CHARACTERIZING BaF2 DETECTORS FOR USE IN GAMMA RAY DETECTION

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Outline:

- Motivation
- How BaF_2 Works
- Testing the Detectors
- Determining the Good Detectors
- Setting up the Array pt. 1
- Setting up the Array pt. 2
- Cosmic Suppression
- Preliminary Data Analysis
- Acknowledgments

MOTIVATION

Nuclear Equation of State:

-Symmetry Energy

-High Nuclear Density

-Heavy Ion collisions

-Bremmstrahlung Photons

Barium Fluoride:

- High Z material

- Pulse shape discrimination

-Scintillation light in UV

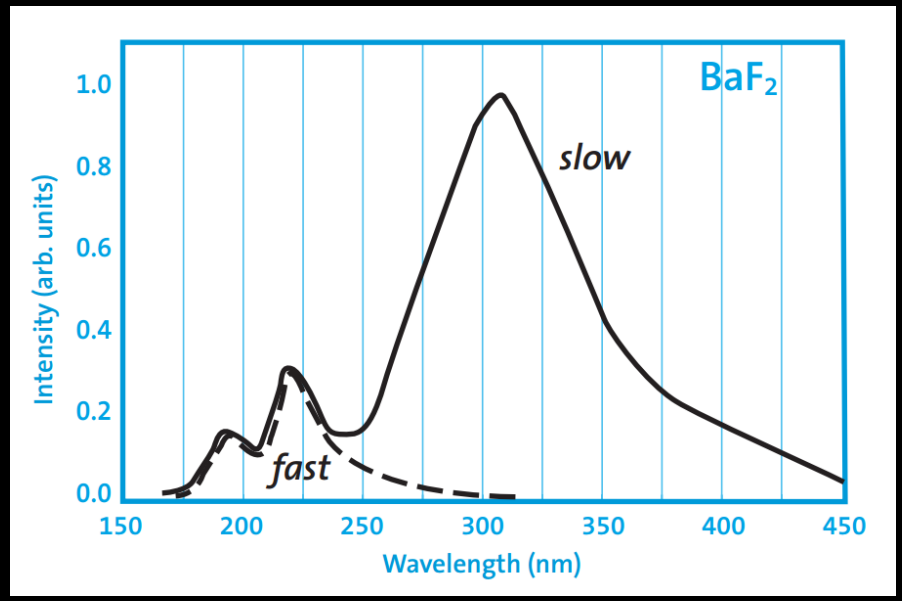
HOW BaF2 WORKS

Barium Fluoride:

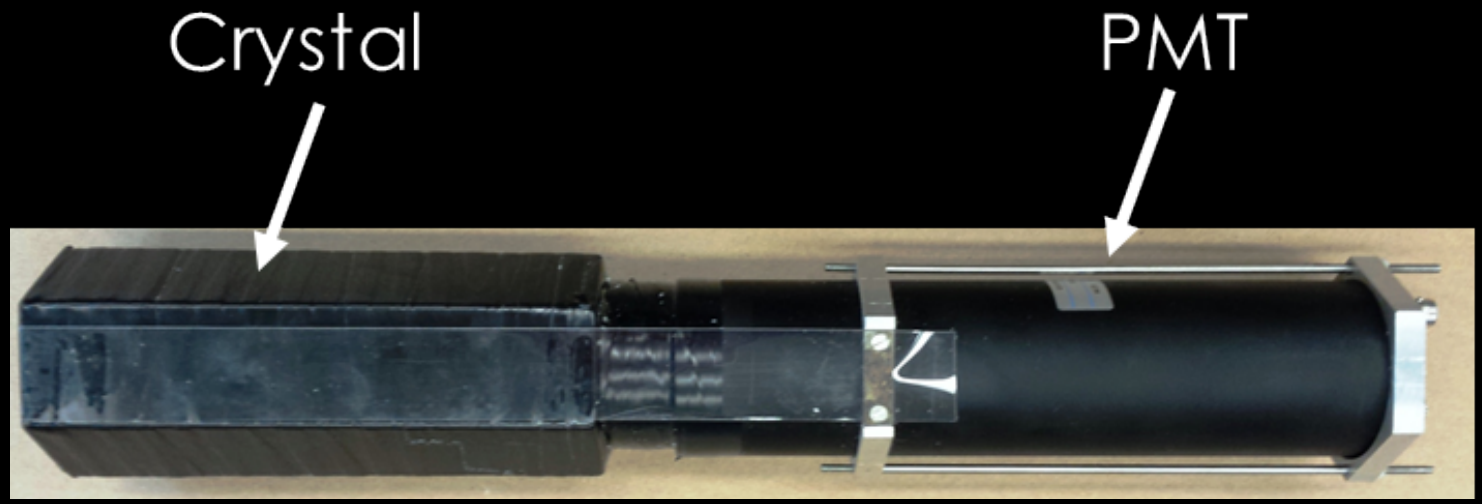
- High Z material
- Pulse shape discrimination
- Scintillates naturally in the UV
- BaF_2 is a very fast scintillator

BaF_2 Detector Composition:

- Crystal
- PMT
- Coupling
- Teflon Tape
- Electrical Tape
- Quartz Window



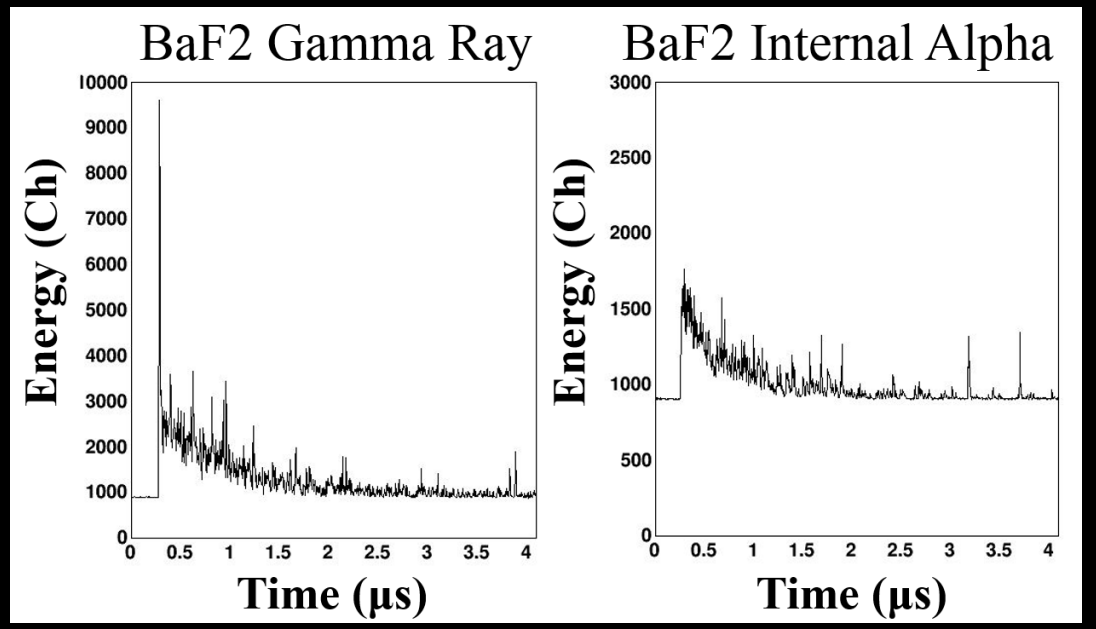
http://www.crystals.saint-gobain.com/uploadedFiles/SG-Crystals/Documents/Barium%20Fluoride%20Data%20Sheet.pdf

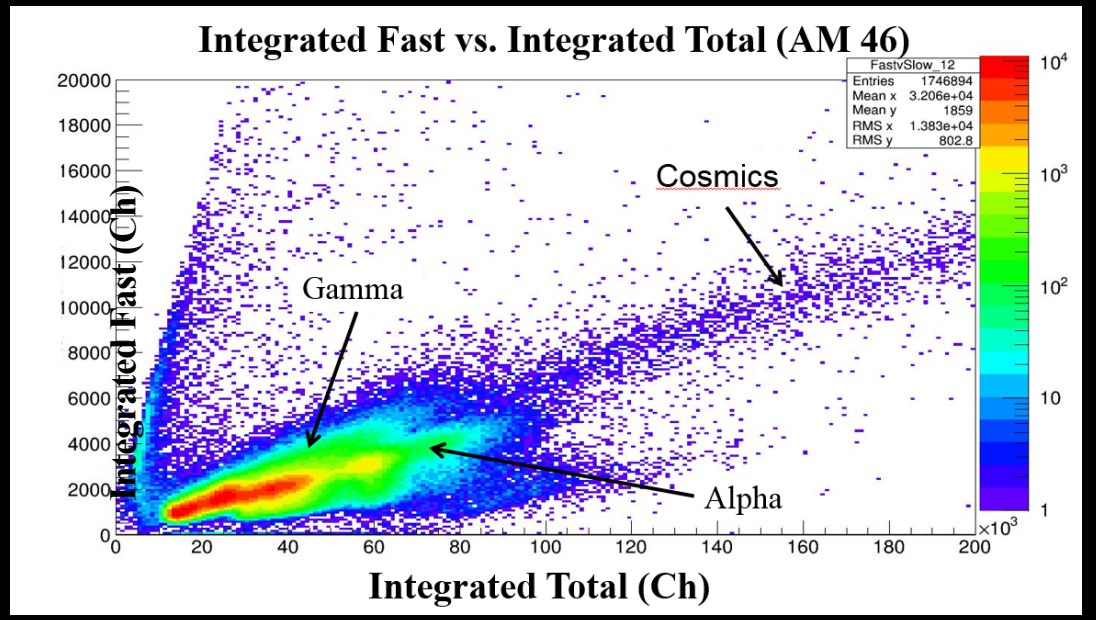


TESTING THE DETECTORS

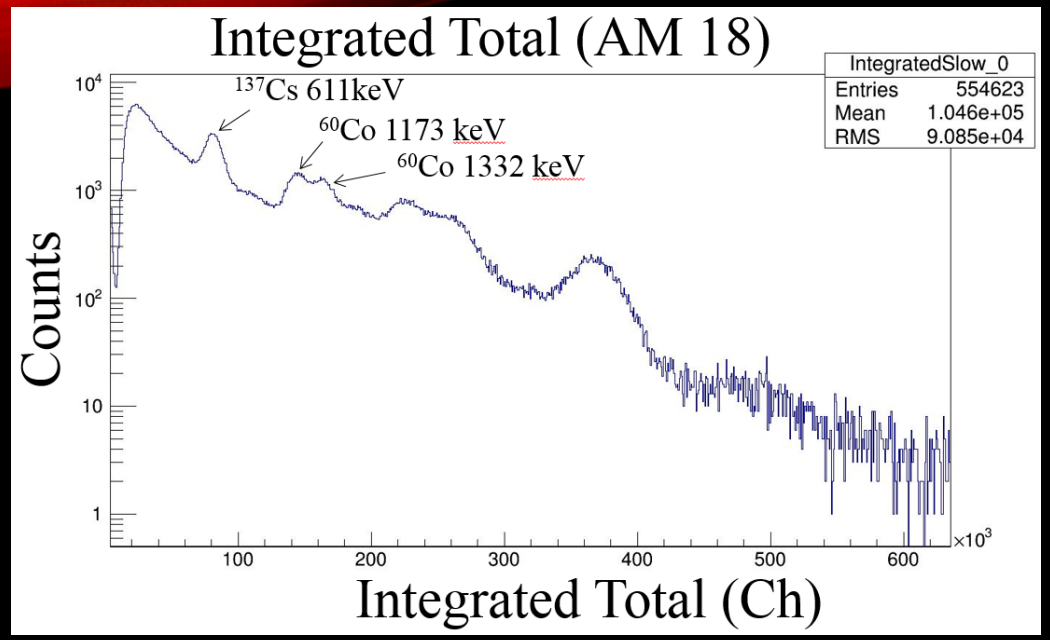
Testing The Detectors:

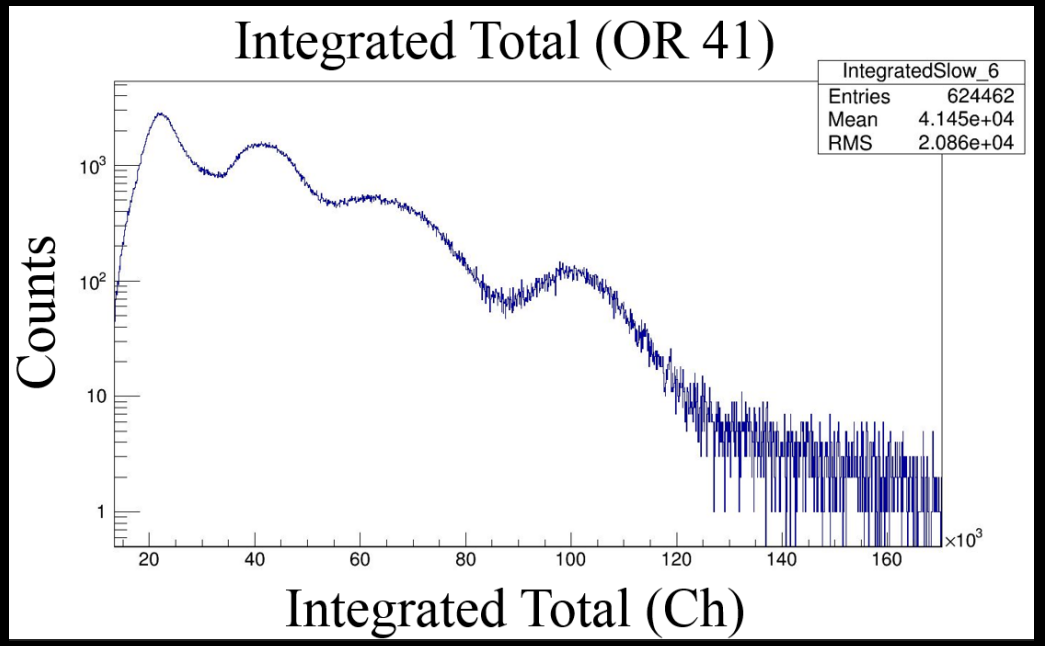
- 15 Detector Batches
- Background for 30 minutes
- With source for 2 hours
  - ^{22}Na
  - ^{60}Co
  - ^{137}Cs





DETERMINING THE GOOD DETECTORS





Factors In Barium Fluoride Resolution:

- Crystal
- Coupling between the crystal and PMT
- Reflective Material degradation

Determining Resolution:

- Not absolute resolution
- Determined by separation of ^{60}Co peaks
- Best 37 were chosen (best around 15.7% res)

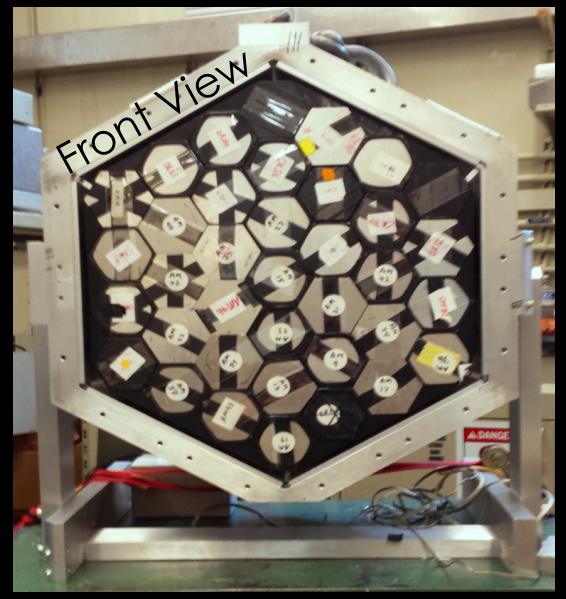
SETTING UP THE ARRAY PT. 1

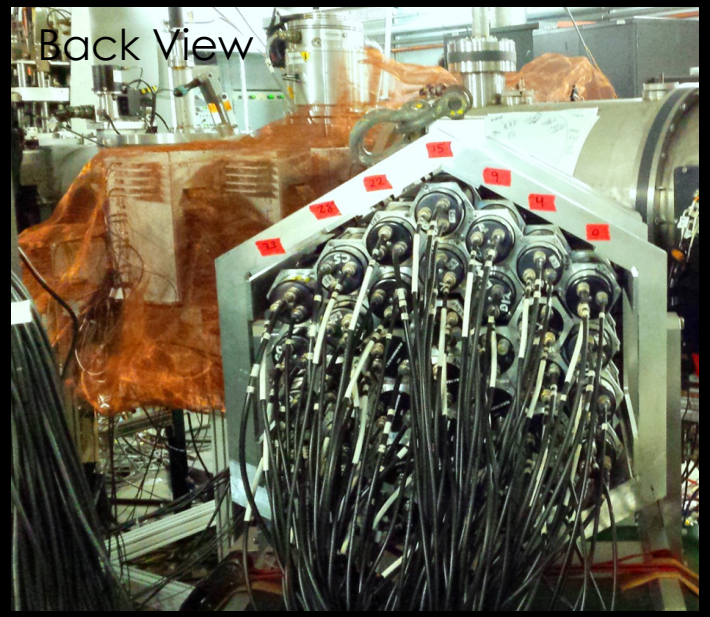
Packing the Array:

- Practicing with polyethylene dummies
- Packing Process
- BaF_2 ordering

Cabling the Array:

- Testing cables
- To Bias Supply
- To Struck 3316's
- To CAEN 1730's

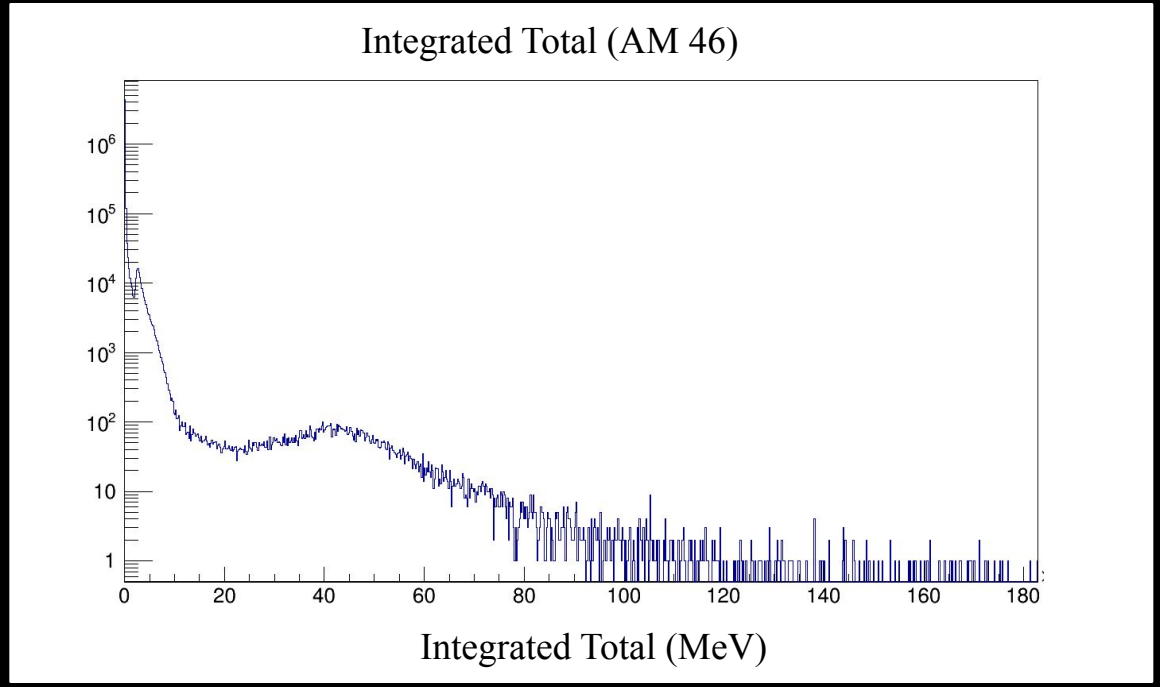




SETTING UP THE ARRAY PT. 2

Gain Matching:

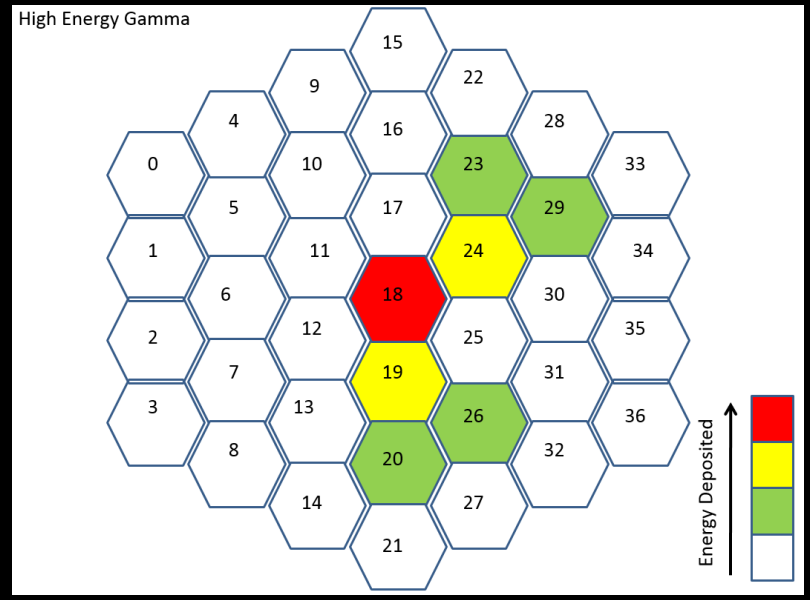
- Choose a peak to gain match
- ~43 MeV Muon peak
- Several voltage iterations (±100 V)
- Exponential fits
- Determining where we want the gain

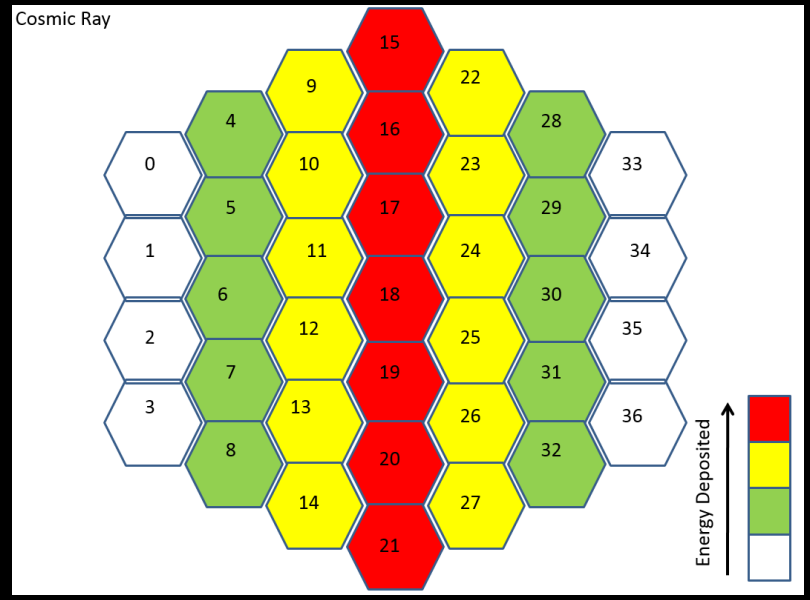


COSMIC SUPPRESSION

How Can Cosmic Rays Be Suppressed?:

- Hit pattern
- Neighboring detector coincidence
- Threshold above ~20 MeV

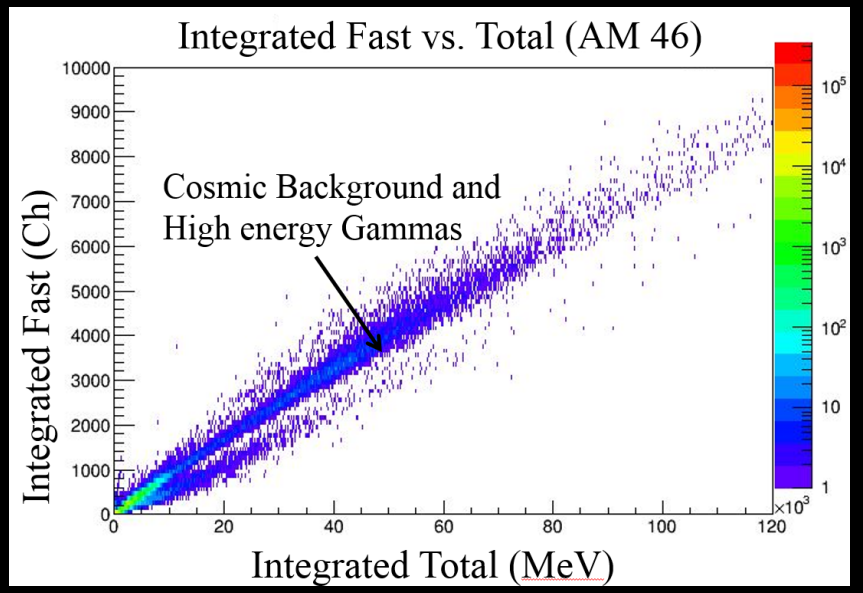


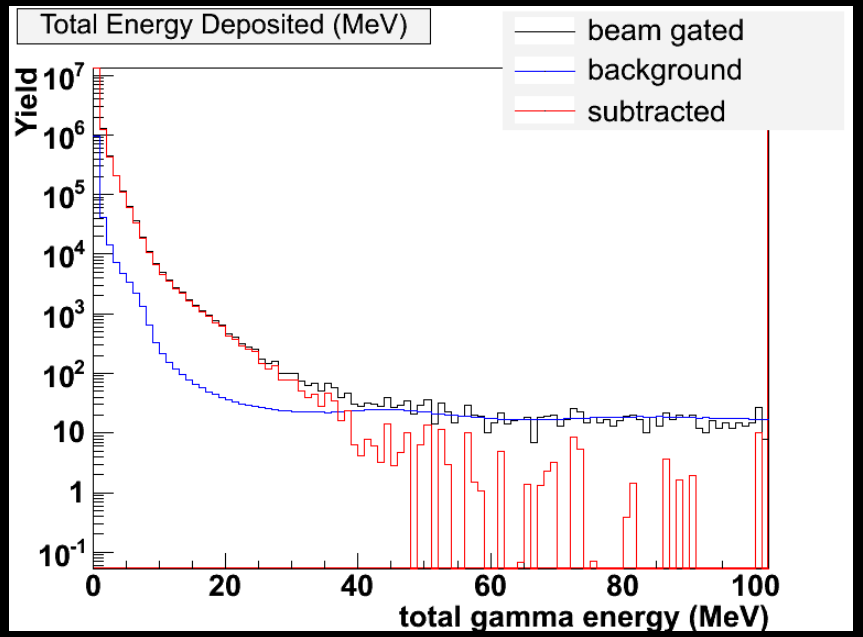


PRELIMINARY ANALYSIS

Data:

- Data was taken with both 3316's and 1730's
- How will higher stats be obtained in the future
- Future plans for the BaF_2 array





ACKNOWLEDGEMENTS

SJY Group:

Sherry Yennello, Alan McIntosh, Mike Youngs, Alis Rodriguez Manso, Lauren Heilborn, Andrew Zarrella, Andrea Jedele, Christine Lawrence.

Collaborators:

Shea Mosby, Robert Varner.

Grants:

DOE grant DE-FG03-93ER40773 , NSF grant PHY-1263281, and Welch Foundation grant A-1266