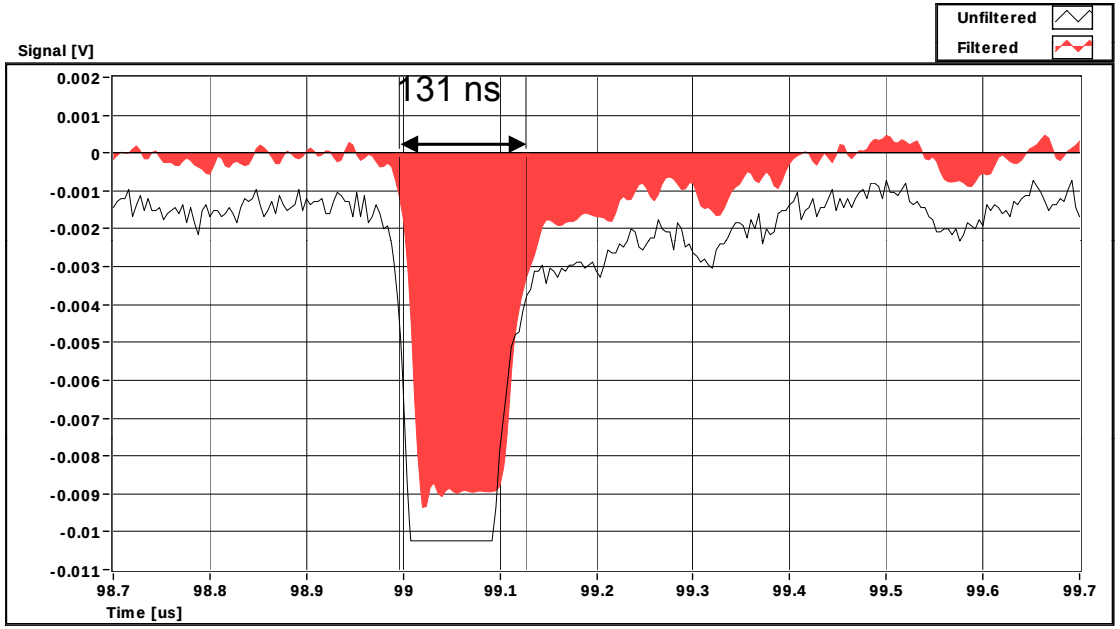
- Initially, the bias voltage was set deliberately low not to risk damaging the oscilloscope inputs. Also, the oscilloscope resolution was set to a few mV/division to make easier seeing a signal.
- Signal clearly chopped off → because of the scope resolution.
- Signal a little wider than → desired due to the low bias voltage (longer time to empty the diamond of free charges).



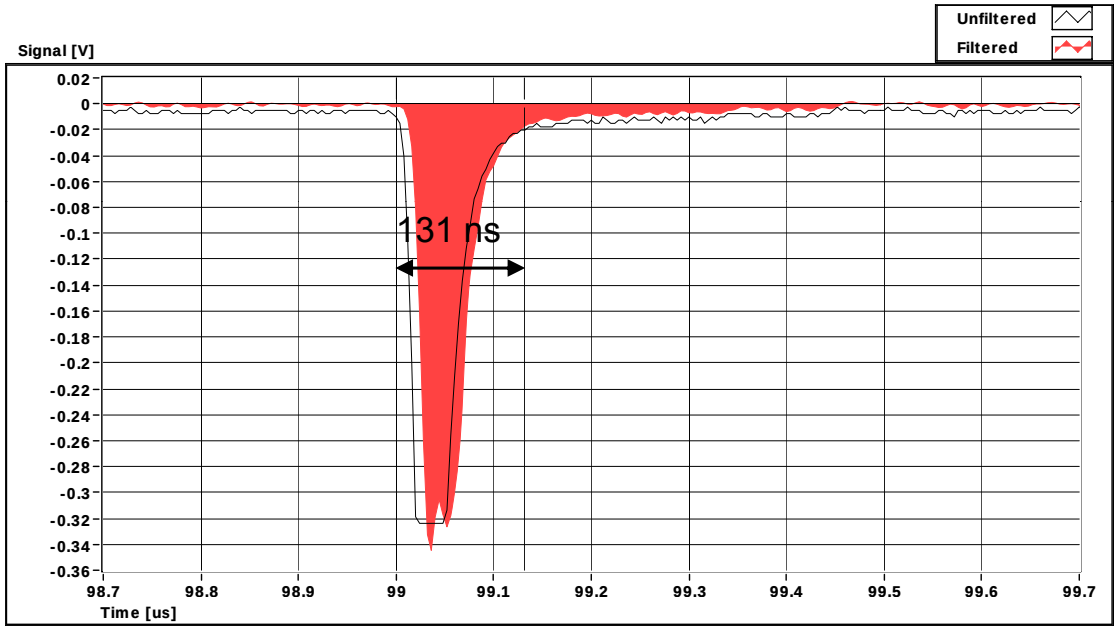

1st signal from diamond detector (corrected with attenuation factor) biased at 50 V.

# Results

- ACEM1, 3rd bunch →
  - Oscilloscope range still too low to capture signal peak.
  - Quite wide signal. As with the diamonds, this is probably due to the low applied voltage (300 V).




- pCVD1, 3rd bunch →
  - Biased at 100 V.
  - Signal width much smaller than first bunch.
  - Rough estimation of real peak value (~1 V) agrees with modeling of signal for a flux of $2*10^5$ (Striganov).



# Conclusions

- Do not use ScopeExplorer.
- Confirmation that the detectors are working and give reasonable signals.
- The diamond detectors are fast enough to clearly distinguish between beam bunches separated 131 ns.