GlueX DIRC Calibration (II)

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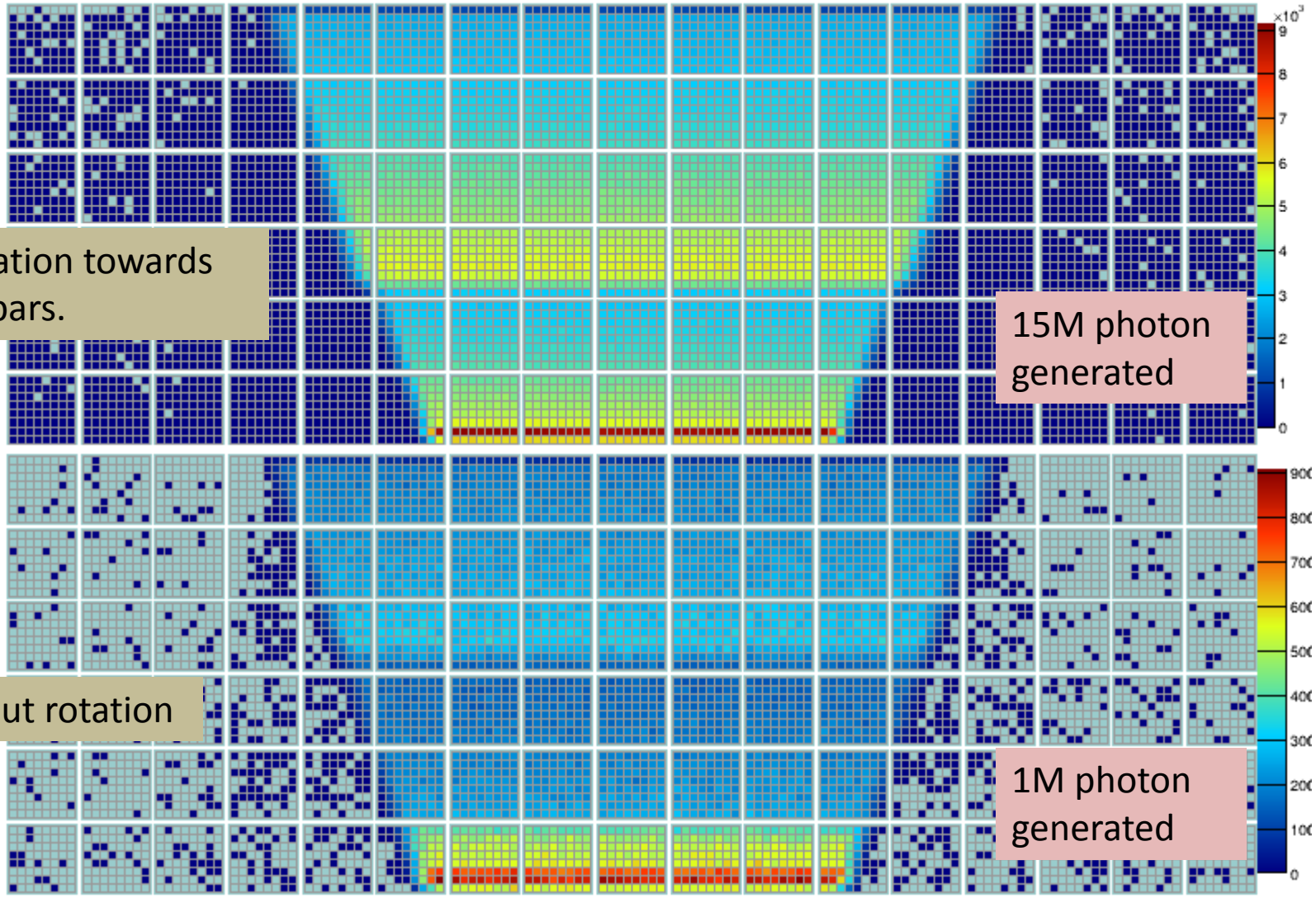
Generated Photon Direction Rotation



Occupancy distribution on GlueX DIRC PMT plane (opening angle 50°)

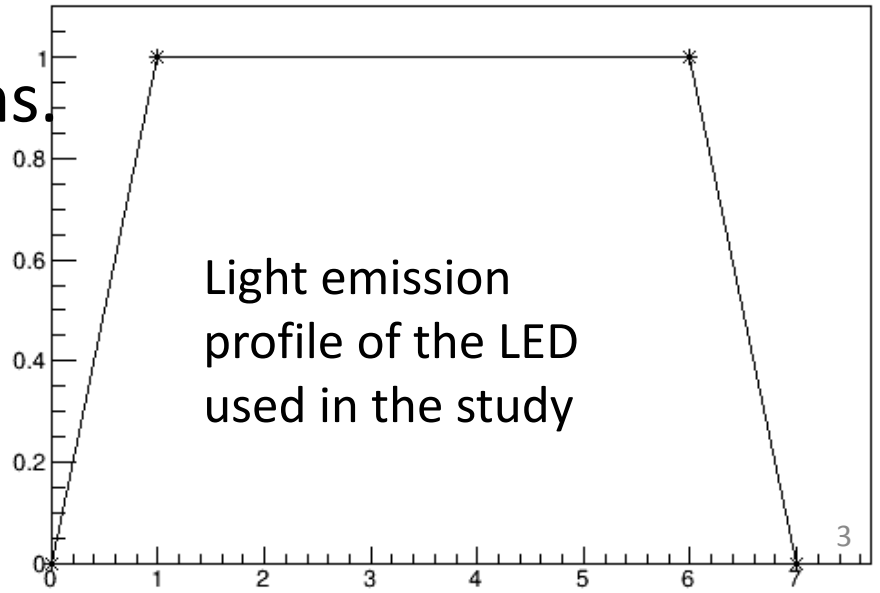
Readout Time Resolution & Light Emission profile of the LED

- Photon time [LED case]= Calculated real time +
  LED contribution based on LED time profile +
  PMT contribution (300 ps Gauss smearing)

- Photon time [Laser case]= Calculated real time +
  PMT contribution based on 300 ps Gauss smearing

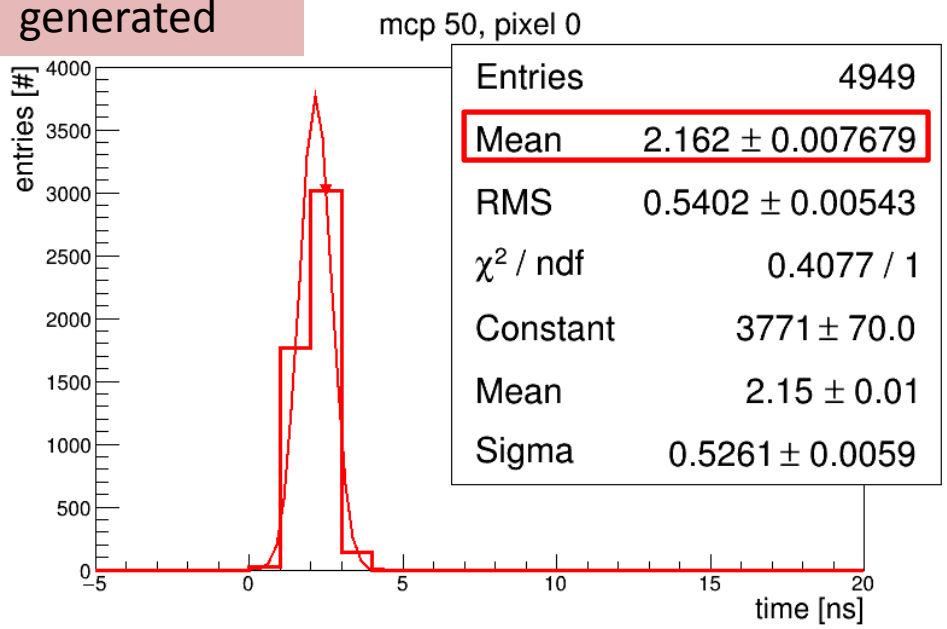
- Readout time resolution is 1 ns.

- Quantum efficiency switched off in this simulations



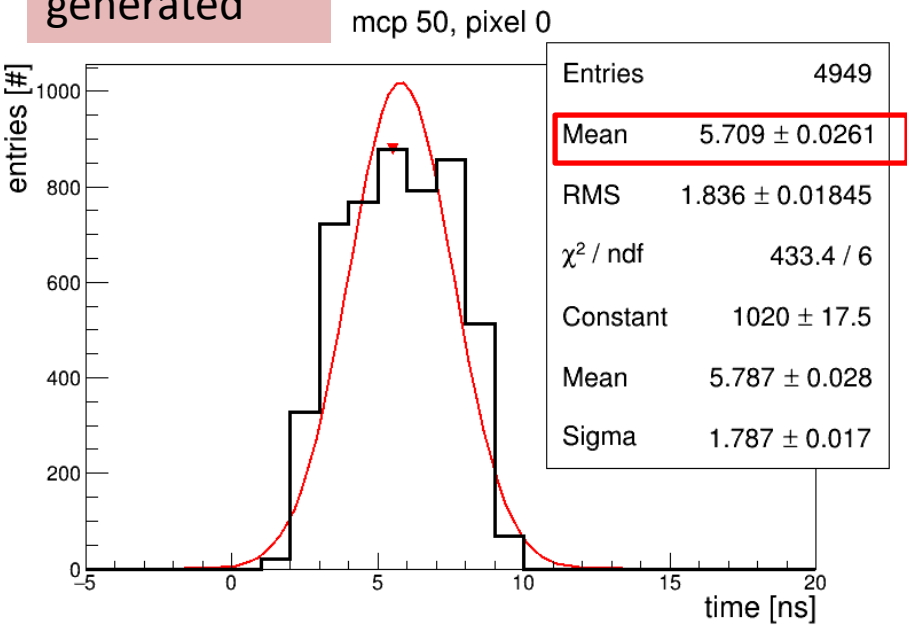
Extraction of the Mean Time and the Error Associated to the Mean at each Pixel

15M photon generated



Laser photon time distribution at one pixel

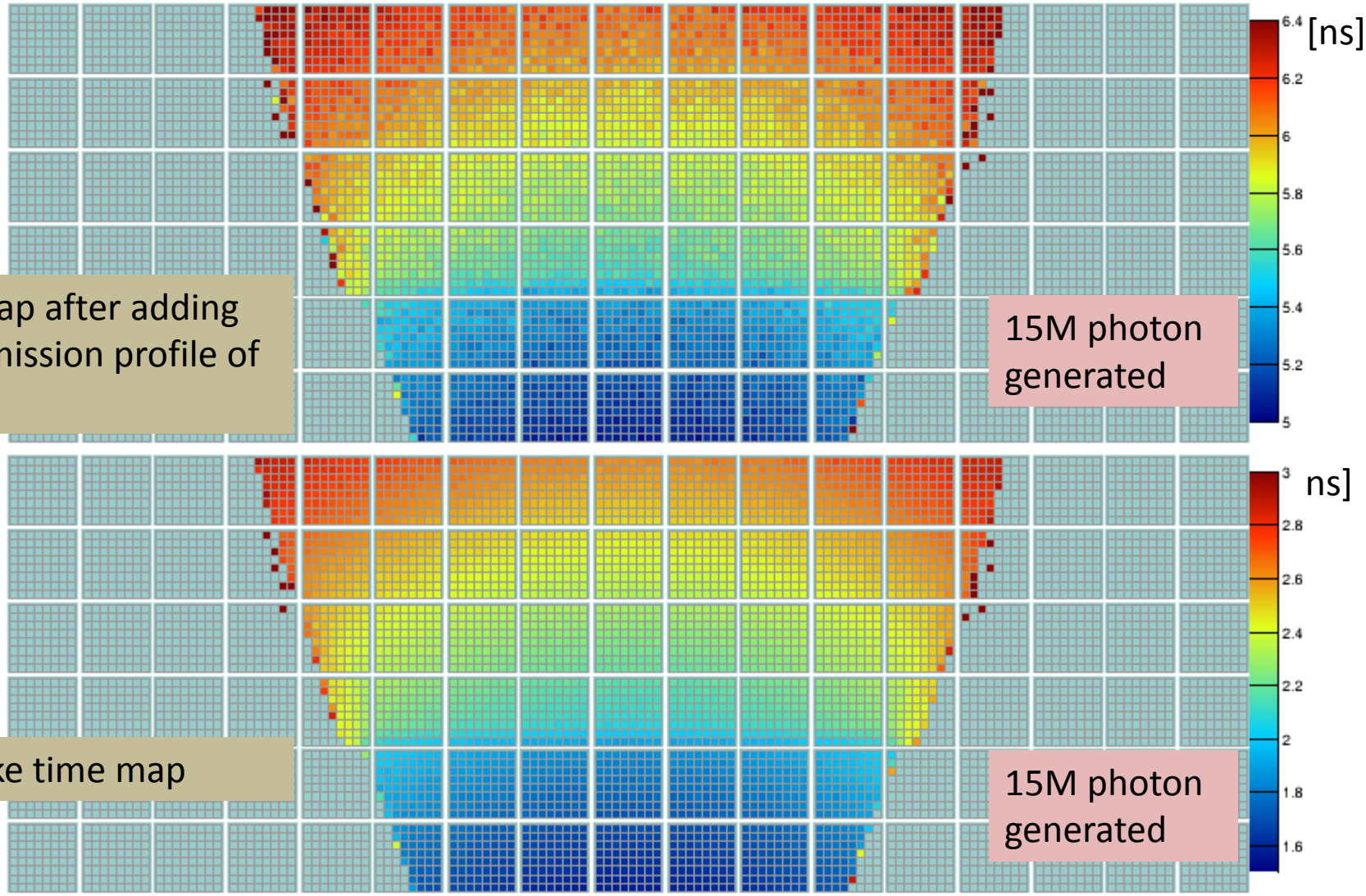
15M photon generated



LED photon time distribution at one pixel

Results on the next slides calculated without applying fitting

PMT Time Map



Time map after adding Light emission profile of the LED

15M photon generated

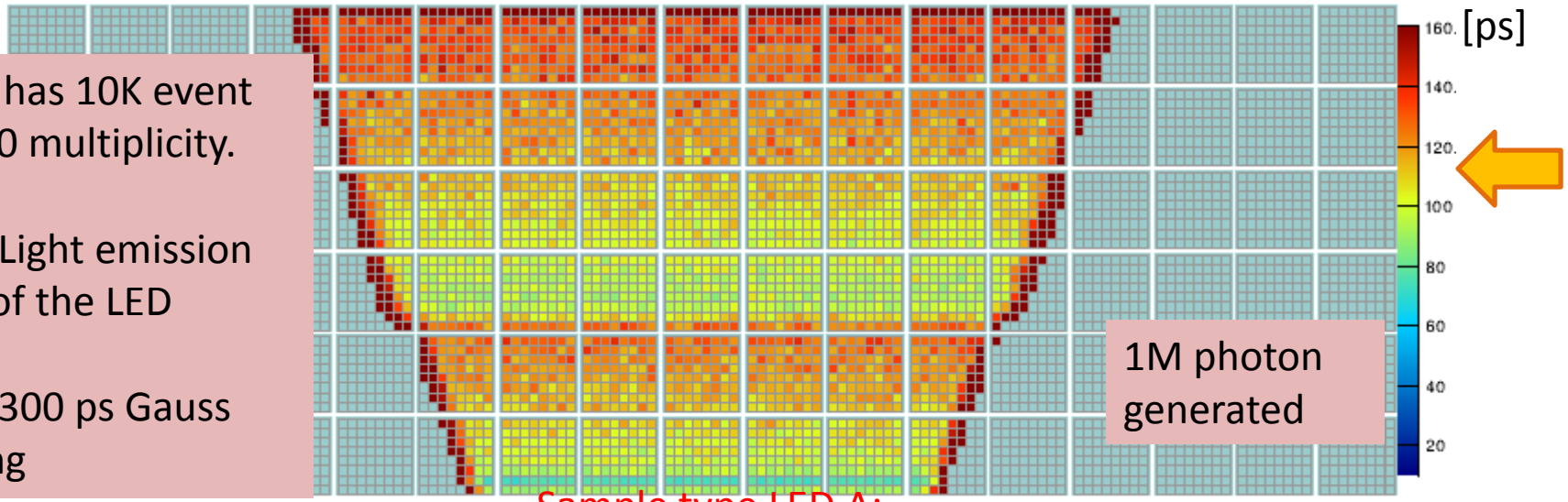
Laser like time map

15M photon generated

Photon mean time distribution on GlueX DIRC PMT plane

PMT Time Error Map

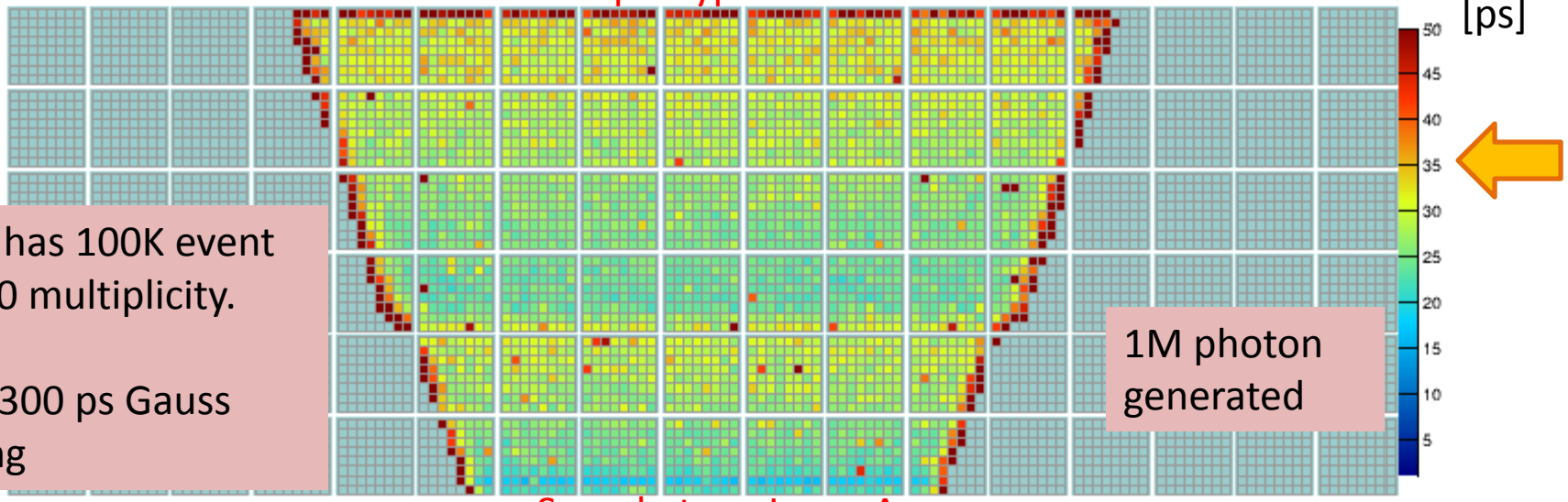
Sample has 10K event with 100 multiplicity.
+
Adding Light emission profile of the LED
+
Adding 300 ps Gauss smearing



1M photon generated

Sample type LED A:

Sample has 100K event with 100 multiplicity.
+
Adding 300 ps Gauss smearing



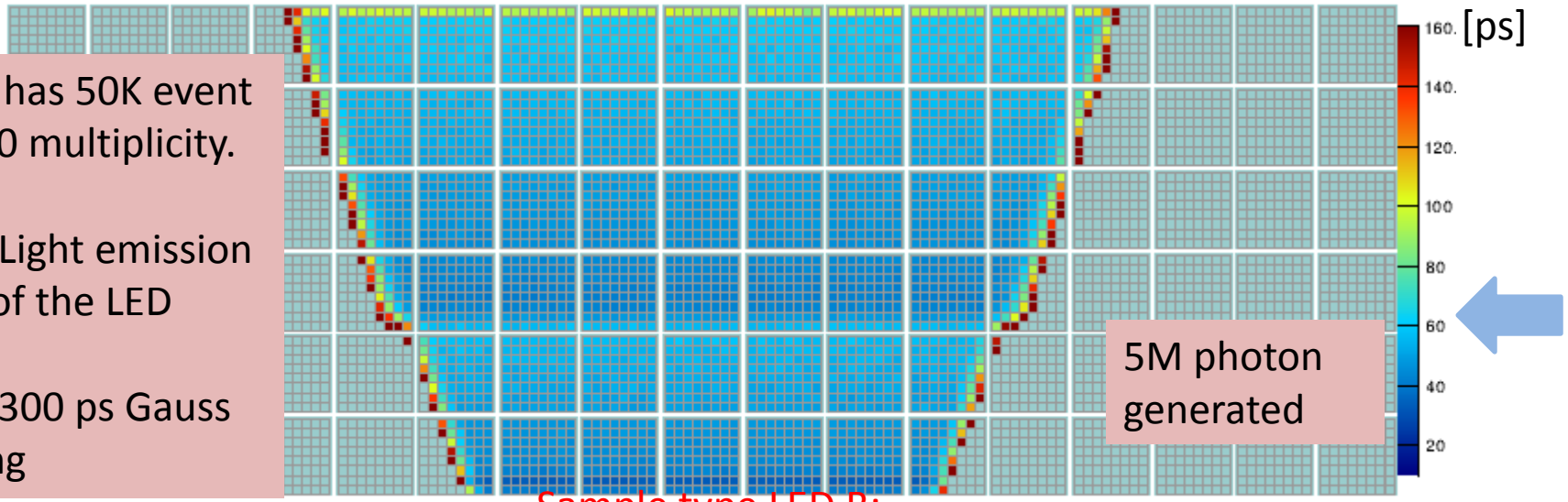
1M photon generated

Sample type Laser A:

Error associated to the mean time on GlueX DIRC PMT plane

PMT Time Error Map

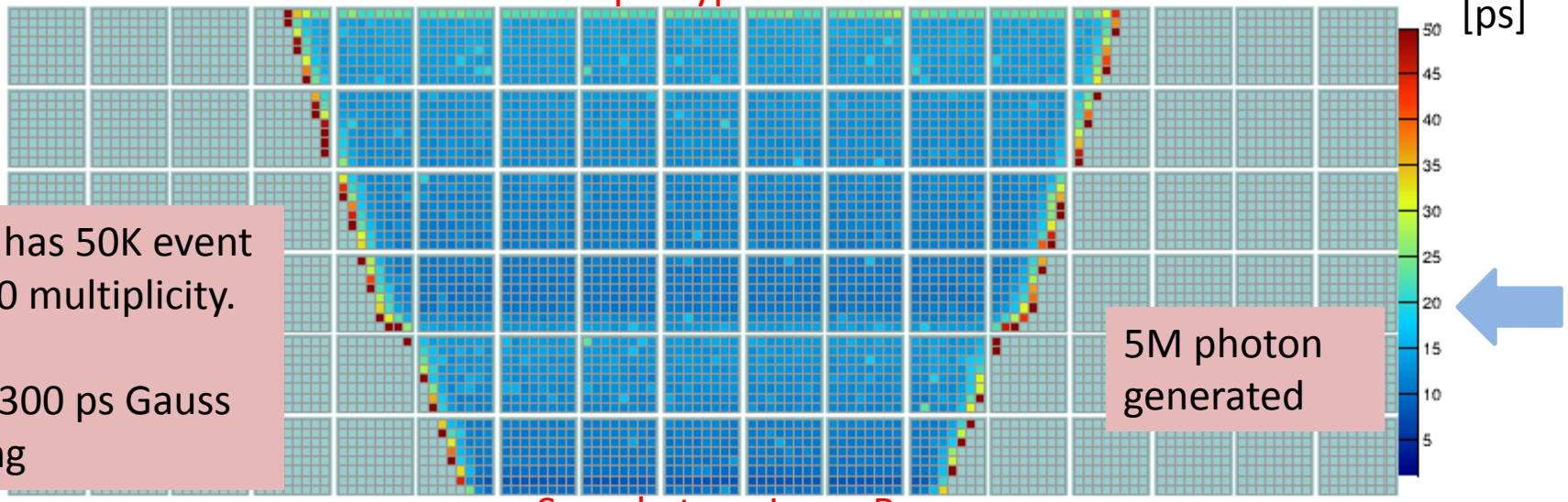
Sample has 50K event with 100 multiplicity.
+
Adding Light emission profile of the LED
+
Adding 300 ps Gauss smearing



5M photon generated

Sample type LED B:

Sample has 50K event with 100 multiplicity.
+
Adding 300 ps Gauss smearing



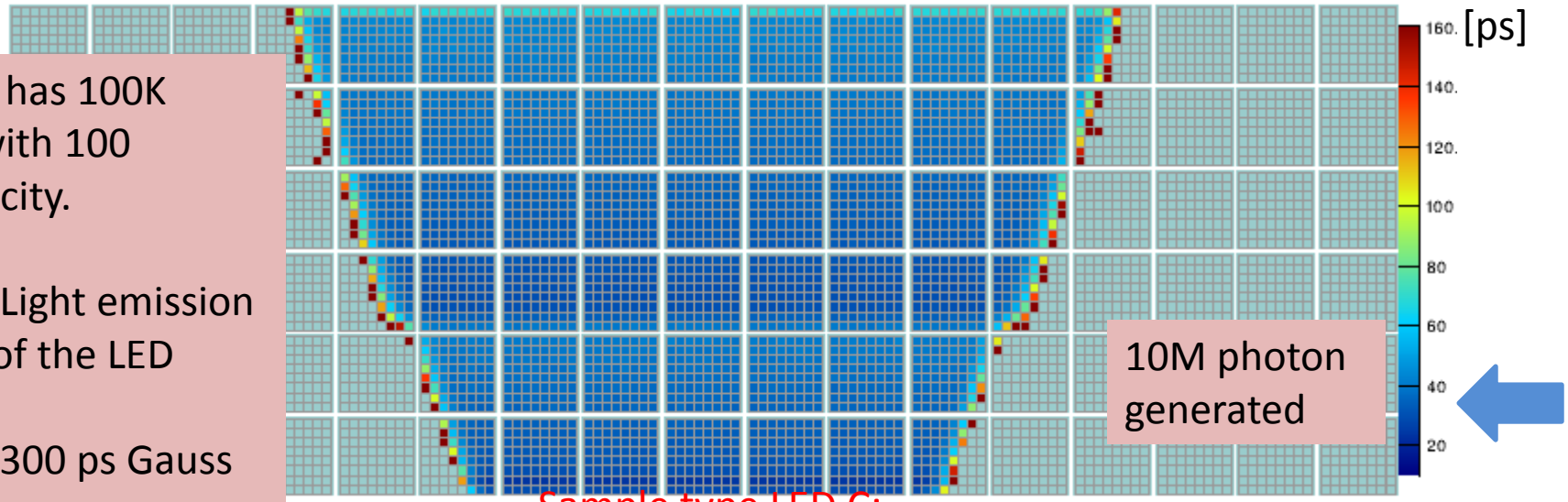
5M photon generated

Sample type Laser B:

Error associated to the mean time on GlueX DIRC PMT plane

PMT Time Error Map

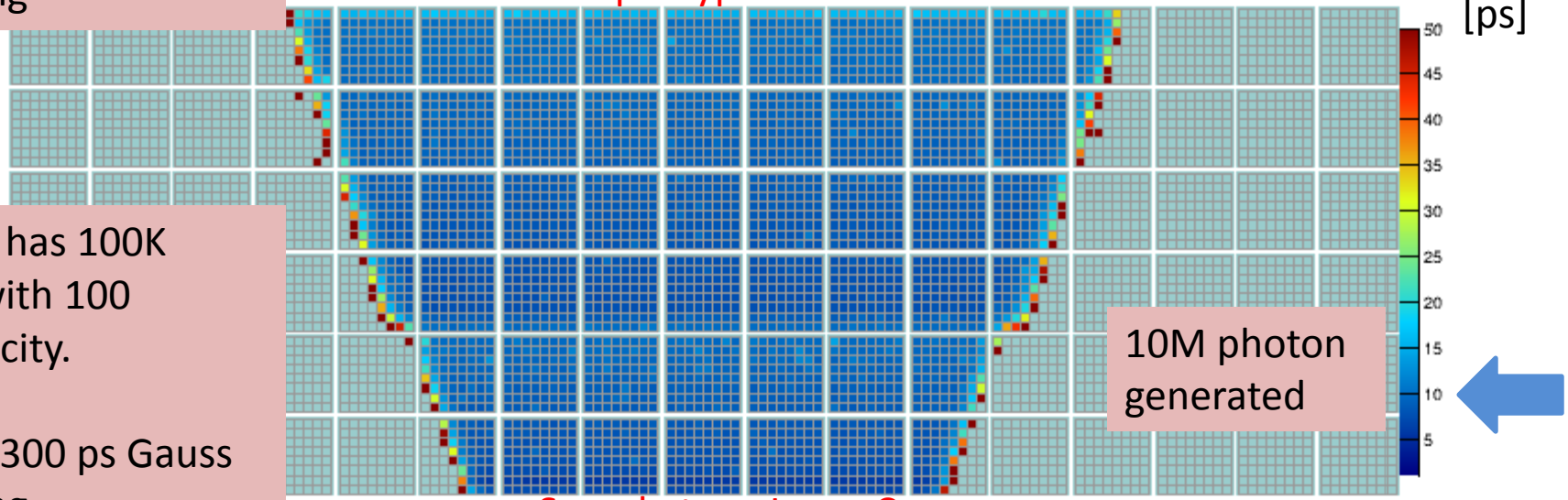
Sample has 100K event with 100 multiplicity.
+
Adding Light emission profile of the LED
+
Adding 300 ps Gauss smearing



10M photon generated

Sample type LED C:

Sample has 100K event with 100 multiplicity.
+
Adding 300 ps Gauss smearing



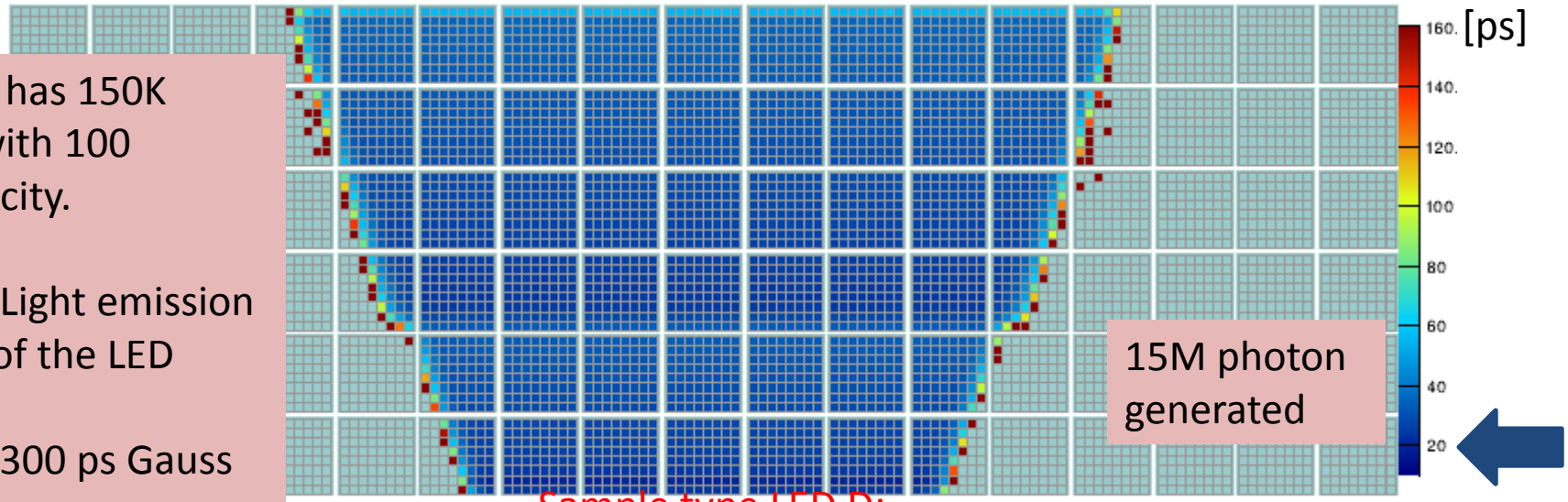
10M photon generated

Sample type Laser C:

Error associated to the mean time on GlueX DIRC PMT plane

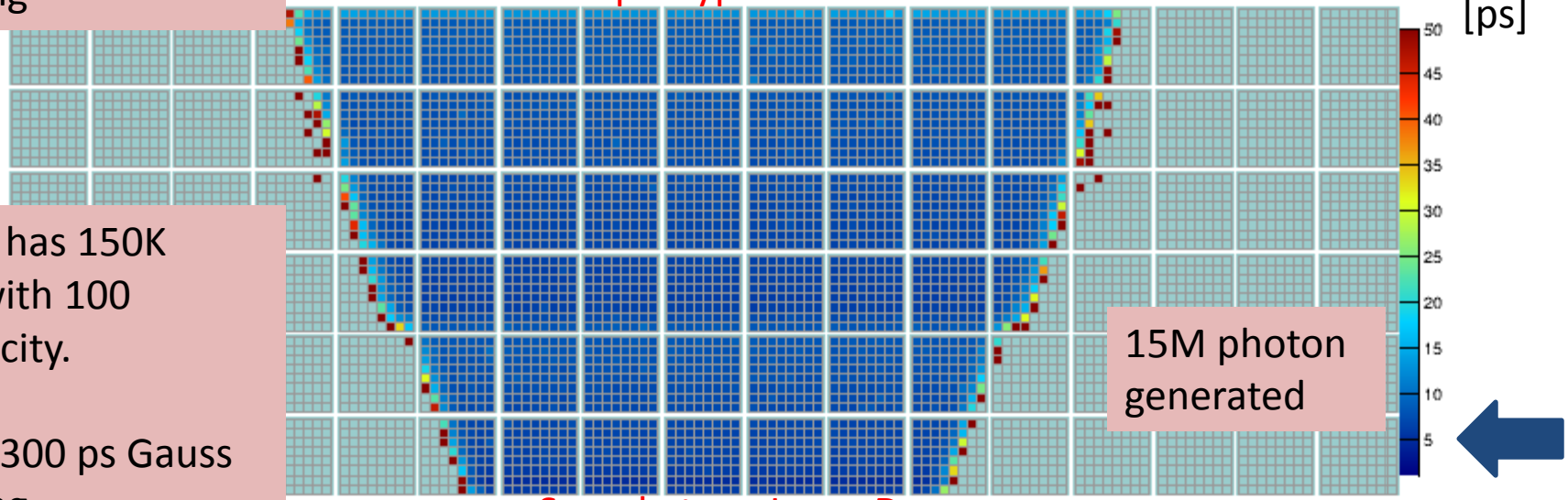
PMT Time Error Map

Sample has 150K event with 100 multiplicity.
+
Adding Light emission profile of the LED
+
Adding 300 ps Gauss smearing



Sample type LED D:

Sample has 150K event with 100 multiplicity.
+
Adding 300 ps Gauss smearing



Sample type Laser D:

Error associated to the mean time on GlueX DIRC PMT plane

Another Approach of Time Calculations

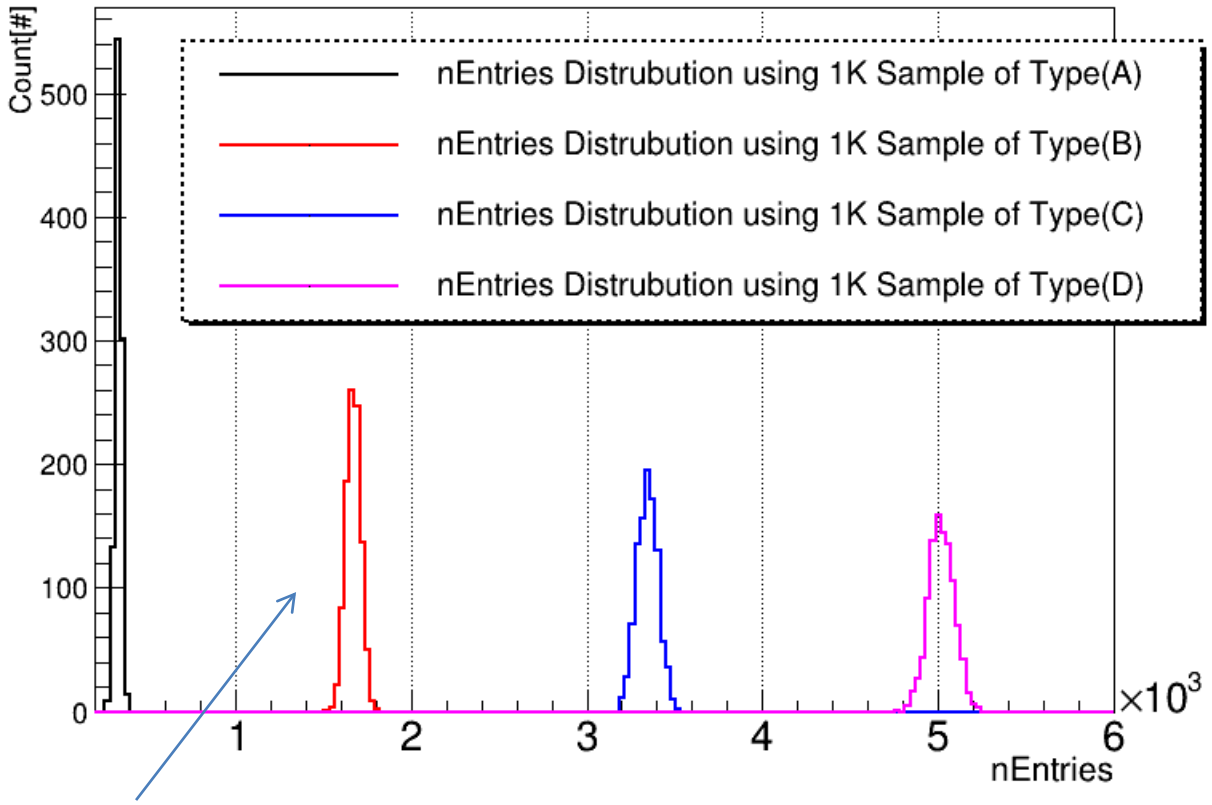
1) Generating samples with different MC seed :

- Dataset A: 1K sample generated by kronos each sample created by using 10K trigger with multiplicity 100
- Dataset B: 1K sample generated by kronos each sample created by using 50K trigger with multiplicity 100
- Dataset C: 1K sample generated by kronos each sample created by using 100K trigger with multiplicity 100
- Dataset D: 1K sample generated by kronos each sample created by using 150K trigger with multiplicity 100

2) Studying number of entries at certain pixel using different datasets, mean of the mean time distribution and error associated to that mean.

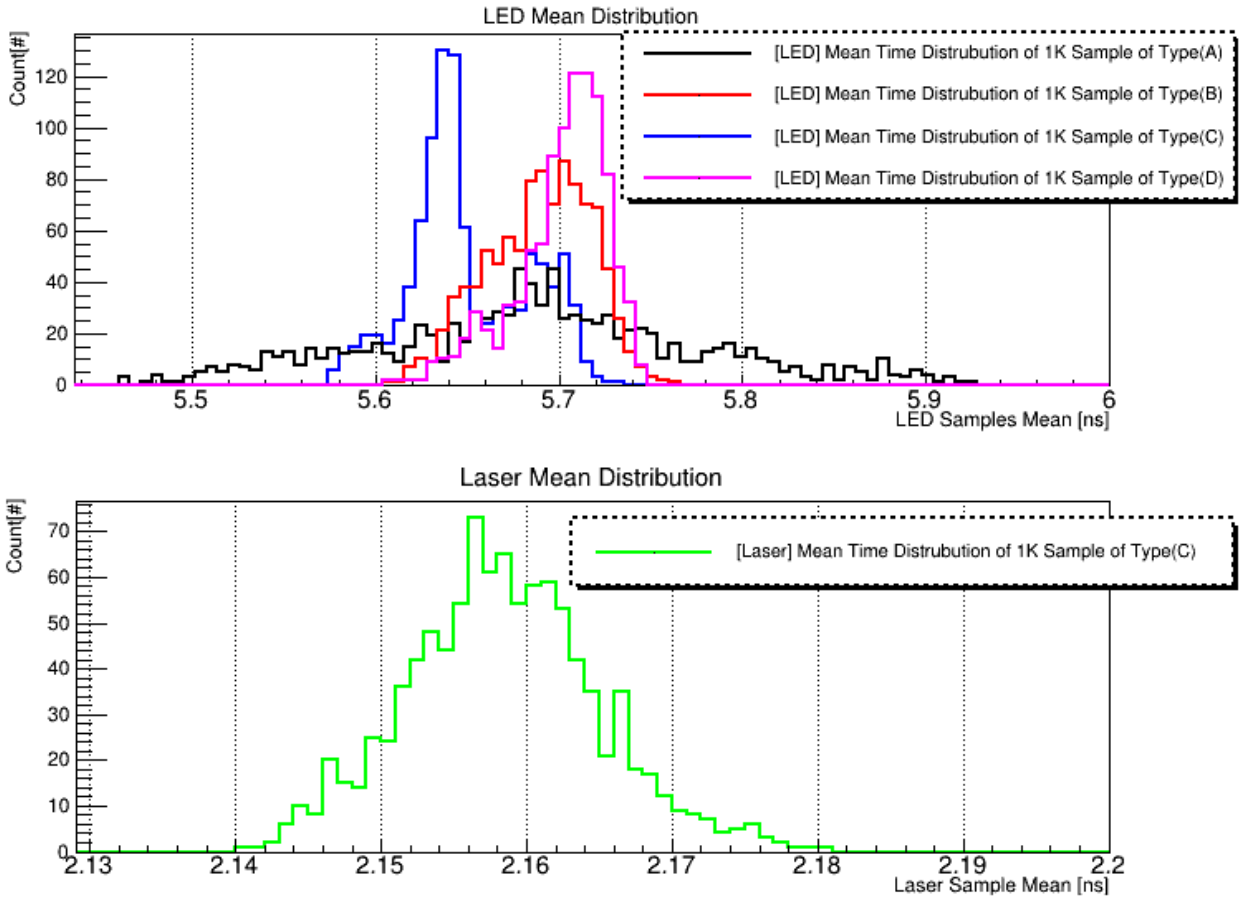
3) Conclusions

Number of photon at Certain Pixel



Using 1000 sample from each datasets, each sample contribute with one entry. E.g. The mean value of the red distribution correspond to the mean number of photon at certain pixel ~ 1.7 K photon using 5M photon.

Mean Time Distribution



Mean of mean time distribution of type LED (Dataset A) samples = 5.68713 [ns]

Mean of mean time distribution of type LED (Dataset B) samples = 5.6894 [ns]

Mean of mean time distribution of type LED (Dataset C) samples = 5.65049 [ns]

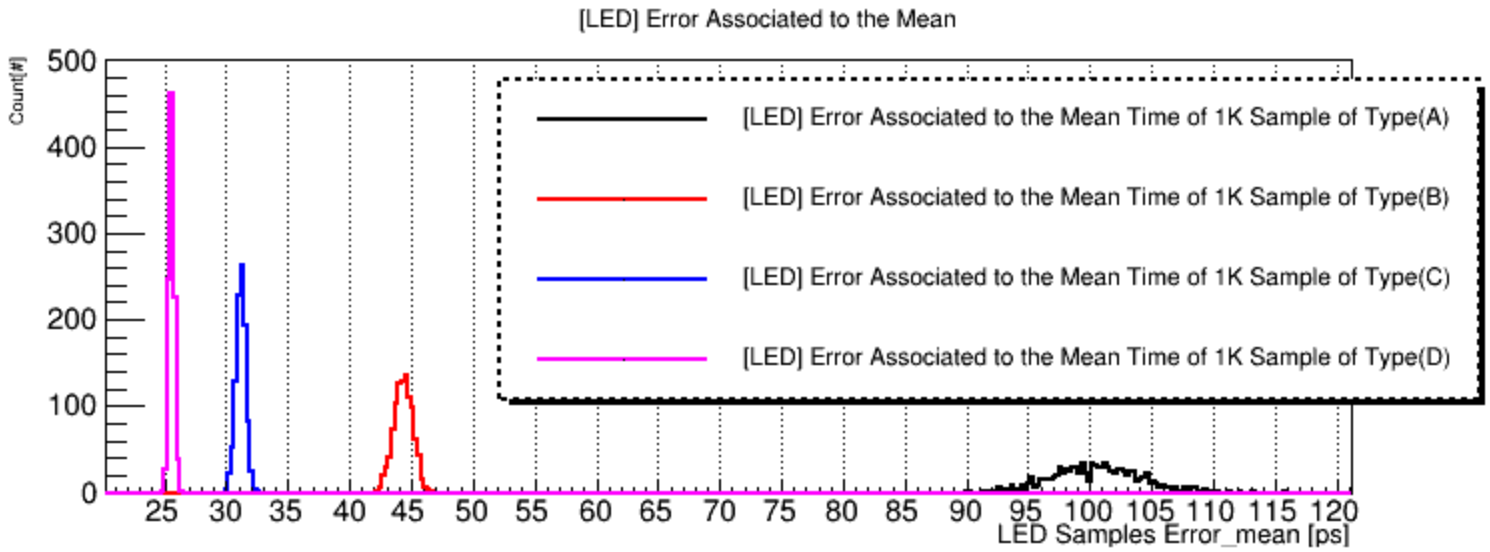
Mean of mean time distribution of type LED (Dataset D) samples = 5.70183 [ns]

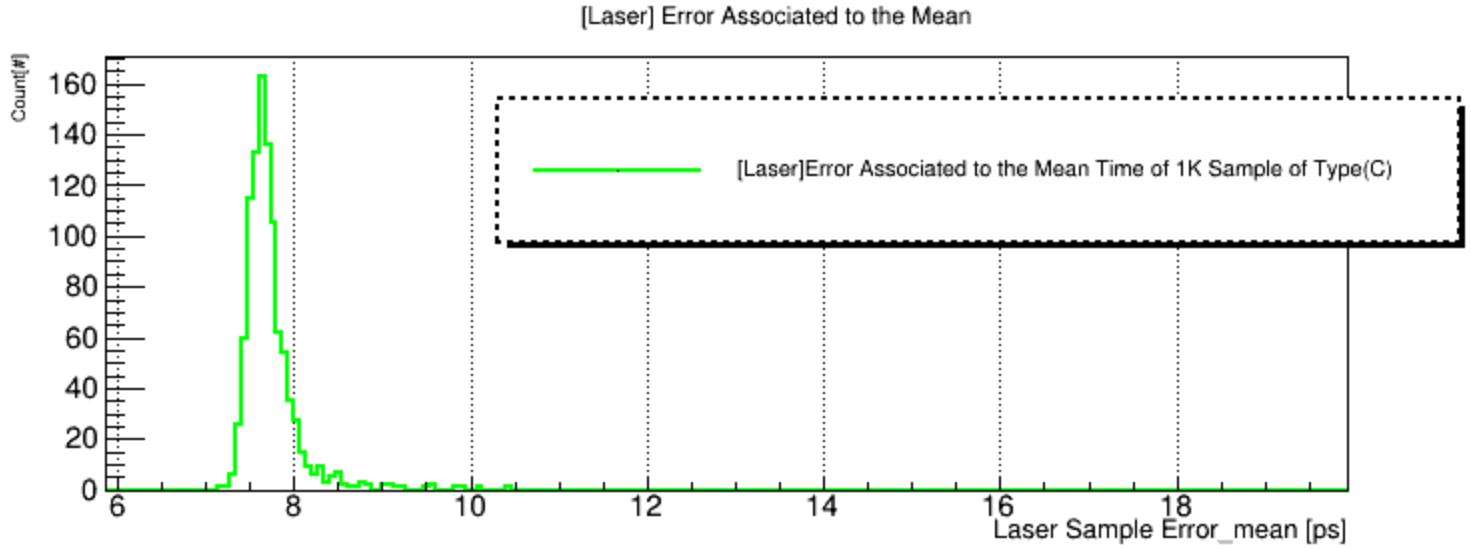
Mean of mean time distribution of type Laser(Dataset C) samples = 2.15842 [ns]

Almost the same

The bigger number of photon used, the smaller sigma of the mean distributions

Error Associated to the Mean





The bigger number of photon used, the smaller error associated to the mean

Conclusion

- At this stage of the study the LED-based calibration system meet the required time resolution of GlueX DIRC.
- Adding noise and using certain fitting function, as for now the results executed without fitting
- Make a generalization for the second approach “slide 10” to cover all pixels on the PMT plane
- Considering quantum efficiency in order to estimate the required statistics.

Thanks for your attention