RF Signal for Hall D

Hovanes Egiyan

Use of RF signal

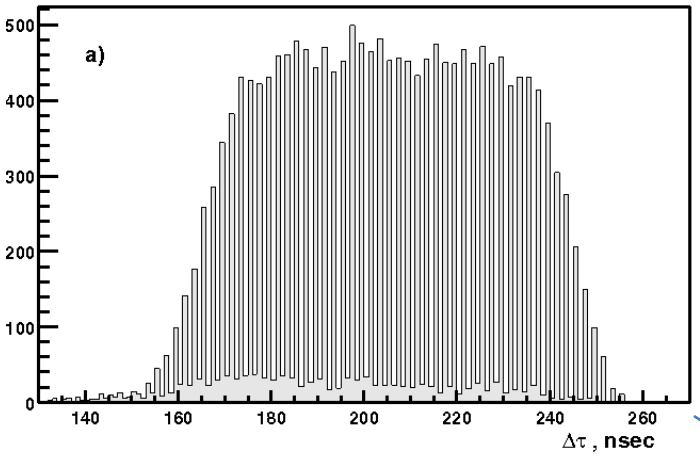
- Use as reference time to calibrate time delays of various counters.
  - Align the individual detectors to any of the RF pulses
  - Resolve the multiples of the beam bunch time periods using coincidences between detectors.
    - Not much statistics is needed for picking out the bunch.

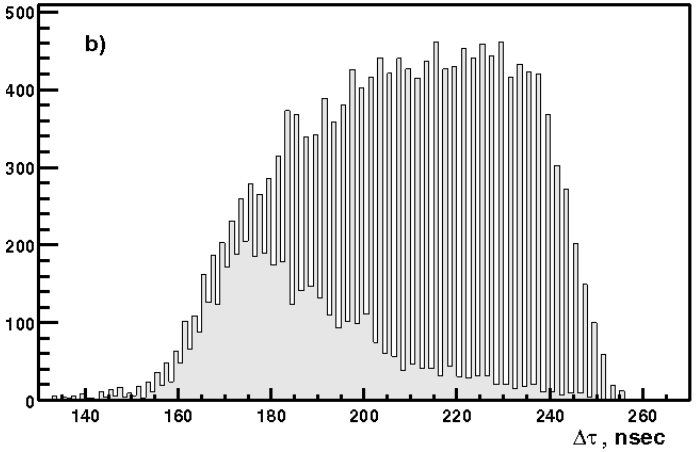
- Use for determining the start time of the events in GlueX with ~15ps resolution by taking out the 200 ps tagger time resolution in the TOF-based PID procedures.
  - Tagger (all counters) should be aligned with respect to the RF-signal in the tagger hall on a run-by-run basis.
  - Timing PID detectors in Hall D should be aligned to the RF-signal in the hall.
  - Calibrate the delay between Hall D and the tagger hall for each run.
  - The procedure for Hall B electron runs can be found at :http://www.jlab.org/Hall-B/notes/clas_notes98/note98-004.pdf. The procedure for Hall B photon runs is even a little simpler.

- RF-signal needs to be prescaled to have ~10MHz rate to work with TDCs.
  - Can have ~3 pulses in each event to use as a reference and to check the TDC calibration.

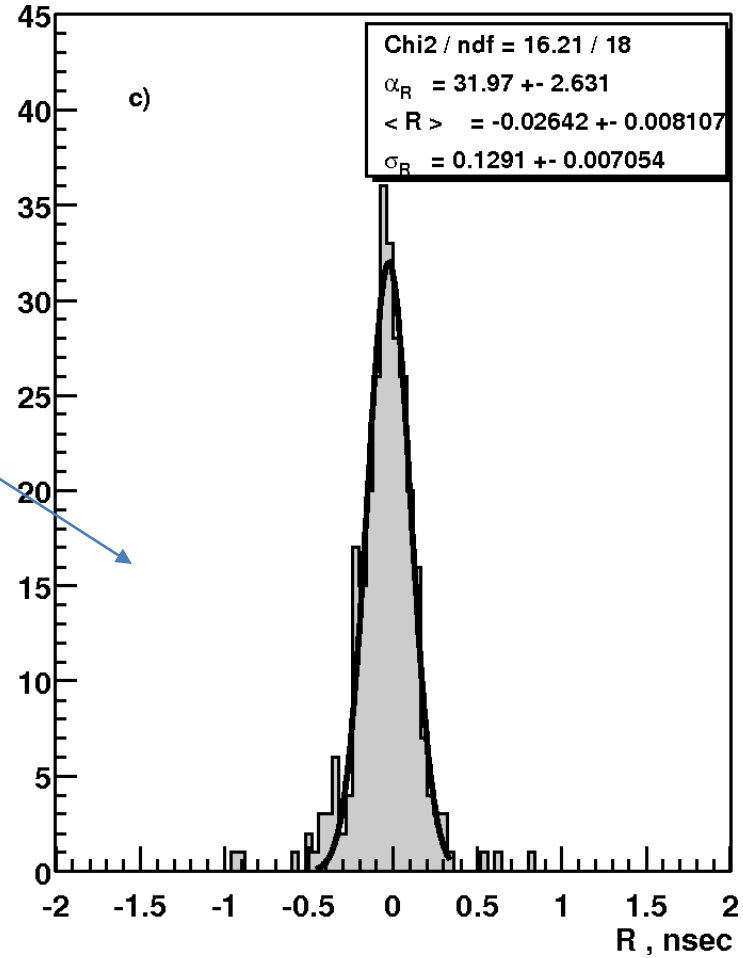
Calibration plots from CLAS

The fence structure in the multiple event data sample is due to the prescaling



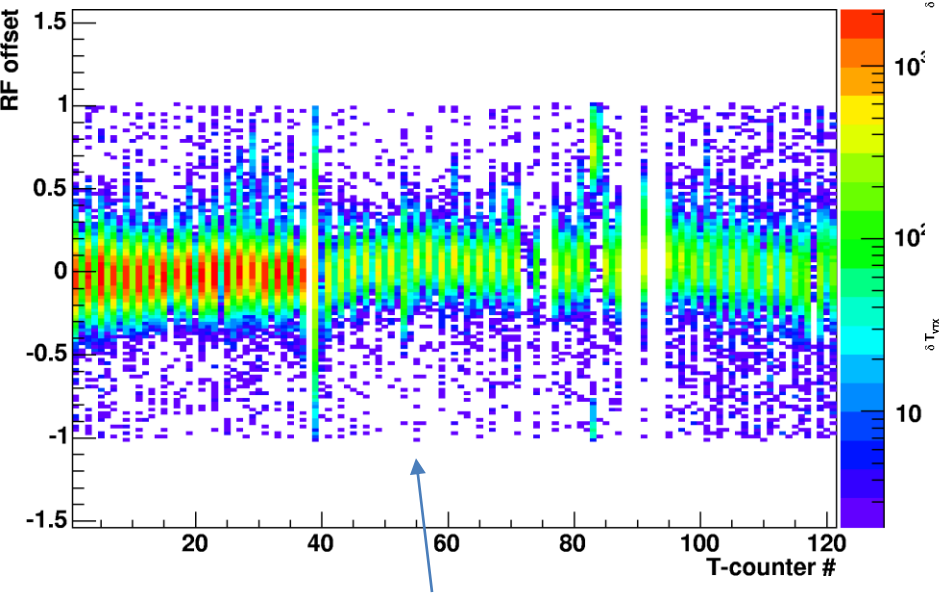


T_{det} - T_{RF}

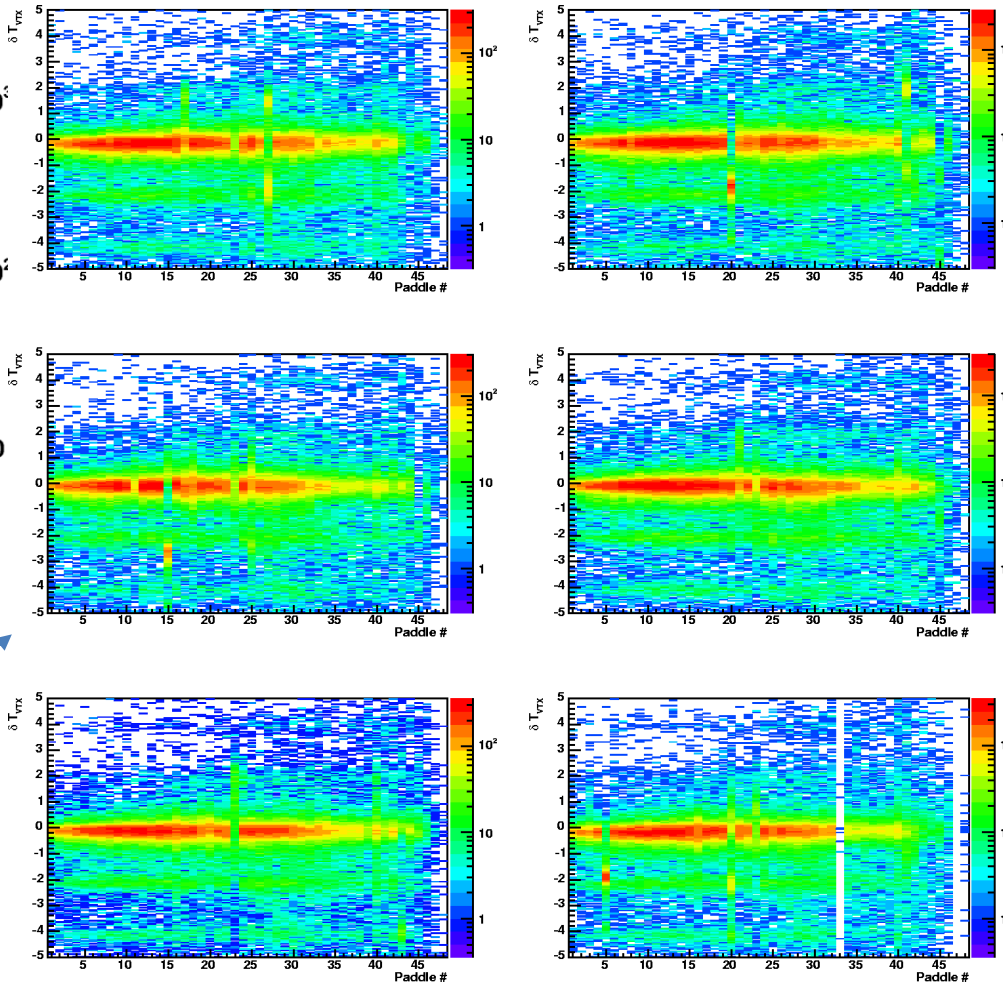


MOD(T_{det} – T_{RF}, 2.004ns)

Calibration plots from CLAS



Tagger timing w.r.t. RF



TOF timing w.r.t. time from the tagger

- Plots shown here already look relatively nice since the timing has previously been calibrated.

Options

- We will get 500MHz (or 250MHz later) electron beam bunches from the injector into tagger hall.
- 10 MHz, 70 MHz, 499 MHz, 1427 MHz synchronized with the laser at the injector.
- There will be a long cable(s) to bring the RF signal to Hall D complex.
  - Expect 6ps/ft/^{0}C variations in the in the phase due to the contraction of the cables under temperature variations, which for a 1000 ft and ~2 ^{0}C temperature change during one run would translate into 12 ps phase drift.
- The accelerator division has schemes of adjusting the phase of the RF using feedback or feed-forward, but they might be costly.
  - Neither in the accelerator's nor in the Hall D 12GEV schedule.
- Hall B uses an RF-cable carrying 499 MHz signal without any compensation for phase drifts, digitizes and prescales it by a factor of 40, and corrects the RF-offset constant offline on a run-by-run basis.
  - Hall D probably should simply do the same with customized prescale factor.
  - Need RF-signal in both tagger hall and Hall D.
  - Sergey Kuleshov from Santa Maria volunteers to build the digitizing and prescaling boxes.
  - If the beam is 249 MHz, the extra RF-pulse can be prescaled out in the digitizing box. The sudden jumps in the RF-phase due to the ambiguity can be threated by the same RF-calibration constant.
- Your thoughts?