Status Report

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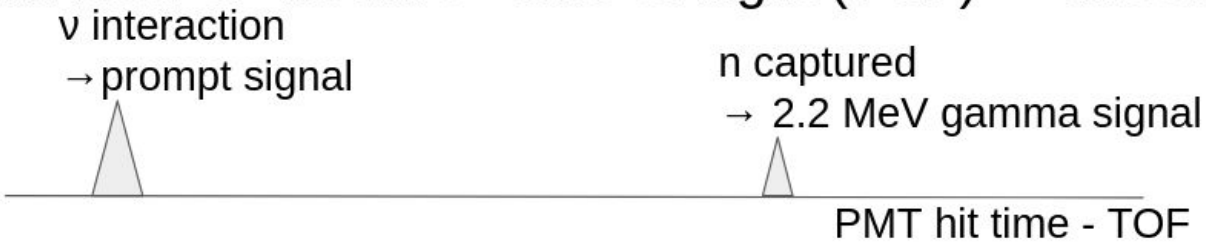
mPMT-Japan meeting

Updates

- n-tagging
  - Implementation of N10 search (ongoing)

N10 method

- Search candidates which satisfy # of hit PMTs in 10 ns time window of “hit time - time of flight (TOF)” > threshold

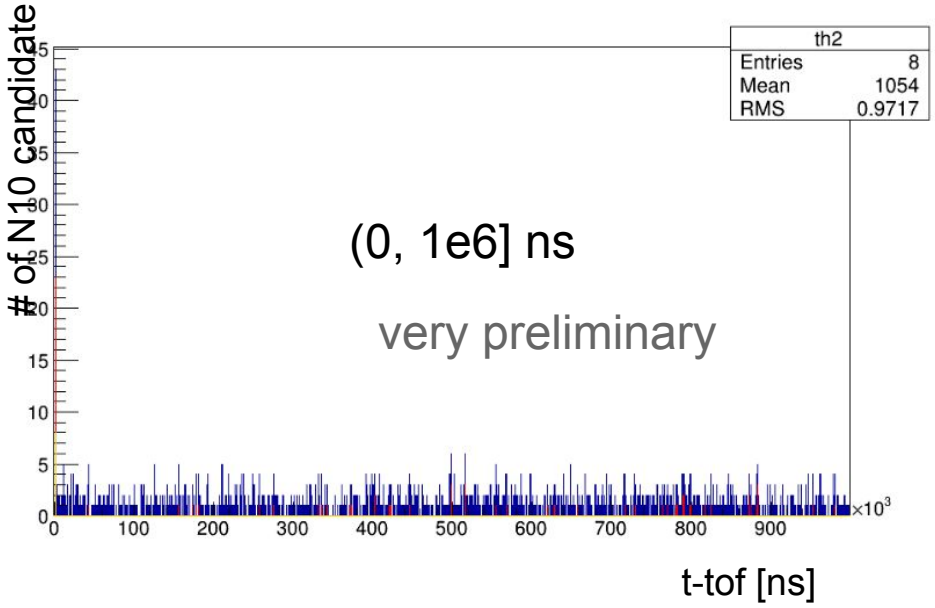


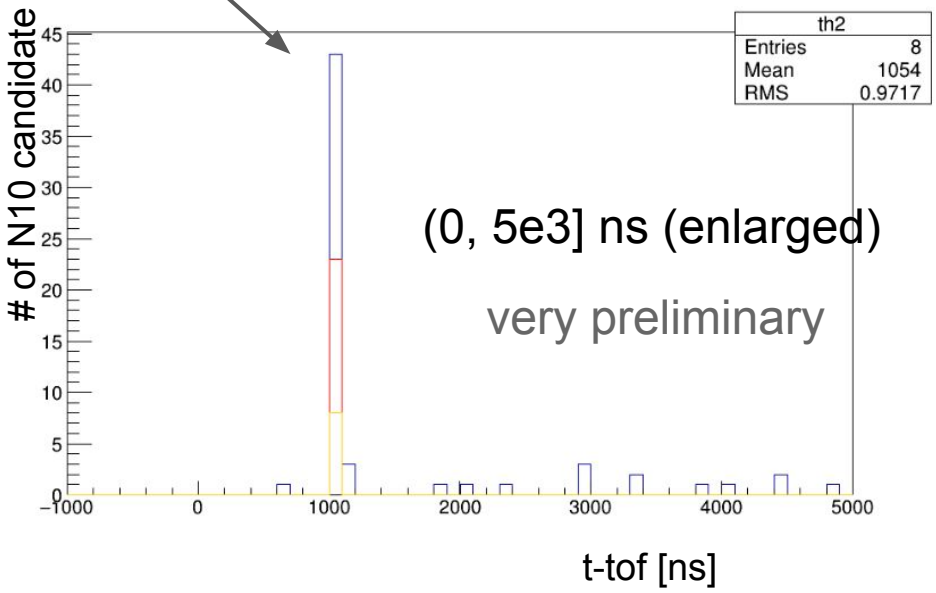
MC

- 2.2 MeV gamma ray at 1,000 ns
- Detector:
  - B&L 20,000 (DR = 4.2kHz)
  - mPMT 10,000 (DR of 3inch PMT = 100Hz)
- Generated the dark hits in (-1e3, 1e6) ns

N10 trigger time

- Ran the code with 10 events (MC)
- Changed threshold of N10 threshold
  - 5 (blue), 7 (red), 10 (orange)
- 2.2 MeV signal is tagged
  - Some events are counted by twice or more times
- Continue investigation
  - Dependencies of threshold, etc.





Todo

- Check the N10 candidate search in larger stats.
  - Check the dependency of the threshold, the dark rate, # of PMTs
- Implement other variables for multi-variable analysis

Backup

Neutron tagging

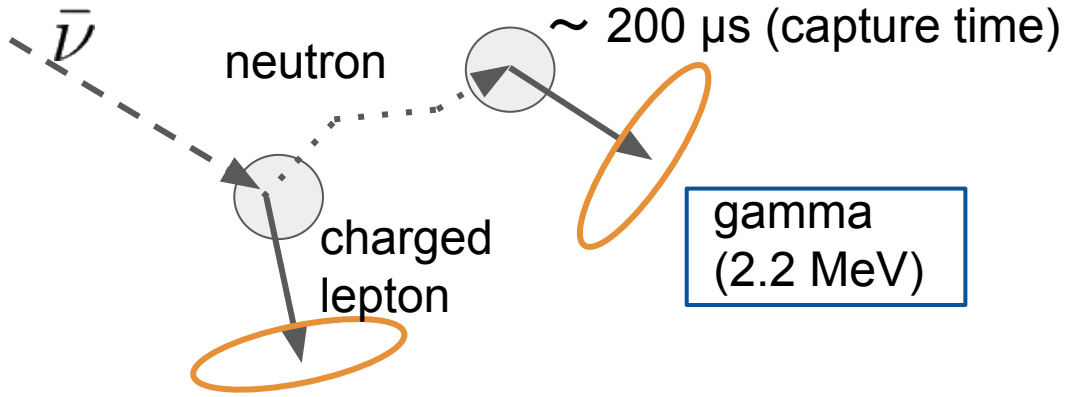
- Charged current quasi-elastic scattering

$$\bar{\nu}_{e/\mu} + p \rightarrow e^+/\mu^+ + n \qquad \nu_{e/\mu} + n \rightarrow e^-/\mu^- + p$$

  - In case of $\bar{\nu}$, a neutron is generated
  - Generated neutron will be captured by hydrogen nuclear
  - Emits 2.2 MeV gamma-ray

→We can tag $\bar{\nu}$ by 2.2 MeV gamma-ray

- Neutron tagging (n-tagging) → useful for $\nu/\bar{\nu}$ identification
  - Reduce other neutrinos background
  - → Effective for DSNB, proton decay search etc.



2.2 MeV gamma-ray signal

- Generated 10,000 events of 2.2 MeV gamma-ray
- Distribution of total # of hit PMTs in one event
  → Expected hits:
  - 50cm PMT: ∼ 6 hits
  - mPMT: ∼ 1 - 2 hit