Update on Muon Decays in KM3NeT/ORCA

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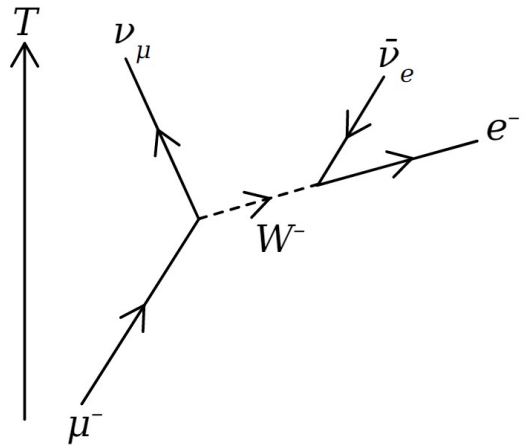
Muon Decays

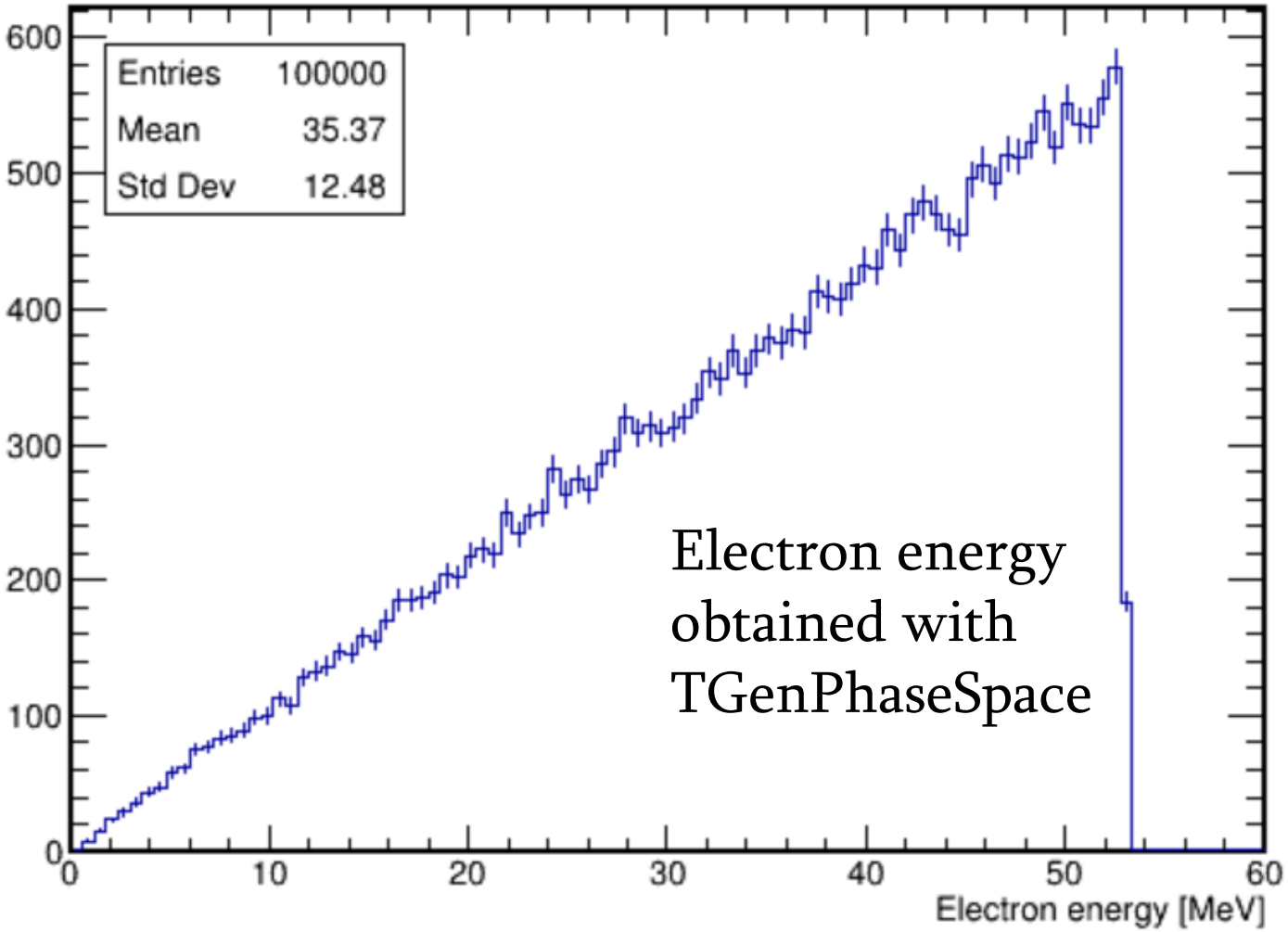


$$\mu \rightarrow e + \nu_\mu + \nu_e \qquad 100\%$$

$m_\mu = 105.6583745 \pm 0.0000024$ MeV

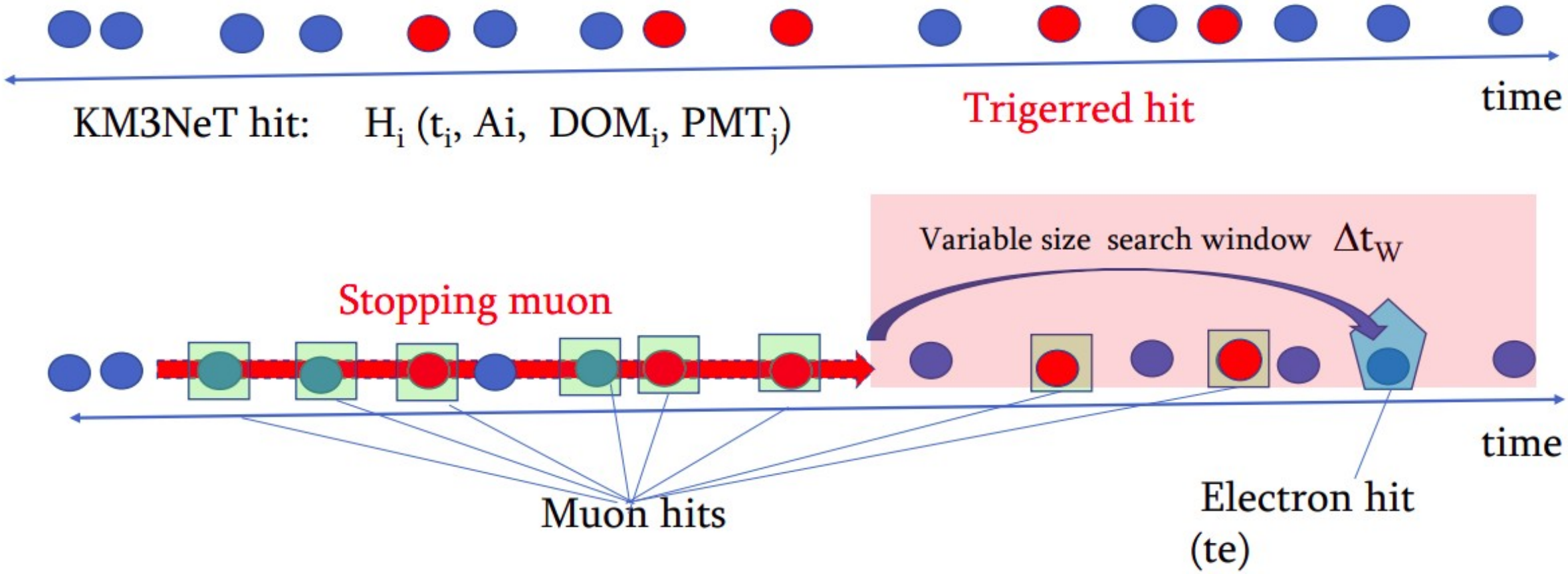
$\tau_\mu = (2.1969811 \pm 0.0000022)$ μsec

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

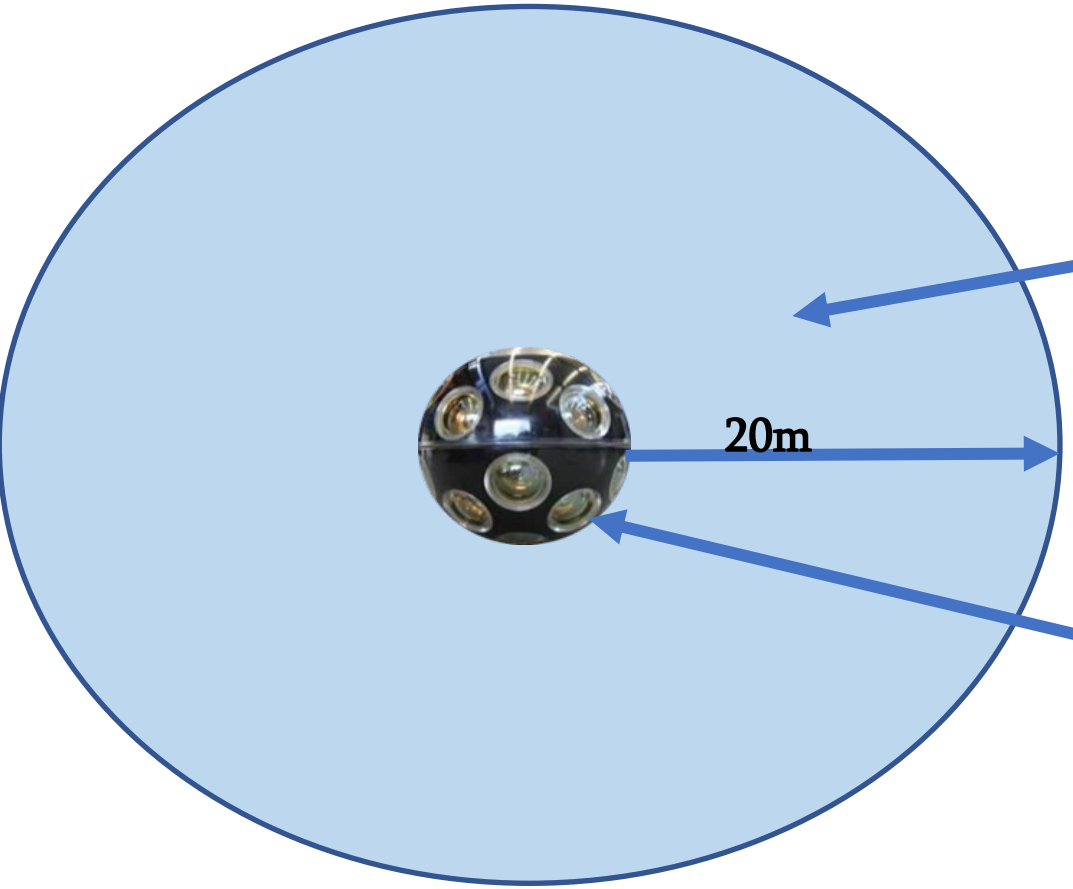


KM3NeT Event

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



Simulations with ROOT and KM3Sim



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

5x10^6 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

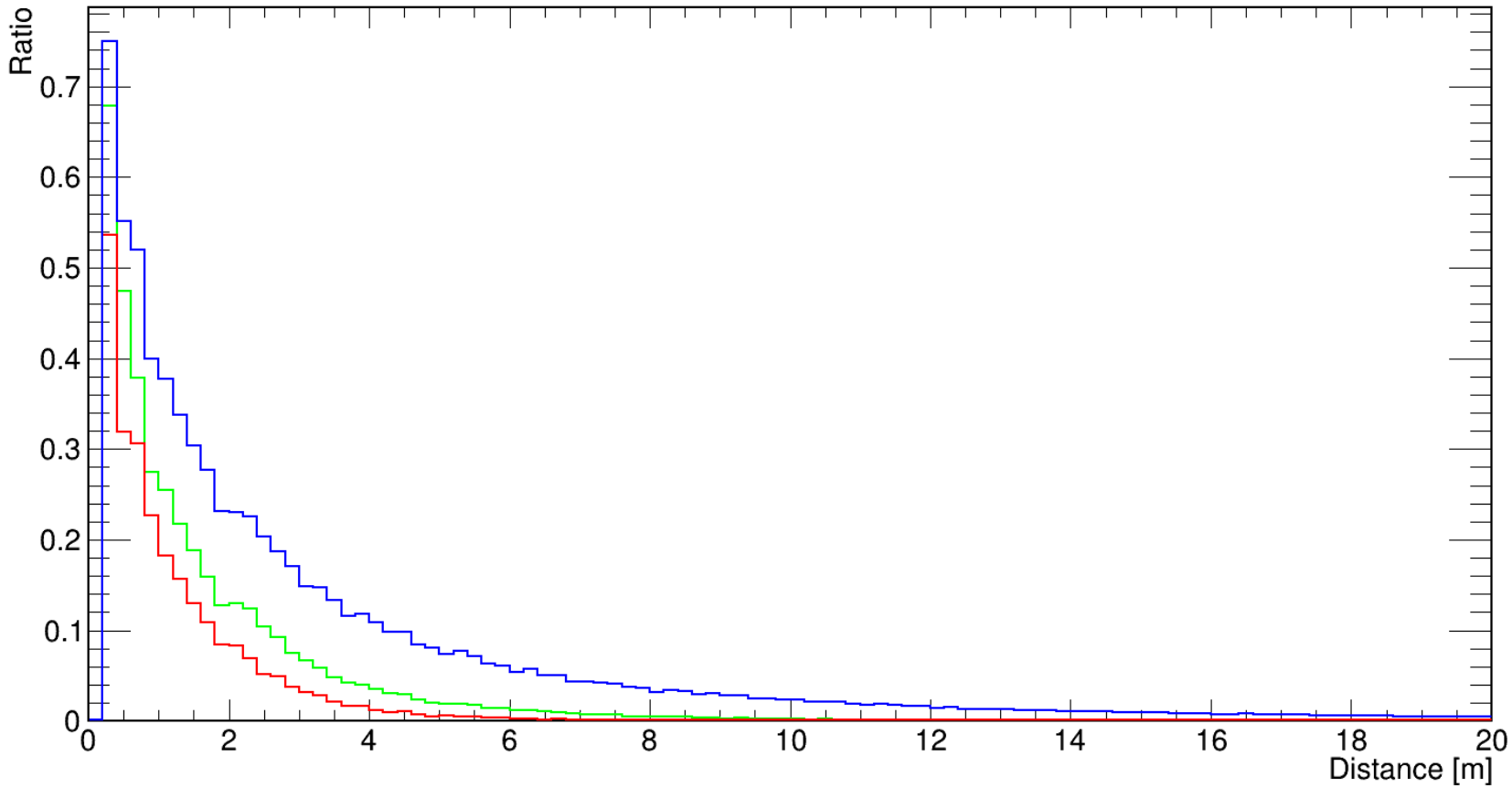
Hits from Michel electron

Michel electron MC

$$Ratio = \frac{number\ of\ envents\ with\ multiplicity > m}{number\ of\ all\ events}$$

m=0,1,2

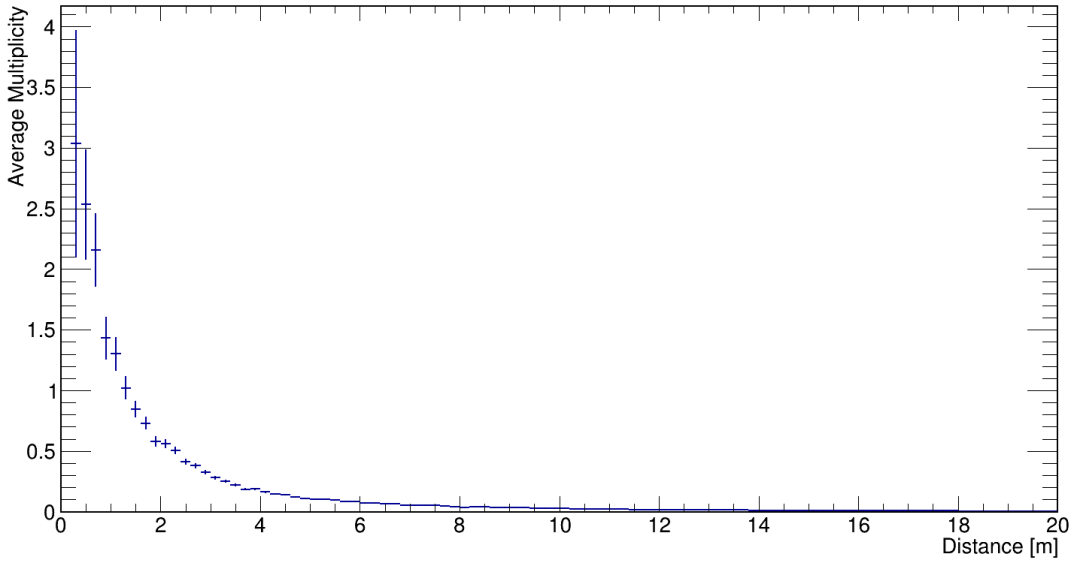
Multiplicity at the different distances



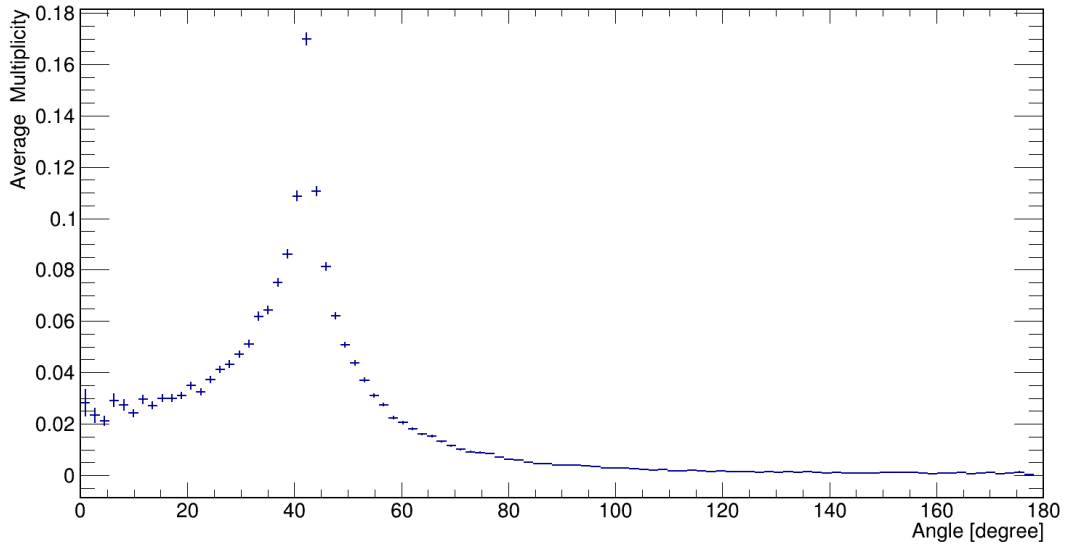
Michel electron MC

- Michel electron propagation and light are simulated with KM3Sim

Average Multiplicity at the different distances

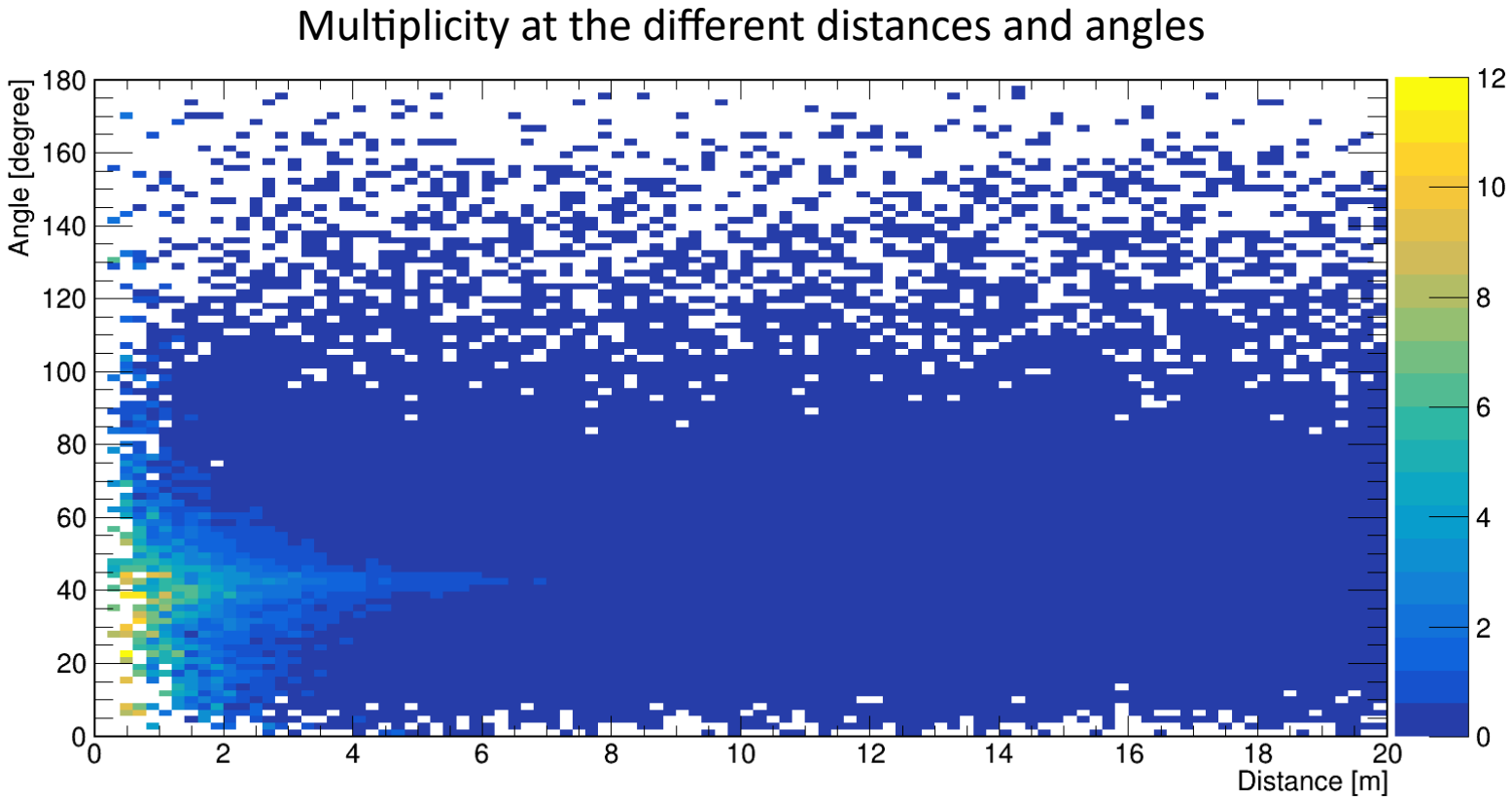


Average Multiplicity at the different angles

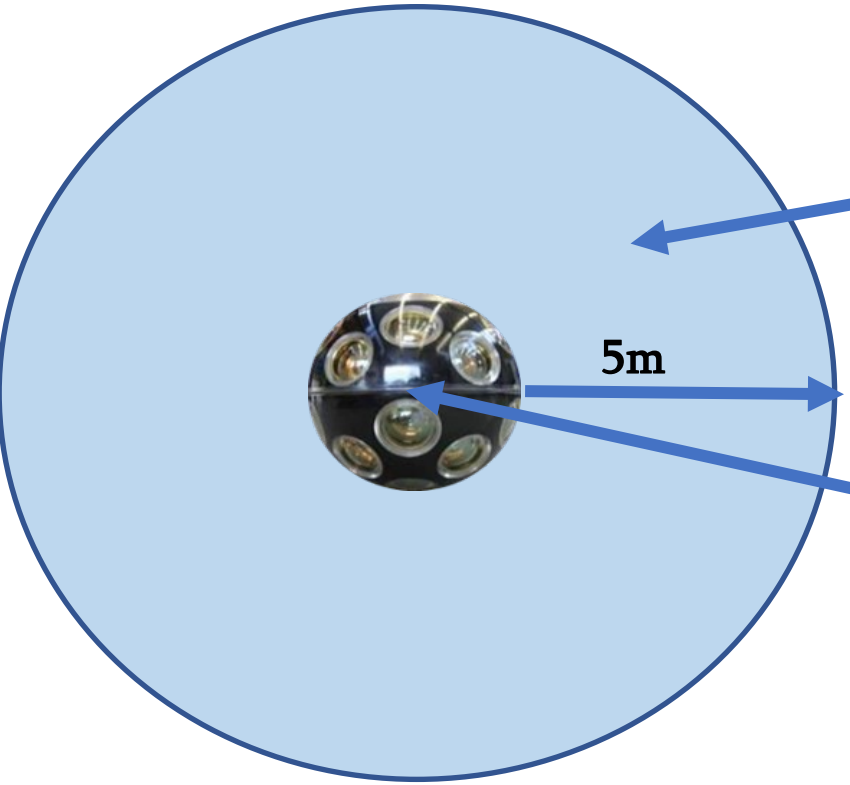


Michel electron MC

- Michel electron propagation and light are simulated with KM3Sim



Simulations with ROOT and KM3Sim



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

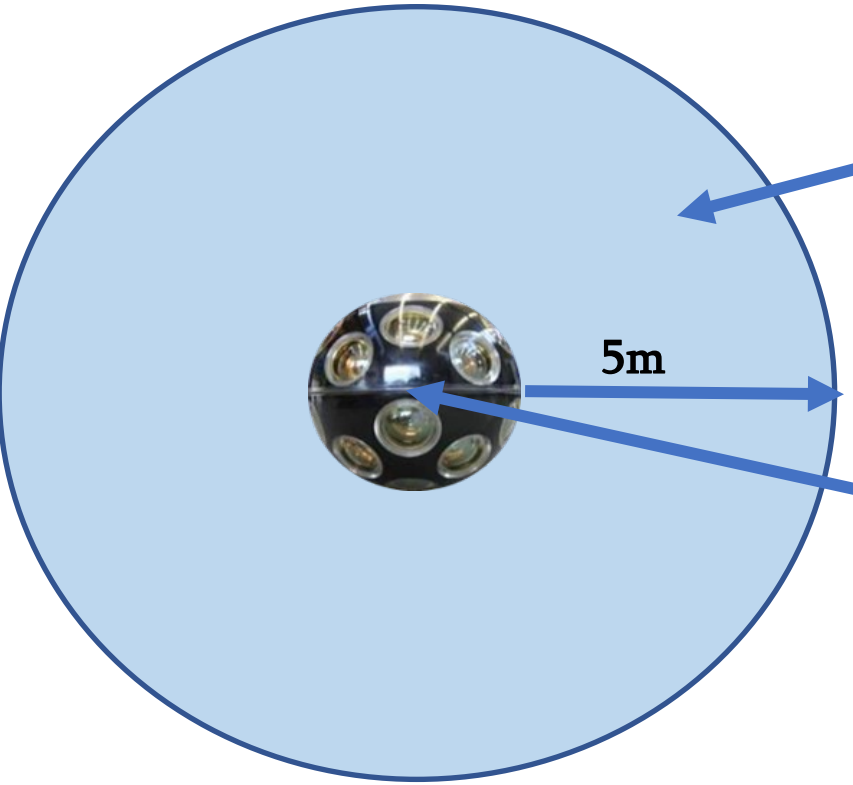
$1x10^6$ muon decays with ROOT TGenPhaseSpace

```
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

μ Decay Simulations KM3Sim



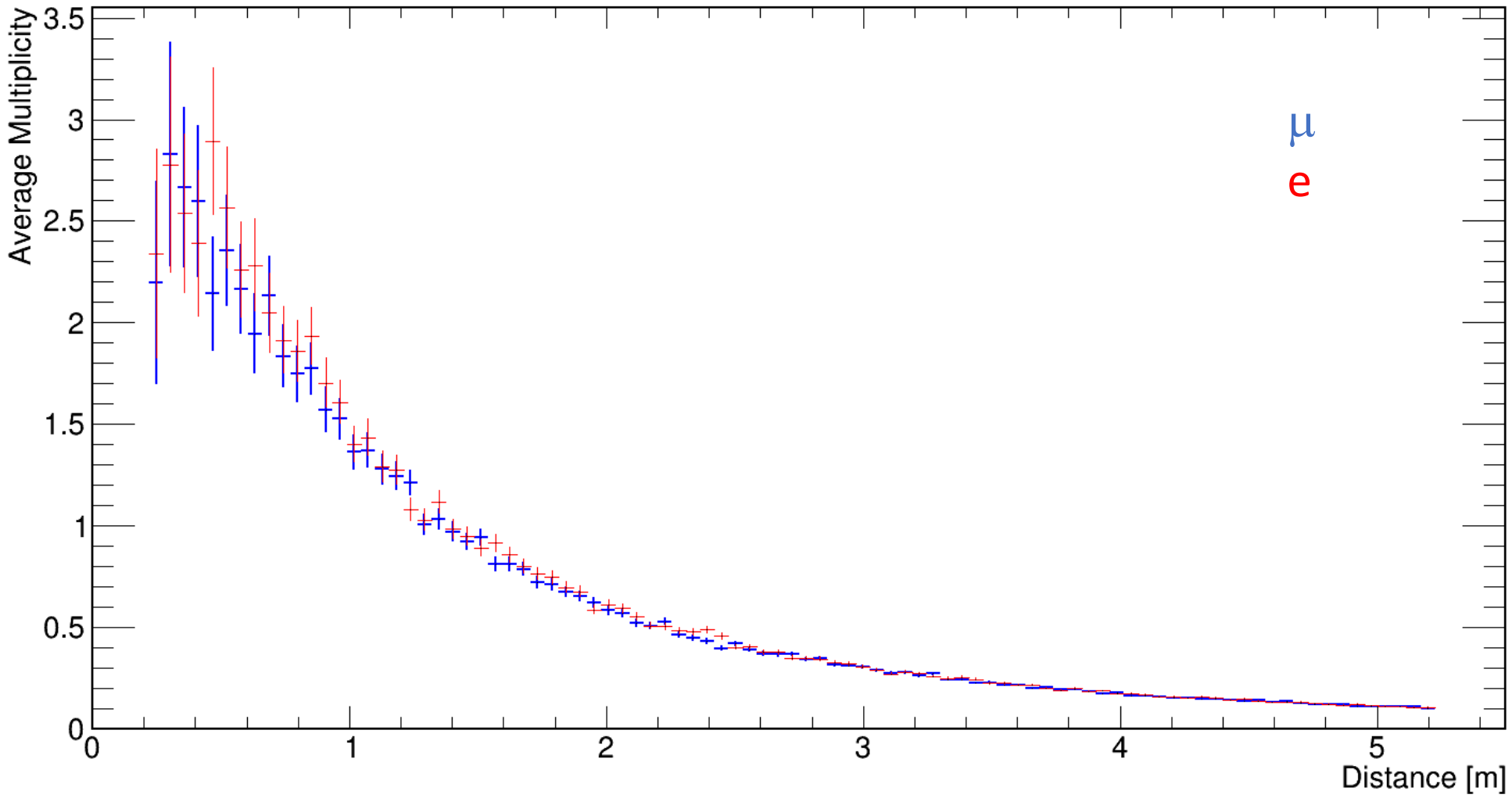
1x10^6 1 MeV muons

```
start_event: 1 1
track_in:   1    432.166 580.091 190.005 0.360927 0.251029 0.12924 0.001  0.000000 5
end_event:
start_event: 2 1
track_in:   1    432.06 580.995 194.168 0.434684 0.722568 0.764675 0.001  0.000000 5
end_event:
```

Muon decay, Light & Detector (single DOM) simulations with KM3Sim

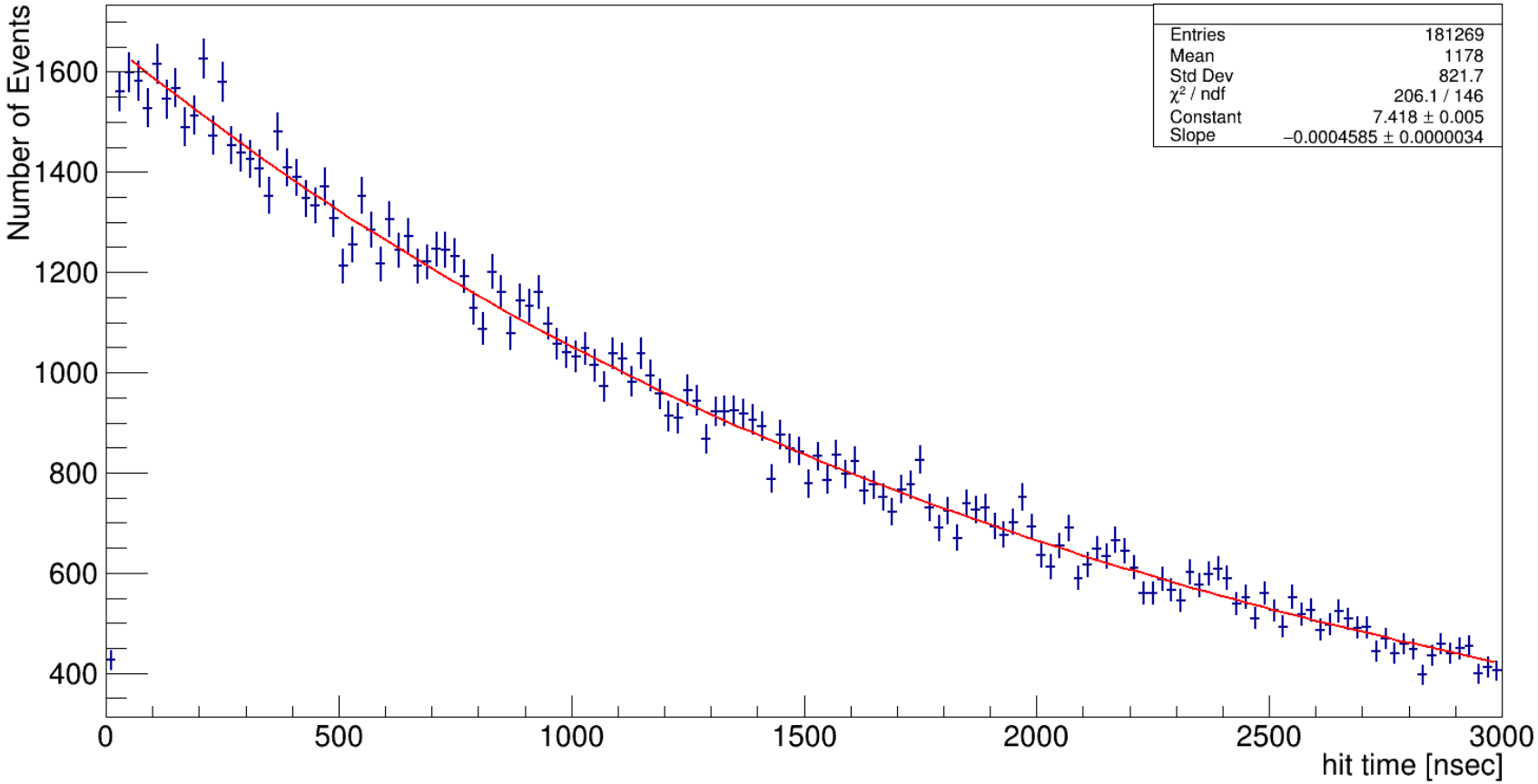
Hits from Michel electron

Muon Decay Simulations with ROOT and KM3Sim



Muon Decay Simulations with KM3Sim

Hit time = First hit time of the event



τ = 2181 sec

Summary and Outlook

- Signals from Michel electrons were studied with ROOT TGenPhaseSpace and KM3Sim for d<20 m, where d is a distance between decay point and DOM
- Muon decays were simulated with KM3Sim
- Michel electron signal from ROOT and KM3Sim were compared
- First look of muon decay distribution

- Further studies of muon decay parameters from MC
- Search for decays in ORCA6 data