

PHENIX Preliminary Data Request

Plenary Presentation

Name: Attila Bagoly, Máté Csanád

PWG: PLHF

What Observable: 3 particle B-E corr. strength

System, Energy, Run: Au+Au, 200 GeV, Run-10

Last PWG Presentation Date: December 22, 2016

Last PWG Presentation Link: [abagoly_threeparticleHBT_final1.pdf](#)

Analysis Note #: 1288

Analysis Note Web Link: [analysisnote.pdf](#)

What plots are requested preliminary?

Example $C_3(k_{12}=k_{13}=k_{14})$ diagonal correlation functions with fits (2 plots, p1387)

Correlation strength: λ_3 (1 plot, p1388)

New Core-Halo independent parameter $\kappa_3 = \frac{\lambda_3 - 3\lambda_2}{\lambda_2^{3/2}}$ (1 plot, p1389)

Partial coherence: f_c - p_c plot, where f_c fraction of core, p_c fraction of coherent pions (2 plots, p1390)

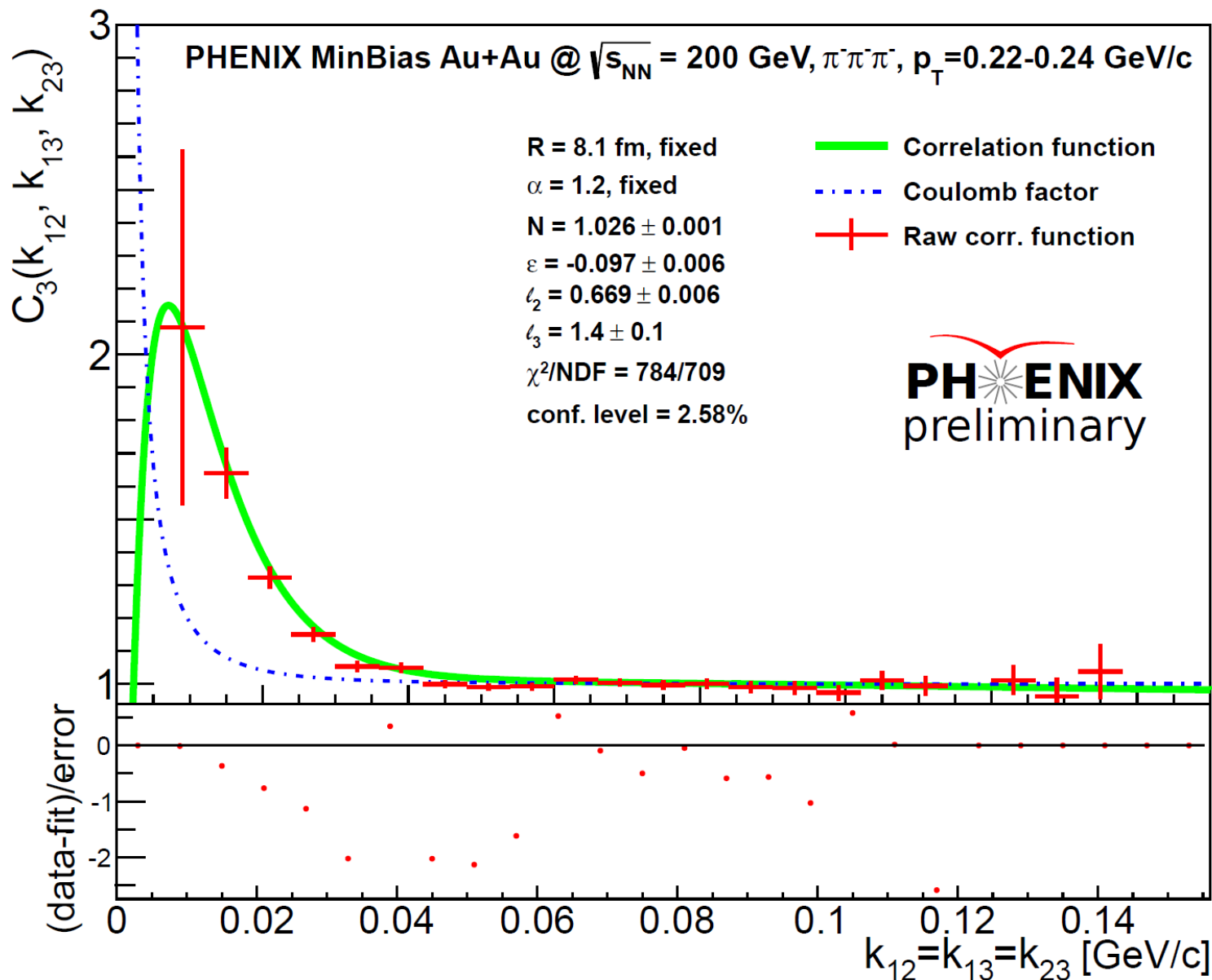
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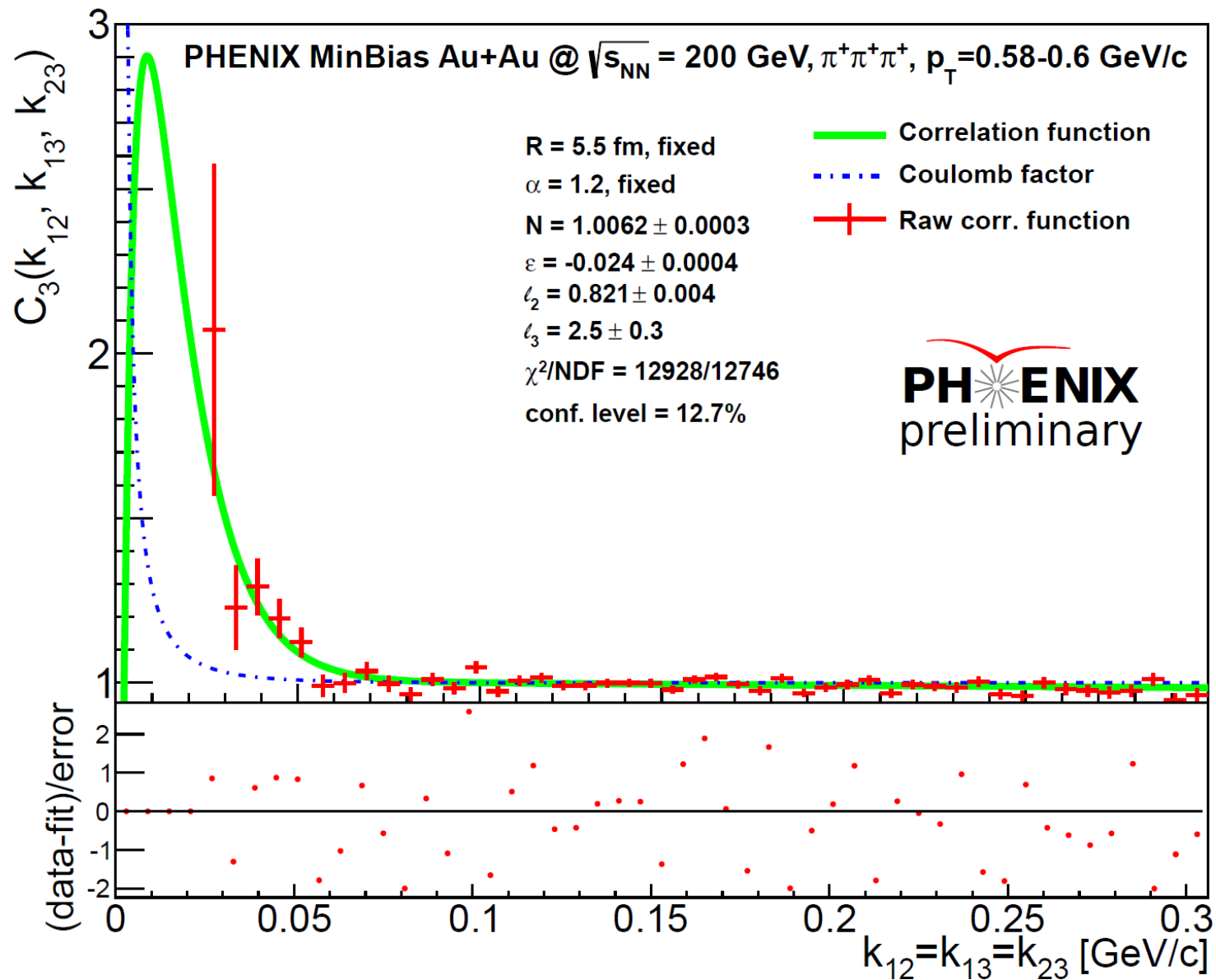
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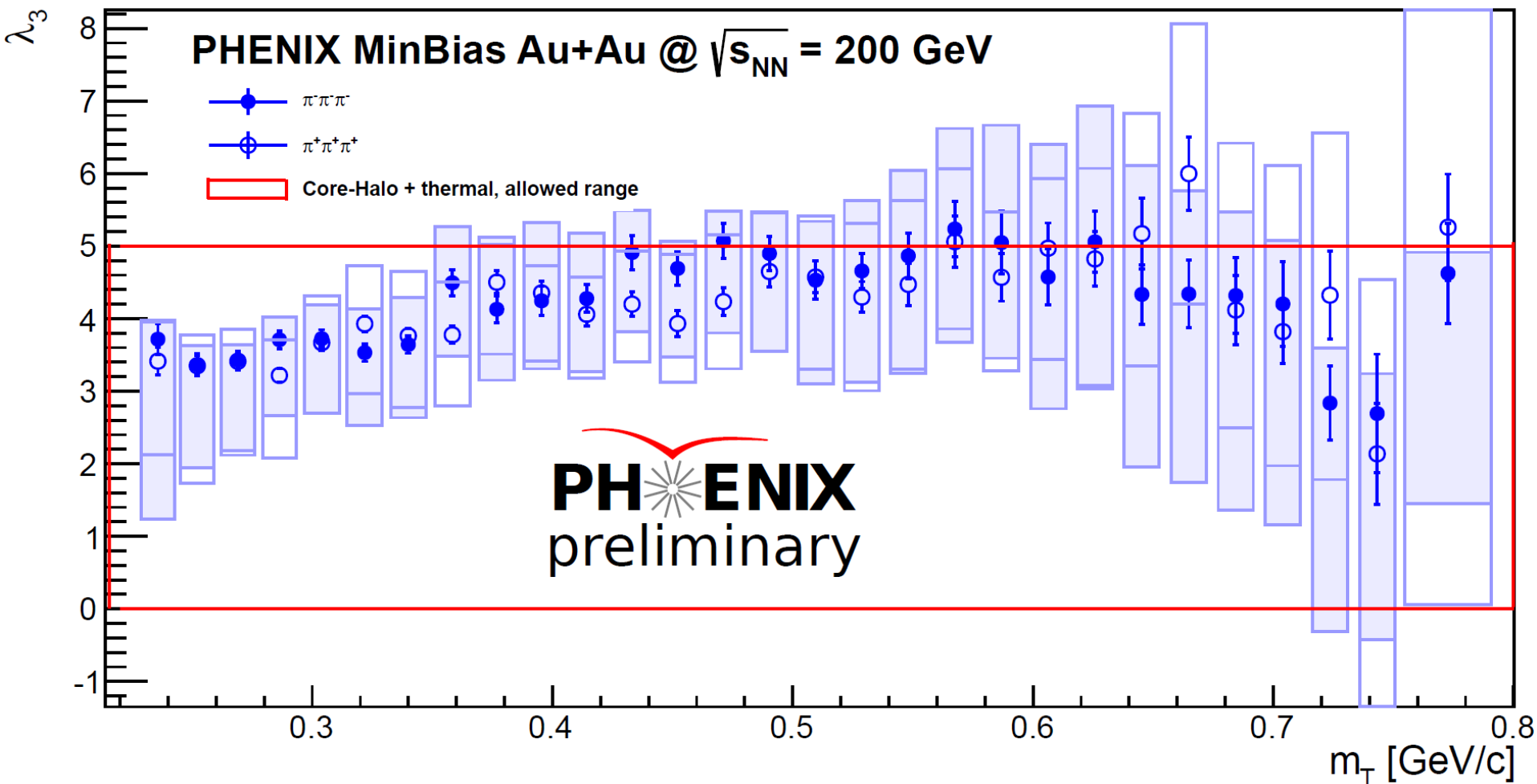
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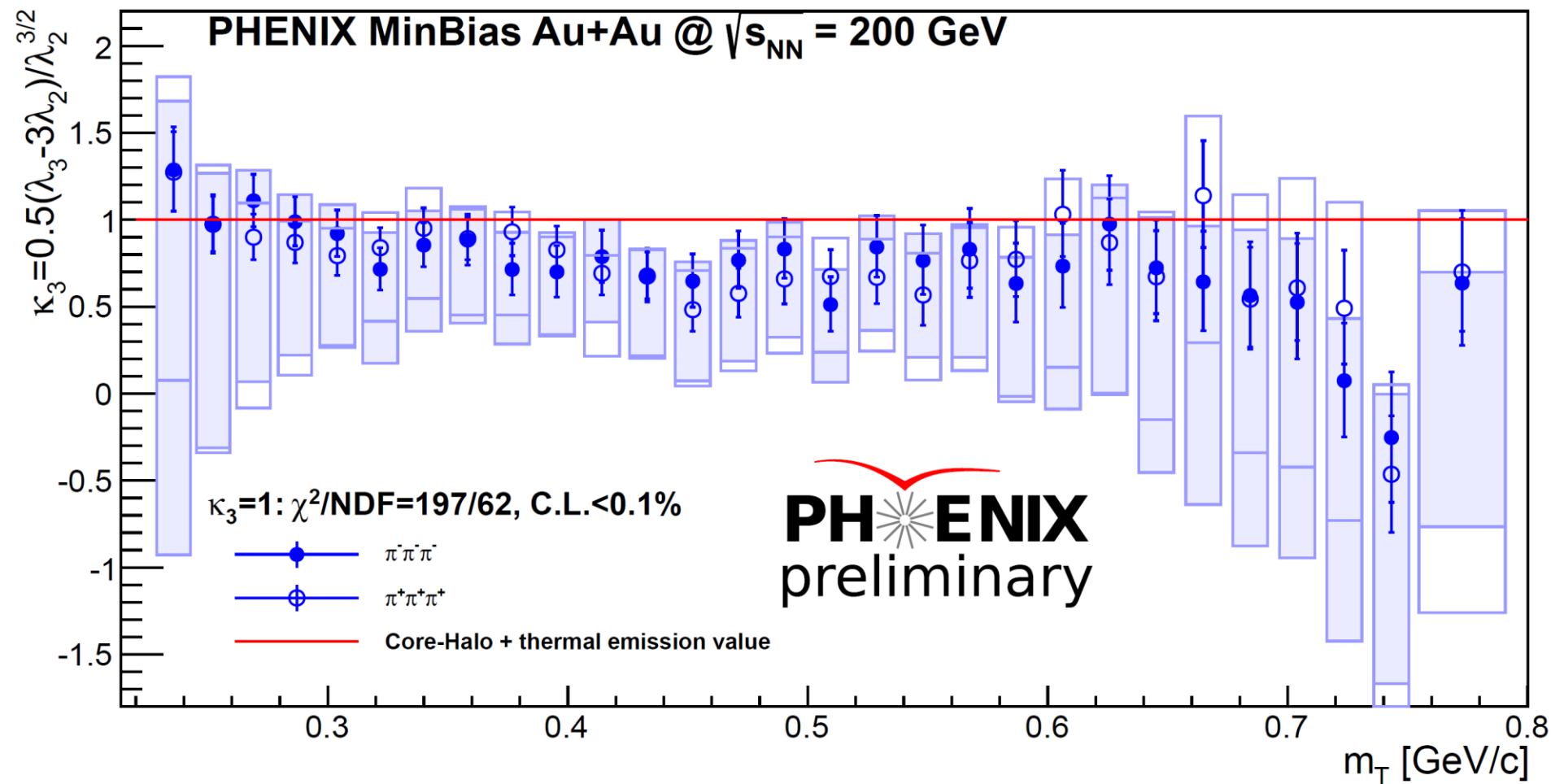
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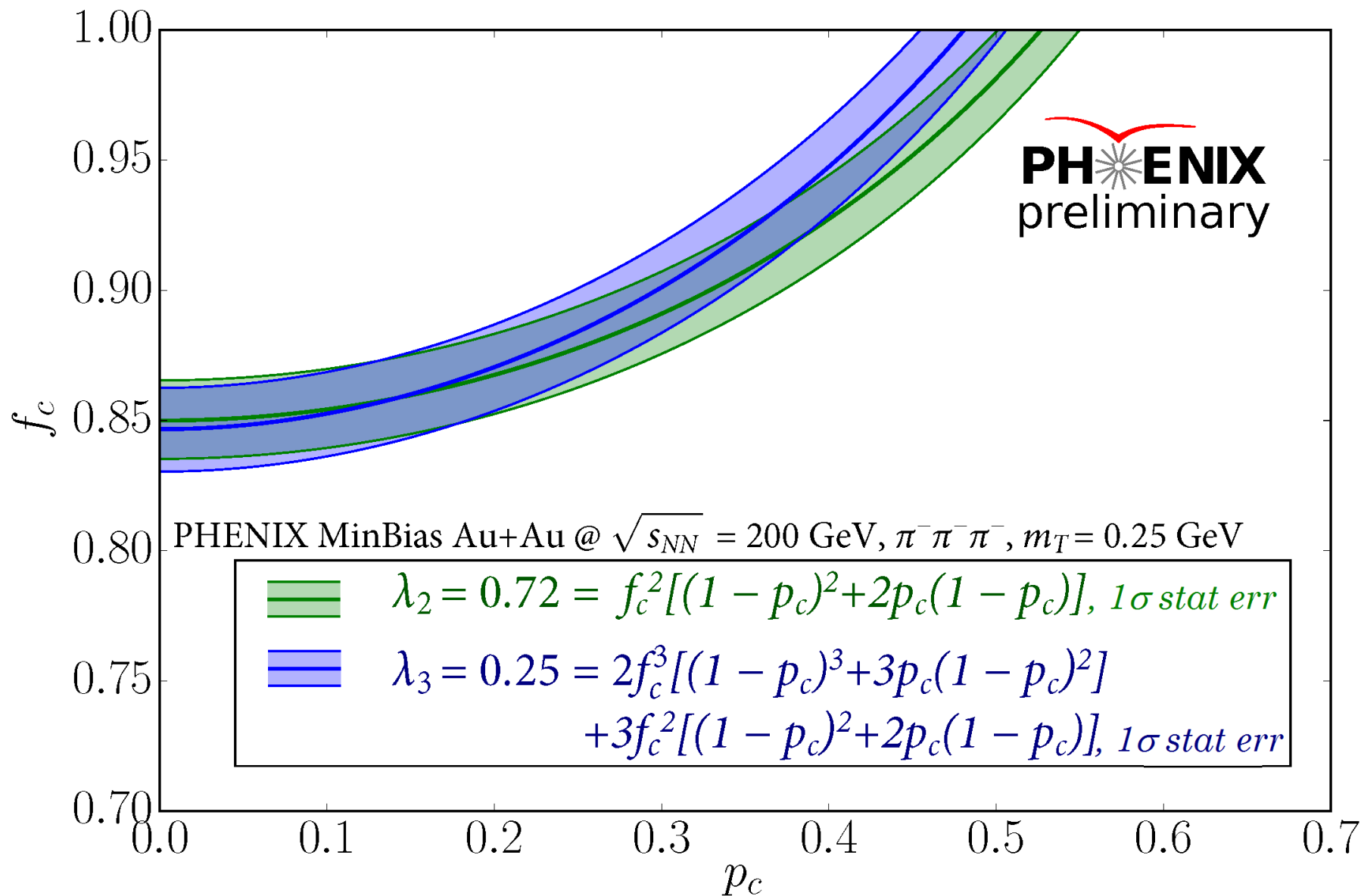
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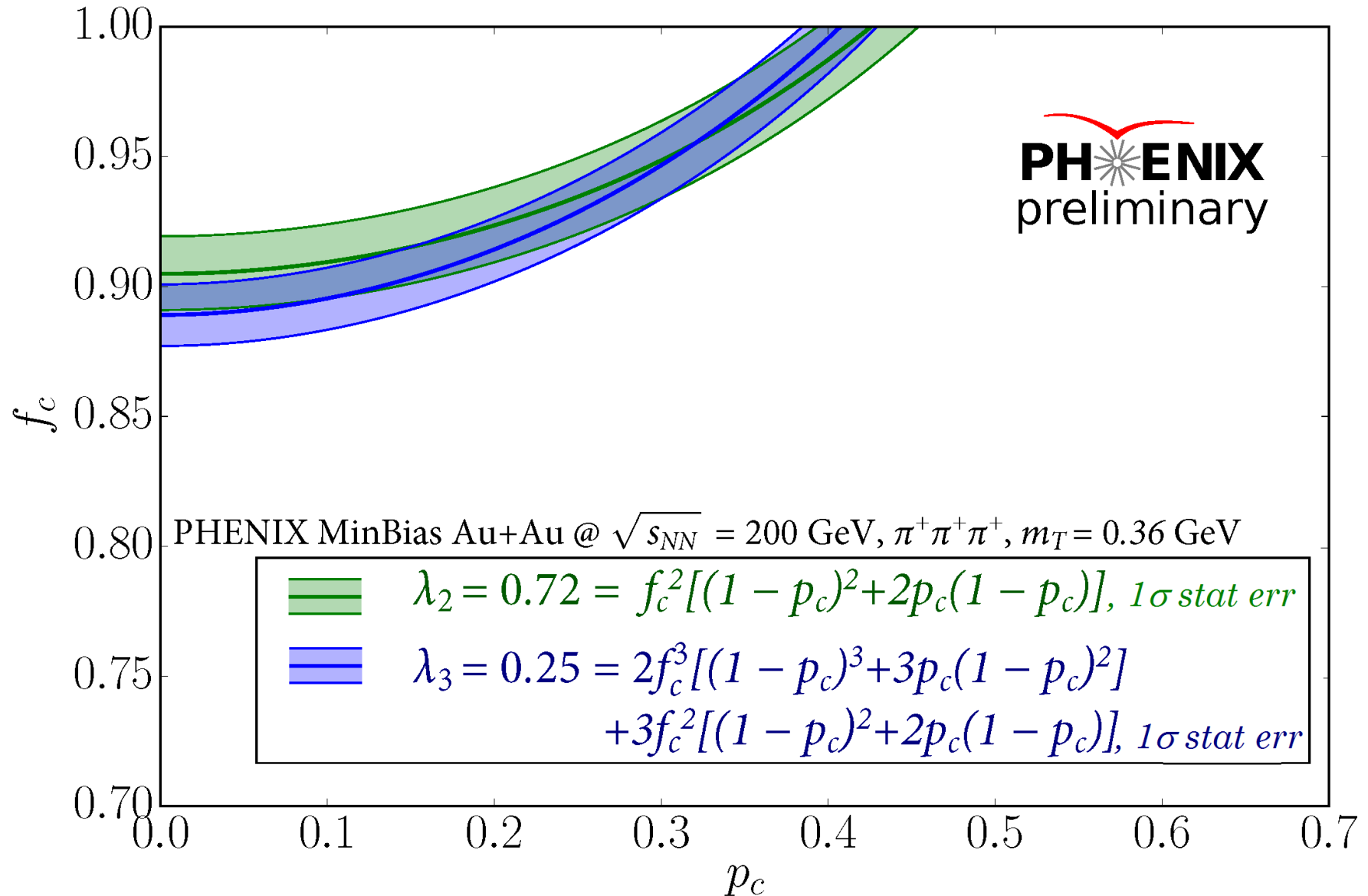
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Basic Information

Data set: Run-10 Au+Au 200 GeV MinBias

Data provenance (i.e. reconstruction tag): pro84

Analysis code location in CVS (required):

recalibration, compressed DST generation (see AN1187):

[offline/AnalysisTrain/hadrons_run11/train_sources/hadron_pid_dst/](#)

Measurement: [offline/analysis/hbtmeasure_3particle/](#)

Fitting: [offline/analysis/hbtlevyfit_3particle/](#)

Basic analysis cuts (details in AN1288):

used event cuts: MinBias, $|z_{\text{vtx}}| < 30$ cm

track cuts: quality, n0, usual TOF, ECENT cuts, 2s (dphi, dz) in PbSc/TOF

pion PID: 2s m2 cut in PbSc/TOF.E/TOF.W, 2.5s veto for K, p

two track cuts (explained in AN1244):

- tower/slat/strip ID cut

- customary shaped cuts in DCH zed/phi and PbSc, TOF zed/phi

event mixing: 3% wide centrality & 2cm wide zvtx bins.

Basic Information & Provenance, part 2

Please list all recalibrators used in this analysis

centrality calibration, beam shift & mom. scale calibration

PbSc hadron timing, TOF East/West timing, PID variable tuning

PbSc/TOF/PC2/PC3 hadron track matching

Were any of these not in the MasterRecalibrator?

- only centrality, beam shift & mom. scale calibration is from MasterRecal

- others are private calibrations (done specifically for this analysis)

Location in CVS of Recalibrator codes

- see AN1187; general location: [offline/AnalysisTrain/hadrons_run11/](#)

- DST used for this corr. func. measurement generated with Taxi 5202:
[offline/AnalysisTrain/hadrons_run11/train_sources/hadron_pid_dst](#)

What's the observable

What observable is analyzed?

Three particle Bose-Einstein correlation and their Levy parameters, in 29 p_t bins, from 180 to 780 MeV/c

What will be plotted?

Correlation strength (λ_3), Core-Halo independent parameter (κ_3) as function of m_t

f_c - p_c plots for partial coherence

What's new about this result?

Three particle correlation functions with Levy sources

What is the question that this new result will answer?

Pion production mechanism details beyond core/halo; coherent pion production?

Analysis Issues (~2 slides)

What were the main issues in the analysis?

Visualization of fits, high memory usage of 3D histograms,
slow fit in 3D, many fit parameters

What concerns were raised in PWG meetings?

Why is R , α is taken from PPG194, and not used as fit parameter? What are the f_c - p_c plots?

What was the resolution for these issues?

We used R , α as fit parameters, the results was consistent with PPG194 (see AN1288 figure 5), but using them from PPG194 reduce the number of parameters and it's easier and faster to fit. Explanation of f_c - p_c plots was extended in AN1288 section 6.3.

Page number / figure in AN with the details...

Chapter 4 plots in figure 5

Chapter 6.3

Relation to Previous Analyses

Are there previous results for the same observable?

No

Are there previous results for a related observable?

m_T -integrated f_c - p_c with Gaussian fits (ID p0278, QM05 preliminary) PPG194 partly

Are there any non-PHENIX results for this observable?

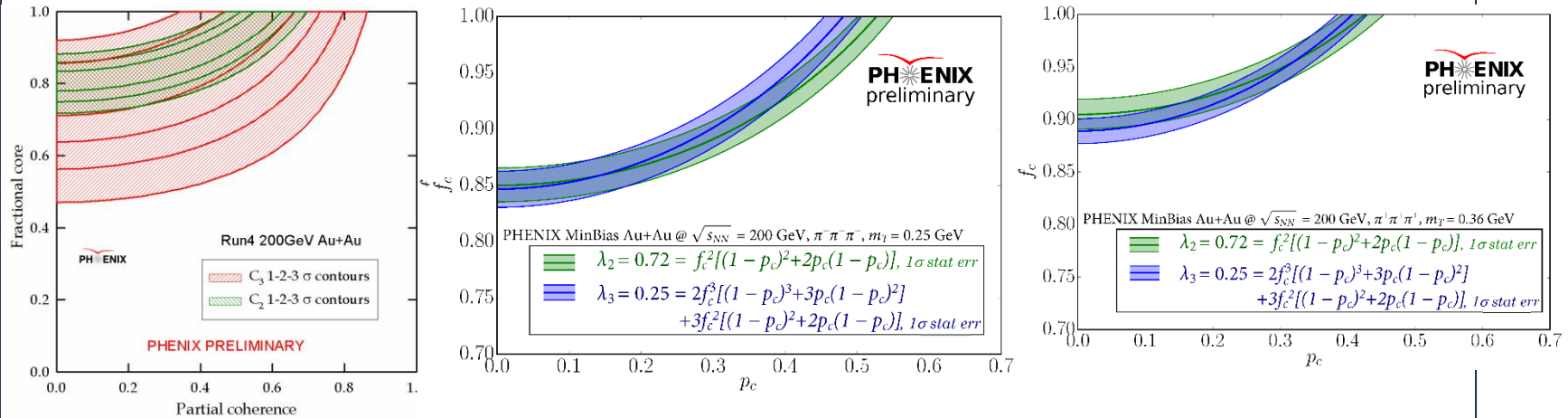
No Levy fits was done, no 3D analysis (12, 23, 31)

Similar observable in ALICE measurements: arXiv:1512.08902, arXiv: 1310.7808

Not directly comparable

Comparison of New & Old PHENIX Results

Show plot(s) of this comparison



Summarize how good/bad the agreement is

Values of λ_2 and λ_3 give similar (f_c , p_c) ranges with 1 sigma stat errors

Results compatible with partially coherent source

At the given m_T , $f_c < 0.82$ and $p_c > 0.5$ are excluded

Explain any disagreement:

Previous result: not with Levy sources, m_T -integrated

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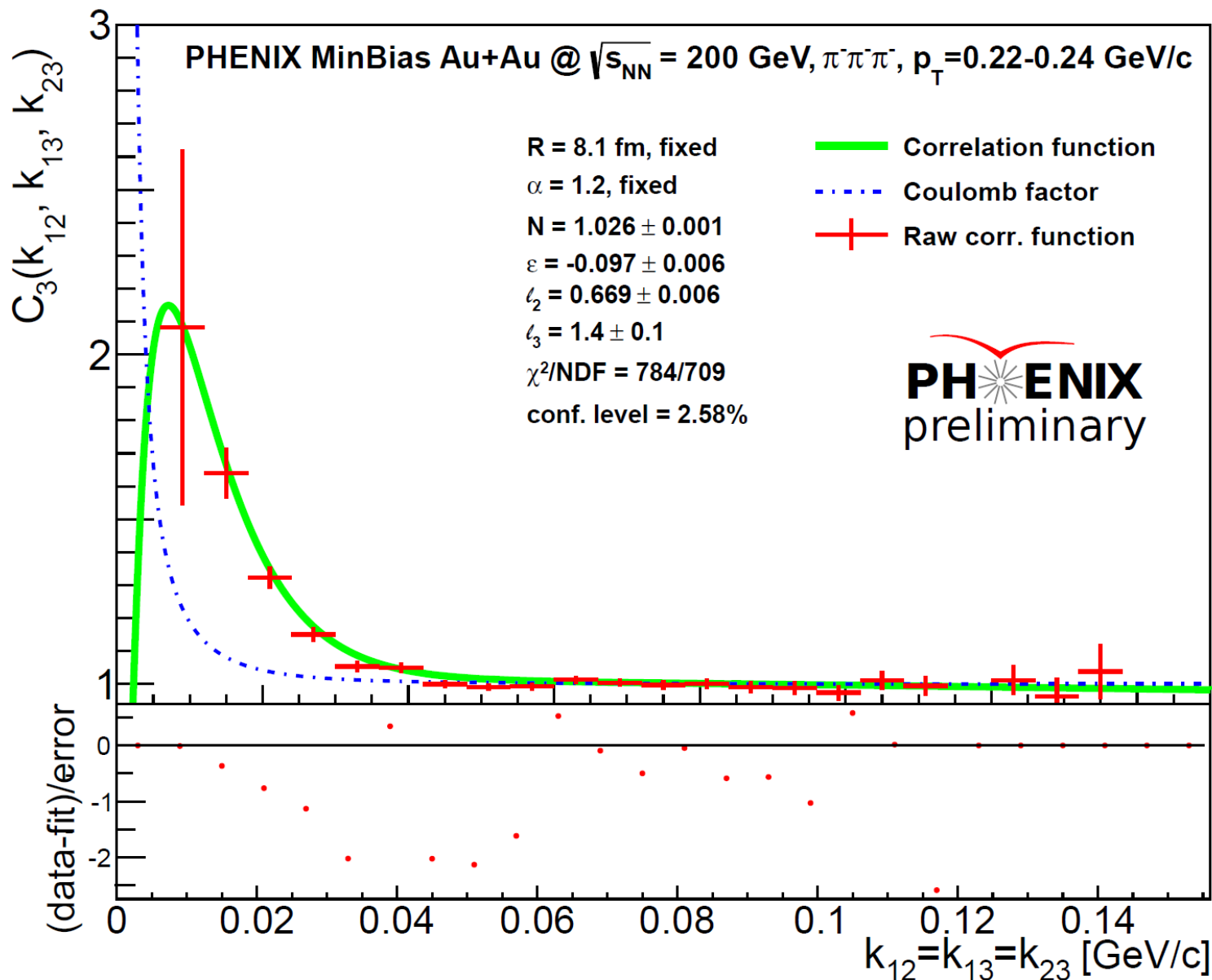
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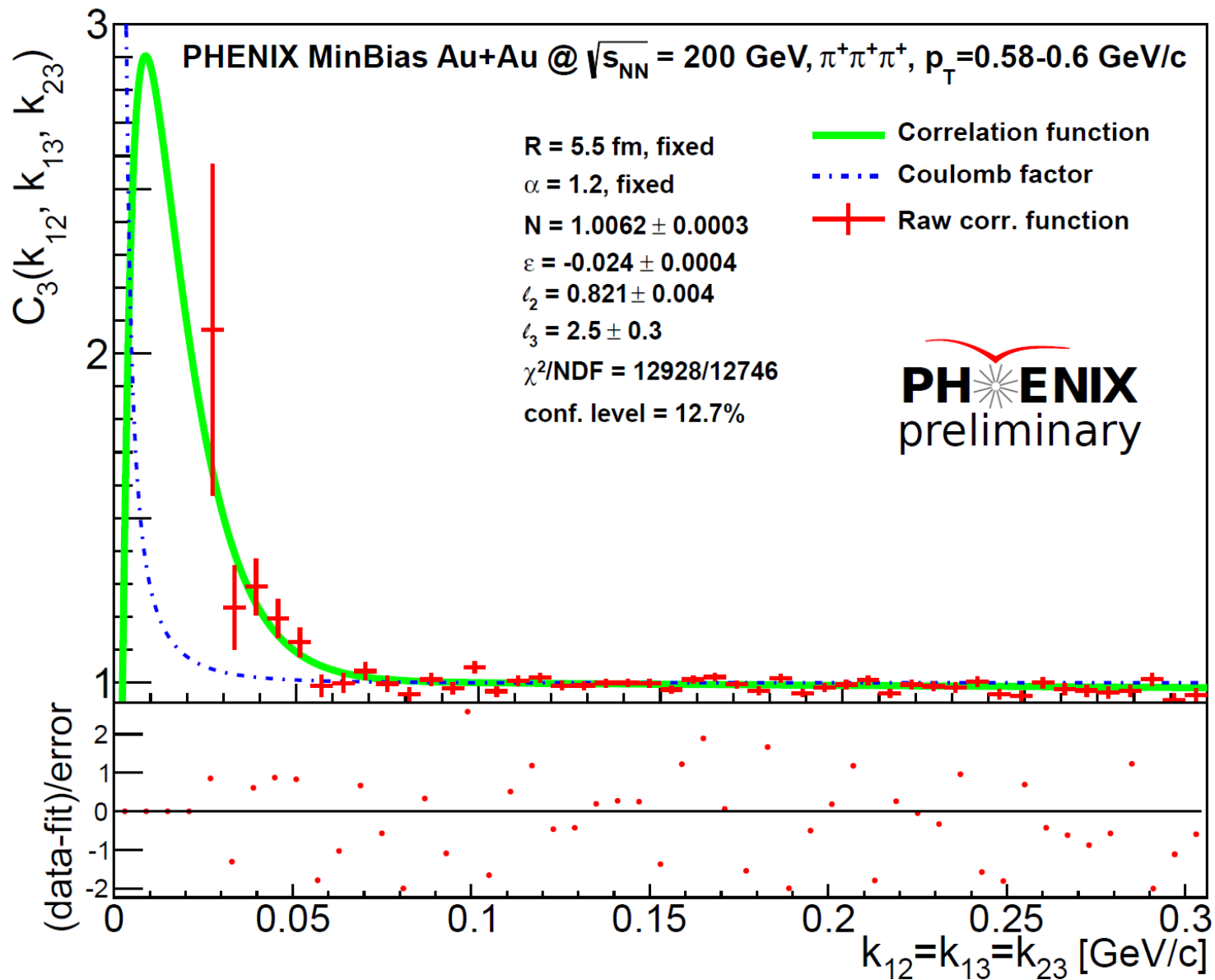
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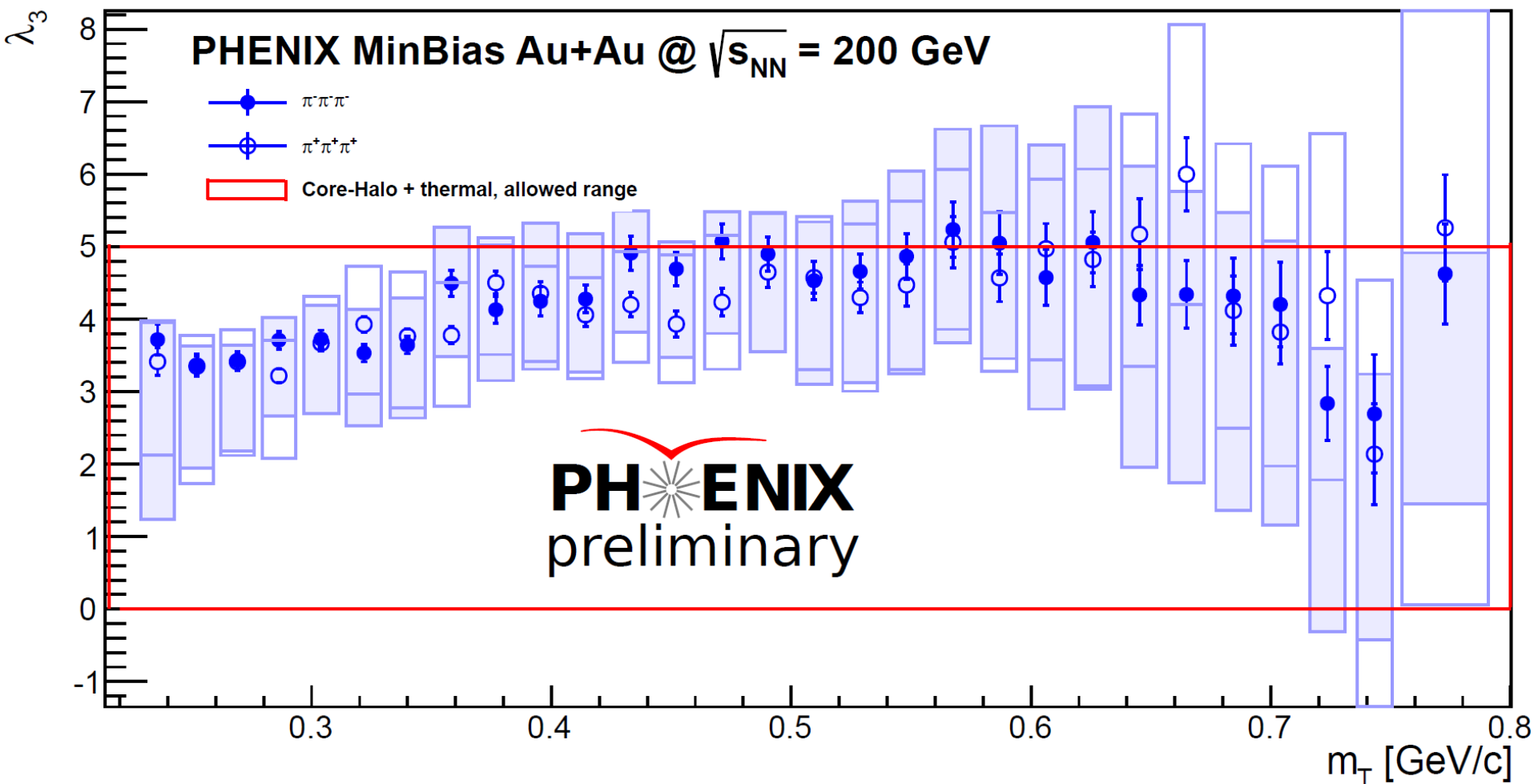
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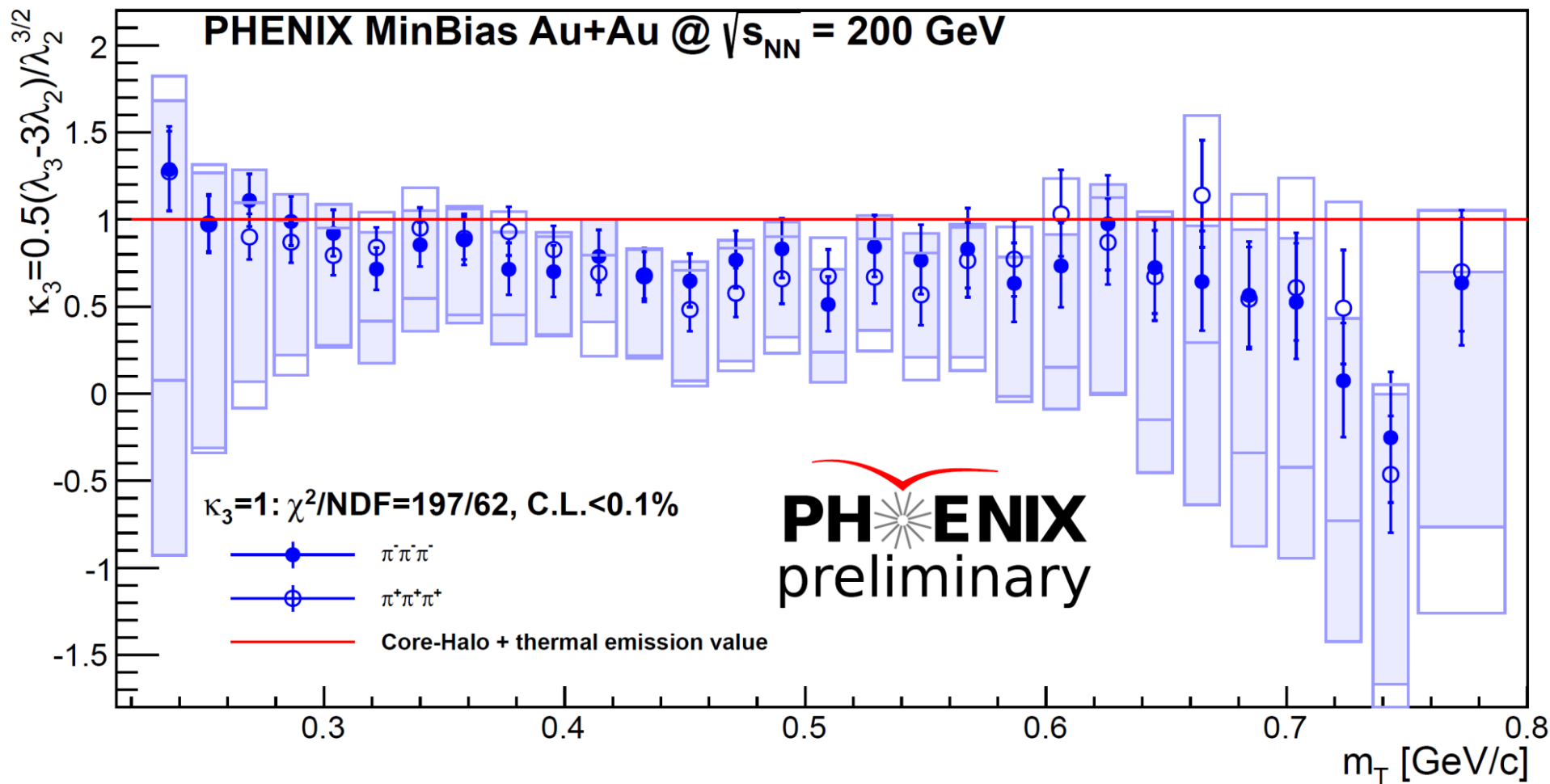
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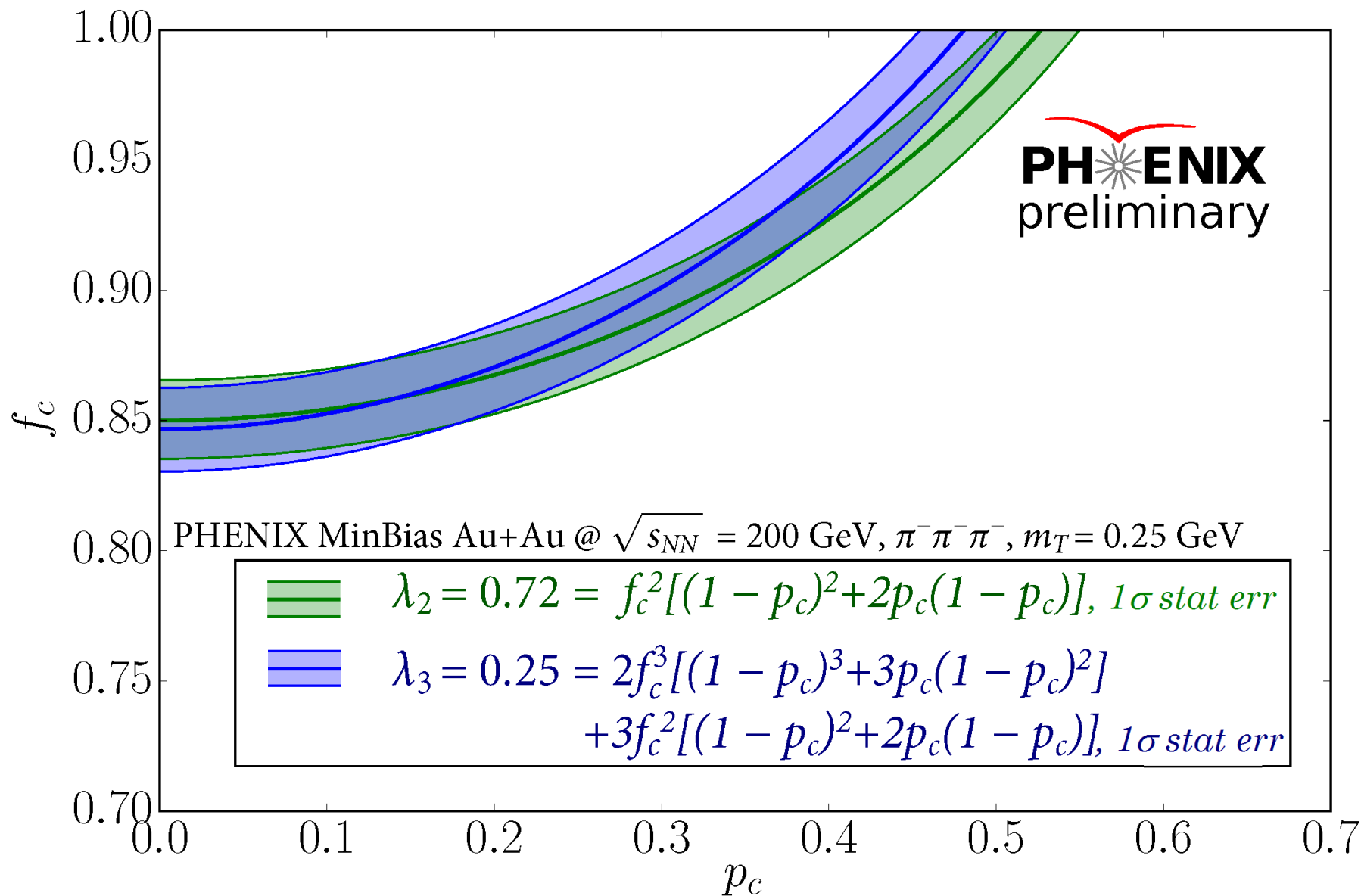
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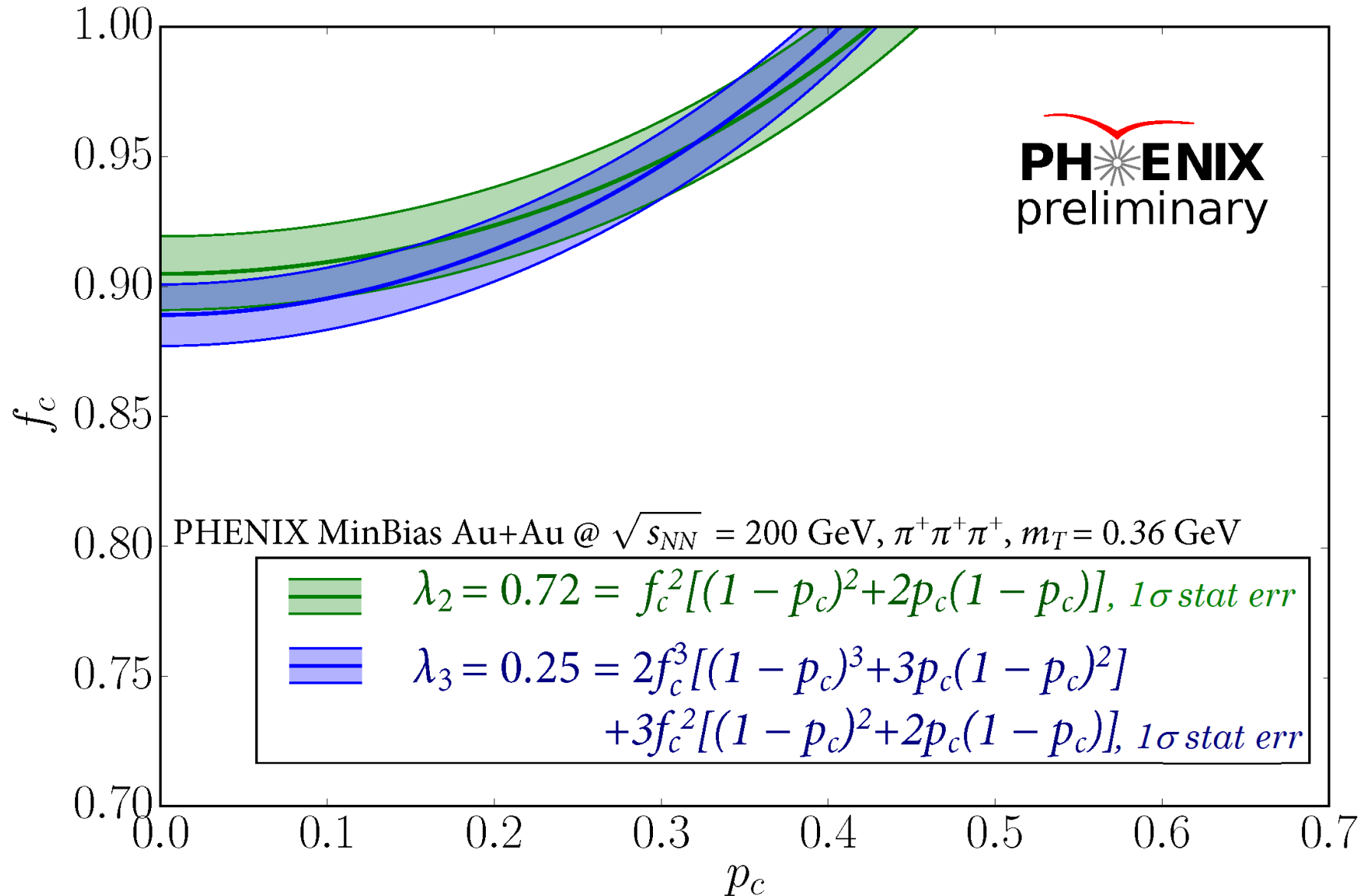
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Physics Knowledge Gained

What did we learn?

Strength of three-particle correlations (λ_3) within the core-halo&thermal emission limits (0-5) at all m_T values

Two- and three-particle correlation strength values (λ_2 & λ_3) are consistent within 1 sigma in an extended region on the (f_c , p_c) plots at various values of m_T .

In statistically significant manner we can exclude:

small values of halo contributions ($f_c < 0.82$ region)

scenario that partial coherence is dominant ($p_c > 0.5$ region)

A small ($p_c < 0.5$) partial coherence cannot be excluded.

Possibility of coherent particle production or other deviations from thermal emission

Model-dependent possibility for extracting coherent pion fraction

If comparisons to theoretical models, provide plots and direct links to arXiv papers

D. Gangadharan, Phys.Lett. B762, arXiv:1605.07296

S. Akkelin et al., Phys.Rev. C65 (2002) 064904.

T. Csörgő, Phys. Lett. B409 (1997) 11, hep-ph/9705422

T. Csörgő, Heavy Ion Physics 15 (2002) 1, hep-ph/0001233

The Path to Final Results

What improvements are expected for the final results

Better numerical calculation for Coulomb factor

m_T dependent determination of the excluded regions

Is all the data available used ?

Yes (Run10)

How much statistical / systematical gain?

Not much change expected

What is the timescale to achieve final result ?

1-1.5 month until Coulomb correction calculated

Will have to see about 4-pion correlations

Work will be done by: Attila Bagoly, Máté Csanád

Any Other Information

We are thinking about measuring 4-pion correlations