

# A Tagged Photon Beam for Detector R&D

David Christian

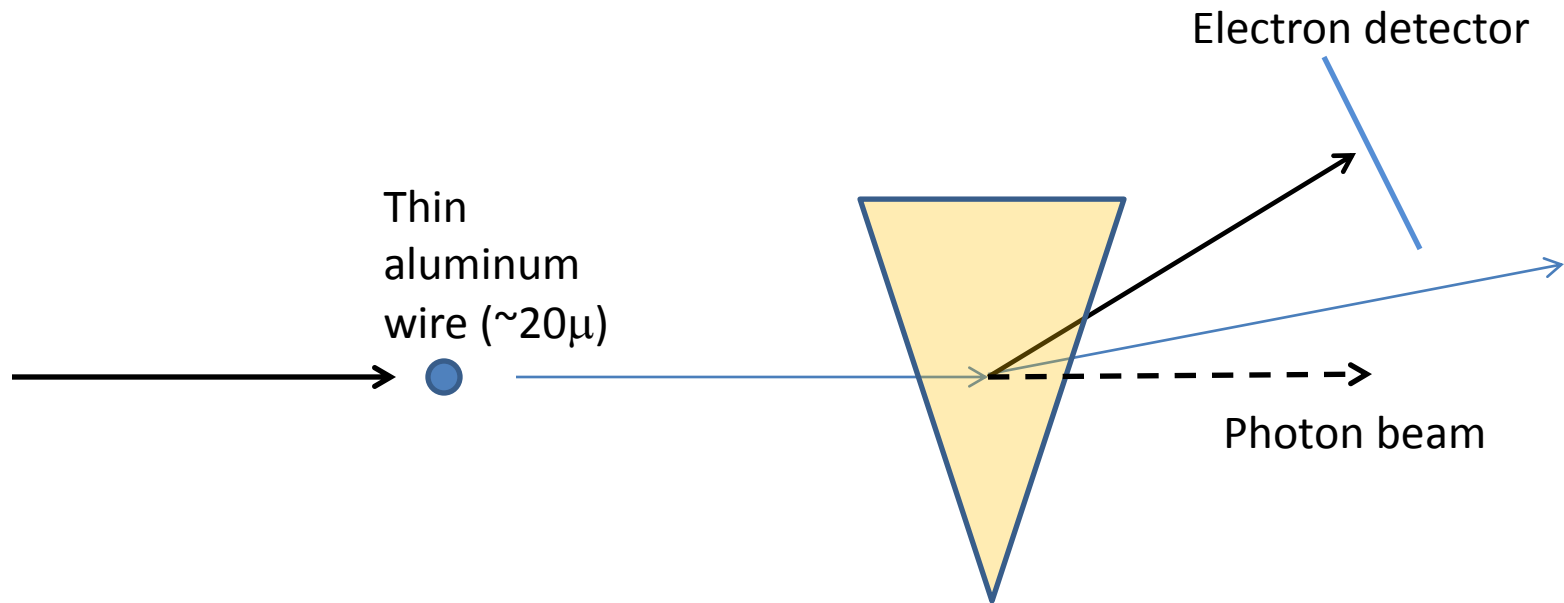
Fermilab

July 24, 2013

# Why include a tagged $\gamma$ beam?

- A tagged bremsstrahlung beam can be made at ASTA that will:
  - Have little impact on the  $e^-$  beam
  - Be very inexpensive
  - Provide an important resource for detector R&D

# Tagged Bremsstrahlung Beam

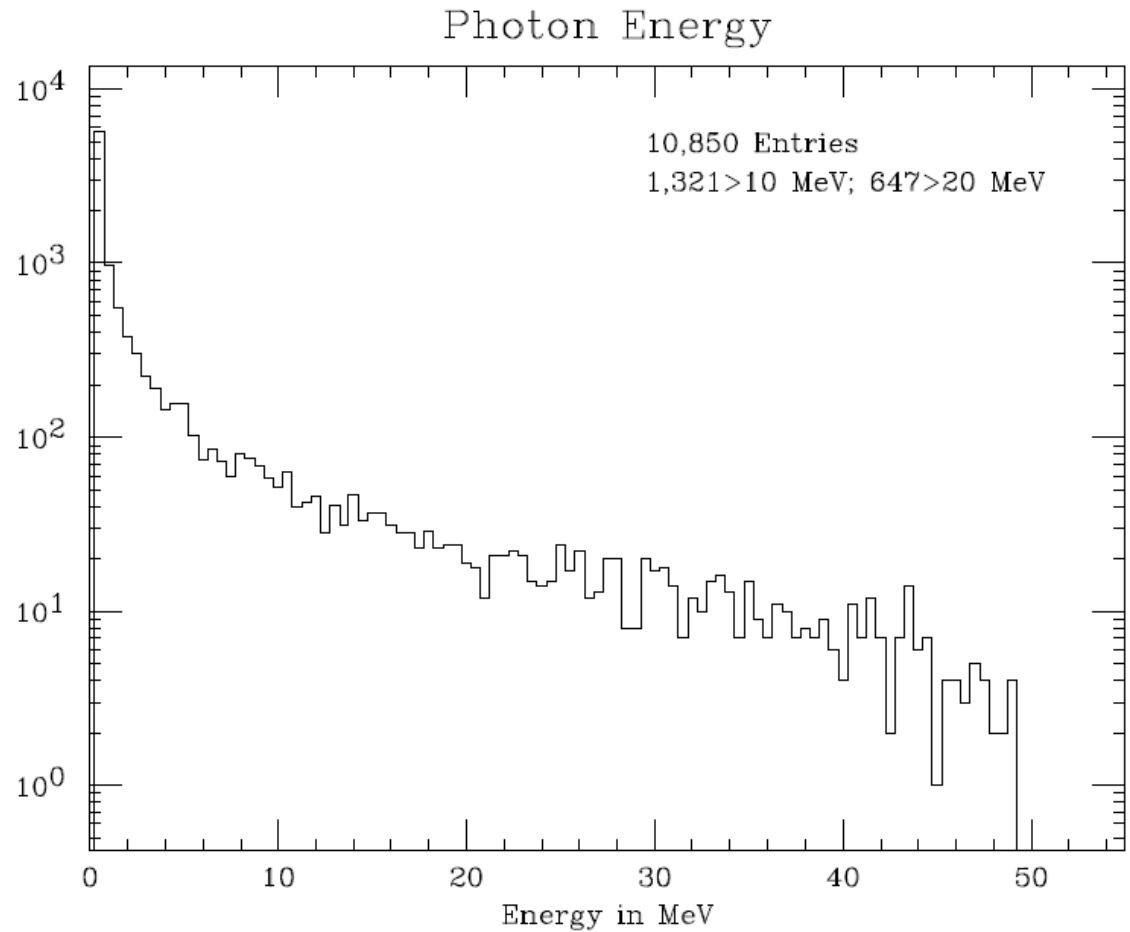


# Low energy $\gamma$ s are an important background for experiments

- ORKA ( $K^+ \rightarrow \pi^+ \nu$  [anti] $\nu$ )
  - $K^+ \rightarrow \pi^+ \pi^0$  w/asymmetric  $\pi^0$  decay
    - $K^+$  decay at rest  $\rightarrow$  min E for  $\gamma$  from  $\pi^0$  decay = 20 MeV
    - $\rightarrow$  QE (20 MeV) is often hard for EM detectors designed primarily for much higher energy
- Project X ( $K^0 \rightarrow \pi^0 \nu$  [anti] $\nu$ )
  - $K^0 \rightarrow \pi^0 \pi^0$ 
    - Also w/asymmetric  $\pi^0$  decay
    - Decay in flight  $\rightarrow$  no lower limit on  $E(\gamma)$

# Bremsstrahlung Spectrum

- G4Beamline simulation of  $1E7$   $e^-$  passing through 20 microns of Al ( $\sim 2E-4$  of Lrad)
- Need to tune for low rate (wire in beam halo?) to get 1 gamma in relevant time window.



$\gamma$ s produced into a forward 10 mrad cone

# Can use “Low Energy Dipole”

Field integral = 720 Gauss-M  
 (~25 degree bend for 50 MeV)  
 “We have spares.”

Subject: Re: ASTA dipoles?                      Re ASTA dipoles.txt  
 From: Mike Church <church@fnal.gov>  
 Date: 12/10/2012 12:18 PM  
 To: David Christian <dcc@fnal.gov>

Dave,

Attached are the specs and drawings for our low energy (50 MeV) dipoles.  
 Built by Everson-Tesla and we have spares.

Also attached are the drawings for the high energy dipoles.  
 These magnets were a hybrid project between Fermilab Everson-Tesla. We have no  
 spares.

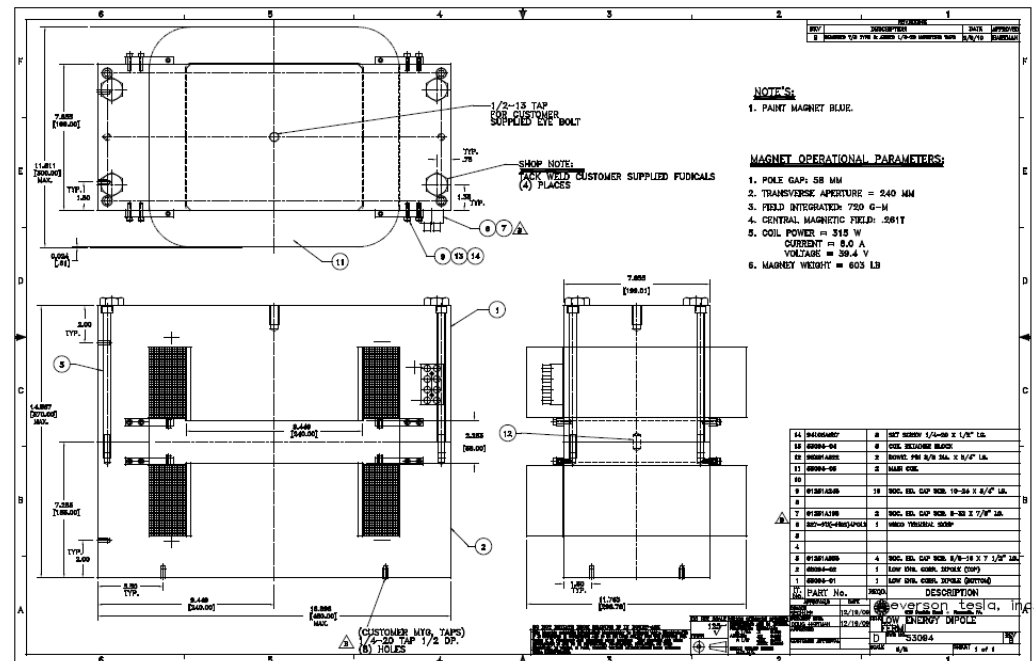
Both these magnets can be viewed at ASTA.

Mike

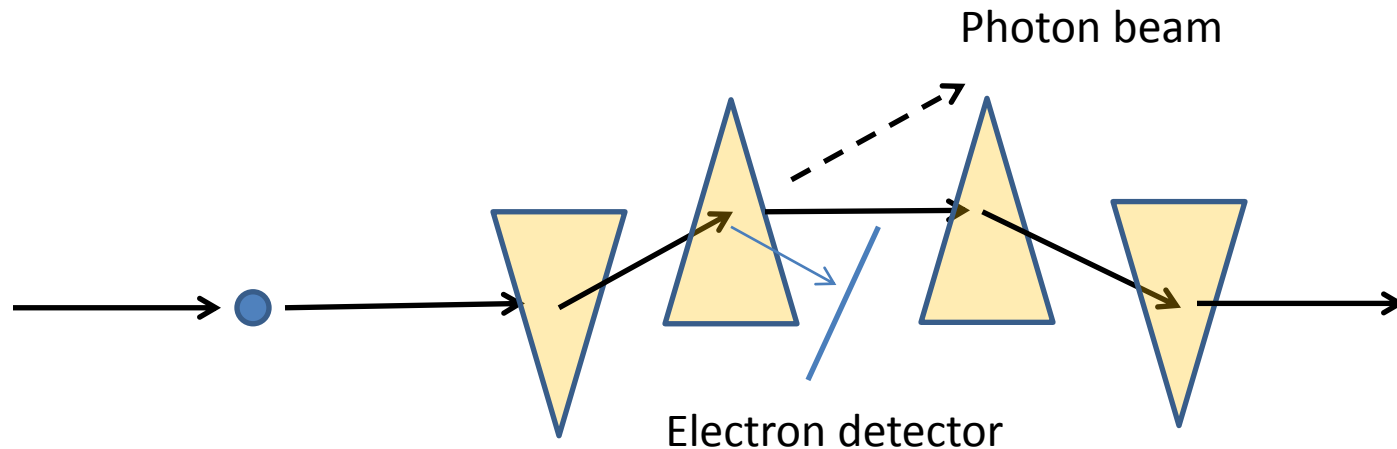
On 12/10/2012 11:45 AM, David Christian wrote:

> Hi Mike,  
 >  
 > Do you have specs for dipoles that will already be built for use in/by ASTA?  
 > I thought I might see if a standard magnet could be used for a bremsstrahlung  
 beam.  
 >  
 > - Dave

Attachments:  
 LED\_spec\_09\_30\_10.pdf    129 KB  
 LED Magnets Design Parameters\_final.doc 61.5 KB  
 LED 53094-B DWG\_final.pdf    1.4 MB  
 dipole\_assembly\_color.pdf    204 KB  
 RFP\_371081-09pg.pdf        518 KB



# Possible layout



- Thin wire → “minor” beam disruption
- Wire or beam can be moved while tagged beam is not in use
- No expensive parts required
  - Extra magnets (use existing spares)
  - Vacuum pipe
  - Detector array – scintillator or SSD depending on available real estate

# Another possibility

