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# Measuring the Energy Resolution of MicroBooNE at the MeV-Scale

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## I - Introduction

**MicroBooNE** has the opportunity to **study the energy resolution of a LArTPC (Liquid Argon Time Projection Chamber) at low MeV energies** through **doping** the argon **with radon-222**. Here we looked at MicroBooNE simulation to examine the energy resolution for the collection plane (plane 2) using the reconstructed energy of a $\beta$ that comes from a **bismuth 214 – polonium 214 coincidence decay in the radon chain**.

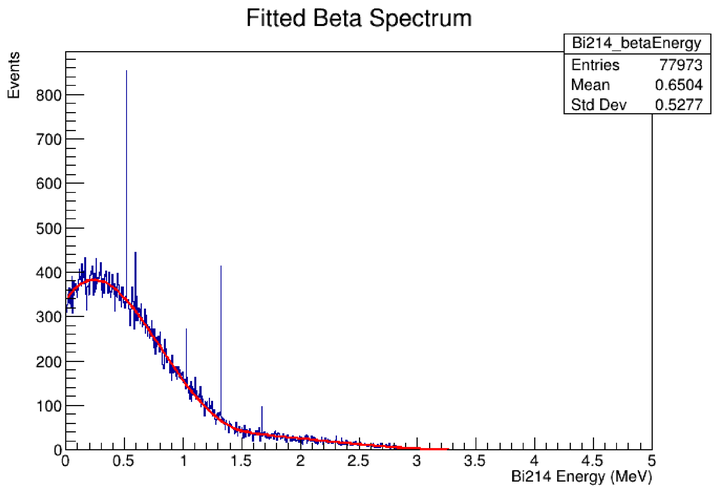


**Figure 1: In progress. The fitted $\beta$ spectrum produced from a Bi214 decay. This is the simulated true energy fitted with Betashape from the International Atomic Energy Agency (IEAE) Nuclear Data Services (NDS) Live Nuclide Chart. (https://nds.iaea.org/relnsd/vcharthtml/VChartHTML.html)**

## II - Purpose

To measure the energy resolution (precision) of MicroBooNE at low MeV energies using a bismuth 214 – polonium 214 coincidence decay in simulation.

## III - Methods

Once simulated, we defined fractional energy reconstruction error to be $(E_{\text{Reconstructed}} - E_{\text{True}})/E_{True}$ and **plotted this against reconstructed energy**. Then we went **bin by bin** in this space and **fitted each with gaussians**.

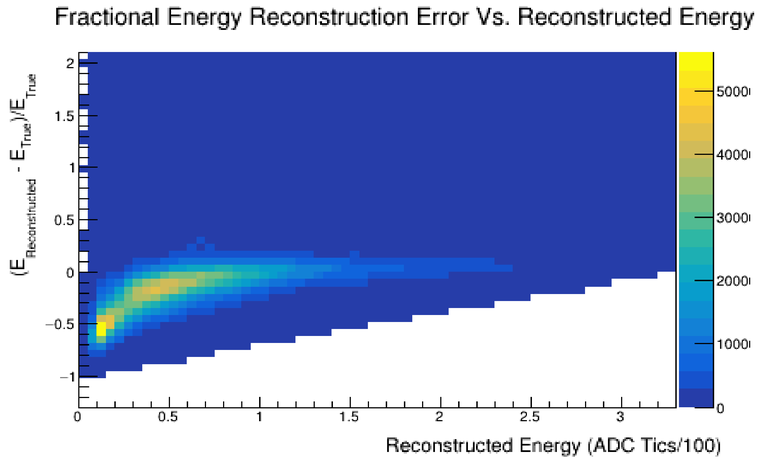


**Figure 2: In progress. Fractional Energy Reconstruction Error vs. Reconstructed Energy for the decay $\beta$ with the x-axis being a rough conversion to MeV.**

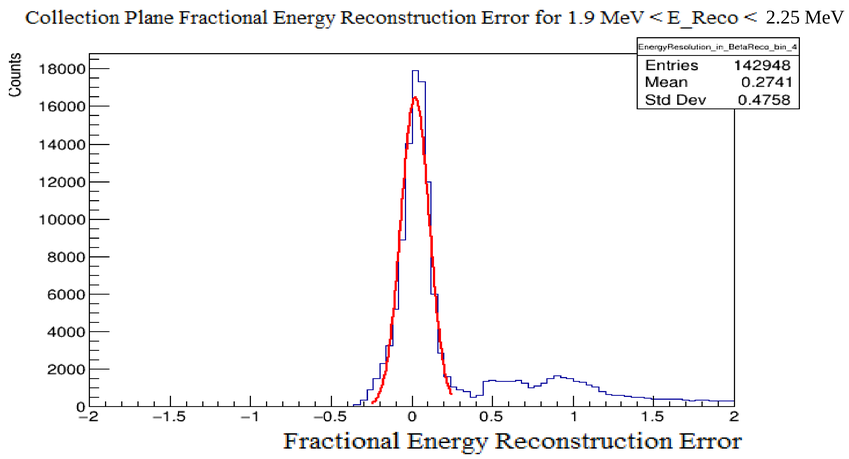


**Figure 3: In progress. Gaussian fit to collection plane fractional energy reconstruction error histogram for 1.9 MeV < E_Reco < 2.25 MeV.**

## IV - Results

From the fitted plots, we **extracted the widths of the of the gaussian fits** which were then plotted for each bin spanning the space. **This width represents the energy resolution.** This gave us a plot we can fit and use to measure the energy resolution of real data.

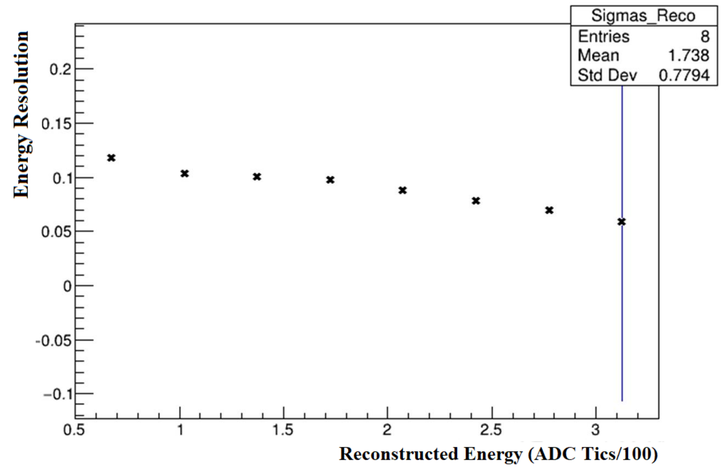


**Figure 4: In Progress. The width of gaussian fits to the collection plane fractional energy reconstruction error histograms for each bin of reconstructed energy.**

## V - Conclusions

We have **created a functional description of the bismuth-214 spectrum in Figure 1** and studied how this function description changes with reconstructed energy. This **can then be used to measure the energy resolution of real data.**



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