

X(3872) production

- **Martin Galuska study (2009):**
 - $B(X \rightarrow J/\psi 2\pi)$ and $B(X \rightarrow p\bar{p})$ both unknown
 - Assumption in analysis: $B(X \rightarrow J/\psi 2\pi) = 10\%$
 - $\sigma_{p\bar{p} \rightarrow X} = 50 \text{ nb}$ (coffee-break estimate by Braaten)
- **Meanwhile:**
 - PDG & Exotics Review (arXiv:0910.3138v2 [hep-ex]):
 $2.6\% < B(X \rightarrow J/\psi 2\pi) < 6.6\%$
 - LHCb Measurement (Eur. Phys. J. C73, 2462 (2013)):
 $B(X \rightarrow p\bar{p})/B(X \rightarrow J/\psi 2\pi) < 0.002$

$\Rightarrow B(X \rightarrow p\bar{p}) < 0.002 \cdot B(X \rightarrow J/\psi 2\pi)$ (values entangled!)

X(3872) production

- Crossing Symmetry (or detailed balance):

$$\sigma_{i \rightarrow X}(E) = \frac{(2J+1)}{(2S_1+1)(2S_2+1)} \frac{4\pi}{k^2} \frac{\Gamma^2/4}{(E-E_0)^2 + \Gamma^2/4} \cdot B(X \rightarrow i)$$

- For $p\bar{p}$ @ $J=1$, $E = E_0 = M_X$, $k^2 = p_{\text{breakup}}^2(X \rightarrow p\bar{p}) = (M_X^2 - 4m^2)/4$

$$\sigma_{\text{peak}, p\bar{p} \rightarrow X} = \frac{12\pi}{M_X^2 - 4m^2} \cdot B(X \rightarrow p\bar{p}) \stackrel{\text{LHCb}}{<} 2.551 \mu\text{b} \cdot B(X \rightarrow J/\psi \pi^+ \pi^-) \stackrel{[2.6\% \dots 6.6\%]}{}$$

$$\Rightarrow \sigma_{\text{peak}, p\bar{p} \rightarrow X} < \overset{2.6\%}{66.3 \text{ nb}} \dots \overset{5\%}{128 \text{ nb}} \dots \overset{6.6\%}{168.3 \text{ nb}} \text{ @ CL95} \cdot \text{CL90}$$

product of LL and UL not really an UL!

- Proposal: Use $\sigma_{p\bar{p} \rightarrow X} = 100 \text{ nb}$ instead 50 nb

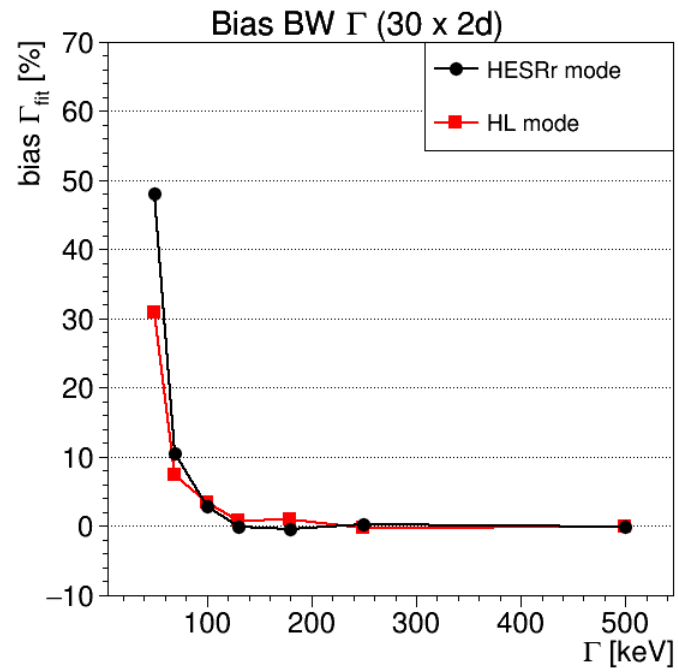
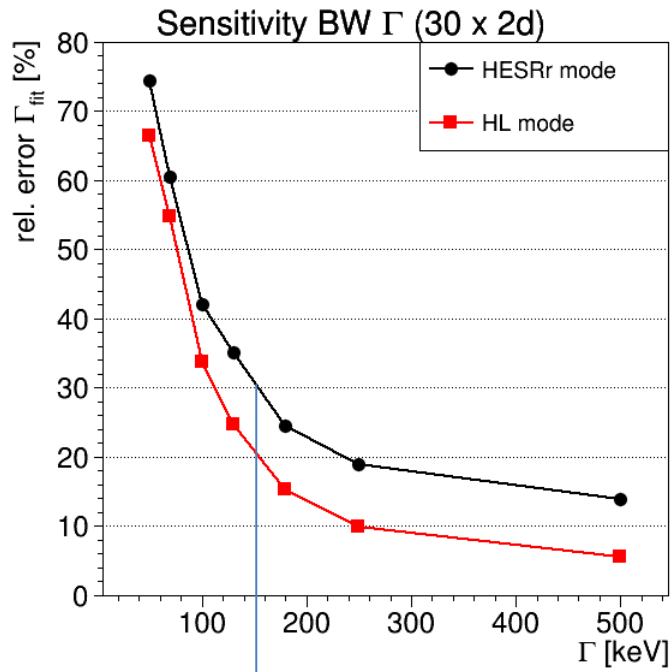
(BESIII uses $B(X \rightarrow J/\psi 2\pi) = 5\%$ in some paper $\Rightarrow \sigma_{p\bar{p} \rightarrow X} < 128 \text{ nb}$)

new

Martin

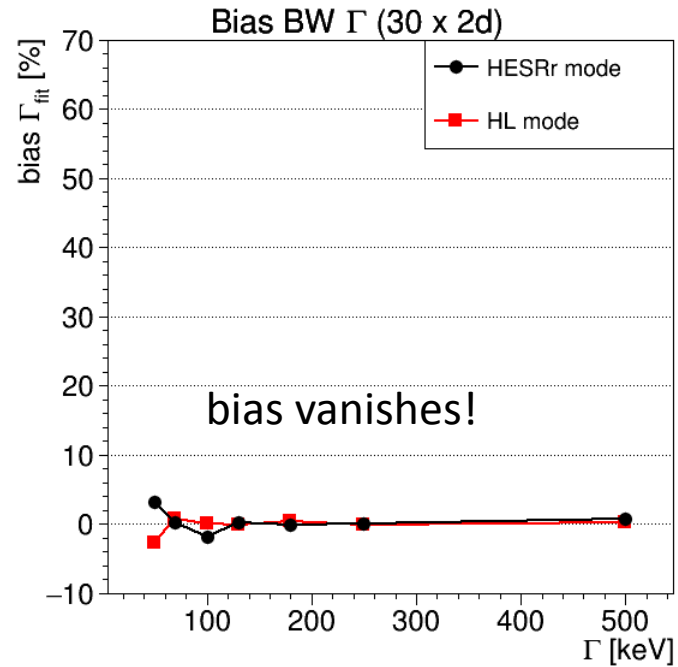
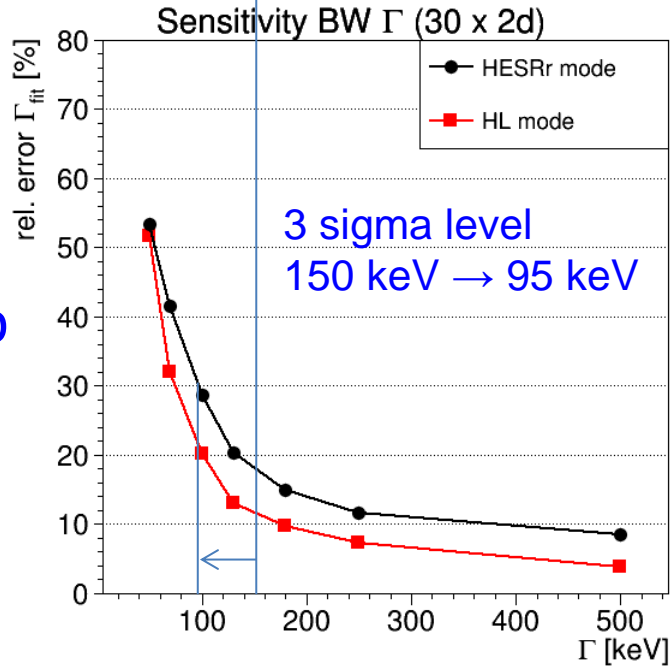
- NB: $\sigma_{p\bar{p} \rightarrow X} \cdot B(X \rightarrow J/\psi 2\pi) = 100 \text{ nb} \cdot 5\% = 50 \text{ nb} \cdot 10\% = 5 \text{ nb}$ (same!)

50nb

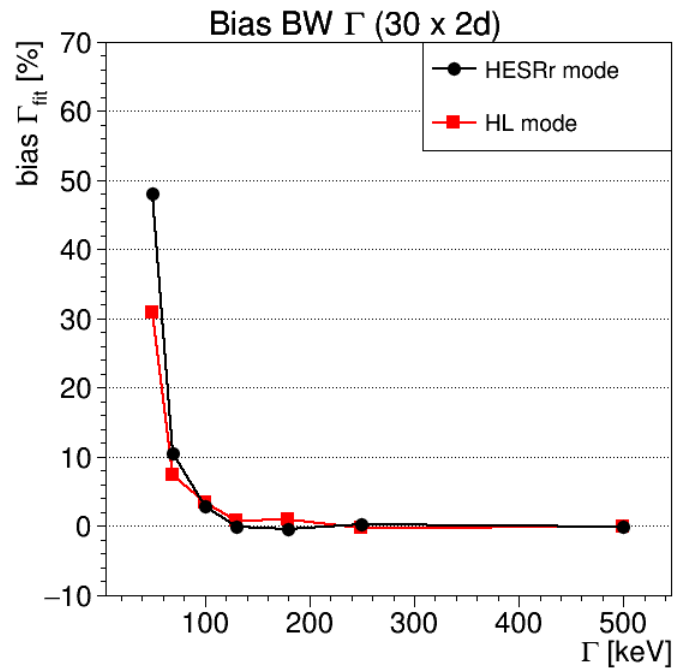
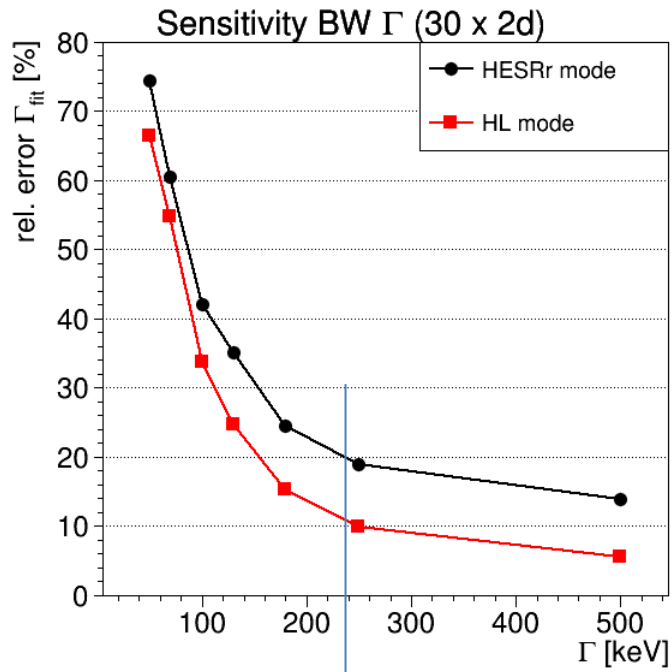


dp/p
HL : 1E-4
HESRr: 5E-5

100nb



50nb



dp/p
HL : 1E-4
HESRr: 5E-5

100nb

