While the Spring run was performed at energies lower than desired, the energy of the coherent peak for the photon beam fortuitously overlapped nicely with previous SLAC measurements of the beam asymmetry associated with the reaction $\gamma p \to \rho^0 p$ [1]. The SLAC measurement found that the polarization transfer from the incident photon to the ρ^0 meson was very high, with the subsequent $\pi^+\pi^-$ decay of the ρ^0 carrying away the polarization information through the decay pions. The angular distribution of the $\rho^0 \to \pi^+\pi^-$ decay is given by $\sigma = \sigma_0[1 + P\Sigma\cos(2\psi)]$, where ψ is the azimuthal angle of the π^+ in the rest frame of the ρ^0, σ_0 is the unpolarized cross section, the degree of beam polarization is P, and the beam asymmetry is Σ. For the case where the momentum transfer to the ρ^0 was restricted to $|t| < 0.4$ the SLAC results indicate the beam asymmetry $\Sigma \approx 0.93$ when we took an average of the data.

Since the ρ^0 is easily produced and beam asymmetry measurements for the reaction $\gamma p \to \rho^0 p$ are available in the energy range of the coherent peak for the Spring run, a preliminary estimate of the polarization of the photon beam could be made. For an estimate of the beam polarization using the asymmetry of the ρ^0 decay, we took a *single two-hour* Spring run that utilized linearly-polarized incident photons from the oriented diamond radiator. The requirements for an event to be processed were that (1) a single matched photon to the event, (2) the photon energy was within the energy range of 2.5 to 3.0 GeV, (3) a start-counter hit could be matched to one of the charged tracks, (4) a proton, a π^+, and a π^- were present within the event, (5) the missing-mass-squared for the reaction $\gamma p \to p\pi^+\pi^-$ was consistent with zero to within 0.03 GeV^2, and (6) the momentum transfer was such that the mandelstam variable t satisfied $|t| < 0.4$.

With these conditions met, a plot of the $\pi^+\pi^-$ mass distribution was created and fit to a Breit-Wigner-plus-constant ansatz. As seen in the left-hand panel of Fig. 1, where the black line represents the total fit and the blue line shows the constant term added to the Breit-Wigner, the mass distribution of the ρ^0 has the correct mass and is fairly clean. The mass range of the ρ^0 used for estimating the photon beam polarization was from 0.6 to 0.92 GeV, and in that mass range, the background of the fit was found to be about 4% of the total.

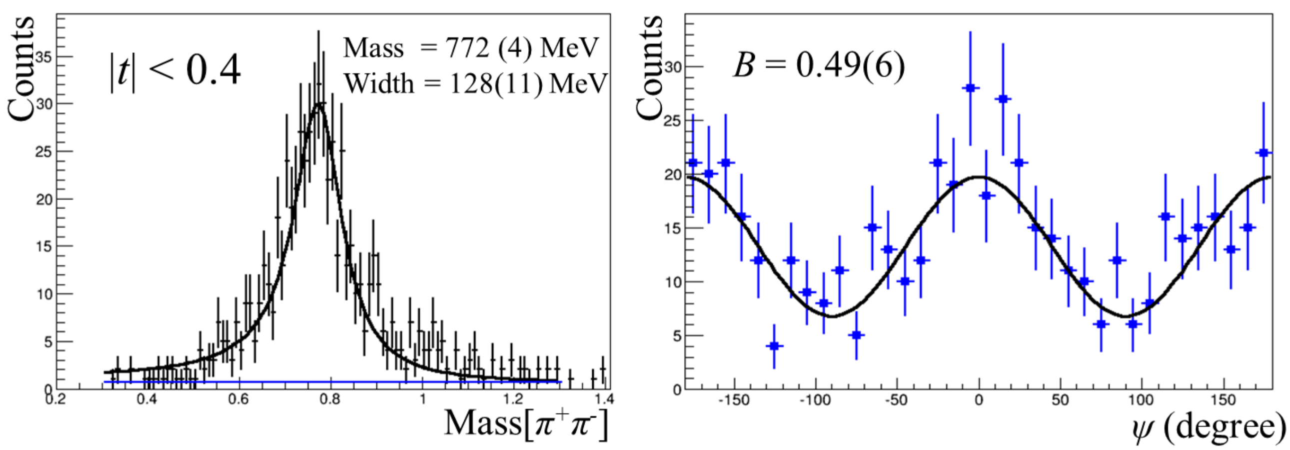

FIG. 1: Invariant mass of $\pi^+\pi^-$ (left panel) and azimuthal distribution of π^+ as seen in the ρ^0 rest frame for the decay $\rho^0 \to \pi^+\pi^-$ (right panel). The lines in each panel represent the fits described in the text.

The azimuthal distribution of the π^+ (boosted to the ρ^0 rest frame) can be found in the right-hand panel of Fig. 1, where the black line represents a fit of the data to the function $A[1 + B\cos(2\psi)]$, with A and B being parameters of the fit. A value of $B = 0.49 \pm 0.06$ was extracted from the fit. Now, assuming the beam asymmetry is 0.93, and that the 4% background is completely unpolarized (causing a dilution of 4%), then the beam polarization is estimated as being 0.55 ± 0.07. This value is consistent with the value of the polarization P measured with the triplet polarimeter.

[1] J. Ballam *et al.*, Phys. Rev. Lett. **24**, 960 (1970).