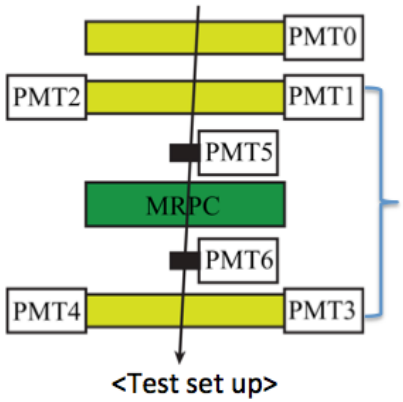
MRPC update

Sanghwa Park

Cosmic data analysis

- Analyzed one of cosmic runs from Yi
- Slewing correction
- Effective time resolution: 0.18 ns (need to subtract PMT resolution in order to get the intrinsic time resolution)
- Test set up:

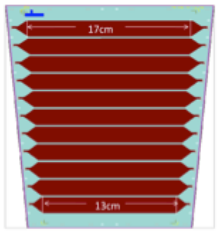
$$\sigma_{\text{intrinsic}} = \sqrt{\sigma_{\text{eff}}^2 - \sigma_{\text{ref}}^2}$$



<Test set up>

- Reference time: (T1+T2+T3+T4)/4

Average of PMT1-4 to remove time jitter



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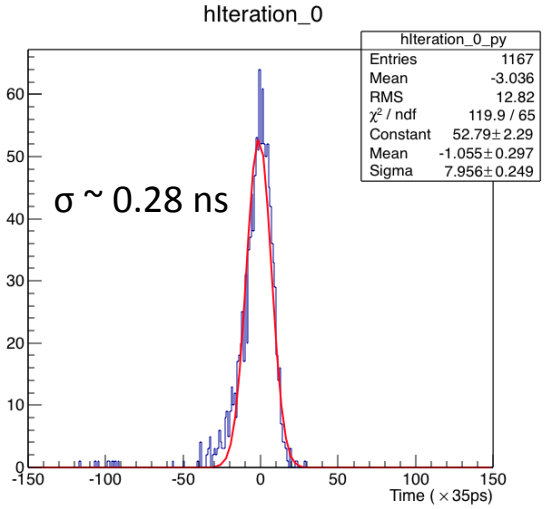
- Readout at the both end

- Charge signal: sum of left and right
- Time: average of $TDC_{MRPC1(left)}$ and $TDC_{MRPC2(right)}$

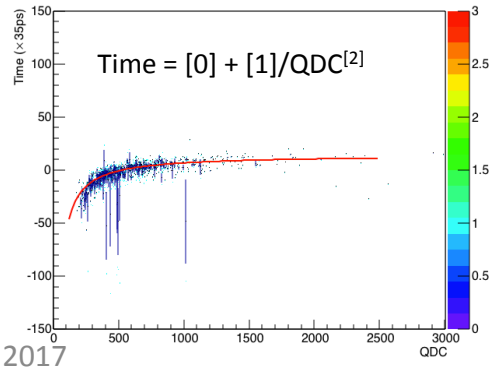
Average from both strip ends Reference time Shifted to be centered around 0

- Time = $(T_{MRPC(left)} + T_{MRPC(right)})/2$ - (T1+T2+T3+T4)/4 - 1085

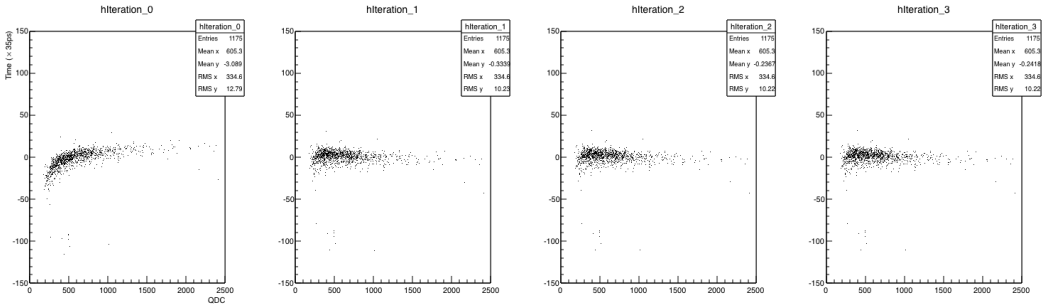
- distribution before slewing correction:



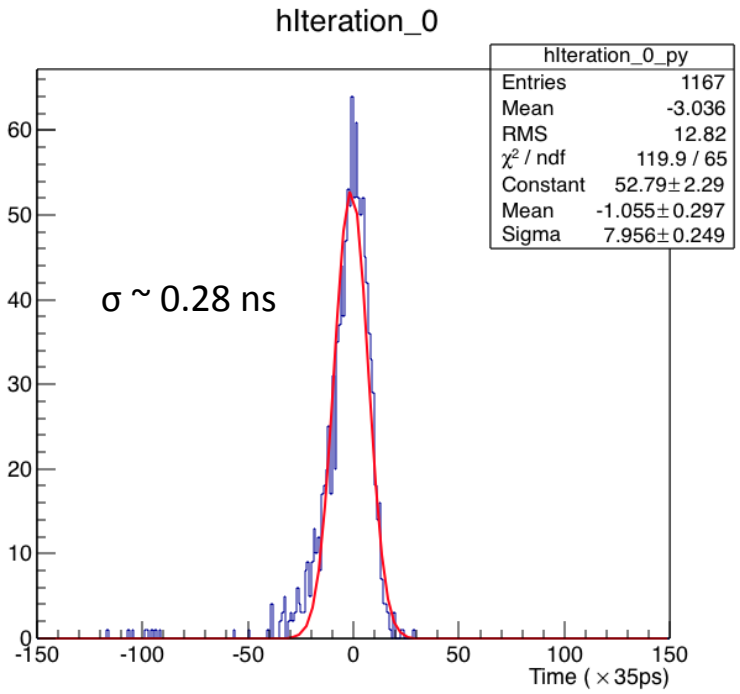
- Slewing correction:
  - Consistent resulting time resolution from various function fits
  - [0]+[1]/sqrt(QDC)
  - [0]+[1]/$QDC^{[2]}$
  - Higher order polynomial

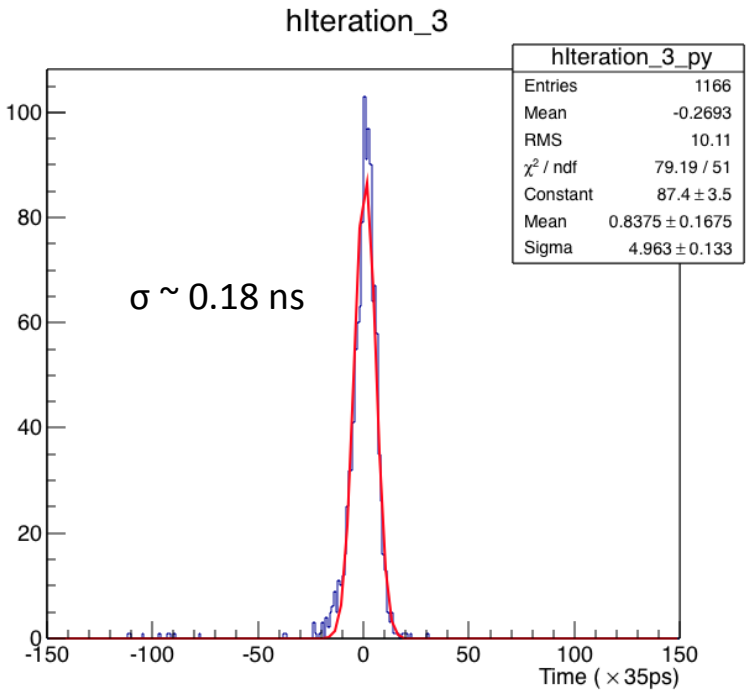


Iteration:

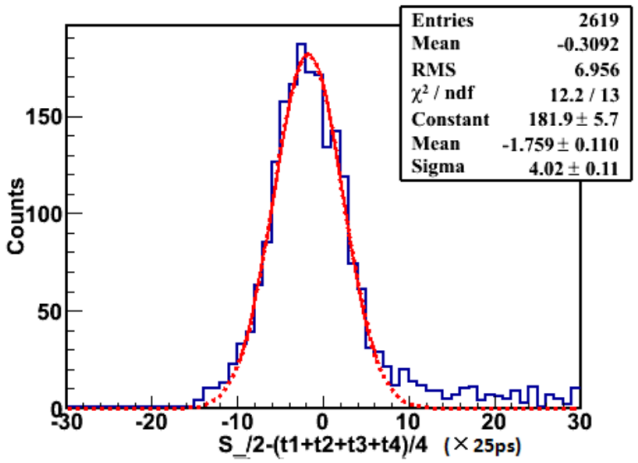


Time resolution after slewing correction

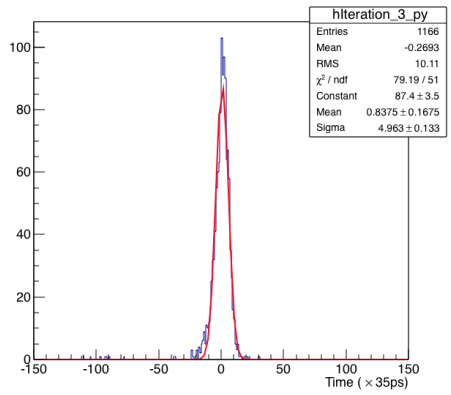


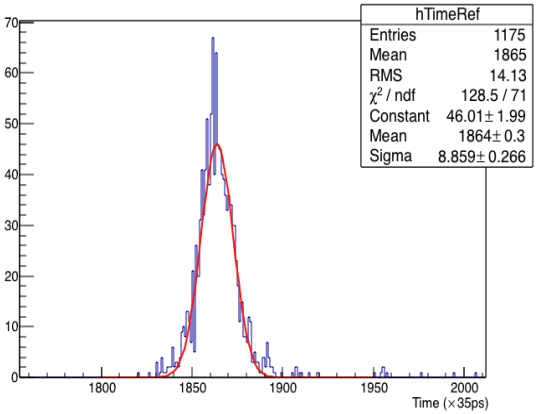


- Time resolution from the test result (published): ~100ps (reference time resolution: ~87 ps → MRPC time resolution ~ 50ps)



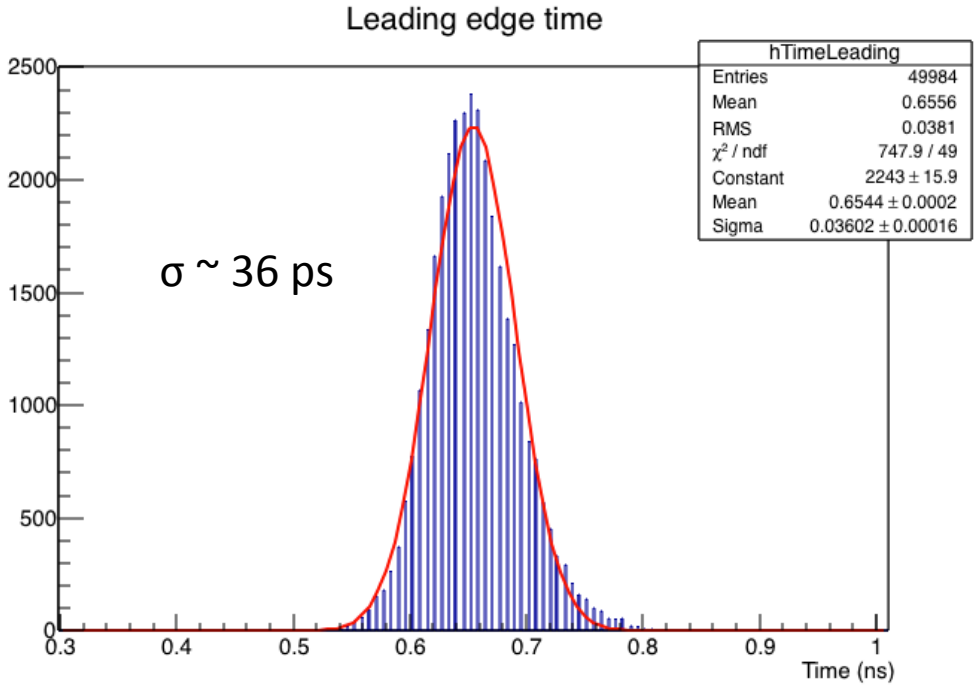
- Time resolution from this cosmic run: ~180 ps
- Reference time resolution: > 300 ps





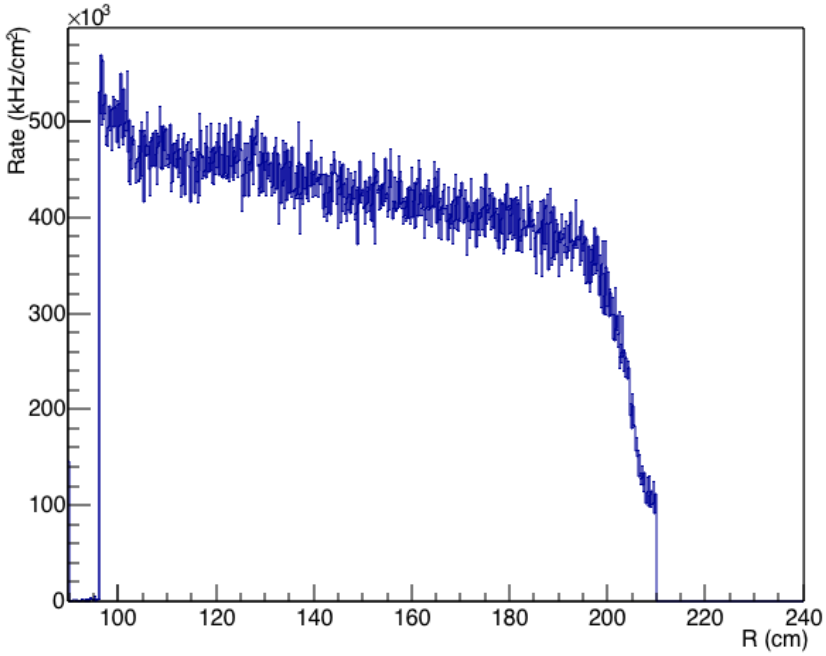
Time resolution from MC

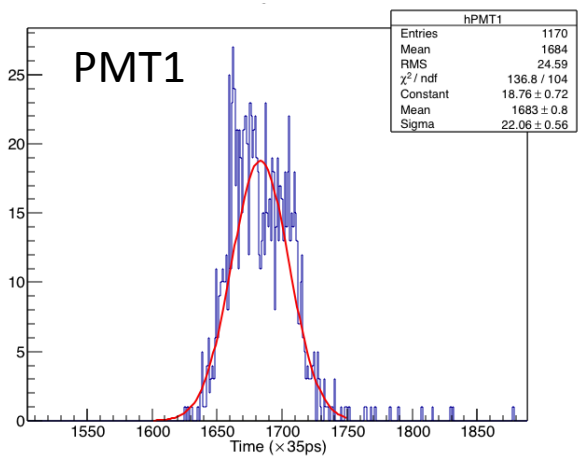
- 1 GeV single muons
- Signal propagation time, time jitter of readout are not considered here.

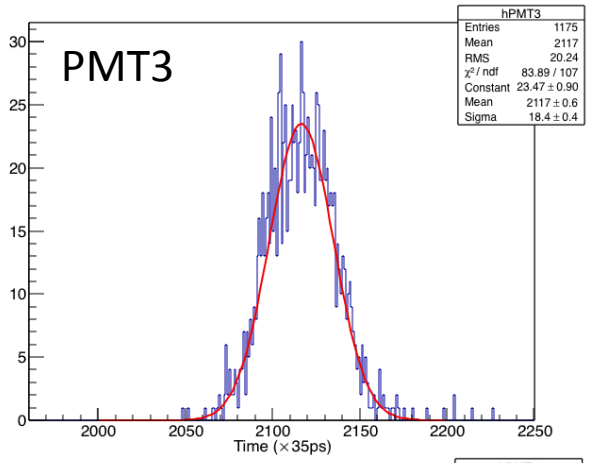


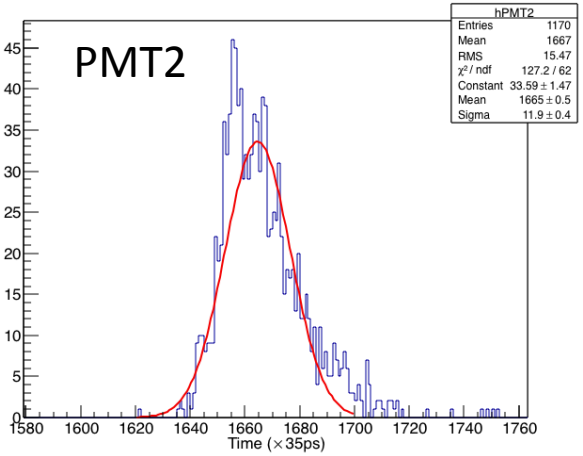
backup

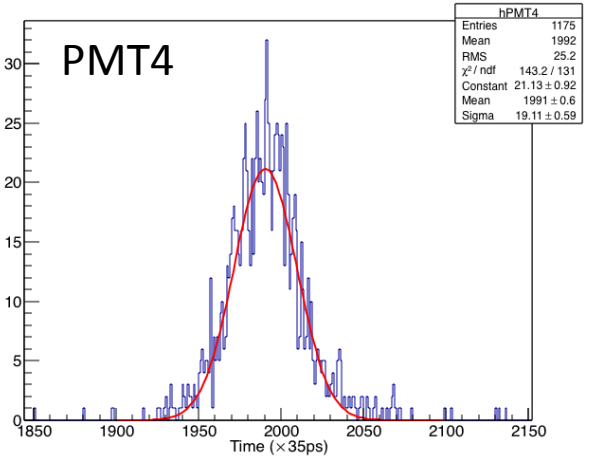
Rate in front of MRPC (all particles)



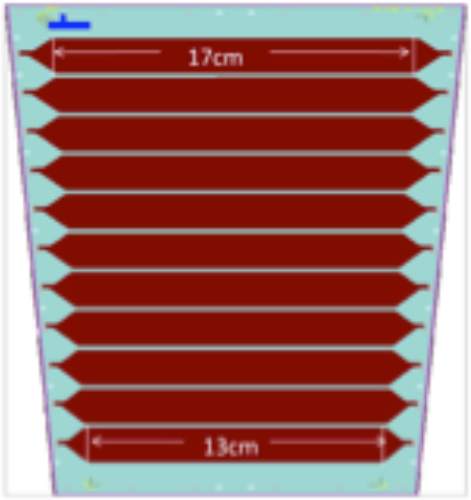

PMT1
hPMT1
Entries 1170
Mean 1684
RMS 24.59
χ² / ndf 136.8 / 104
Constant 18.76 ± 0.72
Mean 1683 ± 0.8
Sigma 22.06 ± 0.56
Time (×35ps)


PMT3
hPMT3
Entries 1175
Mean 2117
RMS 20.24
χ² / ndf 83.89 / 107
Constant 23.47 ± 0.90
Mean 2117 ± 0.6
Sigma 18.4 ± 0.4
Time (×35ps)


PMT2
hPMT2
Entries 1170
Mean 1667
RMS 15.47
χ² / ndf 127.2 / 62
Constant 33.59 ± 1.47
Mean 1665 ± 0.5
Sigma 11.9 ± 0.4
Time (×35ps)


PMT4
hPMT4
Entries 1175
Mean 1992
RMS 25.2
χ² / ndf 143.2 / 131
Constant 21.13 ± 0.92
Mean 1991 ± 0.6
Sigma 19.11 ± 0.59
Time (×35ps)

1. PMT calibration
2. Is cosmic test result reasonable? If not, data with more statistics?
3. Design parameters (strip length)
4. Electronics noise?
5. Charge sharing?
6. Readout -> combined all channels?



<A MRPC module>