Primex Count Rates Target Selection/19 days of beam time

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•Goals

•Measure Z, k dependence of cross section

•Insure that we have >10K integrated counts in Primakoff peak

•Insure that we have a sufficient signal/noise ratio

•Test one cross section at reduced flux

•Measure Compton cross section in Be and C

•Conclusions, Goals can be met!

•Measure Energy dependence in Pb

•Z dependence in C, Pb

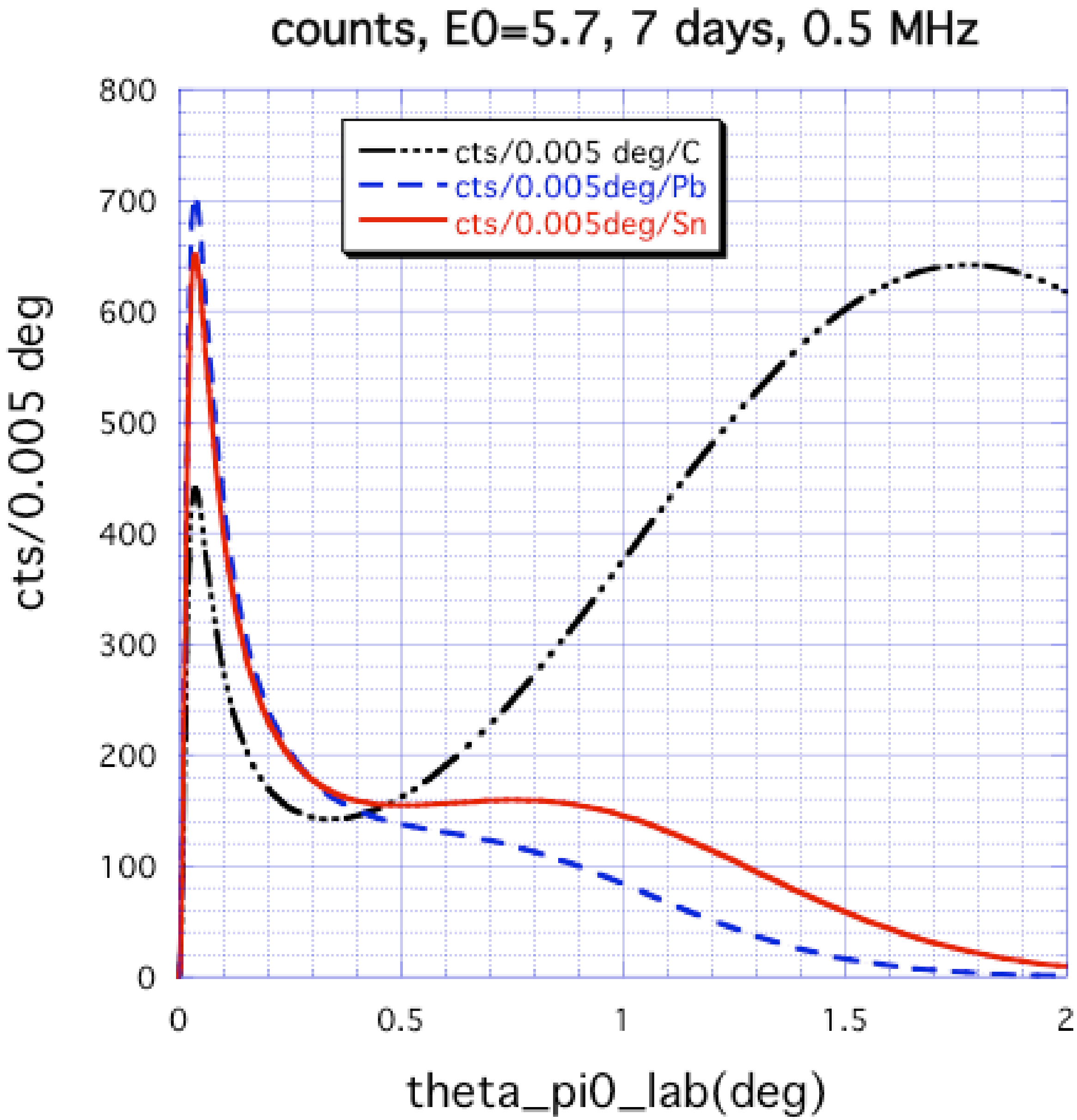
•Reduced flux run

•Compton cross section run

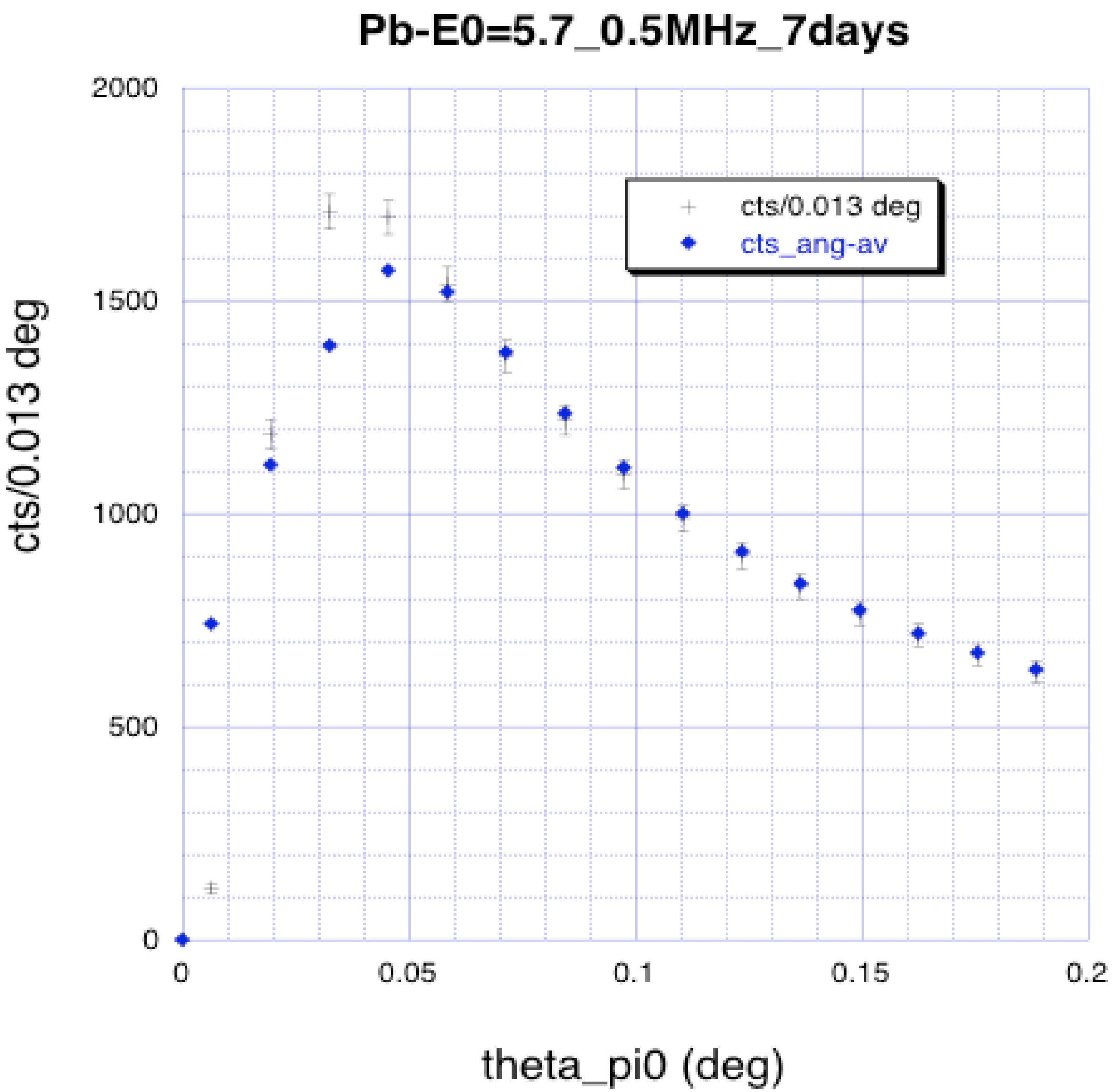
Count Rate Calculations

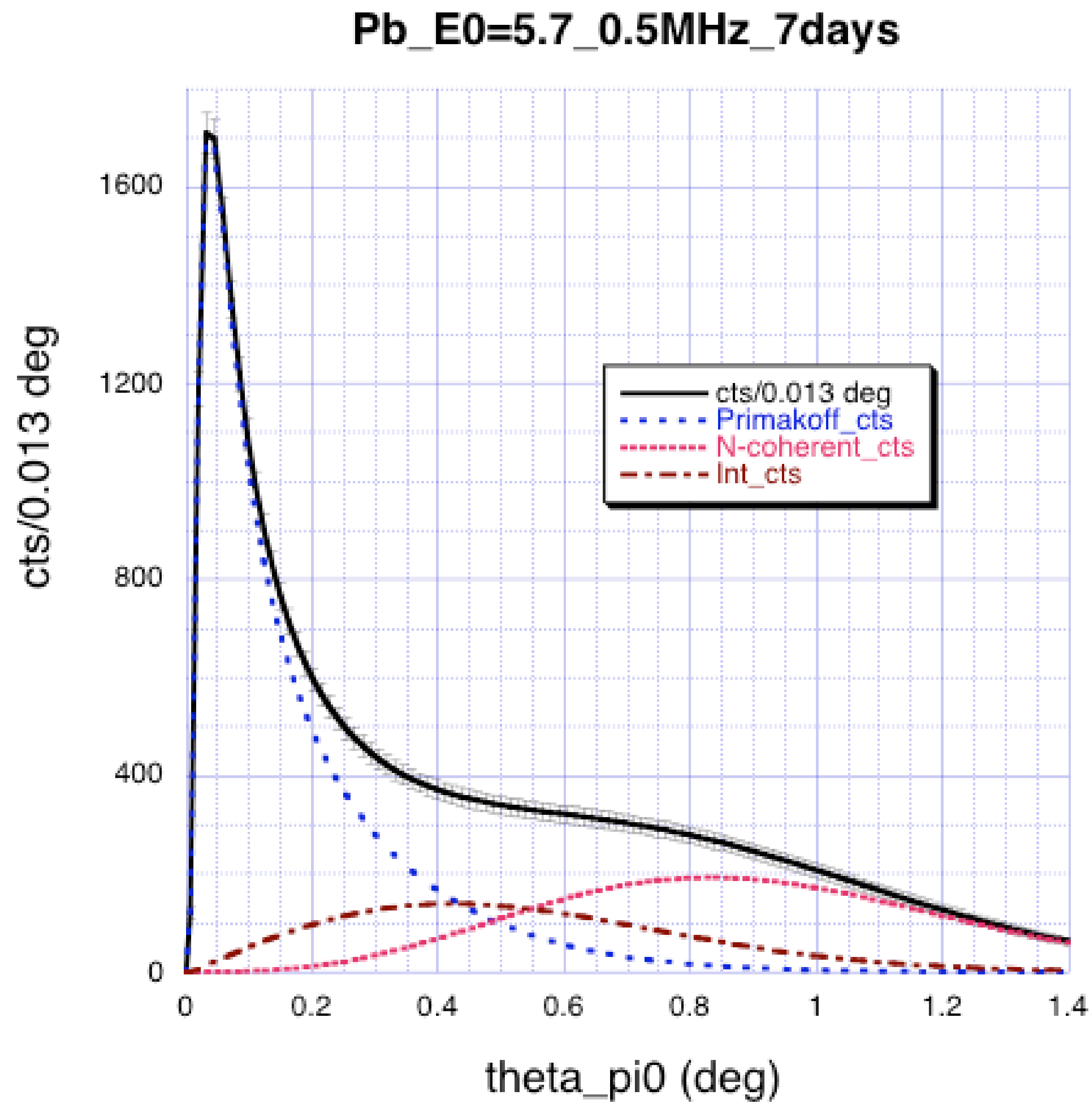
- Tagging range 0.77 $\rightarrow$ 0.95 E_0
- T counters at 0.5 MHz
- $N_\gamma = 8 \times 10^6 \rightarrow 1.6 \times 10^7$ photons/sec
- 5% RL targets
- Geometric efficiency =0.7 independent of angle and energy

check the photon flux that we can use in the test run


counts, E0=5.7, 7 days, 0.5 MHz
cts/0.005 deg/C
cts/0.005deg/Pb
cts/0.005deg/Sn
cts/0.005 deg
theta_pi0_lab(deg)
0
100
200
300
400
500
600
700
800
0.5
1
1.5
2

Angular resolution effects only at small angles




Pb_E0=5.7_0.5MHz_7days
cts/0.013 deg
0
400
800
1200
1600
0
0.2
0.4
0.6
0.8
1
1.2
1.4
theta_pi0 (deg)
cts/0.013 deg
Primakoff_cts
N-coherent_cts
Int_cts

Primakoff Angular Integration Range

$$\sigma(\theta) = \sigma_P(\theta) + \sigma_N(\theta) + \sigma_I(\theta)$$

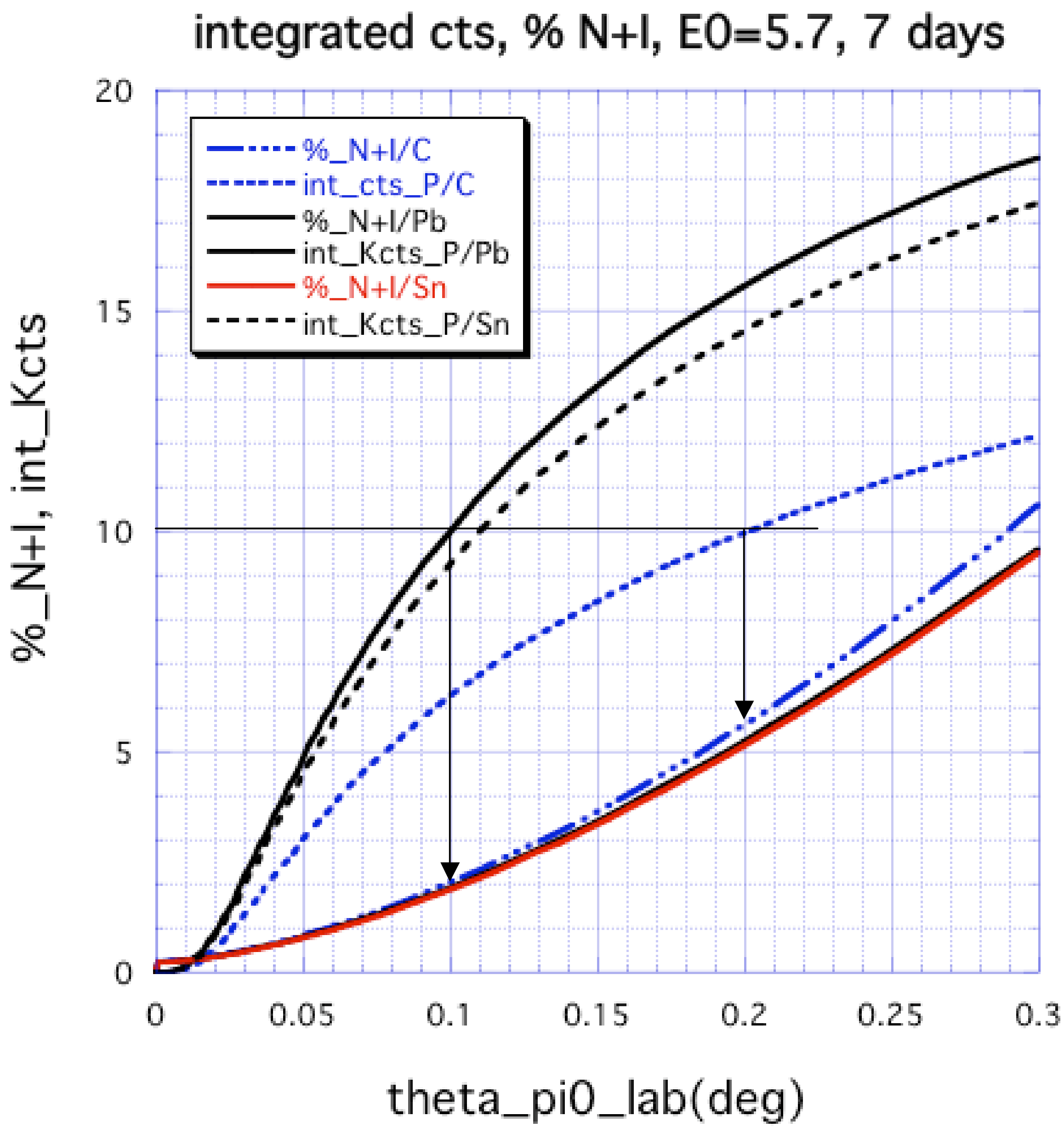
$$\sigma_{int}(\theta_c) = \int_0^{\theta_c} d\Omega \sigma(\theta)$$

$$f_{N+I}(\theta_c) \equiv \frac{\sigma_{I,int}(\theta_c) + \sigma_{N,int}(\theta_c)}{\sigma_{int}(\theta_c)}$$

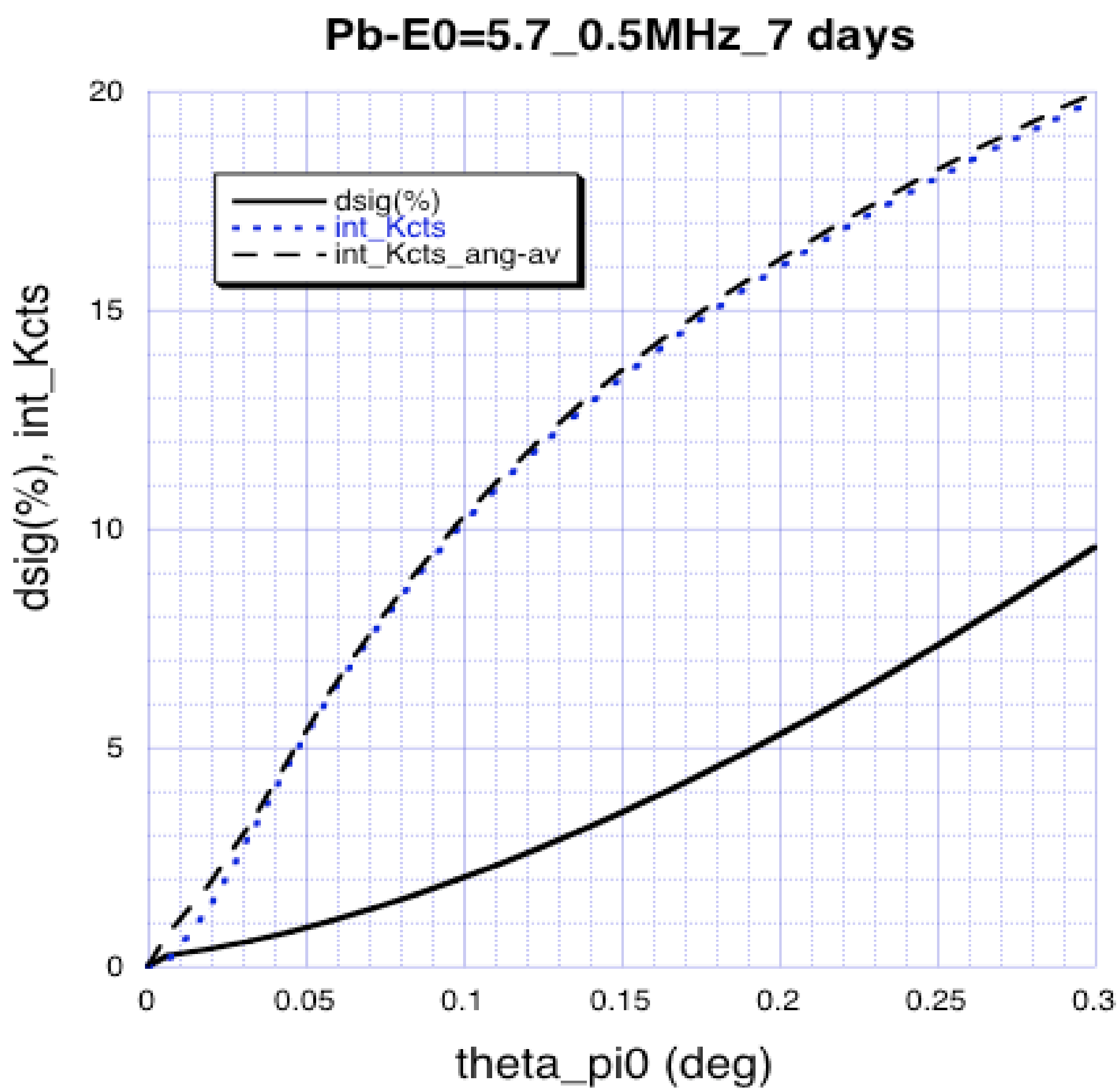
We need to pick θ_c such that $f_{N+I}(\theta_c)$ is sufficiently large to get good statistics, but small enough to accurately correct for this background. This can be achieved with:

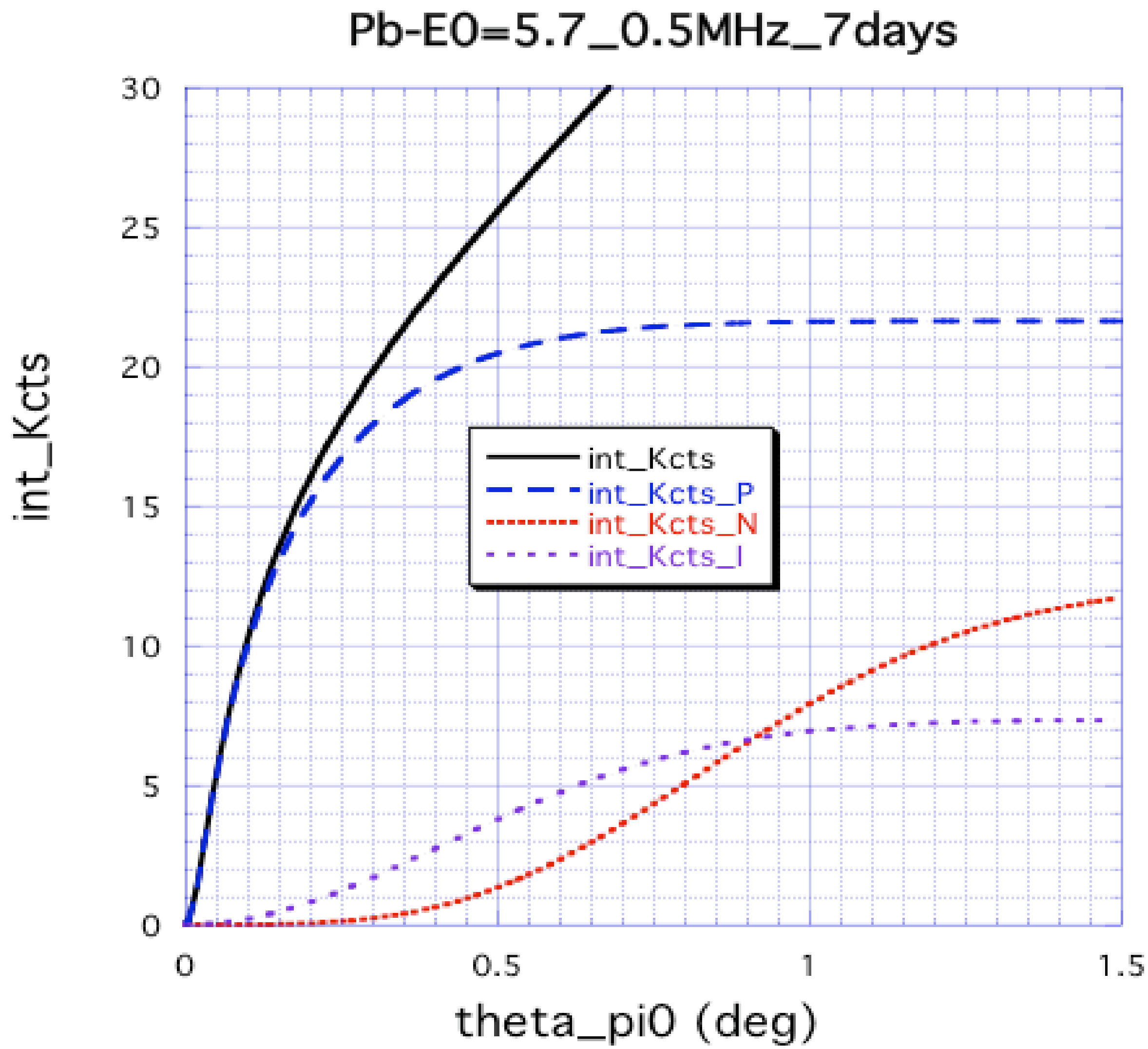
$$2\% \leq f_{N+I}(\theta_c) \leq 5\%$$

Then a 10% error in $f_{N+I}(\theta_c)$ will cause a systematic error in the Primakoff cross section between 0.2% and 0.5%.

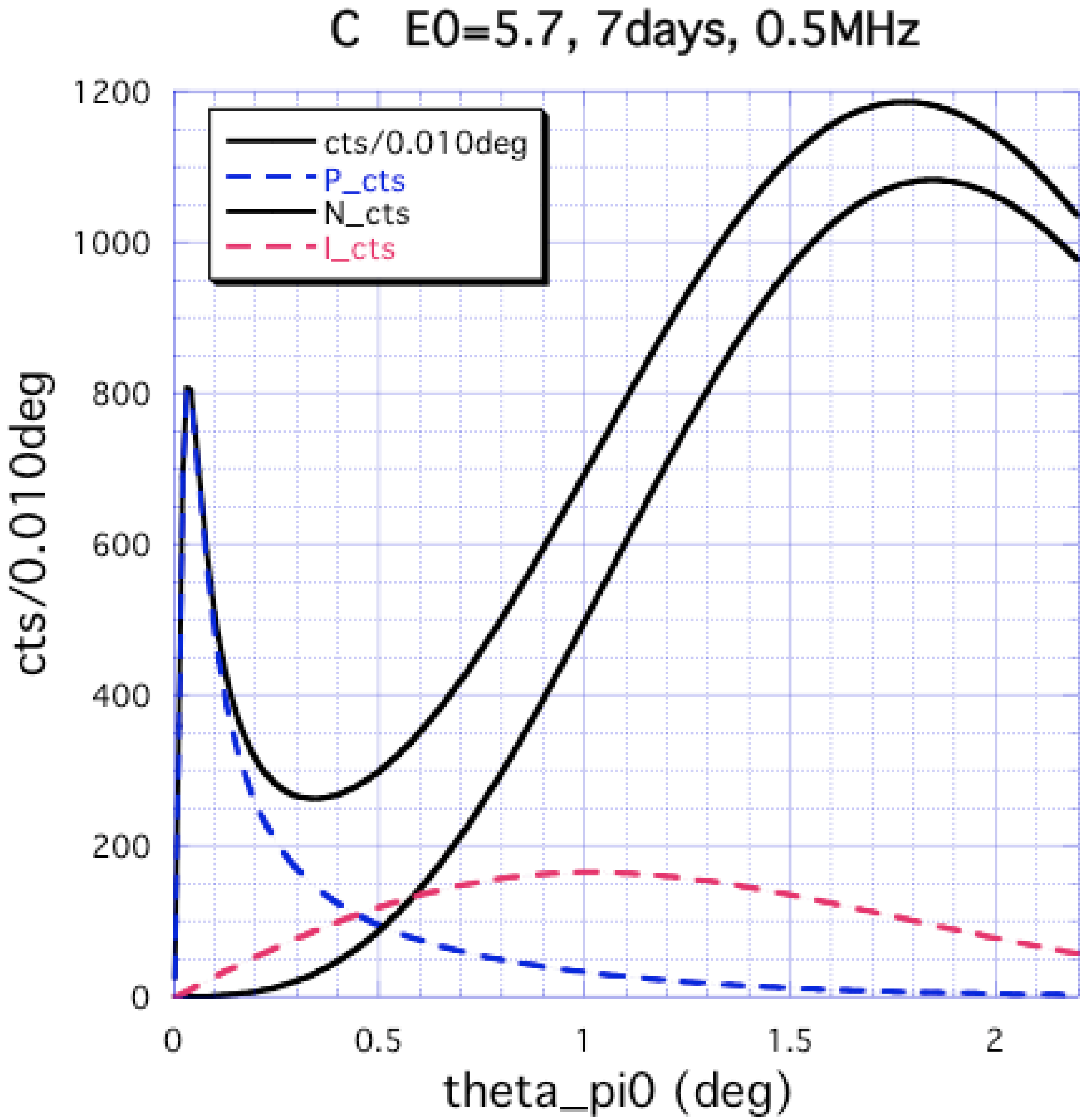

integrated cts, % N+I, E0=5.7, 7 days
%_N+I/C
int_cts_P/C
%_N+I/Pb
int_Kcts_P/Pb
%_N+I/Sn
int_Kcts_P/Sn
%_N+I, int_Kcts
theta_pi0_lab(deg)
0
5
10
15
20
0
0.05
0.1
0.15
0.2
0.25
0.3

Small effect of angular resolution on integrals

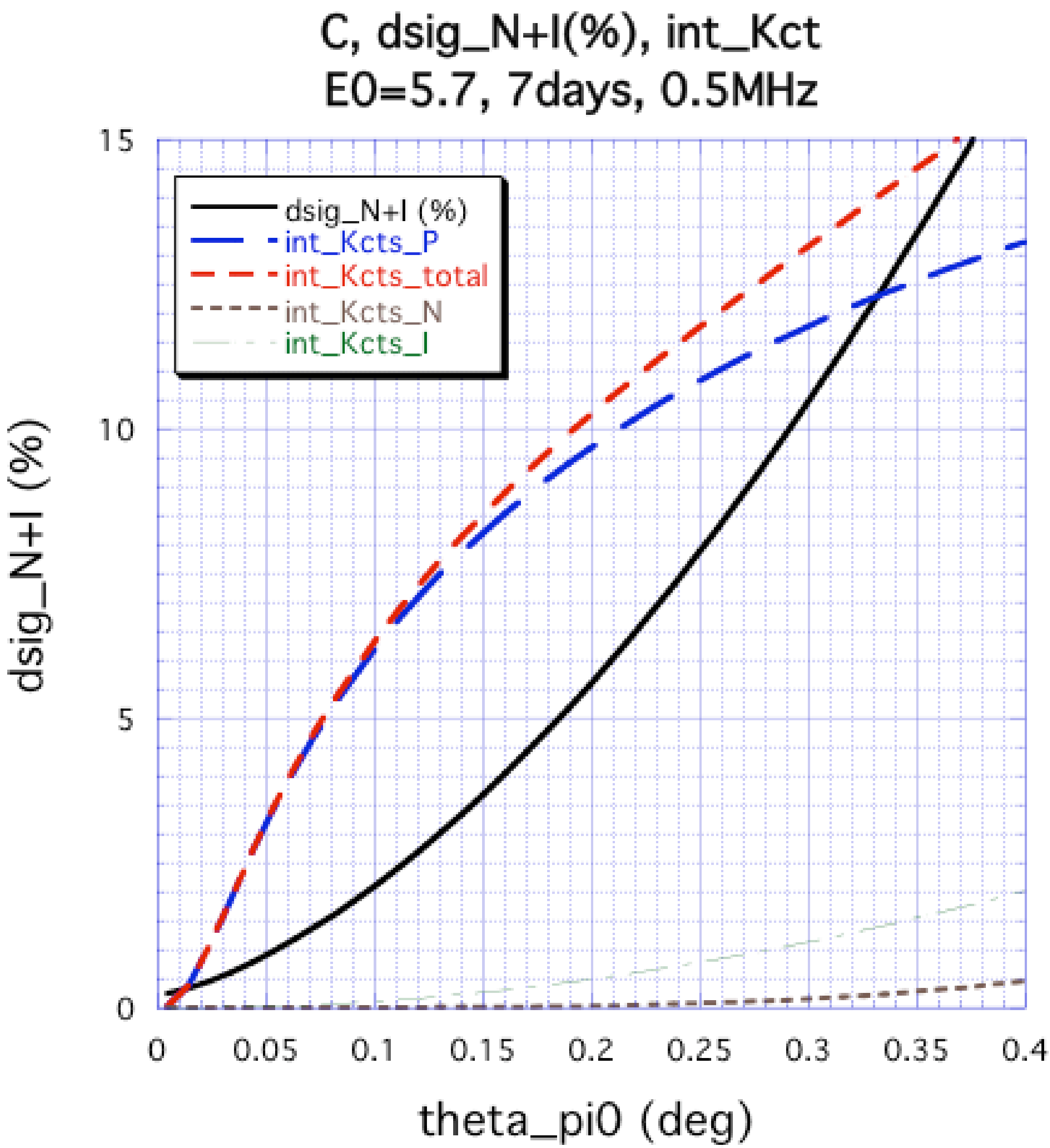


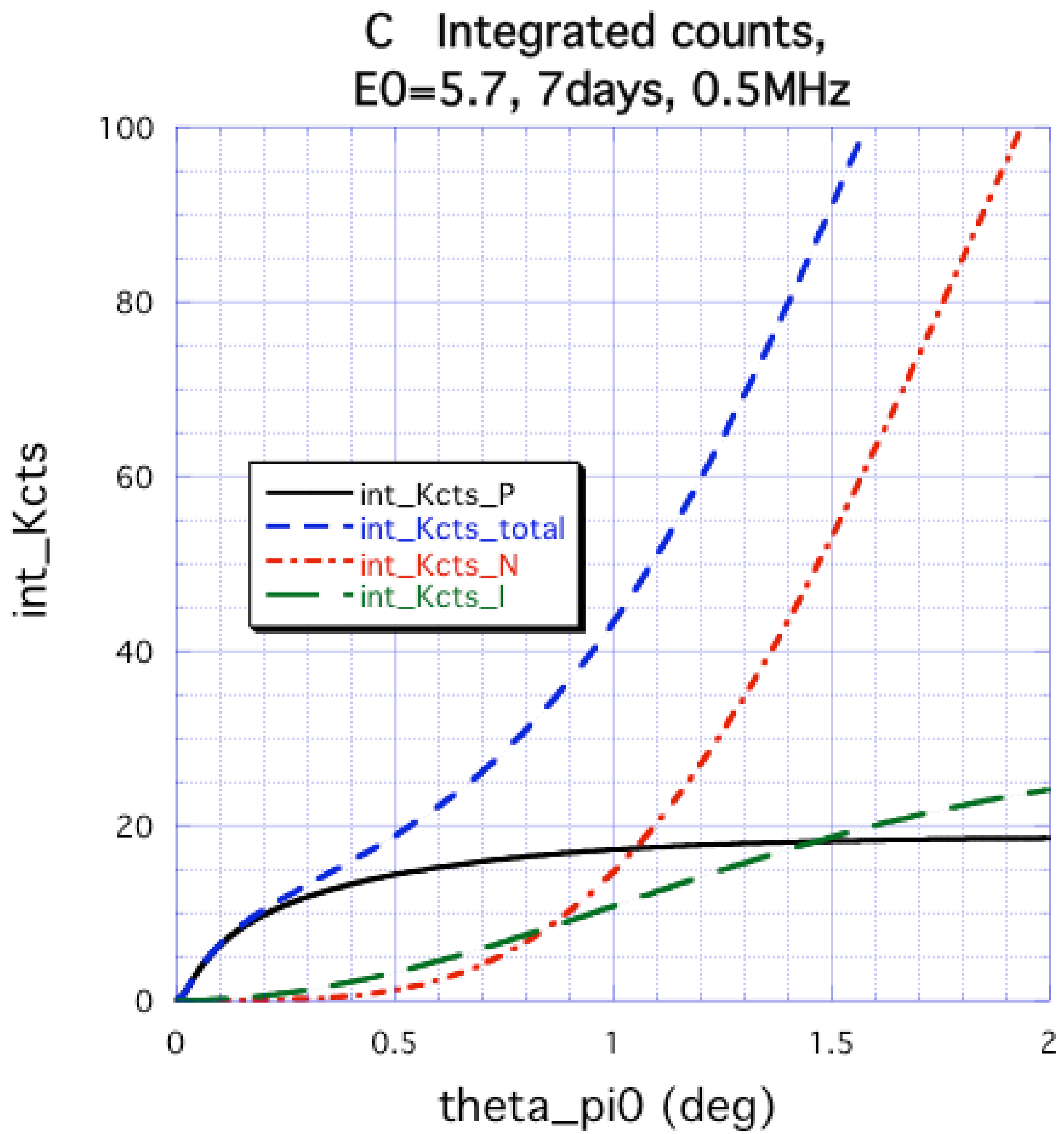


Pb-E0=5.7_0.5MHz_7days
30
25
20
15
10
5
0
0
0.5
1
1.5
int_Kcts
theta_pi0 (deg)
int_Kcts
int_Kcts_P
int_Kcts_N
int_Kcts_I



C E0=5.7, 7days, 0.5MHz
cts/0.010deg
P_cts
N_cts
I_cts
1200
1000
800
600
400
200
0
0
0.5
1
1.5
2
cts/0.010deg
theta_pi0 (deg)


C, dsig_N+I(%), int_Kct
E0=5.7, 7days, 0.5MHz
dsig_N+I (%)
int_Kcts_P
int_Kcts_total
int_Kcts_N
int_Kcts_I
15
10
5
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
dsig_N+I (%)
theta_pi0 (deg)

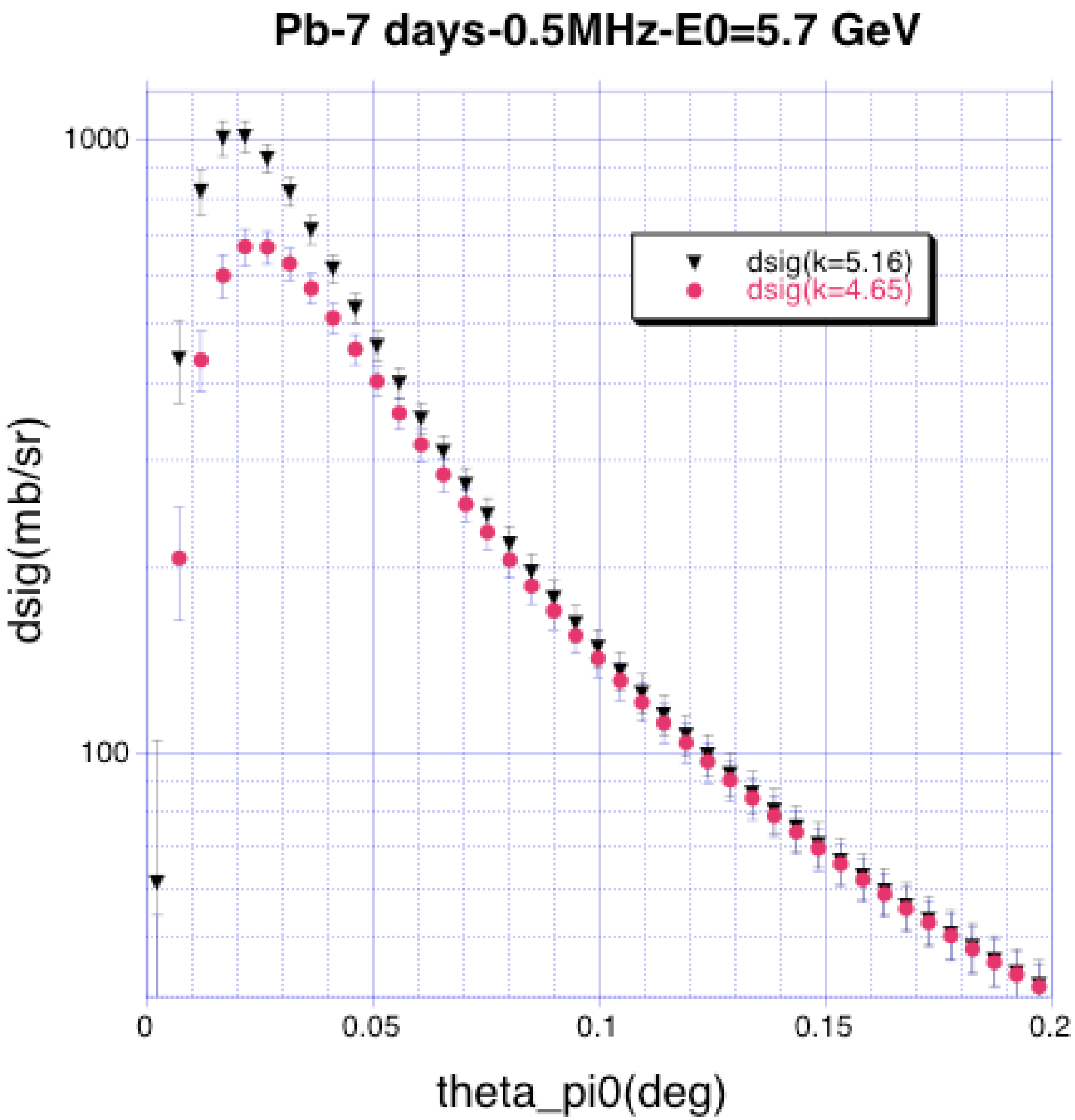


C Integrated counts,
E0=5.7, 7days, 0.5MHz
int_Kcts_P
int_Kcts_total
int_Kcts_N
int_Kcts_I
int_Kcts
theta_pi0 (deg)
0
20
40
60
80
100
0.5
1
1.5
2

Integration Regions 7 days, 0.5 MHz

	Counts	θ_c (deg)	f_{N+I}(%)
Pb	10K	0.10	2.0
Pb	15K	0.19	5.0
C	10K	0.20	5.5

Energy dependence: two bins



Possible methods to make measurements at a reduced photon flux

1. Compton effect: high count rate high background
   (pair spectrometer magnet is off)
2. Nuclear coherent π^0 production in C: high count rate (but at a larger angle than Primakoff, ie more counts in the Pb-glass)
3. Primakoff peak in Pb: this is closest to what we want but will take the most time

Run Plan Suggestions

•Determine photon flux level
•Start experiment with Pb
• get 20K cts for $\square_c = 0.10^0$
• divide the energy region into two bins
•Analyze data as a function of $\square_c > 0.10^0$
•Run C for 10K cts
•Run Pb for 10K cts at a lower beam intensity

•Conclusions, All goals can be met in the allocated running time

- Measure Energy dependence in Pb
- Z dependence comparing C and Pb
- Compton scattering cross sections in Be and C
- Reduced flux run with one of the three methods
  (probably the nuclear coherent production in C)

Some suggestions for measurements

- Measure target attenuation in low photon beam using TAC
  - This technique could possibly be used to measure target uniformity
- Compton cross sections in Be, C with singles and coincidence
  - Test HYCAL position resolution
  - Measure photon energy
  - Test beam offset, angle

Test the effect of taking the inner crystal out of the trigger
Test inner absorber (??) before permanent installation

Suggestions for Online Analysis

Sort data into three bins
inner, inner-outer, and transition hits
Use only the first two in the online display