# <sup>19</sup>F(γ,α)<sup>15</sup>N Measurement at JLab Injector

February 17, 2016

# OUTLINE

- Measuring <sup>19</sup>F( $\gamma$ , $\alpha$ )<sup>15</sup>N at HIGS
- GEANT4 Model
- Gamma Flux
- Expected Rate with C<sub>2</sub>F<sub>6</sub>
- Expected Number of Bubbles
- Penfold-Leiss Unfolding
- Expected Cross Section Measurement
- Remarks

#### MEASURING <sup>19</sup>F( $\gamma, \alpha$ )<sup>15</sup>N AT HIGS



# GEANT4 MODEL

- Gap between radiator and collimator = 0.6 inches
- Distance between radiator and center of glass cell = 14.0 inches



#### GAMMA FLUX



# EXPECTED RATE FOR $C_2F_6$



## EXPECTED NUMBER OF BUBBLES

 Cosmic background rate in chamber fiducial volume at JLab Injector is about 10<sup>-3</sup> Hz (or 1 event every 15 minutes)

$$dy_i = \sqrt{y_i + 2y_i^{bg}}$$



7

Electron Beam K. E.	Εγ (MeV)	Beam Current (μA)	Time (hour)	<b>y</b> i	y <sub>i</sub> (bg)	dy <sub>i</sub> /y <sub>i</sub> (with bg, %)
4.85	4.80	50	100	333	400	9.7
4.95	4.90	20	50	454	200	6.3
5.05	5.00	10	20	509	80	5.0
5.15	5.10	5	10	667	40	4.1
5.25	5.20	1	5	502	20	4.6
5.35	5.30	0.001	1	768	4	3.6

## PENFOLD-LEISS UNFOLDING

Eγ (MeV)	Cross Section (nb)	Stat Error (with bg, %)
4.8	0.34	9.7
4.9	1.87	7.5
5.0	10.2	6.4
5.1	54	5.3
5.2	460	5.6
5.3	4.42e+06	3.6



#### Remarks

• Calculate systematic error: energy, ...

Beam Current, δΙ/Ι	3%
Photon Flux <i>, δφ/φ</i>	5%
Radiator Thickness, <i>δR/R</i>	3%
Bubble Chamber Thickness, $\delta T/T$	3%
Bubble Chamber Efficiency, $\varepsilon$	5%

- For 1nA, use Hall B beam
- We are only approved to 10 μA, we will need 50 μA.