Tagger Microscope Commissioning Status Report

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Outline

1. FADC signals
   a. What is the variation of the pedestal with time, on a scale from seconds to days?
   b. What is the pedestal width, instantaneous and long term?
   c. How often the pedestal should be measured?

2. Typical FADC spectra for "hits": associated with tracks if possible.

3. What readout threshold should be used?
   a. What would be the detection efficiency (energy cutoff)?
   b. How often should be the threshold adjusted?

4. Signal rate above the threshold, without beam and at some beam conditions

5. If TDC readout exists: timing difference FADC-TDC, nhits(FADC) vs nhits(TDC) for given channels.

fADC pedestal variation during a run
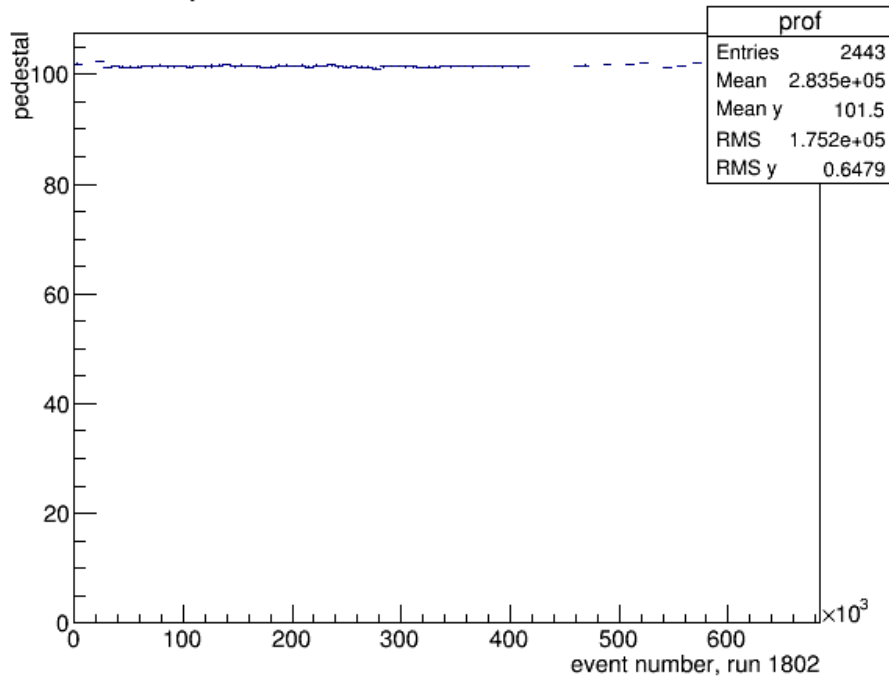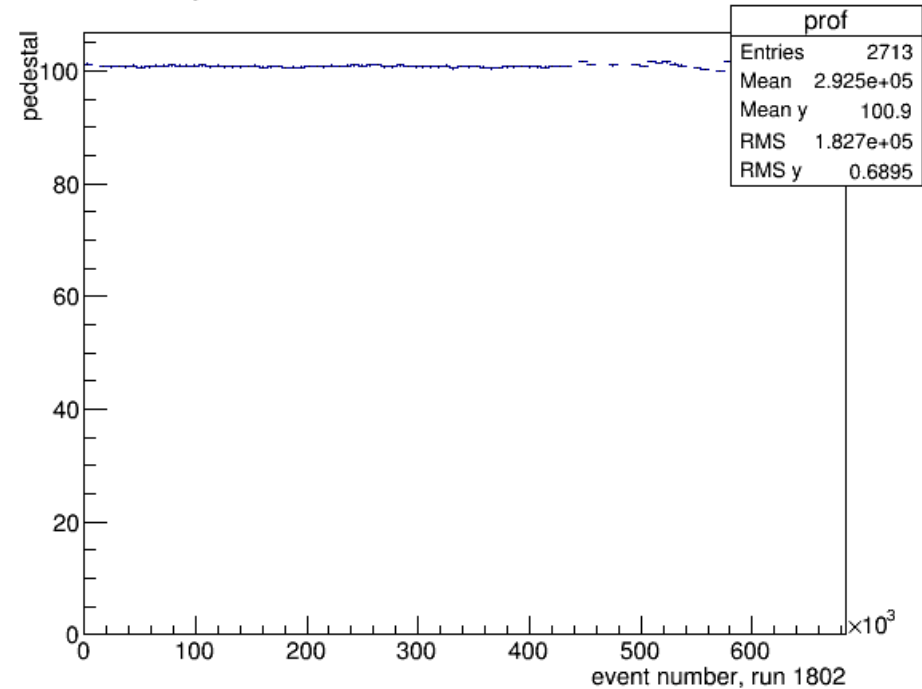
fADC pedestal variation over weeks
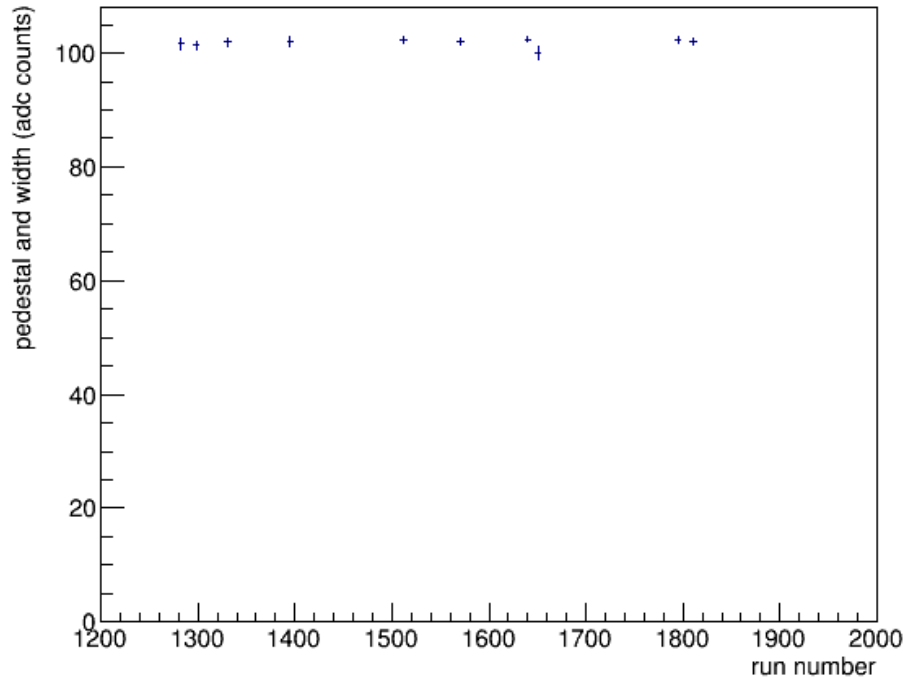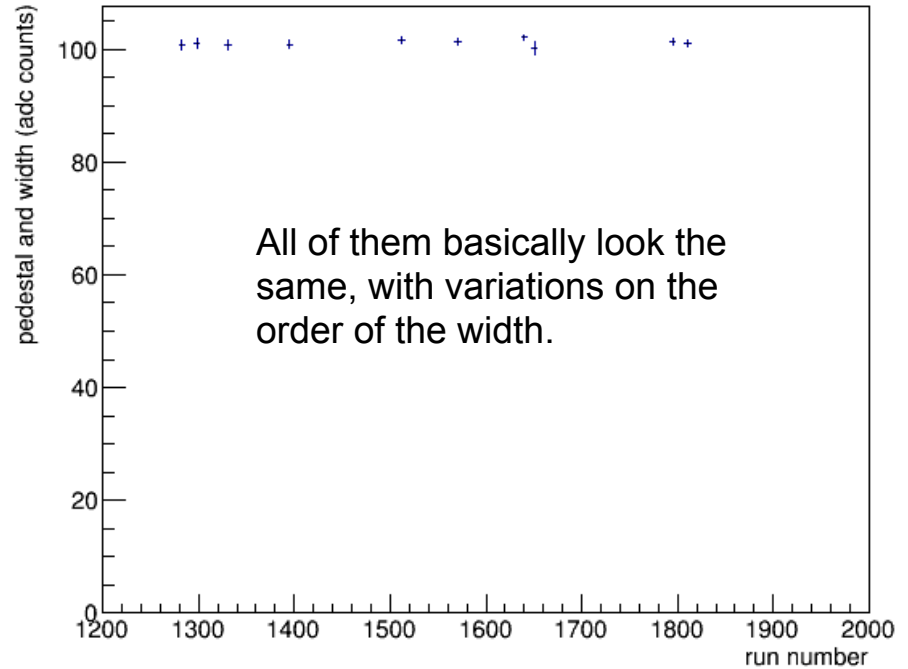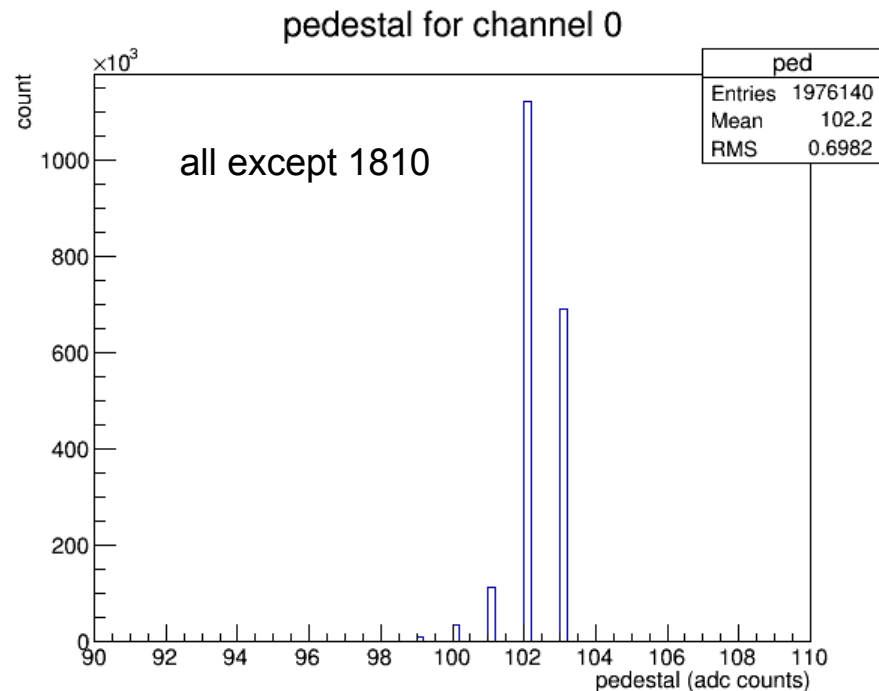
pedestal vs run number for channel 0

pedestal vs run number for channel 20

All of them basically look the same, with variations on the order of the width.
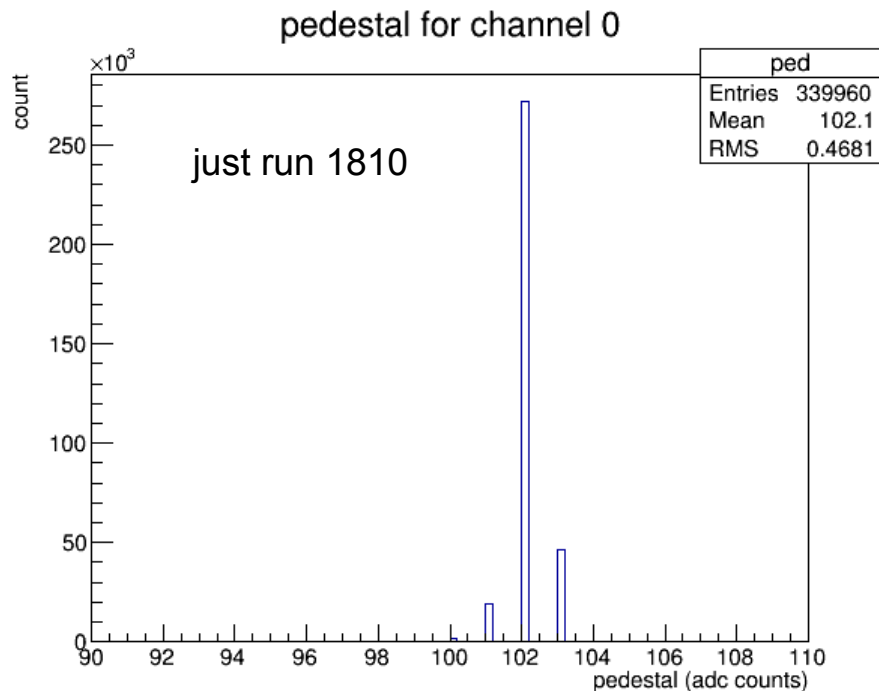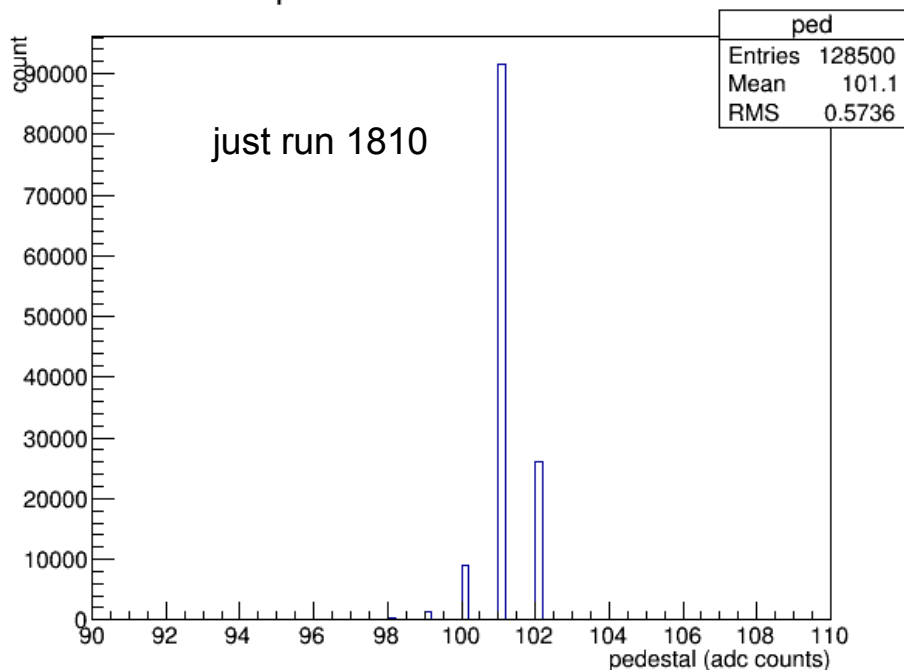
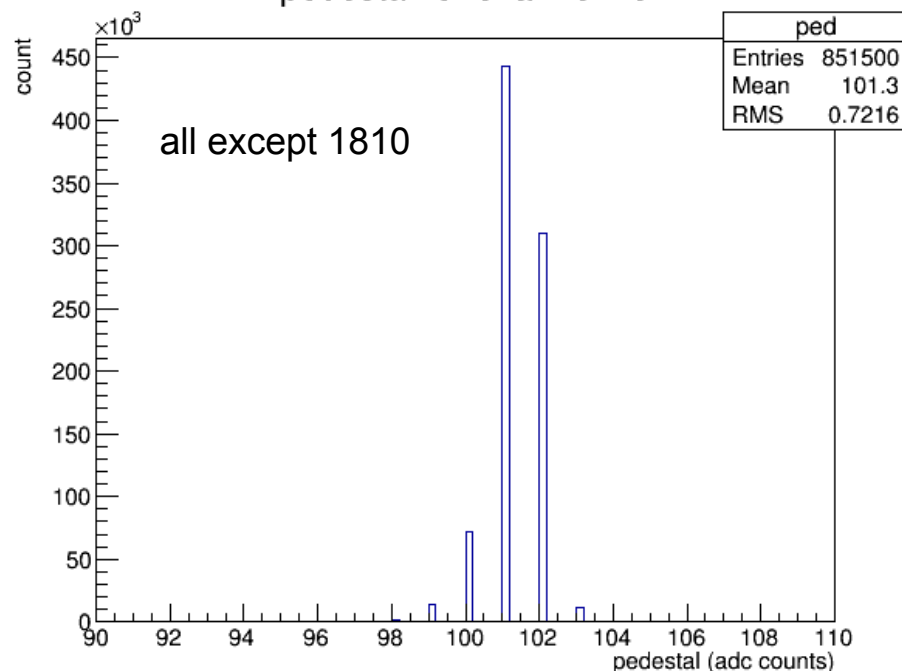# fADC pedestal width

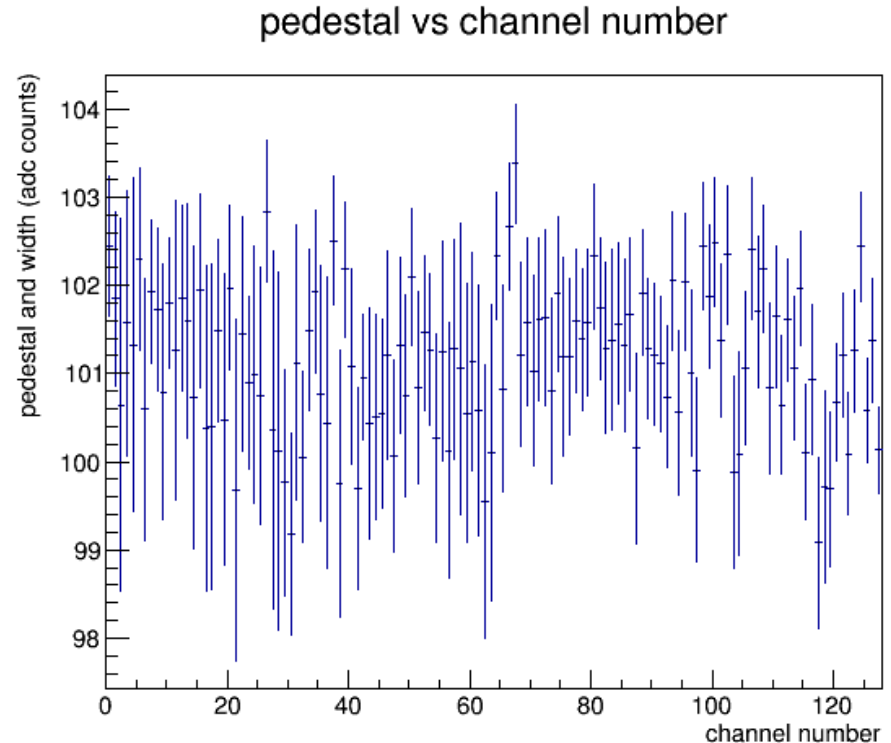# fADC pedestal width

fADC pedestal positions and widths

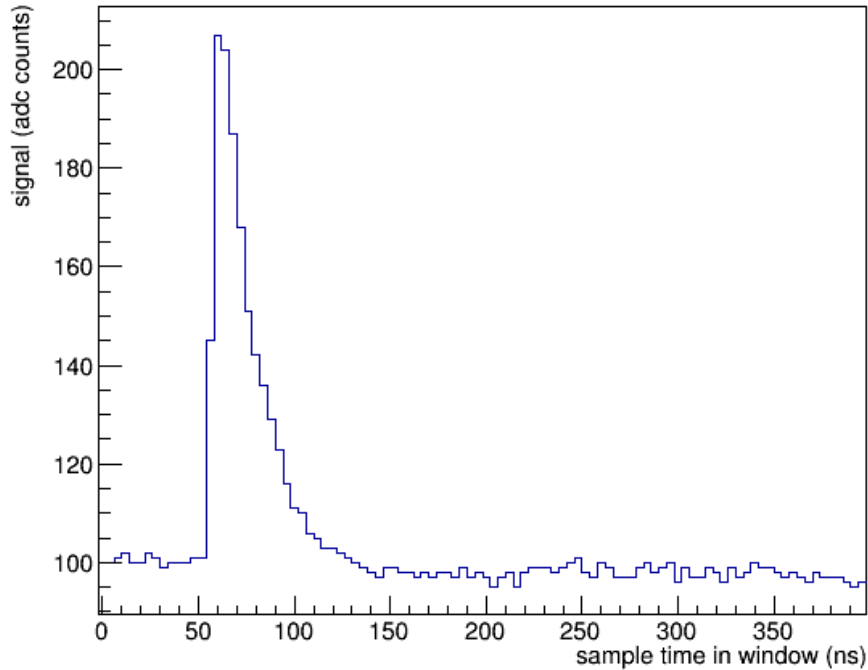measurements in low gain mode

- readout threshold should be **>5σ** over pedestal.

- pedestals vary over range 99 - 104

- **σ ~ 1-2 channels**

- readout threshold ~ **115 channels**

- **1 week pedestal update interval is more than adequate.**

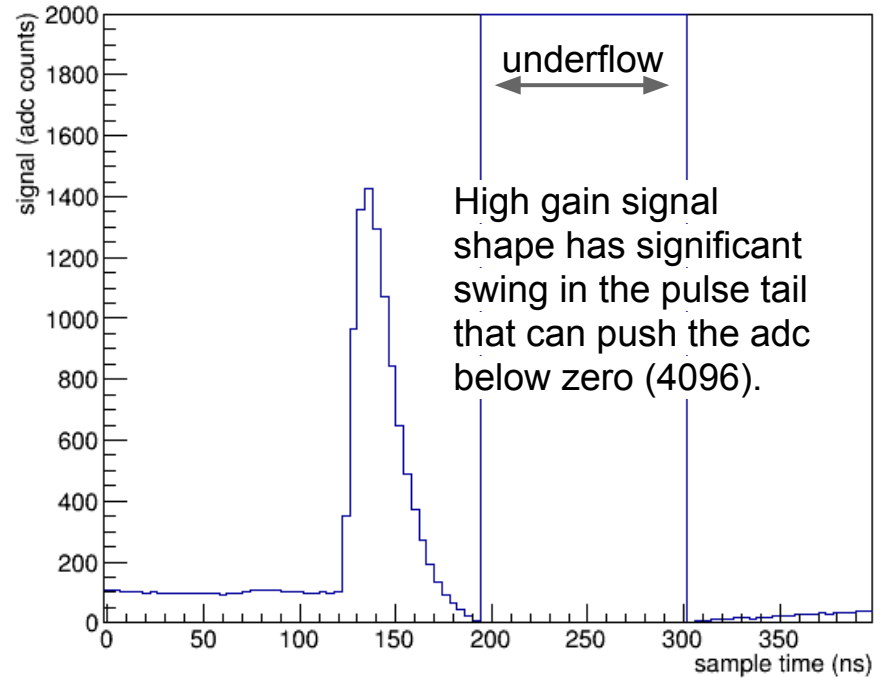
pedestal vs channel number

Typical fADC "hits" pulse shape

typical hit in low gain

typical hit in high gain

underflow

High gain signal shape has significant swing in the pulse tail that can push the adc below zero (4096).

fADC "hits" pulse spectrum

pulse height spectrum, channel 3

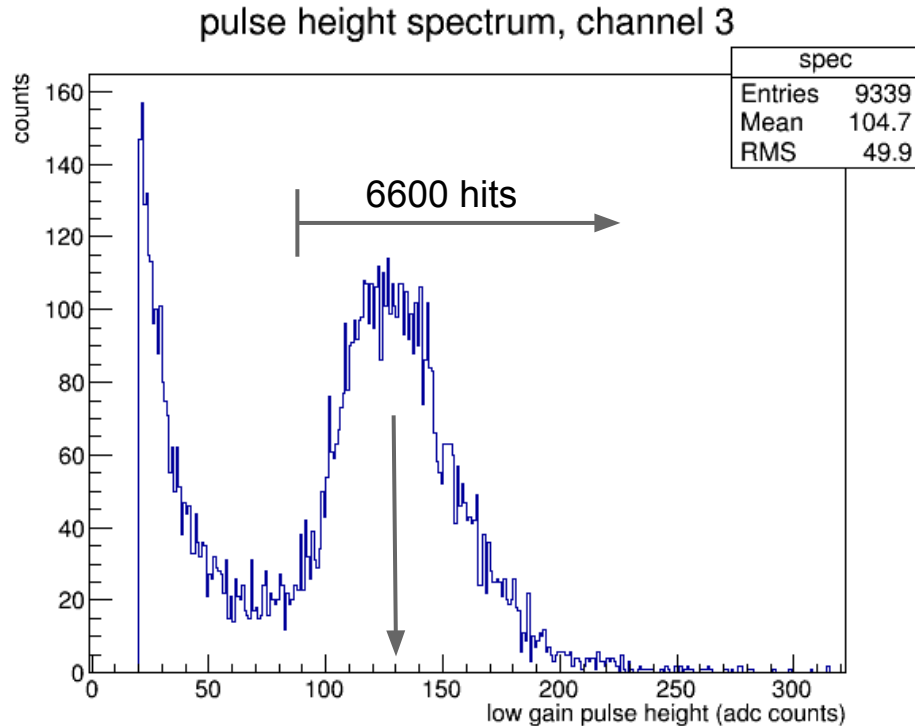| spec	
Entries	9825
Mean	402.9
RMS	601.9

readout threshold
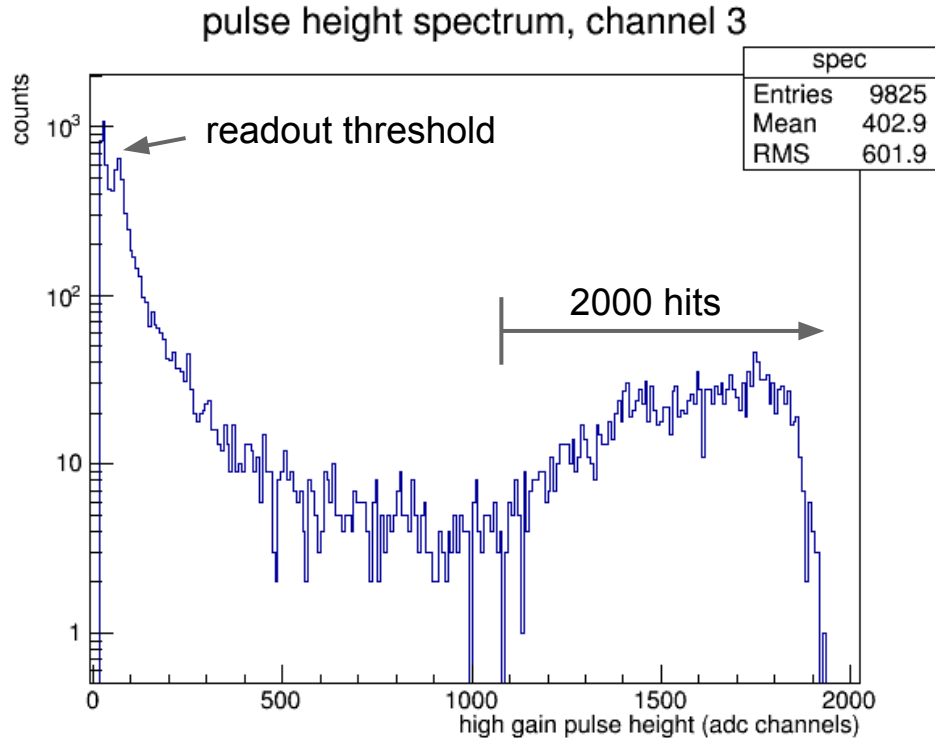
2000 hits

measurements in high gain mode (run 8998)

- amplifier output saturates at ~1.8V

- after 50:50 splitter, becomes 0.9V

- **hits are saturating the preamplifier**

- **total hit count agrees well with expectations ~1800 hits over bg.**

- difficult to count pixels in pulses that are saturating the amplifier, **look next at low gain**

fADC "hits" pulse spectrum

pulse height spectrum, channel 3

spec	
Entries	9339
Mean	104.7
RMS	49.9

6600 hits

low gain pulse height (adc counts)

measurements in low gain mode
(run 1807)

- amplifier far from saturation

- very clean scintillation signal

- **width dominated by Landau fluctuations, not photon statistics**

- **total hit count agrees well with expectations ~5800 hits over bg.**

- difficult to count pixels in low gain, cannot see individual pixels

- rough guess: **<Npix> ~ 200**

fADC pulse normalization

two-step procedure:

1. Determine the single-pixel pulse height in high gain mode.

2. Use columns with both individual fiber (low gain) and summed (high gain) readout and to transfer the absolute gain calibration from high gain to low gain signals.

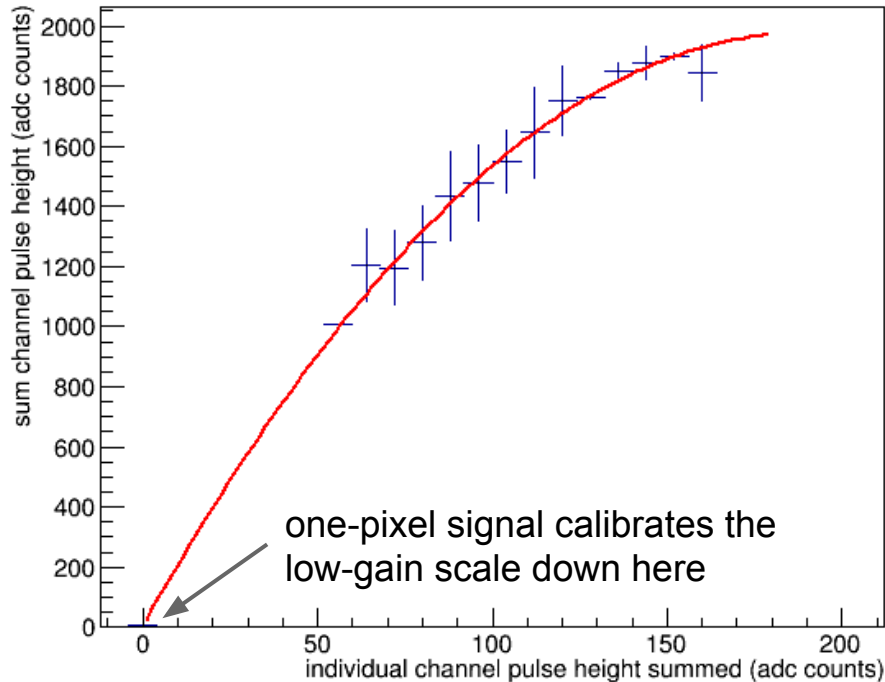# 1) **single pixels in high gain**

dark noise spectrum, all channels

h1_1_1	
Entries	231591
Mean	13.09
RMS	6.044
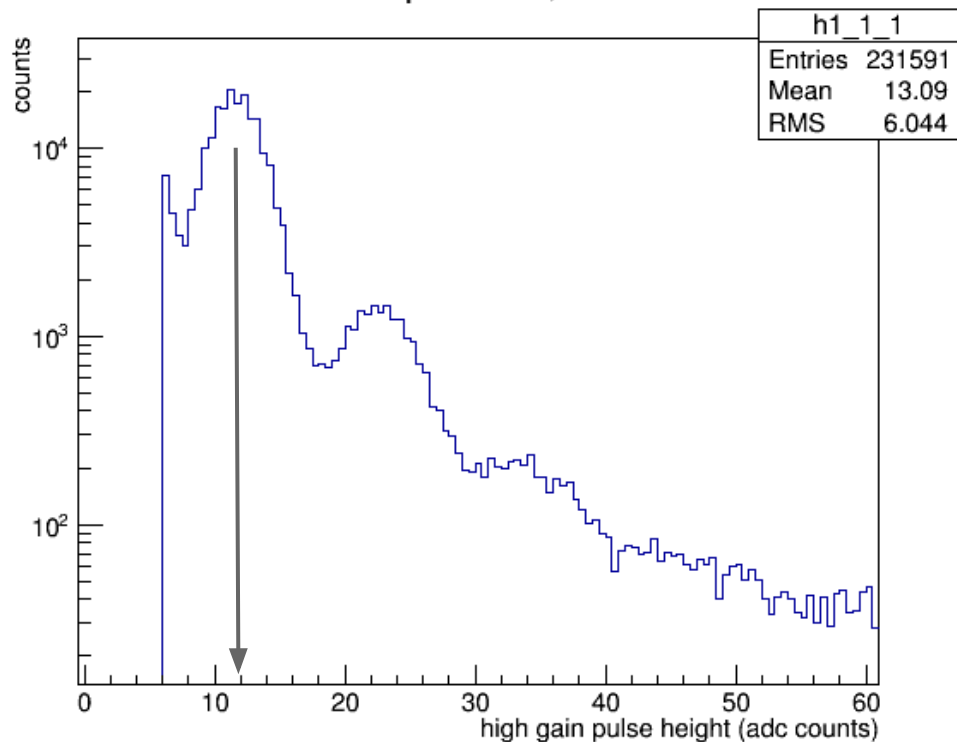
single pixel mean pulse height
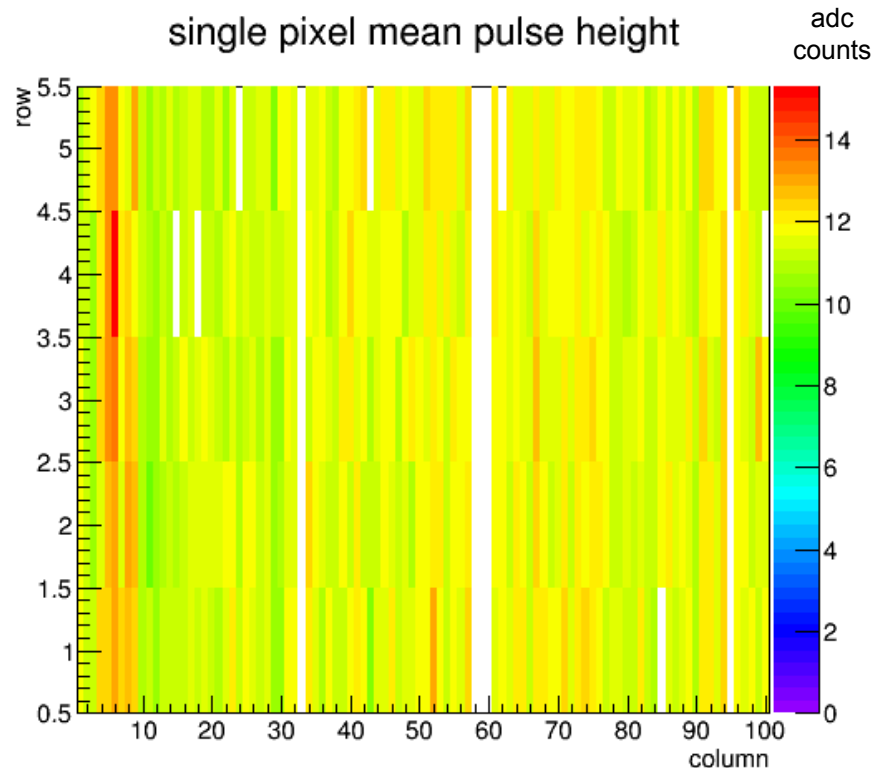
2) **low gain -- high gain matching**

sum vs individual pulse heights

one-pixel signal calibrates the low-gain scale down here

fit to second order polynomial

Chi2 =   3.63713
Ndf   =   11
p0   =   5.01006 +/- 4.08208
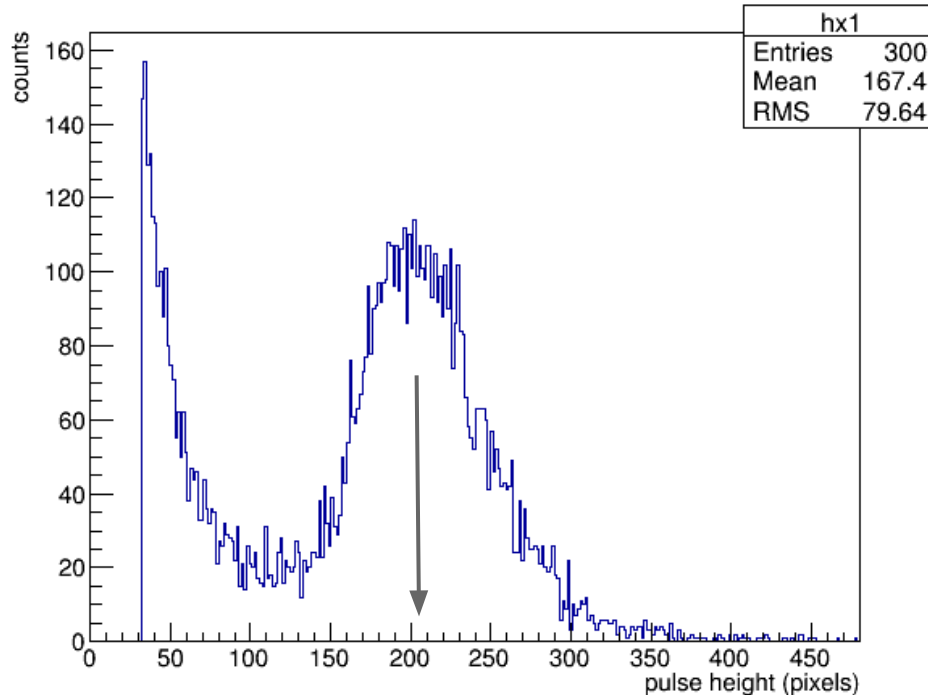**p1   =   20.7665 +/- 0.542004**
p2   =   -0.05465 +/- 0.003883

low-gain calibration:
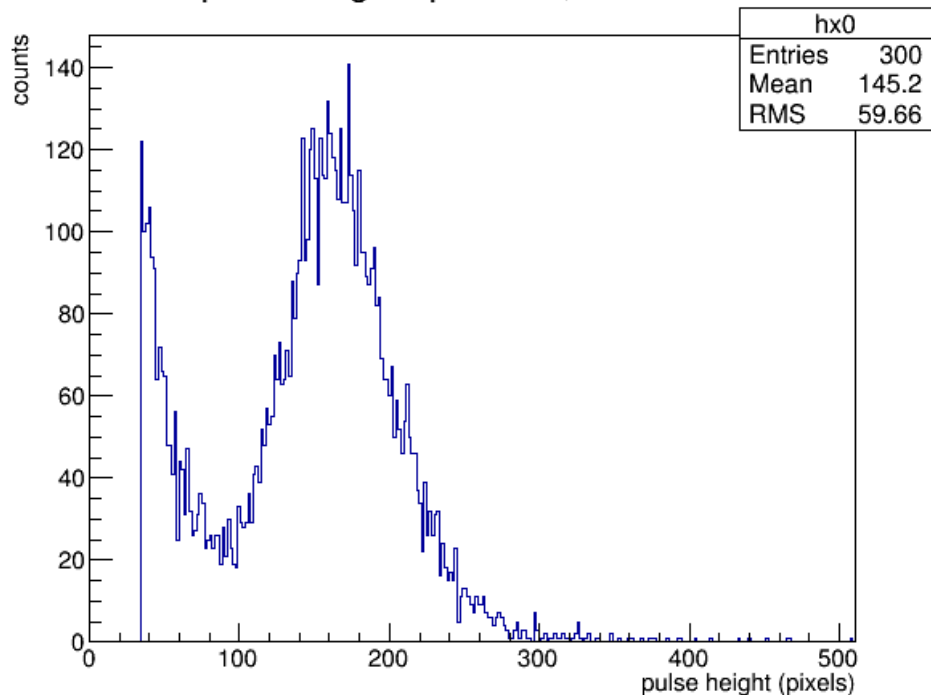**high-gain linear scale / 20**

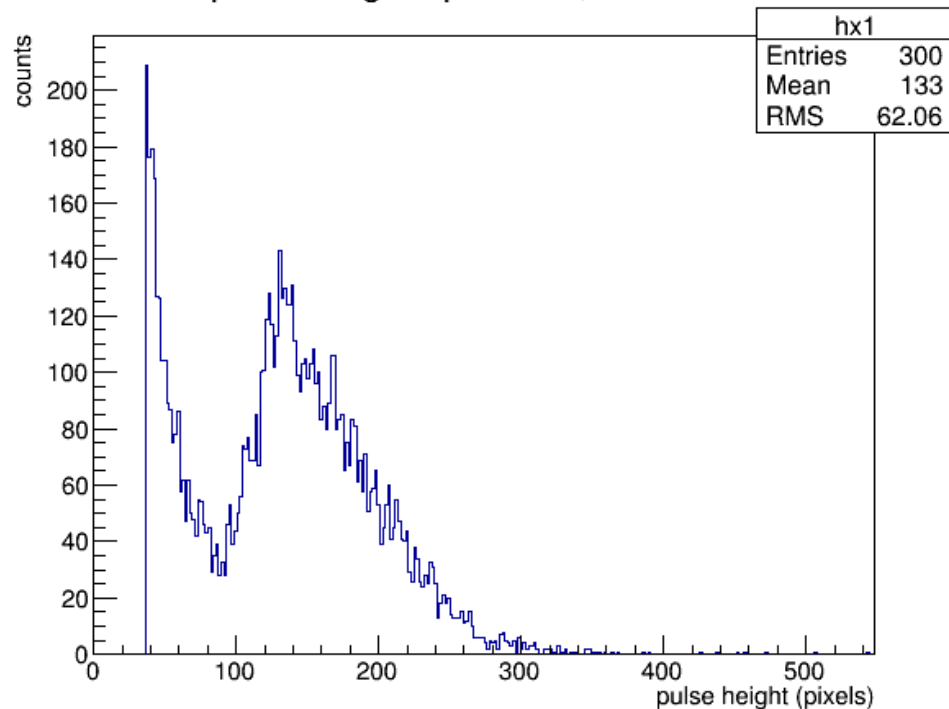# fADC "hits" pulse spectrum

pulse height spectrum, channel 3

hx1	
Entries	300
Mean	167.4
RMS	79.64

- **total hit count agrees well with expectations ~5800 hits over bg.**

- adc scale now converted to pixels

- **<Npix> = 210**

fADC "hits" pulse spectrum

fADC "hits" pulse spectrum

fADC "hits" pulse spectrum

fADC "hits" pulse spectrum

TDC hits

ntdc

htemp	
Entries	330203
Mean	0.7276
RMS	0.8087
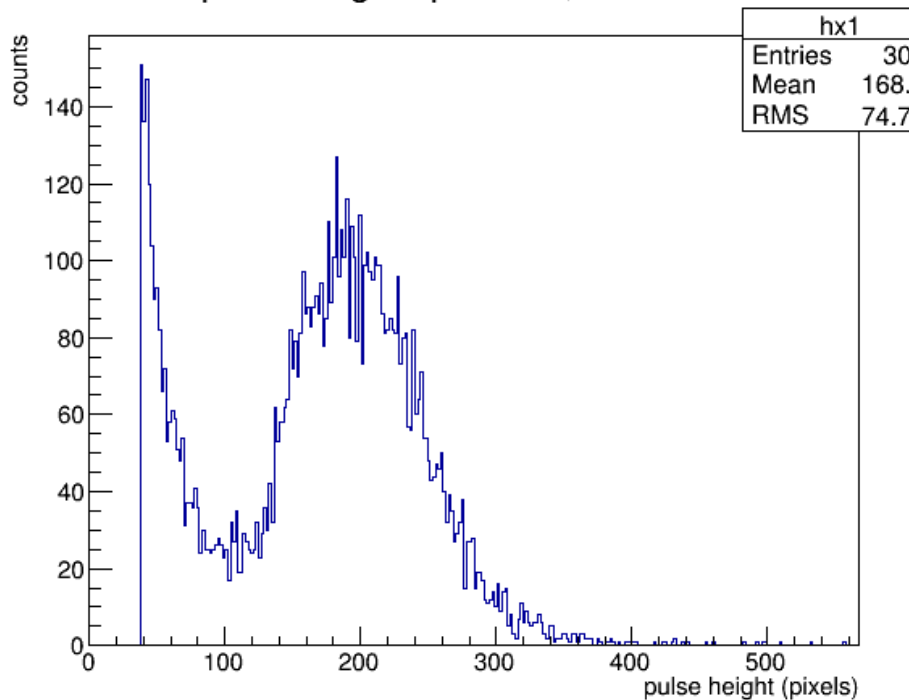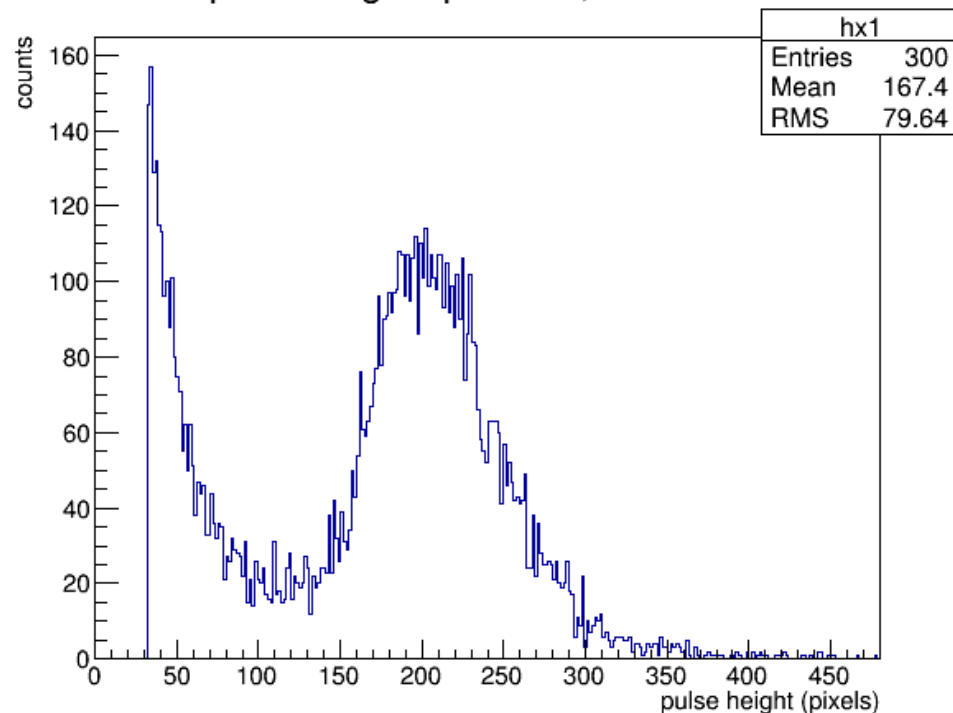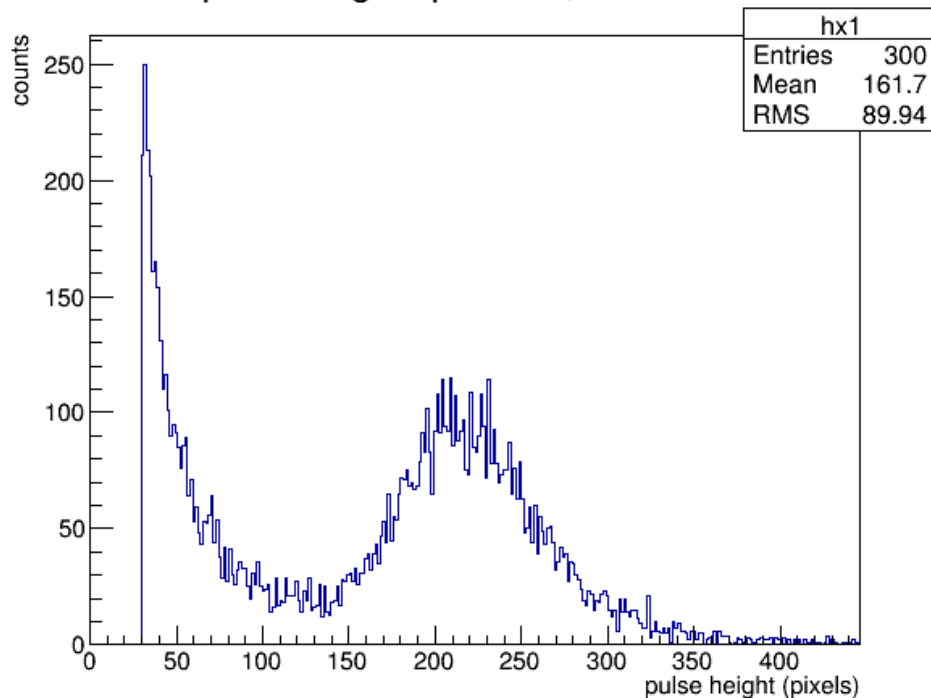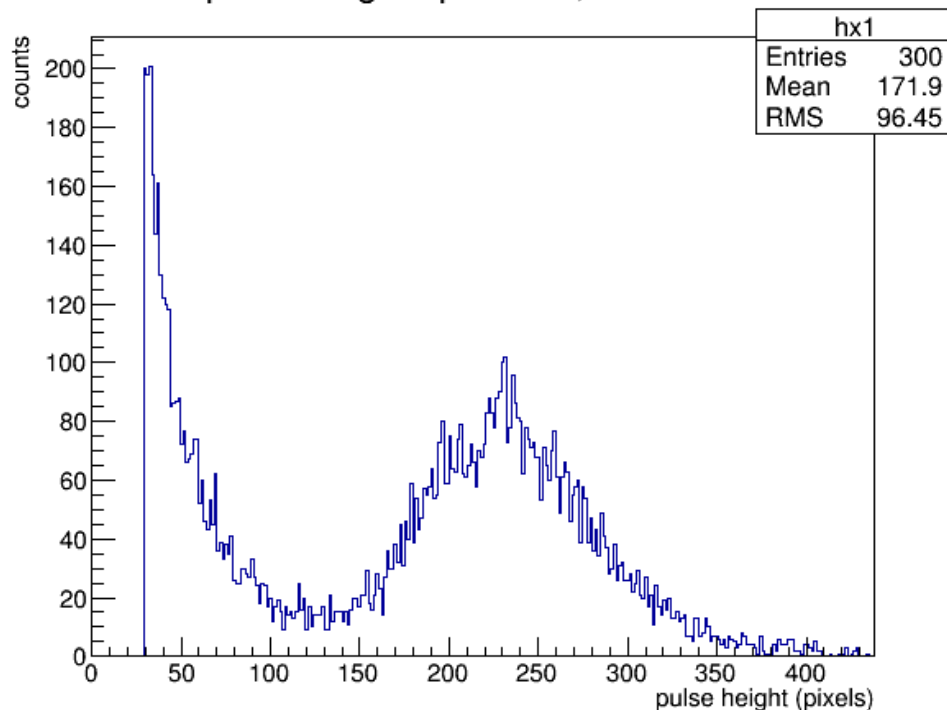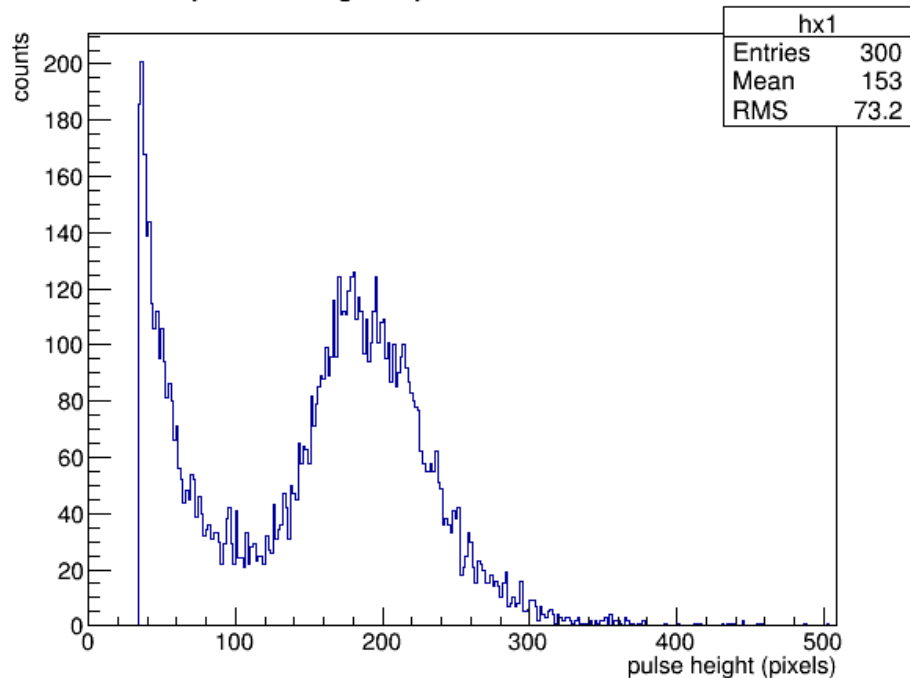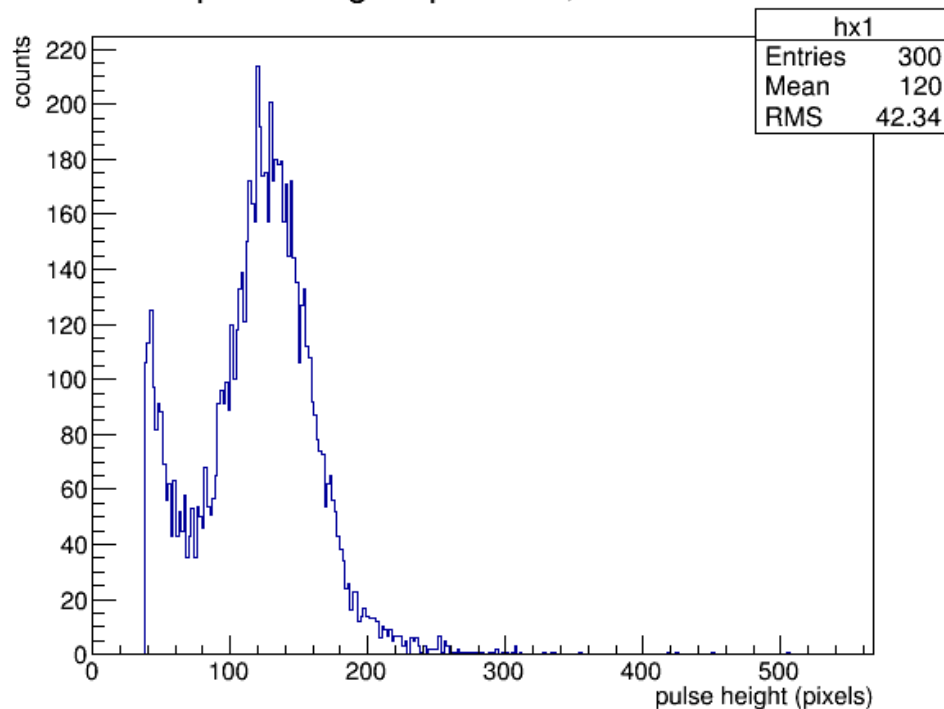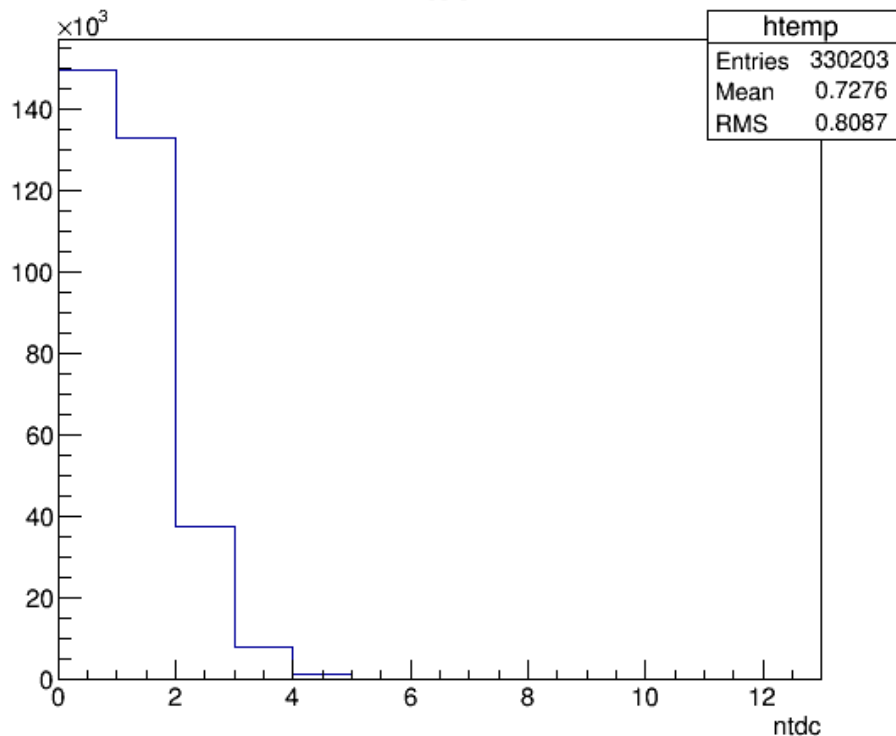
TAGM tdc time relative to trigger

htemp	
Entries	240245
Mean	4513
RMS	2879
χ^2 / ndf	72.17 / 35
p0	3345 ± 10.8
p1	2506 ± 52.7
p2	2284 ± 5.0
p3	232.9 ± 5.5

400 ns window

TAGM tdc - trigger time (ticks)