Hadron Spectroscopy at COMPASS

A selective overview at the QCD10 Montpellier

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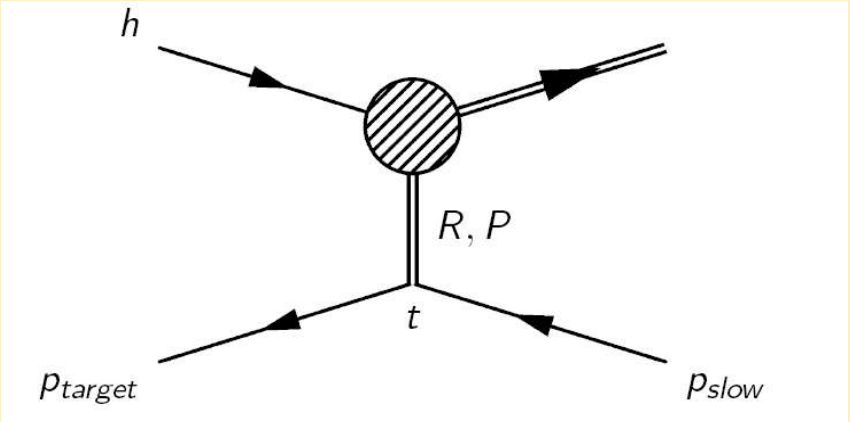
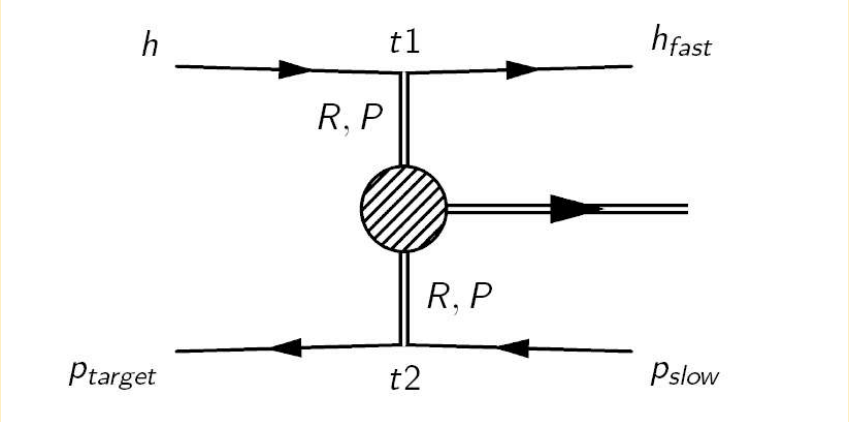
Production mechanisms

Spectroscopy to search for exotic particles with

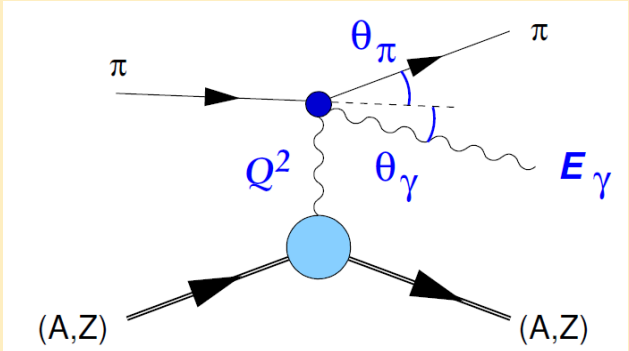
Diffractive Scattering:



Central Production:

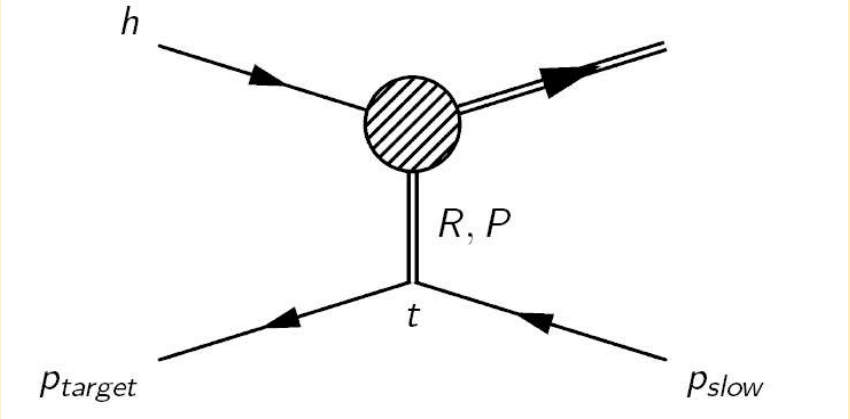


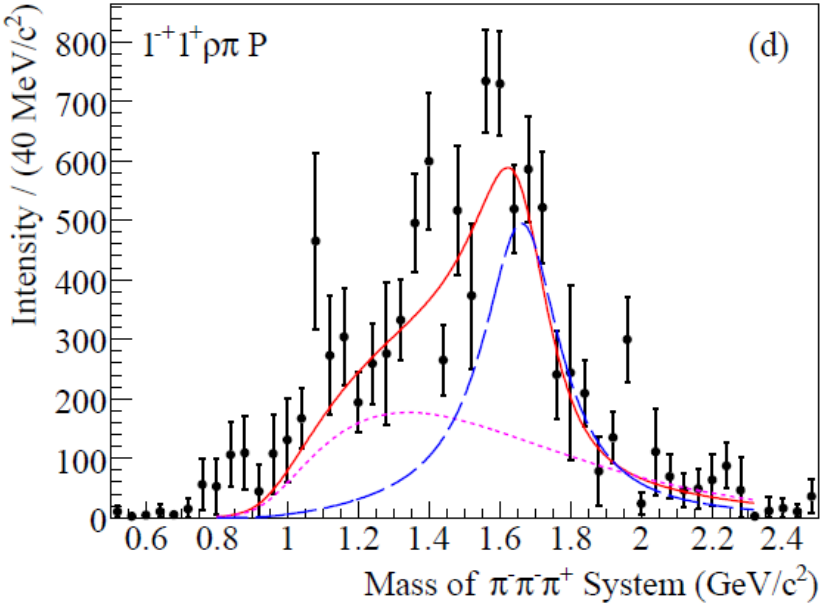
Photon exchange:



Production mechanisms

Diffractive Scattering:

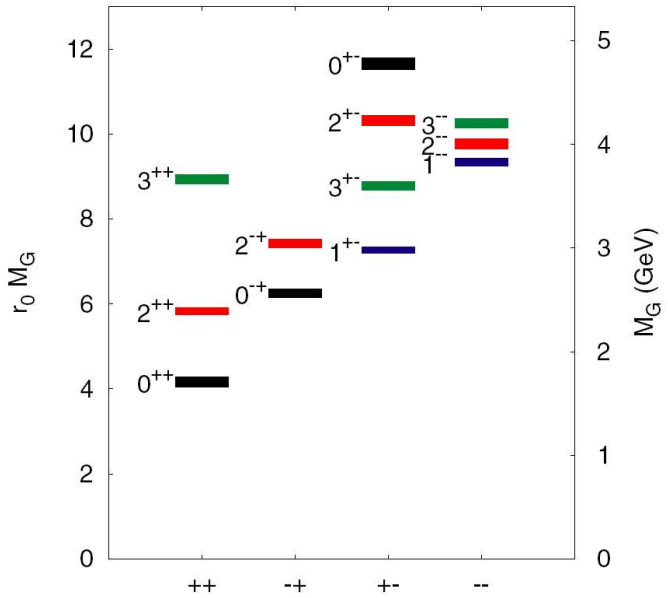




PRL 104, 241803 (2010)

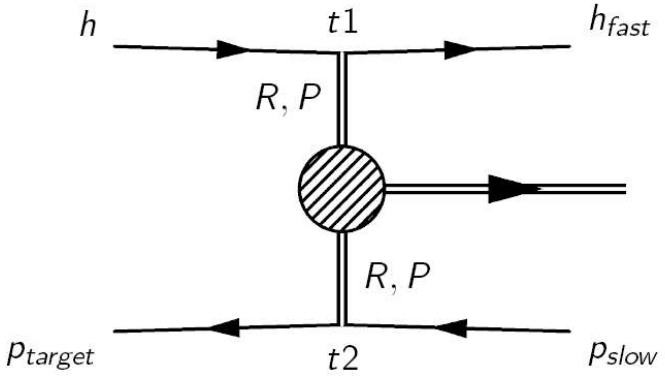
- SPE (single pomeron exchange)
- search for hybrid-candidates: $\pi_1(1600), \pi(1800)$

Production mechanisms



Y. Chen et al., Phys. Rev. D 73, 014516 (2006)

Central Production:



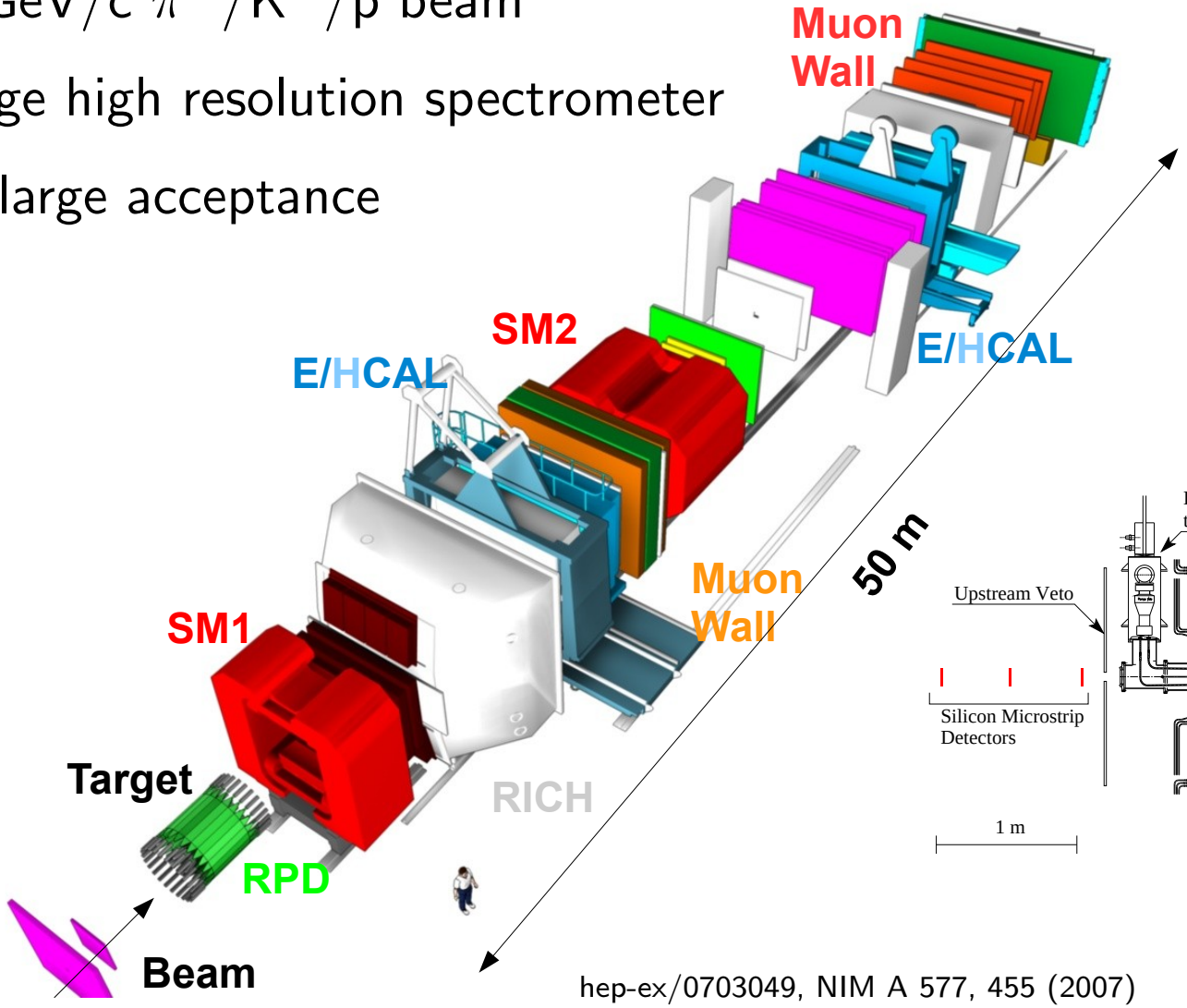
- formation of resonances at central rapidities
- search for glueballs, study flavour-neutral decays
- clarify situation on f_0 resonances

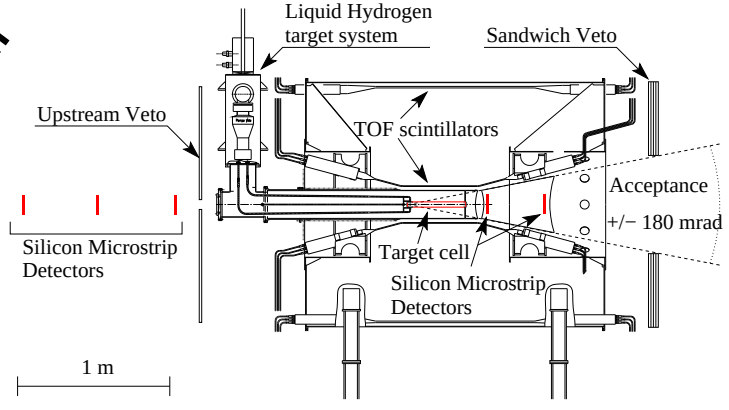
The COMPASS spectrometer at CERN

190 GeV/c $\pi^{\pm}$/K$^{\pm}$/p beam

2 stage high resolution spectrometer

with large acceptance

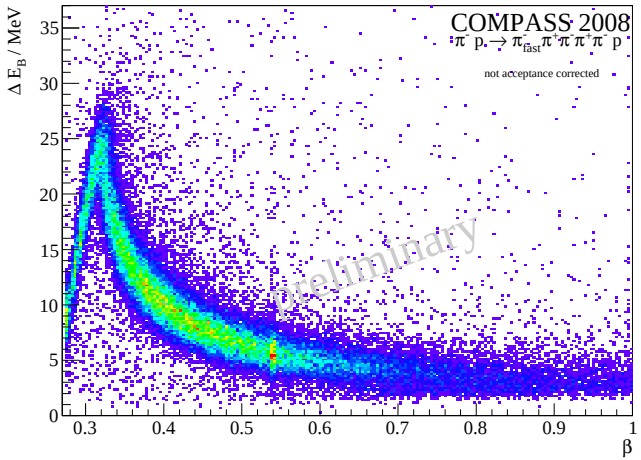


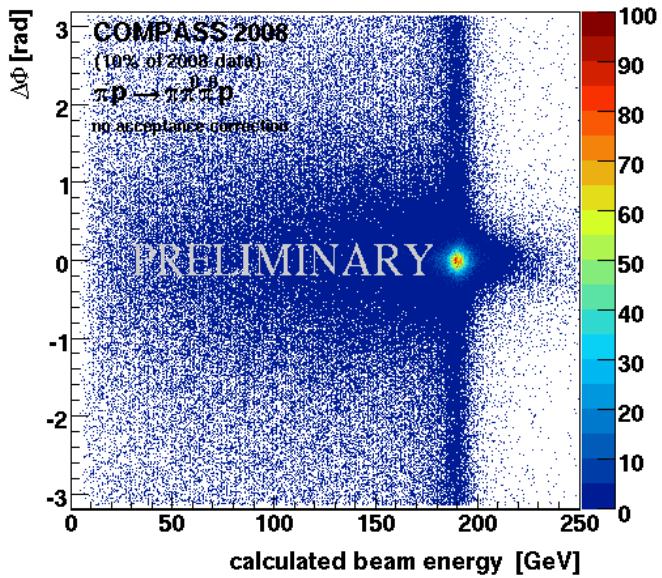


hep-ex/0703049, NIM A 577, 455 (2007)

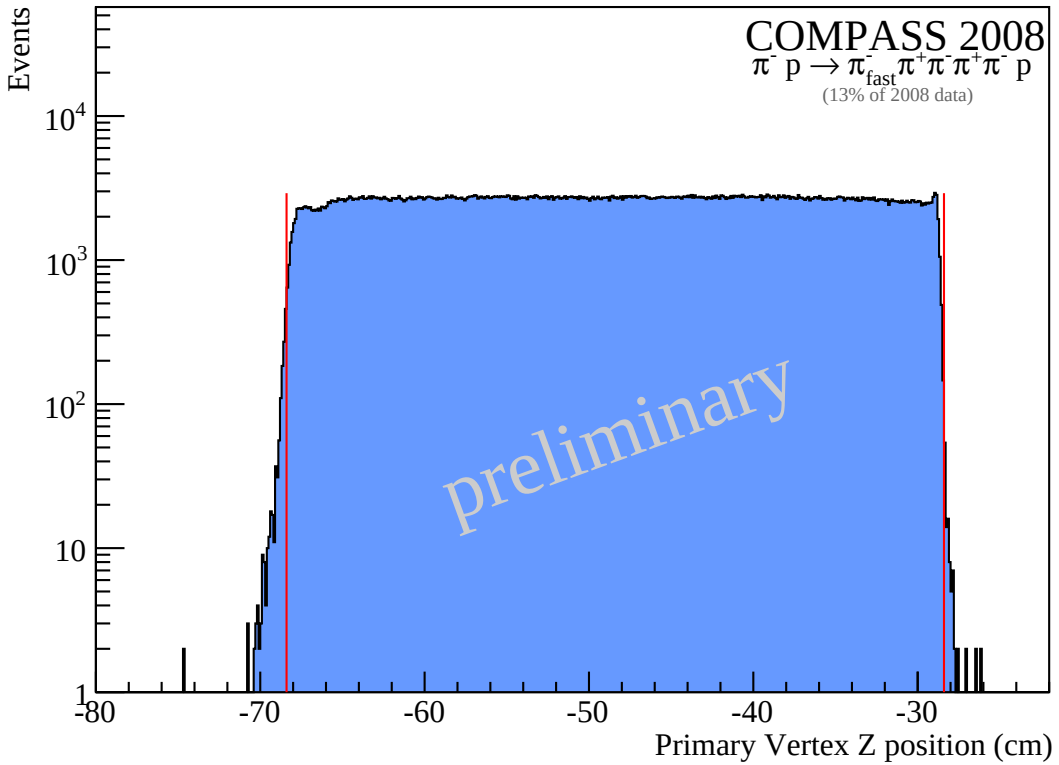
Event selection

Clean trigger due to Recoil Proton Detector





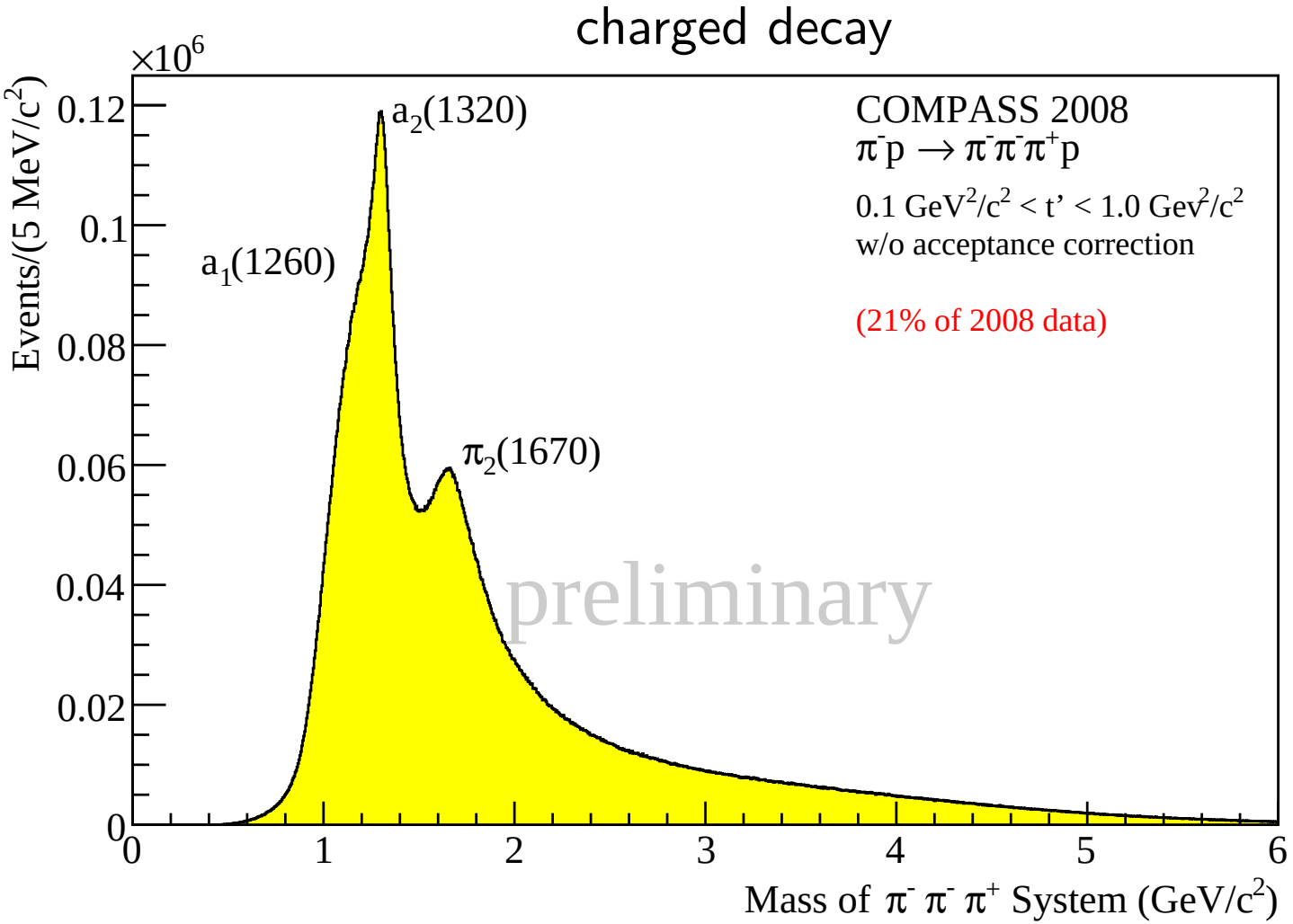
Event Selection is similar for most of the channels:



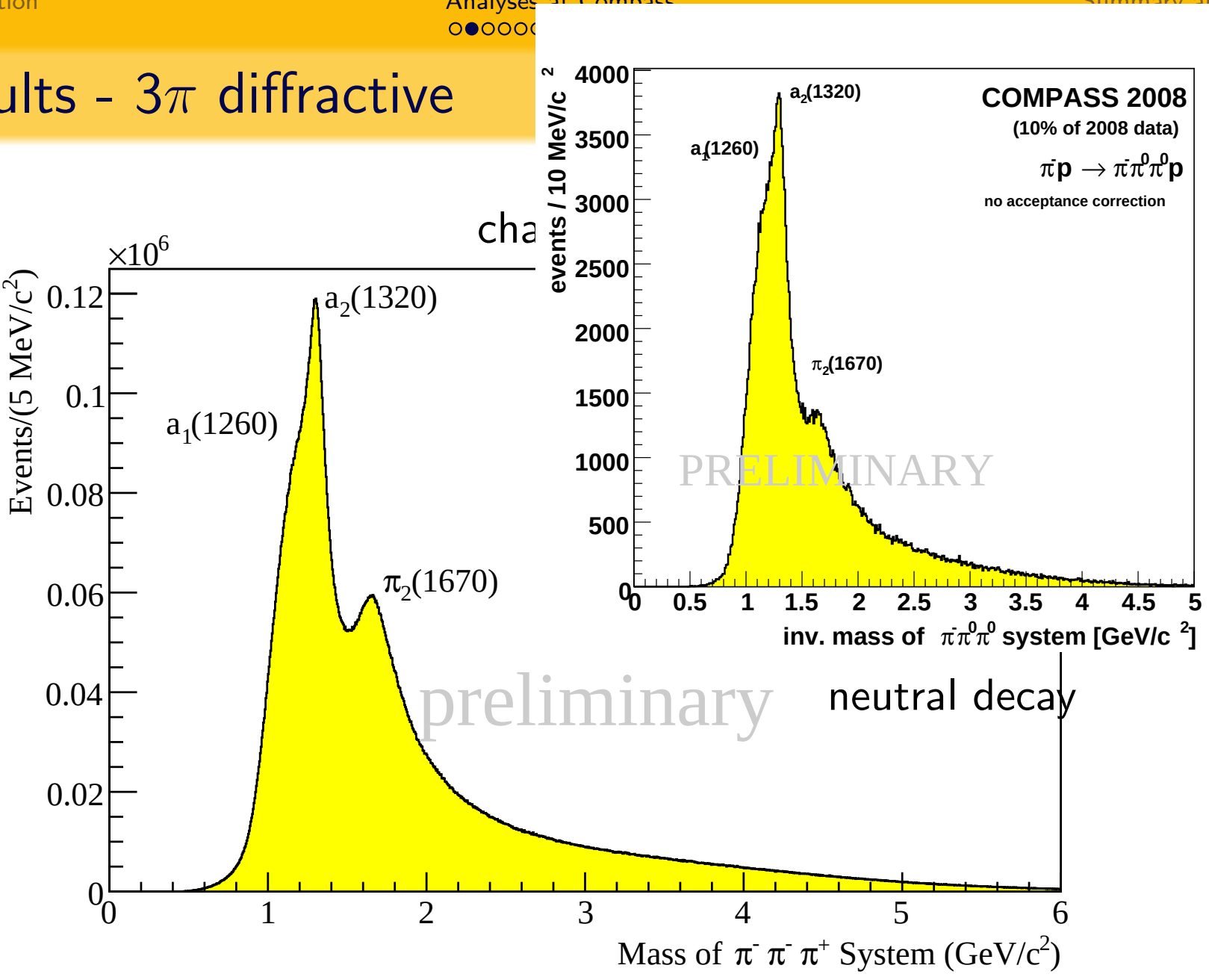
Vertex selection

Exclusivity

Results - 3π diffractive

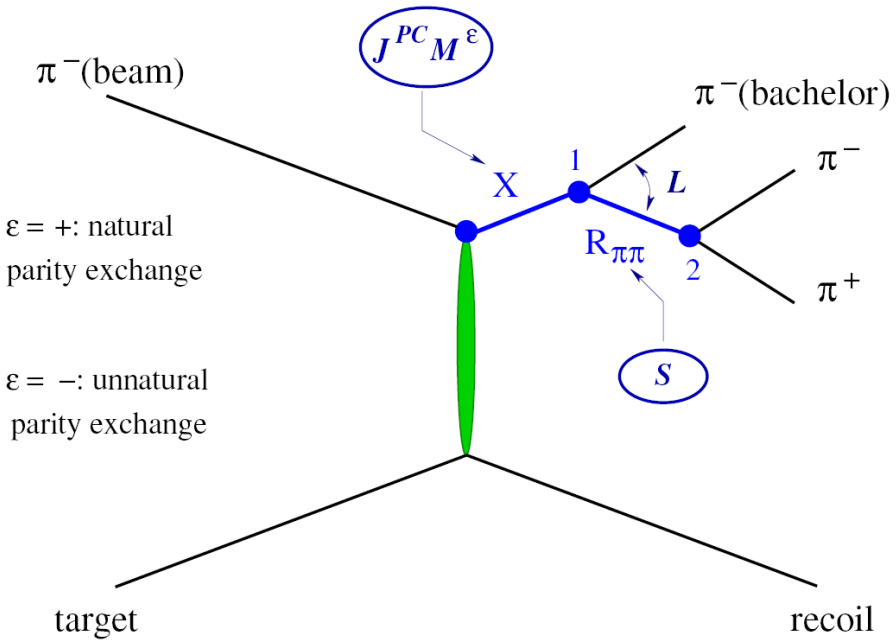


Results - 3π diffractive



Partial wave analysis - 3π diffractive

Analyse decay in the *isobar model*:

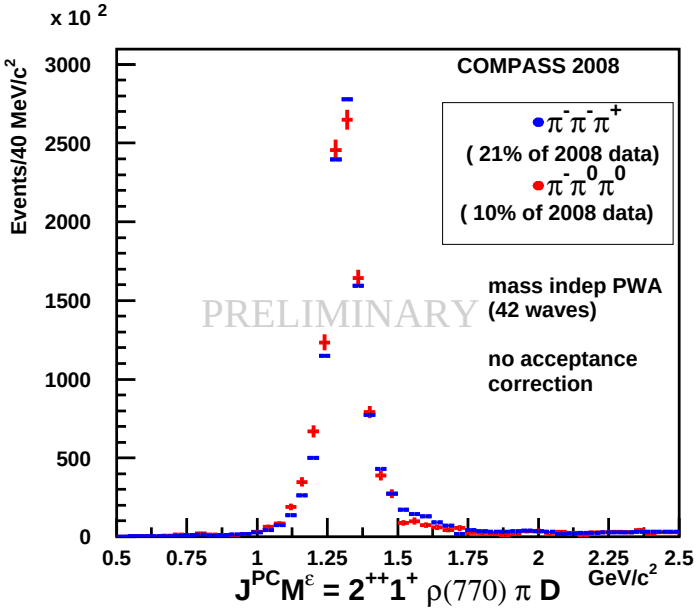


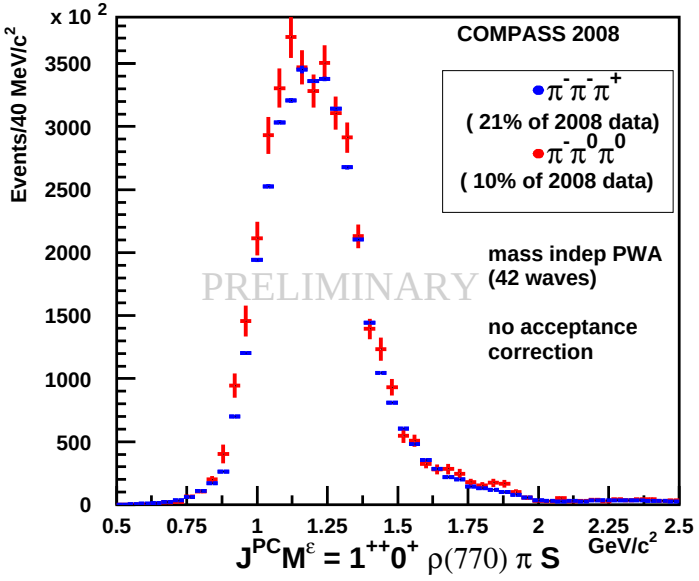
- intermediate two-particle decays
- *reflectivity* basis
- amplitudes in the *helicity* formalism:
  expand to D-Functions or Zemach-Tensors

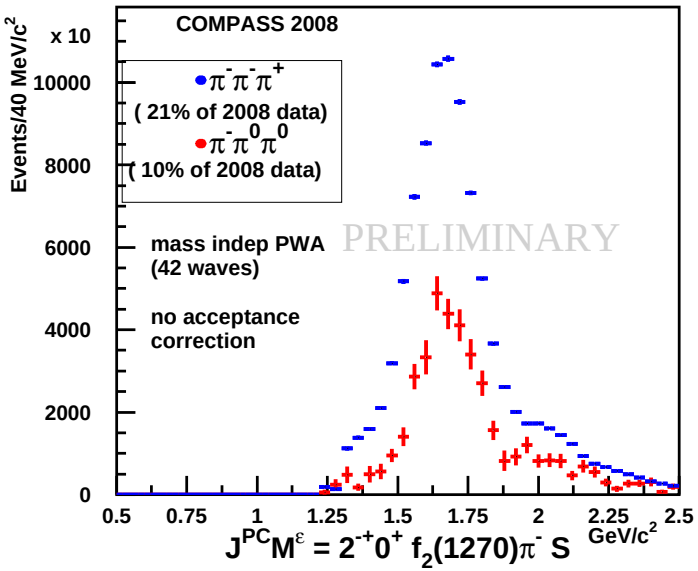
two-step-fit:

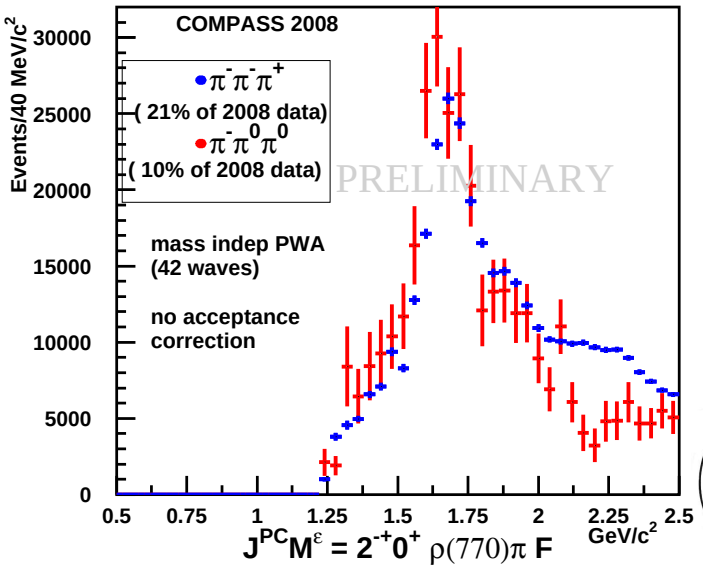
1. Mass-independent PWA in $40 MeV/c^2$ bins
   - extended log-Likelihood fit with an extended set of waves (42)
   - acceptance corrected
2. Mass-dependent χ^2 fit
   - contains the 6 dominant waves
   - Breit-Wigner parametrization of the resonances

Results - 3π diffractive



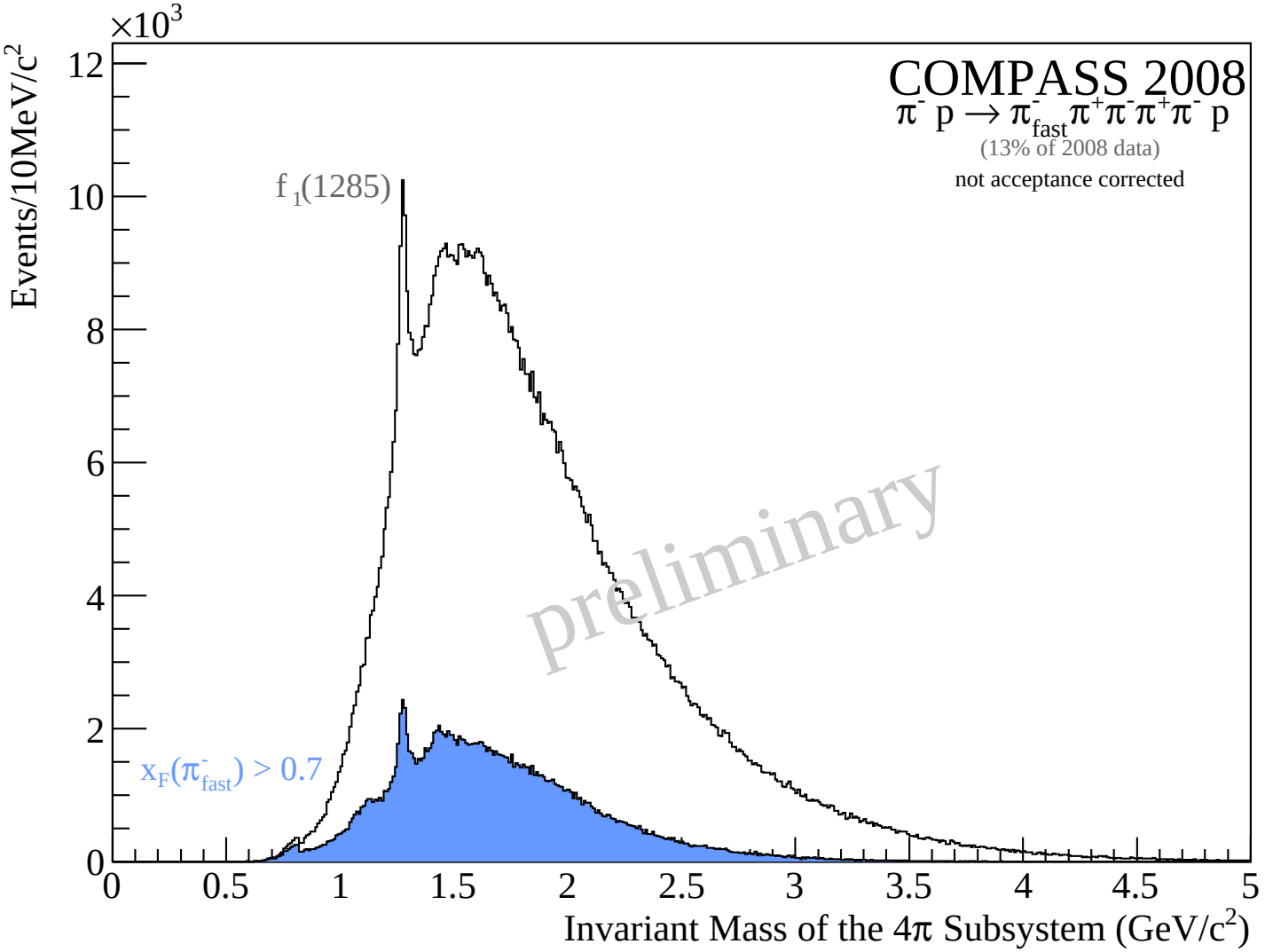






Selected results from other channels

Central production - $\pi^- p \to \pi^-_{fast}(\pi^+\pi^-\pi^+\pi^-)p_{recoil}$



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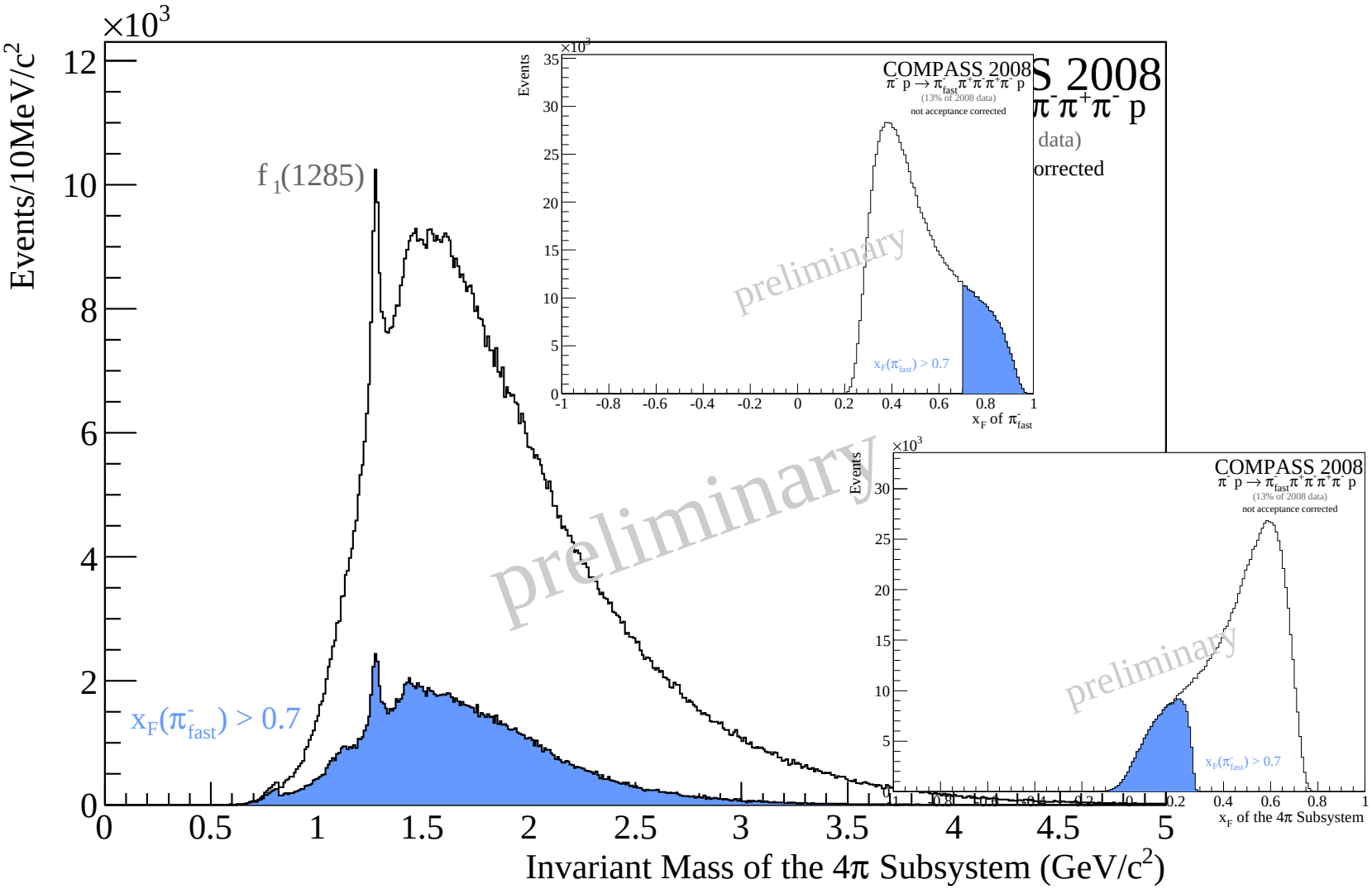
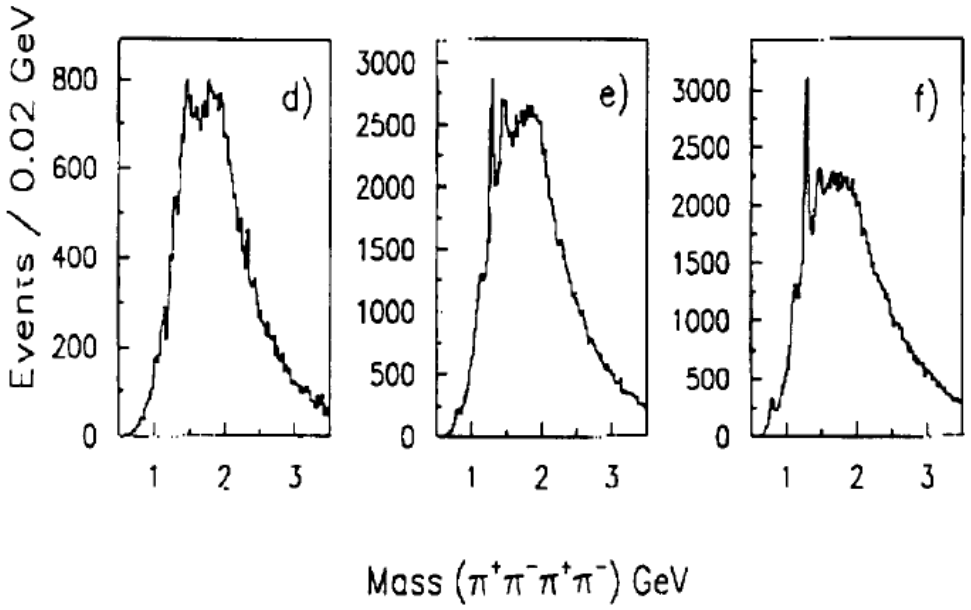
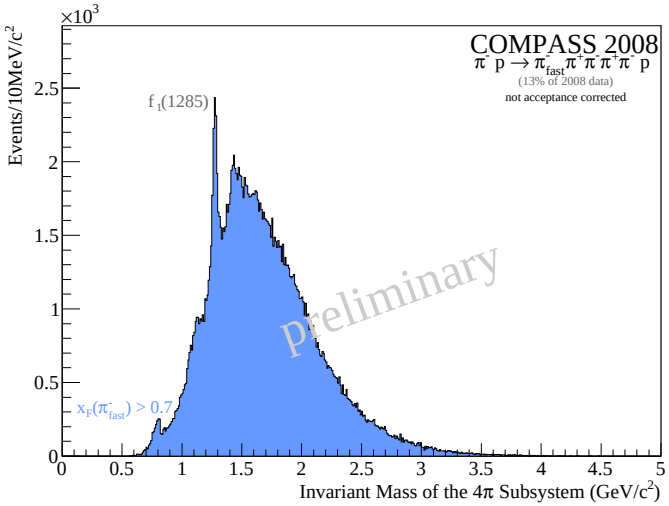


Selected results from other channels cntd.





$$dP_t = p_t^{recoil} - p_t^{fast}$$

WA102:

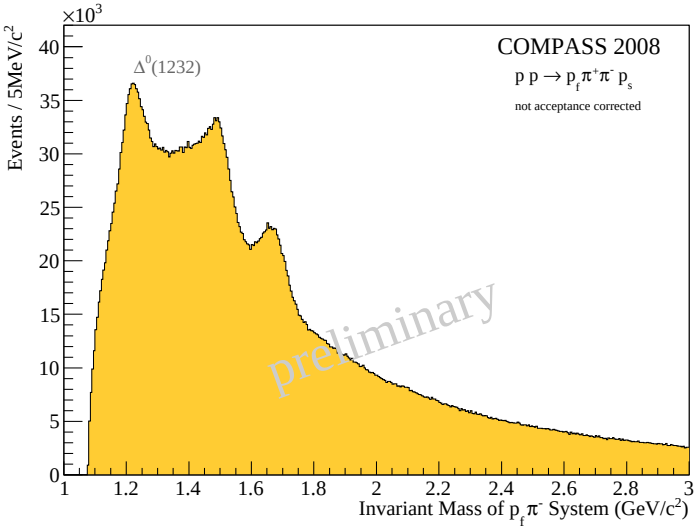
d) $dP_t < 0.2$ GeV

e) 0.2 GeV $< dP_t < 0.5$ GeV

f) $dP_t > 0.5$ GeV

COMPASS: all dP_t up to now, binning in dP_t with the full data set to come

Selected results from other channels cntd.

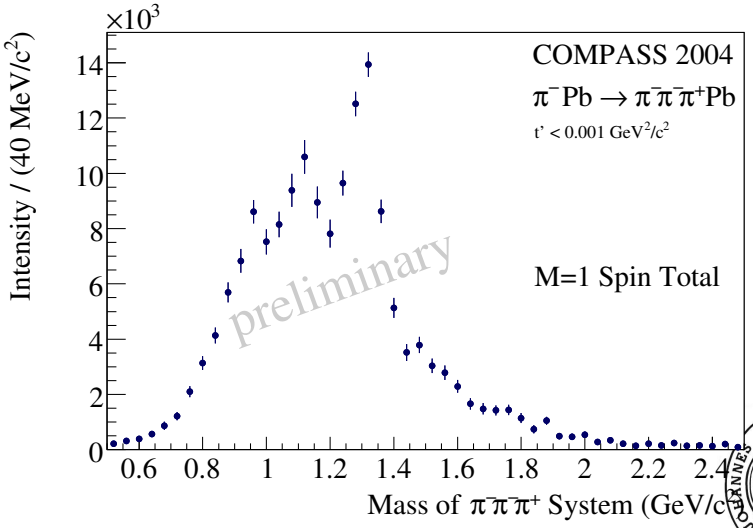


Baryon spectroscopy

- Hadron campaign not only for mesonic resonances
- high statistics on baryons
- proton beam with no acceptance cut on the forward direction

Analyses in different t regimes

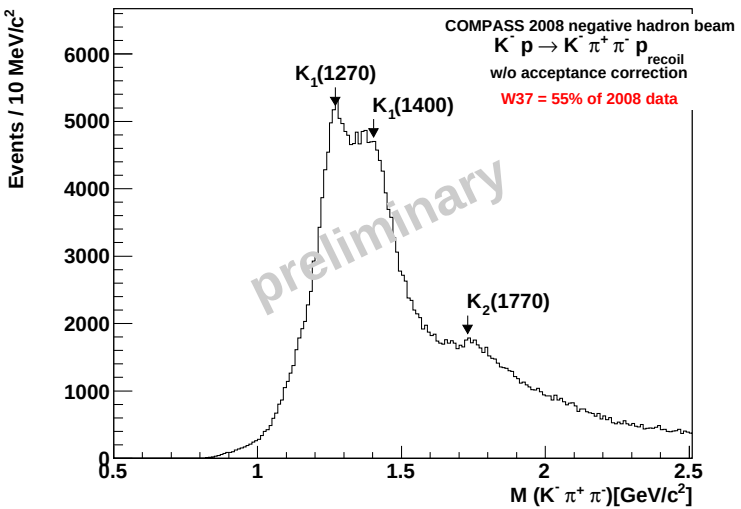
- access to t regimes from very low t (Primakoff) up to high $t > 1\,\mathrm{GeV}^2$
- measurements with different target materials (H_2, Pb, W, Cu)



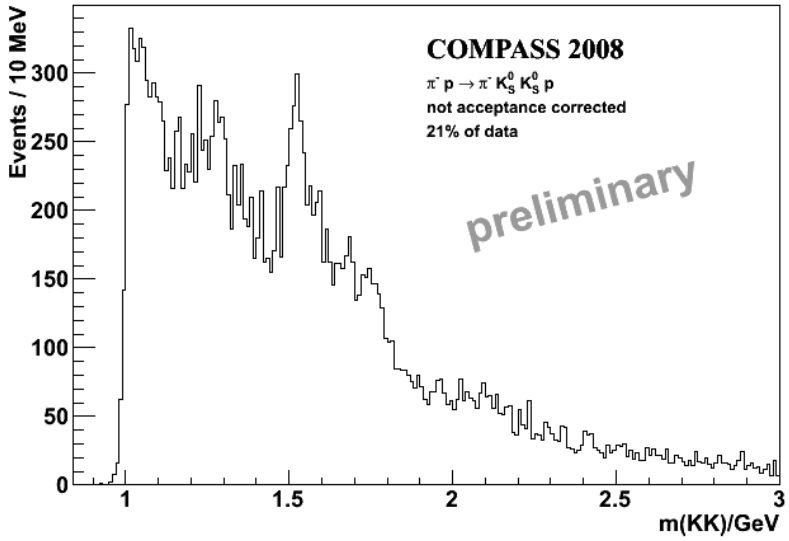
Selected results from other channels cntd.

Kaonic beams

- kaon component in the beam
- study resonances with strangeness



Kaon beams



Channels with final state kaons

- interesting for flavour-neutral resonance decays (glueballs)
- access to higher mass ranges

Summary and Outlook

- COMPASS Hadron program - a first glance at upcoming results
- huge amount of data, mostly 200x more than previous experiments
- access to basically all decay modes (charged/neutral/kaonic)
- analyses with $\pi^{\pm}$/$K^{\pm}$/p beams on H_2,Pb,Cu,W targets
- Partial Wave Analysis started for a lot of channels

Next steps:

- acceptance corrections to be completed 2008/2009 data
- introduce the next level of event selection (eg. glueball filter)
- include both central and diffractive mechanisms in the PWA
- coupled channels analysis