

Baryonspektroskopie – 2-Körper-Endzustände

Tobias Weisrock

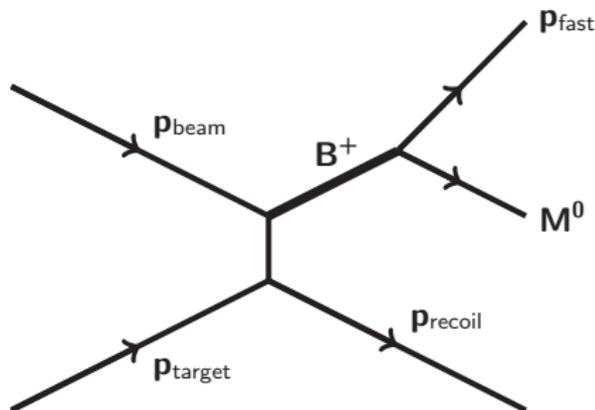
29. April 2013



JOHANNES GUTENBERG
UNIVERSITÄT MAINZ

Vorüberlegungen

- ▶ 2-Körper-Zustände sind technisch einfacher zu behandeln
- ▶ kein Isospin Austausch in der Produktion \Rightarrow nur $I = \frac{1}{2}$ Baryonen
- ▶ viele verschiedene Mesonen im Endzustand zugänglich
 - ▶ $\pi^0 \rightarrow \gamma\gamma$
 - ▶ $\eta \rightarrow \gamma\gamma$
 - ▶ $\eta \rightarrow \pi^+\pi^-\pi^0$
 - ▶ $\omega \rightarrow \pi^+\pi^-\pi^0$
 - ▶ $\eta' \rightarrow \pi^+\pi^-\eta$
 - ▶ ...



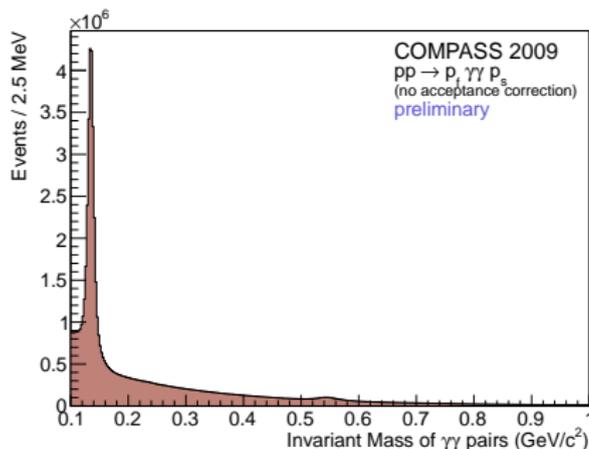
Erinnerung: Vorselektion

1. DT0-Trigger
2. 1 primärer Vertex im Target
3. einlaufendes Proton in mind. 1 CEDAR und kein Pion in beiden CEDARs
4. rekonstruiertes Rückstoßproton

Schnitt	Events	% abs	% rel
ohne	11'321'059'587		
DT0-Trigger	10'825'412'397	95.62	95.62
1 Primärvertex im Target	8'993'834'917	79.44	83.08
einlaufendes Proton	7'925'572'030	70.01	88.12
Rückstoßproton	5'674'142'337	50.12	71.59
	3'967'769'836	35.05	69.93

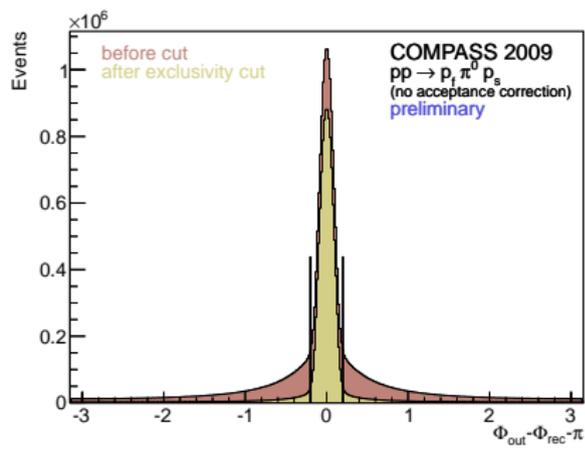
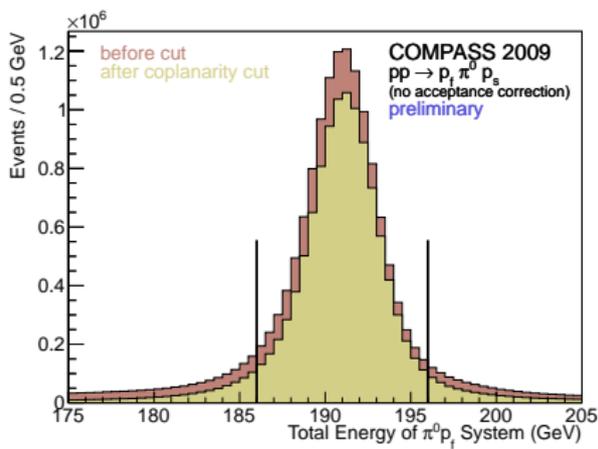
pp \rightarrow p_{rec}($\gamma\gamma$)p_f – Schnitte 1

1. 1 auslaufendes geladenes Teilchen
2. Ladung **+1**
3. genau 2 Photonen ($\geq 2??$)
 - ▶ Energie größer (1,2) GeV in ECAL (1,2)
 - ▶ LED/Laser Korrekturen
 - ▶ Korrekturen aus OZI Analyse



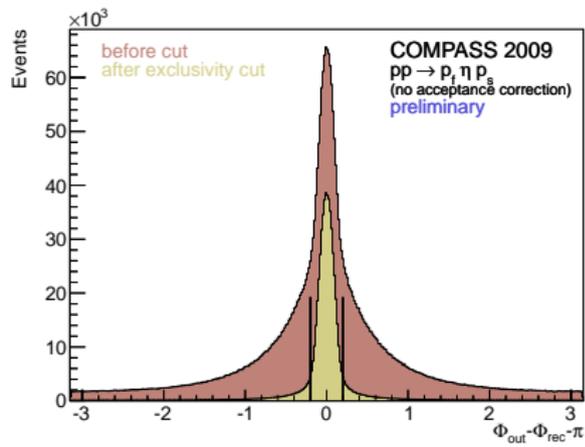
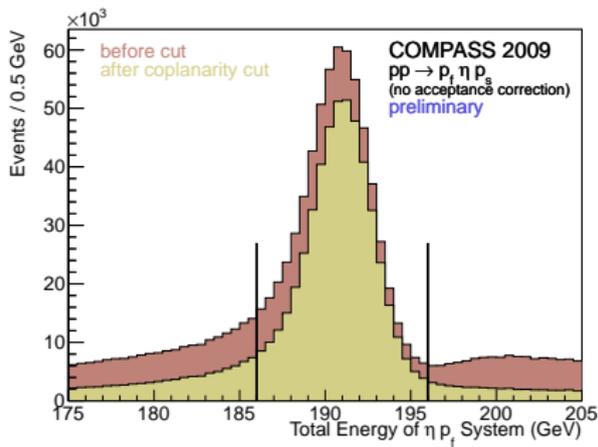
$pp \rightarrow p_{\text{rec}}(\gamma\gamma)p_{\text{f}}$ – Schnitt 2

1. Photonen bilden ein π^0 oder η
2. Exclusivity
3. Coplanarity



$pp \rightarrow p_{\text{rec}}(\gamma\gamma)p_{\text{f}} - \text{Schnitte 2}$

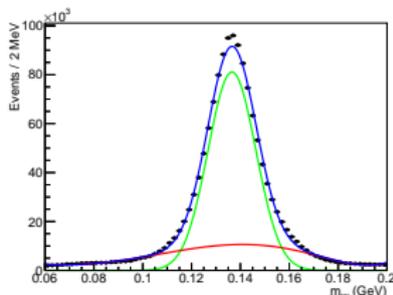
1. Photonen bilden ein π^0 oder η
2. Exclusivity
3. Coplanarity



π^0/η Selektion

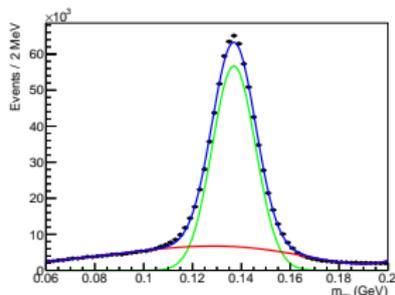
- ▶ Invariante $\gamma\gamma$ Masse innerhalb von 2σ um die PDG Masse
- ▶ Skalieren der Photonenergie auf PDG Masse

π^0 in ECAL (1,1)



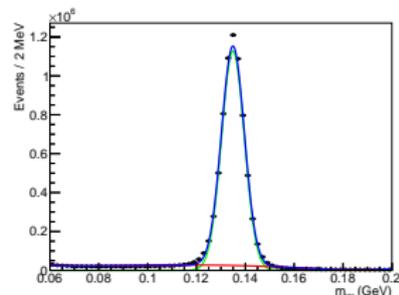
$$\sigma = [9.79] \text{MeV}$$

π^0 in ECAL (1,2)/(2,1)



$$\sigma = [8.87] \text{MeV}$$

π^0 in ECAL (2,2)



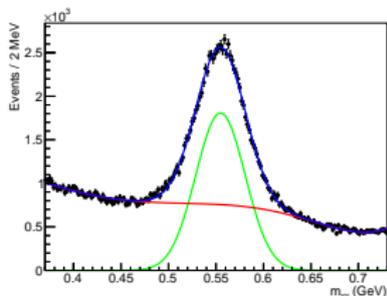
$$\sigma = [4.68] \text{MeV}$$

$$f(m) = n_{\text{sig}} \cdot \exp - \frac{(m - m_0)^2}{2\sigma^2} + n_{\text{bkg}} \cdot \text{Pol}(m)$$

π^0/η Selektion

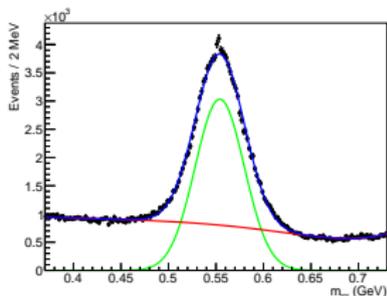
- ▶ Invariante $\gamma\gamma$ Masse innerhalb von 2σ um die PDG Masse
- ▶ Skalieren der Photonenergie auf PDG Masse

eta in ECAL (1,1)



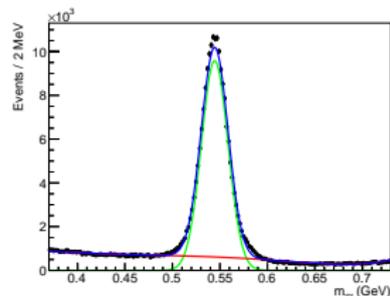
$$\sigma = [26.0]\text{MeV}$$

eta in ECAL (1,2)/(2,1)



$$\sigma = [25.8]\text{MeV}$$

eta in ECAL (2,2)

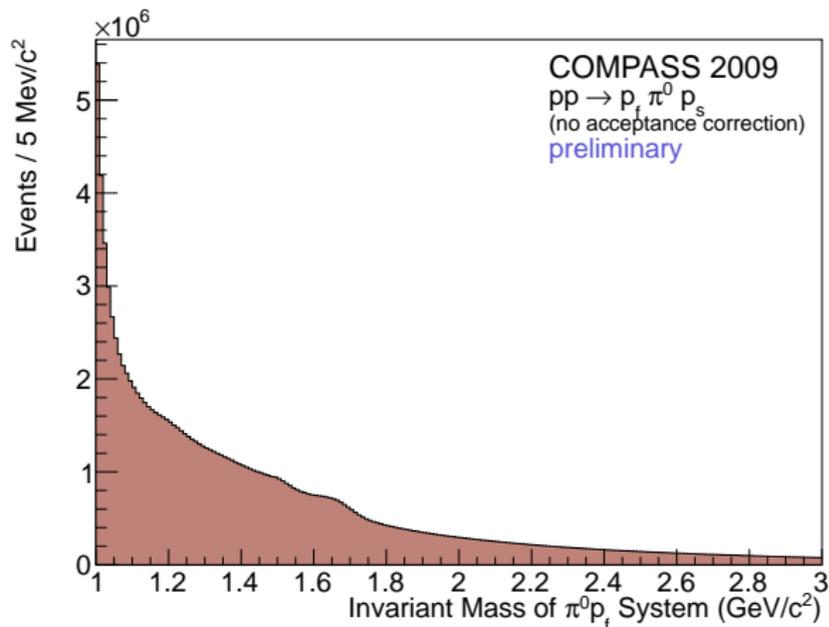


$$\sigma = [14.1]\text{MeV}$$

$$f(m) = n_{\text{sig}} \cdot \exp\left[-\frac{(m - m_0)^2}{2\sigma^2}\right] + n_{\text{bkg}} \cdot \text{Pol}(m)$$

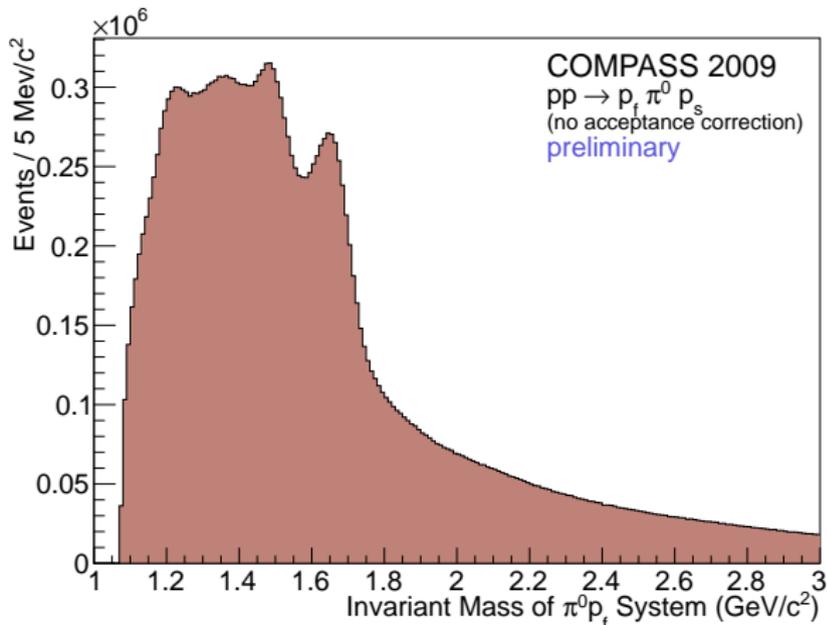


1 geladenes Teilchen + 2 Photonen



179'670'597 Events



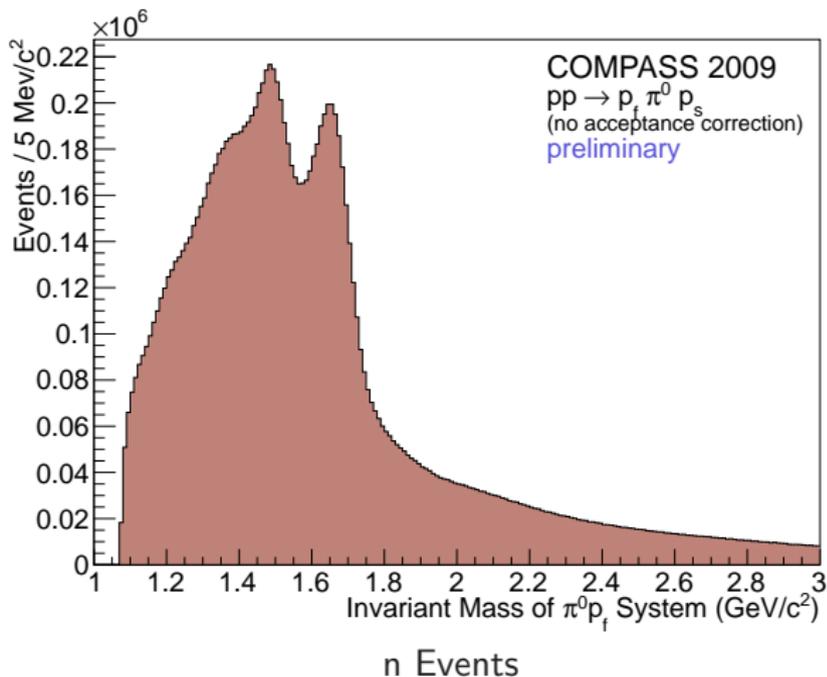

 π^0 identifiziert


25'915'398 Events



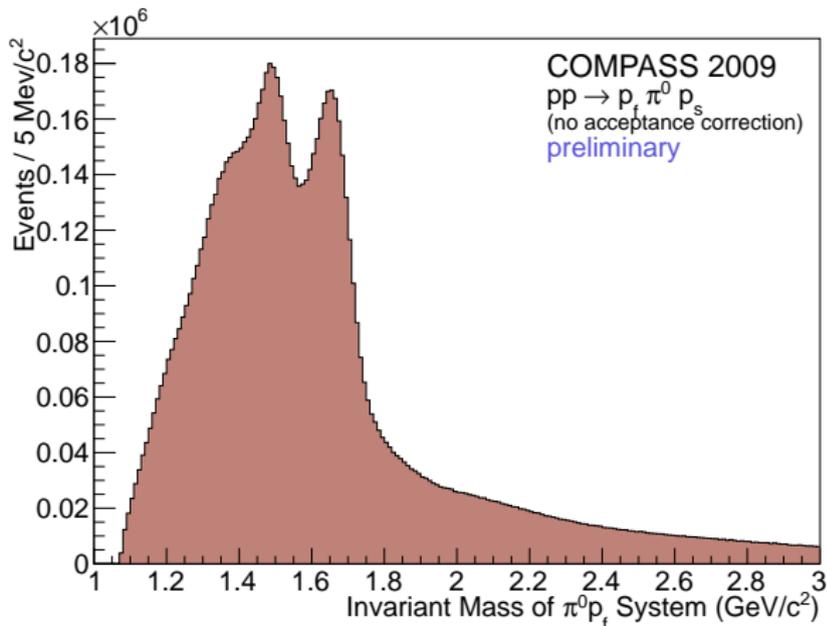


Coplanarity





Exclusivity

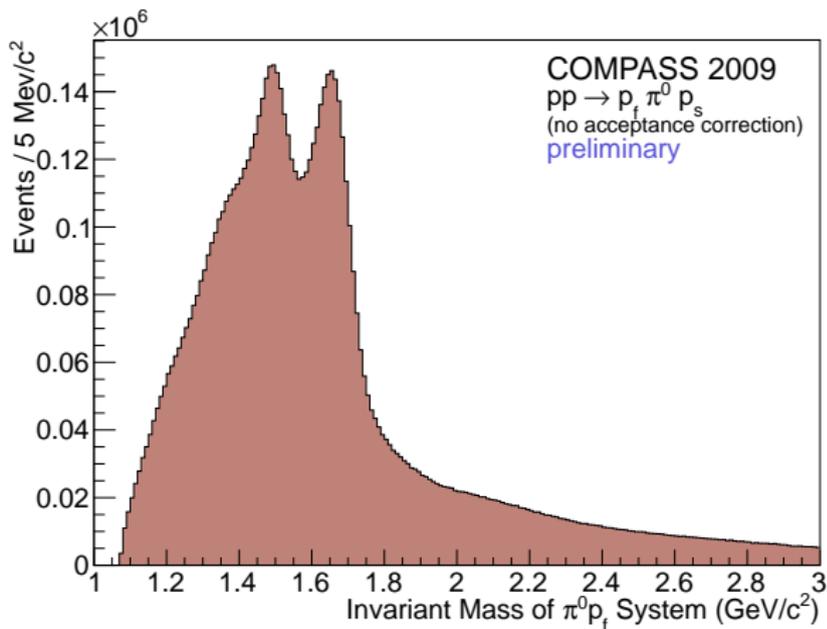


10'837'137 Events





$$0.1 < t' < 1.0$$

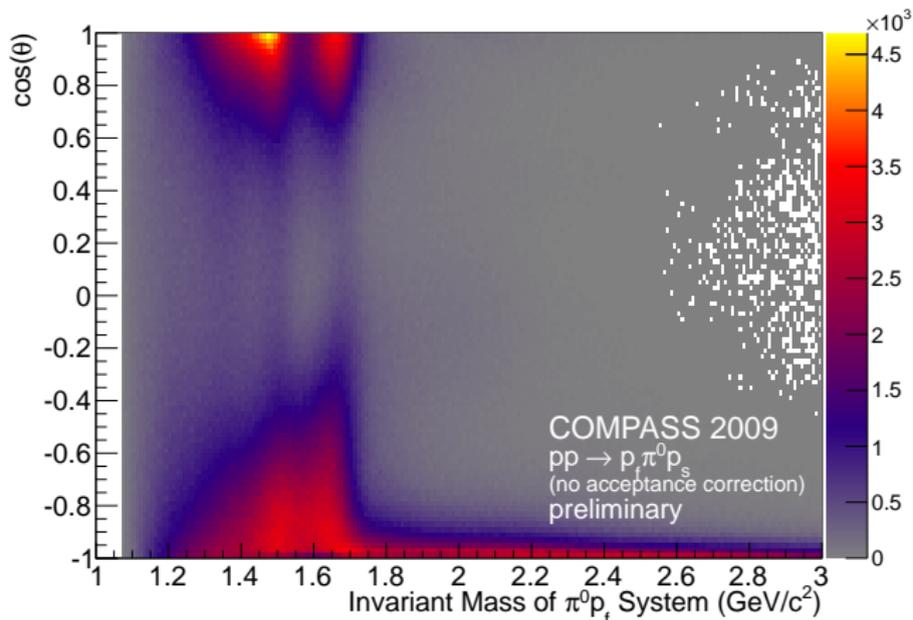


8'869'276 Events



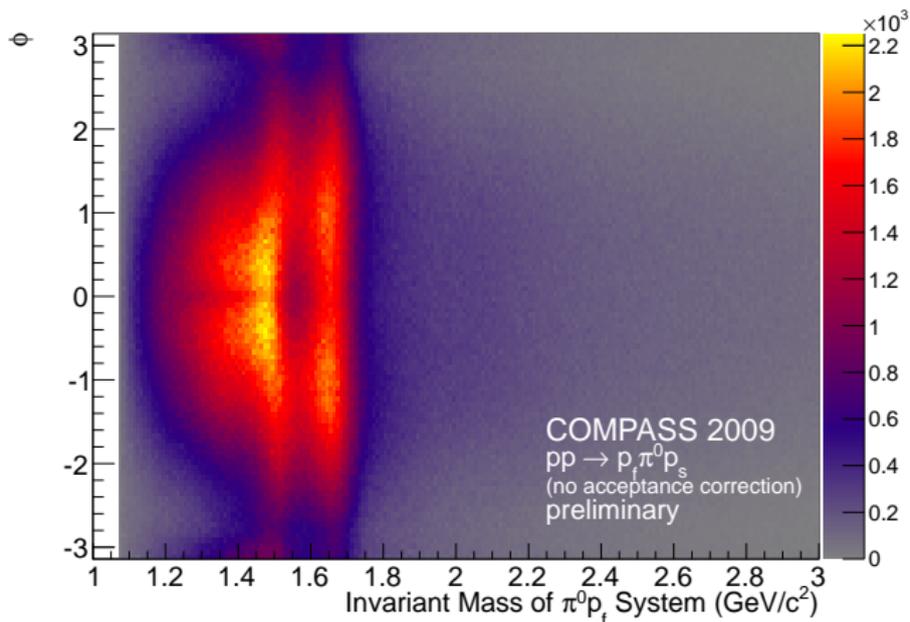
$pp \rightarrow p_{\text{rec}} \pi^0 p_{\text{f}} - \text{Winkel}$

Azimuthwinkel $\cos(\theta)$ gegen invariante Masse



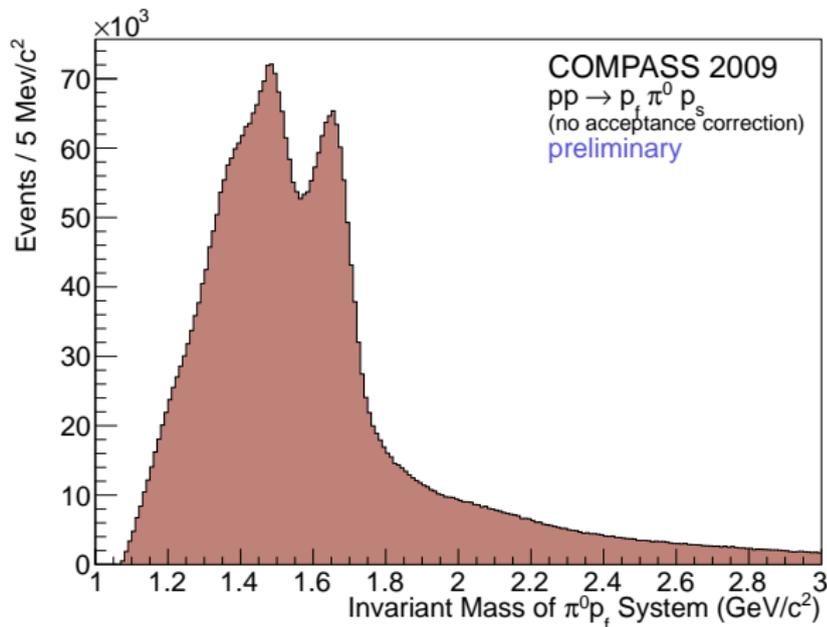
$pp \rightarrow p_{\text{rec}} \pi^0 p_{\text{f}} - \text{Winkel}$

Polarwinkel ϕ gegen invariante Masse



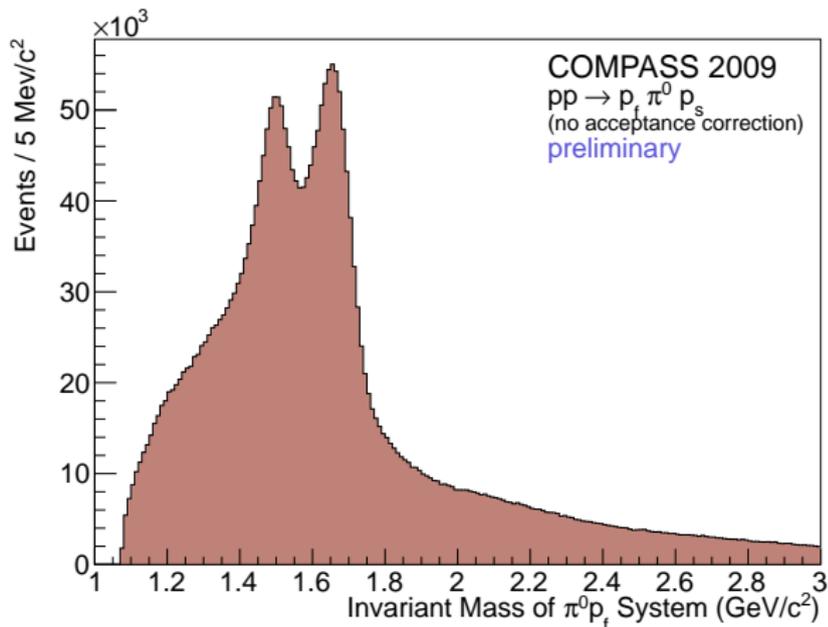
$pp \rightarrow p_{\text{rec}} \pi^0 p_f - t'$ Abhängigkeit

$$0.1 < t' < 0.2$$



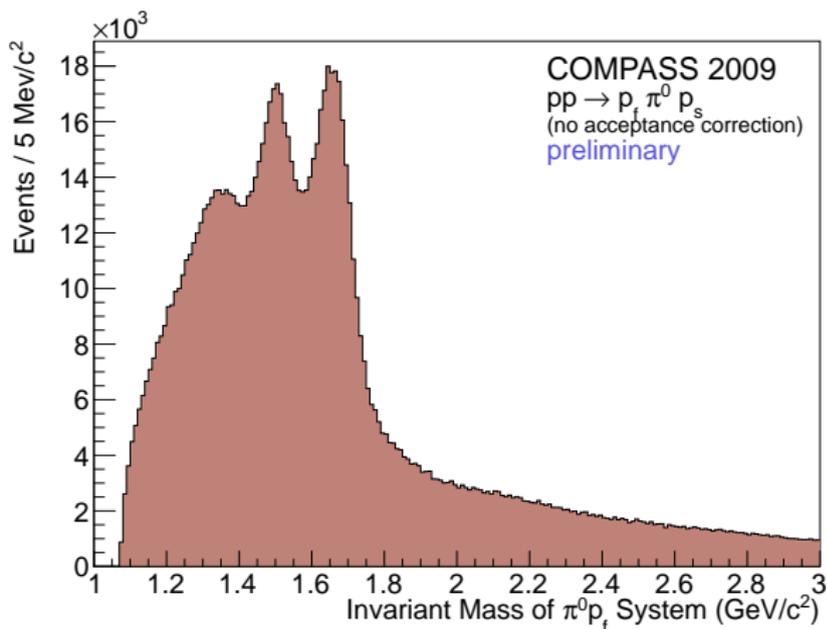
$pp \rightarrow p_{\text{rec}} \pi^0 p_f - t'$ Abhängigkeit

$$0.2 < t' < 0.4$$



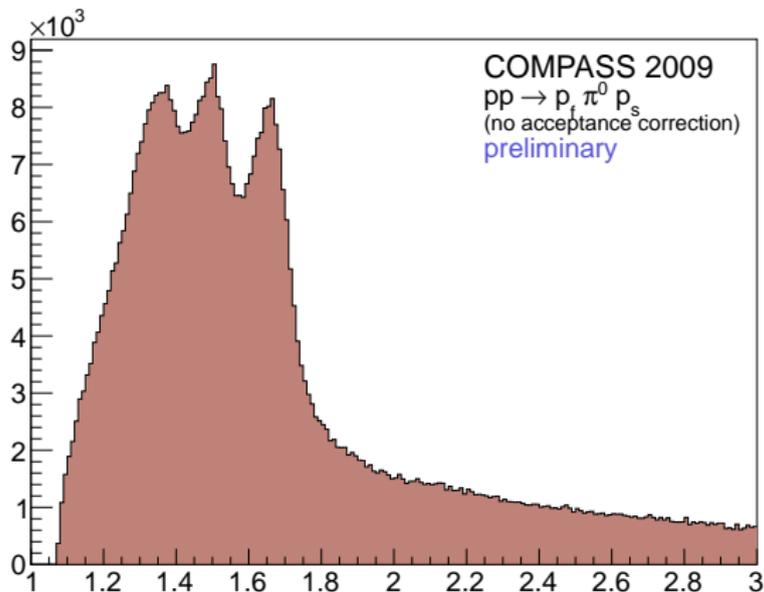
$pp \rightarrow p_{\text{rec}} \pi^0 p_f - t'$ Abhängigkeit

$$0.4 < t' < 0.6$$



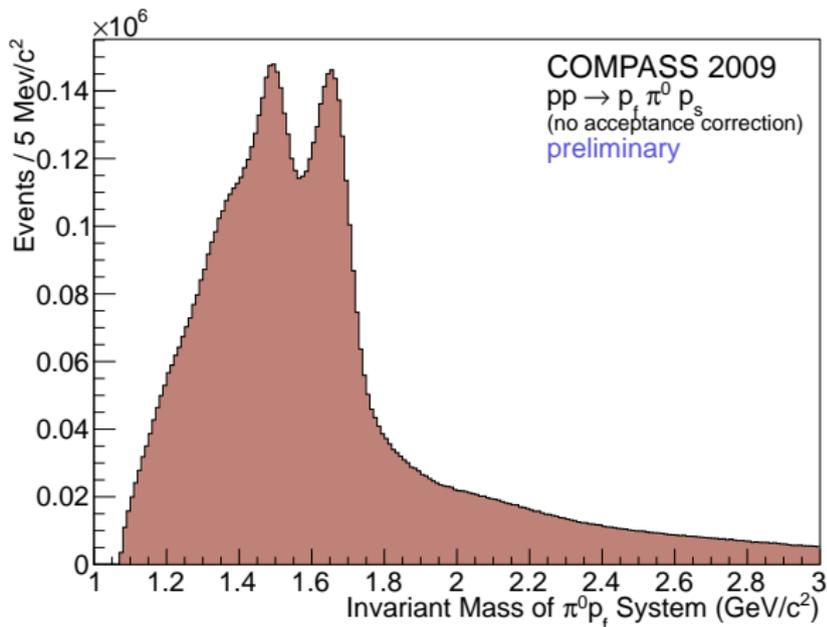
$pp \rightarrow p_{\text{rec}} \pi^0 p_f - t'$ Abhängigkeit

$$0.6 < t' < 1.0$$



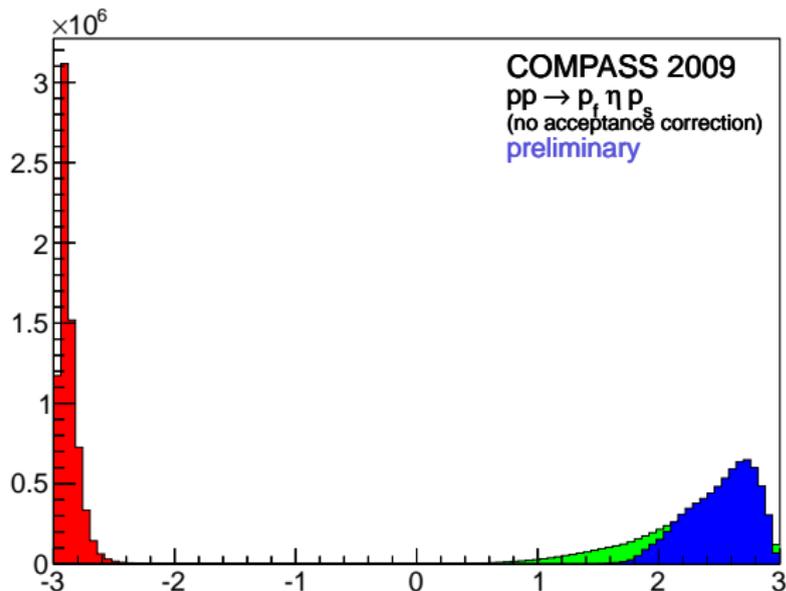
$pp \rightarrow p_{\text{rec}} \pi^0 p_f - t'$ Abhängigkeit

$$0.1 < t' < 1.0$$



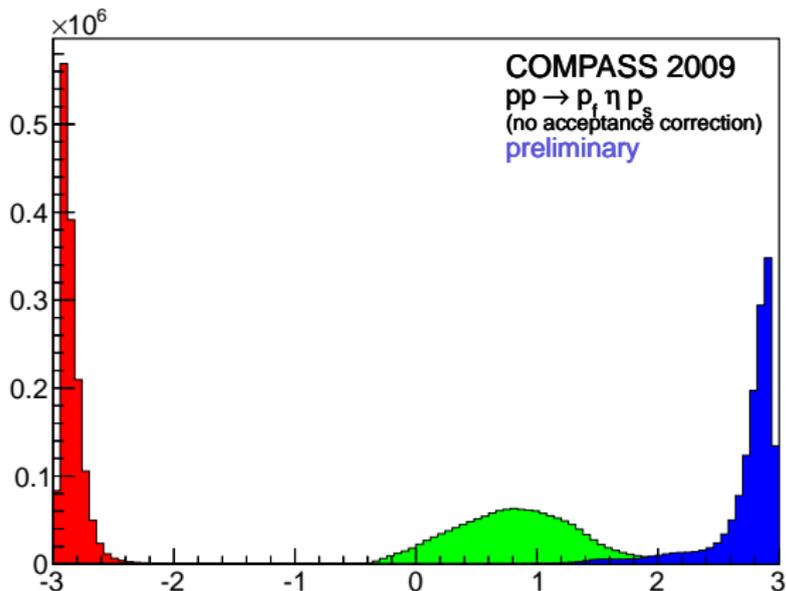
$pp \rightarrow p_{\text{rec}} \pi^0 p_{\text{f}} - \text{Rapiditäten}$

$$m_{p\pi^0} < 2 \text{ GeV}$$



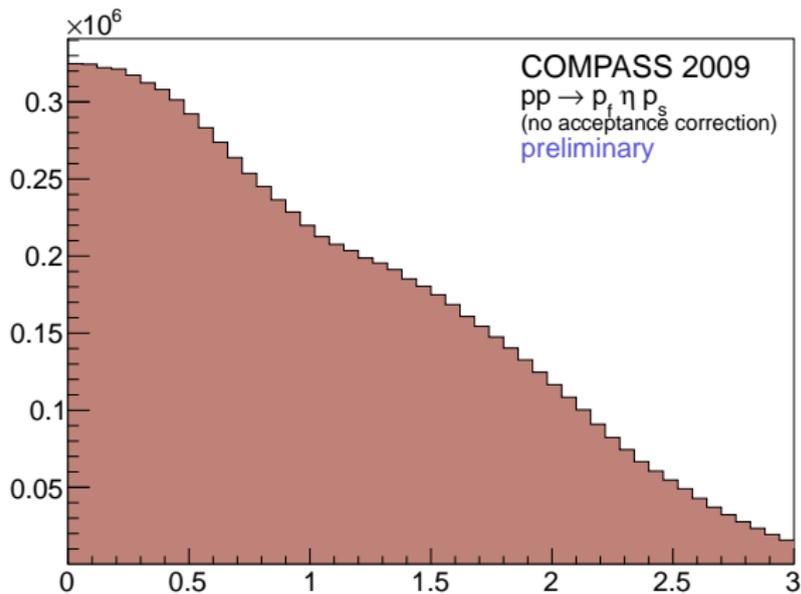
$pp \rightarrow p_{\text{rec}} \pi^0 p_{\text{f}} - \text{Rapiditäten}$

$$m_{p\pi^0} > 2 \text{ GeV}$$



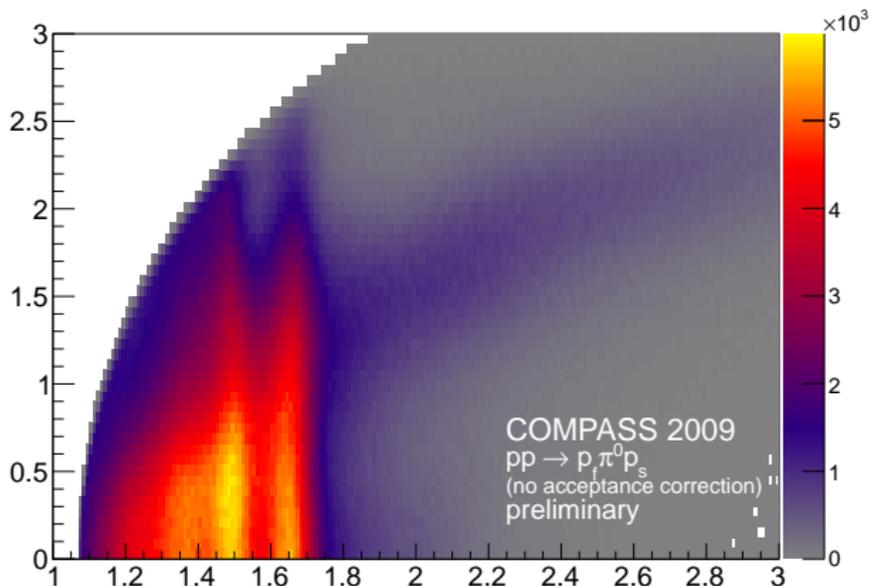
$pp \rightarrow p_{\text{rec}} \pi^0 p_{\text{f}}$ – Rapiditäten

Rapiditätslücke



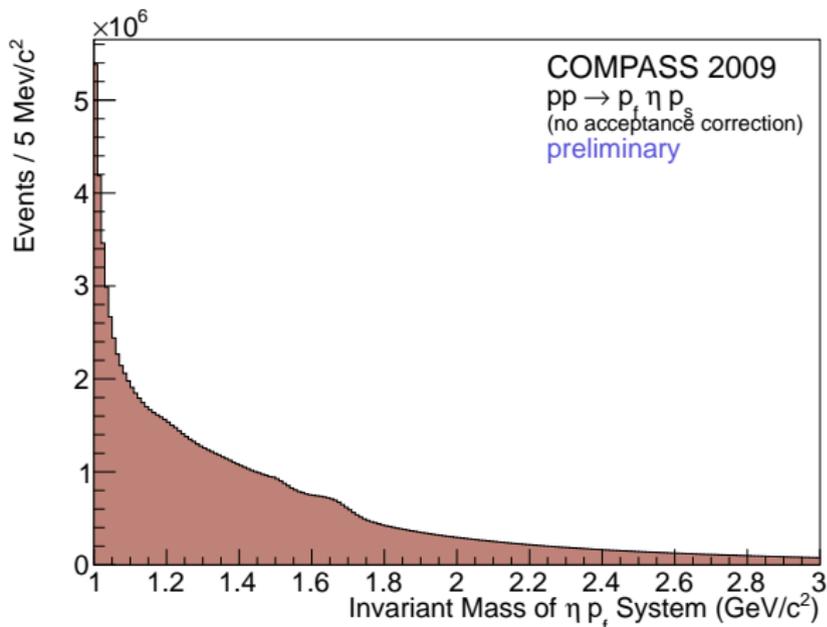
$pp \rightarrow p_{\text{rec}} \pi^0 p_{\text{f}} - \text{Rapiditäten}$

Rapiditätslücke gg. $m_{p\pi^0}$



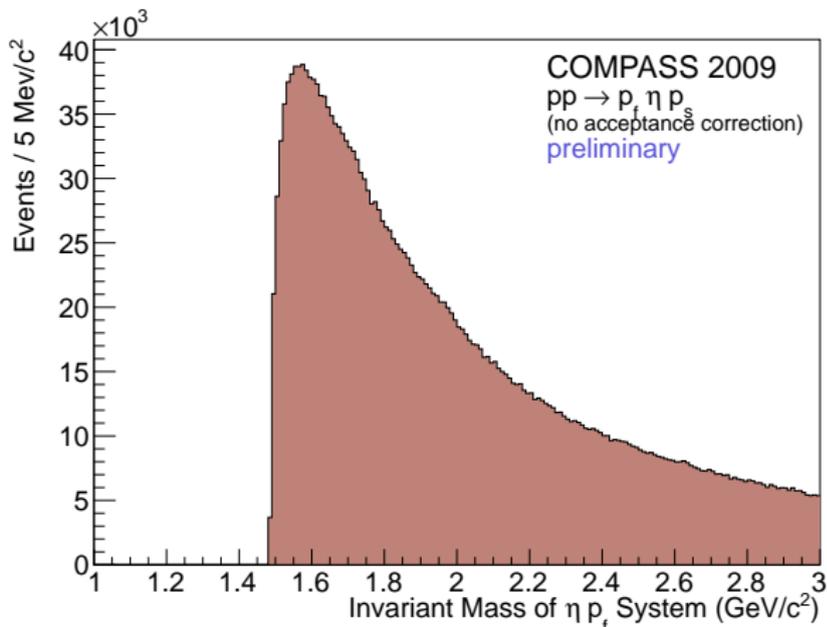
$pp \rightarrow p_{\text{rec}} \eta p_f$

1 geladenes Teilchen + 2 Photonen



179'670'597 Events



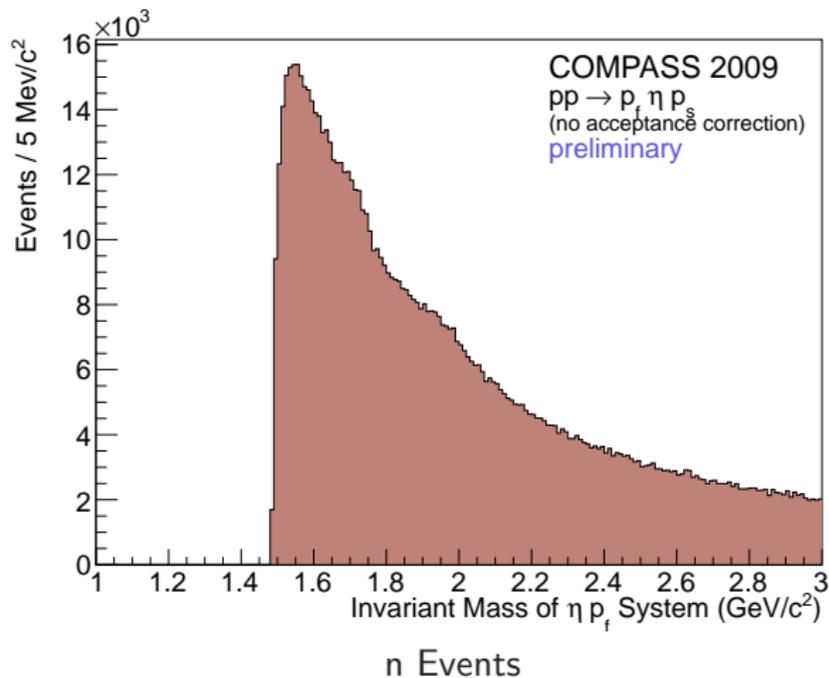
$pp \rightarrow p_{\text{rec}} \eta p_f$
 η identifiziert


2'768'168 Events



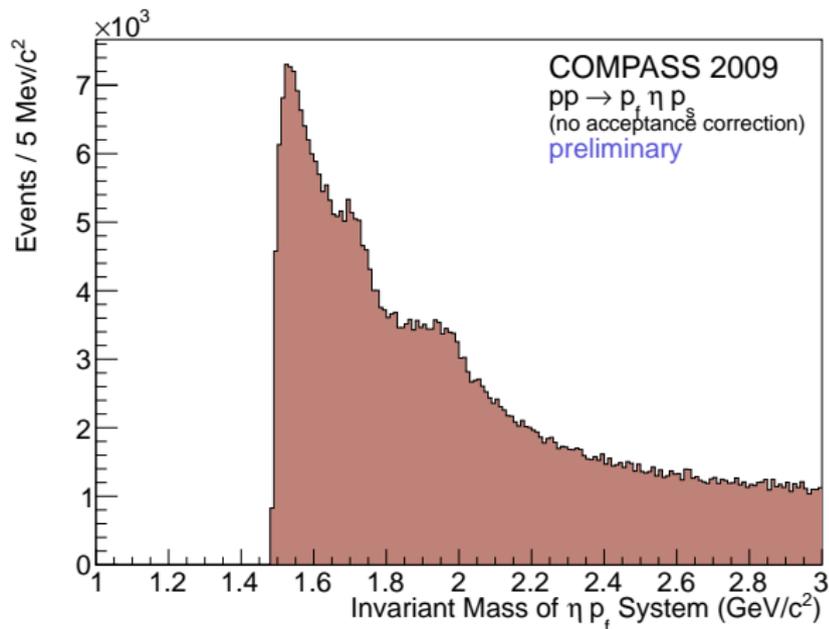
$pp \rightarrow p_{\text{rec}} \eta p_f$

Coplanarity



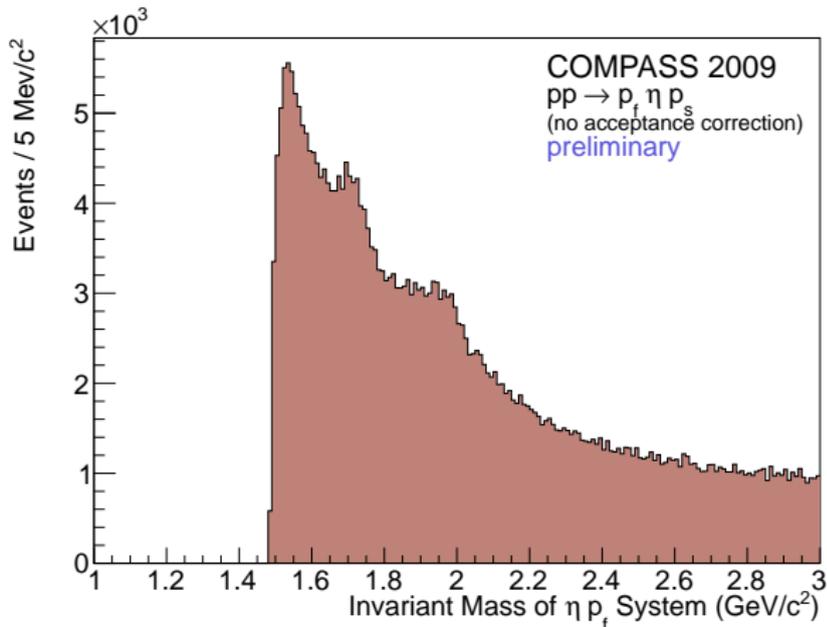
$pp \rightarrow p_{\text{rec}} \eta p_f$

Exclusivity



488'832 Events



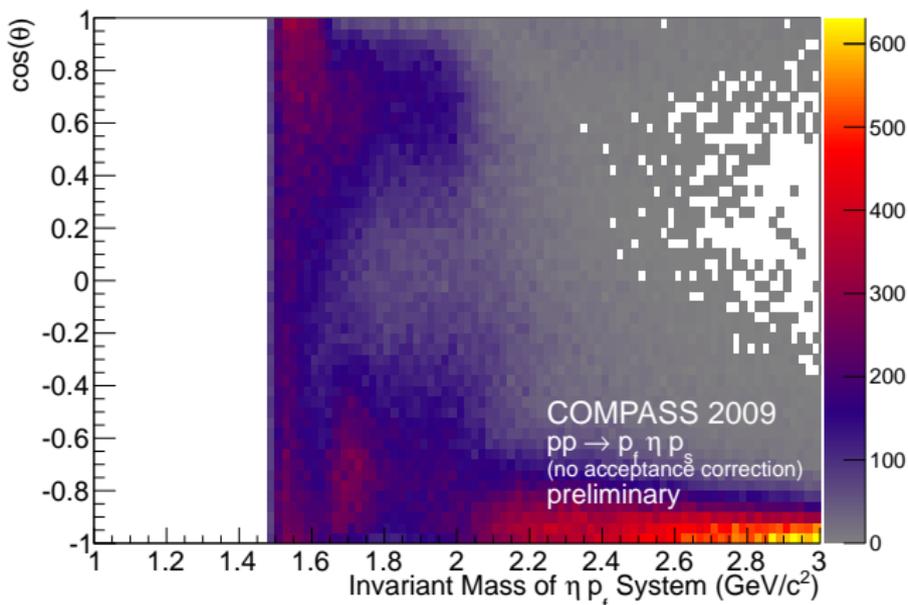
$pp \rightarrow p_{\text{rec}} \eta p_f$
 $0.1 < t' < 1.0$


413'625 Events



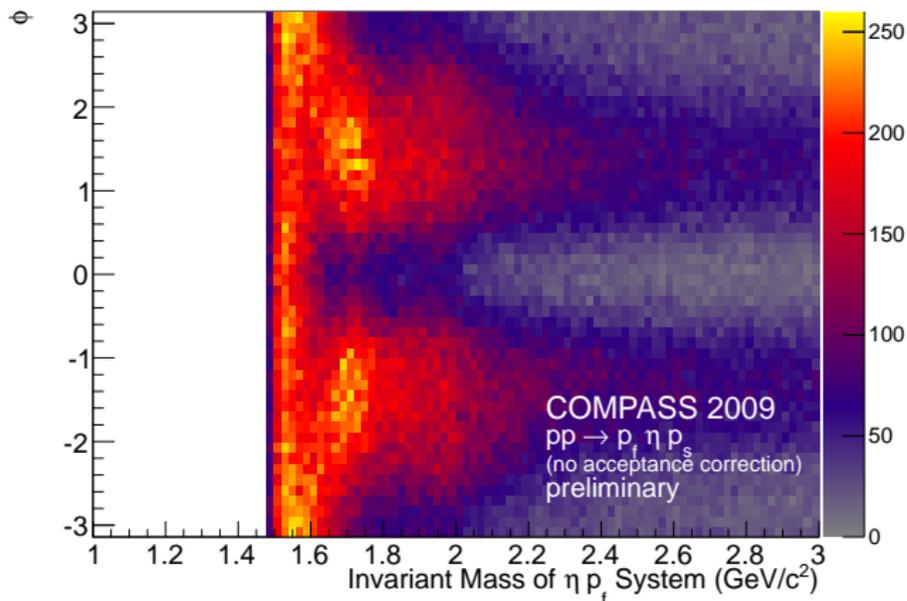
$pp \rightarrow p_{\text{rec}} \eta p_f$ – Winkel

Azimuthwinkel $\cos(\theta)$ gegen invariante Masse



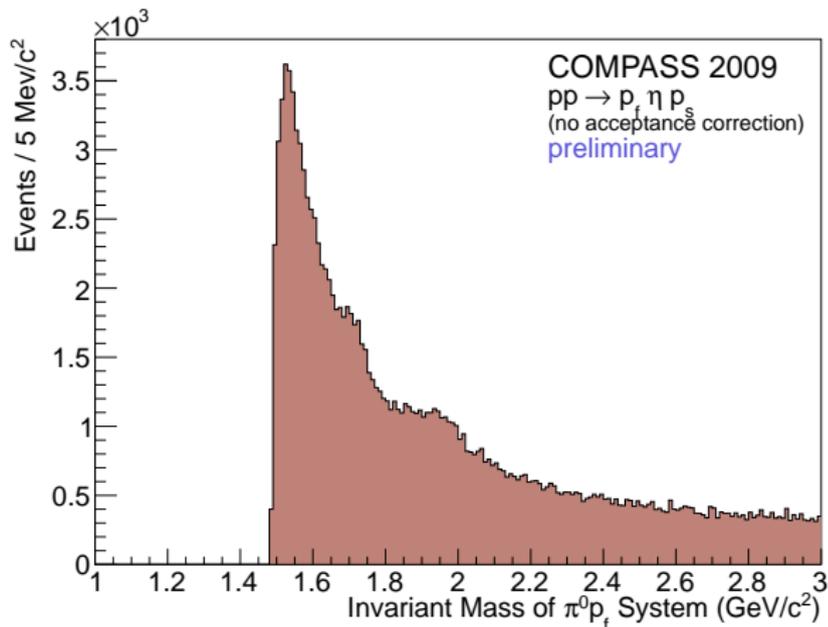
$pp \rightarrow p_{\text{rec}} \eta p_f$ – Winkel

Polarwinkel ϕ gegen invariante Masse



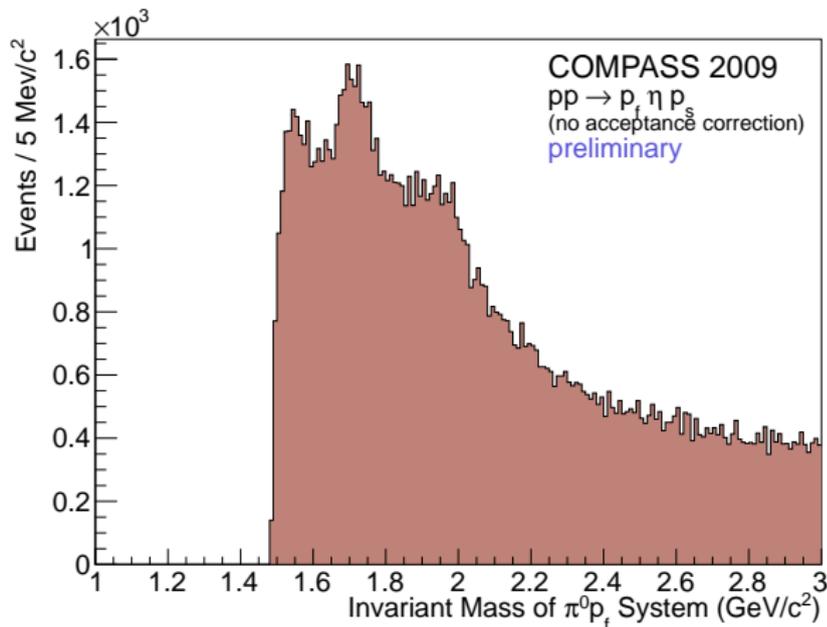
$pp \rightarrow p_{\text{rec}} \eta p_f - t'$ Abhängigkeit

$$0.1 < t' < 0.2$$



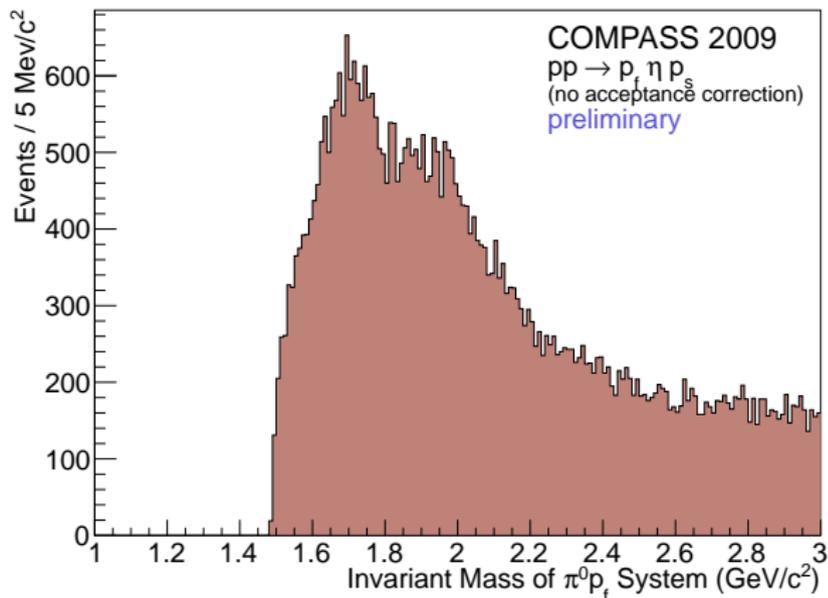
$pp \rightarrow p_{\text{rec}} \eta p_f - t'$ Abhängigkeit

$$0.2 < t' < 0.4$$



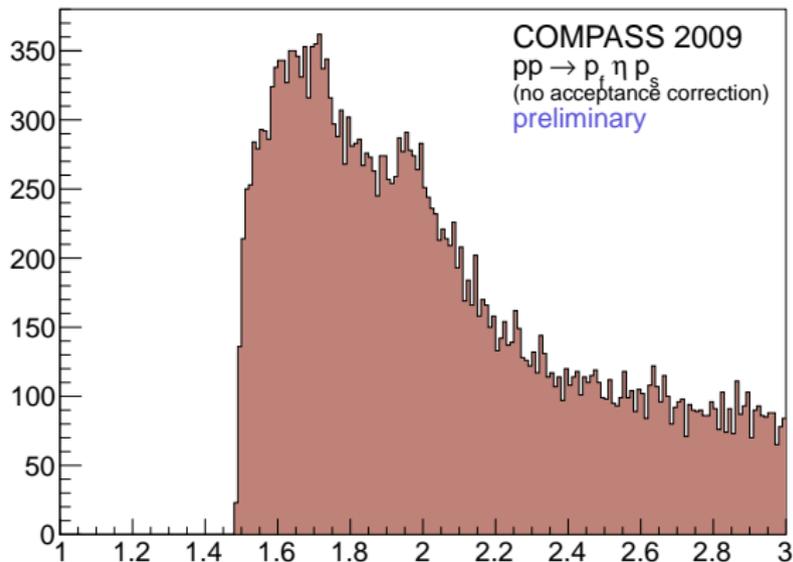
$pp \rightarrow p_{\text{rec}} \eta p_f - t'$ Abhängigkeit

$$0.4 < t' < 0.6$$



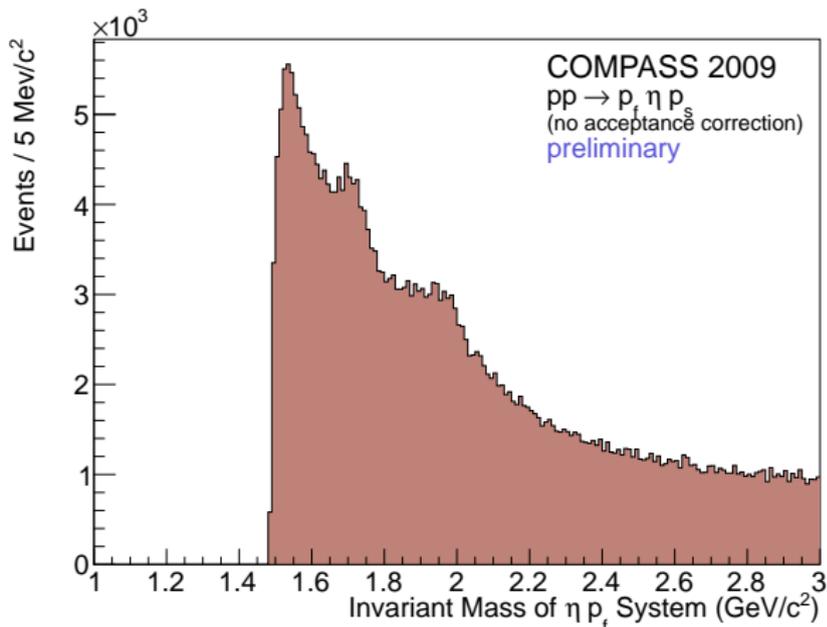
$pp \rightarrow p_{\text{rec}} \eta p_f - t'$ Abhängigkeit

$$0.6 < t' < 1.0$$



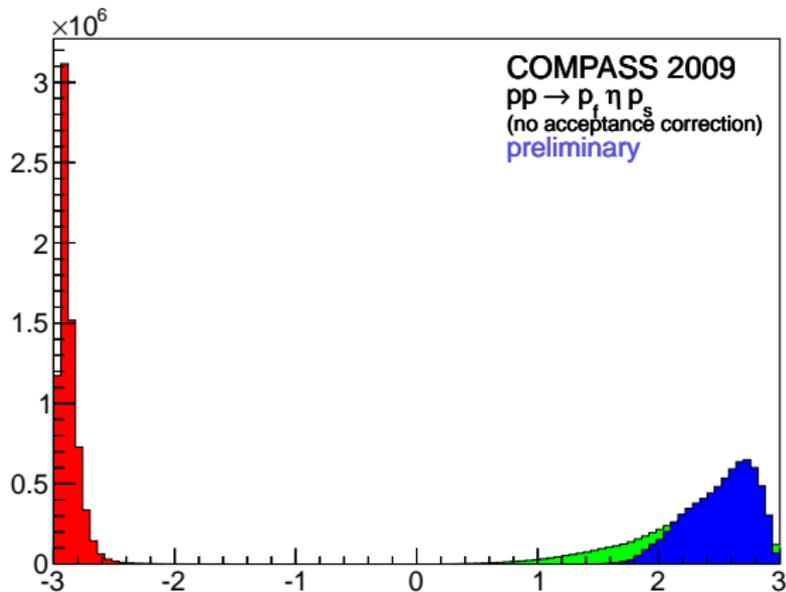
$pp \rightarrow p_{\text{rec}} \eta p_f - t'$ Abhängigkeit

$$0.1 < t' < 1.0$$



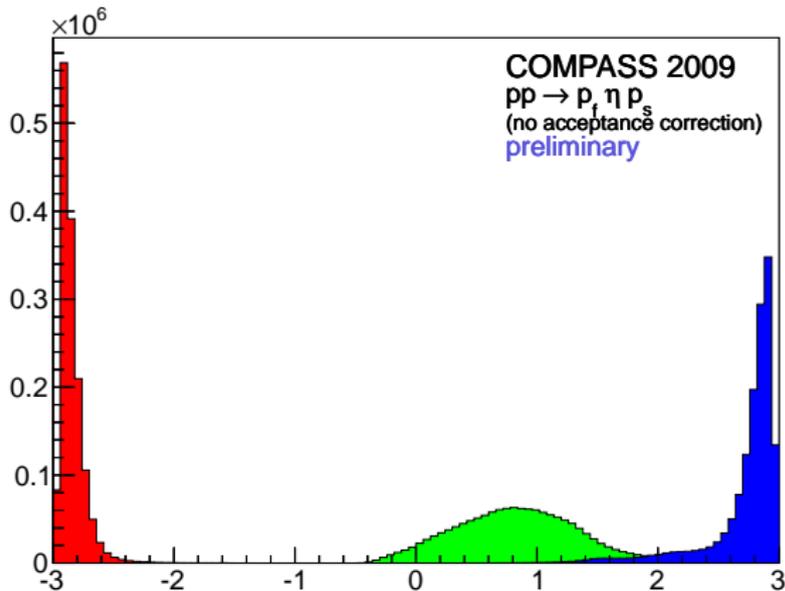
$pp \rightarrow p_{\text{rec}} \eta p_f$ – Rapiditäten

$$m_{p\eta} < 2 \text{ GeV}$$



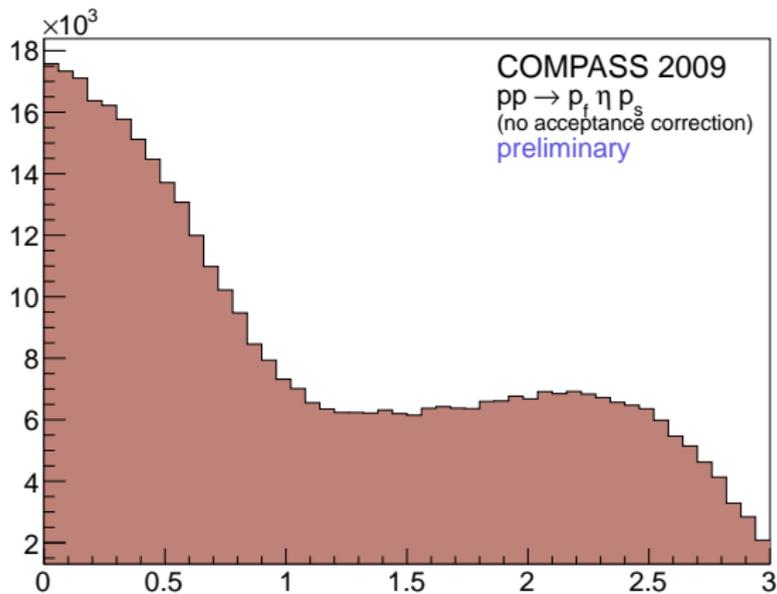
$pp \rightarrow p_{\text{rec}} \eta p_f$ – Rapiditäten

$$m_{p\eta} > 2 \text{ GeV}$$



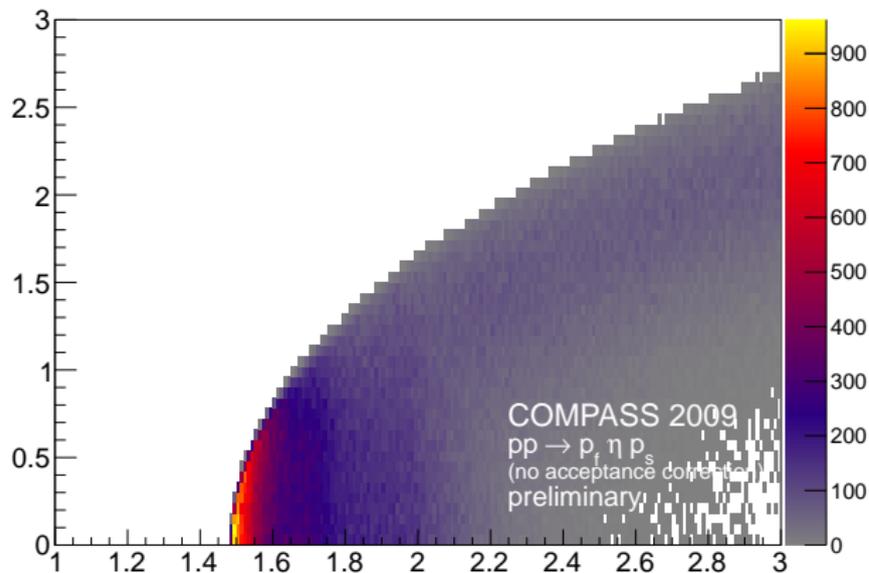
$pp \rightarrow p_{\text{rec}} \eta p_f$ – Rapiditäten

Rapiditätslücke



$pp \rightarrow p_{\text{rec}} \eta p_f$ – Rapiditäten

Rapiditätslücke gg. $m_{p\eta}$



BACKUP

