# LGD Resolution

GlueX Detector Review

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## Introduction

R. Jones and M. Kornicer studied the LGD shower resolution in Radphi in detail. They find that the energy resolution is given by:

$$\frac{\sigma_E}{E} = 0.036 + \frac{0.073}{\sqrt{E}} \tag{1}$$

The spatial resolution is given by:

$$\sigma_\rho = \sqrt{\left(\frac{7.1}{\sqrt{E}}\right)^2 + (X_0 \sin\theta)^2}\ mm \tag{2}$$

where $\rho$ locates the shower position in the plane of the LGD measured from the center of the LGD, $\theta$ is measured from the normal to the LGD plane, $X_0$ is the radiation length of glass and $E$ is the photon energy in GeV.

I wrote a Monte Carlo program generating $\pi^0$ and $\eta$ mesons for the Radphi, E852 and GlueX setups with the above resolution functions:

1. **Beam energy**: I assume a uniform photon beam between 3.0 and 5.4 GeV for Radphi, 18.0 GeV for E852 and 9 GeV for GlueX;
2. **Target to LGD**: I assume distances of 1.0 m, 5.4 m and 5.0 m for the three experiments respectively.
3. **LGD transverse dimensions**: I assume circular stacks of radii 0.5 m for Radphi and 1.0 m for GlueX and a 1.68 by 2.8 m rectangular stack for E852.
4. **Photon cuts** I require a minimum photon energy of 150 MeV and a minimum photon separation of 8 cm.

Results: Please see the plots of Figure 1.

I obtain $\pi^0$ mass resolutions of 16 MeV for Radphi and 8 MeV for E852 compared to measured resolutions of 18 and 10 MeV. For GlueX we predict 9 MeV.

For the $\eta$ I obtain mass resolutions of 40 MeV for Radphi and 27 MeV for E852 compared to measured resolutions of 40 and 25 MeV. For GlueX we predict 30 MeV.

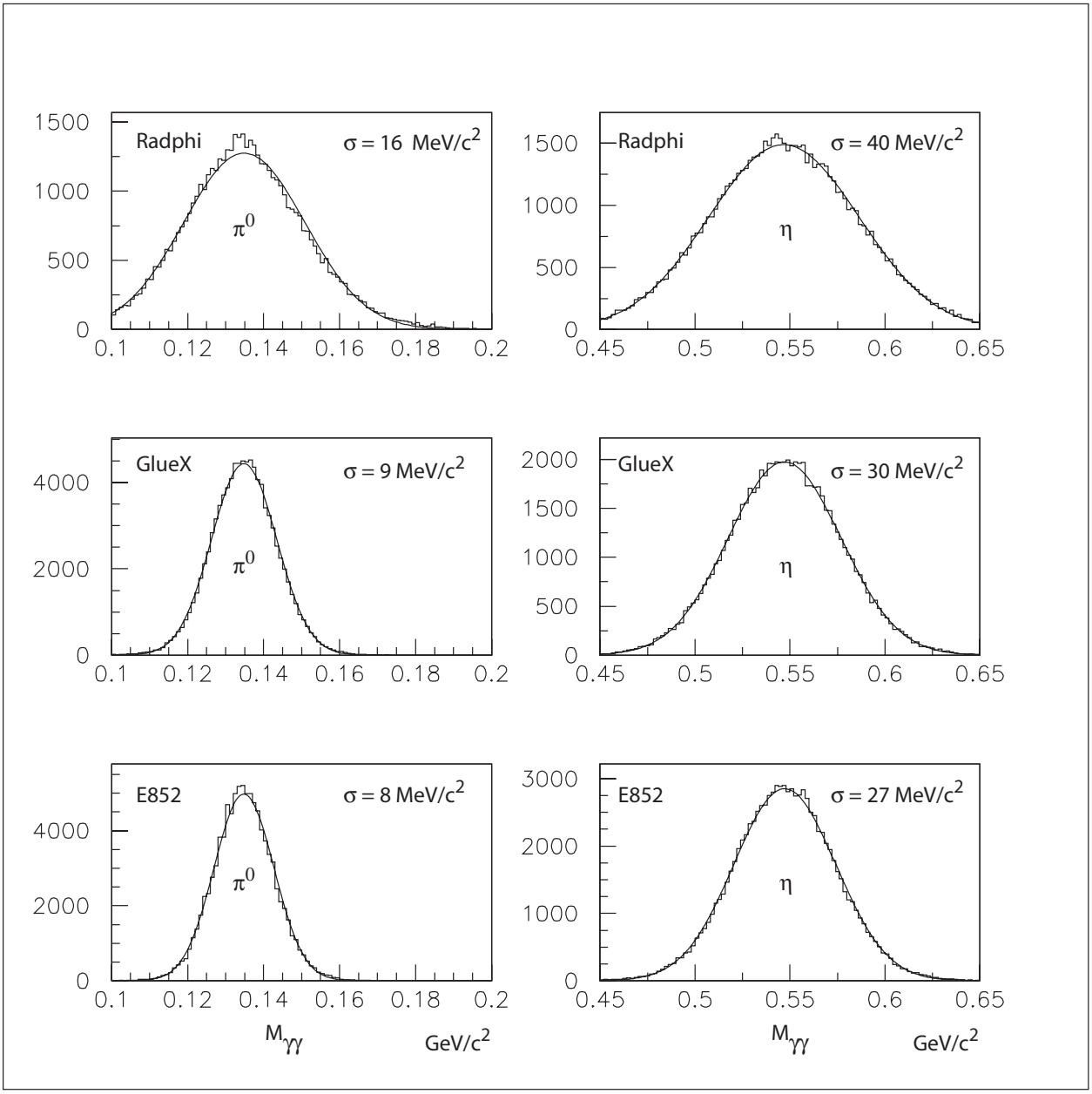


Figure 1: Simulated diphoton mass for the $\pi^0$ and $\eta$ using the Radphi, GlueX and E8652 geometry.