

1. Motivation

OZI rule:

- states processes with disconnected quark lines are forbidden¹
- explains phenomenologically suppressed decay modes and production of vector mesons

Prediction for ratio of ϕ / ω production²:
 $R = \sigma(AB \rightarrow X\phi) / \sigma(AB \rightarrow X\omega) = 4.2 \cdot 10^{-3}$
 with A and B hadrons

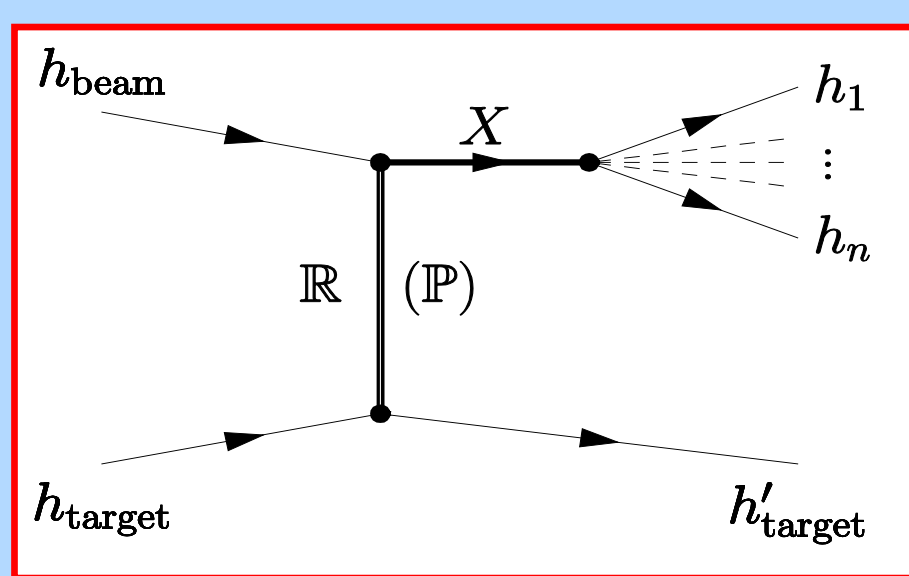
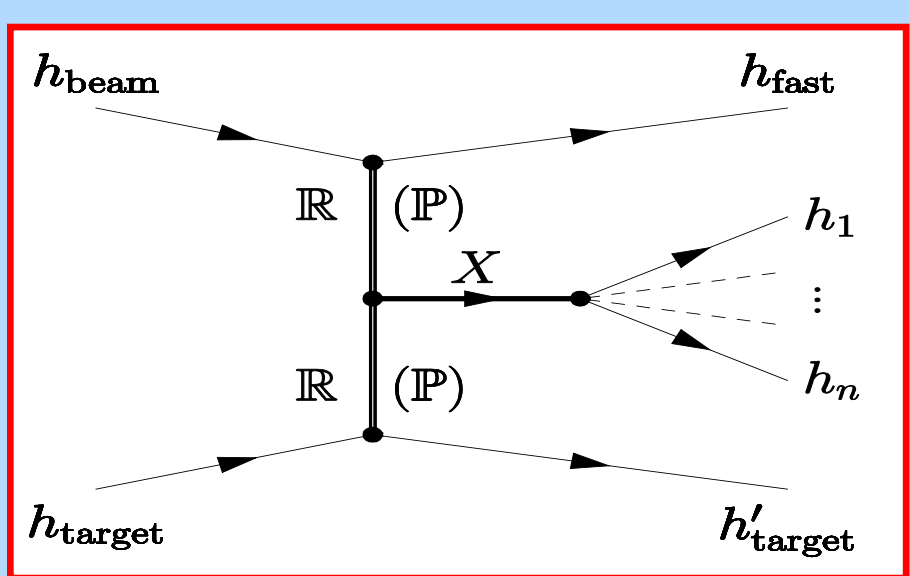
Several violations found, possible explanations:

- gluonic intermediate states³
- polarised hidden strangeness component in the nucleon⁴

Different production mechanisms available for a study at COMPASS:

Central production

Diffractive production

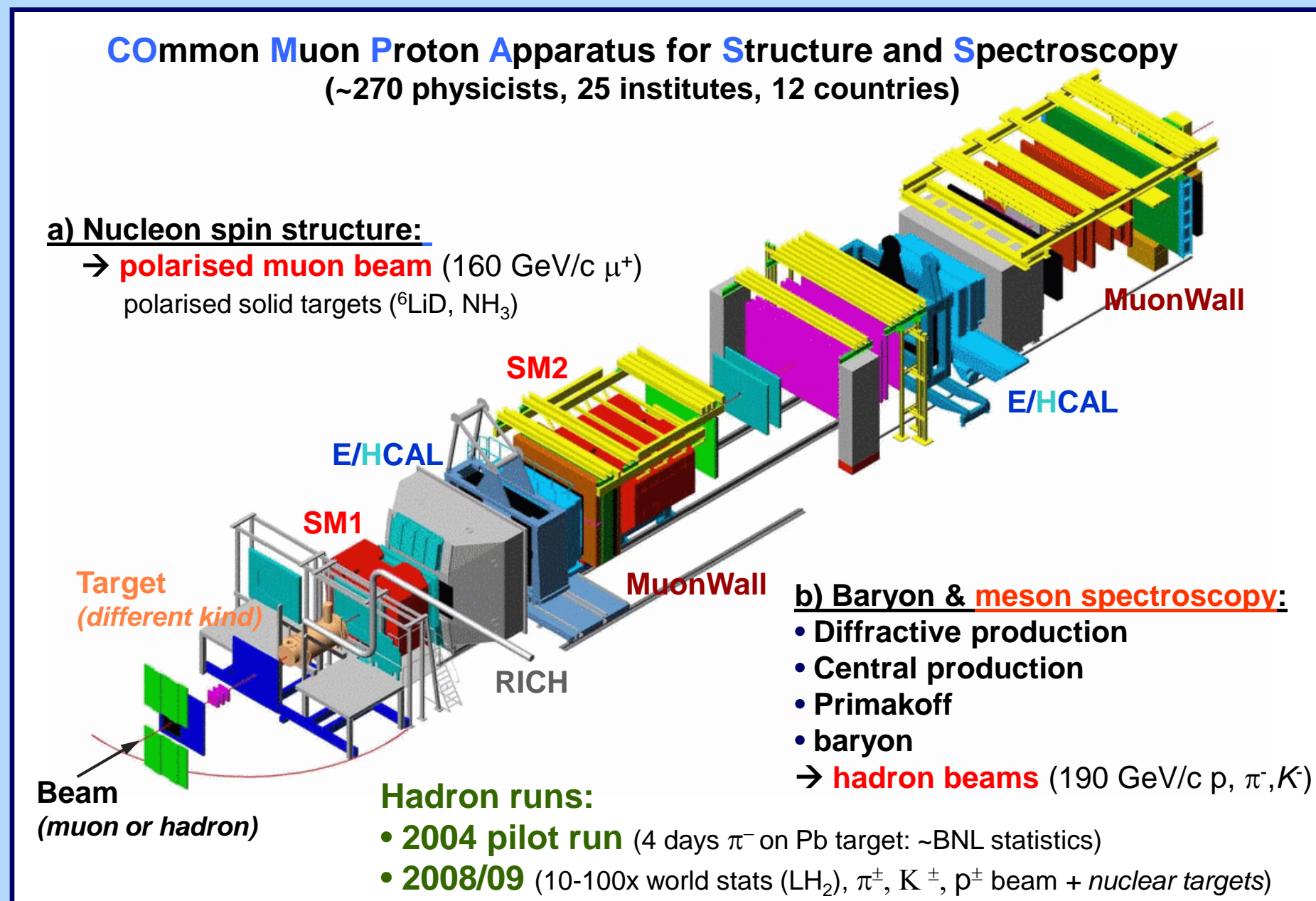


- [1] S. Okubo, Phys. Lett. 5 (1963) 165, G. Zweig, CERN report TH-401 (1964), J. Iizuka, Prog. Theor. Suppl. 38 (1966) 21f
- [2] H.J. Lipkin, Phys. Lett. B 60 (1976) 371
- [3] S. J. Lindenbaum, Nuovo Cim. 65 A (1981) 222
- [4] J. Ellis et al. Phys. Lett. B 353 (1995) 319, J. Ellis et al. Nucl. Phys. A 673 (2000) 256

2. The COMPASS experiment

- two stage spectrometer
- high resolution, large acceptance
- ~250 000 read-out channels, ~1 PB / year

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



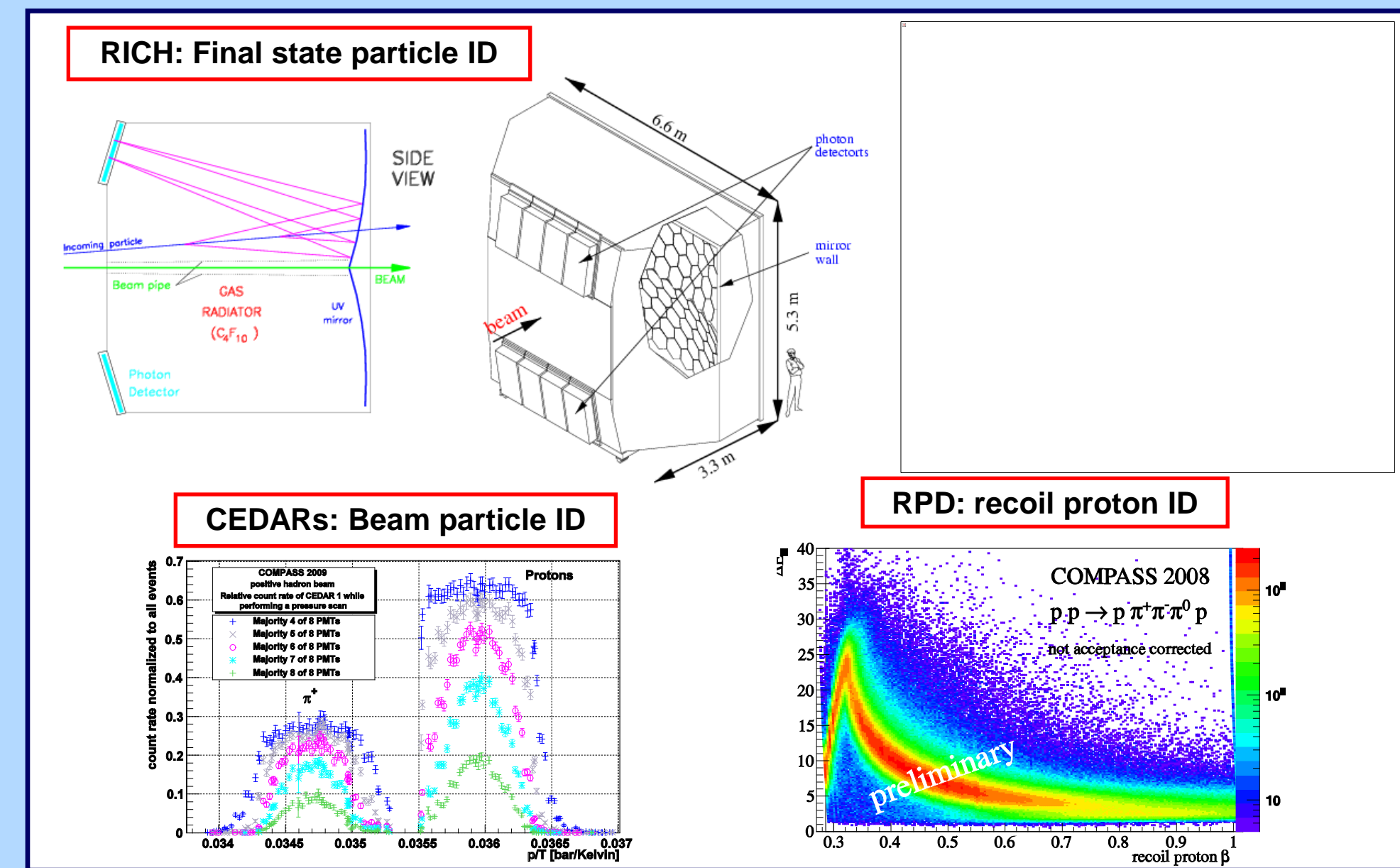
Experimental setup 2008/09:

- 190 GeV/c beam (π^\pm, K^\pm, p), liquid H₂ target
- new pixelised tracking detectors
- new recoil proton detector RPD (exclusive trigger)
- 2 CEDARs (beam particle PID)
- Calorimetry in both stages – upgraded 2008/09
- RICH in 1st stage – upgraded in 2006

[NIM-A587:371-387, 2008], [NIM-A616:21-37, 2010]

[Hadron set-up 08/09, NIM A, in preparation (2011)]

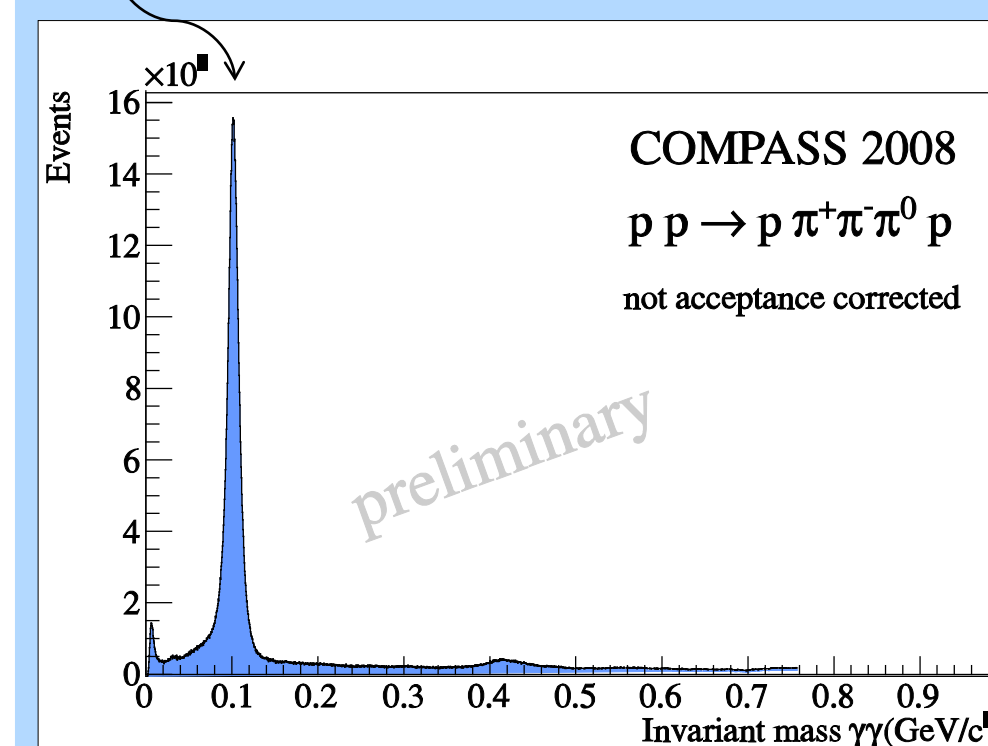
3. Event selection



- Event selection, common cuts for ϕ / ω :**
- primary vertex in target volume
 - three charged tracks, charge conservation
 - beam proton (tagged with CEDARs)
 - recoil proton (tagged by RPD)

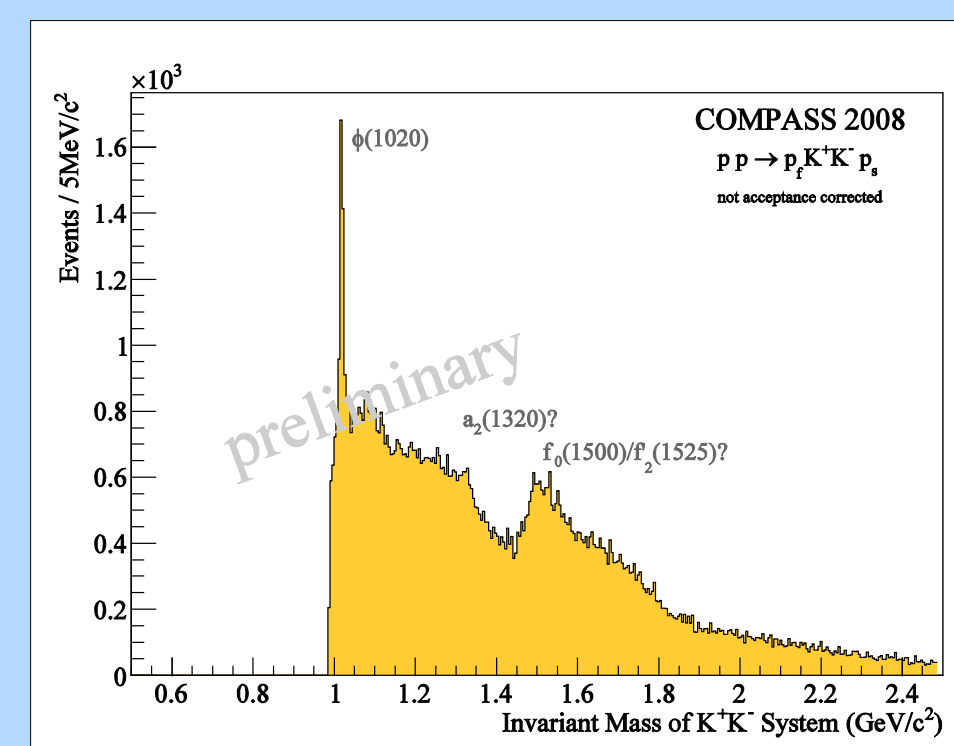
Selection for ω :

- π^0 candidate from ECALs

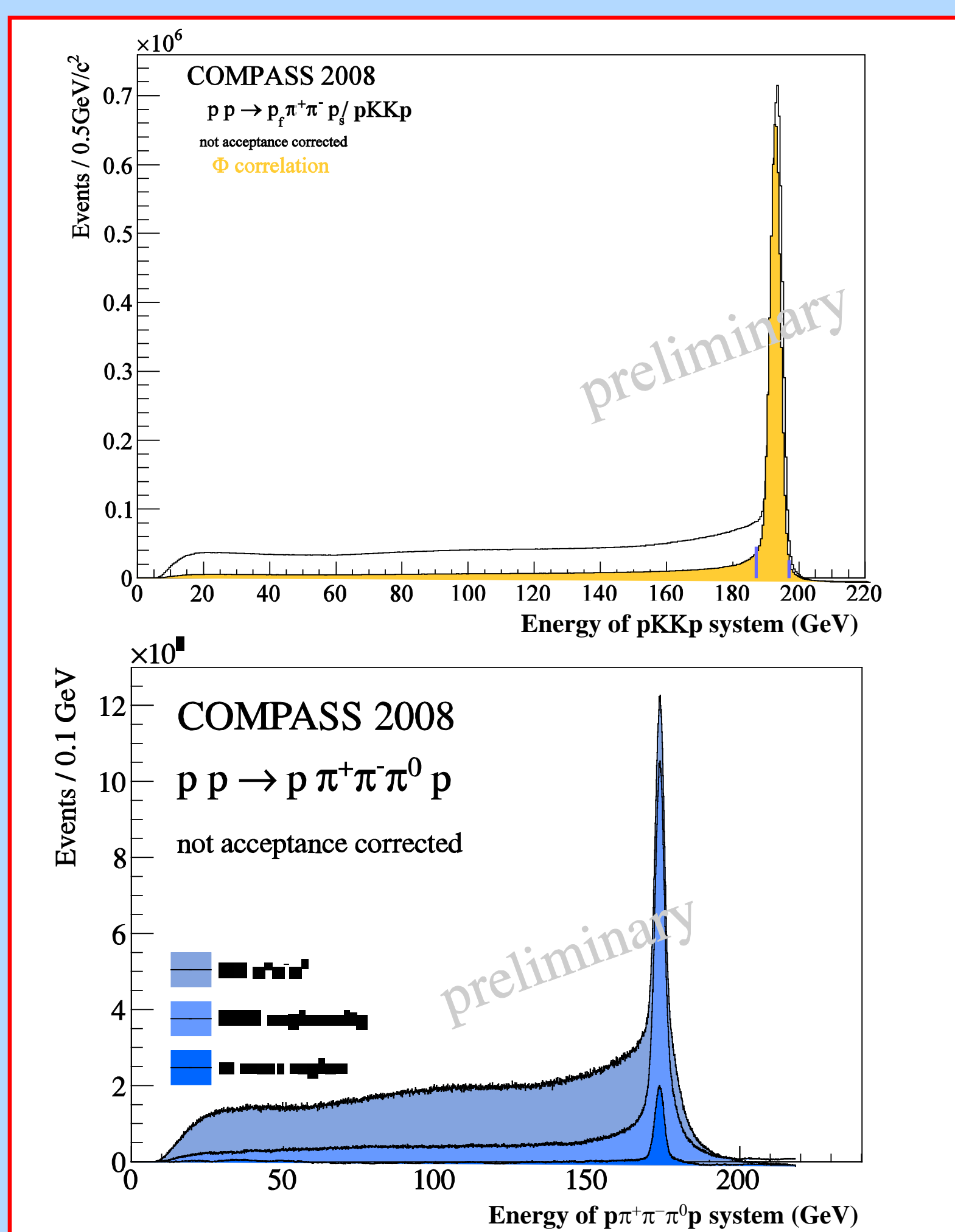


Selection for ϕ :

- Kaon ID with RICH

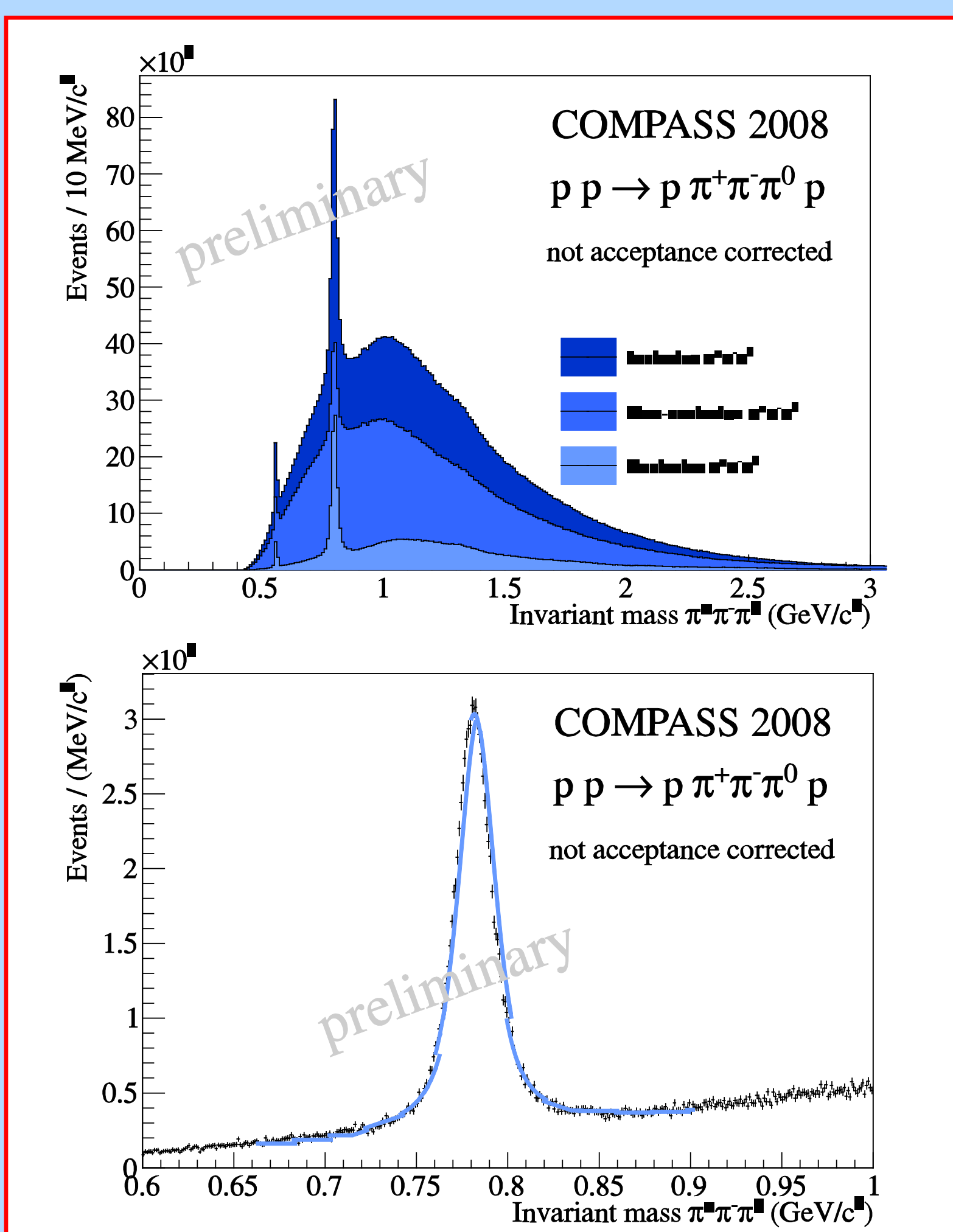


4. Exclusivity



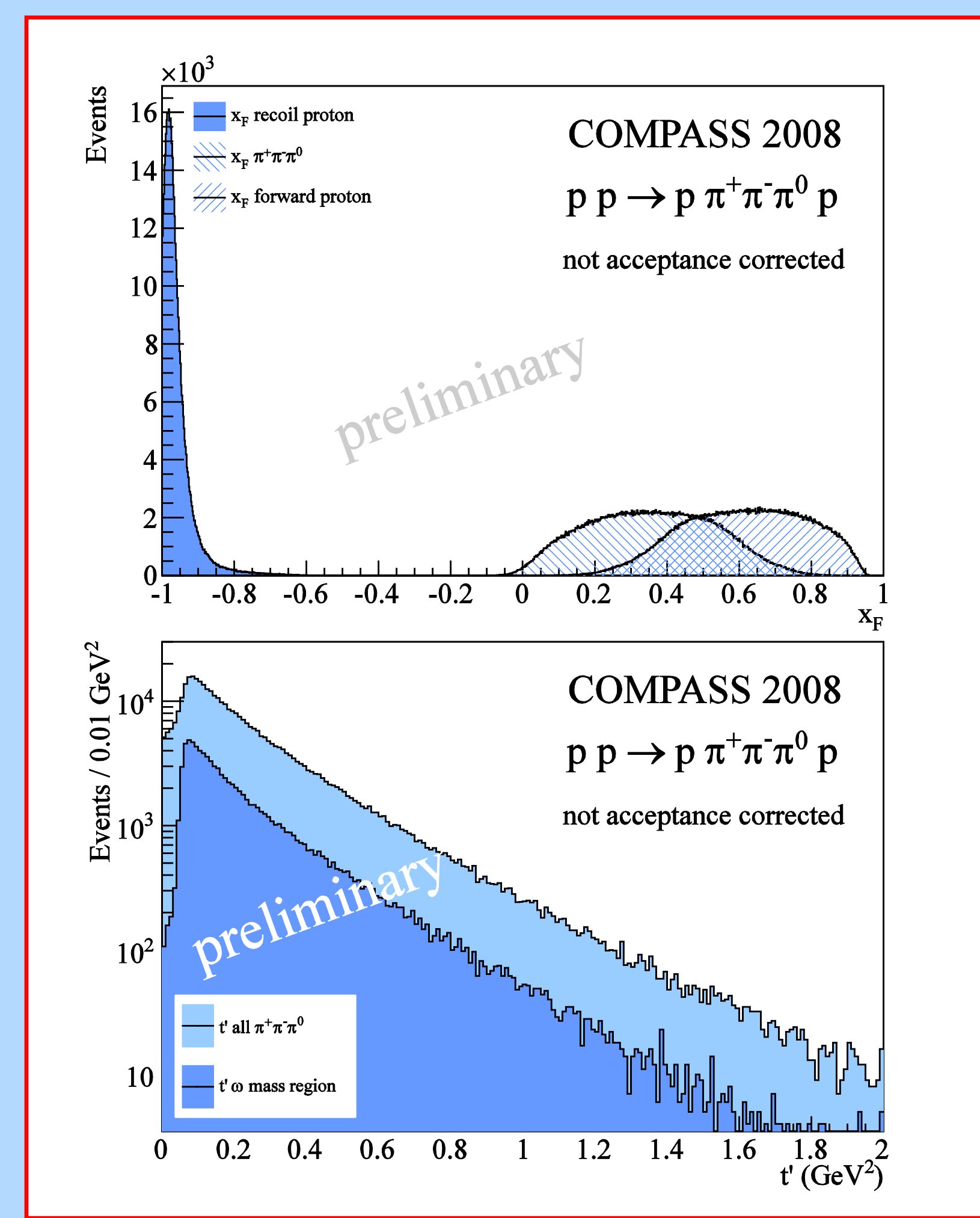
- Exclusive sample is selected by restricting
- energy of total forward system to beam energy
 - angular correlation of recoil proton with forward system (azimuthal)

5. Invariant masses



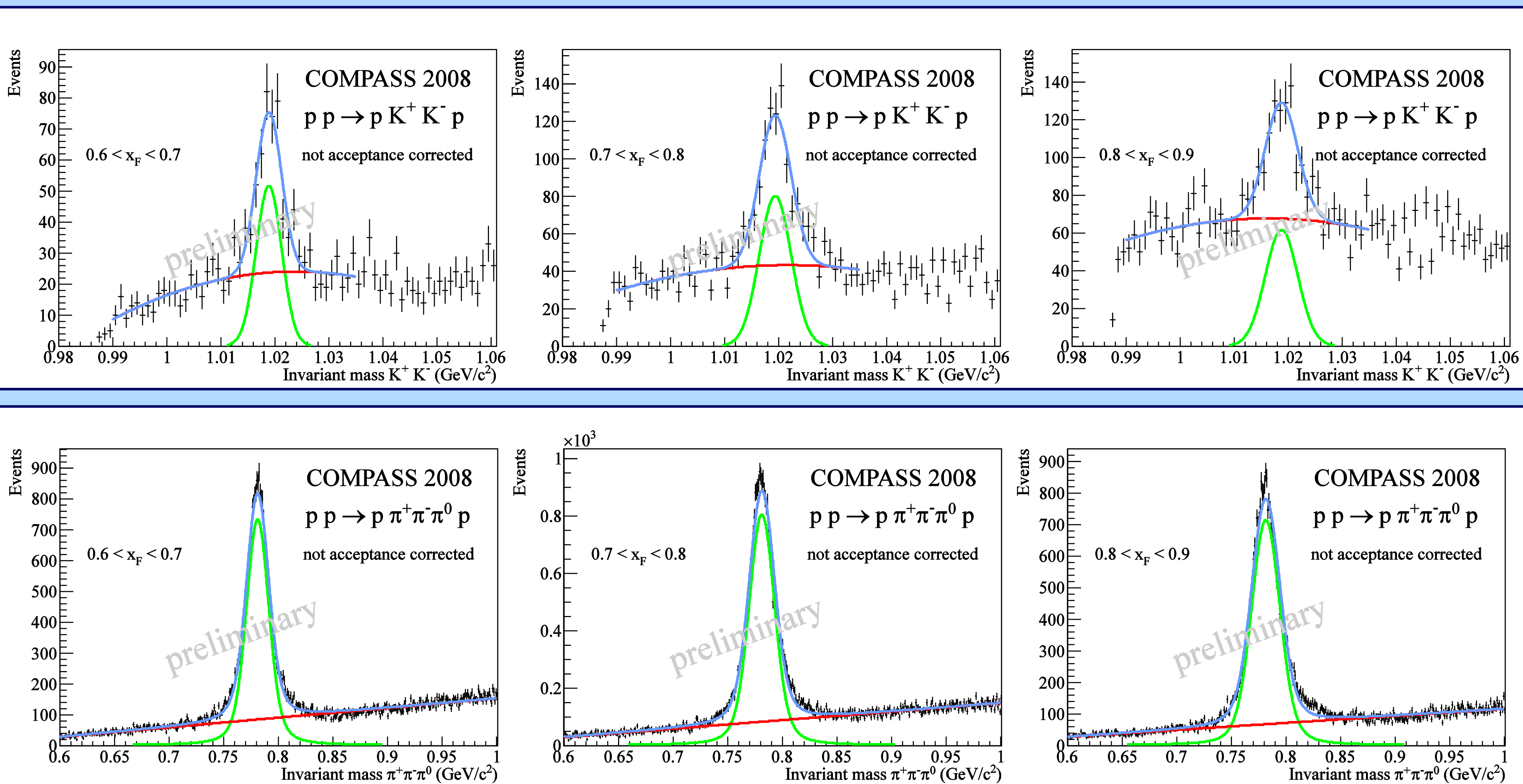
- Top: impact of exclusivity cuts in the $\pi^+\pi^-\pi^0$ invariant mass distribution
 Bottom: example fit of $\pi^+\pi^-\pi^0$ system with Breit-Wigner, folded with Gaussian and background to obtain number of ω

6. Kinematics



- Top: x_F distributions for the $\pi^+\pi^-\pi^0$ system, the recoiling and the fast proton
 Bottom: t' distribution for the $\pi^+\pi^-\pi^0$ system and restricted to the ω

7. Results in different x_F (fast proton) ranges



- Top: Fit of ϕ yield in different x_F bins. The data is not yet acceptance corrected.
 Bottom: Fit of ω yield in the same x_F binning.
 Blue: fit, red: background, green: peak

8. Summary & outlook

COMPASS:

- test of OZI rule with high statistics and precision
- compare yield with different beams (p, K, π)
- measurement of ϕ / ω with the same setup at the same time
- measure at higher energies compared to former experiments
- OZI study: hadron physics programme profits from better understanding of production processes

Outlook:

- so far only one week of data taking in 2008 used (10% of 2009 data)
- study spin alignment of vector mesons
- 2D binning in t' and x_F

ongoing:

- acceptance studies
- improve background estimation
- processing of 2009 data