E05-110
Coulomb Sum Rule

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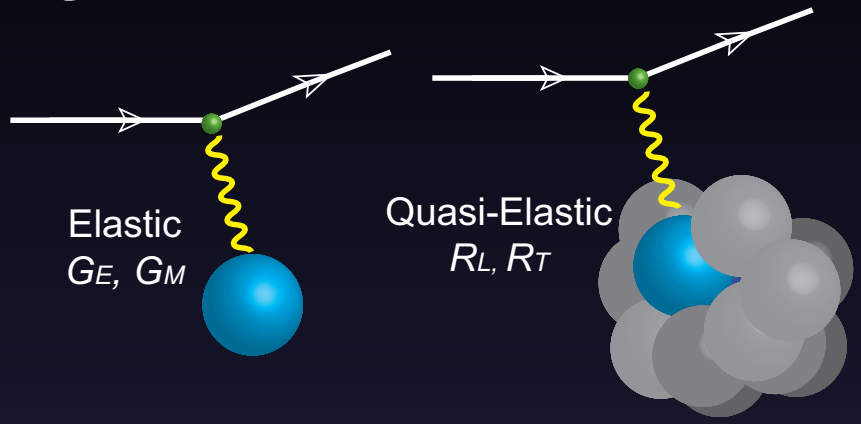
Hall A Collaboration Meeting

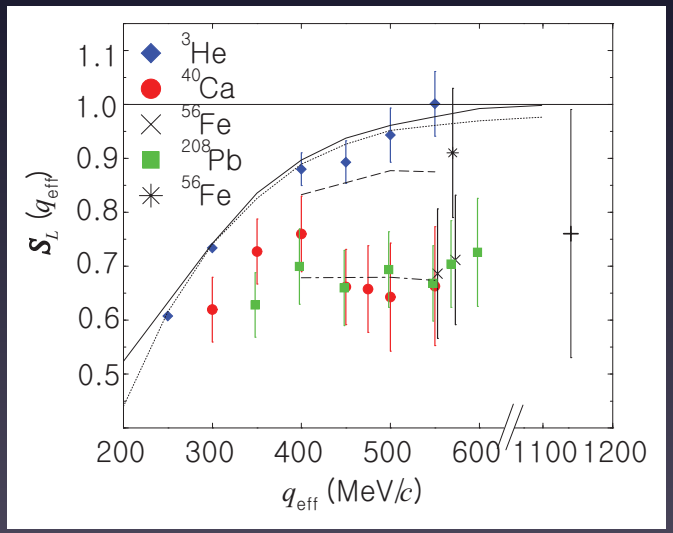
Coulomb Sum Rule

Probing a nucleon inside a nucleus



$$S_L(q) = \frac{1}{Z}\int_{0+}^{\infty} \frac{R_L(q,\omega)}{(G_E^p + N/ZG_E^n)\zeta}\, d\omega \;=\; 1\,?$$

Possible modification of the nucleons' property inside nuclei



E05-110 CSR

- Targets : ^{4}He(g), ^{12}C, ^{56}Fe, ^{208}Pb in LH_2
- $0.55 \leq |\mathbf{q}| \leq 1.0$ GeV
- Beam energy : 0.4–4 GeV
- HRS momentum : 0.1–4 GeV
- HRS angle : 15°, 60°, 90°, 120°
- NaI detector for better understanding of background
- Same kinematic settings for L & R HRS
- Beam time : Oct. 23, 2007 - Jan. 16, 2008

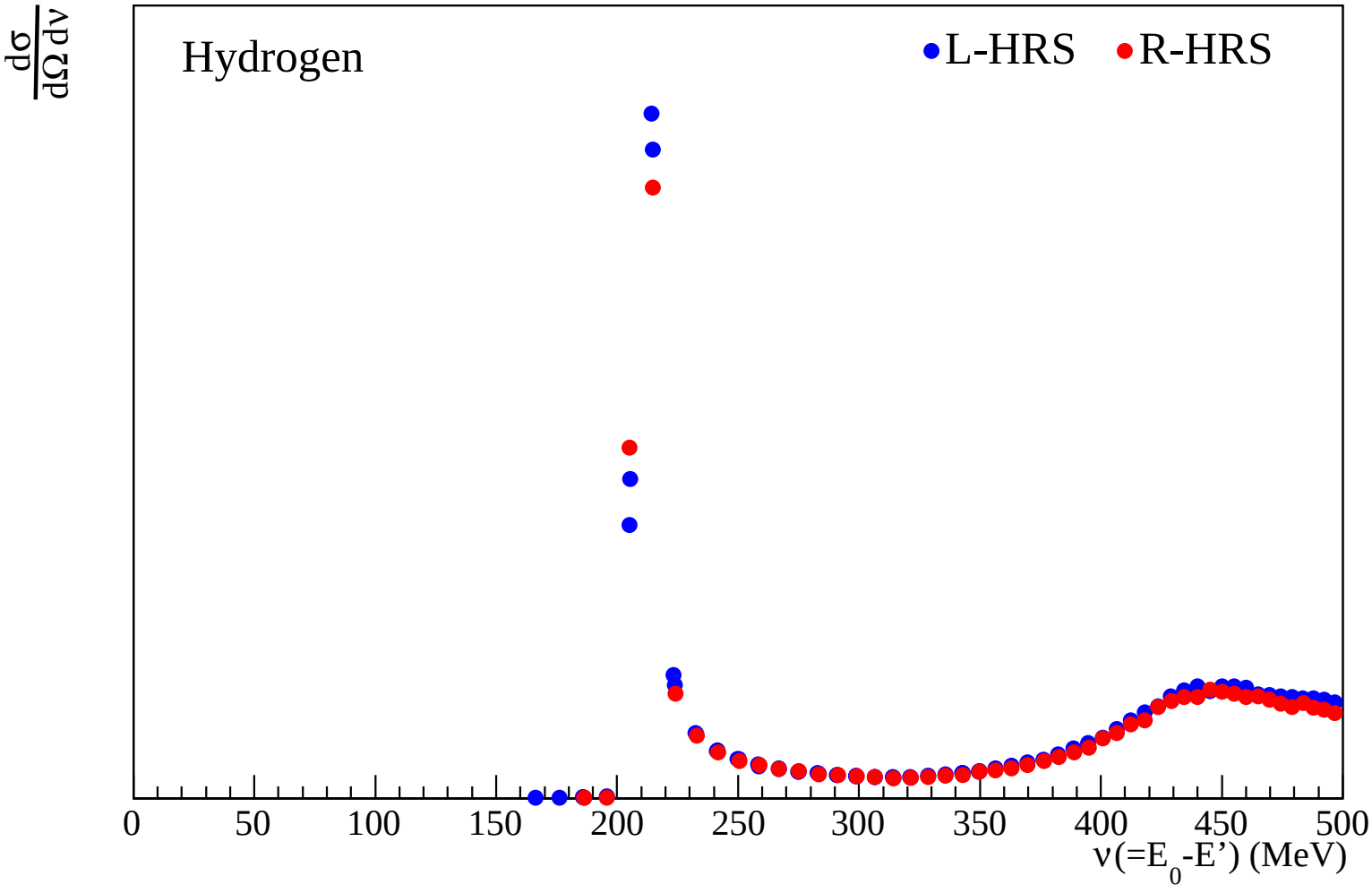
People

Kalyan Allada, Korand Aniol, John Arrington, Todd Averett, Herat Bandara, Werner Boeglin, **Alexandre Camsonne**, Mustafa Canan, **Jian-Ping Chen**, Wei Chen, Khem Chirapatpimol, **Seonho Choi**, Eugene Chudakov, Evaristo Cisbani, Francesco Cusanno, Raffaele De Leo, Chiranjib Dutta, Cesar Fernandez-Ramirez, Salvatore Frullani, Haiyan Gao, Franco Garibaldi, Ronald Gilman, Oleksandr Glamazdin, Brian Hahn, Ole Hansen, Douglas Higinbotham, Tim Holmstrom, Bitao Hu, Jin Huang, Florian Itard, Liyang Jiang, Xiaodong Jiang, Hoyoung Kang, Joe KatichMina Katramatou, Aidan Kelleher, Elena Khrosinkova, Gerfried Kumbartzki, John LeRose, Xiaomei Li, Richard Lindgren, Nilanga Liyanage, Joaquin Lopez Herraiz, Lagamba Luigi, Alexandre Lukhanin, Maria Martinez Perez, Dustin McNulty, **Zein-Eddine Meziani**, Robert Michaels, Miha Mihovilovic, Joseph Morgenstern, Blaine Norum, **Yoomin Oh**, Michael Olson, Makis Petratos, Milan Potokar, Xin Qian, **Yi Qiang**, **Arun Saha**, **Brad Sawatzky**, **Elaine Schulte**, Mitra Shabestari, Simon Sirca, Patricia Solvignon, **Jeongseog Song**, **Nikolaos Sparveris**, **Ramesh Subedi**, **Vincent Sulkosky**, Jose Udias, Javier Vignote, Eric Voutier,Youcai Wang, John Watson, Yunxiu Ye, **Xinhu Yan**, **Huan Yao**, Zhihong Ye, Xiaohui Zhan,Yi Zhang, Xiaochao Zheng, Lingyan Zhu

and

Hall-A Collaboration

Underdone Spectra $E_0 = 739$ MeV, $\theta = 60°$



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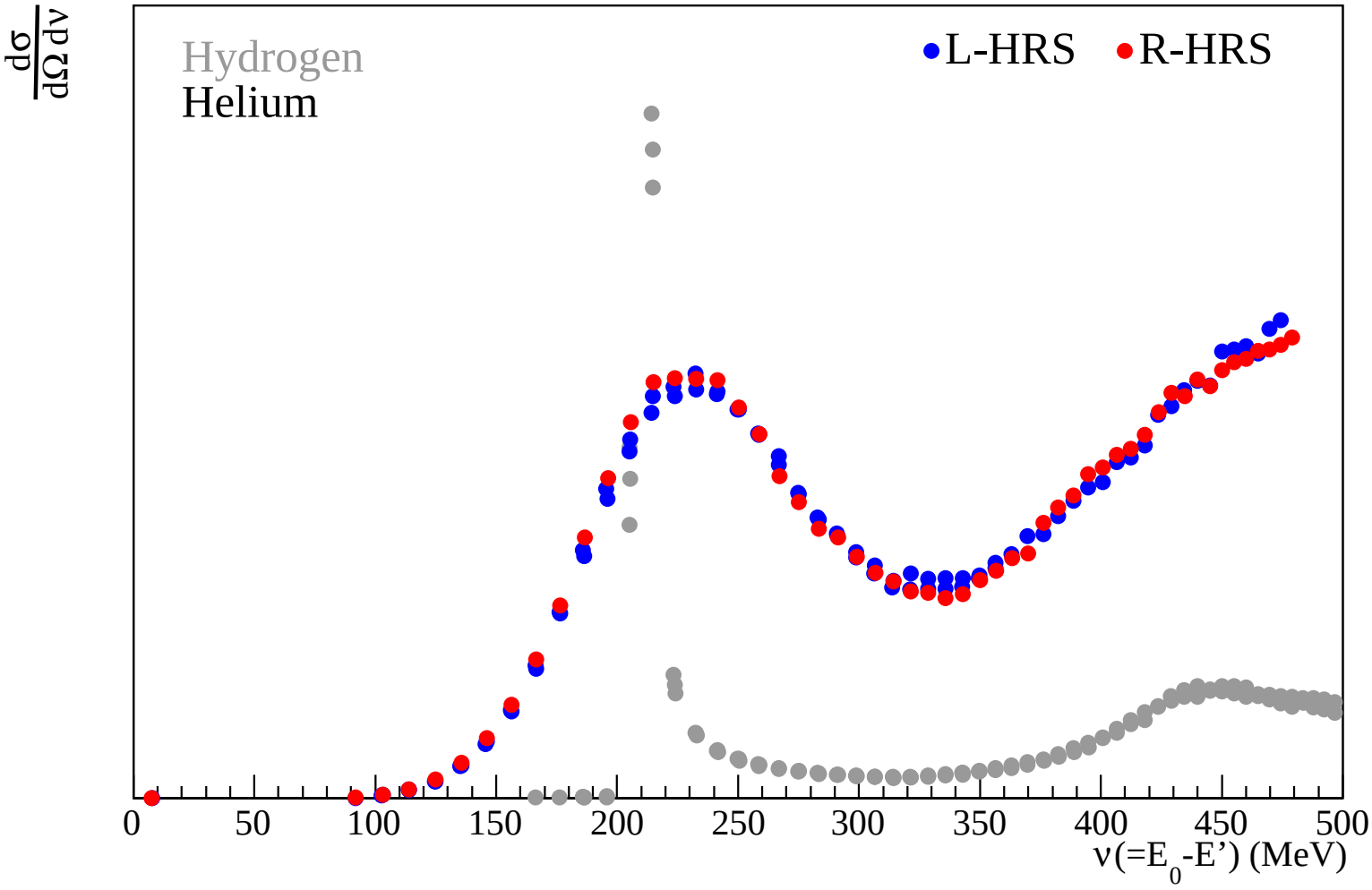

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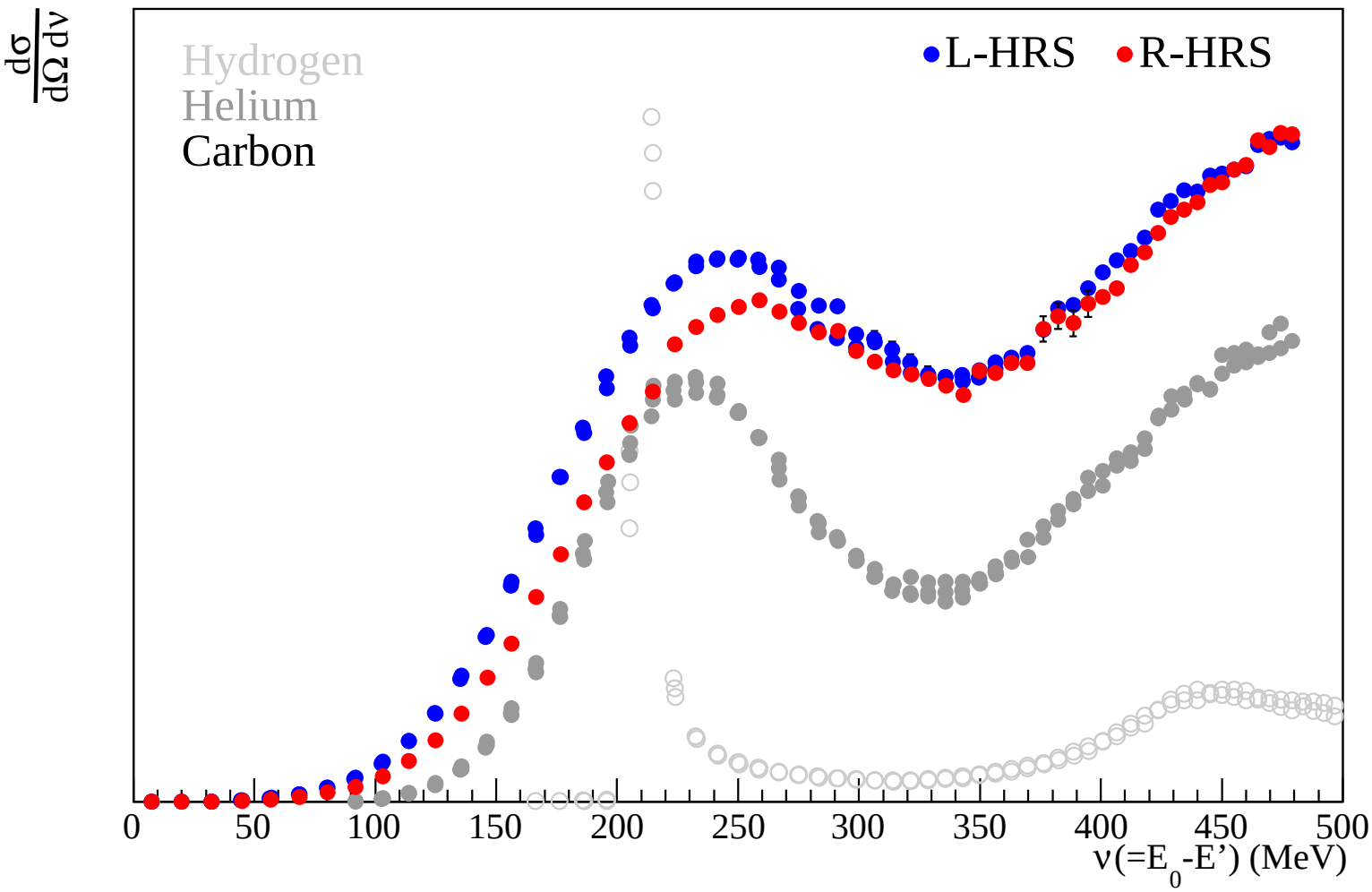

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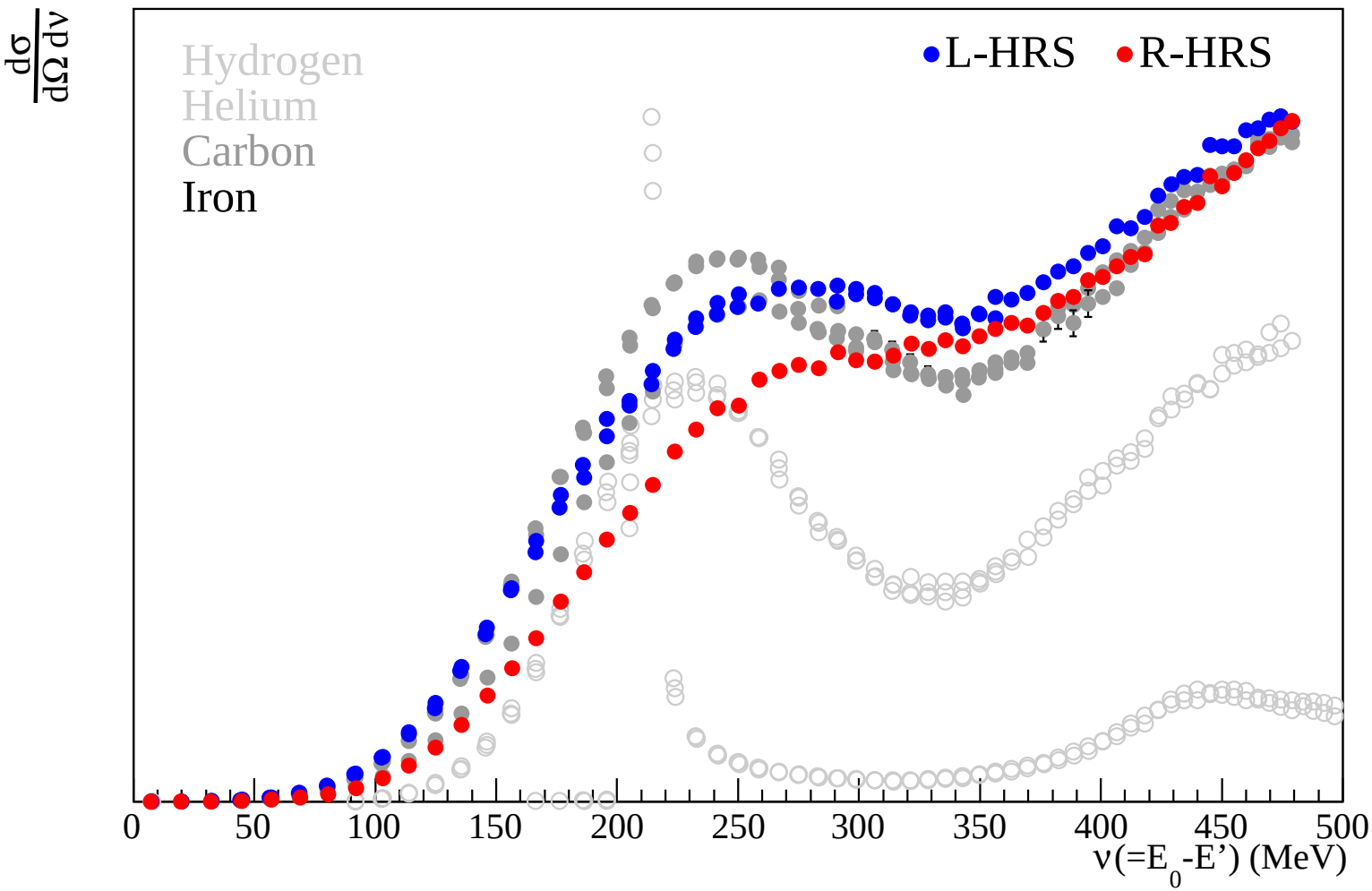

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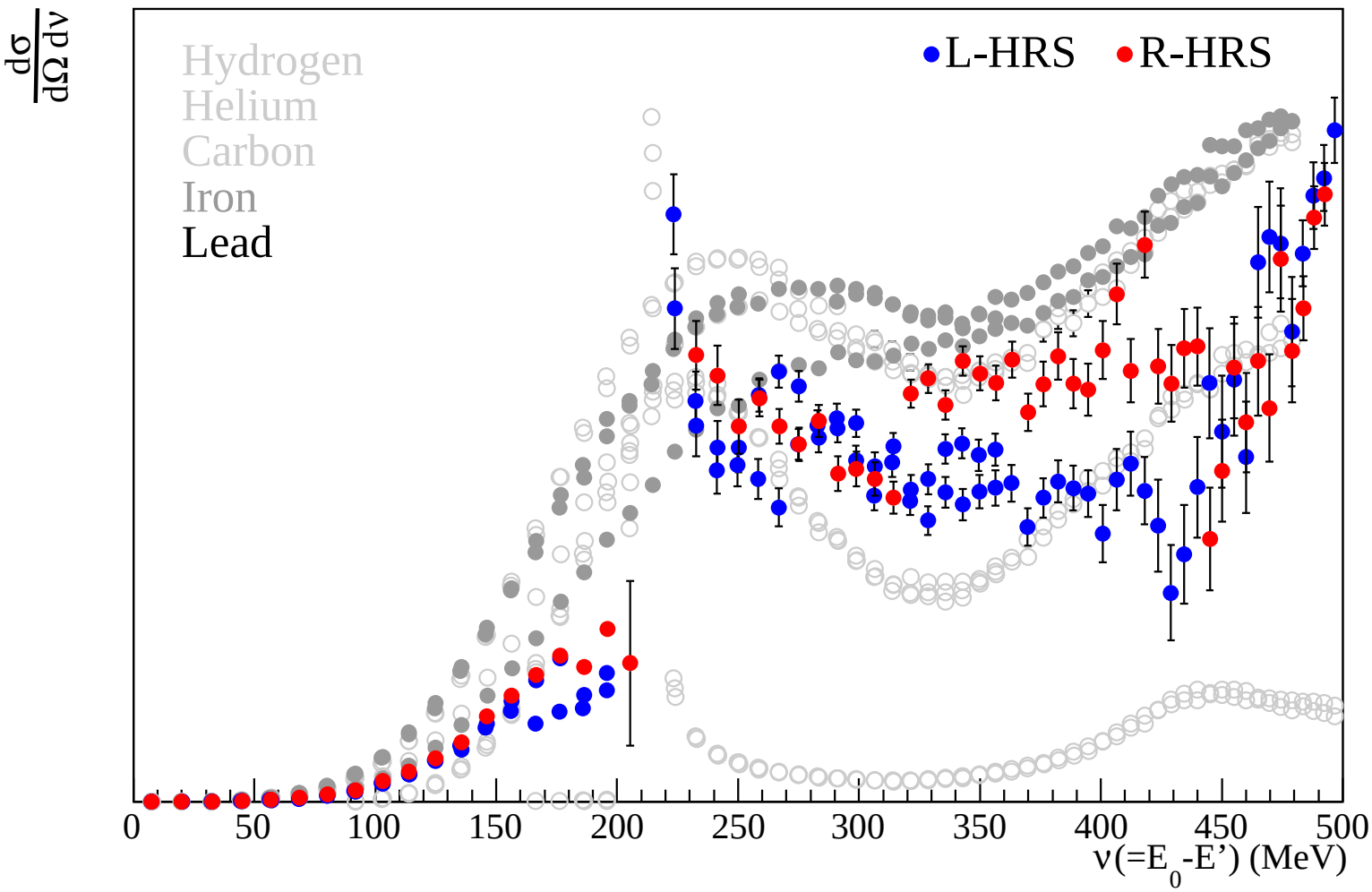
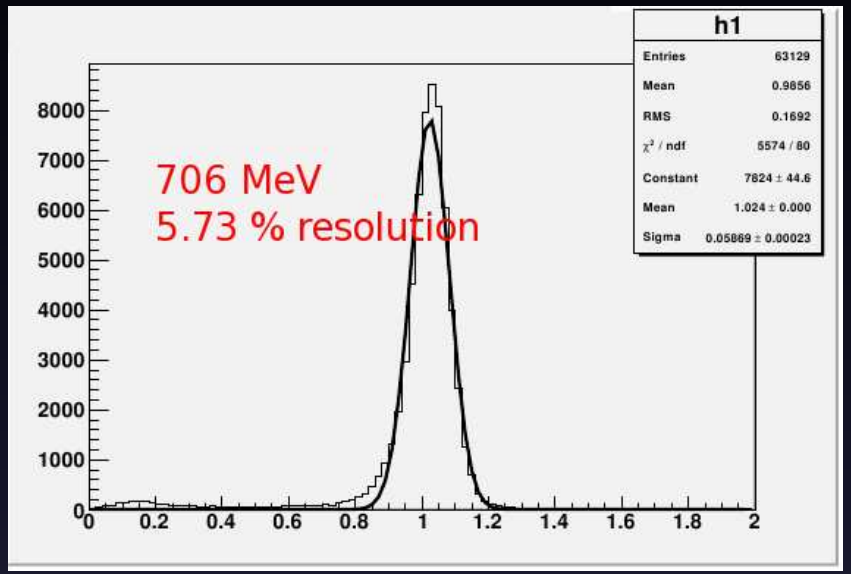


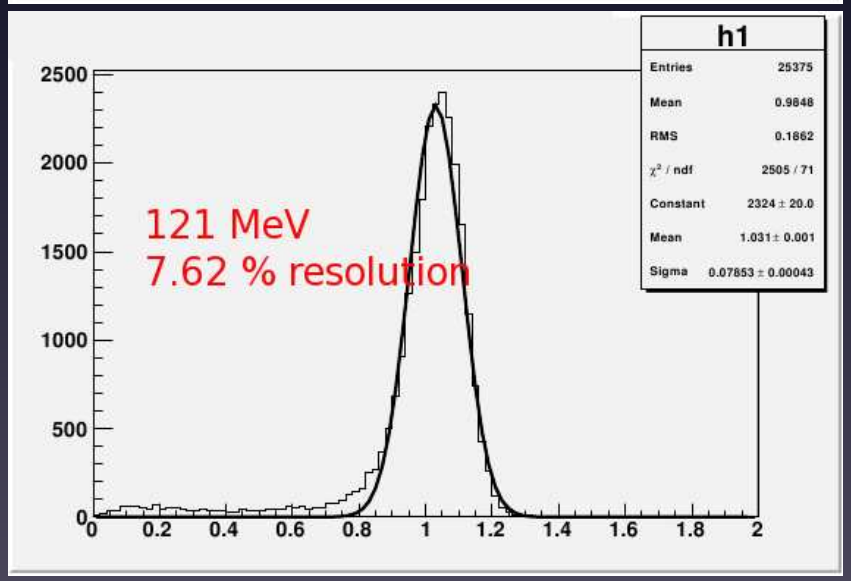
Analysis in Progress

- Detector calibration, efficiency
  - ✓ Cerenkov, (pre-)shower, etc.
  - ✓ NaI detector
- HRS related
  - ✓ Optimization of optics element
  - ✓ Acceptance study
  - ✓ Momentum calibration
- Target related
  - ✓ Gas/liquid target–beam current(boiling effect)
  - ✓ Pb target thickness
- Beamline
  - ✓ BCM calibration ✓ BPM correction

NaI Detector – Installation/Performance

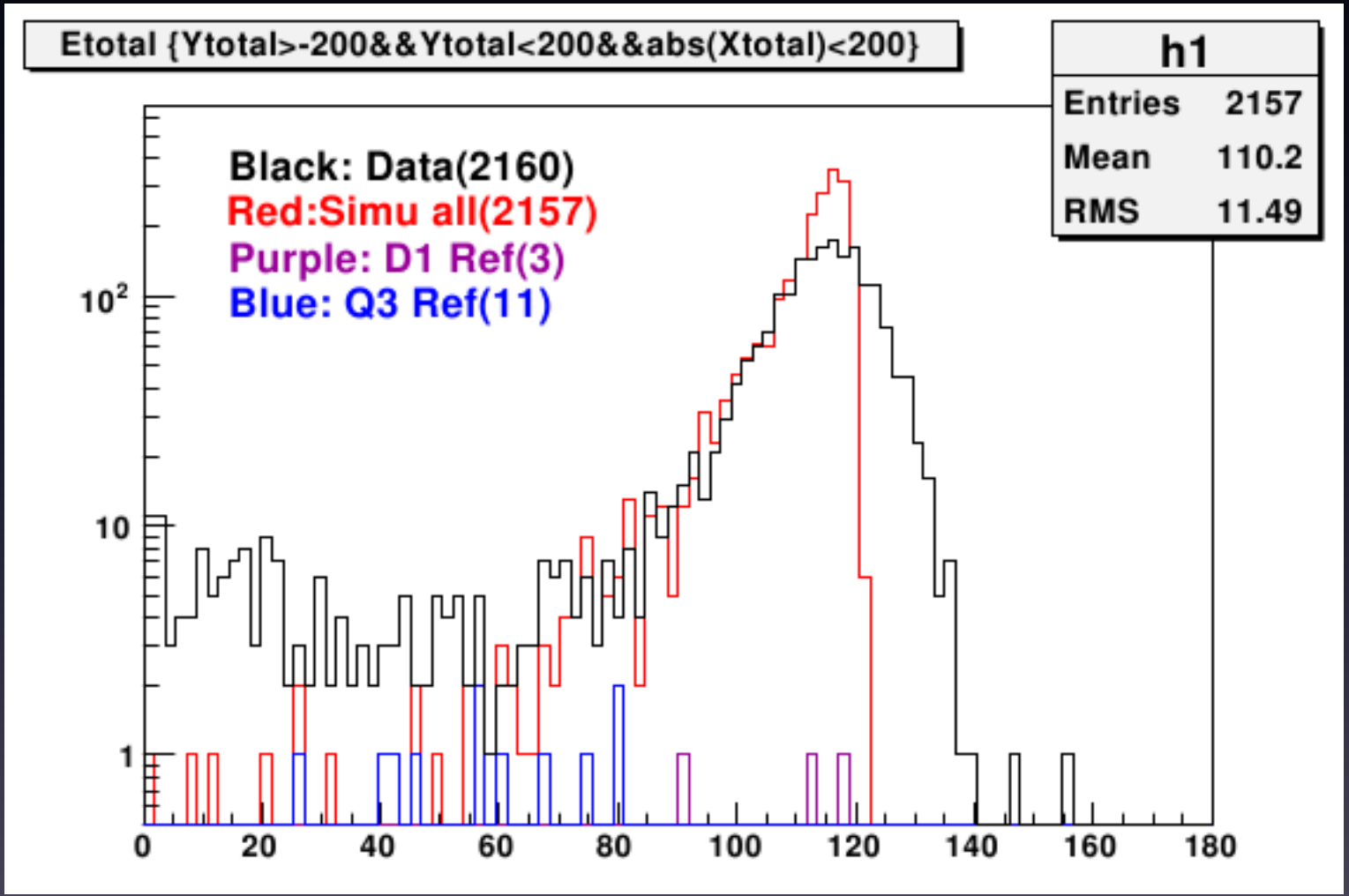
3 boxes x (9x10) pieces of (2.5”x2.5”x12”) crystals



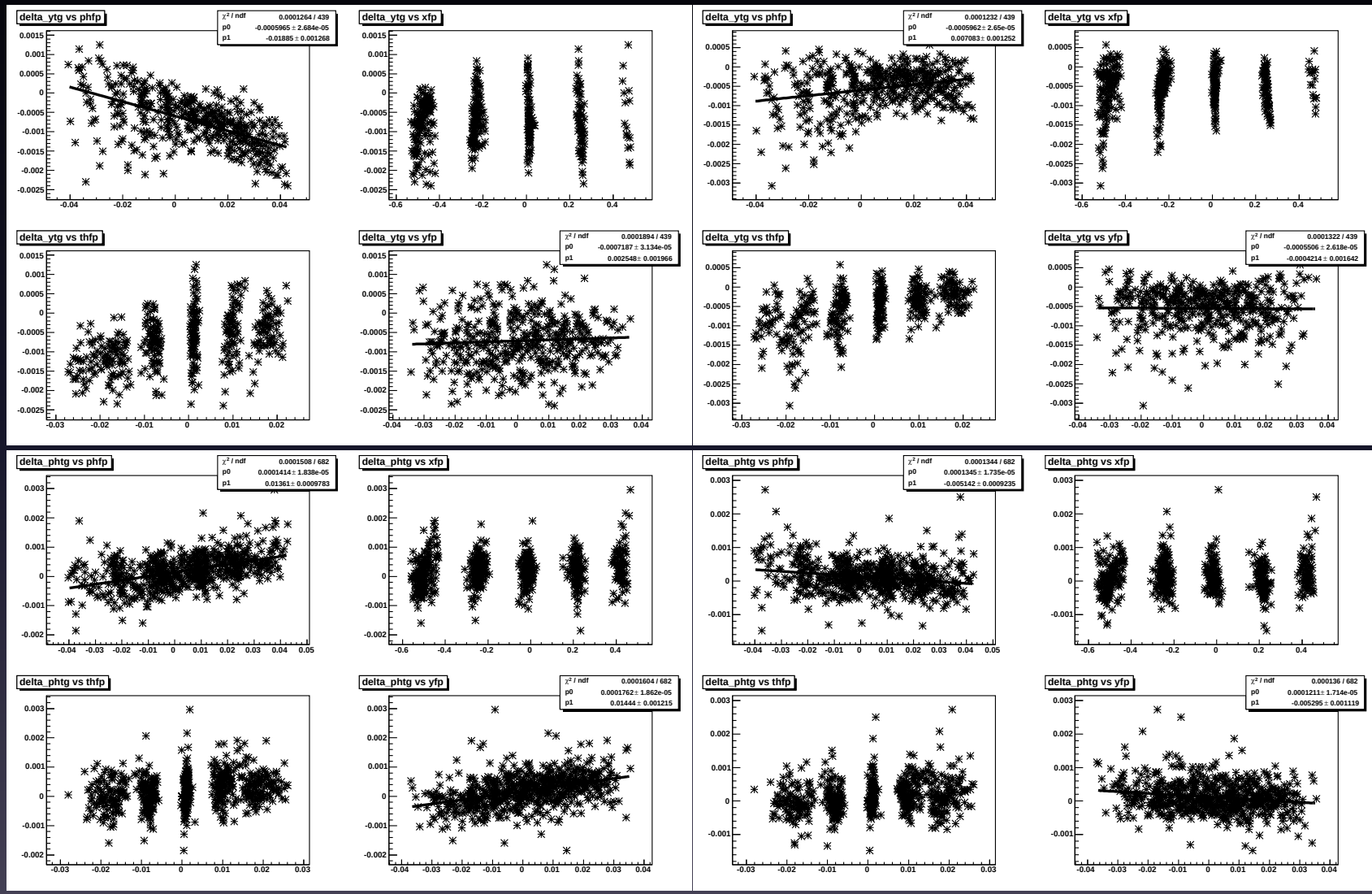


NaI Detector – Electron Reflected from D/Q

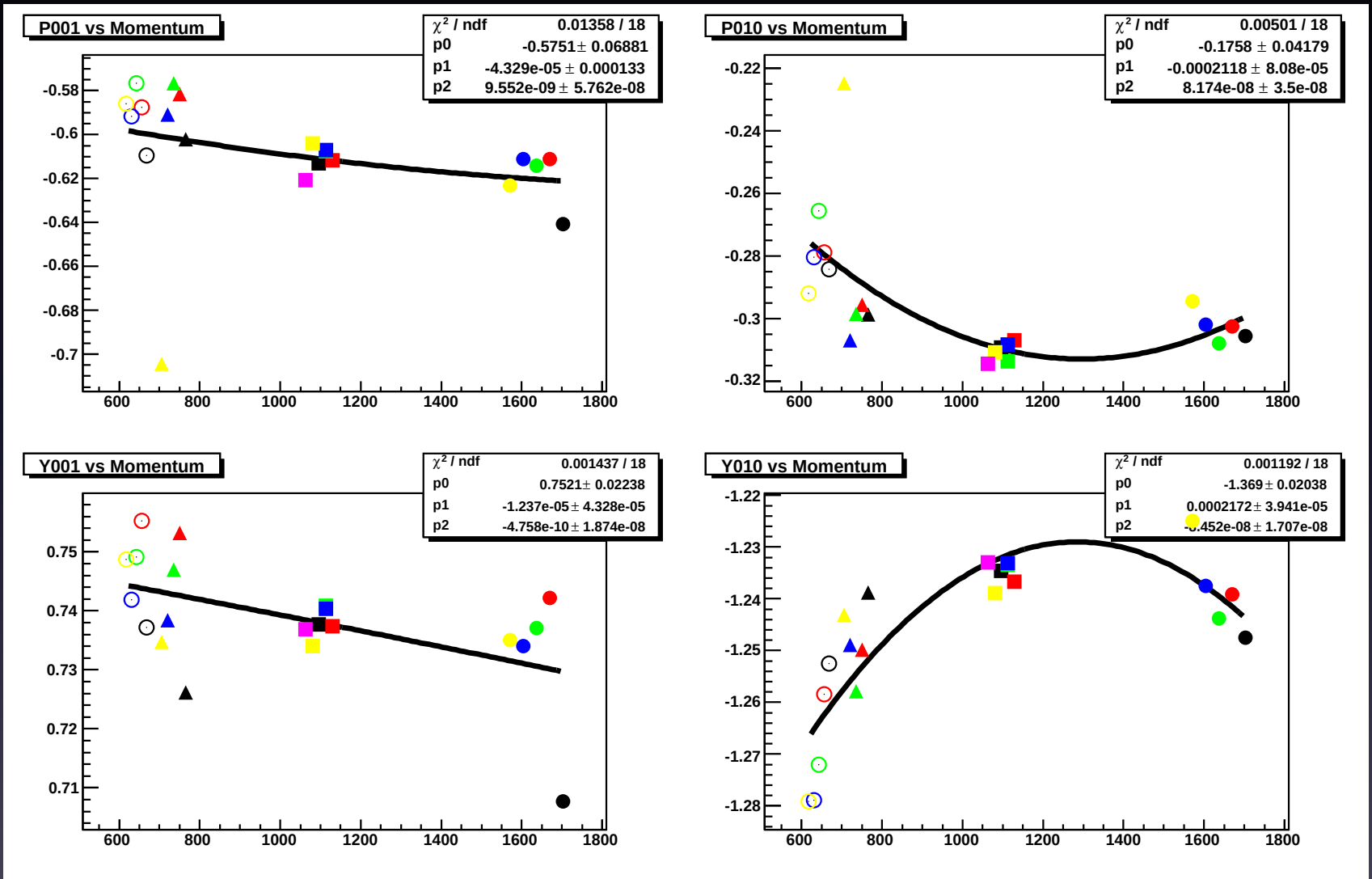
Data and Simulation by Snake/Geant3 and Geant4



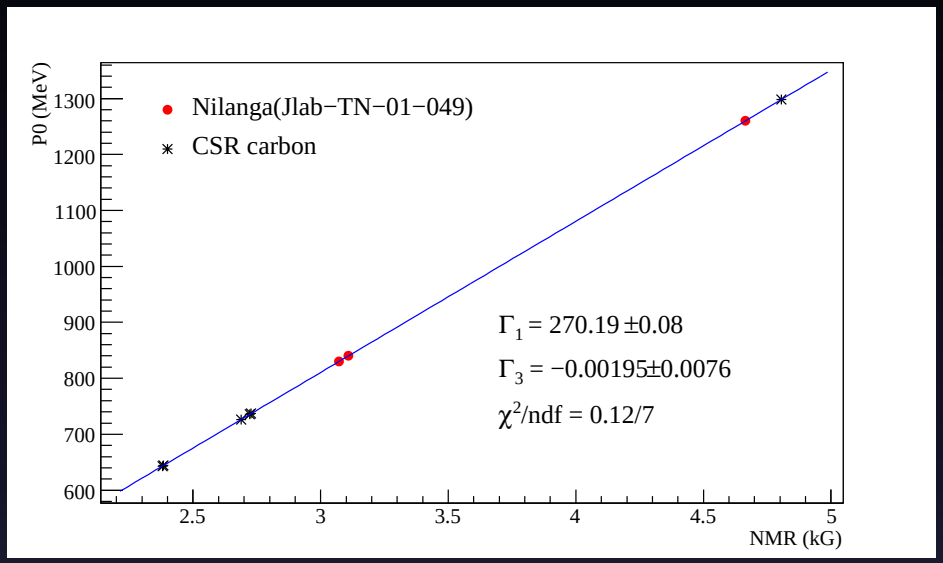
HRS Optics Optimization

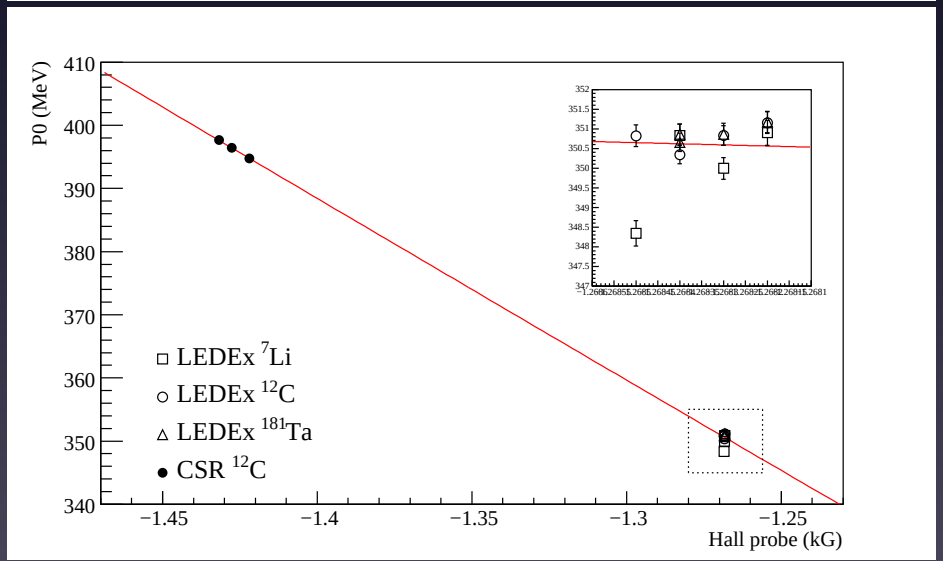


Optics Matrix Elements vs Momentum



HRS Momentum Calibration





Using N(e,e')N$^{(*)}$,

✓ $P0 > 450$ MeV

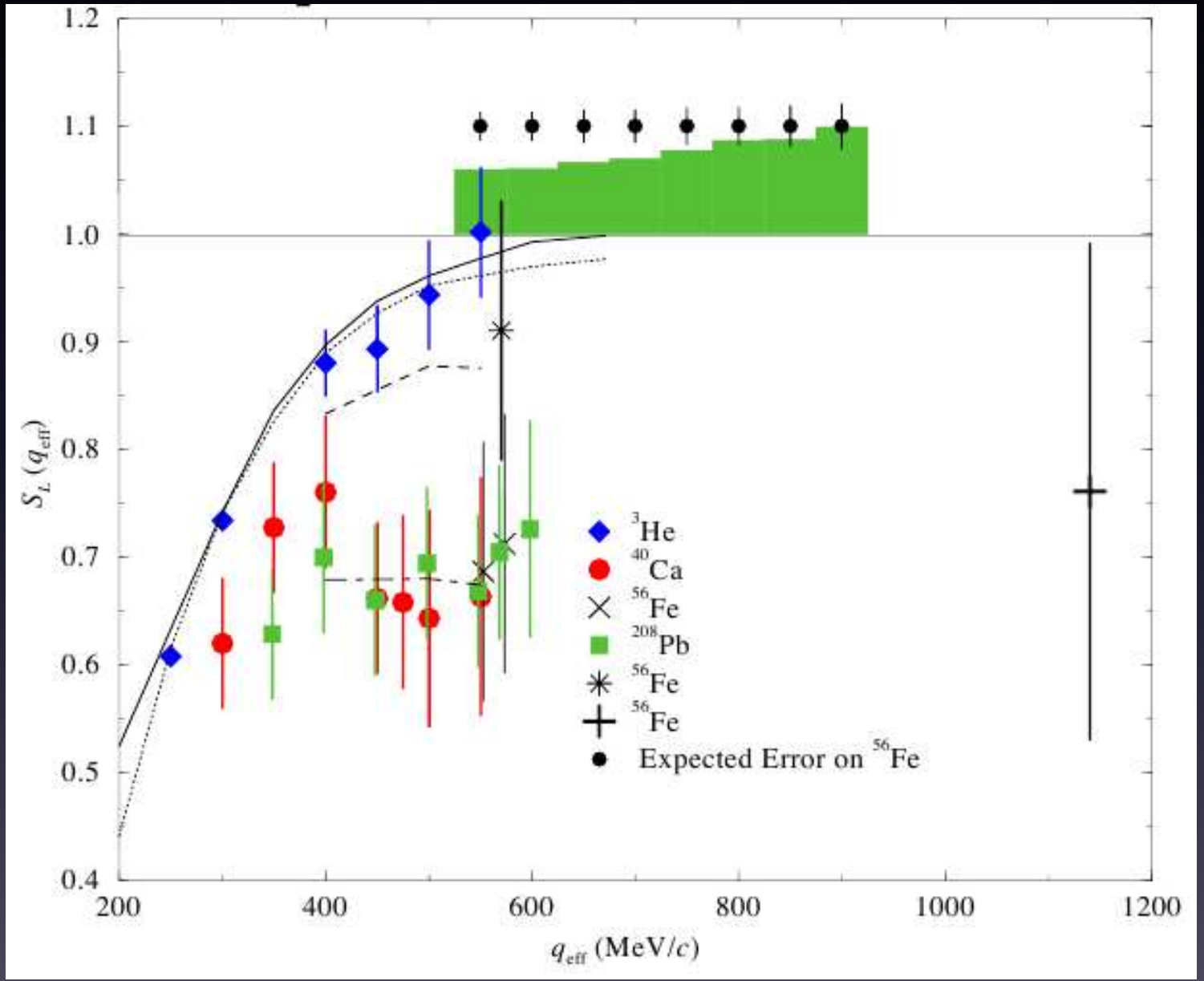
$B_{NMR} \longrightarrow P0$

✓ $P0 < 450$ MeV

$B_{Hall} \longrightarrow P0$

Optics not optimized,
Beam energy correct?

Expected Errors



Summary

- E05-110 CSR investigates the property of the nucleons inside nuclei
- Experiment completed in Jan 2008, analysis in progress
- Key features
  - High enough momentum transfer, previously unexplored
  - Comprehensive single experiment
  - Better background control
- Hope to answer the question on CSR in 1-2 years

Thank you!