



Sparking DOMs in the ORCA data



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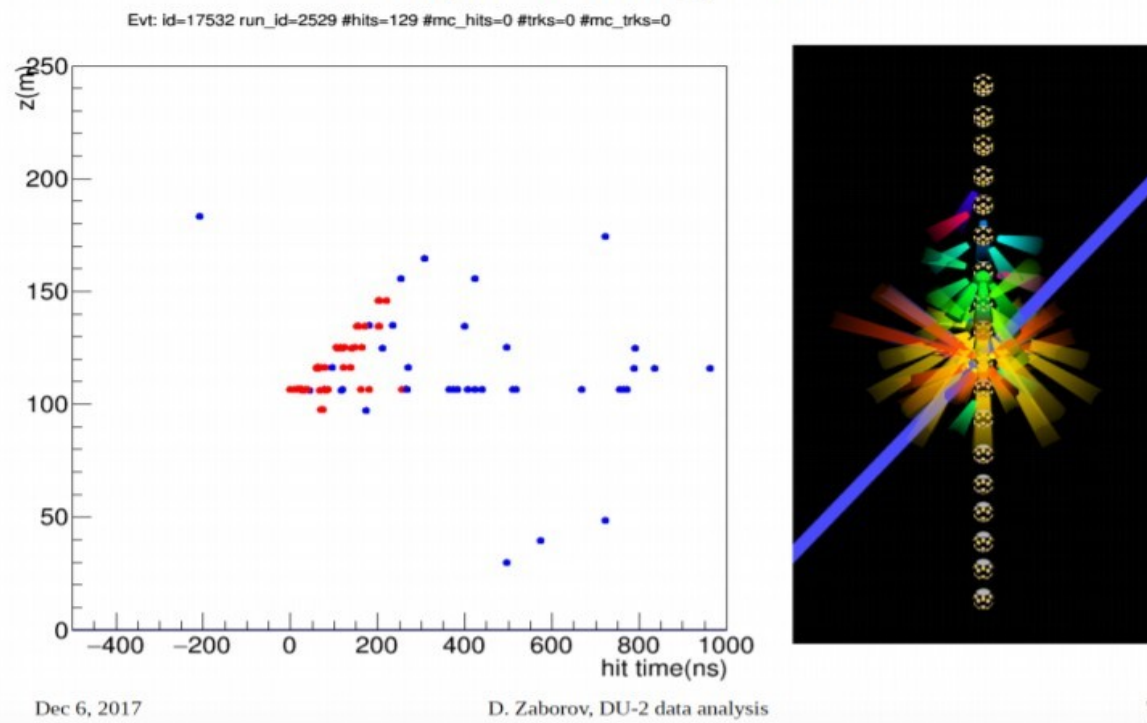
Introduction

- **Problem of Sparking DOMs is a part of the events with largest possible hit (PMT) signal (ToT255)**
- **ToT signals up to now are not included in the KM3NeT MC**
- **We have considered the events, where atmospheric- μ is crossing the ORCA DOM(s) as a possible source of sparking/long time signals in ORCA data**
- **We have selected ORCA4/6 events with at least one ToT255 signal (ToT255 events).**
- **Preliminary analysis of ORCA4/6 ToT255 events from 634/846 runs**
- **Summary and Outlook**

Sparking DOM problem

- Jannik Hofestadt and Dorothea Samtleben
Report on problems with data from ORCA-DU2(KM3NeT DUANA 2019 001)
March 12, 2019
 - - PMT/DOMs signals with max. ToT (255 nsec) and repetitive hit pattern
 - Large signal on neighbouring DOMs
 - Different pattern on different DOMs

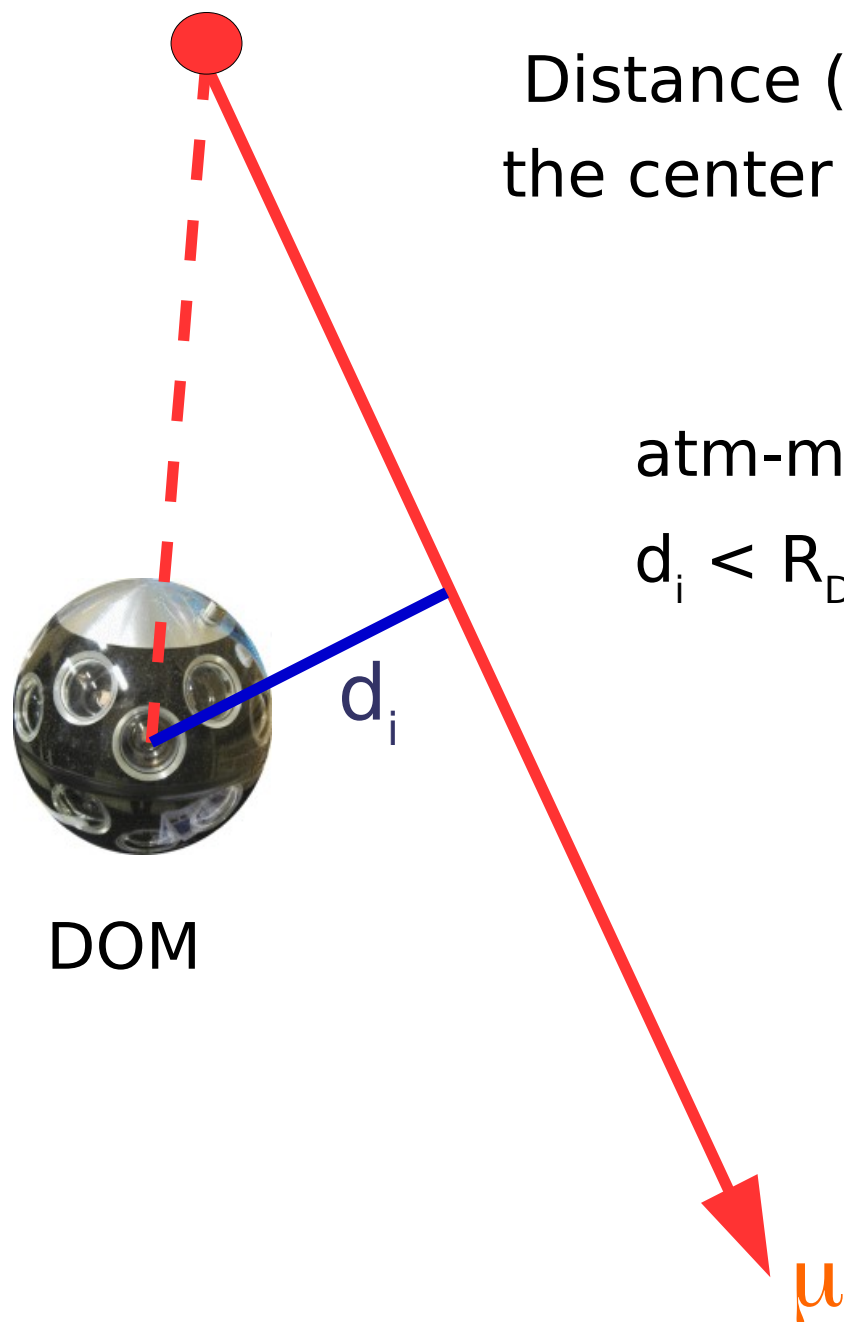
Example of strange event



How to identify “sparking DOMs” in the ORCA4 data?

Start with events where DOM/PMT signals are maximum (255 nsec)

Muon to DOM Distance



Distance (d_i) between atm- μ and the center of DOM_i

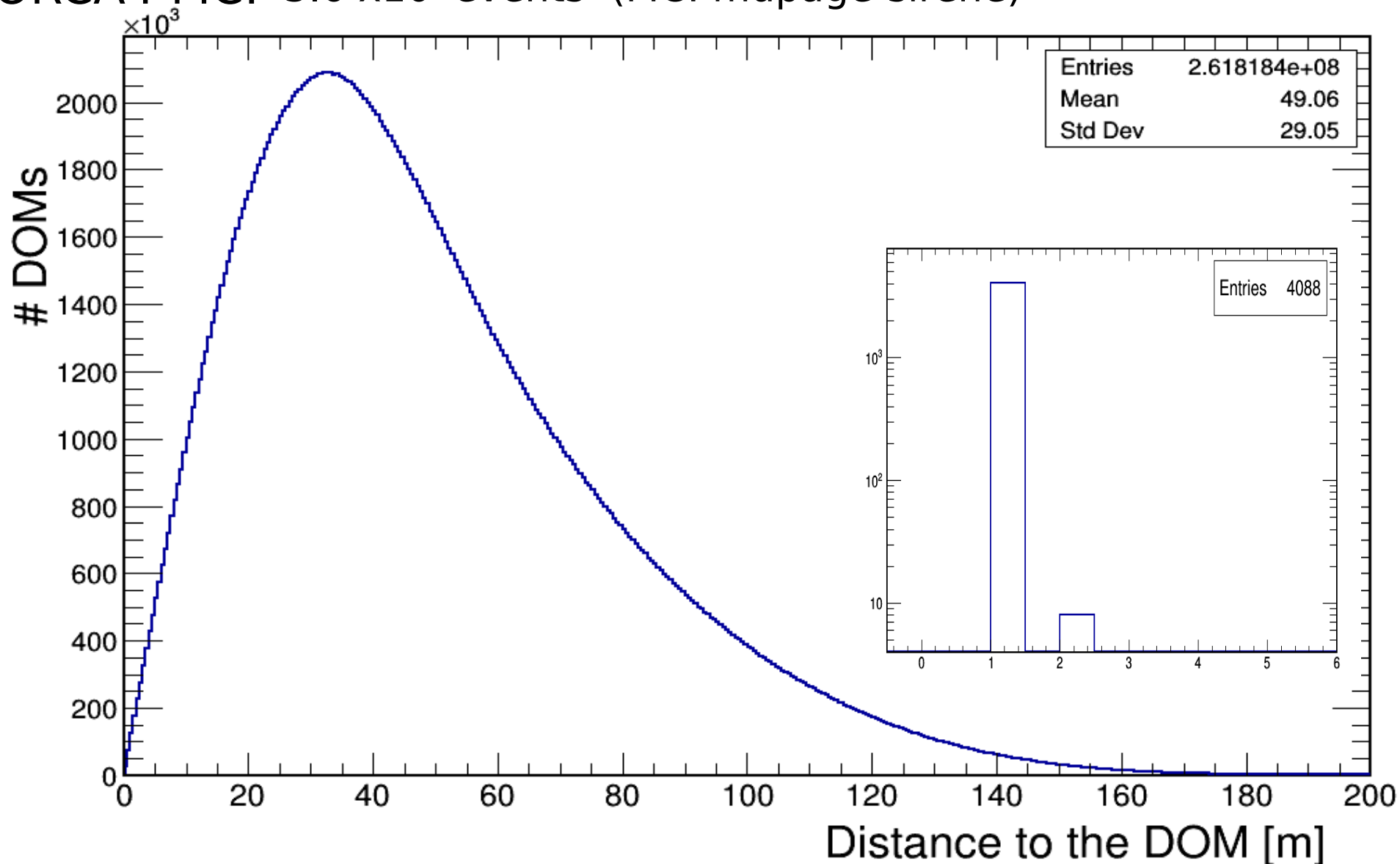
atm- μ is crossing DOM_i if

$$d_i < R_{DOM} \text{ (20 cm)}$$

d_i - was obtained from the ORCA4 MC (mupage \rightarrow sirene)

Muon to DOM Distance

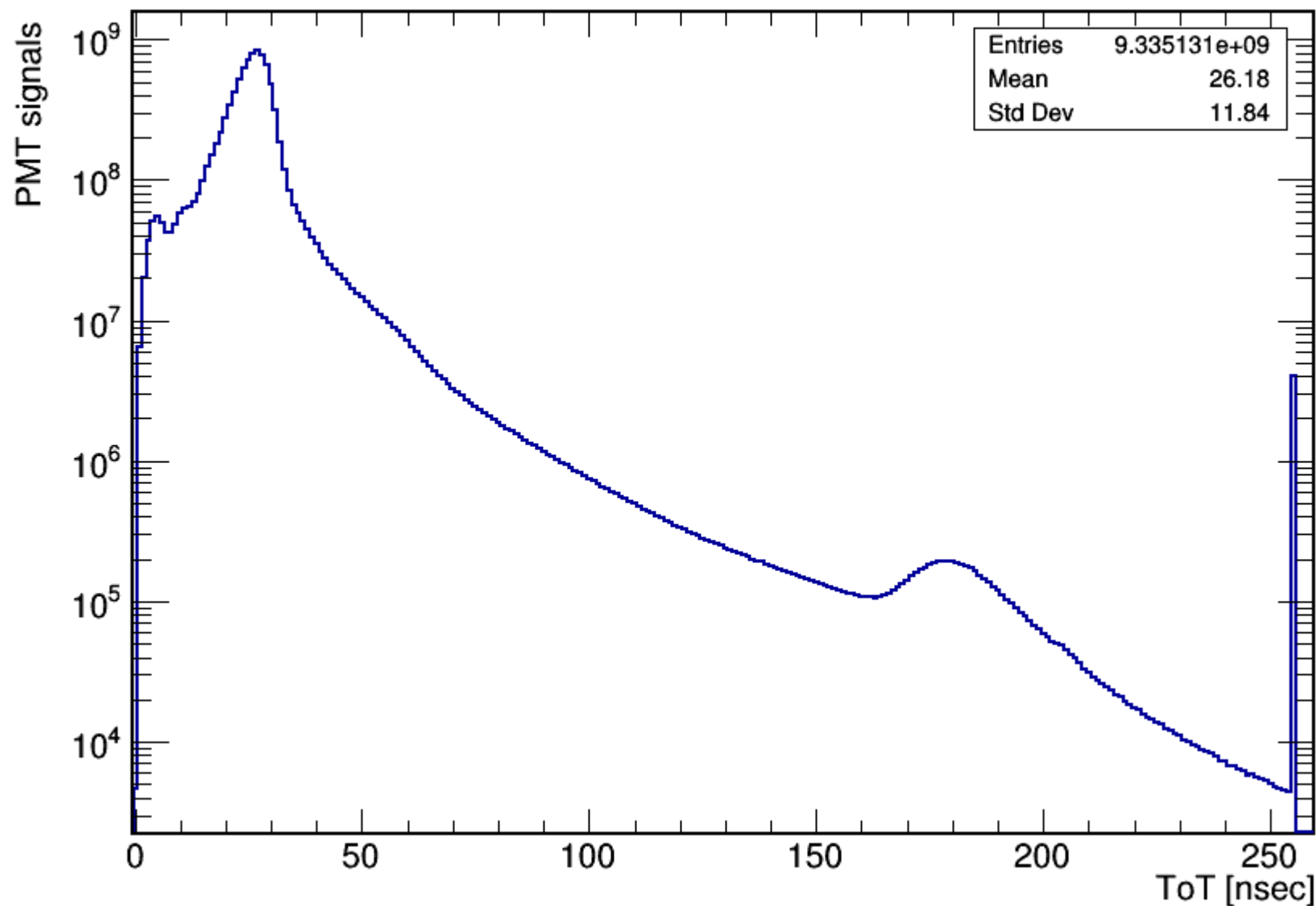
ORCA4 MC: 3.6×10^6 events (MC: mupage-sirene)



4088 events with atm- μ inside the DOM (about 10^{-3})

ToT Signal in the ORCA4 events

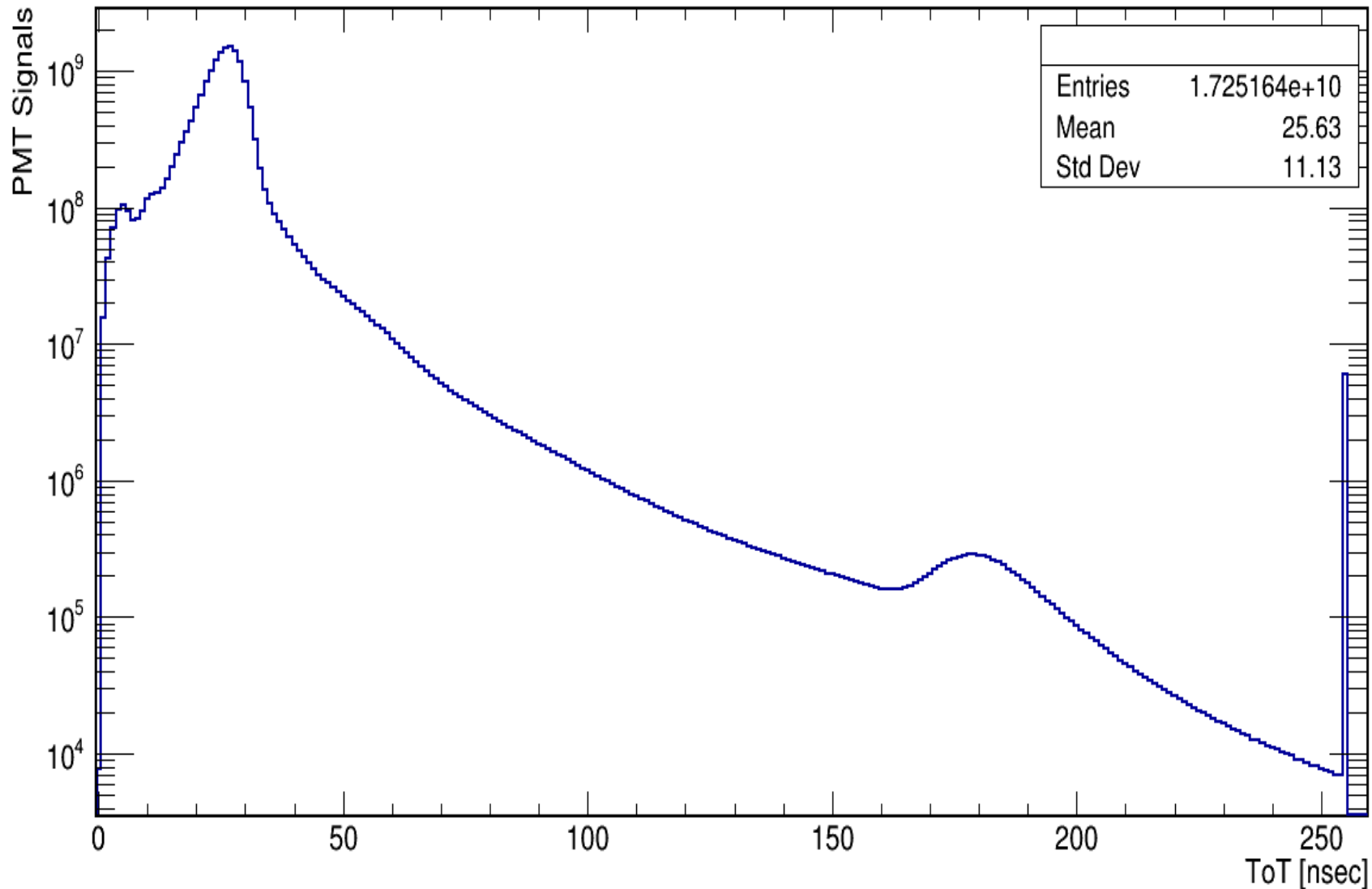
All processed events: 83 634 895 (8.4×10^7 events)



ToT255 event: events with at least 1 hit with ToT=255 nsec

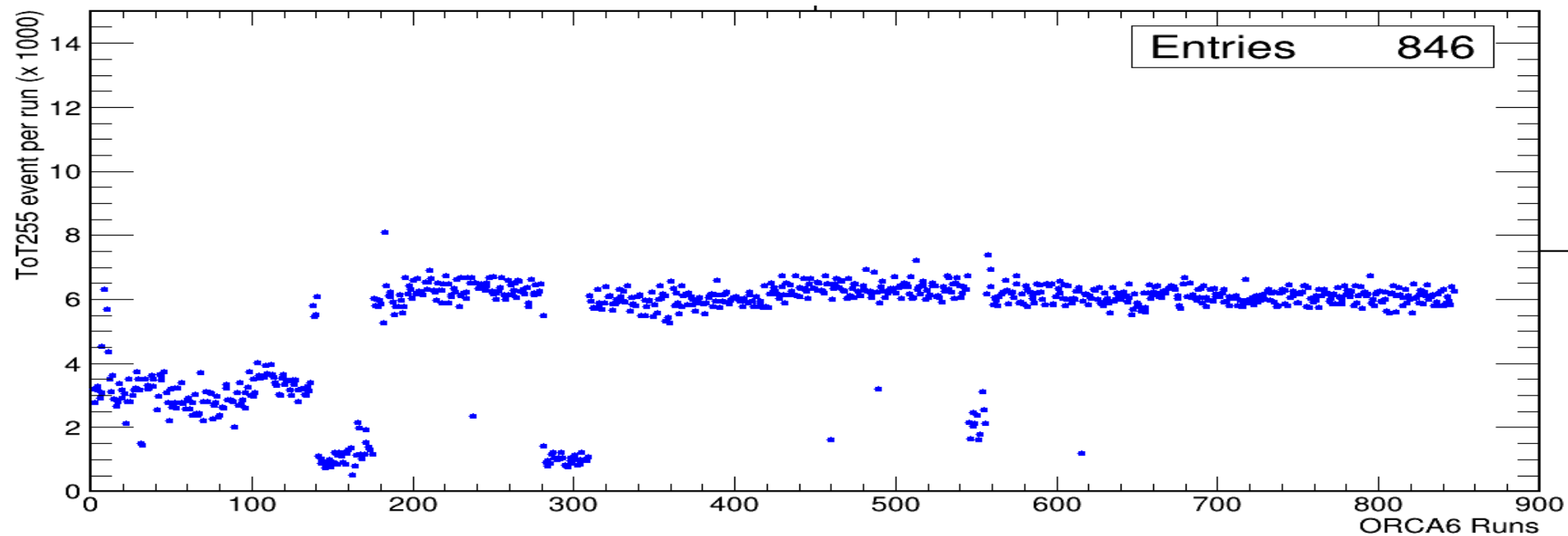
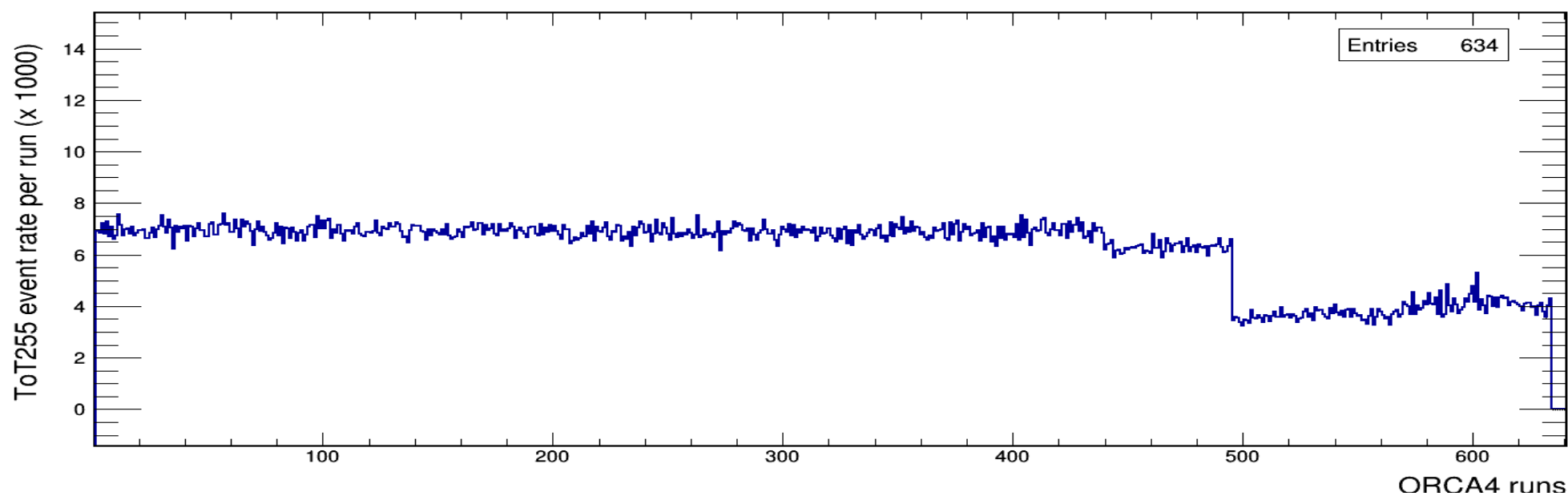
ToT Signal in the ORCA6 events

All processed events: 83 634 895 (8.4×10^7 events)

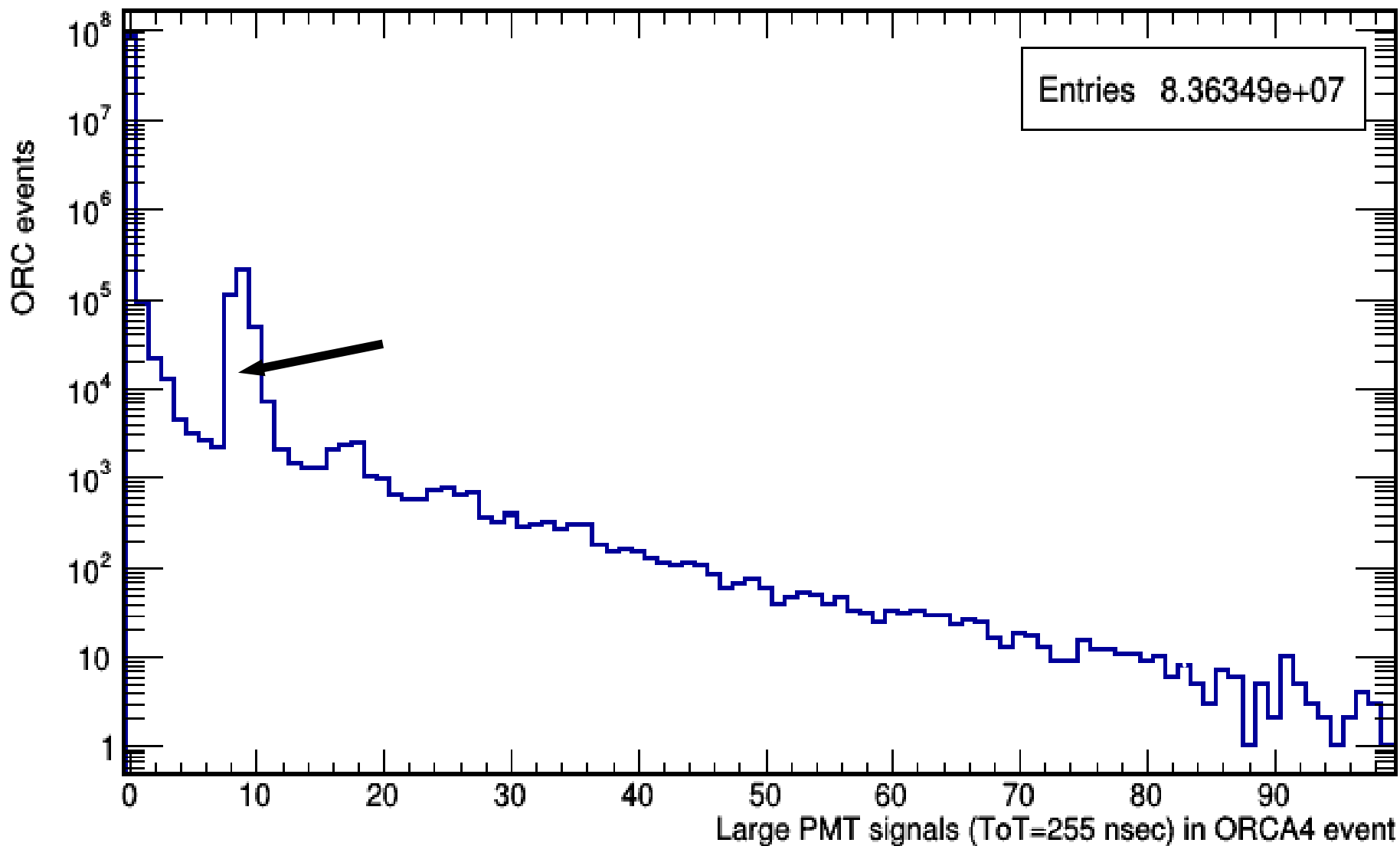


ToT255 event: events with at least 1 hit with ToT=255 nsec

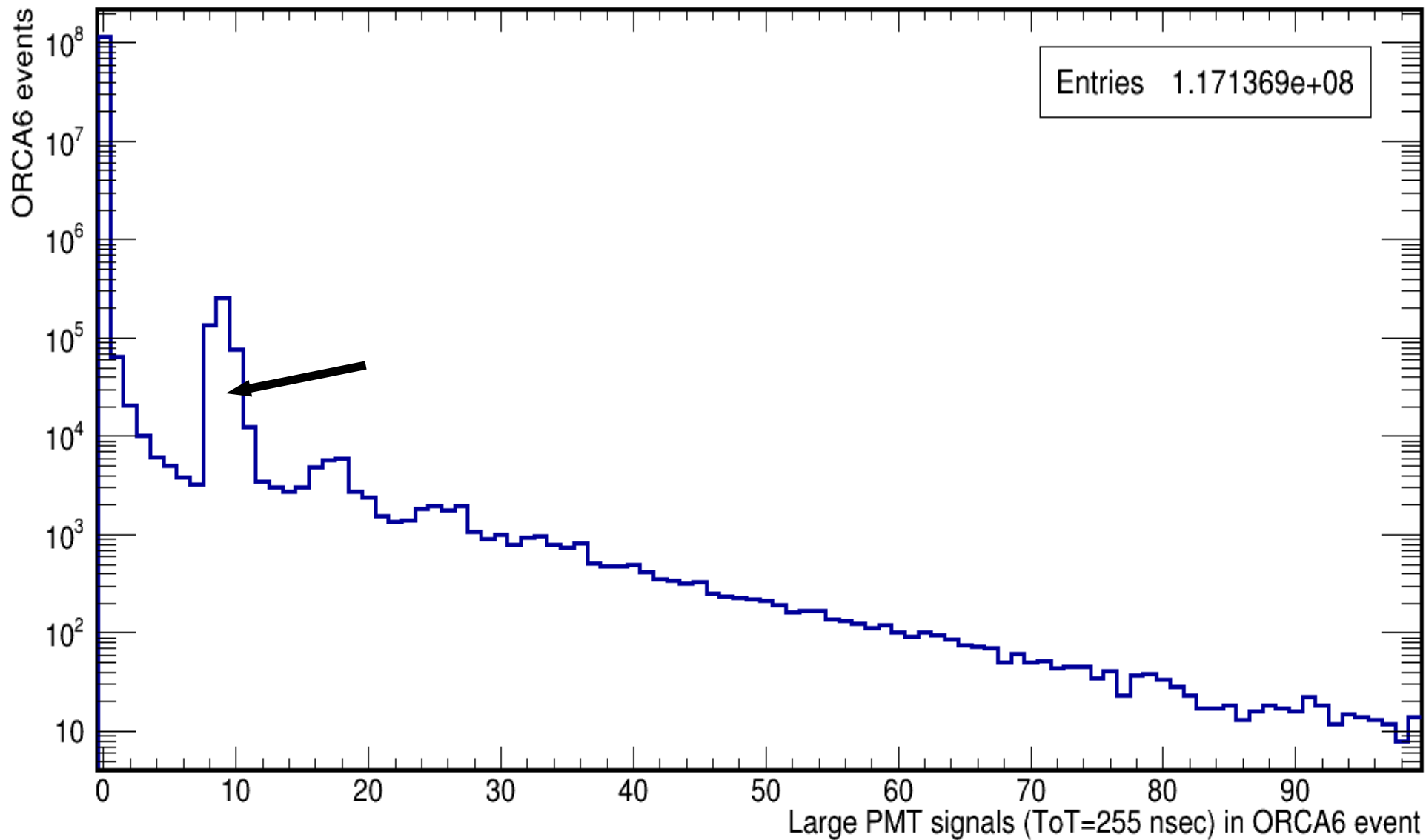
ToT255 Event Rates/Run



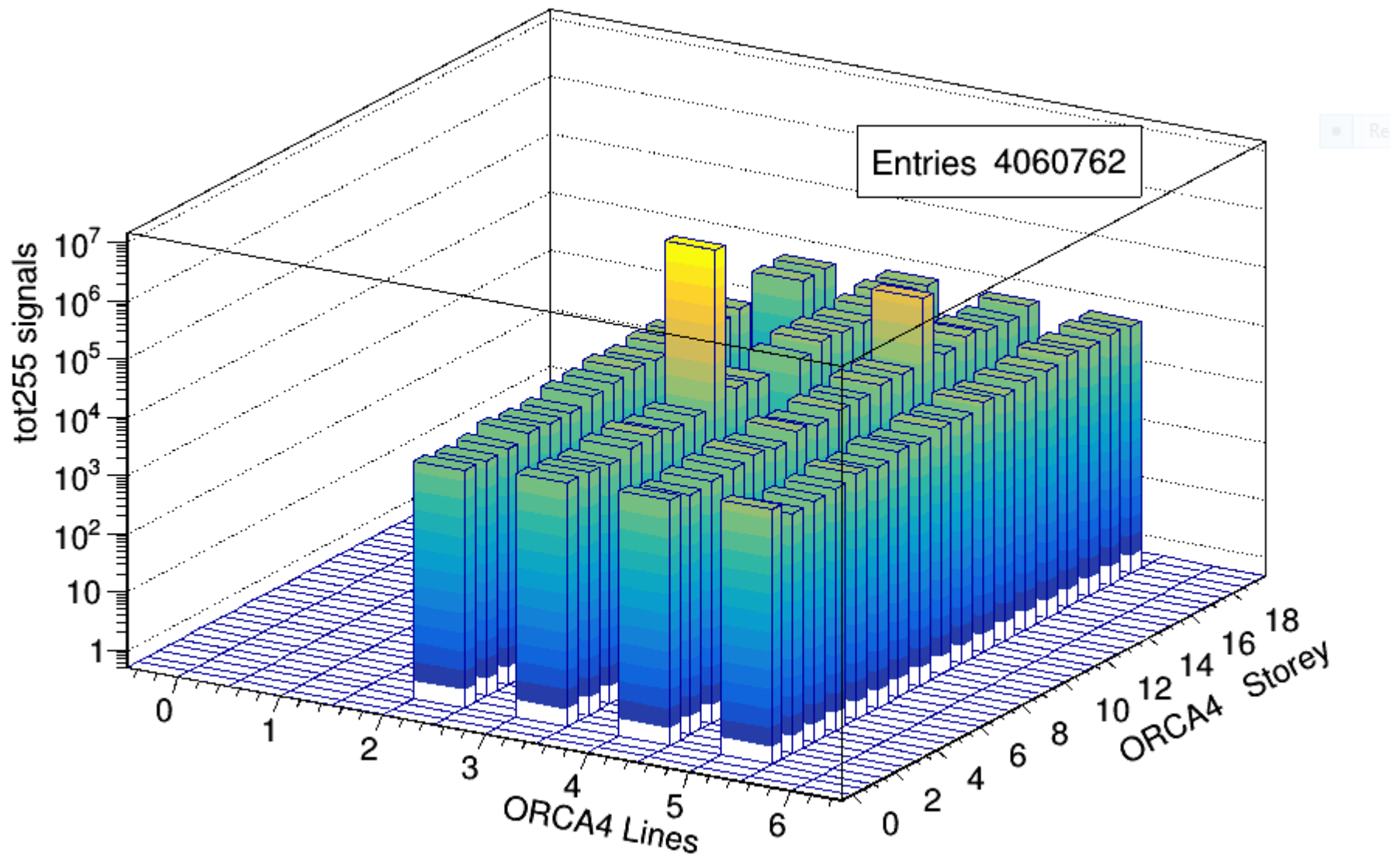
ORCA4 ToT255 Events



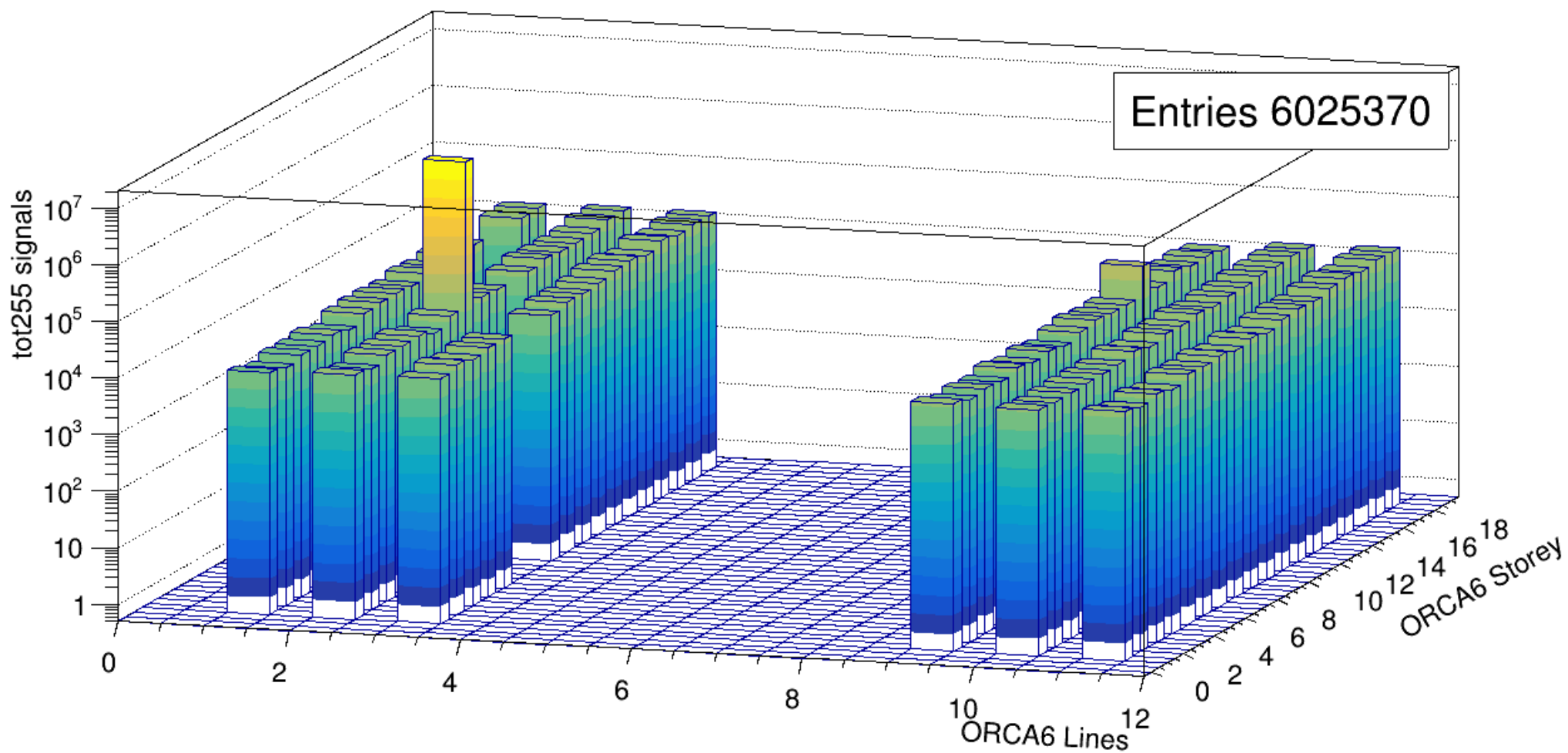
ORCA6 ToT255 Events



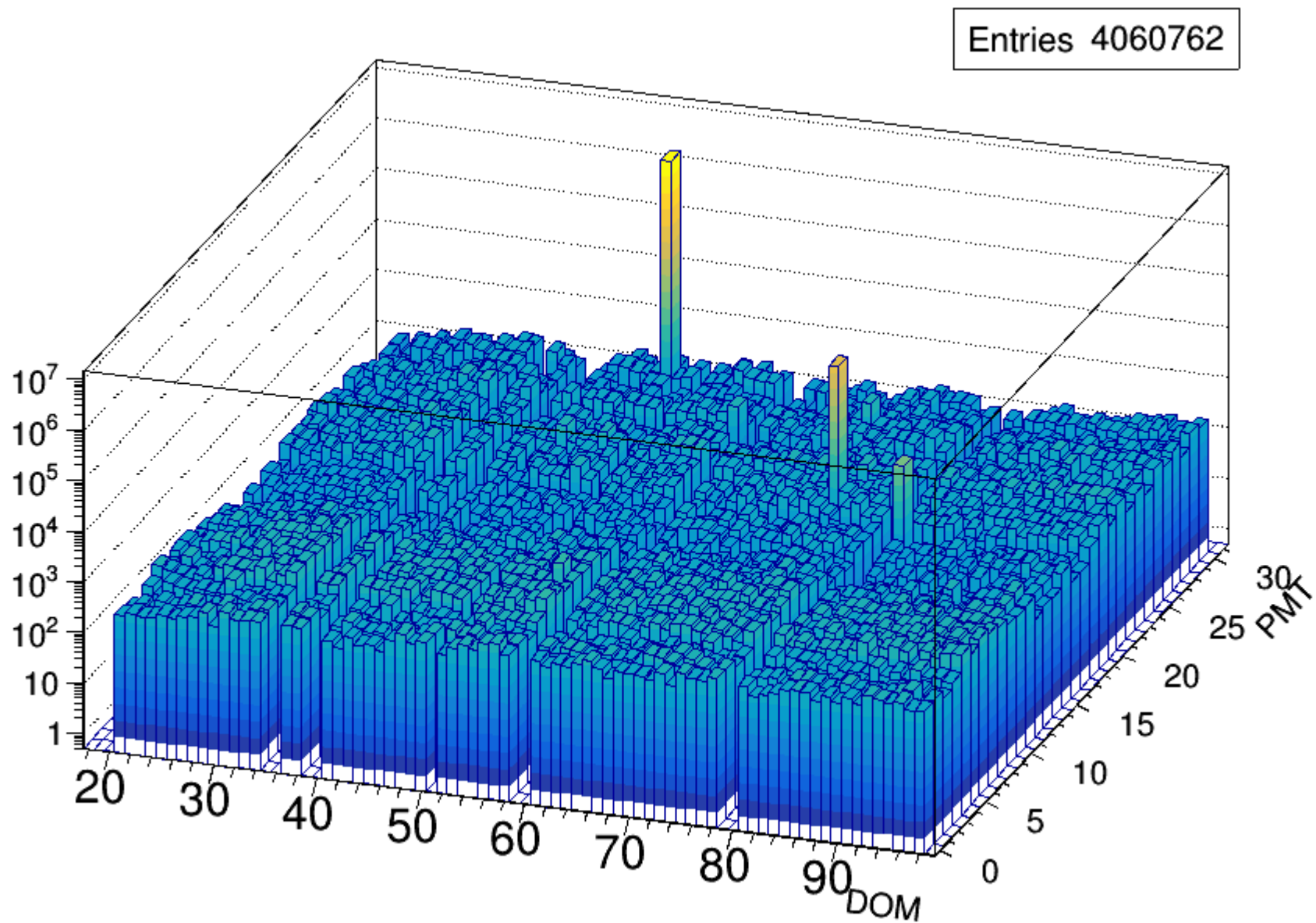
ORCA4 ToT255 Events



ORCA6 ToT255 Events

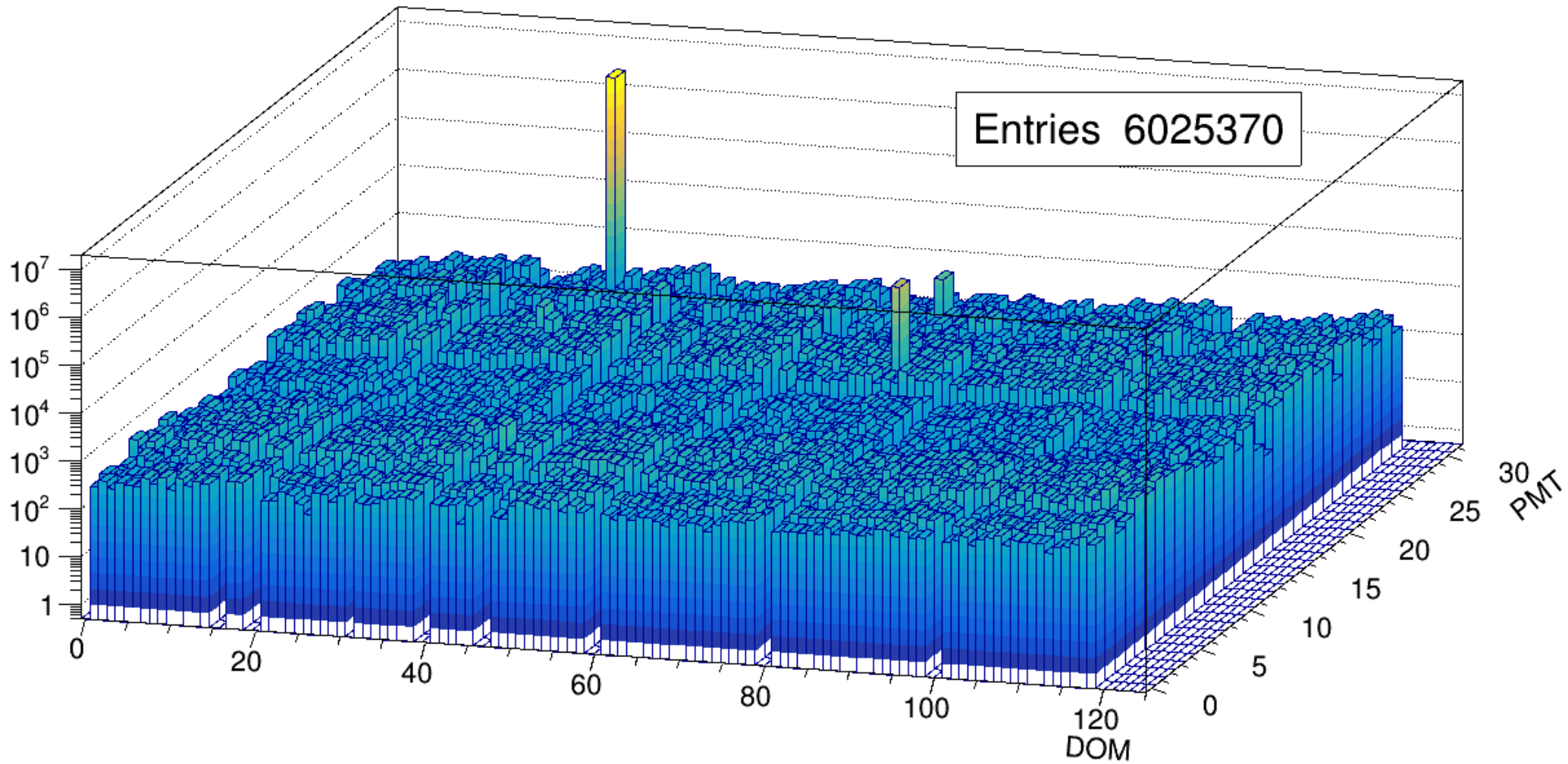


ORCA4 ToT255 Events



See the Bad PMTs int Juergen Brunner's [talk](#)

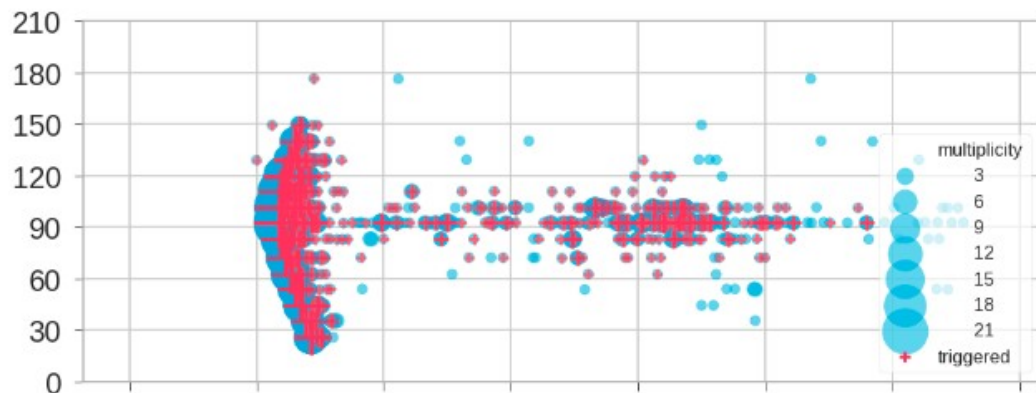
ORCA6 ToT255 Events



Sparking Events zt plot

Detector ID 44, RUN 6581, Event ID 33629

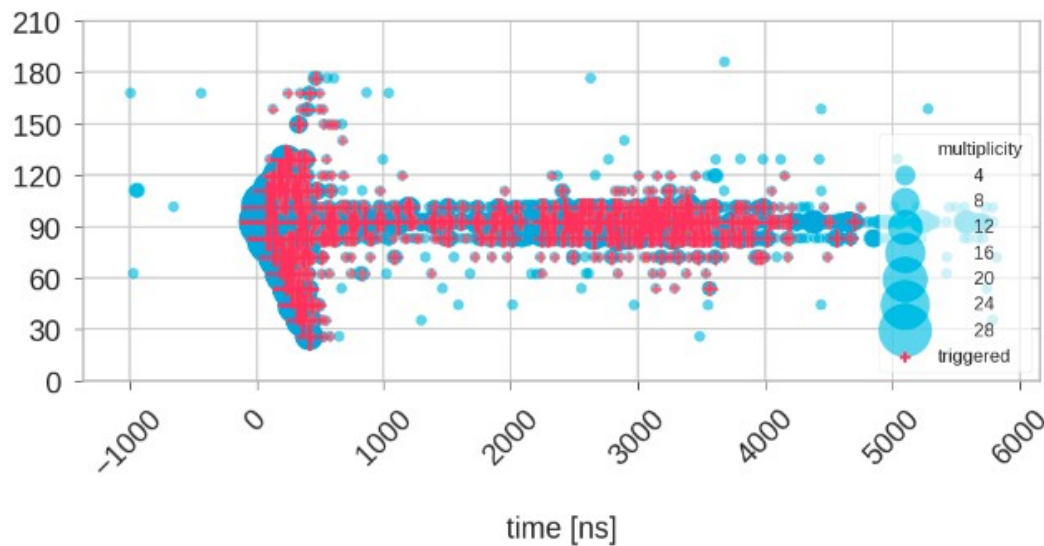
DU2



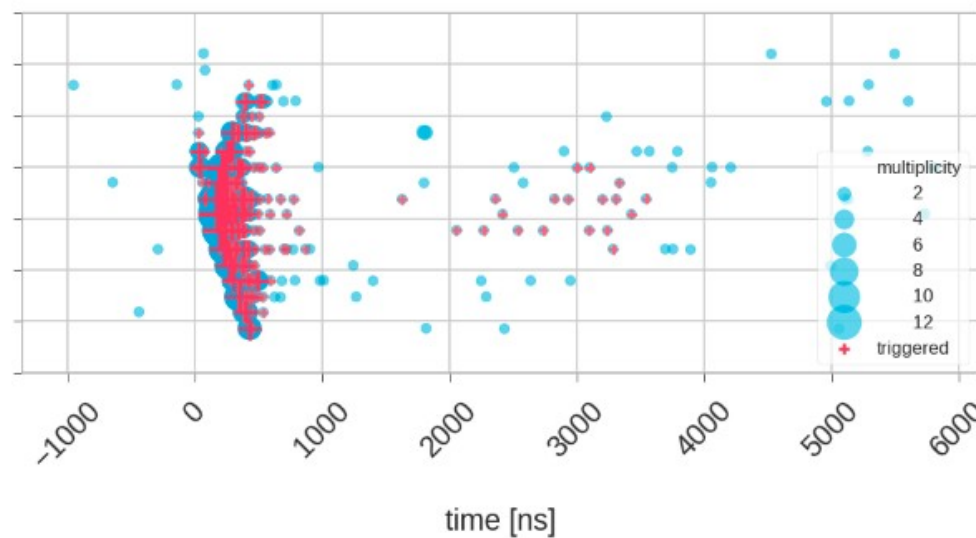
DU3



DU4

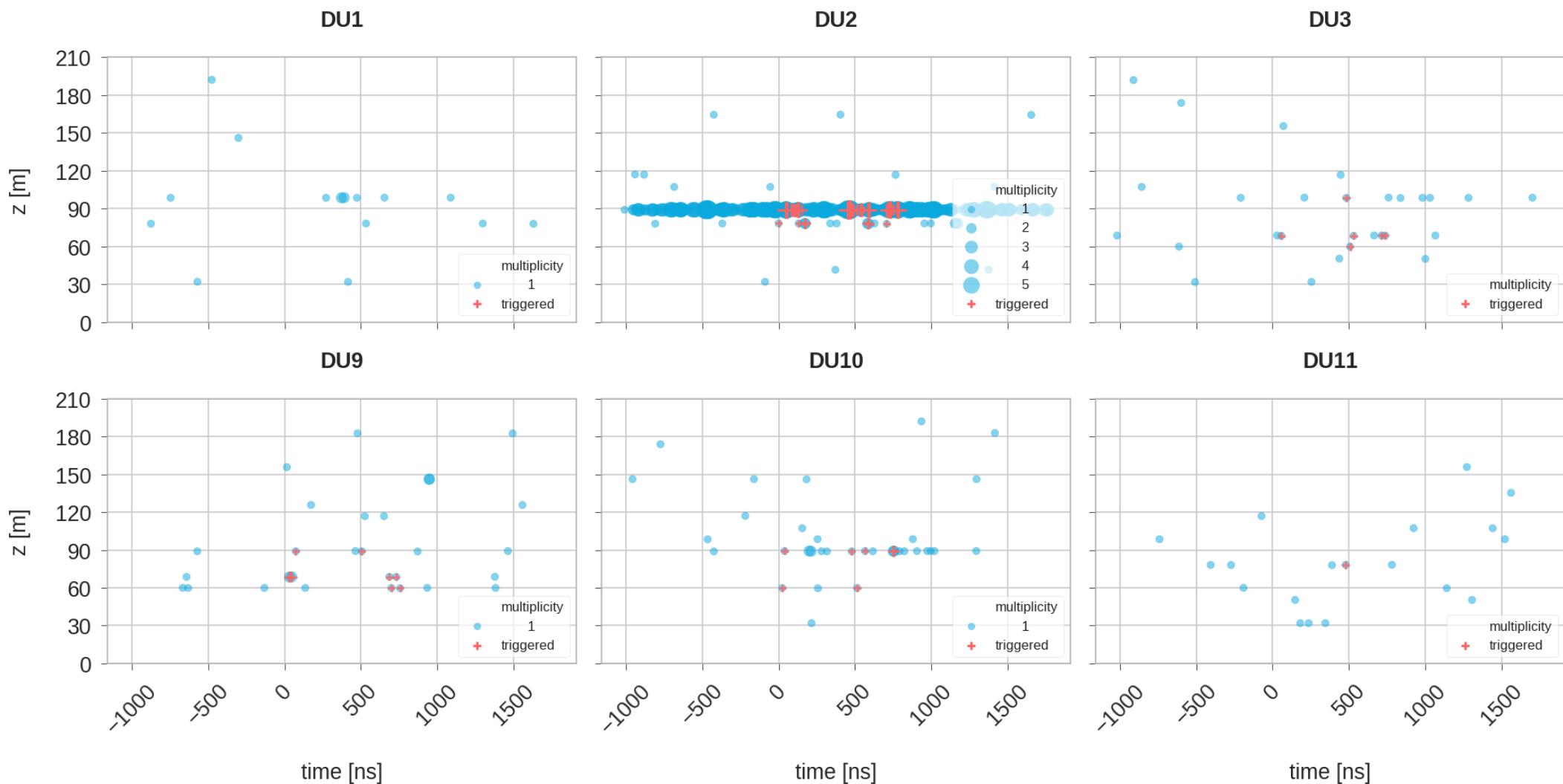


DU5



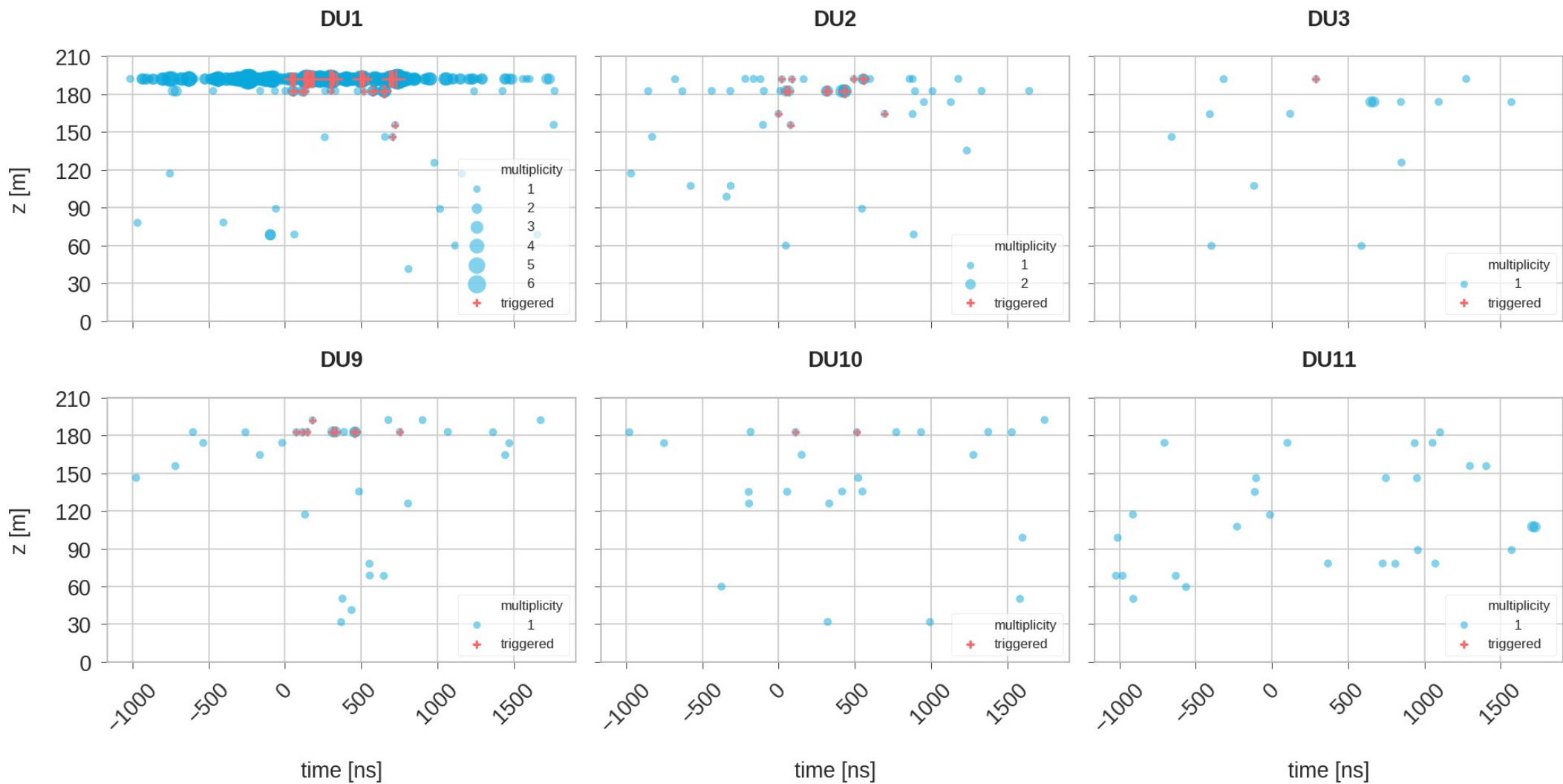
Sparking Events zt plot

Detector ID 49, RUN 7239, Event ID 23580



Sparking Events zt plot

Detector ID 49, RUN 7242, Event ID 12546



Summary and Outlook

- Rate of ToT255 events in the ORCA differs for ORCA4 and ORCA6
- Rate of ToT255 events rates changes from time to time
- DOM on Line 2(3) (dom id: 808447180) is a source of large signals
Source of these signal is a PMT # 29
- Atmospheric muons could be hitting the DOMs with unknow consequences
- Further studies of high ToT255 events are needed for identifying better understanding of sparking DOM problem
- Checking the data for the sparks are planned