

Nuclear Physics Research in Slovenia

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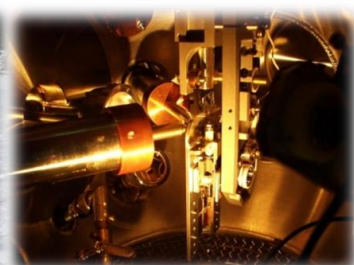
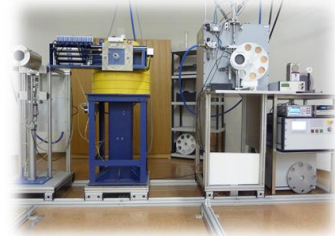
Ljubljana (RECFA visit) | 5 Apr 2019

Introduction: The F2 Department @ JSI

Department of Low and Medium Energy Physics

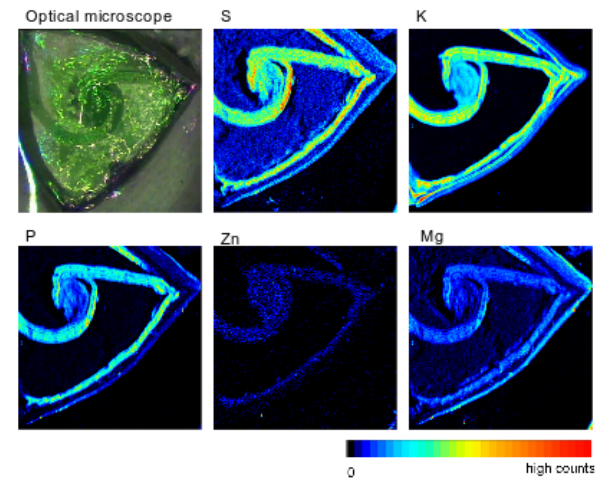
Personnel: 44

- Basic research in nuclear and atomic physics
- Environmental radiological monitoring
- 2 MV tandem accelerator, providing Transnational access
- Advanced applications of charge particle and photon beams at large experimental facilities



Application of nuclear techniques

- Environmental radiological monitoring
hi-res γ spectroscopy, tritium (LSC)
- Archeometry, (art) conservation
- Biomedical applications



Electron screening in nuclear reactions

- Relevant for primordial nucleosynthesis

1: $n \leftrightarrow p$

2: $n(p,\gamma)d$

3: $d(d,p)t$

4: $d(p,\gamma)^3\text{He}$

5: $d(d,n)^3\text{He}$

6: $^3\text{He}(n,p)t$

7: $t(d,n)^4\text{He}$

8: $d(d,\gamma)^4\text{He}$

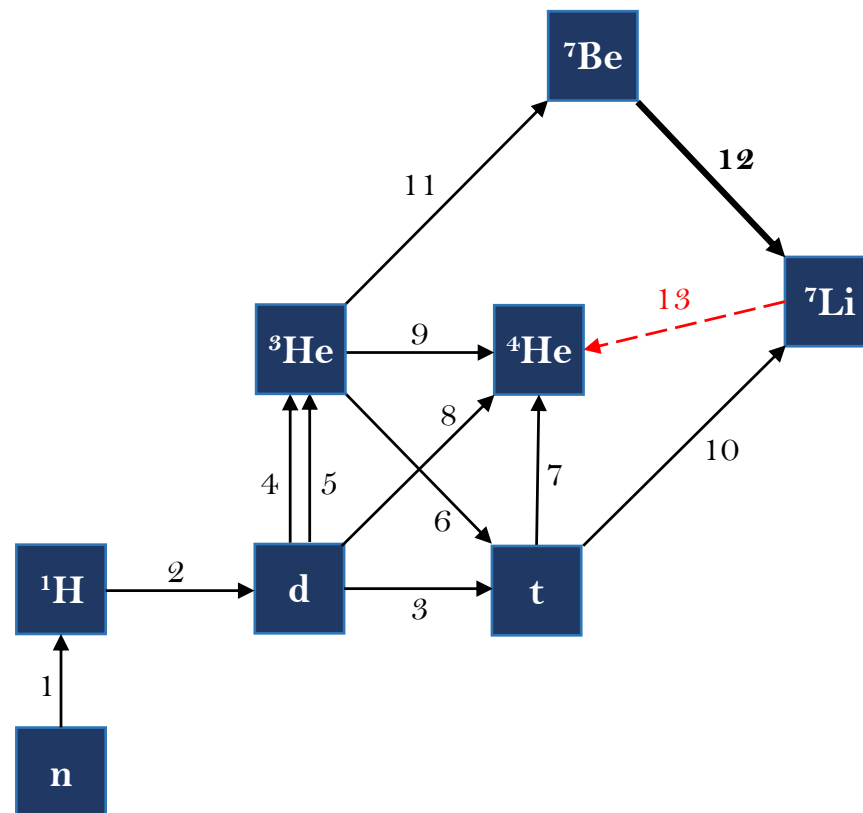
9: $^3\text{He}(d,p)^4\text{He}$

10: $t(\alpha,\gamma)^7\text{Li}$

11: $^3\text{He}(\alpha,\gamma)^7\text{Be}$

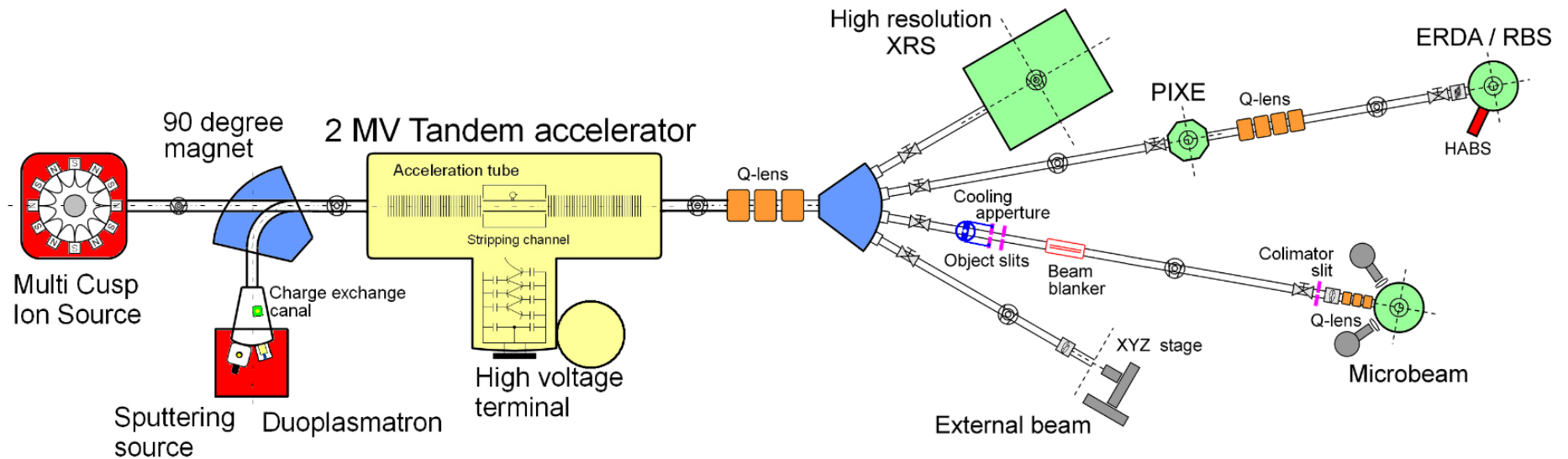
12: $^7\text{Be}(n,p)^7\text{Li}$

13: $^7\text{Li}(p,\alpha)^4\text{He}$



- Study inverse process $^1\text{H}(^7\text{Li},\alpha)^4\text{He}$

2 MV Tandem Ion Accelerator (tandetron) @ JSI

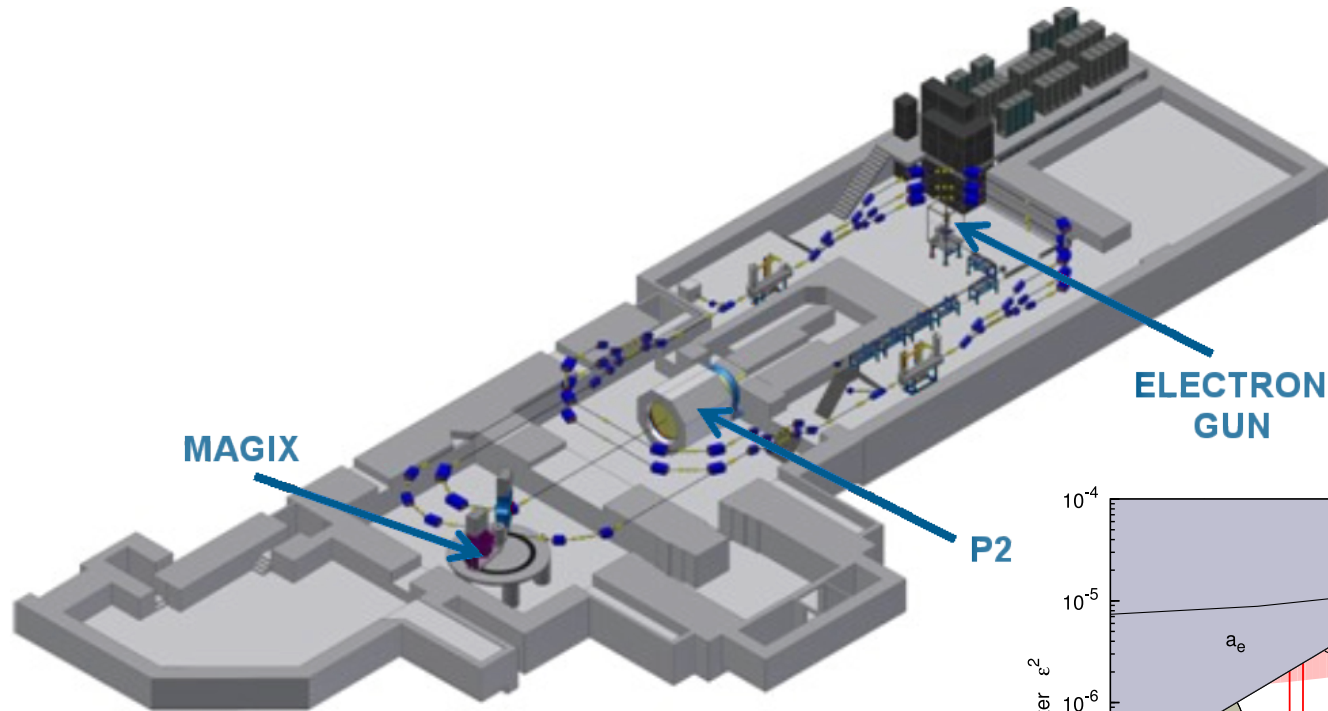


EU H2020 Infrastructure Integrating Activities for Advanced Communities« project “Research And Development with Ion Beams – Advancing Technology in Europe-RADIATE”, No. 824096, 2019-2022

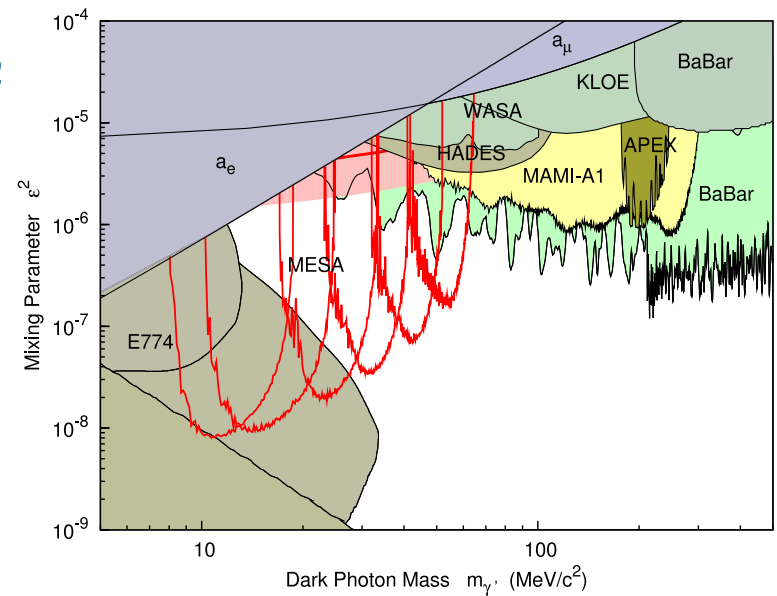
Transnational access (TNA) to the EU ion beam facilities, including ion accelerator at JSI
1400 beam hours of TNA at Jožef Stefan Institute

Structure of Hadronic Systems Research Group (IJS and UL)

- Work at MESA (Mainz, Germany): MAGIX Collaboration

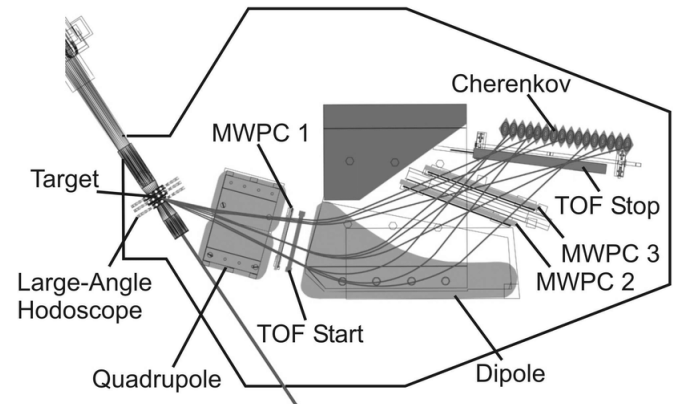
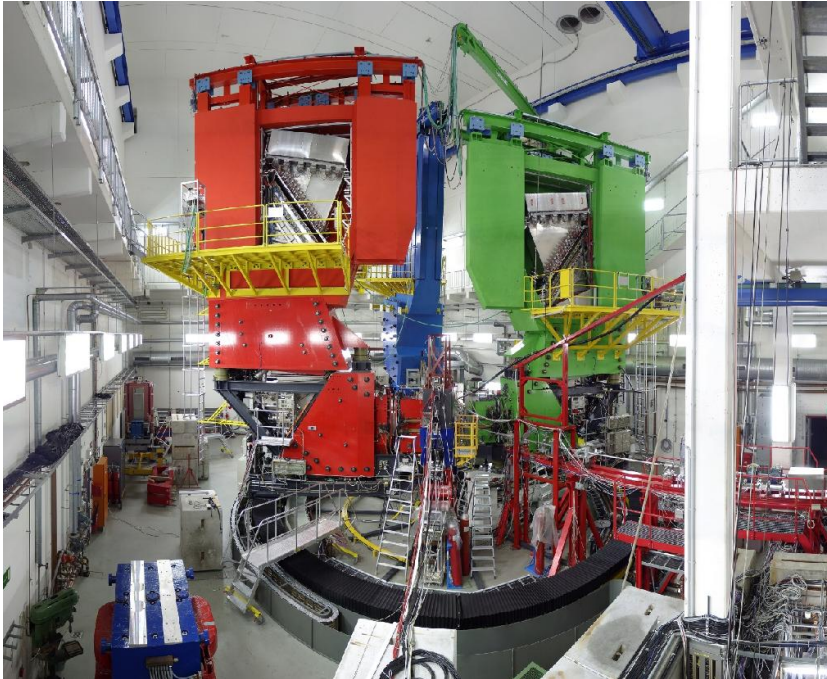


- Dark photon searches
- Proton radius puzzle
- Precision studies of $(e,e'p)$ processes on light nuclei
- ... **and more**

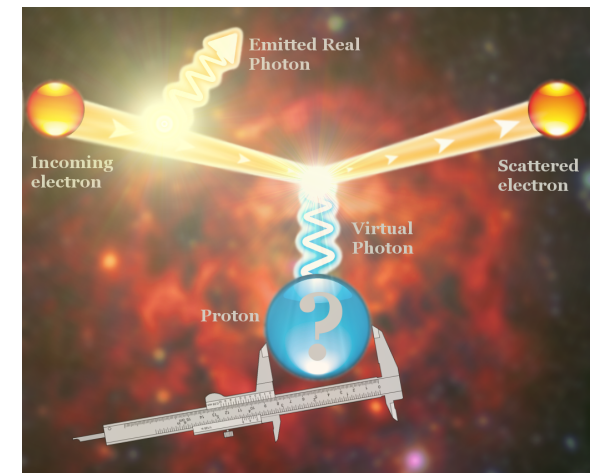


Structure of Hadronic Systems Research Group (IJS and UL)

- Work at MAMI (Mainz, Germany): A1 Collaboration

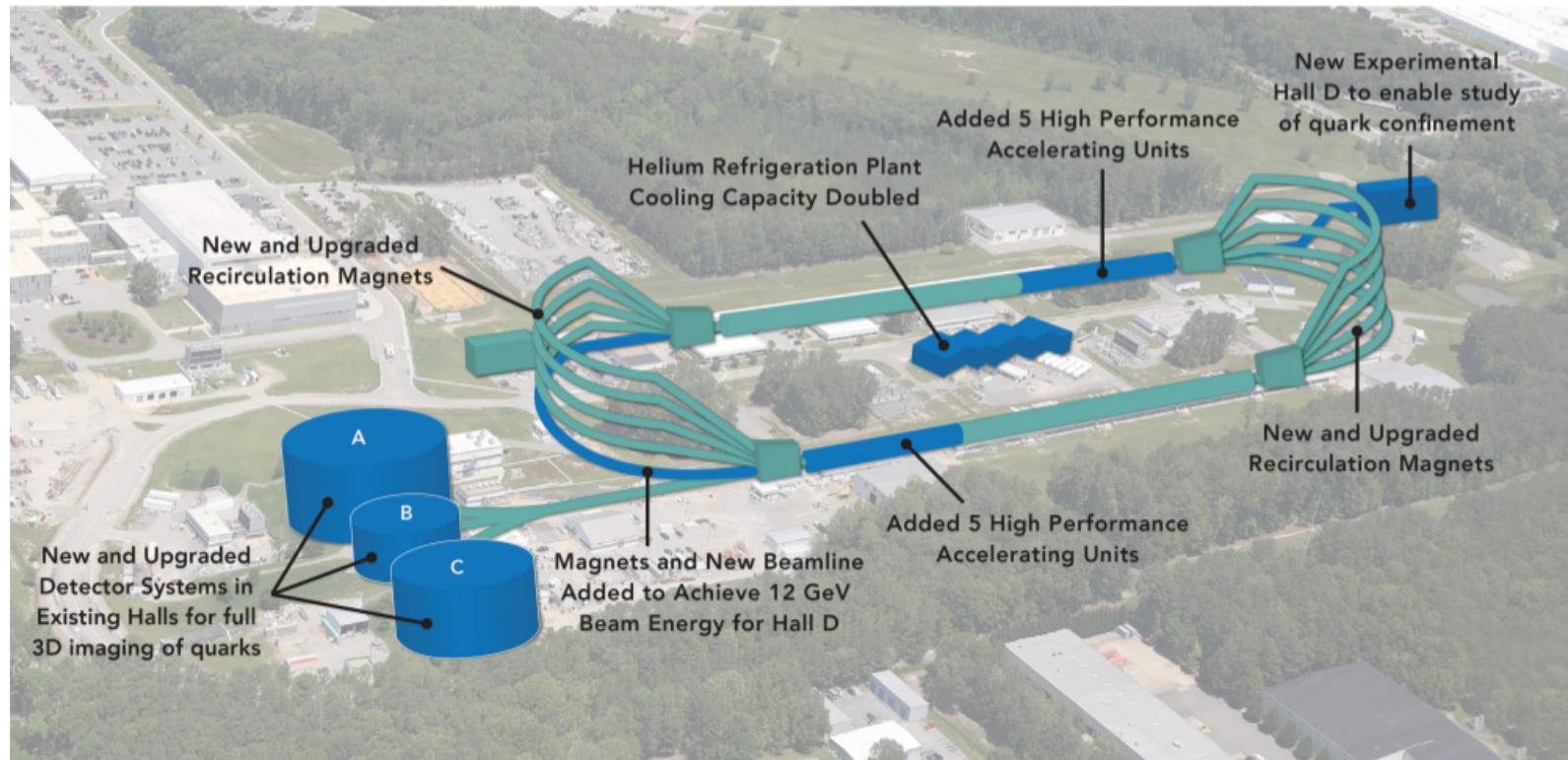


- Nucleon elastic FFs (direct and via ISR)
- Modification of nucleon FFs in nuclear medium
- Structure of nucleon resonances (Δ , Roper)
- Virtual Compton scattering
- EM and spin structure of light nuclei
- $(e,e'p)$ processes
- Hypernuclear physics ... **and more**



Structure of Hadronic Systems Research Group (IJS and UL)

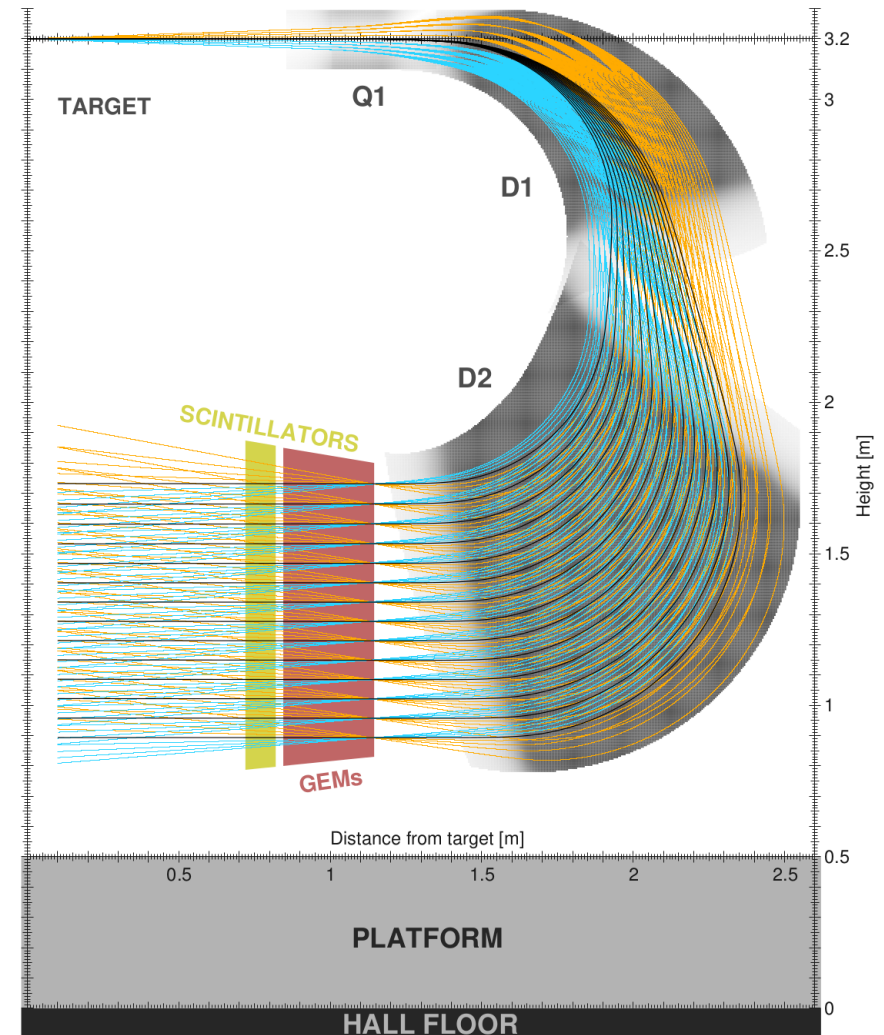
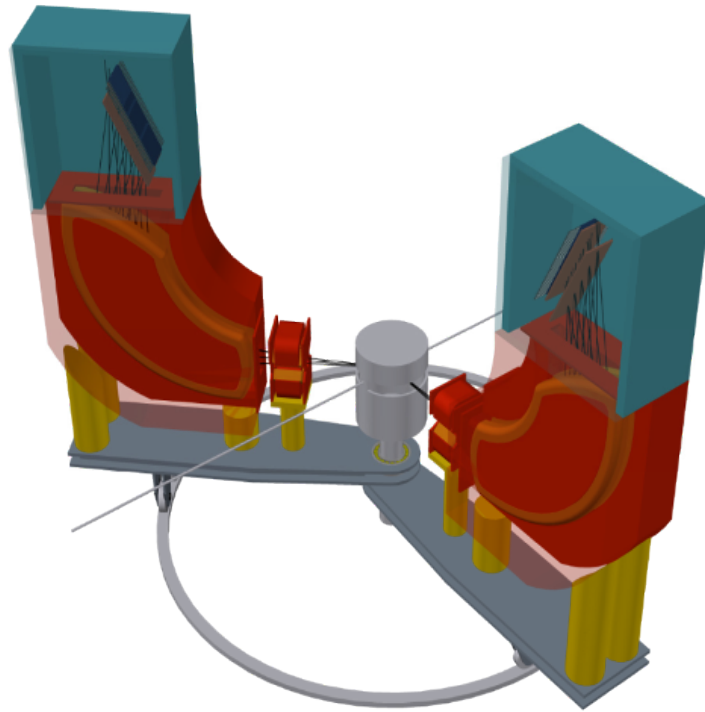
- Work at TJNAF = Jefferson Lab (Newport News, USA): Halls A and C

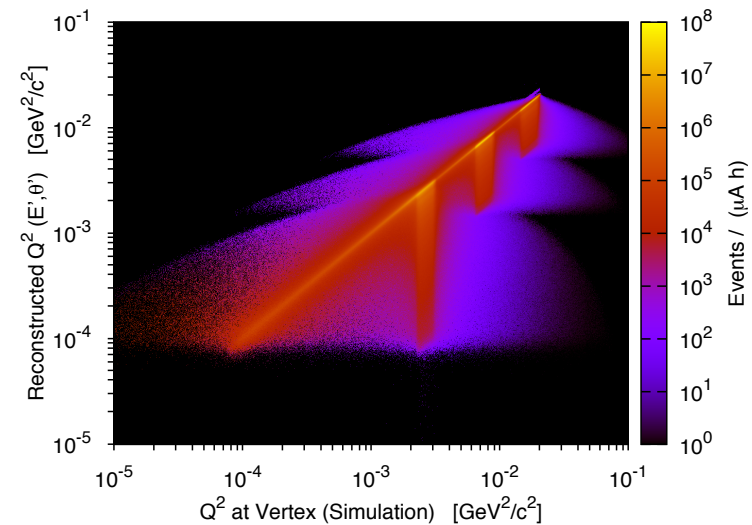
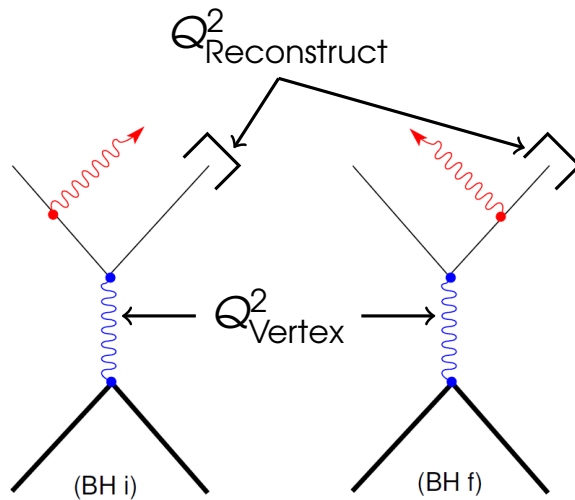
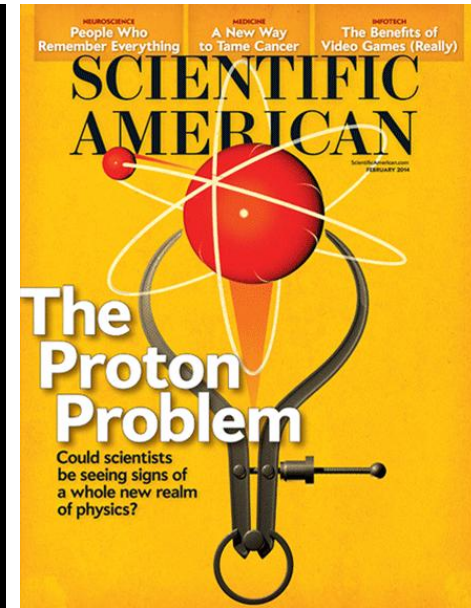


- Spin structure of ^3He
- Wide-angle Compton scattering
- (Future proposal) Clean measurement of axial form-factor
- (Future proposal) High-energy behavior of the GDH sum rule .. **and more**

Involvement at MESA: magnetic optics for MAGIX

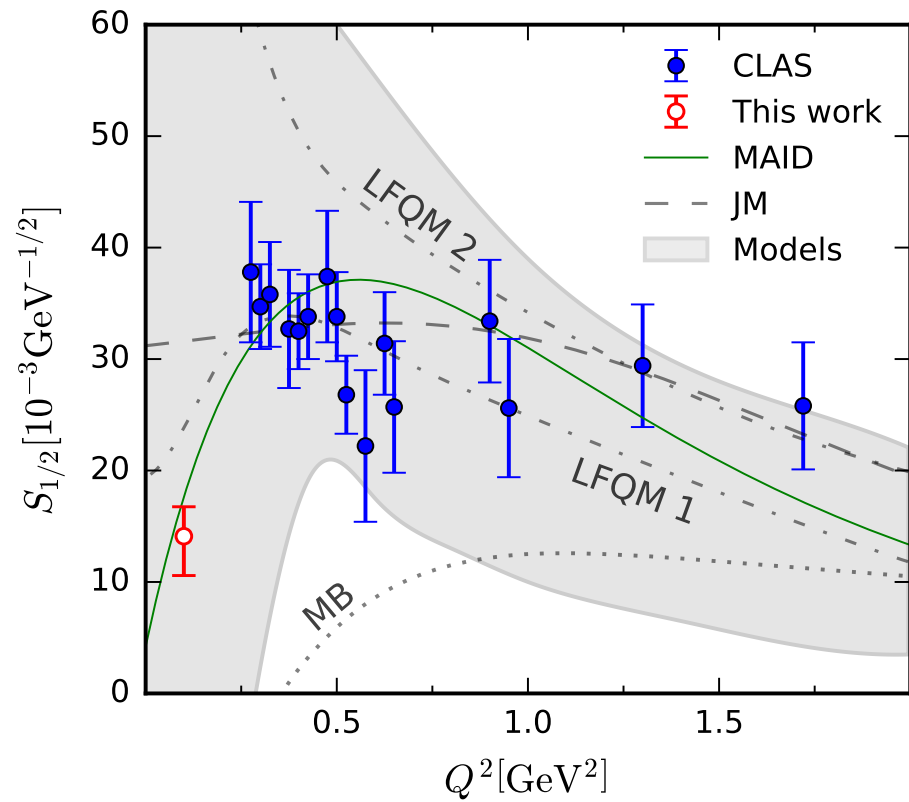
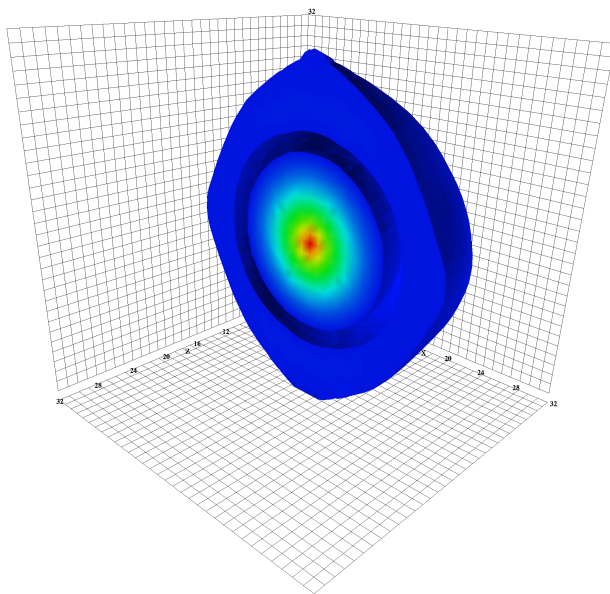
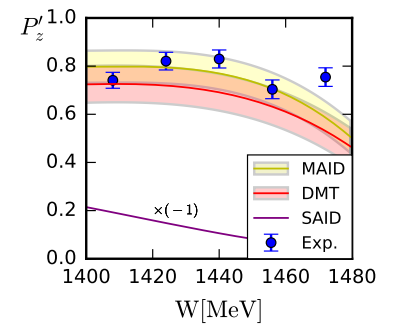
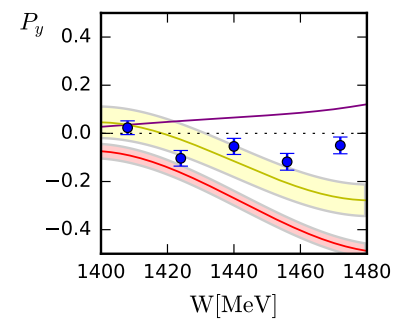
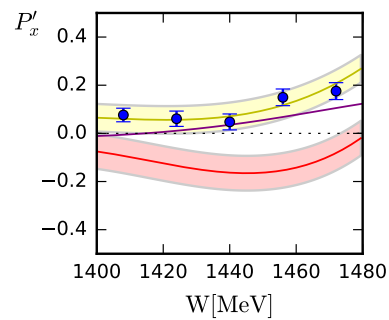
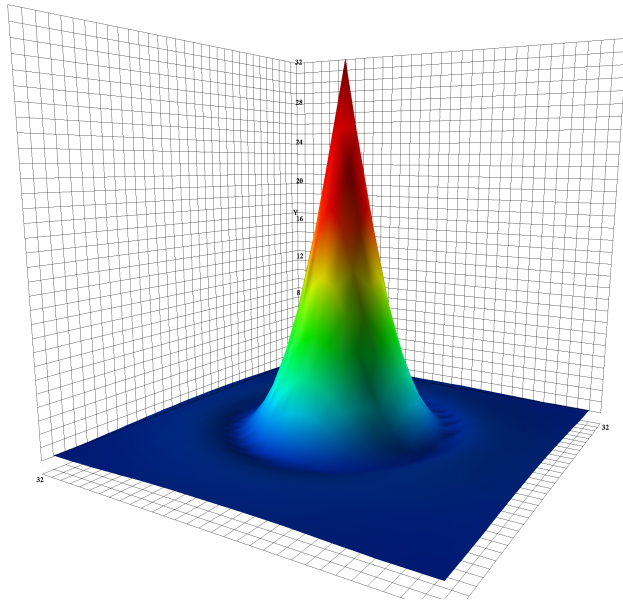
- Two QDD spectrometers for low- Q^2 electron scattering at MAGIX @ MESA
- Physics requirements:
 $p_{\text{max}} > 200 \text{ MeV}$, $\delta p/p < 10^{-4}$ etc.
- Focal-plane detectors
(GEMs or VDCs, scintillators)





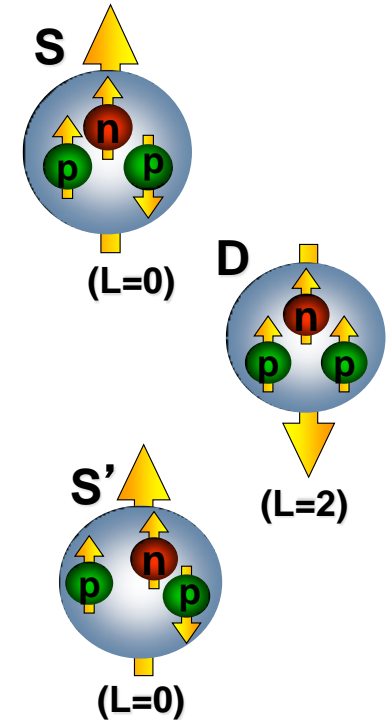
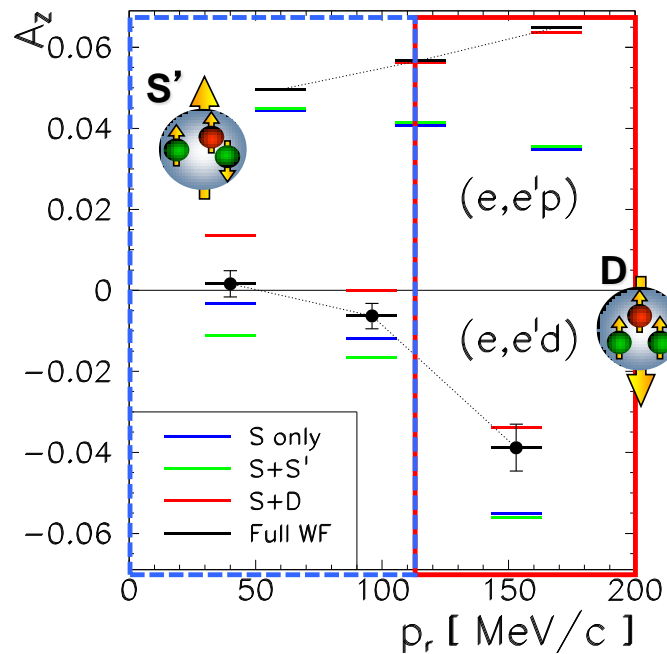
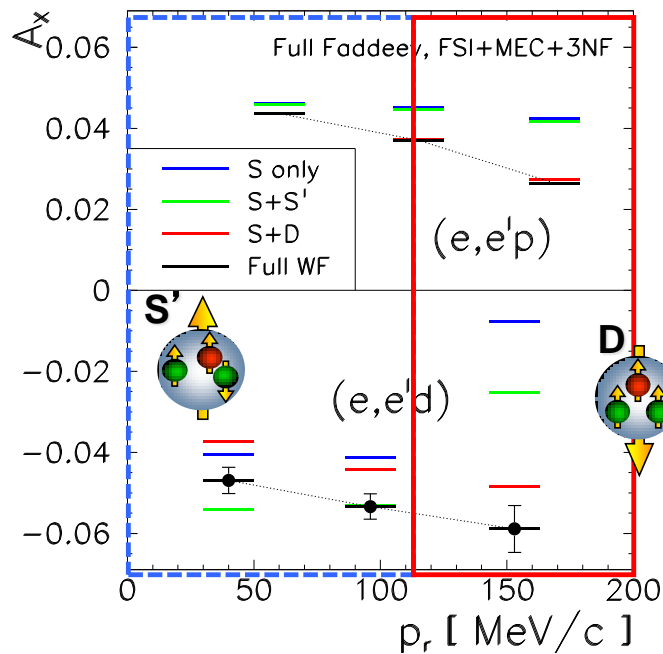
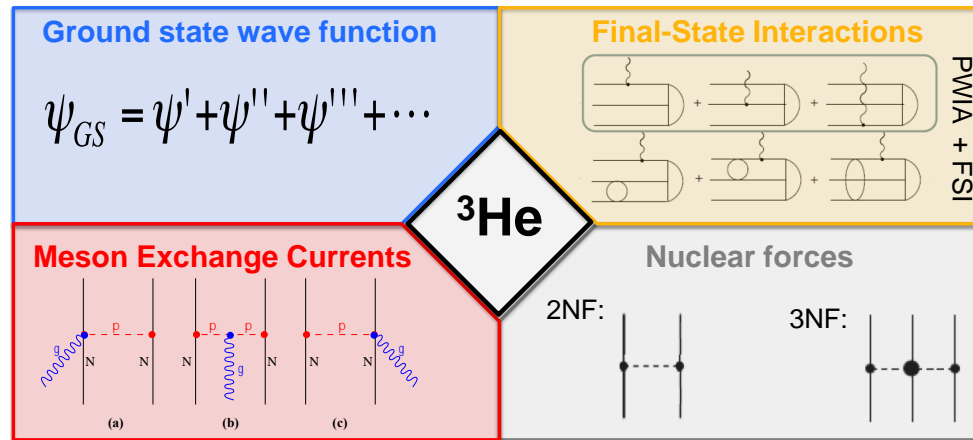
Involvement at MAMI: the Roper resonance

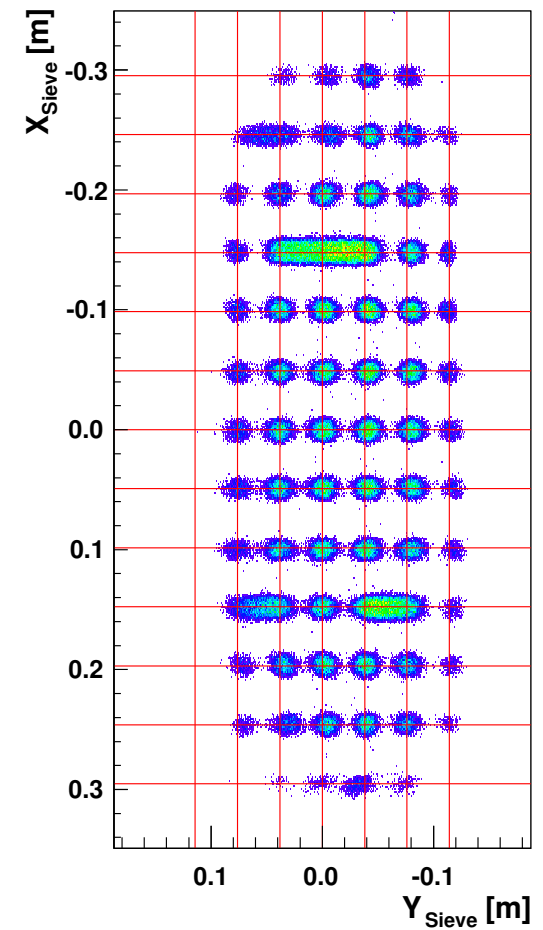
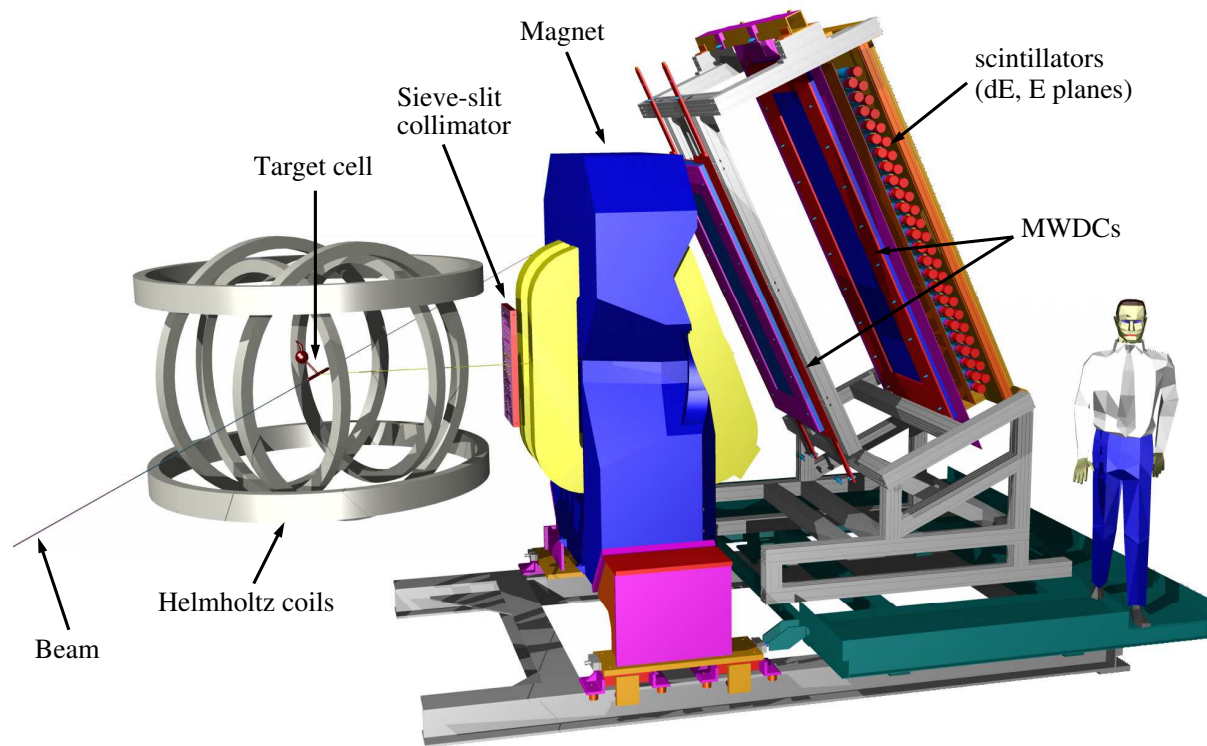
#2



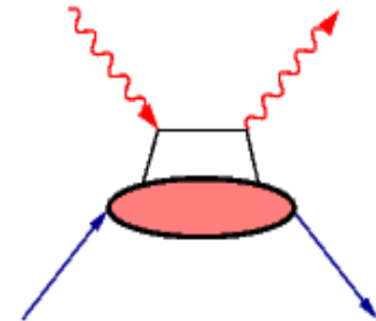
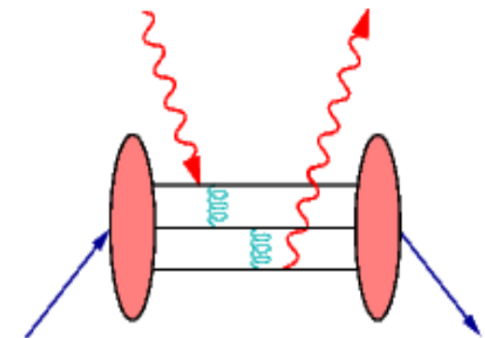
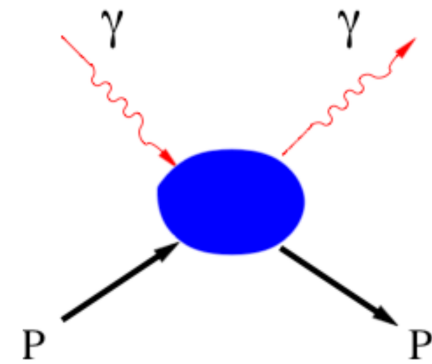
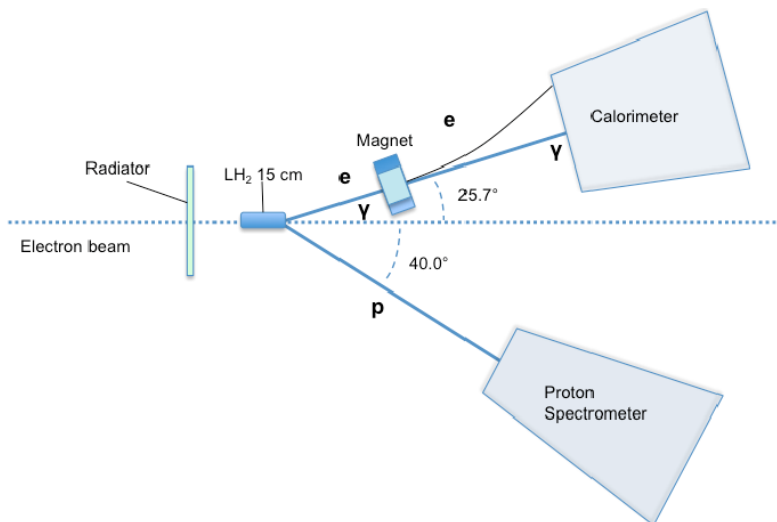
Involvement at JLab: spin structure of ^3He

#1



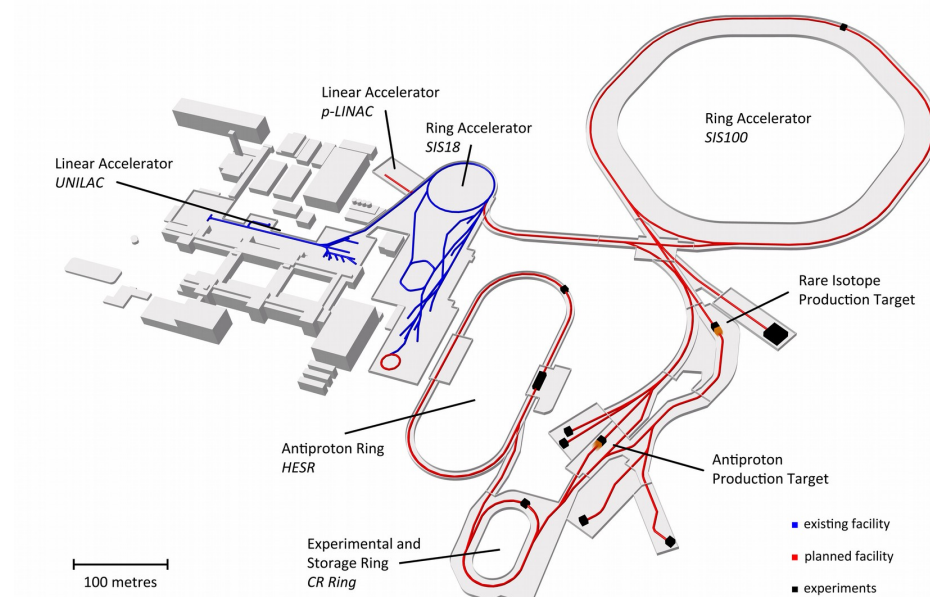
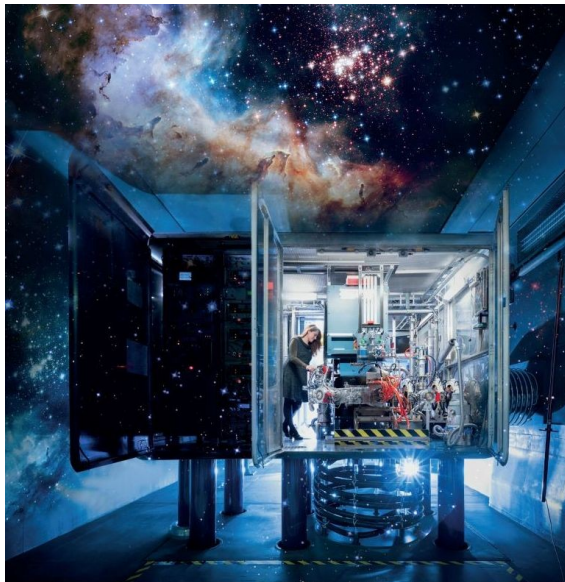


- Hard exclusive nucleon Compton scattering investigated in two complementary regimes:
 - **deeply virtual**: large Q^2 ; $-t/Q^2 \ll 1$
 - **wide-angle**: large $-t, -u$; $-Q^2/t \ll 1$
- WACS is a powerful probe of transverse nucleon structure, similar to high- Q^2 elastic nucleon scattering
- **However**, it remains one of the **least understood fundamental processes** in the few-GeV regime



Involvement at FAIR (Darmstadt)

ESFRI roadmap: **Facility for Antiproton and Ion Research (FAIR)**
(Darmstadt, Germany)

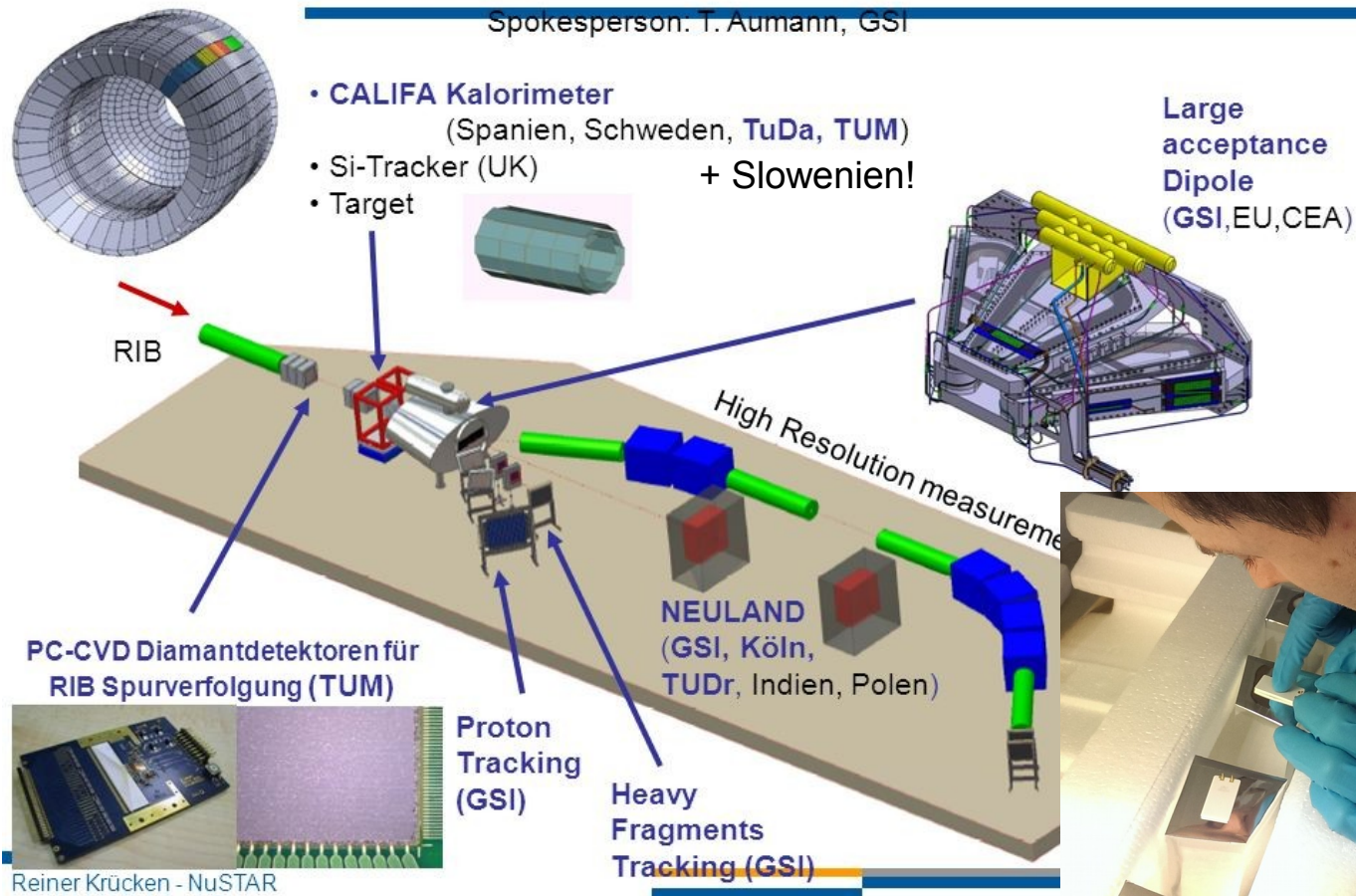


construction of CALIFA Calorimeter in progress,
possibly joining NEULAND construction

R³B @ FAIR

Reactions with Relativistic Radioactive Beams

Spokesperson: T. Aumann, GSI



Target building

Super-FRS tunnel

service building

LEC

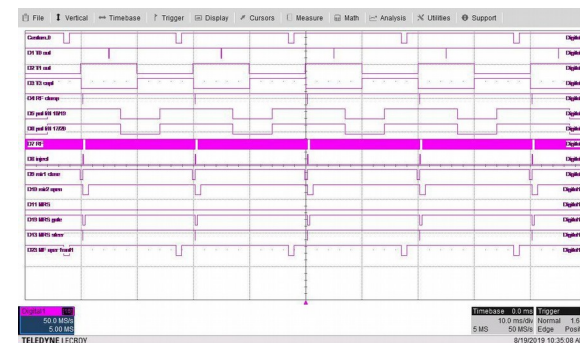
HEC

SIS connection

Direct beam line to NESR

CR, NESR

A hand is shown holding a black plastic frame that houses a green printed circuit board (PCB). The PCB is populated with five white modules, which appear to be custom-built or specialized components, possibly for data logging or sensor interfacing. The modules are arranged in a row, and the entire assembly is resting on a light-colored wooden surface.



DEGAS system of HISPEC/DESPEC collab.

Simulation, optimization and design of BGO backcatcher detectors

