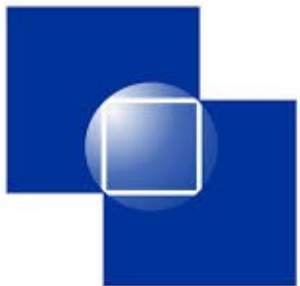




Update of the KM3NeT ORCA6 Analysis (v6)

Gogita Papalashvili, Rezo Shanidze

February 10 2021



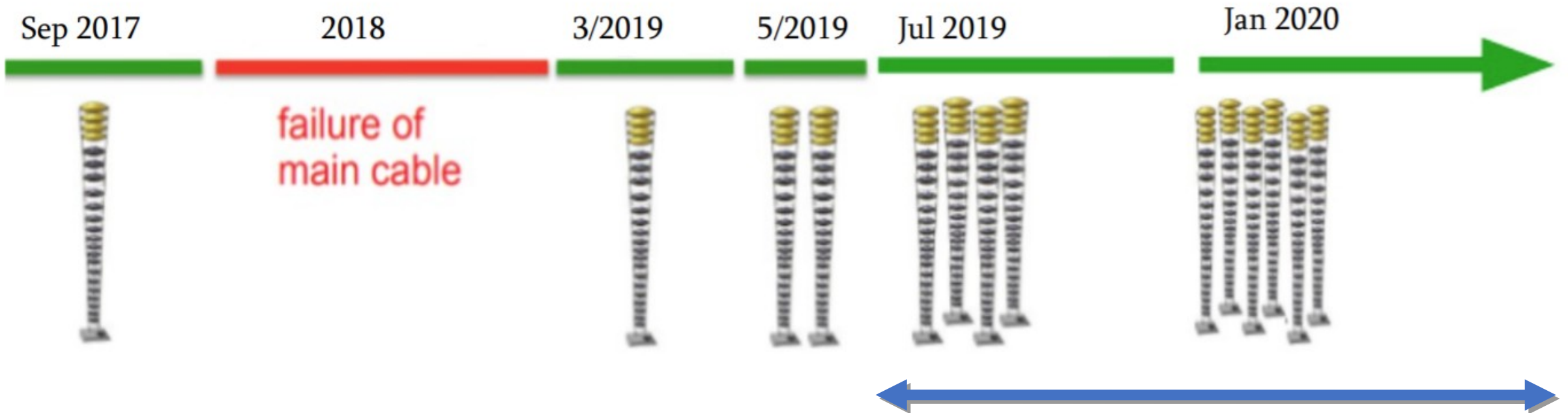
High Energy Physics Institute
Tbilisi State University

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Science Foundation

- ✓ ORCA6 Data and MC
- ✓ Neutrino events selection in ORCA6
- ✓ Summary and Outlook

ORCA6 Processed Data

Current ORCA Configuration: **ORCA6 (from January,2020)**



ORCA processed data (at HPSS Lyon and [@t2.km3net.tsu.ge](mailto:t2.km3net.tsu.ge))

ORCA6 data taking period: 27/01/2020 – 7/01/2021

ORCA6 Processed Data

ORCA6 processed-data releases (by Luigi Fusco):

❖ Released on 29/07/2020

HPSS@Lyon-cc: /in2p3/km3net/data/KM3NeT_00000049/v5.42/reco

853 files (“aanet”); runs: 7231 - 8292 (27/01-11/07/200)

@t2.km3net.tsu.ge: 846 runs: 117 136 924 (1.2×10^8 events)

❖ Announced on Jan 13, 2021

HPSS@Lyon-cc: /in2p3/km3net/data/KM3NeT_00000049/v6_ORCA_test/reco/

994 files (“aanet”); runs: 7942 - 9264 (including 290 runs from first release)

704 runs, (11/07/2020 – 7/01/2021)

@t2.km3net.tsu.ge: 698 runs: 133 673 087 (1.3×10^8 events)

❖ All ORCA6 processed data (1/02/2021):

@t2.km3net.tsu.ge: 1544 runs: 2.5×10^8 events (327.36 days)

about 2.5 x ORCA4 (132.7 days, ZA, 9/02)

ORCA6 v6 MC

ORCA6 v6 MC test data (produced by Luigi Fusco):

git.km3net.de/working_groups/data-analysis/-/issues/11

@cca.in2p3.fr (sps –storage)

❖ Atmospheric muons (atm- μ)

/sps/km3net/repo/data_processing/tag/v6_ORCA_test_rc/prod/mc/atm_neutrino/KM3NeT_00000049/v6_ORCA_test_rc

Generator (mupage) \longrightarrow *light(Sirene)* \longrightarrow *trigger (Jpp)* \longrightarrow *reco(Jpp)*

364 files (3.7 10^8 atm μ)

728 files (5 643 955 events)

❖ Atmospheric neutrinos: (flavors x interaction (CC/NC) x energy (Low, High)

muon neutrinos (ν_μ): **CC, Low (1-50 GeV) High (50-200 GeV) 2x 324**

NC, Low (1-500 GeV)

tau neutrinos (ν_τ): **CC, Low (1-50 GeV) High (50-200 GeV)**

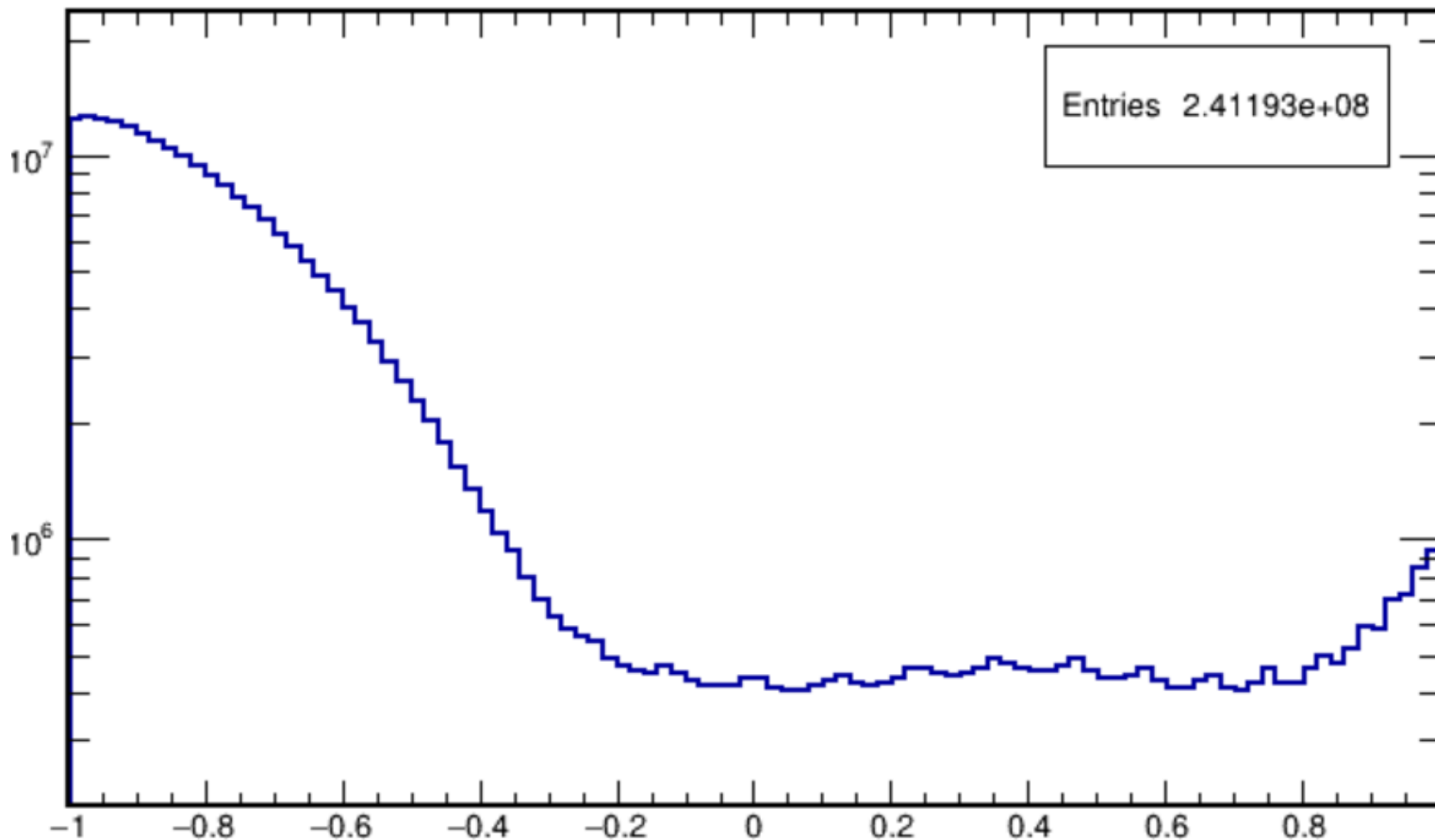
electron neutrinos (ν_e): **CC, Low (1-500 GeV)**

ORCA6 Data

All processed events (v5, v6): **250 810 011** (2.51×10^8)

Live: 327.36 days

Up going tracks: 23 868 868



$$\text{atm-}\mu / \nu_{\mu}\text{-CC} > 10^4$$

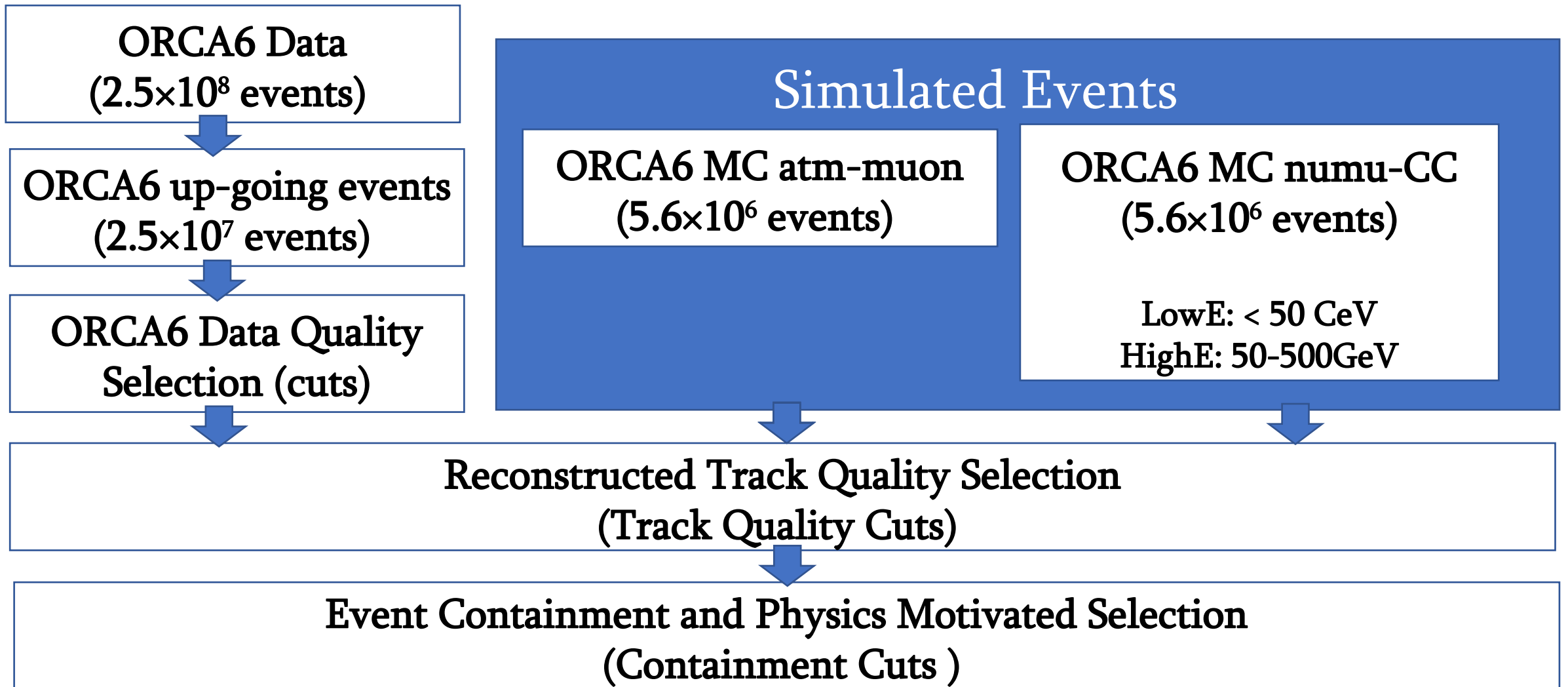
Selection (Cuts)

$$\text{atm-}\mu / \nu_{\mu}\text{-CC} \ll 1$$

Selection cuts:

Event Quality &&
Track Quality &&
Track containment

Neutrino Event Selection

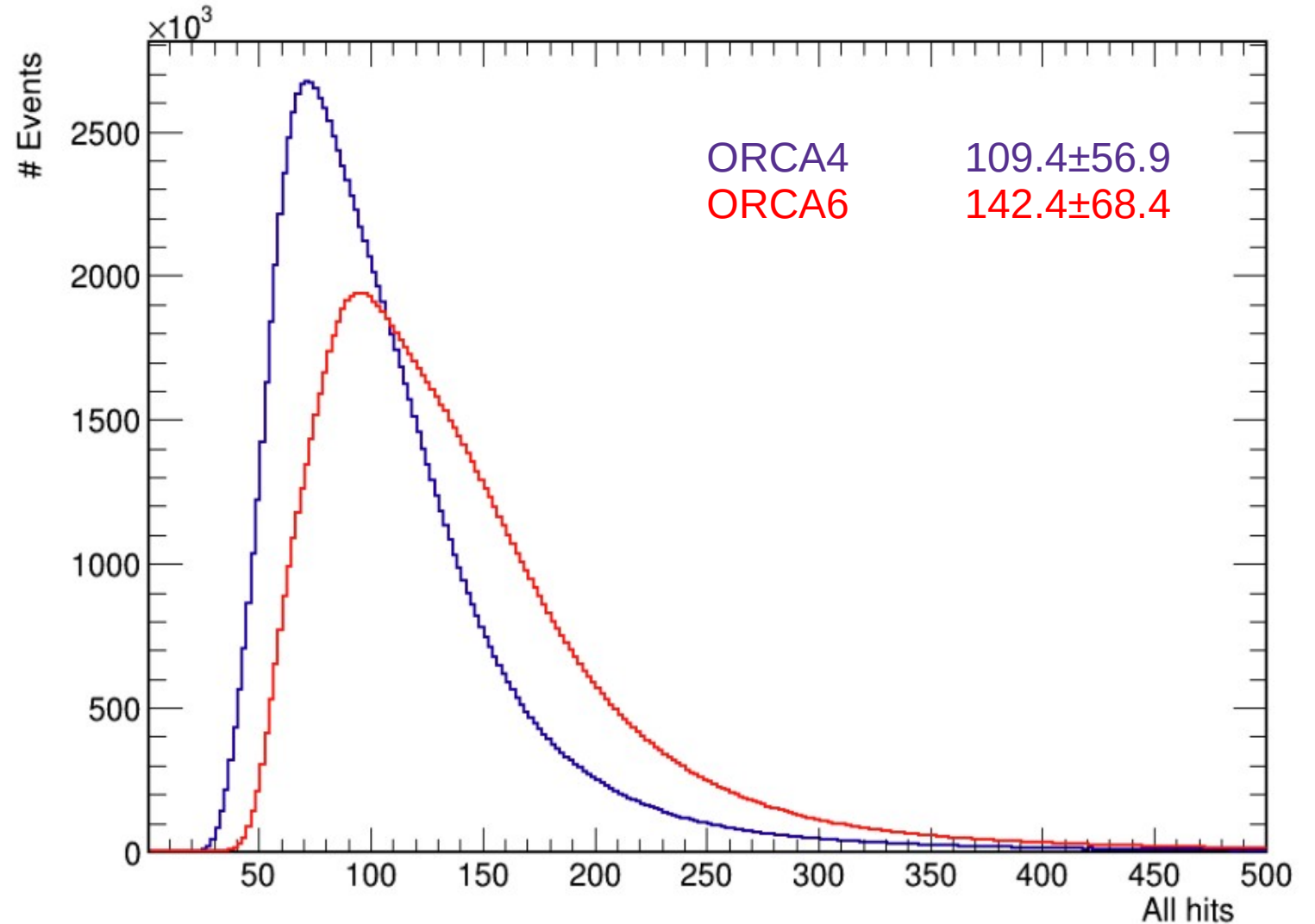


ORCA6 Event Quality - Hits

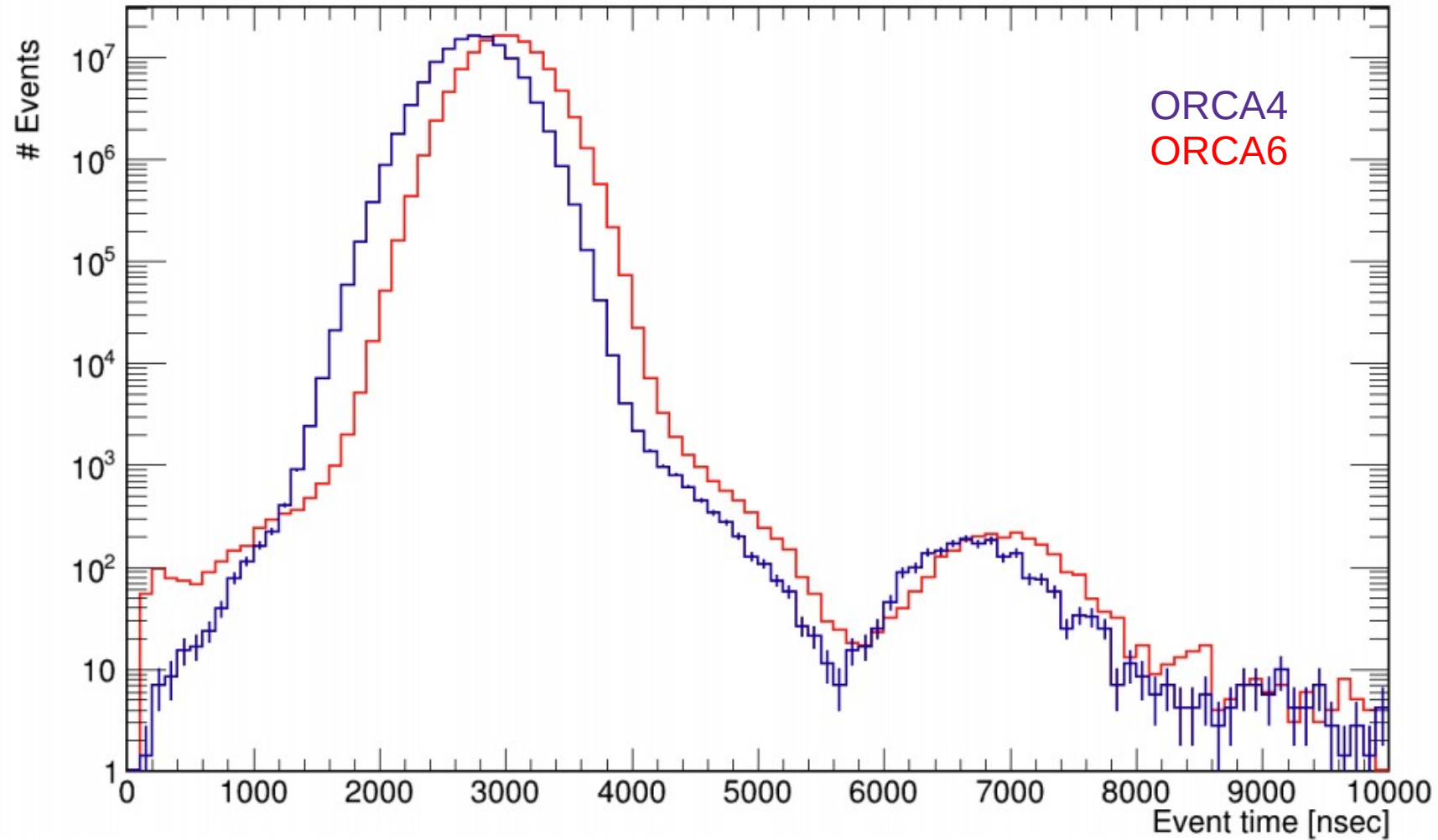
Total number of hits $< H_{\max}$

No signal with ToT 255 nsec

Number of triggered hits > 15



ORCA6 Event Quality - Time



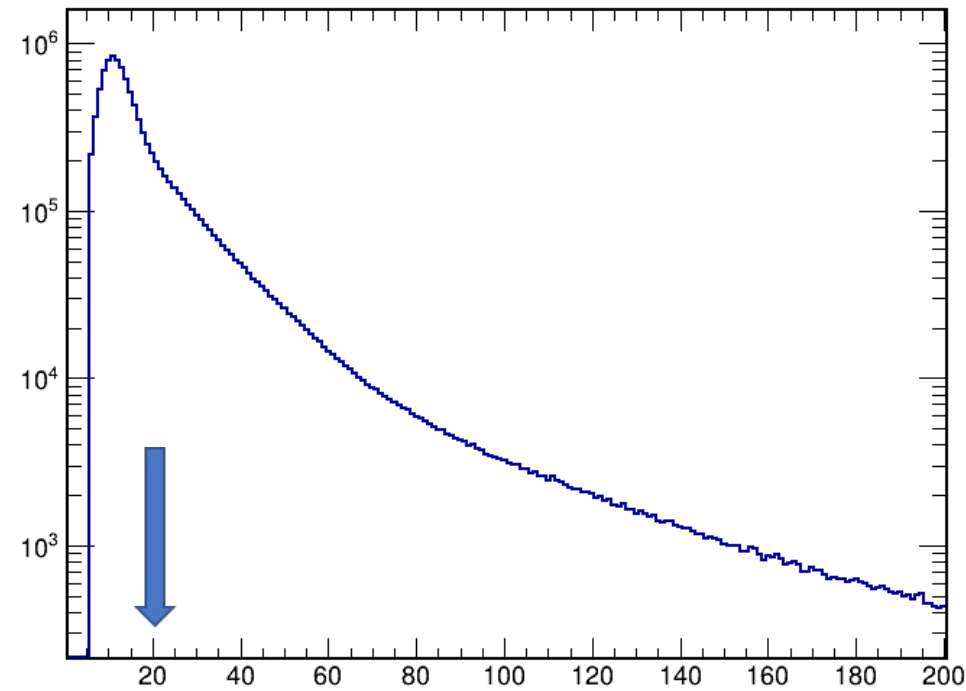
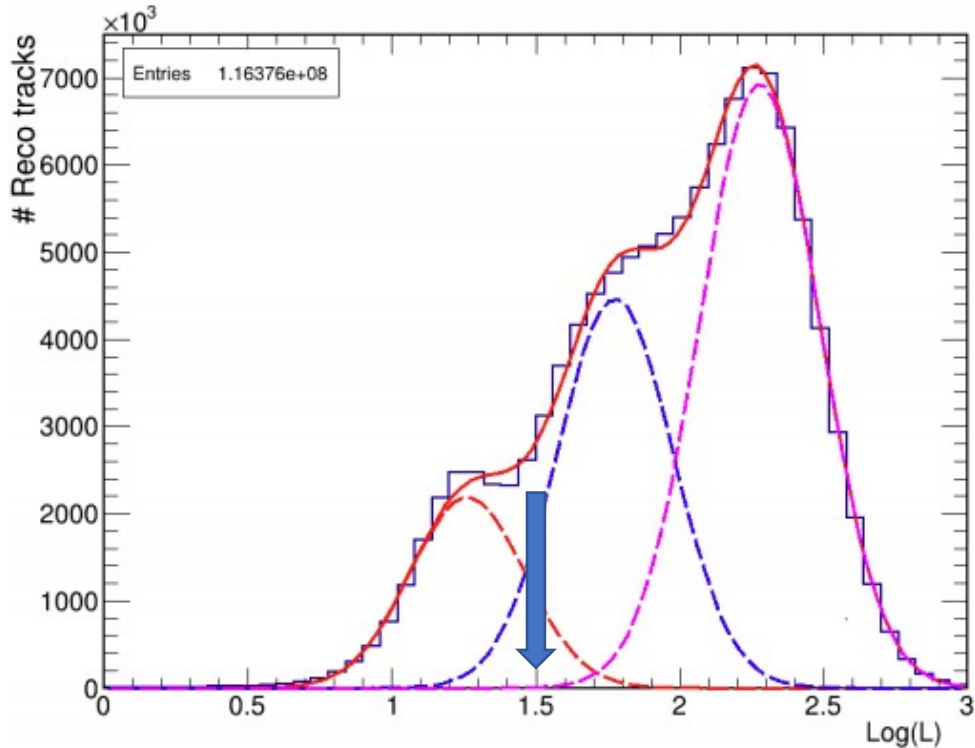
Reconstructed Track Quality

Track parameters:

Starting position, direction, starting time

Track quality:

Reconstruction likelihood, hits in the track, angular resolution, track length

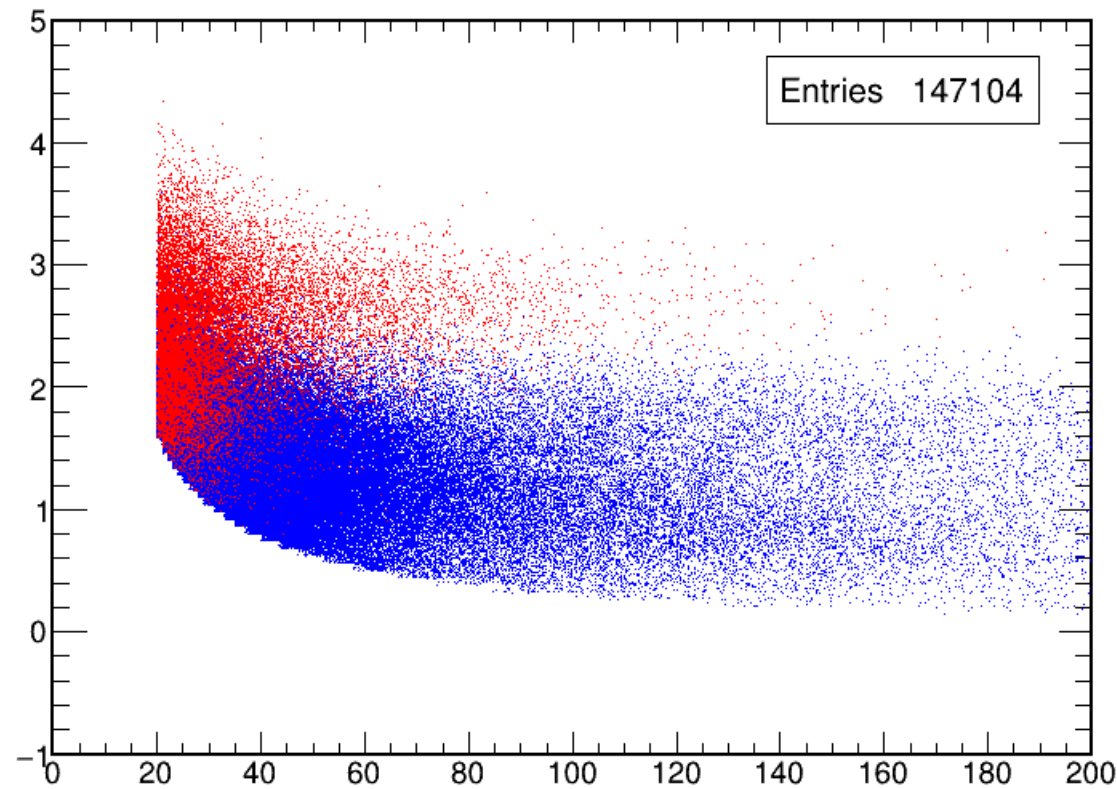
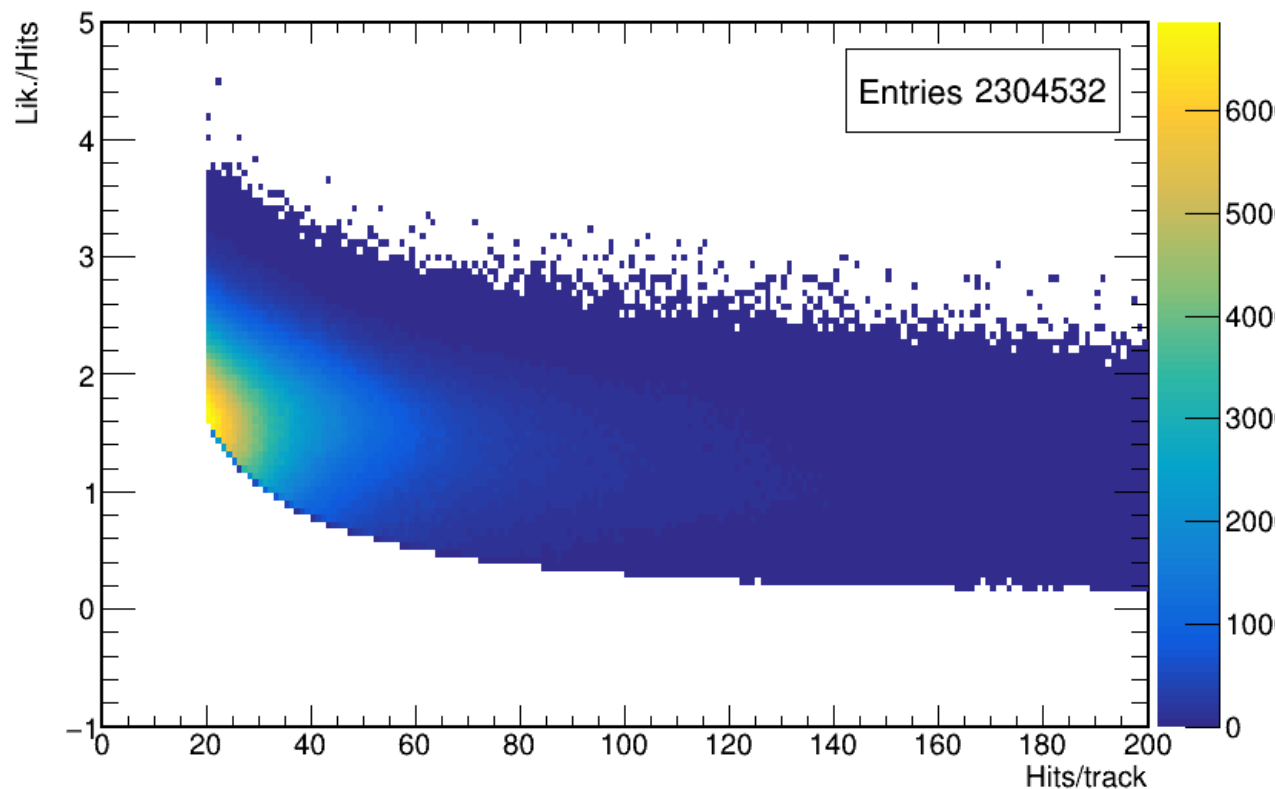


$\log(L) > 1.5$

$N_{\text{hit}} > 20$

Track Likelihood

Track Likelihood/hits vs hits for ORCA6 data(left) and MC

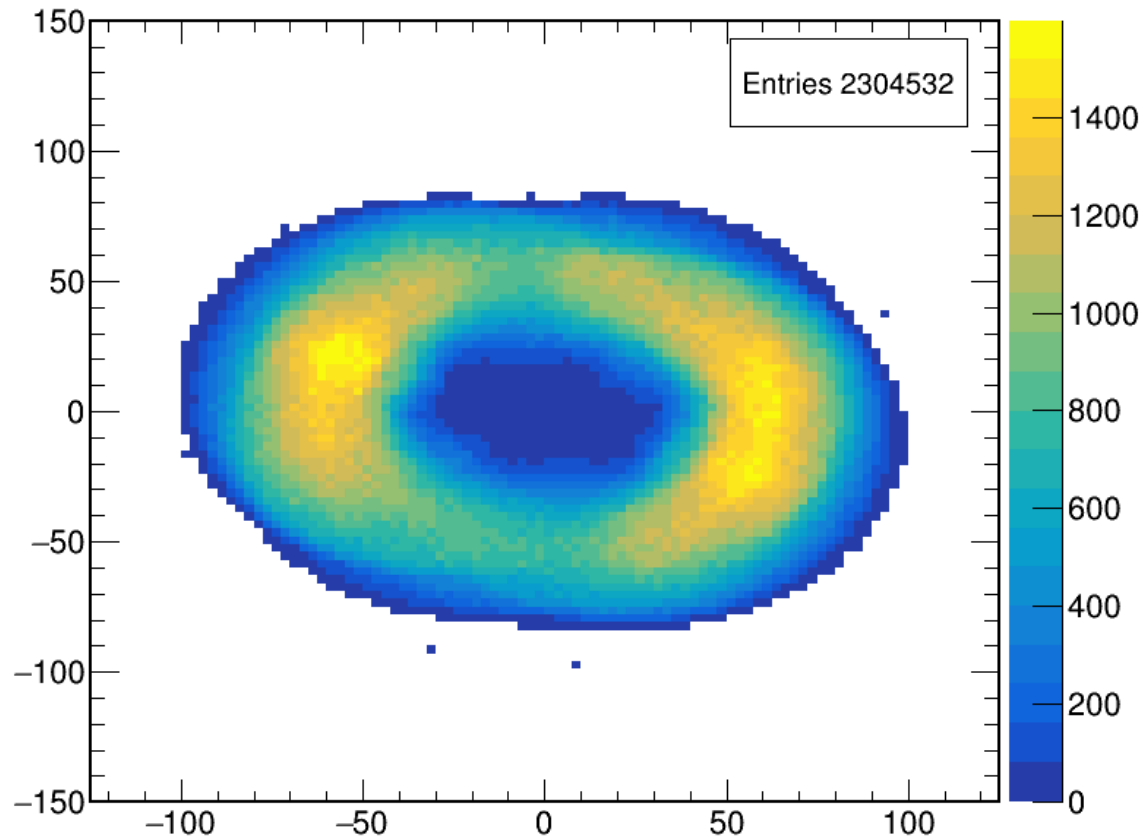


likelihood/nhits > (1.18+1.3*(1-1.5*exp(-0.018*likelihood)))

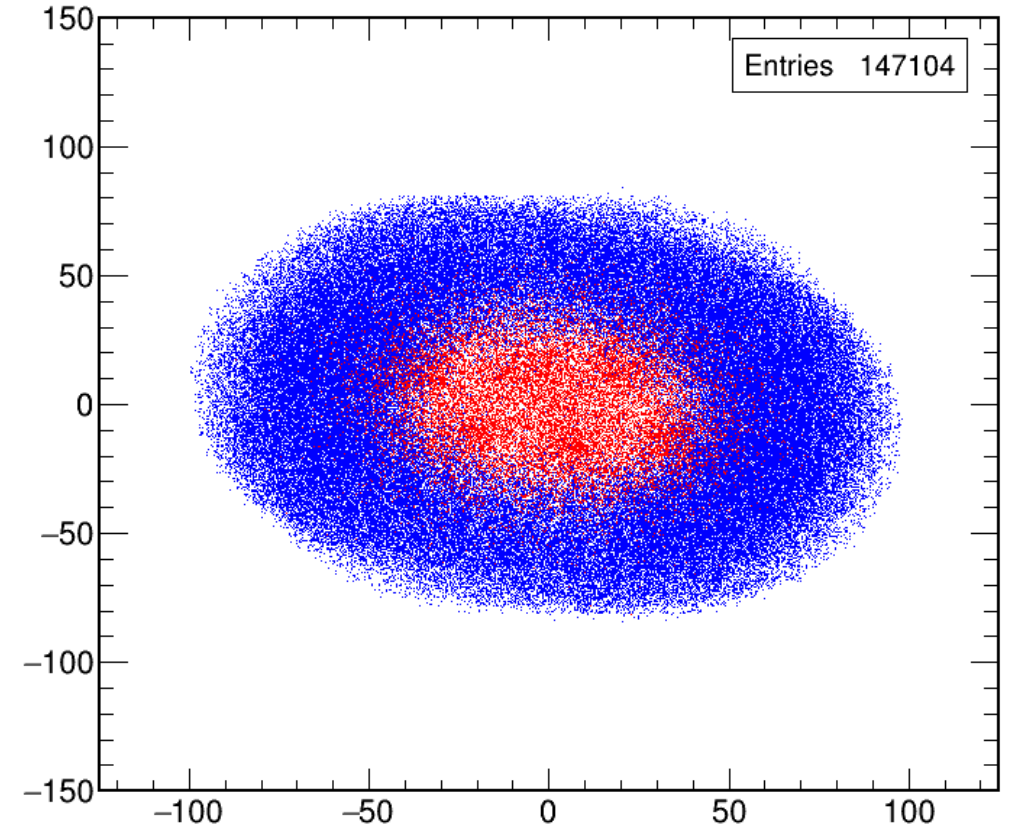
MC: $\text{Atm-}\mu / \nu_{\mu}\text{-CC}$

Track Containment

Track position



Containment in xy plane: $R_{xy} < R_o$



MC: $\text{Atm-}\mu / \nu_{\mu}\text{-CC}$

Summary and Outlook

- ✓ ORCA6 is the largest KM3NeT dataset with $2.5 \cdot 10^8$ events (live: 327.36 days)
- ✓ Atm-muon MC data (mupage) used in this analysis is about 5%
- ✓ More than 1000 neutrinos expected neutrino events in ORCA6
- ✓ Neutrino selection cuts must provide $> 10^4$ suppression of mis-reconstructed atm-muon events
- ✓ Neutrino selection optimization study is ongoing