Bubble Chamber Planning Meeting

24 July 2013

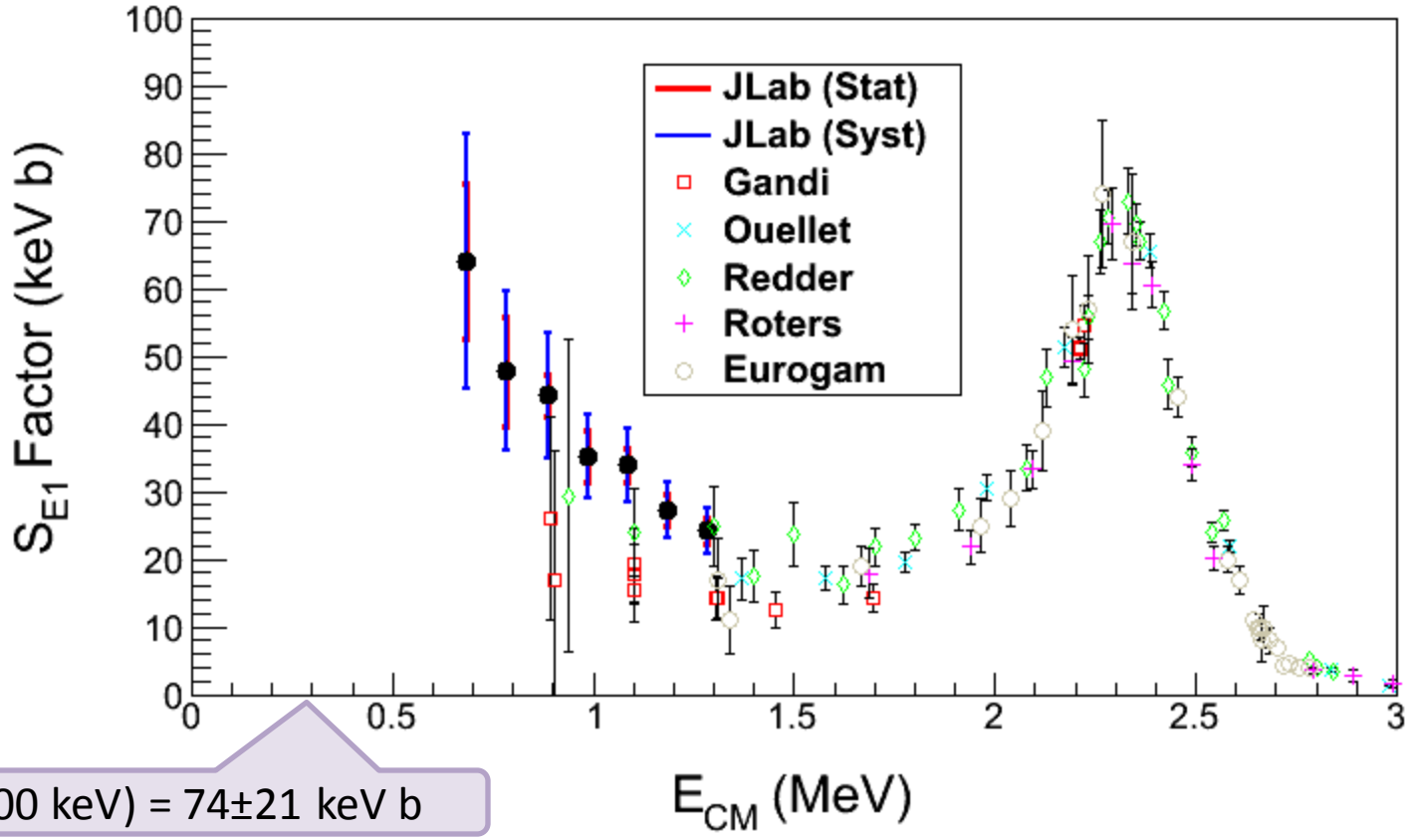
Agenda

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

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

- Statistical Error: dominated by background subtraction from $^{18}O(\gamma,\alpha)^{14}C$ (depletion = 5,000)

- Systematic Error: dominated by absolute beam energy (= 0.2%)



S_{E1}(300 keV) = 74±21 keV b

Schedule

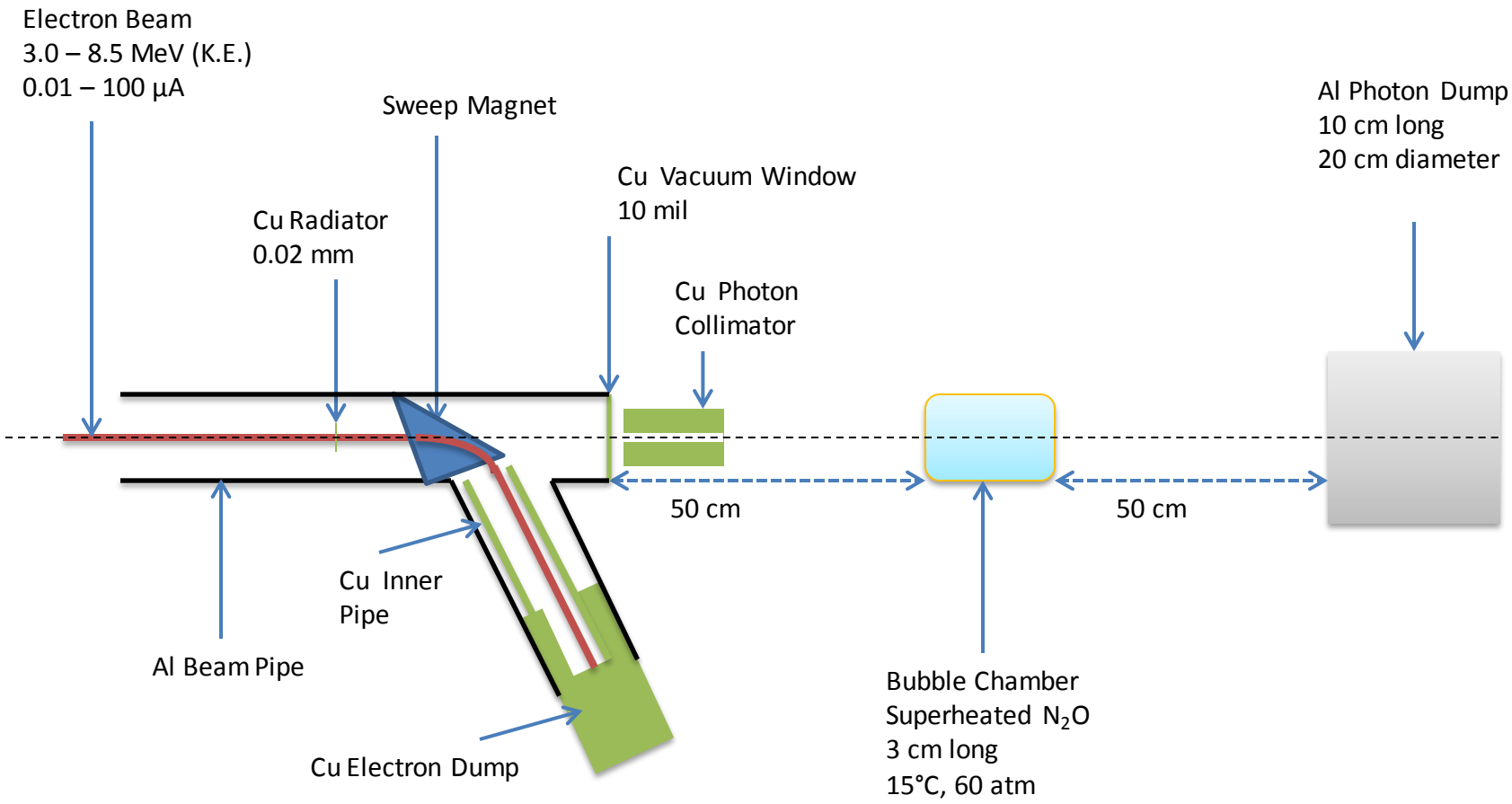
- 12GeV CEBAF Commissioning:

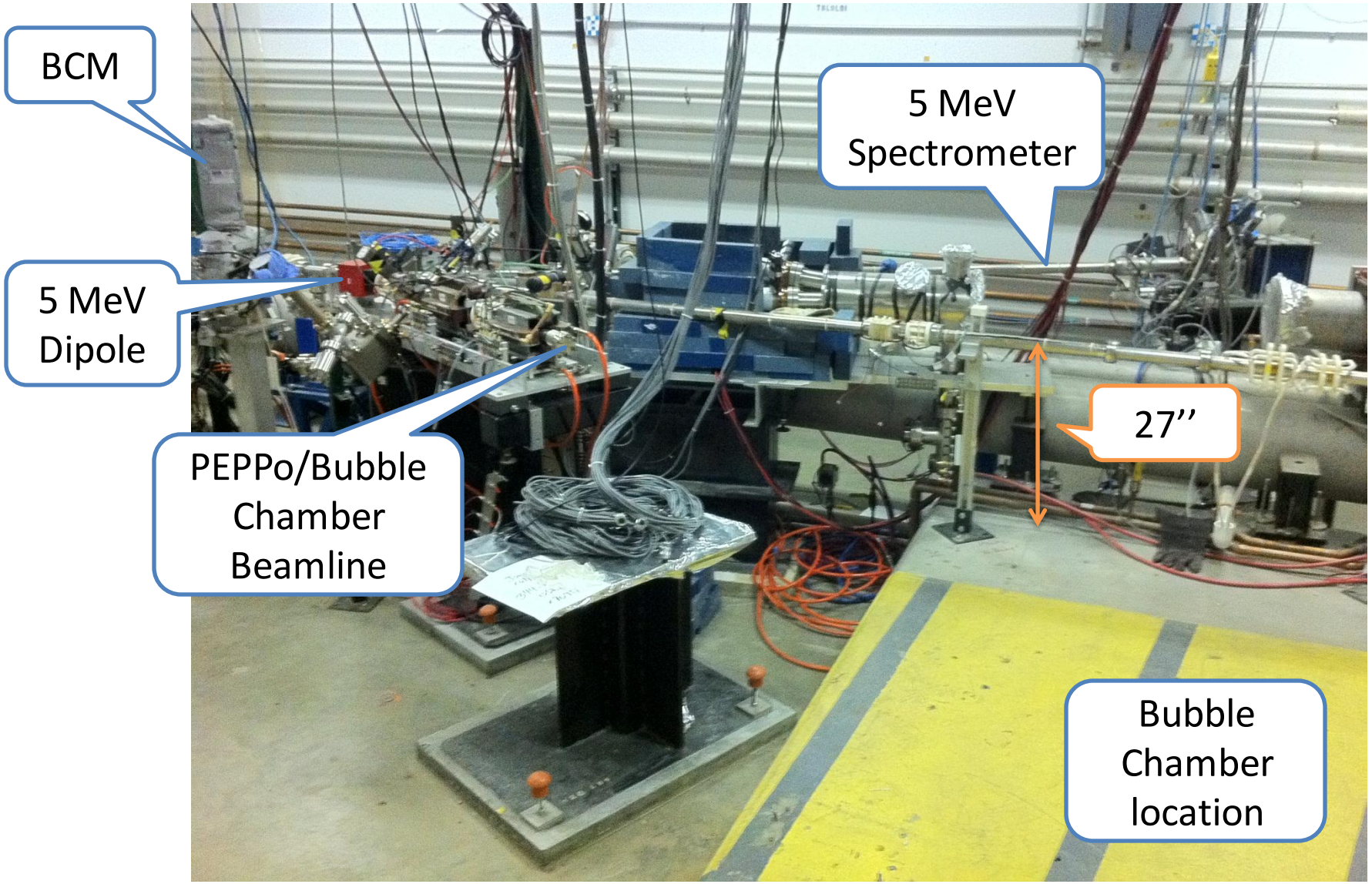
	Start	End
Period I	2013-11-04	2013-12-20
SAD I	2014-01-02	2014-02-05
Period II	2014-02-05	2014-05-07
SAD II	2014-05-07	2014-09-22
Period III	2014-09-22	2014-12-19
SAD III	2015-01-02	2015-02-13
Period IV	2015-02-13	2015-06-12

- 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

- 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 μA)
- Photon Dump


Electron Beam
3.0 – 8.5 MeV (K.E.)
0.01 – 100 µA
Sweep Magnet
Cu Vacuum Window
10 mil
Al Photon Dump
10 cm long
20 cm diameter
Cu Radiator
0.02 mm
Cu Photon
Collimator
50 cm
50 cm
Cu Inner
Pipe
Al Beam Pipe
Cu Electron Dump
Bubble Chamber
Superheated N_2O
3 cm long
15°C, 60 atm


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.

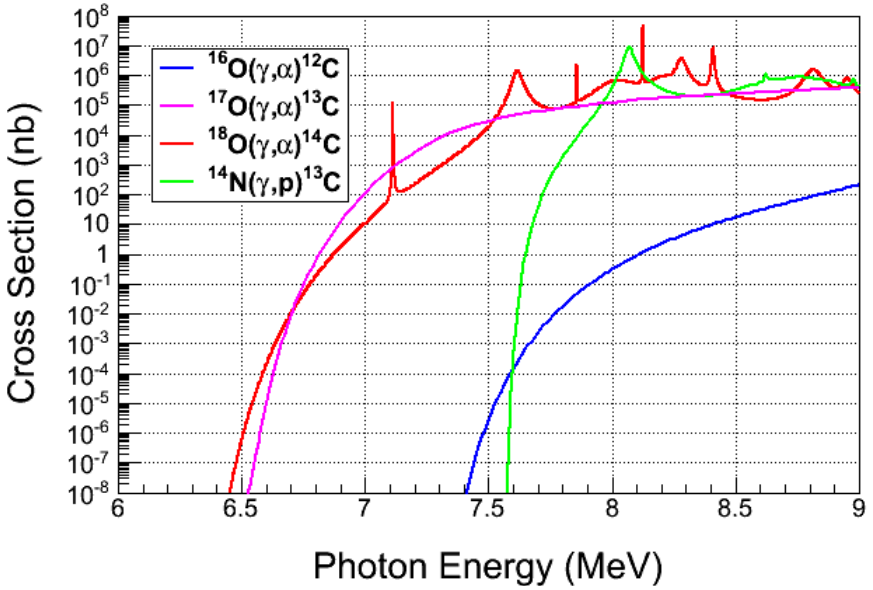
Background

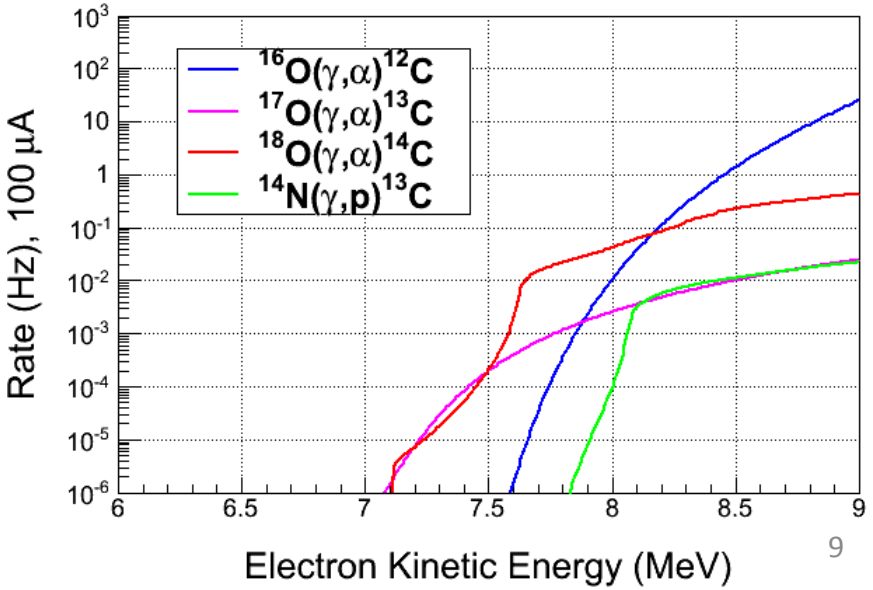
- Must measure:
  - I. $^{17}O(\gamma,\alpha)^{13}C$, enrichment=10%
  - II. $^{18}O(\gamma,\alpha)^{14}C$, enrichment=10%

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

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

- Still need to study $^{17}O(\gamma,n)^{16}O$, …



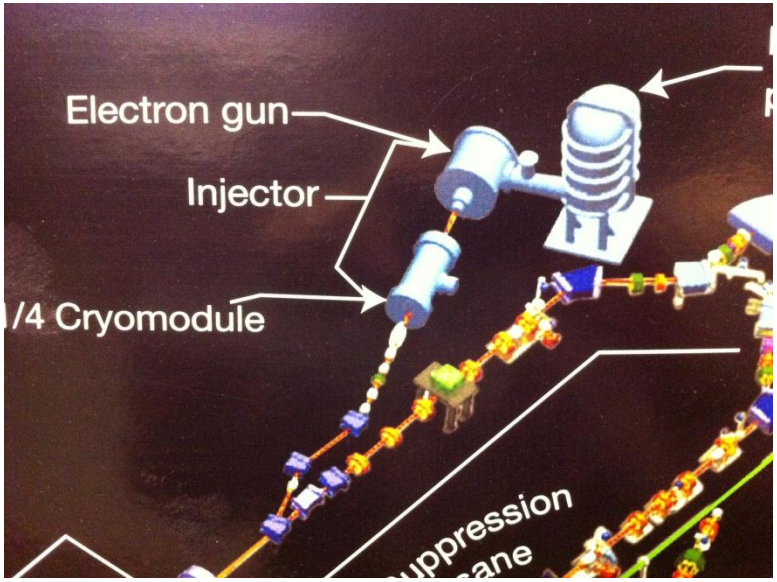


Safety

- 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?