

Status

Mainz Gruppenmeeting

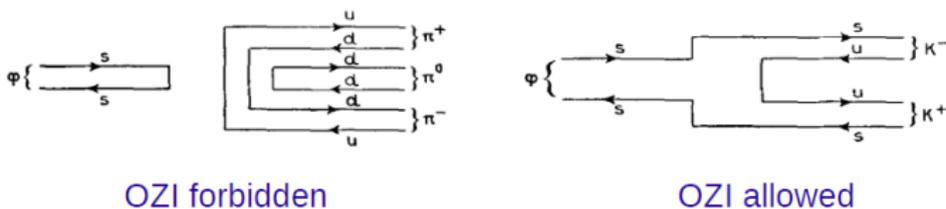
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Institut für Kernphysik Mainz

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Motivation

Okubo-Zweig-Iizuka rule¹: processes with disconnected quark lines suppressed



Calculation² for $\phi(1020)$ to $\omega(782)$ production ratios (A and B non-strange hadrons), not corrected for phase-space:

$$\sigma(AB \rightarrow \phi X) / \sigma(AB \rightarrow \omega X) = 4.2 \cdot 10^{-3}$$

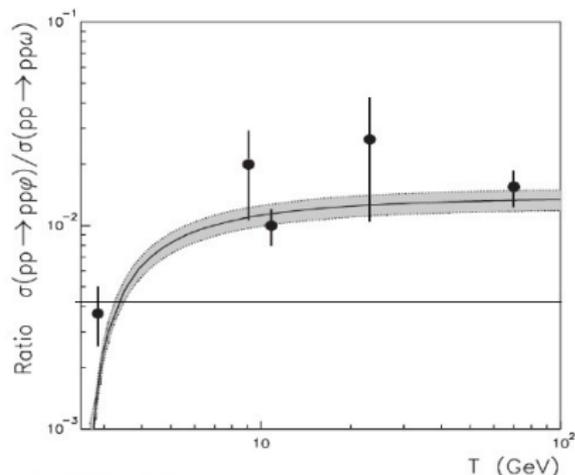
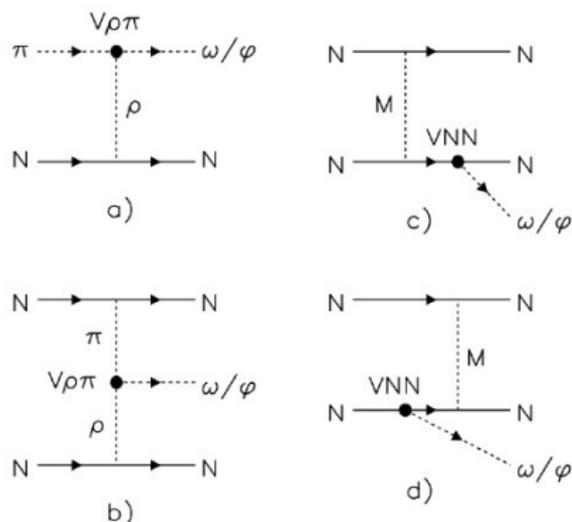
Numerous violations observed, possible explanations:

- reactions on nucleons: strangeness content of the nucleon enhances $s\bar{s}$ production
- intermediate (gluon-rich) states
- differences in production mechanisms

¹S. Okubo, Phys. Lett. 5(1963)165, G. Zweig, CERN report TH-401(1964), J. Iizuka, Prog.Theor.Suppl.38(1966)21

²H.J. Lipkin, Phys. Lett. B 60 (1976) 371

Violations of the OZI rule / COMPASS



No data available for higher energies³

Study at COMPASS:

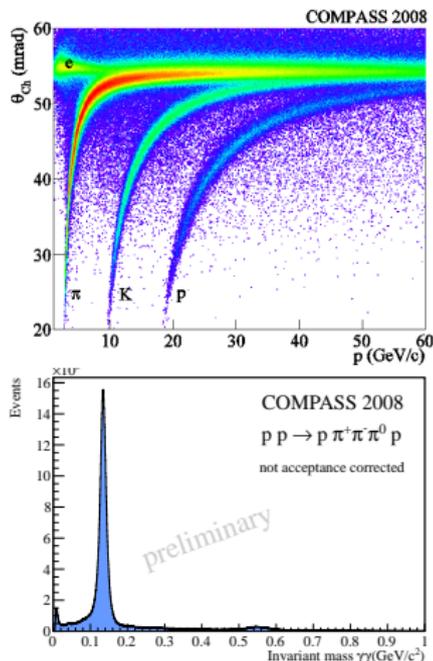
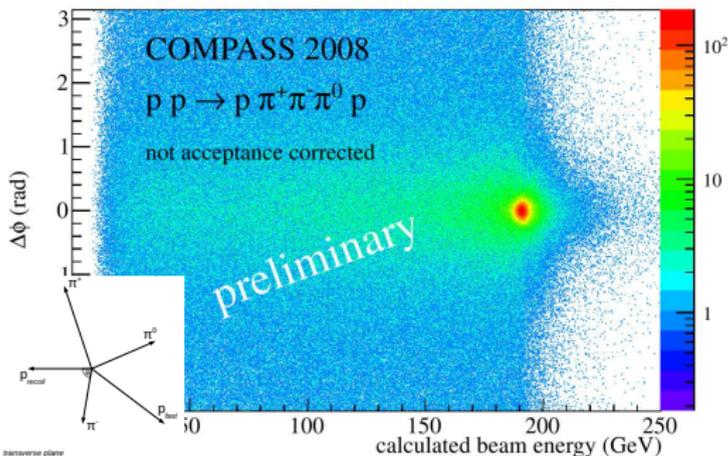
Compare $\phi(1020) \rightarrow K^+K^-$ to $\omega(782) \rightarrow \pi^+\pi^-\pi^0$ production

³ A. Sibirtsev and W. Cassing, Eur.Phys.J.A7(2000)407

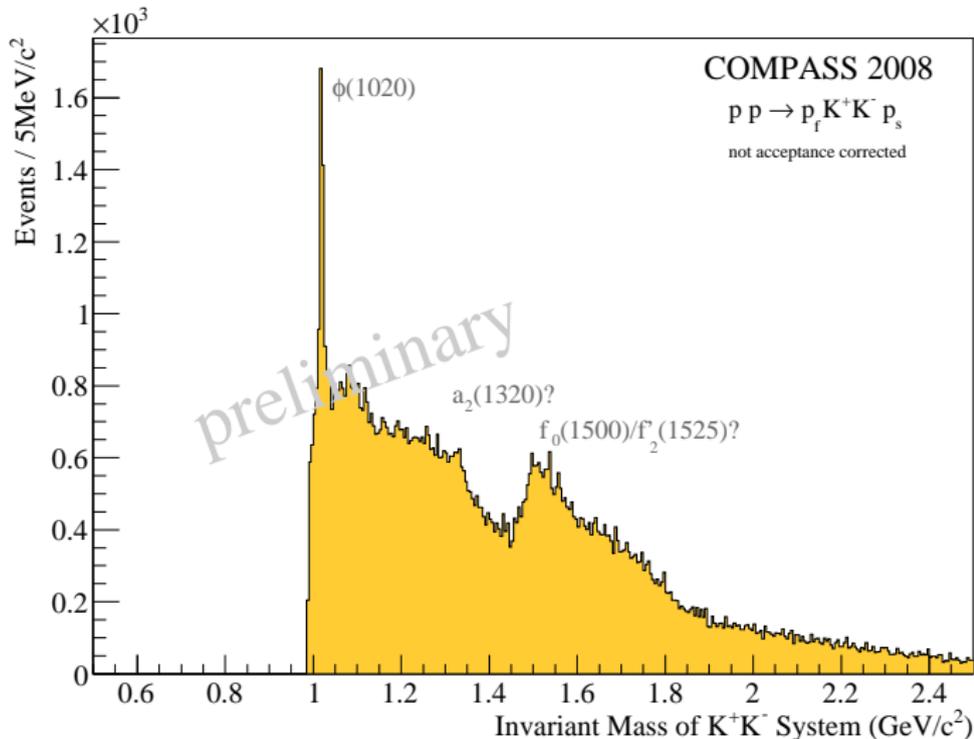
Event selection

Interest in $p p \rightarrow p (\pi^+ \pi^- \pi^0) / (K^+ K^-) p$ final states

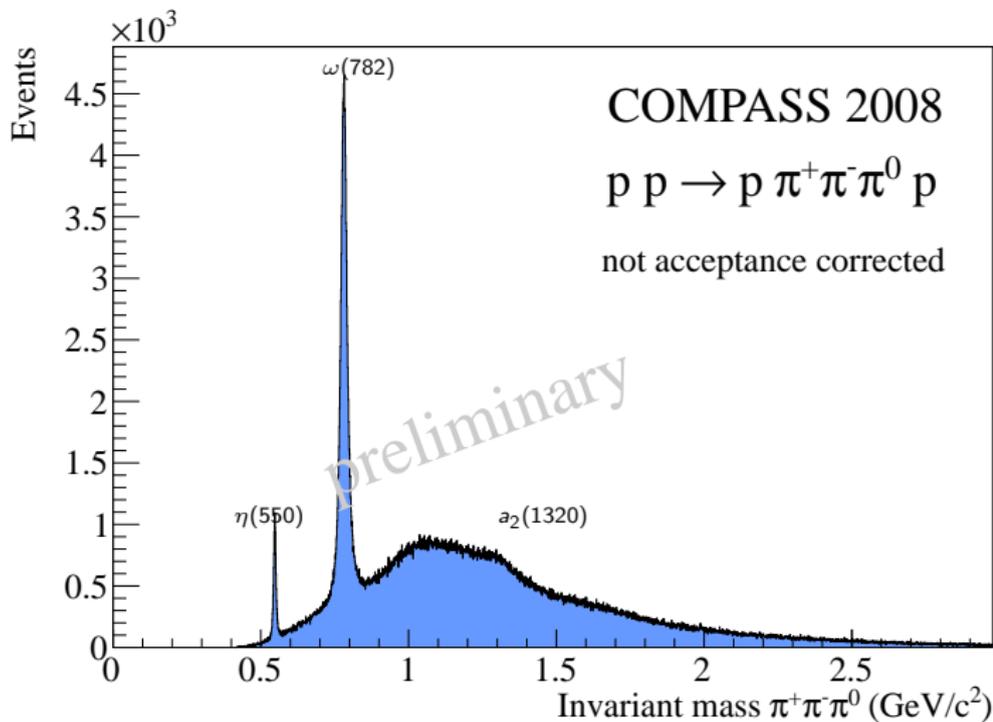
- select event topology (charged tracks, reaction inside target volume, recoil proton etc.)
- ID K^+ with RICH, π^0 with ECALs
- conservation of charge, exclusivity



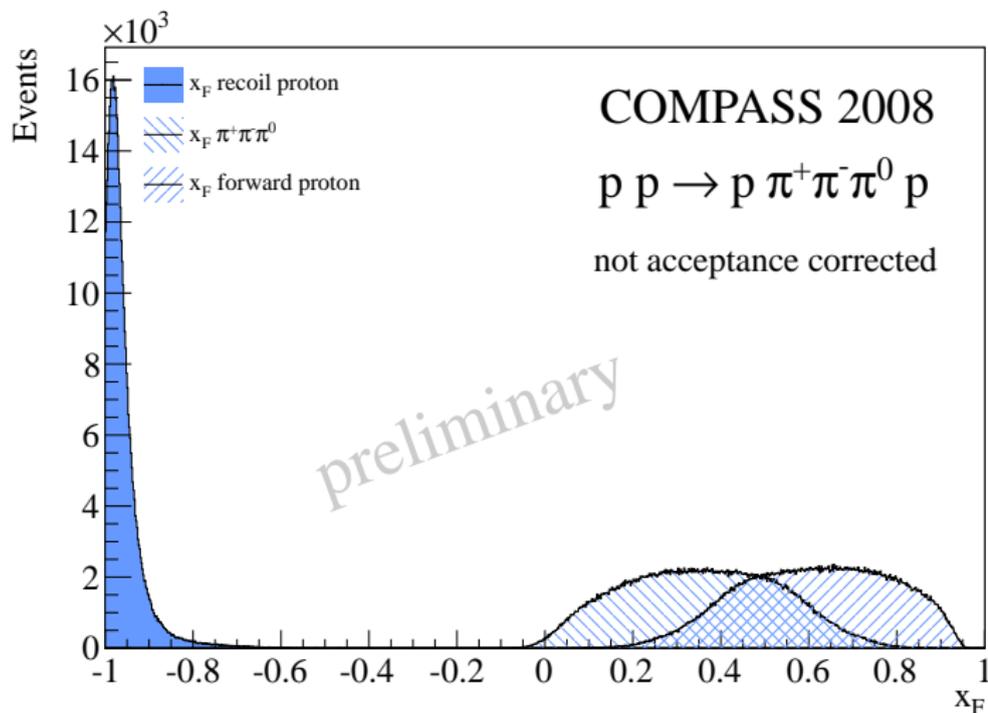
Invariant mass distributions ($K^+ K^-$)



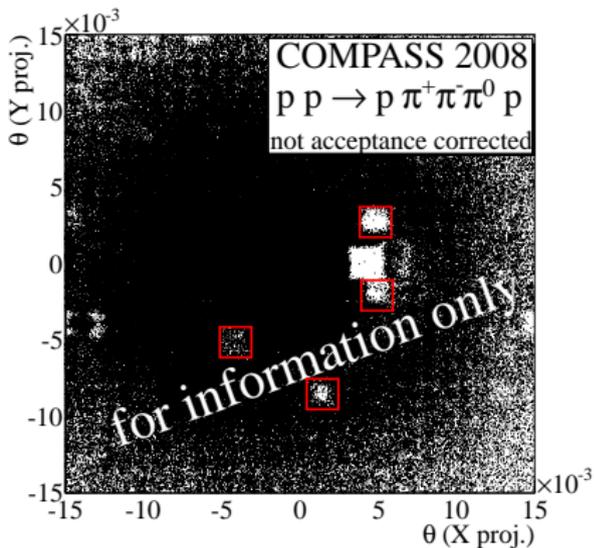
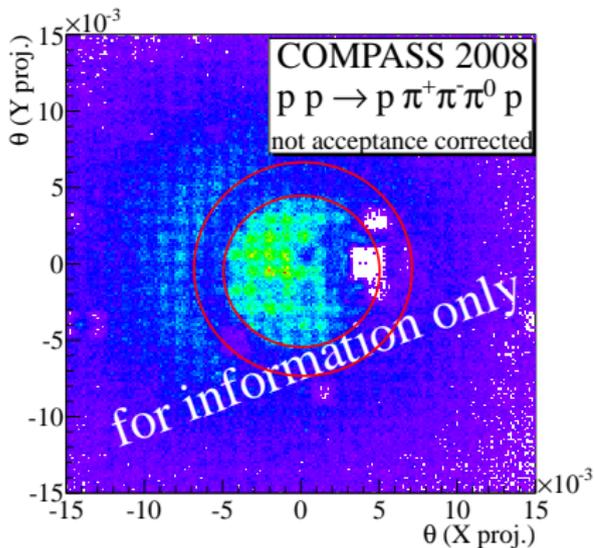
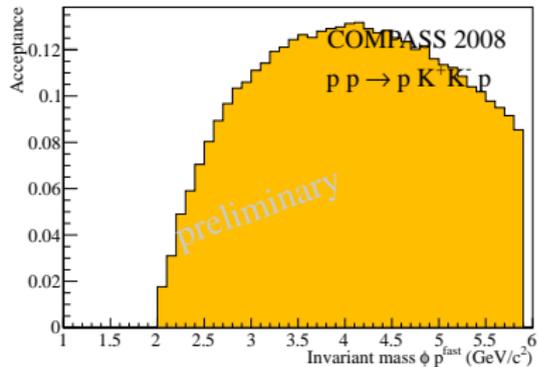
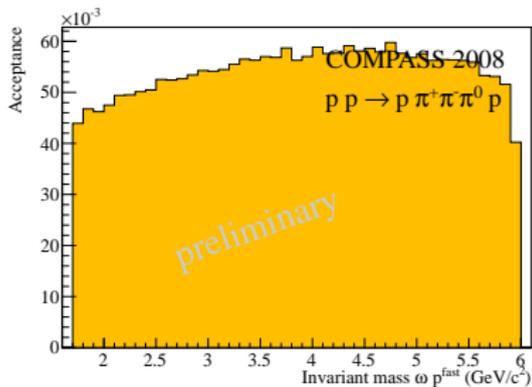
Invariant mass distributions ($\pi^+ \pi^- \pi^0$)



Reaction Kinematics

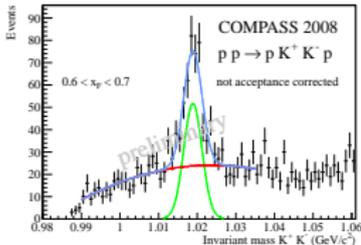


Next slide: Acceptance

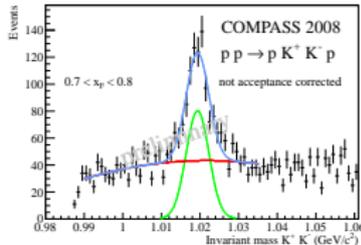


Test OZI violation: Analysis

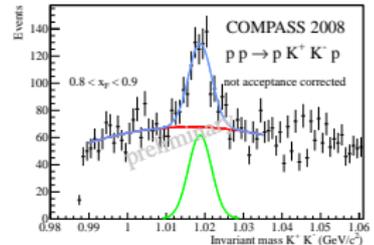
$0.6 < x_F < 0.7$



$0.7 < x_F < 0.8$

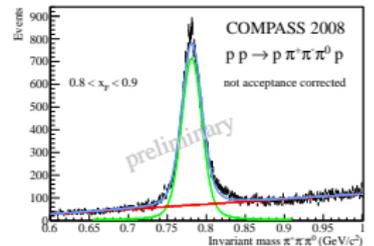
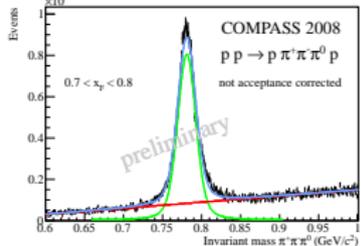
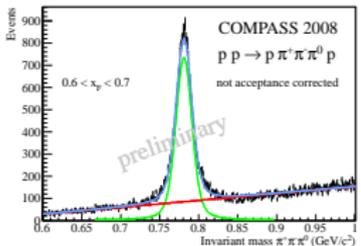


$0.8 < x_F < 0.9$



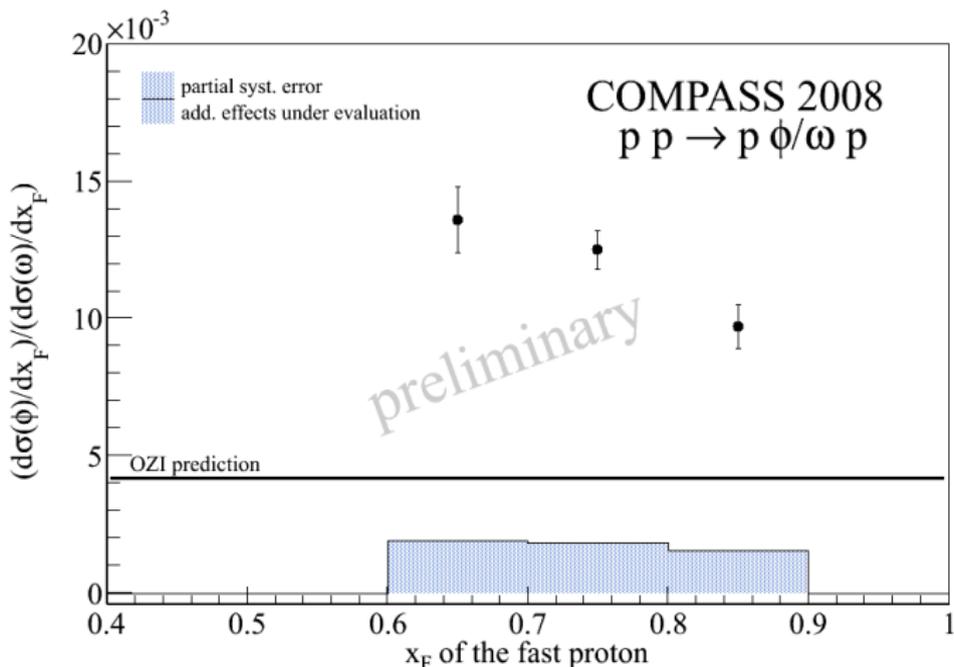
ω

$0.6 < x_F < 0.7$



- ① fit invariant mass distributions with Breit-Wigner folded with Gaussian plus polynomial background in x_F bins \Rightarrow yields
- ② correct for acceptance and branching \Rightarrow corrected yields
- ③ calculate $R = \frac{\text{Number of } \phi}{\text{Number of } \omega}$

Test OZI violation: Result

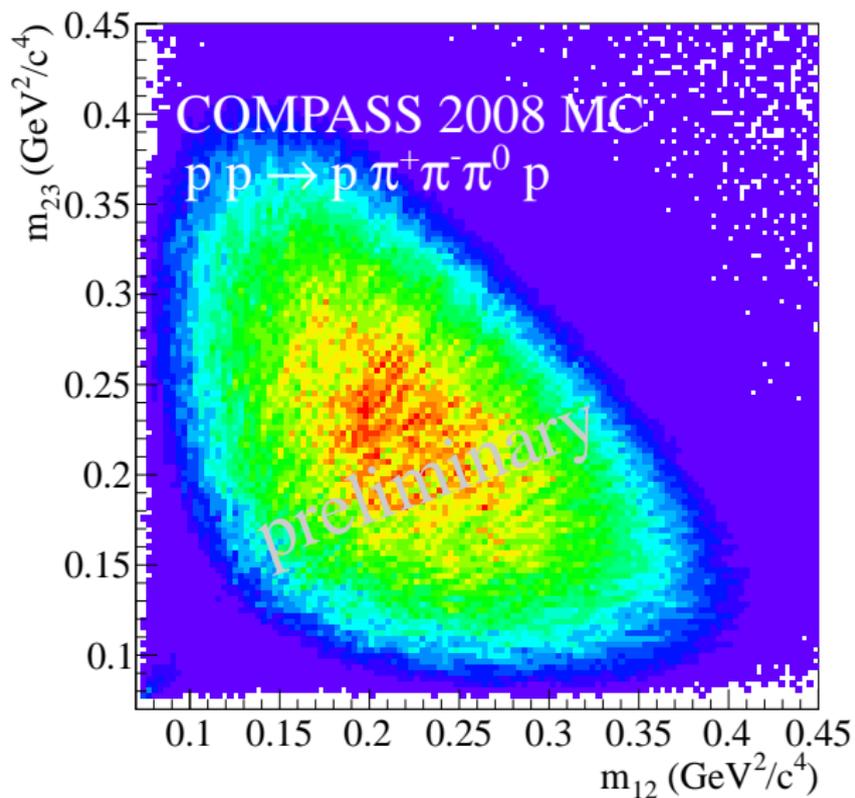


N.B.: Included only systematics from fit and ECAL reconstruction, additional effects are still under investigation

Ongoing

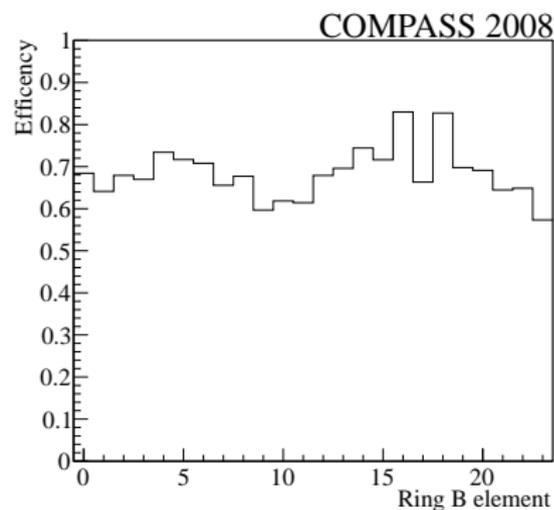
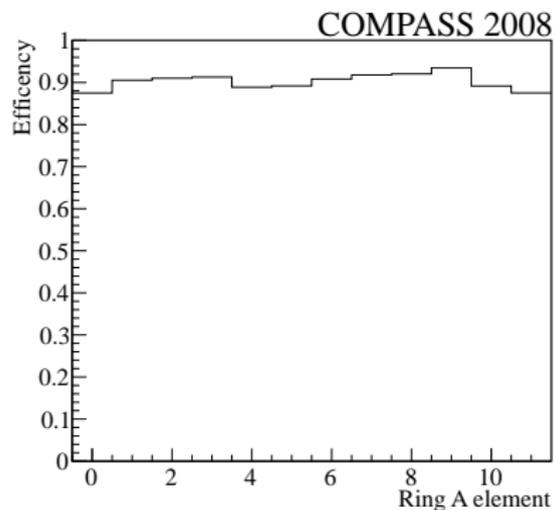
- further systematic studies: RICH matrices
- improve MC:
 - ① generator PWA2000-genbod less than usable, no width of decays, only diffractive generation, no spin \rightarrow Omegagen (*i.e.* stand-alone generation with variable phase-space, width and decay with Dalitz-plot parameters)
Pro: relatively small MC sample already tuned with production mechanisms, generator available
Con: Tuning is time-consuming, very model-dependent
 - ② alternative: multi-dimensional acceptance correction (use flat phase-space, identify independent kinematic variables)
Pro: model-independent, fast
Con: Huge MC sample necessary, some parameters are not completely independent (use of covariance matrices not possible because of binning)
- measurement of ω/ϕ spin alignment via Gottfried-Jackson angles
 \Rightarrow production mechanisms
- publication

Dalitz-plot Omegagen



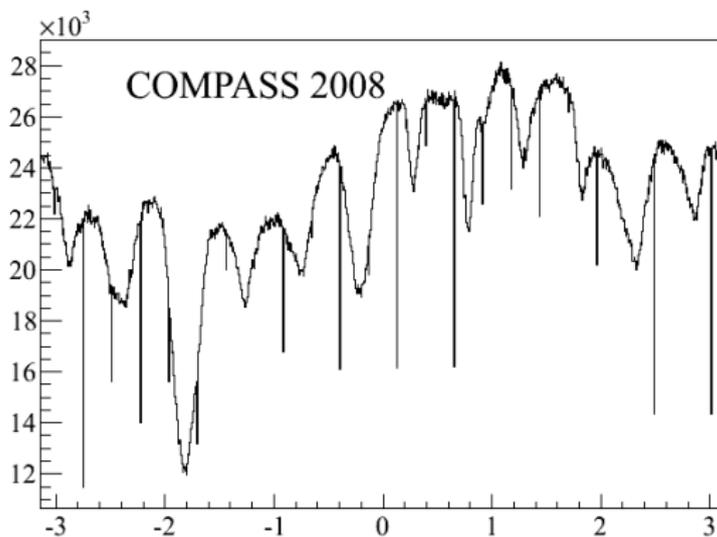
RPD Efficiencies

Summer student project: plots by c. Beirao da Cruz e Silva



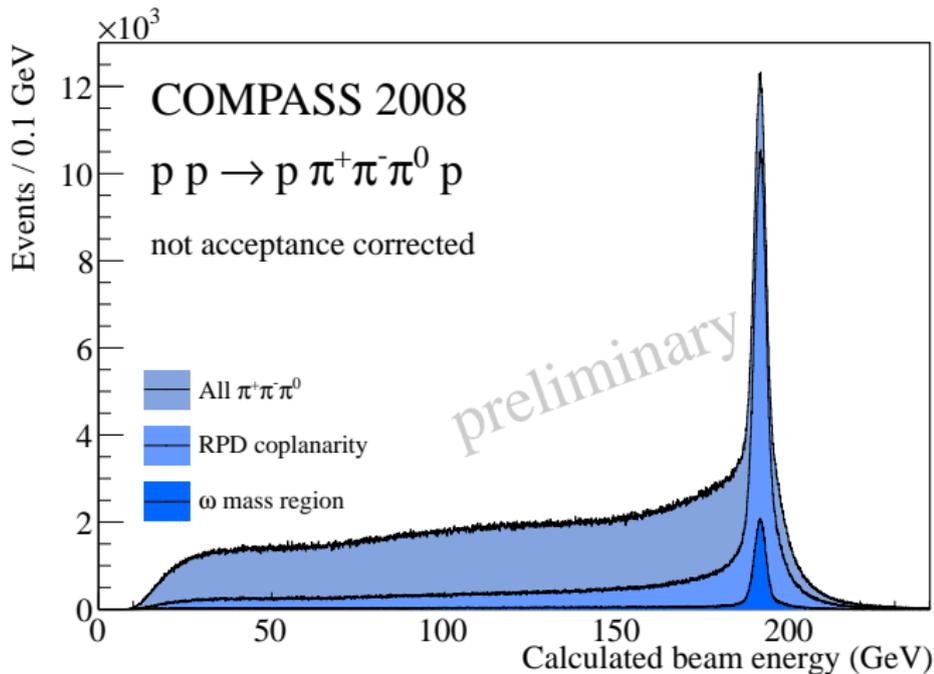
RPD acceptance

Summer student project: plots by c. Beirao da Cruz e Silva



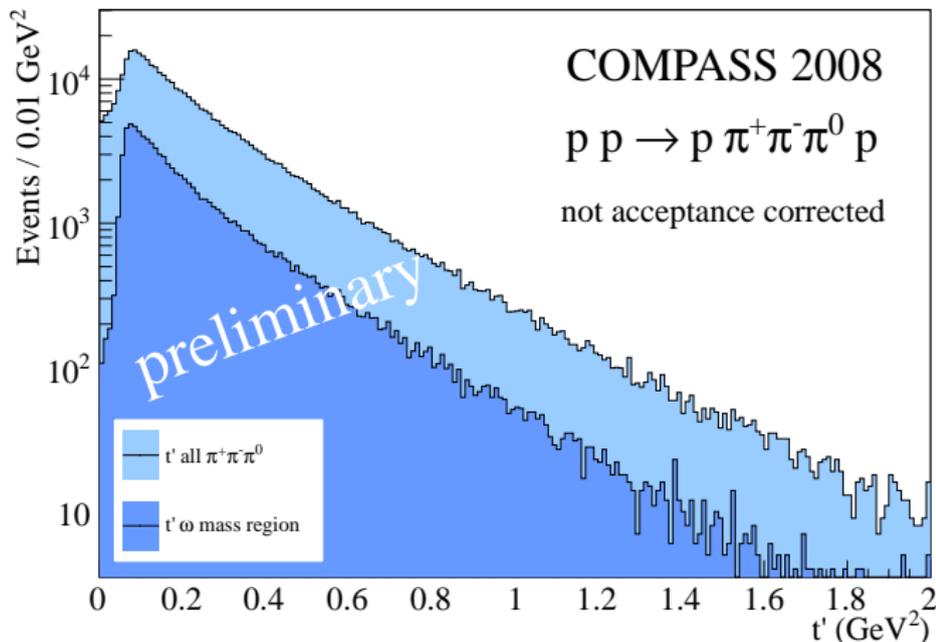
Spares

Exclusivity



Selection of exclusive events: energy balance $191 \text{ GeV} \pm 6 \text{ GeV}$

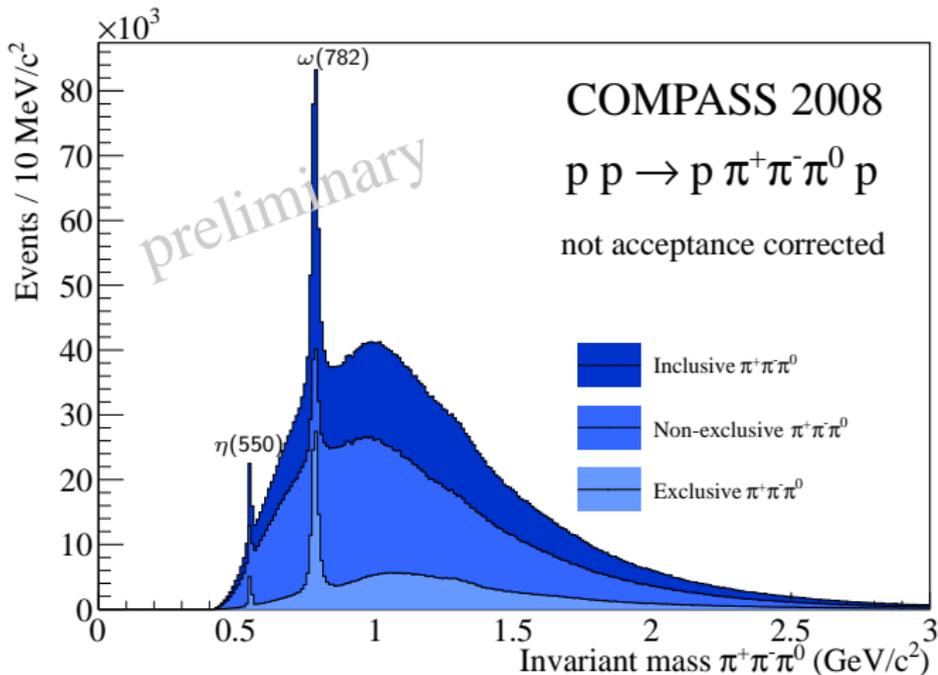
Production mechanism



Ongoing: binning the ratio $R = \frac{\text{Number of } \phi \text{ in } t}{\text{Number of } \omega}$

Background

Composition 2008 data sample: exclusive vs. non-exclusive



Important for background studies