Intro to MINERvA

Noah Harvey Vaughan *(they/them)*
PhD Candidate, Oregon State University

NuXTract 2023
Monday October 2nd, 2023

Oregon State University

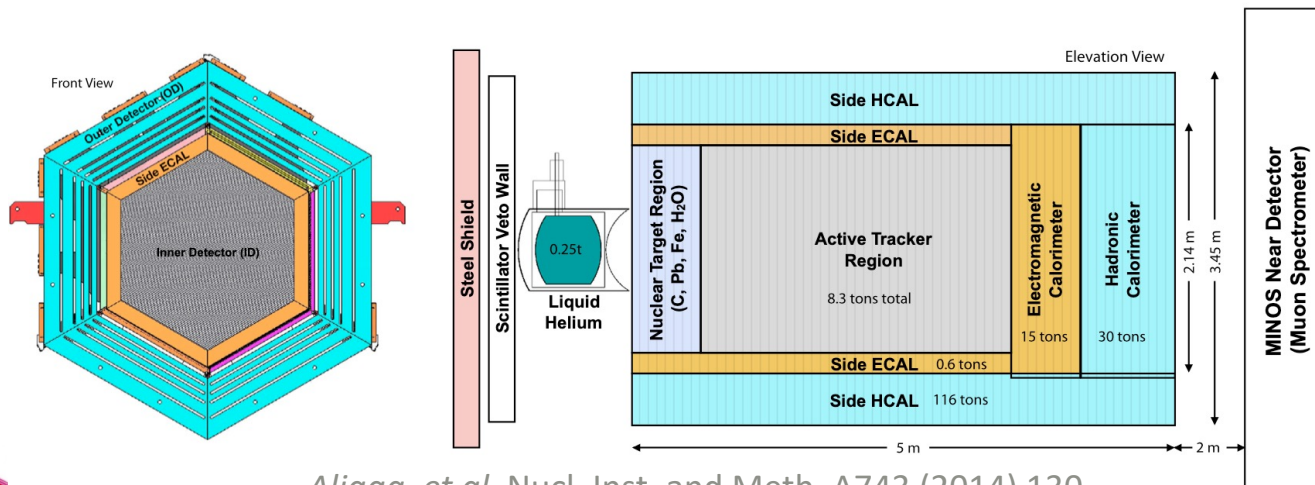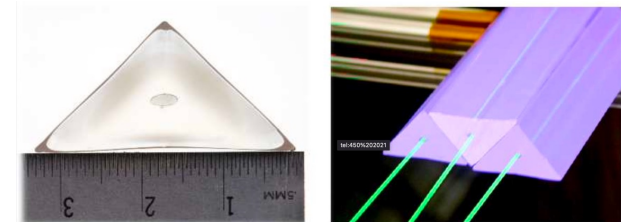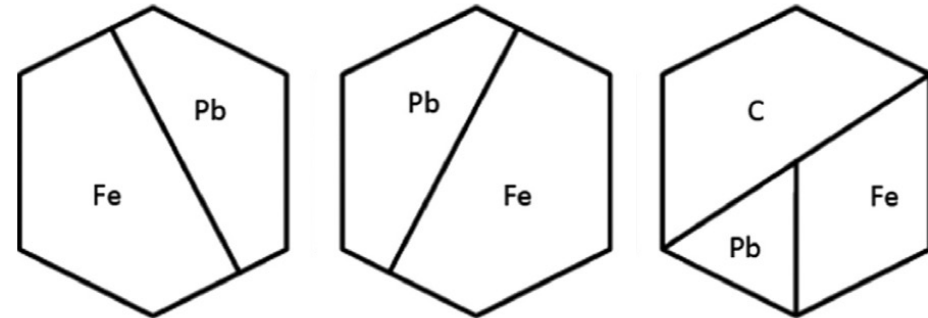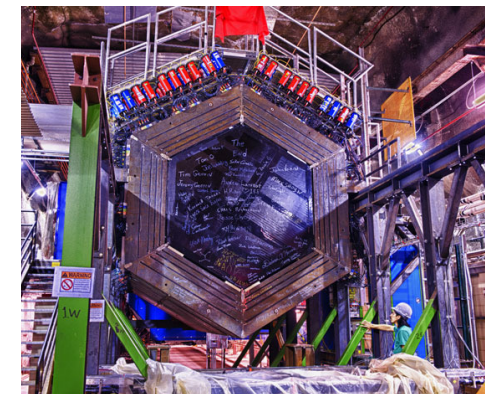# MINERvA Experiment

MINERvA = **M**ain **IN**jector **E**xpe**R**iment on **v** (nu) **A** (atom)

- Dedicated x-section experiment at FNAL
- Data runs from 2009 – 2019:
  - NuMI LE POT: $4.0 \times 10^{20} \; \nu$, $1.7 \times 10^{20} \; \bar{\nu}$
  - NuMI ME POT: $\sim 3 \times$ LE ν, $\sim 7 \times$ LE $\bar{\nu}$

Geometry of nuclear target planes

Front View

Elevation View

Aliaga, et al. Nucl. Inst. and Meth. A743 (2014) 130

Why measure cross sections?

- Exactly what MINERvA was built for!

- Containing both passive nuclear targets & active tracker allows for wide breadth of cross section analyses

- Low- & medium-energy NuMI flux is well constrained

- Very high statistics dataset
    - Uncertainty is systematics dominated in most analyses
    - Allows study of difficult to detect processes e.g., CCE $\bar{\nu}$ on hydrogen

MINERvA for DUNE/HyperK

- $\nu, \overline{\nu}$ spectra overlapping DUNE

- Probes similar processes as HyperK

- Tunes on existing generator informs new versions

- Preservation efforts allow for reanalysis

- Detector planes repurposed for DUNE ND prototypes
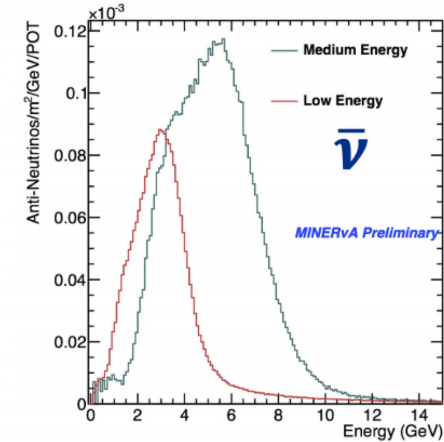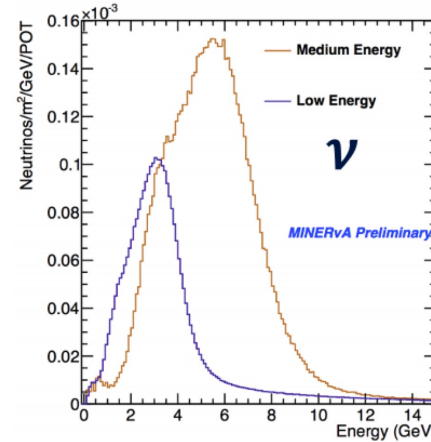
Collaboration in front of MINERvA planes repurposed for DUNE-ND 2x2 prototype

MINERvA at NuXTract

Publishing Cross Sections at MINERvA

- Summary of publication history

- Overview of steps analyzers take to extract a cross section

- More detailed look at unfolding, testing analyzers perform

Tuesday, 3 October, 11:00

Data Preservation at MINERvA

- Efforts to preserve analysis tools, how they're used

- Examples of in-progress "Data Preservation Era" analyses

- Preserving the MINERvA dataset

Wednesday, 4 October, 16:00

Acknowledgements