Comparing Pythia Output with Data

A Preliminary Look

Alex R. Dzierba

Introduction

This is a preliminary look at Monte Carlo data simulated by Pythia comparing it to published data[1]. I am using Pythia parameters as tuned by Eugene Chudakov and Elke Aschenauer and as passed on to me by David Lawrence. I generated 10^5 events. Ratios of cross sections for various topologies for an incident photon energy of 9 GeV are summarized in Table 1. The agreement is quite good.

Distributions for Pythia data corresponding to $\gamma p \to \pi^+\pi^- p$ are shown in Figure 1. At 9 GeV $\gamma p \to \rho^0 p$ accounts for 92% of $\gamma p \to \pi^+\pi^- p$ for data, consistent with Pythia simulations. For the $|t|$ distribution, a fit to $dN/d|t| \propto e^{-a|t|}$ yields $a = 7.4 \pm 0.8$ GeV^{-2} for the Pythia data compared to published data for which $a = 6.5 \pm 0.5$ GeV^{-2}.

Distributions for Pythia data corresponding to $\gamma p \to \pi^+\pi^-\pi^0 p$ are shown in Figure 2. Published data at 9 GeV yield cross sections for ωp, $\rho^-\Delta^{++}$, $\rho^0\Delta^+$ and $\rho^+\Delta^0$ of 1.9 ± 0.3 μb, 1.1 ± 0.2 μb, 0.3 ± 0.2 μb and 0.2 ± 0.2 μb respectively.

The next step is to compare Pythia output for multi-neutral missing mass distributions recoiling against charge particles. Published distributions from bubble chamber experiments are available.

Table 1: Ratios of cross sections for various topologies for an incident photon energy of 9 GeV.

Ratio	Pythia (%)	Data (%)
σ(1-prong)/σ_{total}	7.1	6.9 ± 0.9
σ(3-prong)/σ_{total}	51.8	51.7 ± 1.2
σ(5-prong)/σ_{total}	34.1	27.6 ± 0.7
σ(7-prong)/σ_{total}	5.4	5.5 ± 0.2
σ(9-prong)/σ_{total}	0.3	0.5 ± 0.06
$\sigma(\pi^+\pi^- p)/\sigma$(3-prong)	21	23 ± 1
$\sigma(\pi^+\pi^-\pi^0 p)/\sigma$(3-prong)	9	11 ± 1
$\sigma(\omega p)/\sigma(\pi^+\pi^-\pi^0 p)$	24	25 ± 4

[1] Cross sections at GlueX energies are summarized in A. Dzierba, GlueX-doc-825.

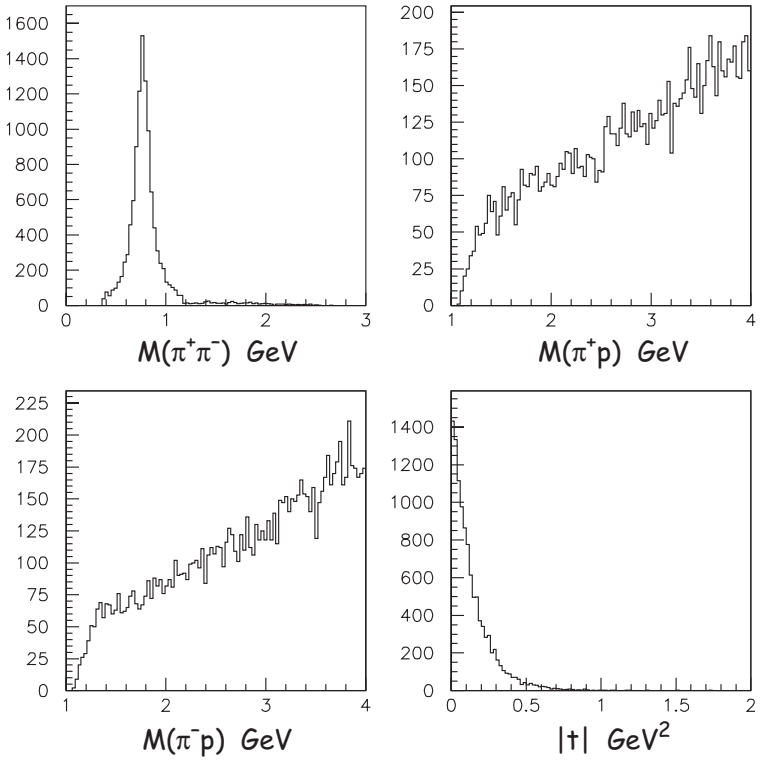

Figure 1: Distributions for Pythia data corresponding to $\gamma p \to \pi^+\pi^- p$ at 9 GeV.

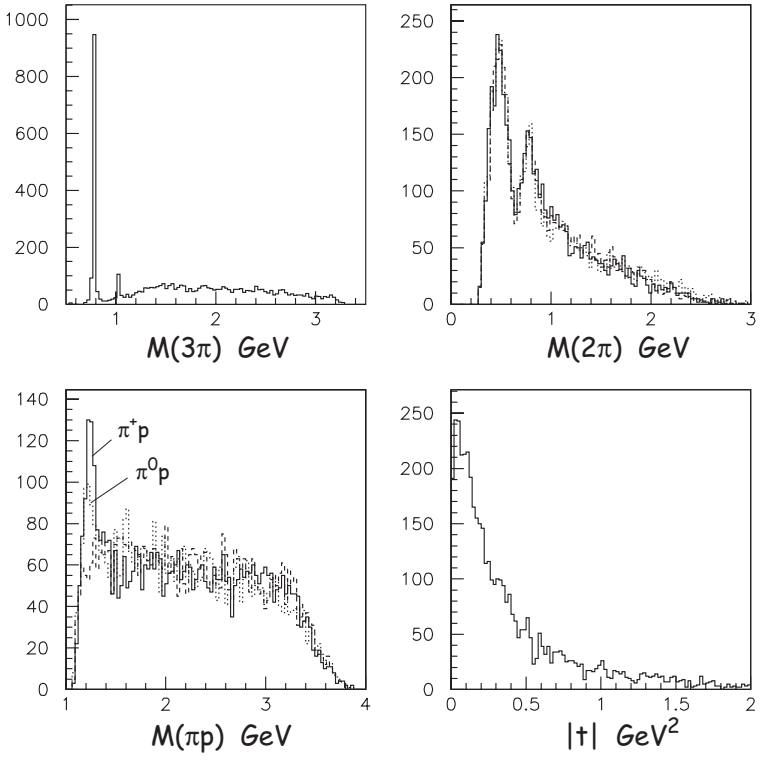

Figure 2: Distributions for Pythia data corresponding to $\gamma p \to \pi^+\pi^-\pi^0 p$ at 9 GeV.