MC Study of Muon Decays in KM3NeT

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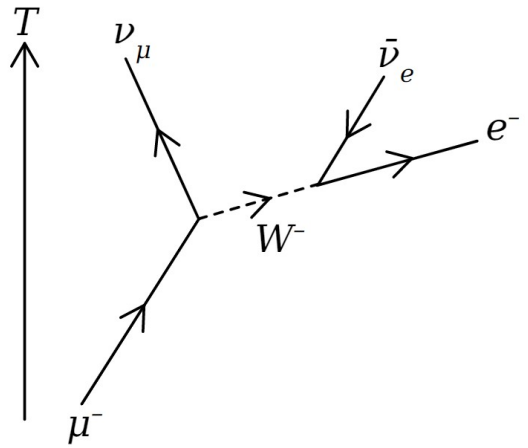
Muon Decays

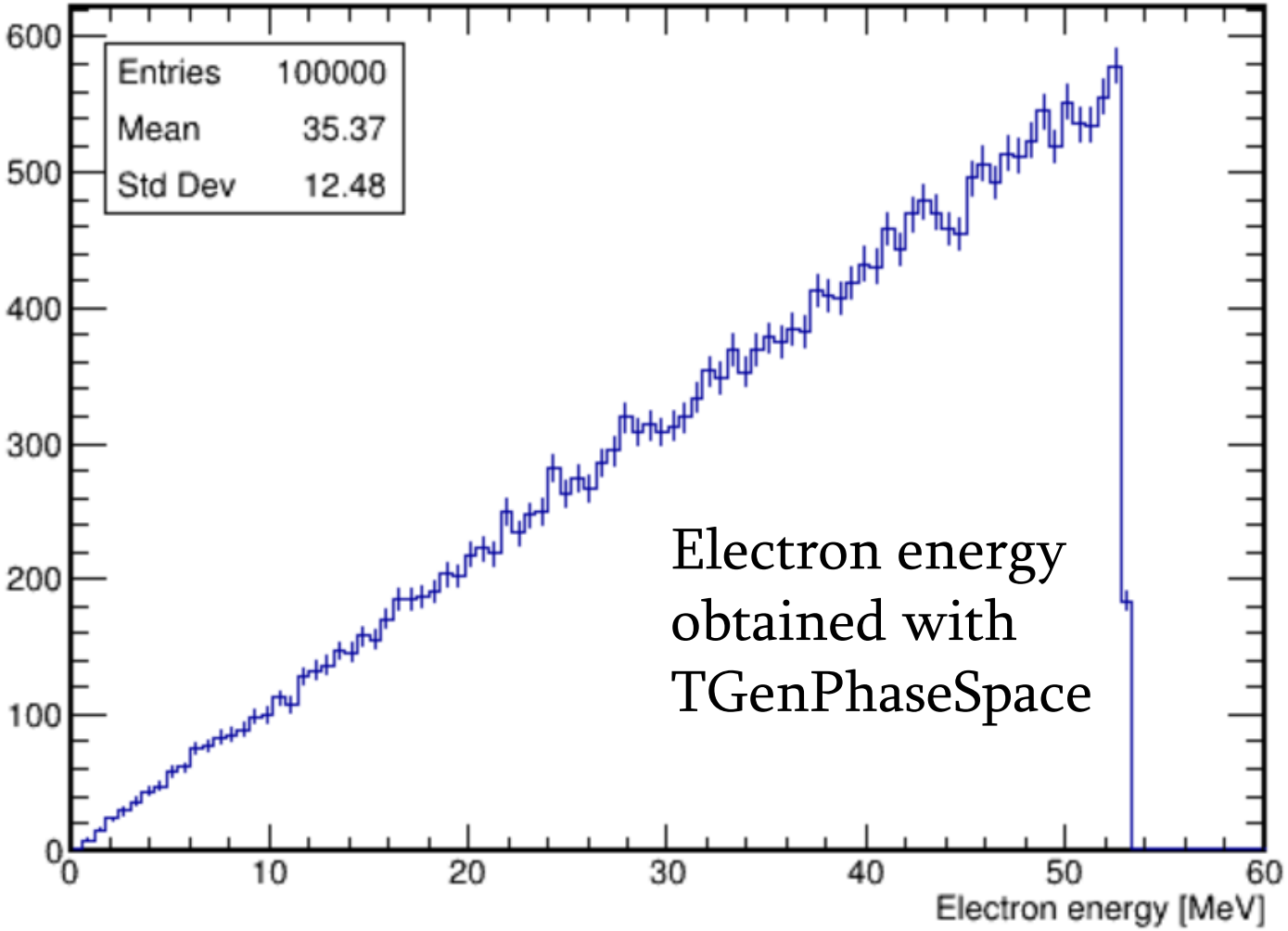


$$\mu \rightarrow e + \nu_\mu + \nu_e \qquad 100\%$$

$m_\mu = 105.6583745 \pm 0.0000024$ MeV

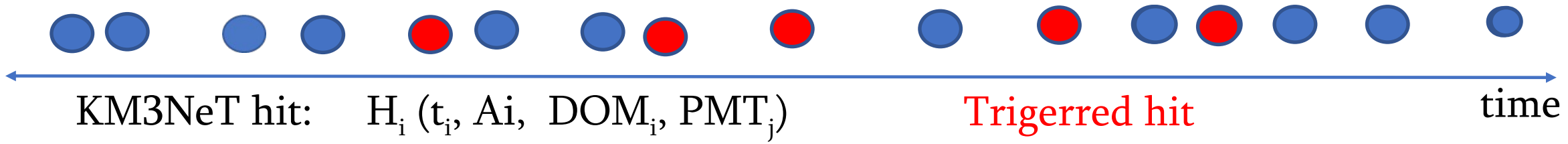
$\tau_\mu = (2.1969811 \pm 0.0000022)$ μsec

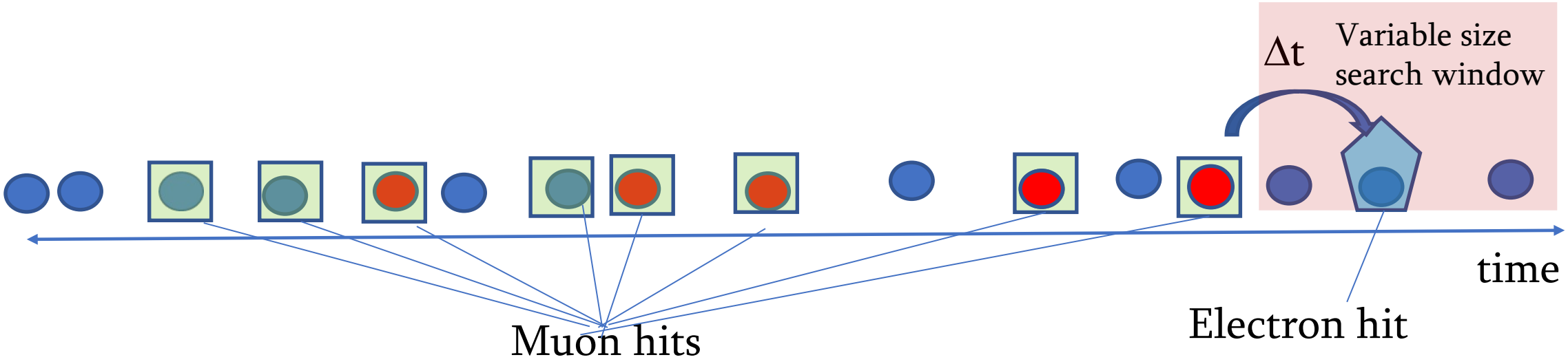
$\tau_{\mu+}/\tau_{\mu-} = 1.00002 \pm 0.00008$



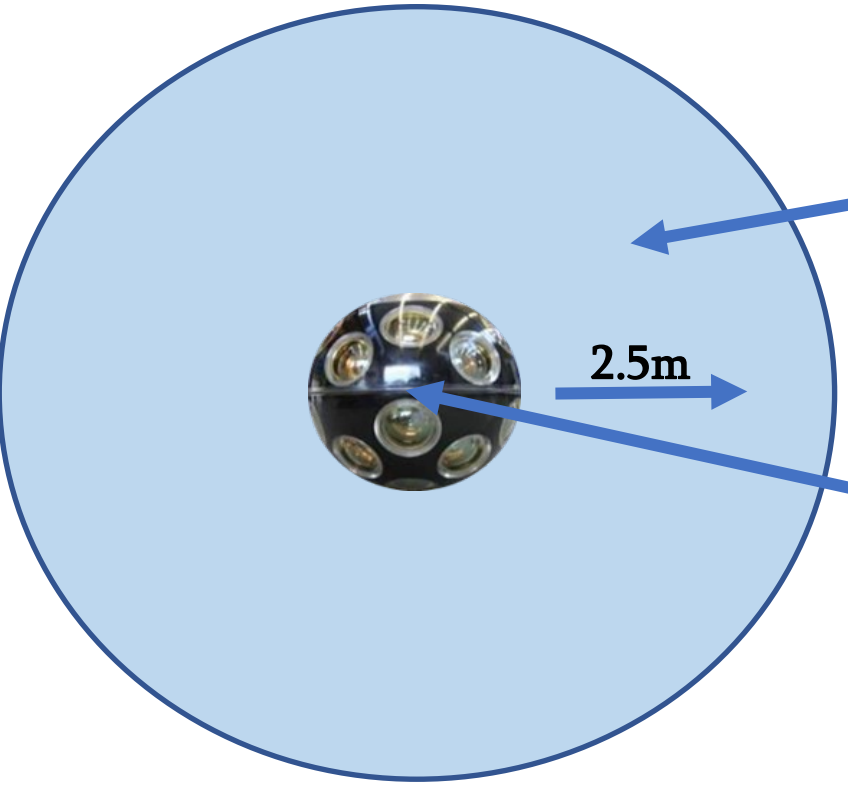
KM3NeT Event

KM3NeT events is a collection of the hits (PMT signals) in the selected time interval





Simulations with ROOT and KM3Sim



$\mu \rightarrow e + \nu_\mu + \nu_e$

$1x10^5$ muon decays with ROOT TGenPhaseSpace

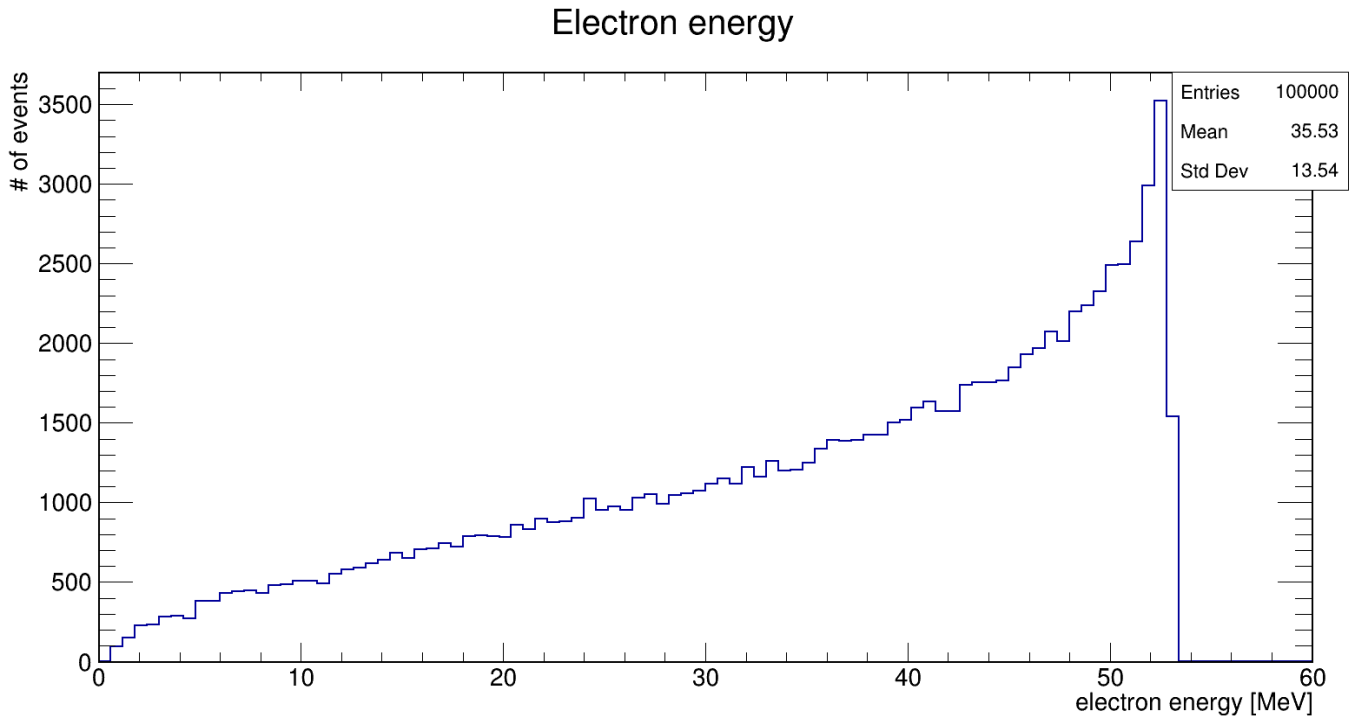
```
start_event: 1 1
track_in:   1    431.289 583.66 188.463 0.134057 0.761815 0.437741 0.0512832  0.000000 3
end_event:
start_event: 2 1
track_in:   1    429.864 582.397 189.867 0.977938 0.839597 0.970802 0.0453897  0.000000 3
end_event:
```

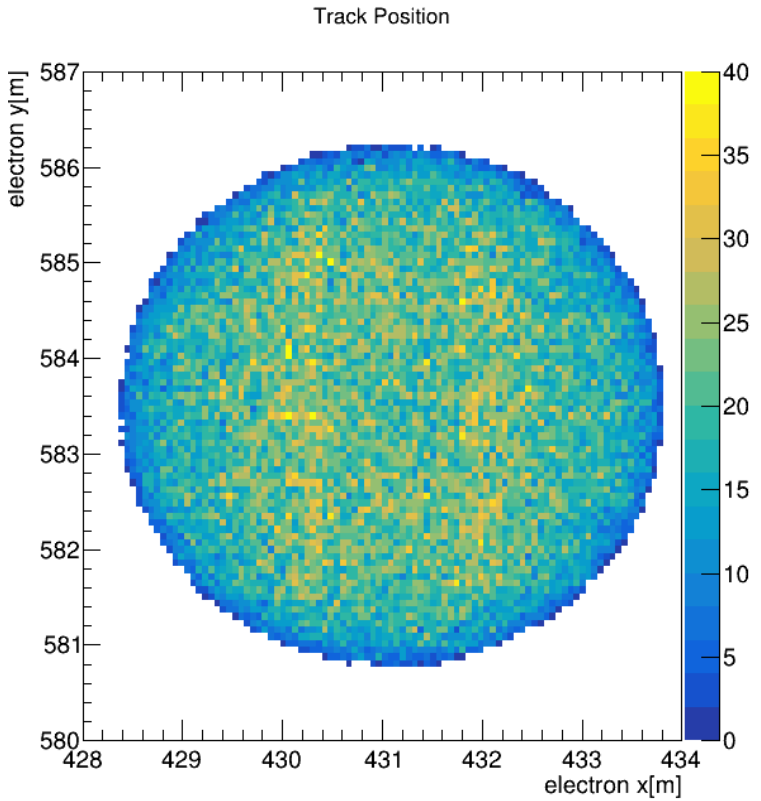
Light & Detector (single DOM) simulations with KM3Sim

Hits from Michel electron

Muon decay MC

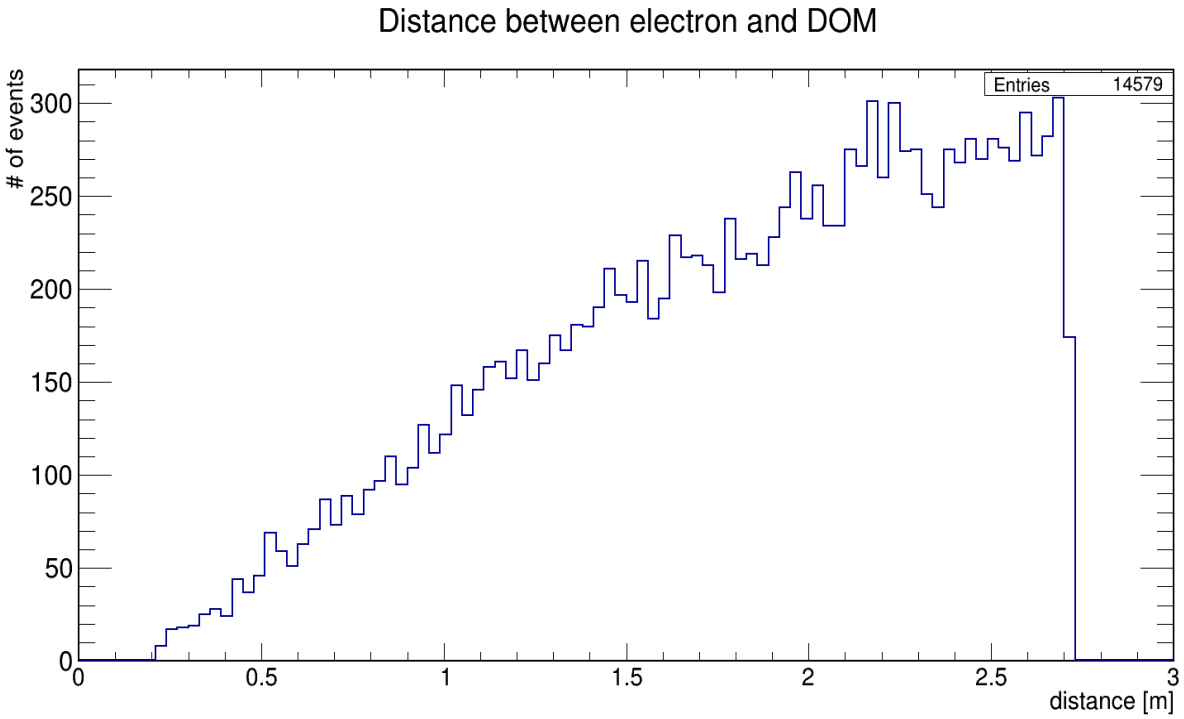
- 1x10^5 muon decays MC is done using ROOT TGenPhaseSpace
- Michel electrons are distributed uniformly around a single DOM, inside 2.7 meters hollow sphere

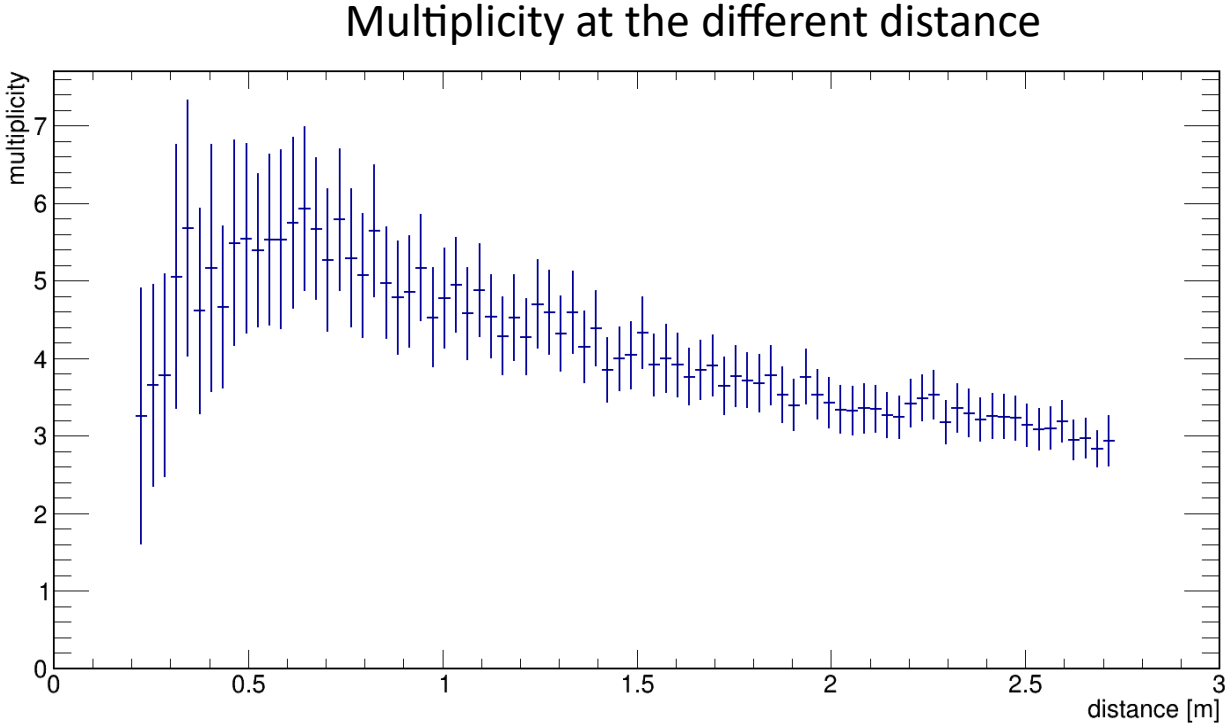




Michel electron MC

- Michel electron propagation and light are simulated with KM3Sim





Michel electron MC

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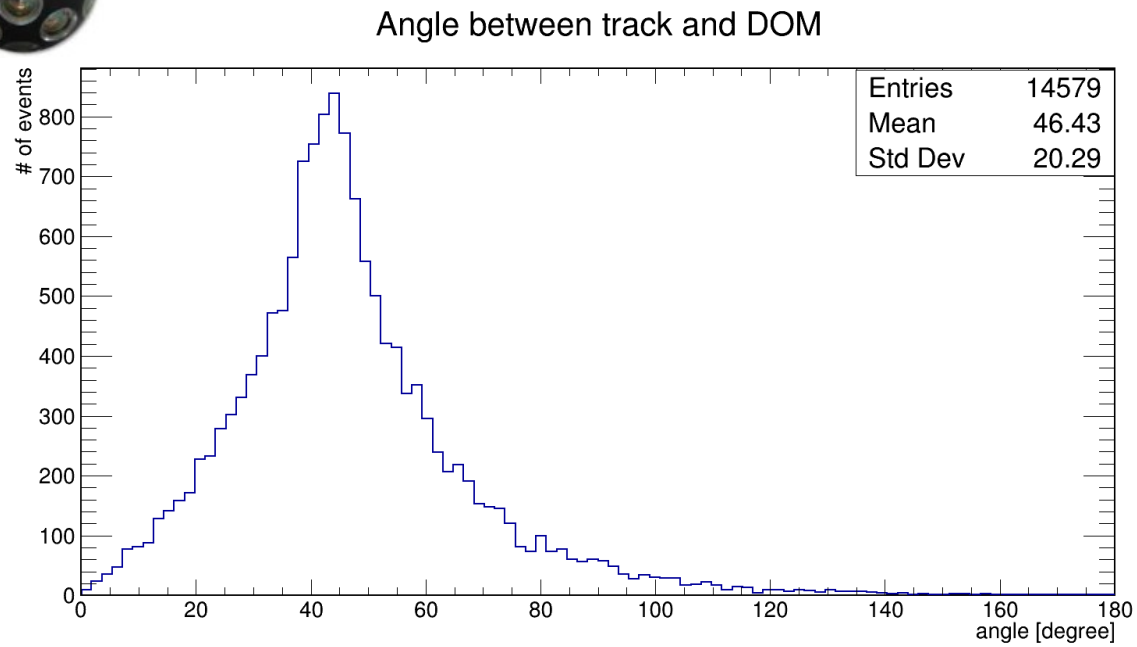
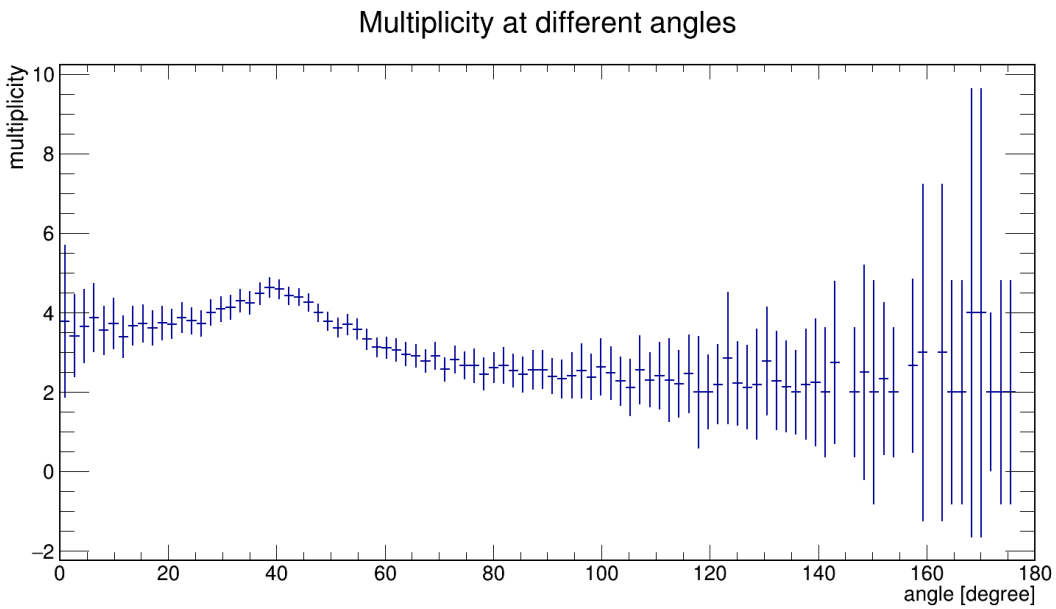
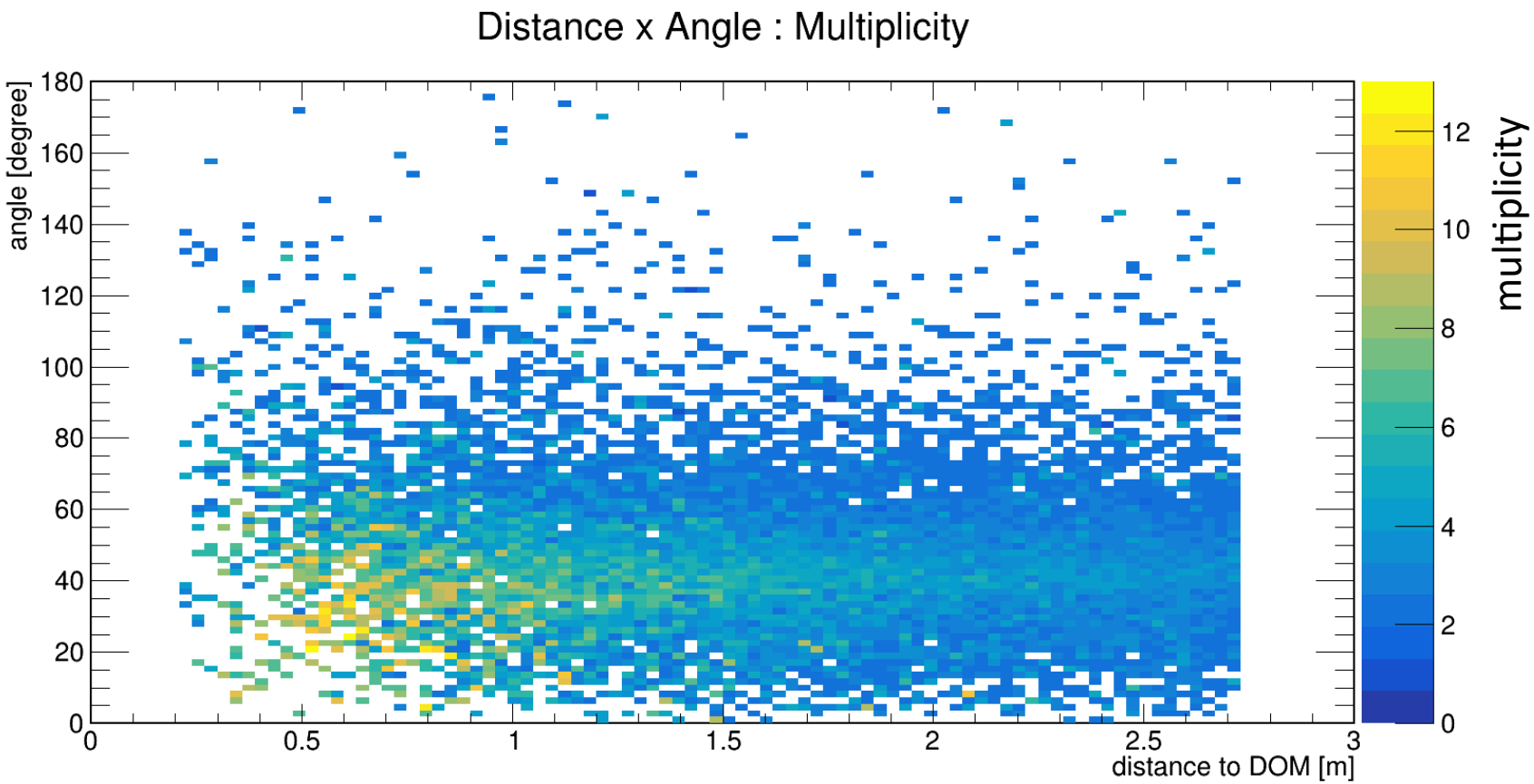


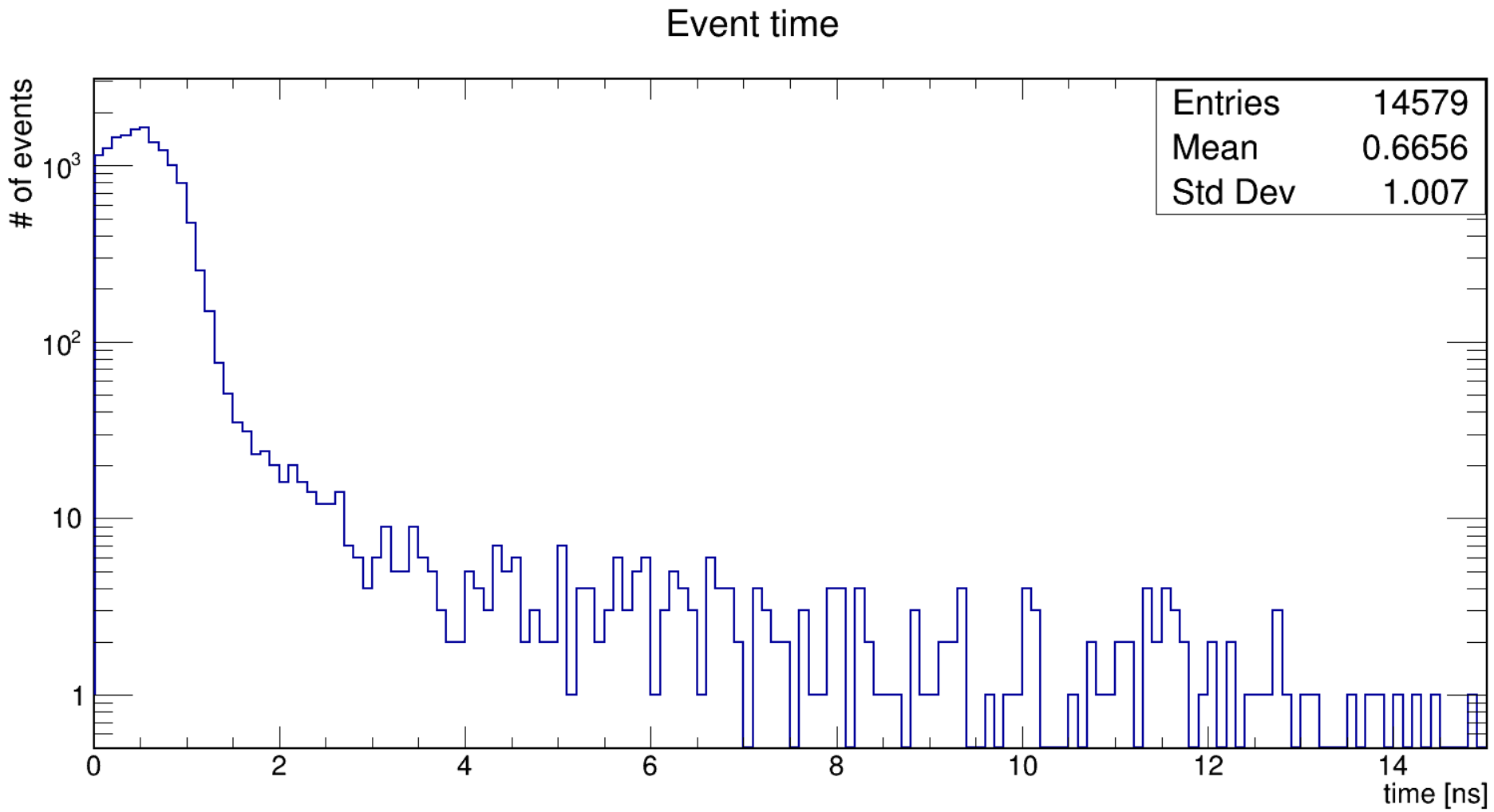


Michel electron MC



Event duration

Δt=Last hit time – First hit time



Summary and Outlook

- Signals from Michel electrons were studied with ROOT TGenPhaseSpace and KM3Sim for d<2.5m, where d is a distance between decay point and DOM
- Dependance of Michel electron signal were studied vs distance from the DOM and angle between electron and DOM
- Overall efficiency for detecting two or more hits is about 15%
- Most of the electron hit time are within $\Delta t=10ns$
- Selection of muon decay candidates in ORCA6 data
- Study of background conditions in the KM3NeT DOMs