

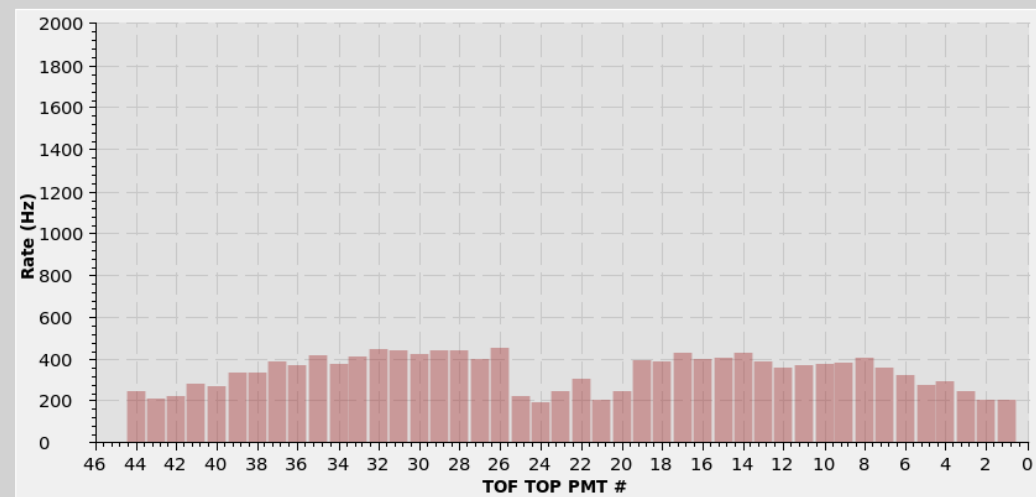
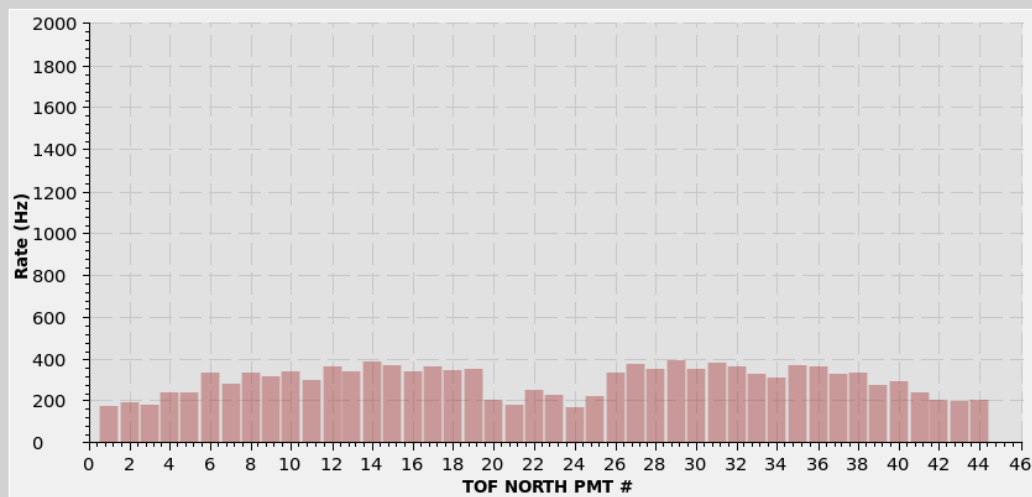
Low level TOF signals

Alexander Ostrovidov

December 15, 2014

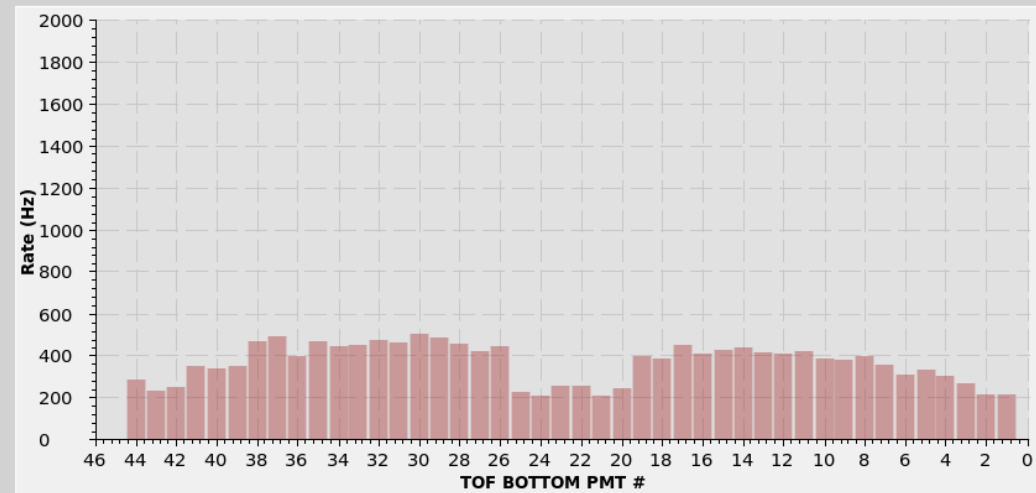
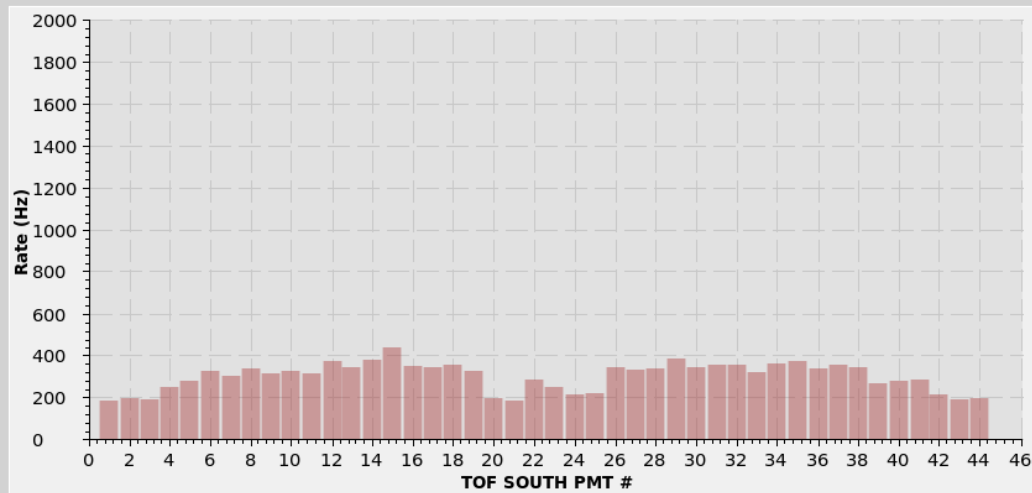
TOF discriminator scalers: No beam

Range: 150 Hz – 500 Hz



BOTTOM ← → TOP

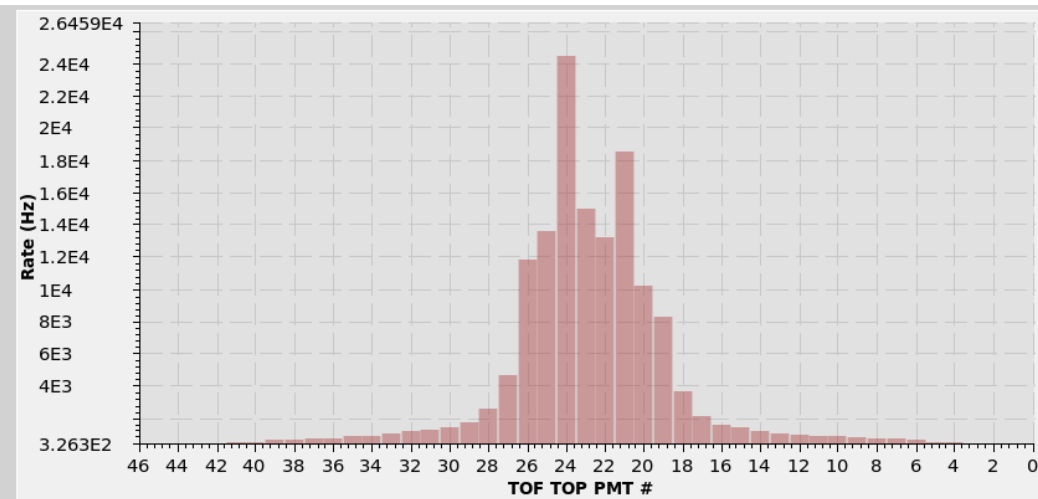
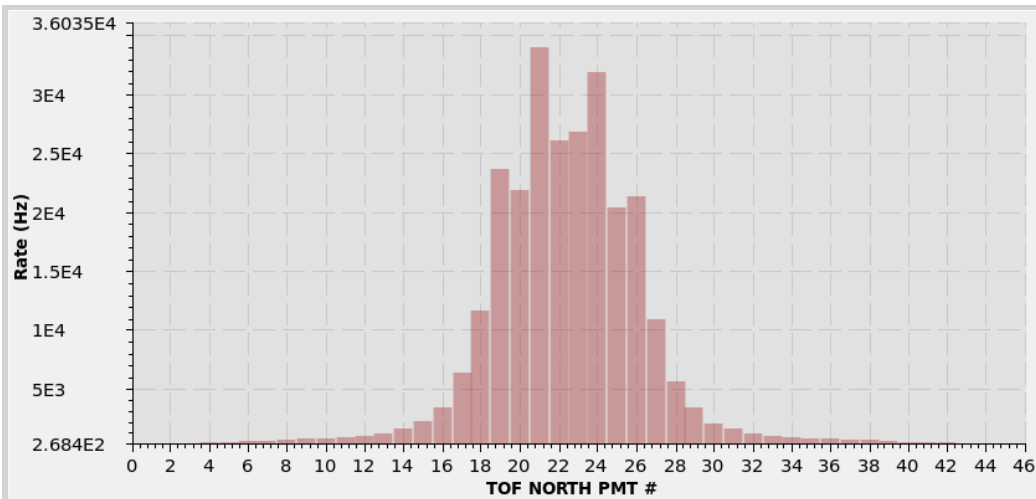
NORTH ← → SOUTH



- Slightly higher rate closer to the beam line

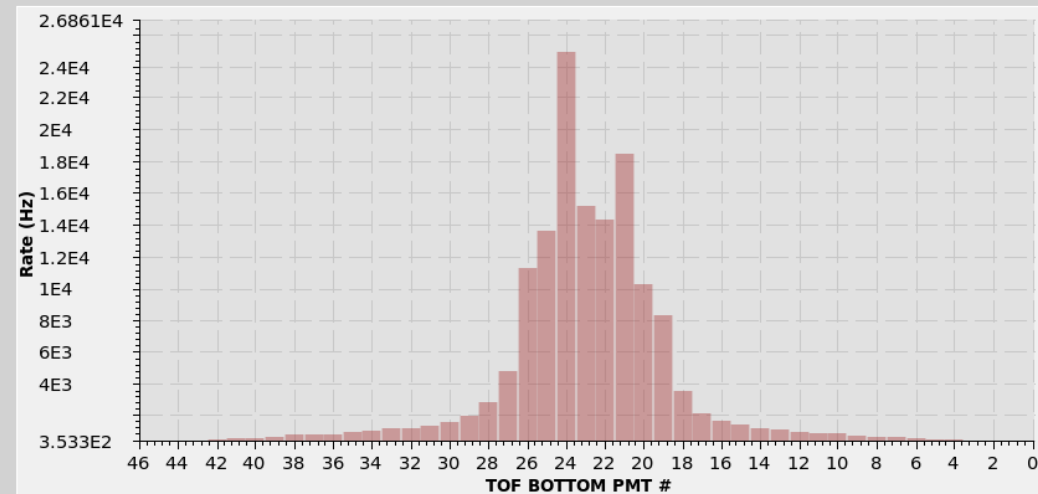
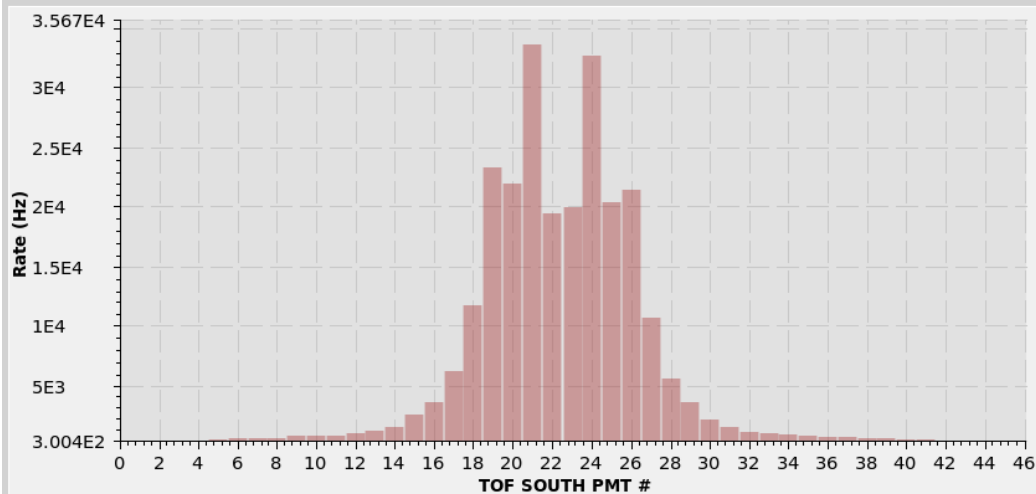
TOF discriminator scalers: 50 nA, 2×10^{-5} radiator

Rate up to 35 kHz at most common running condition



BOTTOM ← → TOP

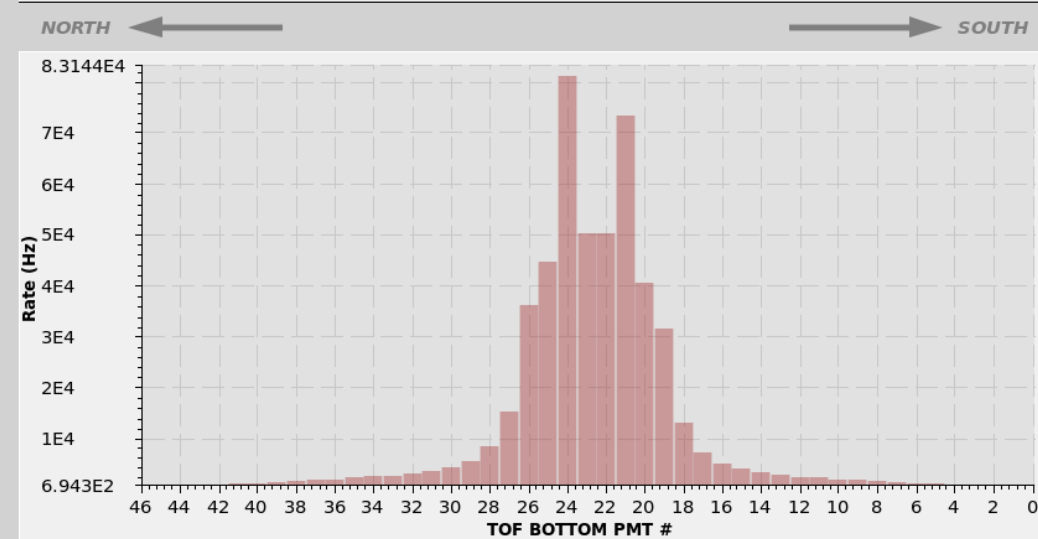
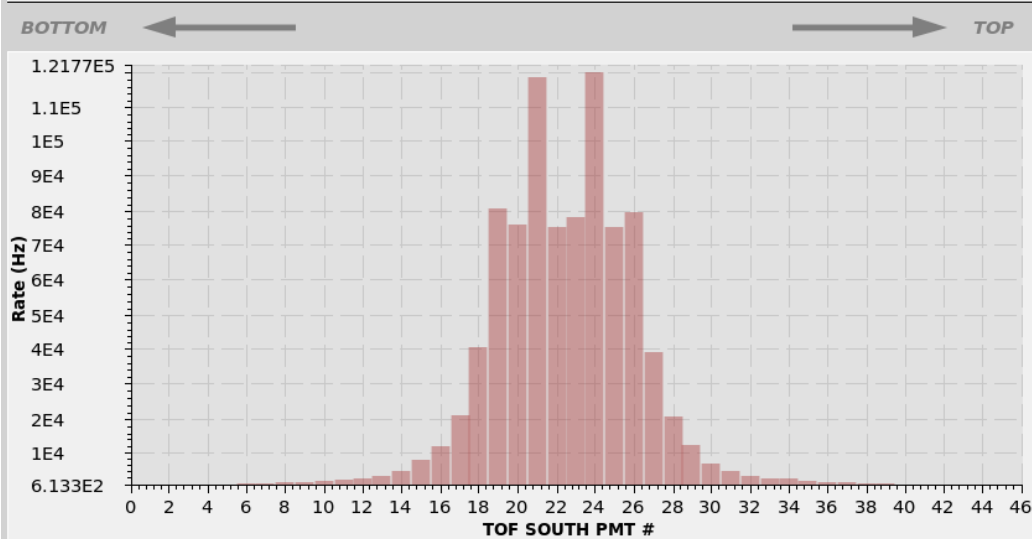
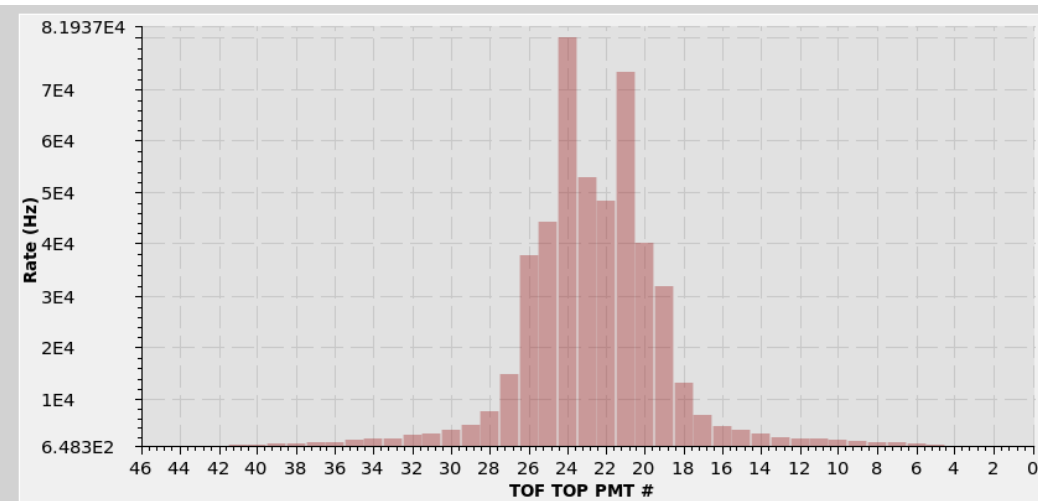
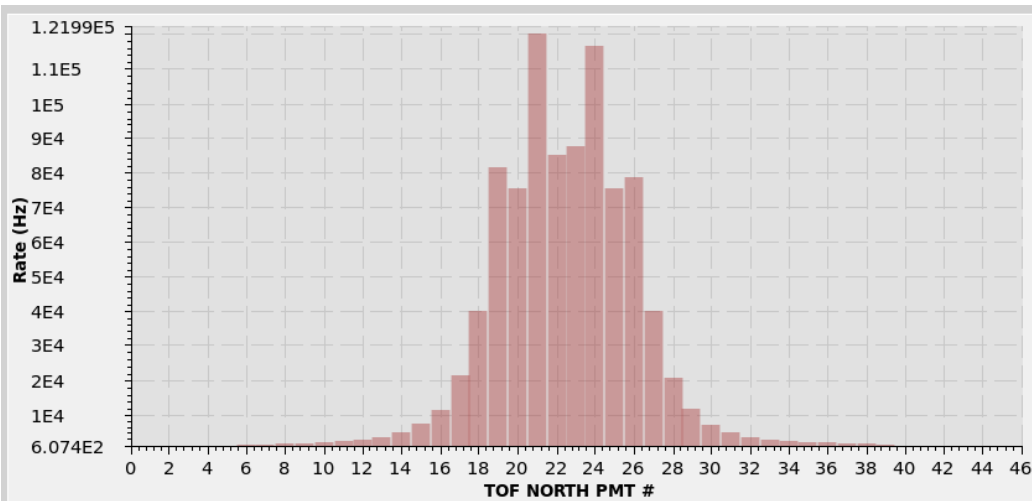
NORTH ← → SOUTH



- Beam is slightly higher to the north (in agreement with ST scalers at that time)
- Upstream plane rate is about 50% higher than downstream plane

TOF discriminator scalers: 200 nA, 2×10^{-5} radiator

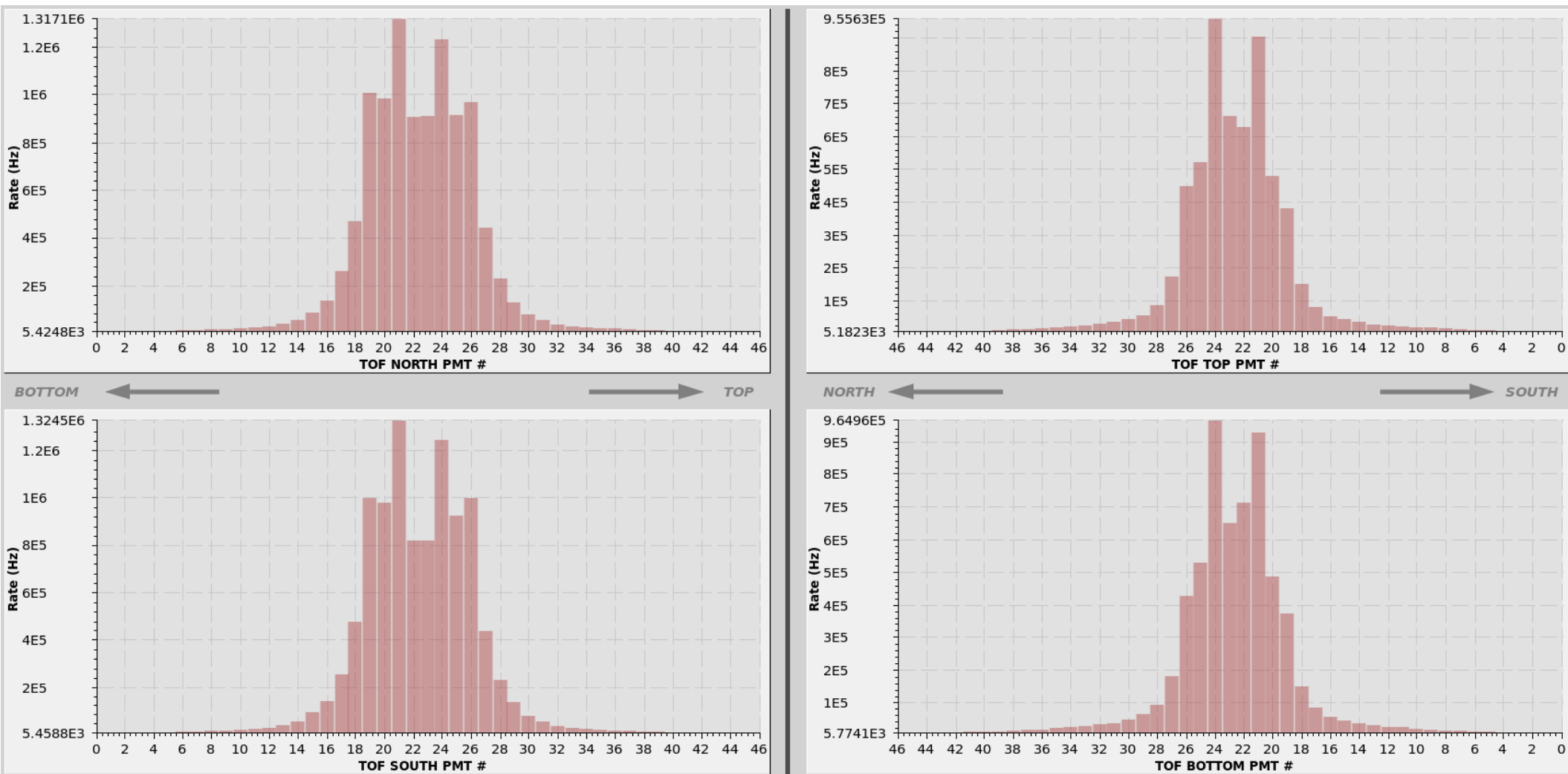
Rate up to 120 kHz



- With 4 times more current, rates are higher by a factor of 3

TOF discriminator scalers: 150 nA, 3×10^{-4} radiator

Rate up to 1.32 MHz at the highest tested luminosity (expected in spring 2015)



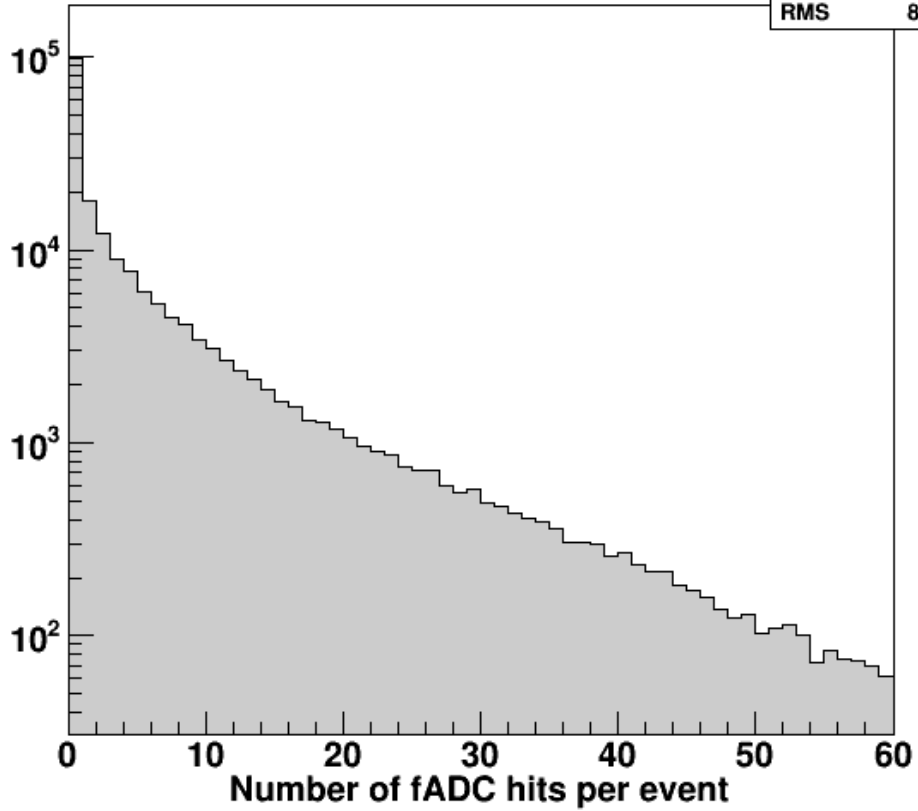
- Rate scales with current/radiator: $120 \text{ kHz} * (3 \times 10^{-4} / 2 \times 10^{-5}) * (150 \text{ nA} / 200 \text{ nA}) = 1.35 \text{ MHz}$
- No obvious deterioration of TOF performance at high rate but more detailed study is needed

Hits Multiplicity: Run 1769

50 nA, 2×10^{-5} radiator, fcal_m8 trigger

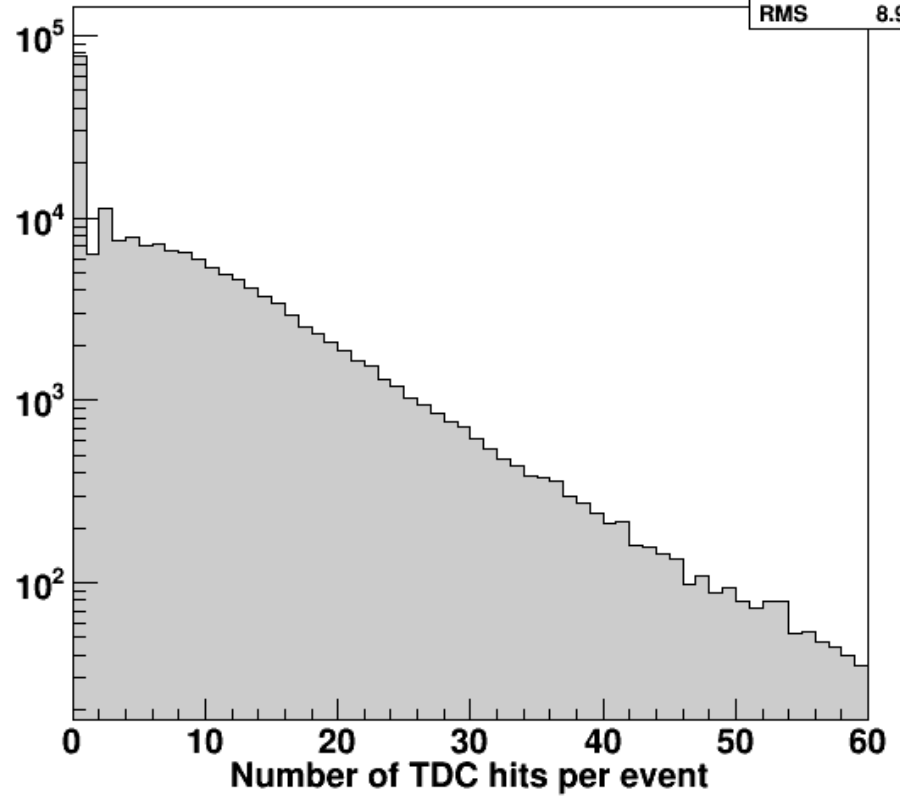
fADC hits multiplicity (run 1769, mode 8)

Entries	203239
Mean	4.711
RMS	8.711

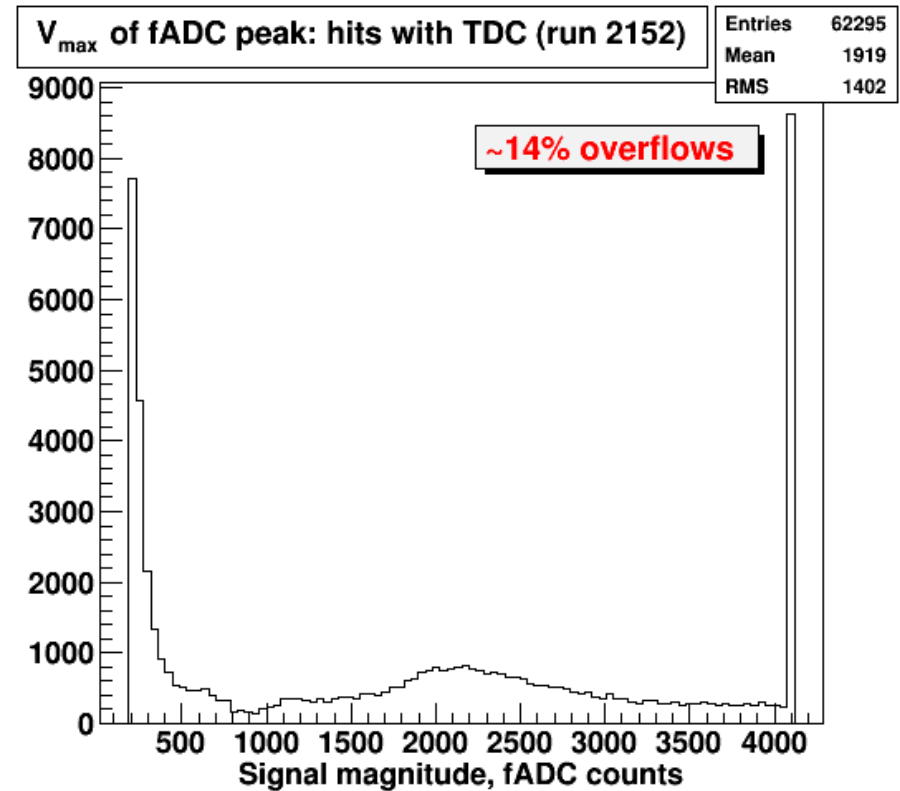
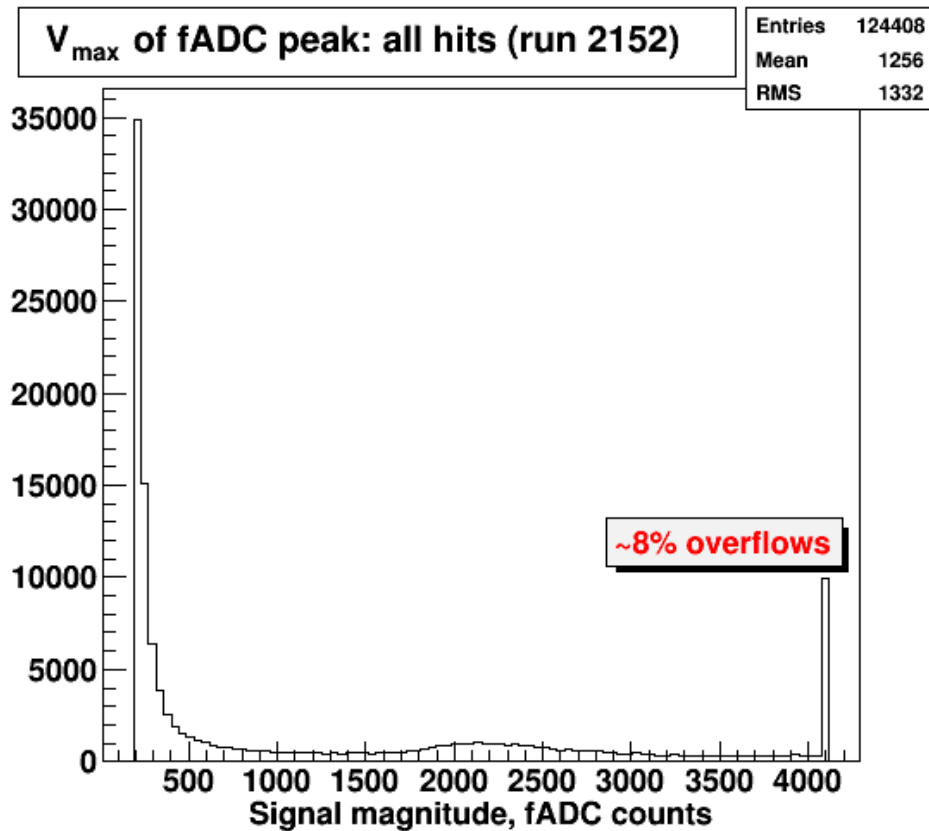


TDC hits multiplicity (run 1769)

Entries	197060
Mean	6.667
RMS	8.964

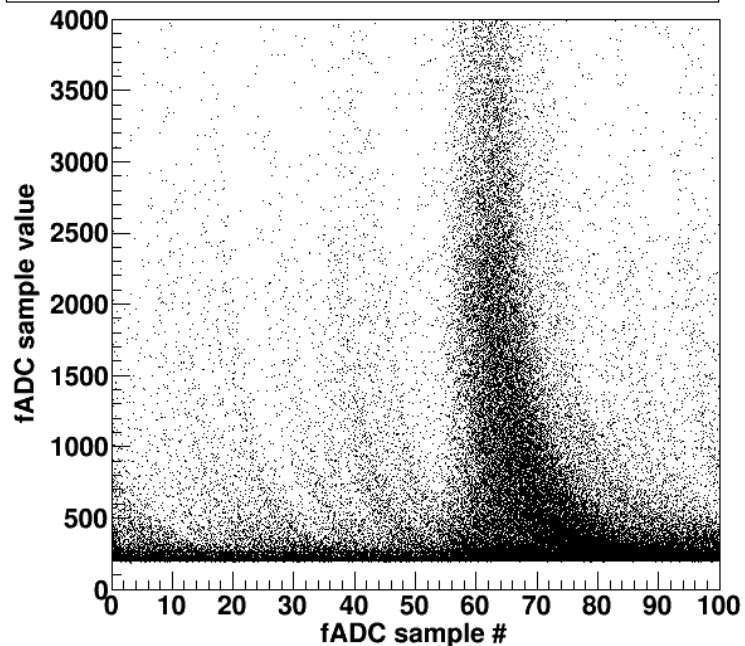


Magnitude of fADC peaks

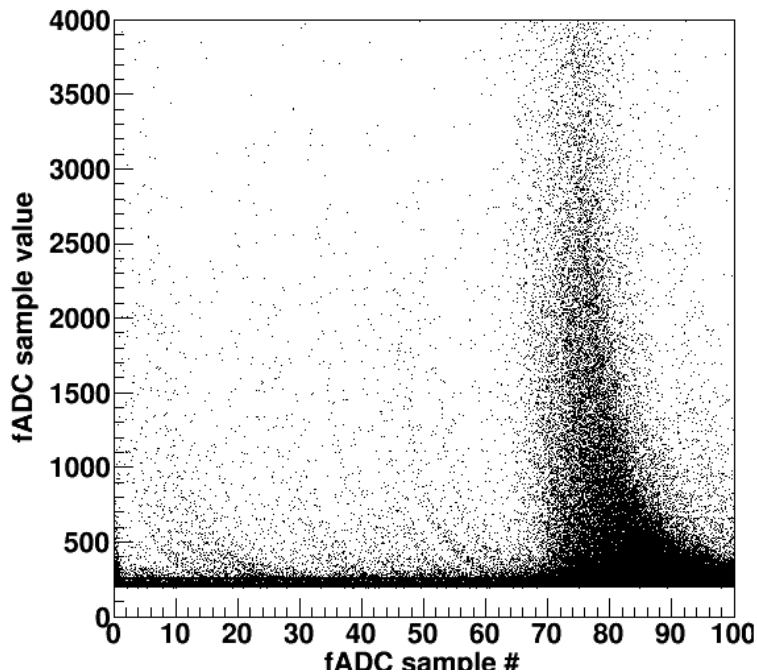


- 8% of all fADC hits and 14% of hits with TDC pair overflow fADC range
- Should we switch FADC250 from 1V to 2V range?

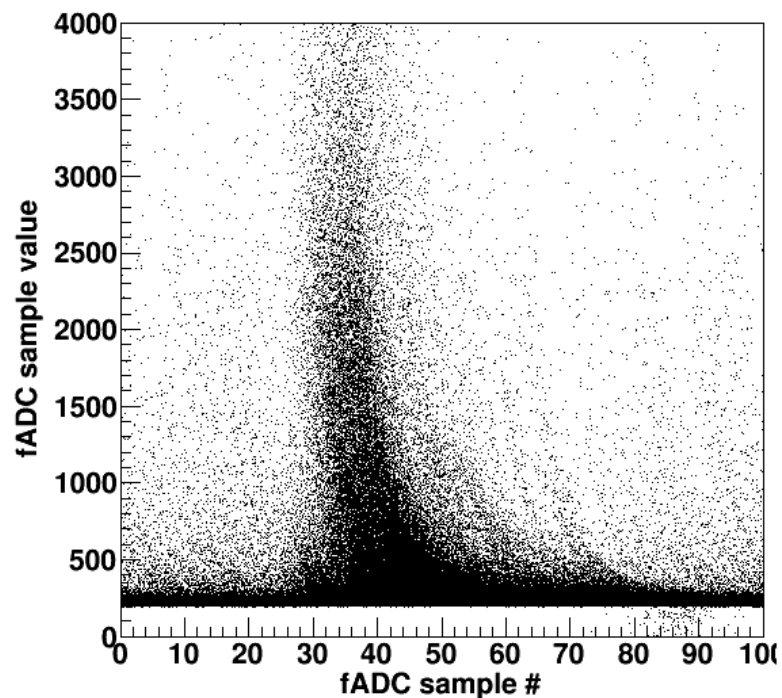
fADC waveform: multiple channels/hits - run 1769



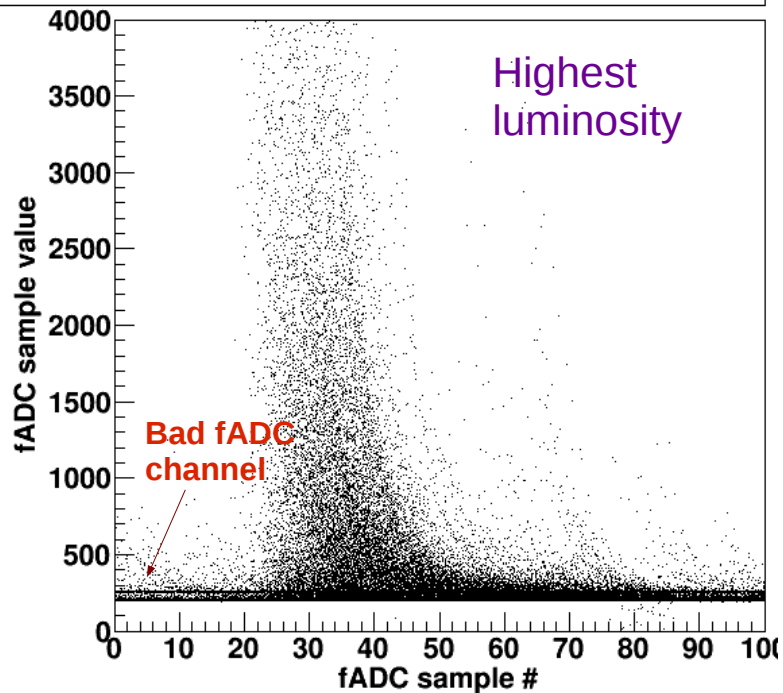
fADC waveform: multiple channels/hits - run 2141



fADC waveform: multiple channels/hits - run 2152



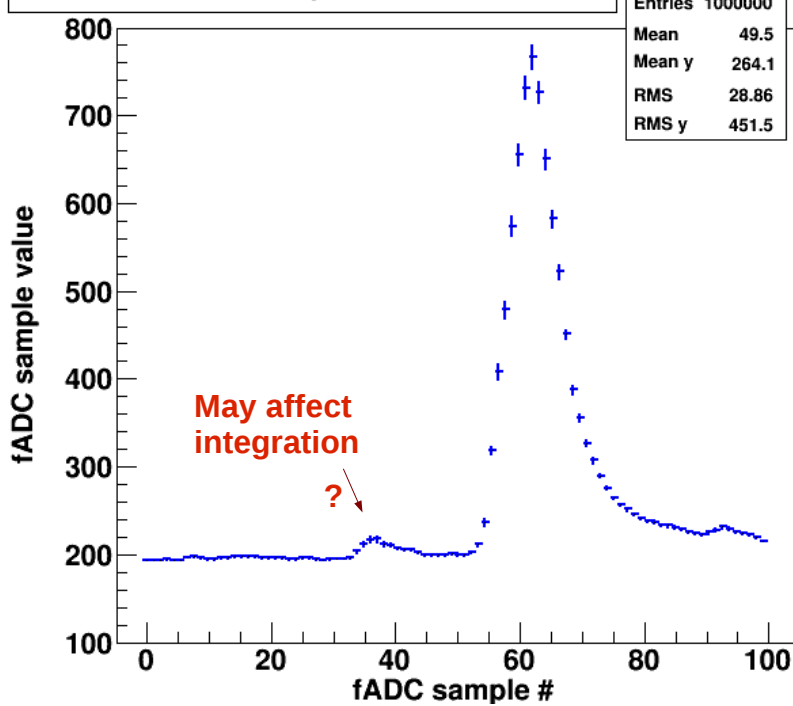
fADC waveform: multiple channels/hits - run 2174



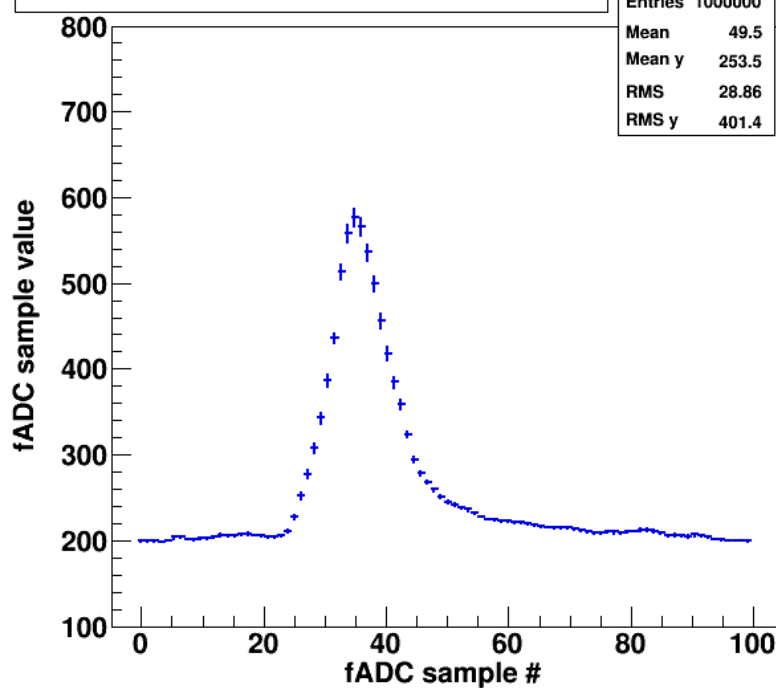
Waveform of fADC pulses

- All hits combined
- Integration may be affected if close to the edge
- Yesterday, one channel's baseline jumped from 200 to 260 without any clear reason

Profile of all fADC pulses - run 1769



Profile of all fADC pulses - run 2152

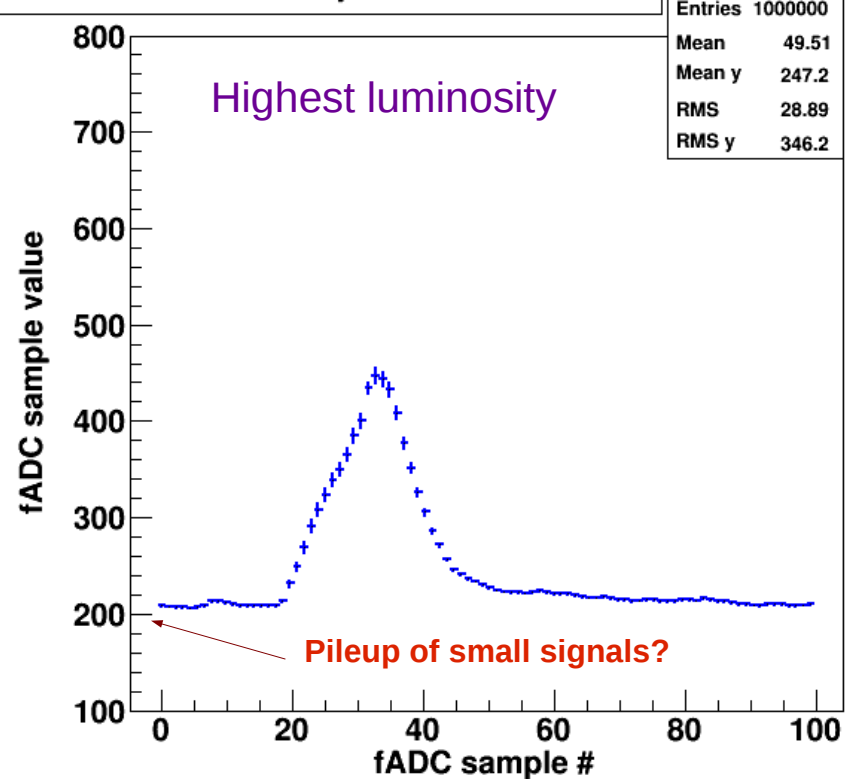


“Average” (profile) fADC pulse

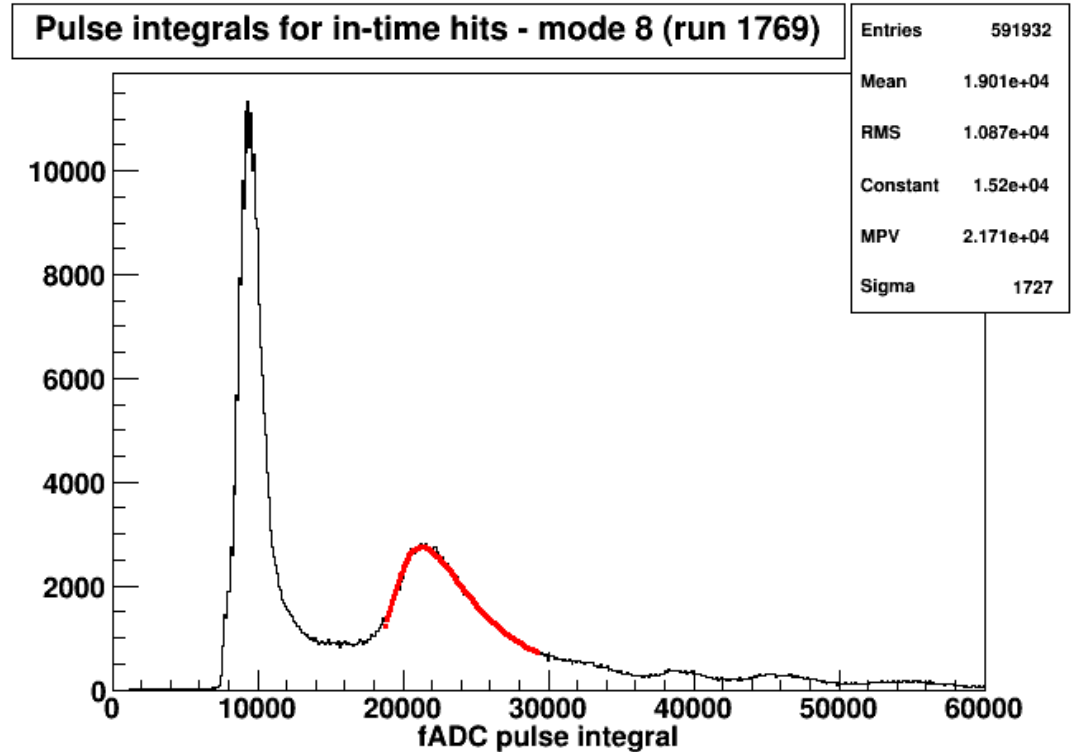
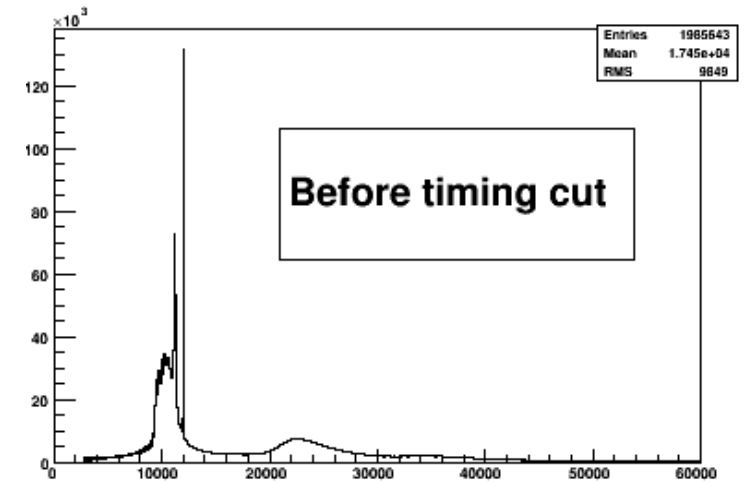
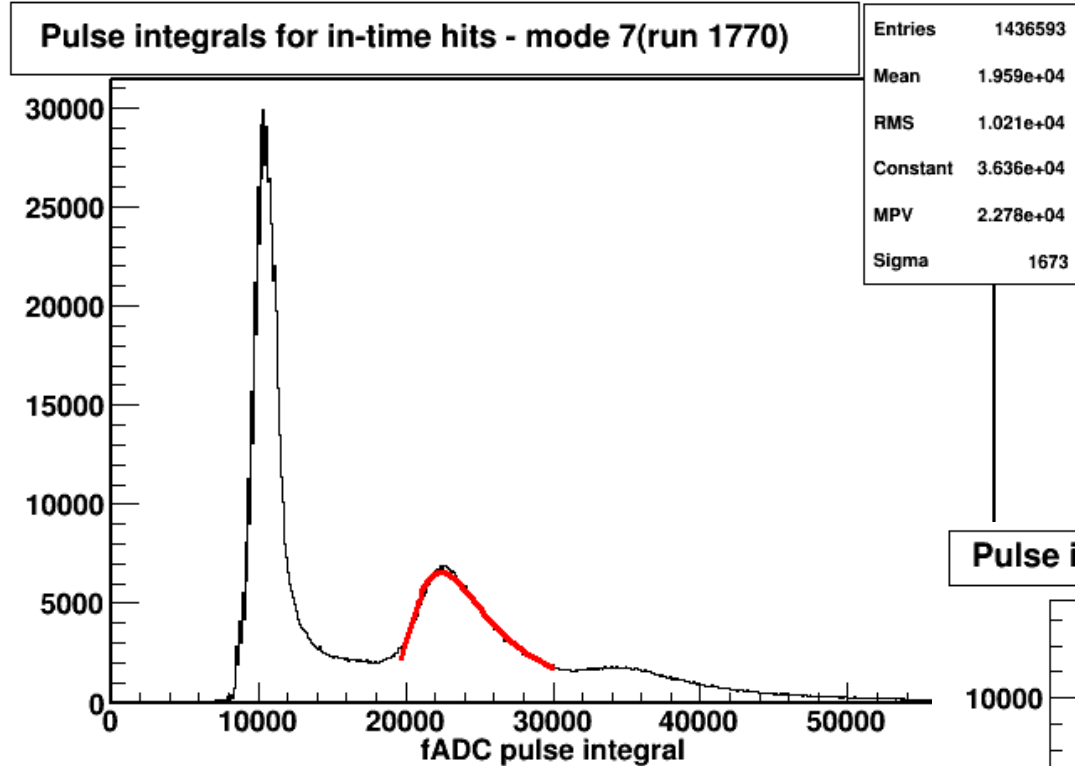
- The nature of “prequel” to the signal is unclear; integration of the main pulse may be affected even with NSA=45
- Can smaller average pulse in 2152 (vs 1769) be explained by fcal_bcal.conf vs fcal.conf?
- In the highest lum. 2174, average^{*)} pulse is higher than baseline (which is still at 200)

*) bad channel excluded

Profile of all fADC pulses - run 2174



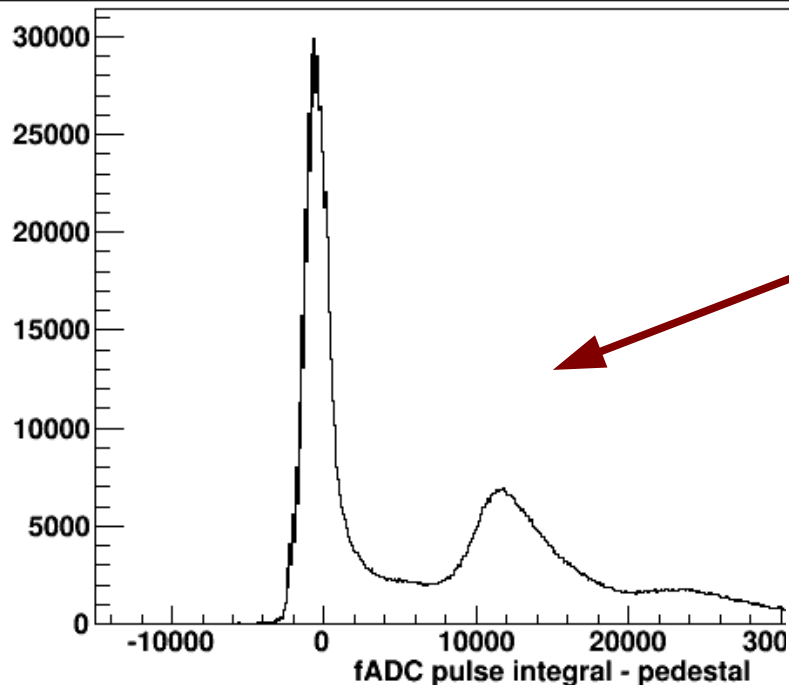
fADC pulse integrals



Firmware integration (mode 7) and JANA integration (mode 8) result in similar distribution of fADC pulse integrals

fADC pulse integrals – pedestal subtraction

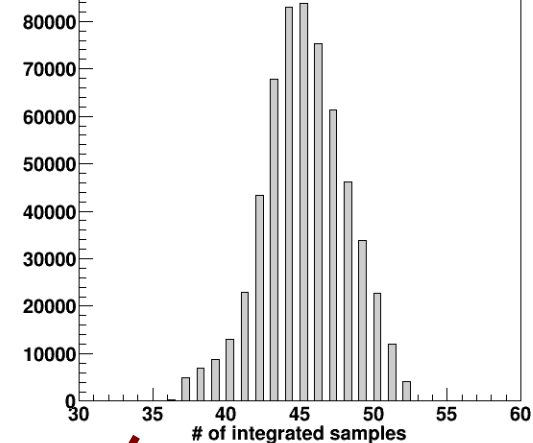
(Pulse integral - Pedestal) for mode 7



Entries 1436593
Mean 8469
RMS 1e+04

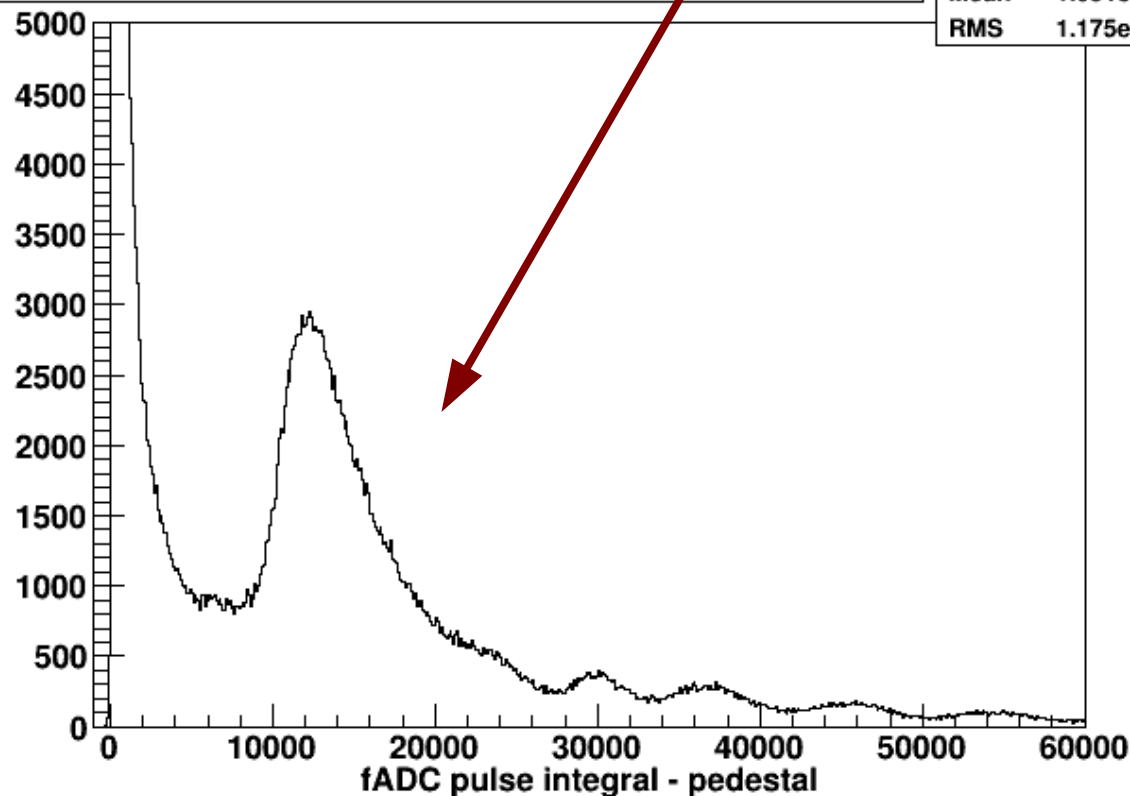
fixed
NSA+NSB

Mode 8: nsamples_integral (run 1769)



Entries 591932
Mean 45.05
RMS 2.914

(Pulse integral - Pedestal) for mode 8

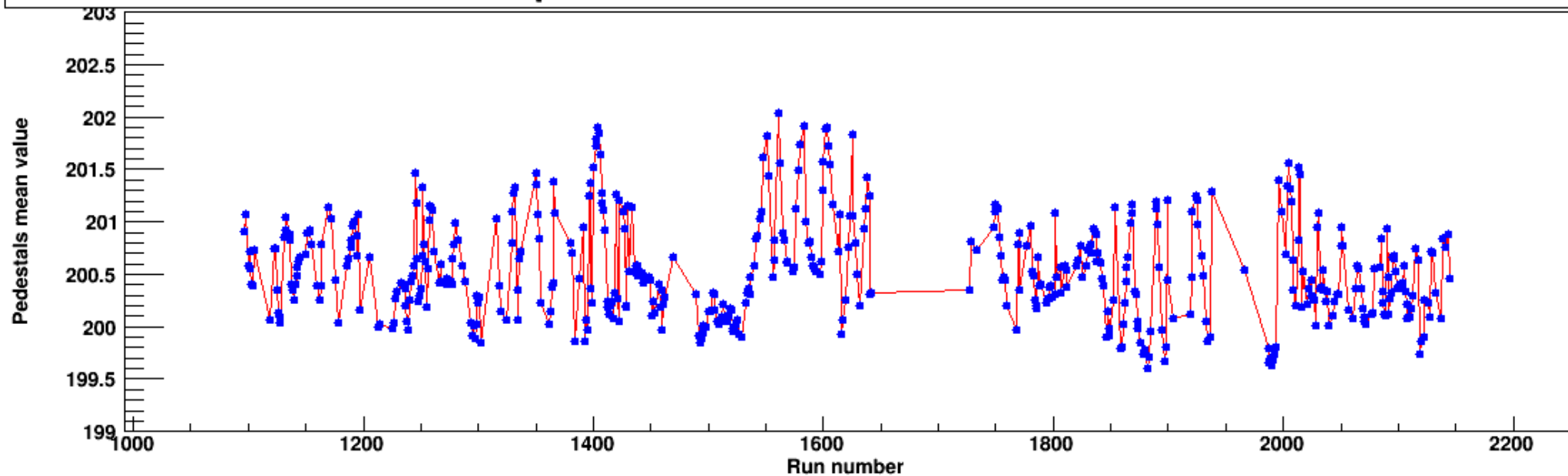


Entries 591932
Mean 1.051e+04
RMS 1.175e+04

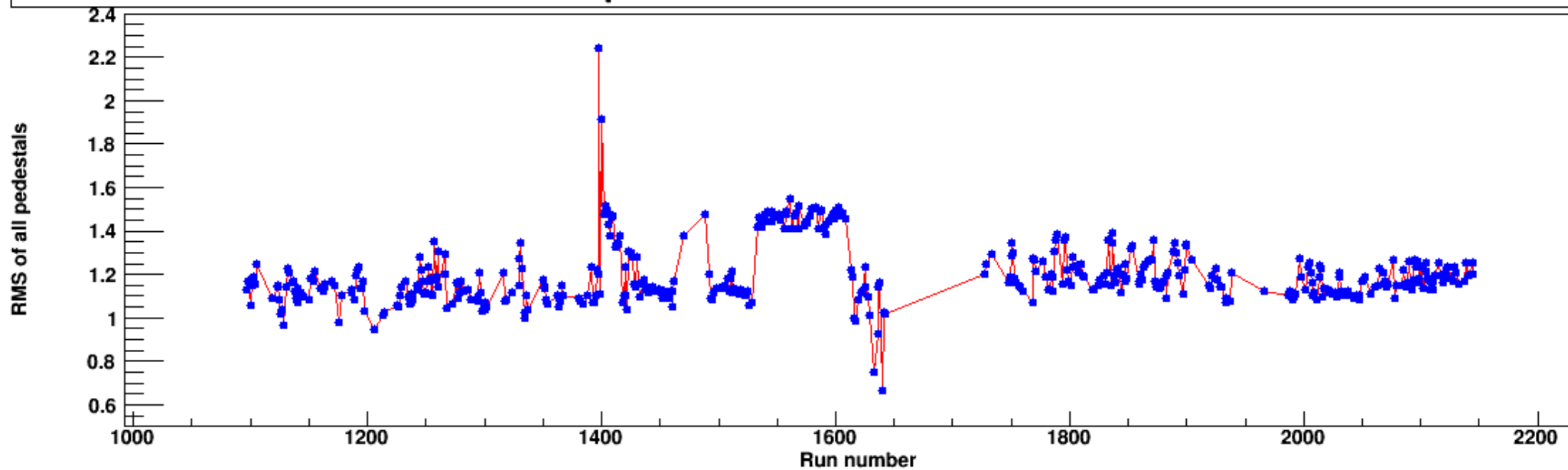
- Mode 7 pedestal subtraction deviates from mode 8 for small signals
- This creates a problem for time walk corrections in mode 7

FADC pedestals – one month interval

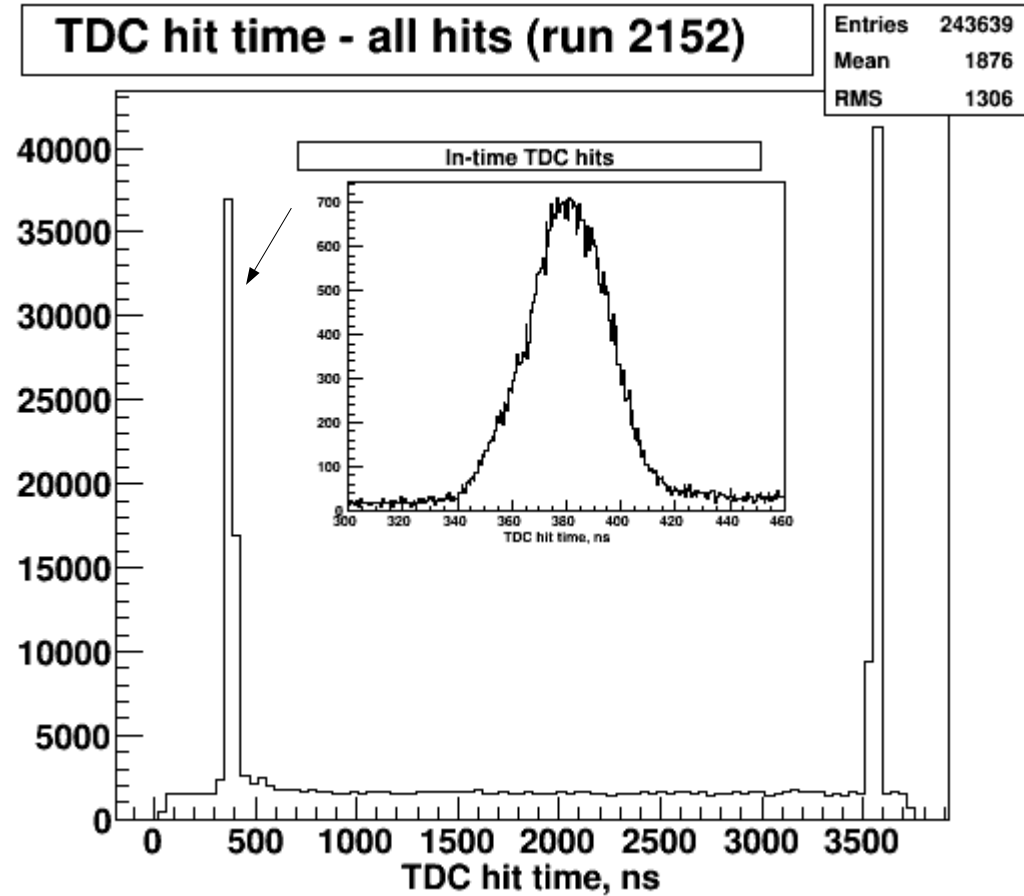
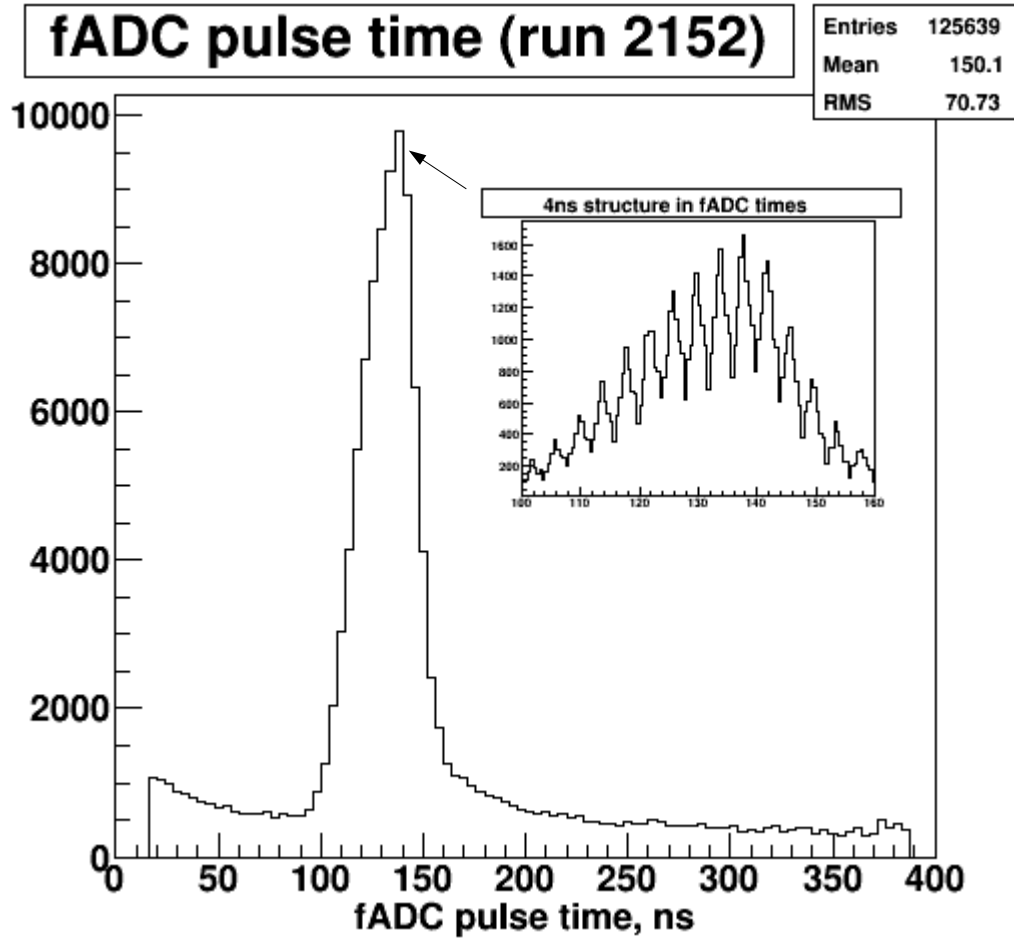
Per-run pedestal mean value for all hits in a run



Per-run pedestal RMS for all hits in a run



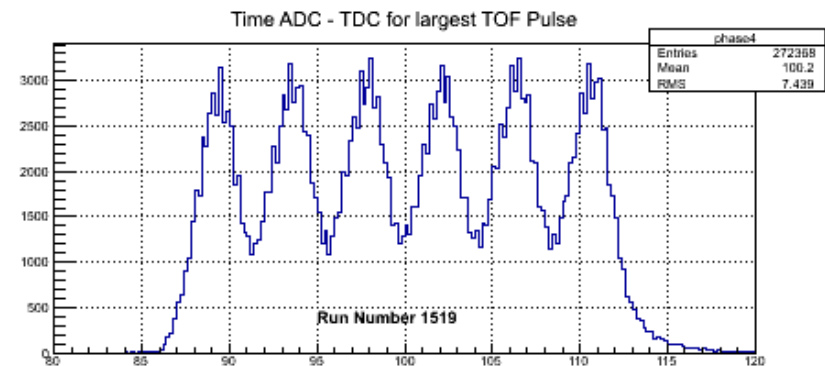
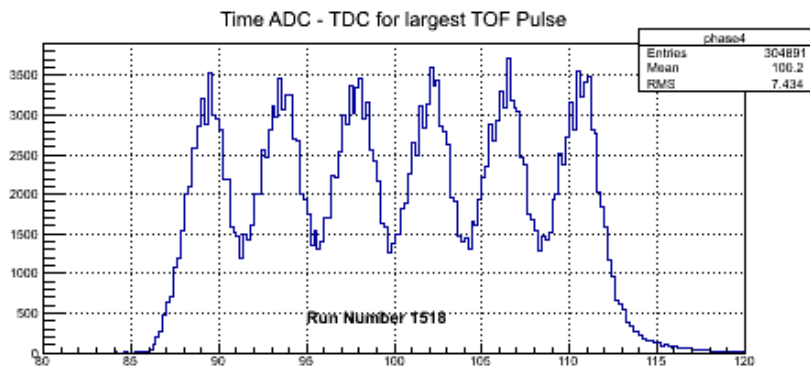
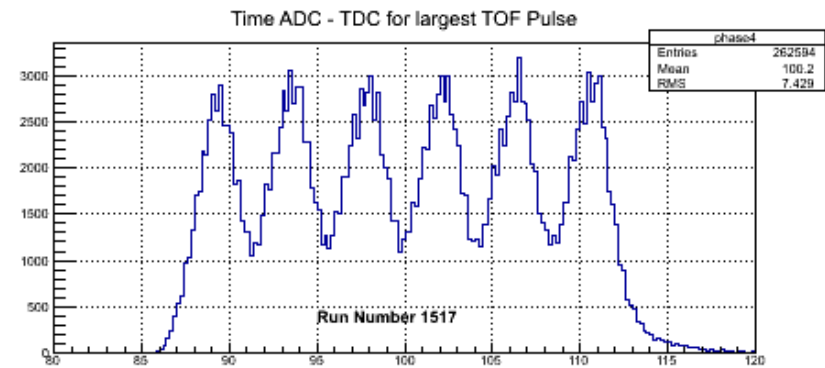
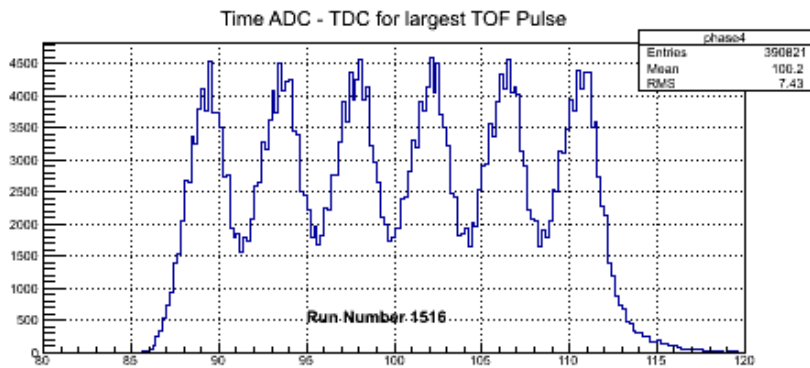
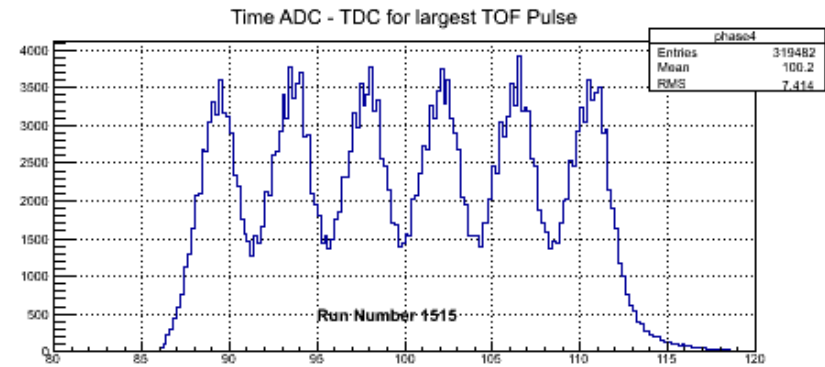
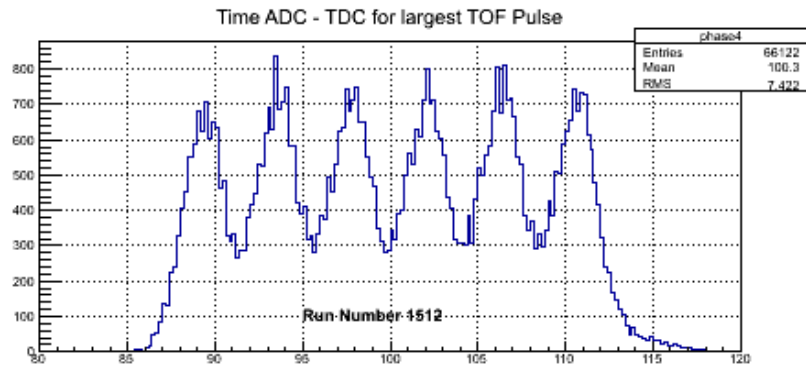
TOF fADC250 and CAEN TDC timing



- About 80 ns spread of both fADC and TDC times relative to the trigger
- FADC firmware algorithm with 62.5 ps step nevertheless results in 4 ns structure

TOF TDC clock phase with trigger

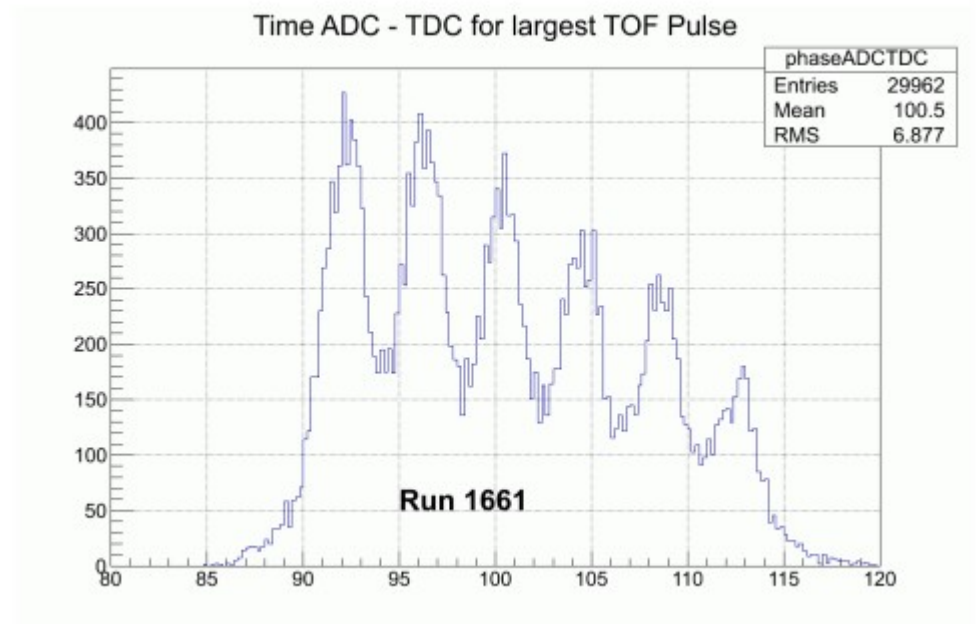
Lognumber 3309602. Submitted by zihmann on Sun, 11/30/2014 - 14:45.



TOF TDC clock phase with trigger

Lognumber 3309602. Submitted by zihlmann on Sun, 11/30/2014 - 14:45.

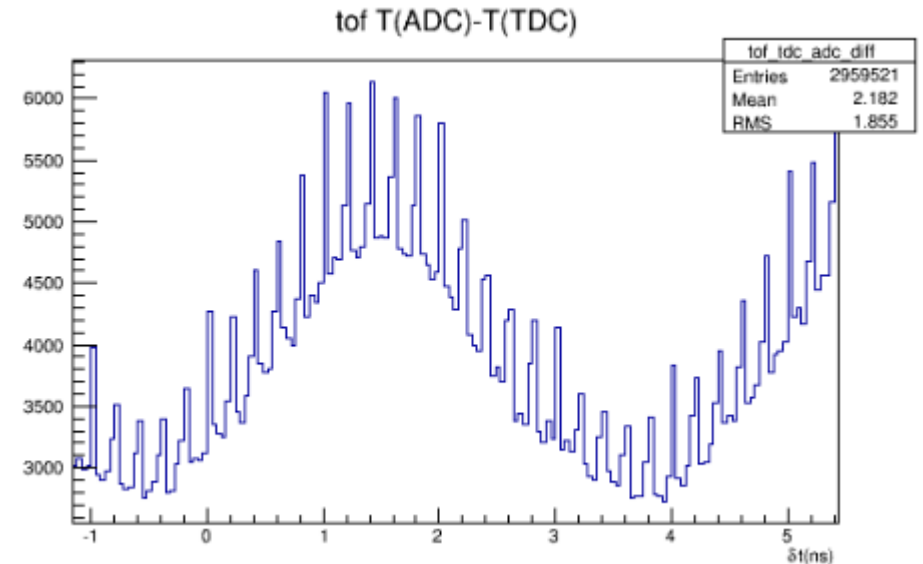
- In high luminosity run:
 - the phase shifted by a few ns;
 - a slope appeared due to dead time



time difference between ADC and TDC for TOF from Run 1515

Lognumber 3310104. Submitted by staylor on Wed, 12/03/2014 - 10:46.

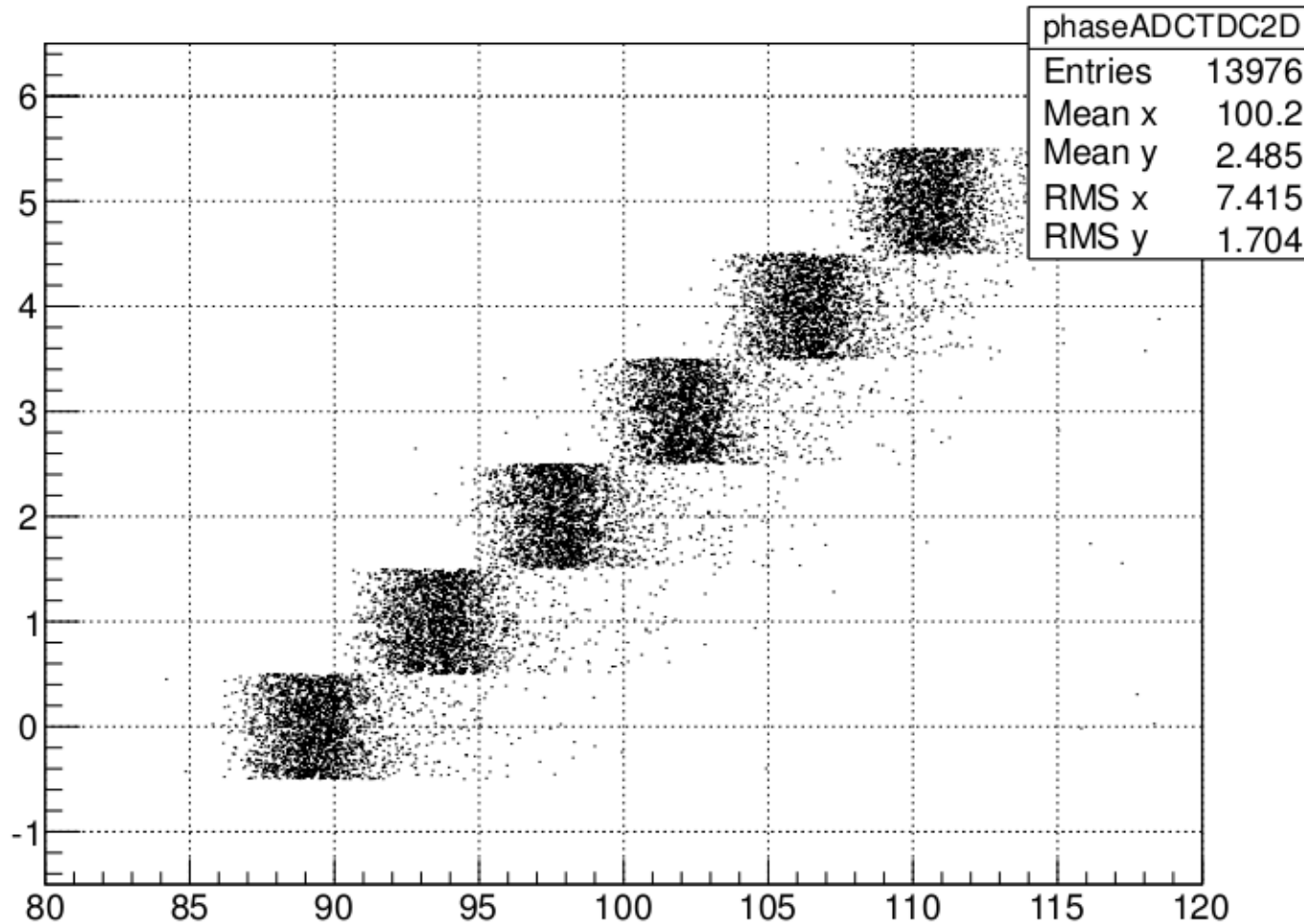
- a peculiar substructure with a period of ~ 200 ps



Time correlation with TI timestamp

Lognumber **3310913**. Submitted by **marki** on Fri, 12/05/2014 - 11:57.

TI_Time vs. Time ADC - TDC

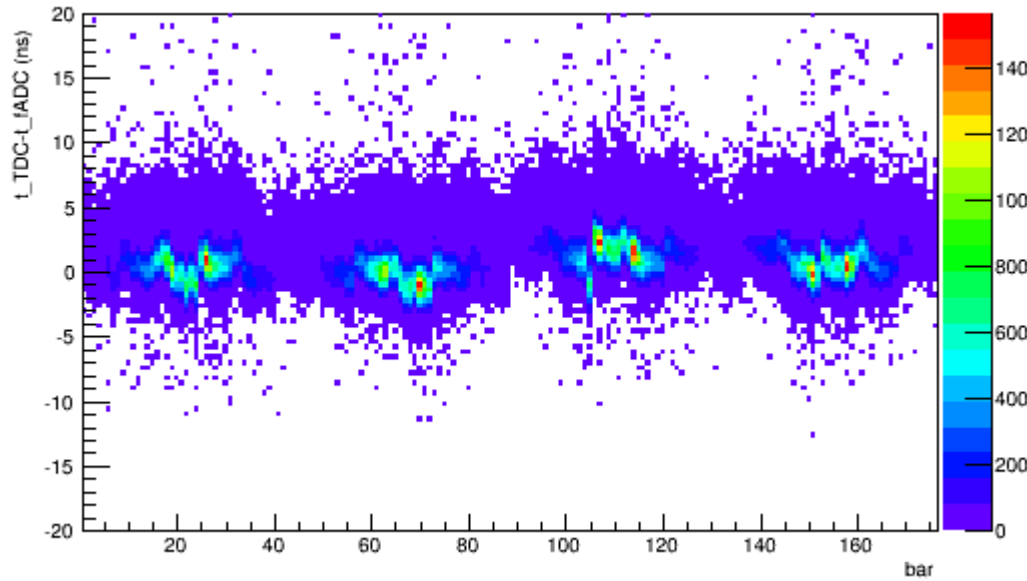


- Phase correction may require per-run calibration

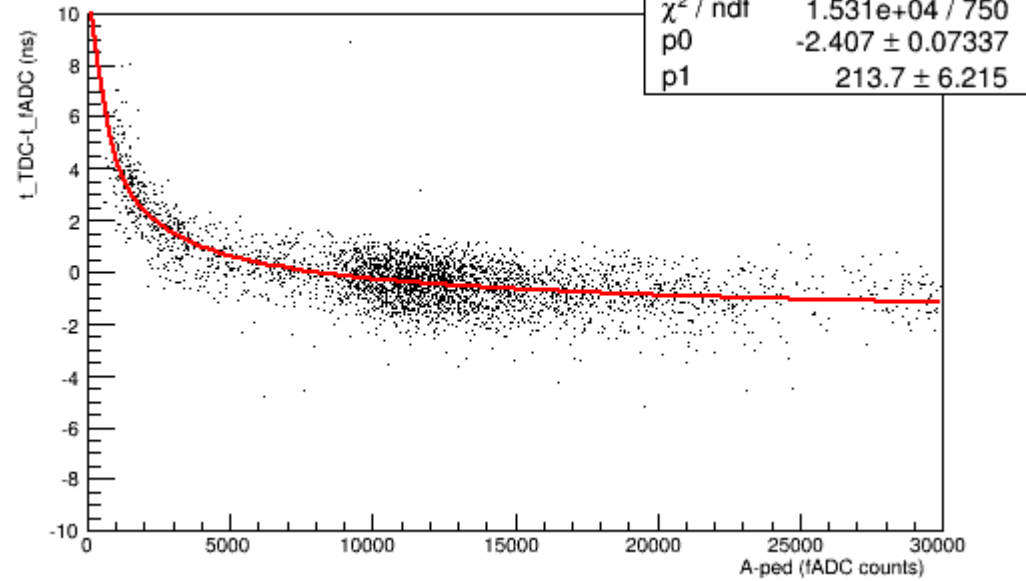
timewalk correction for TOF

Lognumber 3311522. Submitted by staylor on Sun, 12/07/2014 - 14:11.

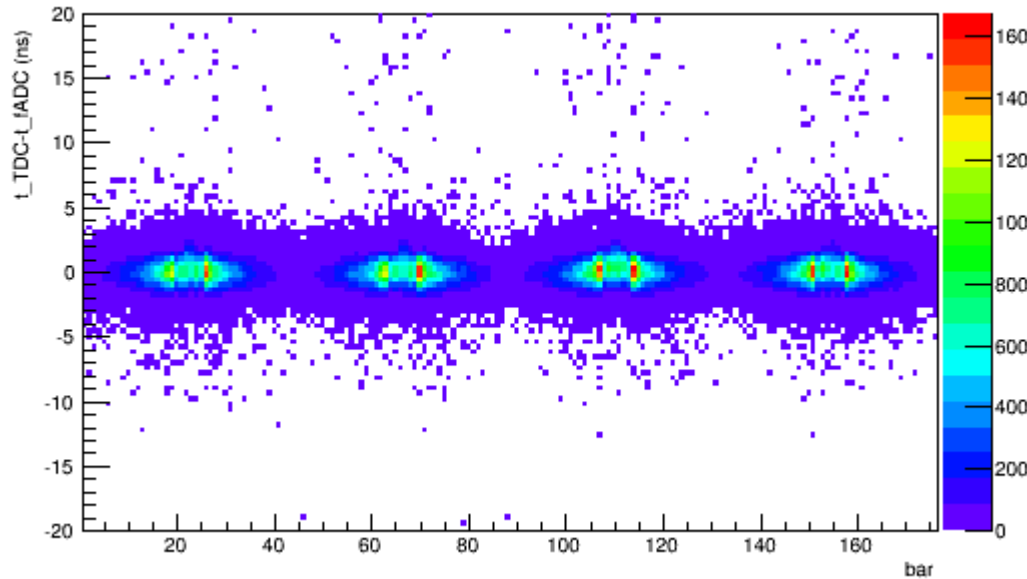
TOF TDC-ADC time difference



TOF time vs integral, vertical bar 22



TOF TDC-ADC corrected time difference



TOF TDC-ADC corrected time difference

