**GlueX Document**
Updated: September 13, 2007

# BCAL and $\eta\pi^0$

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## Introduction

I prepared this brief as background for our BCAL conference call of 9/13/2007. For this note I consider one of our signature reactions: $\gamma p \to \eta\pi^0 p$. The beam energy is 9 GeV, the $\eta\pi^0$ mass is uniform between 1.5 and 2.5 GeV/$c^2$ and the momentum transfer squared from the incident photon to the $\eta\pi^0$ system follows $e^{-5|t|}$. The event vertex is uniform across the 30-cm target centered at $z = 65$ cm in the standard GlueX coordinate system in which BCAL extends from $z = 17$ cm to $z = 407$ cm. The photon angle is the angle with respect to the beam direction which is also the angle with respect to the inner surface of BCAL.

For this final state about 40% of the photons hit FCAL and 60% hit BCAL. Less than 1% are directed to UPV. Figure 1 shows characteristics of photons hitting BCAL from the reaction $\gamma p \to \eta\pi^0 p$: (a) the distribution in $z$ - impact on inner surface of BCAL, (b) the photon angle versus impact point, (c) the photon energy distribution and (d) the photon angle distribution. Note that 50% of the photons striking BCAL have angles between 10° and 20° while 75% have angles between 10° and 30°. This angular regime is of concern because, as shown from the BCAL test data, the energy resolution deteriorates for these angles because of shower leakage out the front of the module. The low angle photons of course hit the downstream end of BCAL. We need to concentrate on low angle with high $z$ near the end of the module in analyzing the BCAL test data.

Figure 2 shows the energy of photons hitting BCAL as a function of impact point. The plot on the left covers photon energies from 0 to 5 GeV while that on the right goes from 0 to 0.5 GeV.

The next step will be to look at these distributions using photons from the Pythia simulation - as described in my GlueX-doc-856-v1.

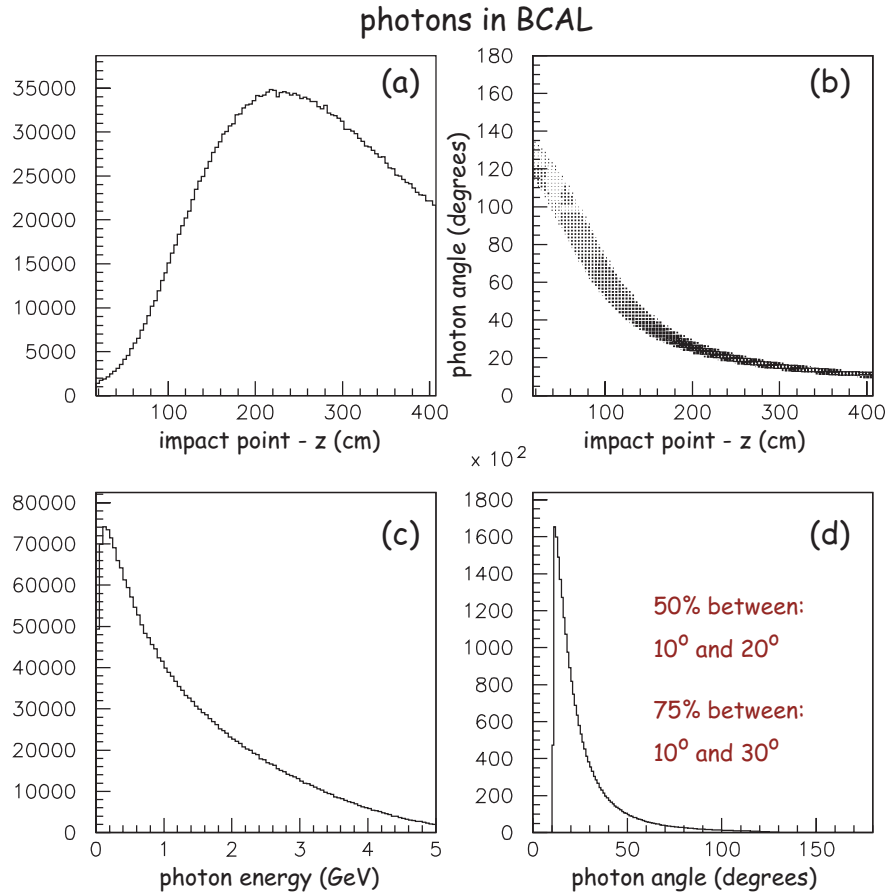


Figure 1: Characteristics of photons hitting BCAL from the reaction $\gamma p \to \eta\pi^0 p$. (a) distribution in $z$ - impact on inner surface of BCAL; (b) photon angle versus impact point; (c) photon energy; and (d) photon angle.

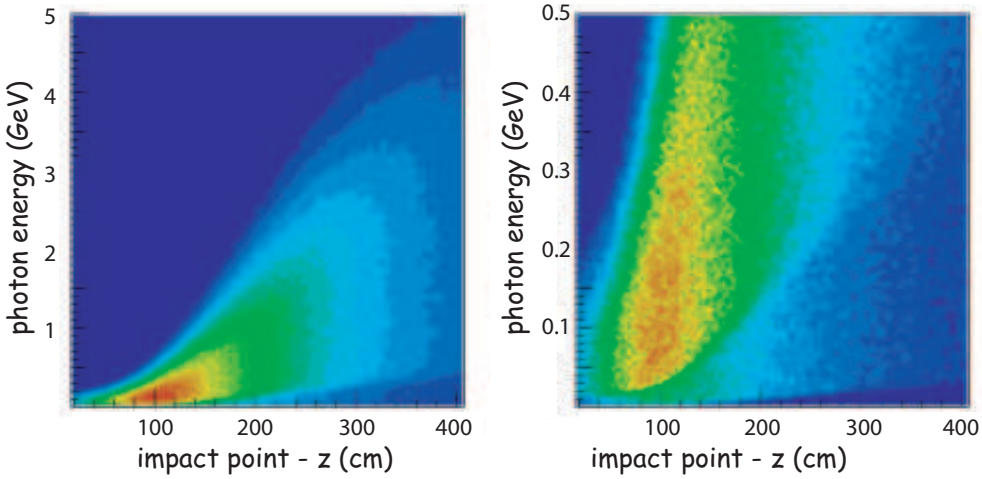


Figure 2: Energy of photons hitting BCAL as a function of impact point. The plot on the left covers photon energies from 0 to 5 GeV while that on the right goes from 0 to 0.5 GeV.