

# Bubble Chamber Planning Meeting

07 August 2013

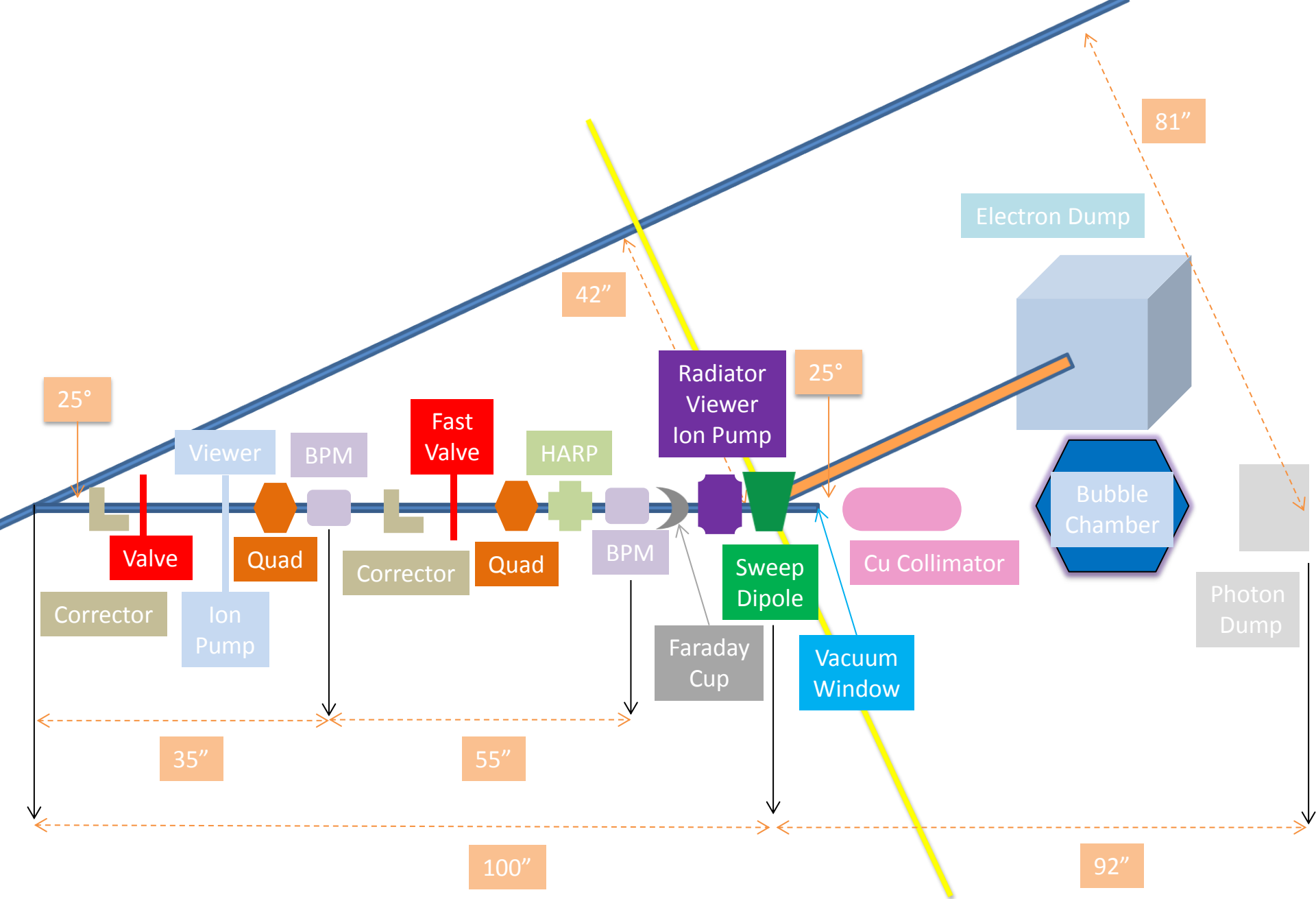
# Agenda

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



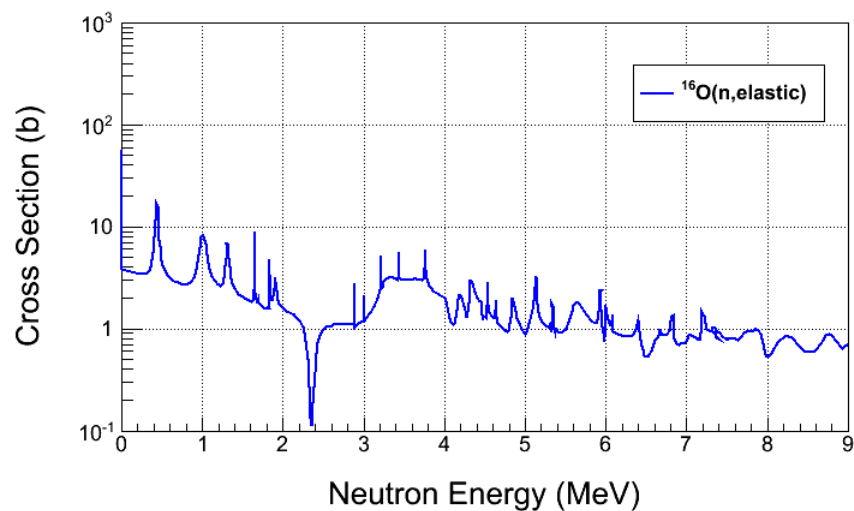
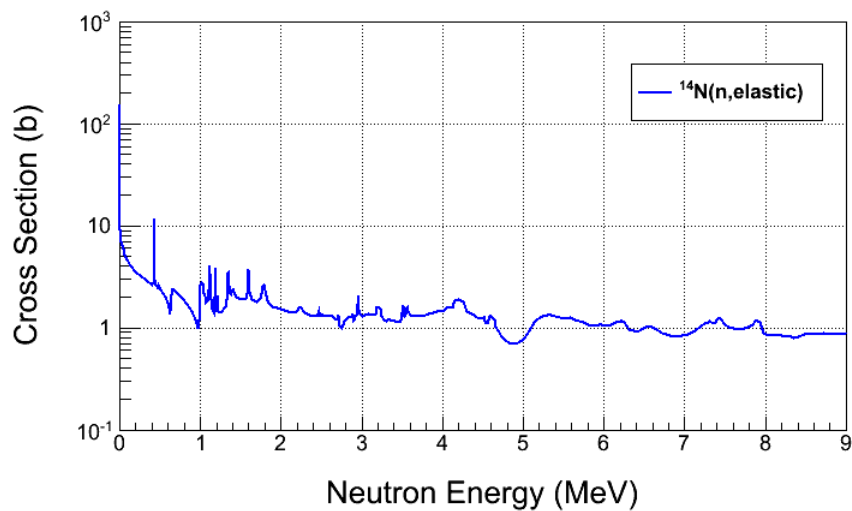
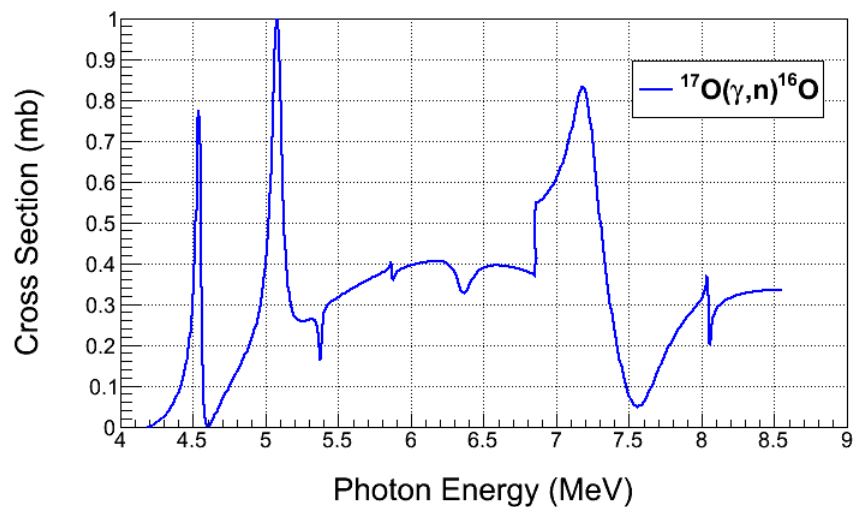
# Cost Estimate

- 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 BPM on Spect. line		Pipe + BPM (\$5,000)	P. Francis (1 week)
New Dipole Magnet	Dipole Magnet (\$8,000) Hall Probe (\$2,000)		Mapping (1 week) EESDC (1 week) 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) Alignment (1 week) Software (4 weeks) EES (5 weeks)
Radiator (cooled ladder, FSD)	0.02 and 0.10 mm Cu foils (\$2,000)	\$4,000	Design (2 week) Alignment (2 days)
Sweep Dipole			
Electron Dump	Pure Cu (\$5,000)	Dump + Pipes (\$10,000)	Design (2 week) Alignment (1 day)
Cu Collimator	Pure Cu (\$5,000)	Collimator + Stand (\$5,000)	Design (1 week) Alignment (1 day)
Photon Dump & Stand	Pure Al (\$3,000)	\$4,000	Design (1 week) 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



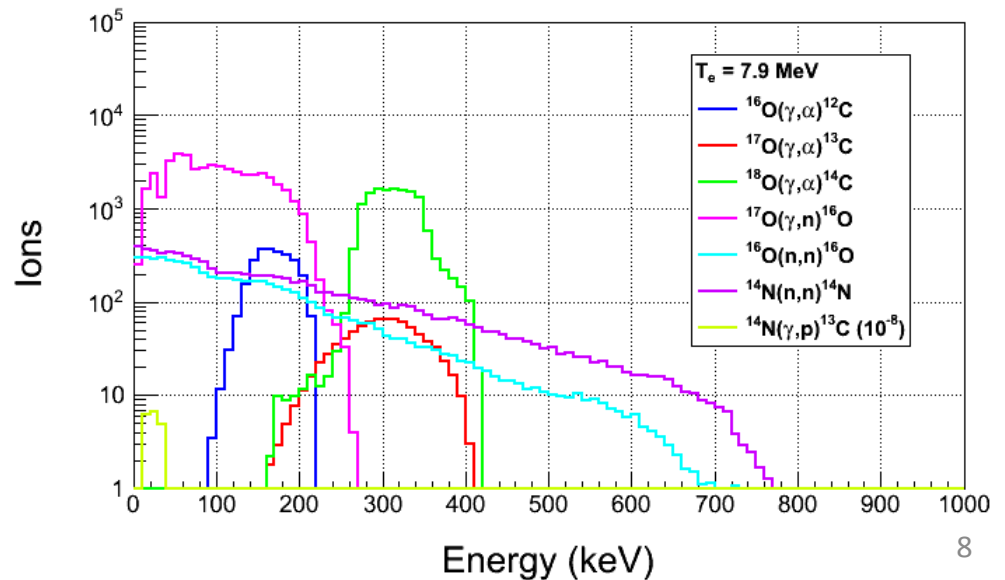
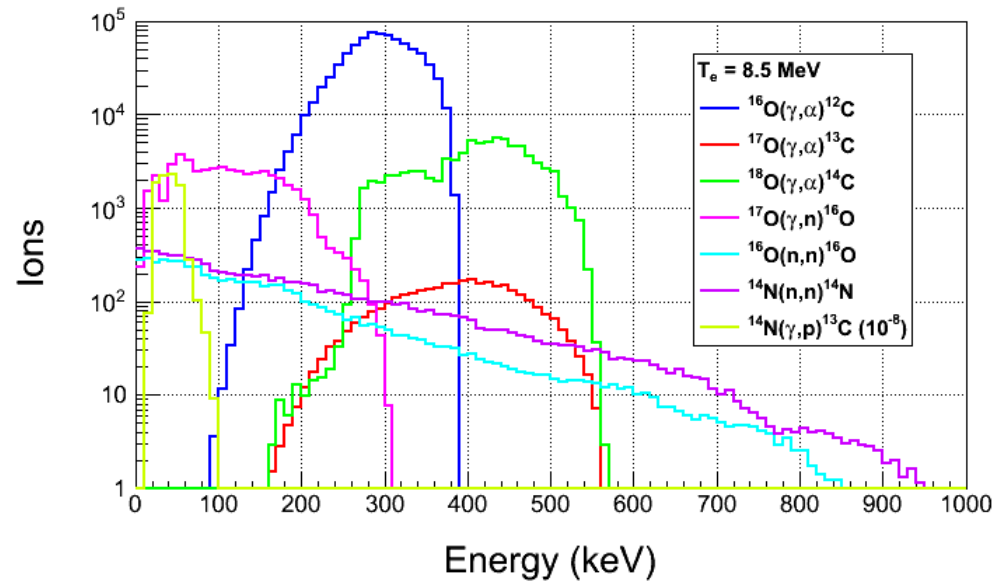
# Ion Energy Distribution

## ➤ Depletion:

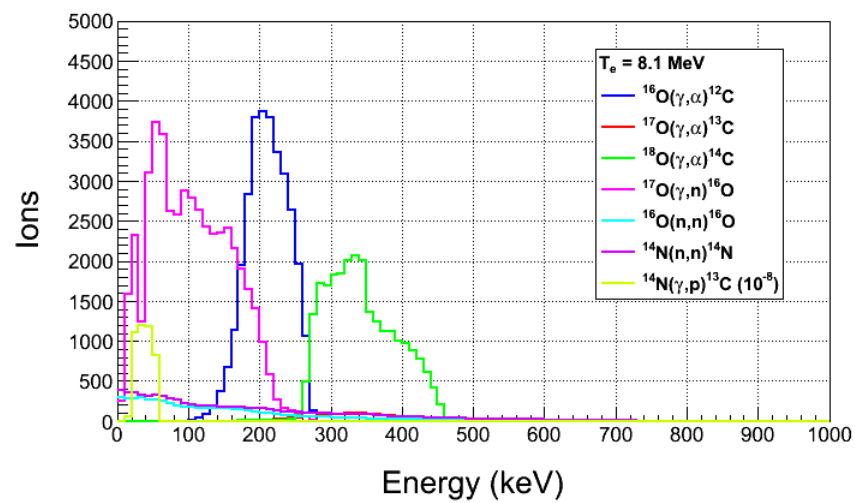
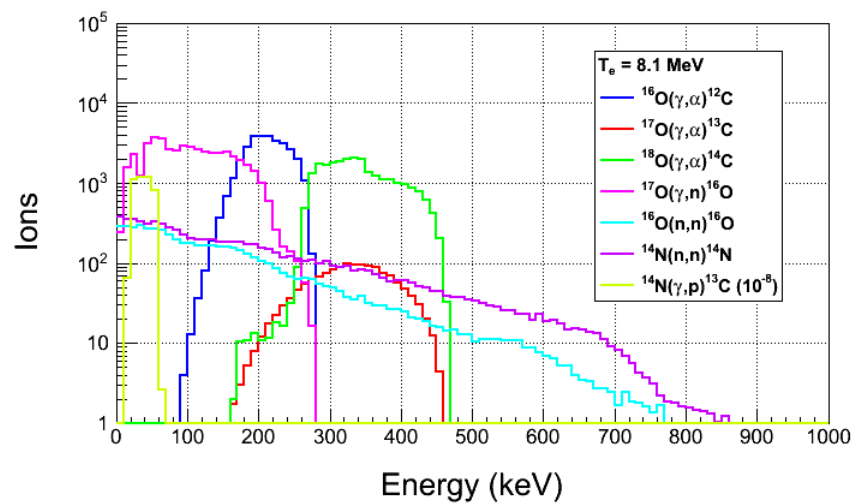
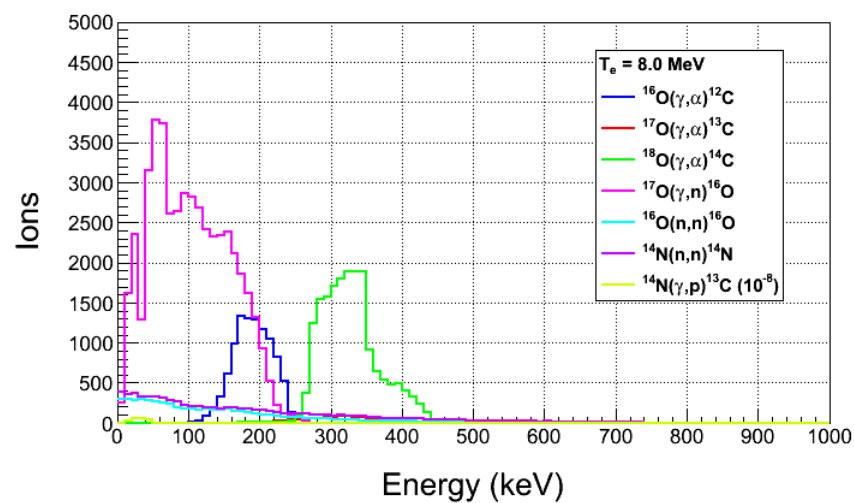
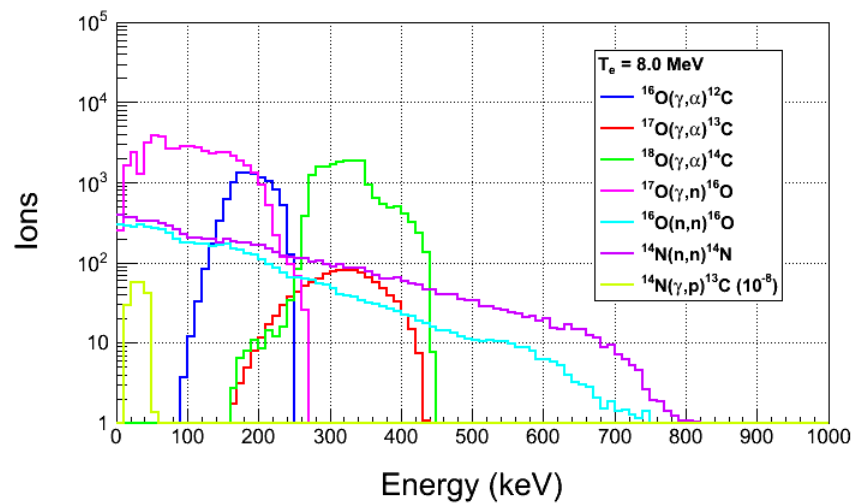
- I.  $^{17}\text{O}$  depletion=5,000
- II.  $^{18}\text{O}$  depletion=5,000

## ➤ Natural Abundance:

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

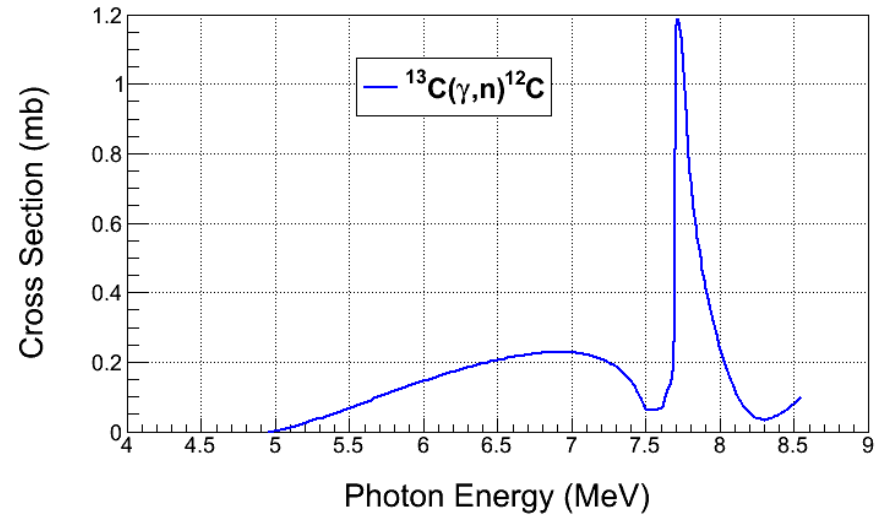






# $^{13}\text{C}(\gamma, n)^{12}\text{C}$ Background

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



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

