

Energy correction

Recap from (really) old study + new plots for D0ARCA021 v9.1

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Introduction/Motivation

First effort to update the energy correction was done in 2020-2021 with full ARCA detector (Anna & Katerina).

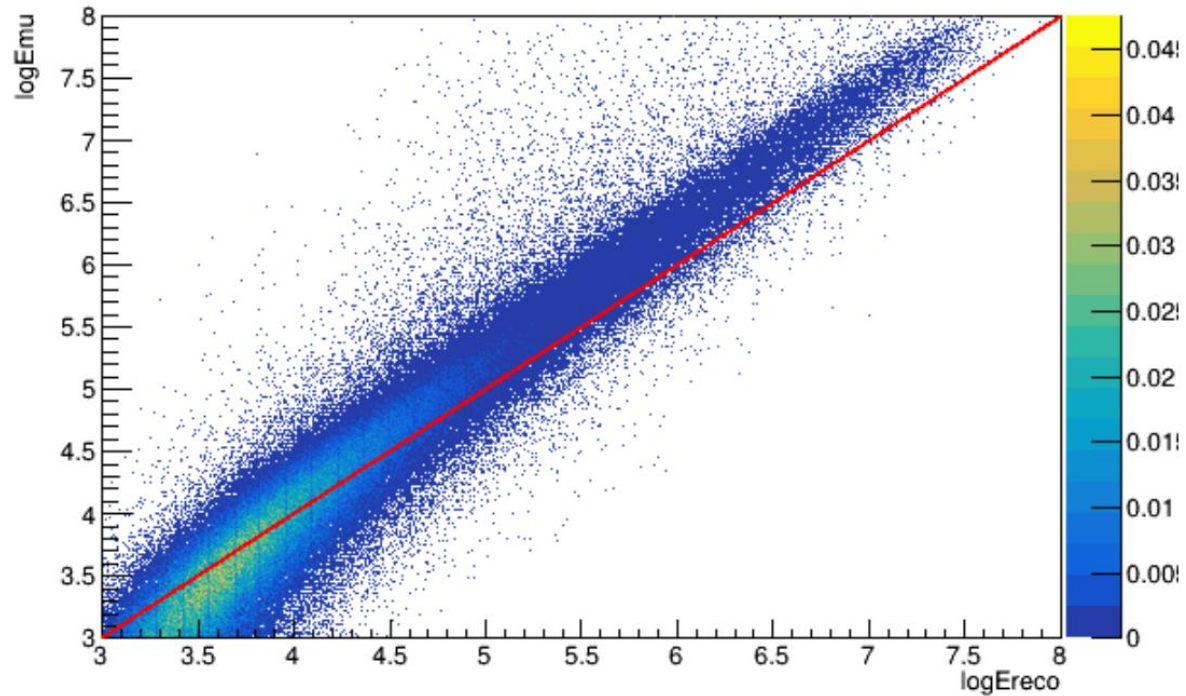
For details, please read: [chapter 10 \(Anna's thesis\)](#) , multiple presentations in ASTRO in 2020-2021 , [git_issue](#)

What is the situation with the smaller configurations ?

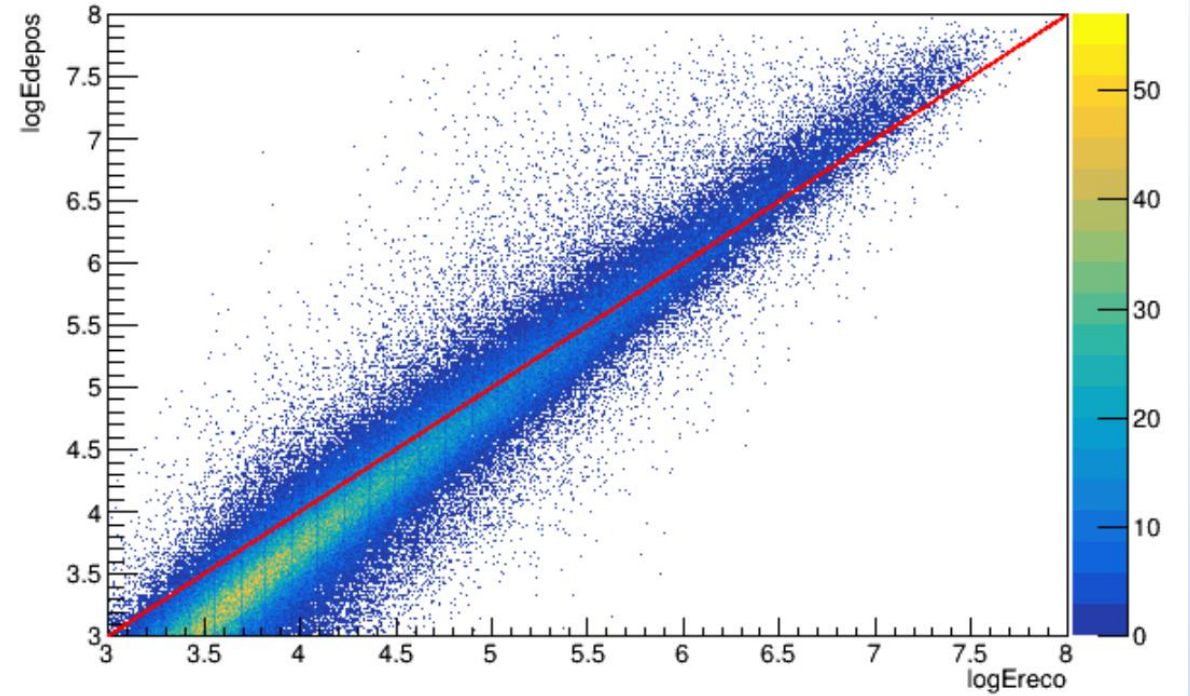
To do:

- Revisit the ARCA energy correction**
- Measure it on ARCA21 MC sample**
- Check its validity on dedicated VHE MC sample**

LogE_mu vs LogE_reco



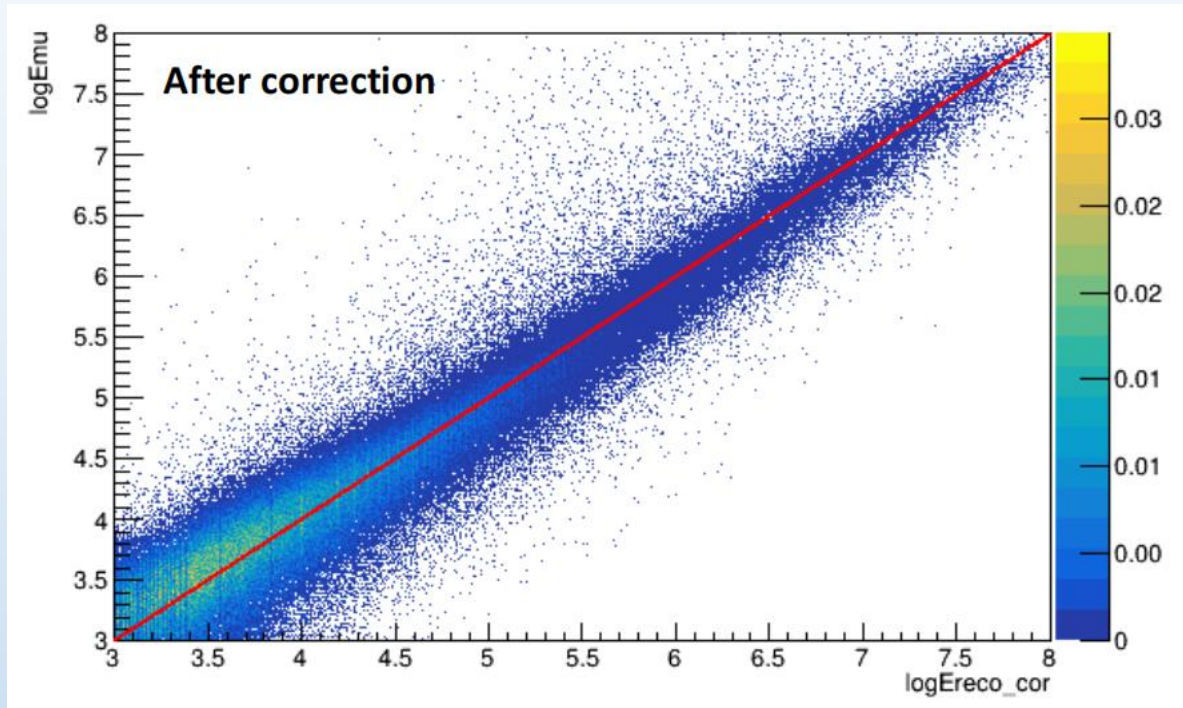
LogE_deposited vs LogE_reco



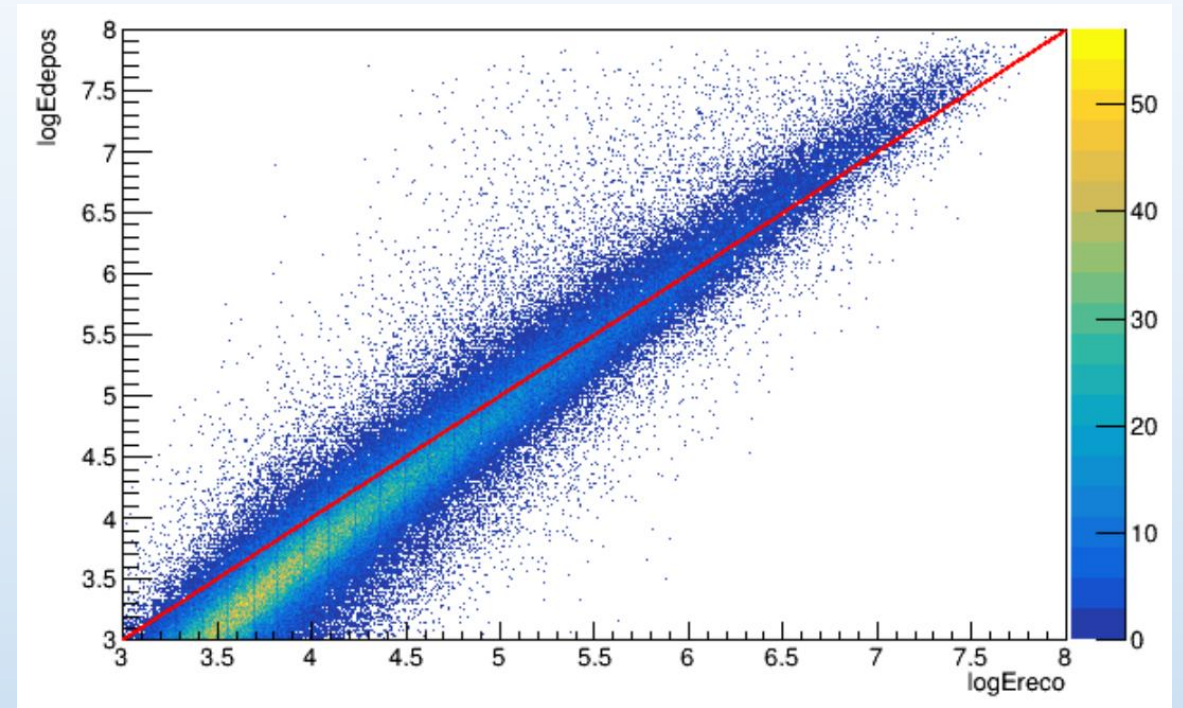
RECAP II - ARCA115 v6 - Anna & Katerina

numuCC sample

LogE_mu vs LogE_reco **corrected**



LogE_deposited vs LogE_reco **corrected**

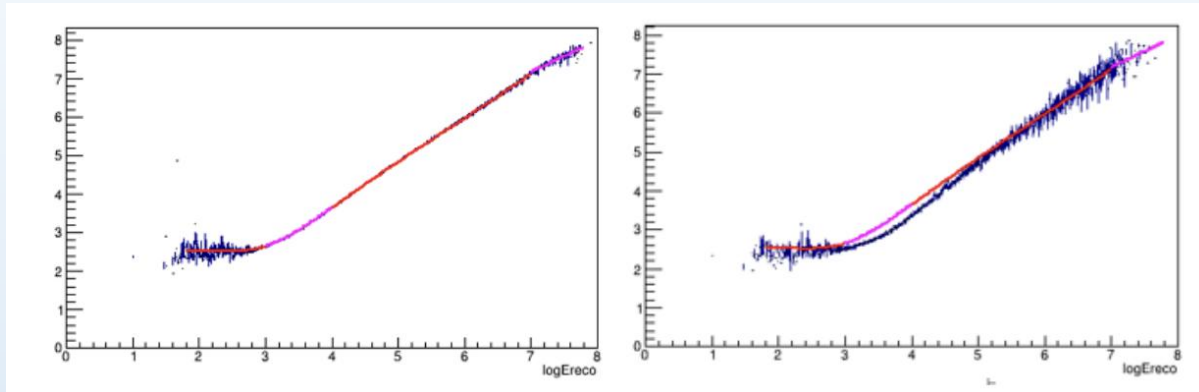


The correction does not work for the deposited energy!

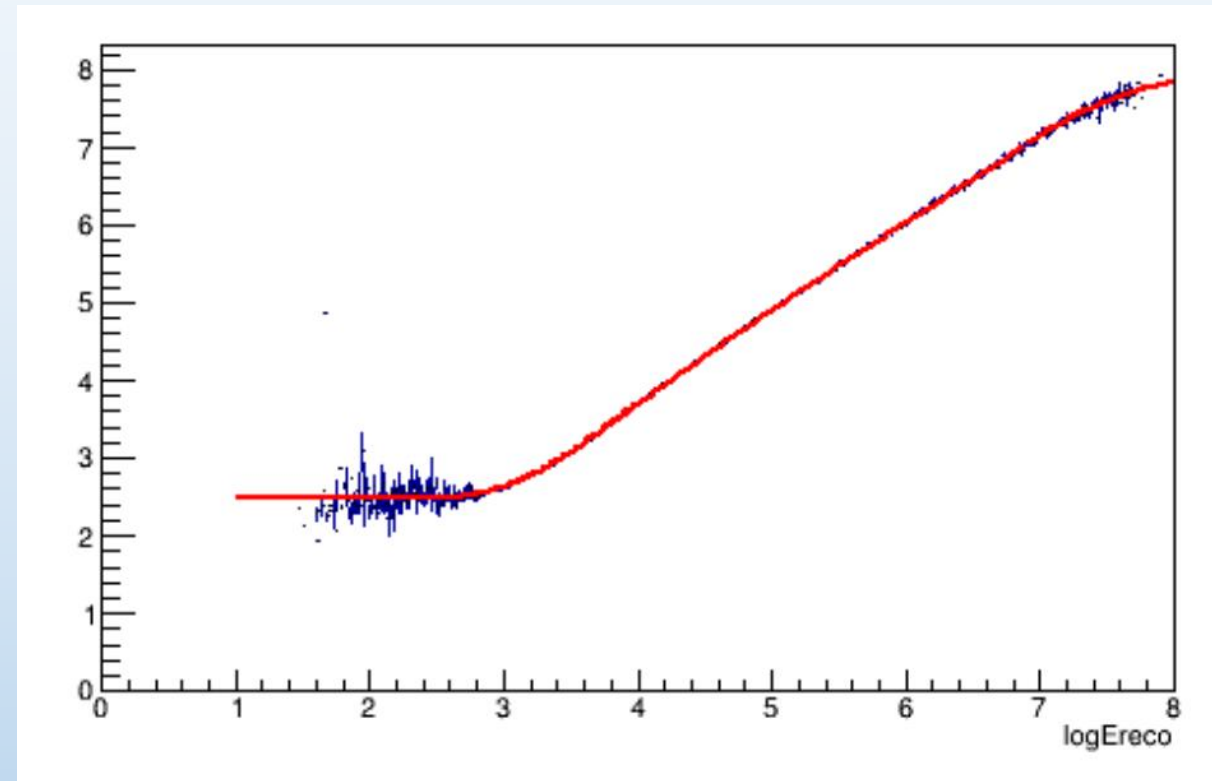
RECAP III - ARCA115 v6 - Anna & Katerina numuCC sample

Idea: Make new correction function based on deposited energy.

- Based on vertex position (in or out of det. volume)
- Based on track direction (vertical or horizontal).

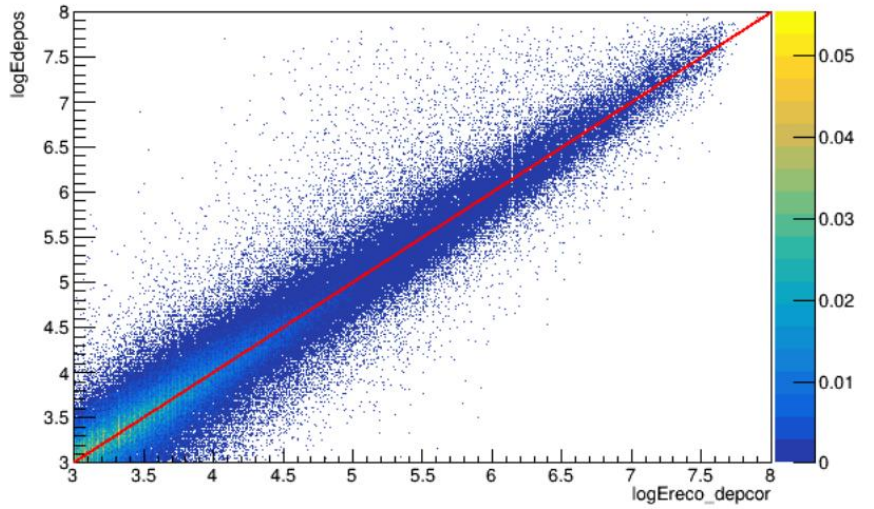


Our correction function

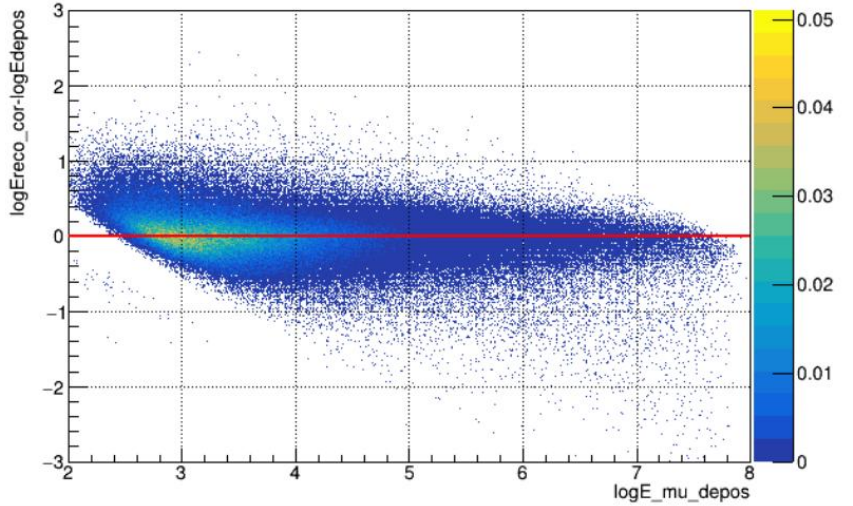


RECAP IV - ARCA115 v6 - Anna & Katerina numuCC sample

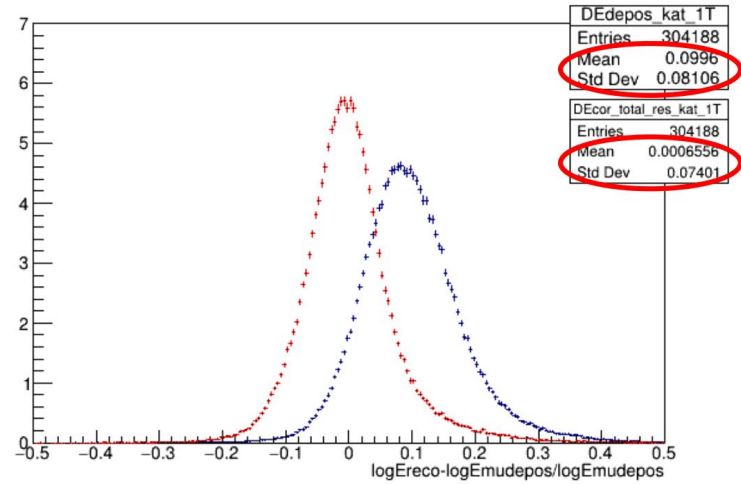
New correction function performance



After correction

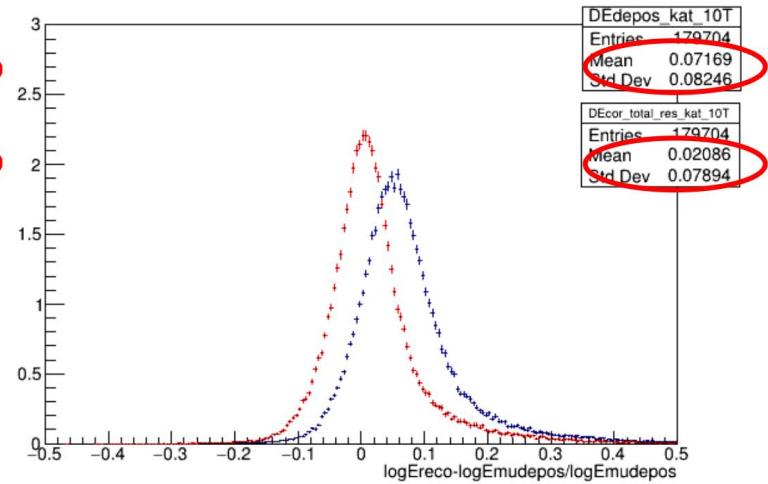


Loose Cuts Events, Energy cut: $\log E_{\mu} > 1$ TeV



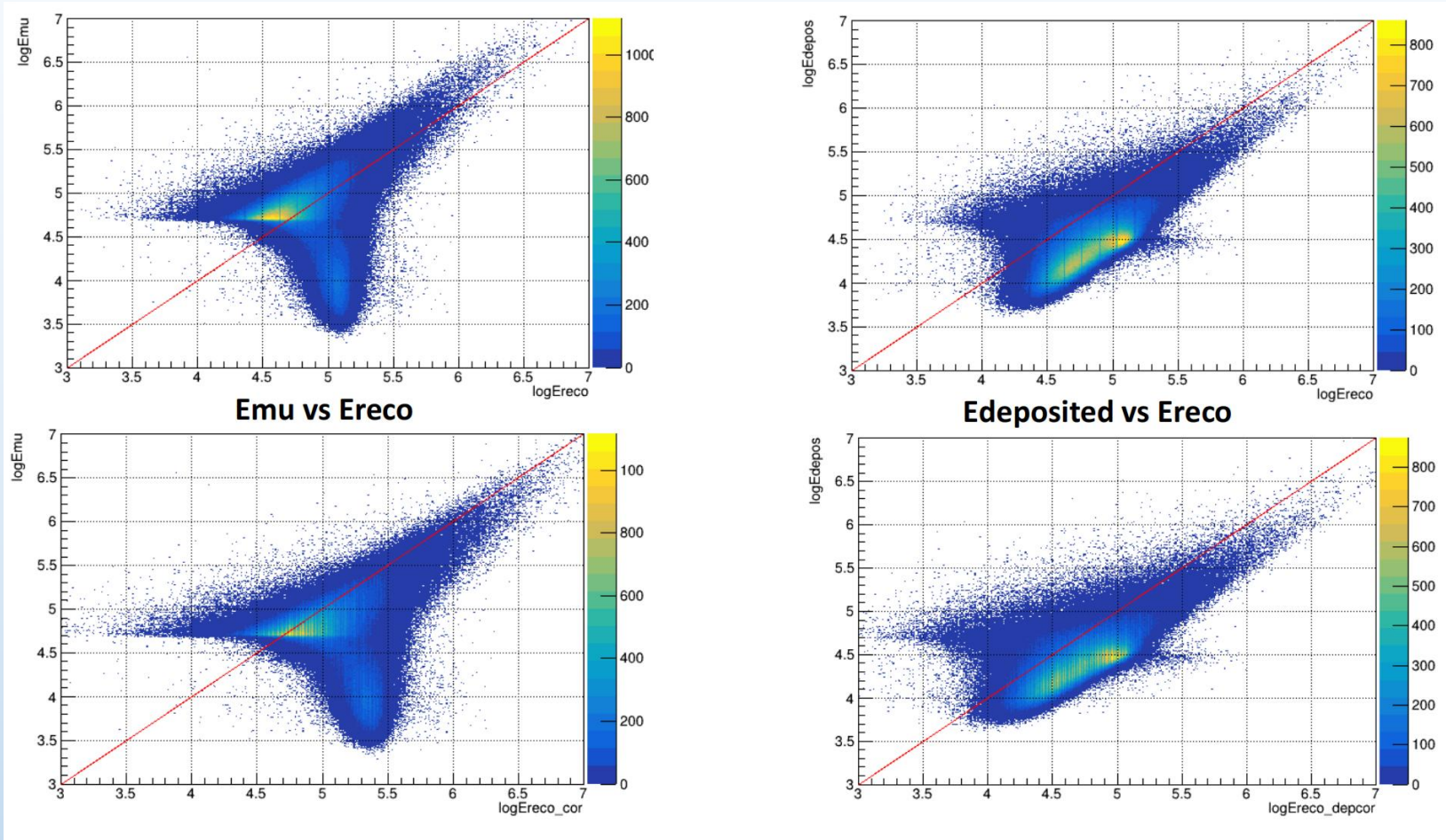
Deposited Energy Resolution before/after correction

Loose Cuts Events, Energy cut: $\log E_{reco} > 10$ TeV



Deposited Energy Resolution before/after correction

What's the performance on atm. muon samples ?



No correction works for atm. muon samples. Why ?

How does reco “know” if it’s a muon from neutrino or a muon from atm. muons ?

RECAP VI - ARCA115 v6 - Anna & Katerina

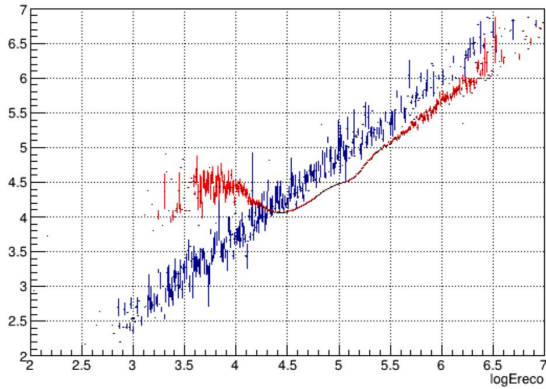
mupage10T, mupage50T

Tests

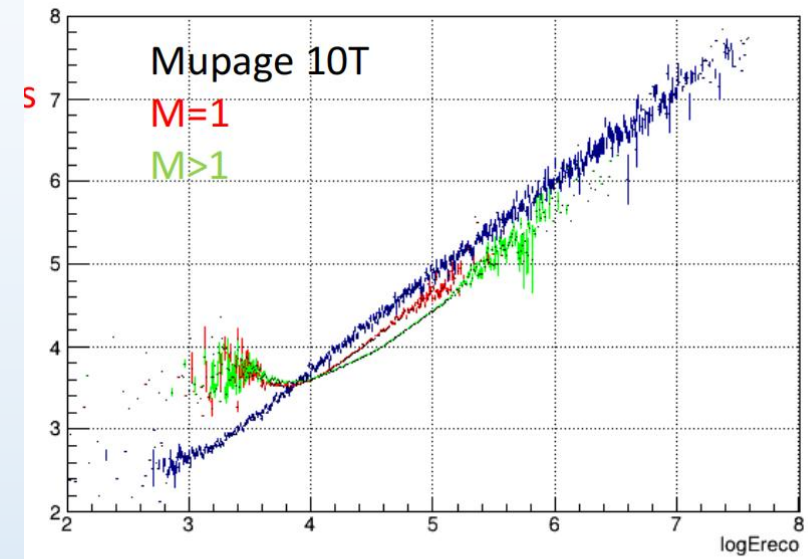
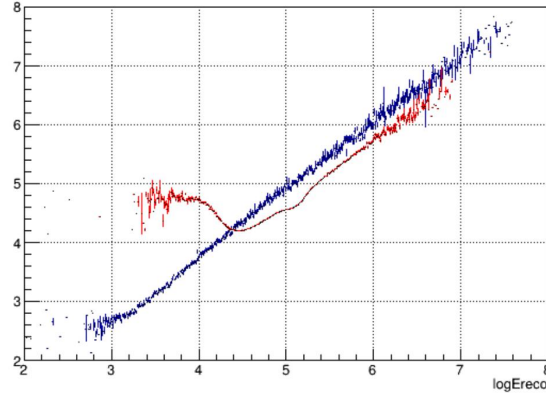
track dir.

multiplicities

Edepos vs Ereco (true vtx out) - VERTICAL

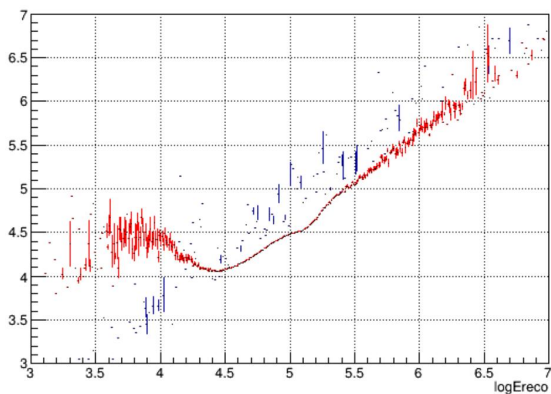


Edepos vs Ereco (true vtx out) - HORIZONTAL

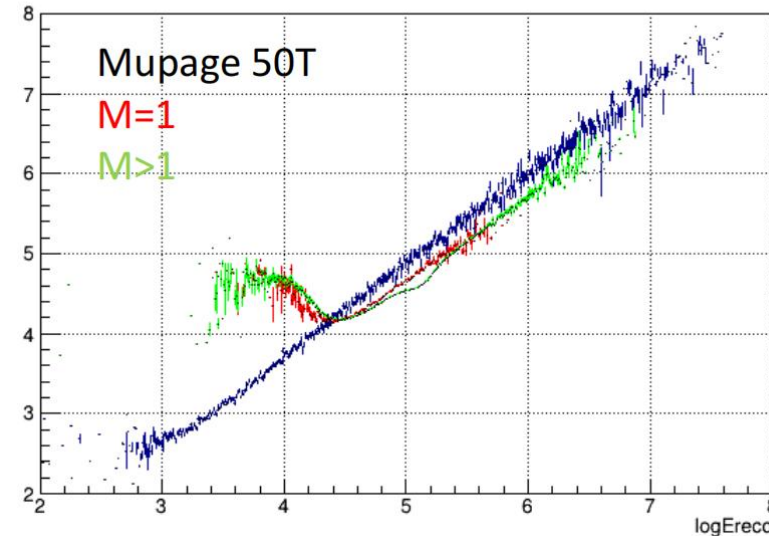
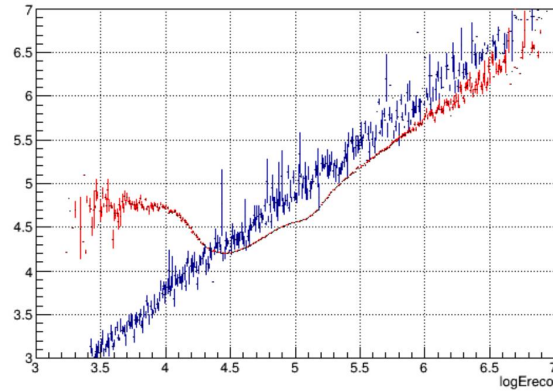


bjorken-Y

Edepos vs Ereco (true vtx out) - VERTICAL - LowY

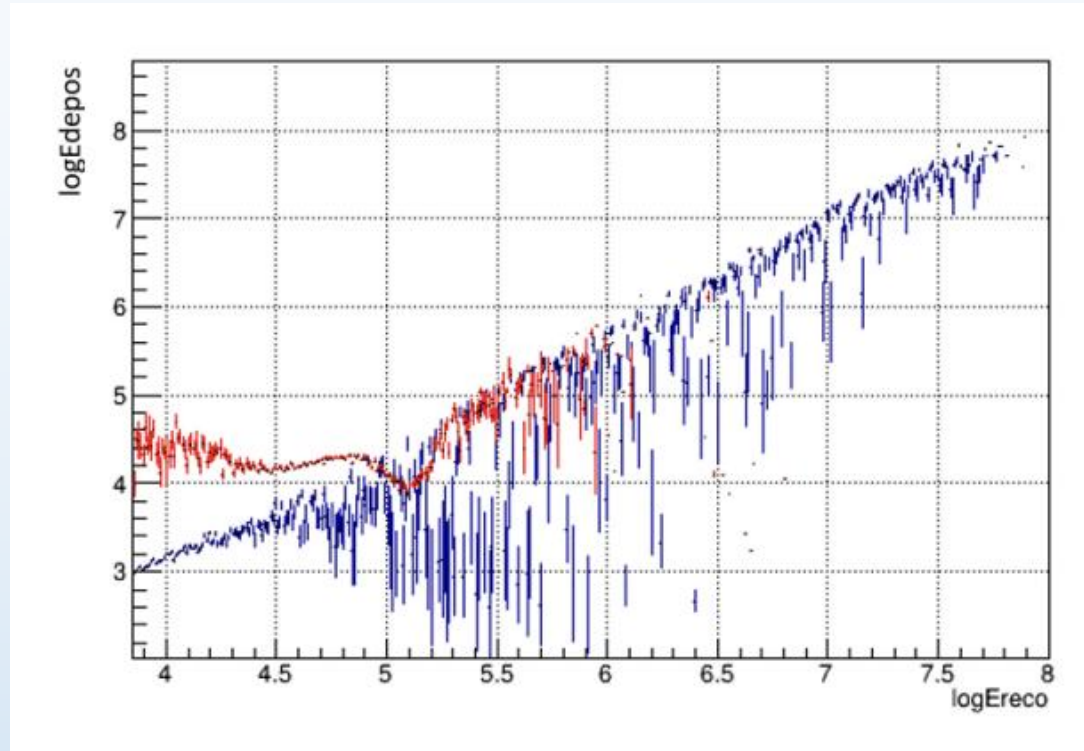


Edepos vs Ereco (true vtx out) - HOR - LowY



RECAP VII - ARCA115 v6 - Anna & Katerina

Neutrinos weighted
with atm. flux
Mupage

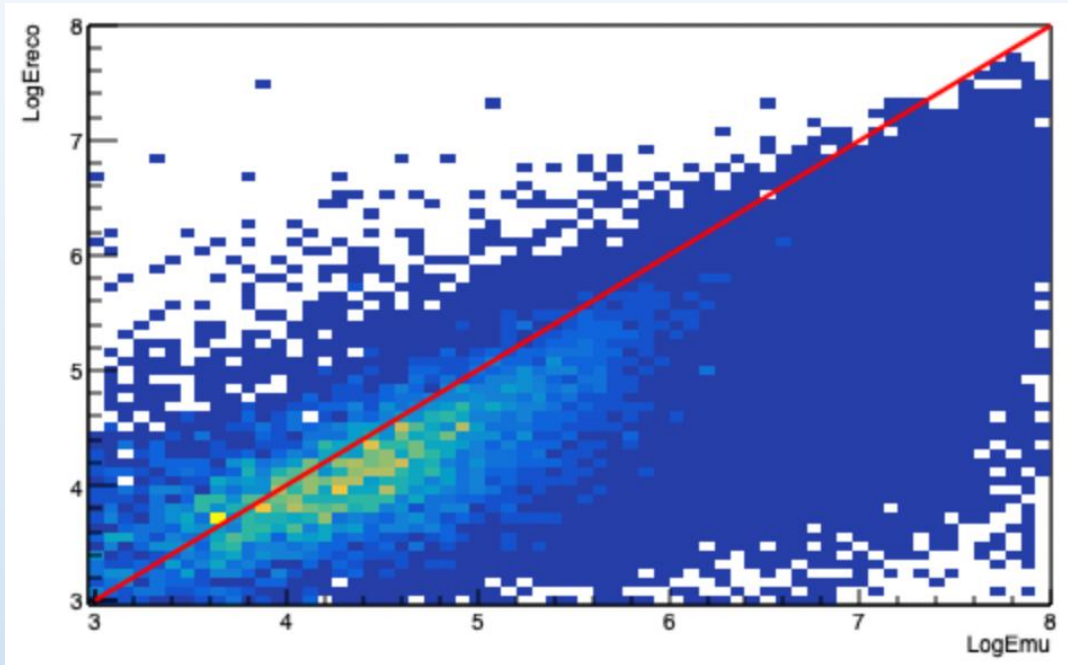


CONCLUSION

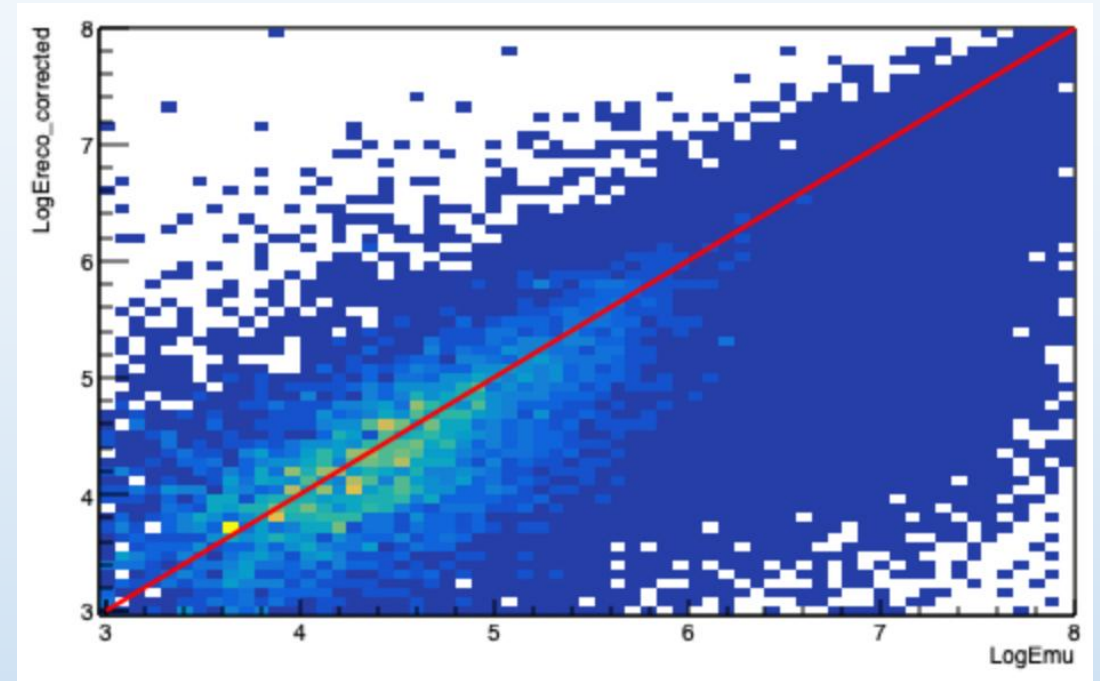
“The reconstructed energy implicitly depends on the spectrum considered for the PDFs used for the track reconstruction. [...] At this point, there was no further effort made to implement the deposited energy in an astrophysical diffuse neutrino flux analysis as the influence on the generation spectrum needs to be addressed.”

vs true muon energy

logE_reco



logE_reco after correction



*It works also for ARCA21

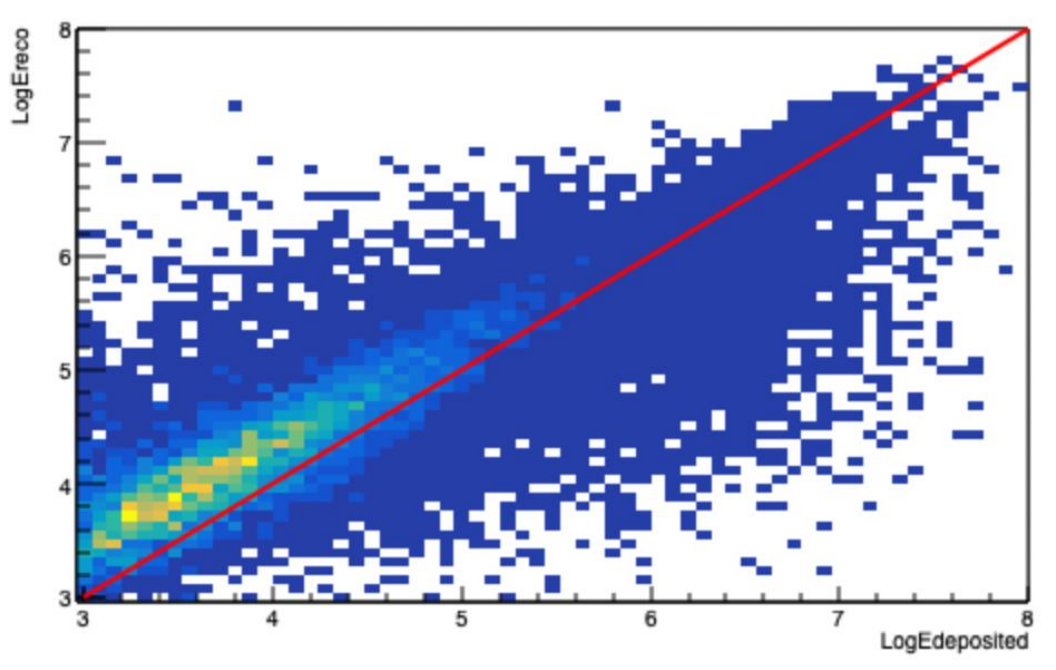
ARCA21 - v9.1 - Energy Studies

neutrinos

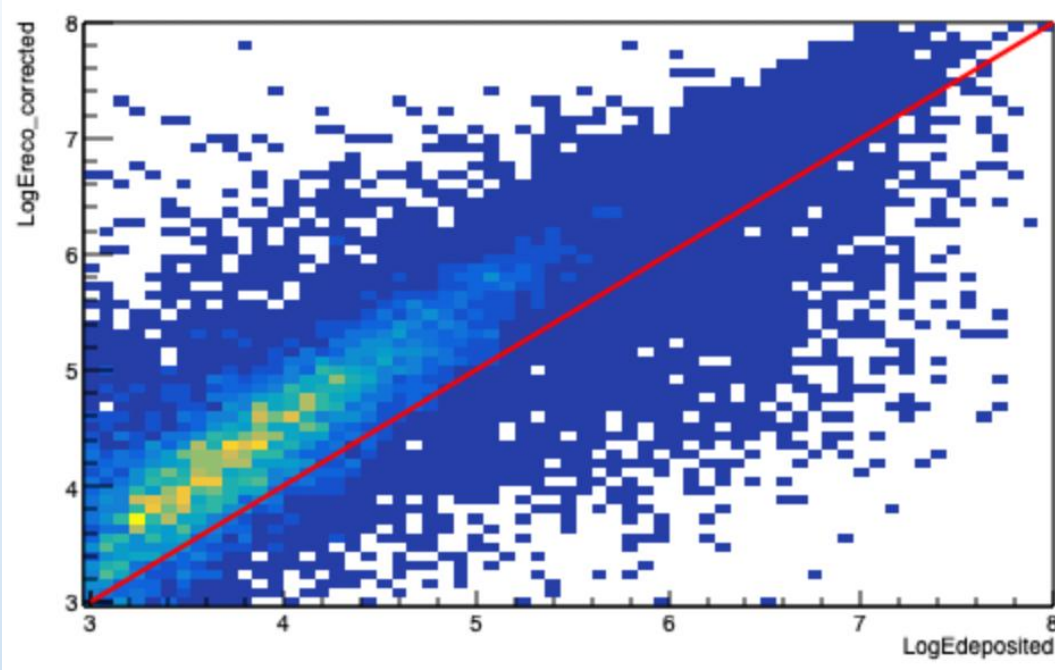
After Vasilis pre-BDT selection

vs deposited energy

logE_reco



logE_reco after correction



*It does not work also for ARCA21

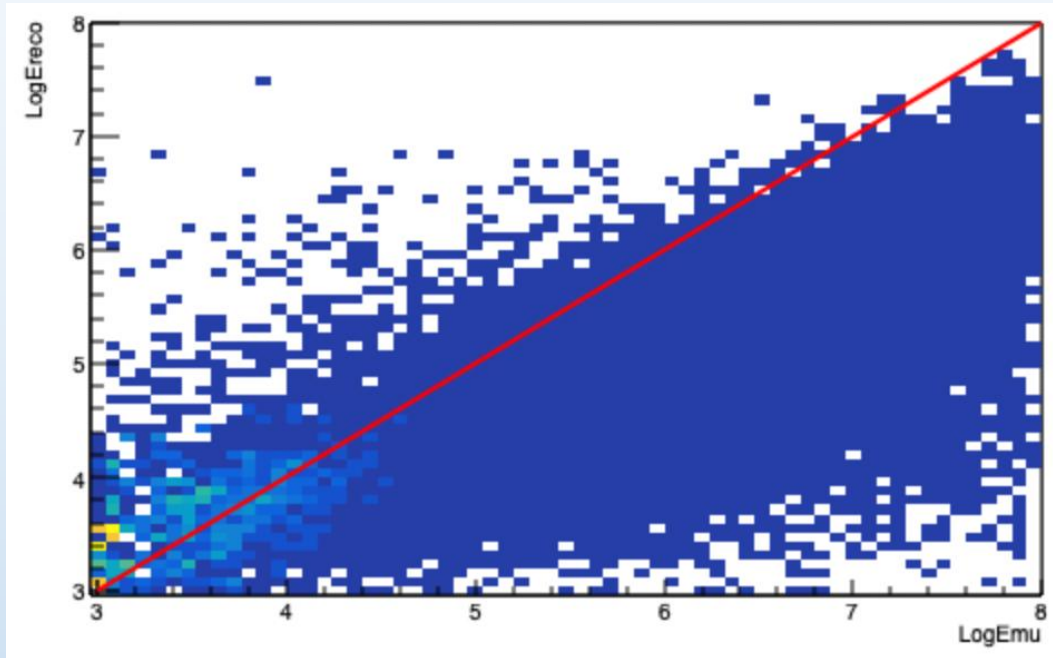
ARCA21 - v9.1 - Energy Studies

atmospheric
neutrinos

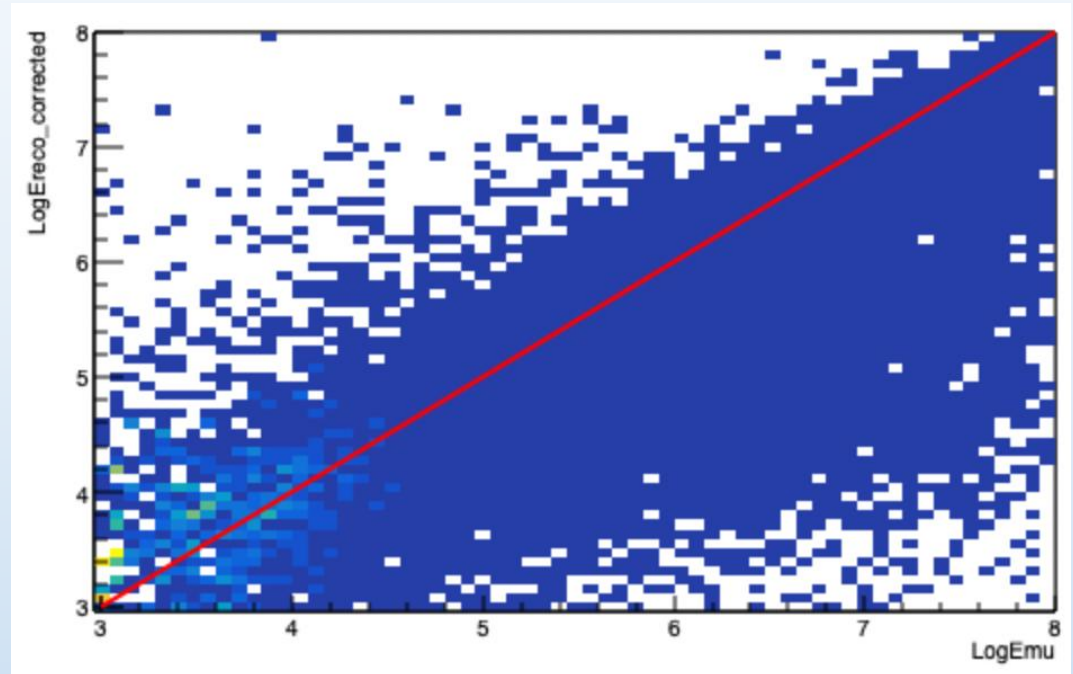
After Vasilis pre-BDT selection

vs true muon energy

logE_reco



logE_reco after correction



*It does not work for atm. neutrinos

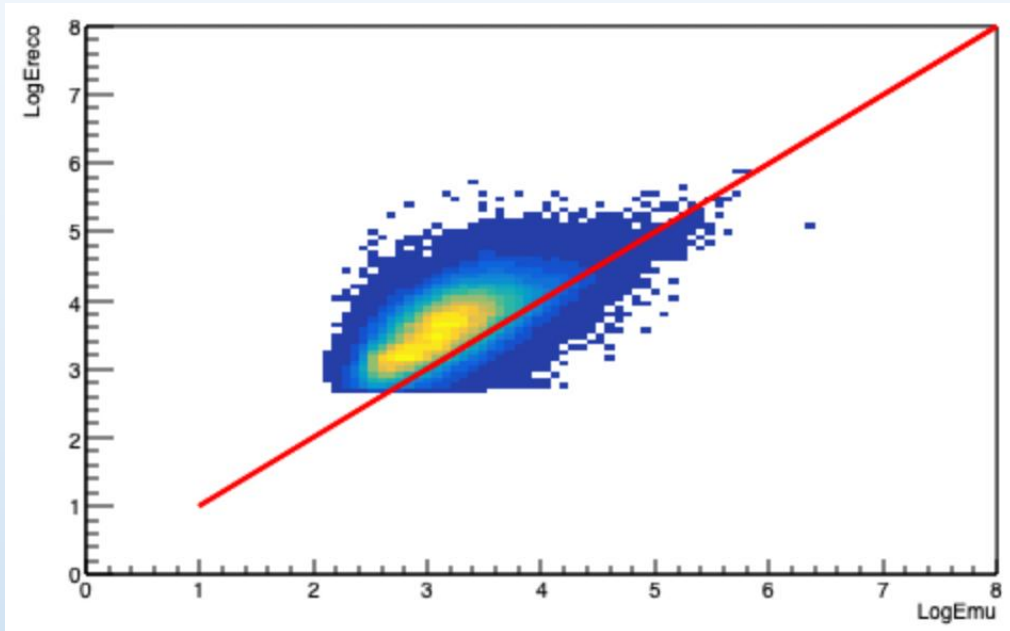
ARCA21 - v9.1 - Energy Studies

atmospheric
muons

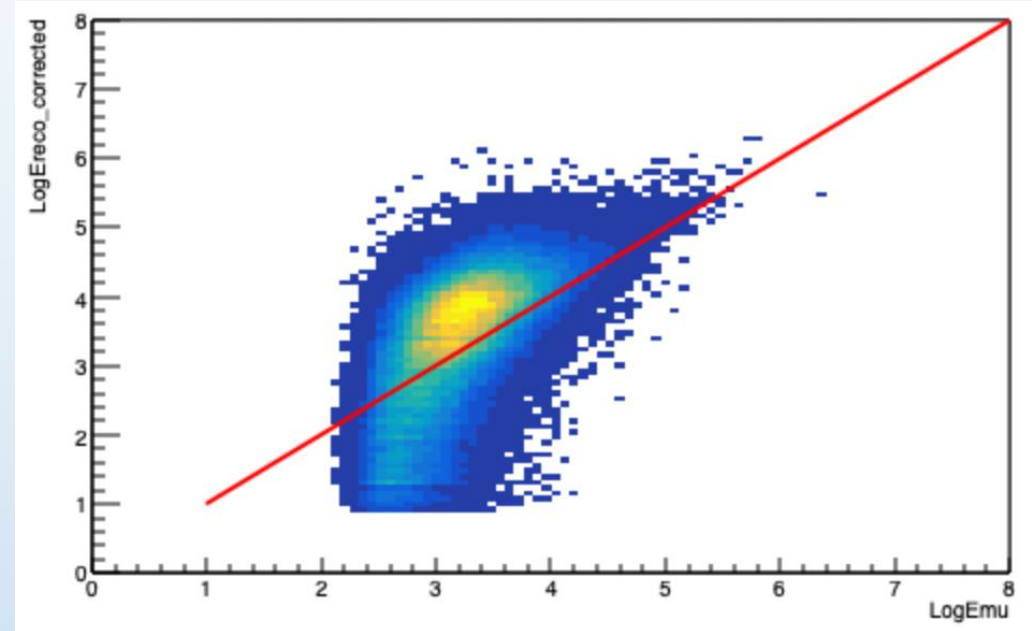
After Vasilis pre-BDT selection

vs true muon energy

logE_reco



logE_reco after correction



*It does not work for atm. muons

ARCA21 - v9.1 - Energy Studies

What is the situation with the smaller configurations ?

First impression is of similar performance.
Further checks will be performed.

To do:

**Revisit the ARCA energy correction
Measure it on ARCA21 MC sample
Check its validity on dedicated VHE MC sample**

Some thoughts:

For a given deposited energy,
we should have a value of reconstructed energy *independent* from the generation spectrum.

I understand that *a priori* we reconstruct “assuming” the particle’s origin (but why?)

How do we proceed ?