



# ORCA4 Data Analysis in TSU

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12 Febary 2020

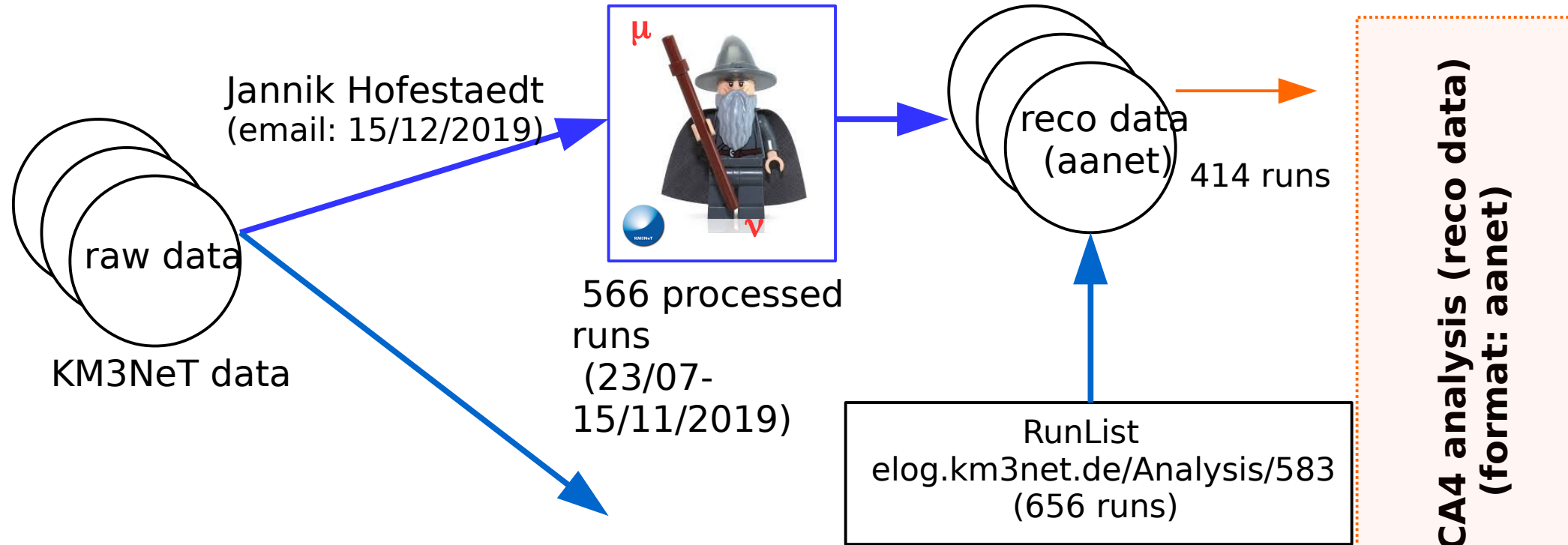
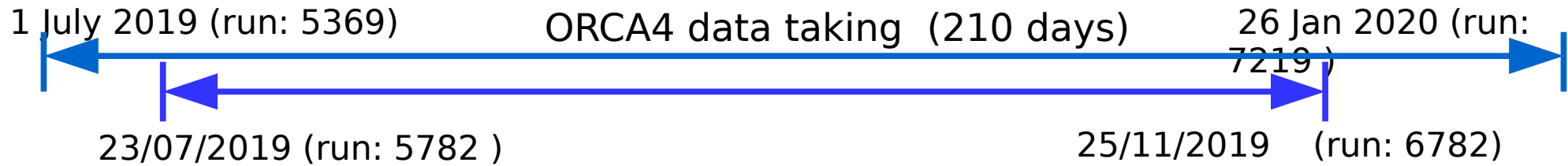
High Energy Physics Institute  
Tbilisi State University



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National Science Foundation

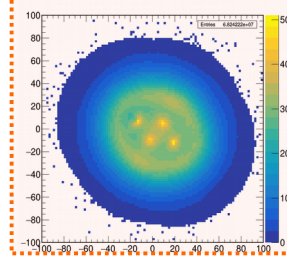
# KM3NeT/ORCA4 data processing (current status)



PHYS. Runs / Livetime  $\geq 3$ h

- $|(UTC_{max} - UTC_{min}) - Livetime| < 100$  sec
- HRV fraction  $< 0.2$

656 runs / 153.6 days livetime  
(83.6% of the physics runs total livetime)



**ORCA4 analysis (reco data)**  
(format: aanet)

D. Stavropoulos  
Analysis & Operation  
WG meeting/  
29/1/2020

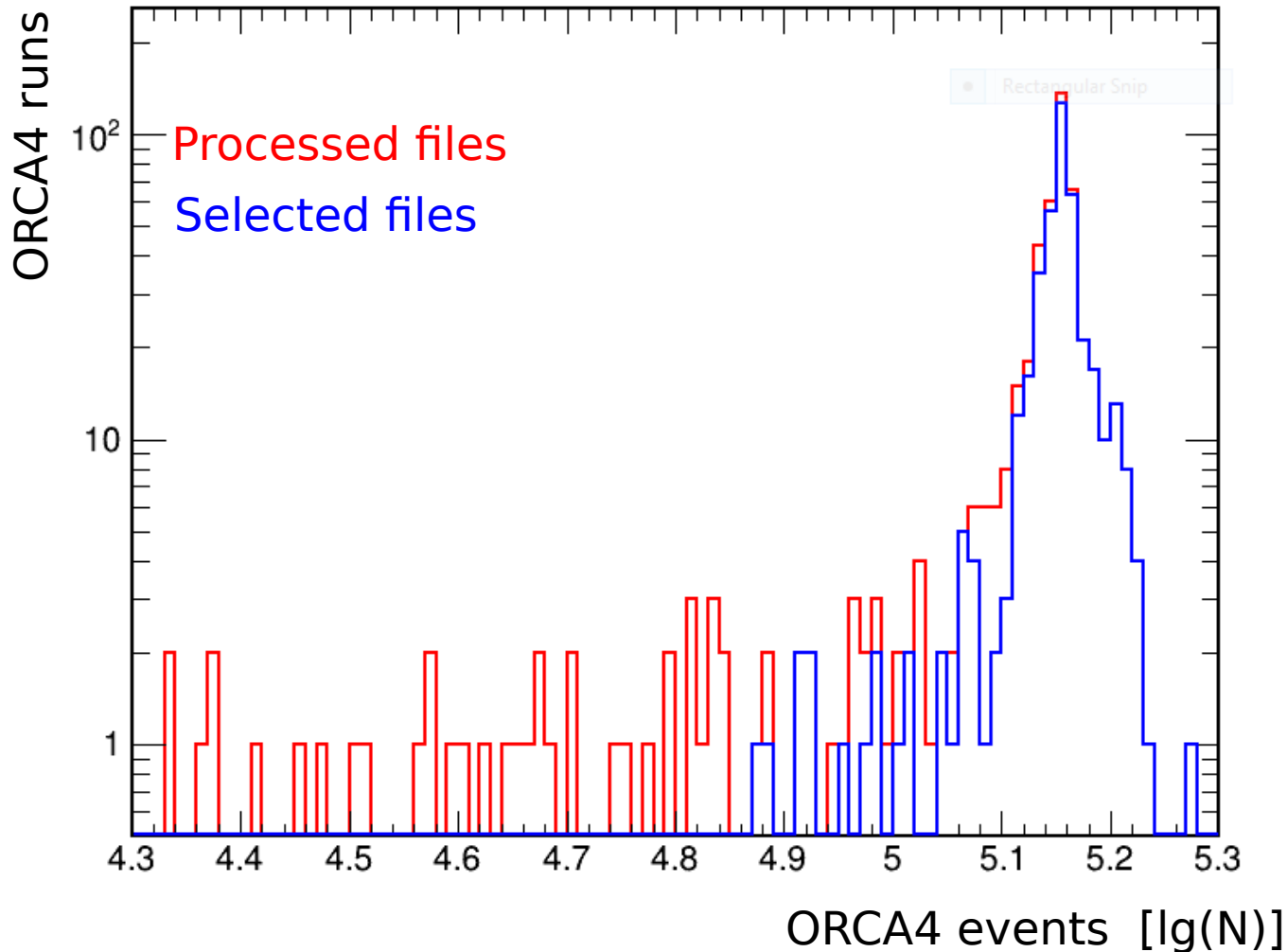
# KM3NeT/ORCA4 processed data

Processed files (23/07-25/11/2019):

533 (  $6.83 \cdot 10^7$  events )

RunList (elog.km3net.de/Analysis/583):

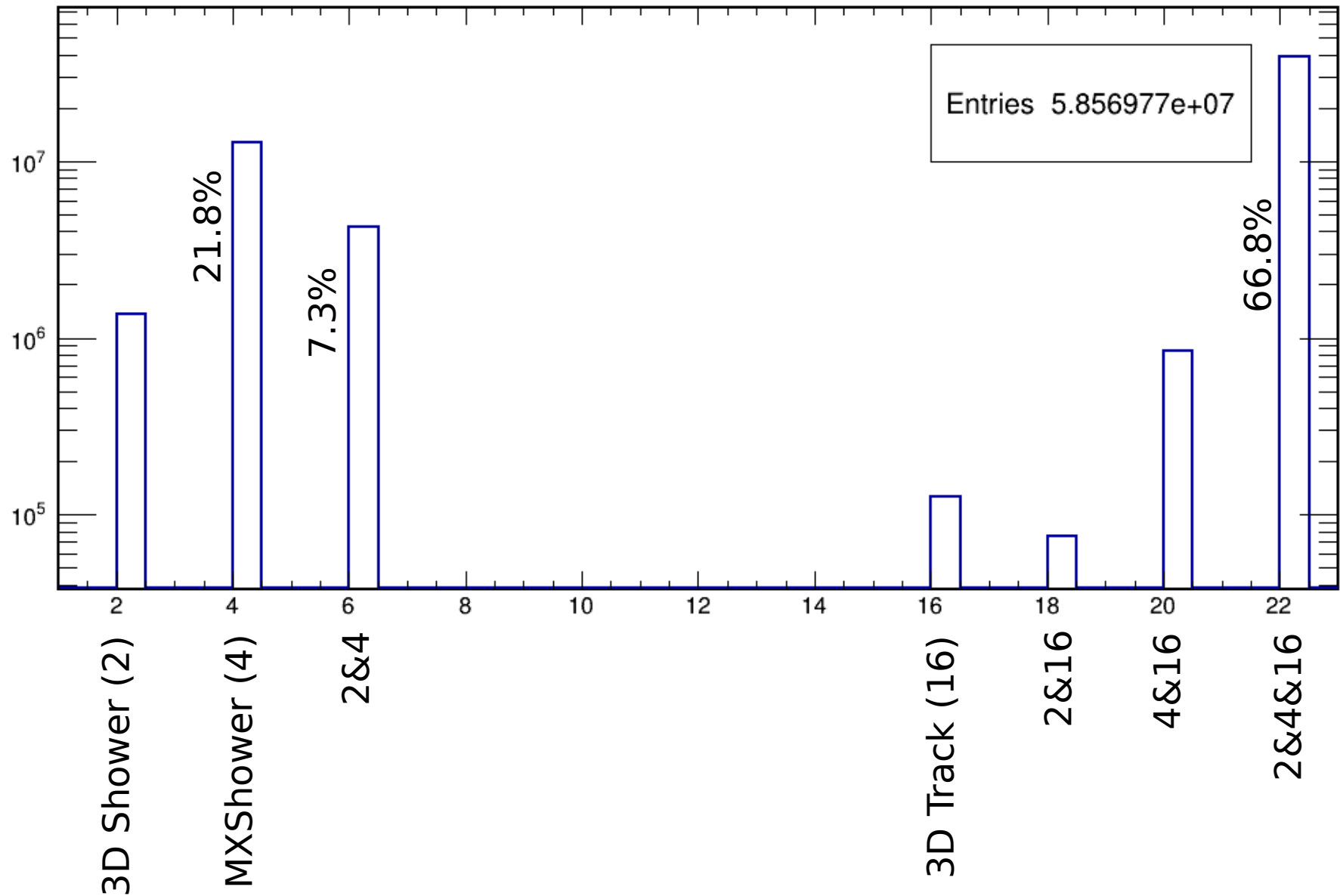
414 (  $5.86 \cdot 10^7$  events, 0.8 of processed )



Run: 6242 from the List  
Is missing from the  
Processed runs

Events per run:  
From processed  
data in aanet format

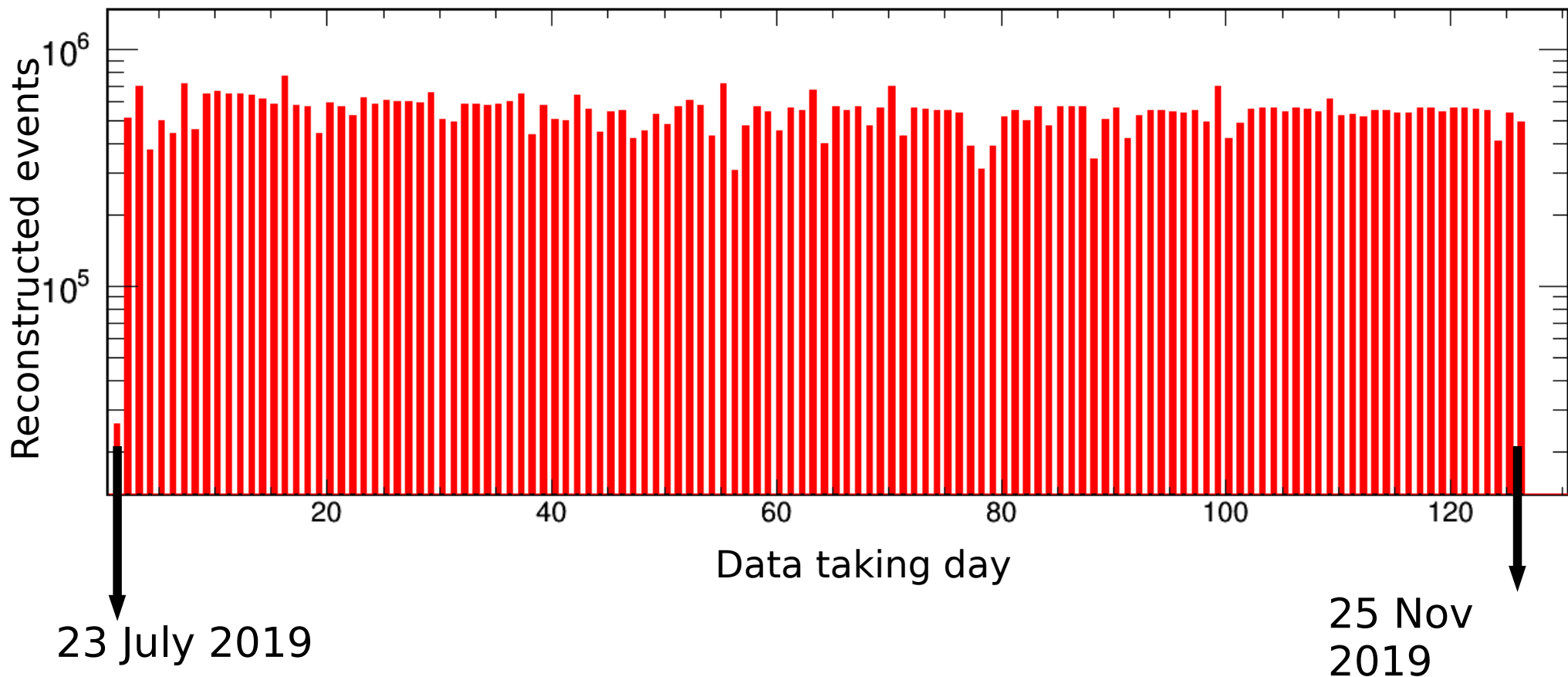
# KM3NeT/ORCA4 processed triggers



# KM3NeT/ORCA4 Data

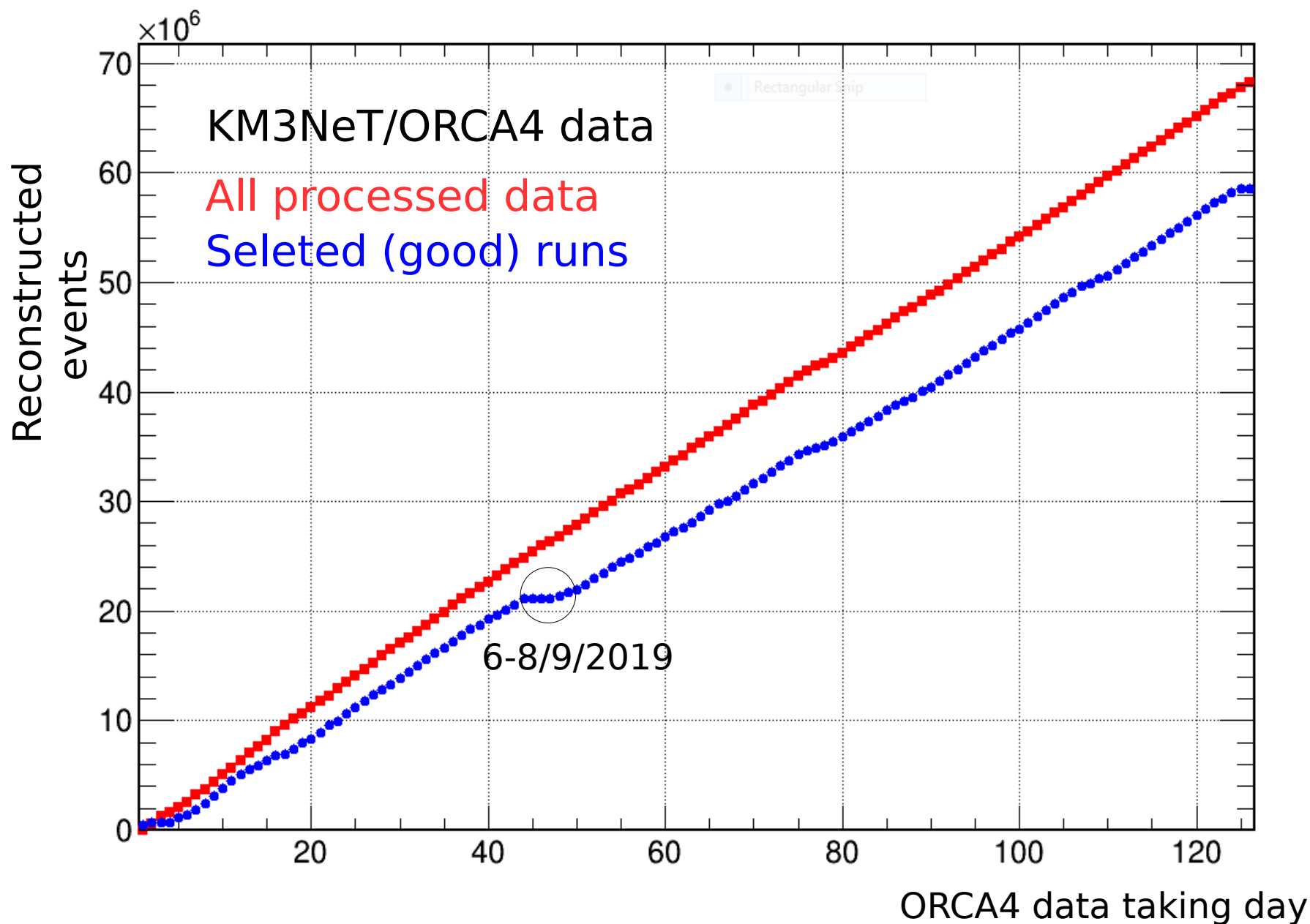
- Processed Data: 23 July 2019 – 25 Nov 2019 (126 days)
- 68 285 262 ( about  $7 \cdot 10^7$  ) reconstructed triggers / 533 files
- Average data taking efficiency - 84.0 % [AE, Genova meeting 11/02/2020]

Reconstructed ORCA4 triggers vs. data taking day



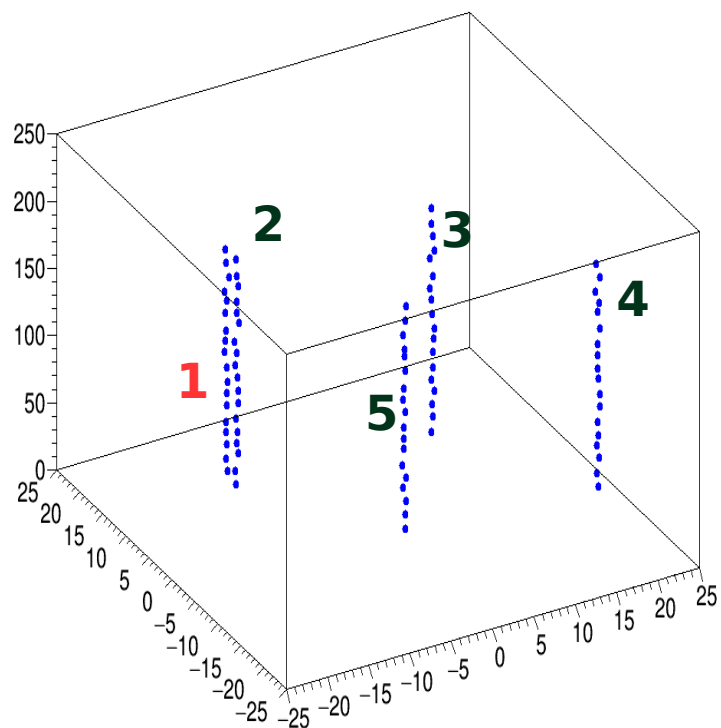
# KM3NeT/ORCA4 Data

- ORCA4 data: 23 July 2019 - 25 Nov 2019 (126 days)

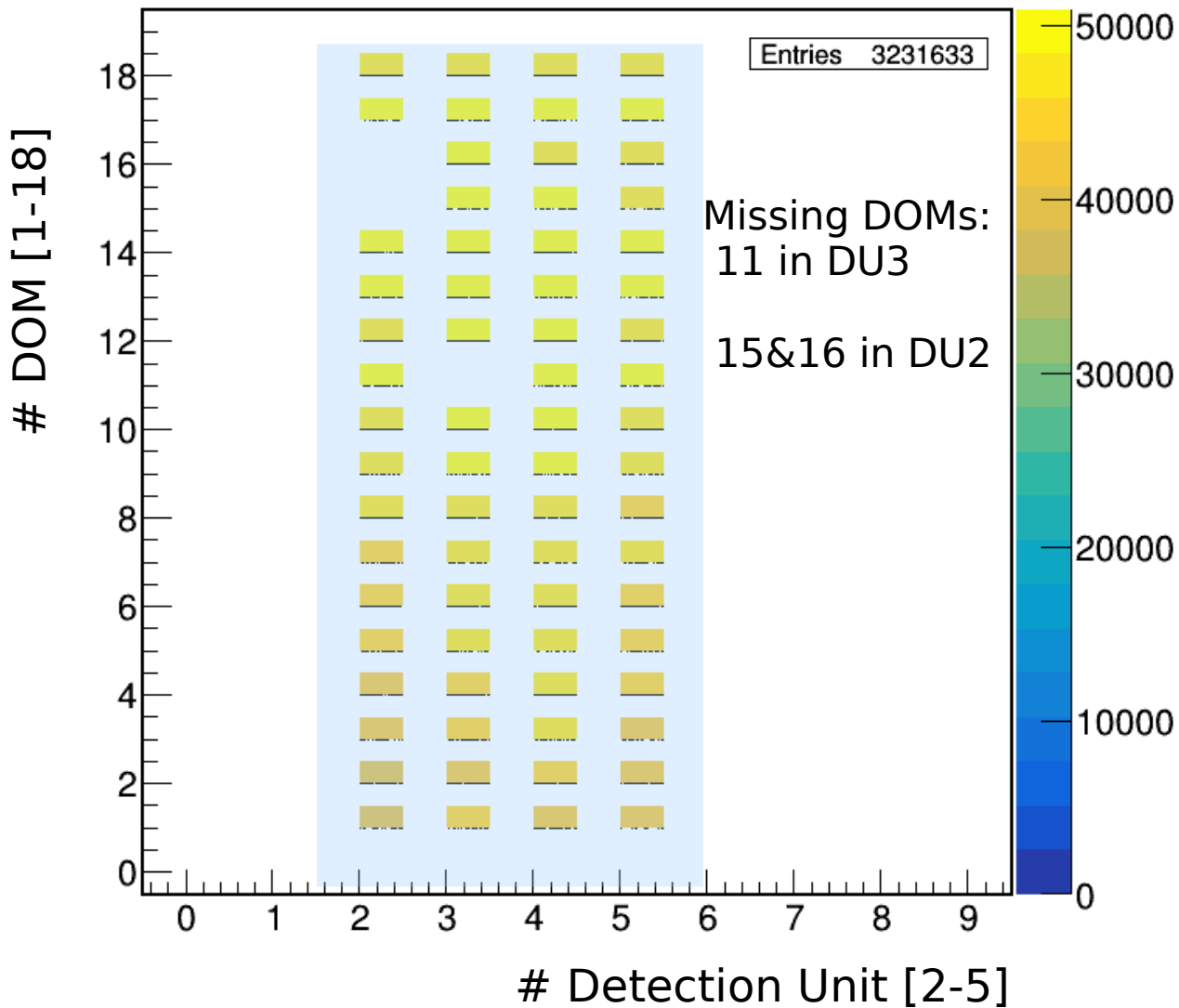


# KM3NeT/ORCA4 Configuration(s)

## ORCA4 Configuration



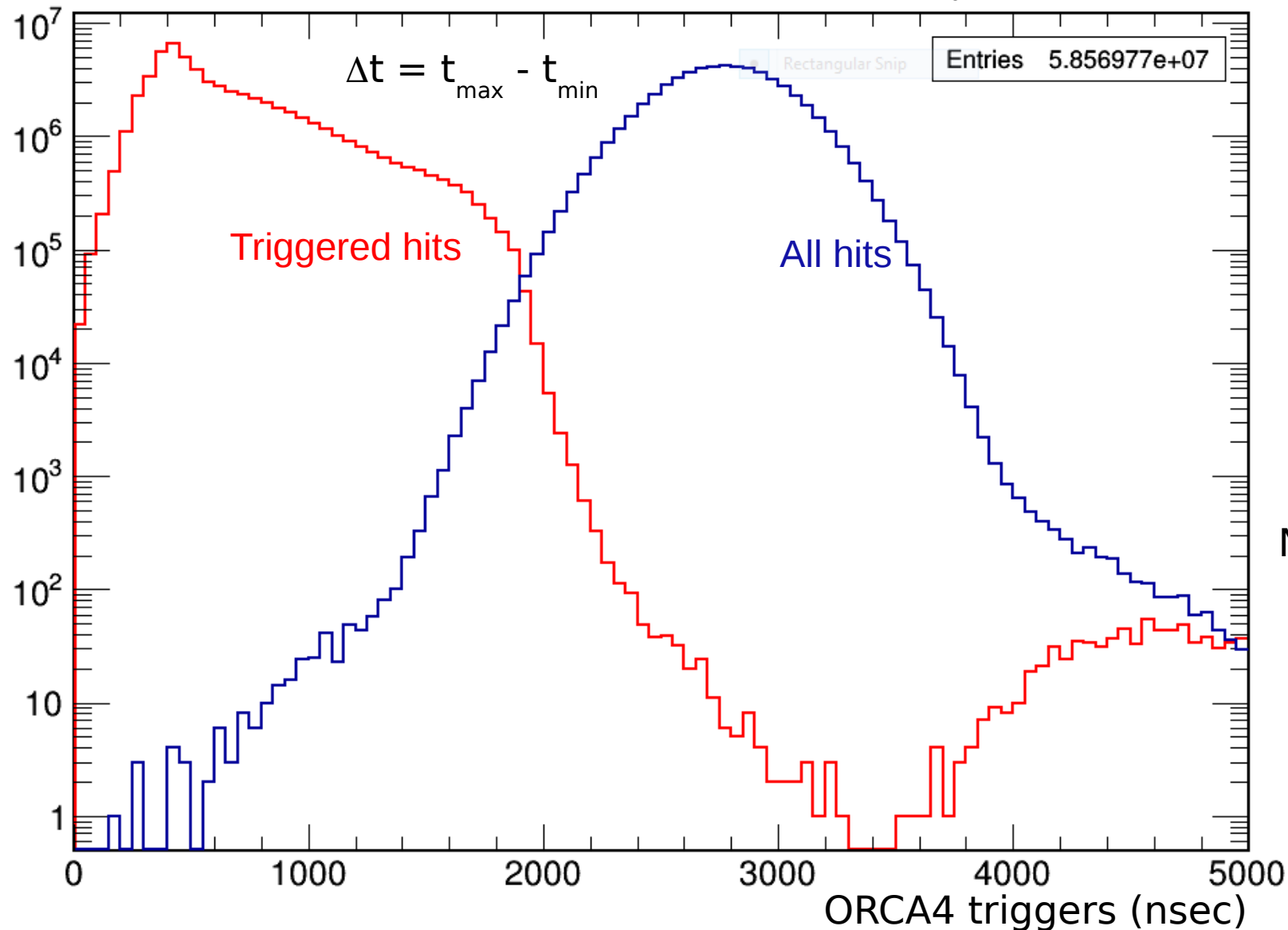
## ORCA4 Detector hits



# KM3NeT/ORCA4 Data (Event time)

All selected processed data:  $5.9 \times 10^7$  events

$t_{\min}$  - time of the first hit in the event  
 $t_{\max}$  - time of the last hit in the event



Expected hits:  
 $N = N_{\text{pmt}} R \Delta t$

$$N_{\text{pmt}} = 69 \times 31 = 2139$$

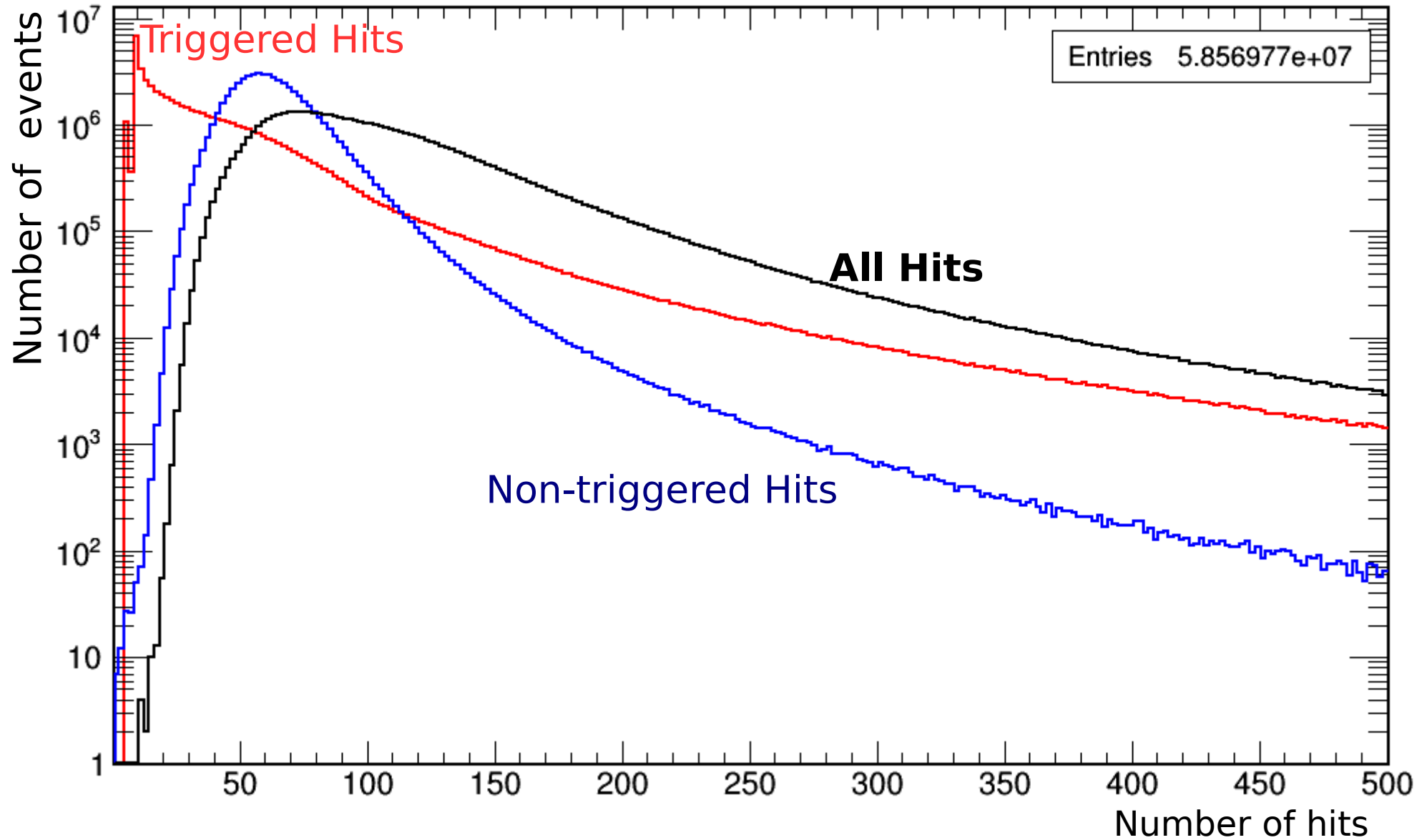
$$R = 10 \text{ kHz}$$

$$\Delta t = 2.8 \text{ } \mu\text{sec}$$

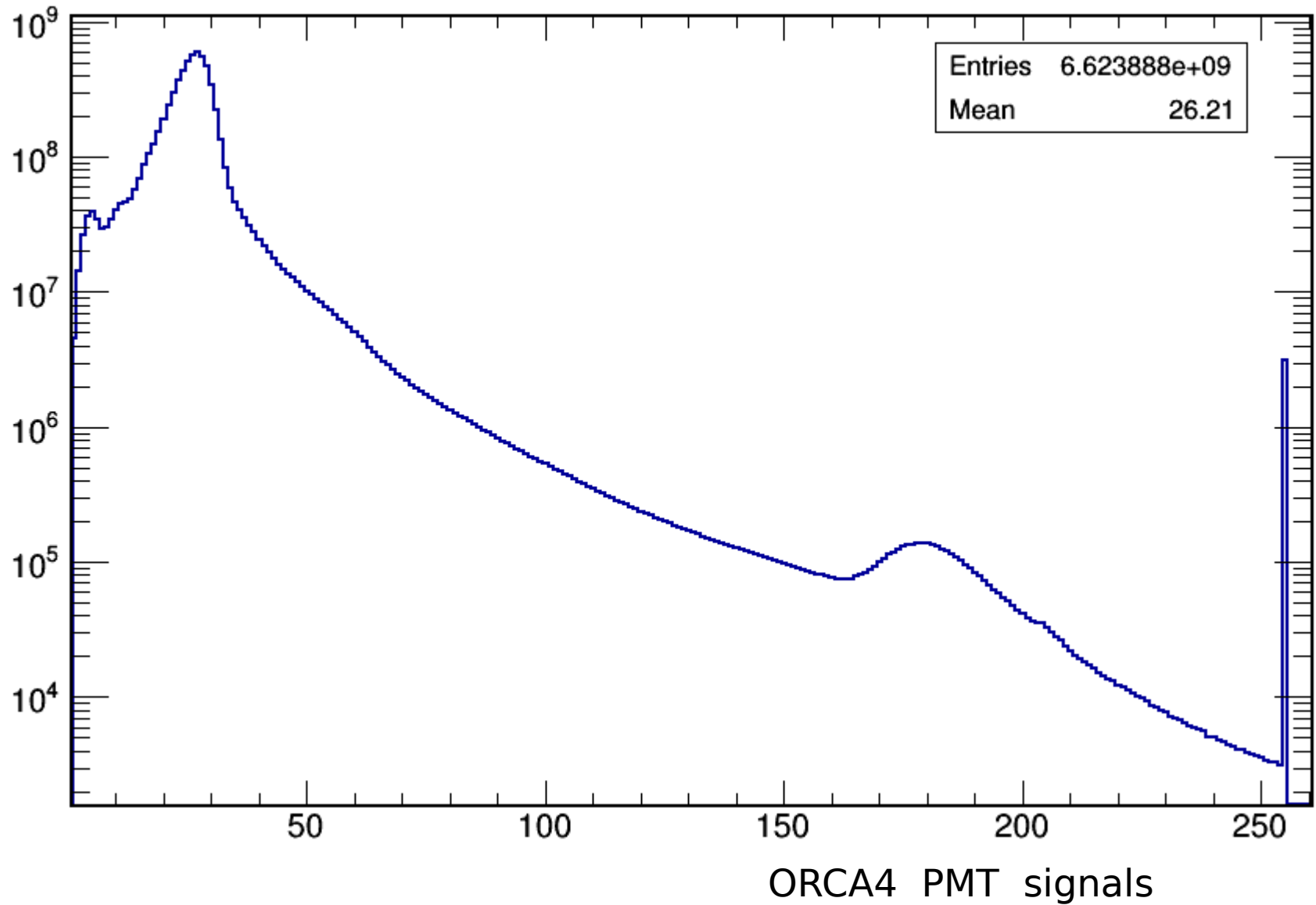
$$N_h \approx 60 \text{ hits (bkg hits)}$$



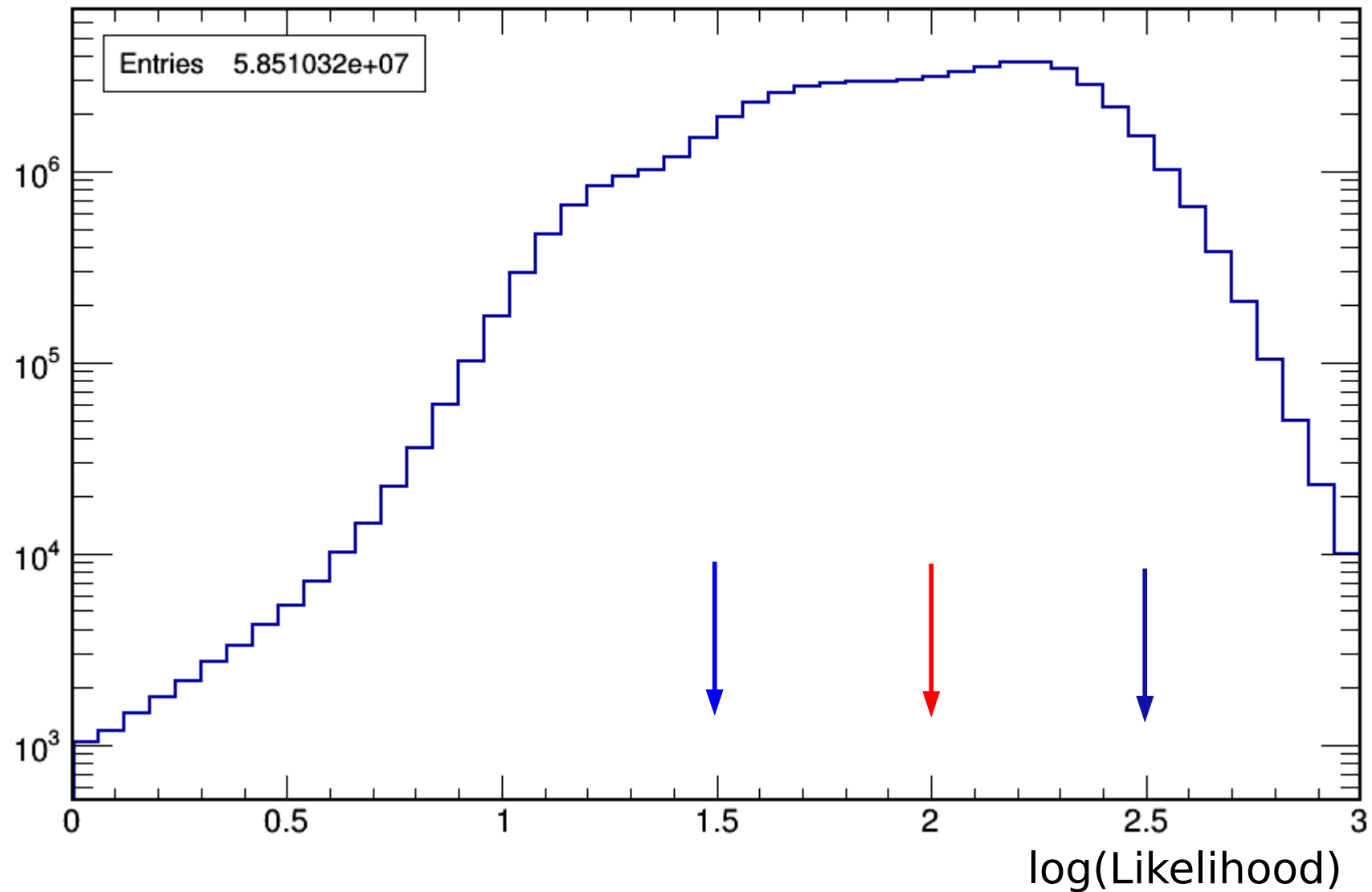
# KM3NeT/ORCA4 Hits



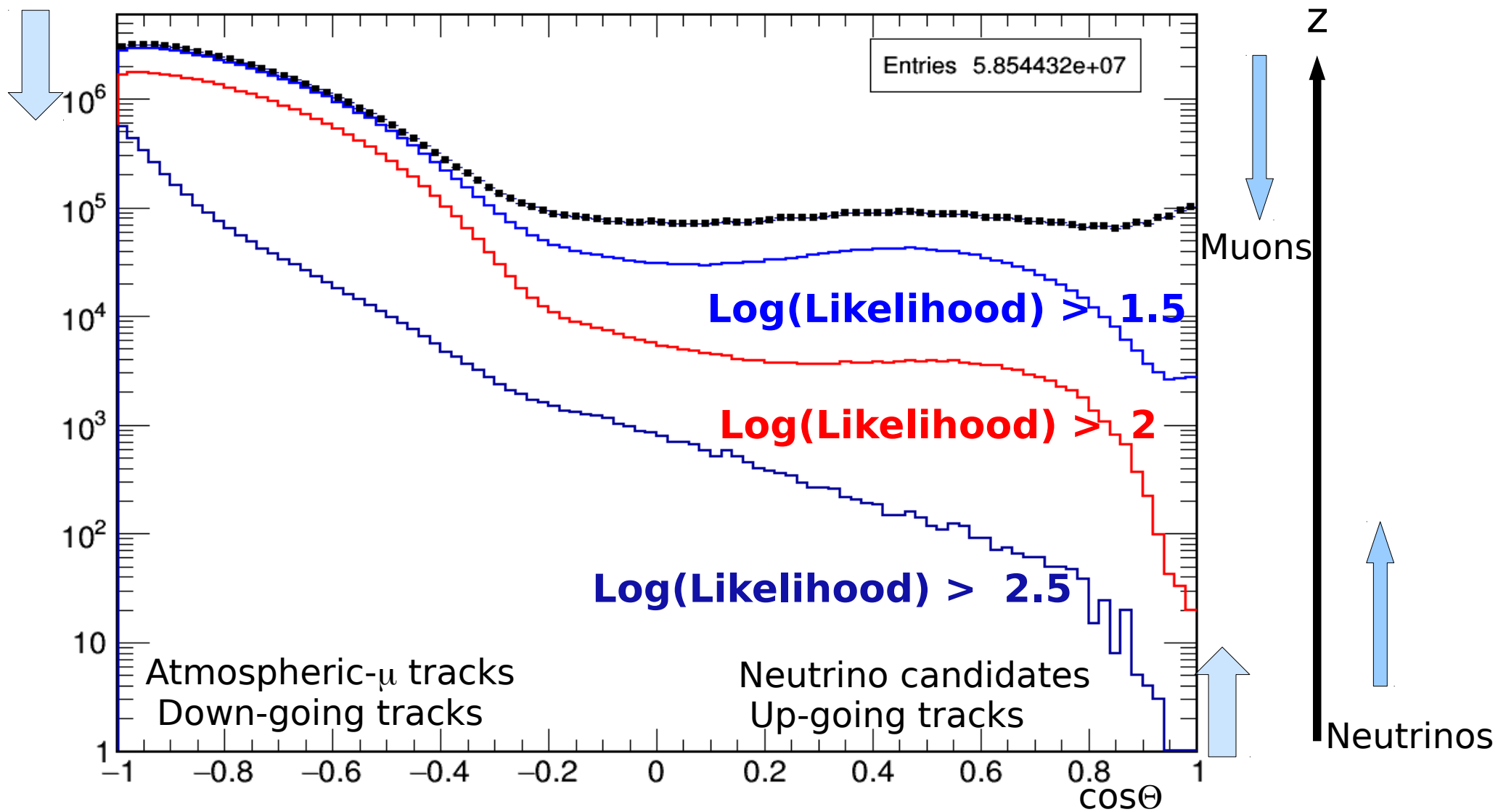
# KM3NeT/ORCA4 Data PMT Signals



# KM3NeT/ORCA4 Track Quality



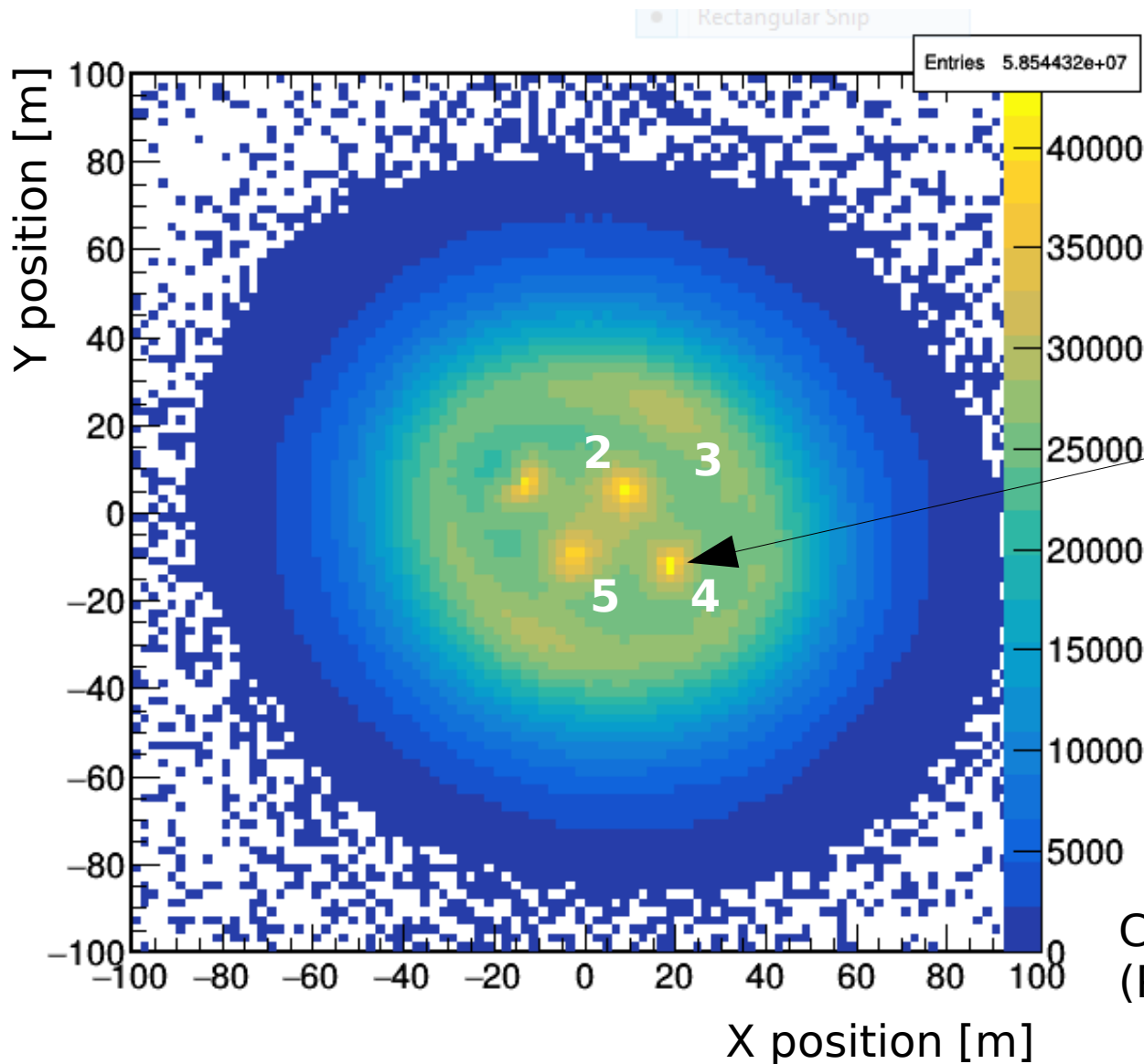
# KM3NeT/ORCA4 data



KM3NeT/ORCA4: reconstructed tracks z-direction

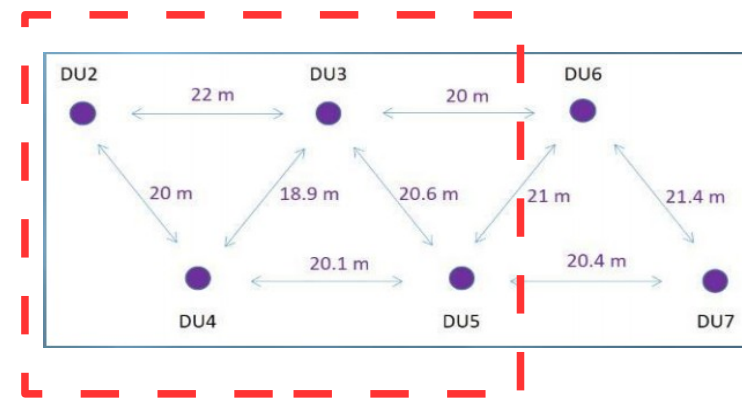
# KM3NeT/ORCA4 Reconstructed Tracks (x,y)

ORCA4 data: 23/07-25/11/2019 (about  $6 \cdot 10^7$  tracks)



KM3NeT/ORCA4  
reconstructed tracks  
starting position (x,y)

KM3NeT/ORCA4 DU

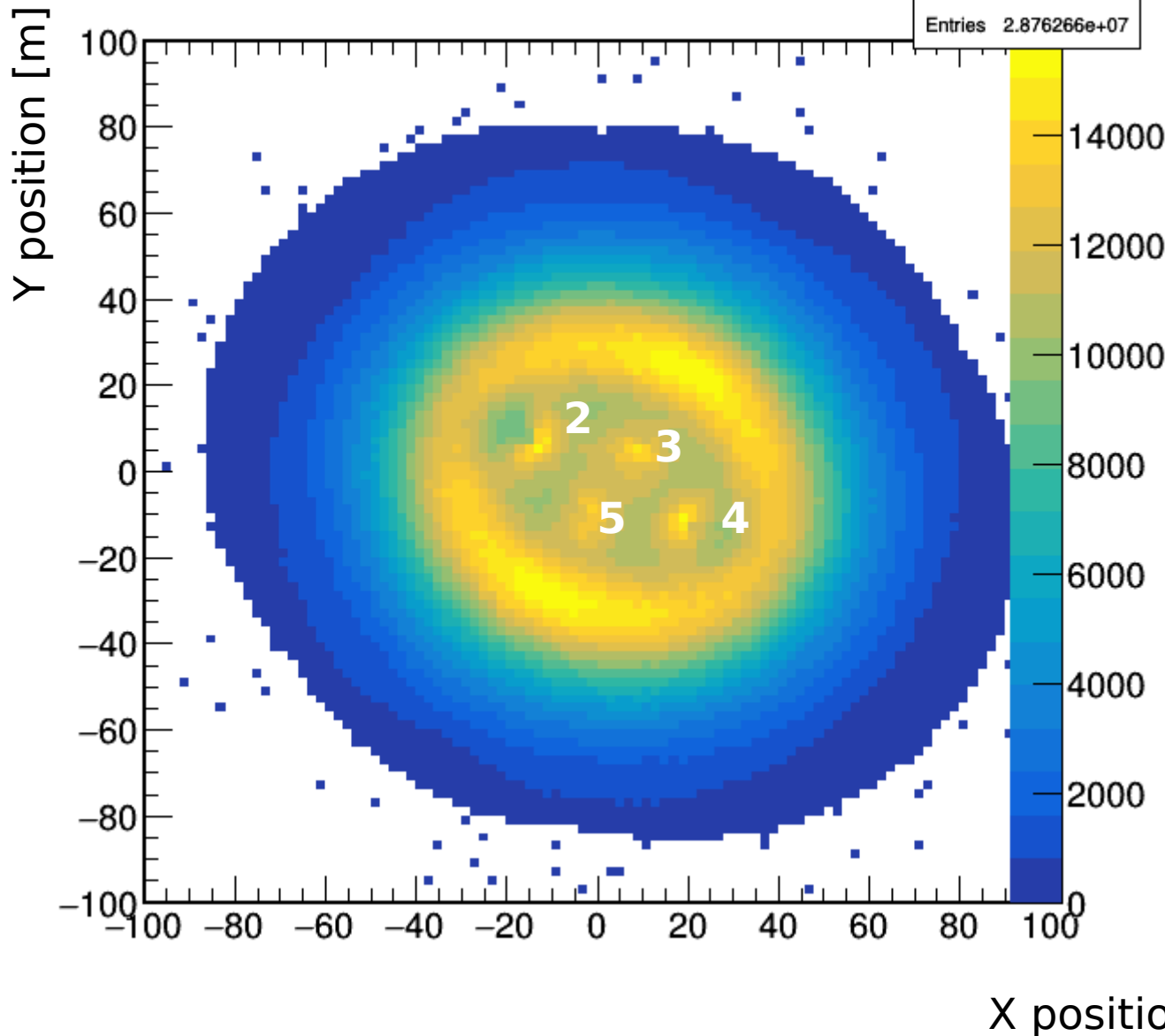


Current ORCA seabed configuration  
(PL, Genova meeting 11/02/2020)

# KM3NeT/ORCA4 Reconstructed Tracks (x,y)

ORCA4 data: 23/07-25/11/2019 (about  $3 \cdot 10^7$  tracks)

**Log(Likelihood) > 2**



KM3NeT/ORCA4  
reconstructed tracks  
starting position (x,y)

# KM3NeT/ORCA4 Data and MC in TSU

- ORCA4 Data: 23/07/2019 - 26/01/2020

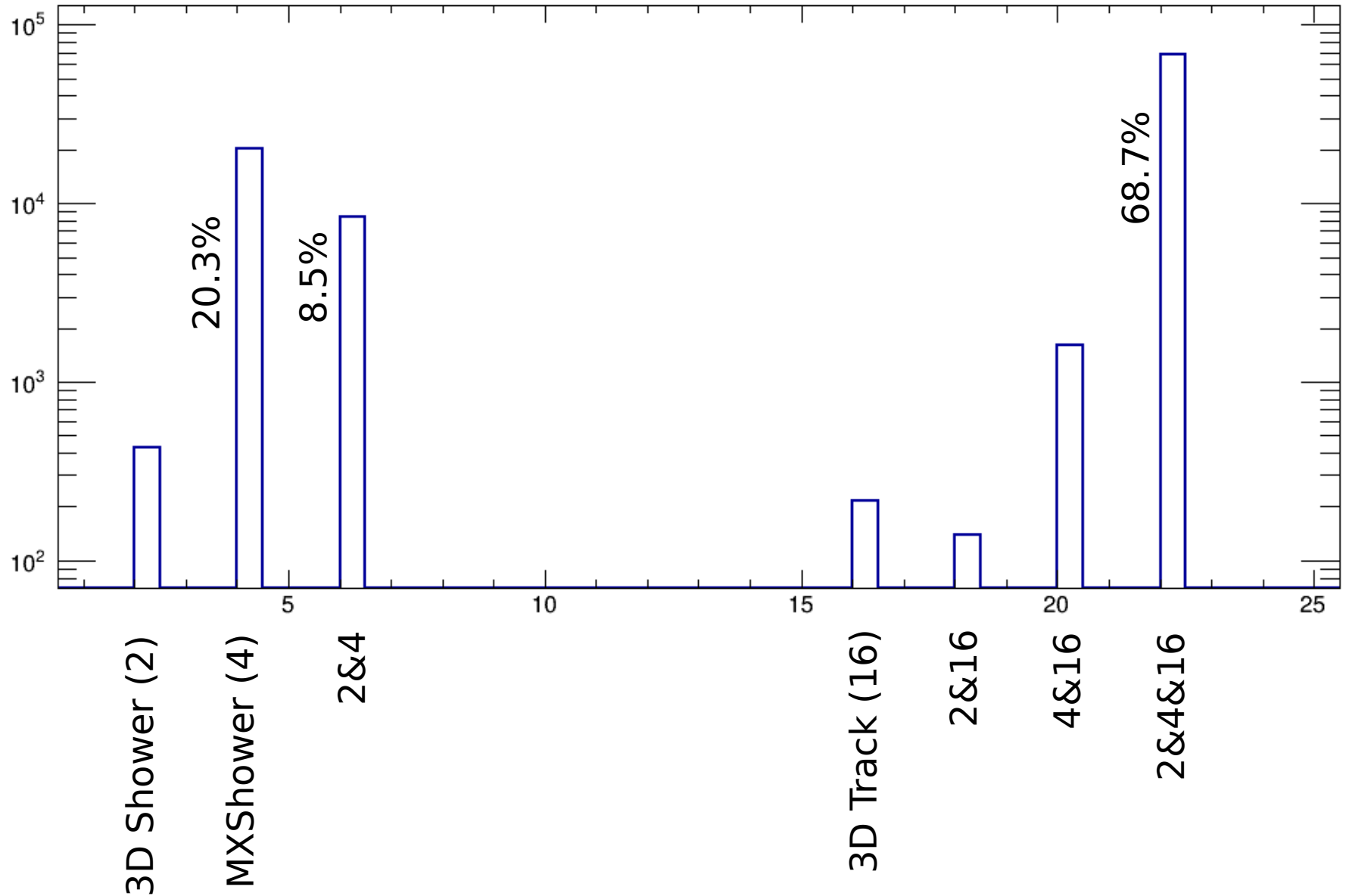
Last ORCA4 run: KM3NeT\_00000044\_00007219.root

## ORCA4 Data and MC in HEPI TSU

ORCA4 data		23/07 - 25/11/2019		566 files (533 analysed) (about $7 \cdot 10^7$ events)
atm- $\mu$ (mupage)			Sirene	1502 files (375 @TSU)
			km3	4394 files
atm- $\nu$ (genhen)	10-10 <sup>8</sup> GeV -1 < cos $\theta_z$ < 1 sim: 10 <sup>5</sup> ev. / File	$\nu_{\mu}$ -CC	Sirene	487810 (about $5 \cdot 10^7$ )
			km3	481320
		anti $\nu_{\mu}$ -CC	Sirene	531424 (about $5 \cdot 10^7$ )
			km3	524506

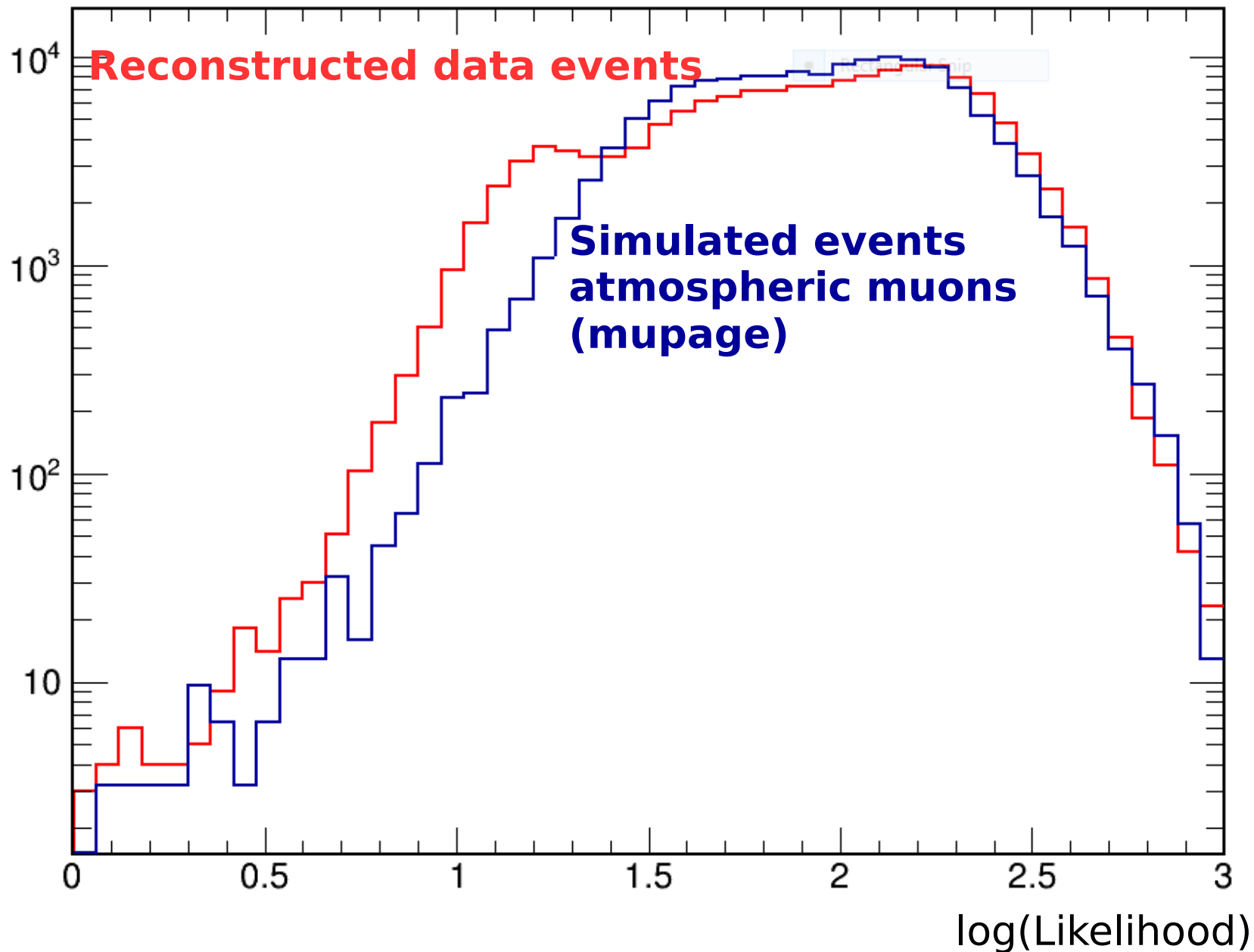
Neutrino MC ?

# KM3NeT/ORCA4 processed mc triggers

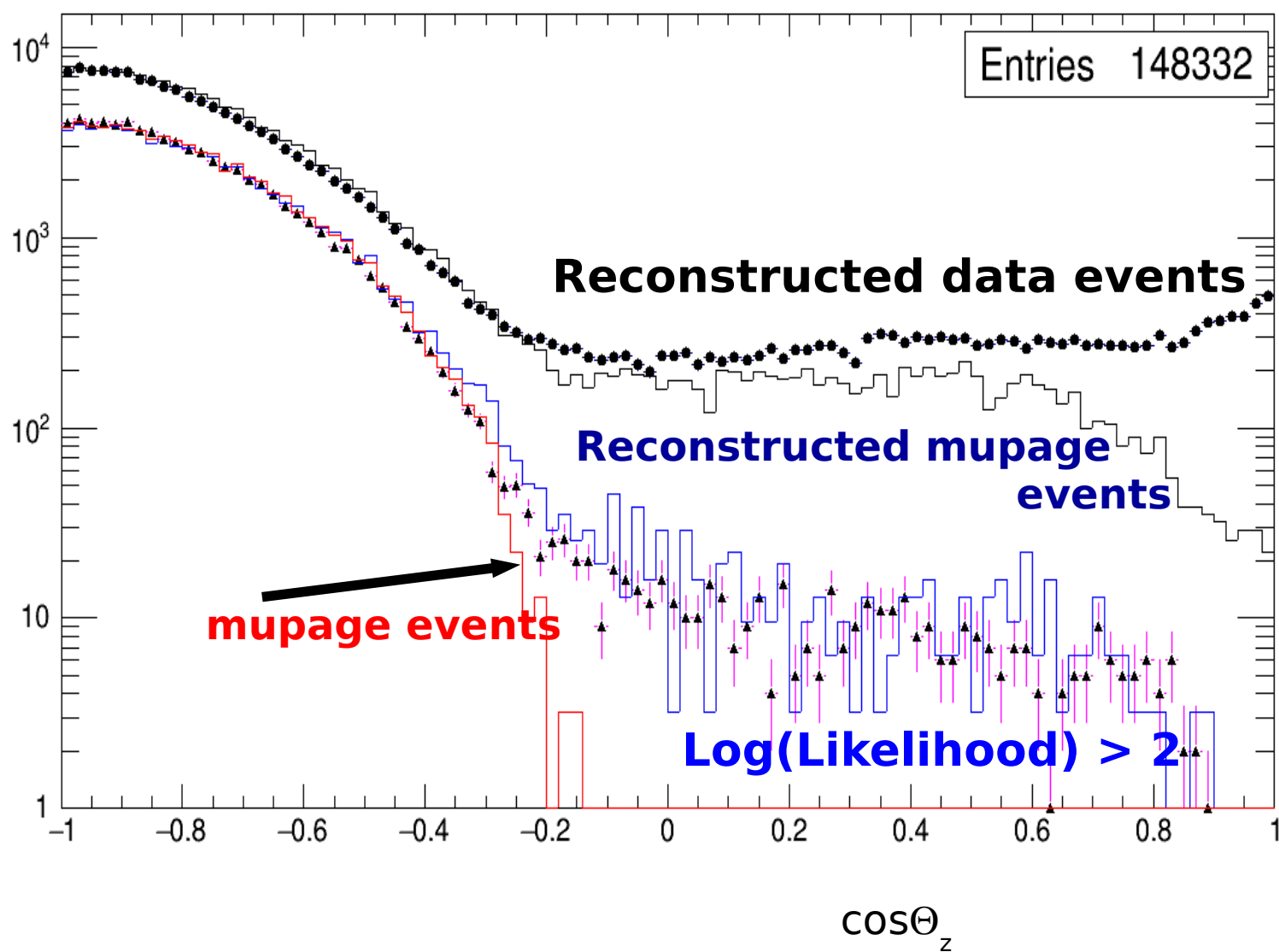




# KM3NeT/ORCA4 Data/MC: Reconstruction Quality



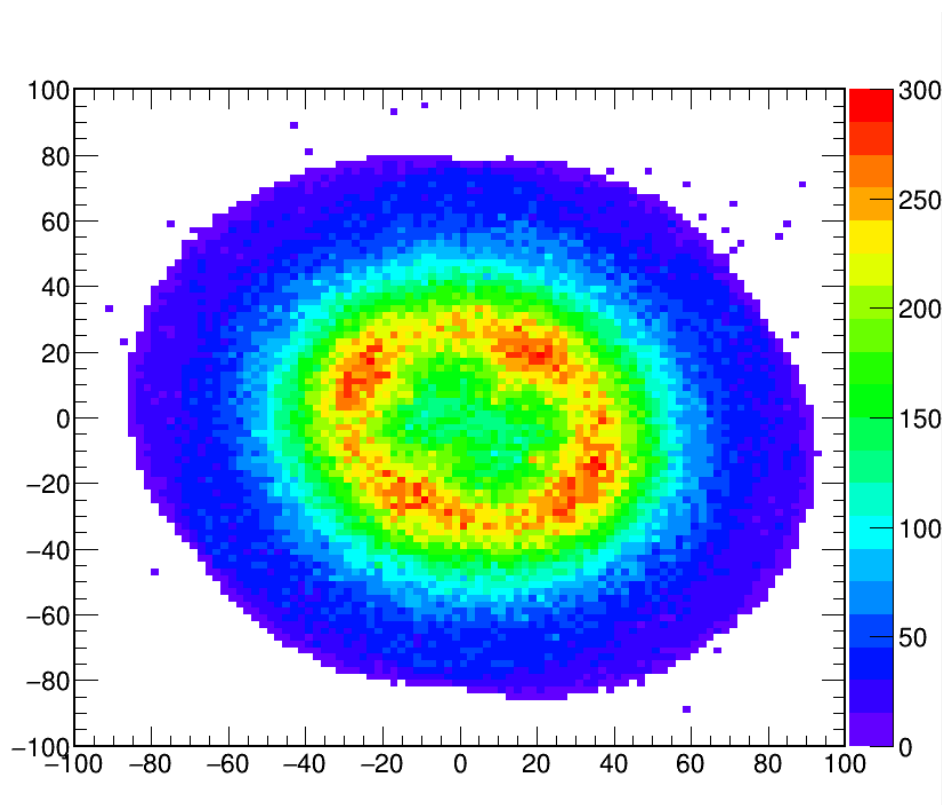
# KM3NeT/ORCA4 Data/MC: Reconstruction Quality



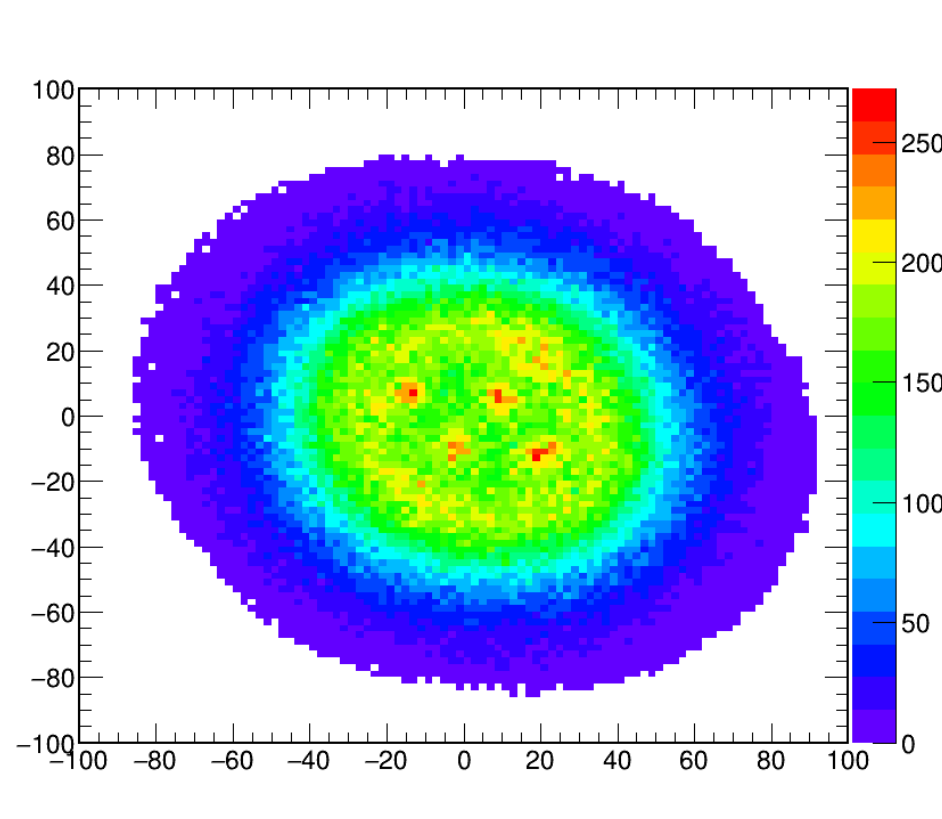
Comparison of data and atm- $\mu$  events

Example for run: 5886

- Reconstructed MC data (atmospheric neutrinos and muons)



Neutrino MC ( $\nu_{\mu}$ -CC / km<sup>3</sup>)



Atm-muon MC (mupage/ km<sup>3</sup>)

Plots with ROOT v5.34/23  
(Color palette is different from v6)

# Summary and Outlook

We have started ORCA4 data analysis @HEPI TSU:

- all processed ORCA4 data runs (126 days of taking, aonet -data form
- Data/MC comparison performed for a small part of this data

To be continued:

- About 40% of physics runs to be processed (JH, LF)
- Data/MC comparison including muon and neutrino simulations
  - Neutrino MC sample ?
- Study of selected muon and neutrino events