

LECM 2025 Working Group Summaries

August 15, 2025

Workshop on Precision Measurements of Radioisotopes (Aug. 11-12)

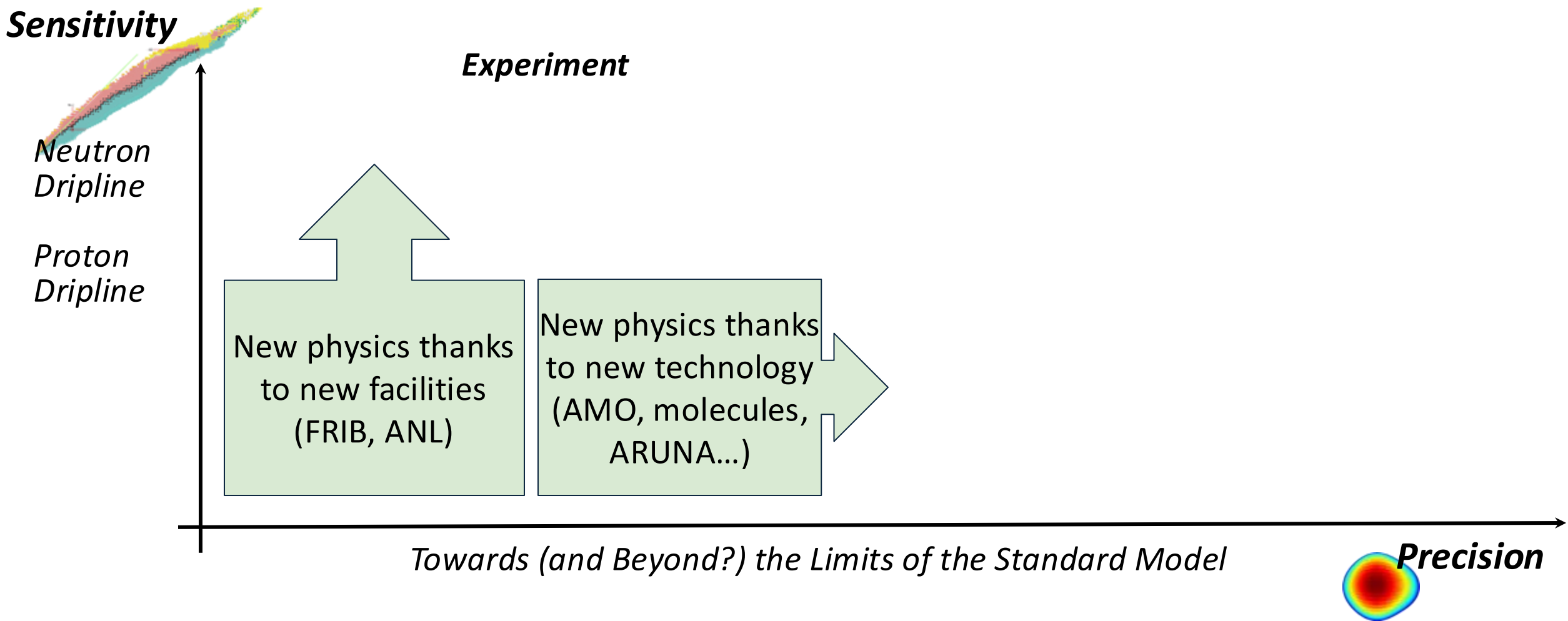


12+ new P.I. in EXP & THEO hires highlight the vast opportunities of our nuclear precision community:





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Sensitivity

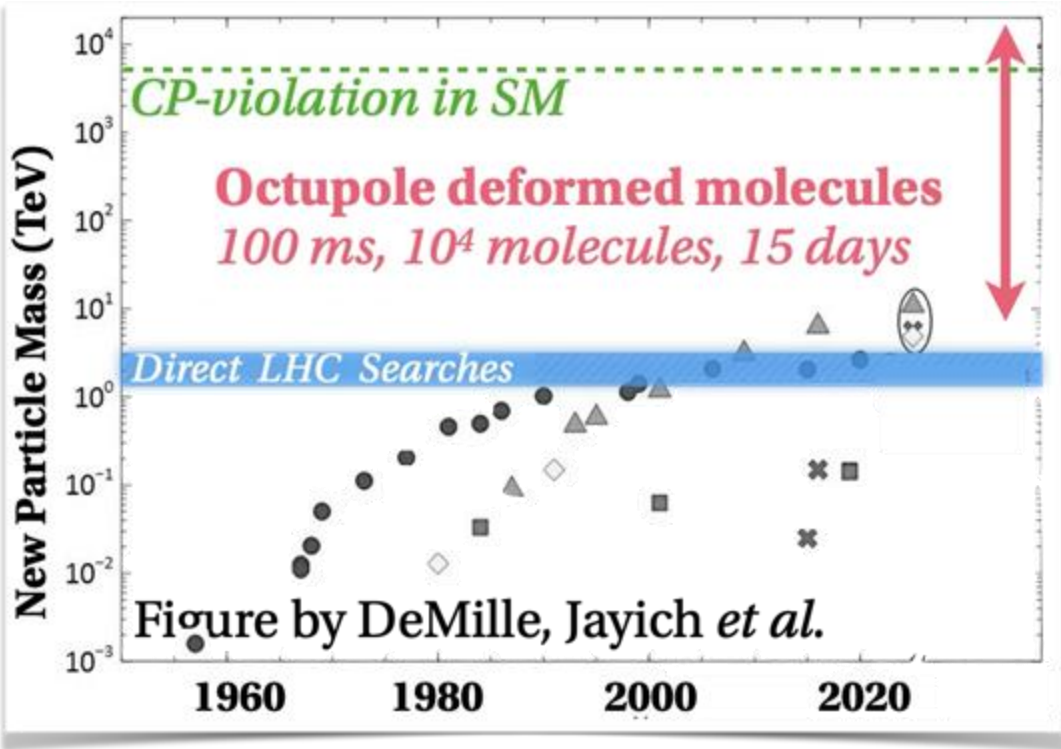
Experiment

Neutron
Dripline

Proton
Dripline

New physics thanks
to new facilities
(FRIB, ANL)

New physics thanks
to new technology
(AMO, molecules,
ARUNA...)

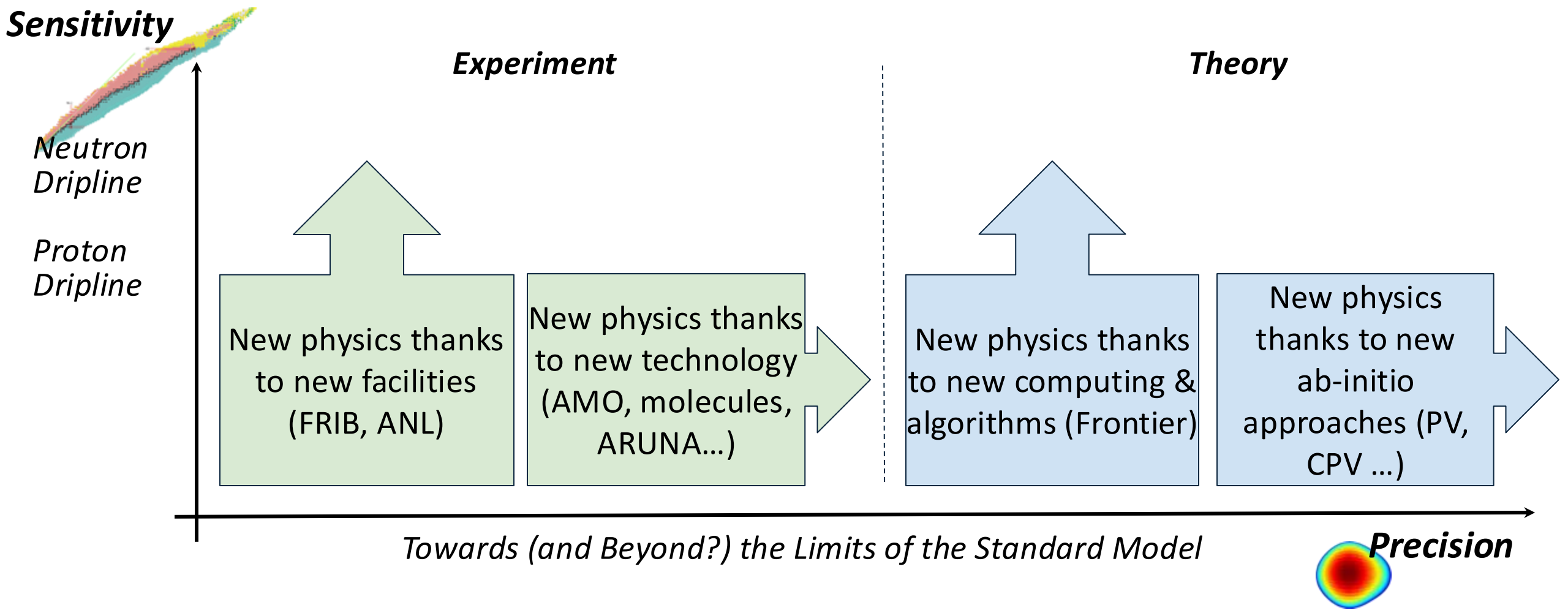


Towards (and Beyond?) the Limits of the Standard Model



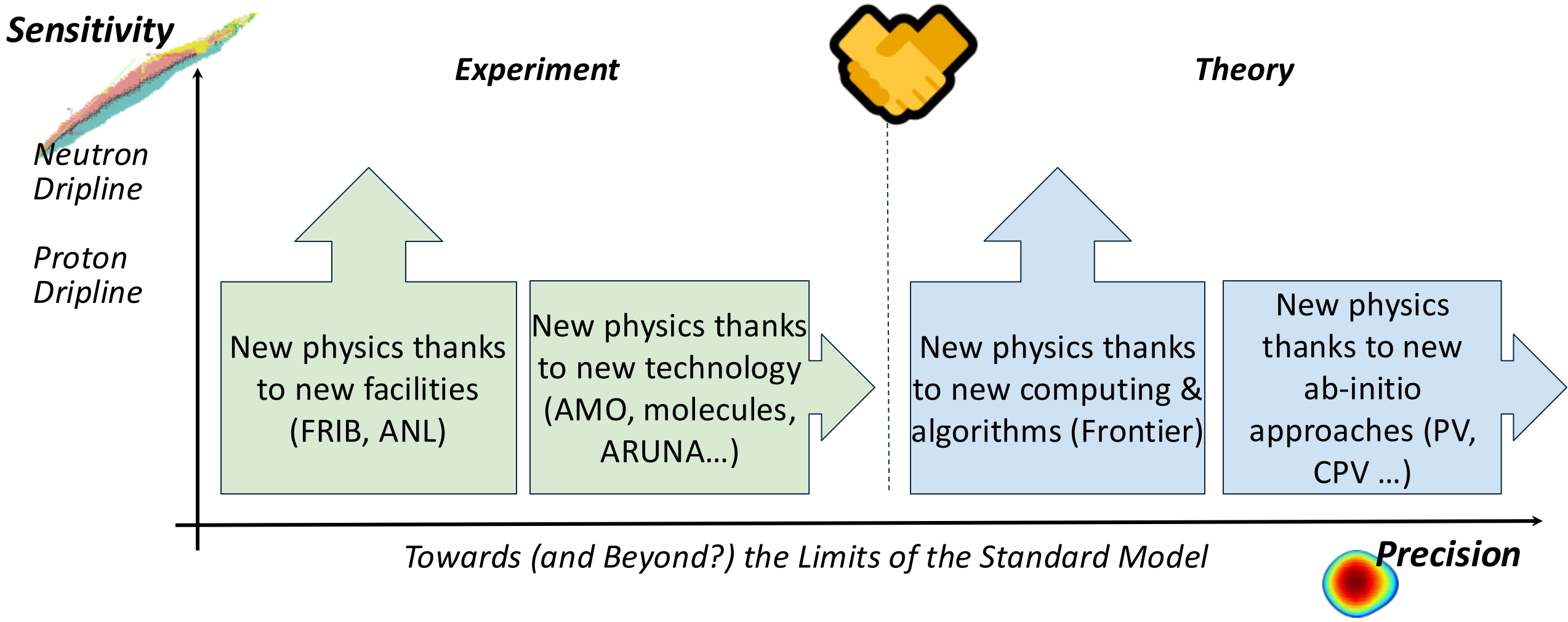


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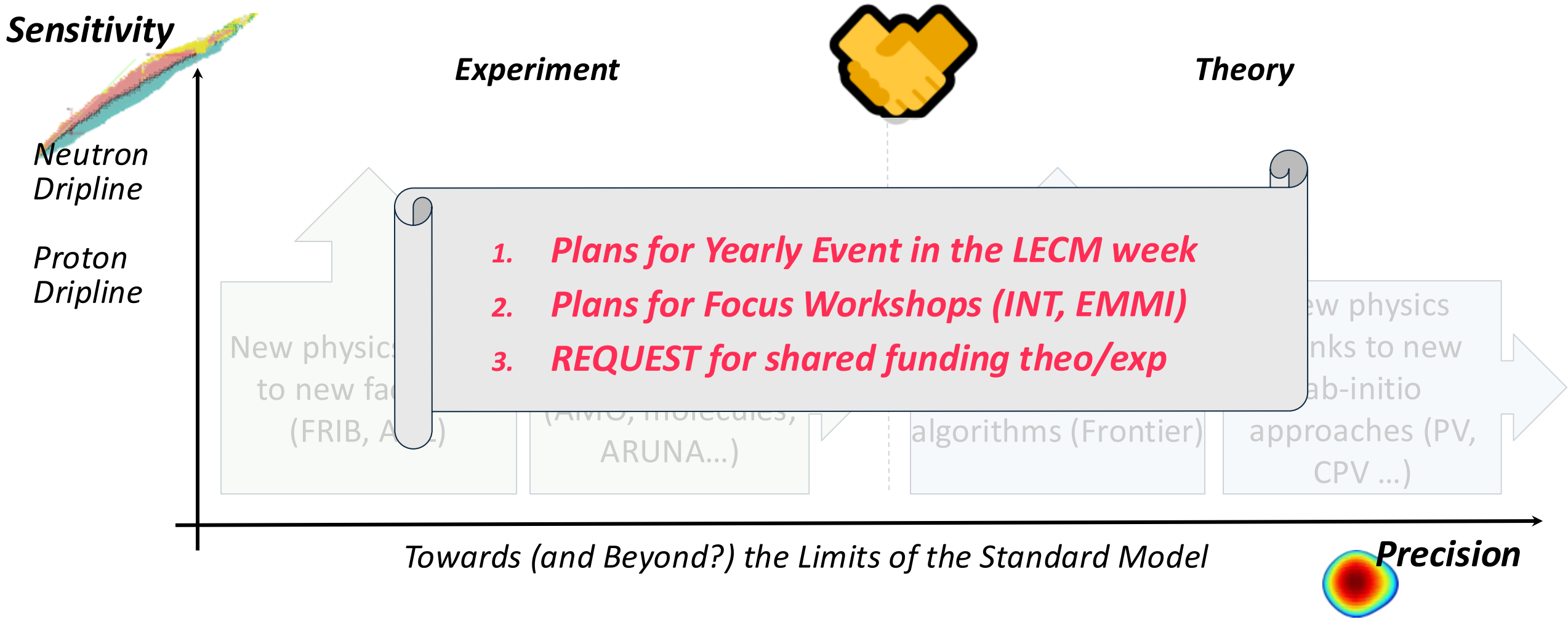


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Early Career Workshop

Organizers: Jennifer Pore (LBL), Becca Toomey (LLNL), Andrea Richard (OU)

- **1-2:30PM:** Unlock the Power of Science Storytelling: A Workshop on Writing for Lay Audiences by Dr. Barbara Gastel (TAMU)
- **2:45 – 4PM:** Reflections on Early-Career Experiences in Nuclear Science: A Panel Discussion Unlocking Insights from Mid-Career Researchers
 - Panelists: Phil Adsley (TAMU), Kay Kolos (LLNL), Cody Folden (TAMU)
- ~50 attendees
- Thanks to Rajesh and Sean for microphone assistance!



**Writing for Lay Audiences:
15 Suggestions (and Some Exercises)**

Some Books

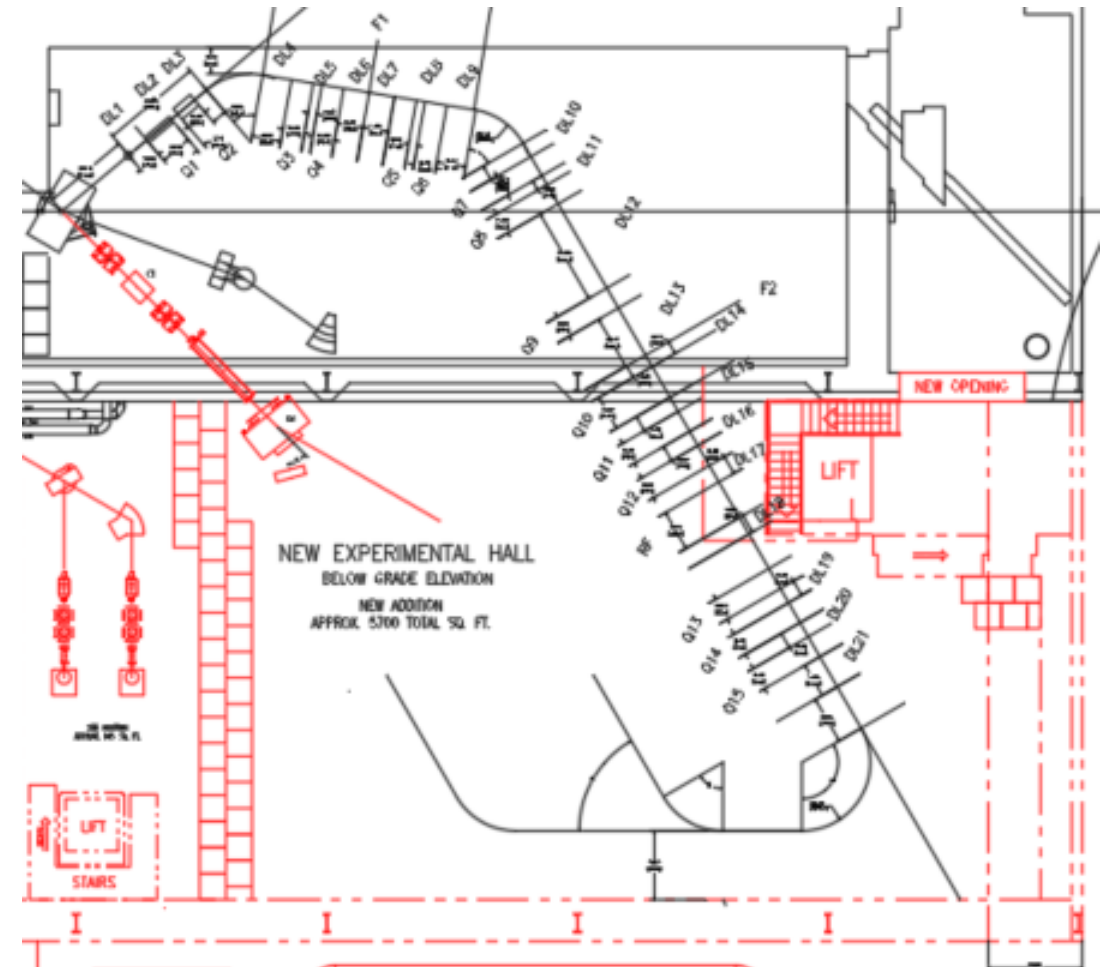


Workshop on SATURN

Separator and Analyzer at TAMU for Understanding Reactions of Nuclei

Grigory Rogachev (Texas A&M U)	Introduction: the case for the new spectrometer at TAMU
Georg Berg (U of Notre Dame)	Preliminary SATURN optics
Brian Roeder (Texas A&M U)	RIB yields with SATURN
Oleg Tarasov (FRIB)	SATURN optics with LISE++
Alan McIntosh (Texas A&M U)	Overview of existing instrumentation at TAMU for experiments with RIBs

- There is an opportunity to build a new separator for RIBs production at the TAMU Cyclotron Institute, leveraging the additional experimental areas to be constructed for the radiation effects program.
- Increased rigidity and acceptance (compared to the existing MARS) are projected to improve the current RIBs rates by a factor of 5x to 100x.
- SATURN can become a valuable resource for the community, producing RIBs in the unique energy range from 10 to 40 MeV/u.



Workshop on Particle Tracking and Timing

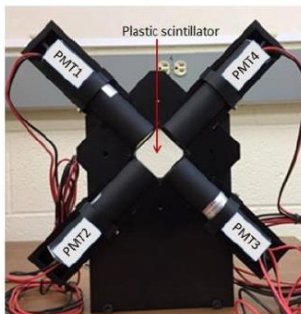
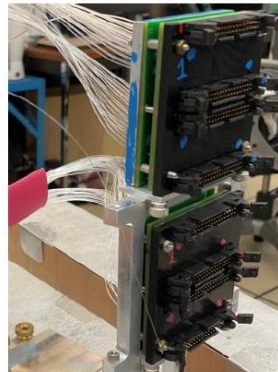
Organizers: A.M. Rogers (UMass Lowell), A. Estrade (CMU), J. Pereira (FRIB)

Attendance: About 40 attendees (~30 in-person, ~10 Zoom)

Speakers: R. Zegers, A. Estrade, J. Pereira, S. DiCarlo, C. Benetti, A. Rogers, L. Wagner, I. Tosltukhin, H. Webb

Presentation Overview

- Update on the High Rigidity Spectrometer (HRS)
- Impact of beam tracking and timing on
 - ToF-Brho mass measurement program
 - S800 experiments
 - Diagnostics
- Applications of MicroChannel Plate (MCP) systems
- Fiber tracking detectors

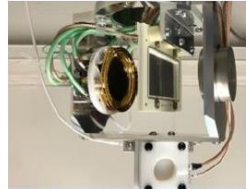
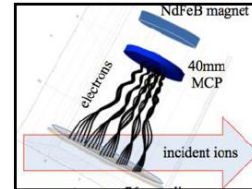
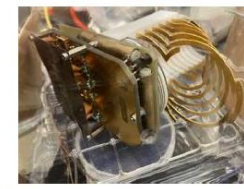
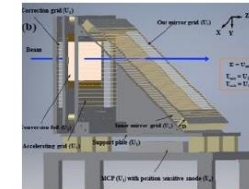
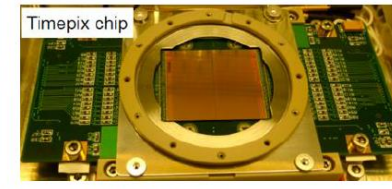


Going forward:

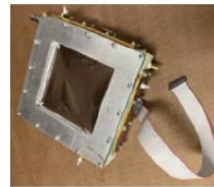
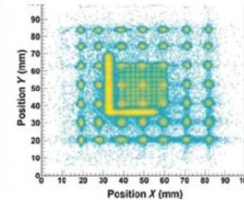
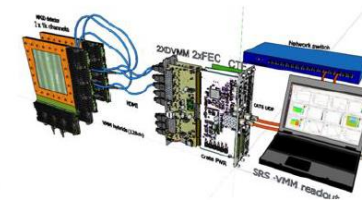
- Continue mission of Working group by enhancing regular meetings to discuss new developments and interests.
- Foster collaboration between different facilities to accommodate beam-testing needs of new equipment.
- Possible repository of online technical documentation (manuals, literature, procedures, vendors...).
- Increase activities to train ECRs in specialized technical skills for detectors (e.g. summer schools dedicated to tracking detectors).

Take aways and discussions

- Low-energy nuclear physics experiments rely on tracking detectors at the forefront of the field. Improvements in performance and development of novel tracking detectors will strongly benefit the scientific program at our facilities.
- MCP/foil-based are an important and optimum tracking solution (thin, compact, radiation hard). MCP readout and e- transport concepts need further development.



- Discussion on novel attractive tracking systems: OPPAC, DL-PPAC, MWPC, FIBERS. New readout schemes are being developed (SRS, FRES-5200,...)



- Radiation-hard particle-identification detectors like Diamond (timing) and Ionization chambers (energy-loss)



Highlights of the Nuclear Data Session

- **Covariance calculation and interpretation for nuclear data** (Keegan Kelley): Presentation of covariance matrix is necessary for accurate quantification of uncertainties.
- **A tool for Reporting Covariances in Manuscripts** (Jason Surbrook)
- **Charge-exchange reactions in improving electron-capture rate library** (Zarif Rahman): An electron-capture rate library and (d,2He) reactions were discussed
- **Ongoing efforts of INDEN-LE** (Richard DeBoer): Recent progress on the international nuclear data evaluation network on light elements was presented.
- **Nuclear data needs for low-energy inelastic neutrino-nucleus scattering experiments** (Sam Hedges)
- **AI-assisted ENSDF formatting**: (Lijie Sun): AI-assisted ENSDF tools for users were presented.
- **Progress of evaluation traineeship at LLNL** (Vincent Cheung)
- **Updates on NNDC database activities** (Christopher Morse)
- **Comments on the $E_x = 2313$ keV level of ^{14}N** (John Kelley)

Isotopes and Applications Working Group Session

Conveners: Andrew Ratkiewicz (LLNL), Ivis Chaple Gore (UTK)

Nuclear Physics for Applications

Guy Savard (ANL) – **Applied nuclear data work at ATLAS**

- Wide variety of beams (high-intensity stable, RAISOR, nuCARIBU, N=126 Factory) coupled with innovative facility (HELIOS, GAMMASHIRE, CPT) or user-supported (GODDESS, SuN, MTAS) devices create opportunities for exciting measurement.
- PAC call – due September 22nd.

René Reifarth (LANL) – **Frontiers of direct neutron-induced reaction measurements**

- Innovative device coupling ISOL and spallation neutron source would enable direct measurements a wide variety of neutron-induced reactions.
- Test experiment show promising agreement with simulations.

Andrew Ratkiewicz (LLNL) – **Recent Direct and Indirect Measurements at LLNL**

- Highlights of direct and indirect measurements conducted at LLNL and beyond. Focus on cross sections, branching ratios relevant to Stockpile Stewardship.

Radioisotopes for Cancer Therapies

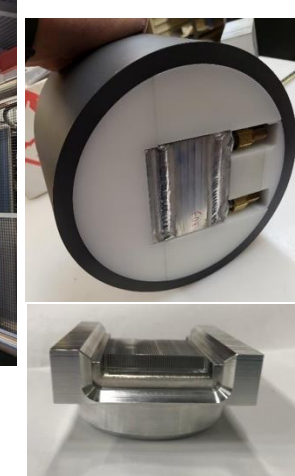
Ivis Chaple Gore (UTK) – **Isotope Harvesting of Medically Relevant Radionuclides**

- Theragnostic development enabled by radioplatinum harvested at FRIB.
- Resins impregnated with ionic liquids show significant promise for separating radioplatinum from contaminants.

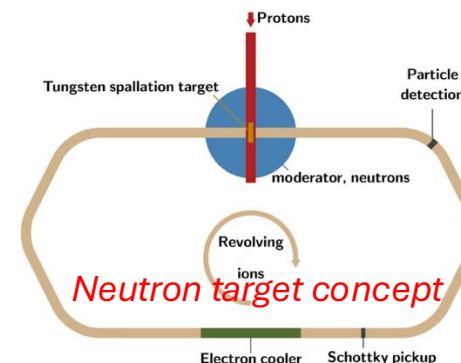
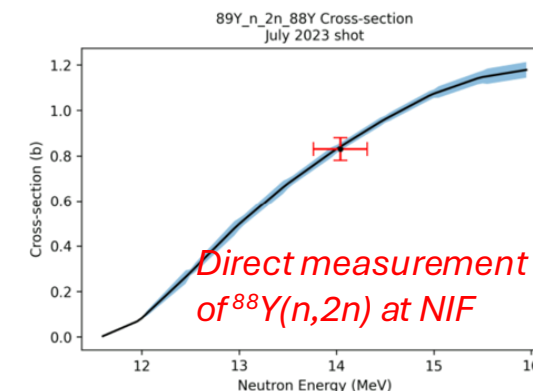
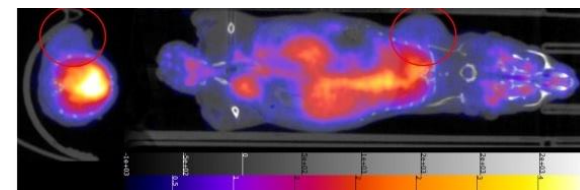
Isotopes for Fundamental Symmetries

Nick Hutzler (CalTech) – **Radioactive Molecules**

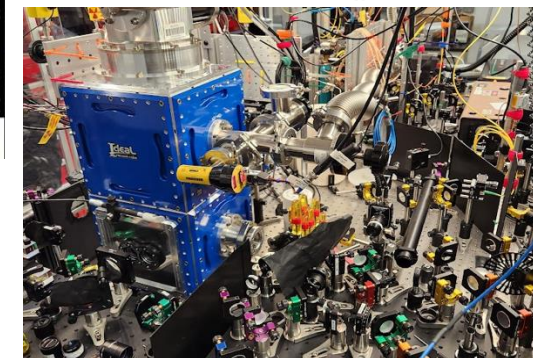
- Radioactive molecules provide a laboratory for studying nuclear structure, actinide radiochemistry, nuclear astrophysics, and fundamental symmetries.
- The isotopes that enable these studies are hard to get, and the need is only growing.



nuCARIBU components



Diagnostic PET imaging of HNSCC using ¹⁸⁹Pt



CalTech “Mini Fridge” for FS measurements



Theory
Alliance

Working Group: Connecting Theory to Experiment

Program:

1. What theorists (esp. FRIB Theory Alliance) bring (C. Johnson)
2. What experimentalists want (A. Macchiavelli, C. Brune)
3. Small group discussions – **how to connect better**
4. Reconvene and discuss

Some takeaways:

- Need **better targeted** theory resources for experimentalists (summer school lecture notes, etc.), esp. at intro/intermediate level
- Schematic models still useful
- Theorists can use more lead time

LECM25 Data Acquisition (DAQ) WG – Session 4

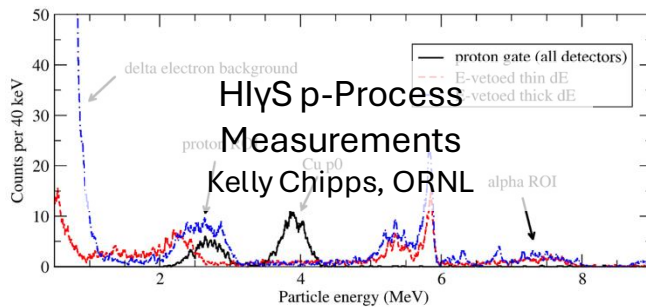
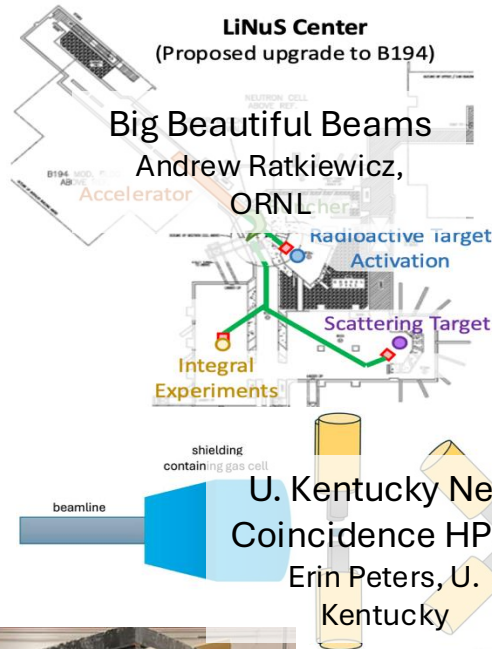
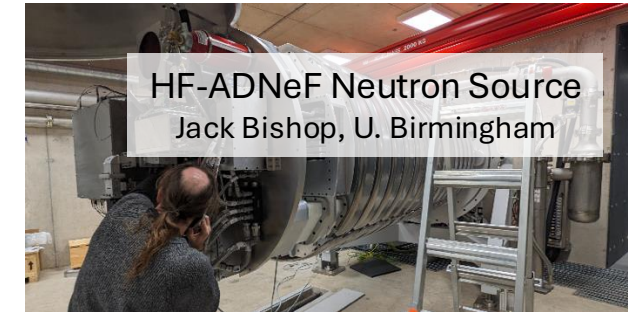
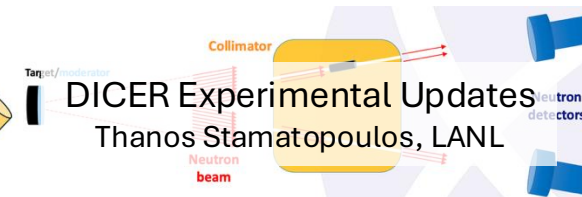
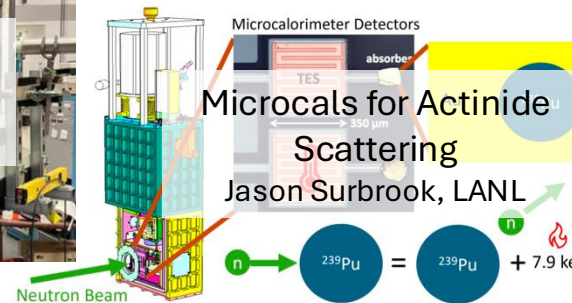
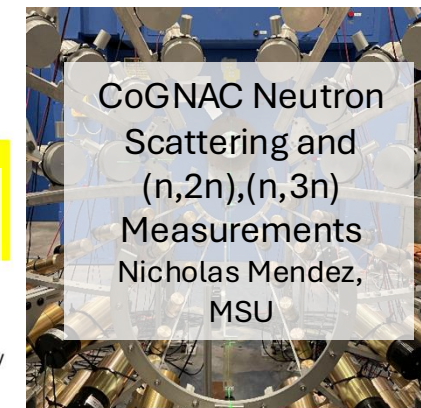
- New technologies for DAQ have been explored spanning topics such as:
 - Compact digitizers with data streaming capabilities and timing synchronization
 - Streaming Readout aiming to complement/replace the hardware-based trigger with a more powerful and flexible software-based approach, that considers the whole detector information for efficient real-time data tagging and selection
 - Timing distribution systems that allows high resolution timing (<30ps) measurements between spectrometers and fragment separators and experimental setups (tens of meters apart)
- Implementation and integration of DAQ and data streaming pipelines to DOE High Performance Computing facilities to increase time for science
- The arrival of GRETA at FRIB!

Summary of the Working Group on n and γ Beams

[$\approx 9 \pm 2$ Virt. Participants]
[$\approx 30 \pm 2$ In-person]

Necessary Complement to Charged-Particle Efforts

- Innovations are expanding the reach and precision of direct n and γ measurements
- New capabilities enhance agility to respond to sponsor and community needs



AT-CATS Working Group:

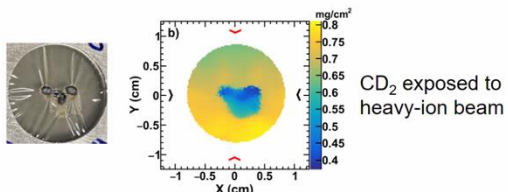
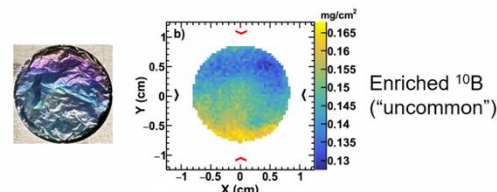
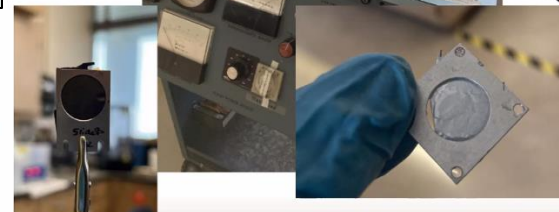
Targets are Critical, and the Community is Working to Increase and Improve Targetry Capacity



- updates from the target labs at San Jose State (Nick Esker), TAMU (Travis Hankins), and CATS (Claus MG) – *we are growing!*
- an outlook from Arizona Carbon Foils (Connie Stoner) – *commercial companies can help!*
- news from INTDS (John Greene) – *next meeting is in Japan, join the Society!*
- NTDSS 2025 (Phil Adsley) – *hosted in the coming days at TAMU, we're forming a new organizing committee!*

& thanks to the AT-CATS cats:

Max, Twitch, Shanks, Finch, and Tanks

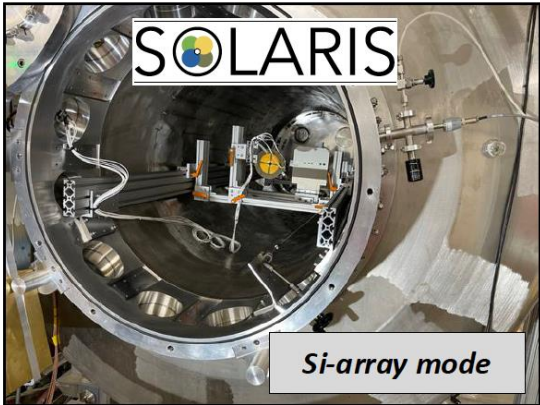


Solenoid Detectors Working Group Summary 2025

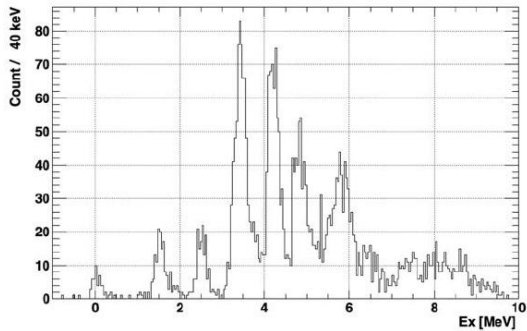
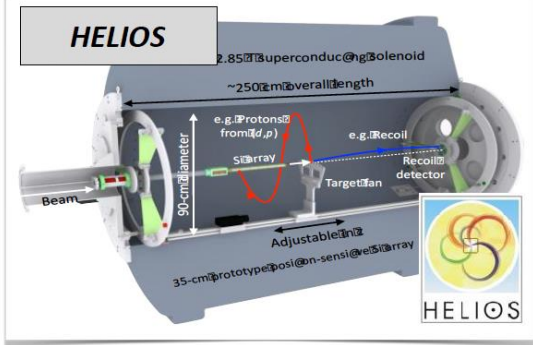
Updates from: HELIOS, SOLARIS, ISOLDE Solenoidal Spectrometer (ISS), AT-TPC, SSNAPPD [approx. 40 attendees across Zoom & in-person]

Speakers: Ben Kay (Argonne), Daniel Bazin (FRIB), Liam Gaffney (Liverpool), Cade Dembski (Notre Dame), Yassid Ayyad (USC)

Take-away points: vibrant, growing community, exciting progress/upgrades and results from all devices, new ideas to evolve capabilities/targets

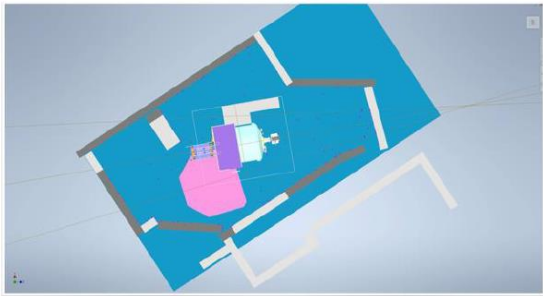
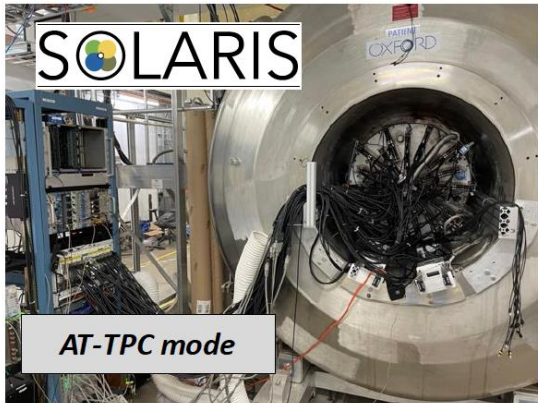


SOLARIS: Major mechanical structures and DAQ complete, Si arrays nearing completion. Two Letters in past 18 months. *First successful measurement with FRIB via study of the $^{29}\text{Mg}(d,p)$ reaction (July 2025)*

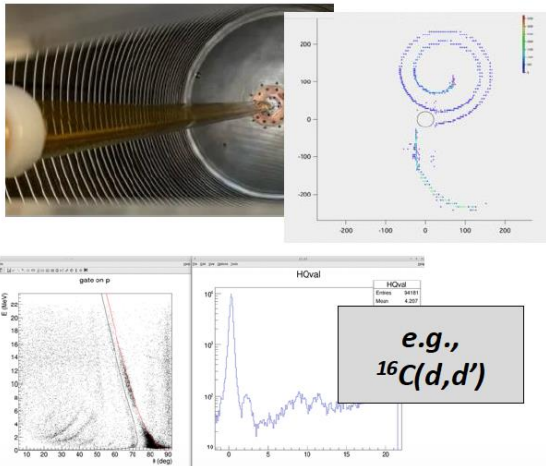


HELIOS: ‘workhorse’ device, common infrastructure with SOLARIS, many successful studies with in-flight beams in 2024-2025.

Planning to move HELIOS to new location at ATLAS, the former ATSCAT area to enhance RAISOR program (transmission improvement and beam tracking) – targeting winter of 2026-2027. Second AT-TPC campaign planned.

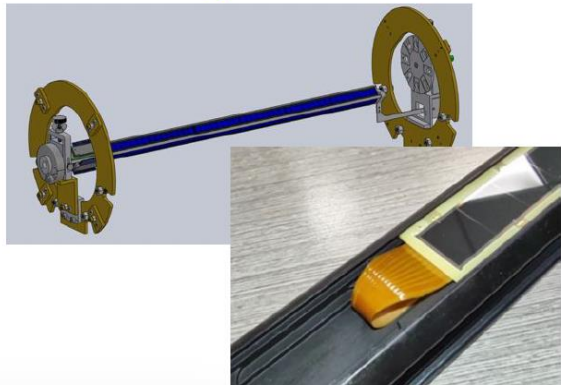


AT-TPC: Successful first campaign at ATLAS, great data from FRIB, and demonstration of the new “inner tube” for rare gases, focusing first on ^3He , opening up many new opportunities



ISS: Full exploitation mode, many new results ($^{132}\text{Sn}(d,p)!$), first fission studies.

SSNAPD: Using Notre Dame’s “TriSol” setup as a solenoidal spectrometer, *testing detectors and new mounting structure*



Nuclear Astrophysics Working Group

Organizers: Melina Avila (ANL), Catherine Deibel (LSU), Hendrik Schatz (MSU/FRIB)

Focus on new developments, equipment, collaborations, etc., of interest to the community for future work

- Oral contributions:

- J. Clark “What’s new with nuCARIBU and the N=126 Factory”
- D. Bardayan “New Developments for Nuclear Astrophysics Research at the Notre Dame Nuclear Science Lab”
- D. Robertson “Awakening the Underground Star Factory: The CASPAR Comeback”
- A. Richard “Nuclear Astrophysics Studies at Ohio University”
- L. Wagner “SECAR in Action”
- C. Stoner “Nuclear Chemistry & Target Fabrication at ACF-Metals”
- H. Schatz “The Center for Nuclear Astrophysics Across Messengers (CeNAM)”
- J. Blackmon “Nucleosynthesis Uncertainties Workshop Summary”

- Take aways:

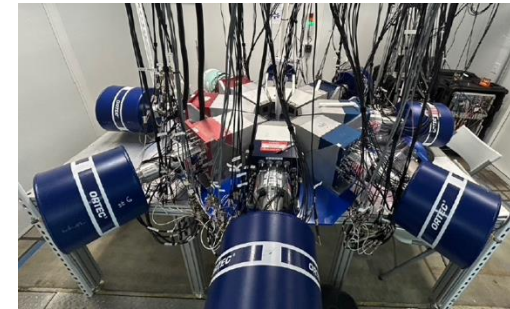
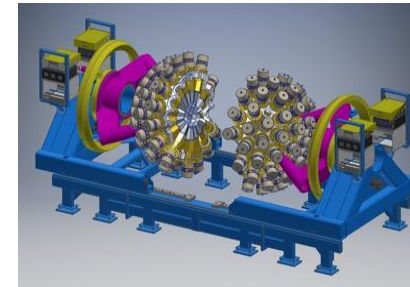
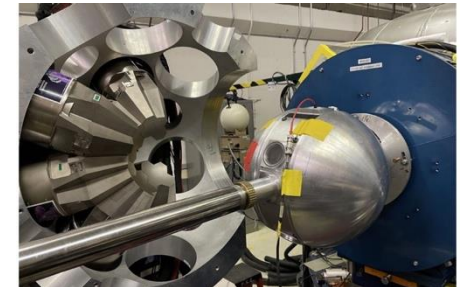
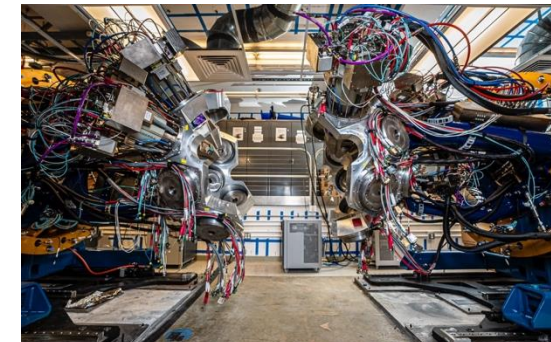
- There is a variety of exciting upcoming opportunities for unique measurements relevant to nuclear astrophysics (new equipment, new RIBs, new targets, etc.)
- Centers focused on facilitating collaboration and communication across the disciplines that span nuclear astrophysics is crucial to progress and success



High Resolution In-Beam Gamma Spectroscopy

- **GRETINA (Nirupama Sensharma - ANL)**
 - ✓ Final GRETINA campaign has been running from August 2024 – October 2025 at ANL.
 - ✓ Most active GRETINA campaign with three successful sub-campaigns have been performed with the FMA, GODDESS and CHICO-X totaling ~180 days of experiments.
- **GAMMASPHERE (Mike Carpenter – ANL/Ryan Tang)**
 - ✓ Gammasphere is getting ready for a new campaign at the AGFA for heavy element spectroscopy.
 - ✓ New electronics including a Timing-Analog Converter for RF timing have been developed/implemented.
- **CLARION (Vandana Tripathi – FSU)**
 - ✓ CLARION2-TRINITY remains at FSU, performing Coulex, sub-barrier transfer, fusion evaporation, and beta decay.
 - ✓ The TRINITY array now has 5 rings fully instrumented and a BeGe has been incorporated into the array.
 - ✓ Modifications have been made to allow the array to run with 16 LaBr₃ detectors.
- **HYPERION (Jason Harke- LLNL)**
 - ✓ HYPERION is largest gamma-ray array within NNSA complex with capacity for 14 detectors.
 - ✓ Received final funding for all 14 HPGe clovers and BGO shields with expected completion in 2028.
 - ✓ Suite of software has been developed for offline analysis and data reduction.
- **GRETA (Paul Fallon – LBNL/Stephen Gillespie - FRIB)**
 - ✓ GRETA has **CD-4A approval** following system integration and demonstration of performance at LBNL.
 - ✓ Delivery of GRETA from LBNL to FRIB is underway and commissioning efforts will soon begin to get GRETA ready for experiments.
 - ✓ At PAC 4 GRETA will be offered for experiments in S3 (with the S800) and ReA6 with first experiments possible late 2026/early 2027.
- **GROVER (Mitch Allmond - ORNL)**
 - ✓ New Legend-Greta hybrid prototype with 4 p-type, point-contact, HPGe crystals for x-rays and g-rays
 - ✓ Large dynamic range (20-keV to 10 MeV), excellent energy resolution (0.8 keV at 122 keV and 1.6 keV at 1408 keV), and PSD capabilities
- **LaBr (Vasil Karayonchev - ANL)**
 - ✓ Opportunities for fast-timing measurements at ANL; looking to establish a collaboration for LaBr array

GRETA Phase 1 construction is complete, and commissioning at FRIB will begin soon. It will enable, alongside existing arrays (Gammasphere, CLARION, HYPERION, Clovershare), world-class physics across the community. New detectors (GROVER) are being developed to expand capabilities.



FRIB Theory Alliance Summary



Theory
Alliance

LECM
LOW ENERGY COMMUNITY MEETING

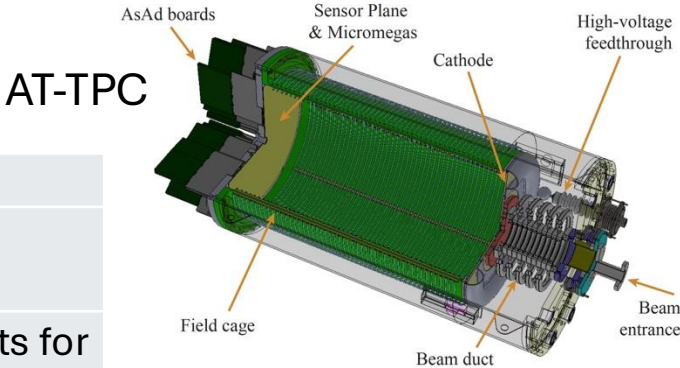
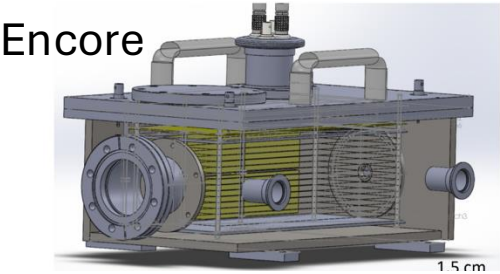
Most wanted: nuclear structure input for reactions modeling	Grigor Sargsyan	FRIB/MSU
Theoretical description of low-energy nuclear reactions	Linda Hlophe	LANL
Ab-initio nuclear theory at the superheavy frontier	Francesca Bonaiti	ORNL
Advancing nuclear physics with emulator technology	Xilin Zhang	FRIB/MSU
Ab-initio G-DMRG for broad many-body resonances	Kevin Fosse	FSU
Few-body methods for bound states and resonances	Sebastian Koenig	NCSU
Active learning for the nuclear equation of state and nuclear scattering	Christian Drischler	OU
FRIB-TA Managing Director's annual business report	Scott Bogner	FRIB/MSU

- ❑ 30 attendees (25 in-person, 5 virtual)
- ❑ 3 FRIB-TA bridges and 4 fellows presented highlights from their research covering a wide range of topics in structure, reactions, fundamental symmetries, uncertainty quantification, and emulator development
- ❑ The managing director summarized the outcome of the renewal and reviewed the FRIB-TA's activities of the last year

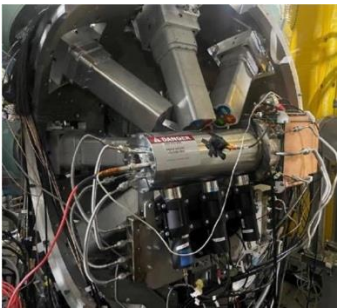
TPC Working group

Daniel Bazin (Michigan State U)	Update on the AT-TPC
Ruchi Mahajan (U of Kentucky)	GADGET Detection System: Current Status and Future Outlook
Jaspreet Randhawa (Mississippi State U)	Development and characterization of gas targets for TPCs for fusion and fission measurement
Sergio Almaraz-Calderon (Florida State U)	Encore
Eilens Lopez Saveedra (Argonne National Lab)	MUSIC
Tony Ahn (CENS, IBS, Korea)	AToM-X for Direct (α ,p) Cross Section Measurements at Low Center-of-Mass Energy

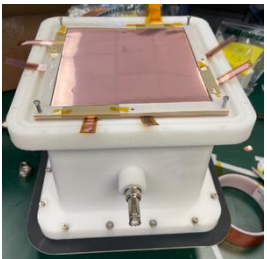
- A wide variety of TPCs has been constructed or are being developed in the US (and worldwide) for the experiments with RIBs and stable beams.
- The technology has matured, and an impressive number of successful experiments have been performed over the last several years.
- There are still challenges of accommodating many thousands of channels of electronics (required for some TPCs) sustainably.



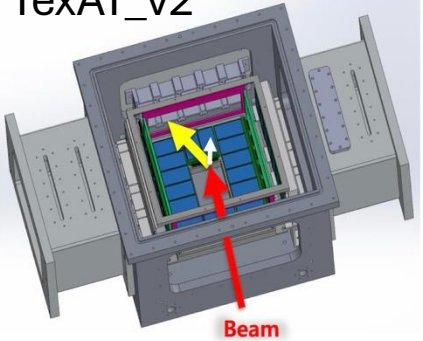
GADGET



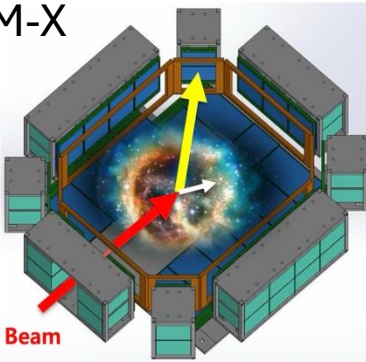
SREFT



TexAT_v2



AToM-X



Precision Measurements WG: Nuclear Science @ National Labs & Universities

- Fundamental Symmetries:
 - RaX: significant progress towards trapping radium-containing molecules for high sensitivity searches for time-reversal violation (MIT/Caltech)
 - NEPTUNE: new program to systematically survey parity-violating anapole moments using trapped molecular ions (TAMU)
 - ST. BENEDICT: Poised to survey beta-neutrino correlations to expand the list of nuclei used for the CKM matrix V_{ud} determination (ND)
 - A new search for the claimed 60 eV? parity doublet in ^{229}Pa using two different cryogenic quantum sensors will be launched soon (FRIB)
- Laser Spectroscopy for Nuclear Structure and Nuclear Astrophysics
 - ATLANTIS: Study of nine neutron-rich Ruthenium isotopes highlight the importance of triaxiality (ANL)
 - BECOLA/RISE – Charge radii measurements of ^{22}Al and ^{23}Al are consistent with no halo structures (FRIB)
 - BECOLA/RISE – Demonstrated improvement in Ni spectroscopy is poised to improve the determination of the slope of the symmetry energy using mirror nuclei by a factor of x2 (FRIB)
- N=126 Factory (ANL) construction and commissioning is well underway with the first precision mass measurements to be reported at the next LECM
- Dedicated two-day satellite workshop was very successful (separate summary)

Radioactive Decay Station Working Group session

Session 1: Thursday August 14, 2025 12:50 – 1:20 pm

Conveners: Robert Grzywacz (UTK), Sean Liddick (MSU),
Nick Scielzo (LLNL), Darek Seweryniak (ANL)

~60 in attendance
In person+zoom

Update on experimental efforts since LECM 2024

J.M. Allmond (ORNL) - FDSi status report,

Z. Xu (UTK) – Summary of 2025 FRIB decay experiments,

D. Seweryniak (ANL) - Overview of decay spectroscopy at ANL,

O. Trasow (FRIB) - Particle identification and FDSi experiments,

M. Piersa-Silkowska (UTK) – Decay experiments with polarized beams,

FRIB and FDSi:

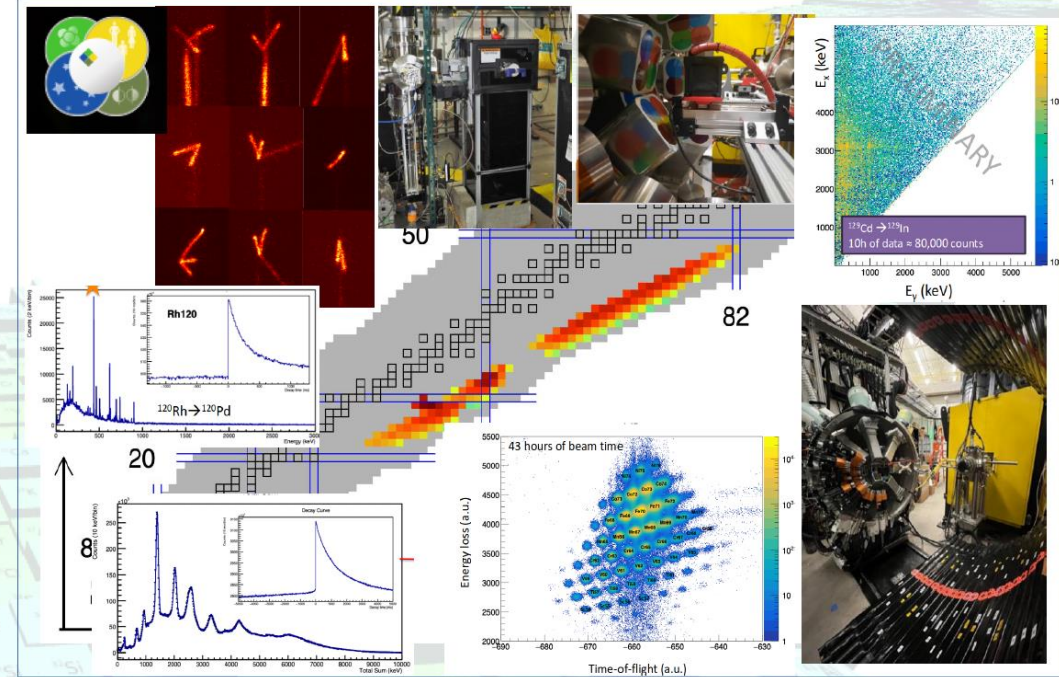
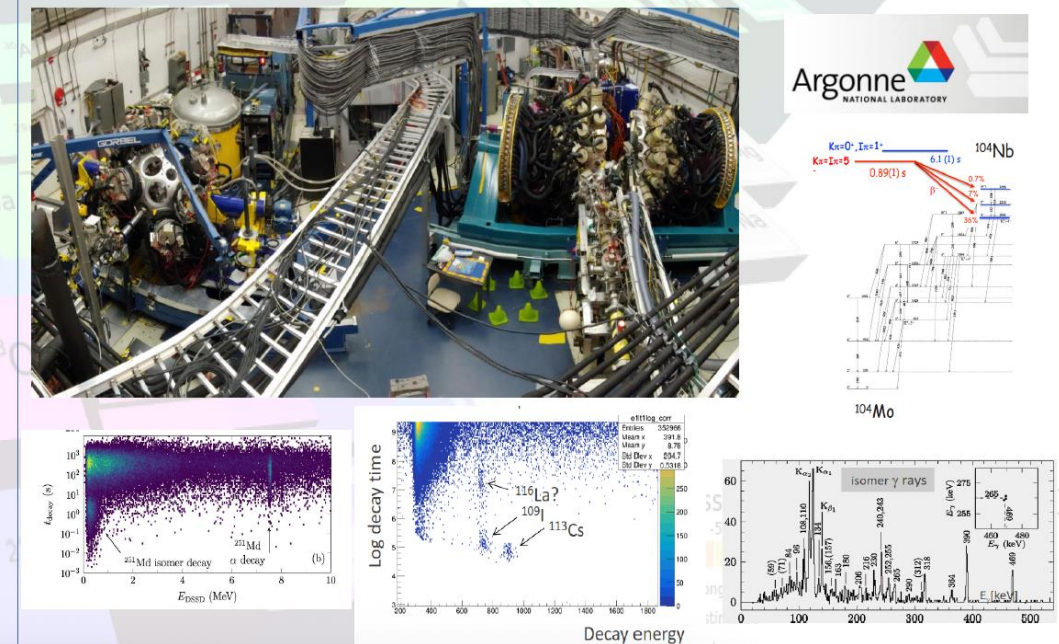
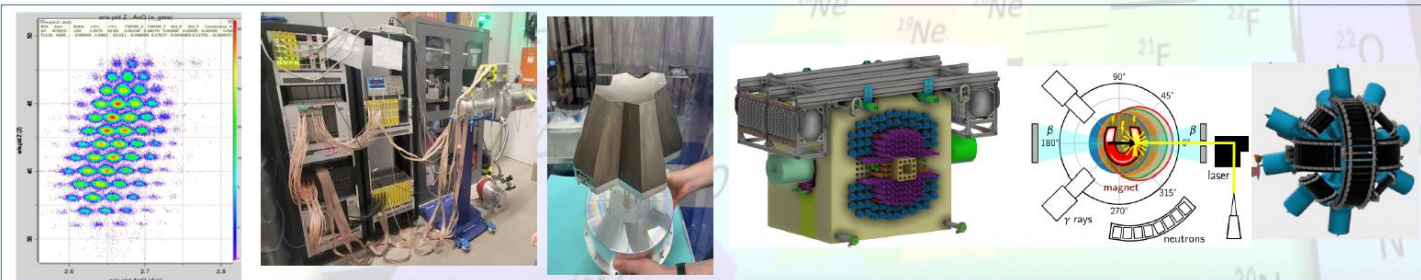
- 6 decay experiments, high quality data, with 20 kW beams,
- FDSi in new FRIB vault (S1),
- First experiments with fission beams at FDSi,
- Regions of ^{48}Ni , ^{78}Ni and ^{132}Sn ,

ATLAS:

- New published results from Agfa, FMA and Gammasphere,
- NuCARIBU – X-ARRAY, MTAS, SunTAN, LACES,

Developments:

- Challenges of high-Z experiments,
- Improved PID methods,
- Charge states and cross sections,
- High-resolution with point contact detector (ICPC),
- Silicon array for FDSi experiments,
- Neutron detectors,



Heavy Element Working Group Summary

Had four presentation on Heavy Element Work labs within the US:

- **ANL**: Spectroscopy of K-isomers around doubly magic deformed shells
- **Texas A&M**: Investigations of entrance channel effects on SHE production and efforts towards novel chemistry studies of superheavy elements
- **ORNL**: Overview of SHE results from around the world
- **LBNL**: Efforts towards a search for Element 120 at Berkeley Lab

Main take aways

- International efforts to search for elements 119 and 120 are heating up with RIKEN, Dubna, IMP and Berkeley in the mix
- Keen interest in properties of SHE beyond new element searches:
 - Probing k-isomers
 - High precision mass measurements
 - Discovery of new isotopes
 - Chemistry

