SECAR Separator for Capture Reactions

Argonne National Laboratory
Central Michigan University
JINA-CEE
Louisiana State University
Michigan State University
Oak Ridge National Laboratory
University of Notre Dame
McMaster University
Indiana University

H. Schatz, August 2015, Low Energy Community Meeting, Slide 1
We Have Come A Long Way

- Direct measurements of astrophysical reaction rates was part of the science goal of an advanced US rare isotope facility from the beginning (ISL studies 90s), LRP2007, FRIB benchmark requirement
- ARIA group discussed first specific project to establish a recoil separator
- JINA driven development of St George separator at Notre Dame, led by G. Berg and M. Couder offered a possible concept
- Many collaboration meetings discussed designs and requirements.
- SECAR collaboration started to develop a St George “inspired” concept and pursue funding opportunities, initially supported by Notre Dame, MSU, JINA
- 2012: Obtained DOE-SC/NP funding to develop a pre-conceptual design
SECAR Enables Direct Measurements of Astrophysical Reactions with ReA3 Beams

KPP: 1e-13 rejection up to A=65
UPP: 1e-17 rejection up to A=65
+/- 25 mrad acceptance
Max rigidity: 0.8Tm, 16 MV

JENSA Gas Target, Incl γ-ray detectors:
U. Greife (CSM), K. Chipps (ORNL)

Focal Plane Design:
J. Blackmon (LSU)

Separator Design:
G. Berg and M. Couder (Notre Dame)

Phase 2

Phase 1

Radioactive beam from ReA3 reaccelerator

H or He gas target

Beam

VF1

VF2

FP1

FP2

FP3

FP4

"Scattered Beam"
SECAR Project Started

- Successful reviews summer 2014 (external experts), October 2014 (DOE-SC/NSF), January 2015 (DOE-SC/NSF)

- SECAR project start March 1, 2015 (Phase 1)
  - For now started establishing SECAR Phase 1 at $9.3M funded by DOE-SC
  - Seek funding for SECAR Phase 2 for $2.4M: will propose to NSF
  - Goal is to execute both phases concurrently to reduce cost and risk

- Project Status
  - On budget and on schedule to deliver SECAR by 2022 (FY2022 Q1) manage to early completion in 2020
  - Ready to select vendors for major procurements (shoot for contract signing in September)
Organization

Delivers defined project scope

- Kent Holland: PS
- Tom Russo: HV
- Manoel Couder: Magnets/WF
- Jeff Blackmon: Focal plane
- Kelly Chipp: Gas target
- Ulrike Hager: DAQ
- Fernando Montes: Diagnostics

SEPARATION

- Infrastructure (Fernando Montes, MSU)
- Separator Systems (Manoel Couder, ND)
- Experimental Systems (Jeff Blackmon, LSU)
- Commissioning (Fernando Montes, MSU)

SECAR Collaboration Council
(Chair: Michael Smith, ORNL)

Project Controls
(Lynda Gauthier, MSU)
(Jim Curley, MSU)

Procurement
(Thomas Nowak, MSU)
New Collaboration Council

- Collaboration Council Functions
  - Represents broader SECAR collaboration in the project
    - Communicates collaboration needs to the project
    - Communicates project information to collaboration
    - Fosters growth of the collaboration
    - Works to make sure SECAR addresses needs of the collaboration

- Current Collaboration Council Members:
  - Dan Bardayan - Notre Dame
  - Alan Chen - McMaster Univ.
  - Catherine Deibel - LSU
  - Uwe Greife - Colorado School of Mines
  - Ernst Rehm - ANL
  - Michael Smith - ORNL (Chair)
  - Frank Strieder - South Dakota School of Mines
  - Chris Wrede - MSU
Project Scope Limited

- Project scope is sufficient to establish a device that fulfills the requirements. It’s the bare minimum as we saved cost as much as possible.

- For optimal science program with maximum impact we need:
  - Active and large collaboration
  - Students and postdocs that are trained at SECAR to carry out science experiments and develop capabilities
  - Supplemental technical developments to enhance capabilities and versatility. Examples:
    » Diagnostics
    » Gamma array (also measure branchings etc)
    » Other detection systems
    » Beam development
Summary

- SECAR will enable direct astrophysical capture reaction rate measurements at FRIB and exciting nuclear astrophysics research.
- It achieves an important goal of the US nuclear astrophysics community.
- We have an ion optical/conceptual design that fulfills requirements.
- SECAR project to realize this design has started with support from DOE-SC for Phase 1. Will seek support from NSF for Phase 2.
- We have a strong team and a strong collaboration in place.
  - Collaboration is open – welcome to join.
  - Now is a good time to think about engagement in SECAR.