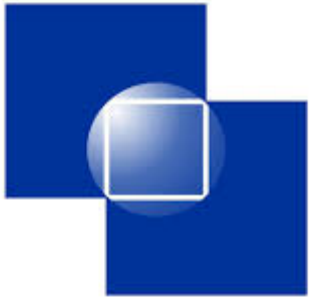

FR-18-1268

Analysis of the ORCA4 data in TSU

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Introduction

- **ORCA4: all data are processed → available at different levels, including Tier-2 computing@TSU**

- **ORCA4: <5% of the ORCA detector → a first multiline ($n_{lines} > 2$) configuration → possibility to check performance parameters**

- **ORCA4 performance → data/MC comparison**

In this presentation:

- ORCA4 data and MC
- Hit level comparisons
- Track level comparisons
- Long time events

Special thanks to Aart and Tamas for helping with analysis optimisation!

KM3NeT/ORCA4 Data

1 July 2019 (run: 5369) — ORCA4 data taking (210 days) — 26 Jan 2020 (run: 7219)

23/07/2019 (run: 5782) — 26/01/2020 (run: 7218)

834 processed runs
(23/07-26/01/2020)

raw data

KM3NeT data

reco data
(aanet)

634 runs

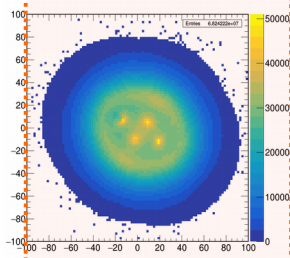
RunList
elog.km3net.de/Analysis/594
(712 runs)

D. Stavropoulos
Analysis & Operation
Elog; 594; 583

PHYS. Runs / Livetime >= 2 h
- $|(UTC_{max}-UTC_{min})-Livetime| < 100$ sec
- HRV fraction < 0.2

712 runs / 153.6 days livetime

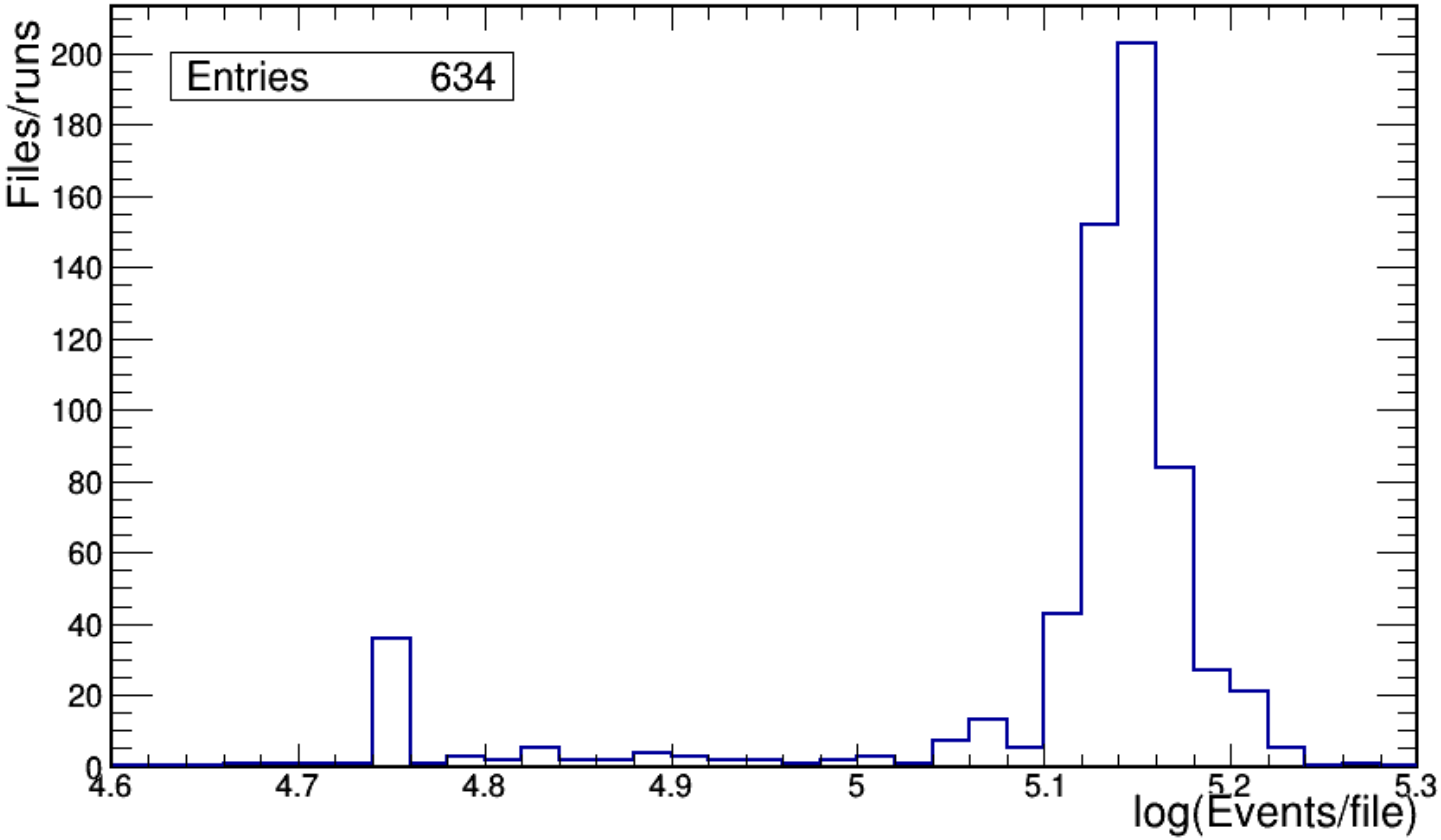
RCA4 analysis (reco data)
(format: aanet)



ORCA4 Data and MC Samples

ORCA4 processed data: 634 data files (aanet-format)

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



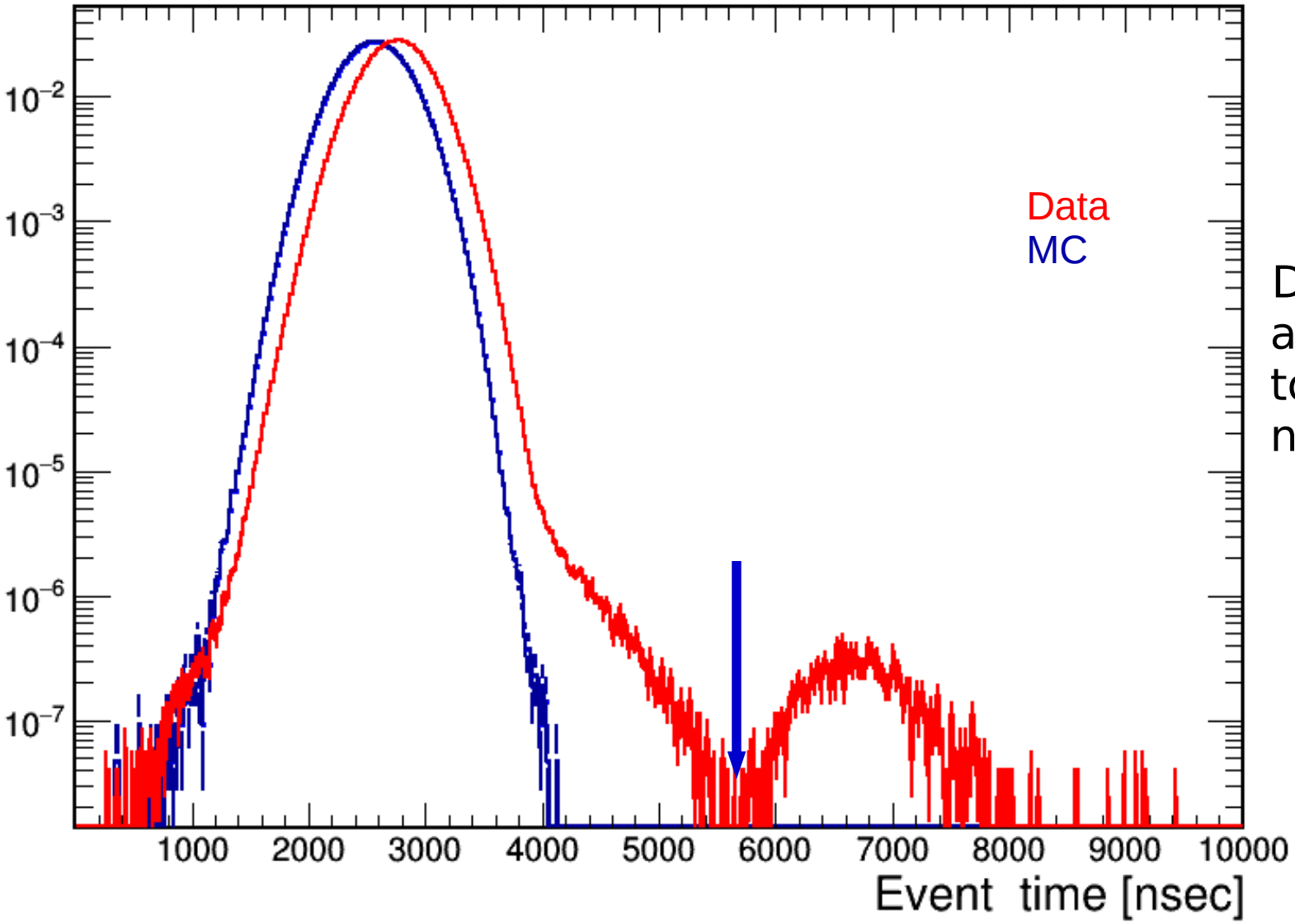
ORCA4 MC sample: rbr production: mupage → sirene →JORCAReconstruction

1436 files → 21 432 435 events (¼ of data)

* https://elog.km3net.de/Analysis/620

ORCA4 Data/MC Comparison: Event Time

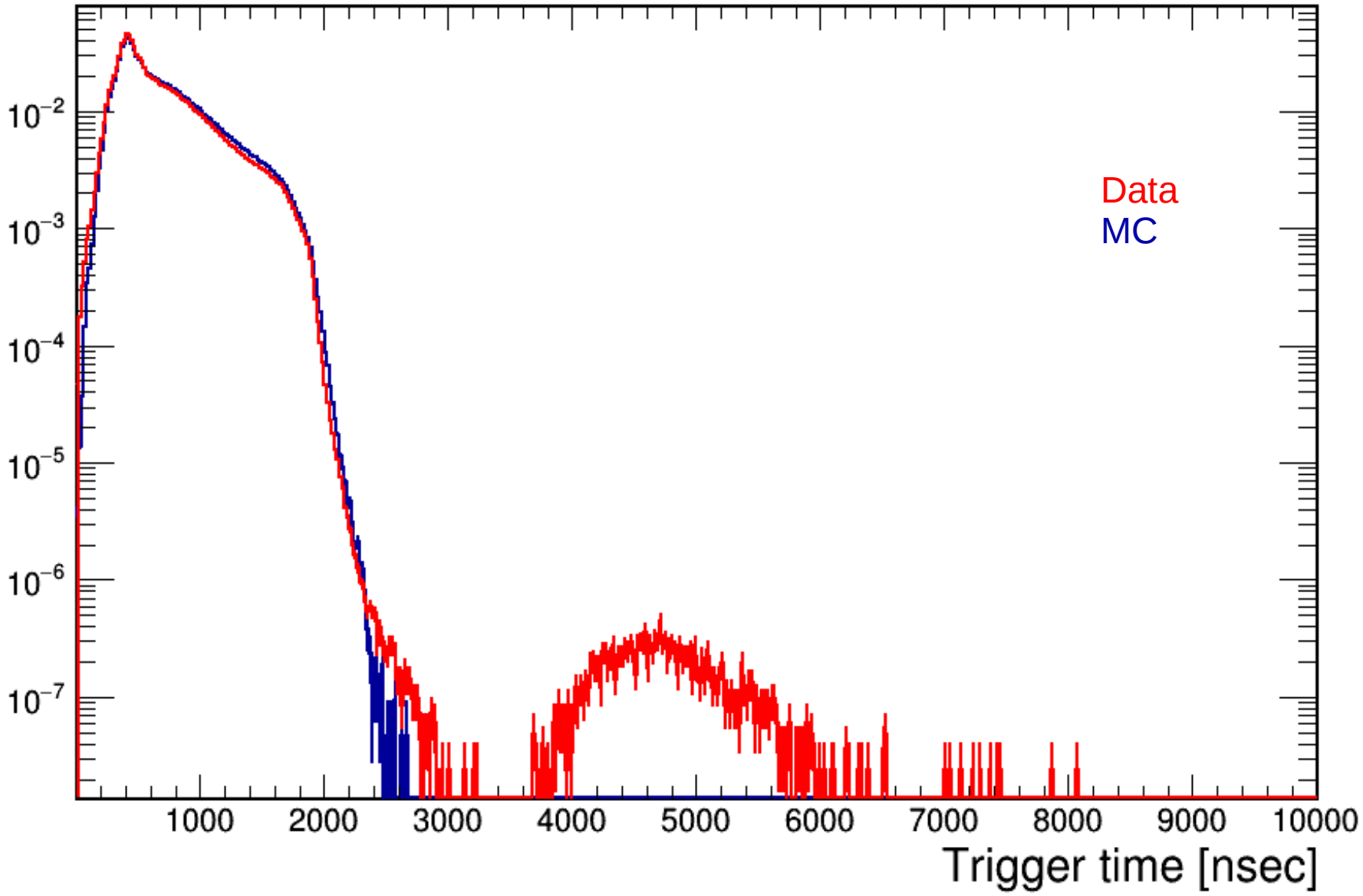
Events time: $\Delta t=(t_{last} - t_0)$ t-time of the hits



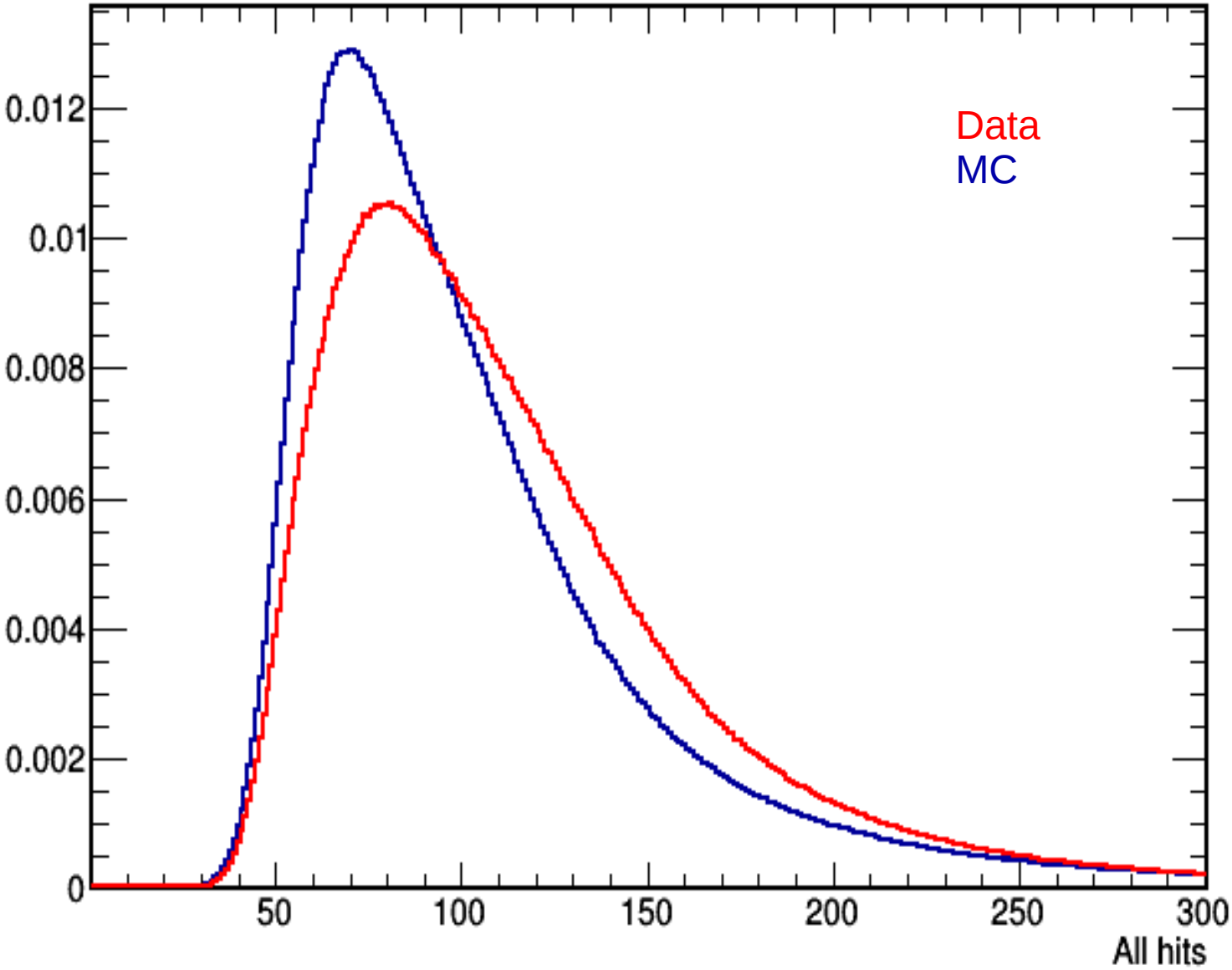
Data and MC are normalized to the event numbers

"Long time events": $\Delta t > 5600$ nsec: 1429 (1.7×10^{-5} off data)

Triggered Hits



All Hits



Study at DOM
Is in progress

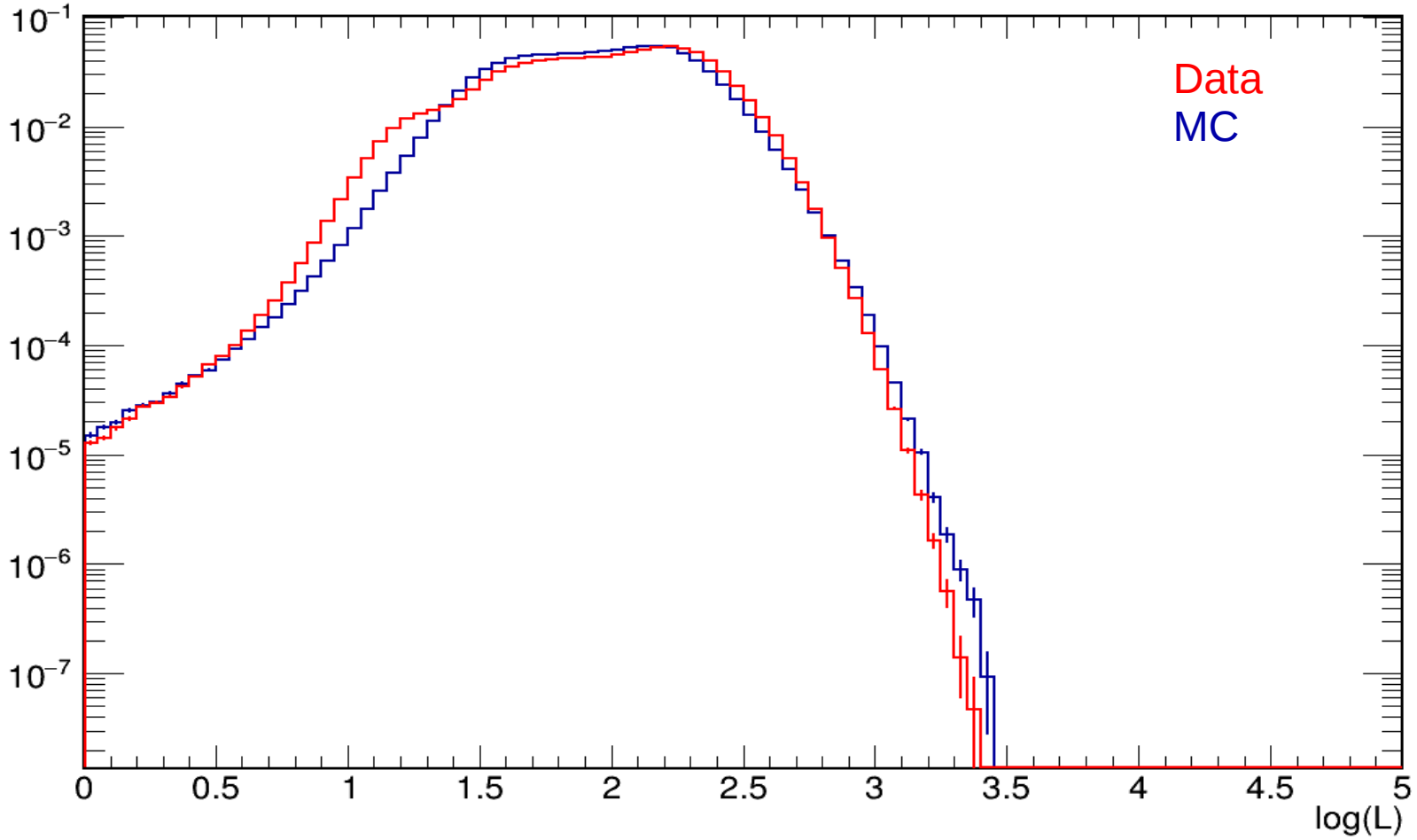
ORCA4 Reconstruction

ORCA4 reconstruction: currently only track like events

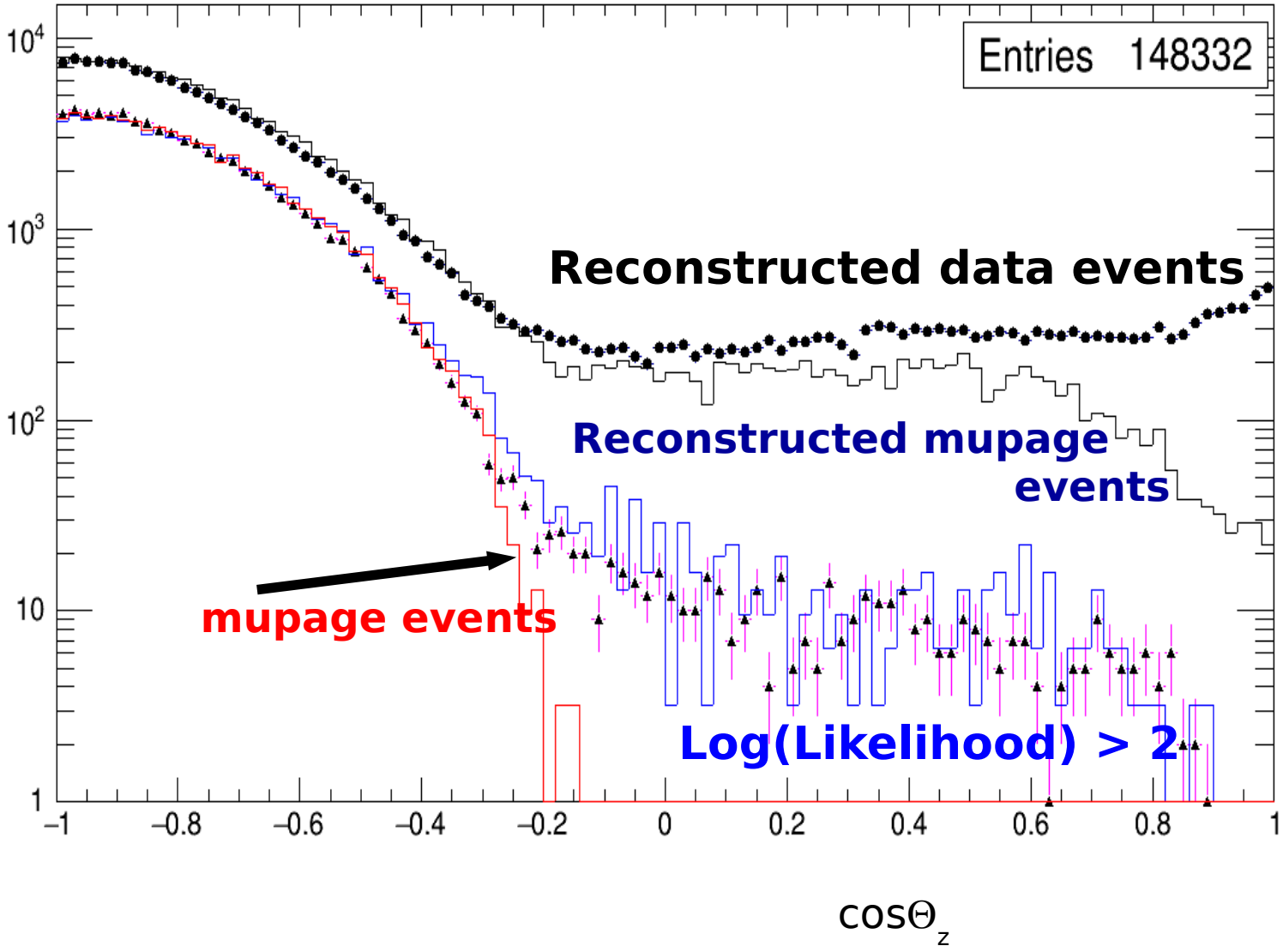
Reconstructed track:

- position: (x,y,z); unit vector of direction (cosx, cosy, cosz), t_0: time

Reconstruction quality: L, fitinf (17 parameters)



KM3NeT/ORCA4 Data/MC: Reconstruction Quality

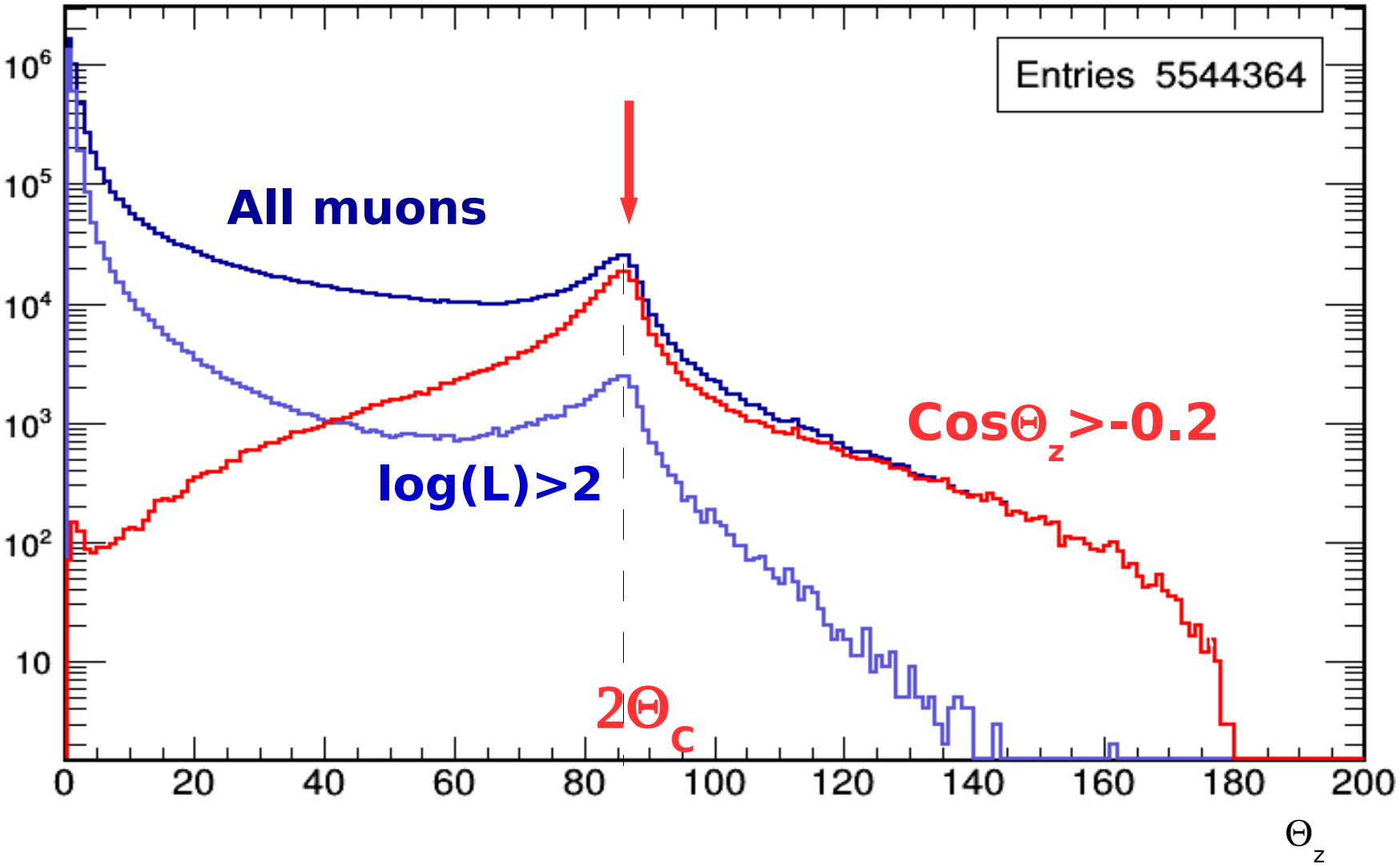


Comparison of data and atm-μ events

Example for run: 5886

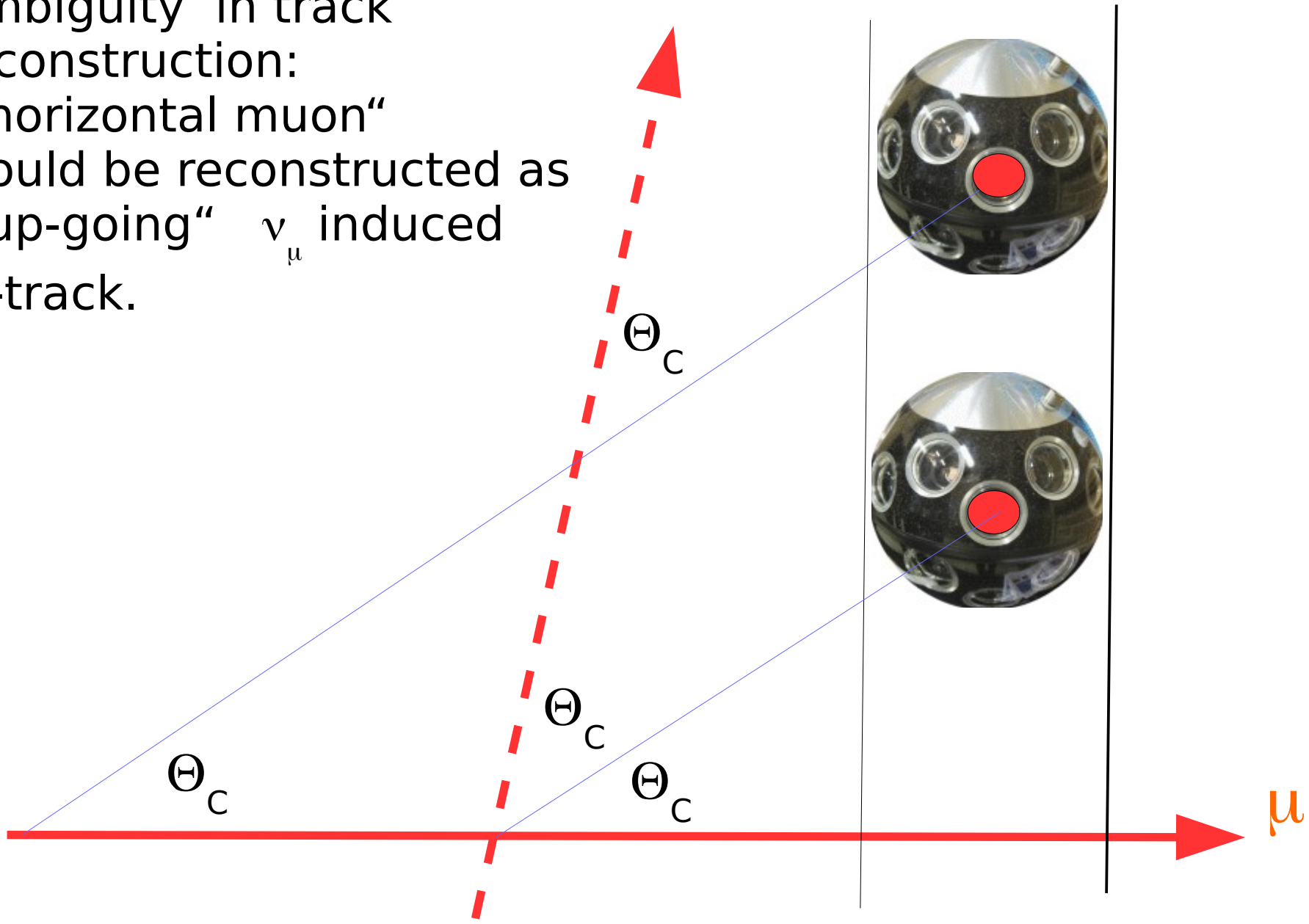
Atmospheric Muons: Angular Resolution

374 mupage-km3 files (rbr - background)
5 544 930 MC events



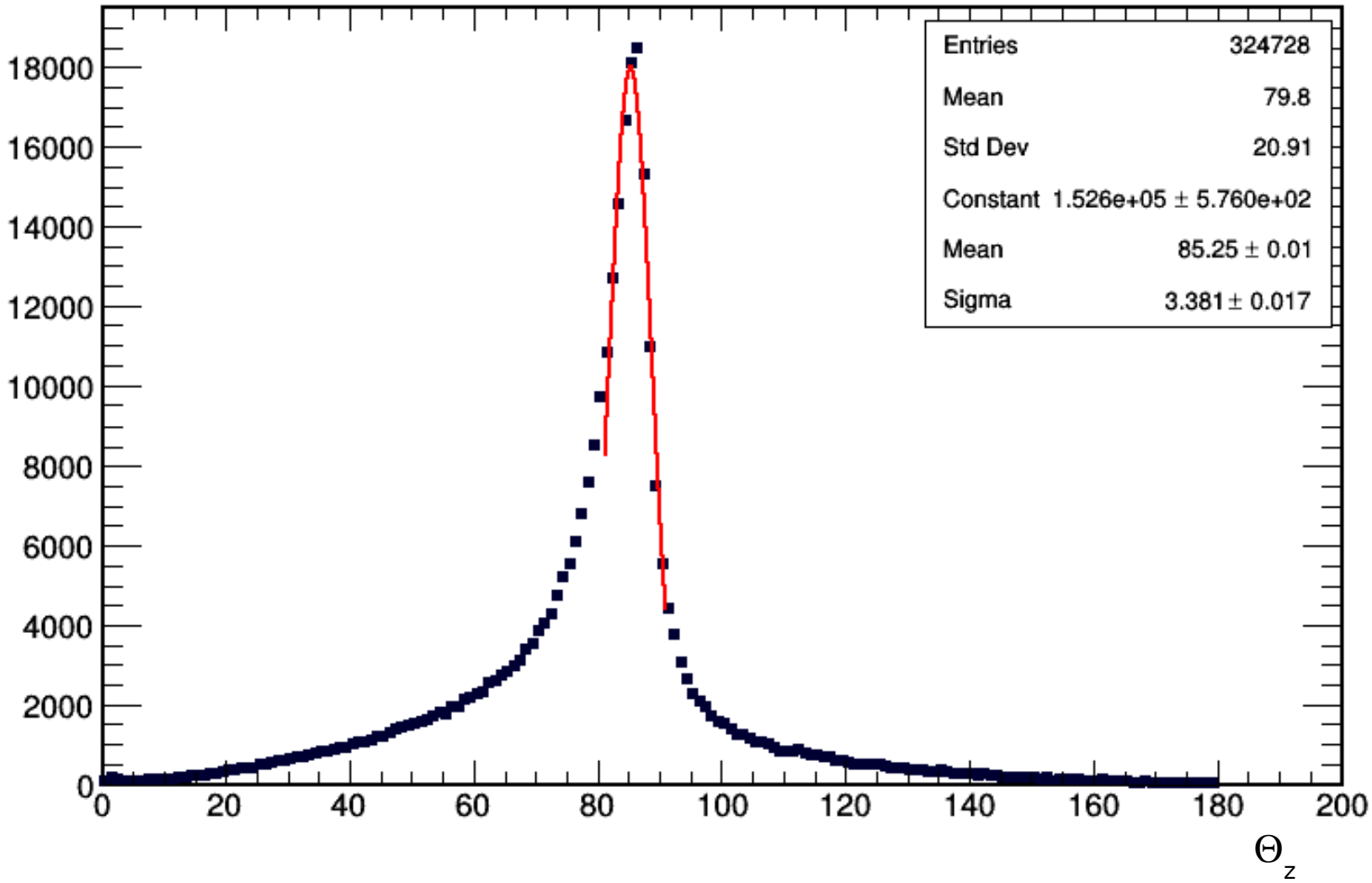
Reconstruction Ambiguity

Ambiguity in track reconstruction:
"horizontal muon"
could be reconstructed as
"up-going" ν_μ induced
μ-track.

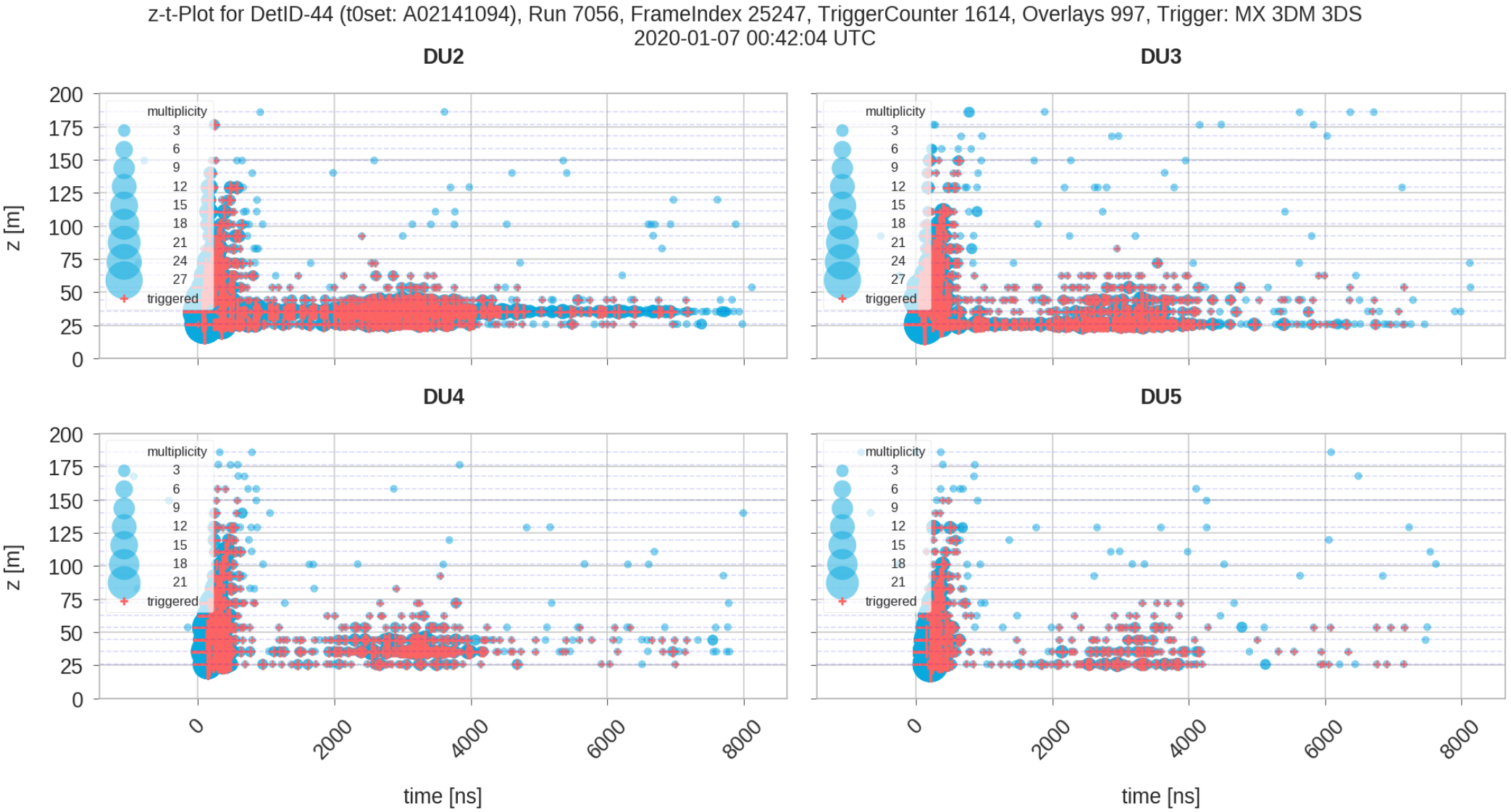


Angular Resolution

374 mupage-km3 files (rbr - background)
5 544 930 MC events



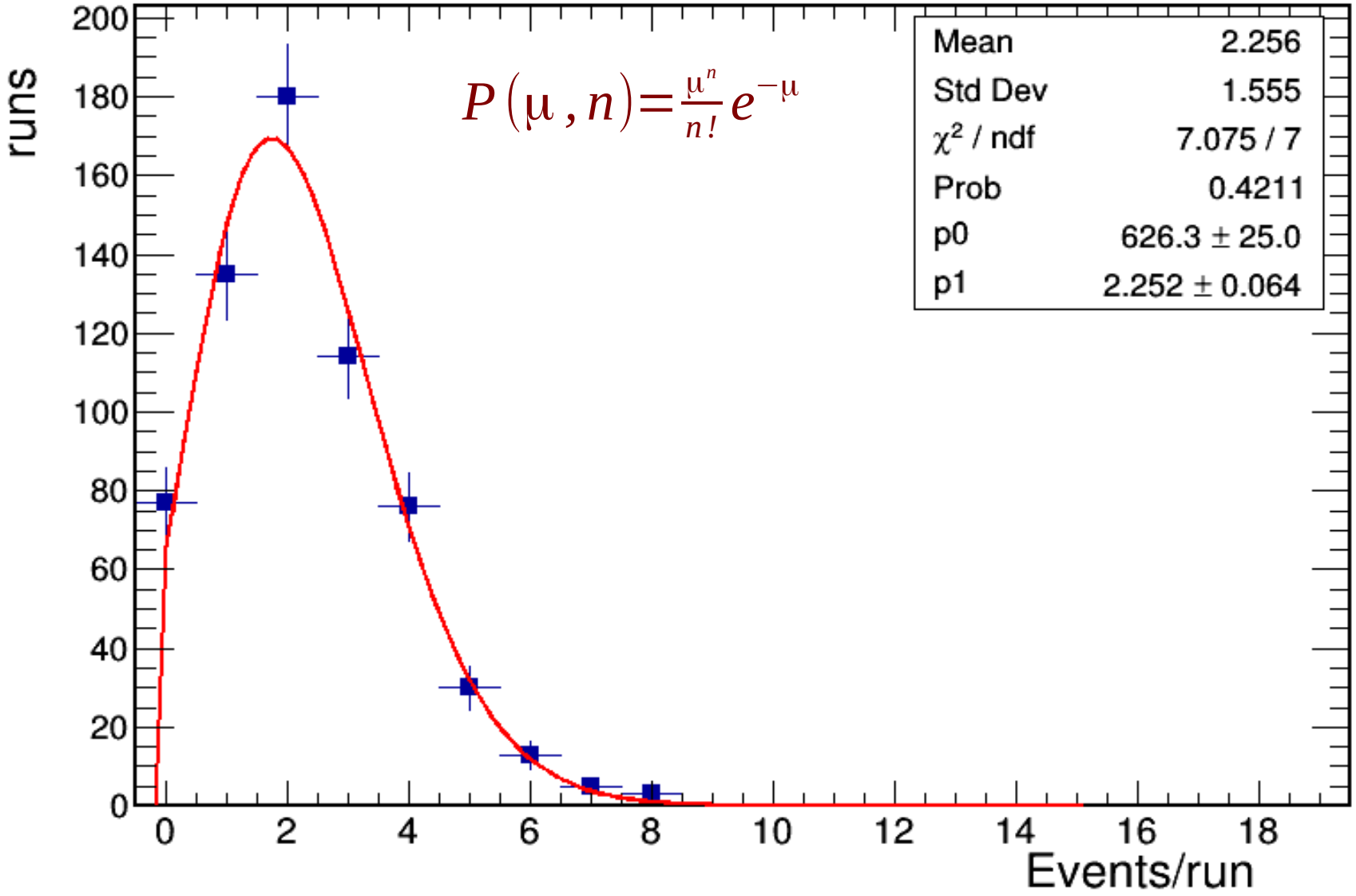
Long Time Event Display



https://elog.km3net.de/Operations+FR/3717

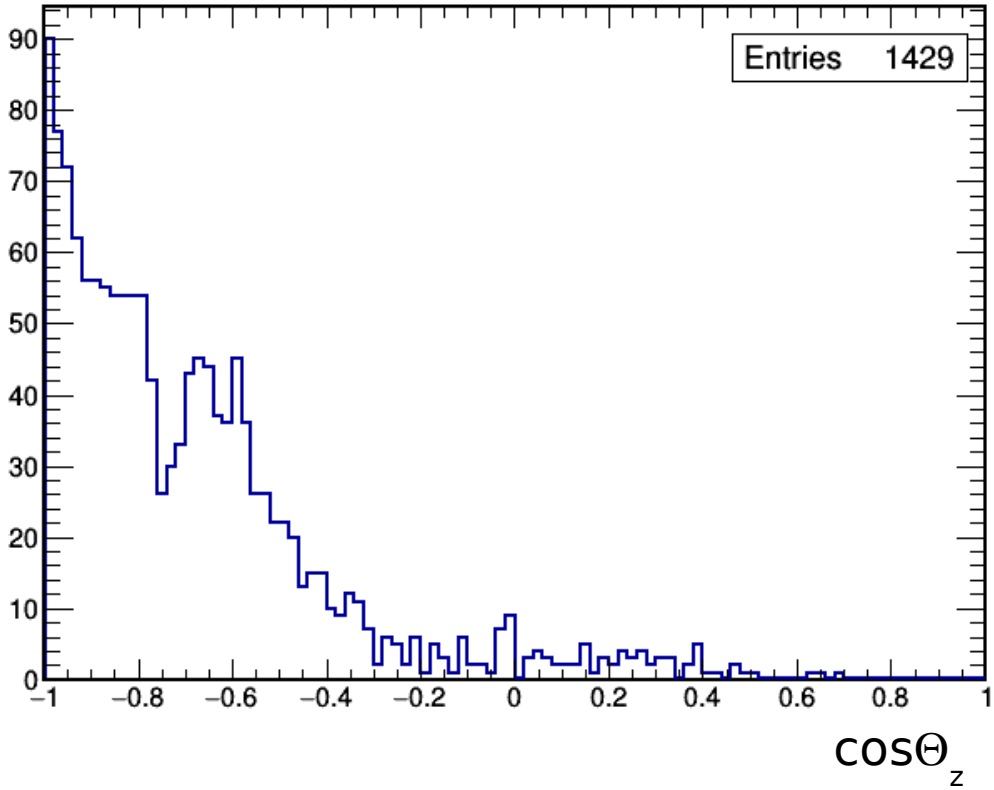
https://elog.km3net.de/Analysis/579

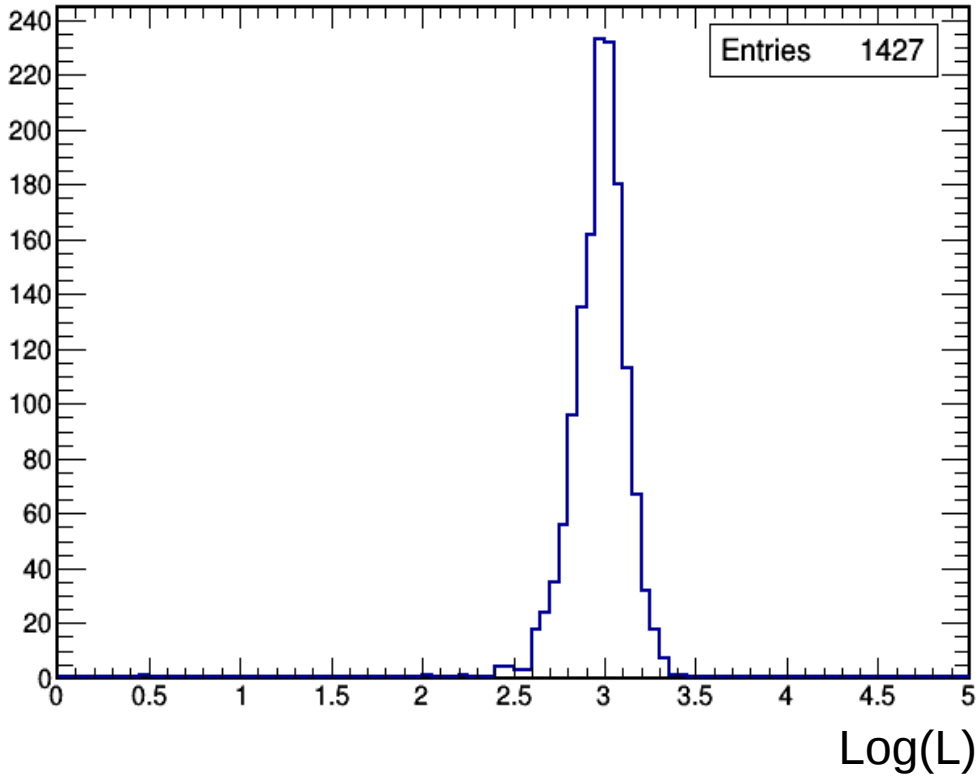
Long Time Event Distribution



Reconstructed Track Parameters

Long Time Events‘ Track Parameters





Summary and Outlook

- All ORCA4 (first multi-line KM3NeT configuration) data is available for the analysis
- Data and MC are currently processed with “track like“ events
- Data/MC comparison is made at different levels, some descripances found
- A small fraction of events (1.7×10^{-5}) have very long time → origin of these events are under the study
- Understanding of ORCA4 performance is a necessary condition for the next step: selection and analysis of neutrino events