

# Bubble Chamber Planning Meeting

07 August 2013

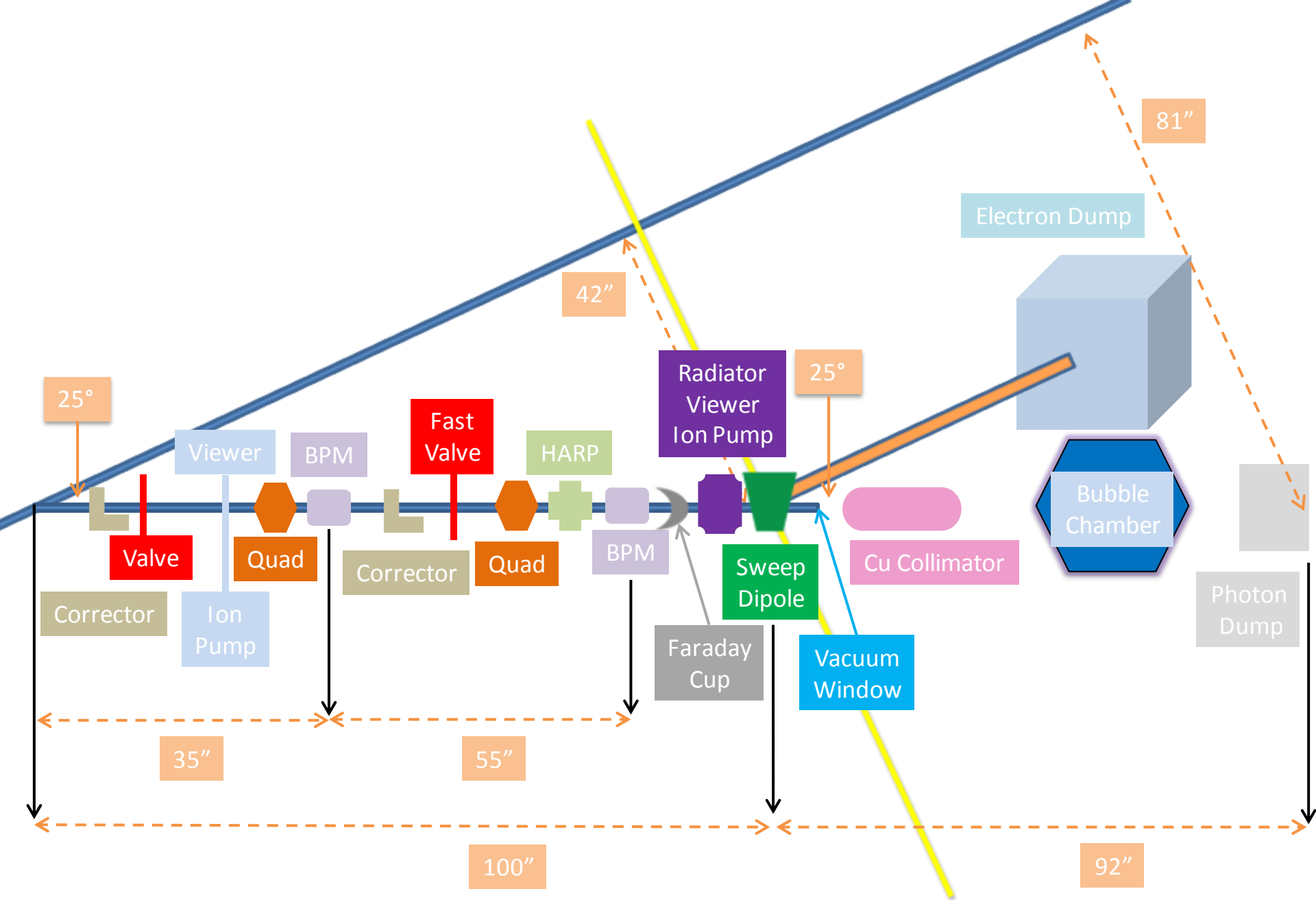
# Agenda

1. Bubble Chamber progress at Argonne
2. Beamline Layout
3. Bubble Chamber cost estimate: procurement and labor
4. Background from  $^{17}\text{O}(\gamma, n)^{16}\text{O}$  and subsequent neutron elastic scattering with  $^{16}\text{O}$  and  $^{14}\text{N}$  nuclei
5. Background from  $^{13}\text{C}(\gamma, n)^{12}\text{C}$  (in case we decide to use  $\text{CO}_2$  instead of  $\text{N}_2\text{O}$ )

# Beamline Layout

- I. HARP to measure beam profile
- II. Fast Valve to protect from vacuum failure
- III. Distance between two BPMs = 55" (was 18" for PEPPo)
- IV. Camera for OTR light from Cu foil
- V. Electron Dump: isolated to measure beam current, 2 kW
- VI. Beam Properties at Radiator:

|                                          |            |
|------------------------------------------|------------|
| Beam Kinetic Energy, (MeV)               | 3.0 – 8.5  |
| Beam Current ( $\mu\text{A}$ )           | 0.01 – 100 |
| Absolute Beam Energy                     | 0.1%       |
| Relative Beam Energy                     | 0.1%       |
| Energy Resolution (Spread), $\sigma_T/T$ | 0.06%      |
| Beam Size, $\sigma_{x,y}$ (mm)           | 1 – 2      |



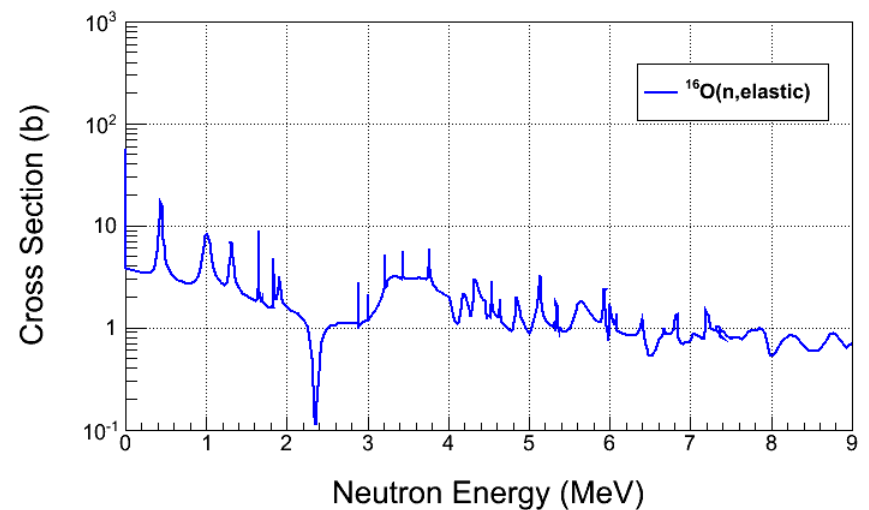
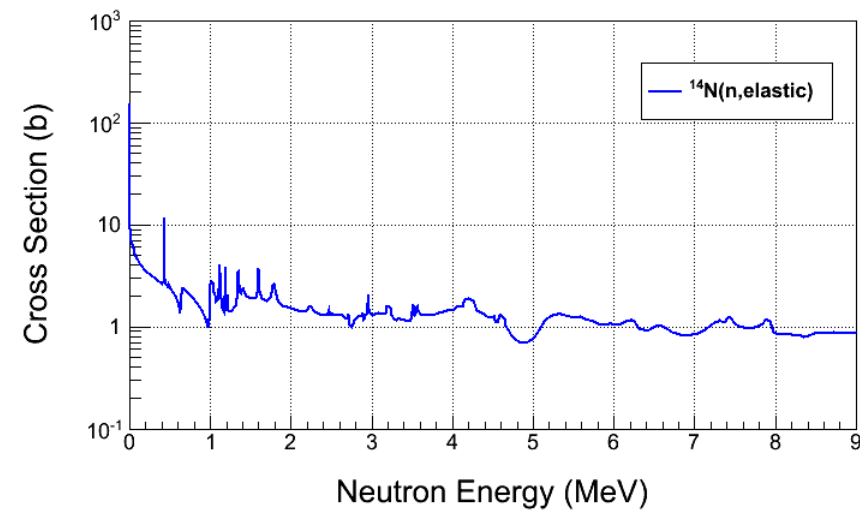
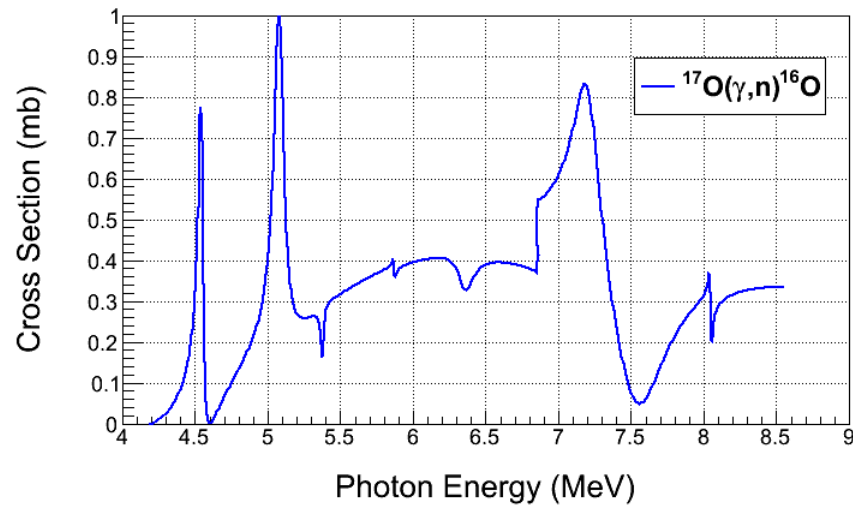
# Cost Estimate

- I. Radiator motion and Sweep Dipole must be in FSD
- II. BCM0L02 and Electron Dump in Beam Loss Accounting (BLA)
- III. Cooled: Radiator and Electron Dump.
- IV. Uncooled: Photon Collimator and Photon Dump
- V. Re-use PEPPo radiator and beamline
- VI. New beamline components: 2 Super Harps + Fast Valve
- VII. Summary of labor cost by group:

| Group              | Labor     |
|--------------------|-----------|
| Survey & Alignment | 3 wks x 2 |
| Magnet Test        | 1 wk x 2  |
| Engineering Design | 12 wks    |
| Software           | 3 wks x 2 |
| EES                | 6 wk x 2  |
| EH&Q               | 4 wks     |

| Item                          | Material Procurement                            | Shop                         | Labor                                                                         |
|-------------------------------|-------------------------------------------------|------------------------------|-------------------------------------------------------------------------------|
| New Dipole Magnet             | Dipole Magnet (\$8,000)<br>Hall Probe (\$2,000) |                              | Mapping (1 week)<br>EESDC (1 week)<br>Alignment (2 days)                      |
| New Power Supply              | Power Supply (\$5,000)                          |                              | Software (2 weeks)                                                            |
| New Beamline                  | 2 Super Harps and Fast Valve (\$30,000)         | Pipes + Pedestals (\$20,000) | Design (6 weeks)<br>Alignment (1 week)<br>Software (4 weeks)<br>EES (5 weeks) |
| Radiator (cooled ladder, FSD) | 0.02 and 0.10 mm Cu foils (\$2,000)             | \$4,000                      | Design (2 week)<br>Alignment (2 days)                                         |
| Sweep Dipole                  |                                                 |                              |                                                                               |
| Electron Dump                 | Pure Cu (\$5,000)                               | Dump + Pipes (\$15,000)      | Design (2 week)<br>Alignment (1 day)                                          |
| Cu Collimator                 | Pure Cu (\$5,000)                               | Collimator + Stand (\$5,000) | Design (1 week)<br>Alignment (1 day)                                          |
| Photon Dump & Stand           | Pure Al (\$3,000)                               | \$4,000                      | Design (1 week)<br>Alignment (1 day)                                          |
| Safety Review                 |                                                 |                              | 4 weeks                                                                       |
| Install                       |                                                 |                              | 6 weeks                                                                       |
| Bubble Chamber                |                                                 |                              | Alignment (1 week)                                                            |
| Total                         | \$60,000                                        | \$48,000                     | \$60,000                                                                      |
| Total (with overhead)         | \$75,000                                        | \$60,000                     | \$90,000                                                                      |

# $^{17}\text{O}(\gamma, n)^{16}\text{O}$ Background



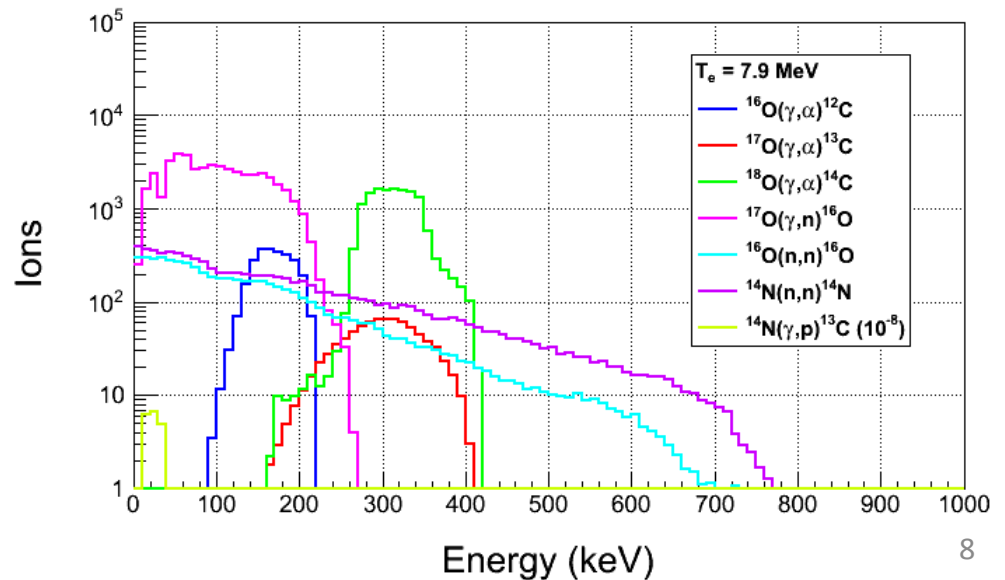
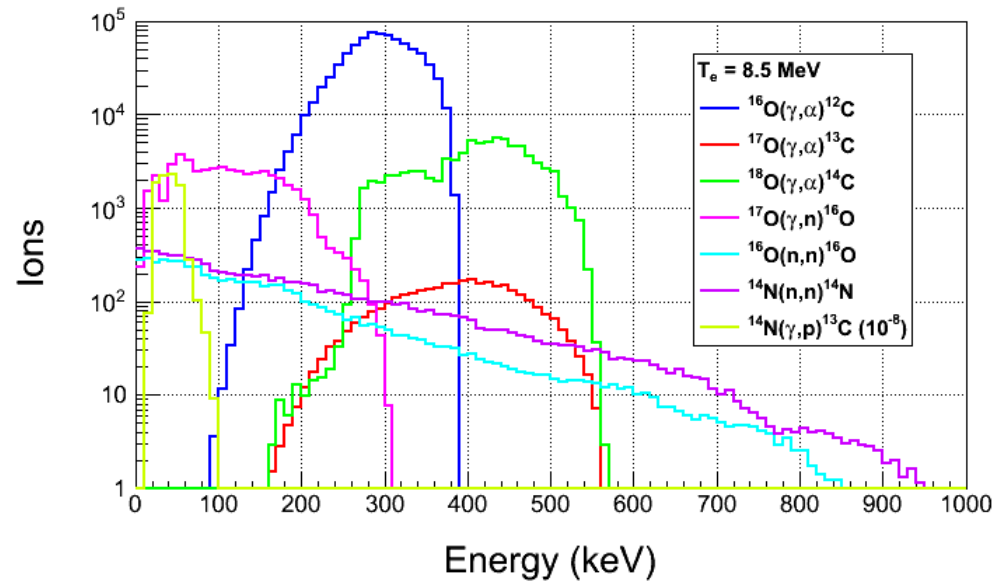
# Ion Energy Distribution

## ➤ Depletion:

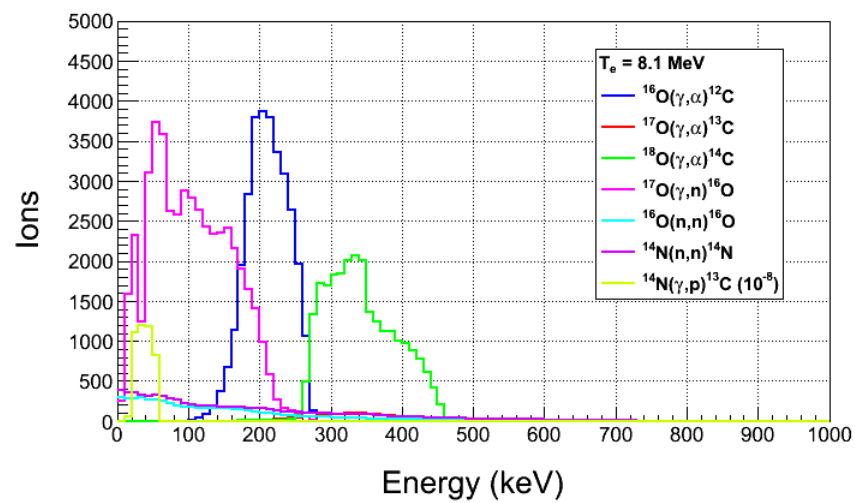
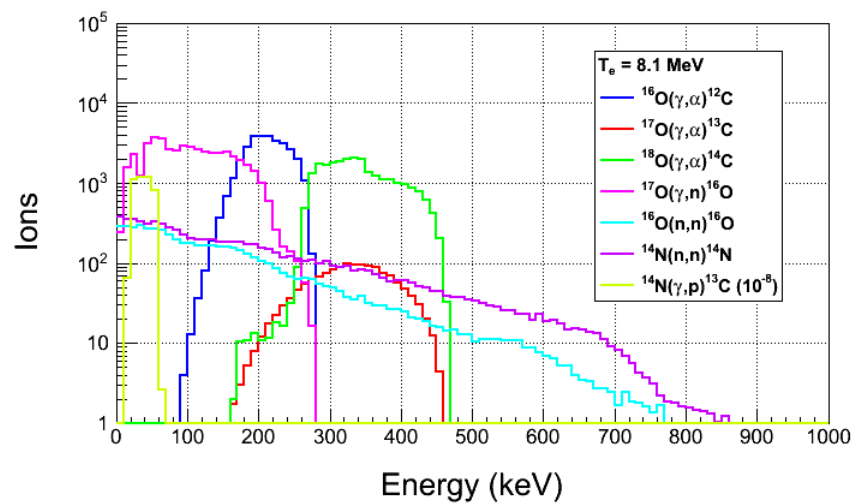
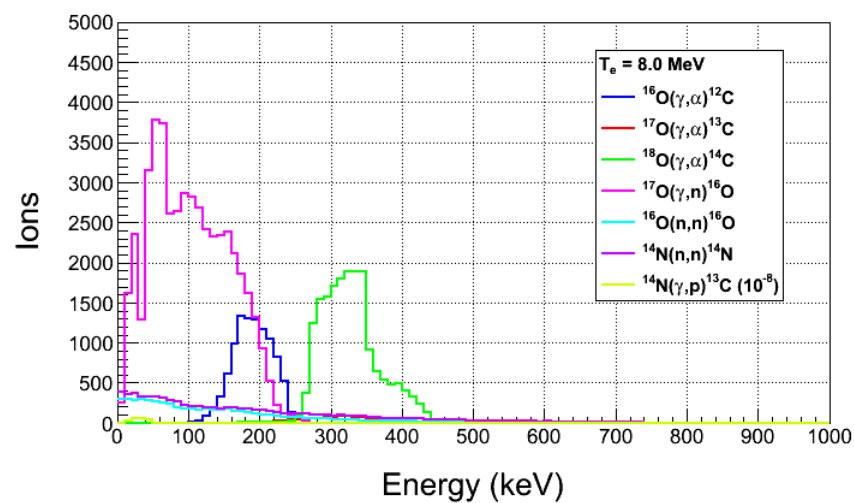
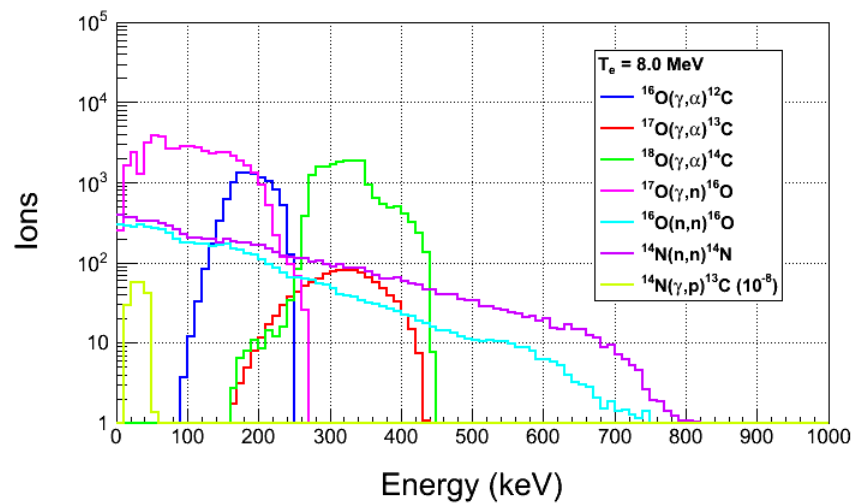
- I.  $^{17}\text{O}$  depletion=5,000
- II.  $^{18}\text{O}$  depletion=5,000

## ➤ Natural Abundance:

- I.  $^{17}\text{O}$ : 0.038%
- II.  $^{18}\text{O}$ : 0.205%

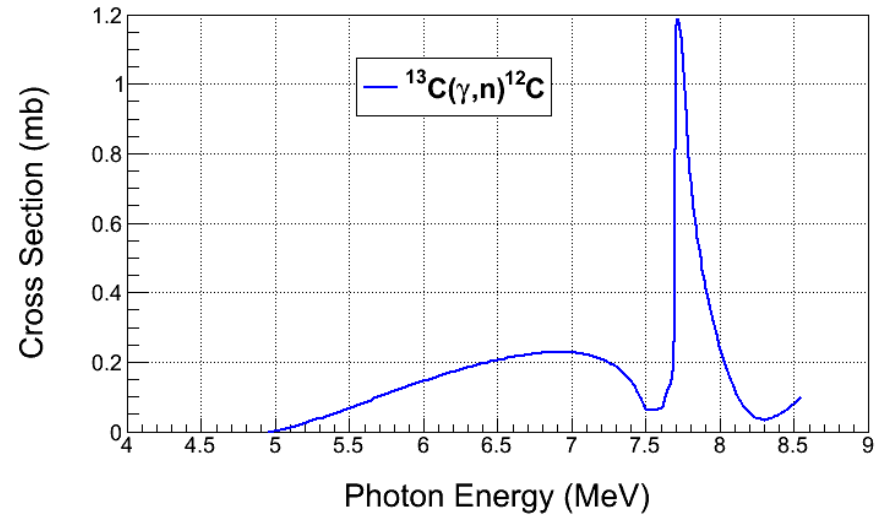






# $^{13}\text{C}(\gamma, n)^{12}\text{C}$ Background

- Depletion:
  - I.  $^{13}\text{C}$  depletion=1,000
- Natural Abundance:
  - I.  $^{13}\text{C}$ : 1.07%



For comparison,  $^{17}\text{O}(\gamma, n)^{16}\text{O}$

