

Bubble Chamber Planning Meeting

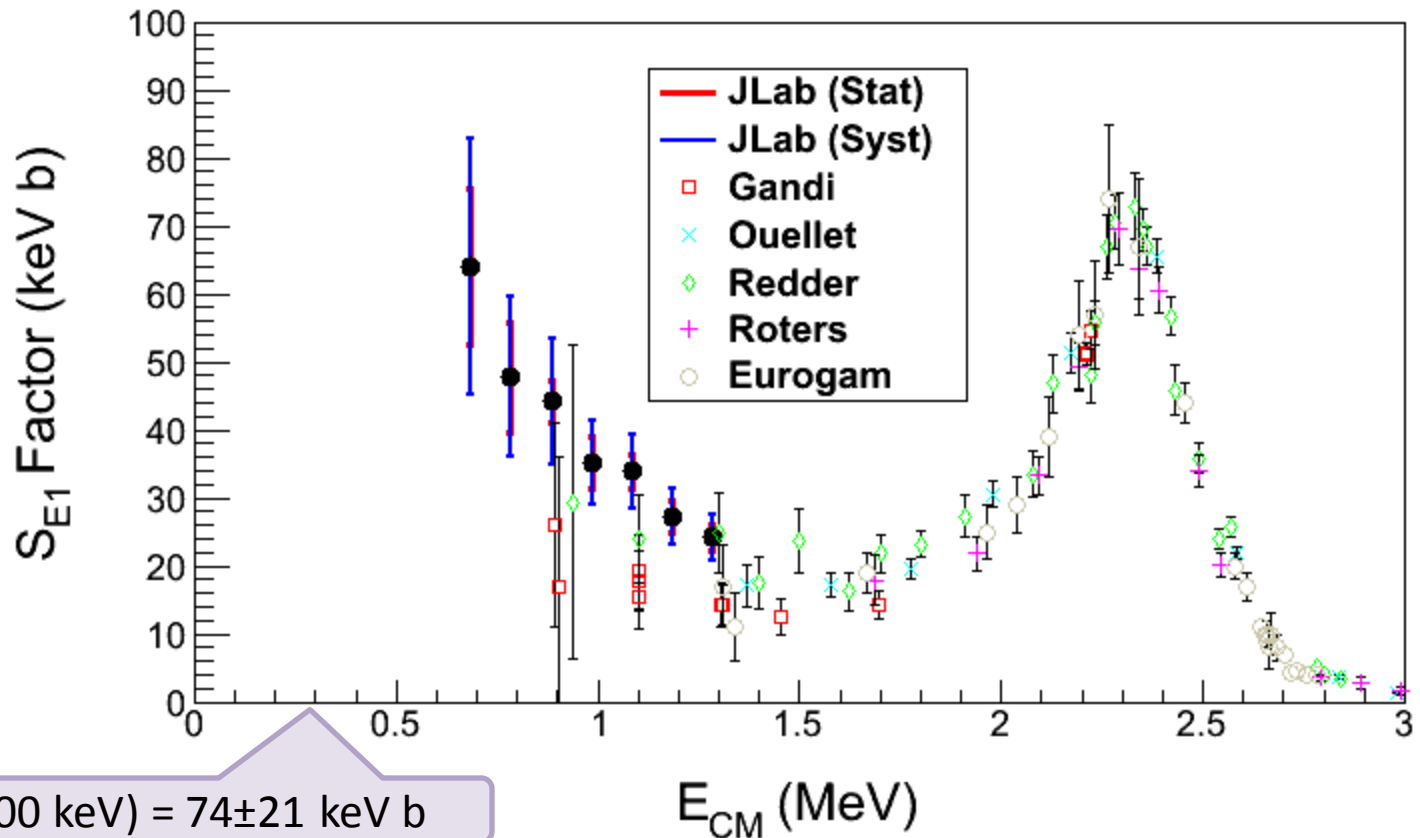
24 July 2013

Agenda

1. Schedule
2. Design of beamline, radiator and dump
3. Bubble Chamber work at Argonne
4. Simulation and Background
5. Absolute beam energy
6. Safety

$^{12}\text{C}(\alpha, \gamma)^{16}\text{O}$ S-Factor

- Statistical Error: dominated by background subtraction from $^{18}\text{O}(\gamma, \alpha)^{14}\text{C}$ (depletion = 5,000)
- Systematic Error: dominated by absolute beam energy (= 0.2%)



Schedule

➤ 12GeV CEBAF Commissioning:

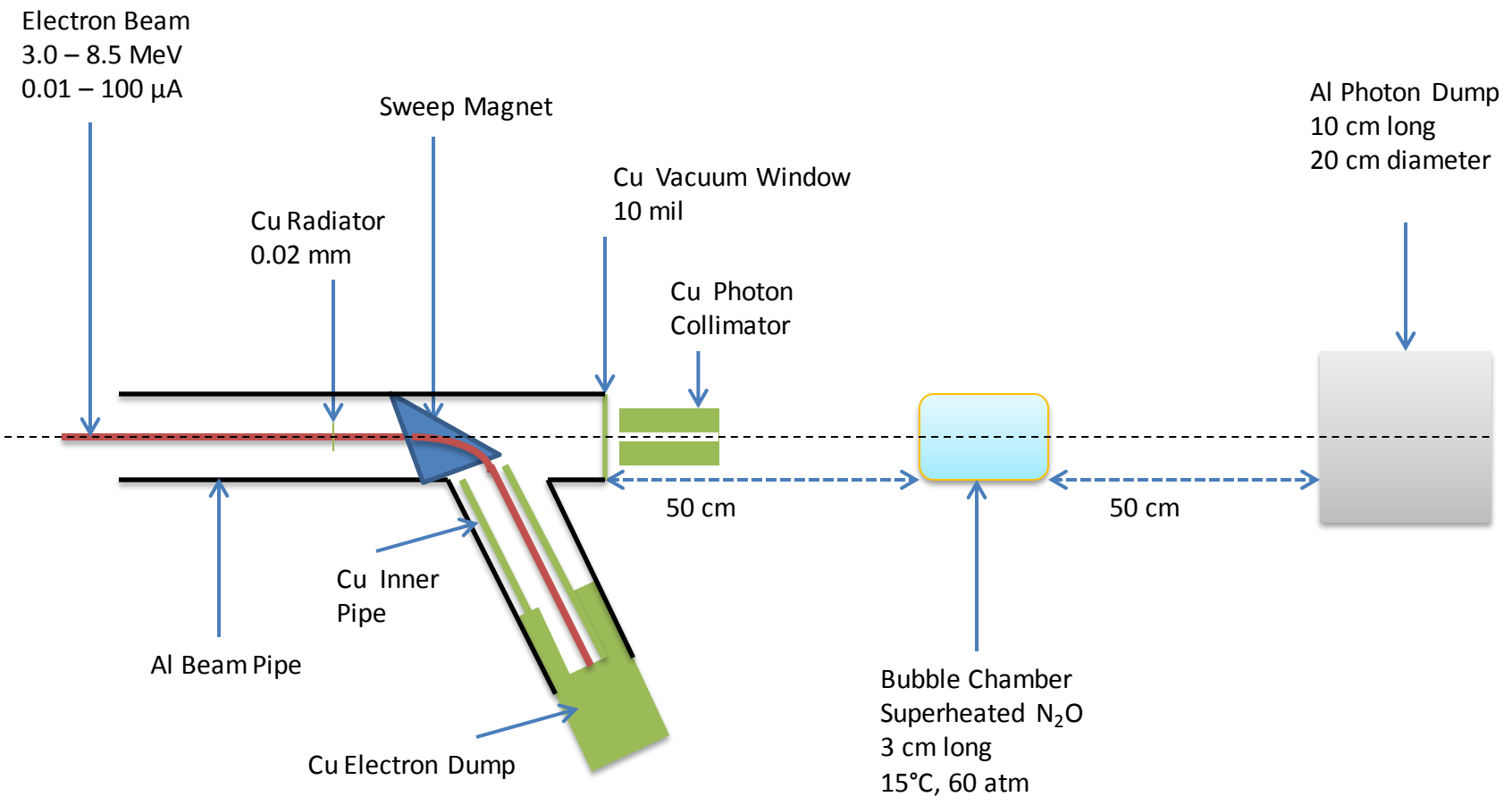
	Start	End
Period I	2013-11-04	2013-12-20
SAD I	2014-01-02	2014-02-05
Period II	2014-02-05	2014-05-07
SAD II	2014-05-07	2014-09-22
Period III	2014-09-22	2014-12-19
SAD III	2015-01-02	2015-02-13
Period IV	2015-02-13	2015-06-12

➤ Bubble Chamber Activities:

- Install beamline, radiator and dump
- Commission beamline, radiator and dump
- Install Bubble Chamber
- Commission Bubble Chamber
- Physics run

Design of beamline, Radiator & Dump

- Add BPM to the 5 MeV Spectrometer line
- Need to design new beamline to replace PEPPo beamline and increase the distance between the two BPMs
- Radiator: 0.02 mm and 0.1 mm Copper
- Electron Dump: 2kW dump (10 MeV, 200 μ A)
- Photon Dump



BCM

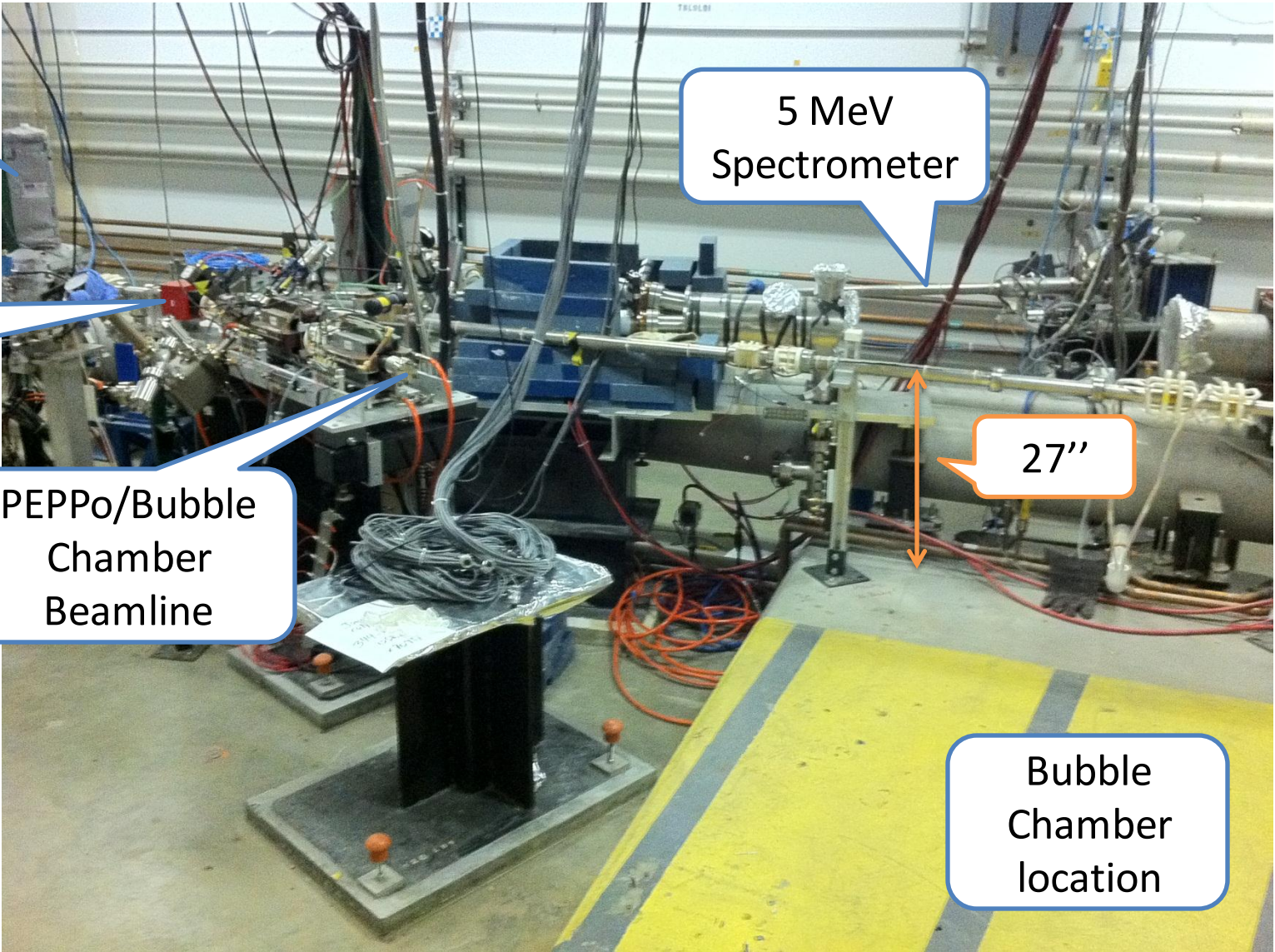
5 MeV Dipole

PEPPo/Bubble Chamber Beamline

5 MeV Spectrometer

27"

Bubble Chamber location



Simulation

- Two programs:
 - I. **GEANT4**
 - II. **FLUKA**

- Both use models that calculate wrong cross sections. Both do not allow for user's cross sections. Suggestion:
 - I. Use GEANT4 and FLUKA to produce the photon spectrum impinging on the super heated liquid.
 - II. Fold the above photon spectrum with our cross sections in stand-alone codes.

- Both GEANT4 and FLUKA are good in neutron tracking. Still need to check the neutron cross sections.

Background

➤ Must measure:

- I. $^{17}\text{O}(\gamma, \alpha)^{13}\text{C}$, enrichment=10%
- II. $^{18}\text{O}(\gamma, \alpha)^{14}\text{C}$, enrichment=10%

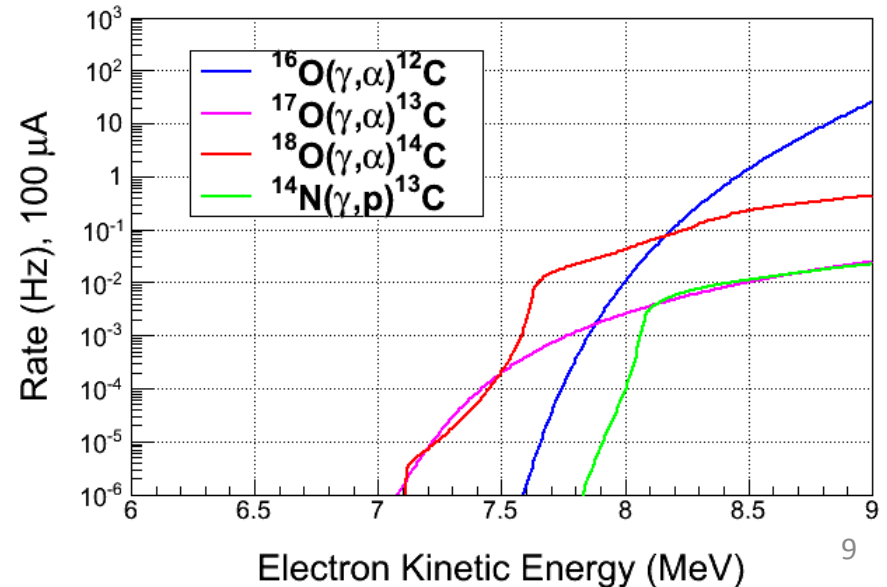
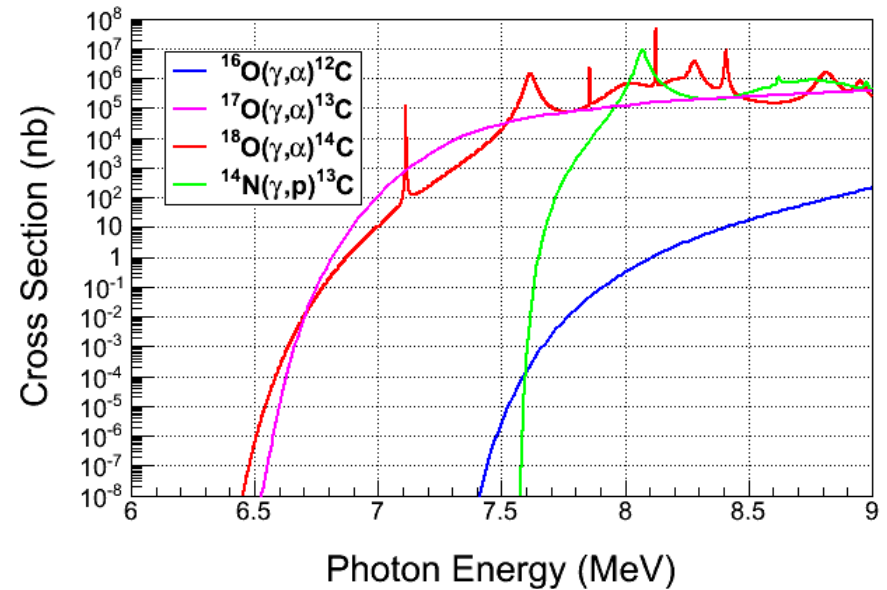
➤ Rates:

- I. $^{17}\text{O}(\gamma, \alpha)^{13}\text{C}$, depletion=5,000
- II. $^{18}\text{O}(\gamma, \alpha)^{14}\text{C}$, depletion=5,000
- III. $^{14}\text{N}(\gamma, p)^{13}\text{C}$, detection eff.= 10^{-8}

Natural Abundance:

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

➤ Still need to study $^{17}\text{O}(\gamma, n)^{16}\text{O}$, ...

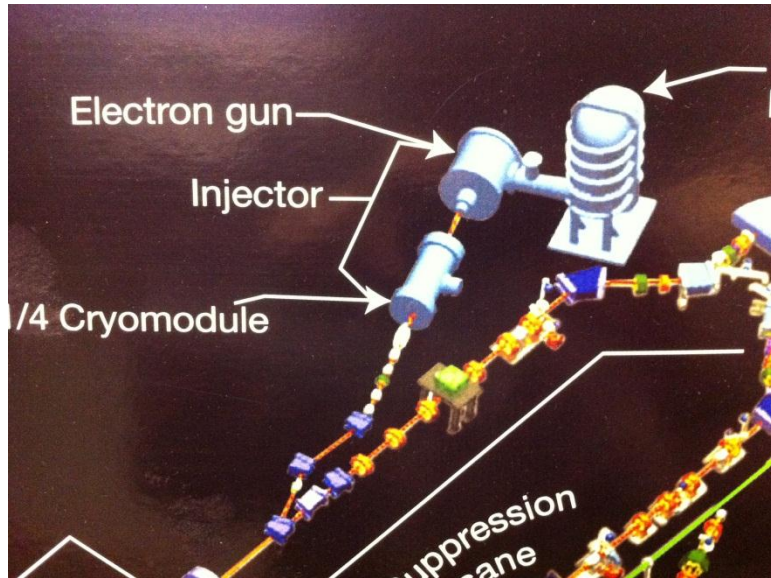


Safety

- High pressure system
- Super heated liquid: N_2O or CO_2
- Buffer liquid: Mercury

Running in FEL?

- Absolute Beam Energy: FEL can measure the energy with a precision of 0.4%. However, it could be very hard to improve (?)



- Required Systems:

- I. Personnel Safety System (PSS)
- II. Liquid helium and RF
- III. Gun Laser
- IV. Staff

Planning Meeting

➤ Do we want to meet every two weeks?

Wednesday 3:00 – 5:00 pm?