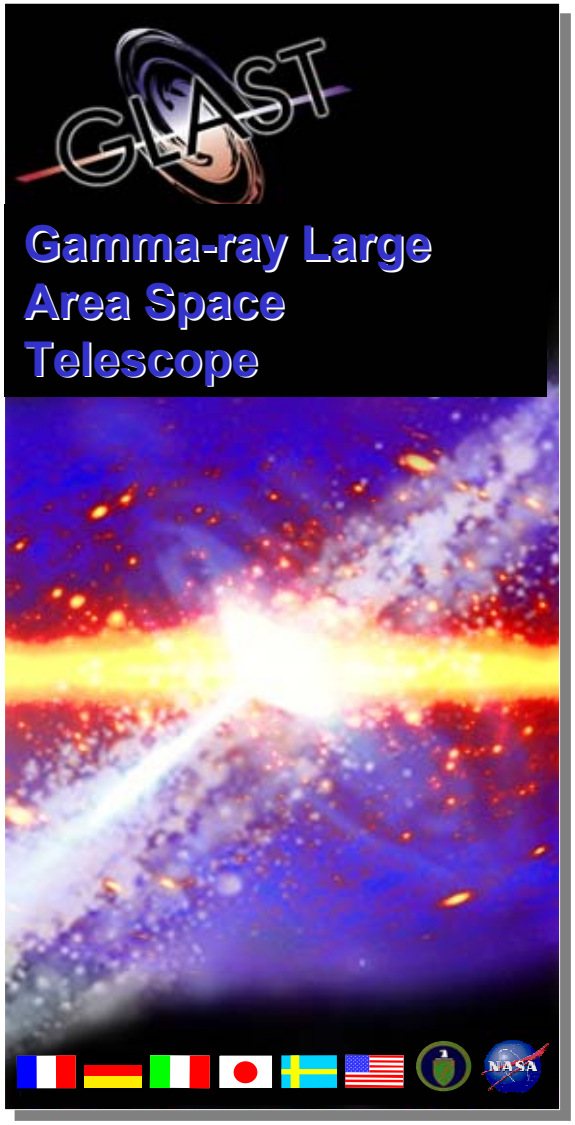

CAL pedestals oscillation.

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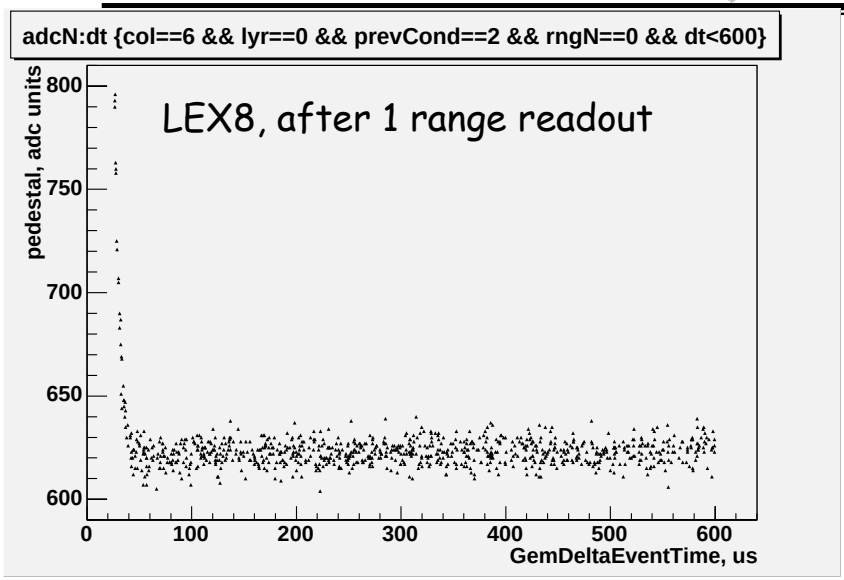
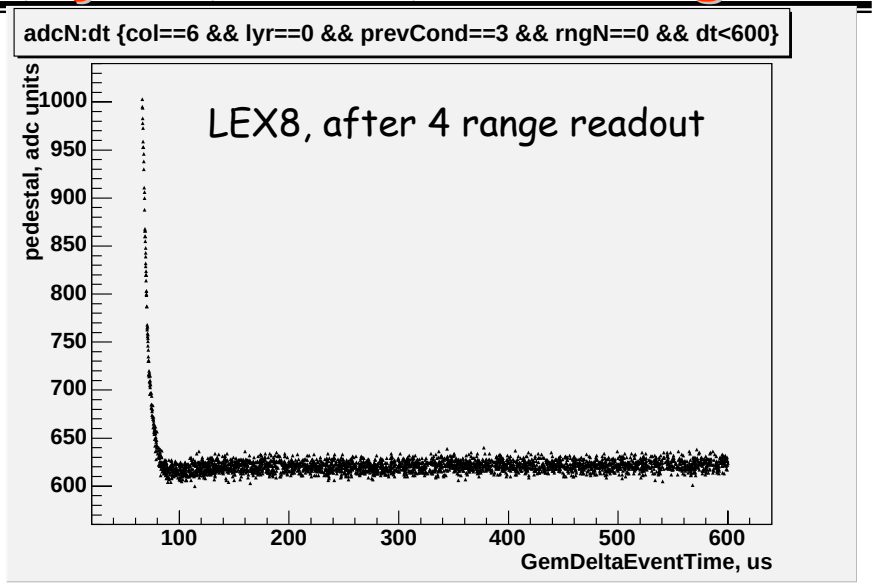
NRL/GMU

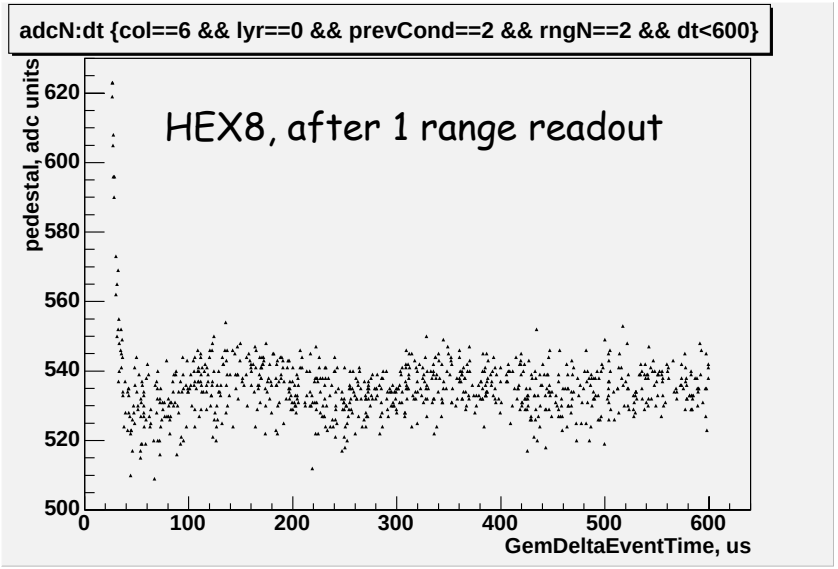
Analysis of CAL pedestals in LAT71x runs

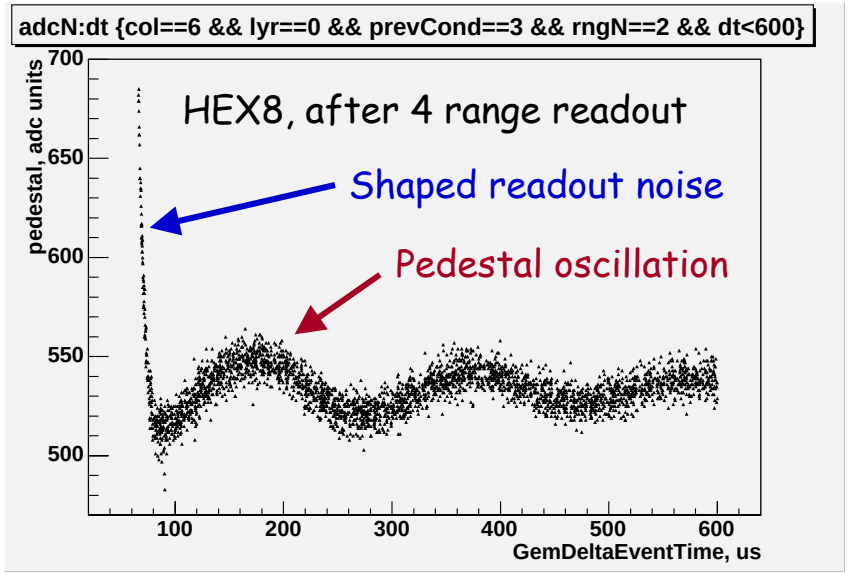
- LAT71x runs have
  - Muon gain for high energy diodes
    - LEX8/HEX8 ratio is ~6, the same as the ratio of surfaces of big and small diodes
      - Electronic gain is the same for LEX8 and HEX8 range
  - Trigger Engine 3 (GemConditionsWord=32)
    - 2 Hz periodic trigger events with unsuppressed 4 range readout
      - Allow to study pedestals in all 4 ranges as a function of GemDeltaEventTime
  - Trigger engine 10 (GemConditionsWord=3: TKR & ROI)
    - provide zero suppressed 4 range readout
  - Trigger engine 7 (GemConditionsWord=2: TKR only)
    - provide zero suppressed 1 range readout
- I tried to study pedestal vs GemDeltaEventTime separately for different readout modes in previous event
  - I made a modification in pedestal extraction procedure of calibGenCAL package to write a "private" Ntuple, containing for each crystal in periodic trigger event the parameters I need:
    - Tower, layer, column, GemDeltaEventTime, adcP, adcN, rangeP,rangeN, prevCond (GemConditionsWord of previous event)

Pedestal vs GemDeltaEventTime
run 077003627, twr=0, lyr=0, col=6, face=Neg

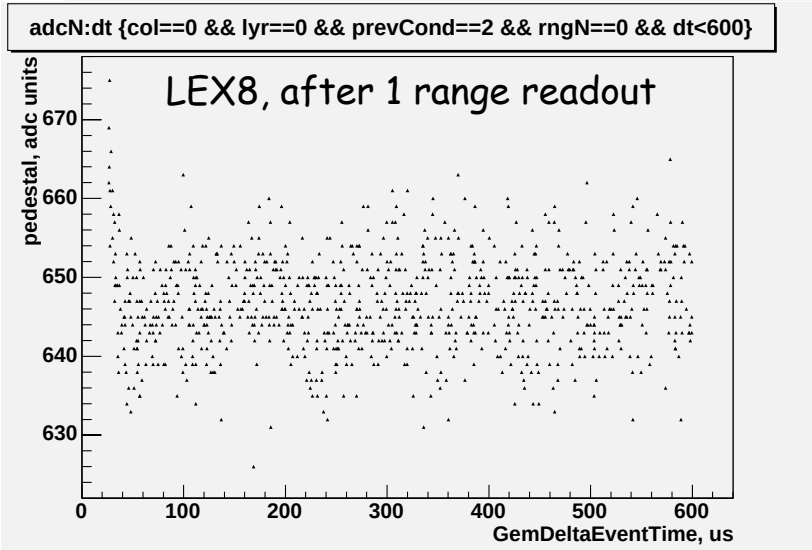


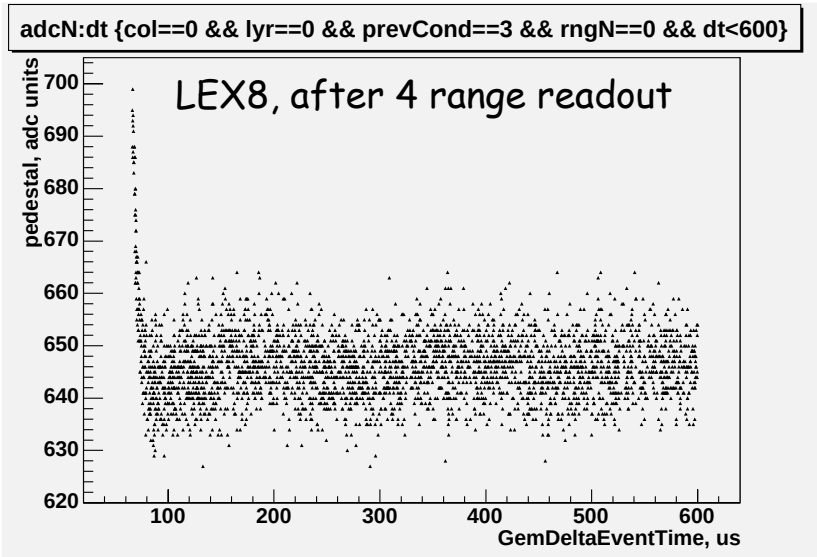


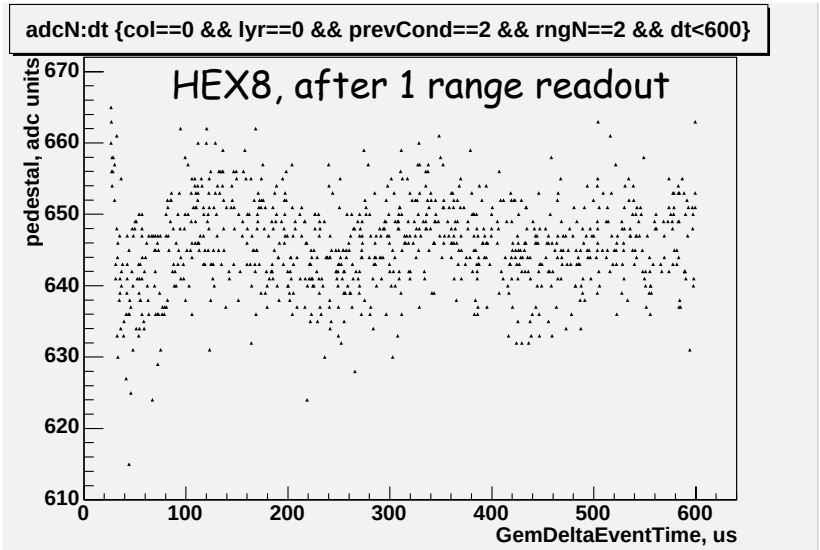


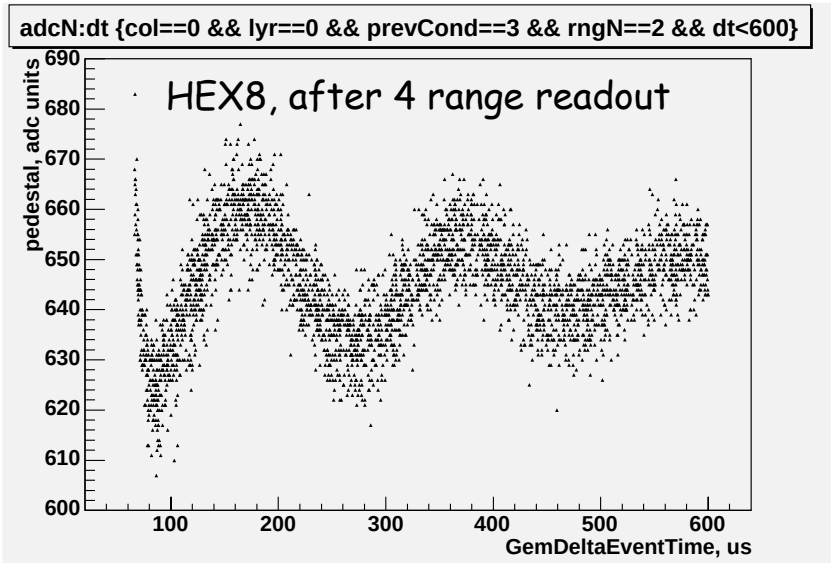


Pedestal vs GemDeltaEventTime
run 077003627, twr=0, lyr=0, col=0, face=Neg





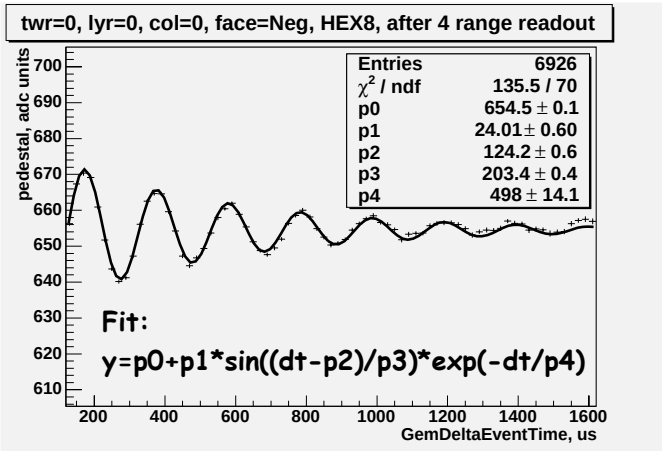


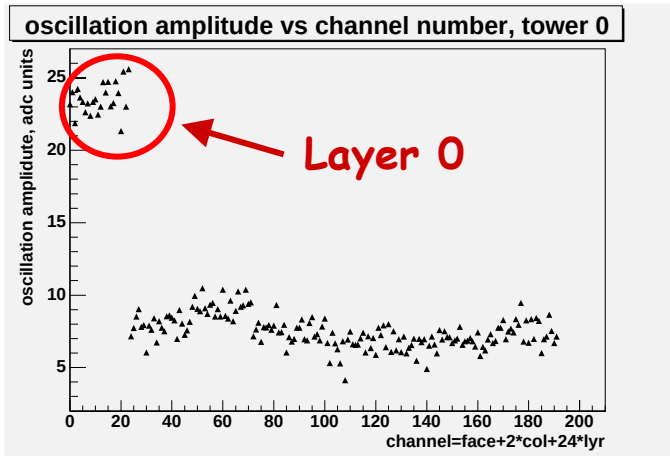


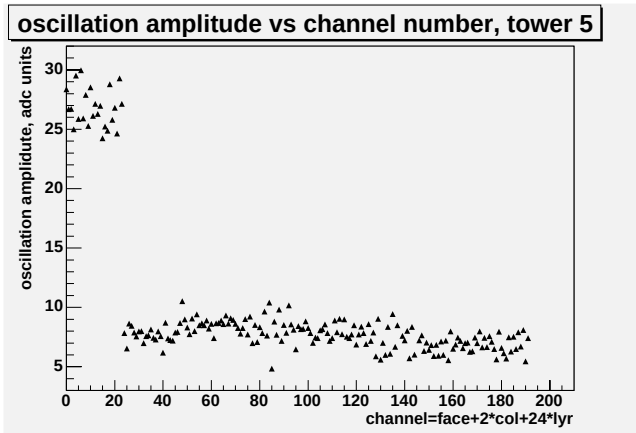
Conclusion from two previous slides

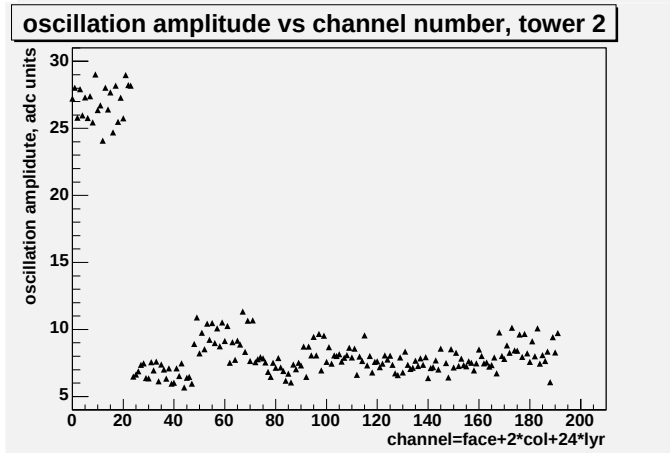
- We see two different effects:
  - Shaped readout noise
    - Exponential tail with time constant ~4 μs
    - Starts right after dead time
    - Already studied
    - Very channel dependent
  - Pedestal oscillation
    - Sinusoidal with period ~200 μs and decay time ~500 μs
    - Much bigger in HEX8 range than in LEX8 range
    - Much bigger after 4 range readout than after 1 range readout
    - Amplitude could be the same for two channels with very different shaped readout noise
- Let's look how pedestal oscillation amplitude vary from channel to channel

Oscillation amplitude vs channel number



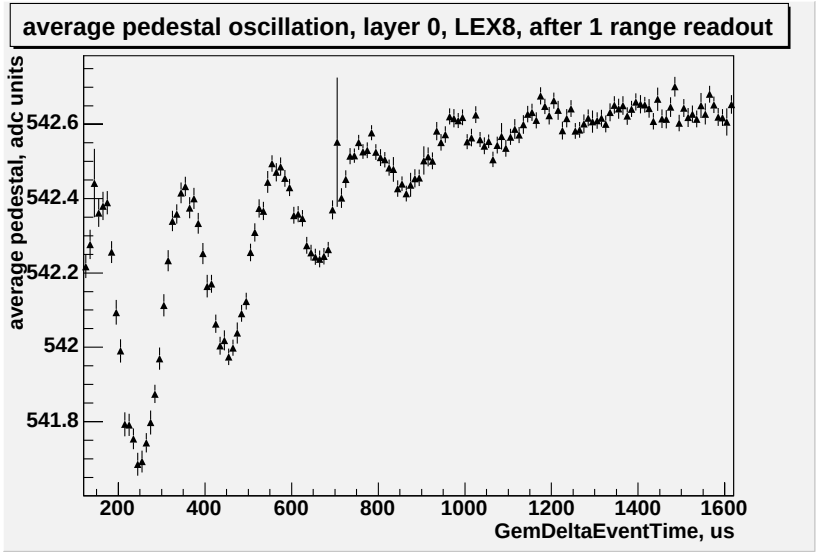


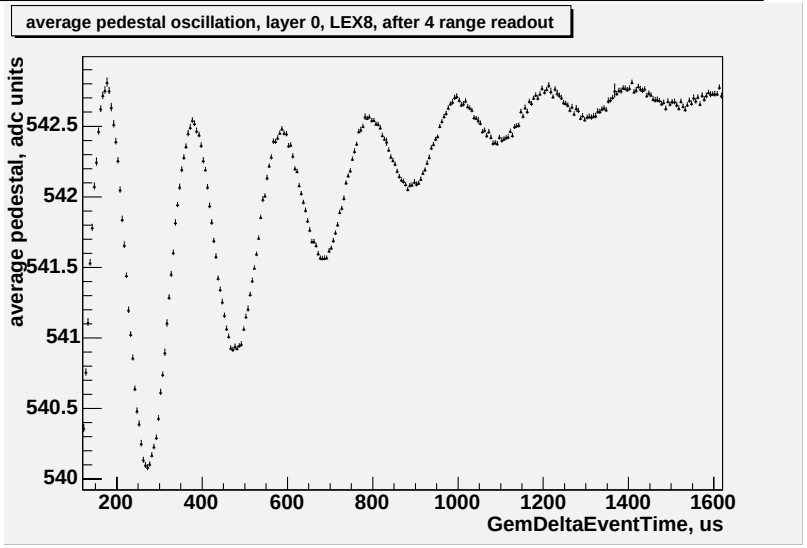


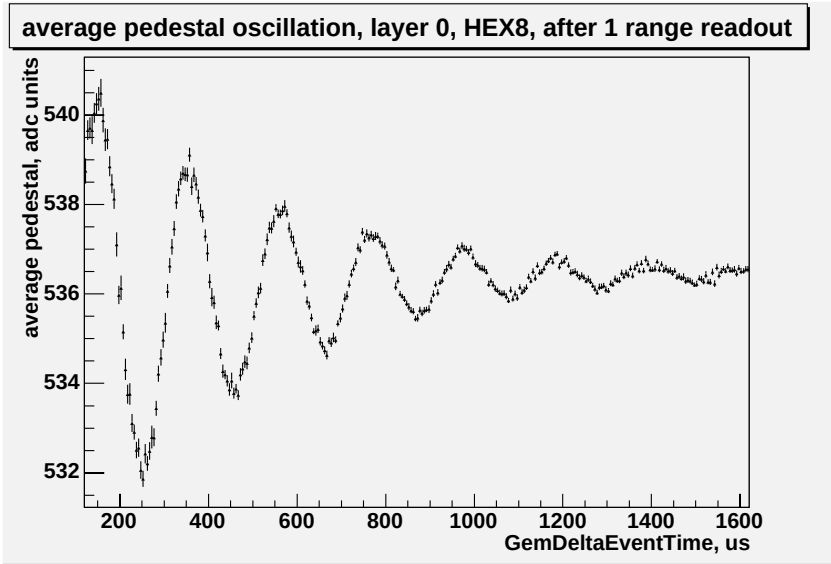


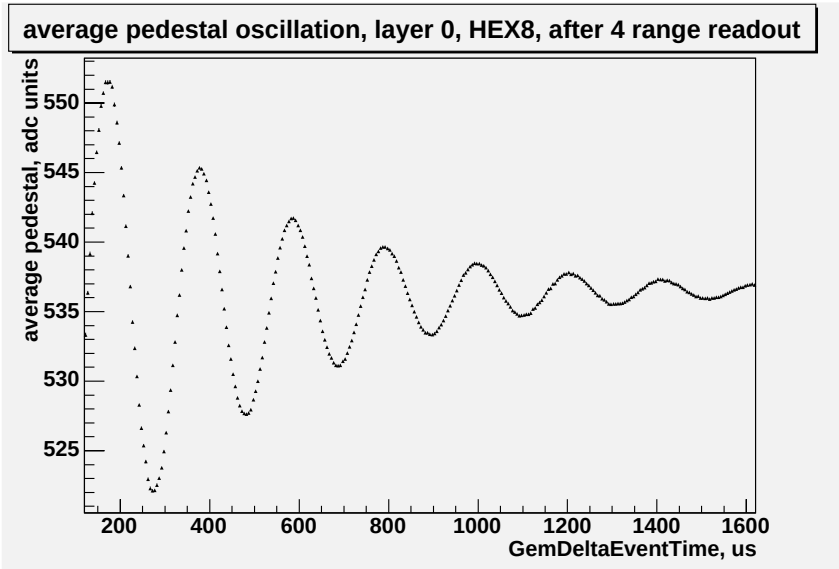
- Oscillation amplitude in layer 0 is 3-4 times bigger than in other layers
- Amplitude doesn't depend strongly on column and tower number.
- Let's look at pedestal oscillation averaged over all crystals of layer 0 (of all towers)

Pedestal oscillations: average of all crystals in layer 0, runs 077003627-077003652









Conclusion

- There is pedestal oscillation with period 200 μs and amplitude ~20 adc units in HEX8 (3 MeV).
- The amplitude depends on type of readout of preceding events – it is much smaller for after 1 range readout
- The oscillation lasts for ~1.0 ms, so it affects significant fraction of the events
- Strange feature: HEX8 range is much more sensitive to this oscillation than LEX8 range, while electronics gain is the same.