Project Journal

Contents

November

24 November 2024

Meeting summary:

Enrique gave me a file with results of a simulation of neutrinos interacting with the **Faser***ν detector.*

using a jet algorithm called anti-kT, we find a large number of jets from the neutrino interactions. We expect to see a small number of jets, so we might want to edit the radius parameter of the jet algorithm.

We also expect all of the hadrons to be included in the jets, so if we miss some of them, it's a sign that the radius might be too small.
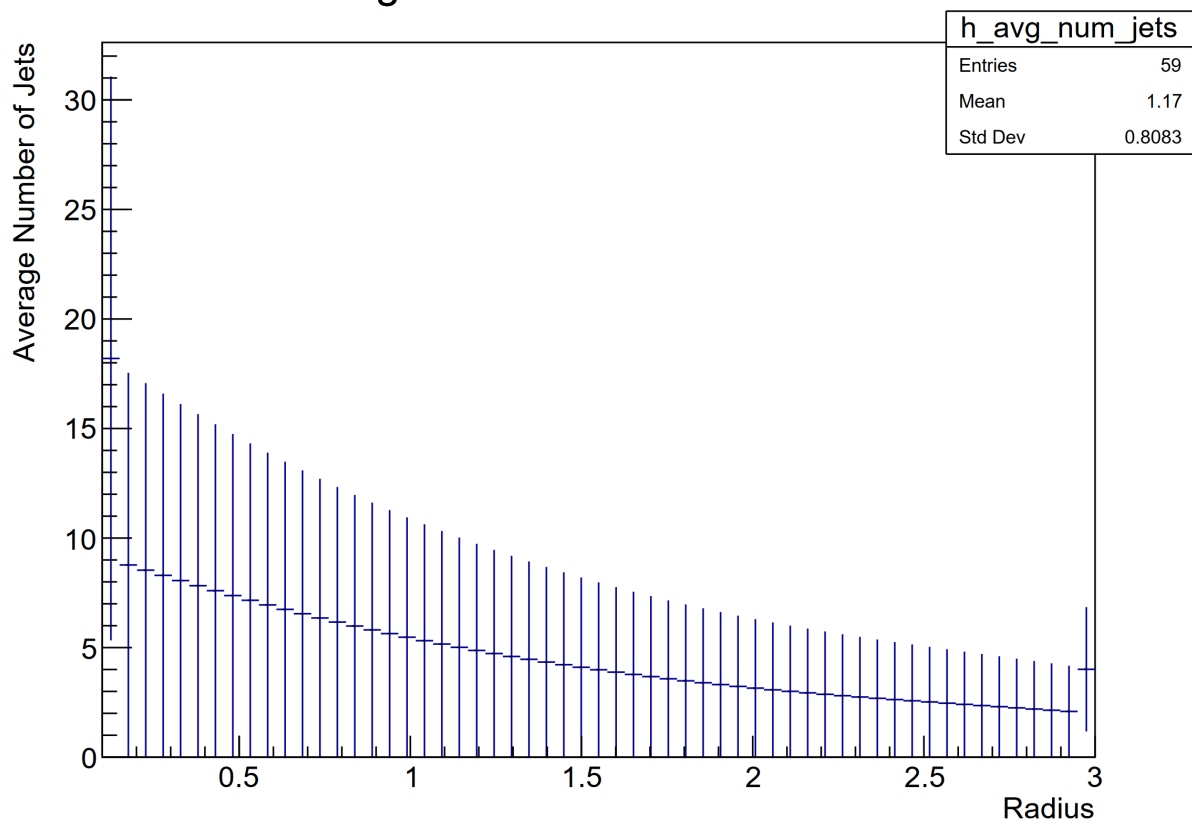
Next Steps:
- *Run the analysis with a varying radius parameter to see how the number of jets and the number of included hadrons change.*
- *Create a plot similar to the one in this link (page 33)*

25 November 2024

Summary of Today's Work:

- *Setup and Initial Runs: Successfully set up the environment and ran initial tests using the jet algorithm.*
- *Data Visualization: Plotted data showing the behavior of jet numbers across different radii, finding a decrease with increasing radii. No optimal cutoff radius identified yet (See Figure 1).*
- *Custom Jet Algorithm: Implemented a custom algorithm (See Figure 2):*
  - *Assumes jets' energy and momentum align with CC event characteristics (e.g., negative momentum relative to leptons, energy summing to neutrino energy).*
  - *Issues Identified:*
    - *Multiple neutrinos and leptons in a single event are problematic, disrupting algorithm reliability.*

h_avg_num_jets	
Entries	59
Mean	1.17
Std Dev	0.8083
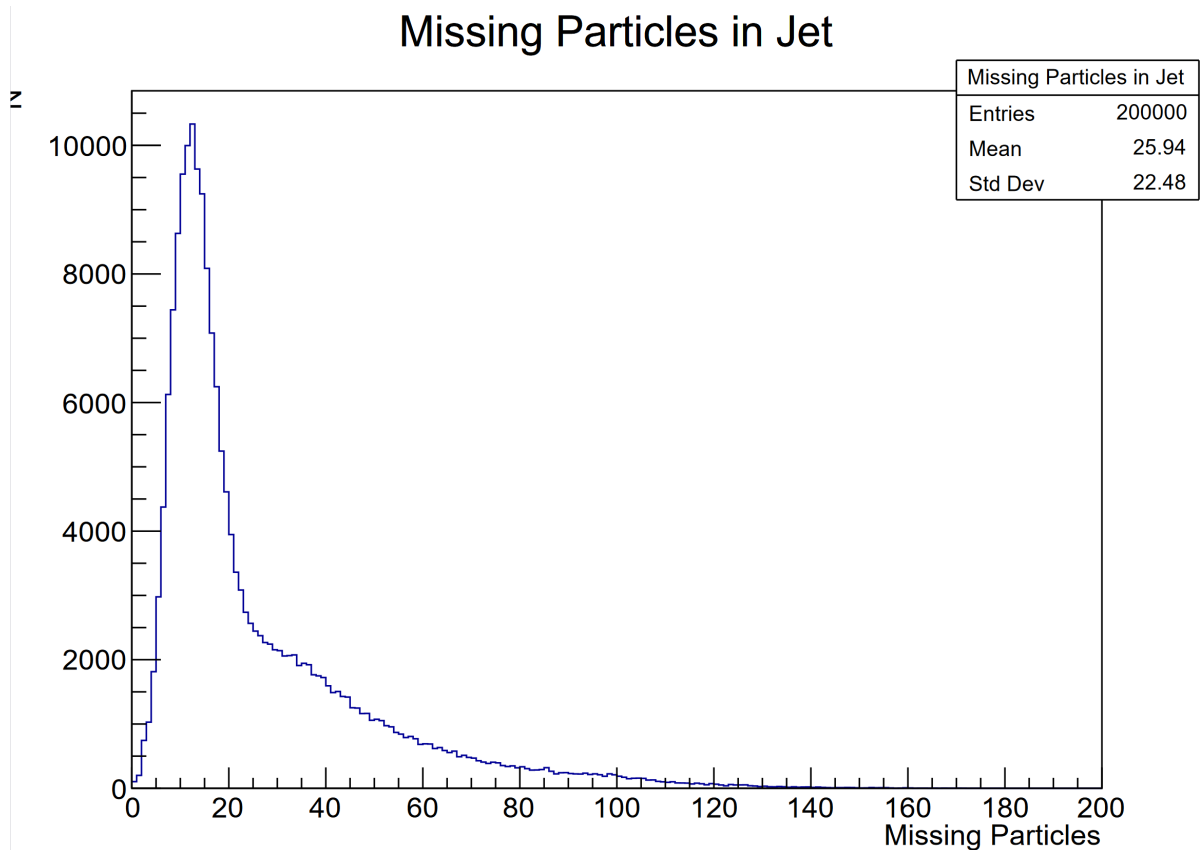
Next Steps:

- *Debug code to resolve multiple neutrino/lepton event handling.*
- *Determine an optimal jet radius for the custom algorithm:*
  - *Evaluate physical significance.*
  - *Plot relevant metrics to assess jet completeness and structure.*
  - *Find radius which saturates the number of included hadrons (or understand why one does not exist).*
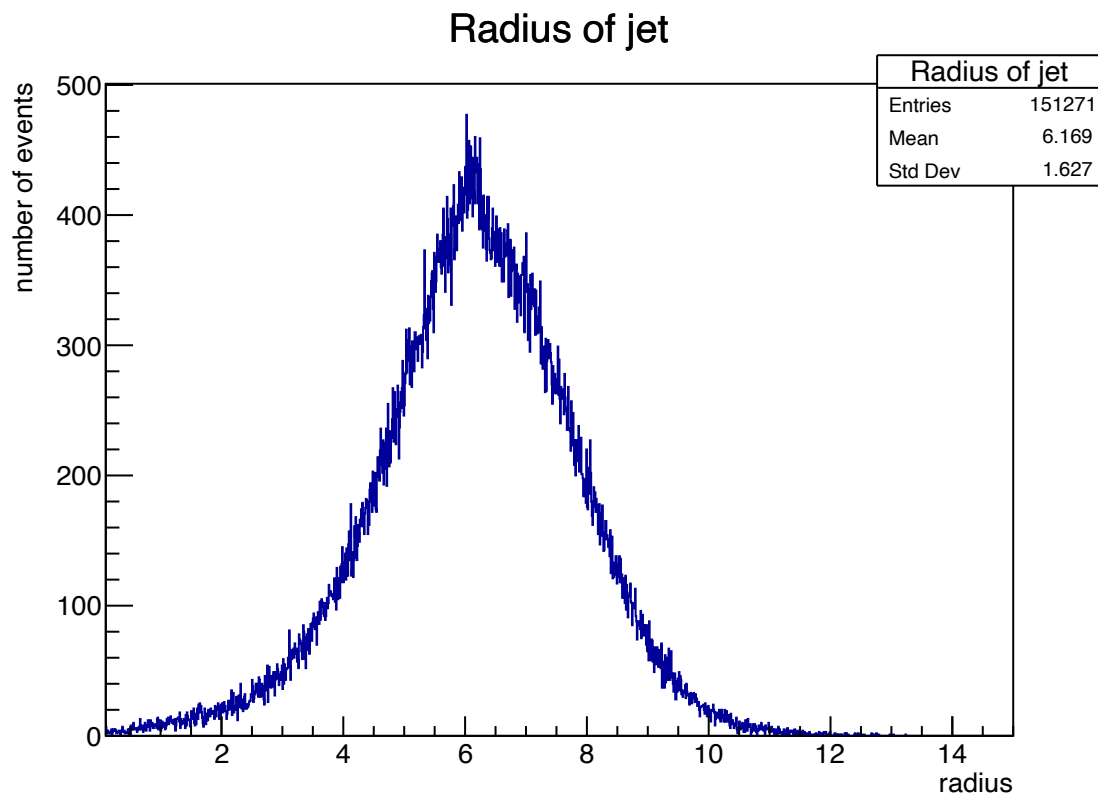
28 November 2024

Work done today:

Setup new mac.

Discussion with Enrique about project:
- *Containment of p_T reaches 100% only around radius ≈ 3 and there is a very large radius distribution of the jets.*
- *Want to find a variable with high correlation with the radius of the jet, so that we can improve the algorithm.*

01 December 2024

Work done today:

- *Most of the work today was to familiarize myself with the data and setting up a good workflow. I fixed some bugs and started to look at what would be a good way to find a variable which is correlated with the radius.*
- *Most of the "double" neutrino events were just bugs in the program, but there are still some events which have this. I am filtering out these events for now as there's not many of them.*
- *For every event, I am searching for the farthest particle from the location where the jet should be. This can be seen in Figure 3.*
- *We can see that the average "radius" (if we want to include all particles in the jet) is 6, and to "capture" all of the cases, we would want to have a radius of about 12.*
- *Now that I have the "radius" of the jet for each event I can start to search for correlated variables.*
- *Need to understand from Enrique what data we will actually have access to in order to determine the possible variables to look at (since we won't have the jet vector for the real data).*

Radius of jet	
Entries	151271
Mean	6.169
Std Dev	1.627

December