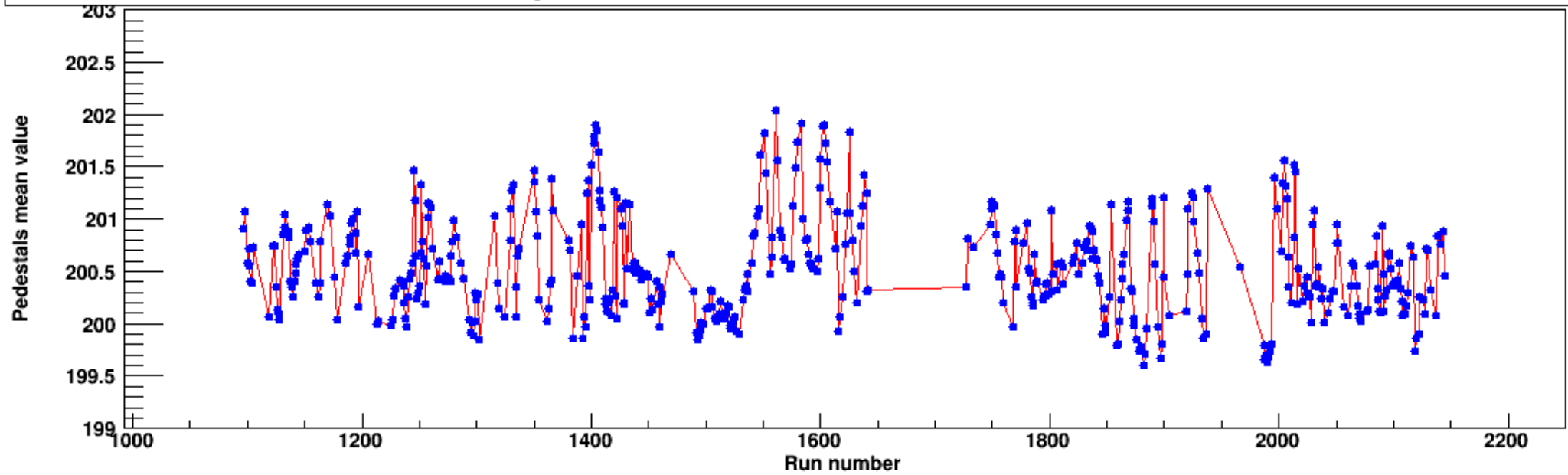
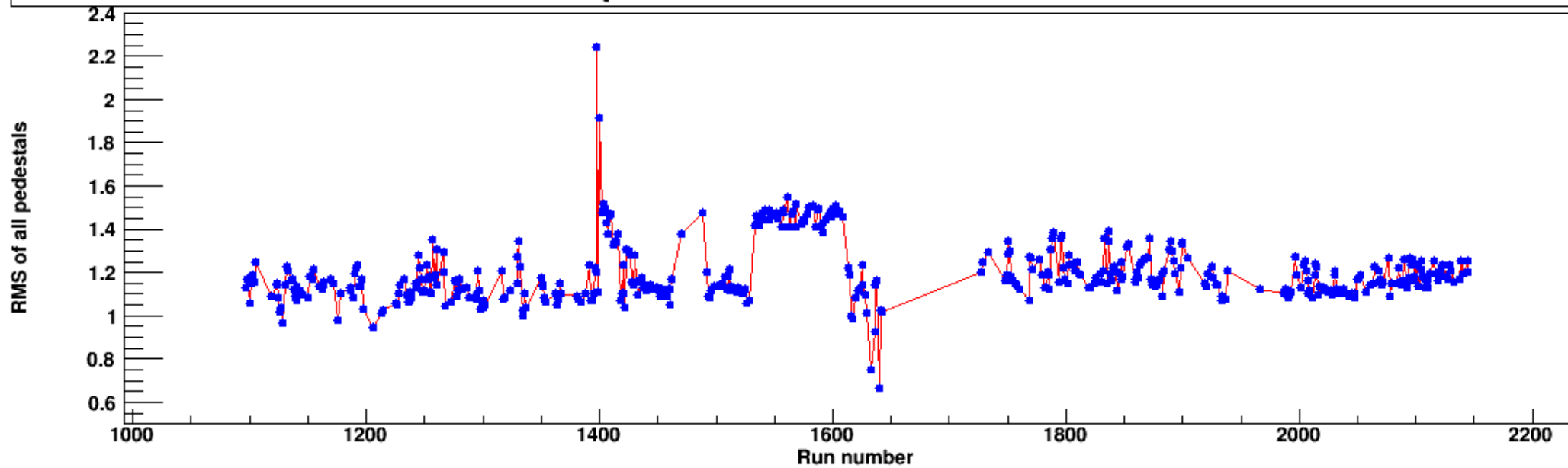


# fADC pedestals – one month interval

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



Per-run pedestal RMS for all hits in a run



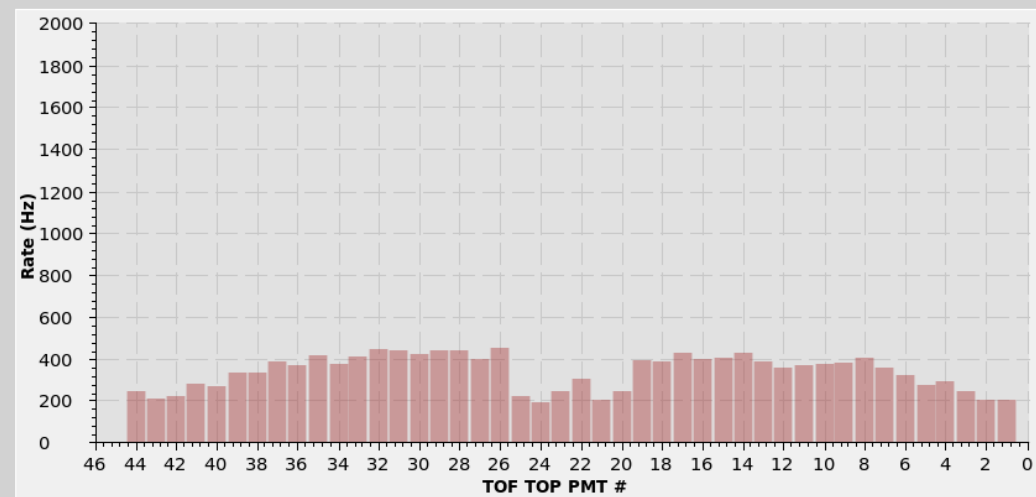
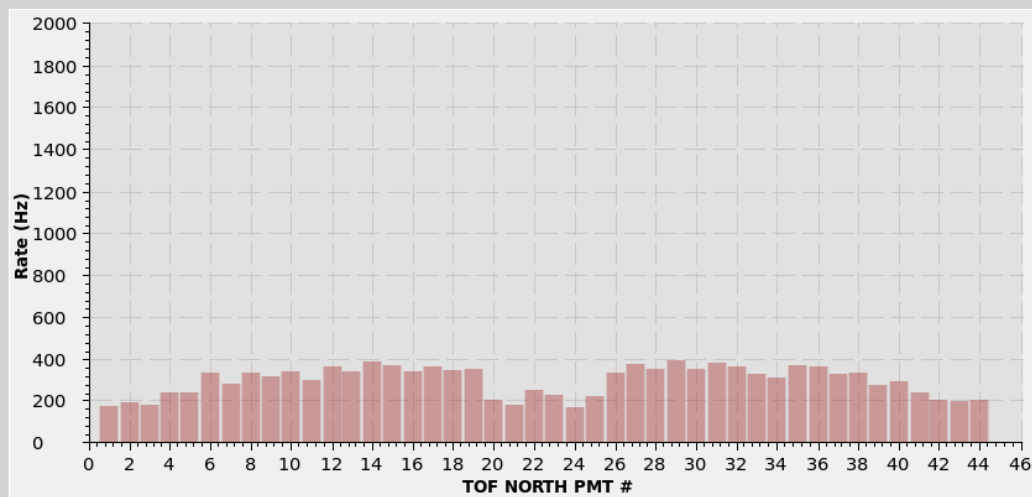
# Low level TOF signals

Alexander Ostrovidov

December 15, 2014

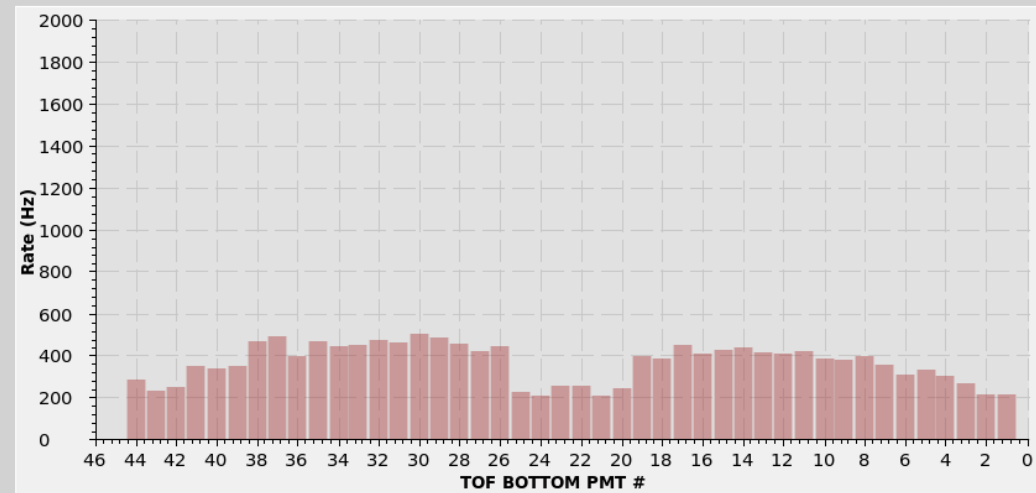
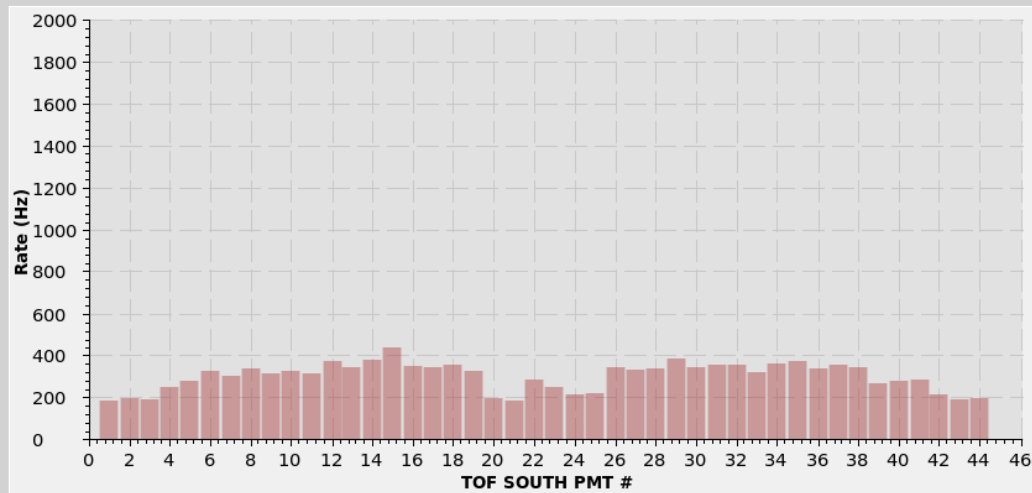
# TOF discriminator scalers: No beam

Range: 150 Hz – 500 Hz



BOTTOM ← → TOP

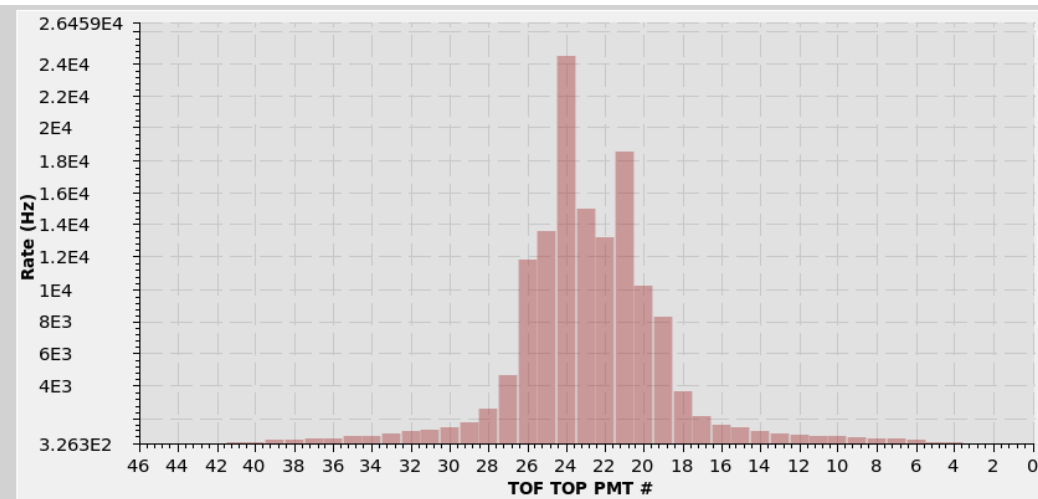
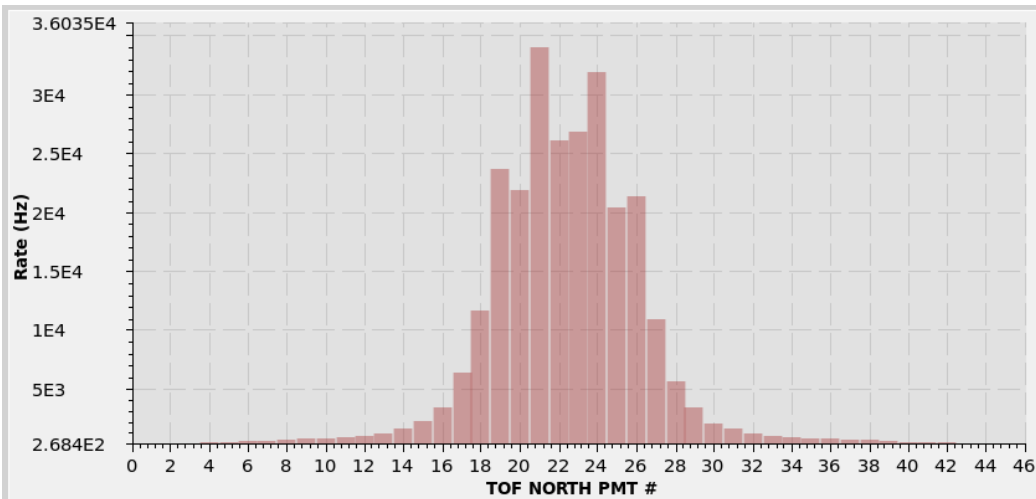
NORTH ← → SOUTH



- Slightly higher rate closer to the beam line

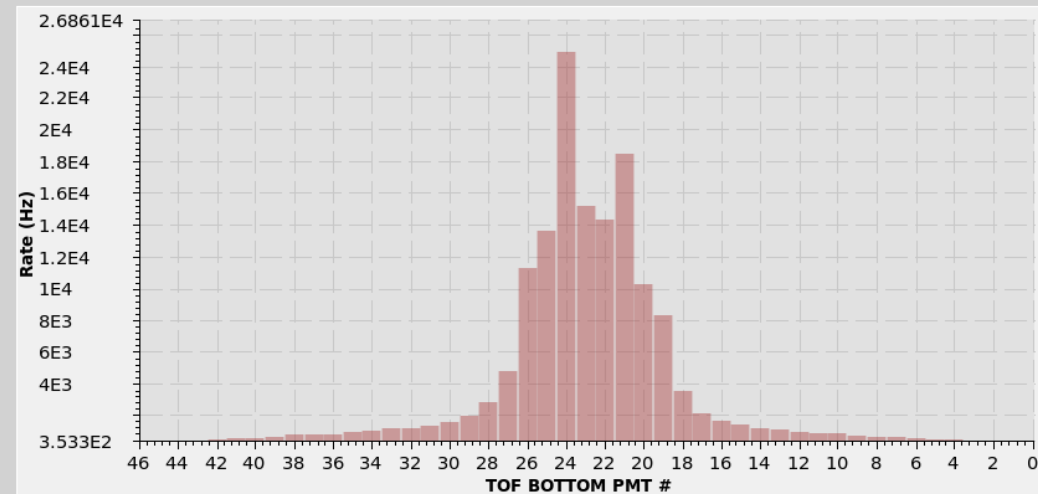
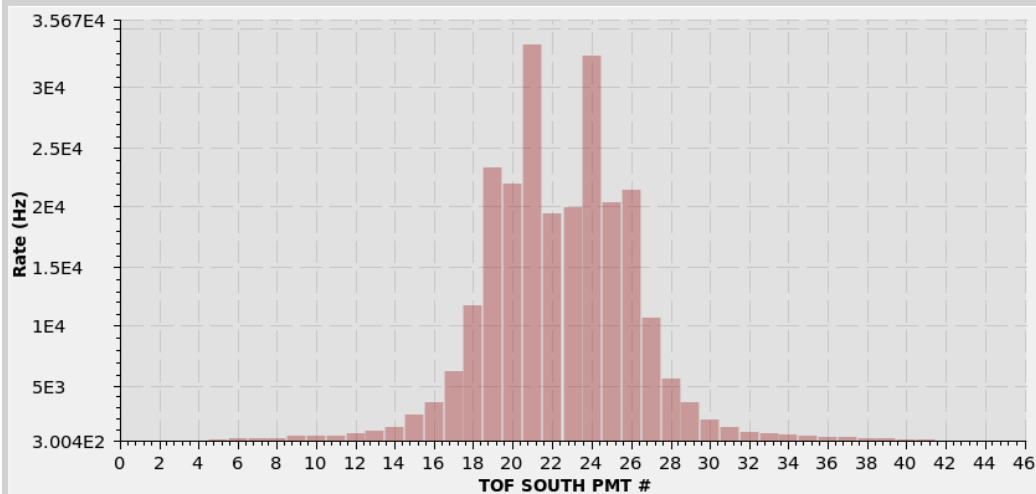
# TOF discriminator scalers: 50 nA, $2 \times 10^{-5}$ radiator

Rate up to 35 kHz at most common running condition



BOTTOM ← → TOP

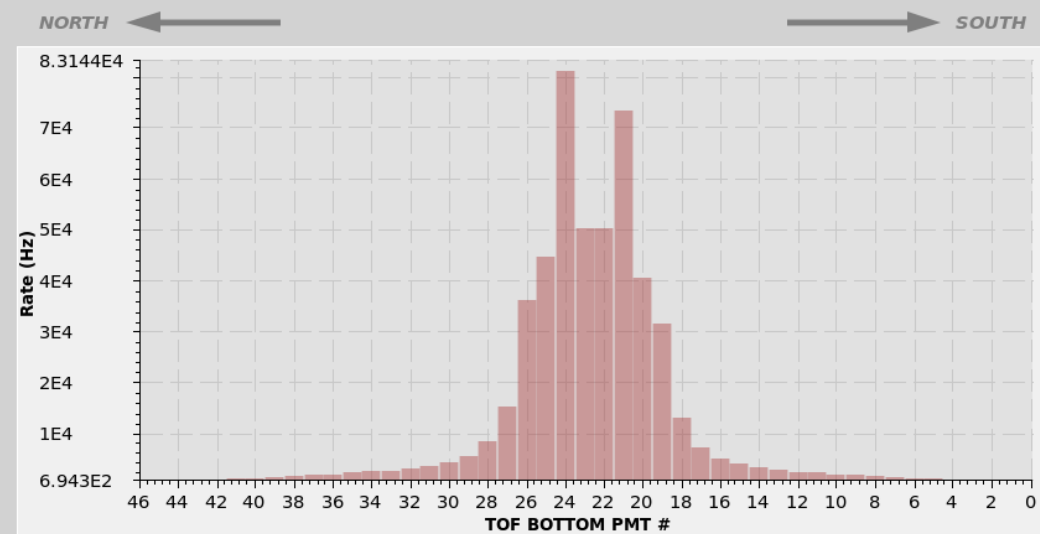
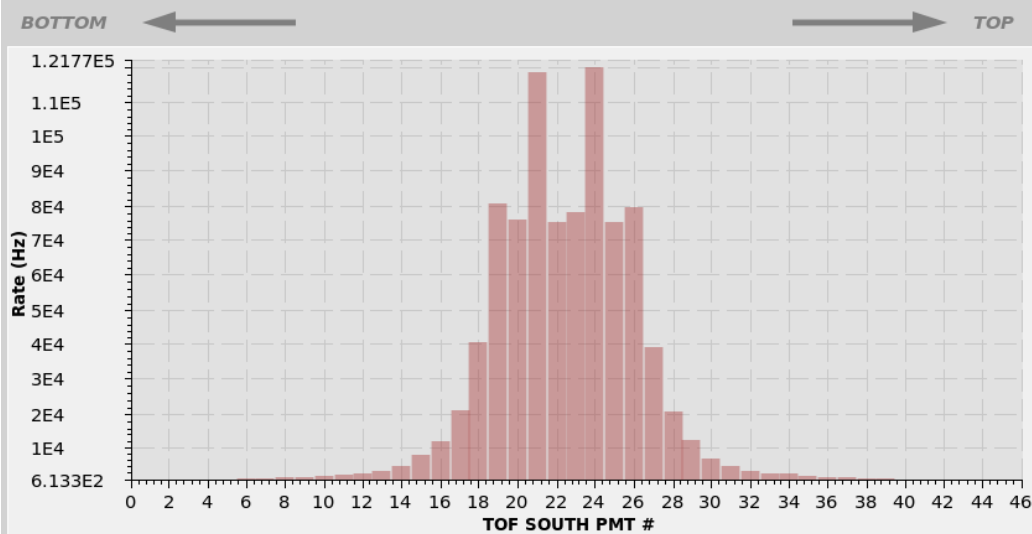
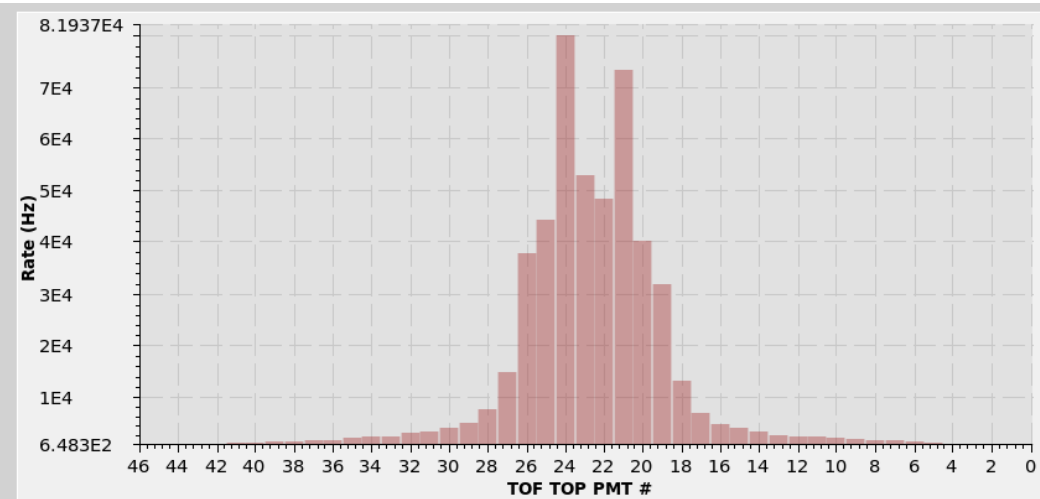
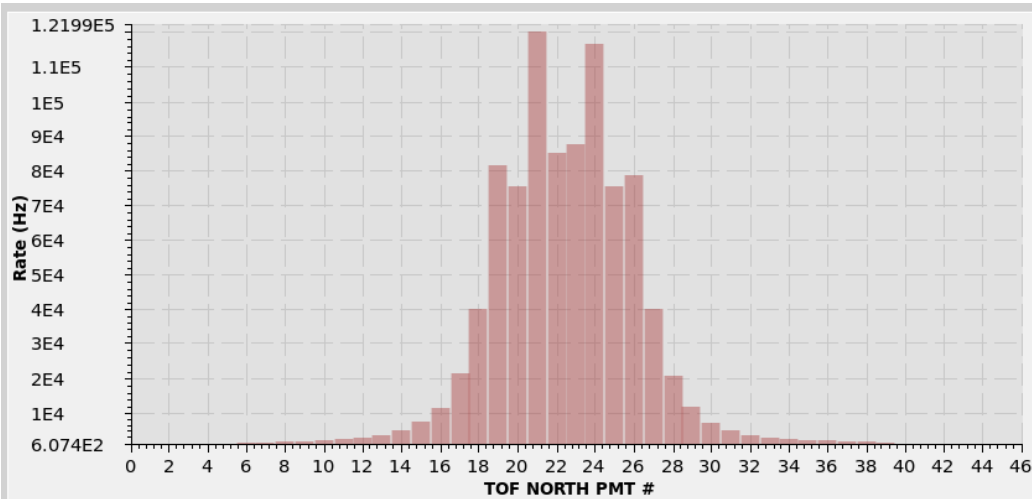
NORTH ← → SOUTH



- 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, $2 \times 10^{-5}$ radiator

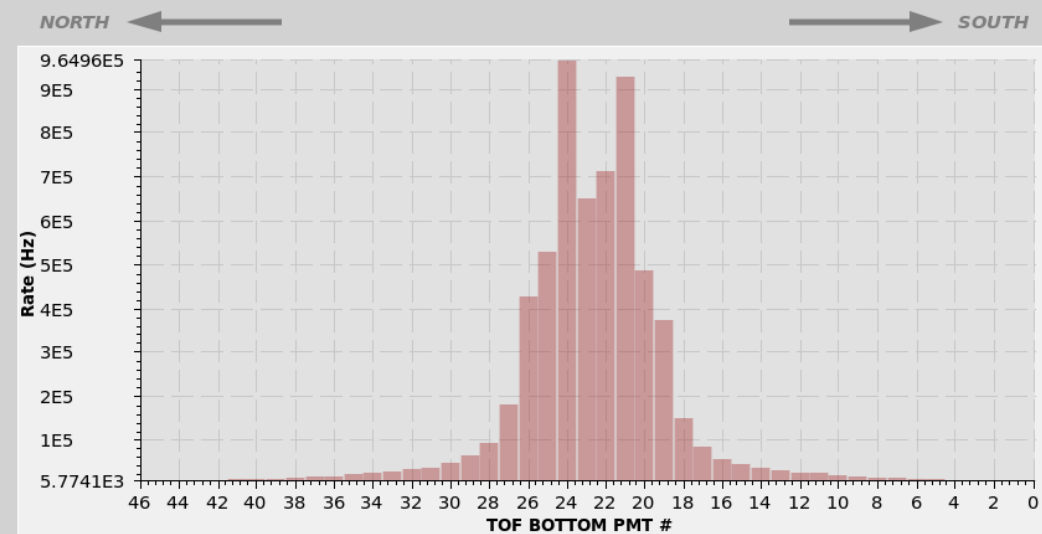
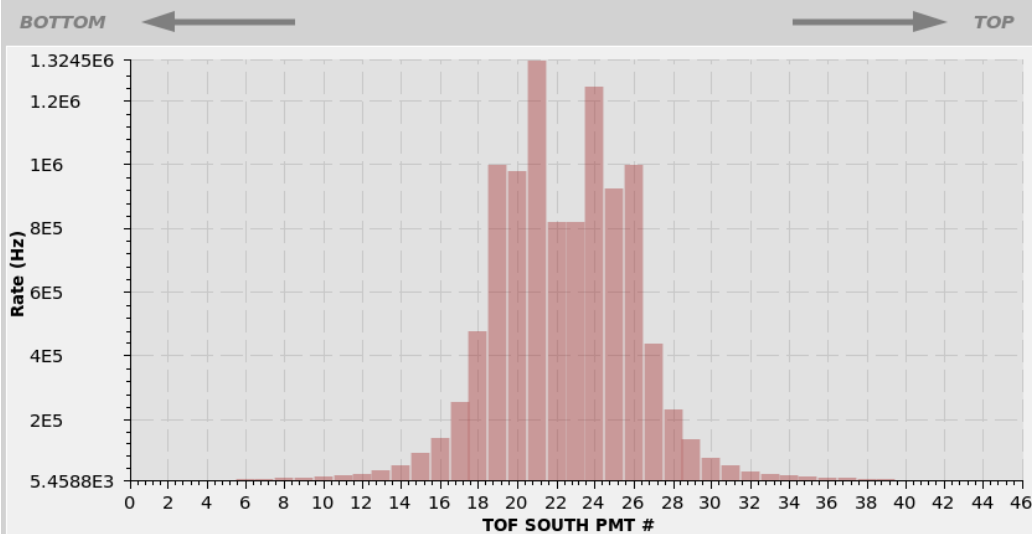
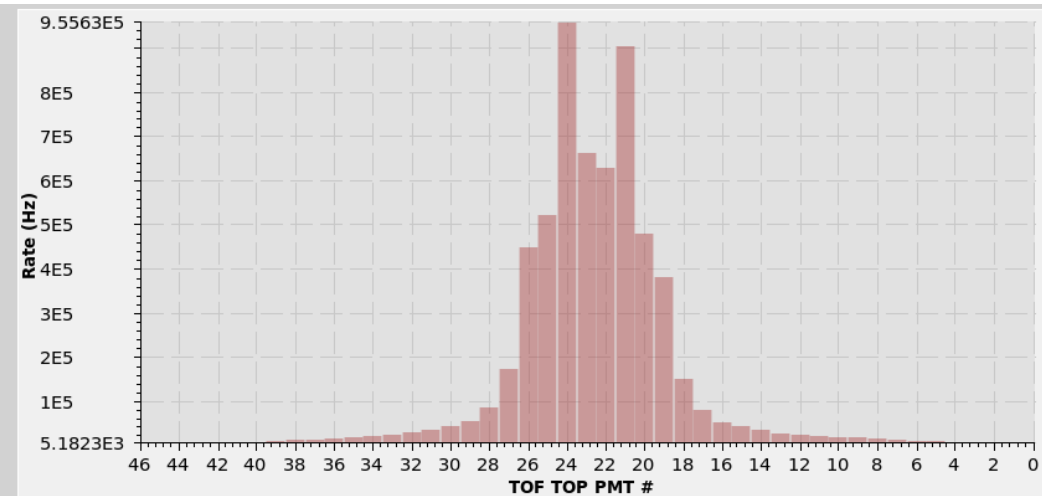
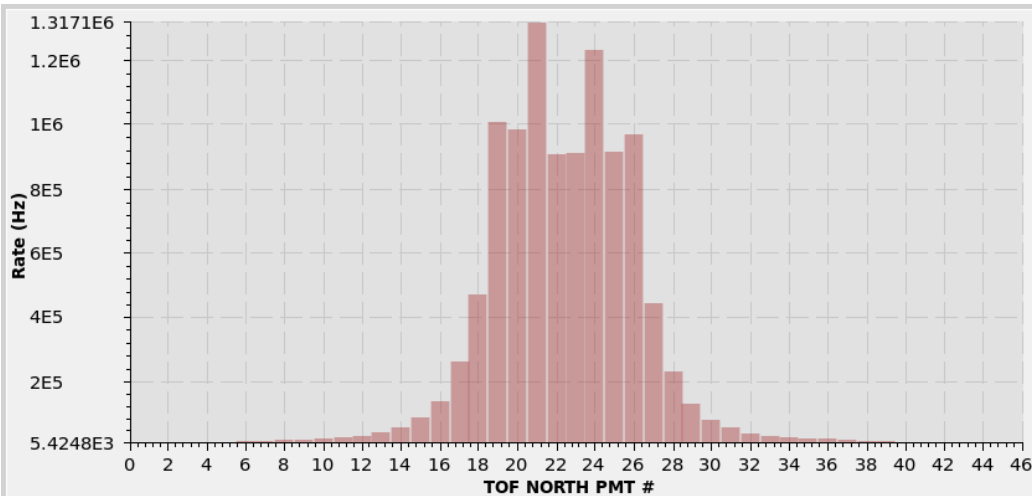
Rate up to 120 kHz



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

# TOF discriminator scalers: 150 nA, $3 \times 10^{-4}$ radiator

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



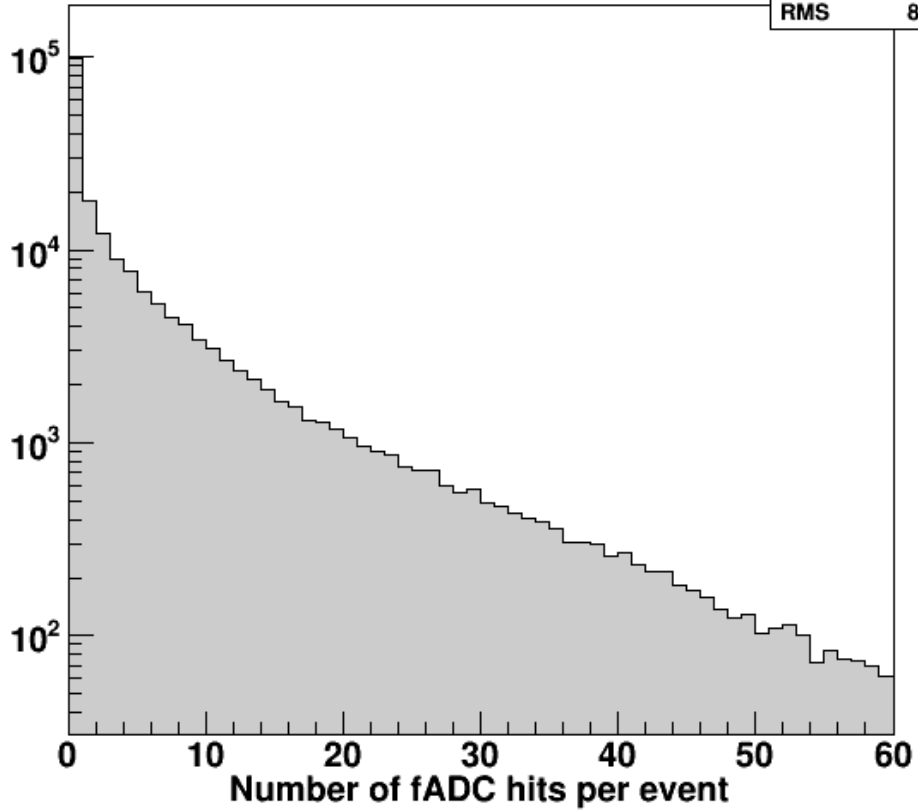
- Rate scales with current/radiator:  $120 \text{ kHz} * (3 \times 10^{-4} / 2 \times 10^{-5}) * (150 \text{ nA} / 200 \text{ nA}) = 1.35 \text{ MHz}$
- No obvious deterioration of TOF performance at high rate but more detailed study is needed

# Hits Multiplicity: Run 1769

50 nA,  $2 \times 10^{-5}$  radiator, fcal\_m8 trigger

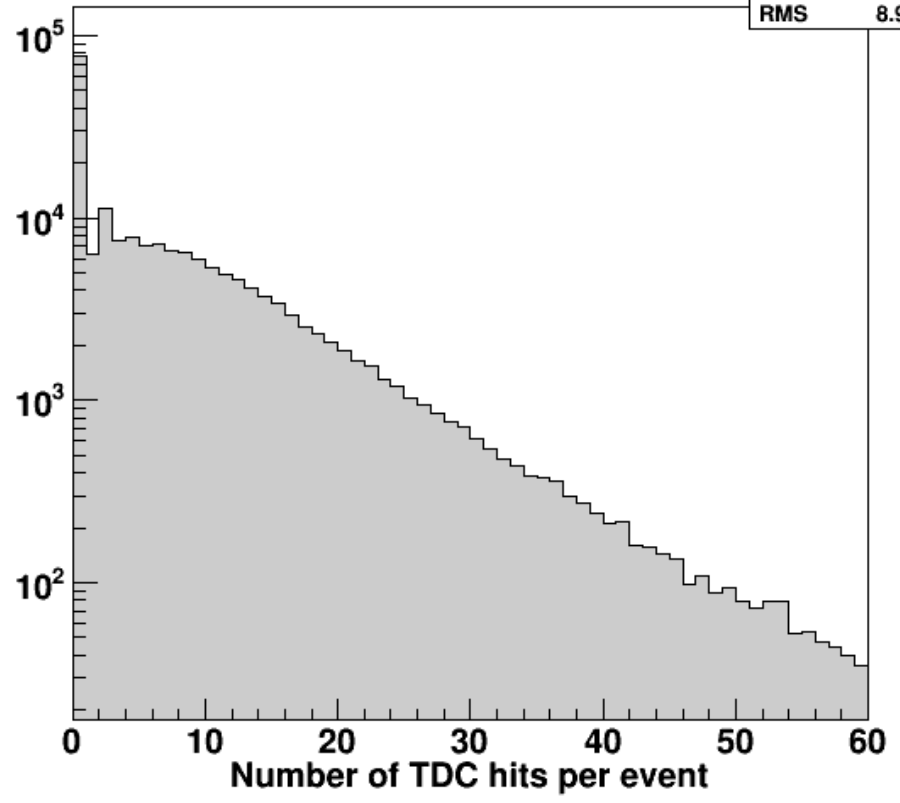
fADC hits multiplicity (run 1769, mode 8)

Entries	203239
Mean	4.711
RMS	8.711

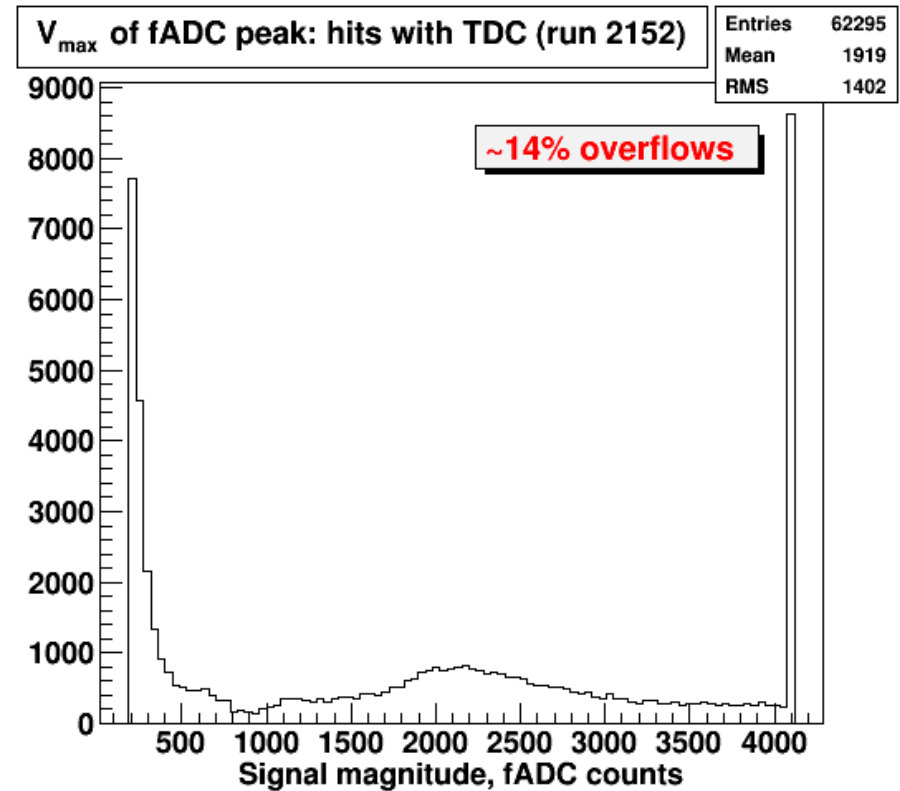
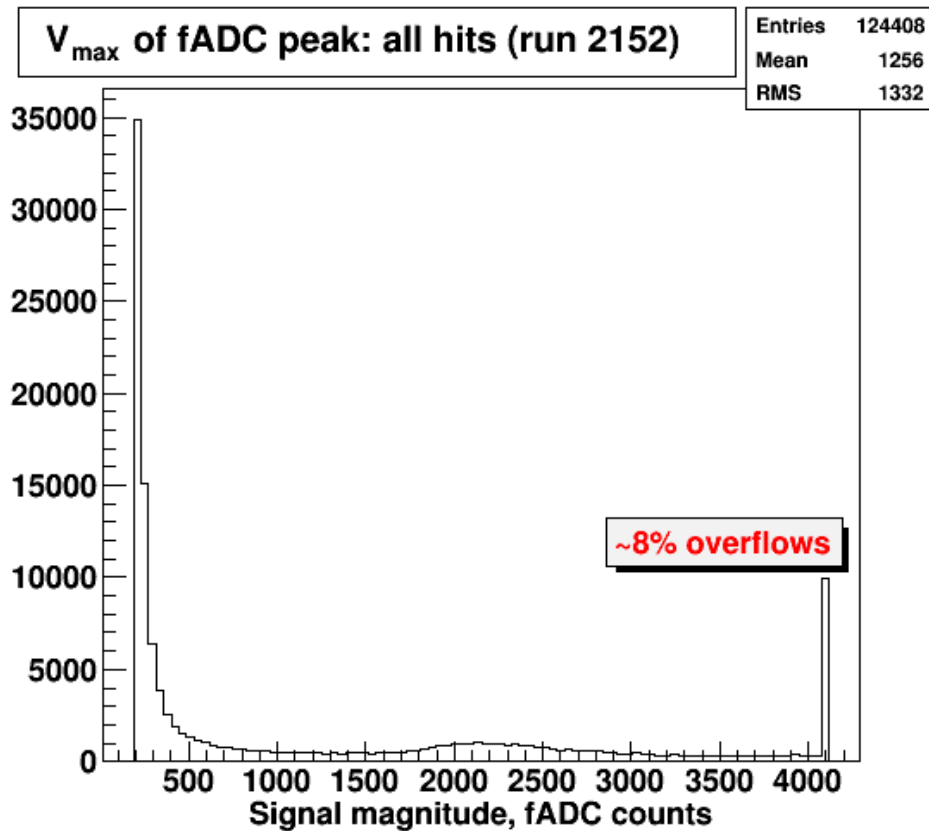


TDC hits multiplicity (run 1769)

Entries	197060
Mean	6.667
RMS	8.964



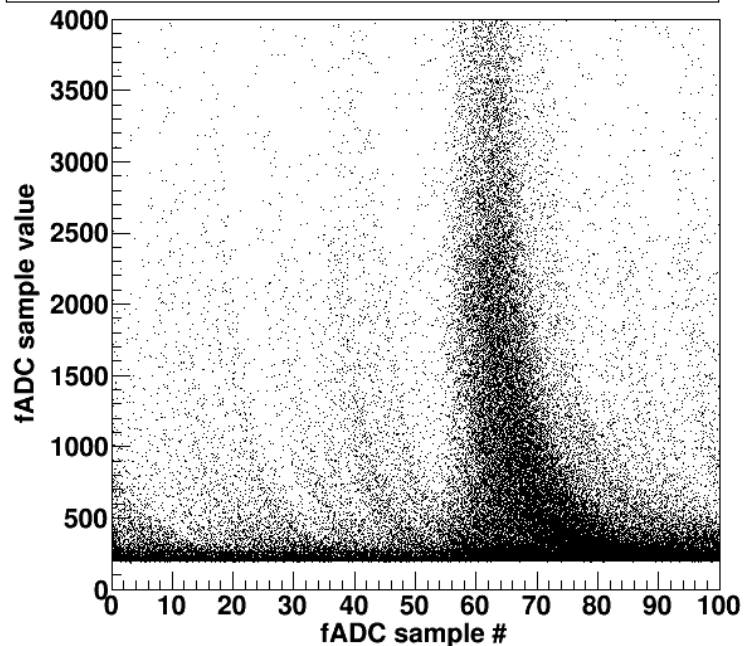
# Magnitude of fADC peaks



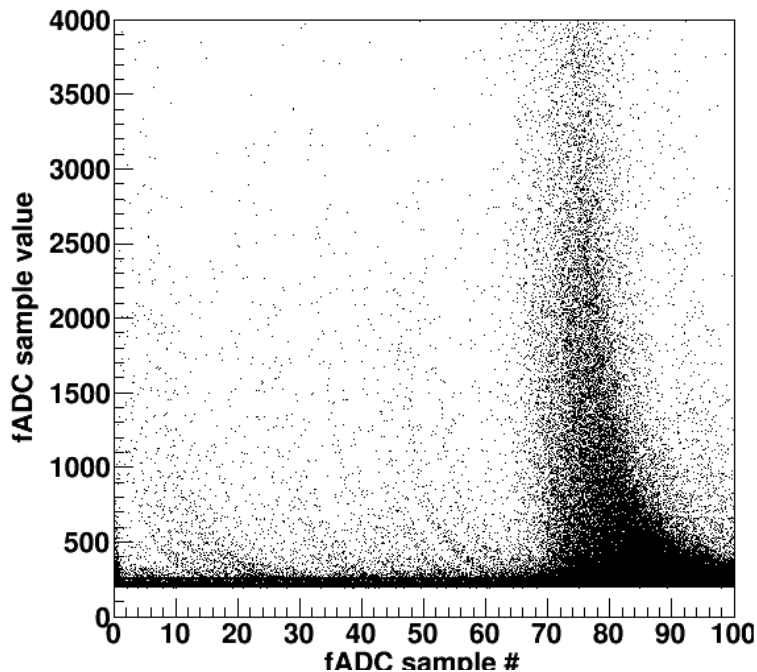
- 8% of all fADC hits and 14% of hits with TDC pair overflow fADC range
- Should we switch FADC250 from 1V to 2V range?



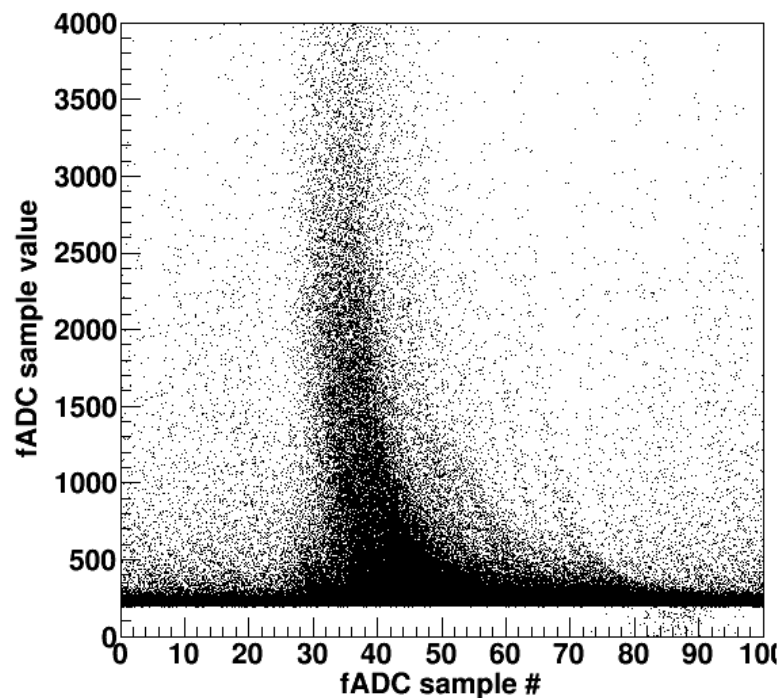
fADC waveform: multiple channels/hits - run 1769



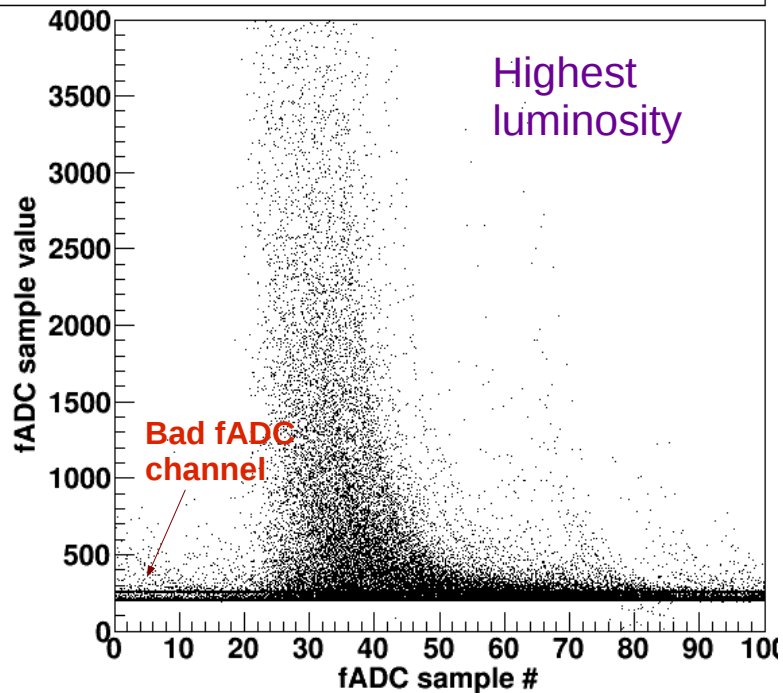
fADC waveform: multiple channels/hits - run 2141



fADC waveform: multiple channels/hits - run 2152



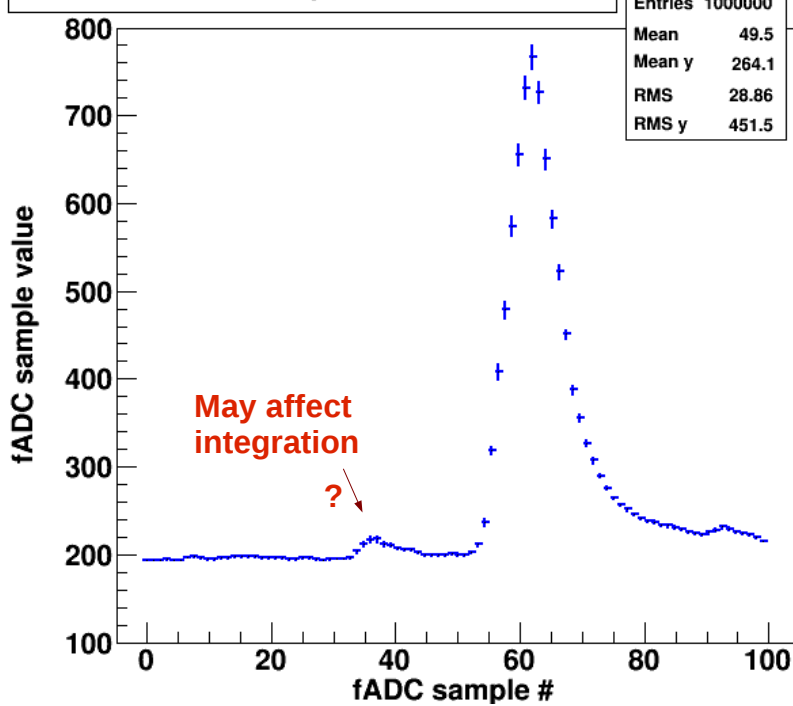
fADC waveform: multiple channels/hits - run 2174



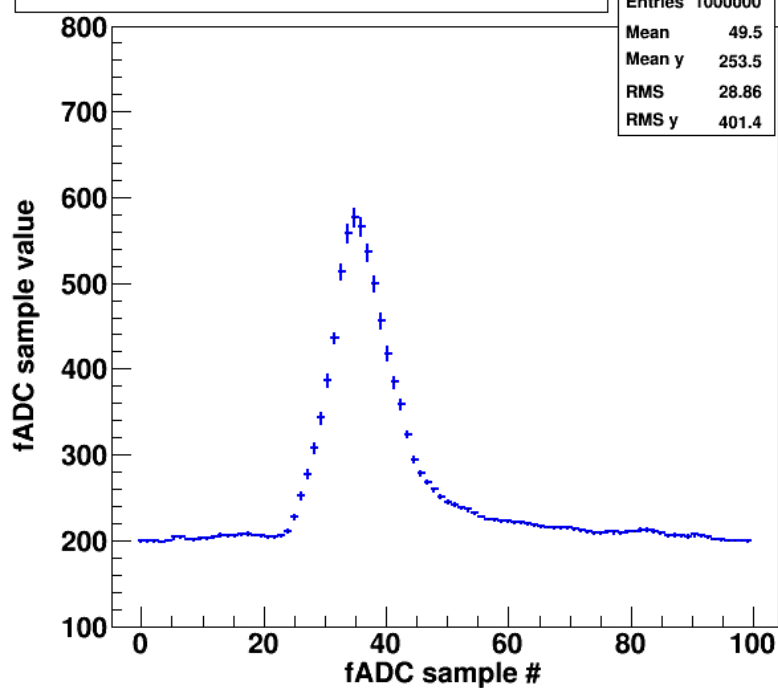
## Waveform of fADC pulses

- 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

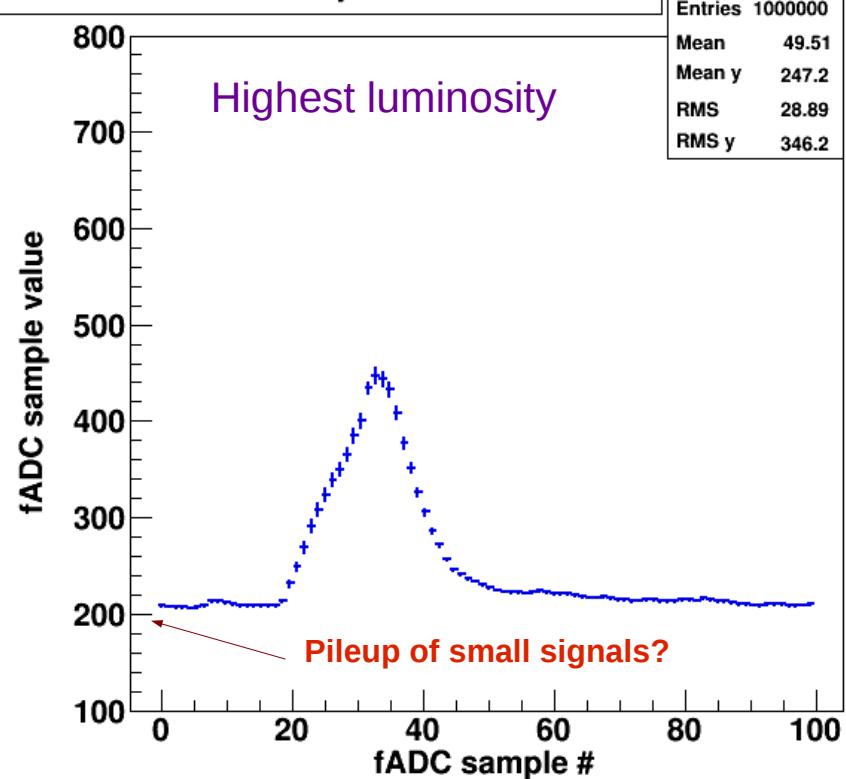


# “Average” (profile) fADC pulse

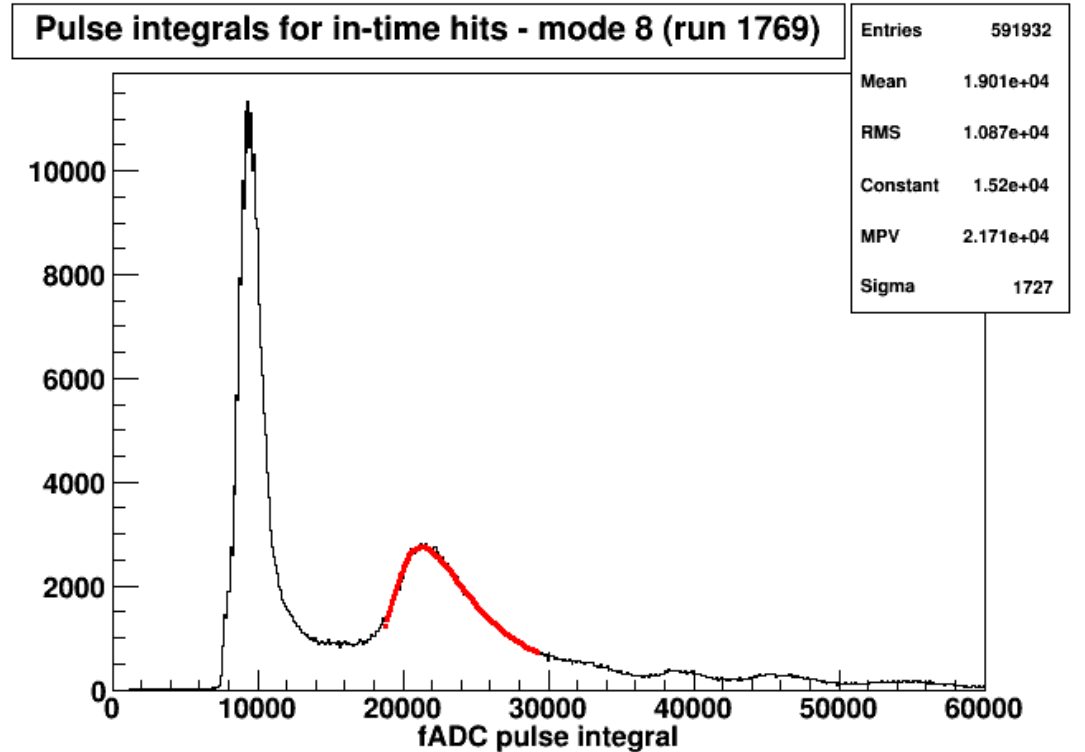
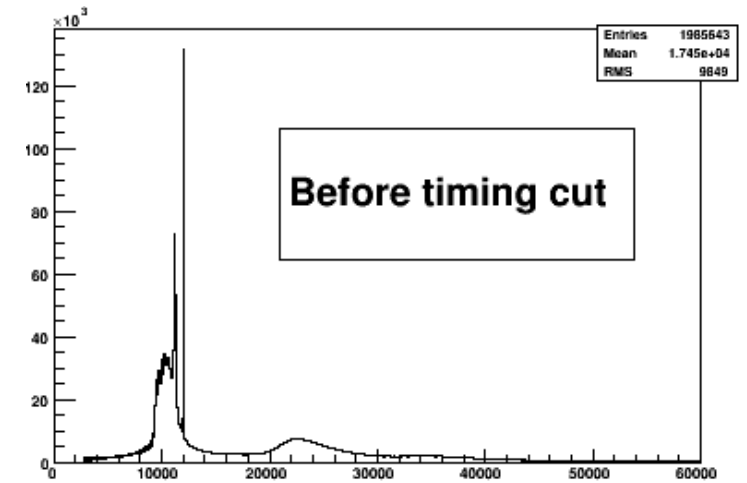
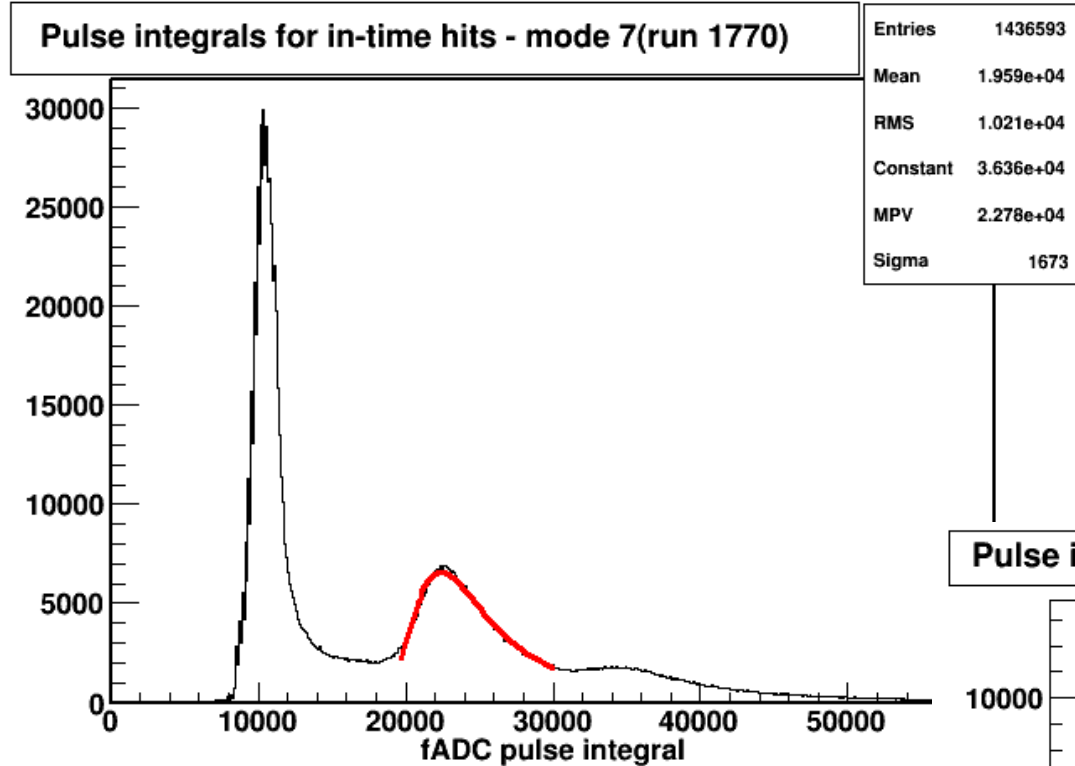
- The nature of “prequel” to the signal is unclear; integration of the main pulse may be affected even with NSA=45
- Can smaller average pulse in 2152 (vs 1769) be explained by fcal\_bcal.conf vs fcal.conf?
- In the highest lum. 2174, average<sup>\*)</sup> pulse is higher than baseline (which is still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

\*) bad channel excluded

Profile of all fADC pulses - run 2174



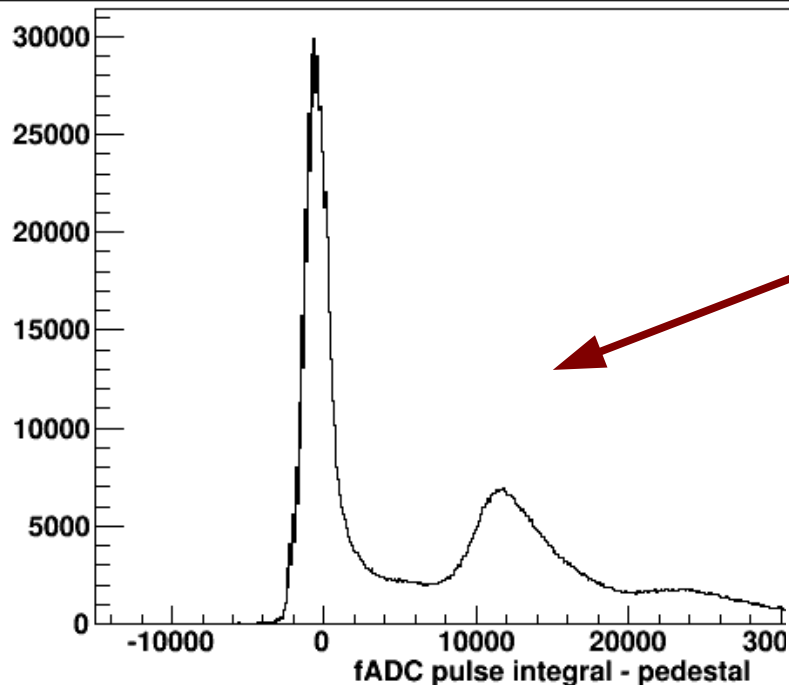
# fADC pulse integrals



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

# fADC pulse integrals – pedestal subtraction

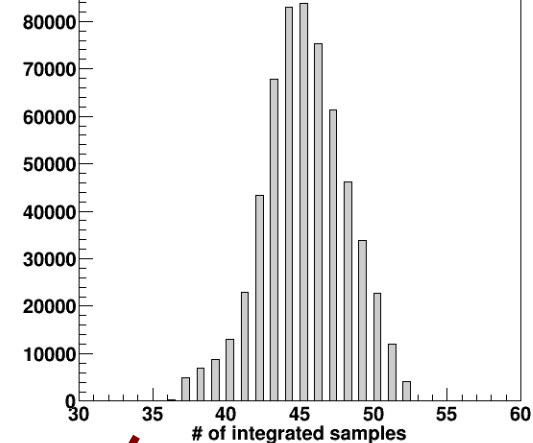
(Pulse integral - Pedestal) for mode 7



Entries 1436593  
Mean 8469  
RMS 1e+04

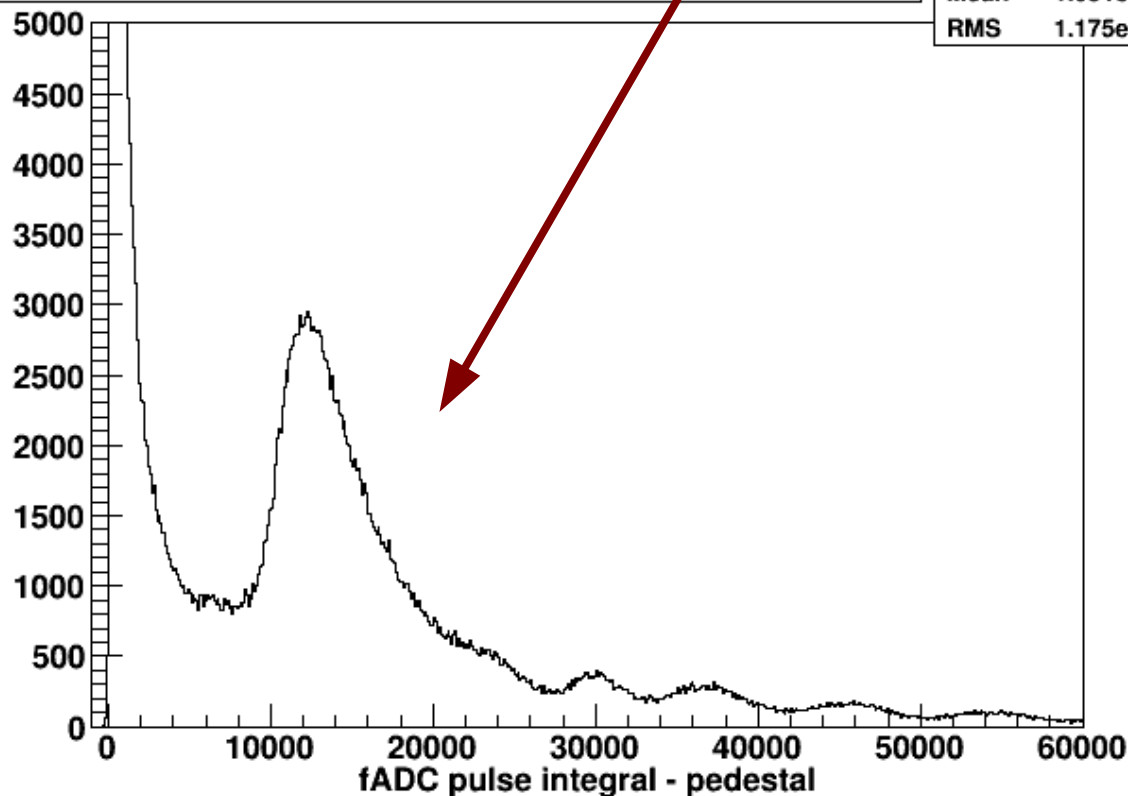
fixed  
NSA+NSB

Mode 8: nsamples\_integral (run 1769)



Entries 591932  
Mean 45.05  
RMS 2.914

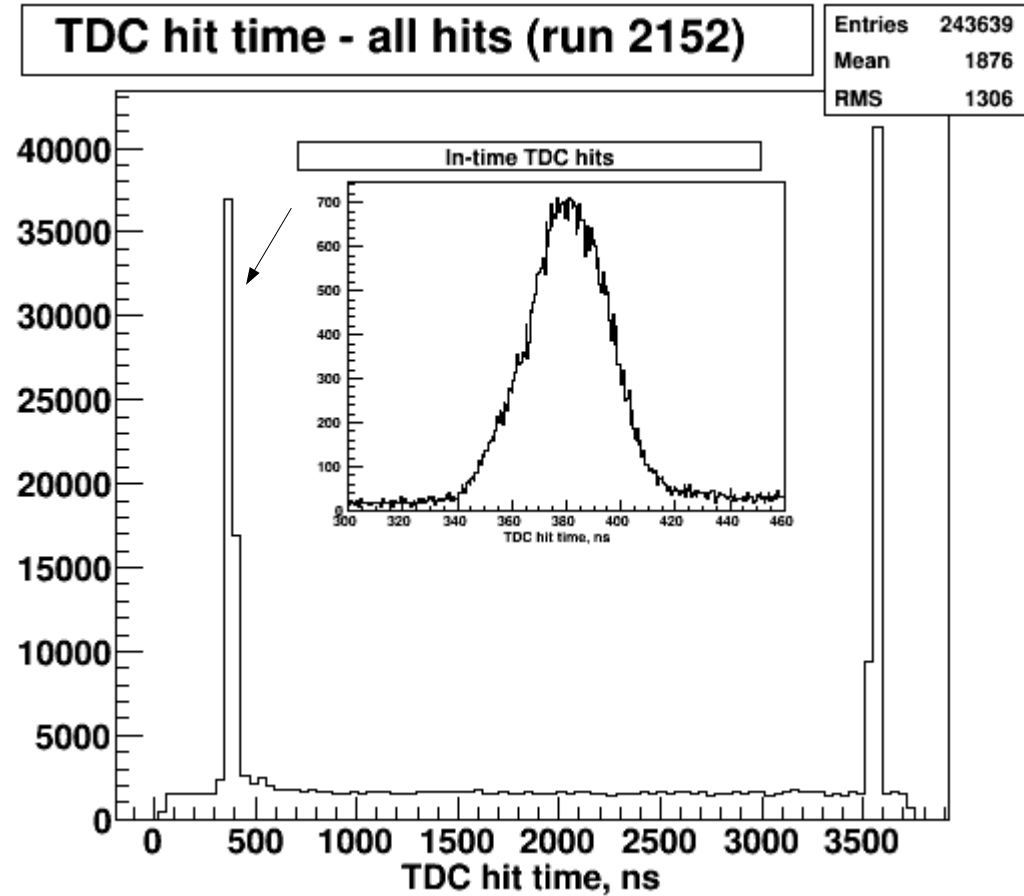
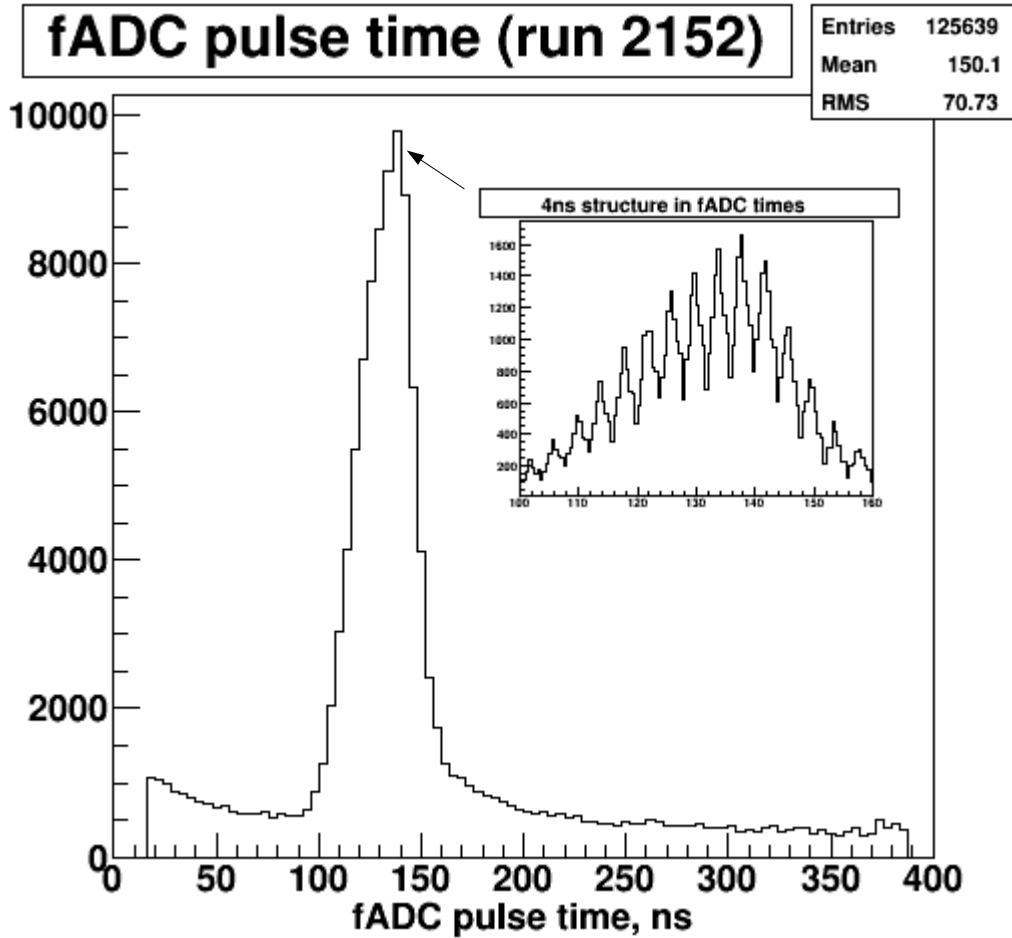
(Pulse integral - Pedestal) for mode 8



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

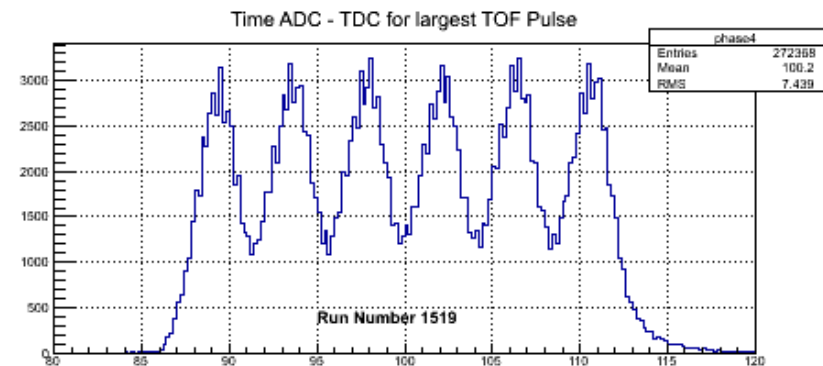
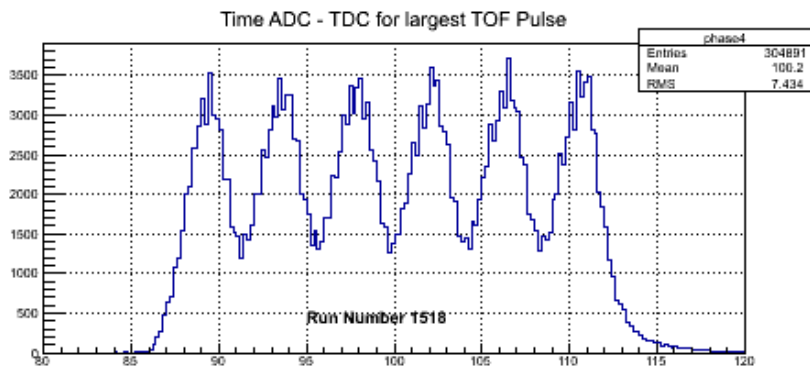
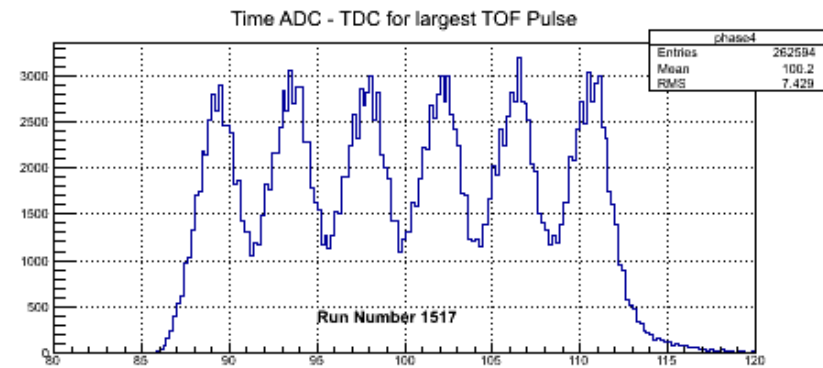
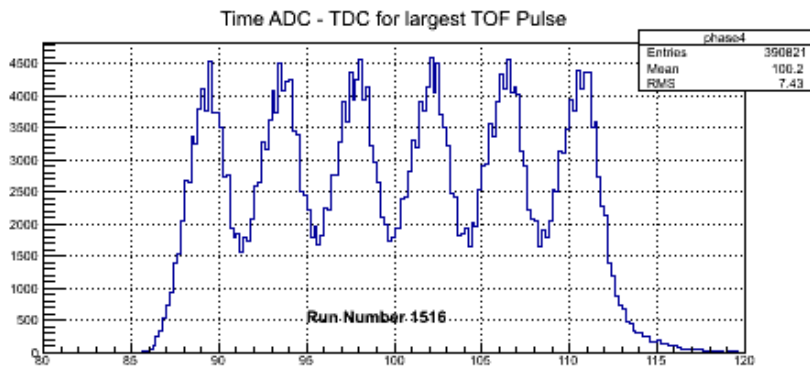
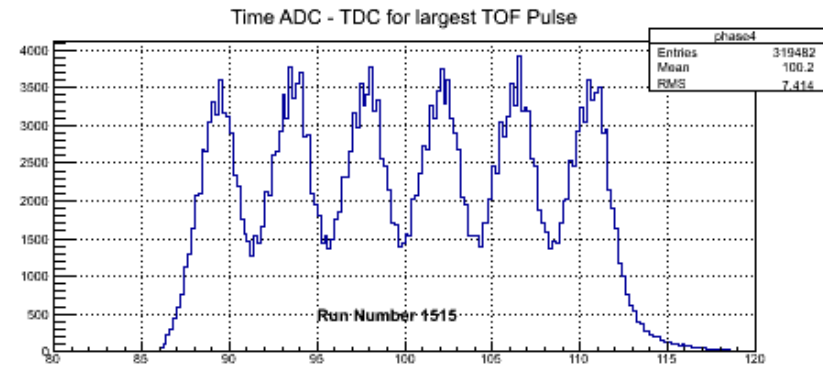
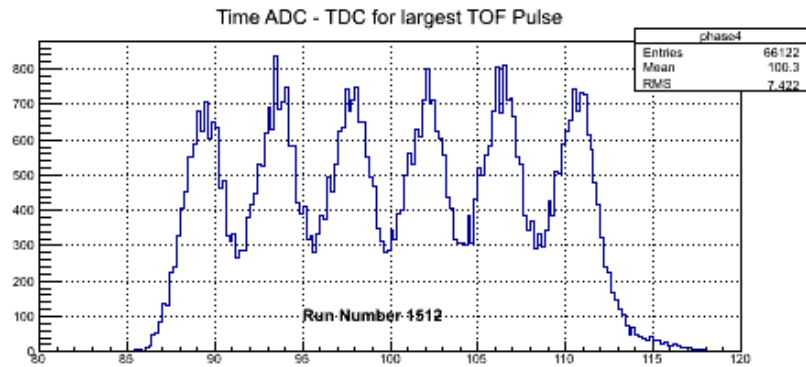
# TOF fADC250 and CAEN TDC timing



- 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

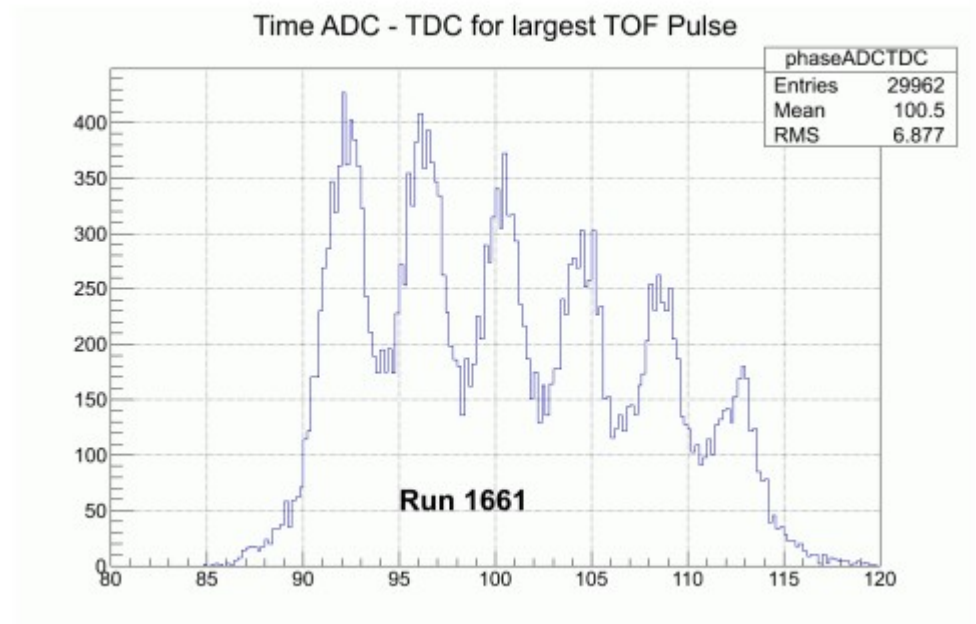
Lognumber 3309602. Submitted by zihmann on Sun, 11/30/2014 - 14:45.



## TOF TDC clock phase with trigger

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

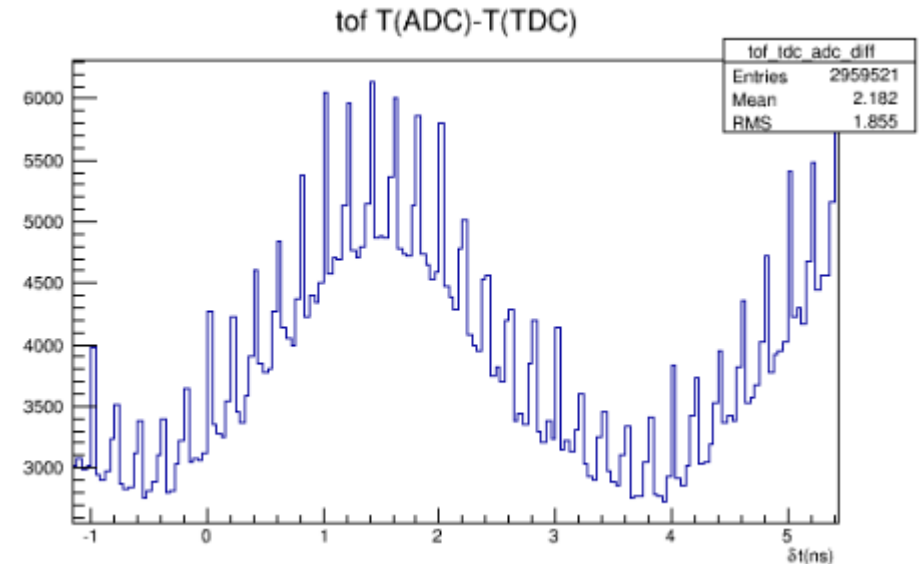
- In high luminosity run:
  - the phase shifted by a few ns;
  - a slope appeared due to dead time



## time difference between ADC and TDC for TOF from Run 1515

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

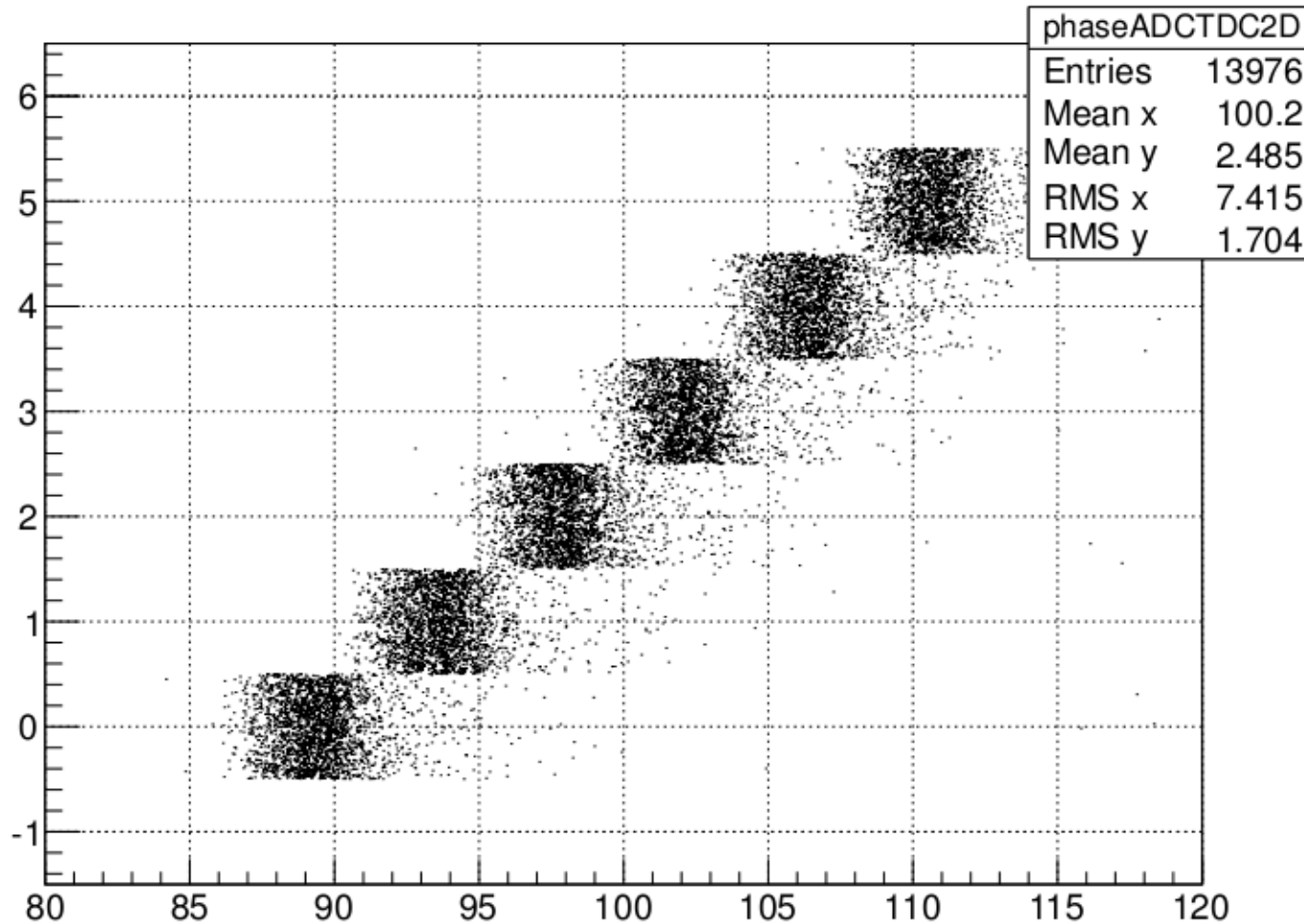
- a peculiar substructure with a period of  $\sim 200$  ps



## Time correlation with TI timestamp

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

TI\_Time vs. Time ADC - TDC



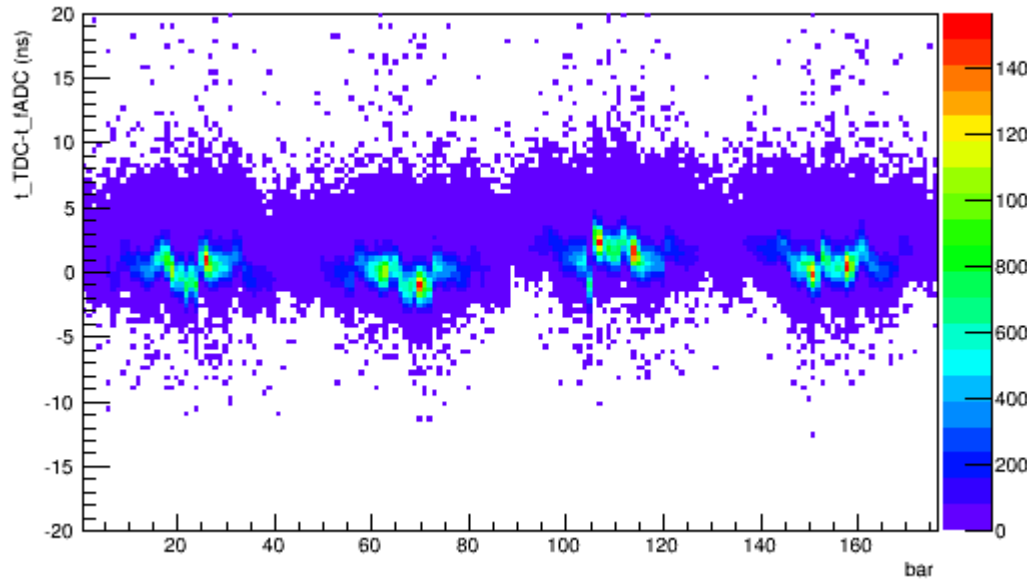
- Phase correction may require per-run calibration



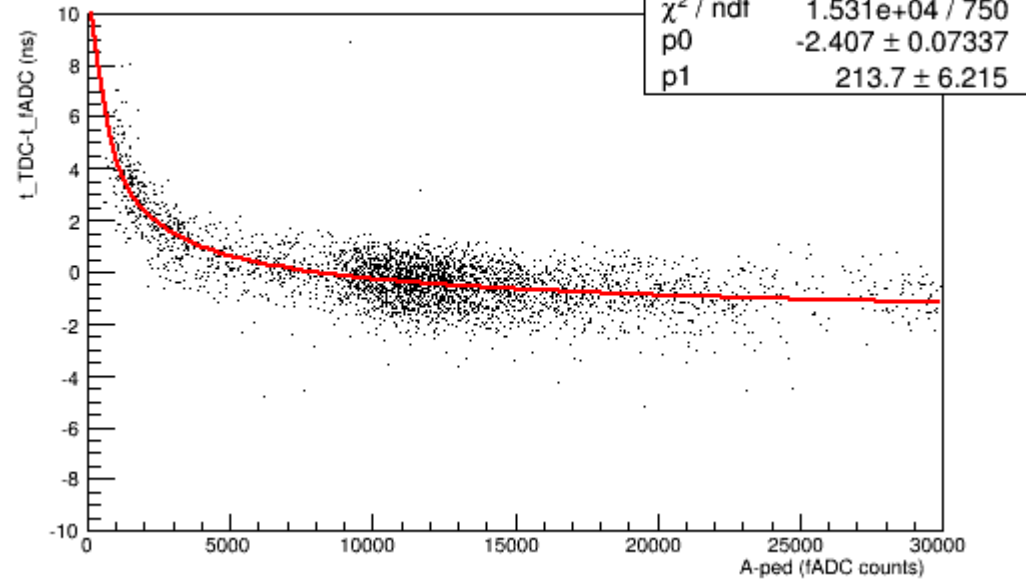
# timewalk correction for TOF

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

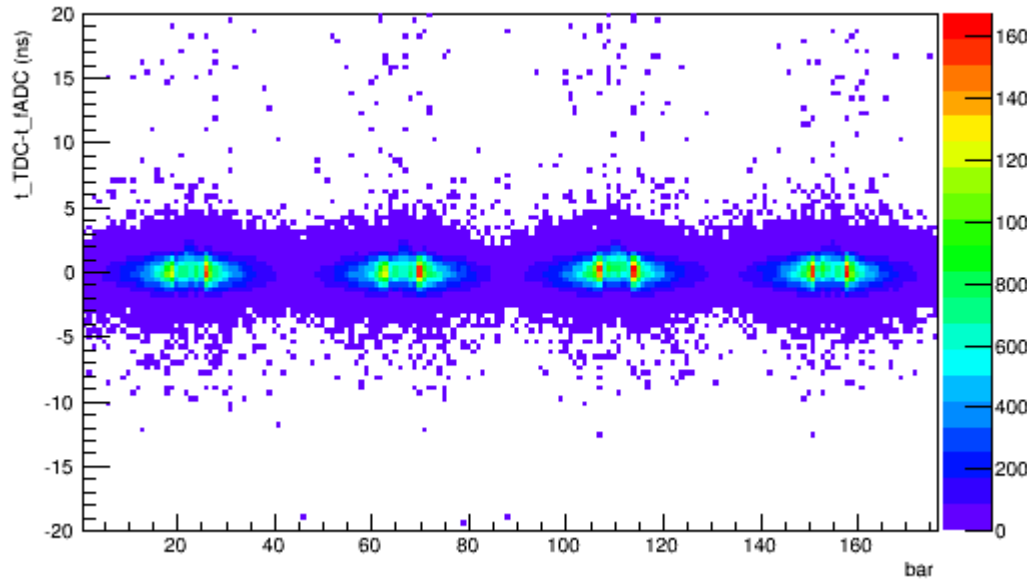
TOF TDC-ADC time difference



TOF time vs integral, vertical bar 22



TOF TDC-ADC corrected time difference



TOF TDC-ADC corrected time difference

