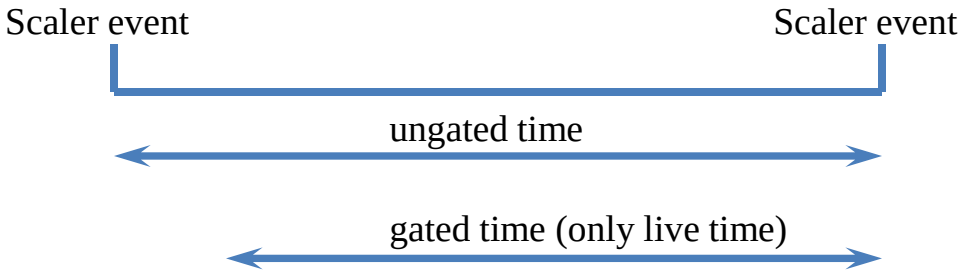
Short note about flux counting[1]

Counters:

There are counters for number of triggers of each kind (bit). In principle they can overflow and jump from *(2^{32} – 1)* to *0*. There are two counters which are counting clock triggers (for PrimEx-I it was *200 kHz* prescaled): *live1* and *live2* – gated and ungated. Ungated counts all the time (reset at the beginning of each run), gated doesn't count when DAQ is busy.

Scaler events:

Written in about *10 sec*. There are different event types: *type=0* – begin and end of run, *type=1* – physical event, *type=10* – scaler event, *type=?* – EPICS event. Each type has an independent enumeration (?).



1 – *written from Eugene explanation in 2005*

Beam trips detection:

By <*livetime*> and its fluctuations.

A measure of expected <*livetime*> could be:

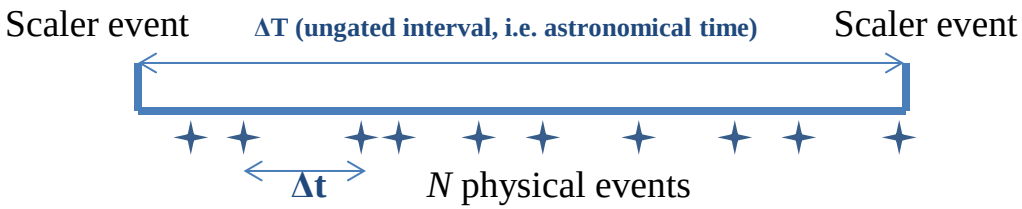
(0.1×<livetime>(previous interval) + 0.9 ×(other prev. intervals)) **[1]**

For the first interval for the prehistory we can use for example the next interval. But it should be manually checked every time if it worked Ok.

Thus we can control differential jumps.

In case of beam trip a whole interval should be excluded from analysis and from counting as previous interval in formulas like **[1]**.

Also for beam trips detection we need to control other time parameters:



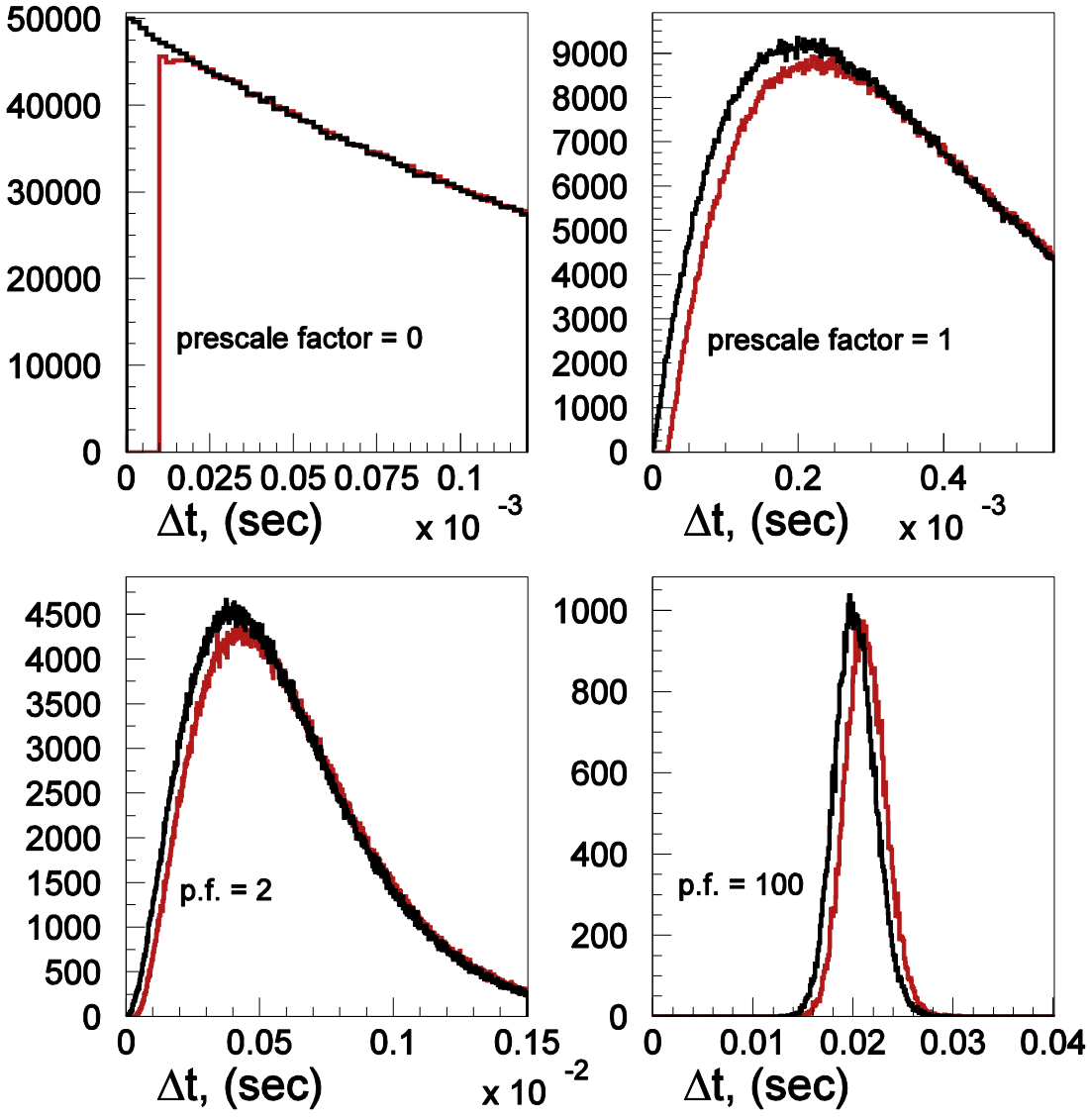
distribution of intervals with mean $\frac{\Delta T}{N}$, where N – number of physical events written in between two scaler events during the period of time ΔT.

Values <Δt> and $\frac{\Delta T}{N}$ must be in agreement within *10% … 20%* with each other and with pre-historical value. Jumps are also excluded like <*livetime*> jumps.

Note: pre-historical values should be recalculated after excluding jumps, and check for jumps needs to be repeated with updated values (once or more than once).

The list of events with the status is to be created, after these checks, see CLAS Note 2005-002 page 17 for example of such list.

Examples of time interval distributions with the different prescale factors. (Mean time interval 200μs, dead time = 0 for black histograms, 10μs for red histograms).

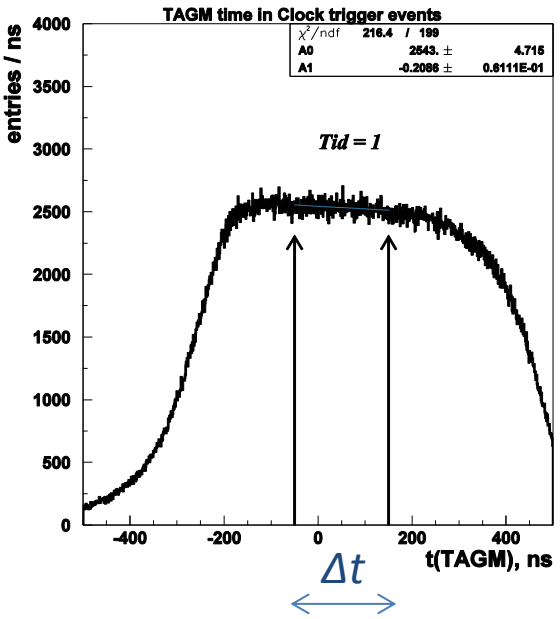


Electron flux counting:

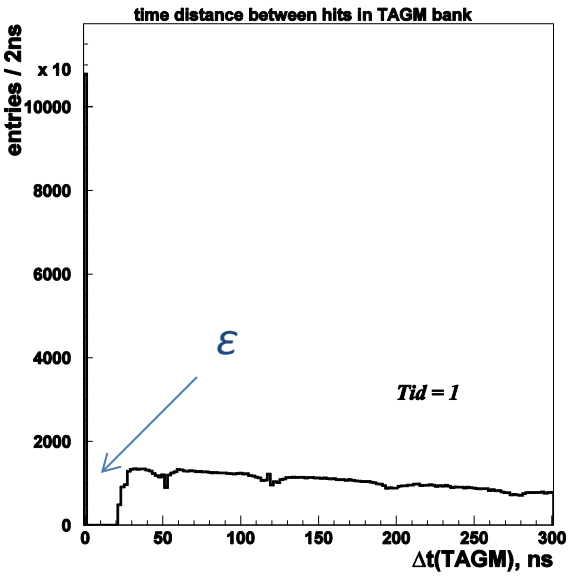
Electron flux is counted for each interval between two adjacent scaler events. Electron rate assumed to be constant within such an interval:

$$\mathbf{Flux(e^-) = t_{gated} \times Rate(e^-)}$$

Distribution on time TAGM_LR hits



Time distance between hits in TAGM_LR



Electron rate per Tid:

$$\boldsymbol{Rate_{Tid}}\,(\mathbf{e^-}) = \frac{\Delta \boldsymbol{T} \cdot \boldsymbol{N_{Hits\,Tid}}(\Delta \boldsymbol{t})}{\Delta \boldsymbol{t} \cdot \boldsymbol{N_{Clock}}(\Delta \boldsymbol{T})} \times \boldsymbol{\nu_{Clock}}$$

Where: $\Delta \boldsymbol{T}$ - time between two scaler events; $\Delta \boldsymbol{t}$ - selected interval where time distribution is flat; $\boldsymbol{N_{Hits\,Tid}}(\Delta \boldsymbol{t})$ - number of TAGM hits for certain Tid observed within $\Delta \boldsymbol{t}$; $\boldsymbol{N_{Clock}}(\Delta \boldsymbol{T})$ – total number of Clock triggers generated during $\Delta \boldsymbol{T}$; $\boldsymbol{\nu_{Clock}}$ - Clock trigger frequency.

Additional correction for dead time (yield correction):

$$Flux_{corrected} = \frac{Flux_0}{1 - \varepsilon}$$

where ε is from time interval distribution for certain Tid

See also CLAS note 2005-002