# NaI-031 Experiment (Temperature Dependence)

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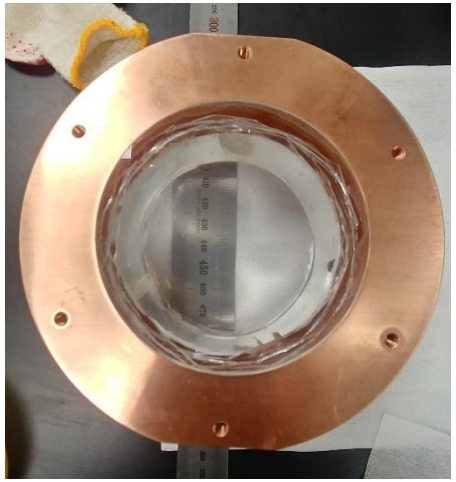
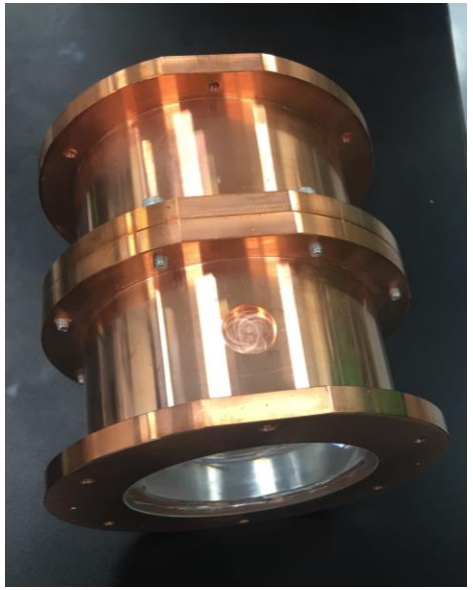
# Purpose of Low Temperature Experiment

- To check light yield according to temperature change
- To observe PSD(alpha, beta/gamma deposited energy)

  when temperature goes down
- To measure PMT noise as a function of temperature

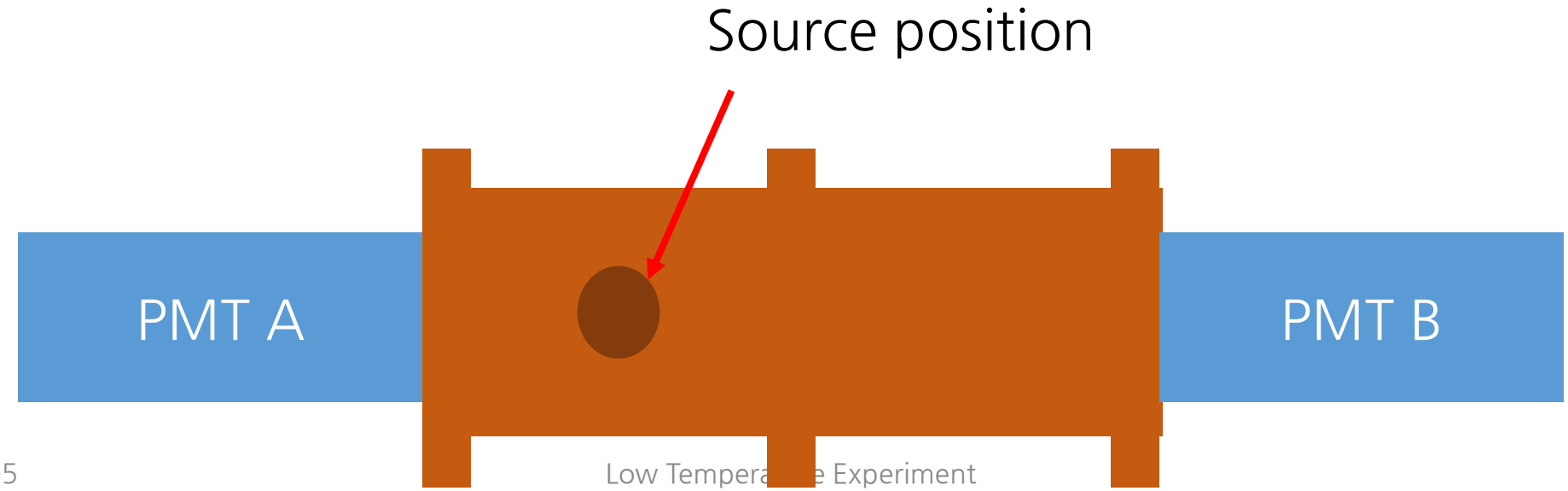
# NaI-031



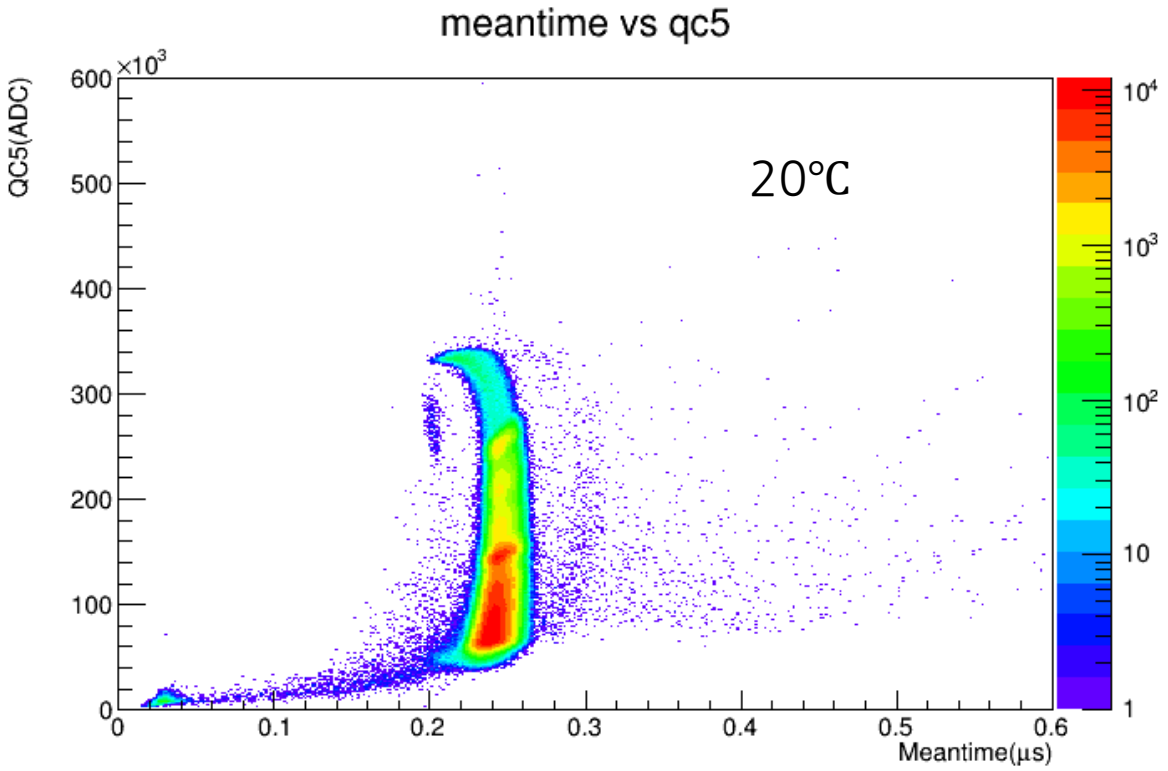



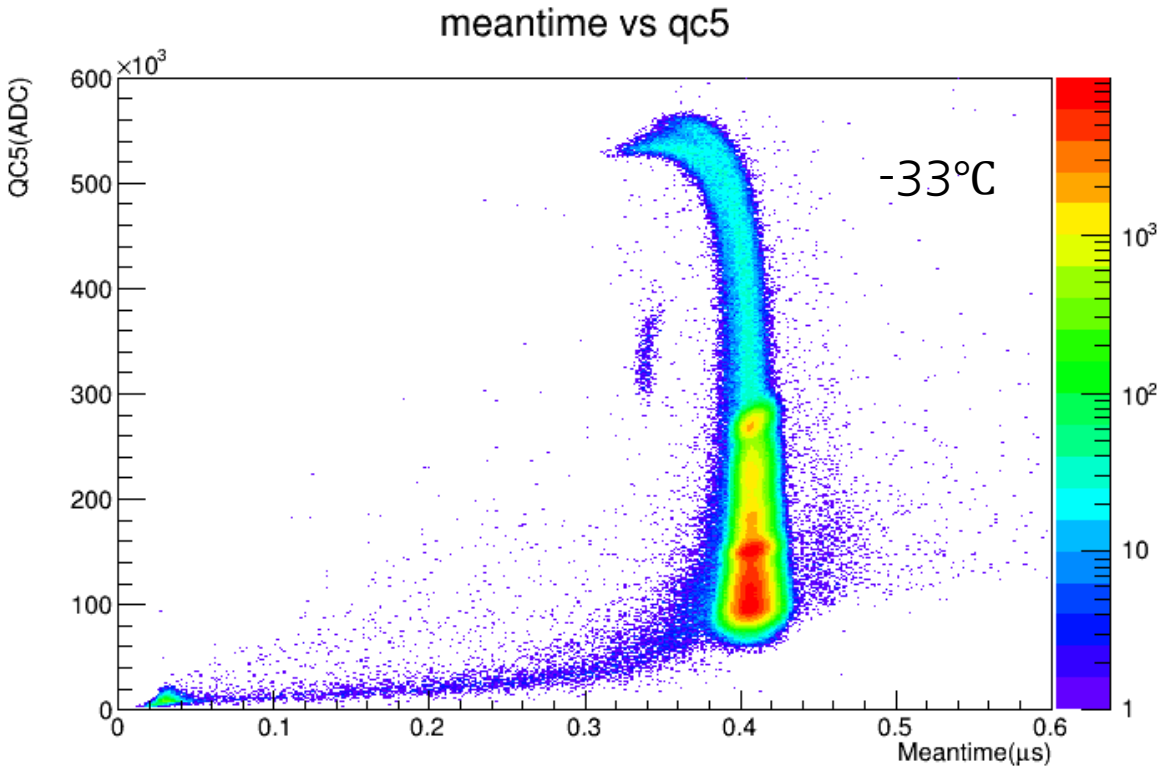
- NaI-031(SICCAS)
  - diameter : 75mm, height : 75mm
  - Weight(expected) : $1.2 \pm 0.12$ kg
  - Alpha Activity : $0.73 \pm 0.16$ mBq/kg
- PMT(SIDE A) : FA0056
- PMT(SIDE B) : FA0158

# Experiment Setup

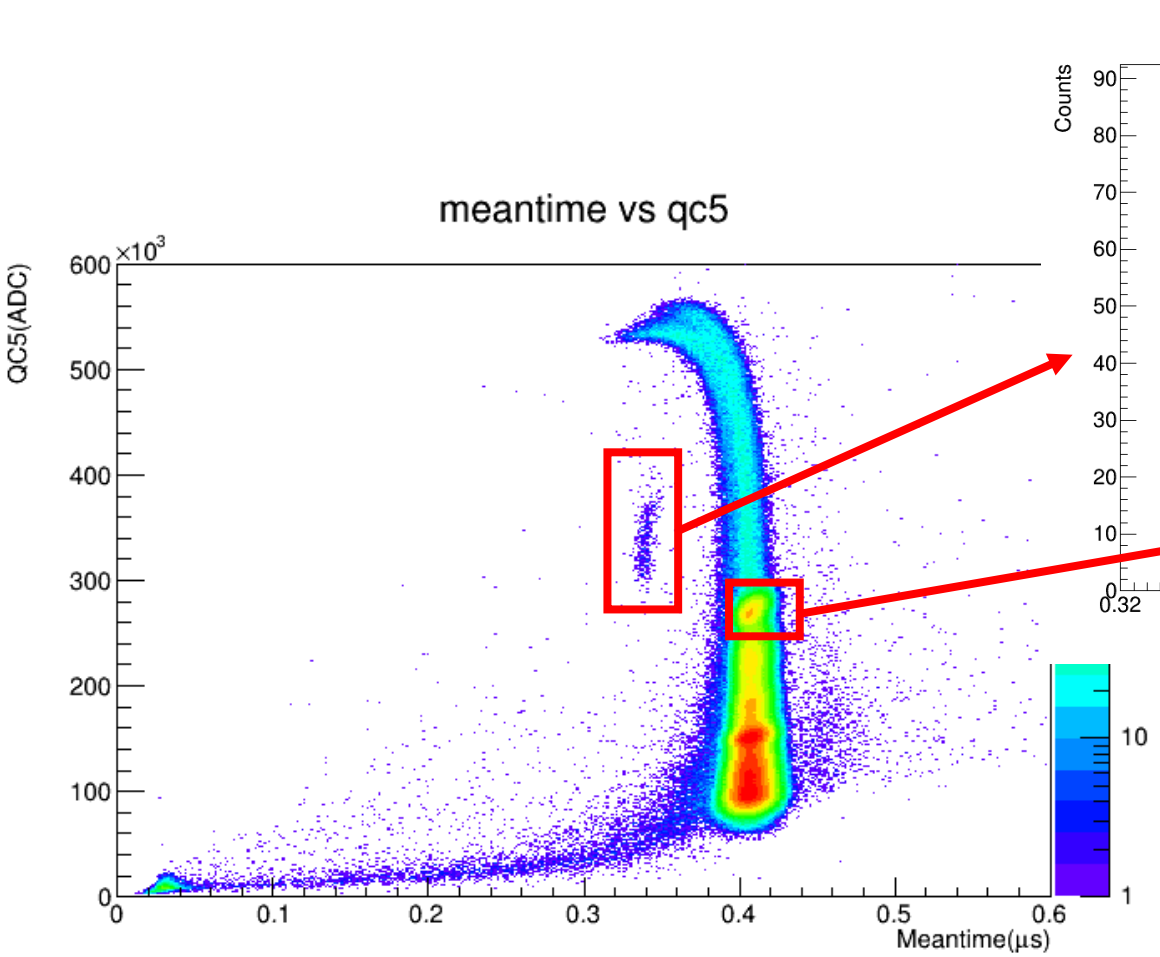
# PSD(alpha, gamma)

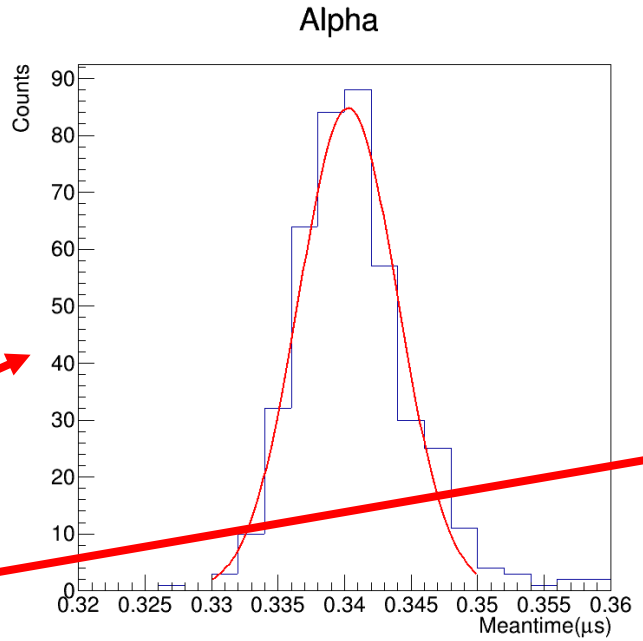


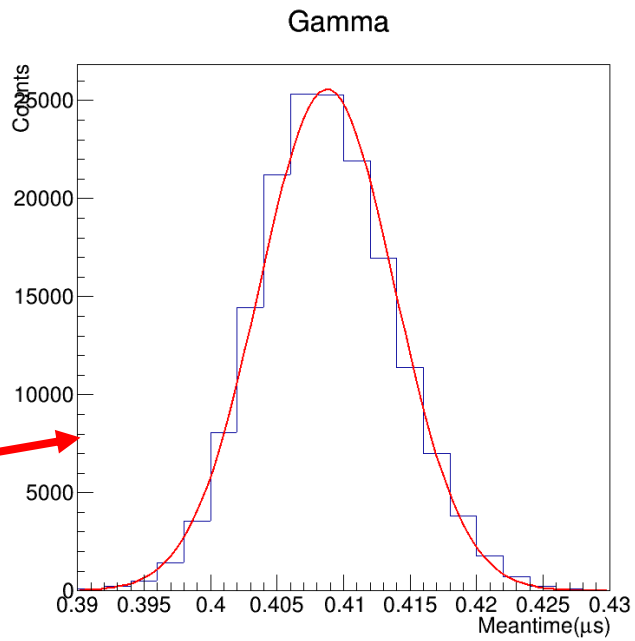




- integration[start to 1.5us] meantime vs adc sum[start to 5us]

# PSD(alpha, gamma)



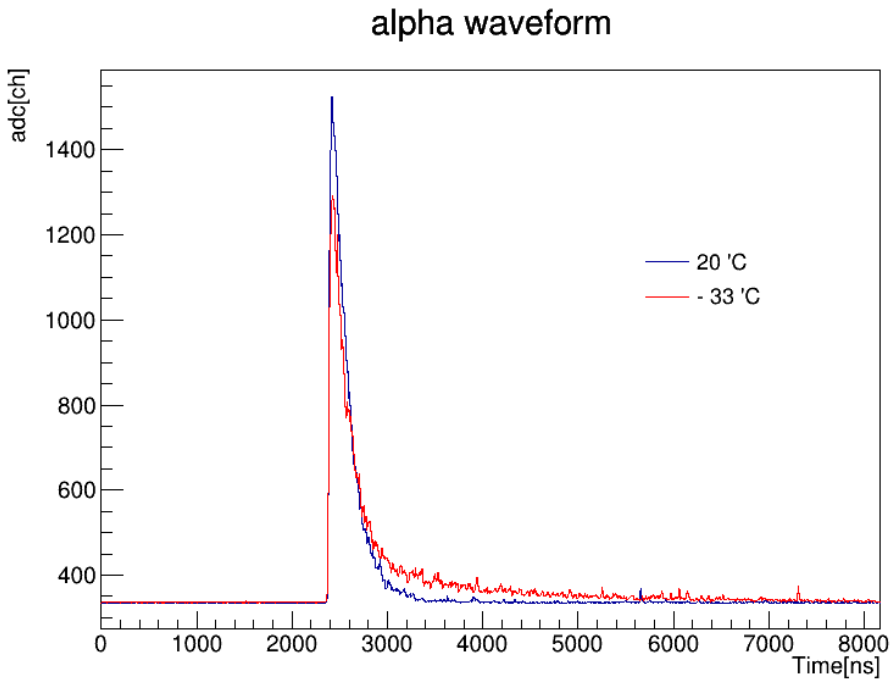



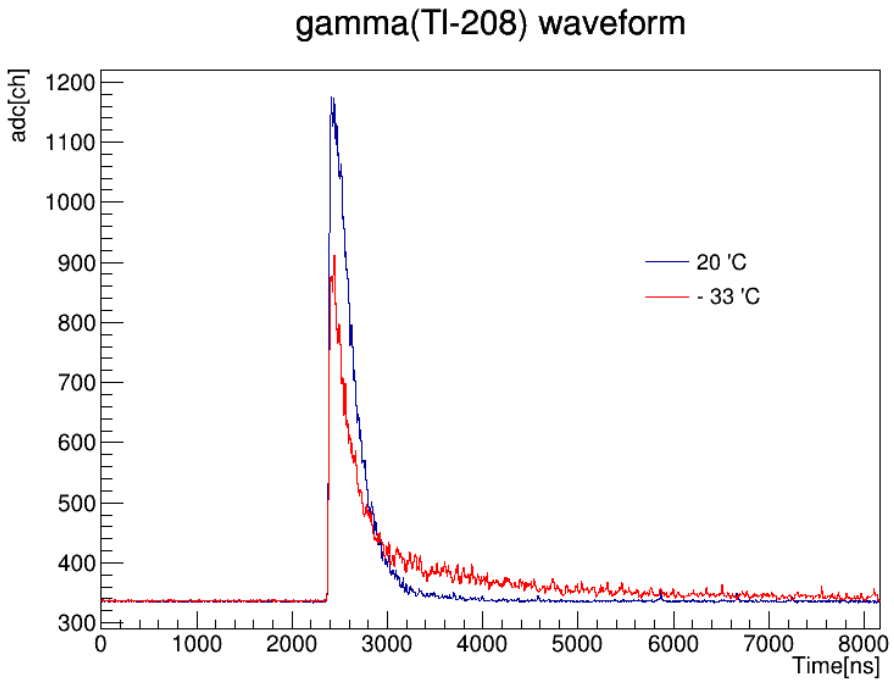




- FoM formula :

$$\frac{Mean_{gamma} - Mean_{alpha}}{\sqrt{{\sigma_{alpha}}^2 + {\sigma_{gamma}}^2}}$$

# PSD(alpha, gamma)




- height at room temperature is higher than height at low temperature
- wave decay time at room temperature is faster than wave decay time at low temperature

# PSD(alpha, gamma) using FoM result

| temp | FoM of PSD(alpha, gamma) | | |
|---|---|---|---|
| | Integration meantime [start to 1us] | Integration meantime [start to 1.5us] | Integration meantime [start to 2us] |
| 20℃ | 5.82±0.26 | 6.06±0.27 | 5.53±0.32 |
| -33℃ | 6.03±0.25 | 7.76±0.36 | 6.92±0.34 |

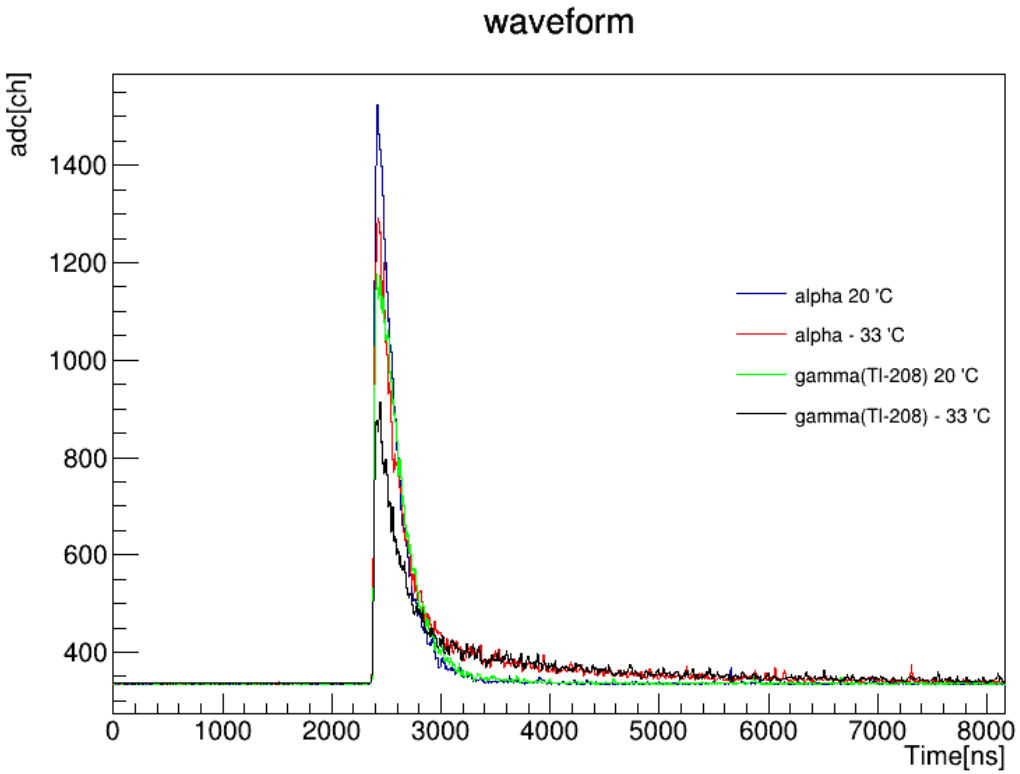
- PSD power at low temperature is better than PSD power at room temperature
- Using integration[start to 1.5us] for PSD is better than using other variables

# Conclusion

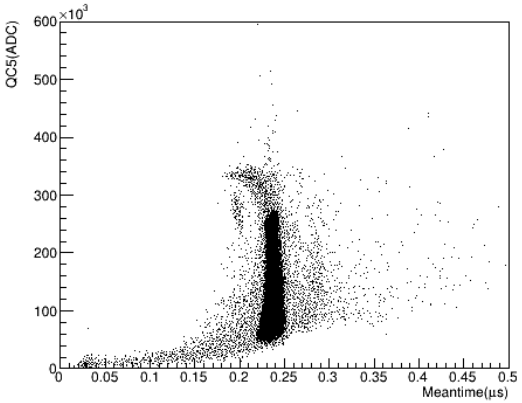
- PSD power at low temperature is better than PSD power at room temperature
- Using nmt1500 for PSD is better than using other variables
- Need to measure at various temperature(0~-33℃)

# Back up

# PSD(alpha, gamma)



# PSD(alpha, gamma) using FoM(nmt1000)



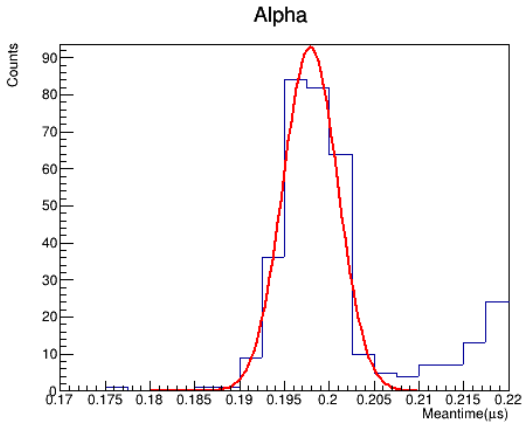

alpah mean : 0.197879 +- 0.000181

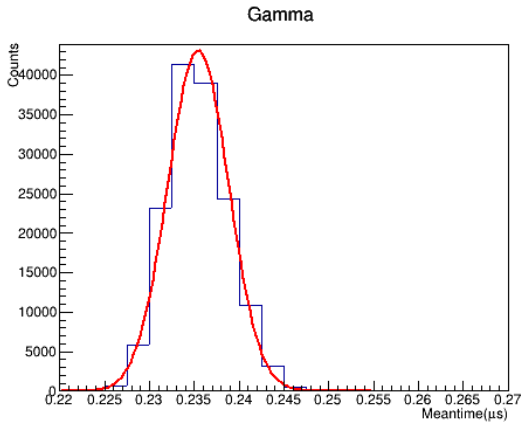
alpah sig : 0.003046 +- 0.000136

gamma mean : 0.235417 +- 0.000009

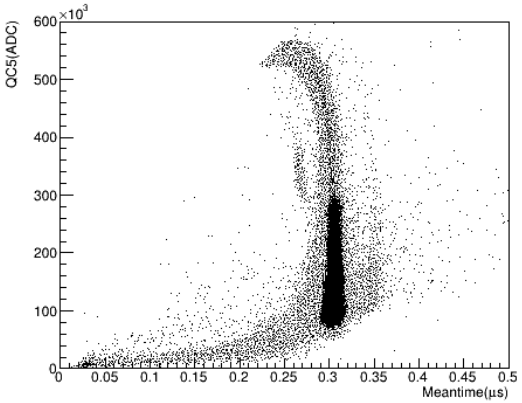
gamma sig : 0.003398 +- 0.000006

FOM : 5.826073+-0.260485




20℃



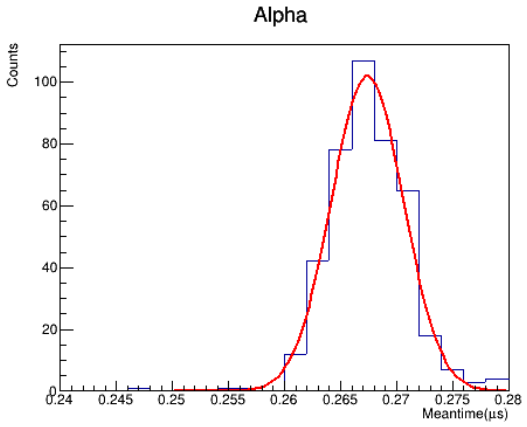

alpah mean : 0.267395 +- 0.000164

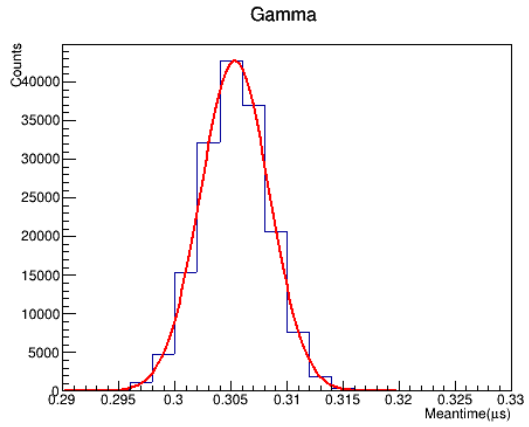
alpah sig : 0.003222 +- 0.000136

gamma mean : 0.305341 +- 0.000008

gamma sig : 0.003061 +- 0.000006

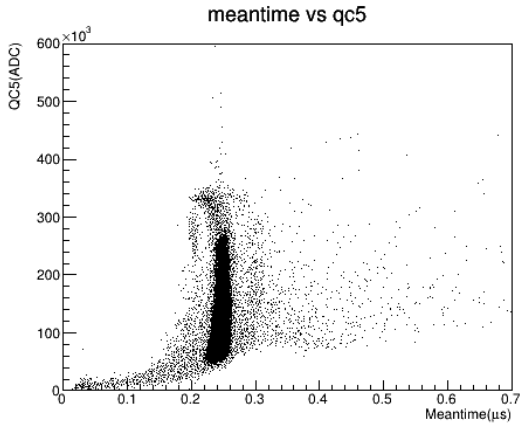
FOM : 6.038887 +- 0.254002




-33℃

# PSD(alpha, gamma) using FoM(nmt1500)



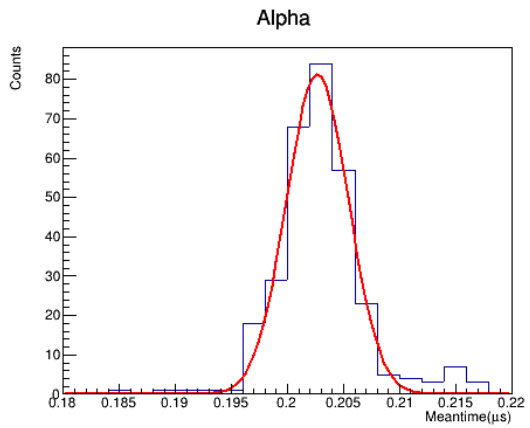

alpah mean : 0.202668 +- 0.000127

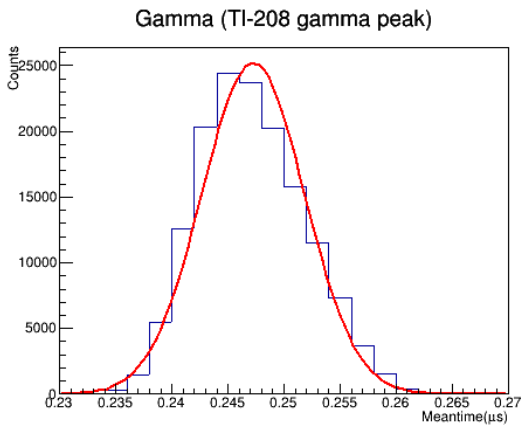
alpah sig : 0.002770 +- 0.000127

gamma mean : 0.247244 +- 0.000013

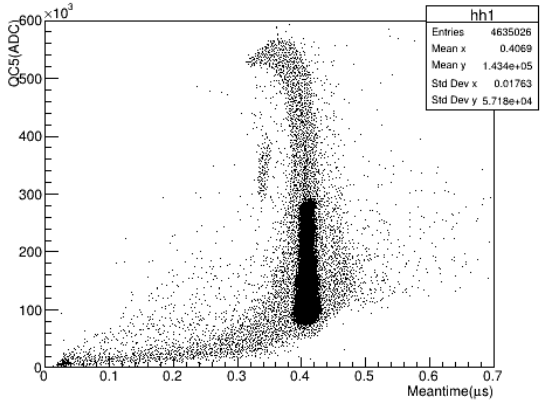
gamma sig : 0.004581 +- 0.000008

**FOM : 6.064244 +- 0.278469**




20℃



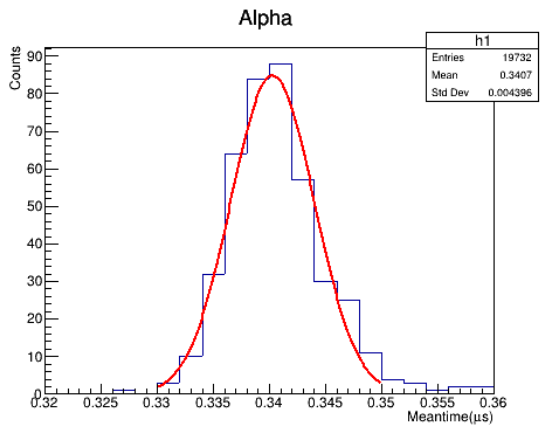

alpah mean : 0.340270 +- 0.000174

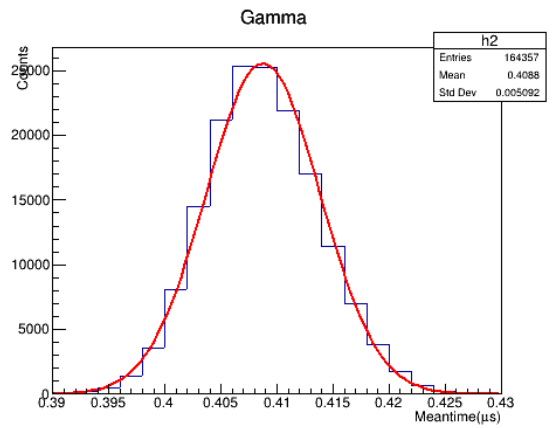
alpah sig : 0.003725 +- 0.000174

gamma mean : 0.408756 +- 0.000013

gamma sig : 0.005090 +- 0.000009

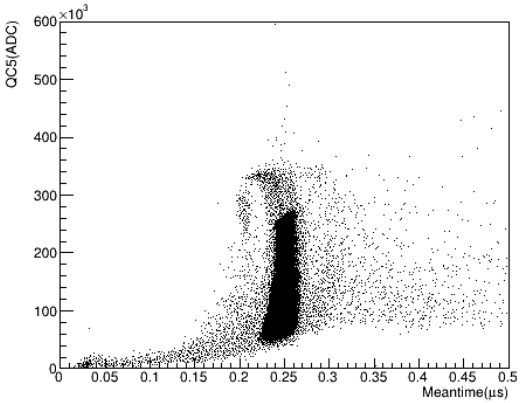
**FOM : 7.769529 +- 0.363386**




-33℃

# PSD(alpha, gamma) using FoM(nmt2000)



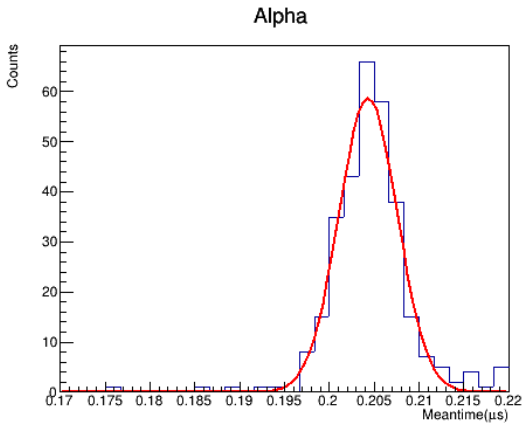

alpah mean : 0.204319 +- 0.000199

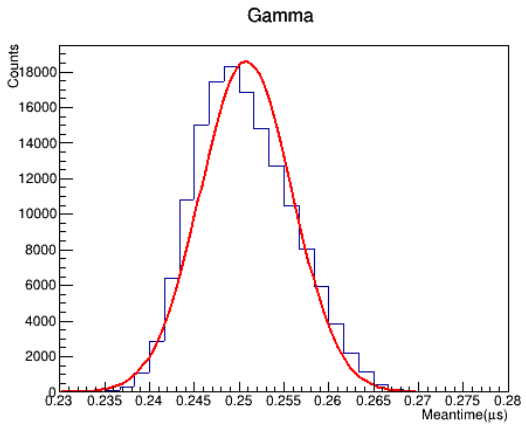
alpah sig : 0.003272 +- 0.000193

gamma mean : 0.250776 +- 0.000016

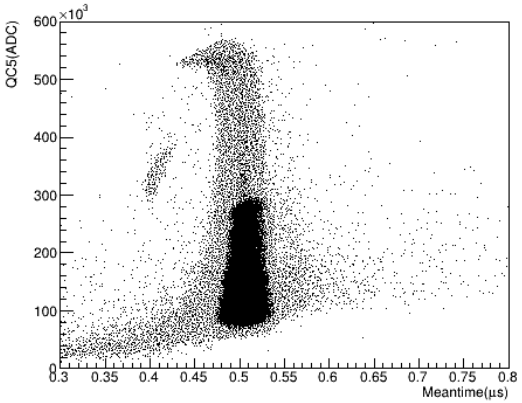
gamma sig : 0.005129 +- 0.000009

**FOM : 5.530450 +- 0.325797**




20℃



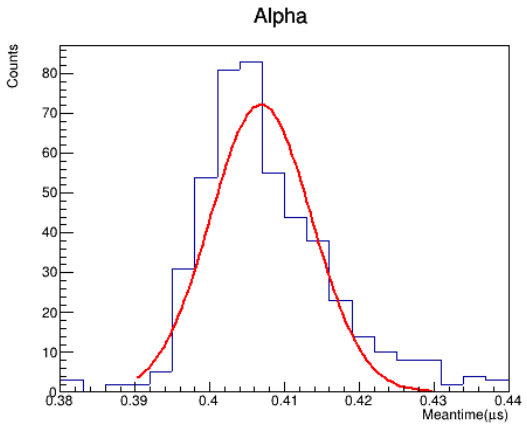

alpah mean : 0.406847 +- 0.000454

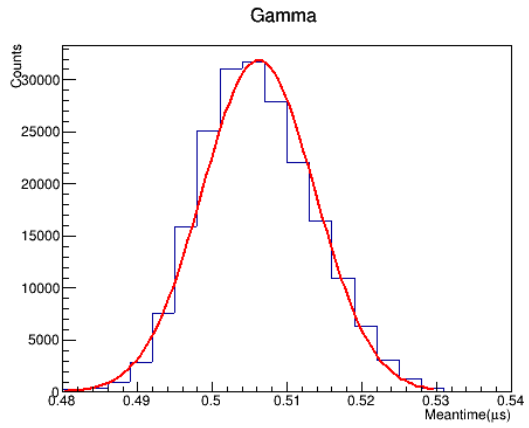
alpah sig : 0.006778 +- 0.000338

gamma mean : 0.506186 +- 0.000018

gamma sig : 0.007562 +- 0.000012

**FOM : 6.927470 +- 0.345396**




-33℃