

Vector meson production and OZI violation at COMPASS

HK12.3 DPG Frühjahrstagung Münster

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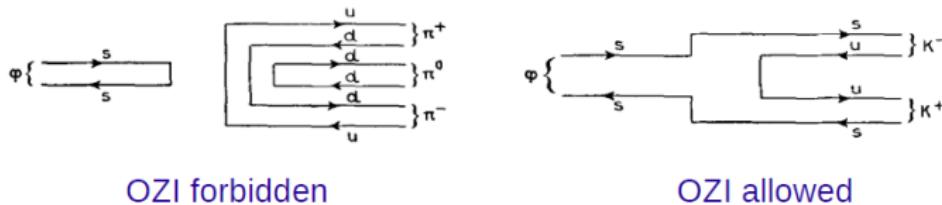


bmb+f - Förderschwerpunkt
COMPASS
Großgeräte der physikalischen
Grundlagenforschung

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Motivation

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



Calculation² for $\phi(1020)$ to $\omega(782)$ decay ratios (A and B hadrons):

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

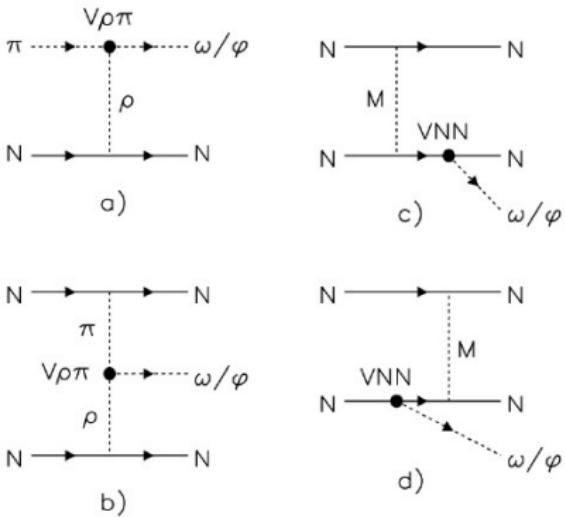
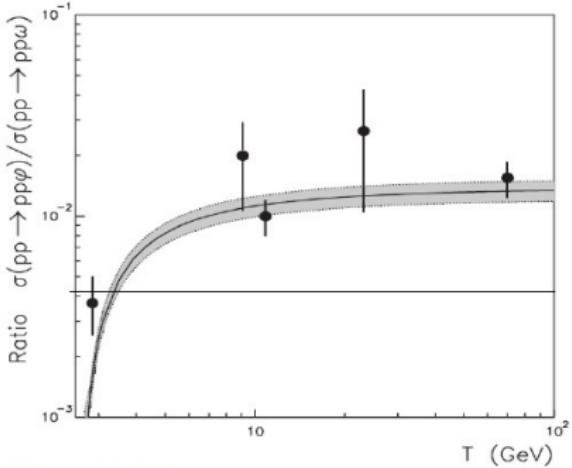
Numerous violations observed, possible explanations:

- 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.Supp.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:

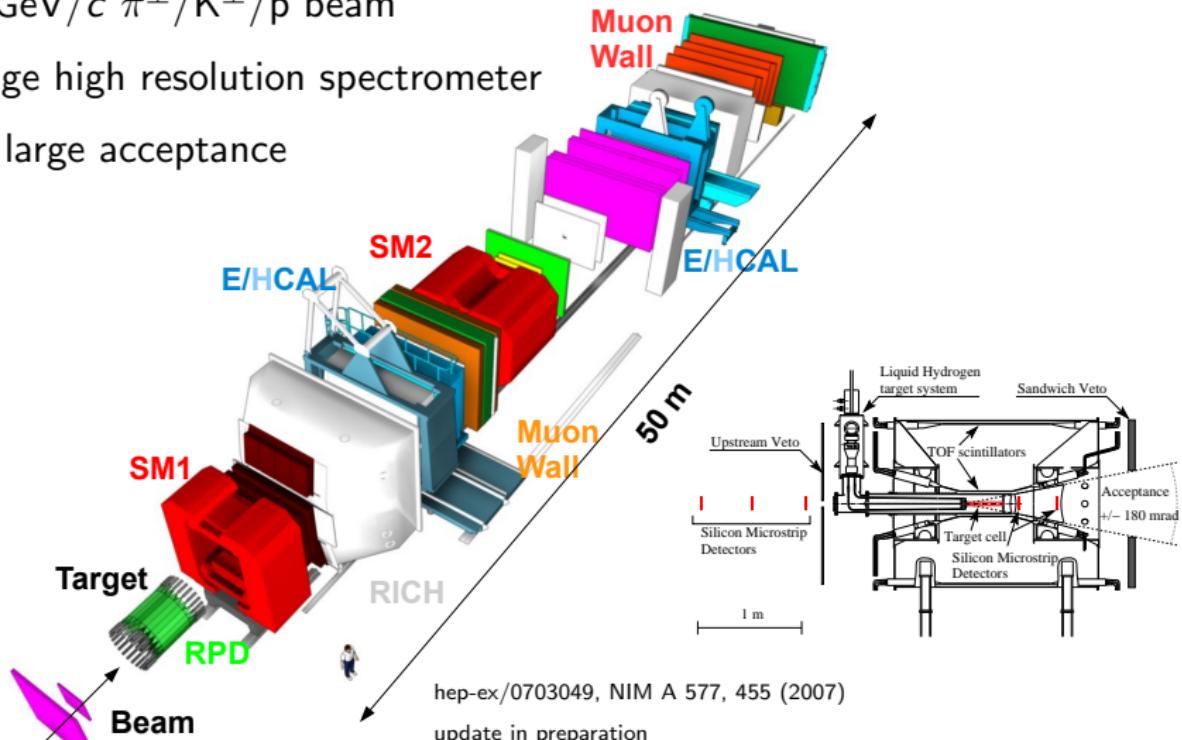
Compare $\phi(1020) \rightarrow K^+K^-$ to $\omega(782) \rightarrow \pi^+\pi^-\pi^0$ production

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

The COMPASS spectrometer at CERN

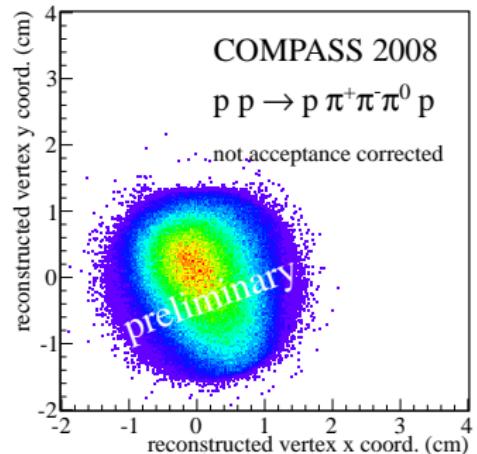
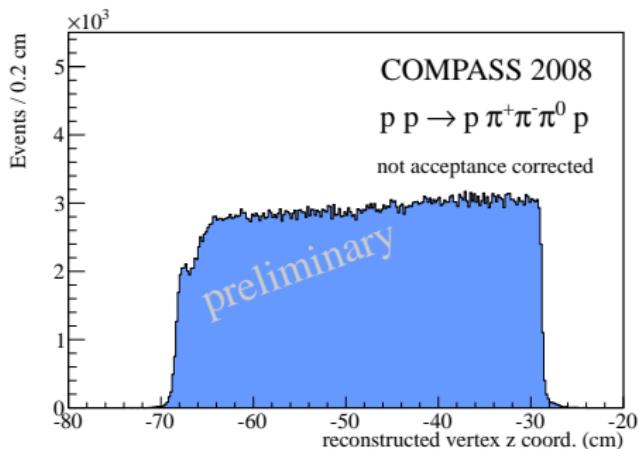
190 GeV/c π^\pm /K $^\pm$ /p beam

2 stage high resolution spectrometer
with large acceptance



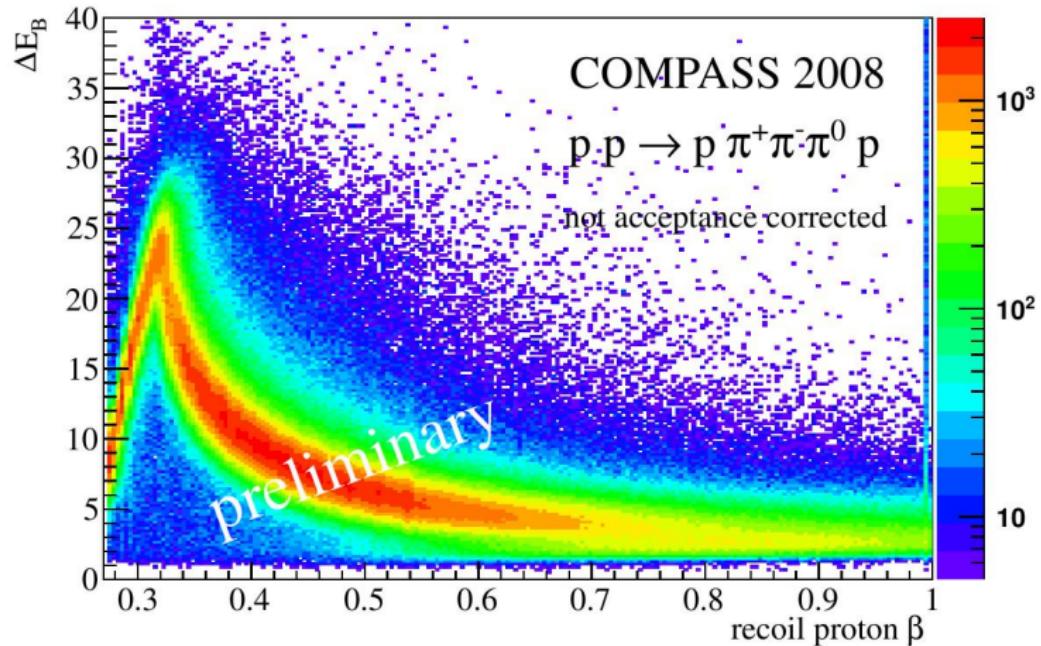
Event selection

Example: $p p \rightarrow p \pi^+ \pi^- \pi^0 p$ final state



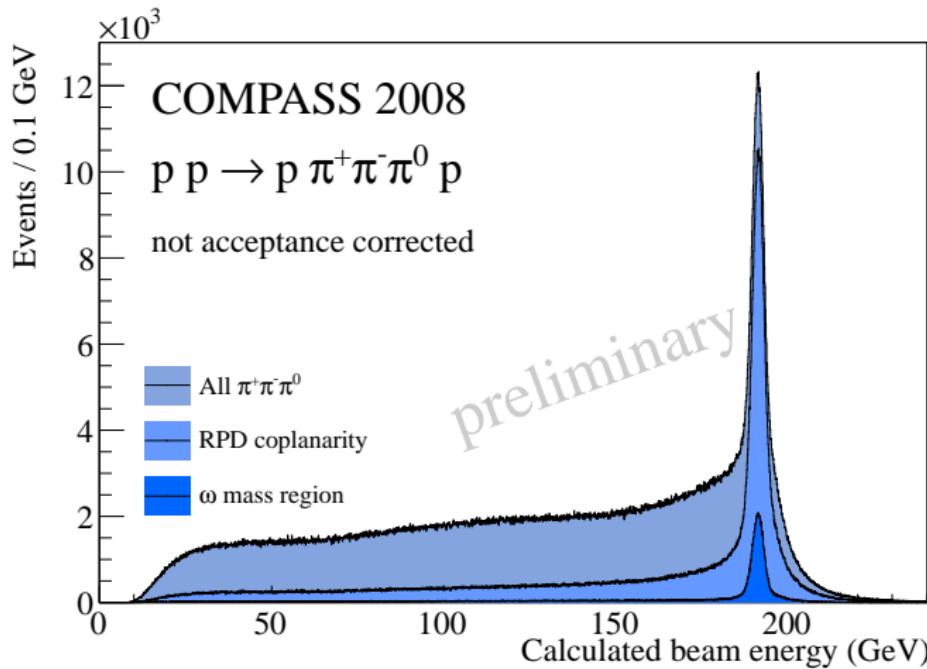
Tracking: Vertex inside target volume

Identifying the recoil proton



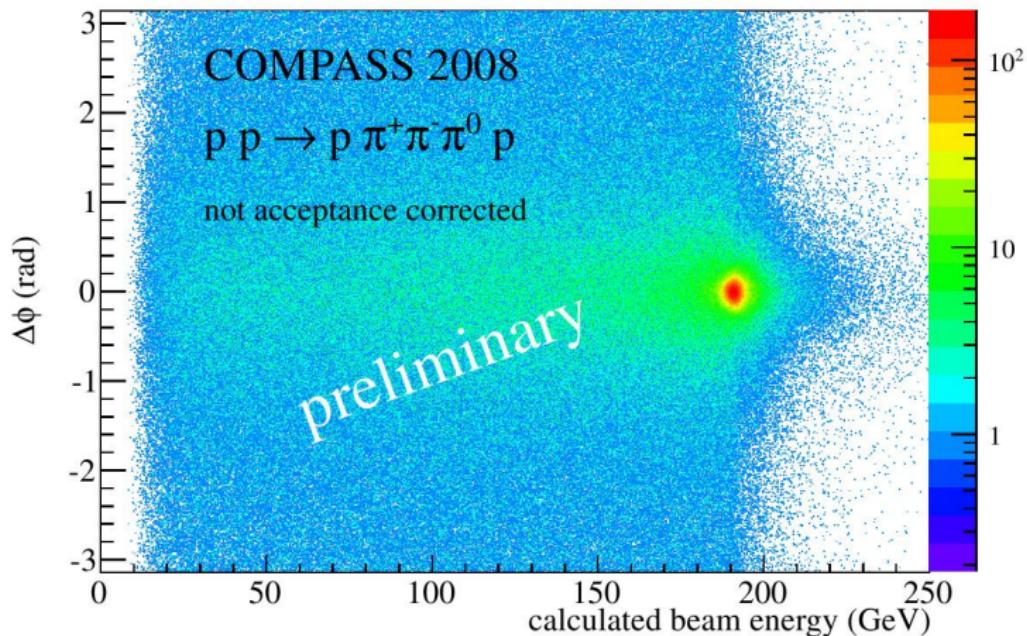
Identification with energy loss / Time-of-Flight measurement (RPD)

Exclusivity I



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

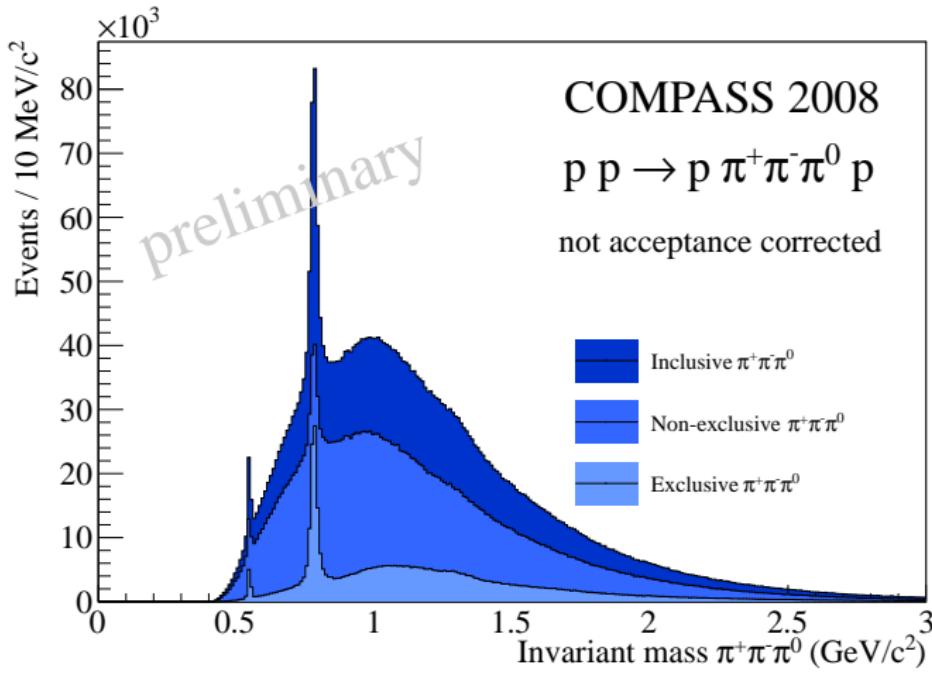
Exclusivity II



Correlation recoil proton / forward system ($\pi^+\pi^-\pi^0$): $|\Delta\Phi| < 0.28$

Exclusivity III

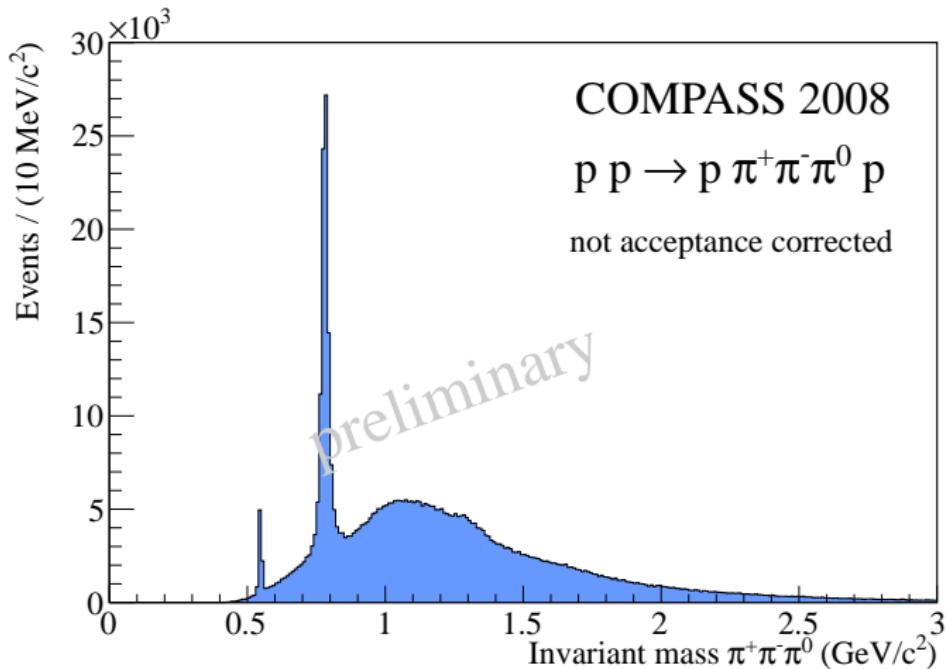
Composition 2008 data sample: exclusive vs. non-exclusive



Important for background studies

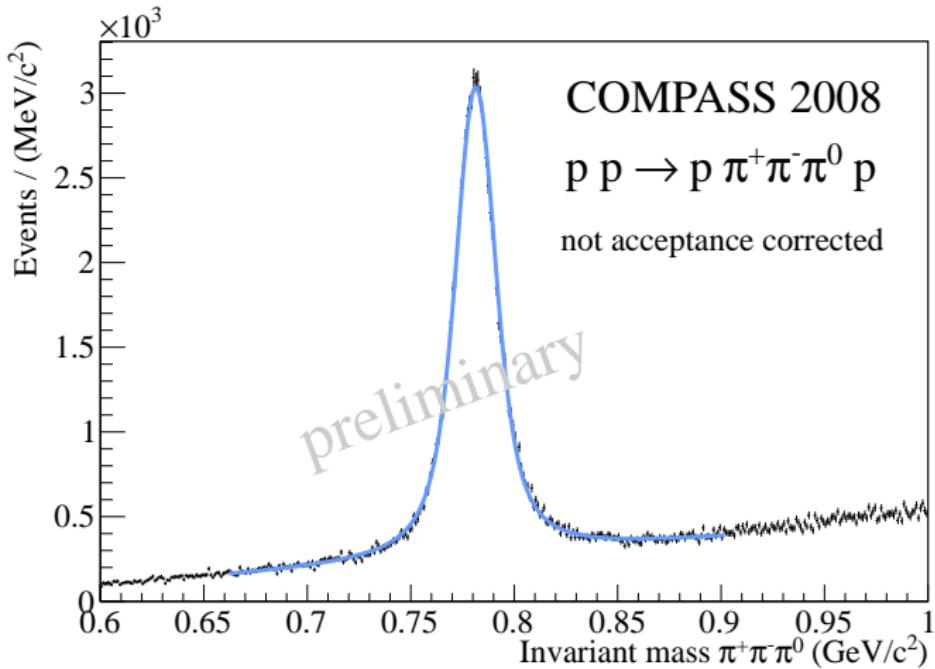
Additional cuts

- main physics trigger (DT0, triggers on recoil protons)
- charge conservation
- beam proton ID with CEDARs
- RPD multiplicity 1
- π^0 candidate
- RICH identifies π^+



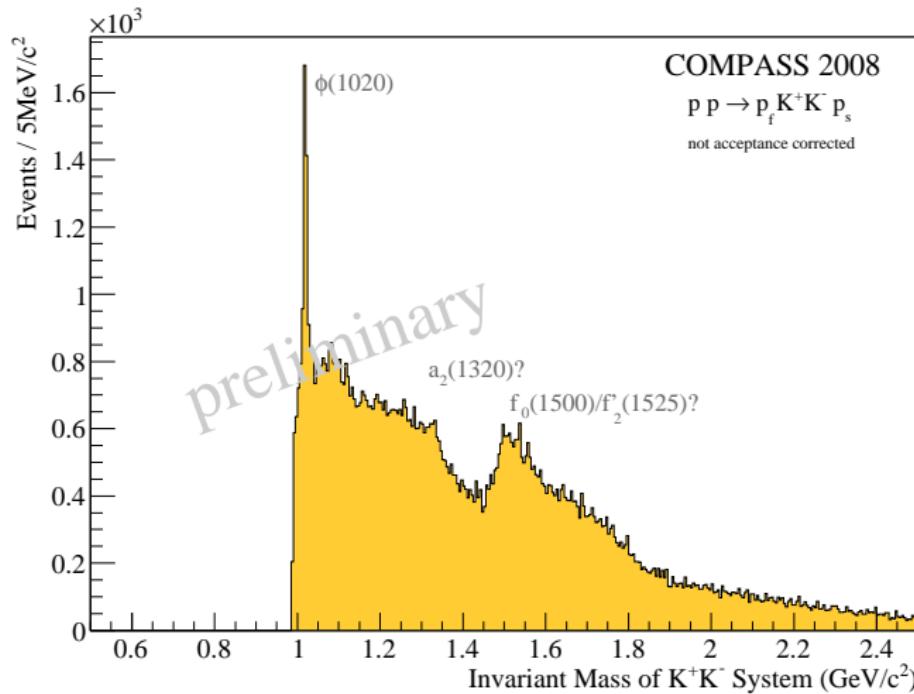
Invariant mass spectrum of the $pp \longrightarrow p\pi^+\pi^-\pi^0p$, final sample.

$\omega(782)$ candidates



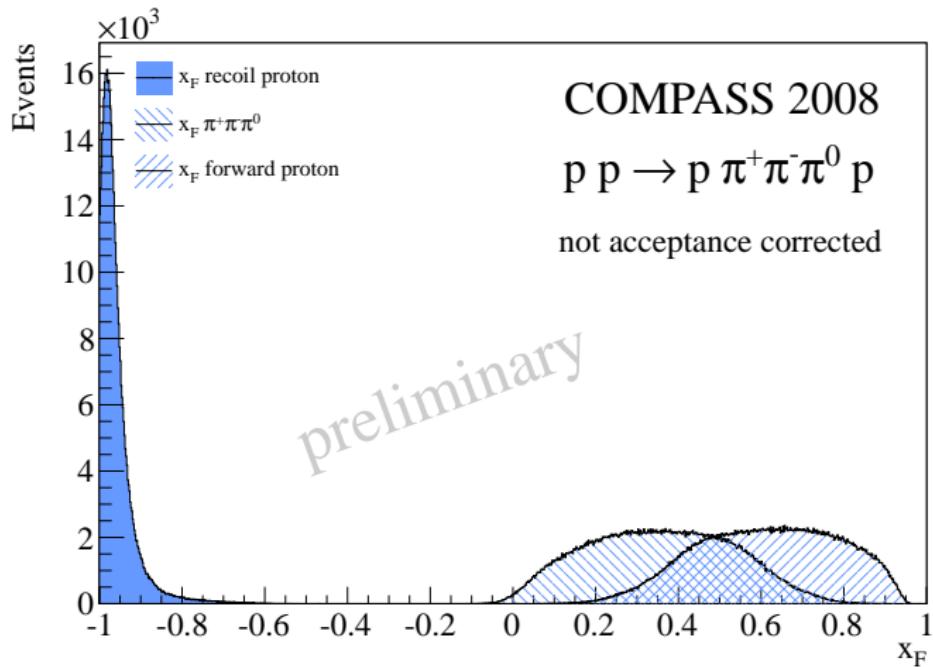
ω candidates: 89604 ± 578 (one week data taking 2008)

$\phi(1020)$ candidates

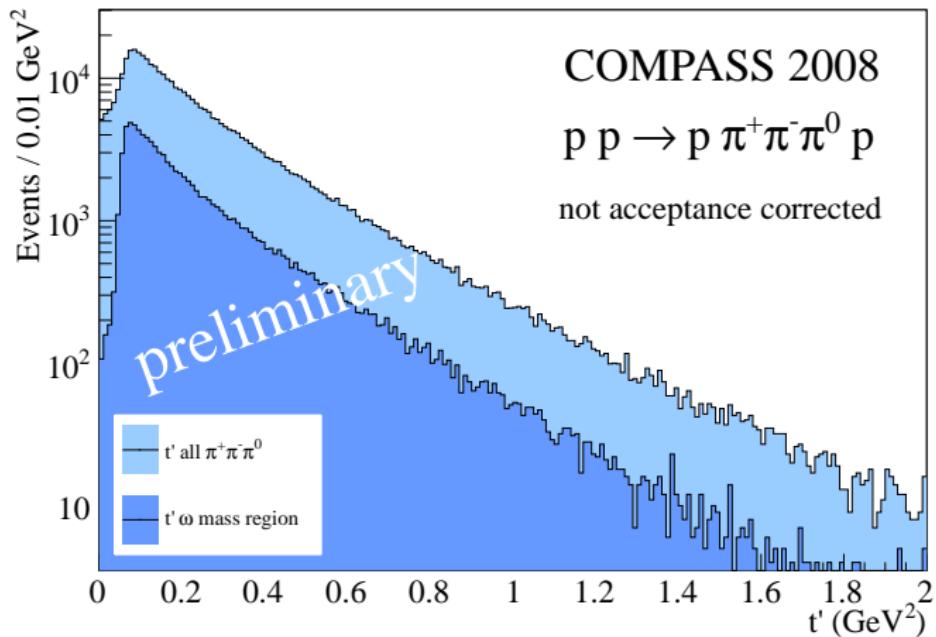


ϕ analysis ongoing

Activities / production mechanism



Activities / production mechanism



Ongoing: binning in t

Outlook and Conclusions

- 2008 proton data promising: huge data sample
- acceptance corrections ongoing:
 - ① ECAL MC description
 - ② generators for different production mechanisms
 - ③ material budget of experimental setup (γ reconstruction)
- measurement of ω/ϕ spin alignment
- determine OZI violation depending on x_F and t