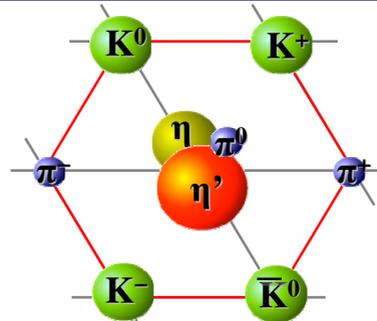


Context

Symmetry Breaking

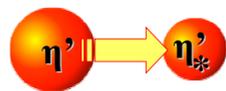
- SU(3) flavor symmetry broken
→ 9 Goldstone bosons
- Explicit breaking of $U_A(1)$ part
→ **8 light mesons & a massive η'** ($m_{\eta'}=958$ MeV)



In-medium $U_A(1)$ Symmetry Restoration

- High energy densities, $\alpha_s \rightarrow 0$
- $U_A(1)$ breaking terms vanish
- η' mass may be restored to quark model value**

$$m_{\eta'}^* = \sqrt{\frac{1}{3}(2m_K^2 + m_\pi^2)} \approx 400 \text{ MeV}$$



- Mass gap: η'_* mesons are trapped in medium
- Appear at low- p_T from condensate

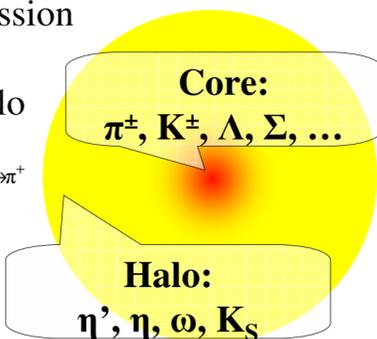
Enhanced η' production

- The lighter a meson, the more abundant it is
- Hagedorn-estimation: $\frac{N_{\eta'}^*}{N_{\eta'}} = \left(\frac{m_{\eta'}^*}{m_{\eta'}}\right)^{2/3} e^{-\left(\frac{m_{\eta'}^*}{m_{\eta'}}\right)}$
- The expected mass drop enhances η' rates by 3-50**

Discovery channel: HBT Correlations

- Core-halo structure of pion emission
- η' has long lifetime
- more η' 's → enhancement of halo
- $N_{\text{halo}}^{\pi^+} = N_{\omega \rightarrow \pi^+} + N_{\eta \rightarrow \pi^+} + N_{\eta' \rightarrow \pi^+} + N_{K_S^0 \rightarrow \pi^+}$
→ reduction of intercept λ^*

$$\lambda^* = \left(\frac{N_{\text{core}}^{\pi^+}}{N_{\text{halo}}^{\pi^+} + N_{\text{core}}^{\pi^+}} \right)^2$$

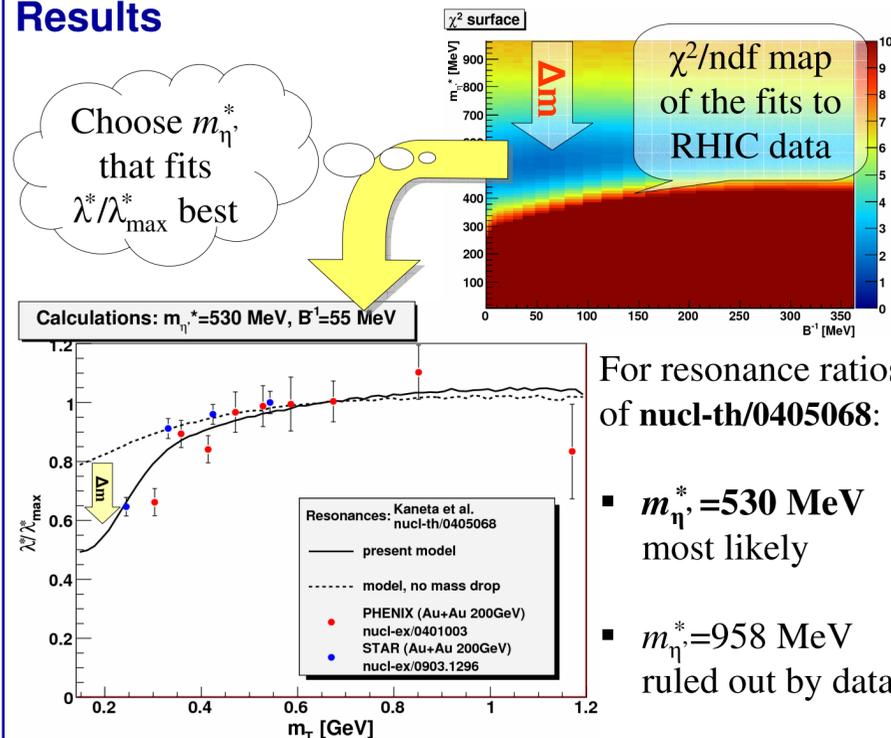


Signals of η' mass reduction

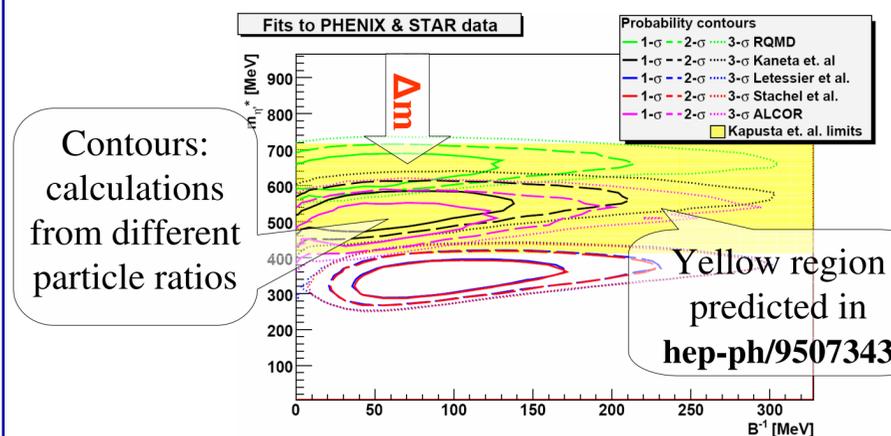
Simulation

- 6 different models for the particle ratios
- Resonance decays using JETSET
- Systematic studies for all the main uncertainties

Results



Comparison with theoretical expectation



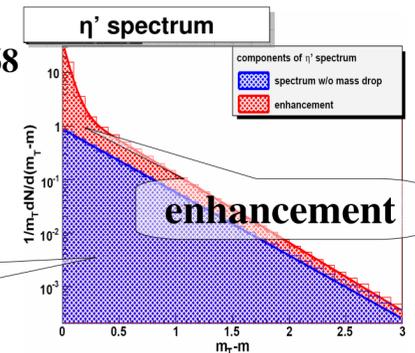
Low- p_T enhancement

Resonance ratios: nucl-th/0405068

- Enhancement factor ~ 24
- Breaks m_T scaling for η'

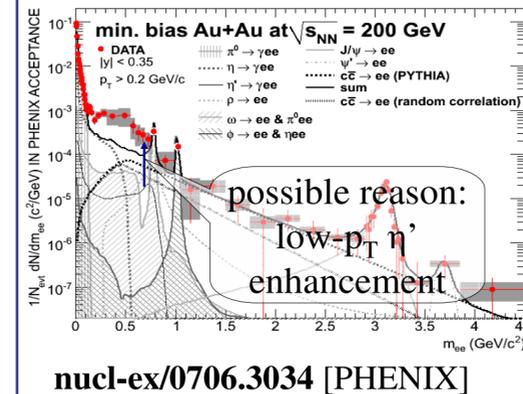
$$m_{\eta'}^* = 958 \text{ MeV}$$

($m_T - m_{\eta'}$) spectrum



- $\eta' \rightarrow \eta + \pi^+ + \pi^- \rightarrow (\pi^+ + \pi^- + \pi^0) + \pi^+ + \pi^-$
→ reduction of $\lambda^*(m_T)$ at $m_T - m_{\eta'} < 250$ MeV

Dilepton spectrum: an alternative way



- Excess at $m_{\ell\ell} < 1$ GeV
- Seen at SPS (CERES) and RHIC (PHENIX)
- Only in A+B reactions
- Absent in p+p

Conclusion

**$m_{\eta'}^* < m_{\eta'} - 200$ MeV
at the 99,9% confidence level**

from PHENIX+STAR $\pi^+\pi^+$ correlation data + 6 models

- Detailed cross-check with dilepton spectrum needed
- More data at low p_T on the strength of λ^* is needed to reduce systematic errors

