Single-particle strength at large momentum transfer

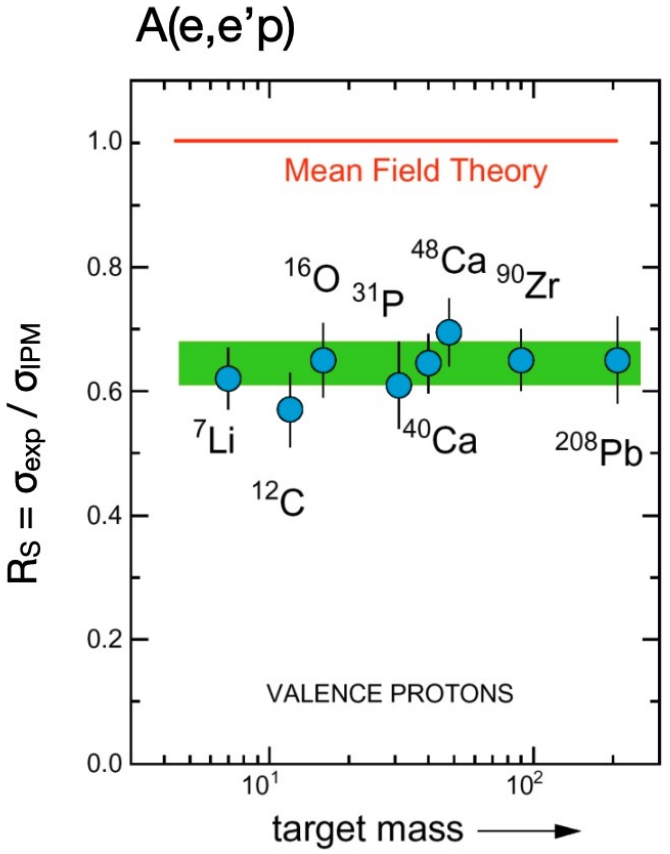
$^{12}C(p, 2p)^{11}B$ in inverse kinematics

Göran Johansson
Tel-Aviv University

5th International Workshop on SRC & EMC-Effect
Lawrence Berkeley National Laboratory, California

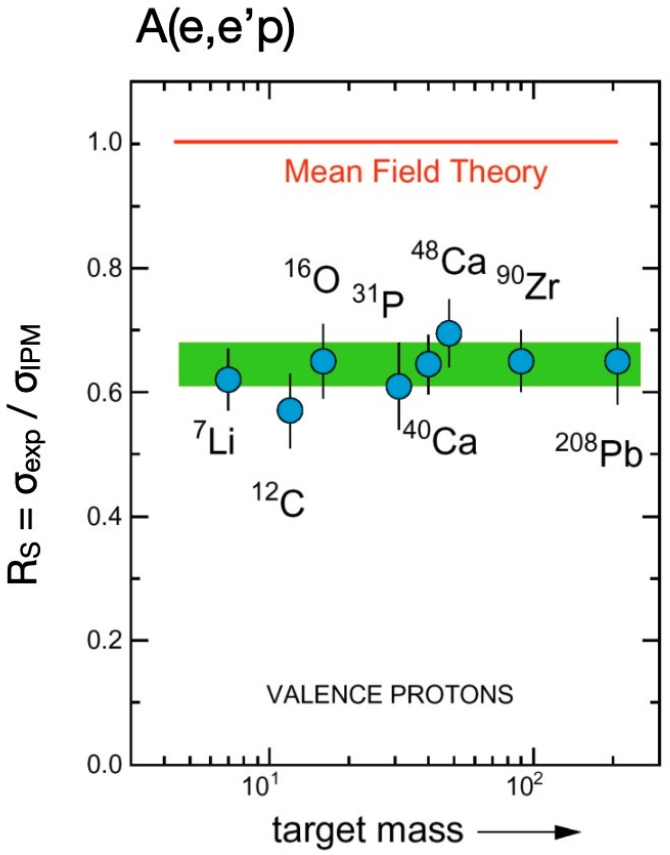
9 June 2026

"Quenched" nuclear single particle strength



L. Lapikas, NPA 553 (1993)

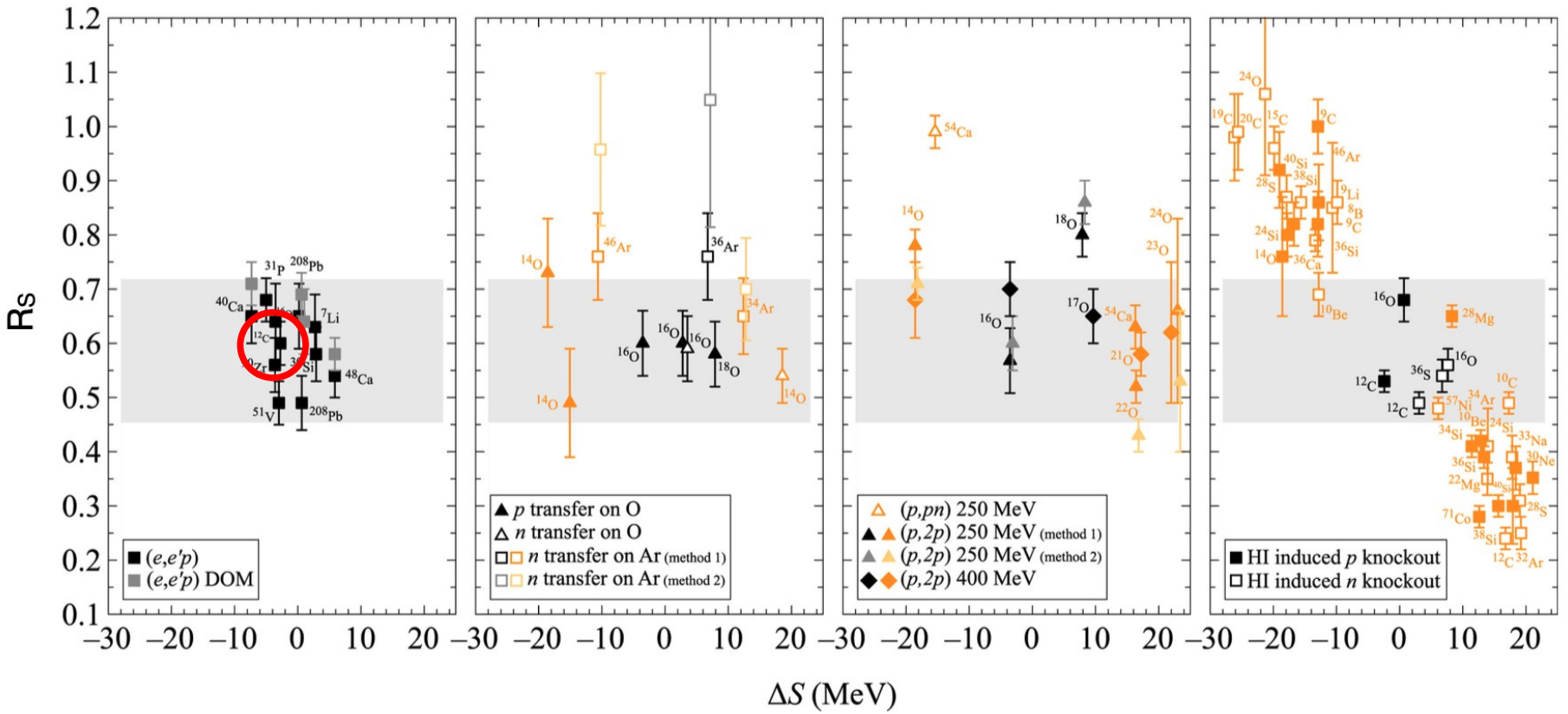
"Quenched" nuclear single particle strength



Short-range correlations

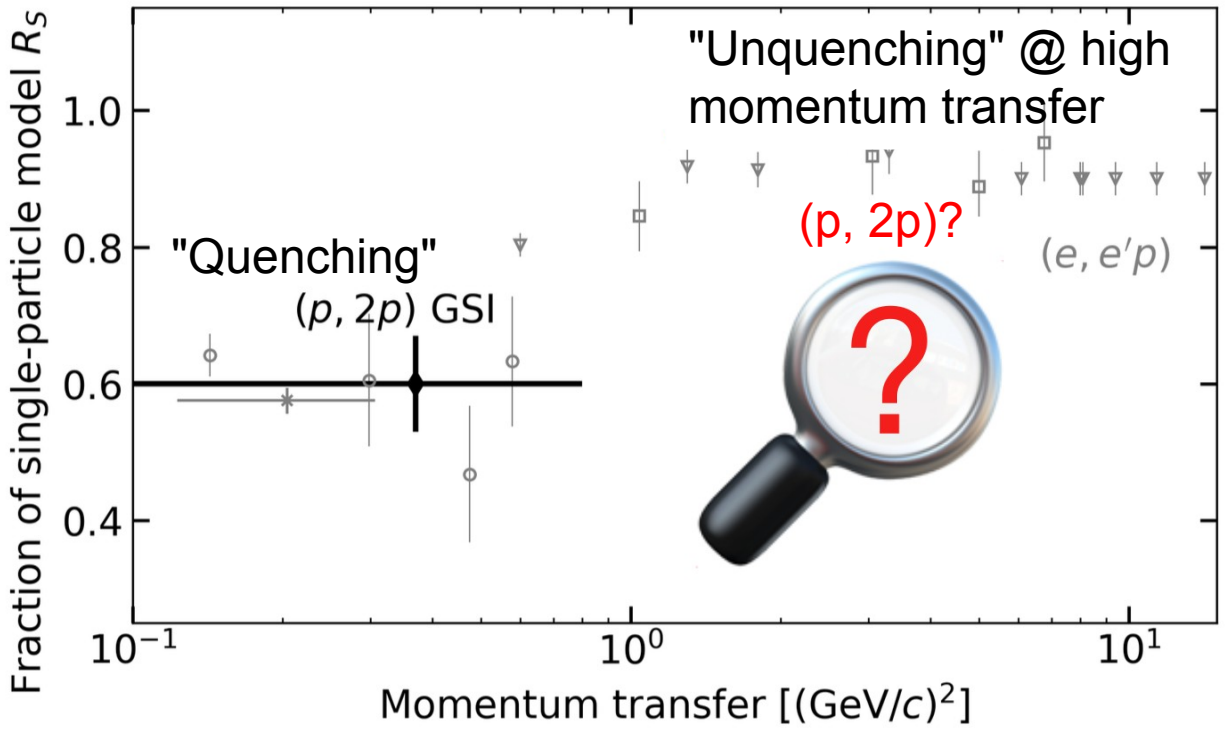
Long-range correlations

L. Lapikas, NPA 553 (1993)



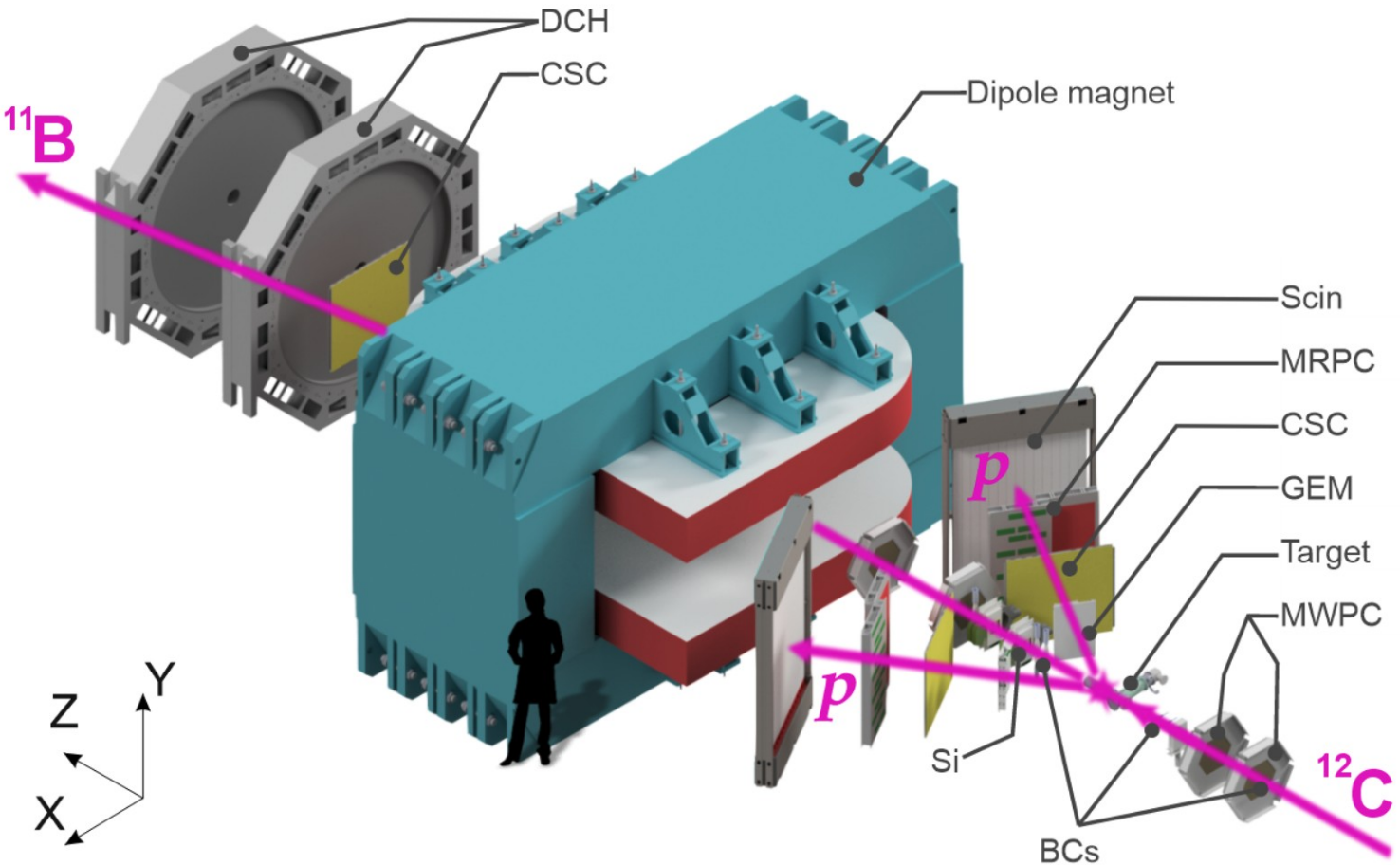
T. Aumann et al., Prog. Part. Nucl. Phys. 118 (2021)

^{12}C Spectroscopic Strength: Scale Depencence?



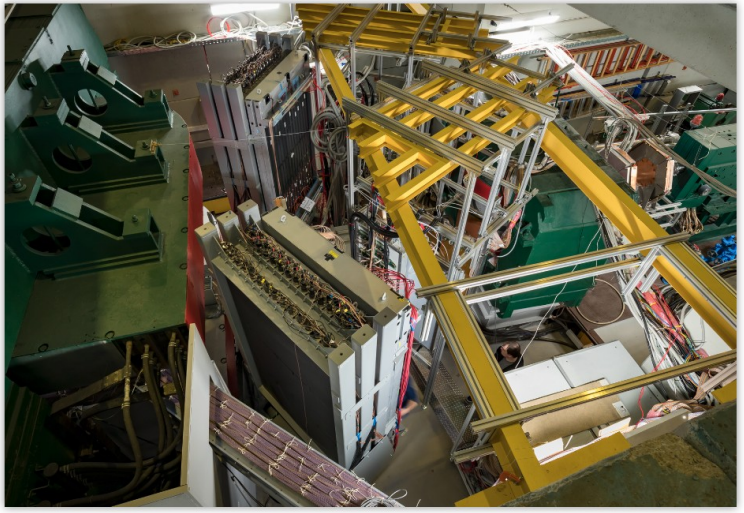
Lapikas et al. PRC, 61(6), 064325
Strikman, et al. PLB, 503
H. Szumilla-Vance et al. PRL, 126, 082301

Experiment: $^{12}C(p, 2p)^{11}B$

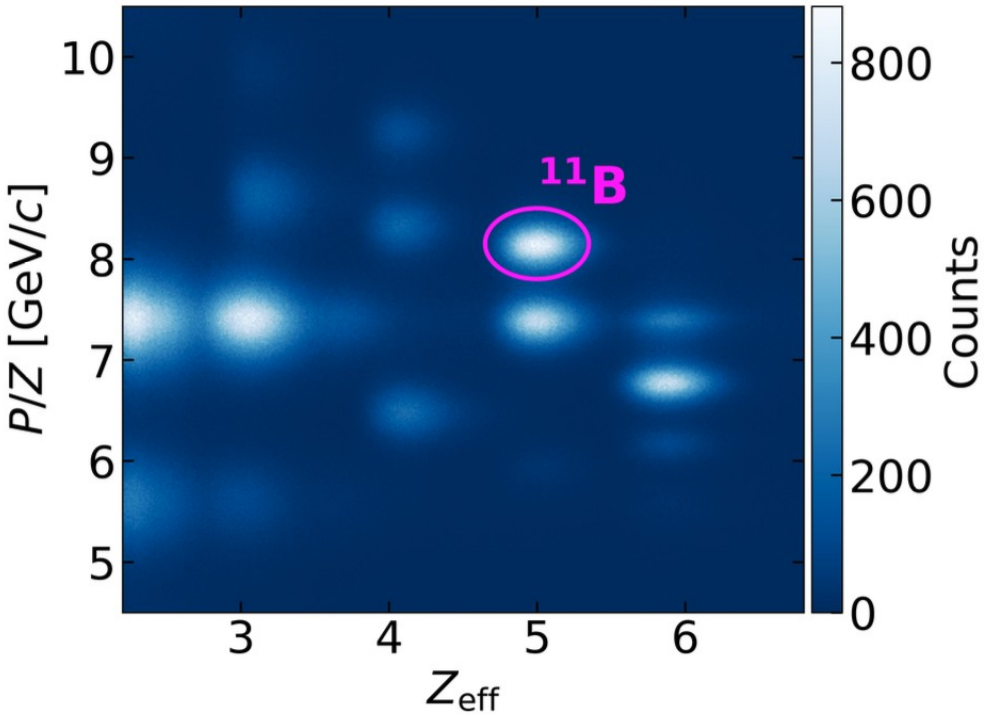


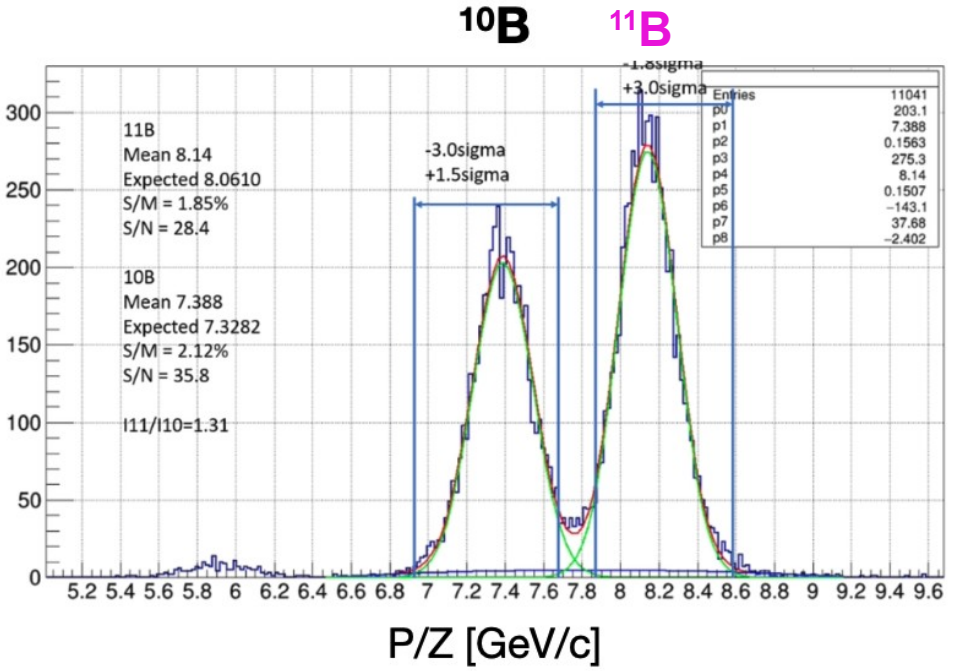
3.75 GeV/c/u

Experimental Setup

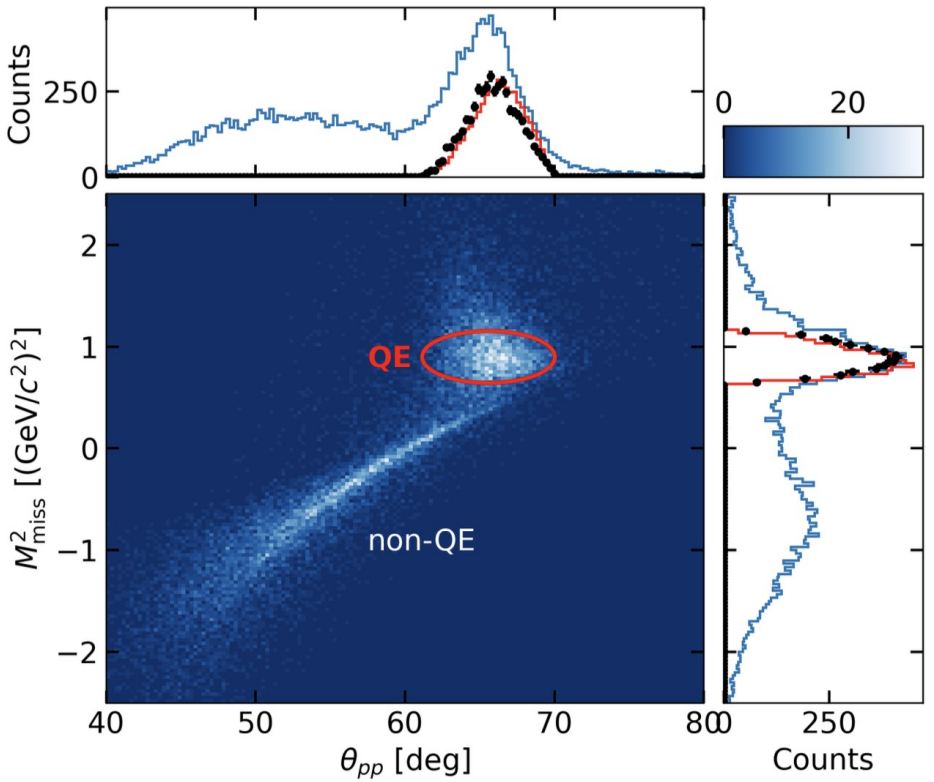


Fragment PID and Selection





Quasi-Elastic Identification - $^{12}C(p, 2p)^{11}B$



$M^2_{miss}=E^2_{miss}-P^2_{miss}$

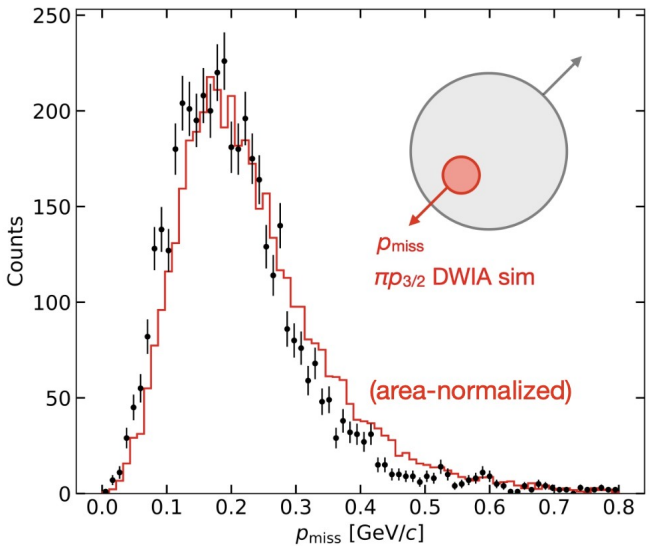
Missing Momentum Reconstruction $^{12}C(p, 2p)^{11}B$

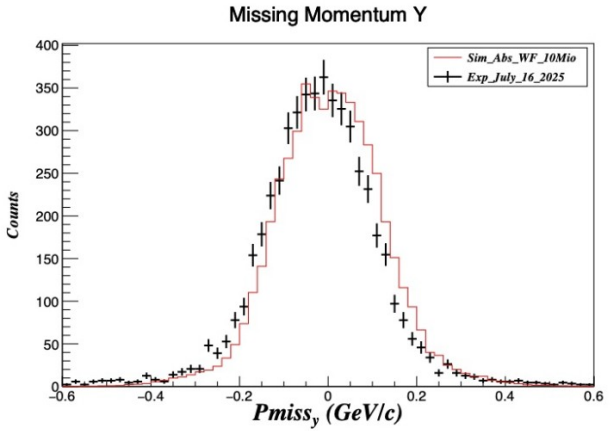
Preliminary 2022 data

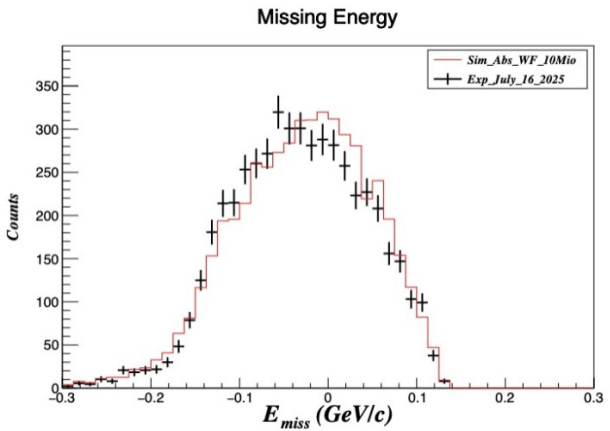
p-shell removal simulation

$P_{miss}=P_{p1}+P_{p2}-P_{tgt}$

W/o ISI/FSI $P_i=P_{miss}$



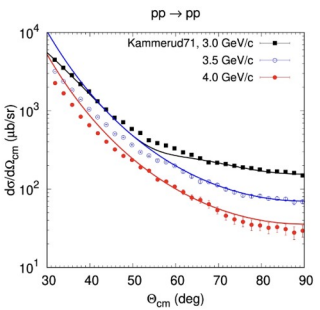




Same as: M. Patsyuk et al. Nature Phys. 17 (2021)

Theory: QE (p,2p)
@ Intermediate Relativistic Energies

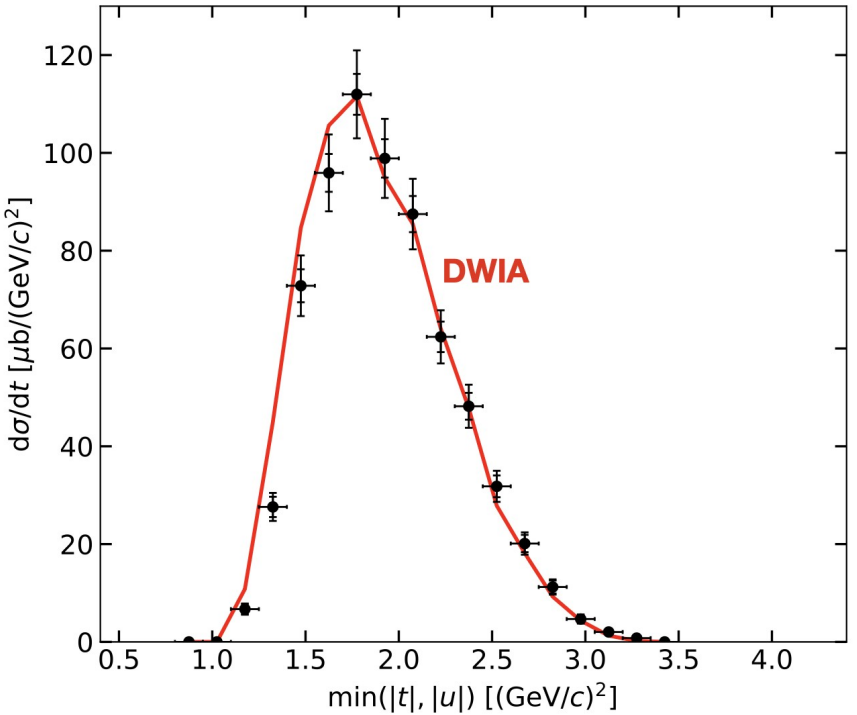
Nuclear Structure	x	(p, 2p)	x	ISI/FSI
Translationally Invariant Shell Model		Impulse Approximation		Glauber Calculation



Alexei Larionov, Yuri Uzikov, PRC 110 (2024)

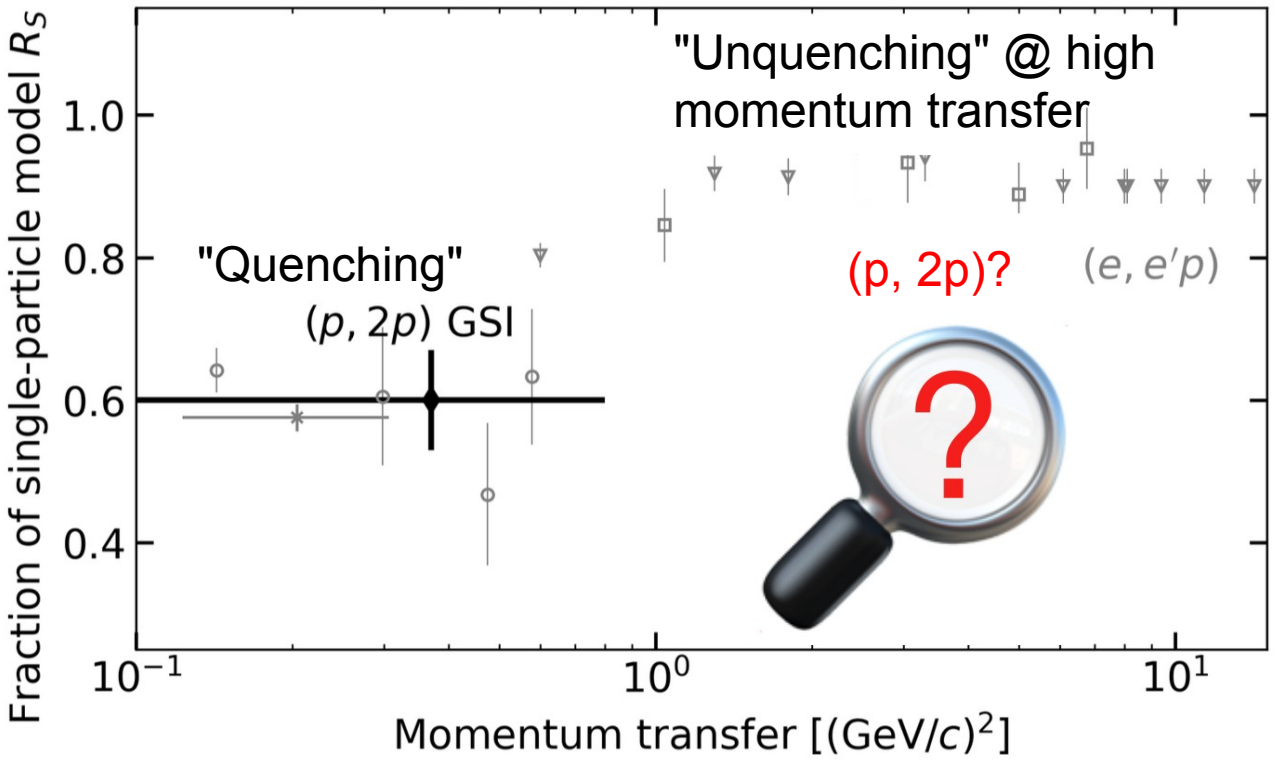
$^{12}C(p,2p)^{11}B$ - QE cross section & Quenching

- σ_{QE}=99.2 ± 1.5(stat) ± 4.5(syst) μb
- Rs = $\sigma_{exp}/\sigma_{theo}$=0.96±0.05

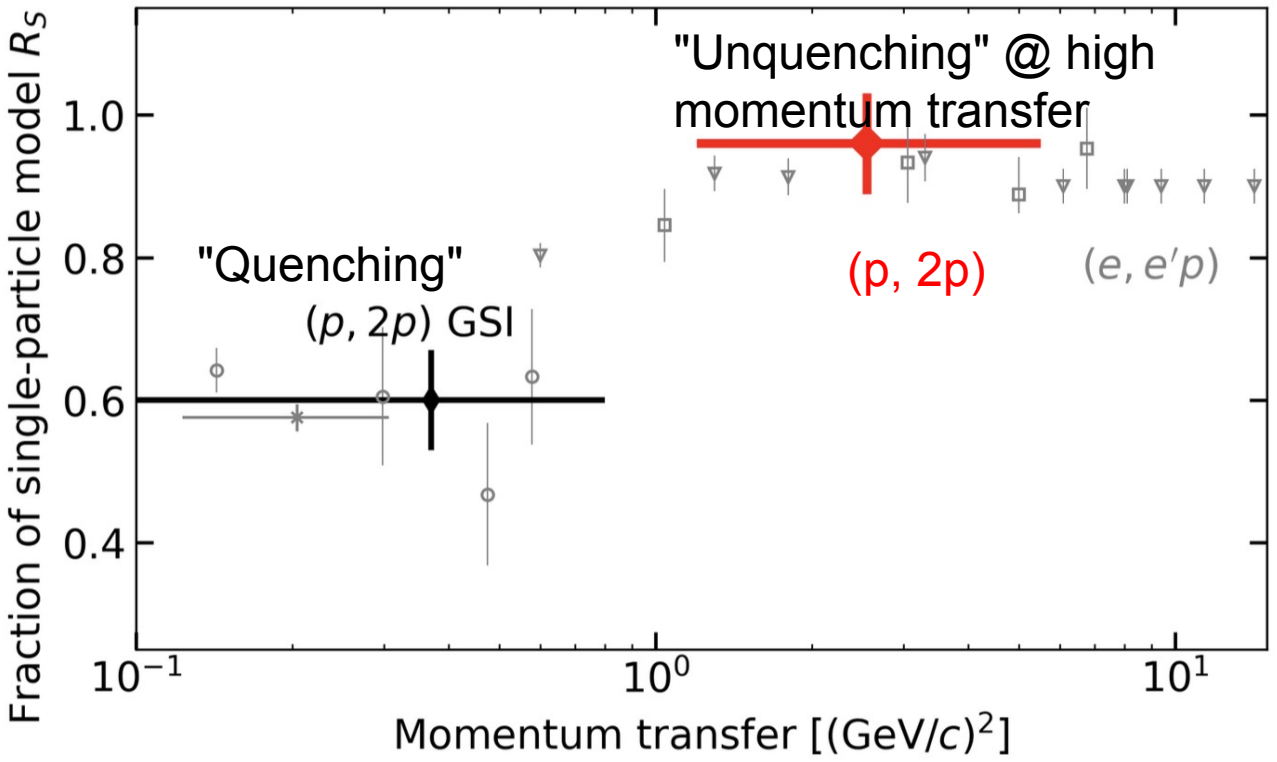


Alexei Larionov, Yuri Uzikov, PRC 110 (2024)

^{12}C Spectroscopic Strength: Scale Depencence?



^{12}C Spectroscopic Strength: Scale Depencence?

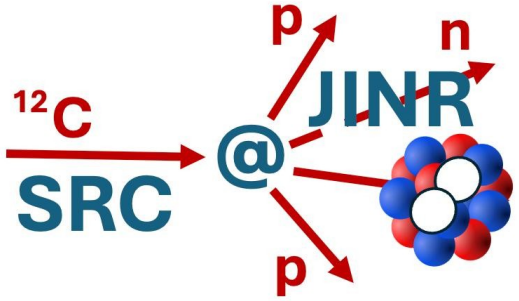


Summary

- The resolution dependent "Quenching" is probe independent
- Explanation

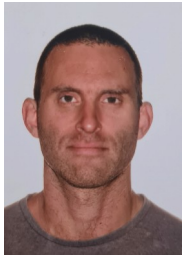
  Nuclear structure?

  Reaction mechanism (ISI/FSI)?

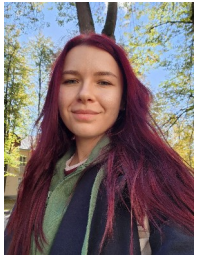


International SRC at JINR group

Students














BERKELEY LAB

TEL AVIV UNIVERSITY

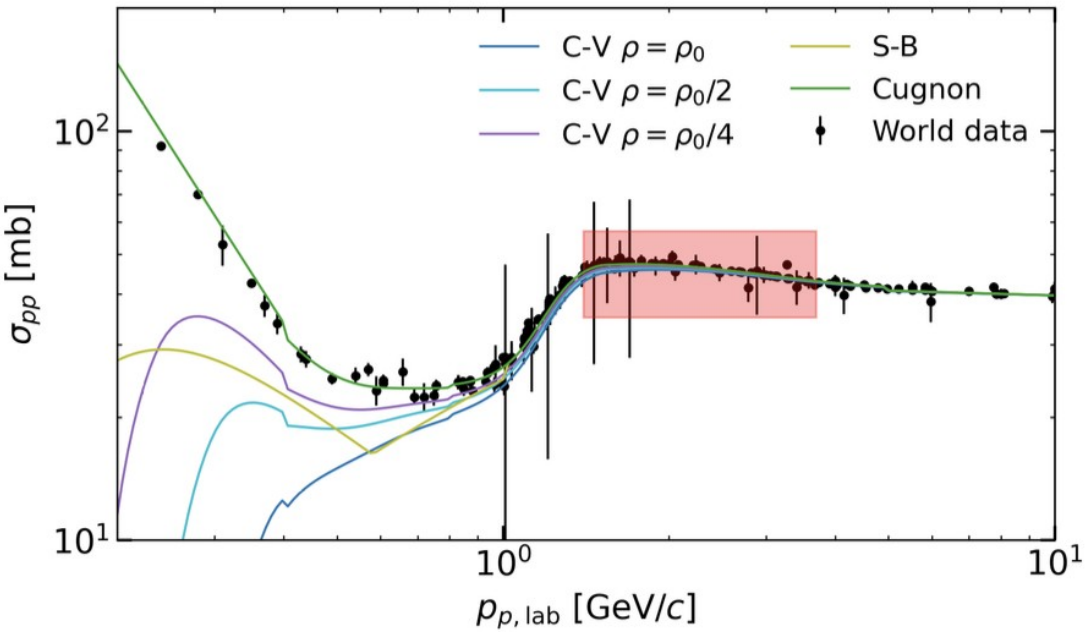
JINR

TSINGHUA UNIVERSITY 1911

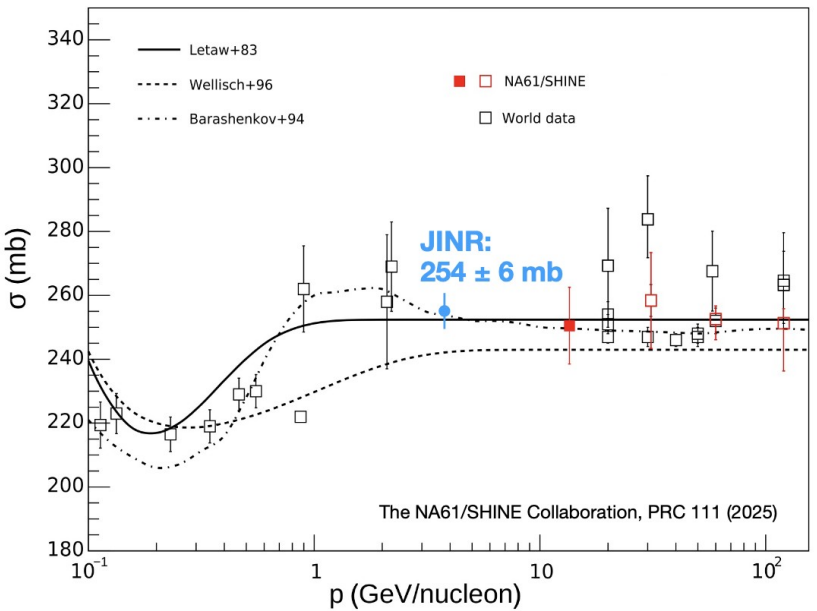
BEIJING NORMAL UNIVERSITY 1902

Thanks!

Backup Slides


C-V $\rho = \rho_0$
C-V $\rho = \rho_0/2$
C-V $\rho = \rho_0/4$
S-B
Cugnon
World data
10^2
10^1
10^0
10^1
σ_{pp} [mb]
$p_{p,\,\mathrm{lab}}$ [GeV/c]

Interaction cross section: $^{12}C \rightarrow X$



Reaction cross section: $^{12}C \rightarrow {}^{11}B$