



and  
the



# 3<sup>rd</sup> Workshop on Quantitative Challenges in EMC & SRC Research

March 22 - 26, 2021

(Or Hen, for the organizers)

<https://mit.zoom.us/j/93249487395>

<https://indico.jlab.org/event/428/>

# (APS) Meeting Code of Conduct

- All participants will conduct themselves in a professional manner that is welcoming to all participants and free from any form of discrimination, harassment, or retaliation. Participants will treat each other with respect and consideration to create a collegial, inclusive, and professional environment at the meeting. Creating a supportive environment to enable scientific discourse is the responsibility of all participants.
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# 3<sup>rd</sup> Workshop on Quantitative Challenges in EMC & SRC Research

## Organizing Committee:



Zhoudunming Tu



Dien Nguyen



Reynier Cruz Torres



Holly Szumila-  
Vance



Alexander Jentsch



Ronen Weiss



Diego Lonardonì



Jennifer Rittenhouse  
West



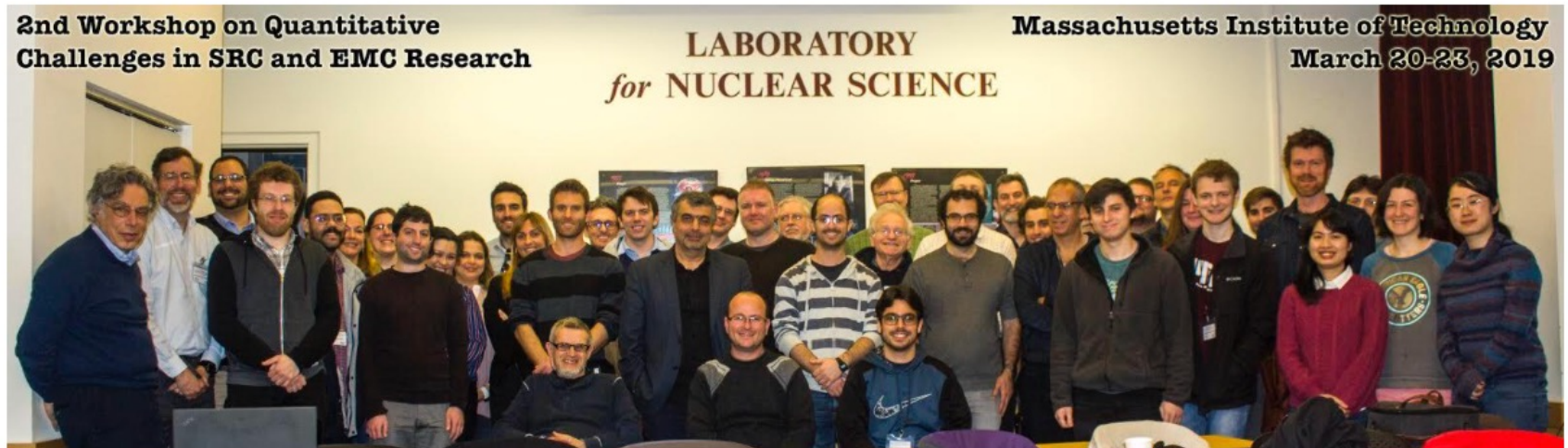
Florian Hauenstein



Julian Kahlbow

## 2019: 2nd Workshop on Quantitative Challenges in SRC and EMC Research

(~60 participants)



## 2016: Quantitative challenges in EMC and SRC Research and Data-Mining

(~40 participants)





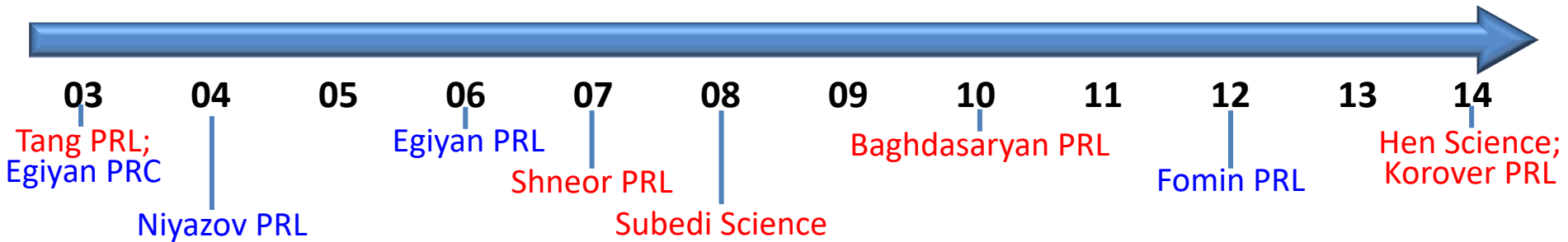
# Previous Meeting Intro Talk:

## Meeting Goal(s)

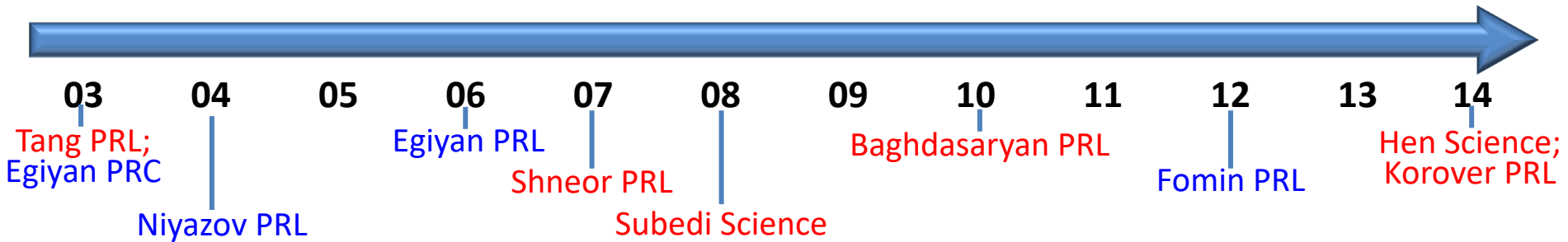
**Understand what SRC data can say about:**

- **NN interaction**
  - **Nuclear wave-function**
  - **Bound nucleon modification**
- 
- Overview recent progress in experiment & theory
  - Emphasis on cross-section models and quantitative analysis of experimental data

# Early Data (21<sup>st</sup> century)



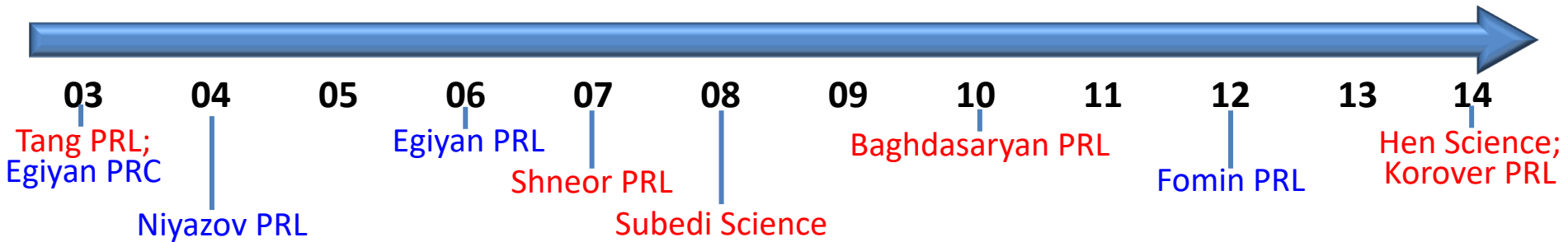
# Early Data (21<sup>st</sup> century)



10 papers in 12 years 😬

\*On average, we have ~one review paper for every ~two experimental papers 😬 😬

# Early Data (21<sup>st</sup> century)



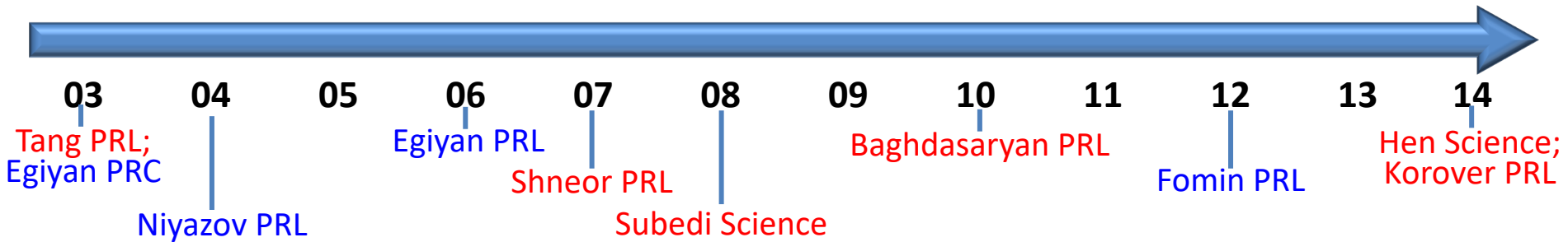
10 papers in 12 years 😊

Very hard start, but...

... they got us going!



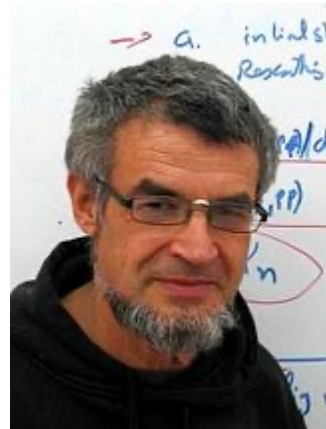
# Early Data (21<sup>st</sup> century)



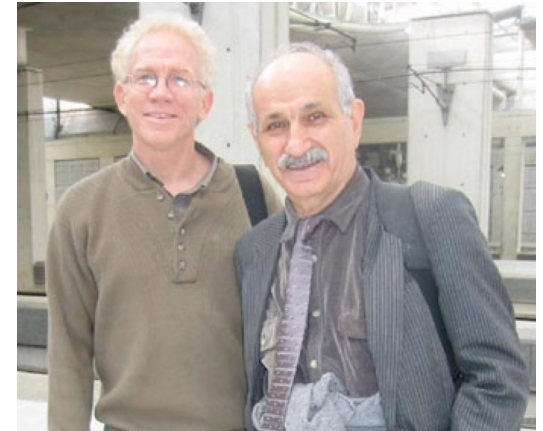
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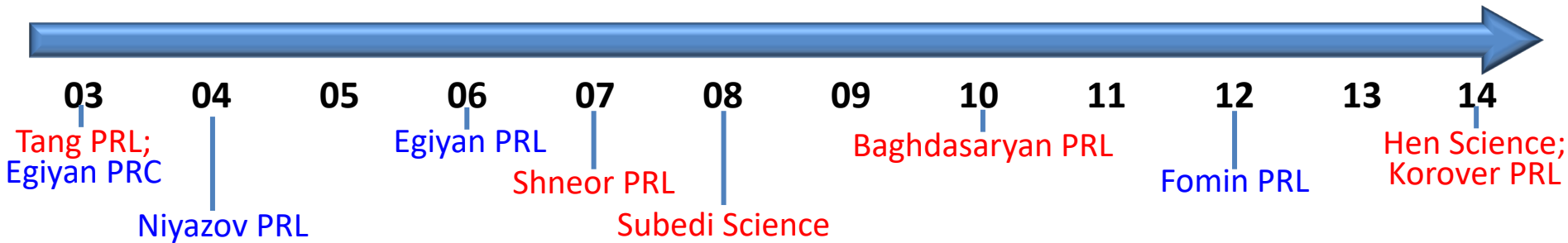
Piassetzky



Day & Egiyan

+ Many others

# Early Data (21<sup>st</sup> century)

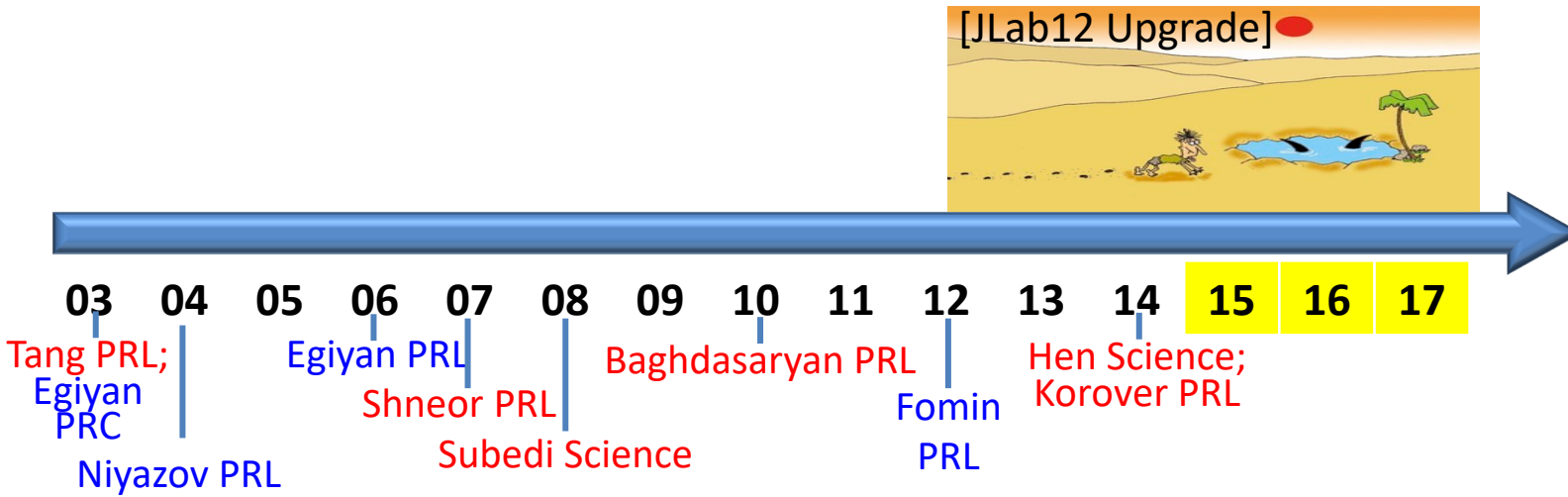


## Two main conclusions:

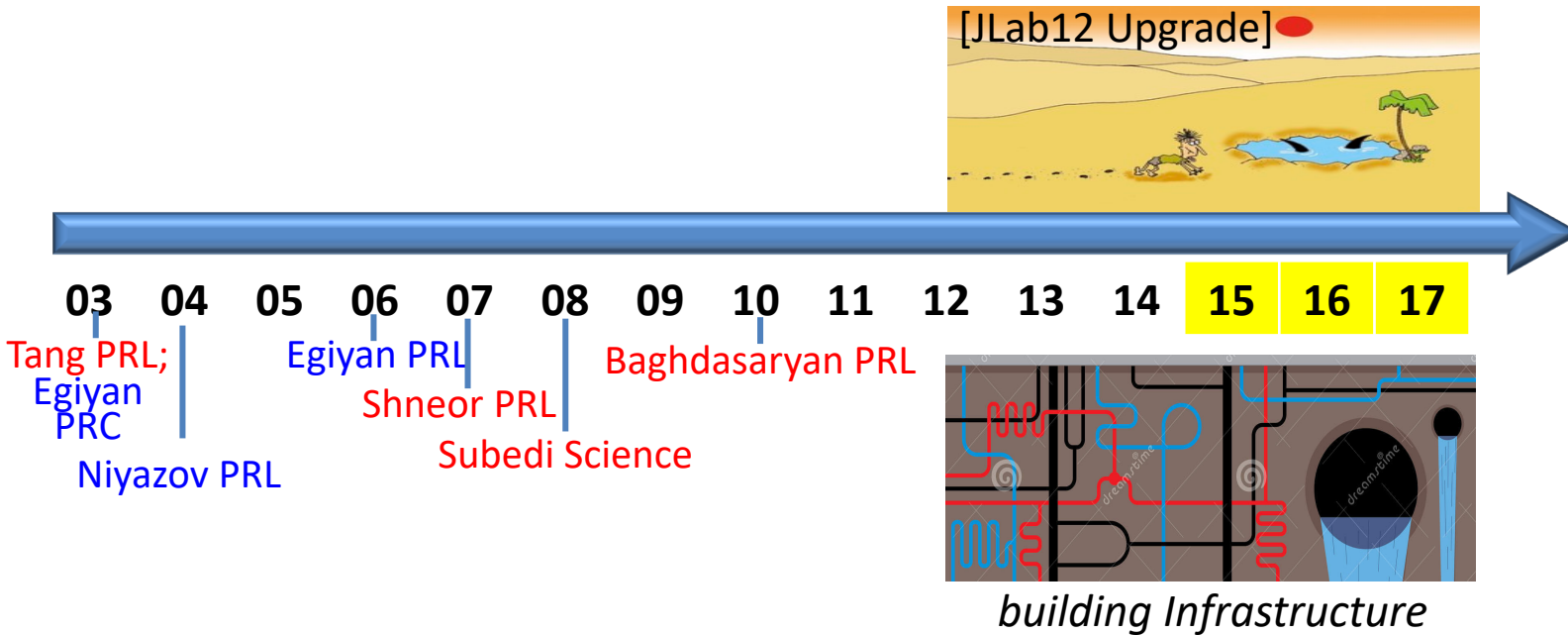
- **Exclusive measurements:** SRCs are np-pairs [Tensor Interaction]
- **Inclusive measurements:** Deuteron scaling-factors measured

\*On average, we have ~one review paper for every ~two experimental papers 😊 😊

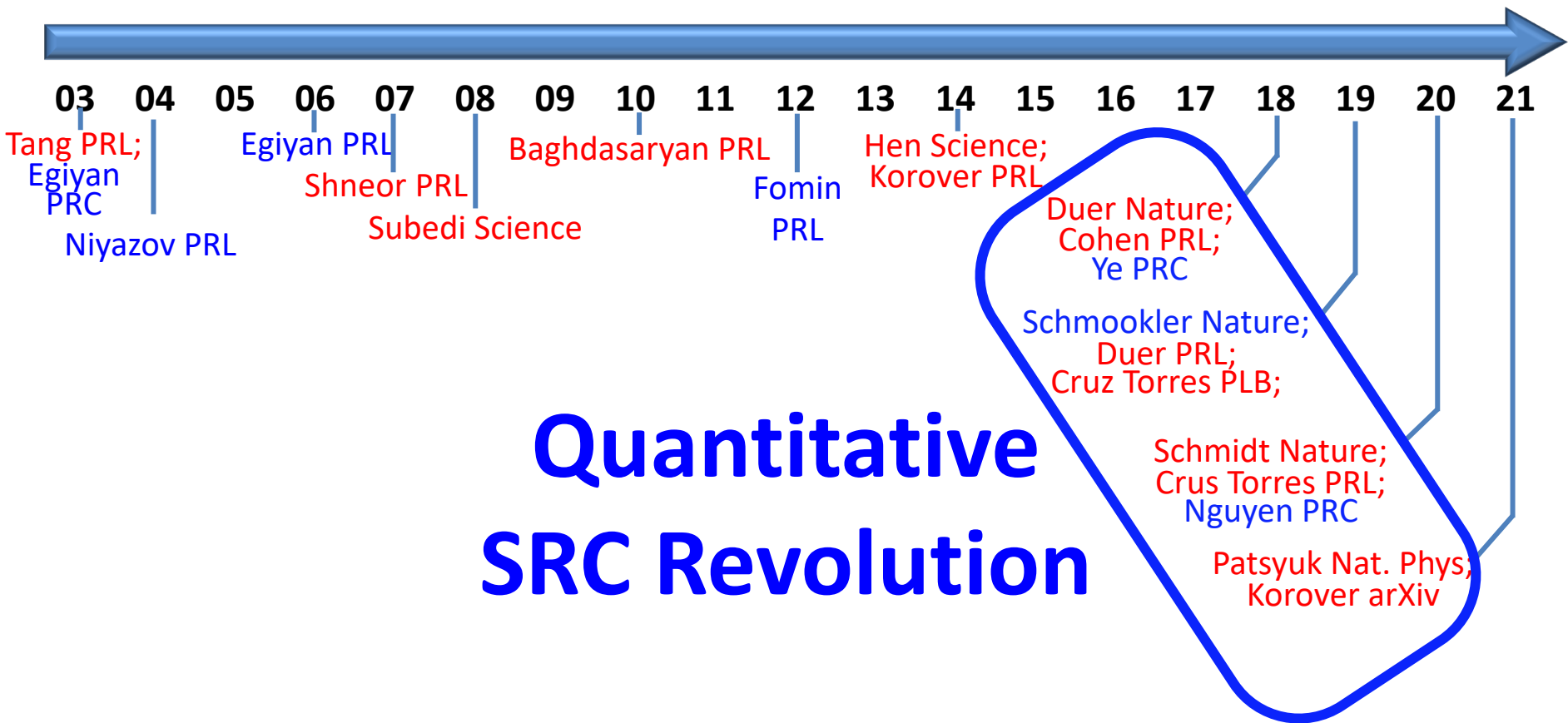
# Early Data (21<sup>st</sup> century)



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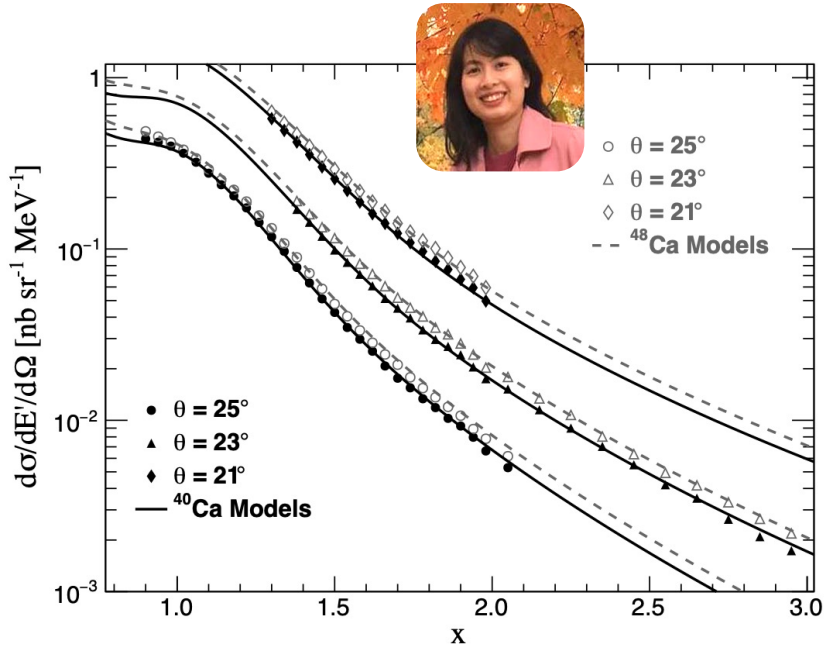
.... Today



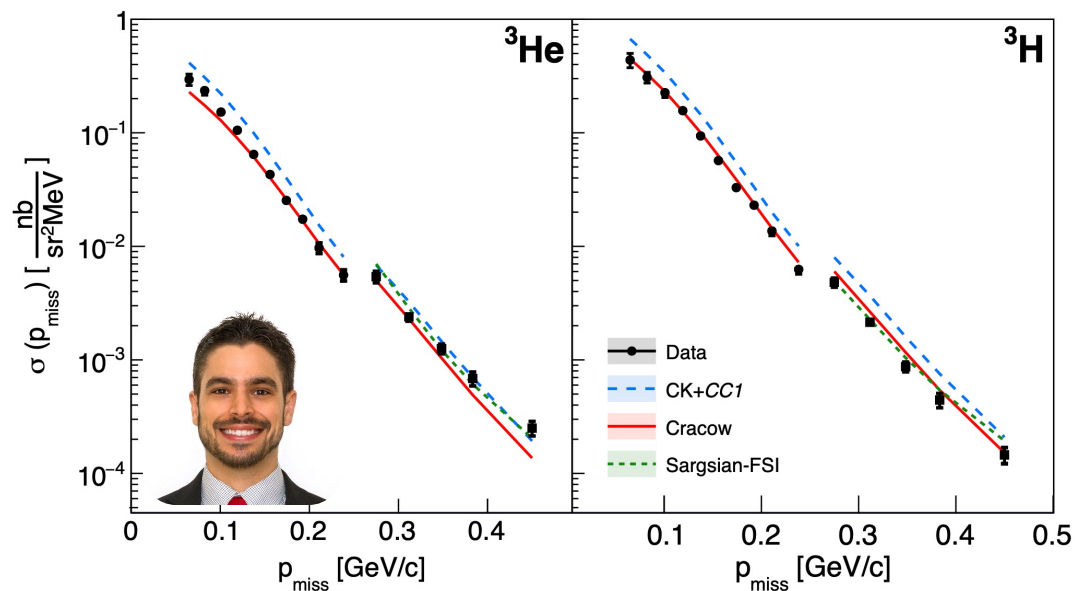
# Previous Meeting Intro Talk:

## New data & Calculations

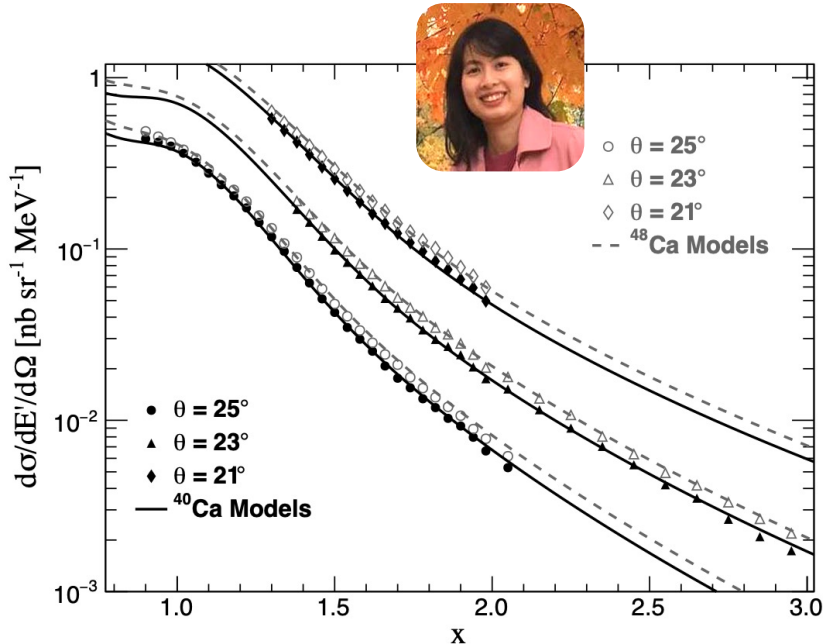
- (e,e'NN): C-Al-Fe-Pb.
- (e,e'N): C-Al-Fe-Pb; C-<sup>4</sup>He-<sup>3</sup>He.
- (e,e'p): <sup>3</sup>H-<sup>3</sup>He.
- (e,e'): <sup>48</sup>Ca-<sup>40</sup>Ca; <sup>3</sup>H-<sup>3</sup>He; (<sup>11</sup>B-<sup>10</sup>B?)
- Ab-initio (e,e') **This has to change** [and is being changed] [cross-sections, Q<sup>2</sup>?]
- More effective (e,e')- $\gamma$  cross-sections
- Many-body ground state calculations



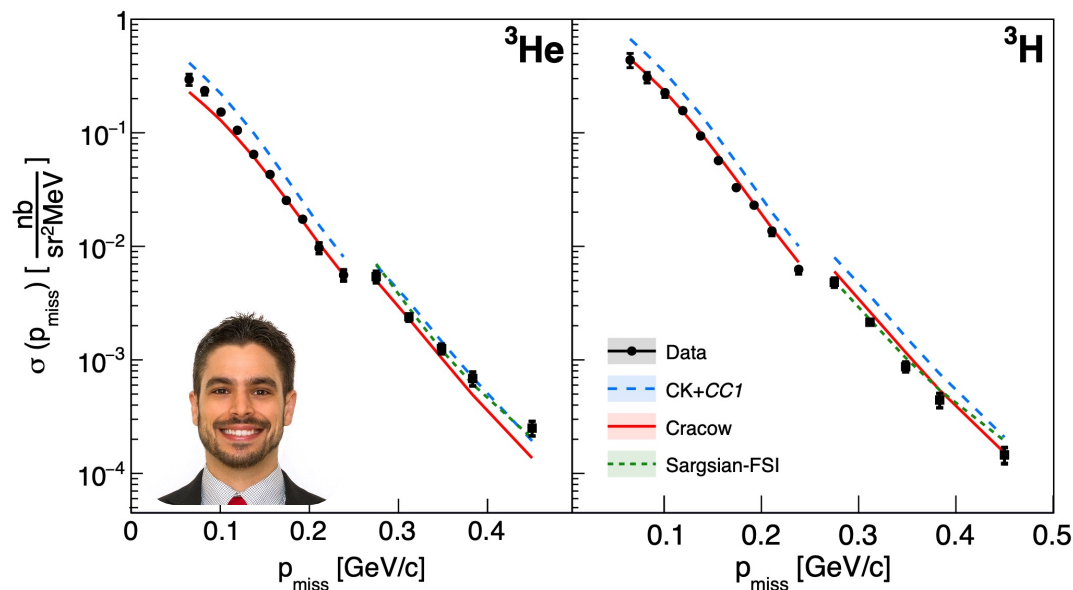
# ABSOLUTE (e,e') & (e,e'p) cross-sections!



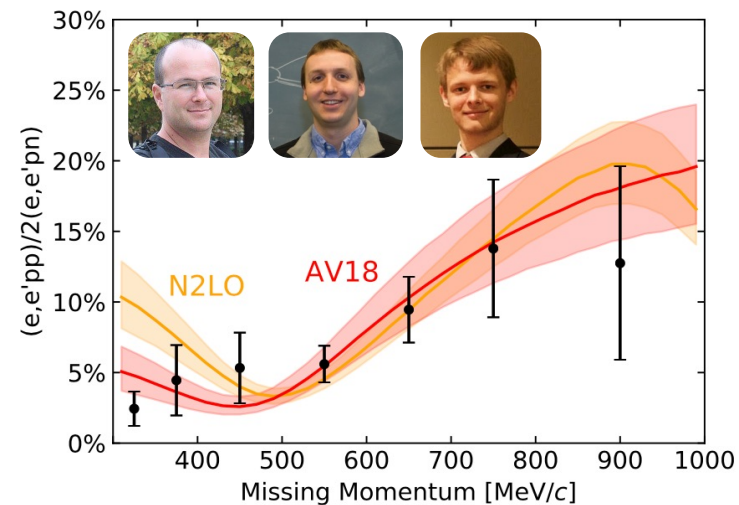
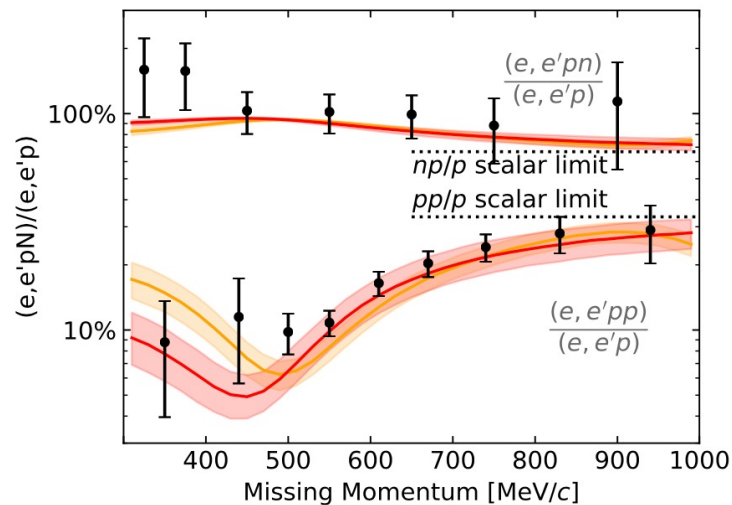




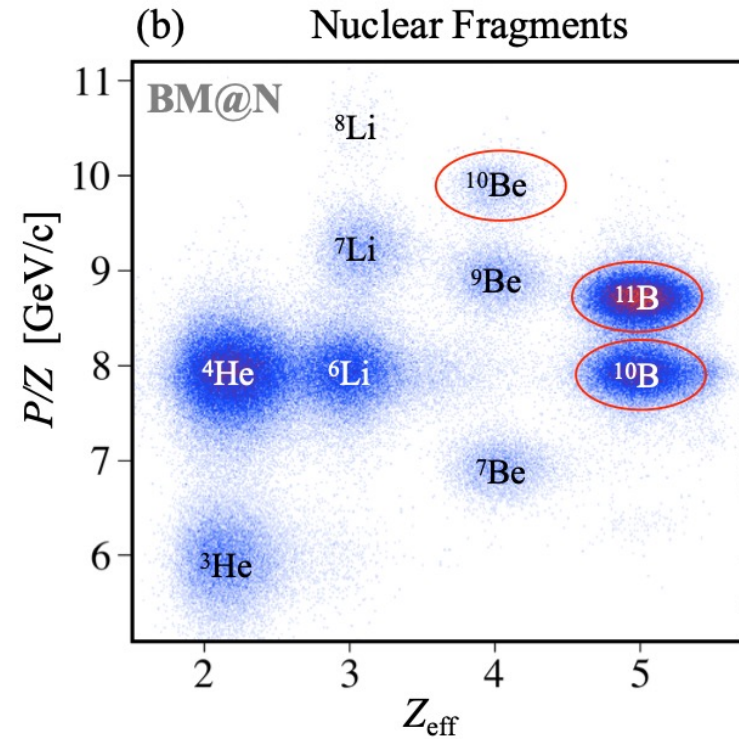
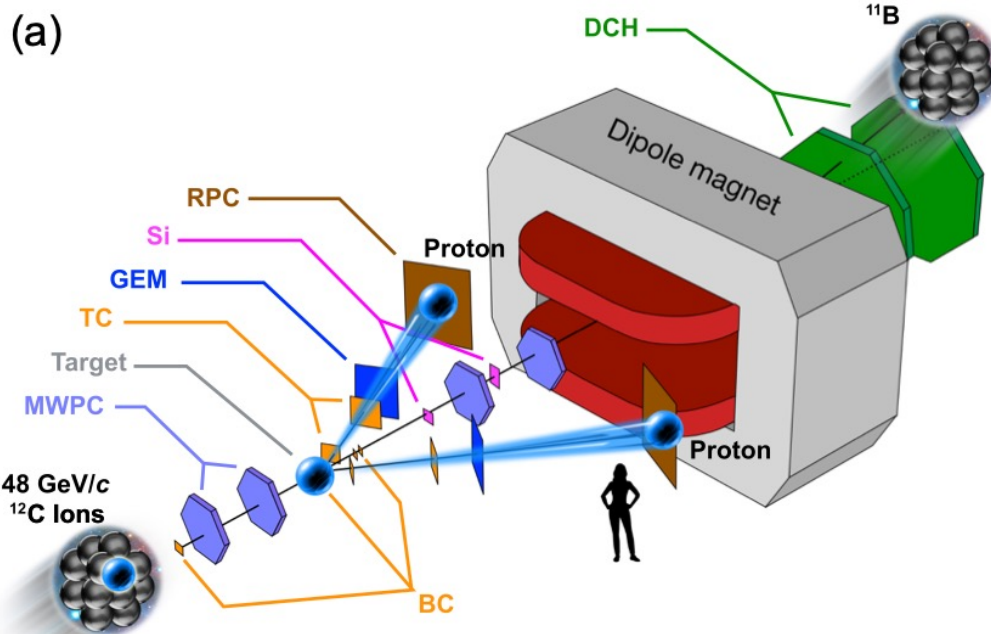
# ABSOLUTE (e,e') & (e,e'p) cross-sections!



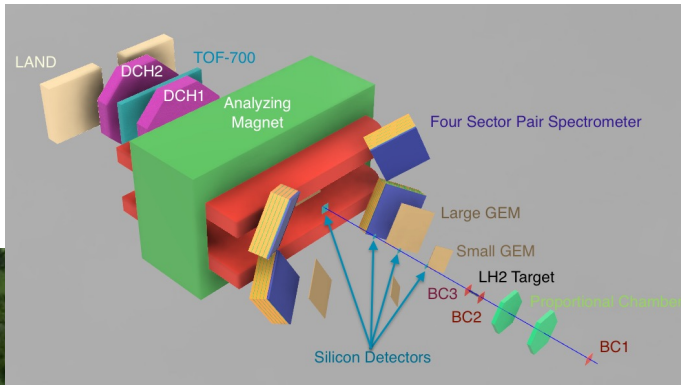
## Detailed (e,e'pN) data



# New Tools...

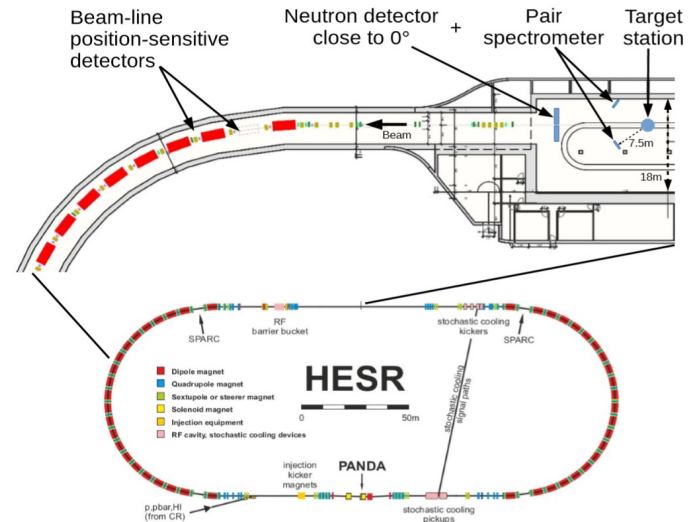
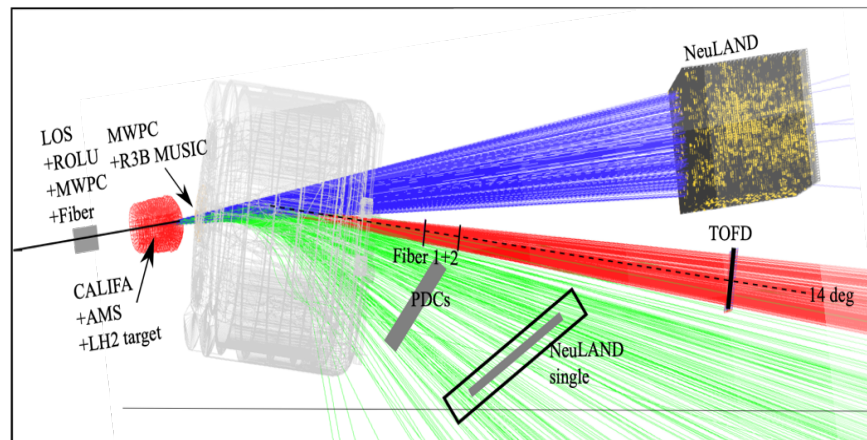
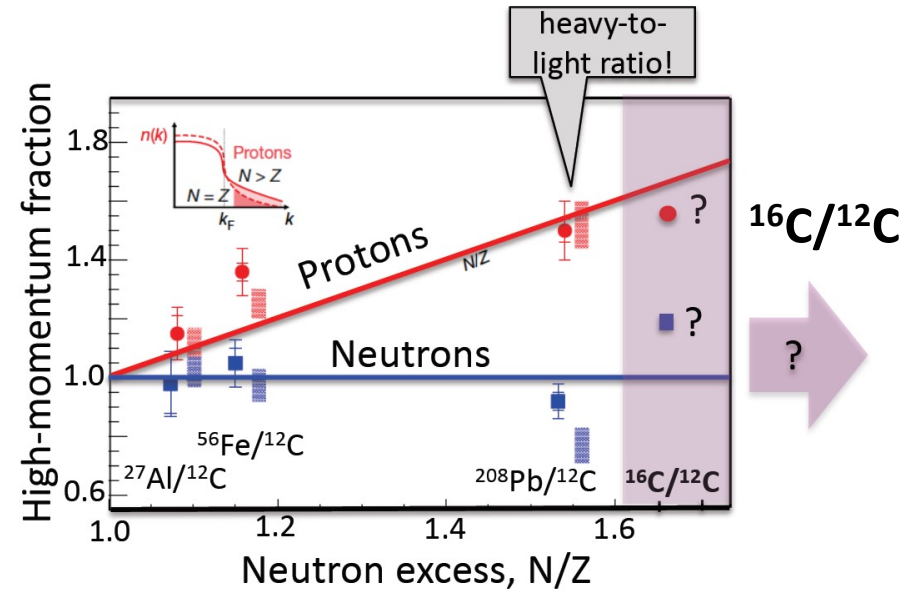
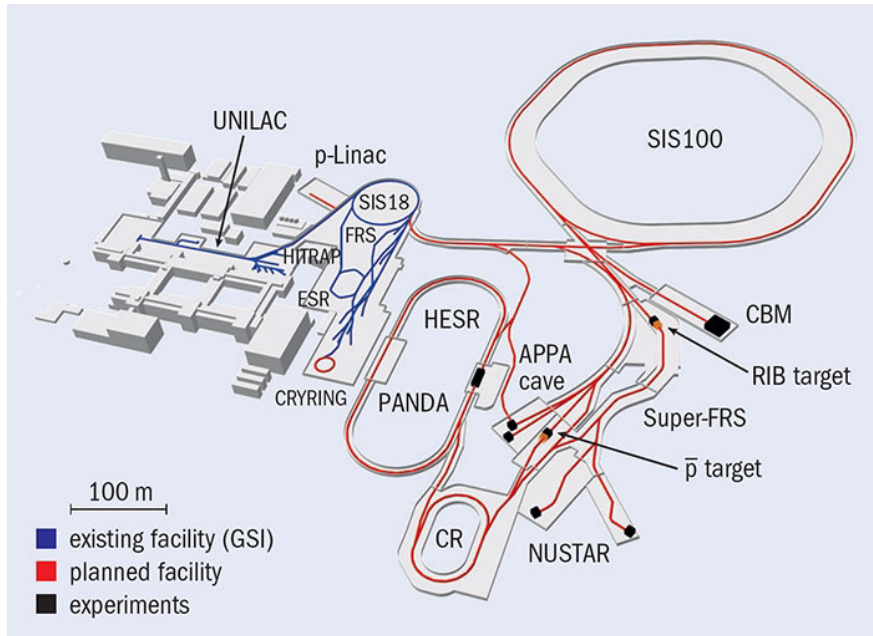


# New Tools...

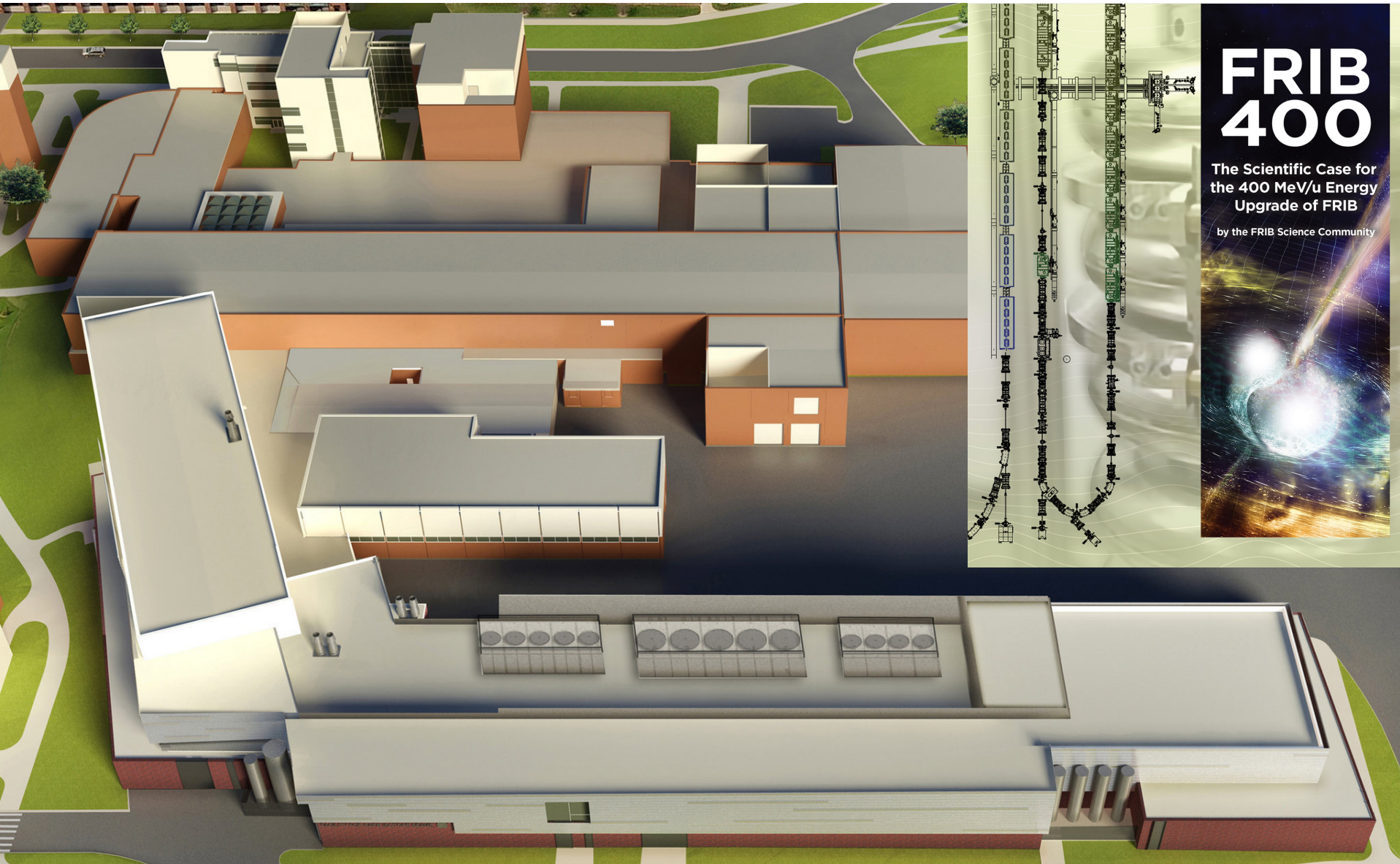




# New Tools...



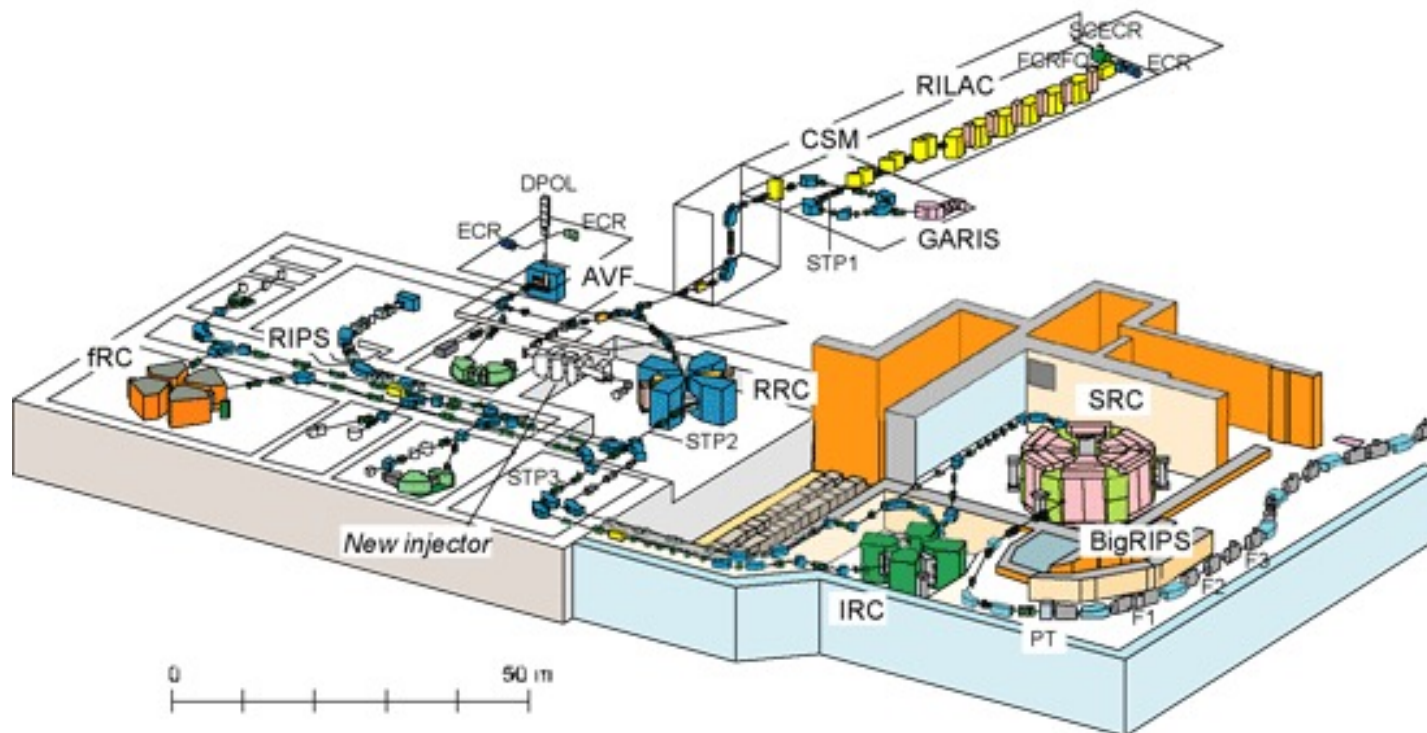
# New Tools...



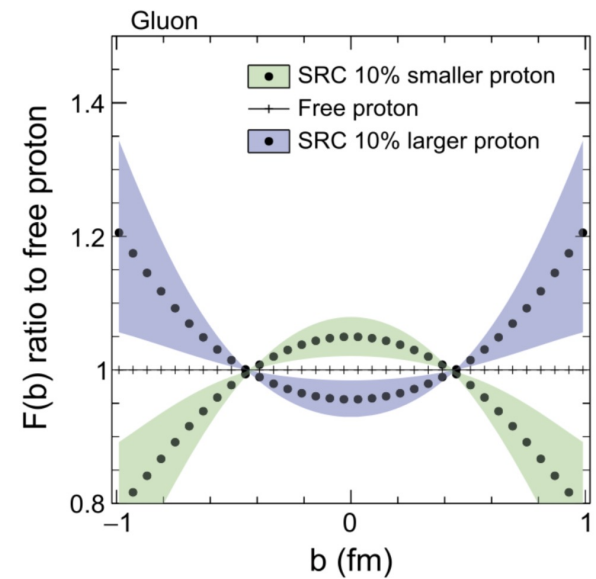
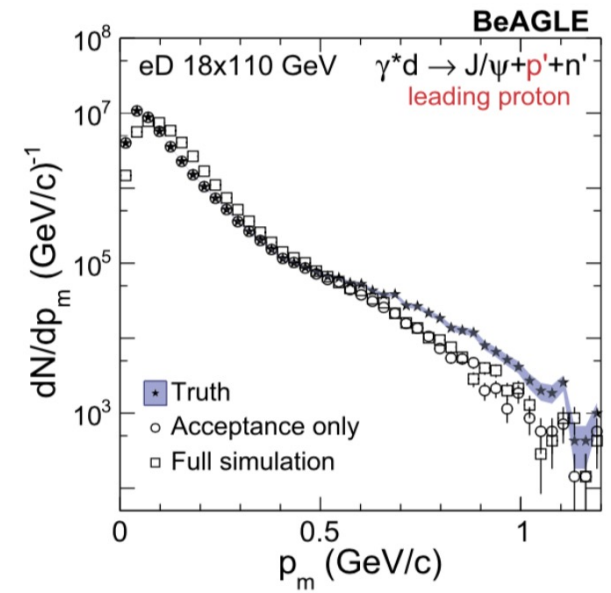
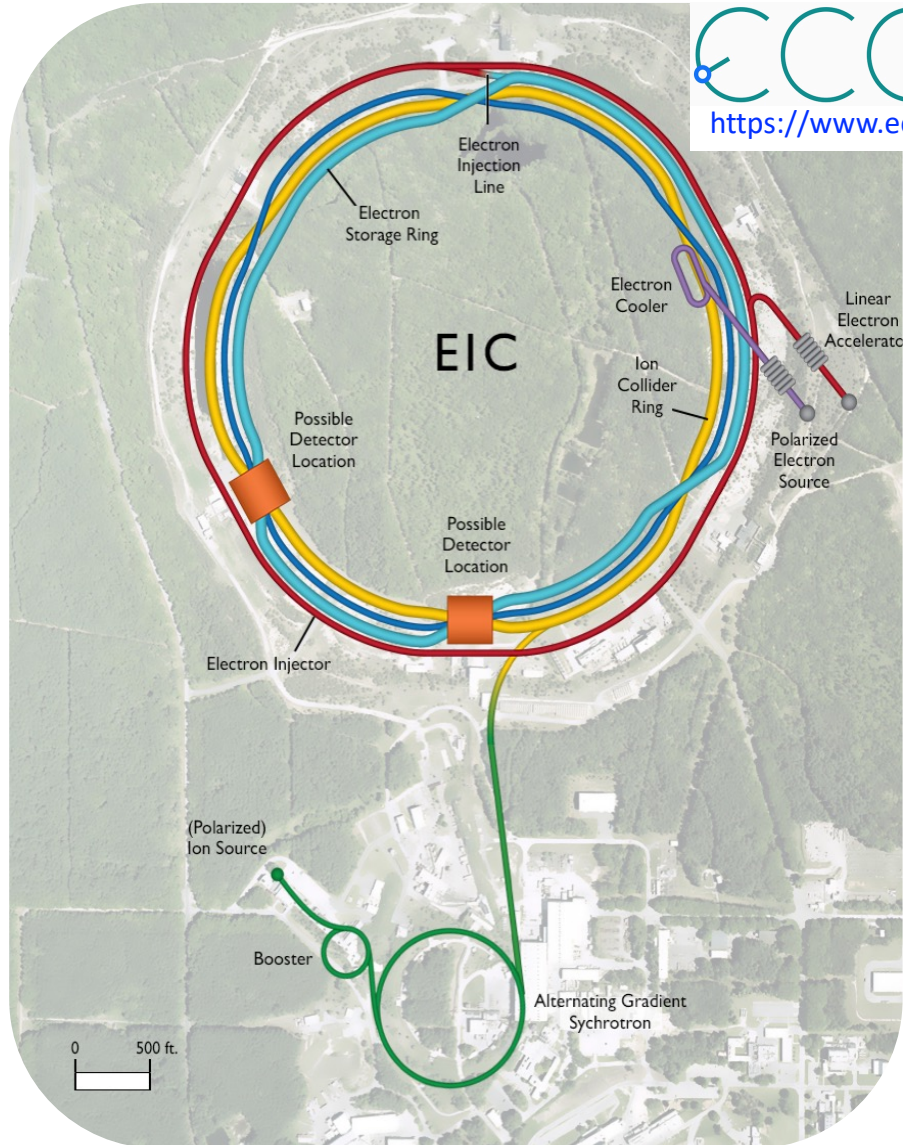


# New Tools...

## RIBF Accelerators



# New Tools...





# New Tools...

Precise Many-  
body Theory

NN  
Interaction

Reaction  
Theory

Effective  
Field Theory

# New Tools...

Precise Many-  
body Theory

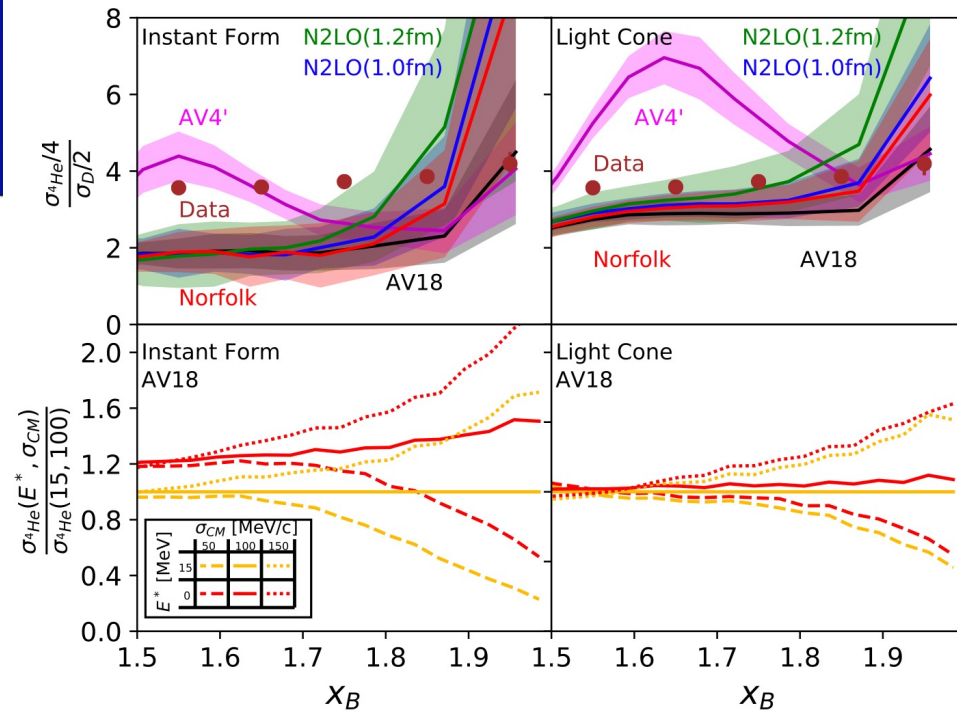
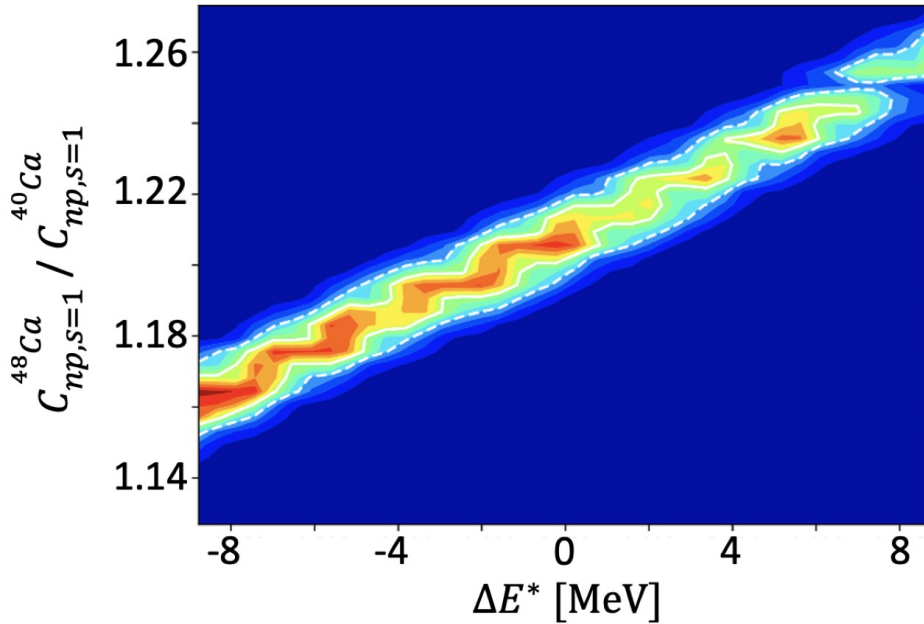
NN  
Interaction

Reaction  
Theory

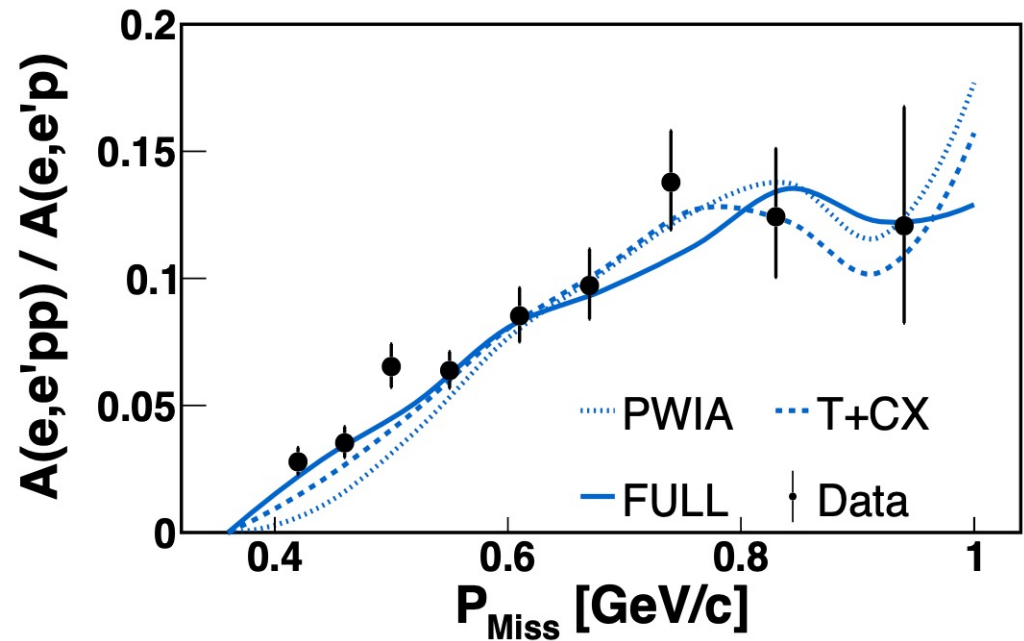
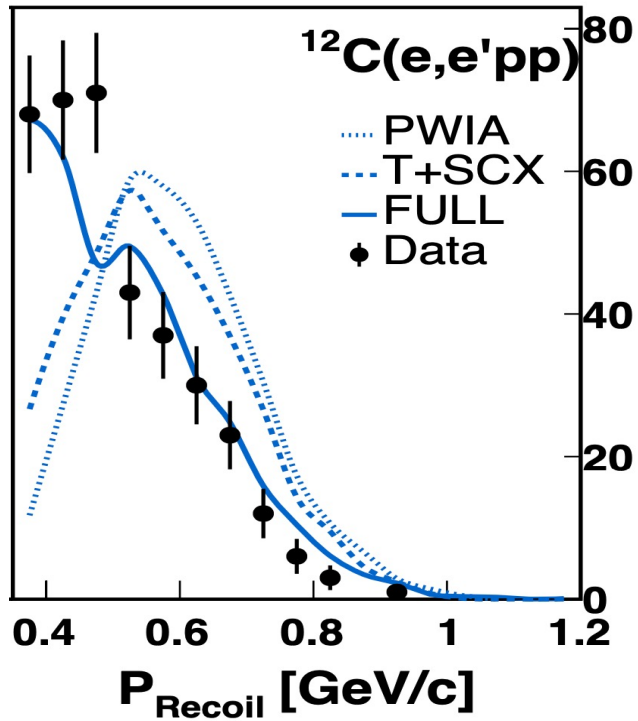
Effective  
Field Theory

**...Lead to new questions!**

# How well do we understand $a_2$ values?



# To what precision are FSI accounted for in exclusive data analysis?



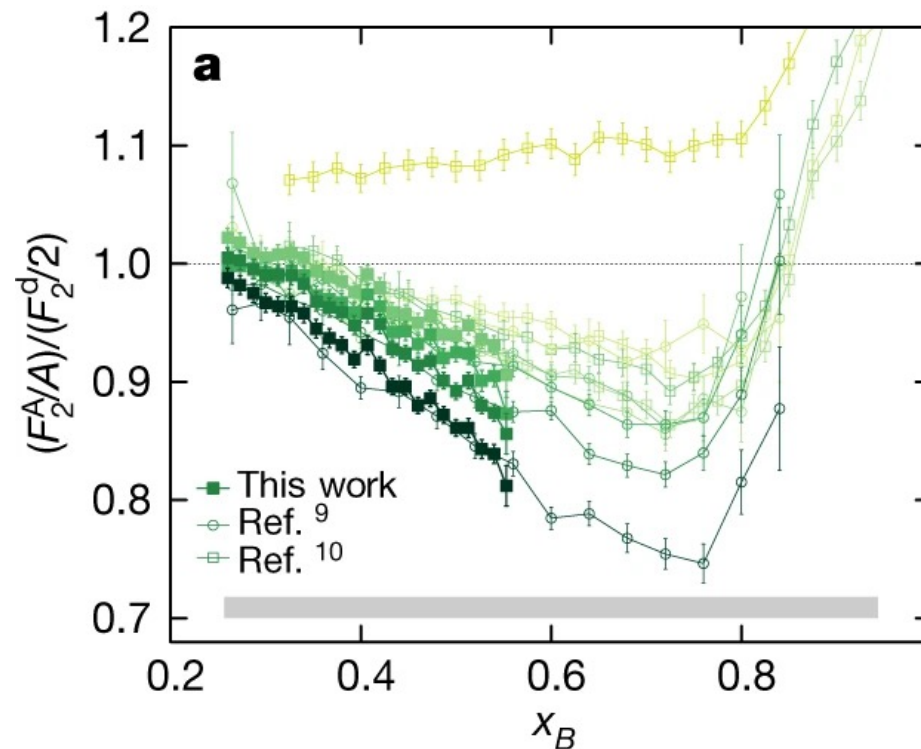
**What can we learn from low-resolution calculations?**

**How to relate SRC data to neutron stars?**

**What observables are most significant moving forward?**

**....**

And.... It's about time we  
fully resolve the EMC Effect!



10:00	<b>Welcome by MIT LNS Director Boleslaw "Bolek" Wyslouch</b> <b>Introduction and Overview</b> <b>Results from RCNP, (p,pd) reactions [20+5] (Isao Tanihata)</b>	10:00 - 10:05 <i>Or Hen</i> 10:05 - 10:25 10:25 - 10:50
11:00	<b>NN Core Studies in A(e,e'NN) 20+5</b> <b>NN Core in d(e,e'p) [20+5]</b> <b>Lattice QCD for Bound Hadrons (20+5)</b>	<i>Axel Schmidt</i> 10:50 - 11:15 <i>Werner Boeglin</i> 11:15 - 11:40 <i>Phiala Shanahan</i> 11:40 - 12:05
12:00	<b>Discussion</b> <b>Lunch Break</b>	12:05 - 12:30 12:30 - 13:00
13:00	<b>Scaling in A/d &amp; (e,e'p)</b> <b>Tritium (e,e'p)</b> <b>JINR Heavy Fragment Results [20+5]</b>	<i>Igor Korover</i> 13:00 - 13:25 <i>Reynier Cruz Torres</i> 13:25 - 13:50 <i>Maria Patsyuk</i> 13:50 - 14:15
14:00	<b>Coffee Break</b> <b>Quenching Factors from MSU [20+5]</b> <b>Quenching Factors from GSI [20+5] (Stefanos Paschalis)</b>	14:15 - 14:25 14:25 - 14:50 14:50 - 15:15
15:00	<b>Discussion</b>	15:15 - 15:40

## Monday:

- Recent highlights



10:00	Symmetry Energy [20+5] (Bao-An Li)	Bao-An Li 	10:00 - 10:25
	Short-range correlation effects on the neutron star cooling [20+5] (Rodrigo Negreiros)		10:25 - 10:50
11:00	Short-range correlation and its applications in neutron star physics [20+5] (Jianmin Dong)		10:50 - 11:15
	Neutron Skin [20+5]	Gerald Miller et al.	11:15 - 11:40
	SRC in Electroweak Observables [20+5] (Saori Pastore)		11:40 - 12:05
12:00	Discussion		12:05 - 12:30
	Lunch Break		12:30 - 13:00
13:00	Theory Overview [20+5]	Mark Strikman	13:00 - 13:25
	Chiral symmetry, the EMC and the anti-EMC effects within the superdense nuclear matter, within the special SRC (20+5) (Leonid Frankfurt)		
14:00	Momentum distributions and short-range correlations in few-nucleon systems with local and non-local interactions [20+5] (Laura Marcucci)		
	Chiral Nuclear Interactions for Quantum Monte Carlo Methods [20+5] (Maria Piarulli)		14:15 - 14:40
	Coffee Break		14:40 - 14:50
15:00	Generalized Contact Formalism Theory [20+5]	Ronen Weiss	14:50 - 15:15
	Generalized Contact Formalism Applications [20+5]	Jackson Pybus	15:15 - 15:40
	GCF Analysis of High-xB Scaling in Inclusive Electron Scattering [20+5] (Andrew Denniston)		15:40 - 16:05
16:00	Effective Spectral Function [20+5] (Noemi Rocco)		16:05 - 16:30
	Discussion		16:30 - 16:55

## Tuesday:

- SRC Implications
- SRC Theory

10:00	Quantifying the nuclear high-momentum fluctuations in symmetric and asymmetric nuclei	Jan Ryckebusch
		10:00 - 10:25
	Density and isospin dependence of SRCs [20+5] (Arnau Rios)	
		10:25 - 10:50
	SRC and LRC in finite and infinite systems (20+5)	Willem Dickhoff
11:00		10:50 - 11:15
	Many-body factorization and position-momentum equivalence of nuclear SRCs (20+5)	Diego Lonardonì 
		11:15 - 11:40
	EFT & Lattice QCD [20+5]	William Detmold
		11:40 - 12:05
12:00	Discussion	
		12:05 - 12:30
	Lunch Break	
		12:30 - 13:00
13:00	History of the EMC Effect [20+5]	Hugh Montgomery
		13:00 - 13:25
	Virtuality [20+5]	Gerald Miller et al.
		13:25 - 13:50
	Mean Field Calculations [20+5]	Ian Cloet
14:00		13:50 - 14:15
	Deuteron EMC Effect [20+5] (Tony Thomas)	
		14:15 - 14:40
	Coffee Break	
		14:40 - 14:50
	EMC and Free Nucleon Structure [20+5]	Efrain Segarra
15:00		14:50 - 15:15
	TBD (20+5)	Wally Melnitchouk
		15:15 - 15:40
	The Nuclear EMC Effect as a Testing Ground for Color Forces (20+5)	simonetta liuti
		15:40 - 16:05
16:00	Discussion	
		16:05 - 16:30

## Wednesday:

- SRC Theory cont.
- EMC Theory

10:00	Tagging Theory (20+5)	Christian Weiss
		10:00 - 10:25
	BAND (20+5)	Tyler Kutz
		10:25 - 10:50
11:00	QCD level EMC Effect: Diquark Structures in Nuclear Matter (20+5)	Jennifer Rittenhouse West
		10:50 - 11:15
	Short Range Correlation and Effective Field Theory (20+5) (Scott Bogner)	
		11:15 - 11:40
	BONUS & BONUS12 (20+5)	Sebastian Kuhn
		11:40 - 12:05
12:00	Discussion	
		12:05 - 12:30
	Lunch Break	
		12:30 - 13:00
13:00	Spectral Function Approach in Describing Valence Quarks in the Nucleon and Nuclei	Misak Sargsian
		13:00 - 13:25
	Transport calculations of FSI in nucleon knockout [20+5] (add Natalie)	
		13:25 - 13:50
14:00	Light Nuclei (e,e'N)	Holly Szumila-Vance
		13:50 - 14:15
	Quenching Factors [20+5] (add Augusto)	
		14:15 - 14:40
	Coffee Break	
		14:40 - 14:50
15:00	GCF and the BeAGLE simulation code (20+5)	Mark Baker
		14:50 - 15:15
	Tritium (e,e')	Shujie Li
		15:15 - 15:40
	Tagging with Tensor Polarized Deuteron (20+5)	Wim Cosyn
		15:40 - 16:05
16:00	Discussion	
		16:05 - 16:30

## Thursday:

- EMC Experiment
- SRC Experiment

10:00	Overview of Approved Hadronic EMC-SRC Experiments [20+5]	<i>Eli Piasetzky</i> 10:00 - 10:25
	GSI Storage Ring (20+5)	<i>Julian Kahlbow</i> 10:25 - 10:50
11:00	Overview of Approved Photonuclear EMC-SRC Program (20+5)	<i>Or Hen</i> 10:50 - 11:15
	Polarized $^3\text{He}$ (20+5) (Miha Mihovilovic)	11:15 - 11:40
	A=3 SIDIS (20+5)	<i>Zhihong Ye</i> 11:40 - 12:05
12:00	Discussion	12:05 - 12:30
	Lunch Break	12:30 - 13:00
13:00	J/PHI (20+5)	<i>Zhoudunming Tu</i> 13:00 - 13:25
	Double Tagging with A=3	<i>Dien Nguyen</i> 13:25 - 13:50
14:00	SRC Study with the EIC (20+5)	<i>Florian Hauenstein</i> 13:50 - 14:15
	Status of the EIC Project (20+5)	<i>Douglas Higinbotham</i> 14:15 - 14:40
15:00	Discussion	14:40 - 15:05

## Friday:

- Future with Hadrons
- Future @ JLab12
- EIC

# For an exciting and productive meeting 😊

On behalf of those who really put this together:



Zhoudunming Tu



Dien Nguyen



Reynier Cruz Torres



Holly Szumila-Vance



Alexander Jentsch



Ronen Weiss



Diego Lonardonì



Jennifer Rittenhouse  
West



Florian Hauenstein



Julian Kahlbow

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