Bubble Chamber Planning Meeting

07 August 2013

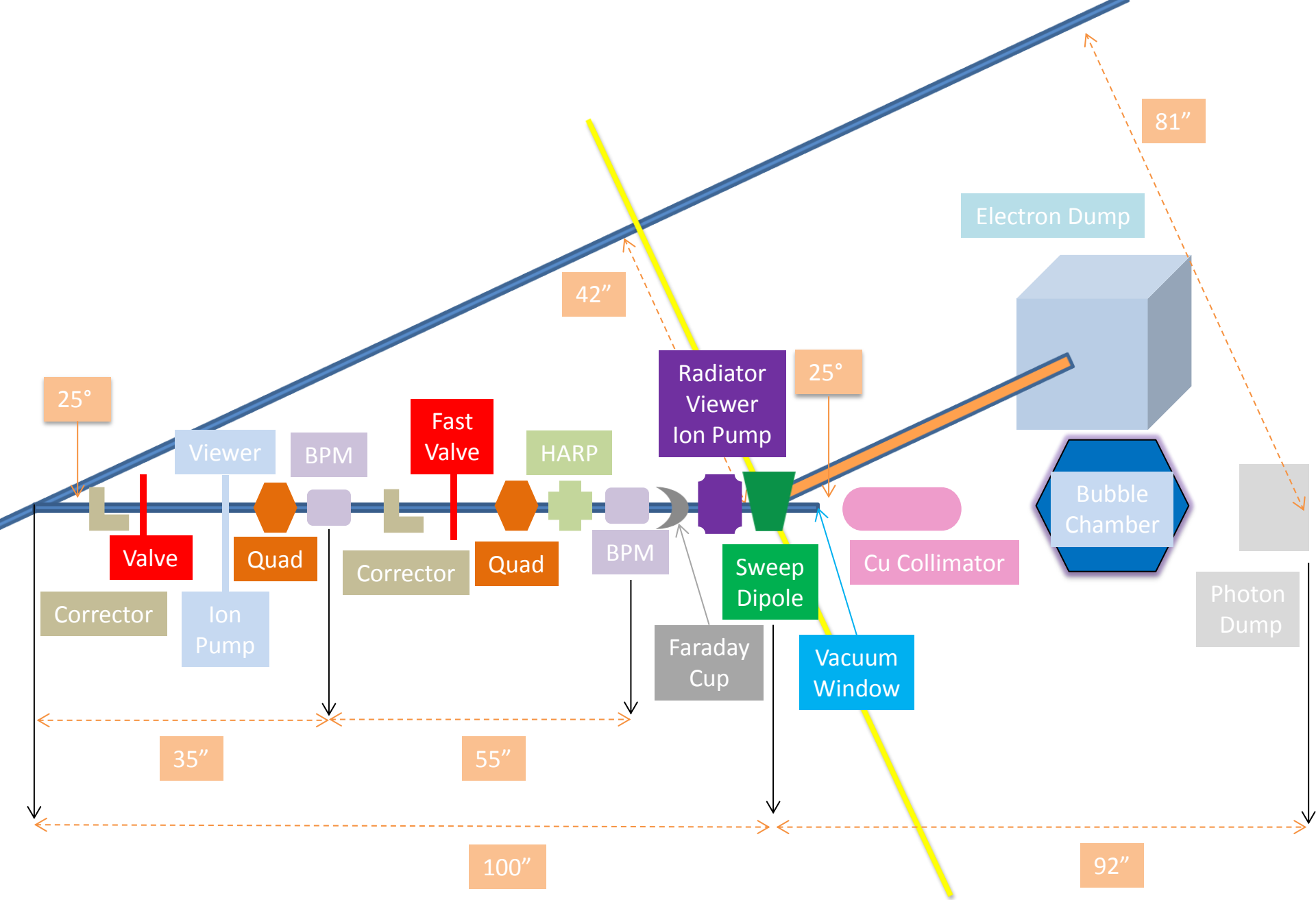
Agenda

1. Bubble Chamber progress at Argonne
2. Beamline Layout
3. Bubble Chamber cost estimate: procurement and labor
4. Background from $^{17}O(\gamma,n)^{16}O$ and subsequent neutron elastic scattering with ^{16}O and ^{14}N nuclei
5. Background from $^{13}C(\gamma,n)^{12}C$ (in case we decide to use CO_2 instead of N_2O)

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 (μA)	0.01 – 100
Absolute Beam Energy	0.1%
Relative Beam Energy	0.1%
Energy Resolution (Spread), σ_T/T	0.06%
Beam Size, $\sigma_{x,y}$ (mm)	1 – 2


81”
Electron Dump
42”
Radiator
Viewer
Ion Pump
25°
25°
Fast
Valve
Viewer
BPM
HARP
Bubble
Chamber
Valve
Quad
Corrector
Quad
BPM
Sweep
Dipole
Cu Collimator
Photon
Dump
Corrector
Ion
Pump
Faraday
Cup
Vacuum
Window
35”
55”
100”
92”

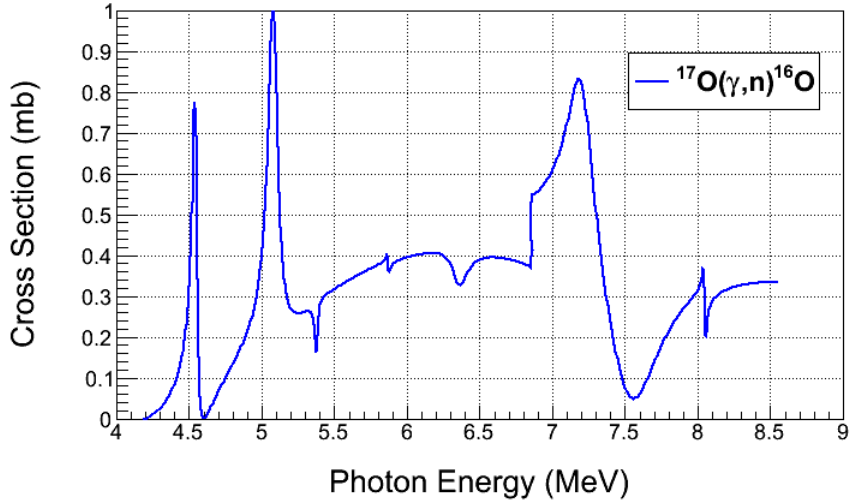
Cost Estimate

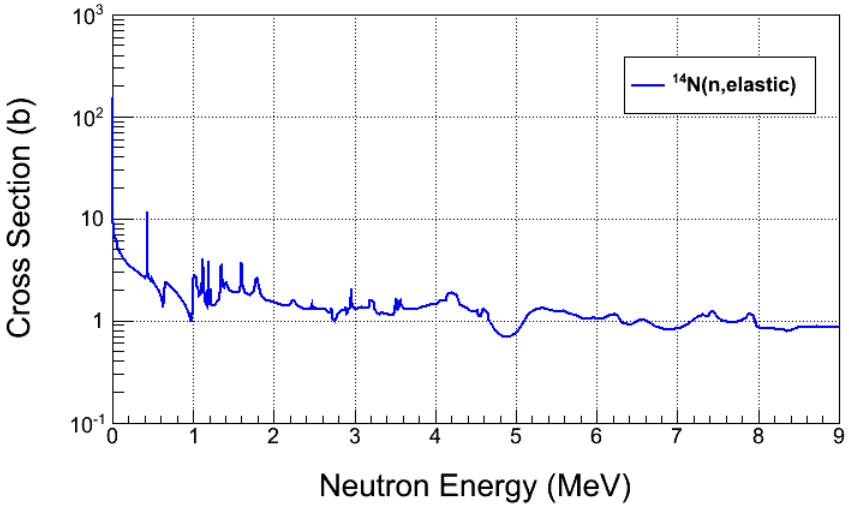
I. Radiator motion and Sweep Dipole must be in FSD
II. BCM0L02 and Electron Dump in Beam Loss Accounting (BLA)
III. Cooled: Radiator and Electron Dump.
IV. Uncooled: Photon Collimator and Photon Dump
V. Re-use PEPPo radiator and beamline
VI. New beamline components: 2 Super Harps + Fast Valve
VII. Summary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

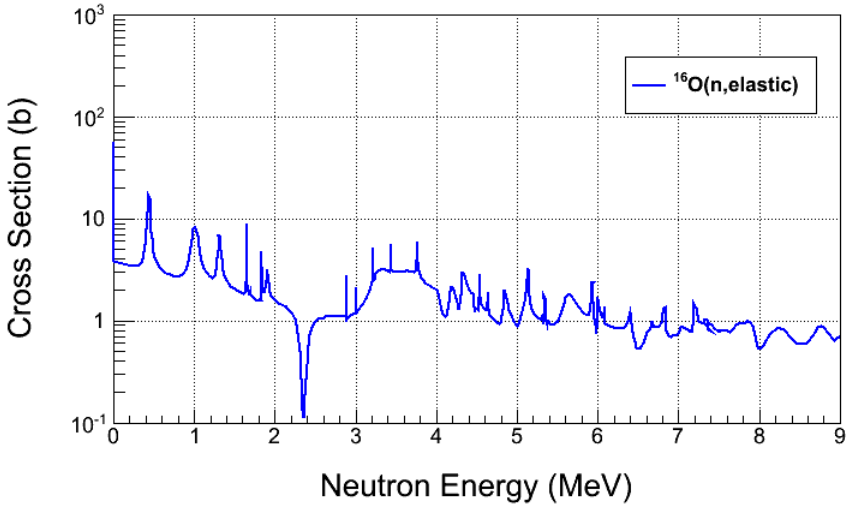
Group	Labor
Survey & Alignment	3 wks x 2
Magnet Test	1 wk x 2
Engineering Design	12 wks
Software	3 wks x 2
EES	6 wk x 2
EH&Q	4 wks

Item	Material Procurement	Shop	Labor
New BPM on Spect. line		Pipe + BPM ($5,000)	P. Francis (1 week)
New Dipole Magnet	Dipole Magnet ($10,000)		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

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



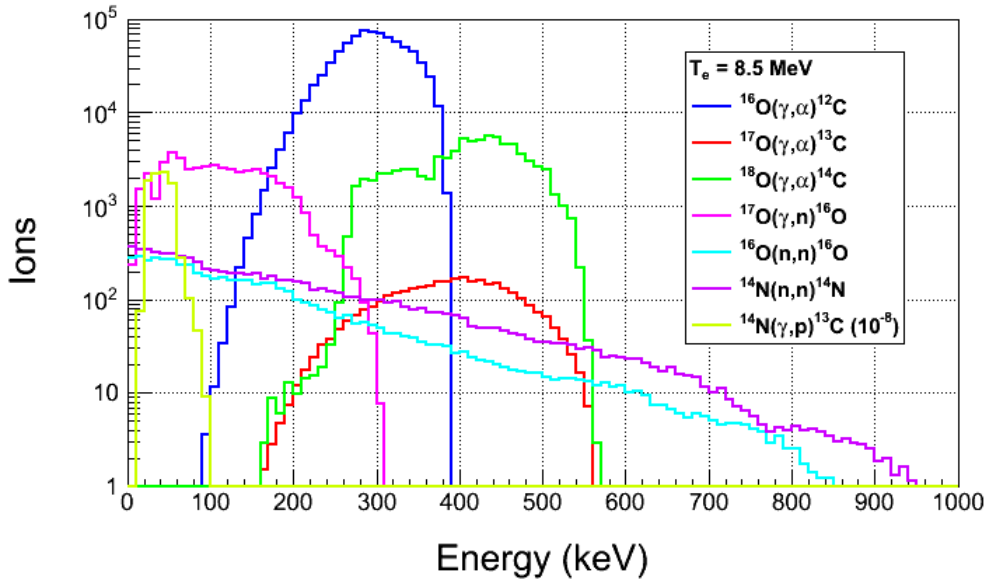


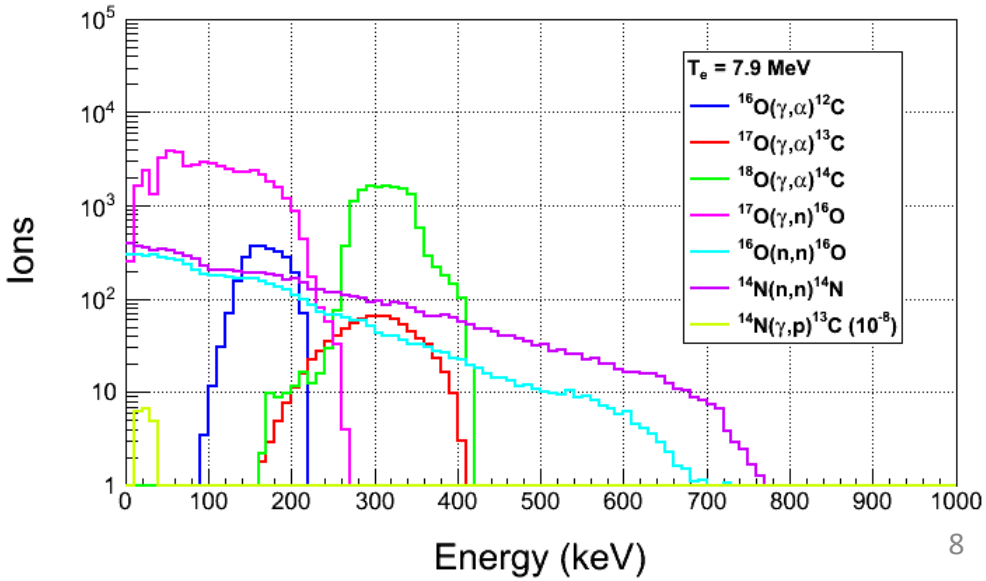


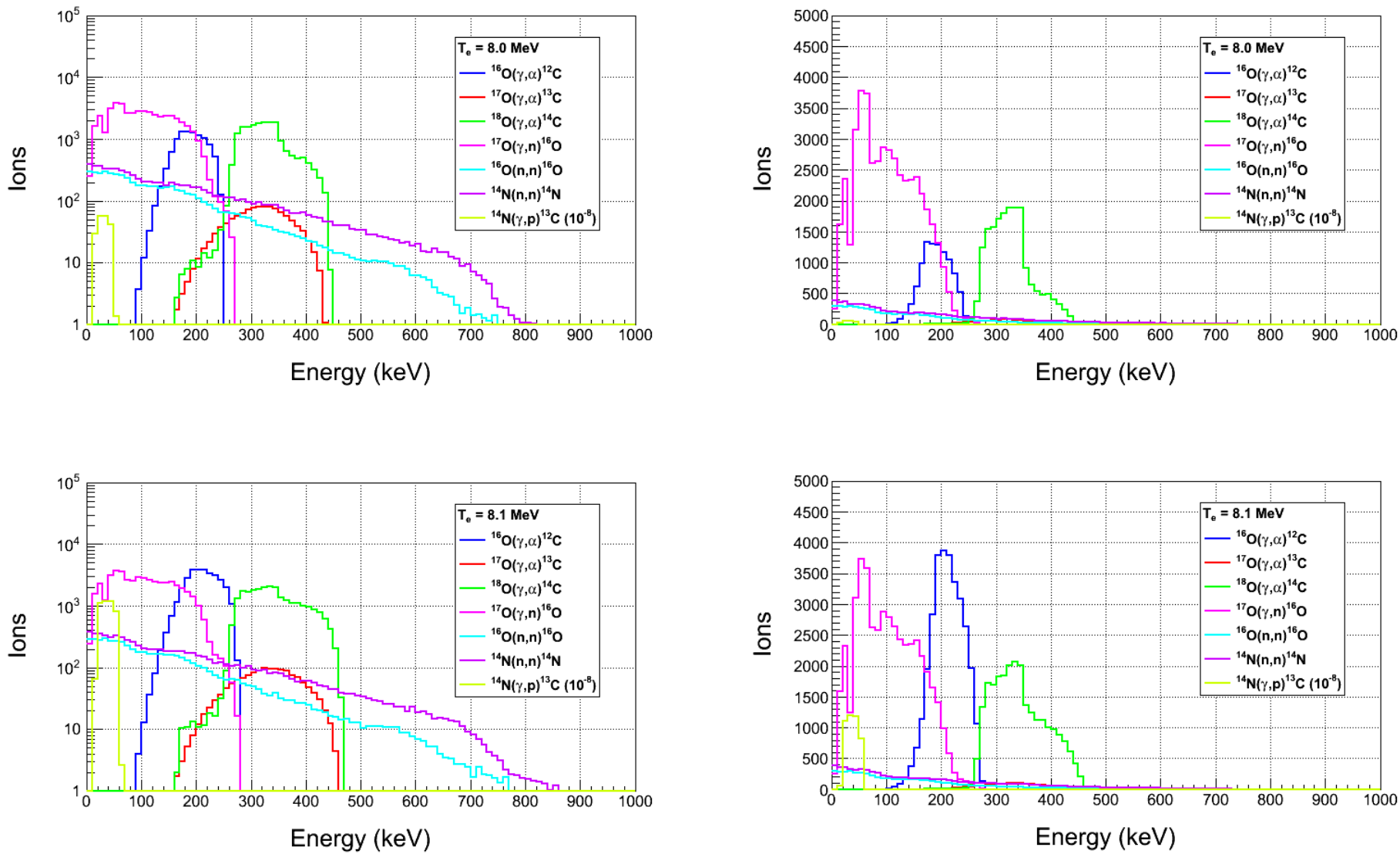
Ion Energy Distribution

- Depletion:
  I. ^{17}O depletion=5,000
  II. ^{18}O depletion=5,000

- Natural Abundance:
  I. ^{17}O: 0.038%
  II. ^{18}O: 0.205%



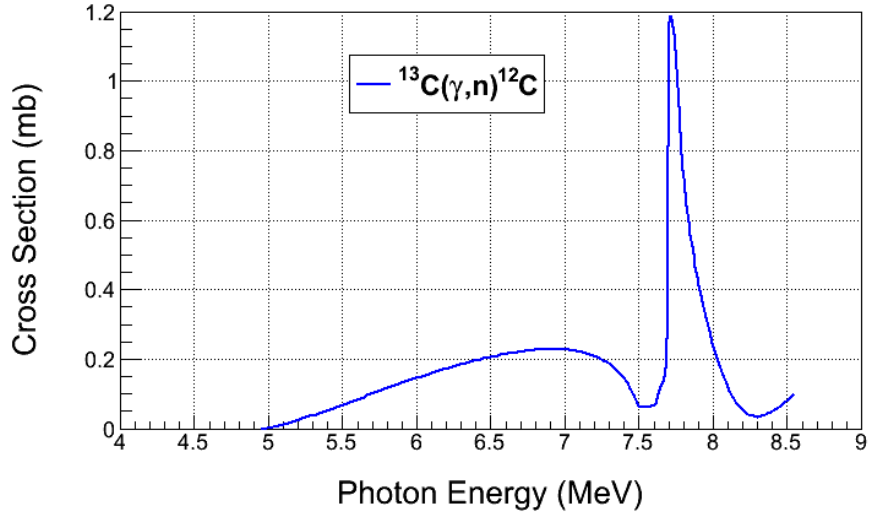



Ions
Energy (keV)
T_e = 8.0 MeV
$^{16}O(\gamma,\alpha)^{12}C$
$^{17}O(\gamma,\alpha)^{13}C$
$^{18}O(\gamma,\alpha)^{14}C$
$^{17}O(\gamma,n)^{16}O$
$^{16}O(n,n)^{16}O$
$^{14}N(n,n)^{14}N$
$^{14}N(\gamma,p)^{13}C$ (10^{-8})
T_e = 8.1 MeV

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

- Depletion:
  I. ^{13}C depletion=1,000

- Natural Abundance:
  I. ^{13}C: 1.07%



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