Correlation Analysis Tool using the Schrödinger equation (CATS)

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Femtoscopy – definitions

$$C(k) = \frac{\mathcal{P}(\vec{p}_a,\vec{p}_b)}{\mathcal{P}(\vec{p}_a)\mathcal{P}(\vec{p}_b)} = \int d^3\vec{r}\, S(\vec{r}) \left|\Psi(\vec{k},\vec{r})\right|^2 \xrightarrow{k\to\infty} 1$$

Single-particle momenta

Relative distance / reduced momentum in the rest frame of the pair

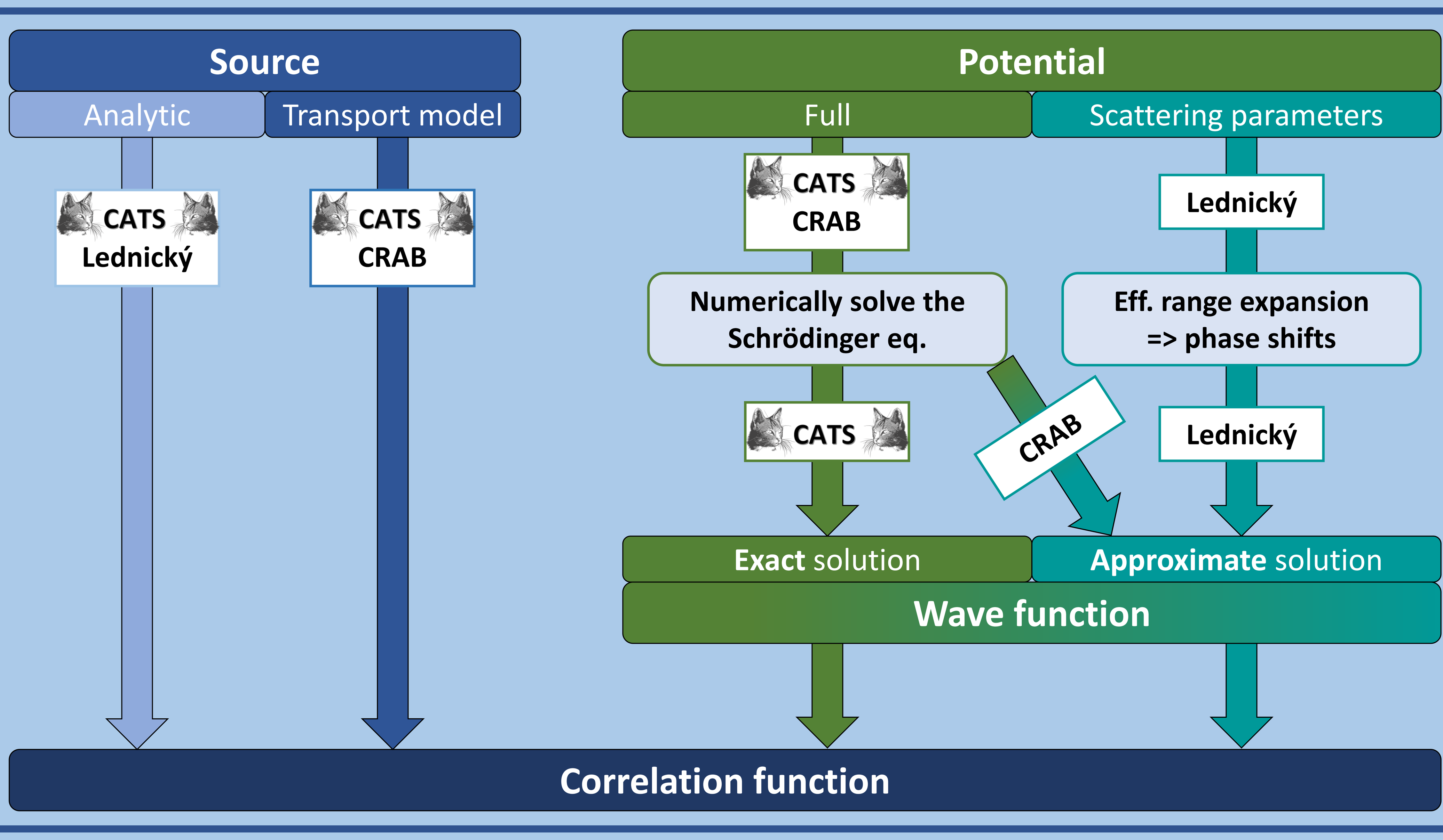
- Correlation function $C(k)$
  Experimentally accessible. $C_{exp}(k) = \mathcal{N}\frac{N_{\mathrm{same}}(k)}{N_{\mathrm{mixed}}(k)}$
- Source function $S(r)$
  Initial spatial distribution of the particle pairs.
- Two-particle wave function $\Psi(k,r)$
  Contains information regarding the two-particle potential.

Femtoscopy can **relate particle correlations** in momentum space to the **interaction potential** between the particles!

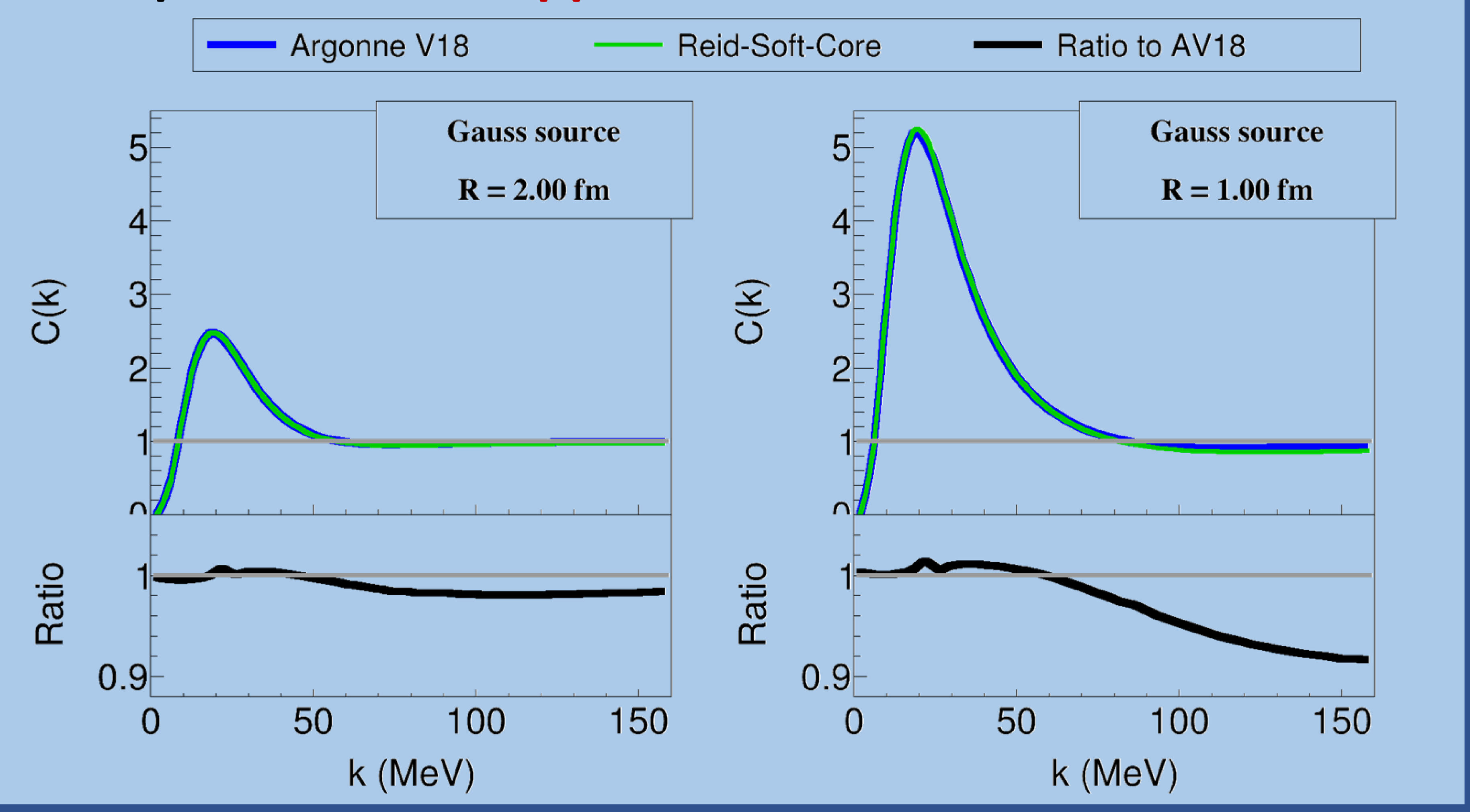
Our goal is to **develop techniques** capable to **compare experimental data** to **model predictions**.

Correlation Analysis Tool using the Schrödinger equation

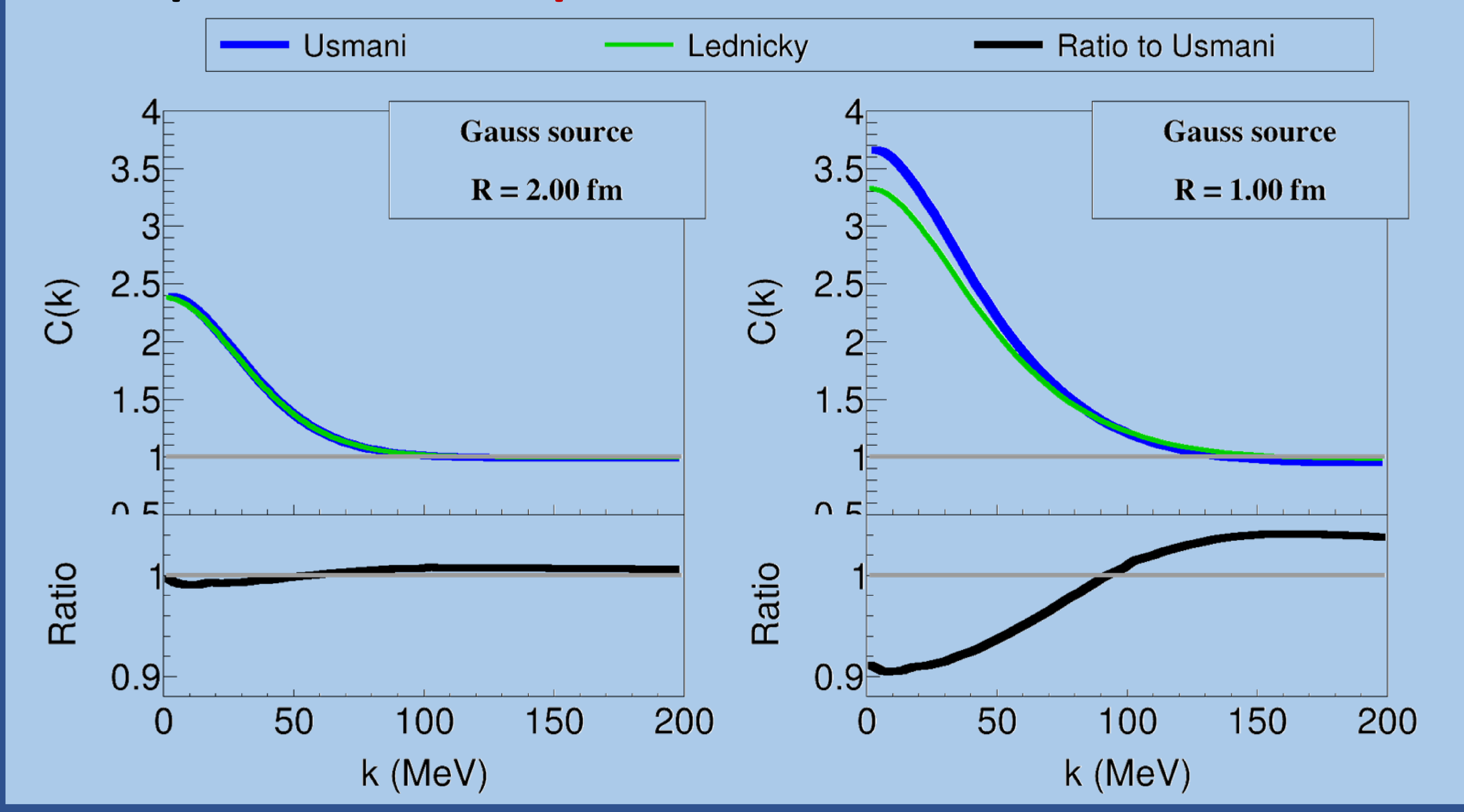
- **Exact solution** by solving the Schrödinger eq. numerically.
- Better description of **small collision systems** compared to other available tool like CRAB[1] or the Lednický[2] model
  E.g. pp @ TeV energies have a source size of around 1 fm
- **Fast performance** due to many optimizations
  E.g. dynamic computing grids, clever buffering etc.



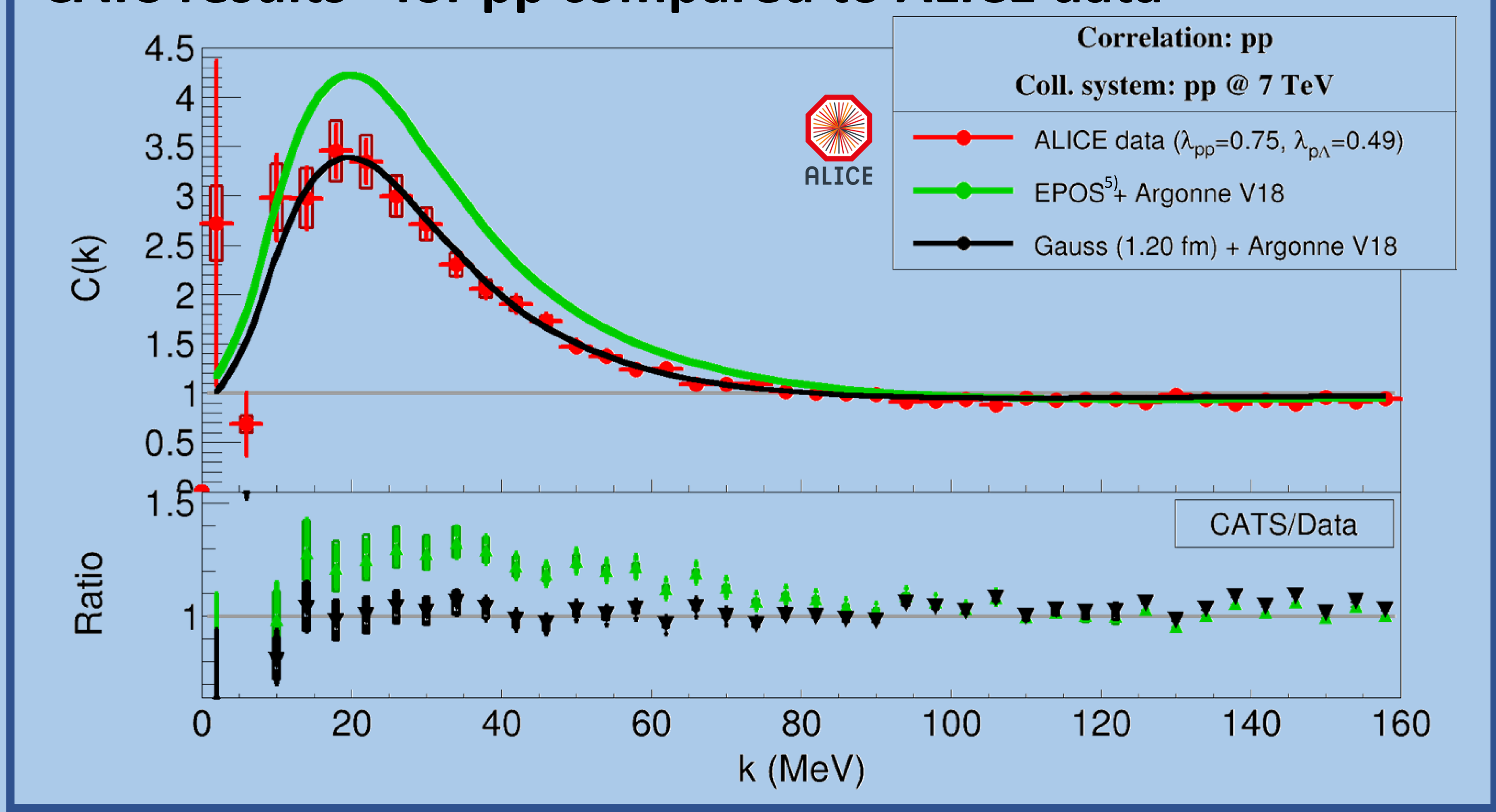
CATS predictions for pp



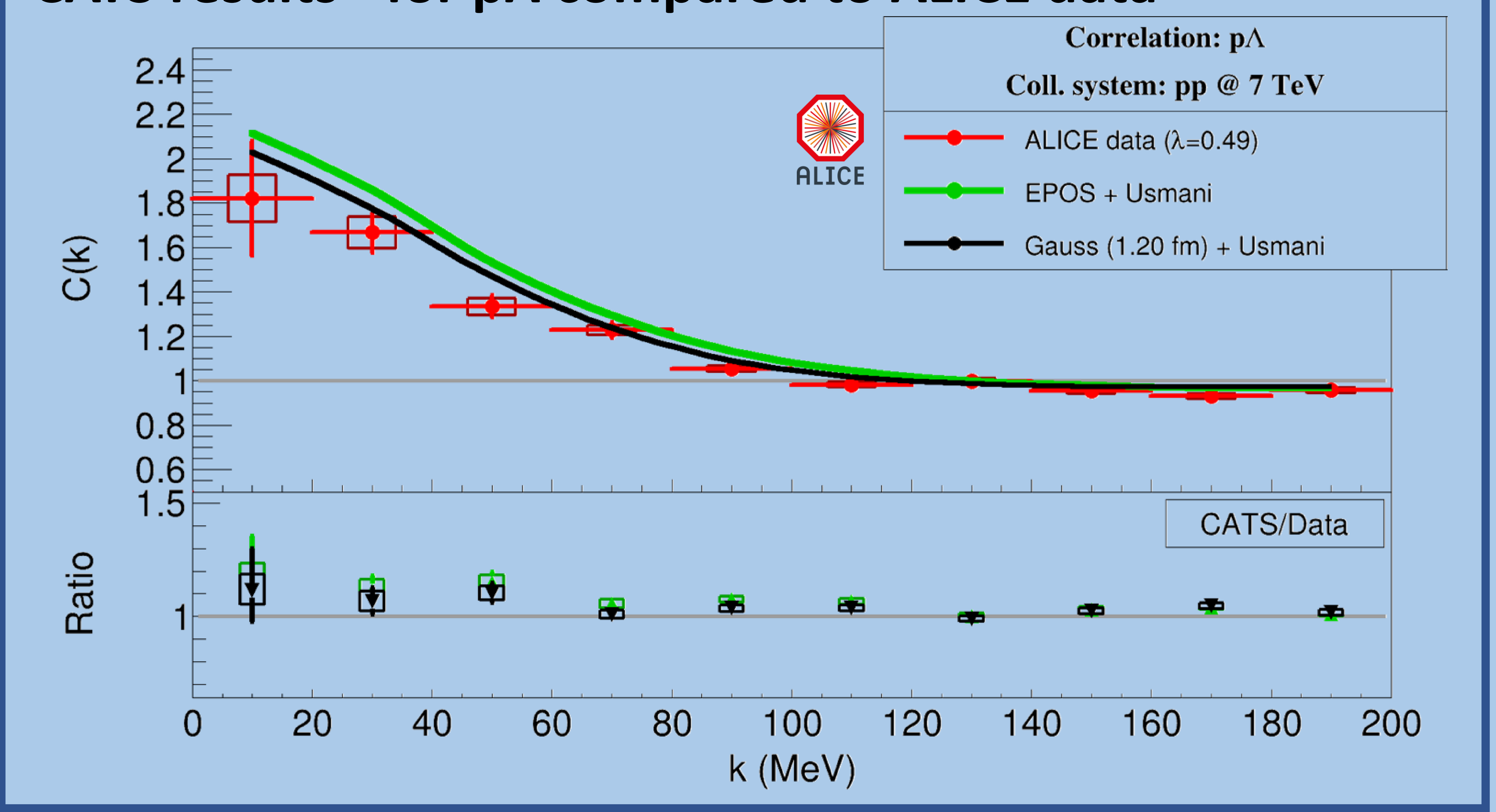
CATS predictions for pΛ



CATS results[3] for pp compared to ALICE data[4]



CATS results[3] for pΛ compared to ALICE data[4]



1) The Correlation Afterburner (CRAB) is a numerical tool for obtaining C(k). It uses an approximate solution at small distances. (http://web.pa.msu.edu/people/pratts/freecodes/crab/home.html)
2) The Lednický model computes C(k) analytically, using a Gaussian source and the scattering parameters of the potential. It woks with the asymptotic solution of the Schr. eq. (J. Nucl. Phys. 35 (1982). [Yad. Fiz.35,1316(1981)], p. 770)
3) Potentials used: pp potential – Argonne V18 (Phys.Rev. C51 (1995) 38-51); pΛ potential – Usmani (Phys.Rev. C31 (1985) 1400-1411)
4) The data points are ALICE **preliminary** results; 5) The EPOS transport model: Phys.Rev. C82 (2010) 044904

Get CATS