



# Presenting the HIJING++ Monte Carlo event generator

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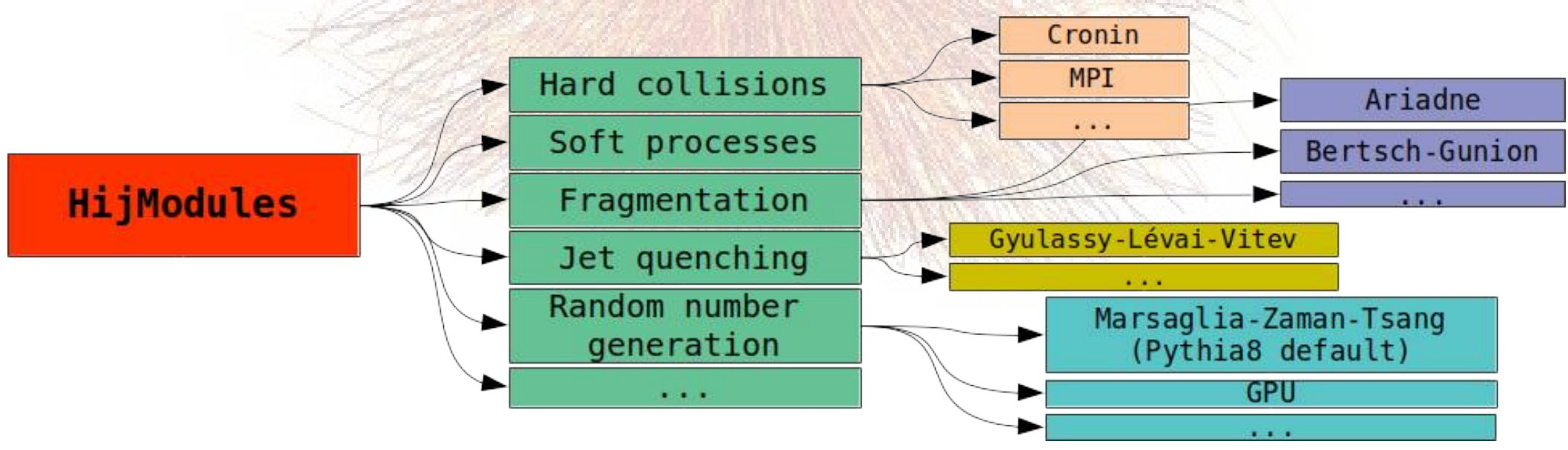


## Introduction

The new high-energy heavy-ion Monte Carlo event generator HIJING++ is presented. HIJING++ is the successor of the original FORTRAN HIJING event generator with the aim to include more sophisticated models of (among others) jet quenching, Cronin effect, (nuclear) PDFs as well as high speed CPU parallel calculations. It has an extensible analysis interface able to extract useful information in a flexible way.

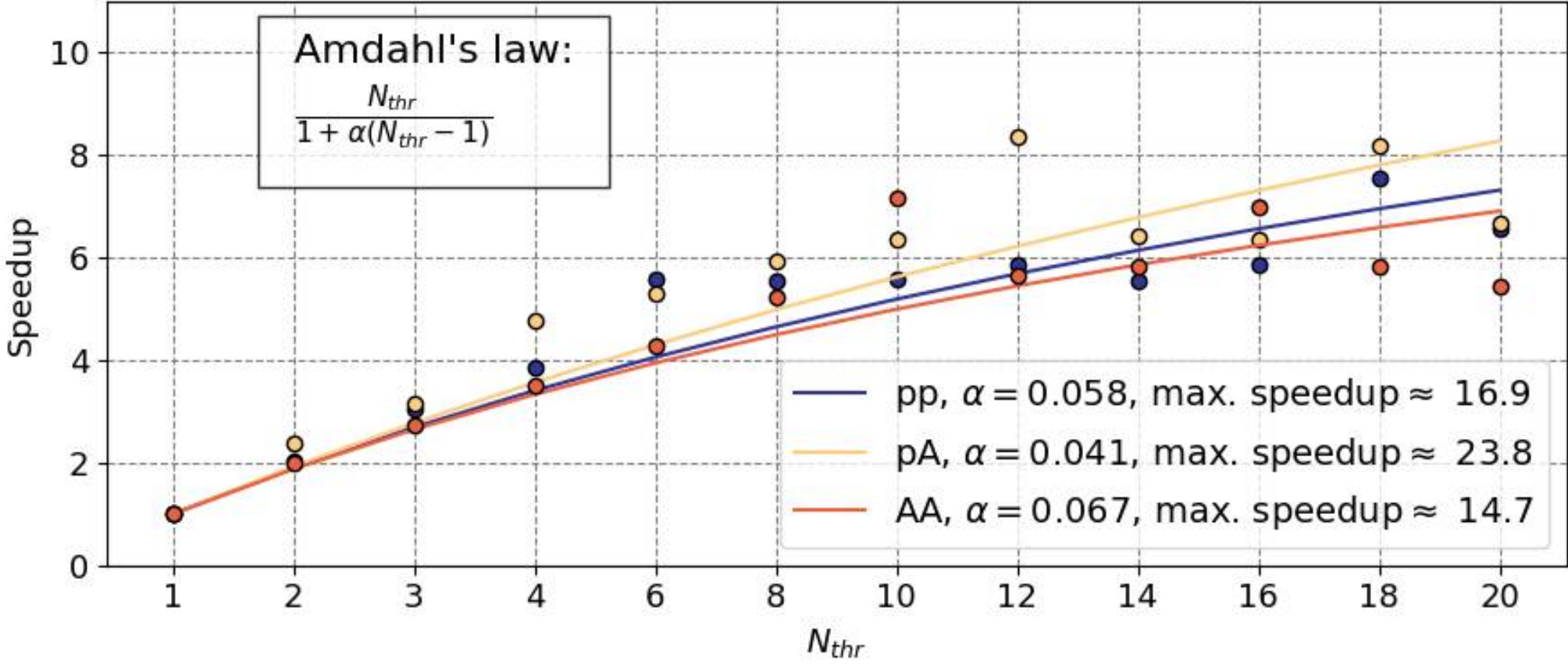
## HIJING++

- Pairwise nucleon interactions (elastic and deep inelastic scattering), hard scattering (partly using PITHYA)
- Diffraction, gluon radiation, Lund fragmentation..., wounded nucleon model
- Completely rewritten in C++ in a CPU parallel, modular fashion



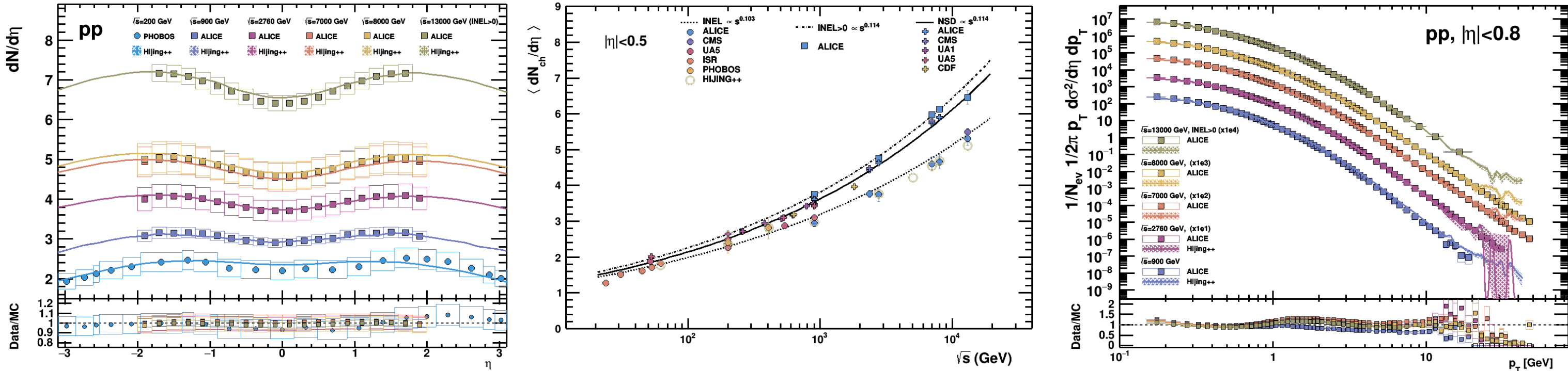
- New **framework**, not an old ported black box
- New features and carefully revised old ones

	FORTRAN HIJING	HIJING++
<b>Precision</b>	single	double
<b>Pythia version</b>	5.3	8.2+
<b>PDF</b>	GRV98lo	LHAPDF6.2+
<b>Colour reconnection</b>	✗	✓
<b>Jet quenching</b>	✓	✓
<b>Multithreading</b>	✗	✓
<b>Analysis interface</b>	✗	✓
<b>Module management</b>	✗	✓

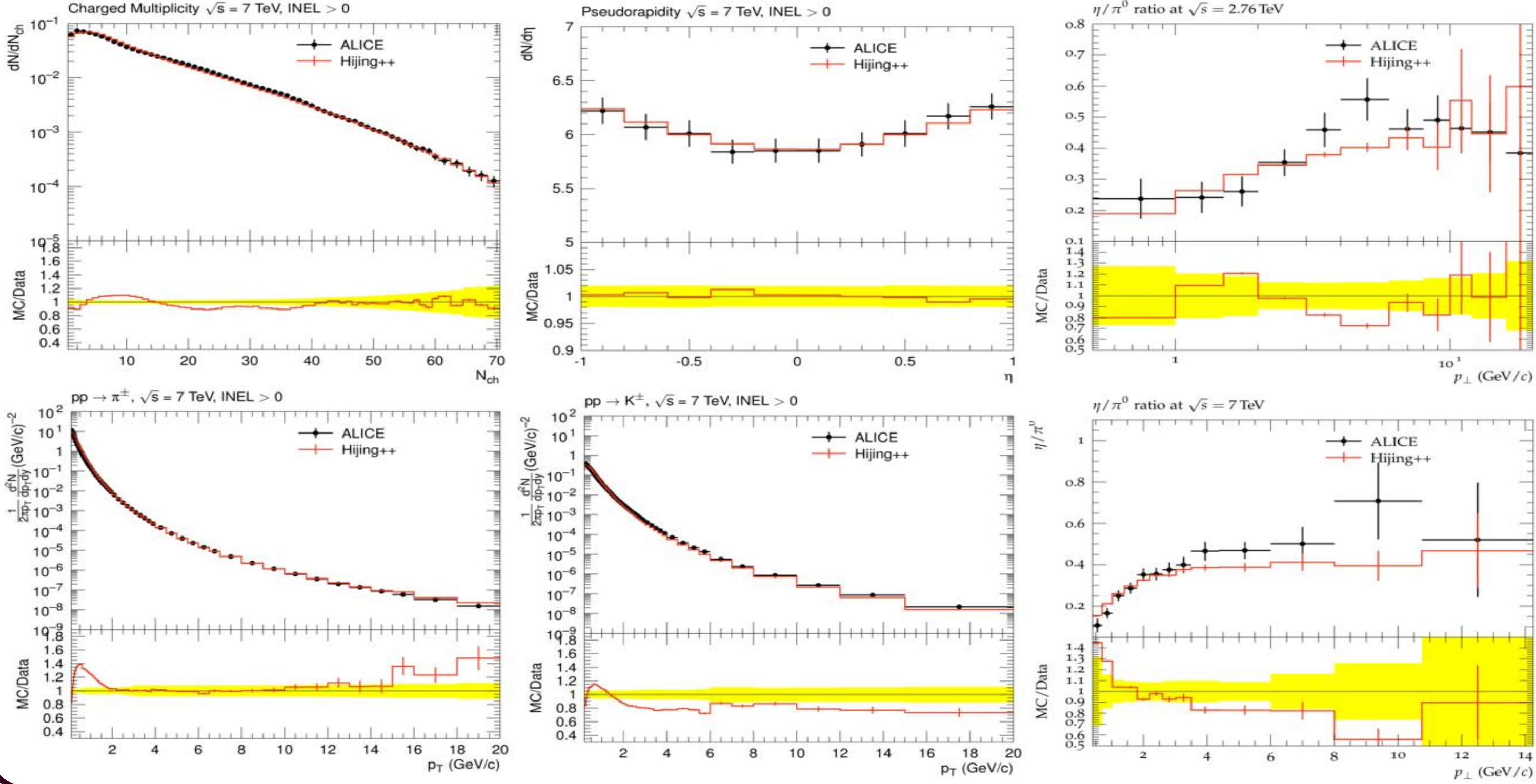


## Status

- The framework is in the testing/polishing phase: the results are promising
- pp → charged pseudorapidity and p<sub>T</sub> spectra:



- Analysis interface: convenient usage with ROOT, Rivet, YODA, HepMC2, FastJet...
- Fine tuning with Professor



## DGLV-CUJET inspired gluon radiation

- Following the hard/inelastic interactions, the energetic partons may emit a gluon in a  $\hat{q}$  formalism
- The medium radiated gluon distribution:

$$\frac{dN_g}{dt dx dk} \sim \hat{q} \left( \sin \frac{t(k-q)^2 + M^2}{xE} \right)^2 \frac{1}{(k^2 + M^2)^2}$$

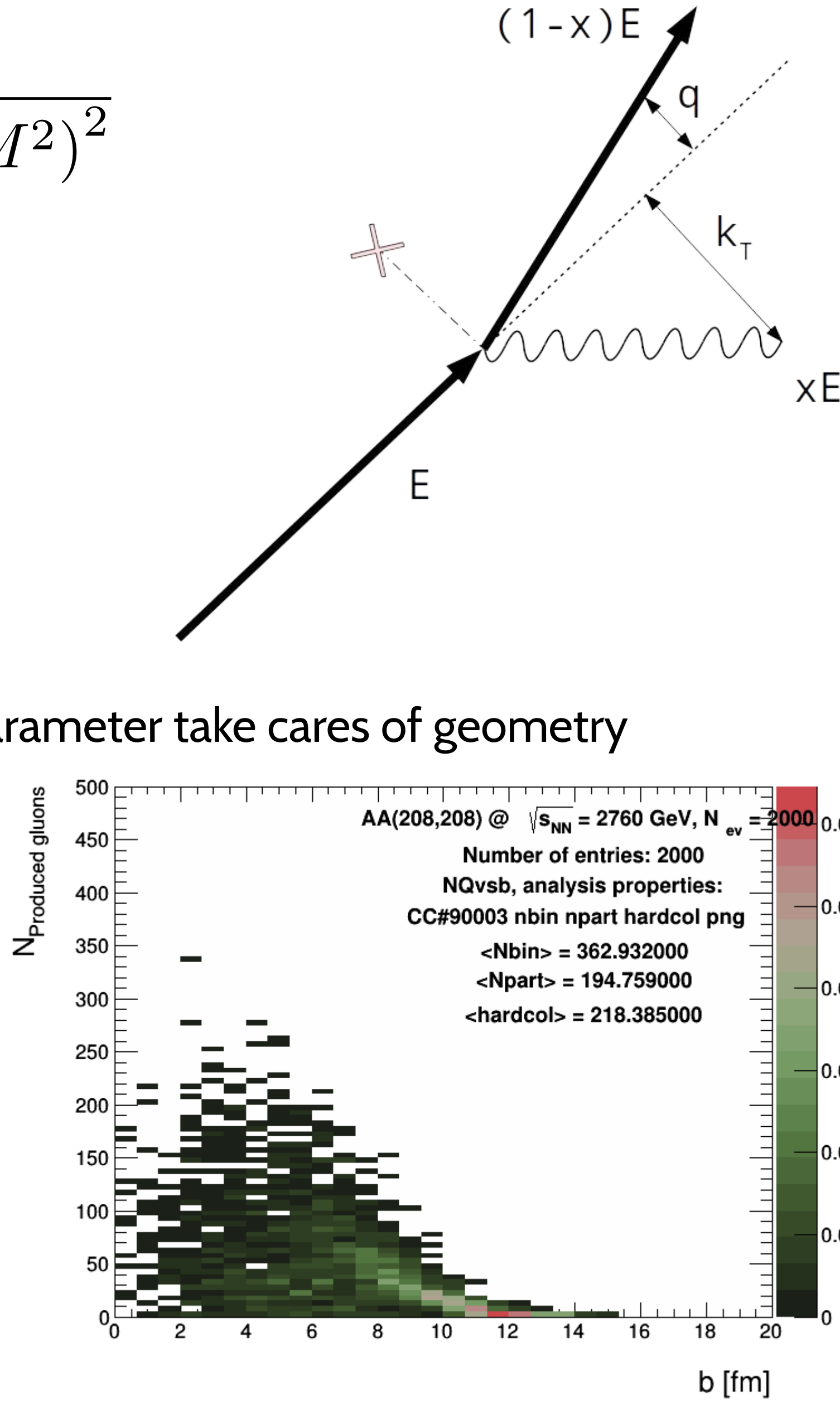
- The momentum exchange:

$$\frac{d\sigma}{d^2q_{\perp}} \sim \frac{1}{(q_{\perp}^2 + M_E^2)(q_{\perp} + M_M^2)}$$

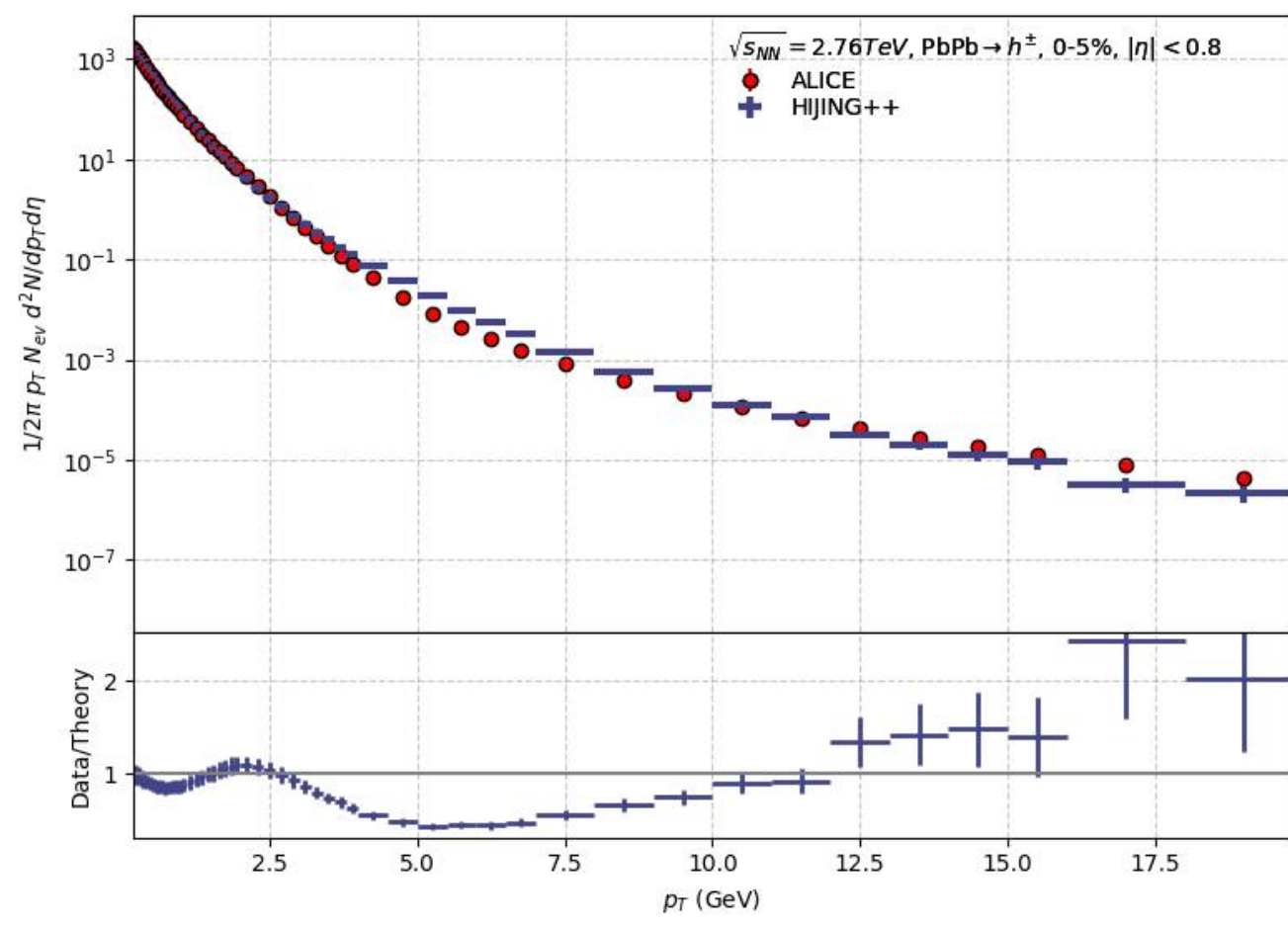
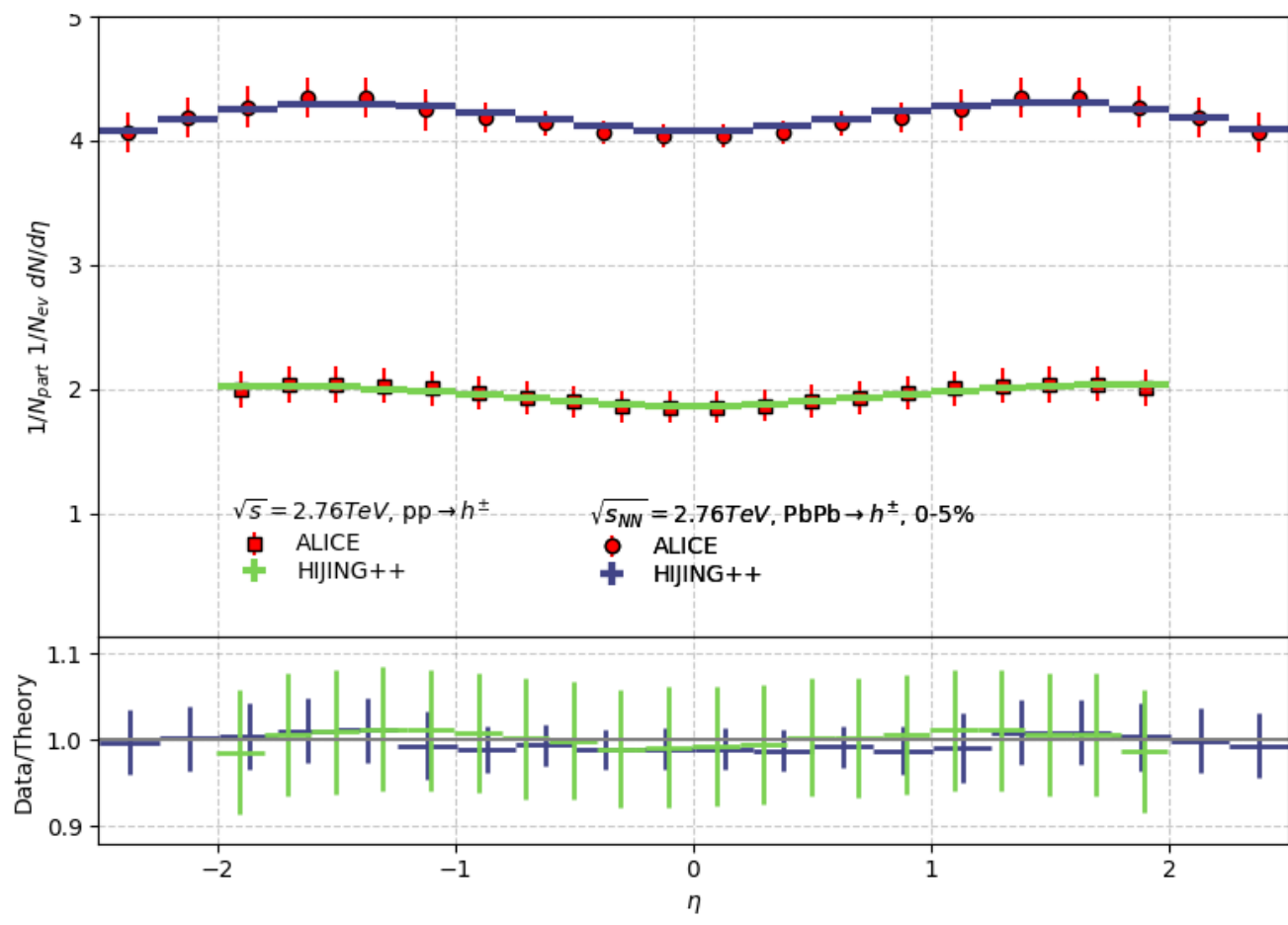
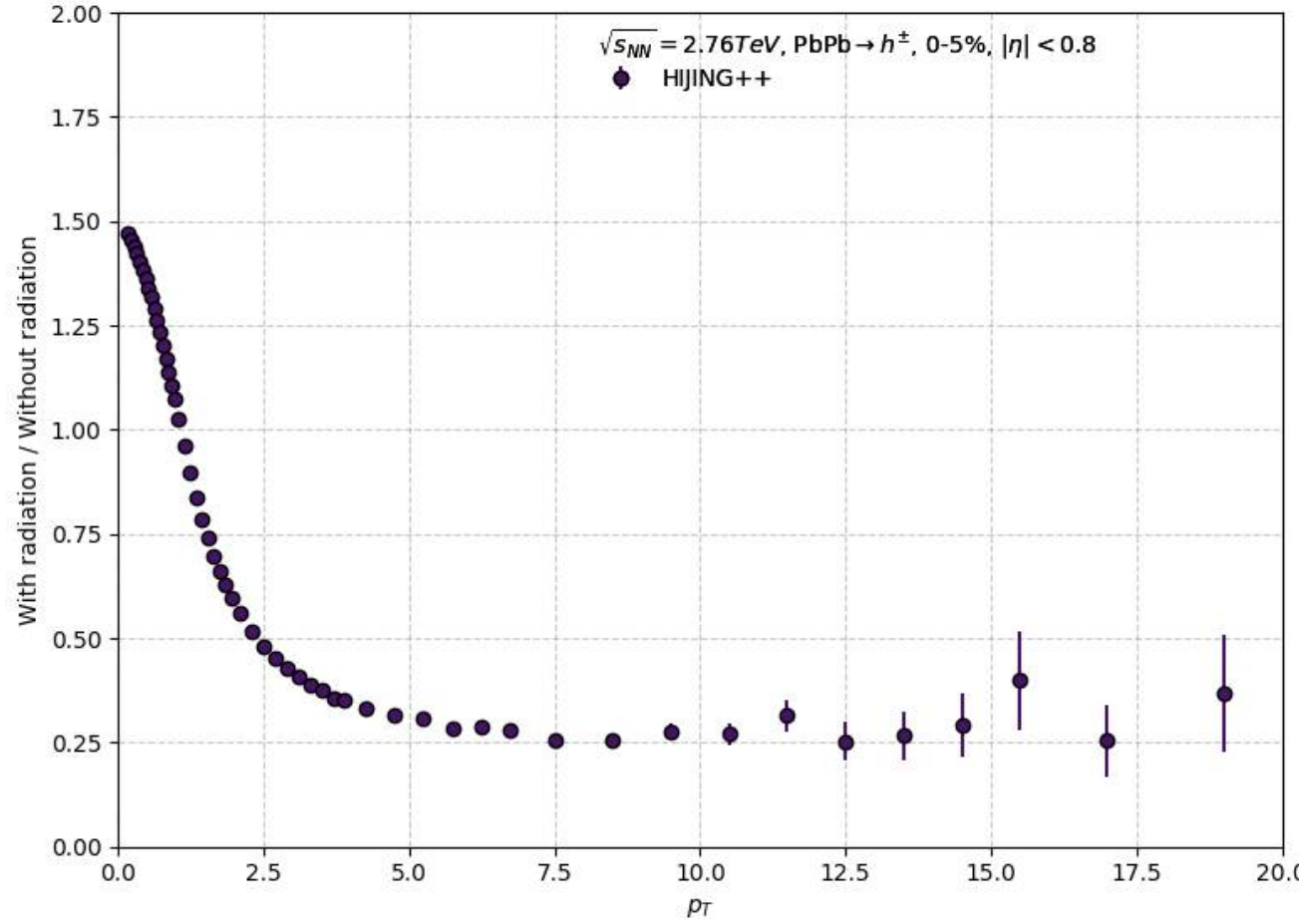
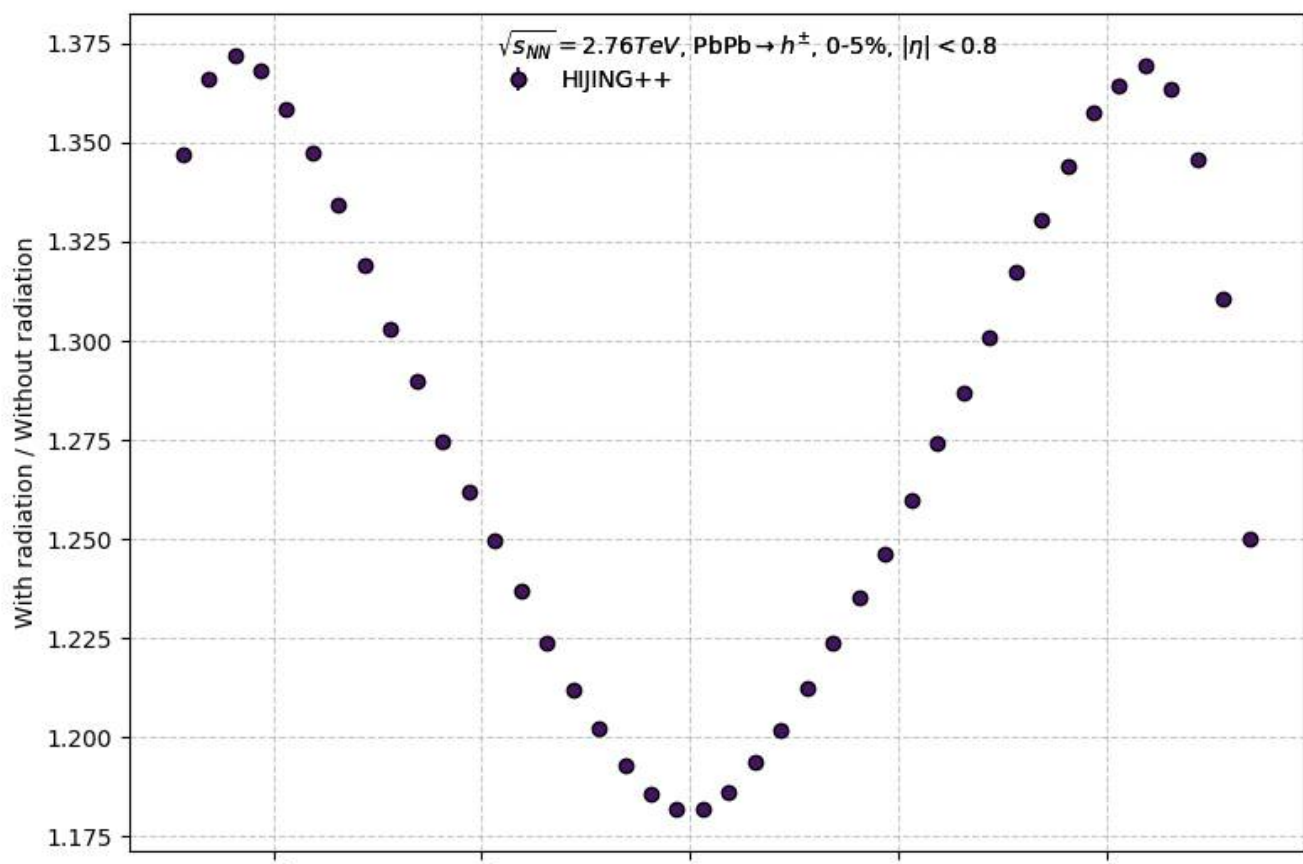
$$\frac{d\sigma}{d^2k} \sim \frac{xE}{\hbar k^4} \left( \sin \frac{k^2 L}{\hbar x E} \right)^2$$

- The energy-momentum is conserved. In addition, the impact parameter take cares of geometry

$$j = (p_z^j, \vec{0}, m_j) \Rightarrow j' = (p_z'^j, \vec{q}, m_j)$$
$$g = (0, \vec{0}, 0) \Rightarrow g' = (xp_z^j, \vec{k}, 0)$$
$$m = (p_z^m, \vec{p}_T^m, m_m) \Rightarrow m' = (p_z^m + (1-x)p_z^j - p_z'^j, \vec{p}_T^m - \vec{q} - \vec{k}, m_m)$$



- Modification of the pseudorapidity and p<sub>T</sub> distributions of final charged particles: enhancement and suppression respectively



## Summary

- HIJING++: modular, CPU parallel framework with analysis interface
- An extensive fine-tuning/validation is under progress
- Medium induced gluon radion: inspired by DGLV-CUJET
- Due to the radiation: enhancement in multiplicity, suppression in p<sub>T</sub>
- Good description of the most central PbPb data

## Acknowledgement

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## References

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