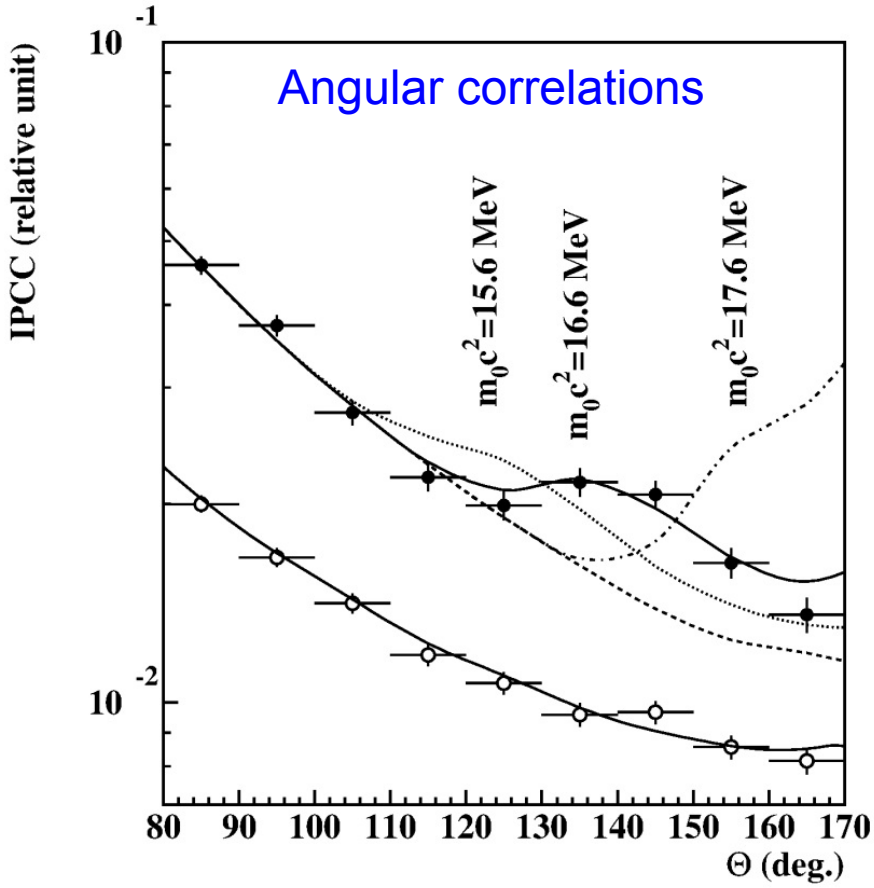
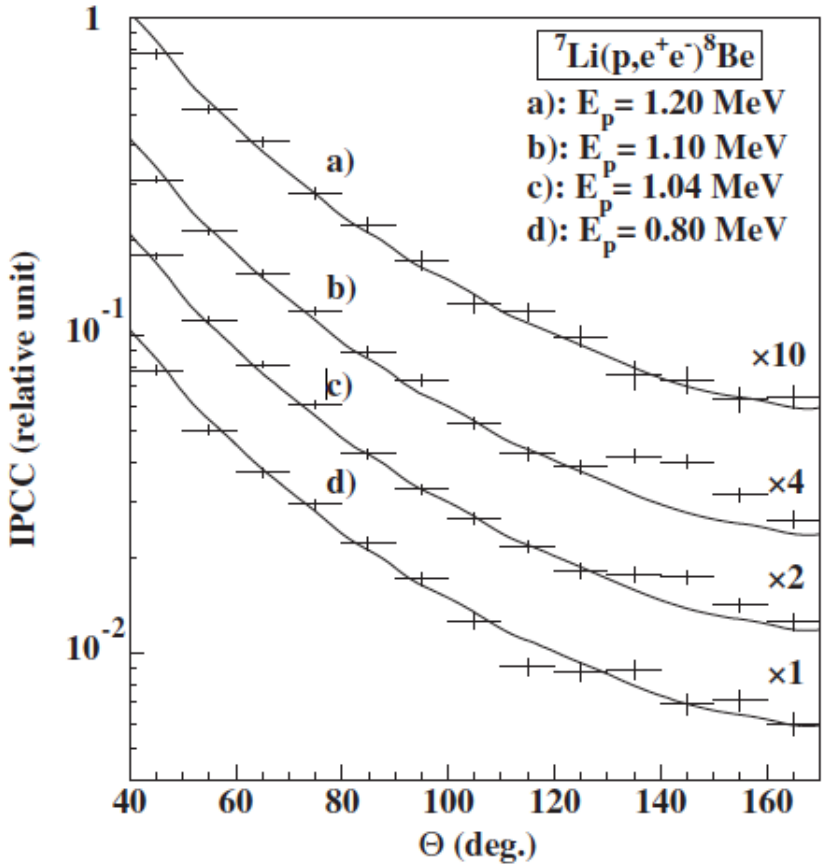
Experimental results (18.15 MeV transition)

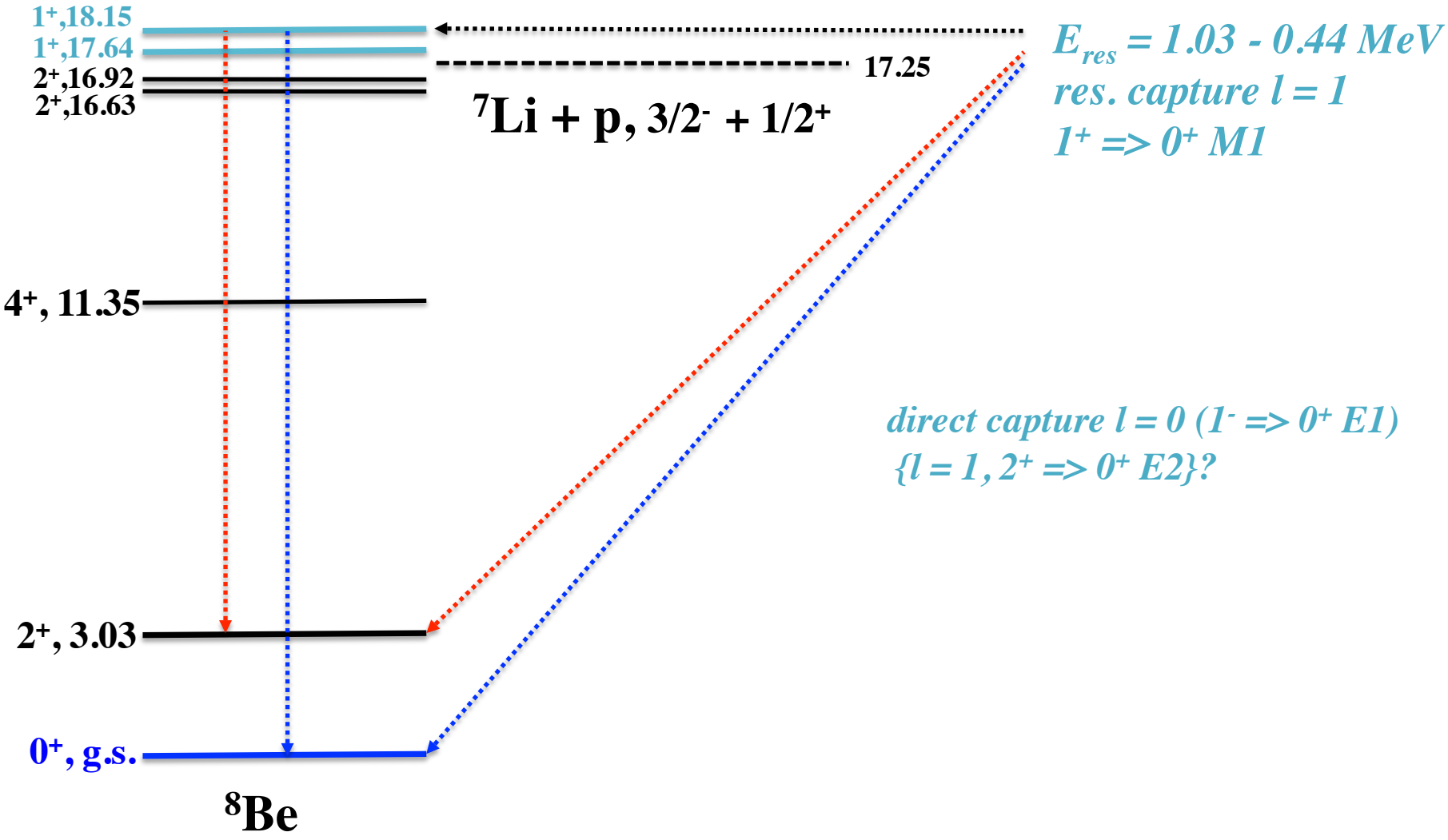
[Krasznahorkay et al. 2016]





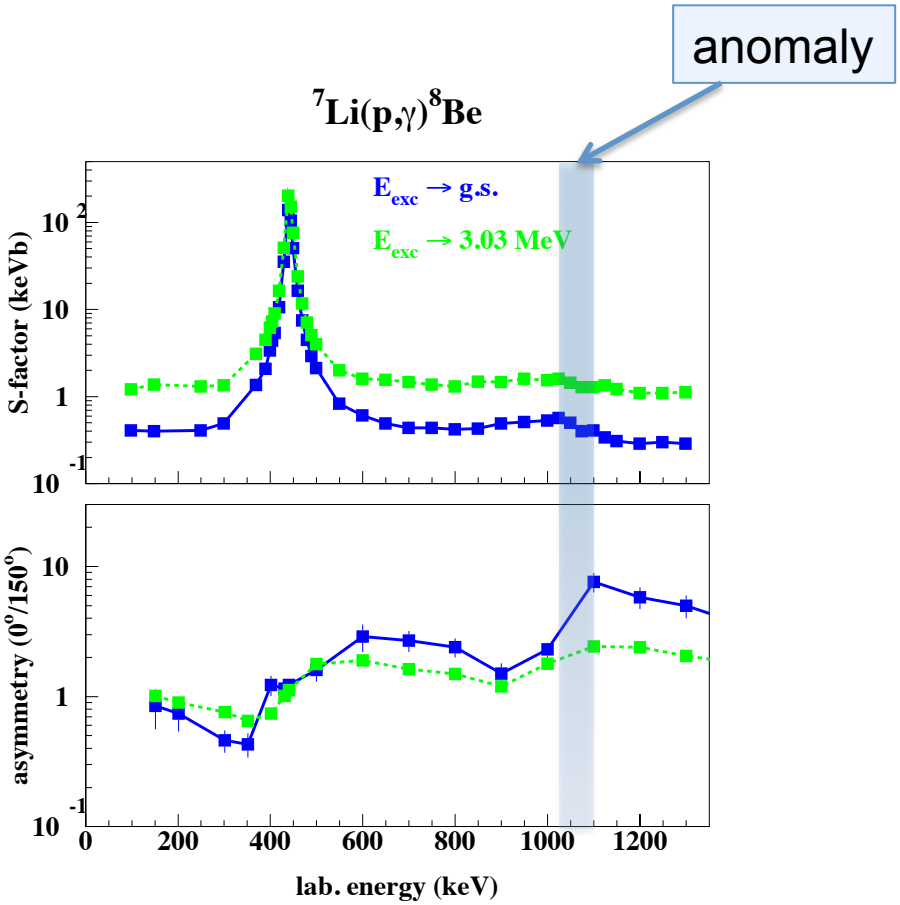
- A bump in **both** the angular separation angle and e+e- invariant mass
- Best explained by the decay of a ≈ 17 MeV boson!

The ^{7}Li(p,γ)^{8}Be reaction around E_p ~ 1 MeV



The resonant ^{7}Li(p,γ)^{8}Be reaction E_p ~ 0.5, 1 MeV

proton beam ~ 1 MeV on LiF target, resonance E_{lab} ~ 1.03 MeV, Γ ~ 138 keV
E_{lab} ~ 0.44 MeV, Γ ~ 11 keV



E_x = 18.15 MeV

σ(1.05 MeV) ~ 30 μb
thin target yield in LiF 150 μg/cm²
=> ΔE ~ 40 keV

Yield(g.s.) ~ 1.0 10^{-10} per proton
dN/dt (1 μA) ~ 600 γ/s ~ 2.5 e^+e^-/s
~ 14 X/h

E_x = 17.64 MeV

σ(0.44 MeV) ~ 4 mb
ΔE ~ 60 keV

Yield(g.s.) ~ 4.0 10^{-9} per proton
dN/dt ~ 25000 γ/s ~ 100 e^+e^-/s

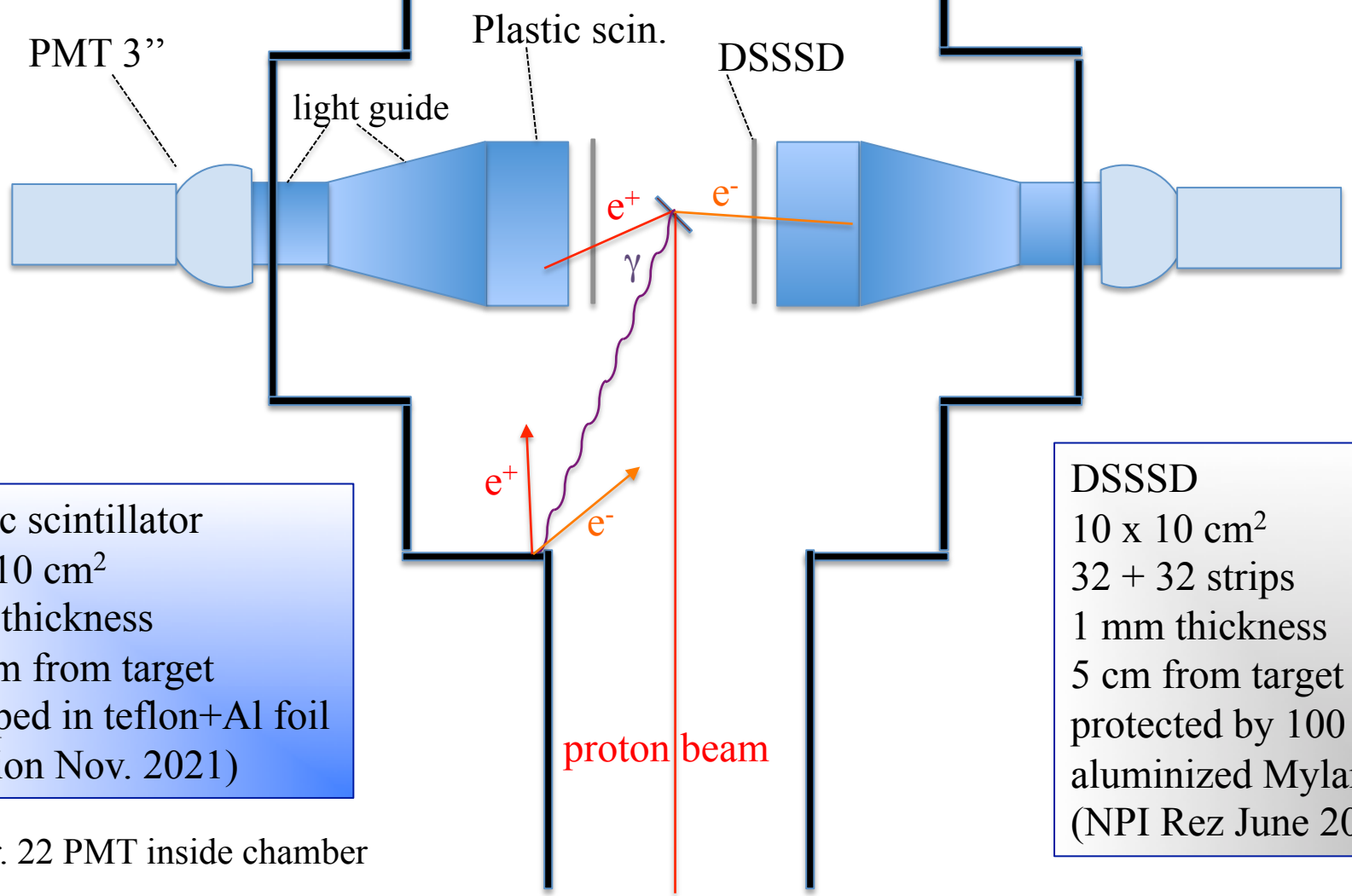
direct capture (E1) ~ resonant capture (M1) at 1.0 MeV

Experiment setup

targets
~150 μg/cm^2 LiF (CaF_2)
on ~50 μg/cm^2 C foil

Faraday cup

background
external pair creation
cosmic rays
quadruple coinc.
(sub ns) + sum energy



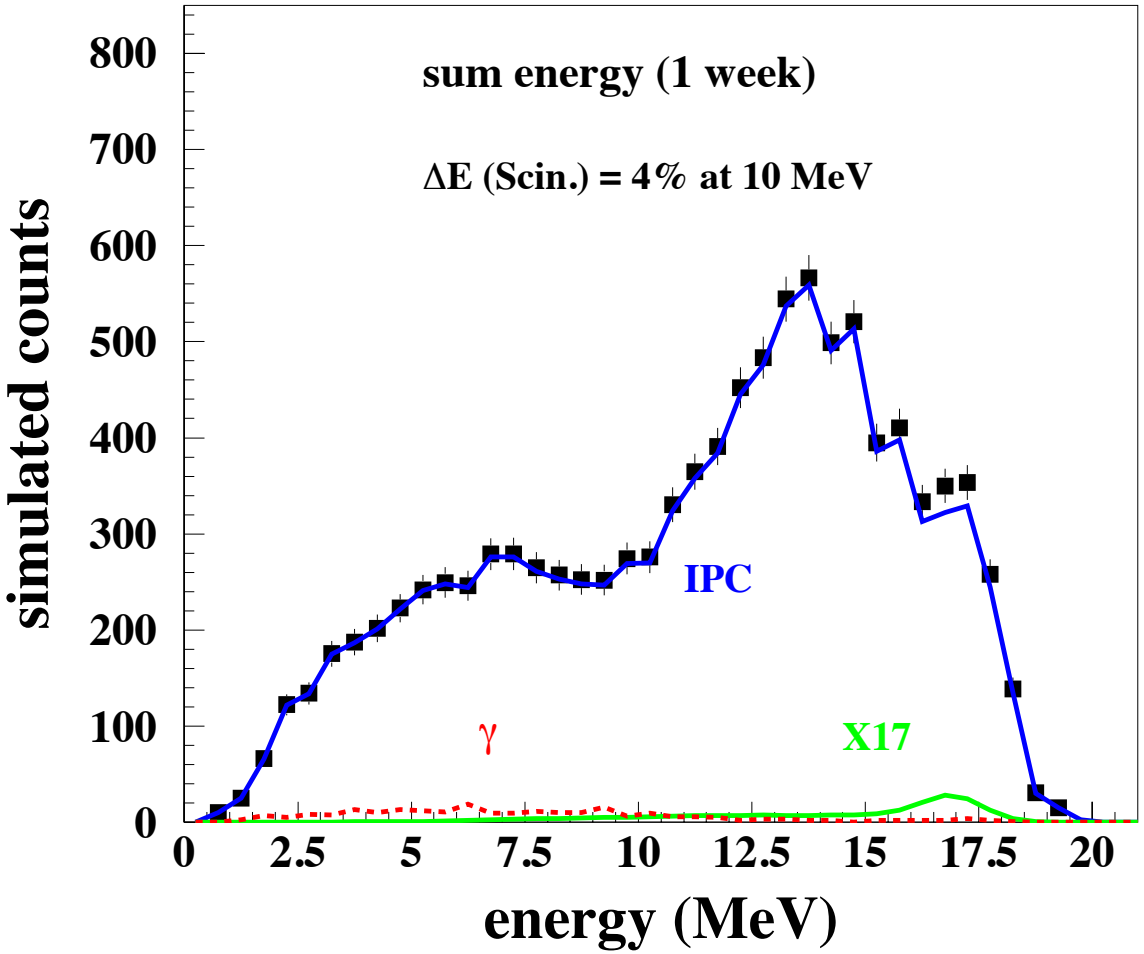
plastic scintillator
10 x 10 cm^2
5 cm thickness
6.5 cm from target
wrapped in teflon+Al foil
(version Nov. 2021)

=> Apr. 22 PMT inside chamber

DSSSD
10 x 10 cm^2
32 + 32 strips
1 mm thickness
5 cm from target
protected by 100 μm
aluminized Mylar foil
(NPI Rez June 2021)

Geant simulations

Setup with target ladder, detector crsytals and foils, and reaction chamber

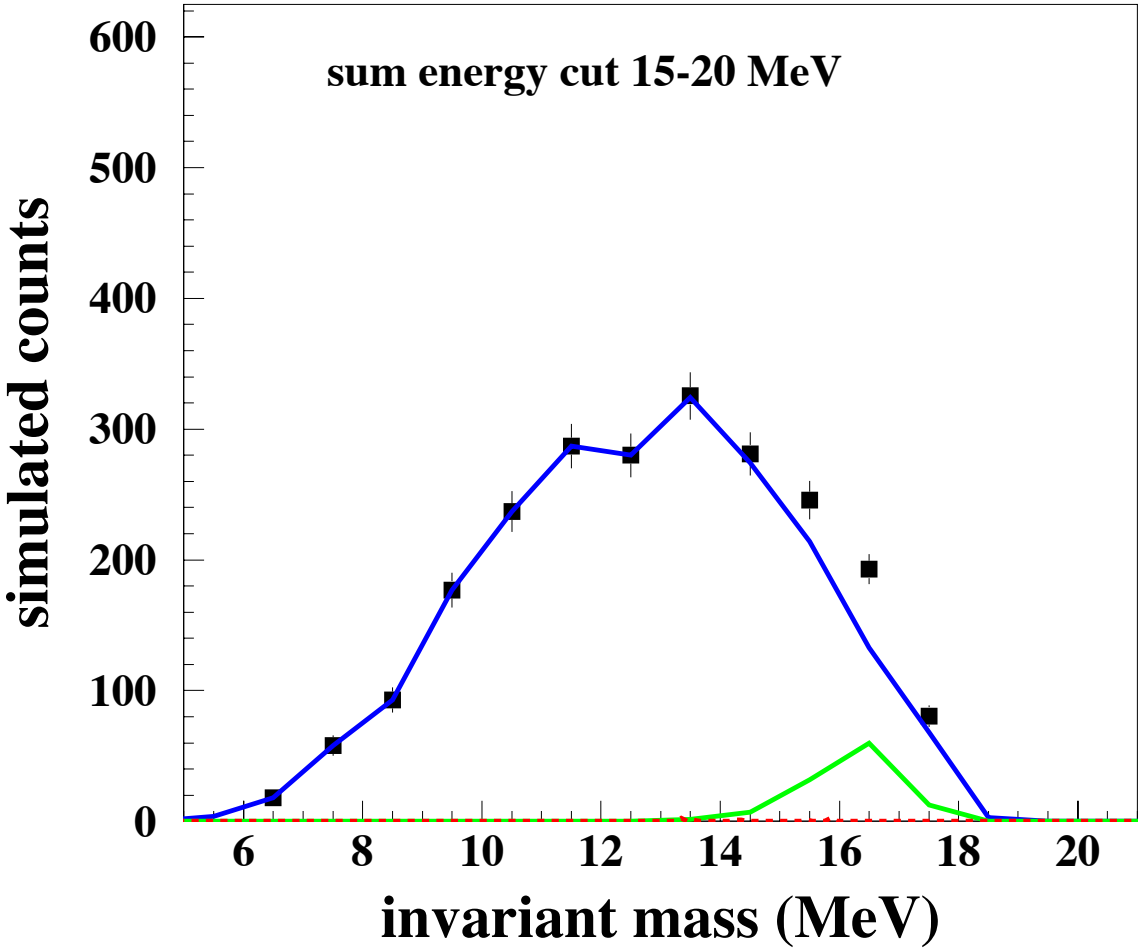


coincidence efficiency
(all 4 detectors with
energy deposit > 50 keV)

~ 0.5% for IPC
~ 9% for X(16.7 MeV)
~ 5E-6 for γ(18 MeV)

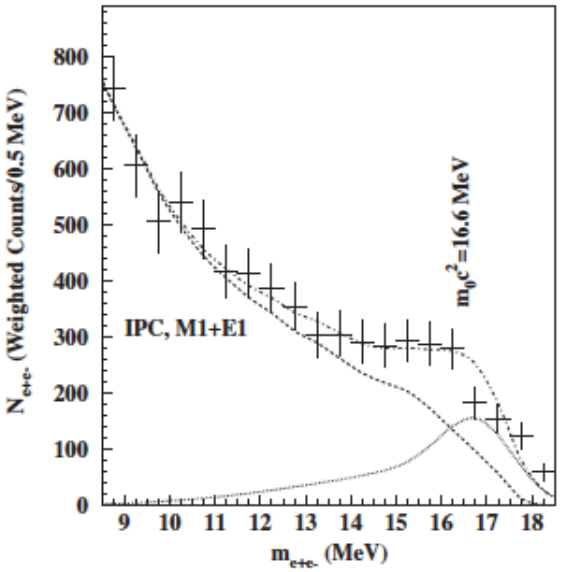
Geant simulations

Setup with target ladder, detector crsytals and foils, and reaction chamber



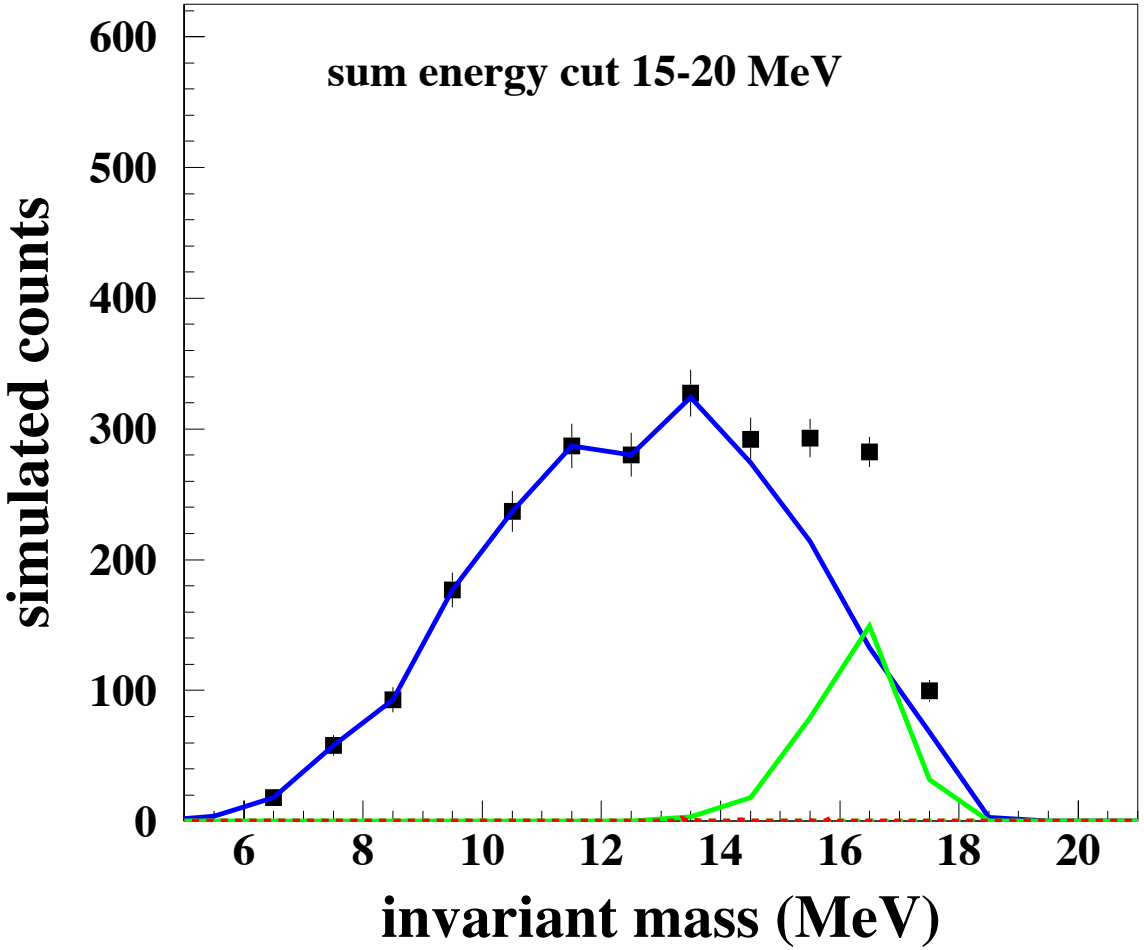
coincidence efficiency
(all 4 detectors with
energy deposit > 50 keV)

~ 0.25% for IPC
~ 9% for X(16.7 MeV)
~ 5E-6 for γ(18 MeV)



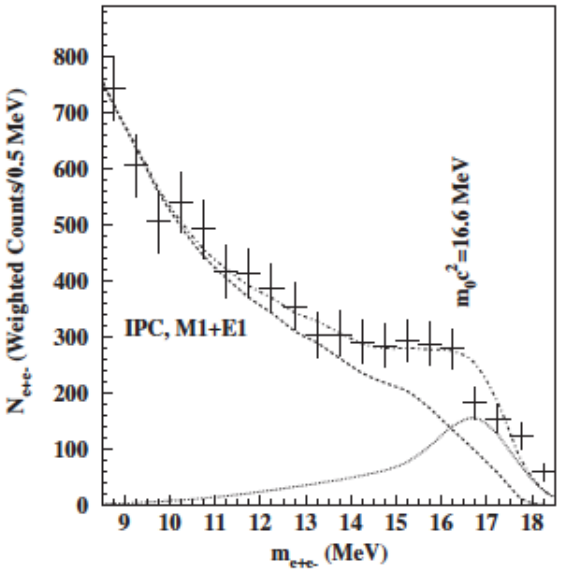
Geant simulations

Setup with target ladder, detector crsytals and foils, and reaction chamber



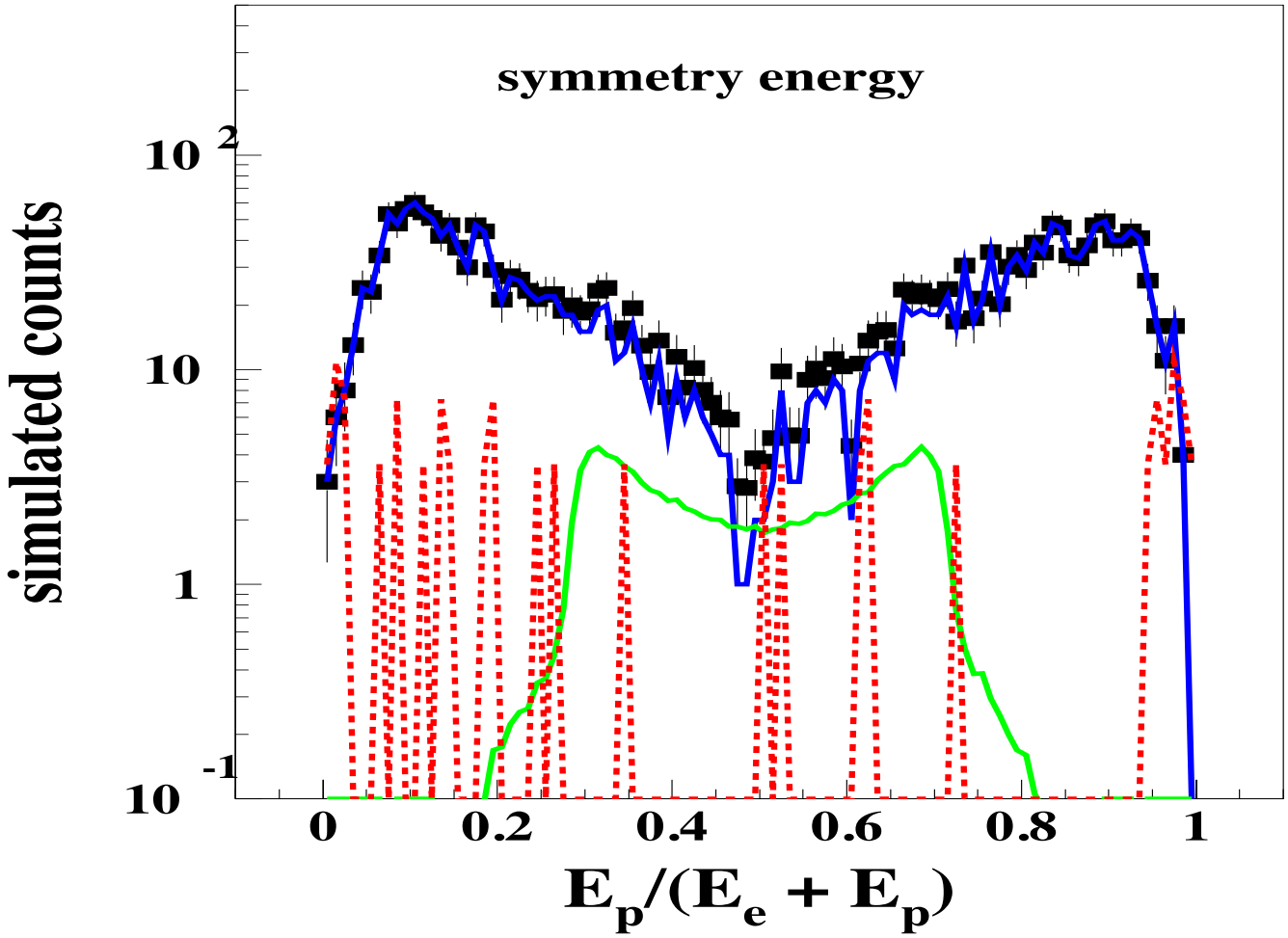
coincidence efficiency
(all 4 detectors with
energy deposit > 50 keV)

~ 0.25% for IPC
~ 9% for X(16.7 MeV)
~ 5E-6 for γ(18 MeV)



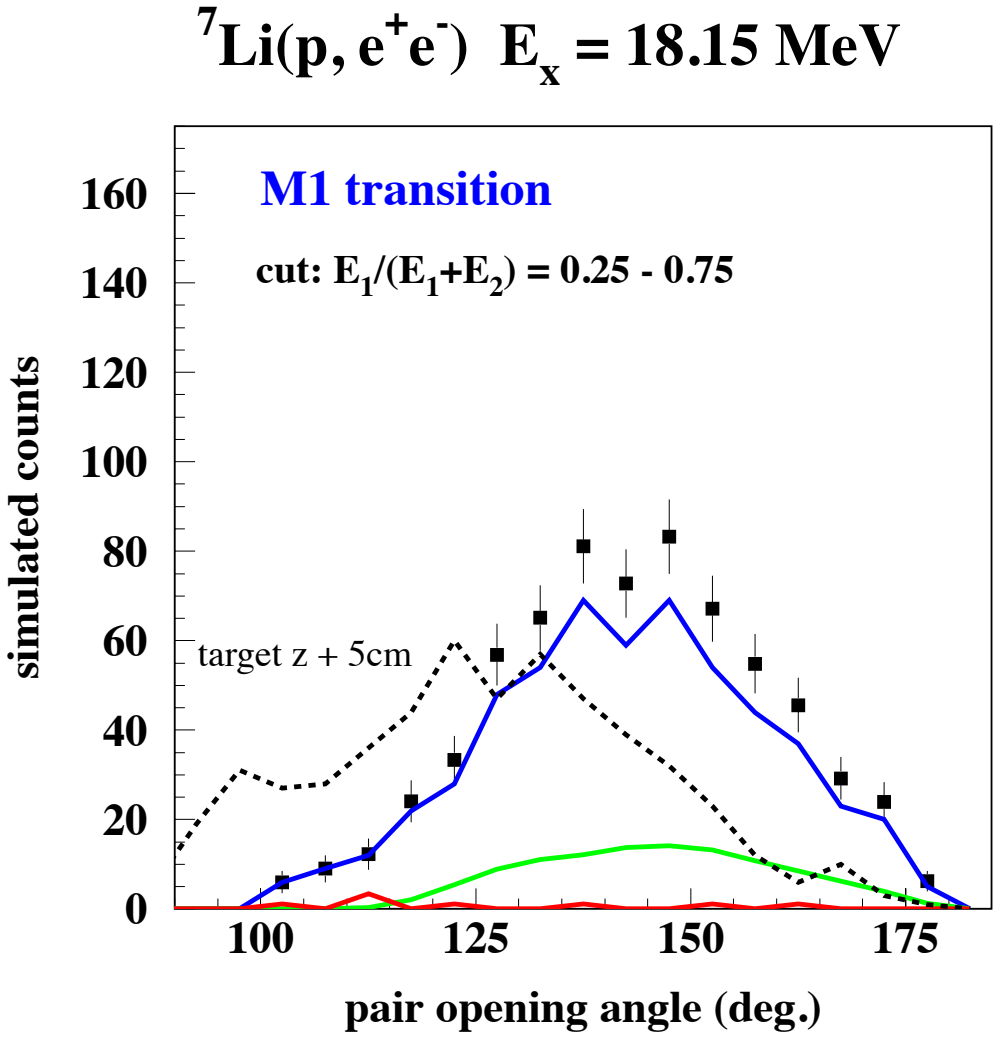
Geant simulations

sum energy cut E_{sum} = 15 – 20 MeV



Geant simulations

Setup with target ladder, detector crsytals and foils, and reaction chamber

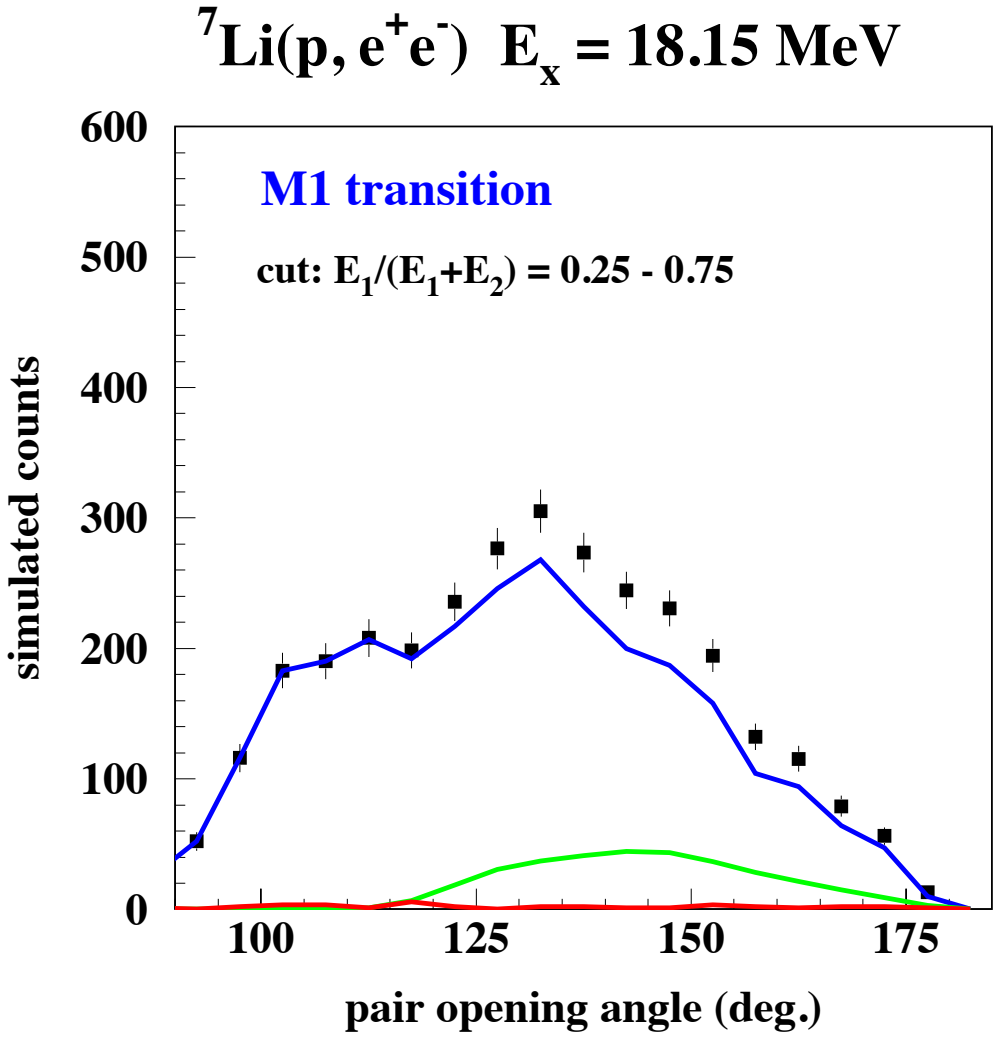


coincidence efficiency
(all 4 detectors with
energy deposit > 50 keV)

~ 0.5% for IPC
~ 9% for X(16.7 MeV)
~ 5E-6 for γ(18 MeV)

Geant simulations

Setup with target ladder, detector crsytals and foils, and reaction chamber



New setup
coincidence efficiency
(all 4 detectors with
energy deposit > 50 keV)

~ 1.2% for IPC
~ 17% for X(16.7 MeV)
~ 1E-5 for γ(18 MeV)