Positronium intensity measurement preparation (GBAR)

SNU

Bongho Kim

PWO calibration study

- Data(16383#; 20us/each) taken with HV (-2kV) with CCD camera

→Data taken by CCD camera exposure trigger signal.

→ Expected beam intensity : 5x10^3 e^+/bunch (10^6positron/s; 200Hz)

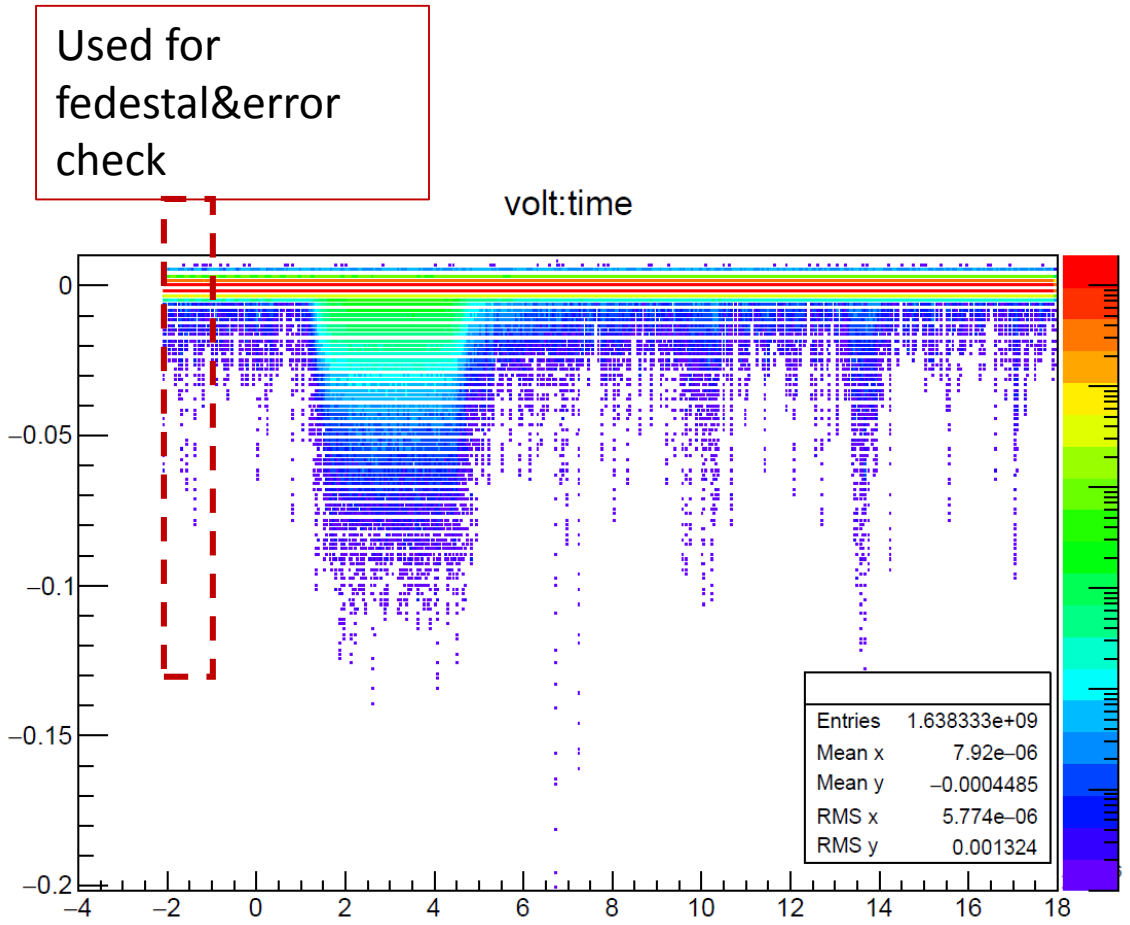
→Right figure shows persistence time distribution

(many background (mainly beam background?) shown

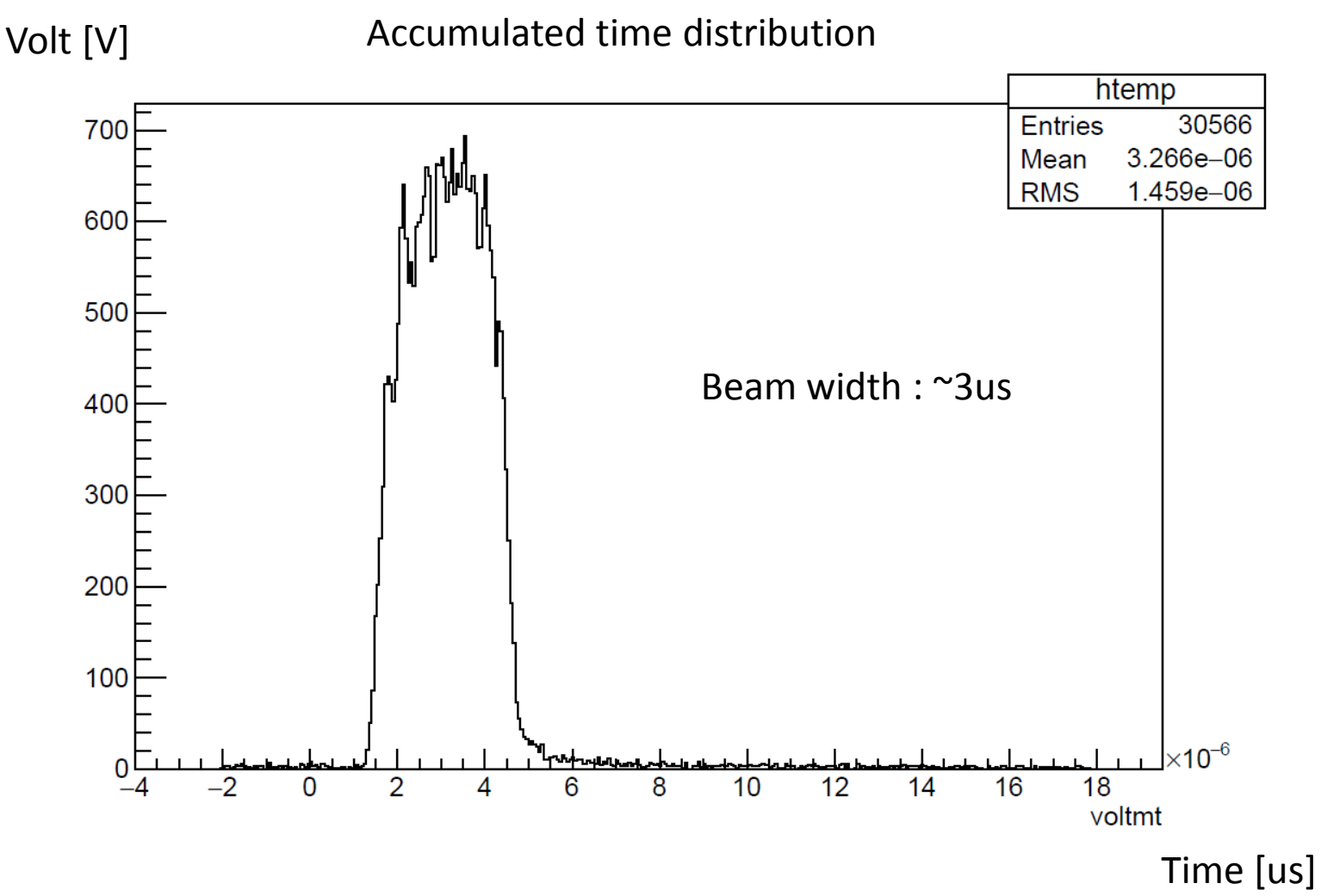
- Data analysis is ongoing but signal parameter is changed.

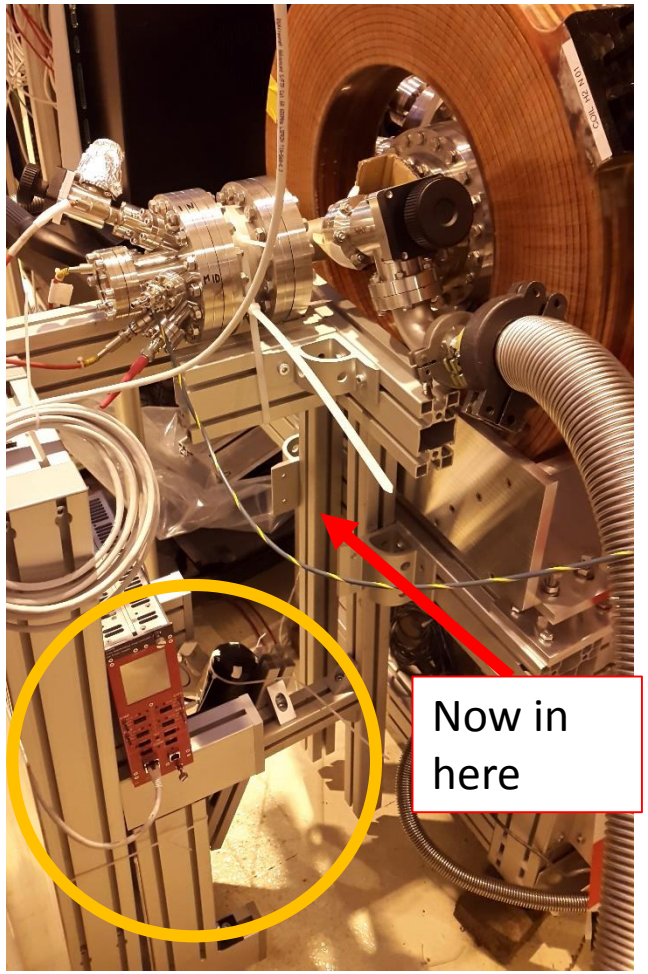
→base line fluctuation : 0.0011V

➔error : 0.0013V (base line + bin quantization)

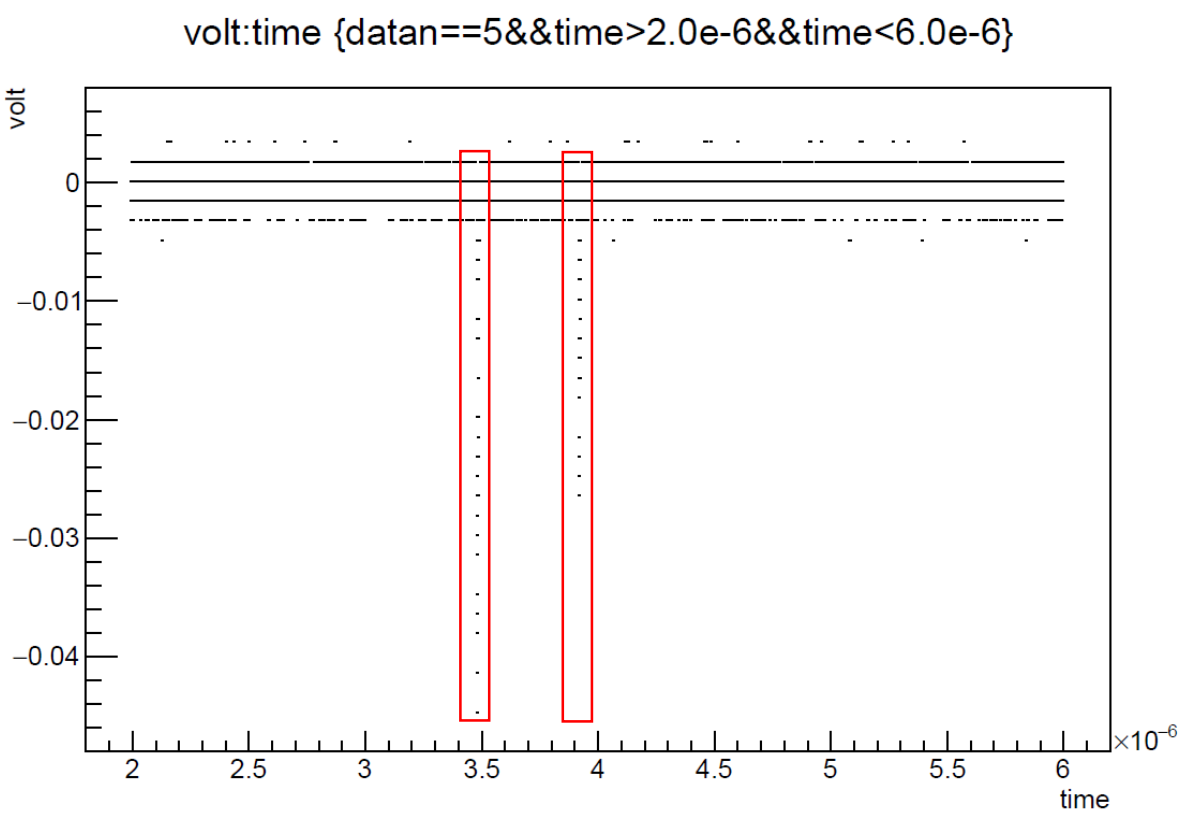


Time distribution for positron beam





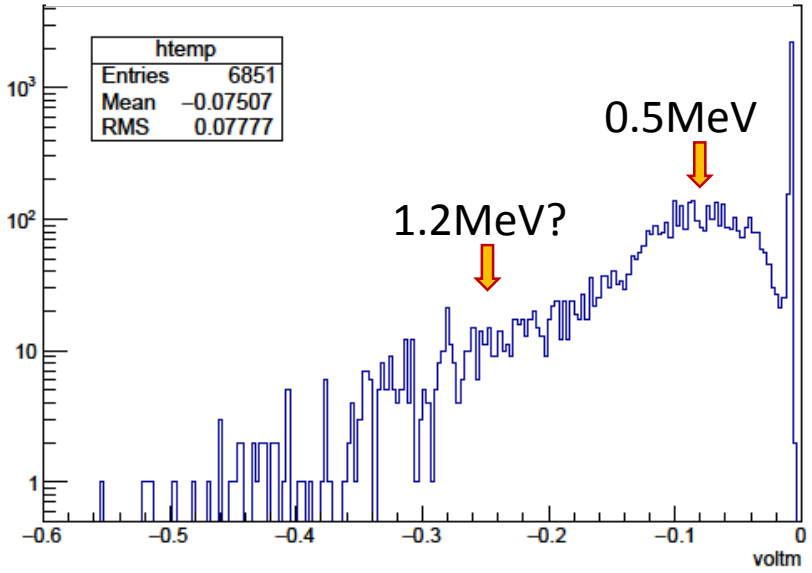
Analysis procedure



- Data reading from -2us to 18us.
- If volt – fedestal >3σ, find 2 more bin in 20ns with maximum height. (signal width is about 10ns)
- From maximum bin, +-50ns region is used for analysis.
- Next peak is searched after 60ns from maximum bin.

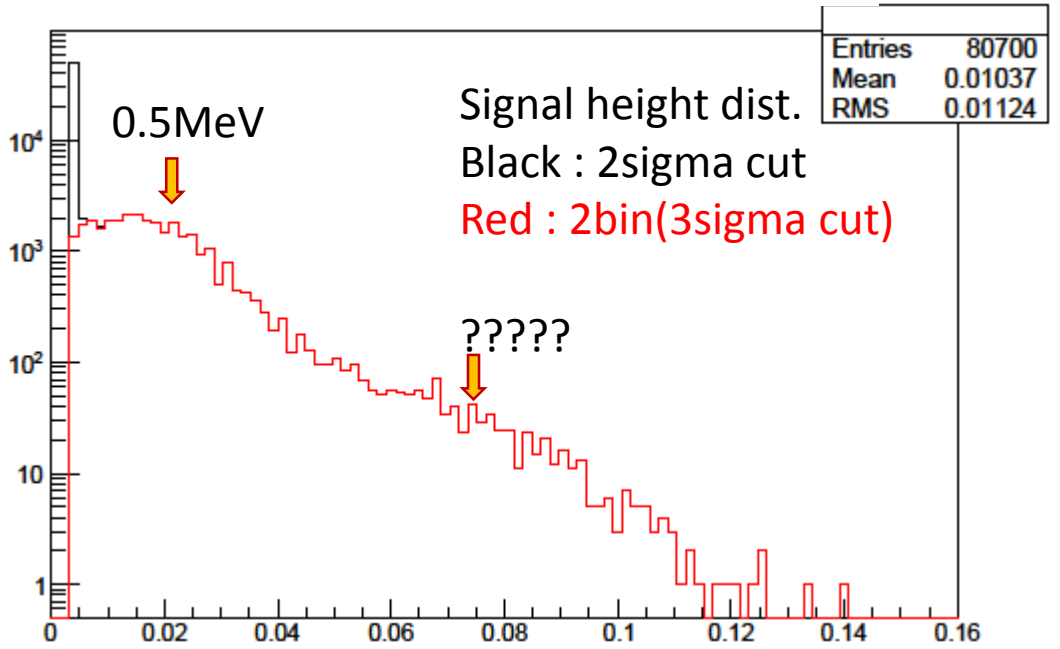
Peak height distribution

peak height distribution with 22Na source at last time



Sorry sign is opposite

peak height distribution with beam



Data taking 20170120 with MCP

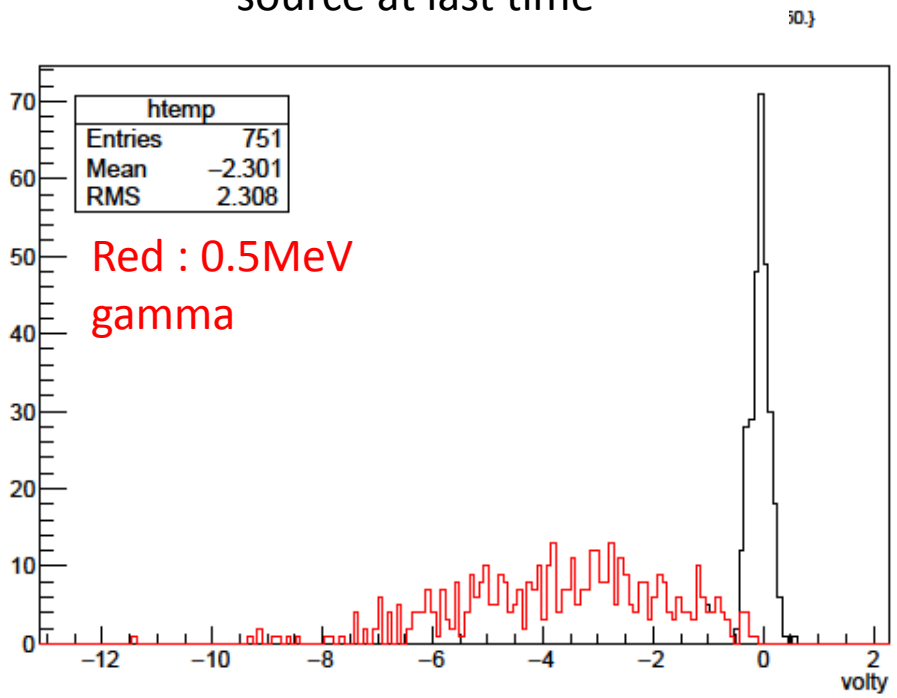
→ Gain is lower than normal status (By B-field : 2.6mT measured by Gauss meter)

→ Gain change was checked to confirm this effect (even dark count is decreased..)

Signal height decreased about 5 times

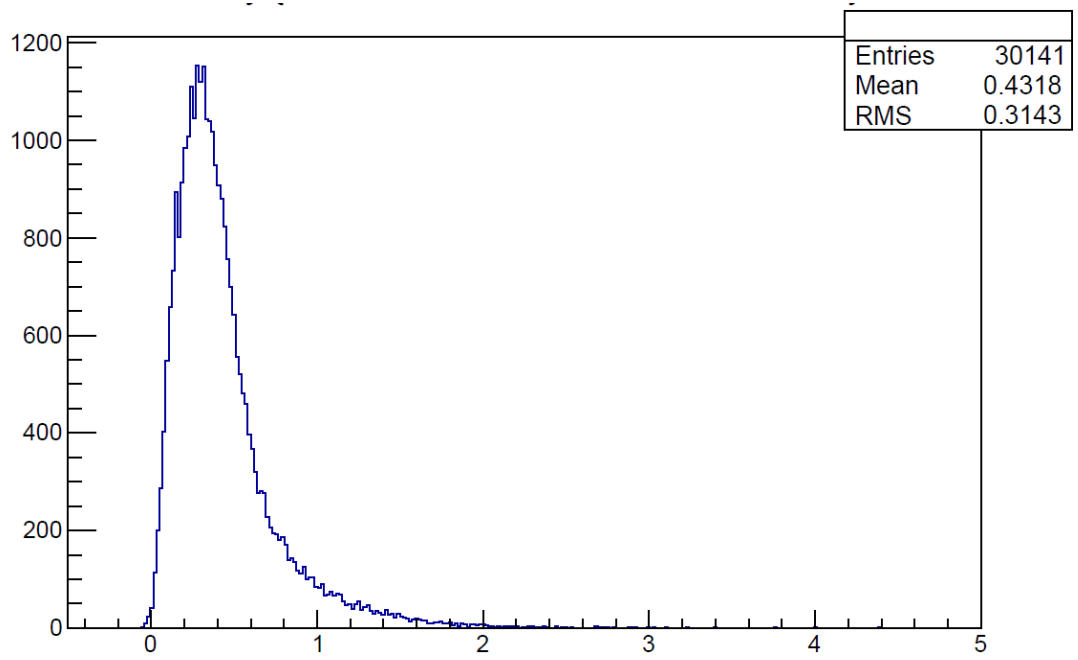
Charge(integral) distribution

peak height distribution with 22Na source at last time

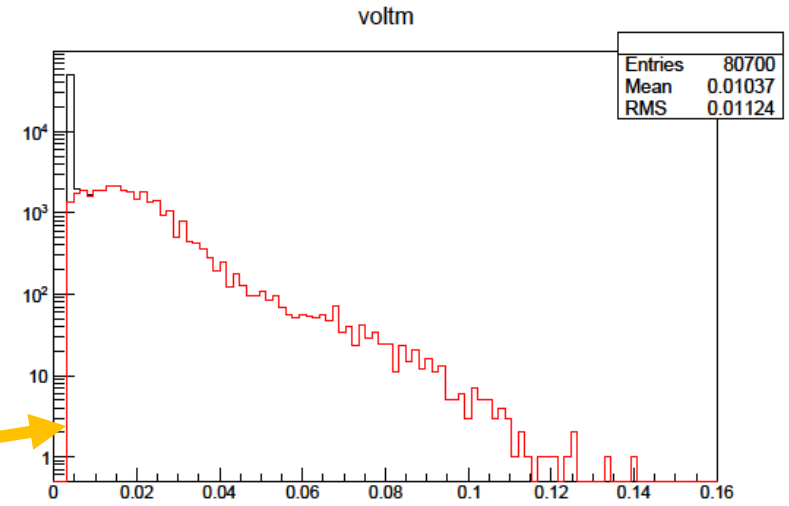


Sorry sign is opposite

peak height distribution with beam



Positron intensity estimation



- Acceptance = $16cm^2/4\pi(22cm)^2 = 0.264\%$
- Cut efficiency ~ 30551/(30551 + 1500)=95%(?)

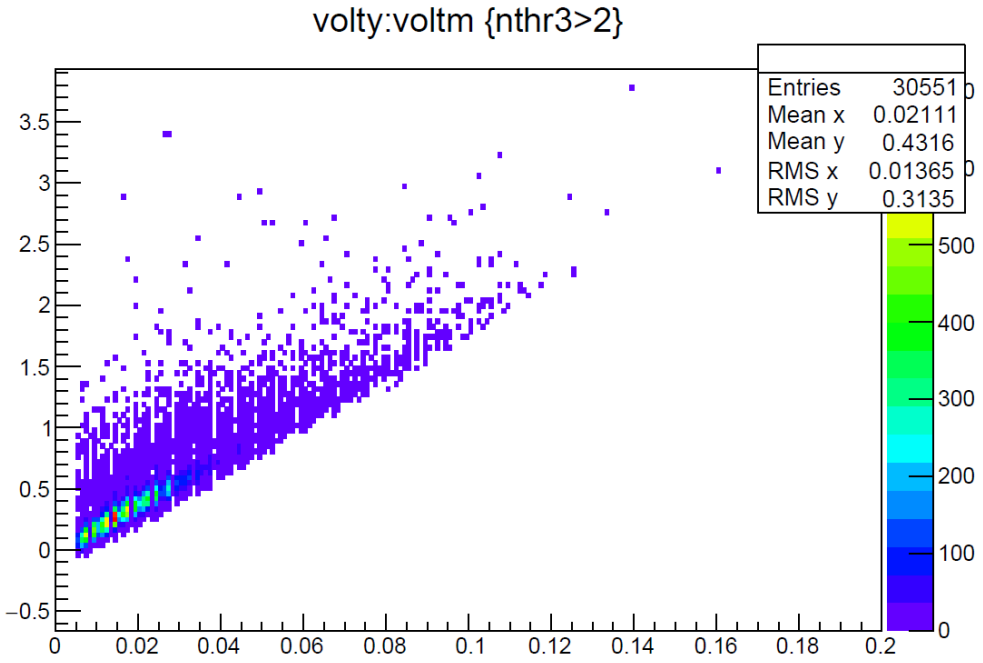
← In peak height distribution,

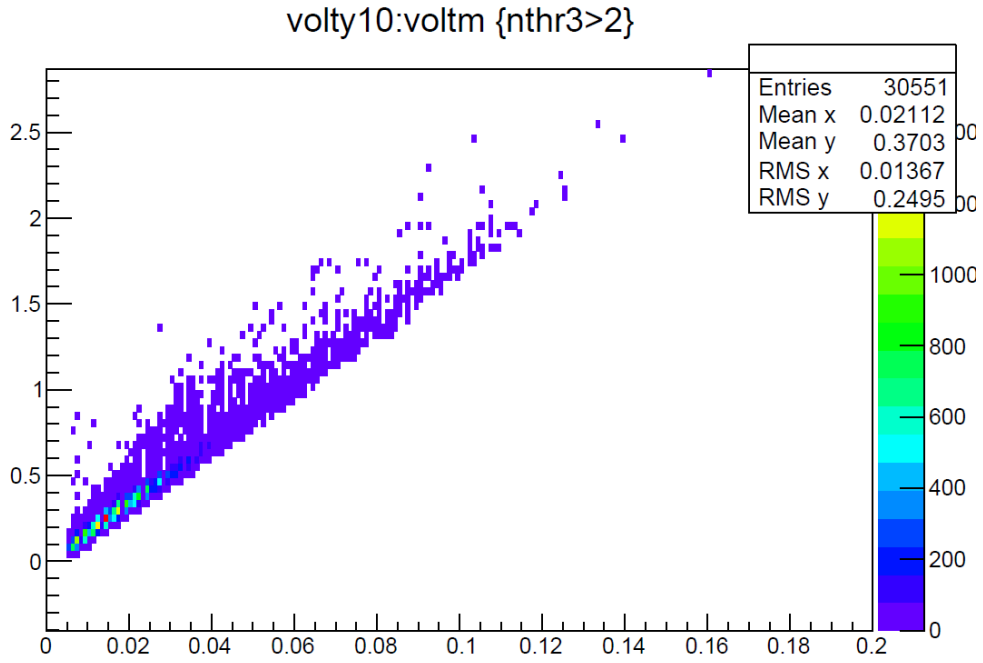
First three bins are empty but 3sigma cut and using 4^{th} bin with assumption of linear increase, 1500# is expected.

30141# gamma measured with time cut and estimated positron number is about 368.2#

→more than 10 times smaller than expectation…. Why?

Additional check



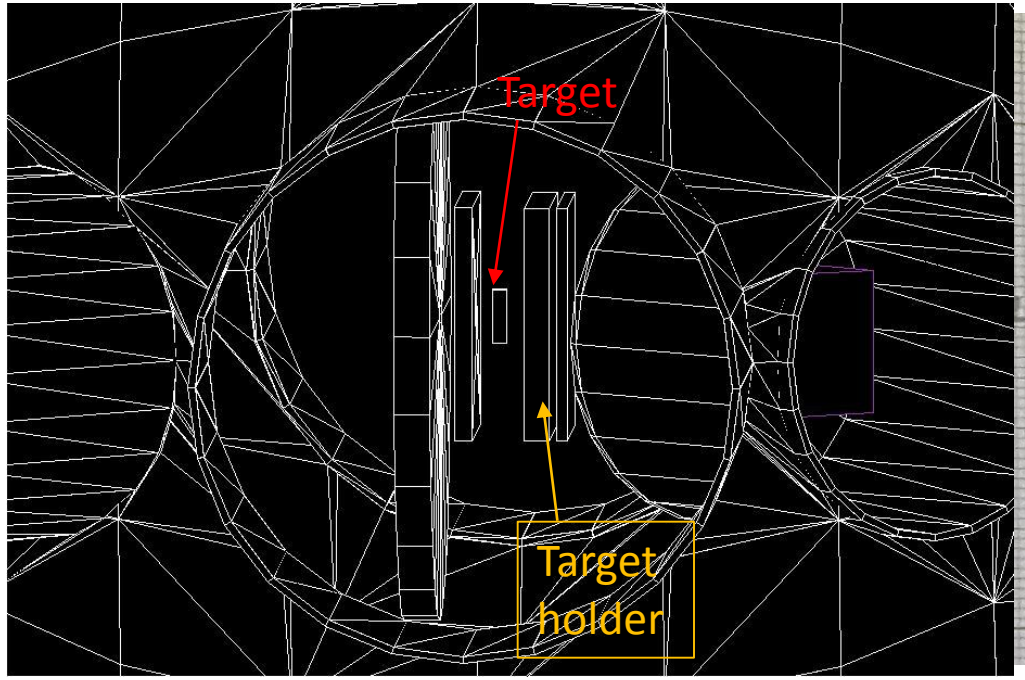


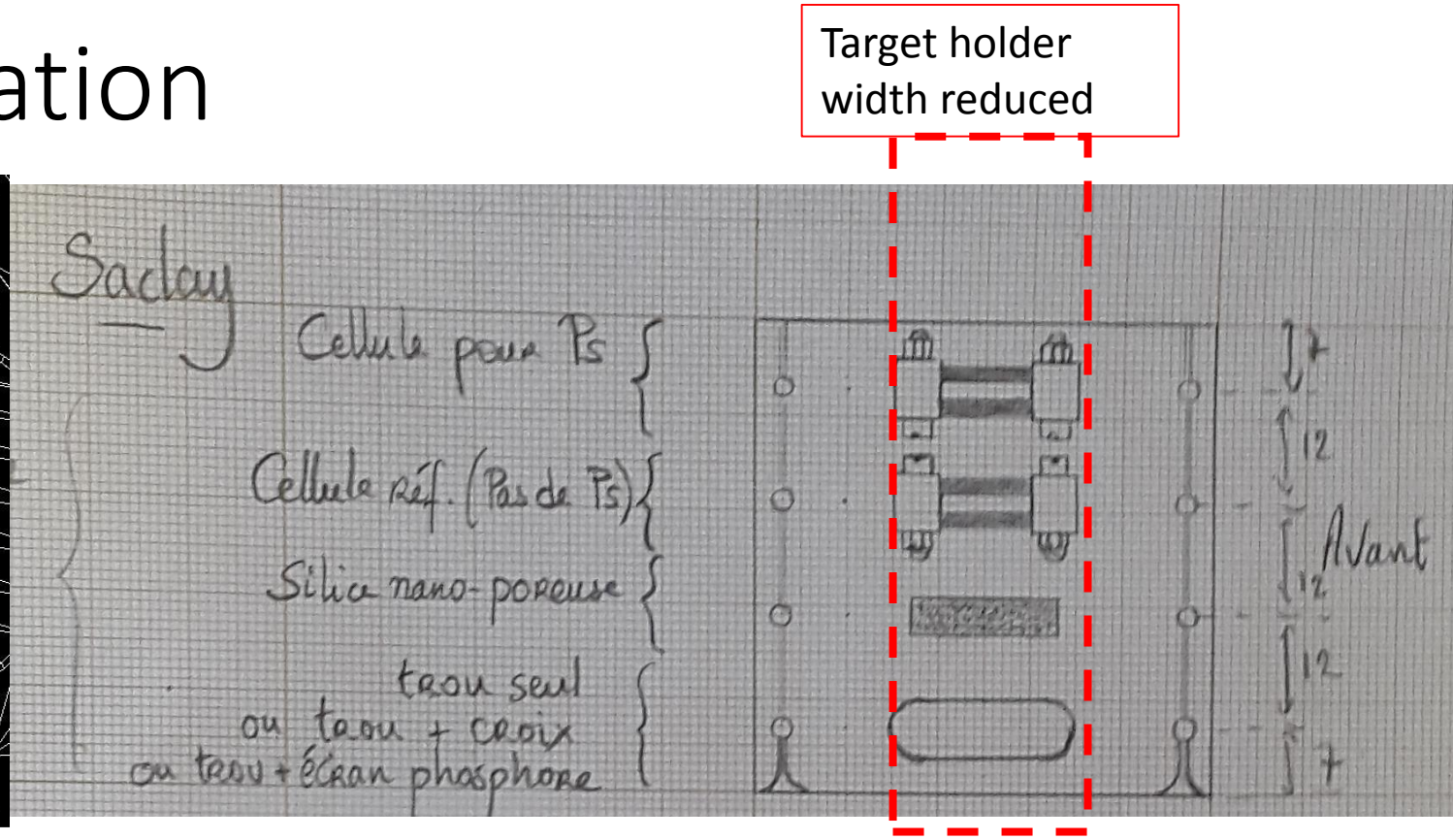
- Height (x-axis): charge(y-axis) distribution for charge from 100ns window **(left)** and from 10ns window **(right)**

→Some possibility of signal overlap?

- RMS, N_bin(>3σ), etc are also being checked..

Positronium simulation



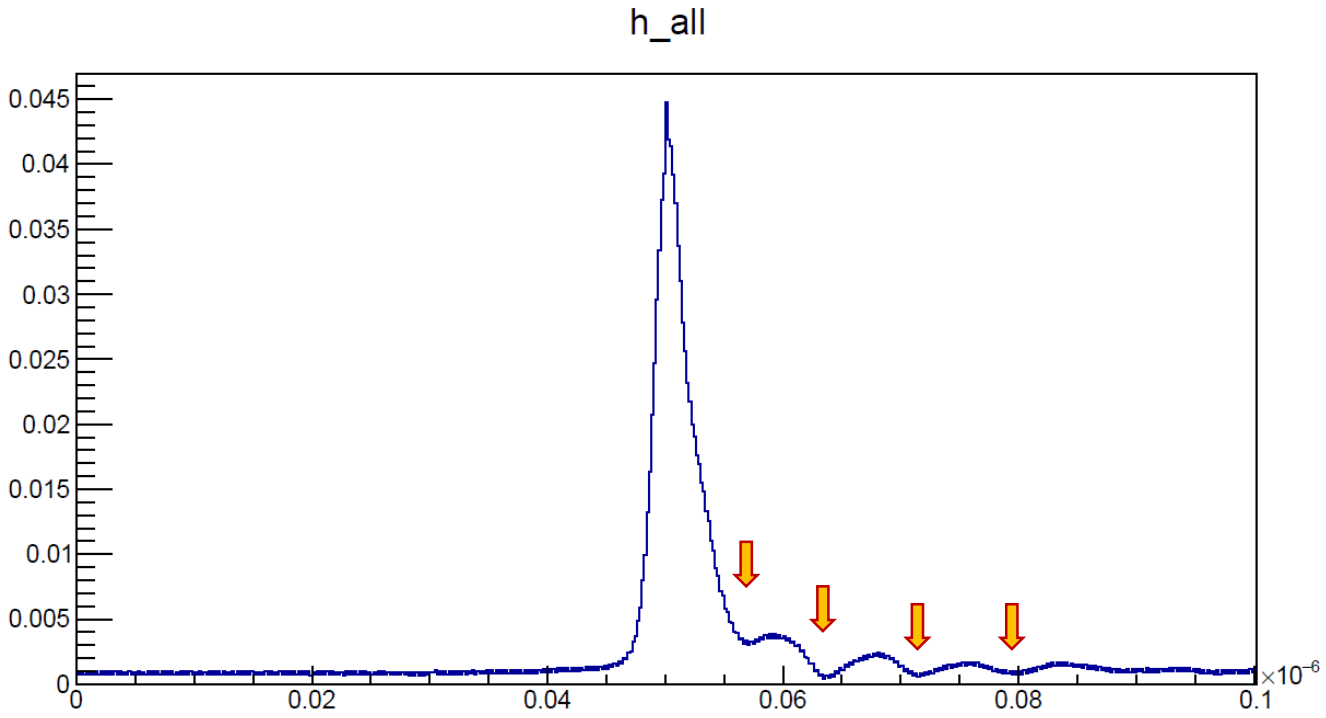


- Simulation with changed target is done and signal is reduce about 1/3.
- I discuss with this effect and Polyne eventually changed design by reducing target width.

Next plan

- Data with 22Na source taken again for confirmation
- PWO detector will be installed far from the magnets.
- I tried to reduce material between PWO detector and annihilation point.
- I will mail about data sharing mail draft to prof.Kim and Patrice on today..

Raw signal distribution (normalized)



- For big signal cases, ringing is shown. (as before)