

# *Revisiting Pion-Deuteron Correlations: Statistical Hadronization Meets Femtoscopy*

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## Article

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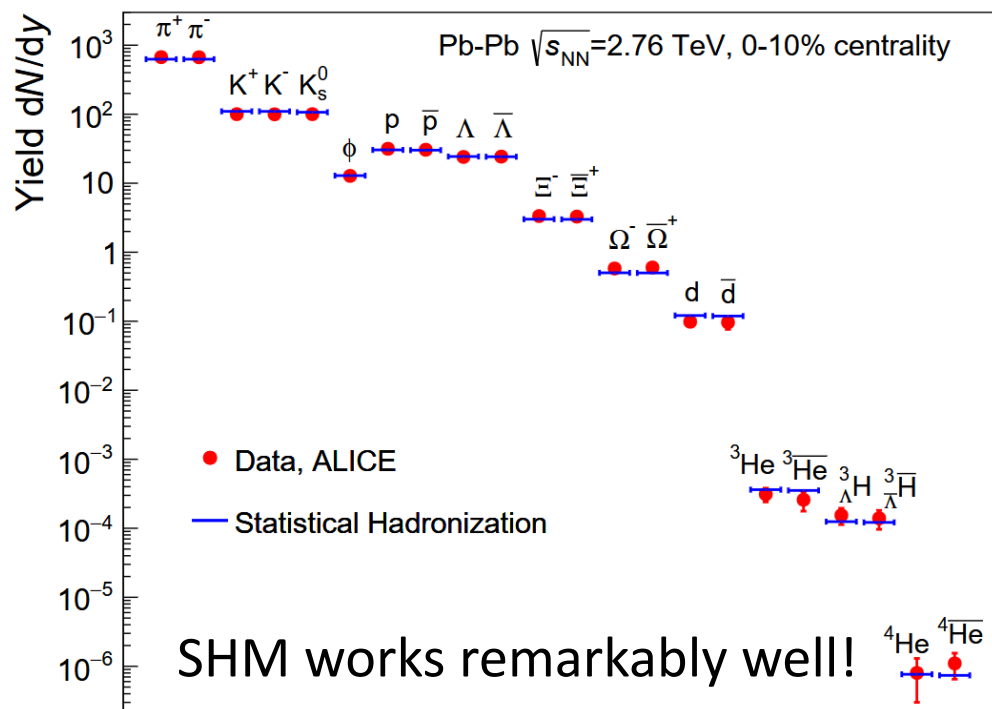
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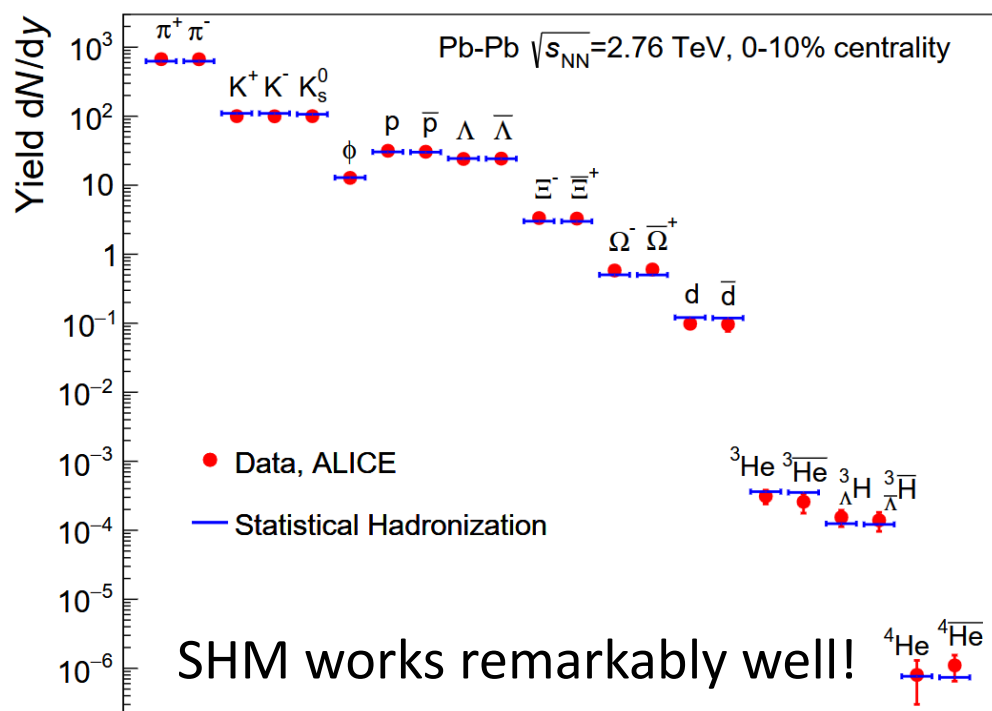
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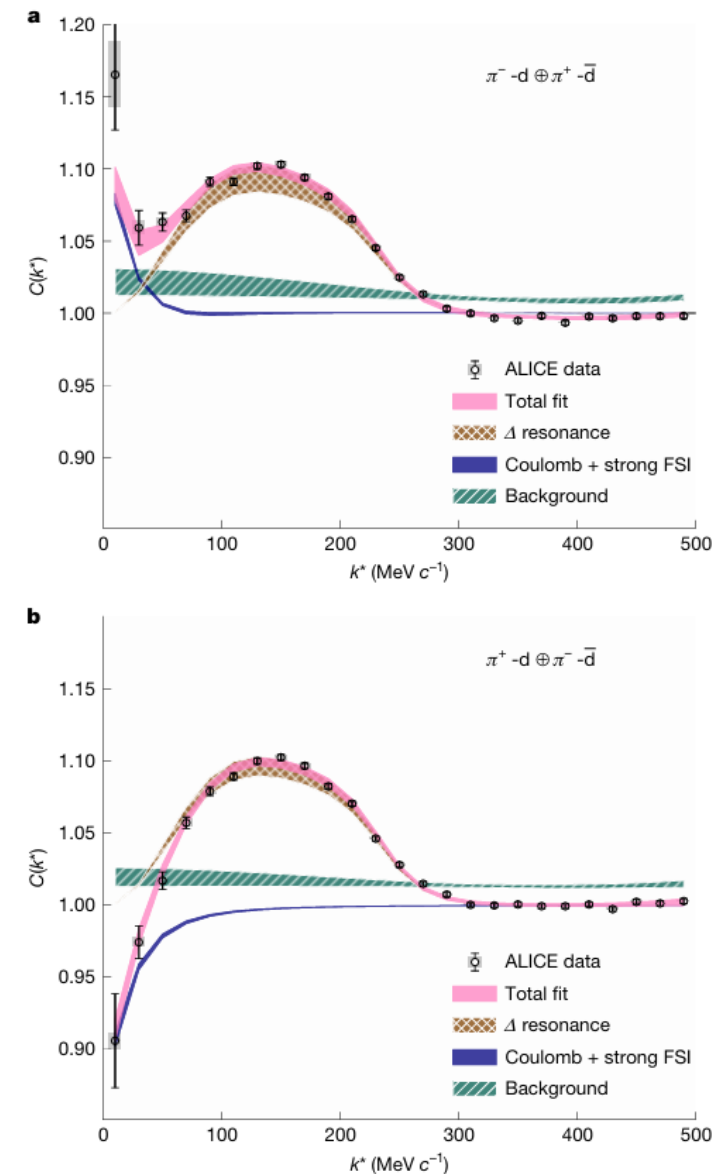
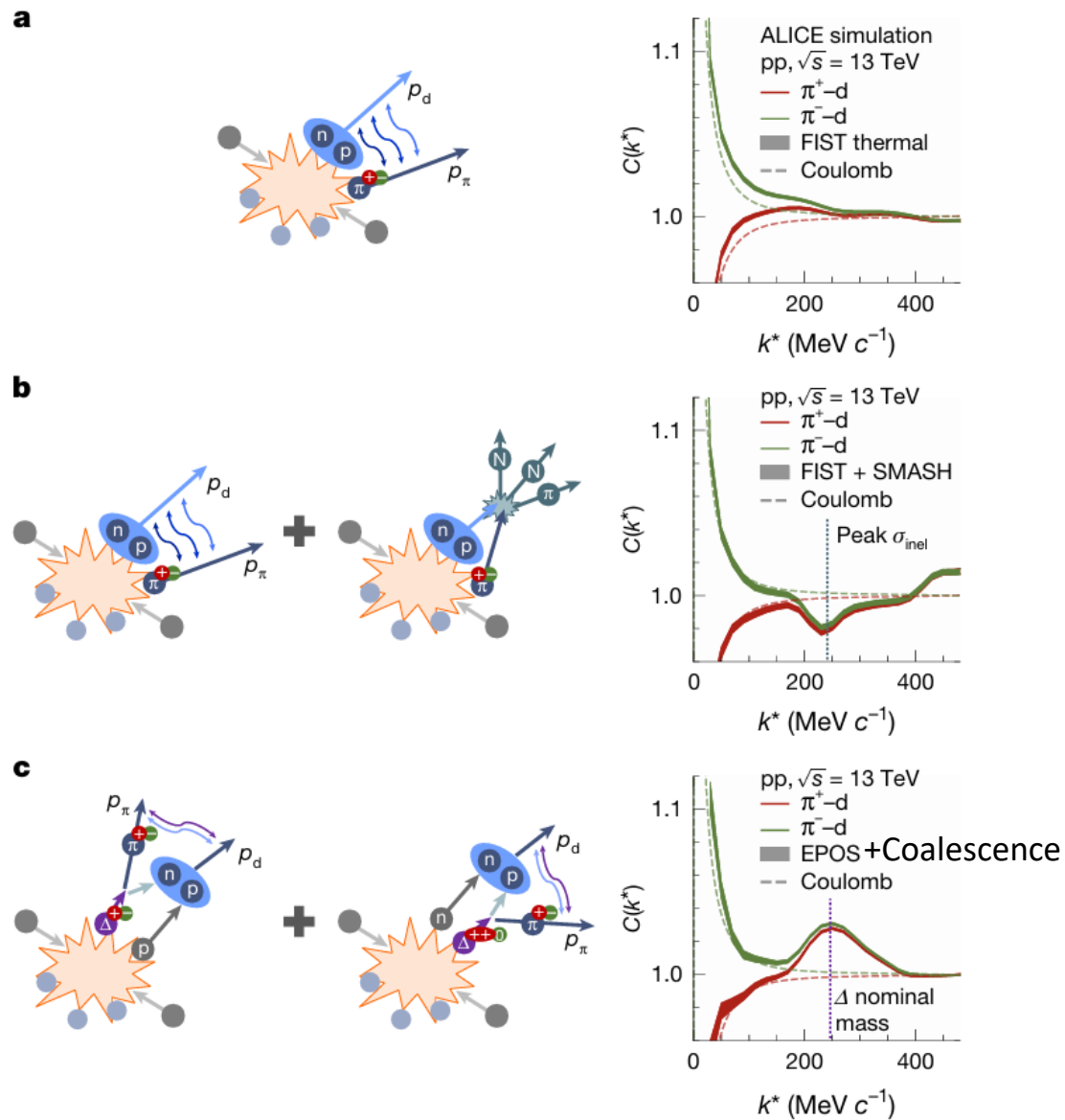


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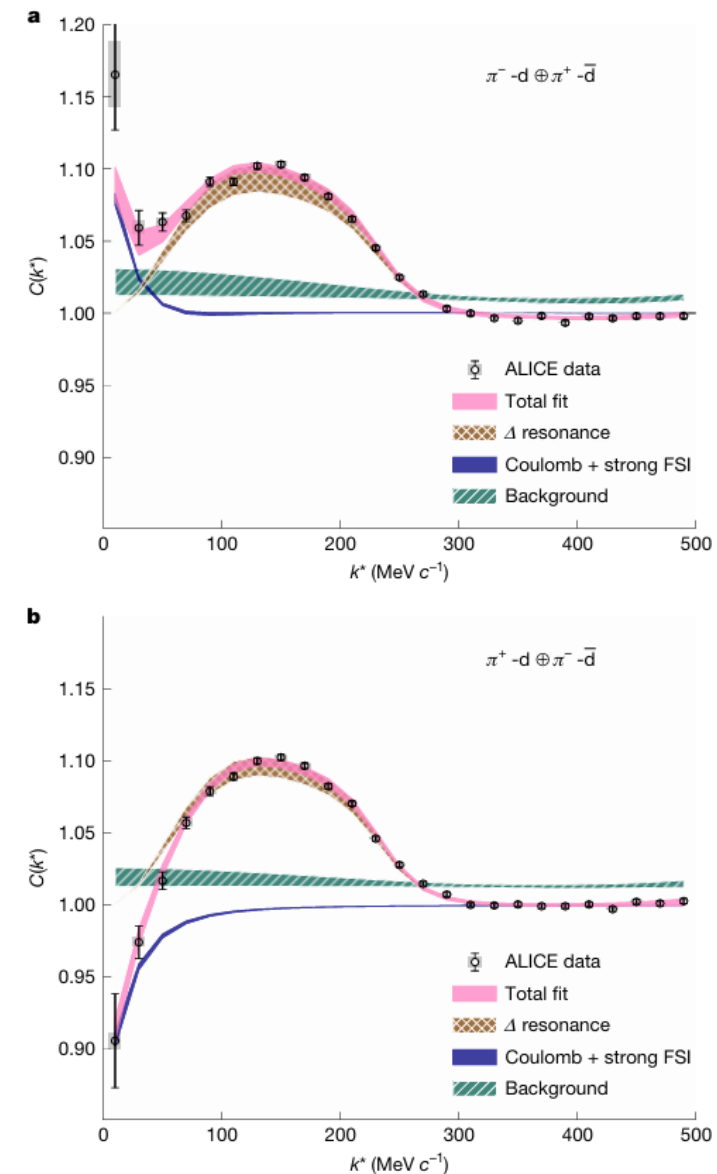
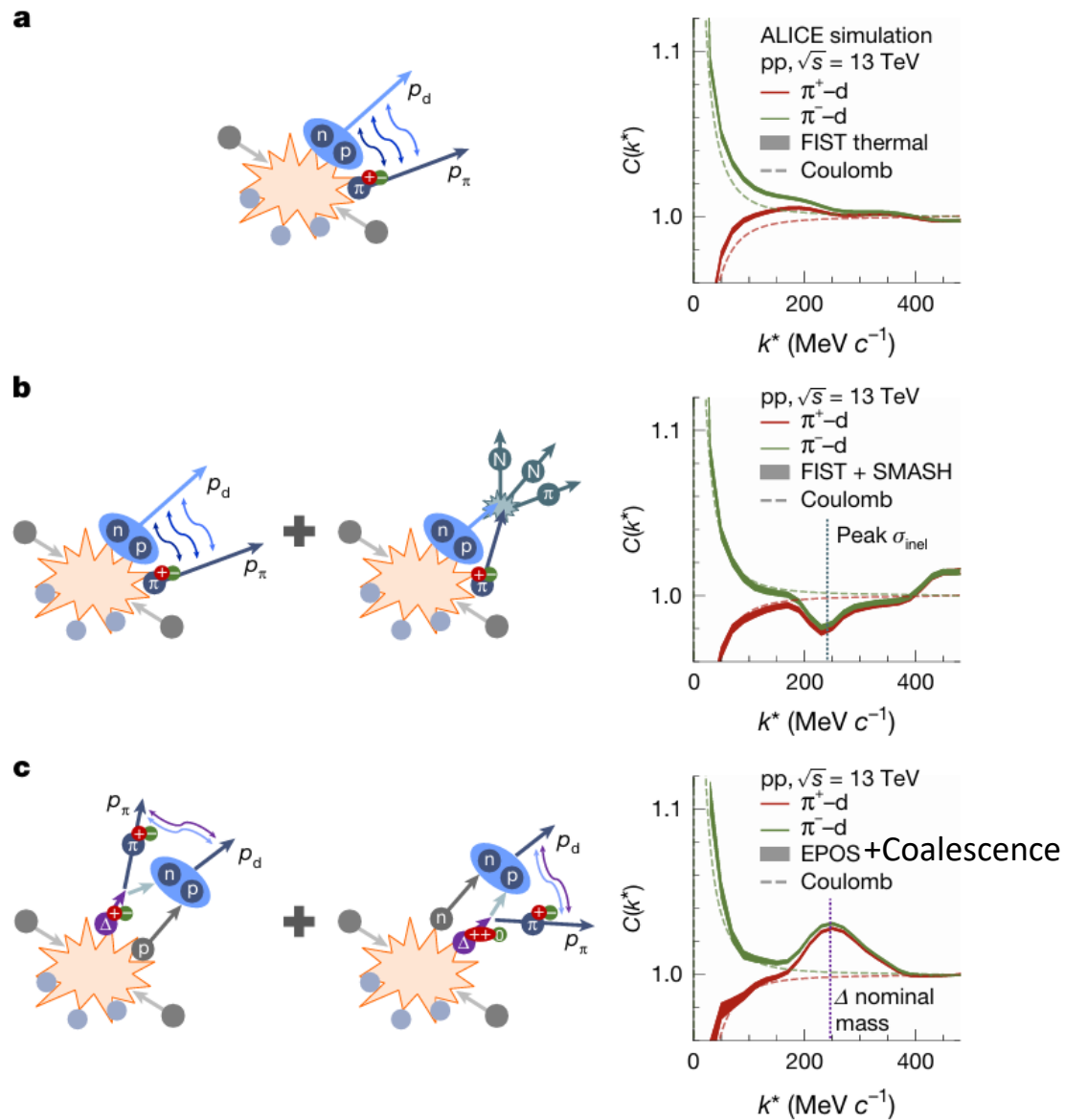
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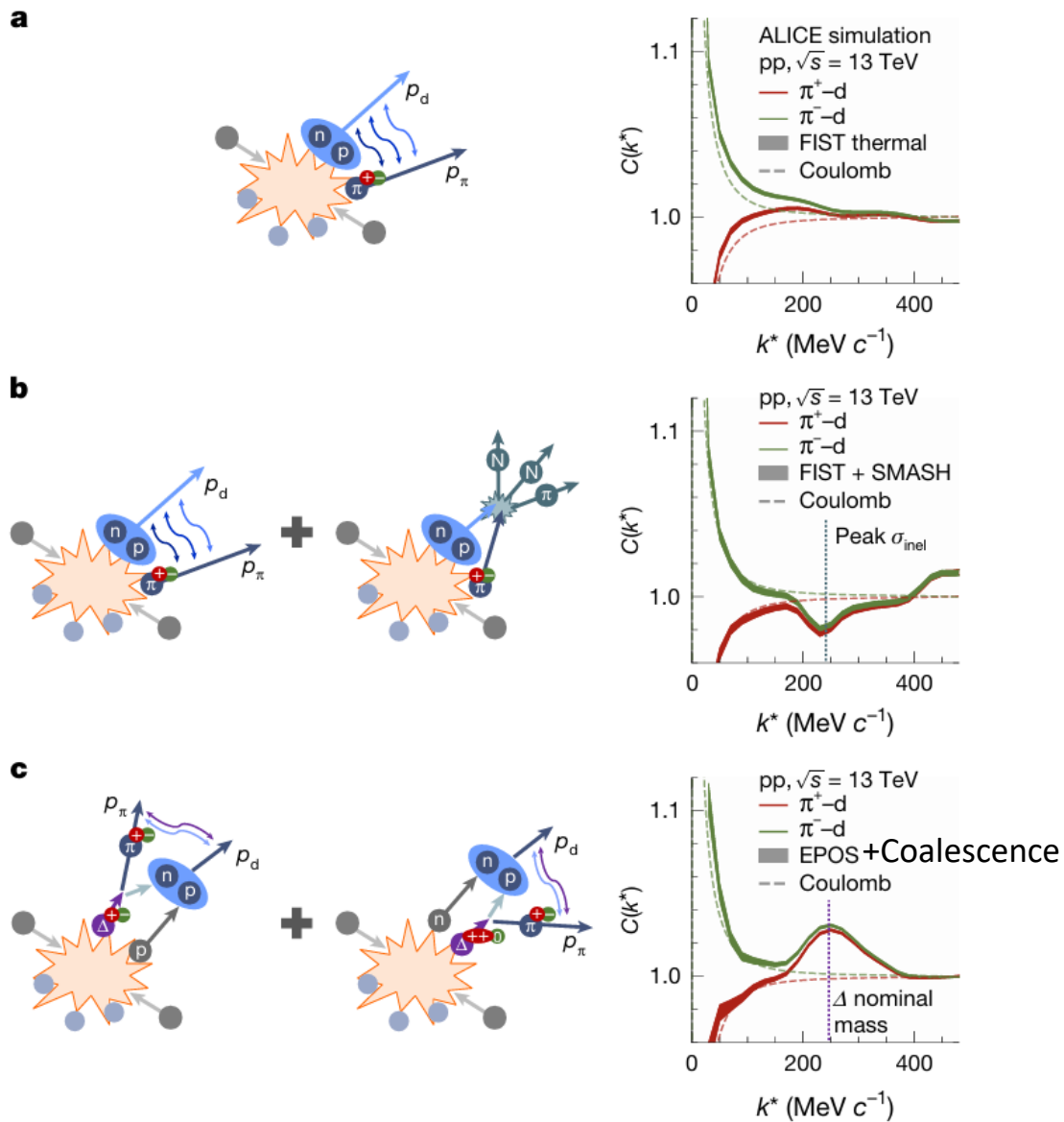
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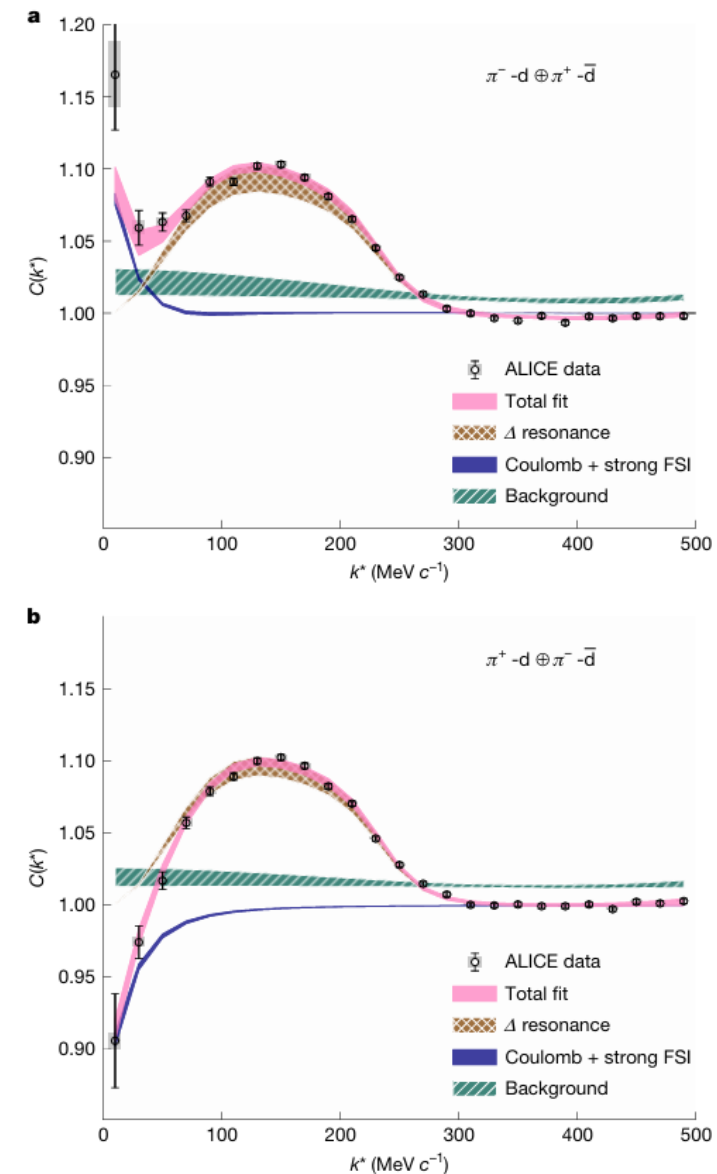
# Introduction



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We have a better interpretation!



# Model & Setup

We use the ThermalBlastMC model [10.5281/zenodo.18238384; PRC 113, 044902 (2026)], in which hadronization happens on the cylindrical boost-invariant hypersurface at constant proper time

$$\Sigma^\mu = (\tau \cosh \eta, r \cos \varphi, r \sin \varphi, \tau \sinh \eta), \text{ where } \tau = \sqrt{t^2 - z^2} = \text{const. and } \eta = \frac{1}{2} \ln \frac{t+z}{t-z}$$

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Then with the help of the Cooper-Frye formula one finds

$$\frac{d^6 N_i}{dp_T dy d\psi dr d\eta d\varphi} \propto \tau r p_T m_T \cosh(y - \eta) \left( \exp \left[ \frac{m_T \cosh \rho \cosh(y - \eta) - p_T \sinh \rho \cos(\varphi - \psi) - \mu_i}{T} \right] \pm 1 \right)^{-1}$$

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The mass distribution of resonances is modelled with the Sill distribution [Eur. Phys. J. A (2021) 57:336]:

$$\frac{d^6 N_i}{dp_T dy d\psi dr d\eta d\varphi} \rightarrow \frac{d^6 N_i}{dp_T dy d\psi dr d\eta d\varphi} \frac{2M}{\pi} \frac{\sqrt{M^2 - M_{th}^2} \tilde{\Gamma}}{(M^2 - M_0^2)^2 + (M^2 - M_{th}^2) \tilde{\Gamma}^2} \theta(M - M_{th}), \quad \tilde{\Gamma} = \Gamma M_0 (M_0^2 - M_{th}^2)^{-1/2}$$

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ThermalBlastMC event loop:

1. Set model parameters, evaluate  $\langle N_i \rangle$
2. For every event generate yield of particles of  $i^{\text{th}}$  type  $N_i$  from Poisson distribution
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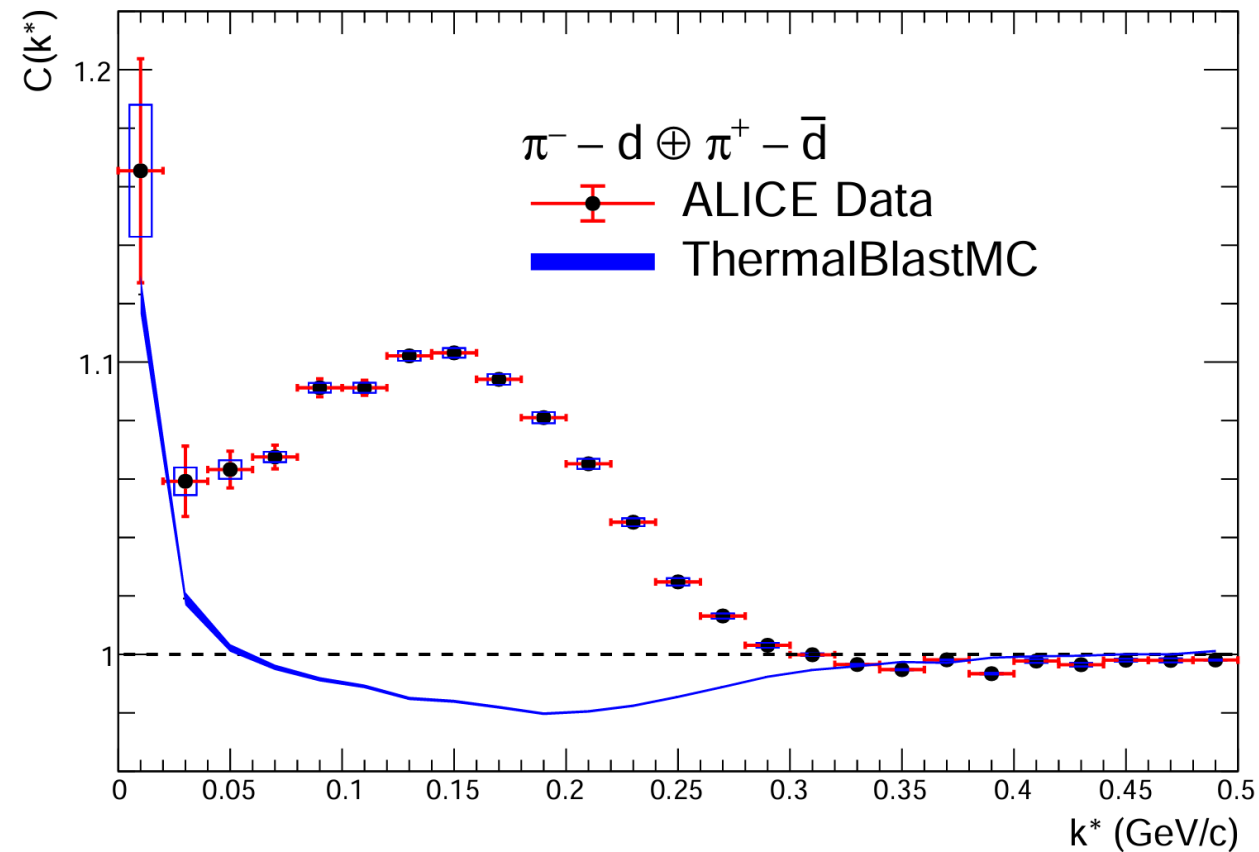
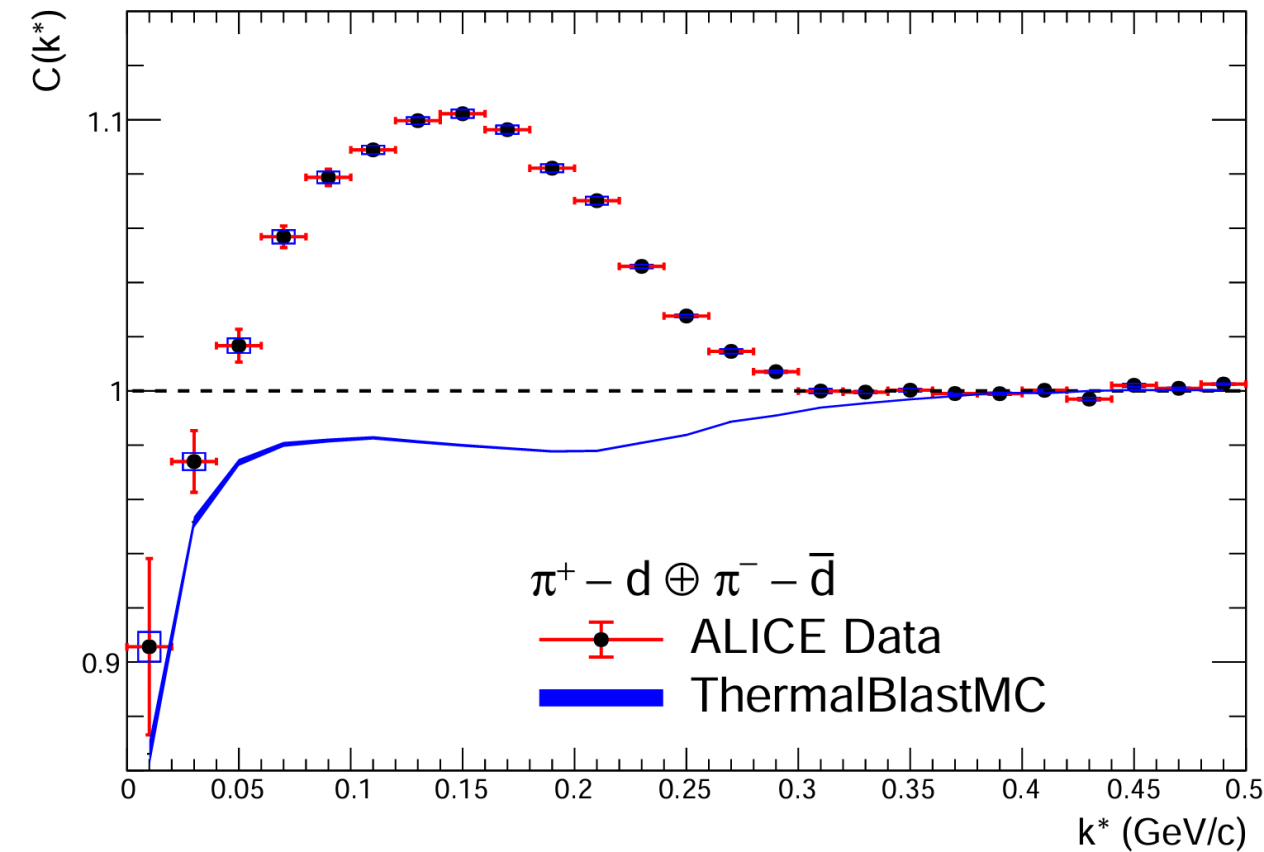
Entries in the same event distribution are weighted with the Coulomb wave function norm  $|\psi(\mathbf{r}^*, \mathbf{k}^*)|^2$ :

$$\psi(\mathbf{r}^*, \mathbf{k}^*) = e^{-\frac{\pi\eta}{2}} \Gamma(1 + i\eta) e^{i\mathbf{k}^* \cdot \mathbf{r}_1^*} F_1(-i\eta, 1, i(k^* r^* - \mathbf{k}^* \cdot \mathbf{r}^*))$$

$$\mathbf{k}^* = \mathbf{p}_\pi^* = -\mathbf{p}_d^*, \quad \mathbf{r}^* = \mathbf{r}_\pi^* + \frac{\mathbf{p}_\pi^*}{E_\pi^*} (t_d^* - t_\pi^*) \theta(t_d^* - t_\pi^*) - \mathbf{r}_d^* - \frac{\mathbf{p}_d^*}{E_d^*} (t_\pi^* - t_d^*) \theta(t_\pi^* - t_d^*), \quad \eta = \frac{\alpha Z_\pi Z_d}{k^*} \frac{m_\pi m_d}{m_\pi + m_d}$$

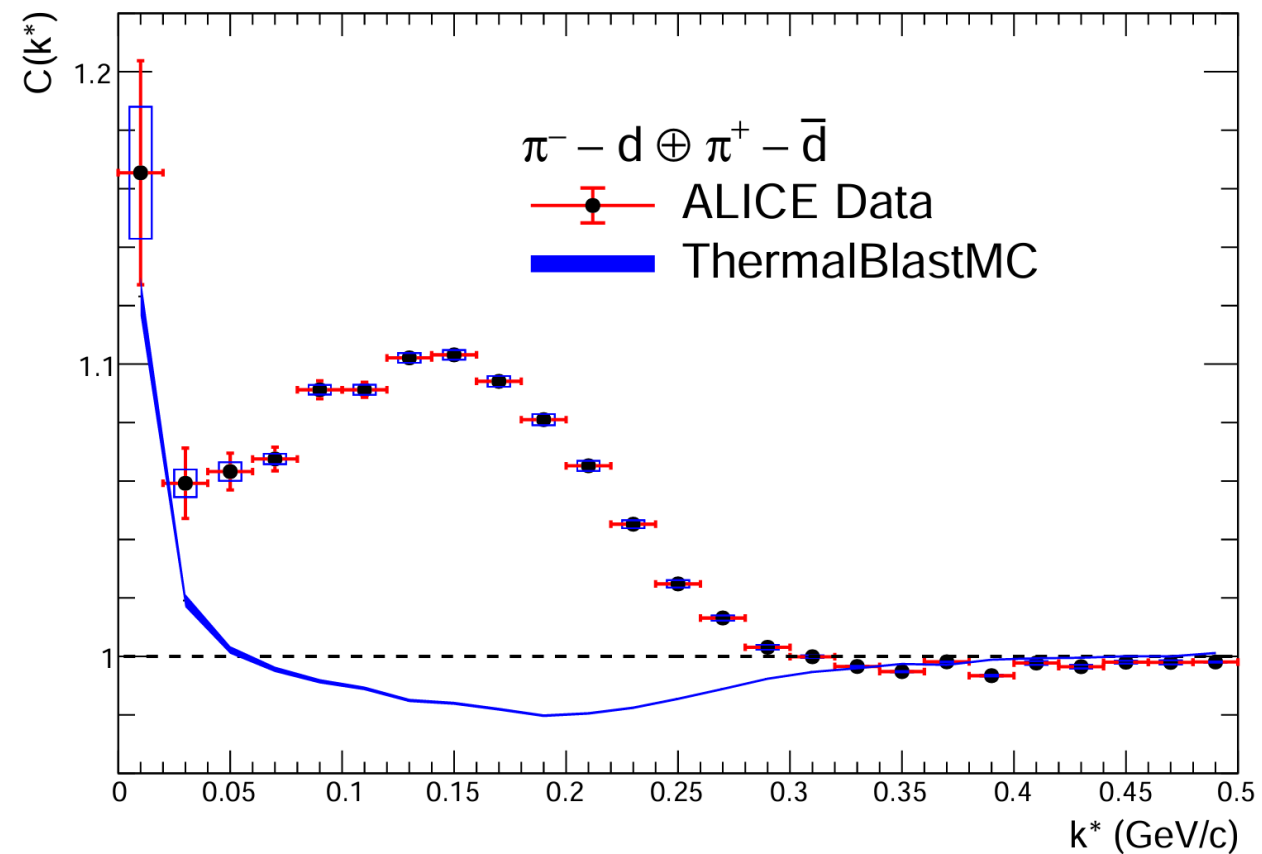
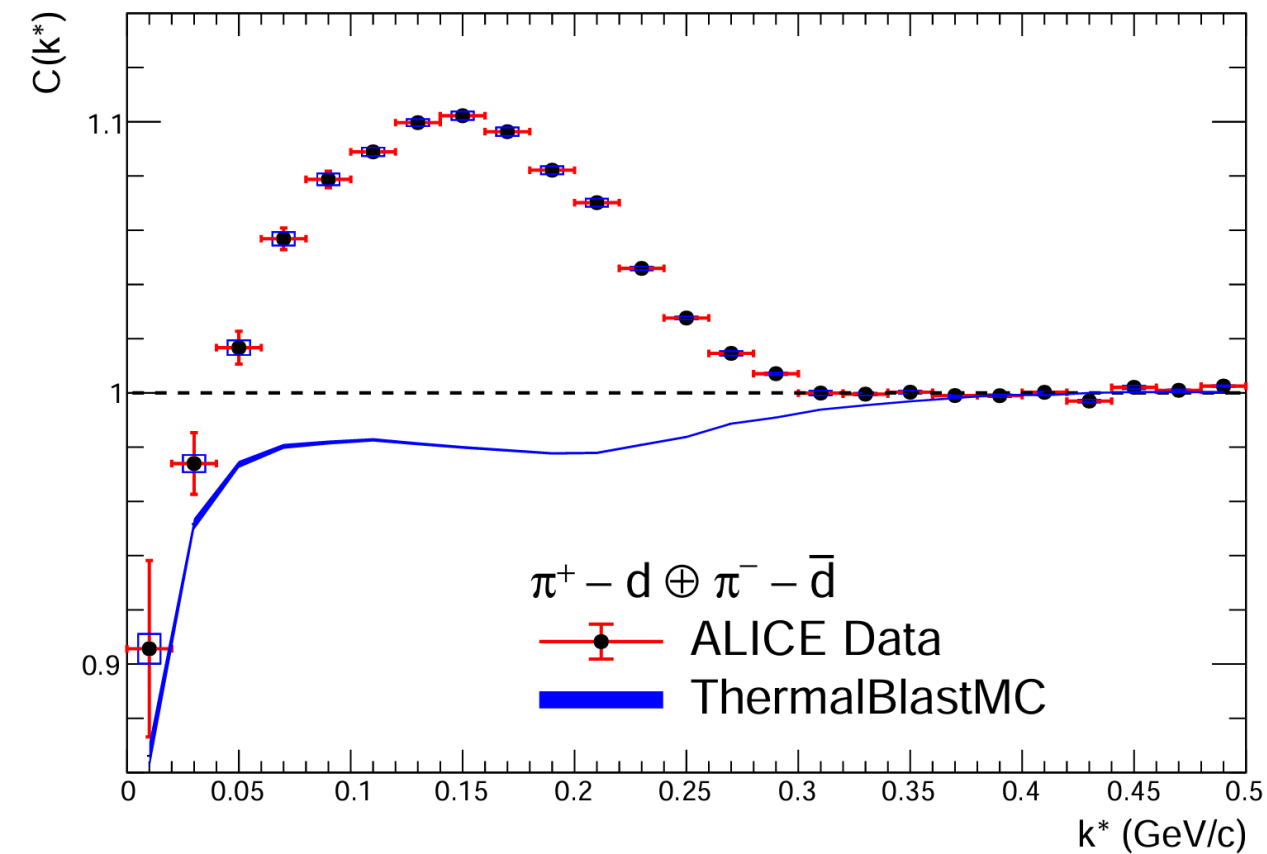
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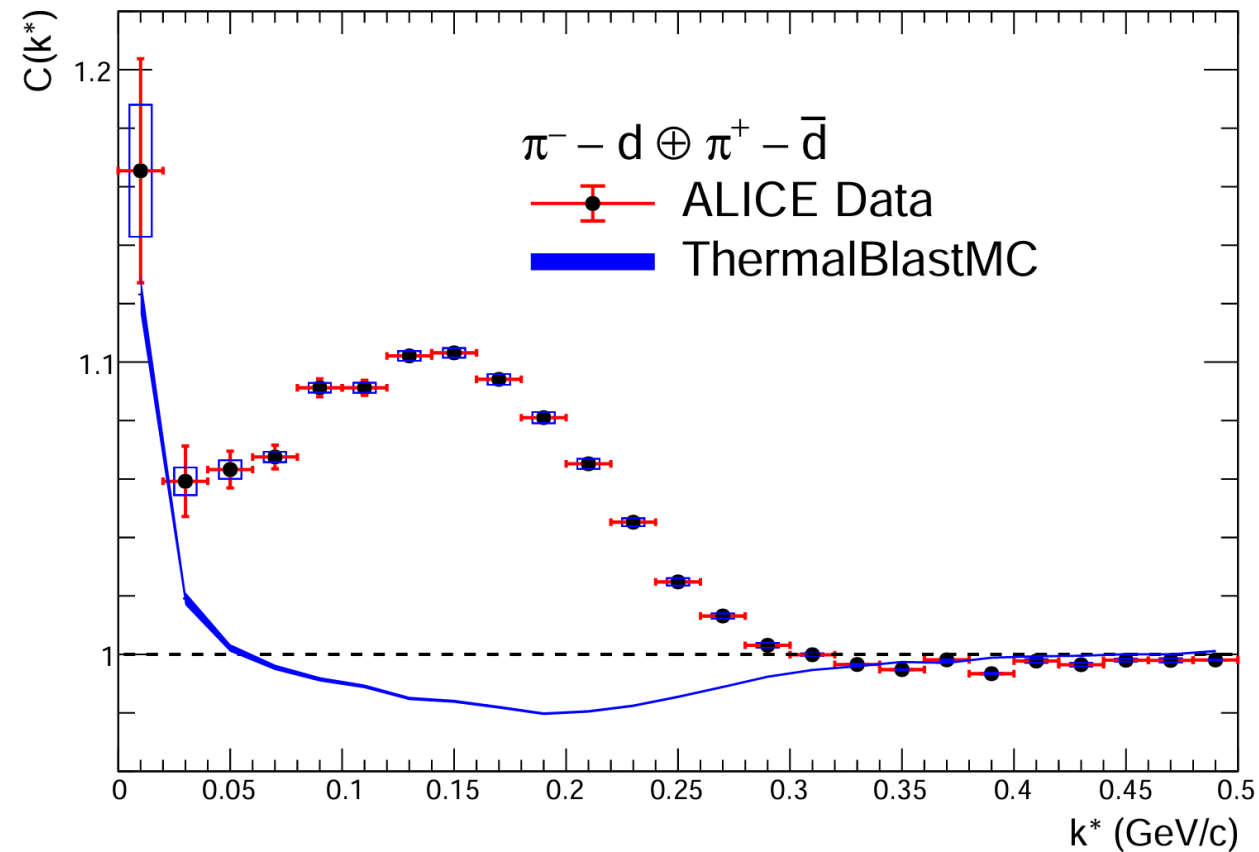
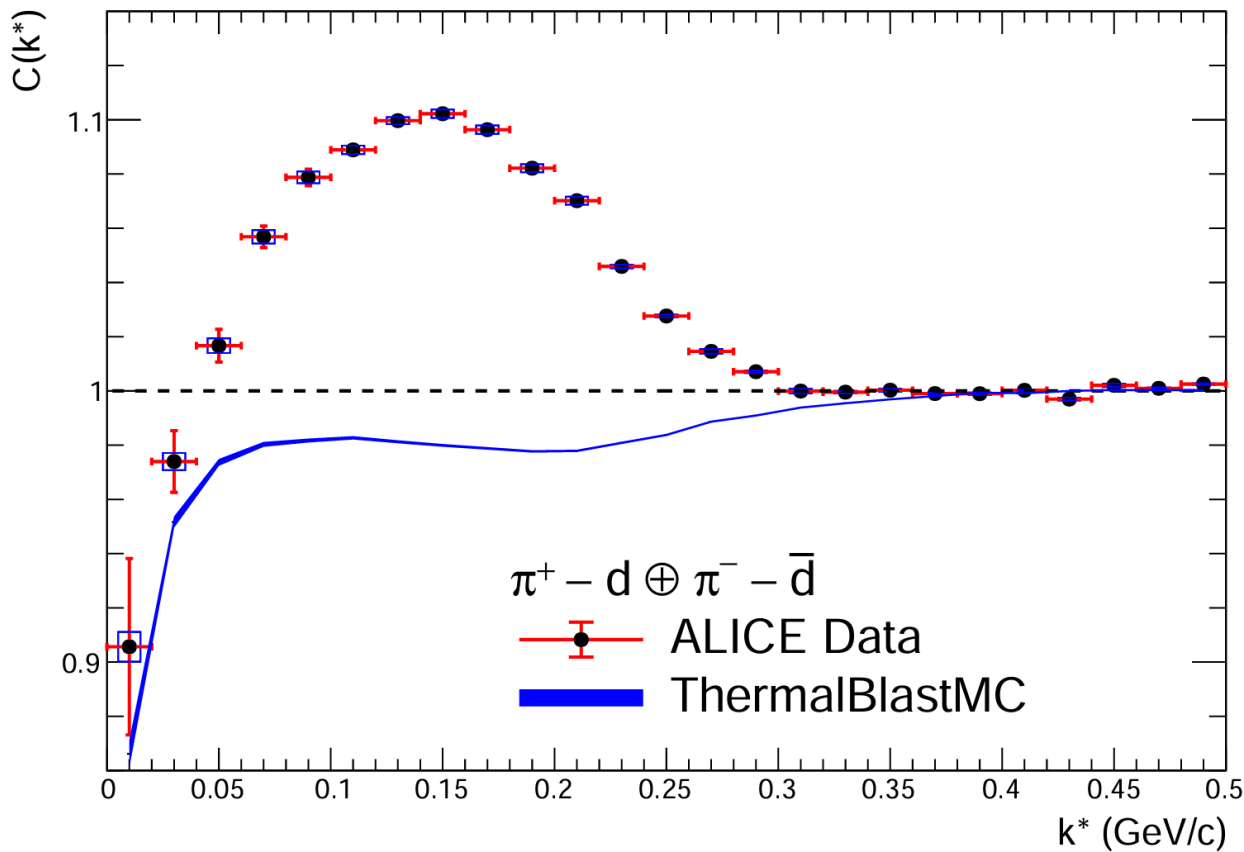
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Missing ingredient?

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**Resonance!**

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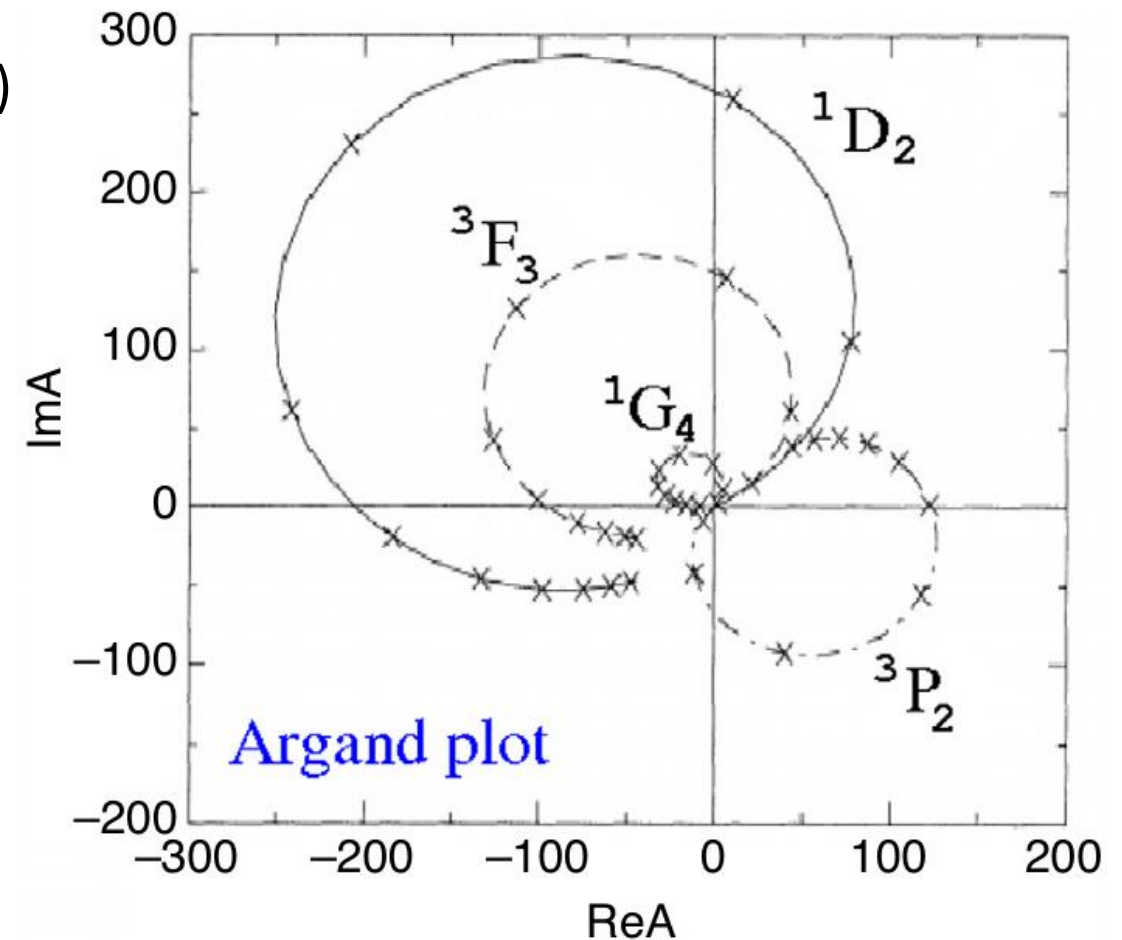
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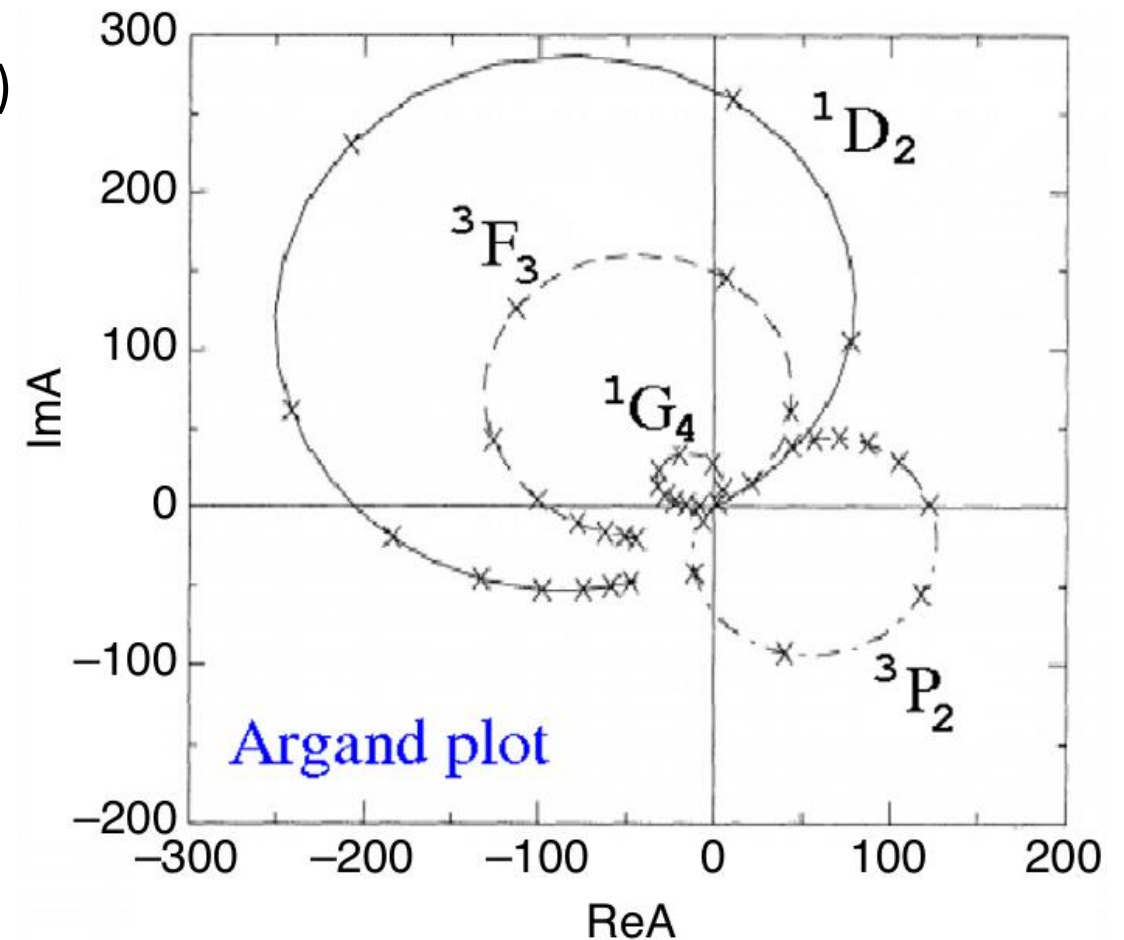
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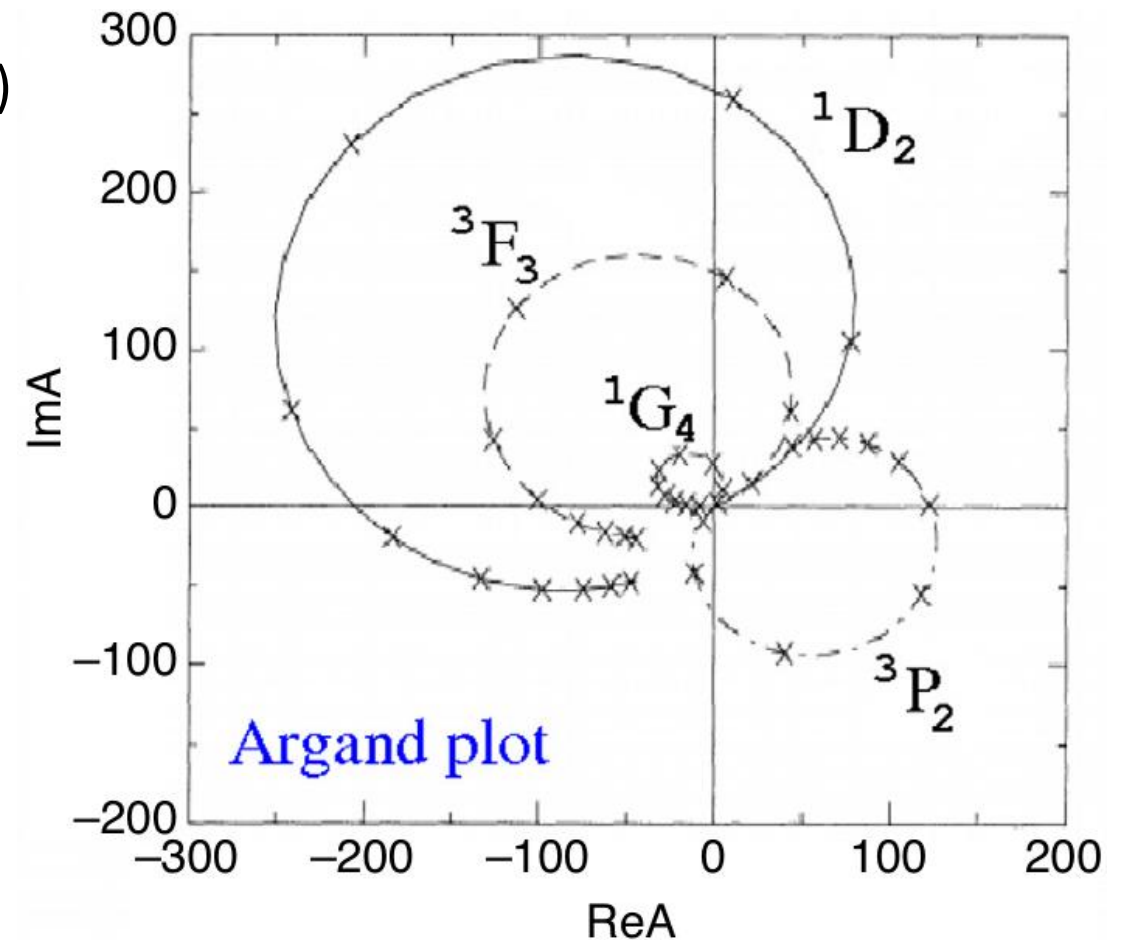
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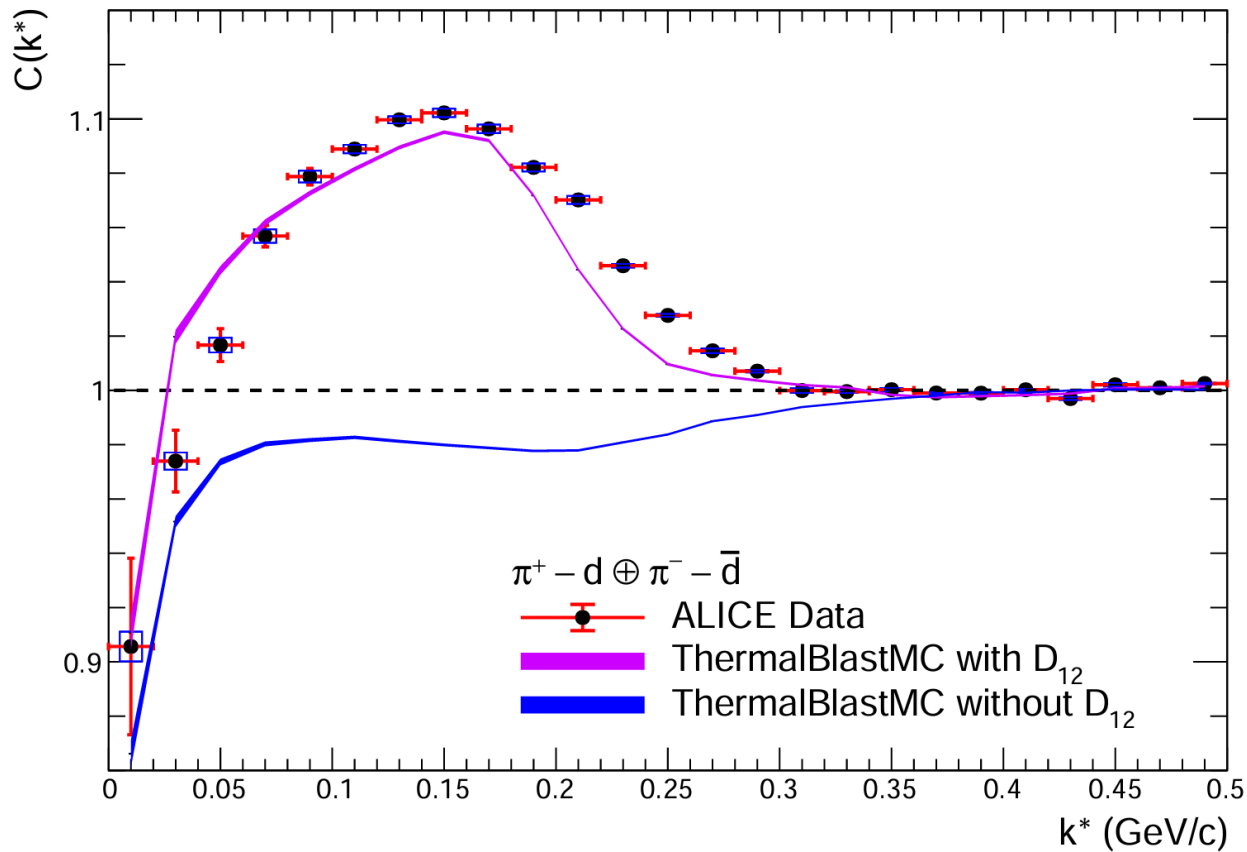
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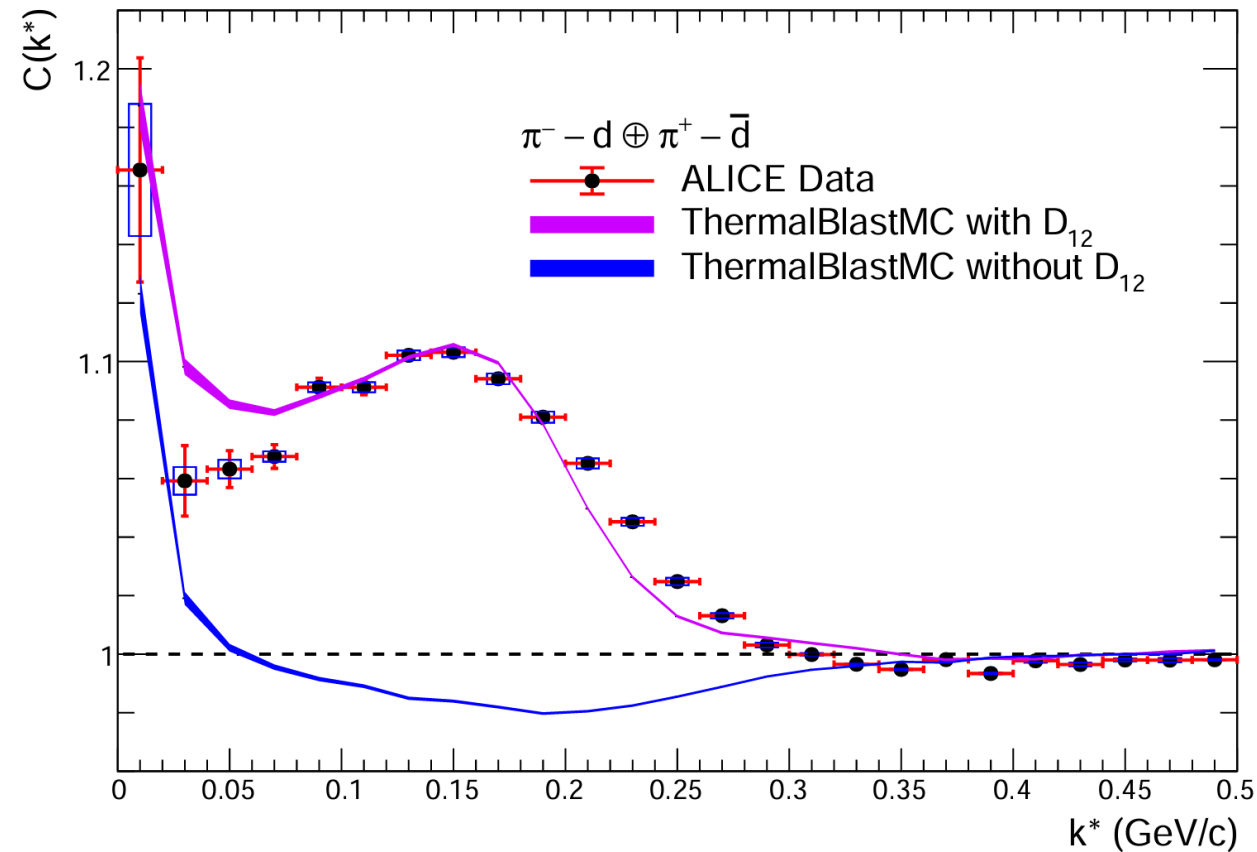
See H. Clement, Progress in Particle and Nuclear Physics 93 (2017) 195–242 and references therein.

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$$BR(D_{12} \rightarrow N + \Delta) = 75\%$$



$$BR(D_{12} \rightarrow \pi + d) = 25\%$$

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Let the dibaryon search begin!