

$pp \rightarrow pp\pi^0$ and $pp \rightarrow pp\eta$ Reconstruction

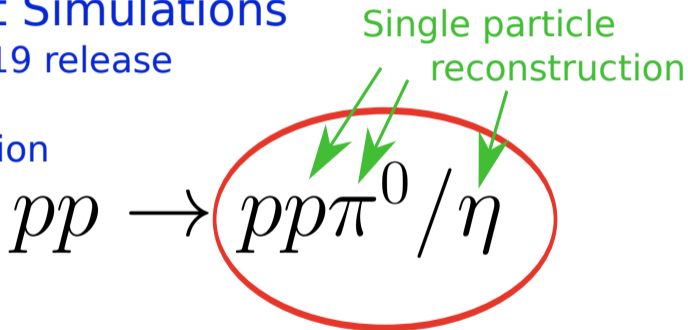


PANDA Collaboration Meeting 01/2020

Overview

PandaRoot Simulations

- October 2019 release
- Geant3
- Full Simulation



Full final state reconstruction
cross sections

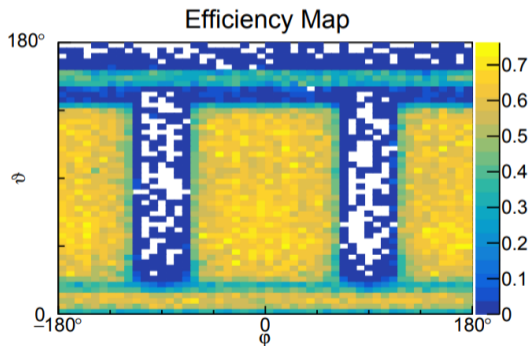
π^0 Reconstruction Efficiency

Simulation

- 10^6 isotropically generated π^0
- p_{π^0} from 0.05 GeV/c to 5 GeV/c

Reconstruction

- Decay: $\pi^0 \rightarrow \gamma\gamma$
- Fit π^0 peak in $\gamma\gamma$ invariant mass spectrum to calculate yield
- Divide by generated π^0



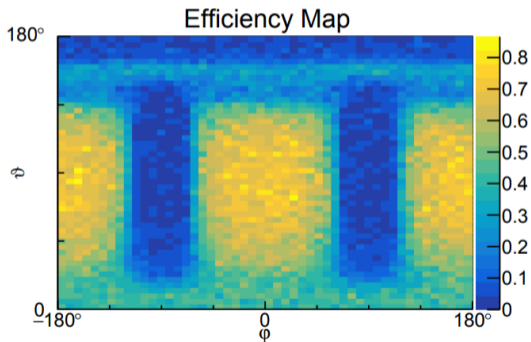
η Reconstruction Efficiency

Simulation

- 10^6 isotropically generated η
- p_η from 0.05 GeV/c to 5 GeV/c

Reconstruction

- Decay: $\eta \rightarrow \gamma\gamma$ (BR = 39.41 %)
- Fit η peak in $\gamma\gamma$ invariant mass spectrum to calculate yield
- Divide by generated η , BR corrected



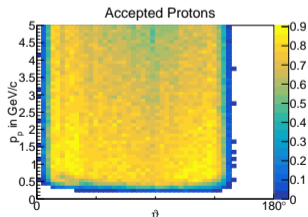
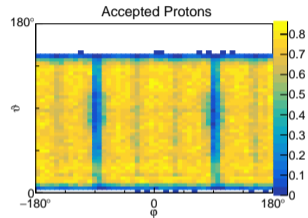
Proton Reconstruction

Simulation

- $5 \cdot 10^5$ isotropically generated p
- p_p from 0.05 GeV/c to 5 GeV/c

Reconstruction

- Tracking options: barreltrack, multikalman proton
- Directly from PID information
- Requirements: 4 hits in MVD or 6 hits in any tracking detector, charge +1
- Use momentum direction of associated MC track for bin assignment



Pluto Event Generator

- A Monte-Carlo event generator
- Hadronic interactions from pion threshold to few GeV/u
- Based on ROOT
- Mainly developed for the HADES physics program

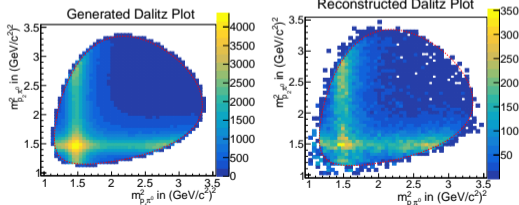
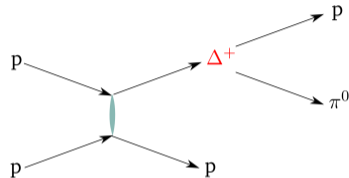
$$pp \rightarrow pp\pi^0$$

Simulation

- p beam momentum: 1.5 GeV/c, 3 GeV/c, 5.4 GeV/c and 15 GeV/c
- Event generation: Phase-space (EvtGen), including $\Delta^+(1232)$ resonance (Pluto)
- 10^6 events each

Reconstruction

- 4C fit on full final state, $200 \text{ MeV}/c^2$ cut around π^0 mass
- Fit π^0 peak in $\gamma\gamma$ invariant mass spectrum to calculate yield



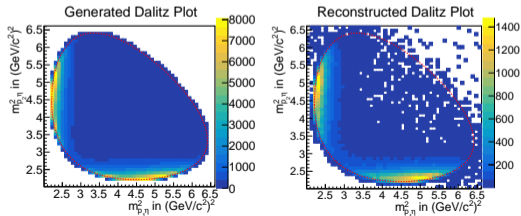
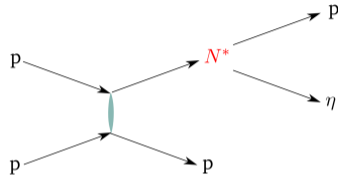
$$pp \rightarrow pp\eta \rightarrow pp\gamma\gamma$$

Simulation

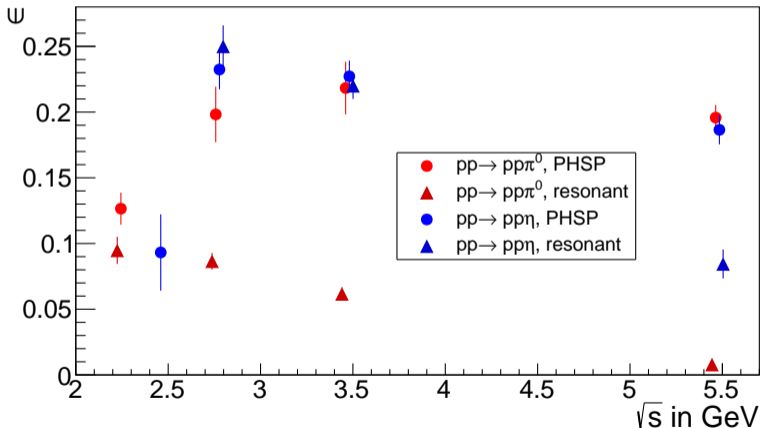
- p beam momentum: 2.06 GeV/c, 3 GeV/c, 5.4 GeV/c and 15 GeV/c
- Event generation: Phase-space (EvtGen), including N^+ (1535) resonance (Pluto)
- 10^6 events each

Reconstruction

- 4C fit on full final state, 500 MeV/c² cut around η mass
- Fit η peak in $\gamma\gamma$ invariant mass spectrum to calculate yield

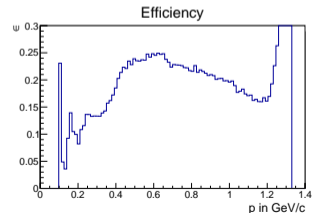
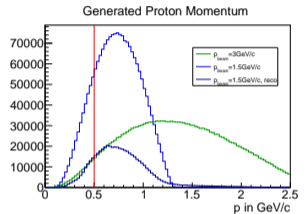
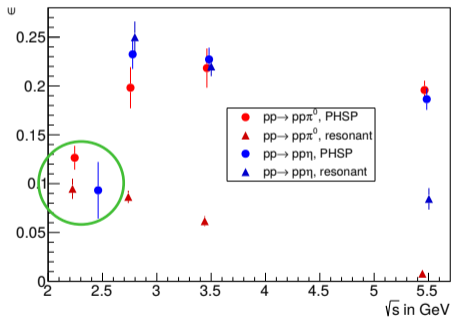


Full Final State Reconstruction Efficiencies



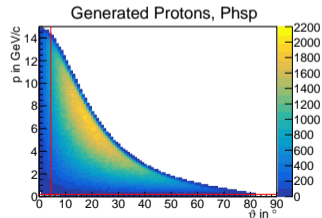
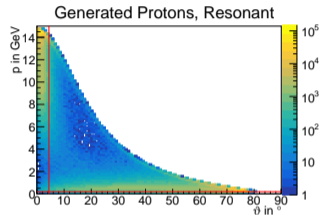
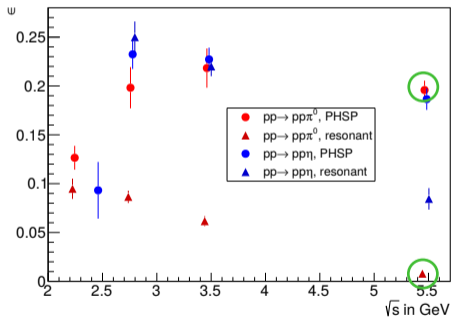
Full Final State Reconstruction Efficiencies

Low Efficiency at Low Energy



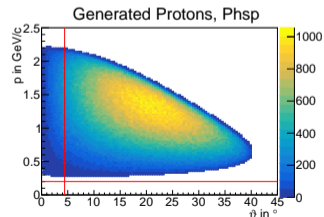
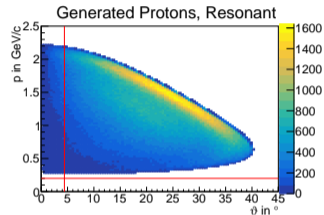
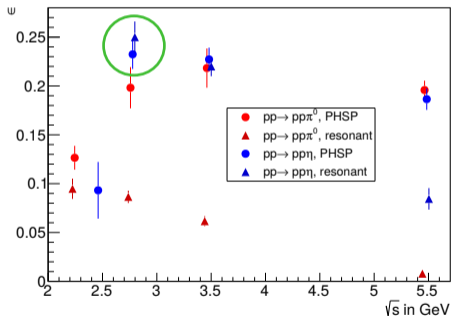
Full Final State Reconstruction Efficiencies

π^0 : Resonant vs. Phase Space Scenario



Full Final State Reconstruction Efficiencies

η : Resonant vs. Phase Space Scenario



Uncertainty Estimates for Cross Section Measurements

Let's Assume...

- $\mathcal{L} = 10^{30} \text{ s}^{-1} \text{ cm}^{-2}$
- Measuring time $t = 10 \text{ min}$

