Accessing Three-Body Dynamics with p–d and Λ–d Correlations in pp Collisions at 13.6 TeV with ALICE

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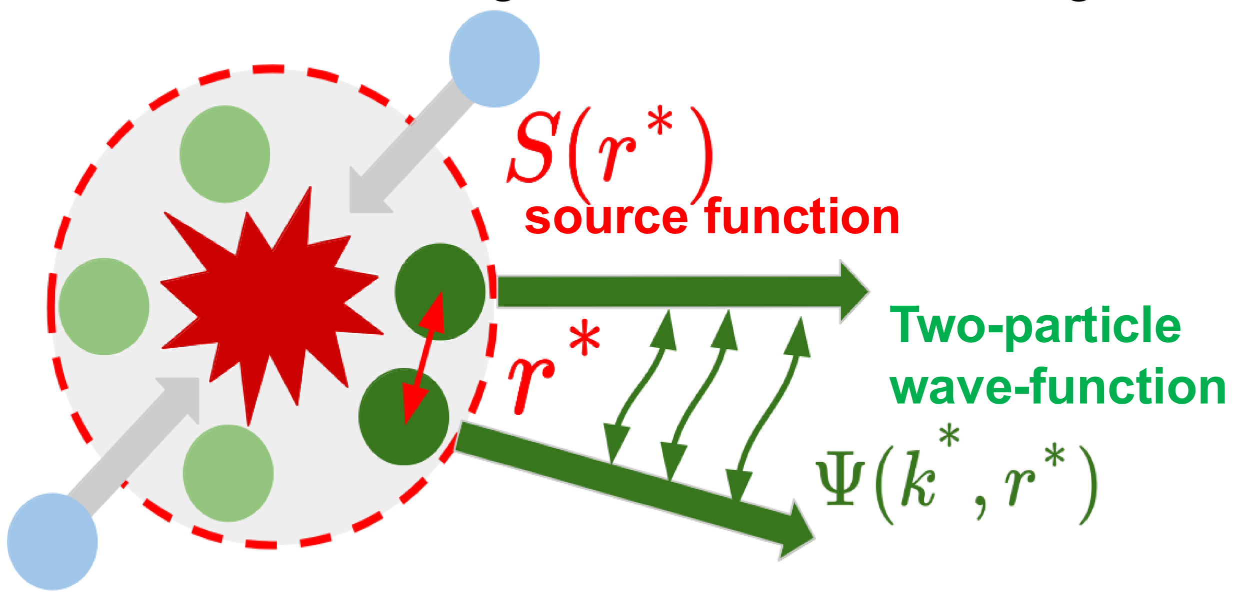
Femtoscopy

- The correlation function ***C(k*)*** can be measured by computing the ratio of the same- (SE) and mixed-event (ME) distributions as a function of the relative momentum in the pair rest frame ***k**** [1]

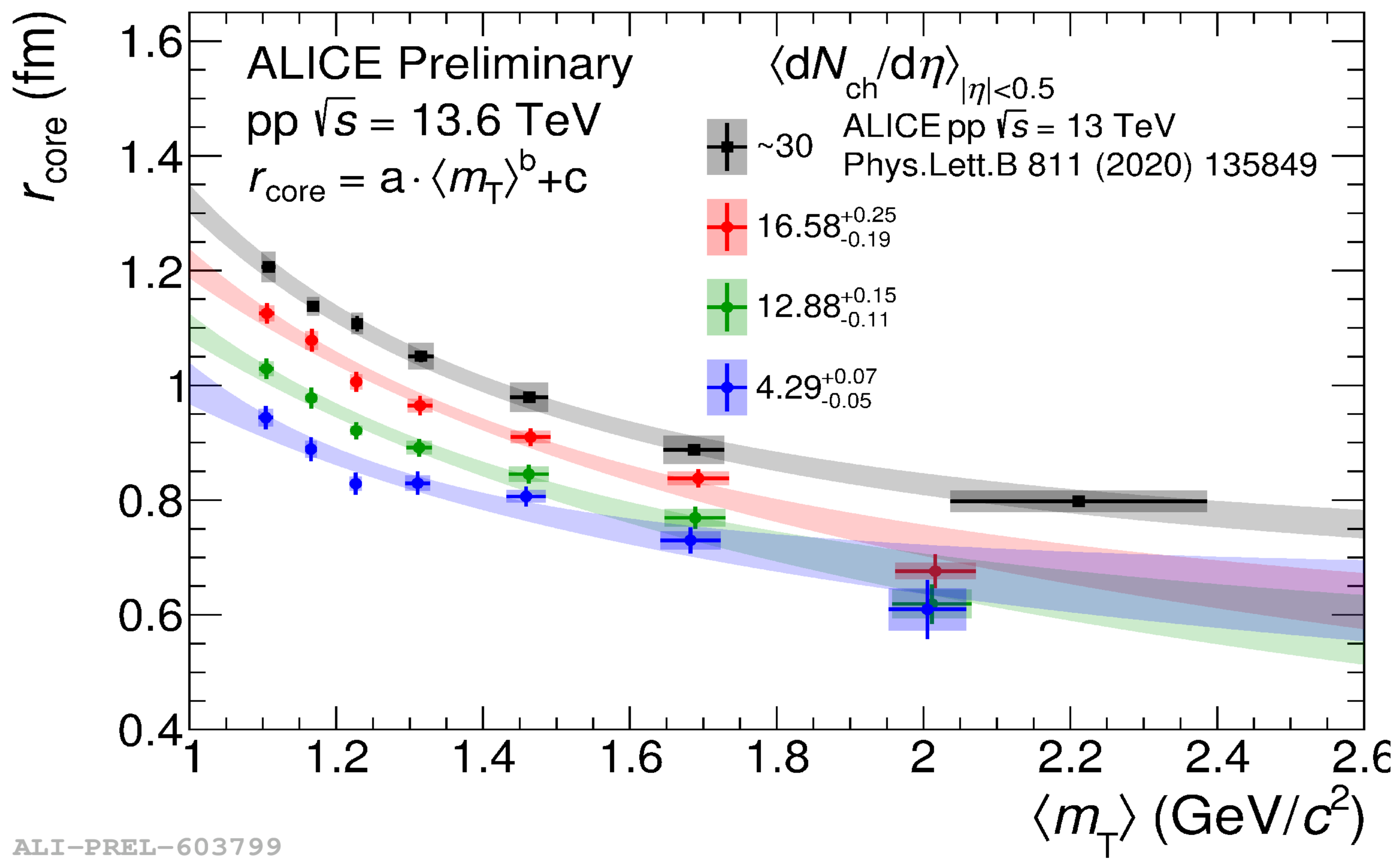
$$C(k^*) = \mathcal{N}\underbrace{\frac{N_{SE}(k^*)}{N_{ME}(k^*)}}_{\text{Experiment}} = \underbrace{\int S(r^*)|\Psi(k^*,r^*)|^2 \mathrm{d}^3 r^*}_{\text{Theory}}$$

- Study hadronic systems with **known interactions** to constrain the **source function**
- Study interaction of multistrange-, charmed- and light nuclei-hadron pairs



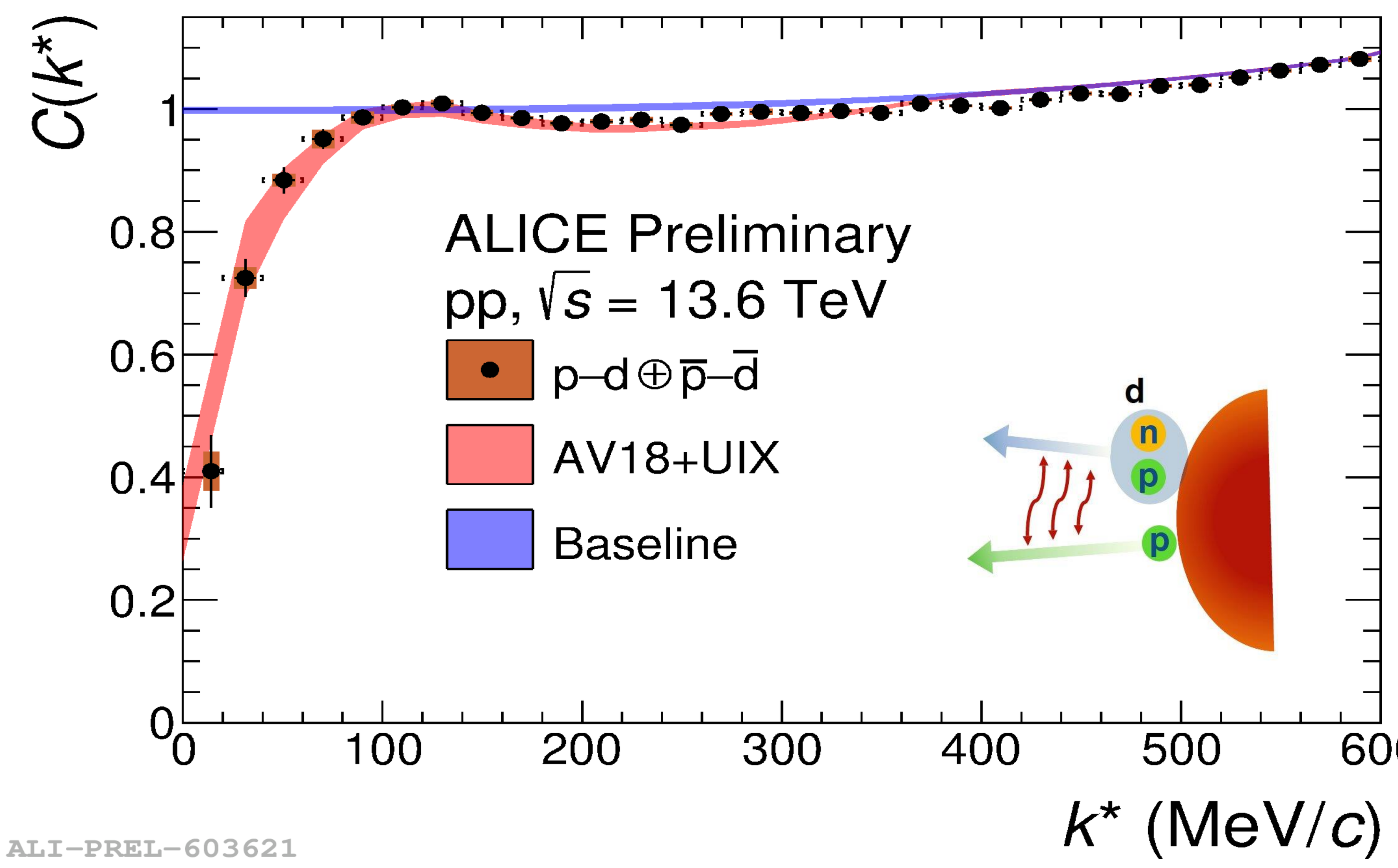
Emission Source

- From the measured proton-proton correlation function in pp collisions at 13.6 TeV, the **core source size** have been measured **differentially in both m_T (transverse mass) of the pairs and the average charge track multiplicity of the events**



- These measurement can be used to estimate the **effective emission source size for any hadron–hadron pair** by accounting for contributions from short-lived resonances [2,3]

p–d correlation measurement



- Calculation performed with **hyperspherical harmonics approach** with Argonne V18 (AV18) + Urbana IX (UIX) potentials considering an **underlying 3 nucleon system** [4]

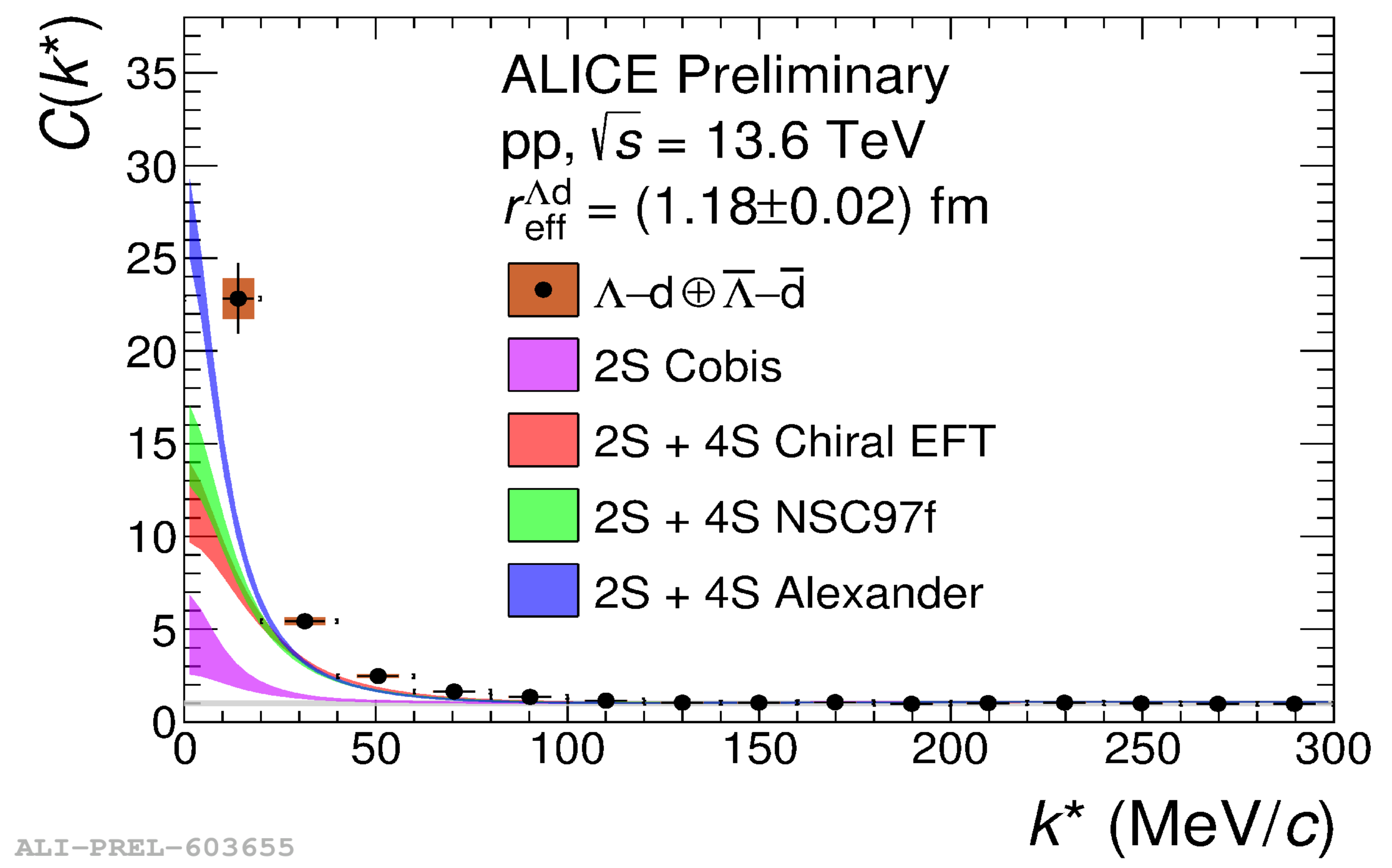
Three-nucleon wave function

$$C_{\mathrm{pd}}(k^*) = \frac{1}{16A_{\mathrm{d}}}\int S(\rho, R_{\mathrm{M}})|\Psi(k^*,\rho)|^2 \rho^5 \mathrm{d}\rho\mathrm{d}\Omega$$

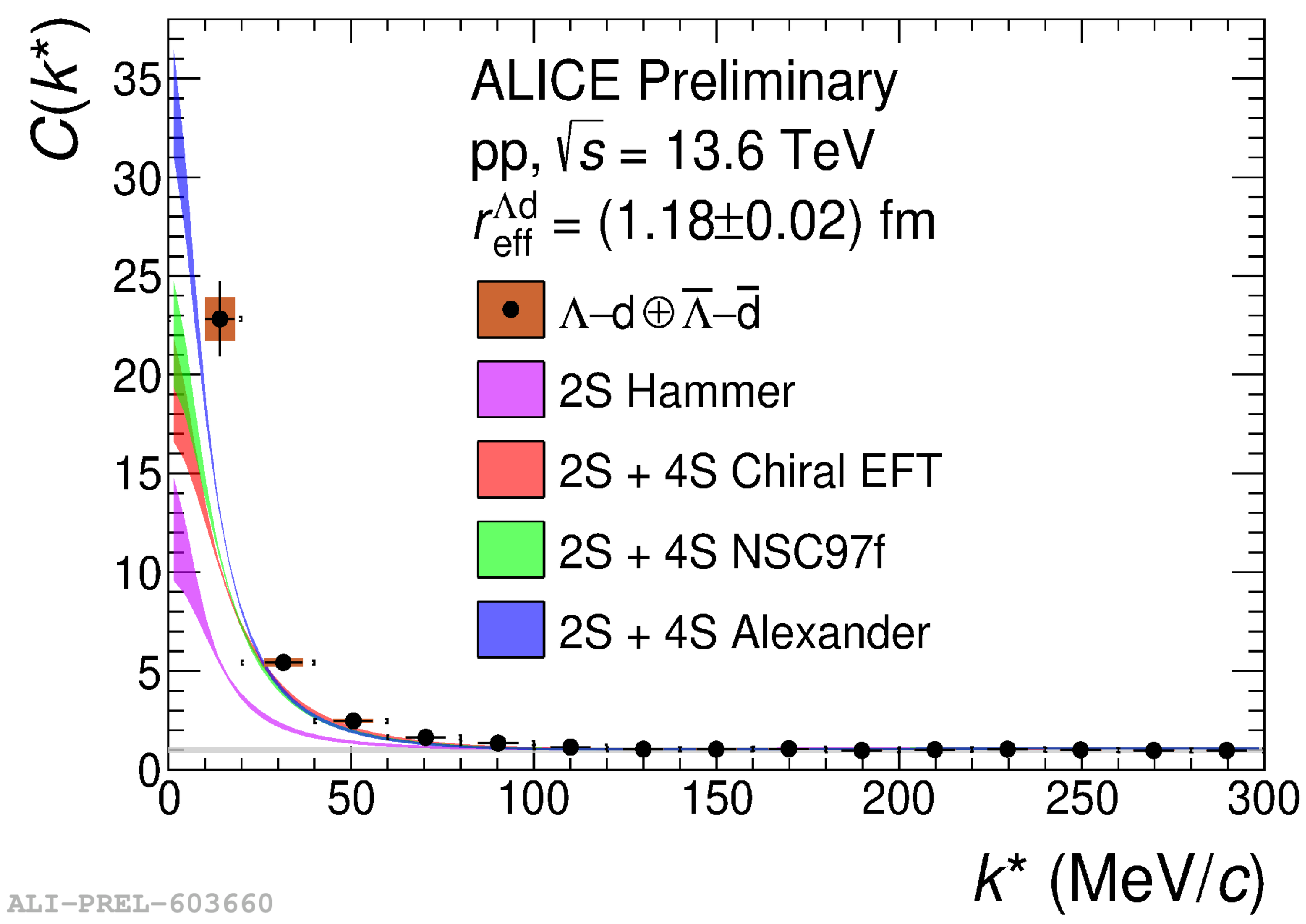
Effective nucleon-nucleon source size in the p-d system

- Effective nucleon-nucleon source size is estimated from source size measurement of proton-proton pairs
- Preliminary results with data taken in **Run 3 increases statistics with respect to Run 2 by a factor of 20** [5]
- In the future the increase in statistics offer possibility for more **differential studies to probe genuine three-body dynamics**

Λ–d correlation measurement



- First ever measurement of **Λ–d correlation function in pp collisions**
- Effective source size $r_{\mathrm{eff}}^{\Lambda d}$ estimated from source size measurement of proton-proton pairs
- The interaction in $^2S_{1/2}$ channel (2S) and $^4S_{3/2}$ channel (4S) is obtained using the Lednicky-Lyuboshits approach with scattering parameter from different theoretical assumption, **revealing tensions between available models and data** [6-11]



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