

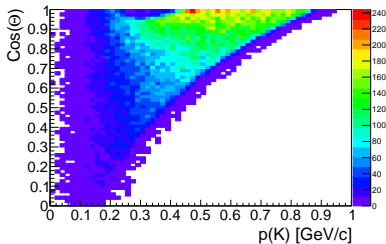
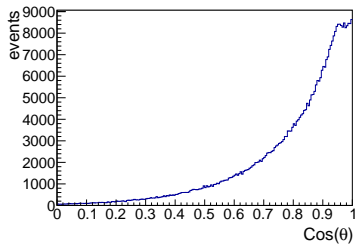
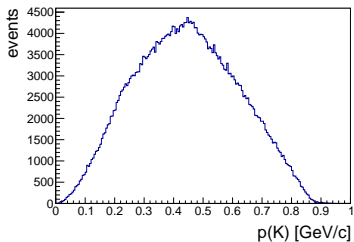
# Analysis of $\bar{p}p \rightarrow \phi\phi$ with PandaRoot

Iman Keshk

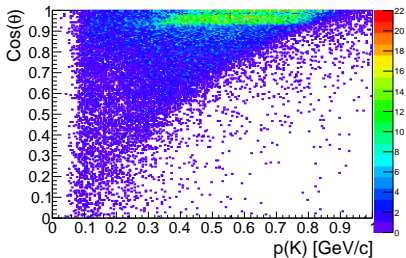
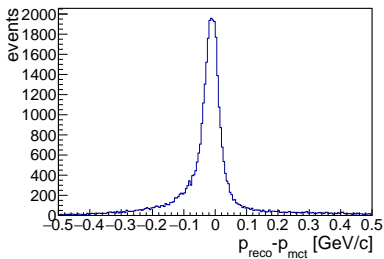
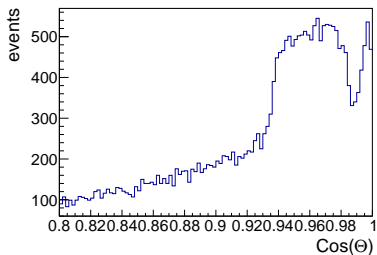
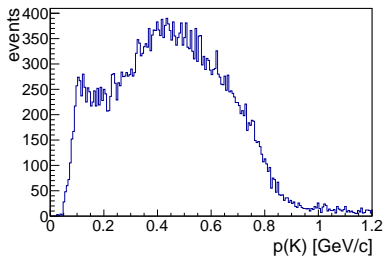
Ruhr Universität Bochum  
Institut für Experimentalphysik I

- 1 PandaRoot release feb17
- 2 100000  $\bar{p}p \rightarrow \phi\phi \rightarrow K^+K^-K^+K^-$  events at  $p_{\bar{p}} = 1.5 \text{ GeV}/c$
- 3 Select kaon candidates from charged tracks with VeryLoose PID criterion
- 4 PidSystems: PidAlgoStt;PidAlgoDrc;PidAlgoMvd
- 5 Create List of  $\bar{p}p$  candidates by forming all combinations of 2  $K^+$  and 2  $K^-$
- 6 Vertex-Fit (RhoKinVtxFitter)  $P_{\bar{p}p} > 0.001$
- 7 4C-Fit (Rho4CFitter)  $P_{\bar{p}p} > 0.001$
- 8 Select combination with min
$$r = \sqrt{(m(K_1K_2) - m_\phi)^2 + (m(K_3K_4) - m_\phi)^2}$$
- 9 Mass window  $r < 10 \text{ MeV}/c^2$

## Generated Monte Carlo Truth



# Reconstructed Kaons



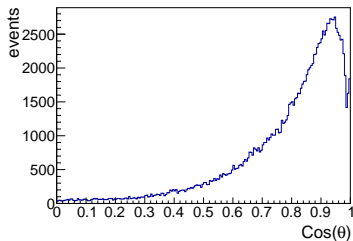
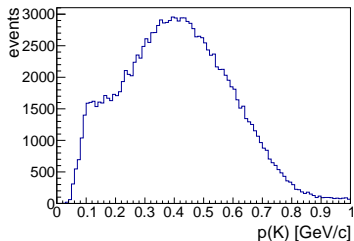
```
{
  UInt_t _uid=0;
  fAllCandList.Cleanup();
  fChargedCandList.Cleanup();
  fNeutralCandList.Cleanup();
  if ( fNeutralCands ) {
    for ( Int_t i1=0; i1<fNeutralCands->GetEntriesFast(); i1++ ) {
      FairRecoCandidate* mic = ( FairRecoCandidate* ) fNeutralCands->At ( i1 );
      _uid++; // uid will start from 1
      RhoCandidate tc ( *_mic, _uid );
      tc.SetTrackNumber ( -1 ); // (i1);
      tc.SetType( 22 ); // default PDG code for neutrals is gamma = 22
      // TODO: Do we want to set something here? It is neutrals anyway.

      if ( 0!=fNeutralProbability && i1<fNeutralProbability->GetEntriesFast() ) {
        PndPidProbability* neuProb = ( PndPidProbability* ) fNeutralProbability->At ( i1 );

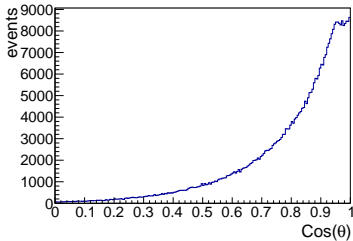
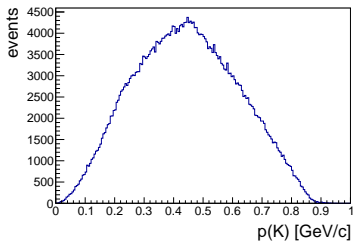
        if ( neuProb == 0 ) {
          Error ( "FillList", "Neutral PID Probability object not found, skip setting pid for candidate %i.", i1 );
          continue;
        }
        // numbering see PndPidListMaker
        tc.SetPidInfo ( 0, neuProb->GetElectronPidProb() );
        tc.SetPidInfo ( 1, neuProb->GetMuonPidProb() );
        tc.SetPidInfo ( 2, neuProb->GetPionPidProb() );
        tc.SetPidInfo ( 3, neuProb->GetKaonPidProb() );
        tc.SetPidInfo ( 4, neuProb->GetProtonPidProb() );
      }
      fAllCandList.Add ( &tc );
    }
  } else {
    if (fVerbose) Warning("PndAnalysis::ReadRecoCandidates()", "No neutral reco array found.");
  }

  if ( fChargedCands ) {
    for ( Int_t i2=0; i2<fChargedCands->GetEntriesFast(); i2++ ) {
      _uid++; // uid will start from (n_neutrals + 1)
      FairRecoCandidate* mic = ( FairRecoCandidate* ) fChargedCands->At ( i2 );
      RhoCandidate tc ( *_mic, _uid );
      tc.SetTrackNumber ( i2 );
      tc.SetType( tc.Charge()*211 ); // default PDG code for charged is pi = +211
      // TODO: Check that no i+1 is requested anymore elsewhere!!!
      fAllCandList.Add ( &tc );
    }
  } else {
    if (fVerbose) Warning("PndAnalysis::ReadRecoCandidates()", "No charged reco array found.");
  }
}
```

reconstructed

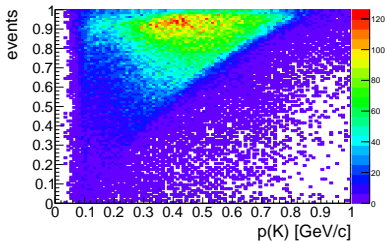


generated Monte Carlo Truth

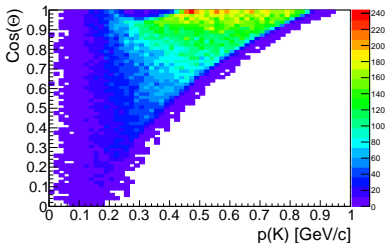


# Momentum Vs. $\text{Cos}(\theta)$

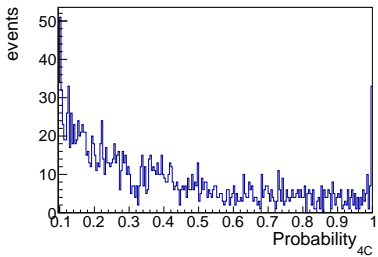
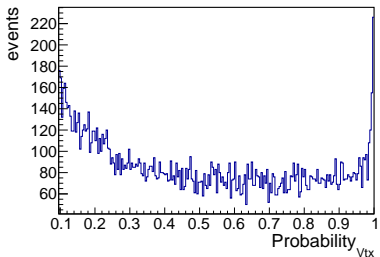
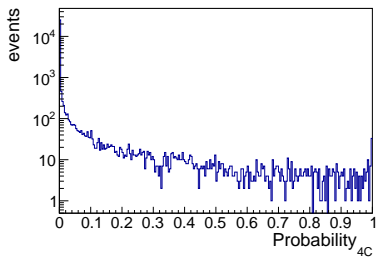
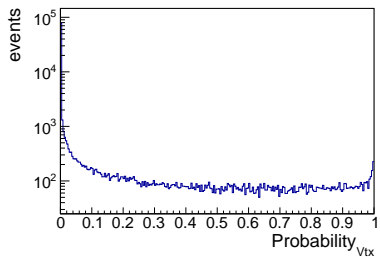
reconstructed



generated Monte Carlo Truth

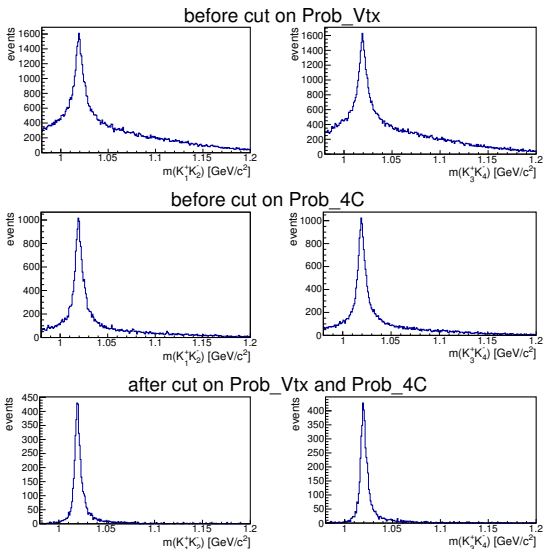


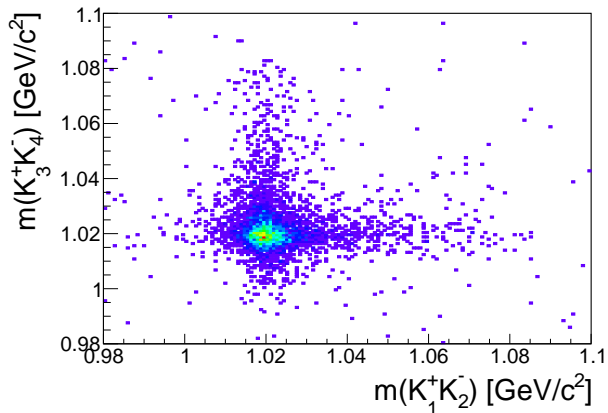
# Probabilities



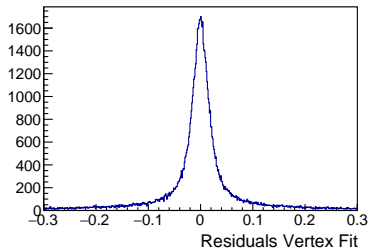
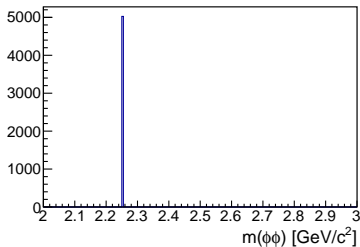
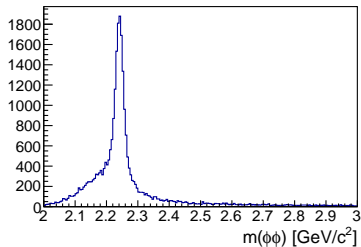
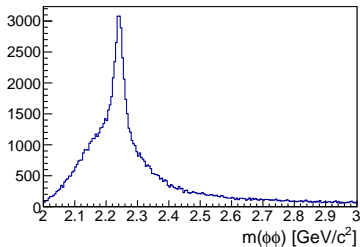


# Reconstructed $K^+K^-$ mass before and after selection criteria



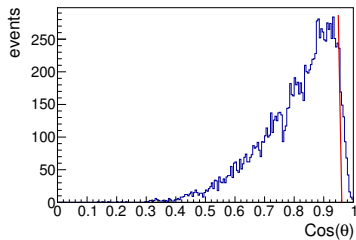
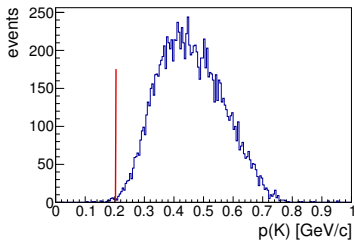


## Reconstructed $\phi\phi$ mass before and after selection criteria

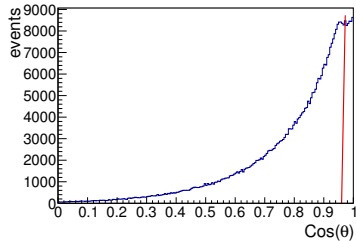
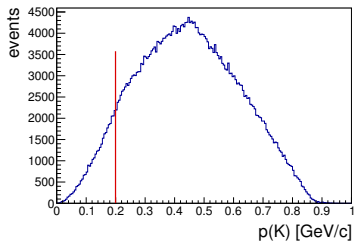


# Mom and Cos( $\theta$ ) after all selection criteria

reconstructed

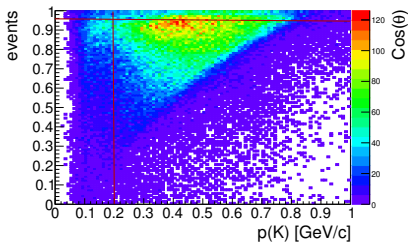


generated Monte Carlo Truth

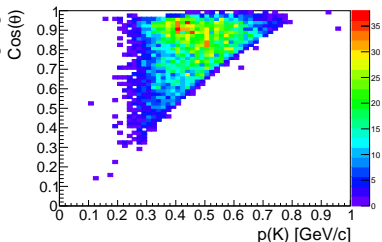


# Momentum Vs. $\text{Cos}(\theta)$

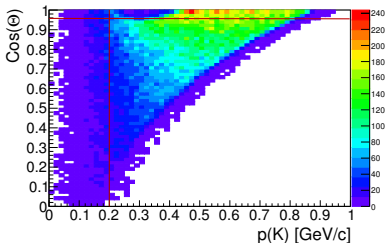
reconstructed before cuts

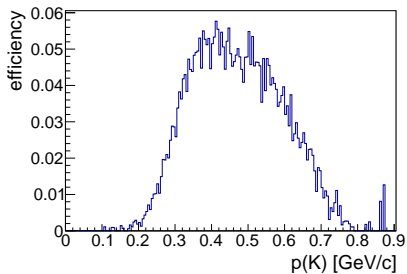
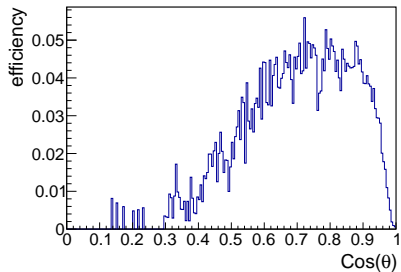


reconstructed after all cuts



generated Monte Carlo Truth





- Charged particles only reconstructed with pion hypothesis in PandaRoot?
- About 20% of events lost in  $\cos(\theta) > 0.96$
- No events reconstructed with  $p_K < 0.2$  GeV (7% efficiency loss)