

# CNO Filtering

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# Outline

- Event description
- Filtering variables
- Basic method
- Determining values

# Event Descriptions

- Used GlastRelease v7r3p3
- 188758 CrHeavylon events generated
- 256677 DC2 background events generated
- Considered events with at least one trigger
- Used a modified ntuple description -> information on individual crystals in calorimeter

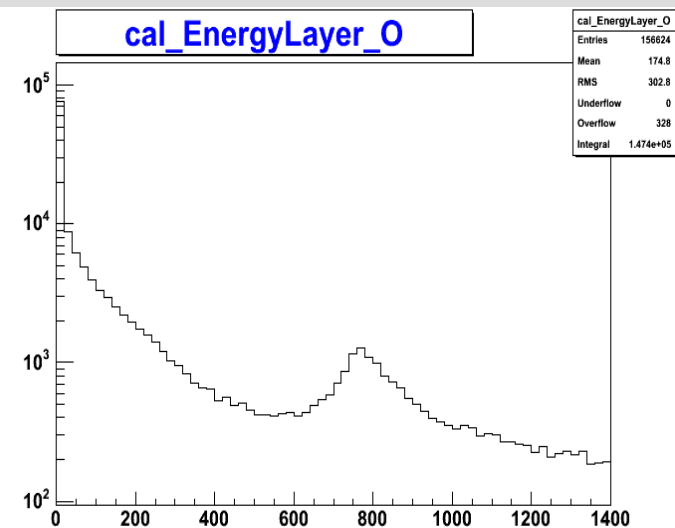
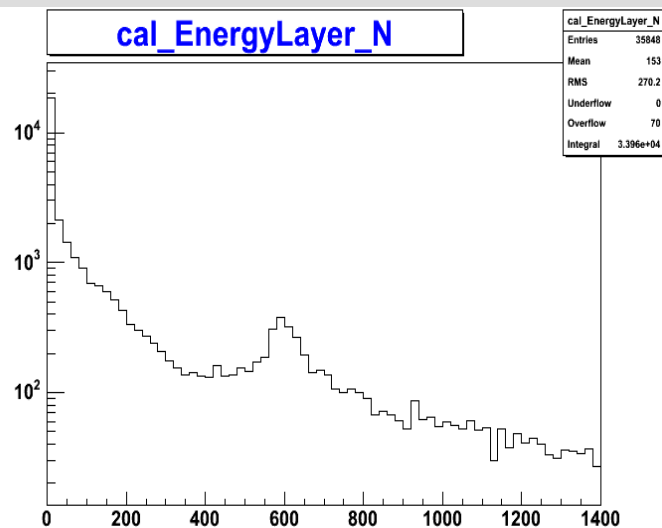
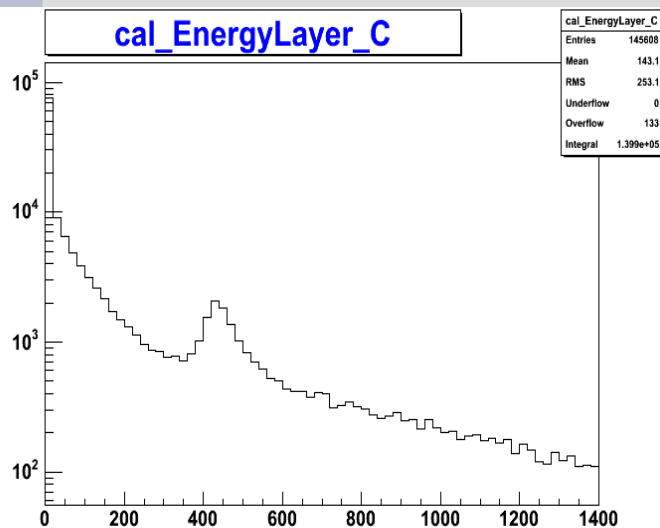
# Variables Used in the Filter

Currently:

- Relative energy difference between a cal. layer and layer 0 (top layer),  $\frac{\text{cal. layer X energy} - \text{cal. layer 0 energy}}{\text{cal. layer X energy}}$
- Threshold energy in a crystal (an attempt to estimate noise and find how many crystals in a layer are above this noise level)
- Number of crystals in a layer over threshold

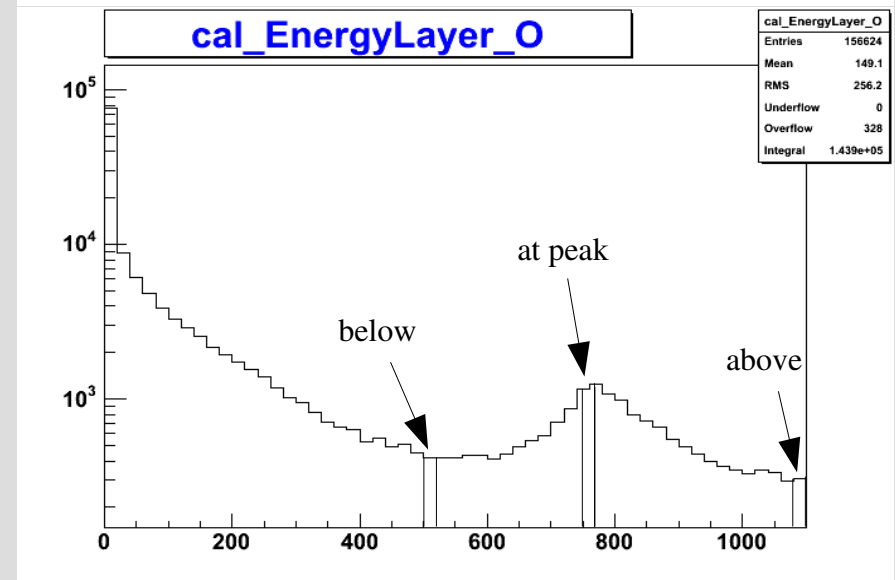
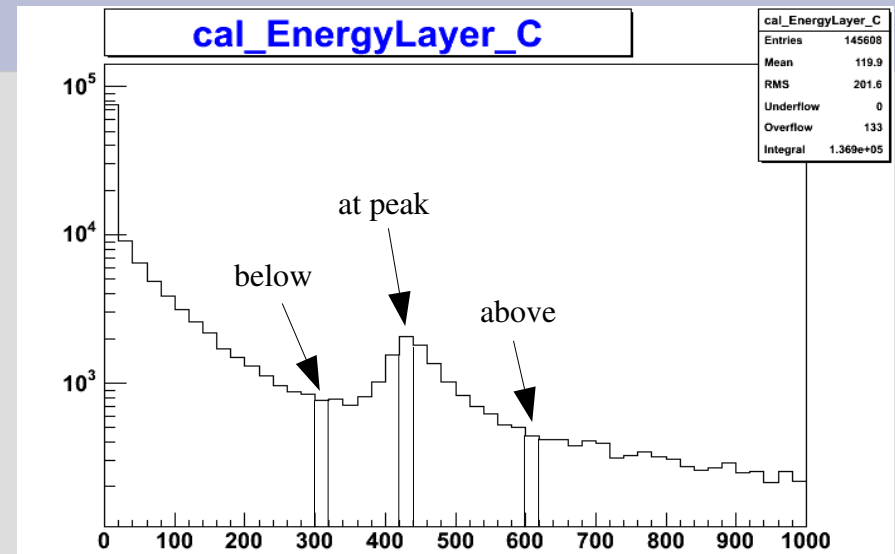
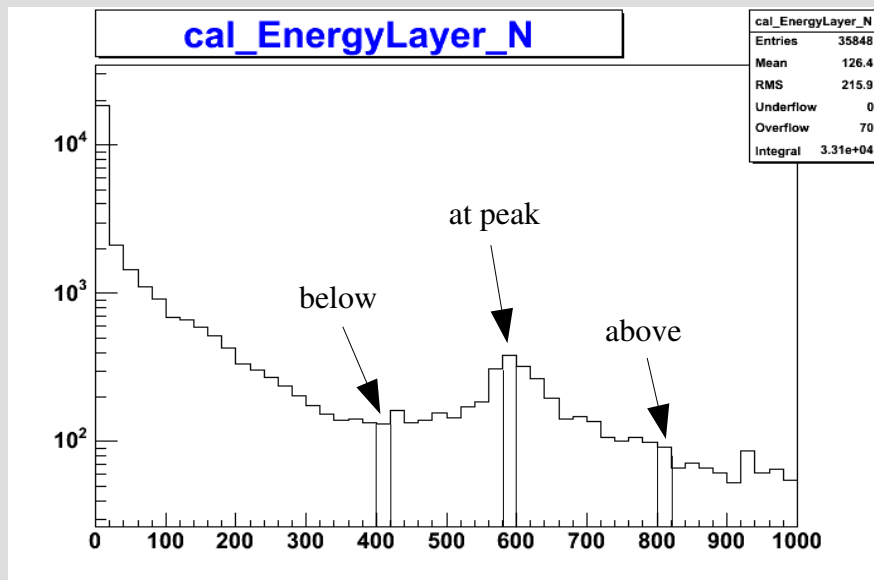
# Basic Method

- In the CNO events, look at plots of cal. energy per layer (corrected for incoming angle) for each type of ion
- Will only concentrate on carbon, nitrogen, and oxygen
- Notice peak -> energy of non-showering particle passing through a layer
- Have summed over all towers



# Basic Method (cont.)

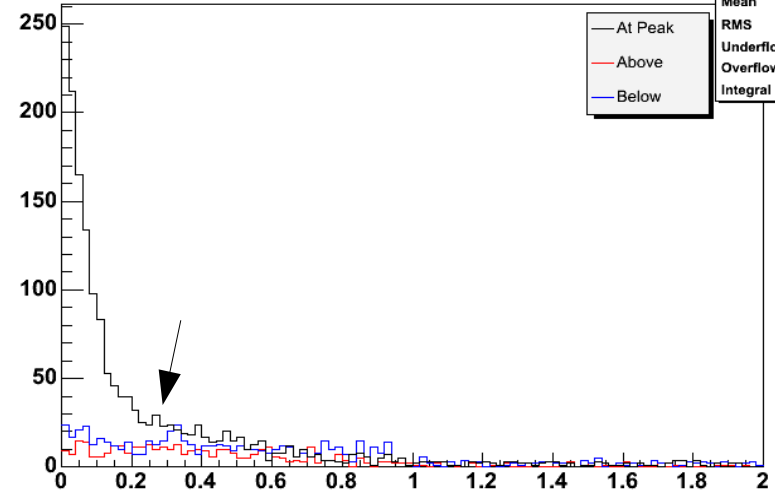
- Make a selection window above, below, and at the peak
- Make a cut on those events with an energy in the top layer of the cal. falling in one of these intervals
- Compare the three regions for the filter variables



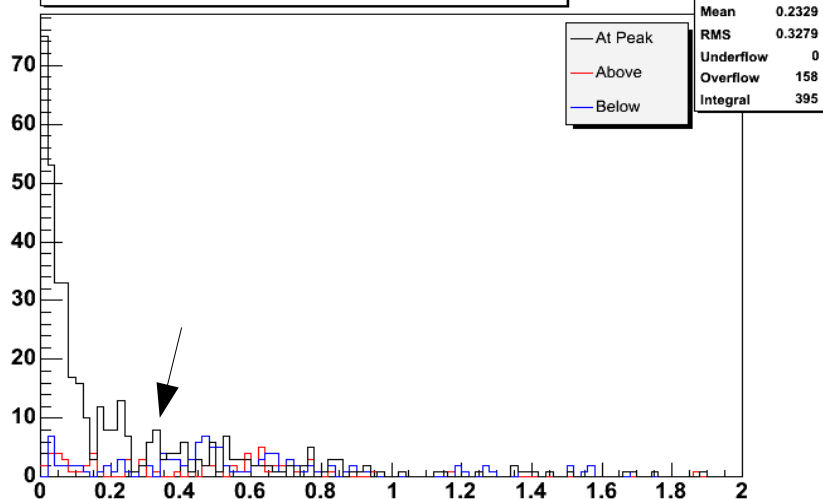
# Relative Energy Difference

- For each event, calculated the relative energy difference between layer 0 and all other layers
- Compared graphs for windows above, below, and at the peak
- Chose 0.2 as the maximum relative energy difference

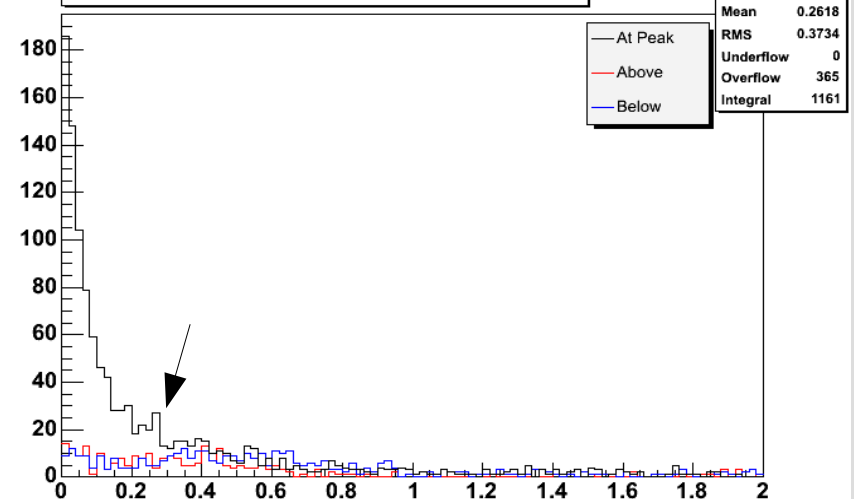
Energy Ratio of All Layers to Layer 0 For carbon



Energy Ratio of All Layers to Layer 0 For nitrogen

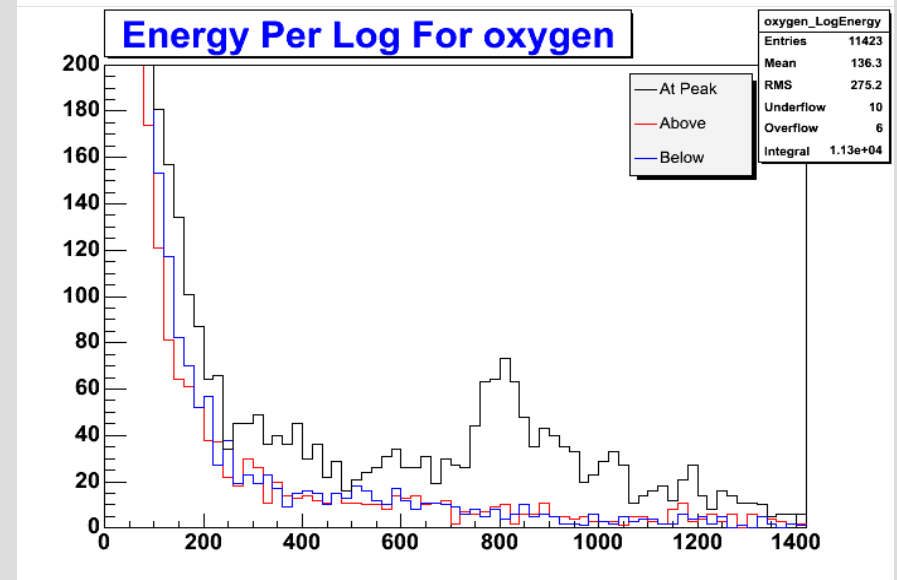
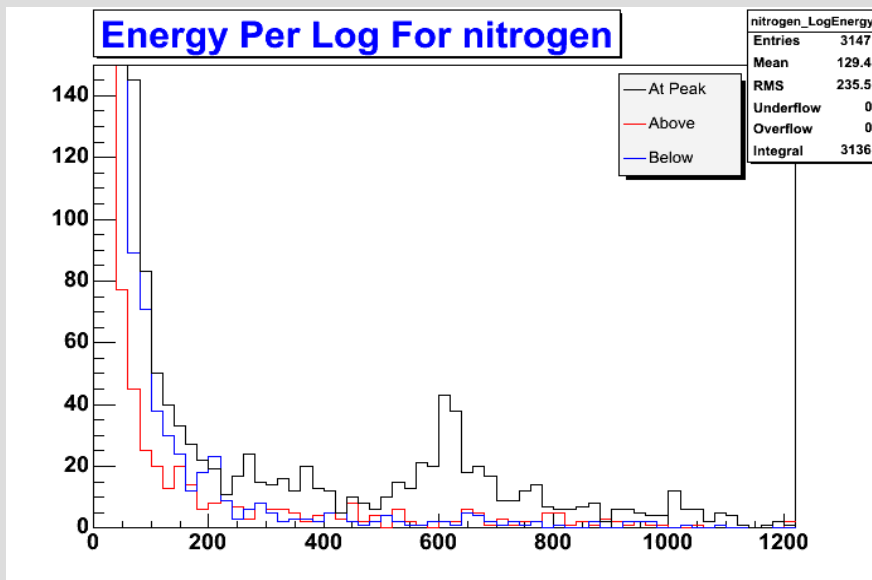
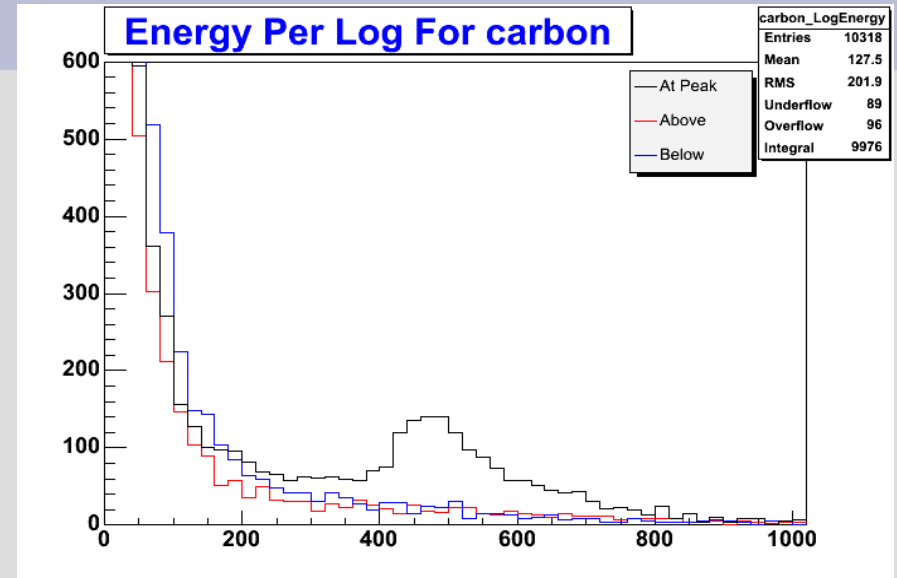


Energy Ratio of All Layers to Layer 0 For oxygen



# Threshold Energy in a Crystal

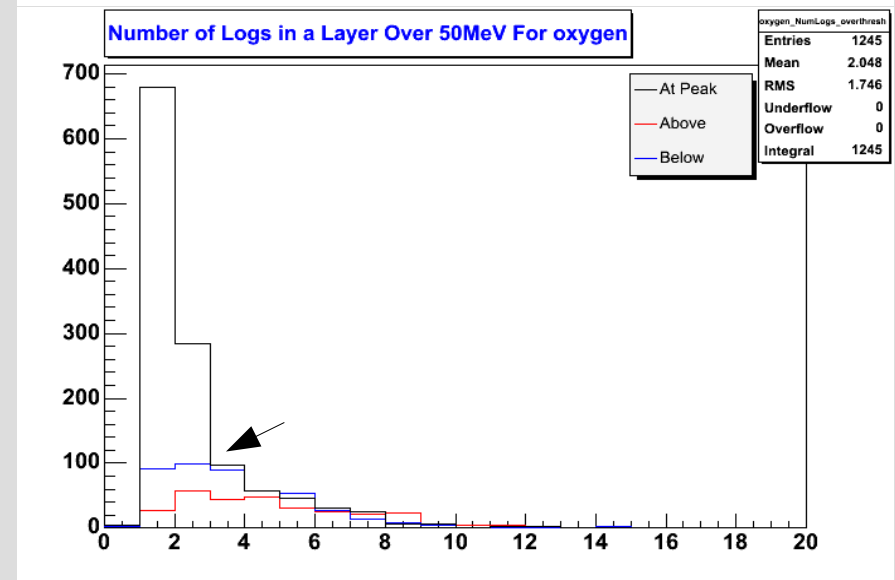
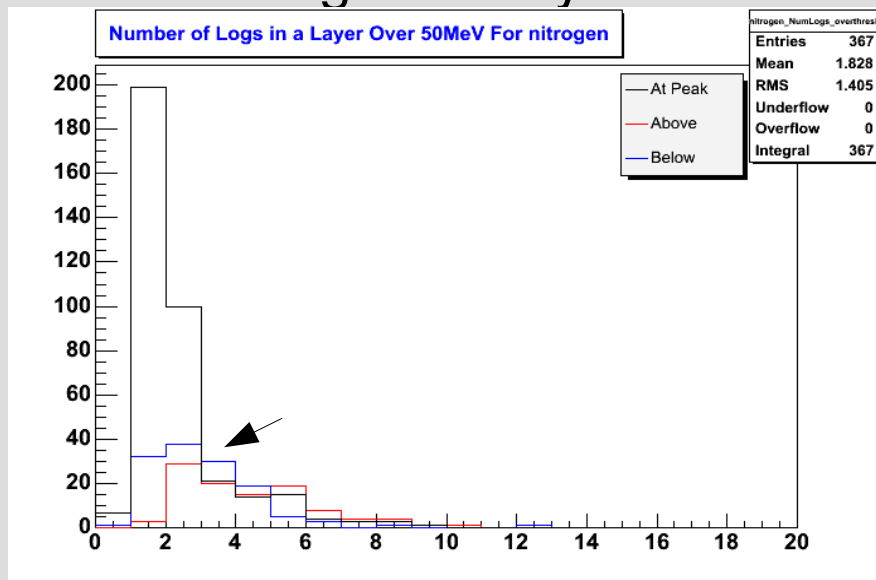
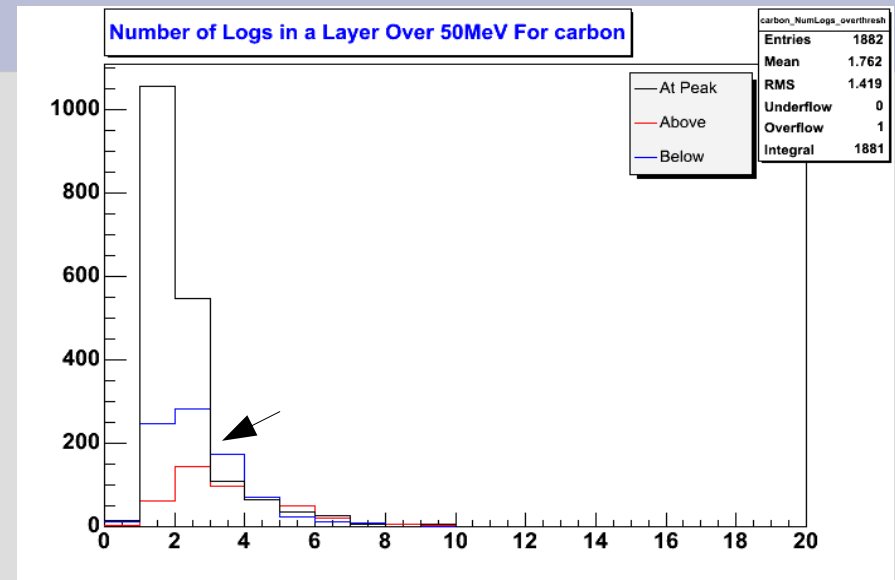
- For each region, plot energy per crystal for all layers
- We chose to set the threshold at 50 MeV





# Number of Logs Over Threshold

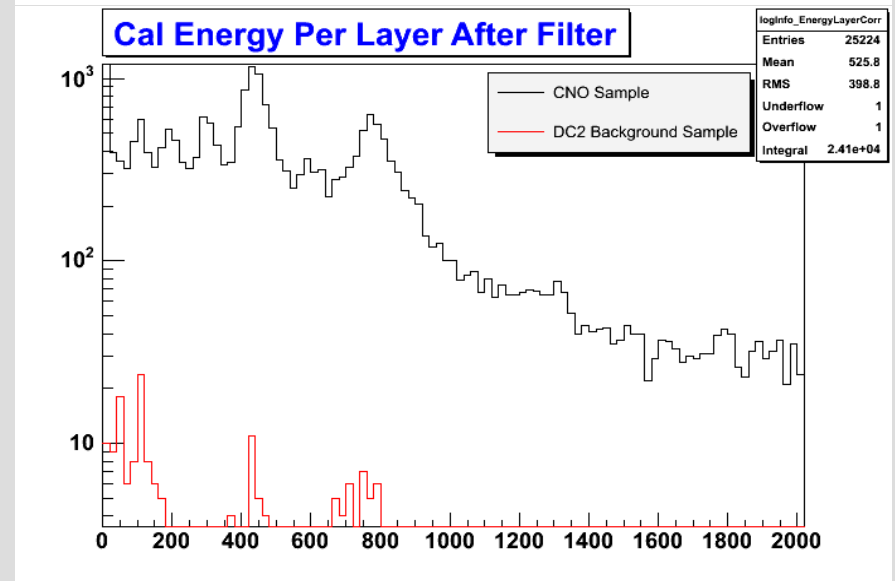
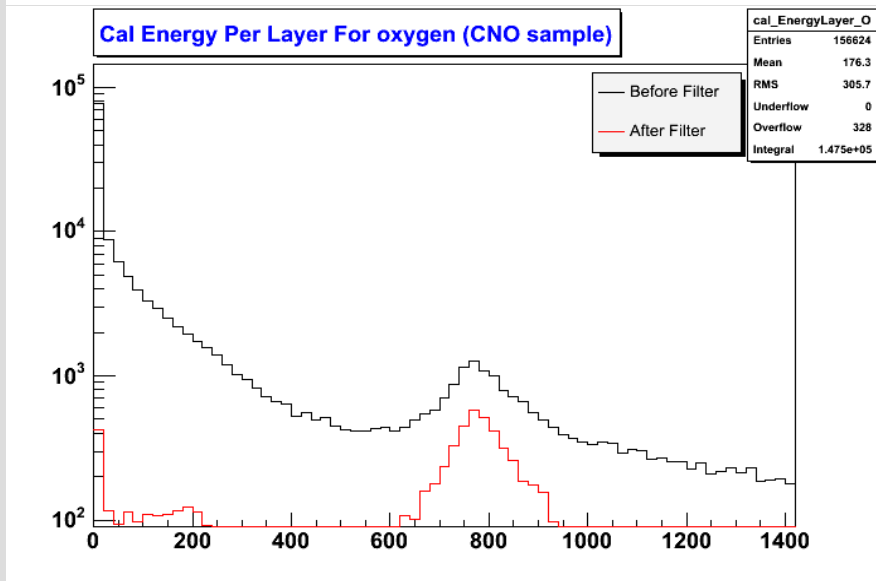
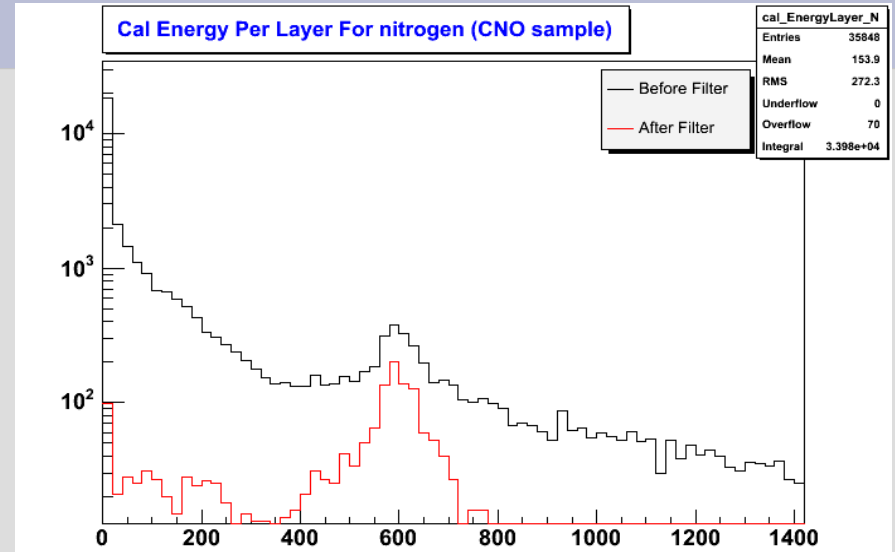
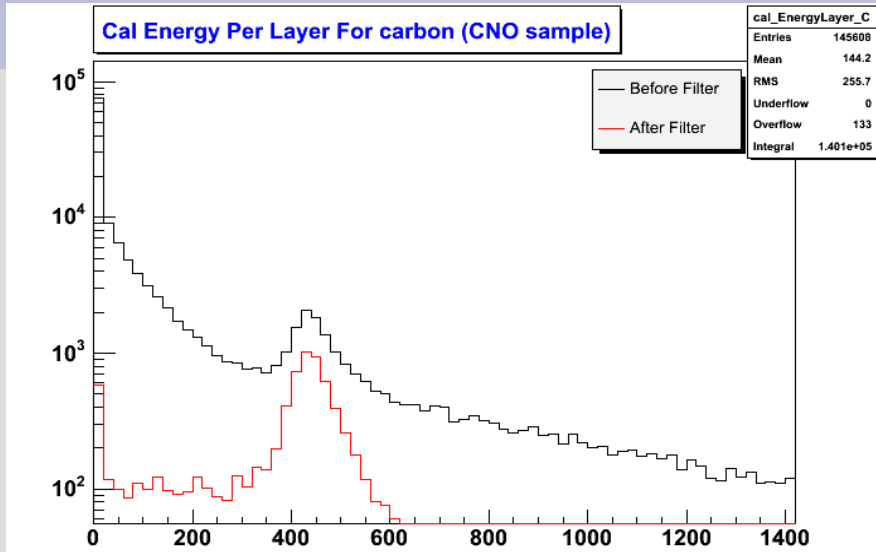
- For each region, plot the number of crystals (logs) in a layer with an energy over the 50 MeV threshold
- Chose the requirement of less than 3 logs in a layer



# Results

- Determined Filter Values:
  - Relative energy difference  $< 0.2$
  - Threshold energy = 50 MeV
  - Number of logs in a layer above threshold  $< 3$
- Proposed Filter Requirements:
  1. CNO trigger bit must be set
  2. Number of logs above threshold in the first three layers must be either 1 or 2
  3. Relative energy diff. between layers 1 and 0, and layers 2 and 0, must be  $< 0.2$
- Event Rates After Filter:
  - CNO: 3.84 Hz , Background including CNO: 7.18 Hz
  - Background minus CNO: 3.34 Hz

# Results, part II



# DC2 Background

Source ID	Source Name	counts
0	CrProtonPrimary	9130
1	CrProtonReentrant	1693
2	CrProtonSplash	1759
1000	CrElectronPrimary	59
1001	CrElectronReentrant	3423
1002	CrElectronSplash	3343
2000	CrPositronPrimary	8
2001	CrPositronReentrant	7777
2002	CrPositronSplash	7771
3000	CrAlpha	1321
4000	CrHeavylon	210
5000	Earth10	10880