



... for a brighter future

3rd Argonne-Fermilab Collaboration Meeting

The US Facility for Rare Isotope Beams (FRIB) Status and prospects at Argonne

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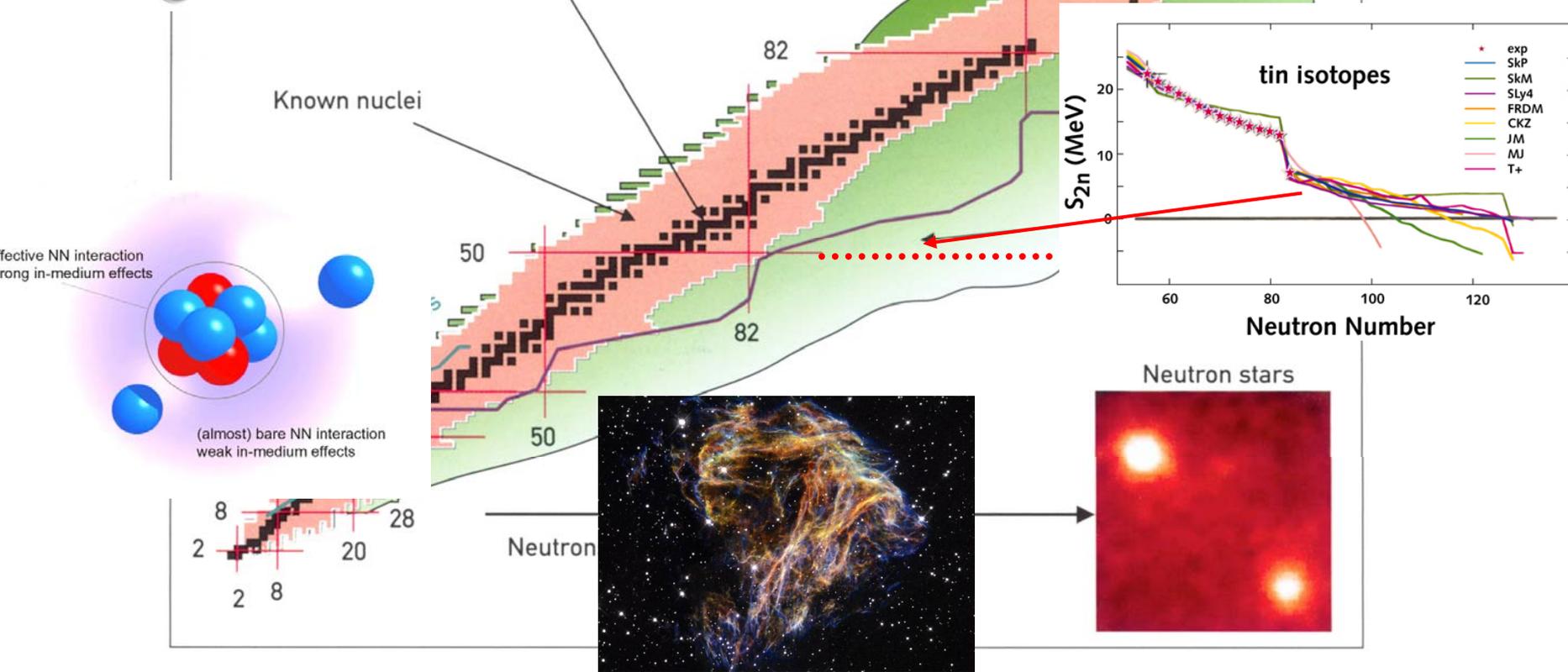
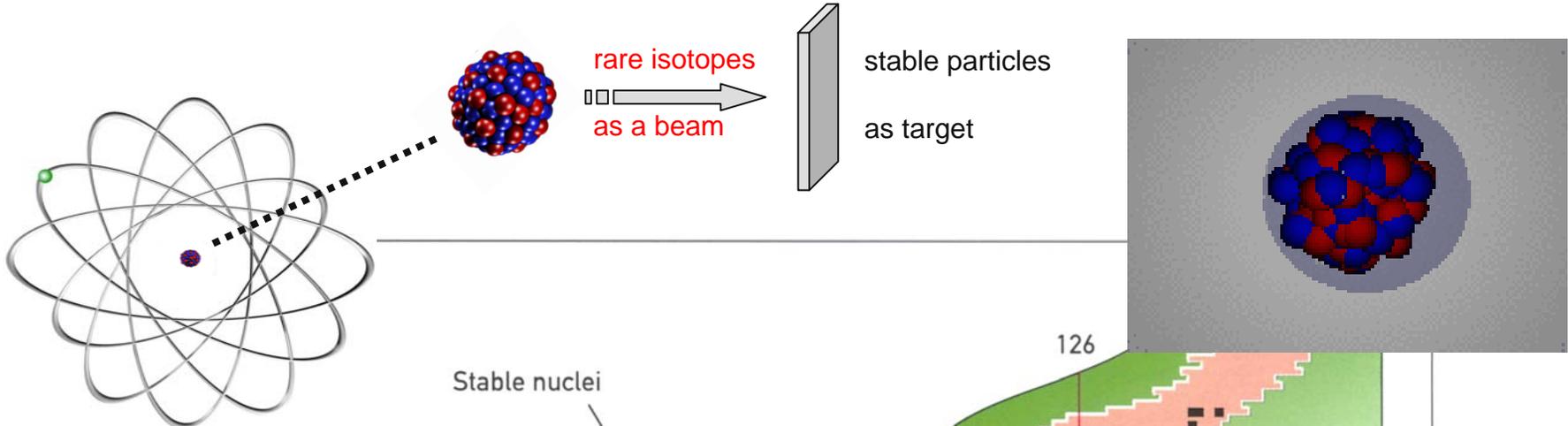
U.S. Department
of Energy



A U.S. Department of Energy laboratory
managed by The University of Chicago

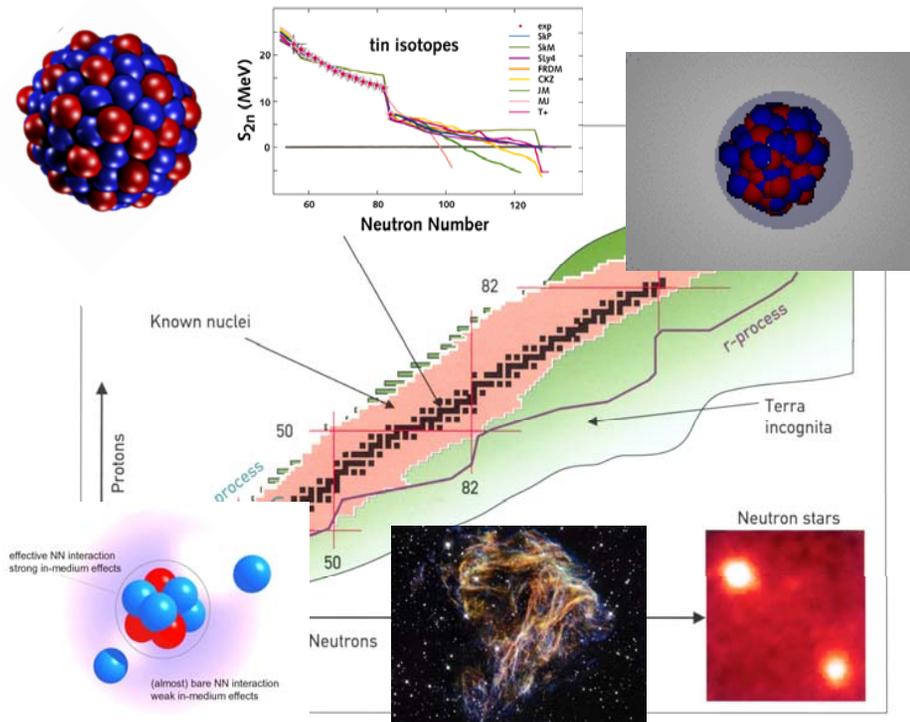
The Context

- There is a worldwide, highly competitive effort towards rare-isotope beam (RIB) facilities
- After a Request for Proposals (RFP) for the US Rare Isotope Accelerator (RIA) was canceled in 2005, the Secretary of Energy announced in 2006 a facility at half the cost of RIA. A Funding Opportunity Announcement (FOA) is expected for early FY08
- Strong support for the US facility and its science is reconfirmed in 2006/07 with a National Academy of Sciences (NAS) Report, a DOE/NSF Nuclear Science Advisory Committee (NSAC) Report and the NSAC Long Range Plan recommendation as the highest-priority new construction project
- Argonne has been a key player in the development of the major next-generation Rare Isotope Accelerator for the US, its novel technology and its unparalleled capabilities
- Argonne is preparing for the FOA of a reduced facility (FRIB at 550M\$) with:
 - facility concept with half the beam energy but equal beam power as RIA (AEBL)This involves a number of activities, among them:
 - formation of a proposal team and management structure
 - partnerships with universities and other national laboratories

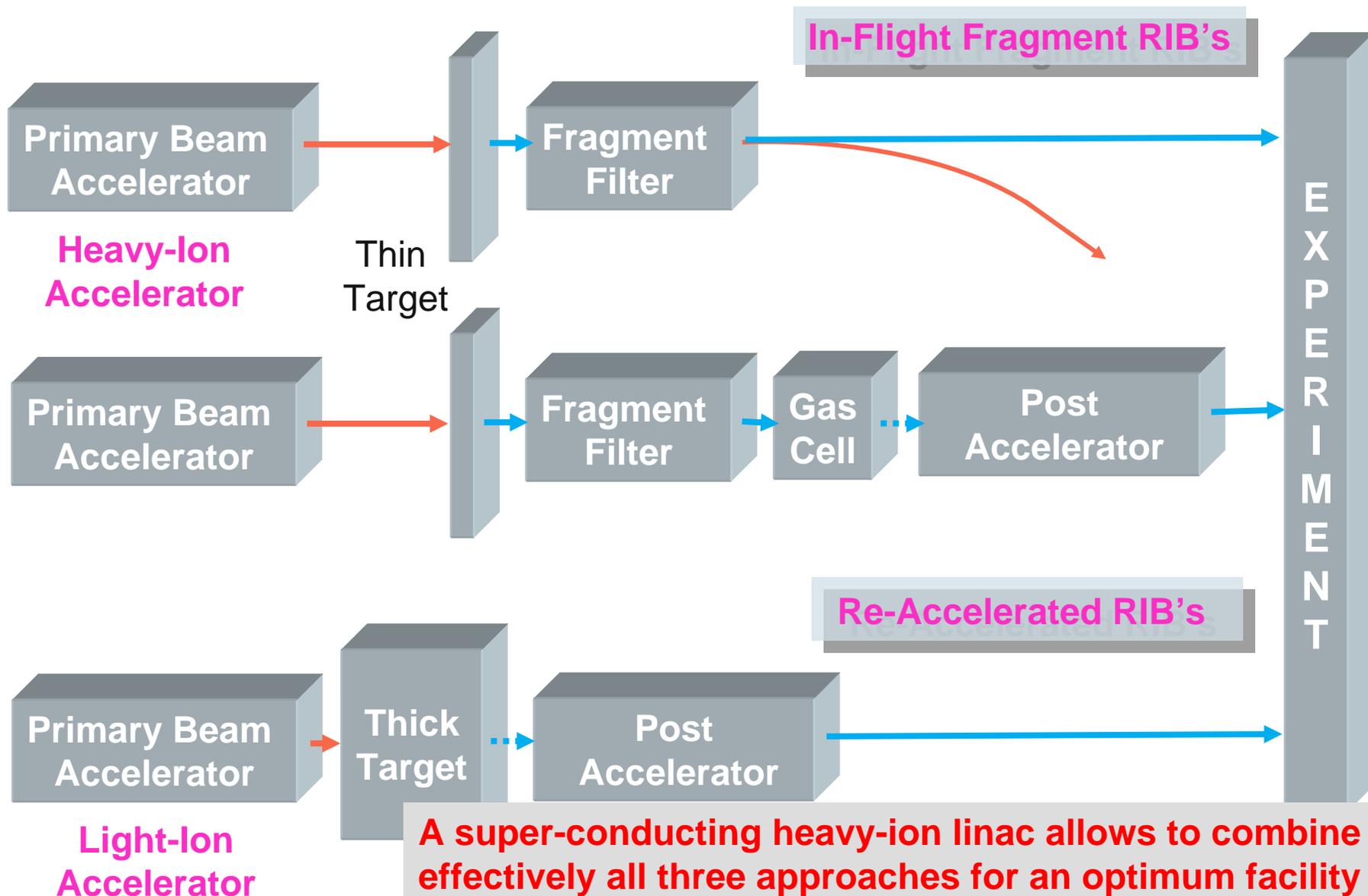


The Science Objectives of the Rare Isotope Facility

- The quantal nuclear many-body system represents *the* manifestation of the strong force in our visible universe. Its properties reflect the underlying fundamental interactions and symmetries. They shape the matter we are made of and the processes that produce that matter. It is important that we explore its properties in all regions of its existence. Specifically:
- Nuclei far from the valley of stability are different than their more familiar, stable counterparts; there are a number of serious competing ideas of why this is so but no resolution without experiment.
- These exotic isotopes are key to exploring the grand scale behavior of the cosmos, including the origin of the heavy elements and the nature of stellar explosions.
- Nuclei with specific properties provide unique opportunities for tests of fundamental interactions and symmetries
- The bounty of isotopes produced by an advanced facility holds great potential for applications in science and technology.
- Manpower trained in the techniques of exotic isotopes are critical for the nation's workforce.

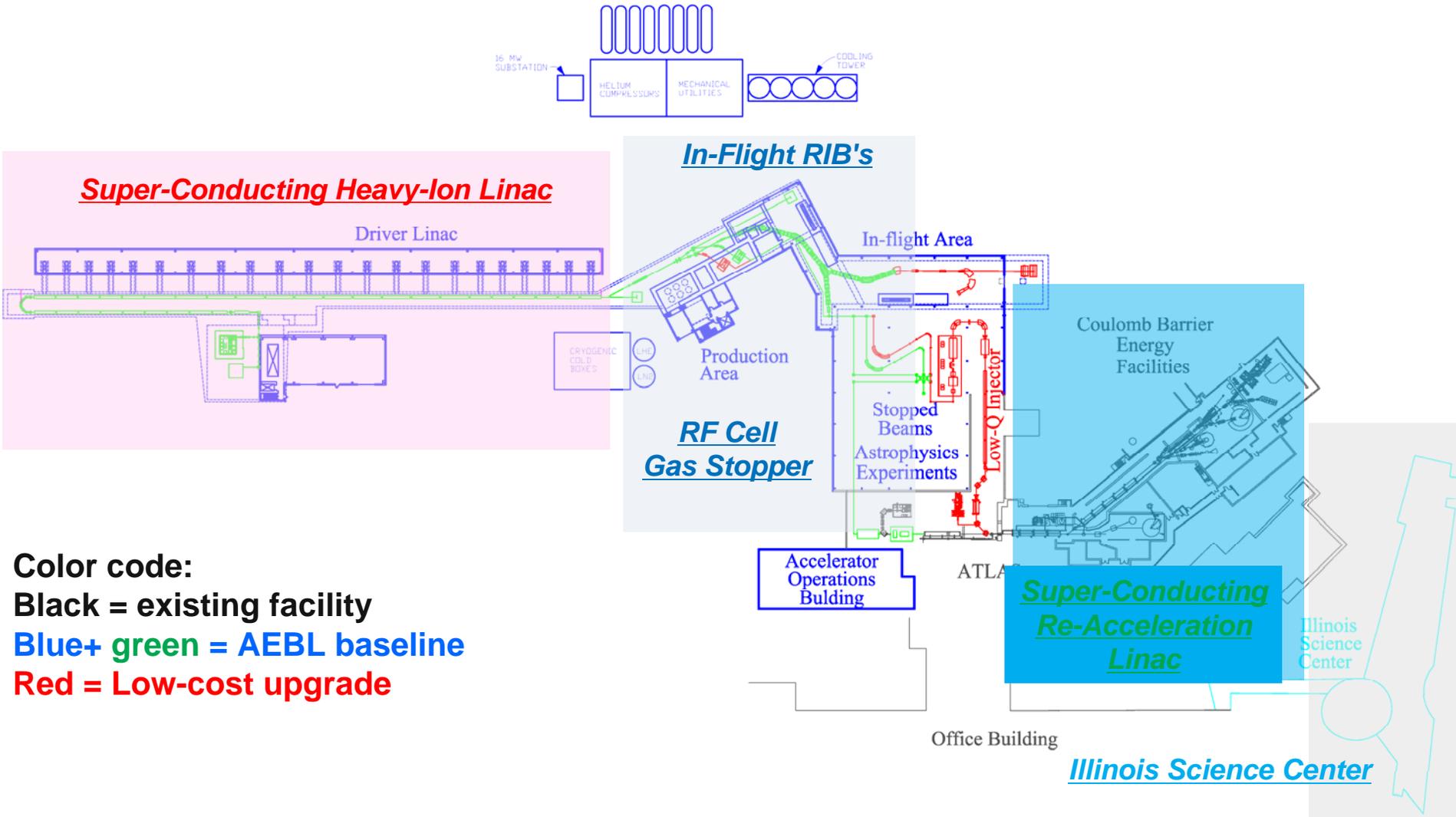


The Concept for FRIB



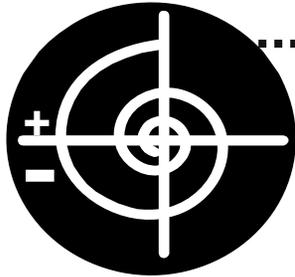
The Facility

Layout of FRIB at ANL (AEBL) – 200 MeV/u, 400 kW



The International Context

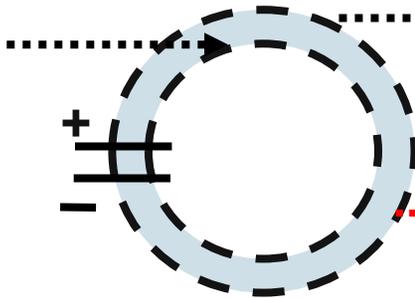
Cyclotron



MSU:
< 1kW

RIKEN:
<1kW
...10kW

Synchrotron



GSI:
<1kW
...25kW

Linac



FRIB:
400kW

MSU

ISOLDE/CERN

FAIR

GSI/Fair (2013)

TRIUMF

Protons only

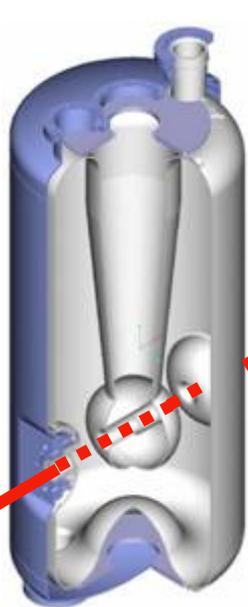
RIKEN RIBF (2007/8)

EURISOL (2020)

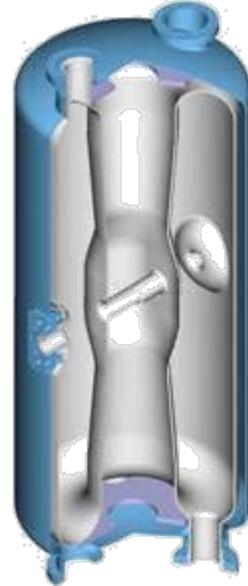
Protons (LI) only

The Technology

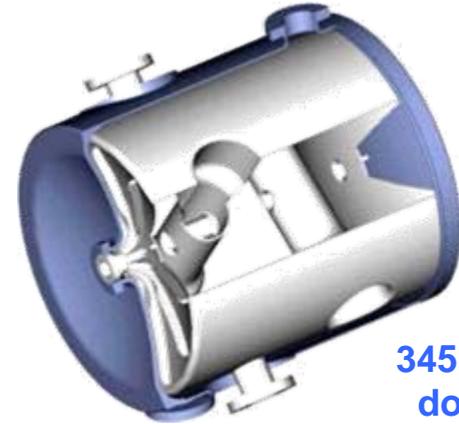
SC cavities covering the velocity range $0.12 < v/c < 0.8$ developed for the RIA driver linac and will be used in FRIB/AEBL



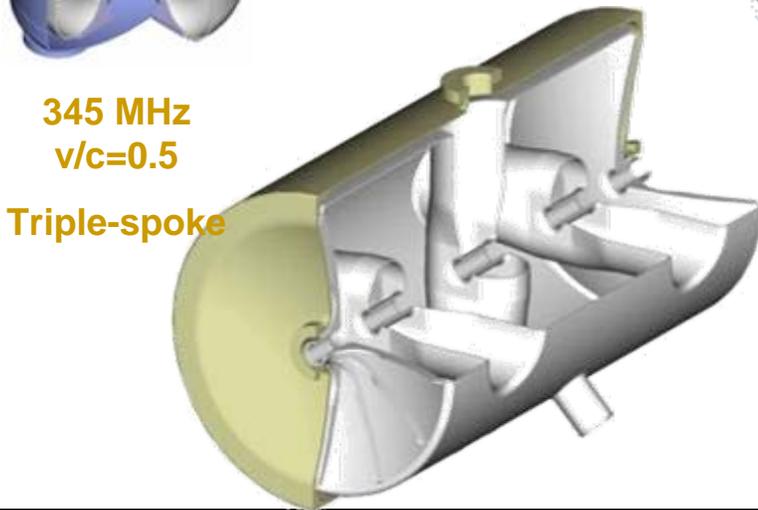
115 MHz
 $v/c=0.15$
Steering-
corrected QWR



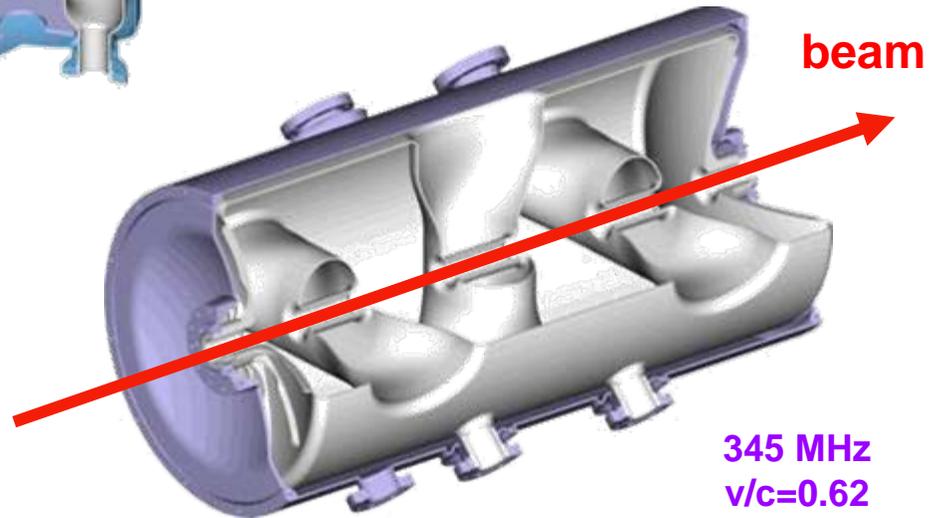
172.5 MHz
 $v/c=0.28$
HWR



345 MHz $v/c=0.4$
double-spoke

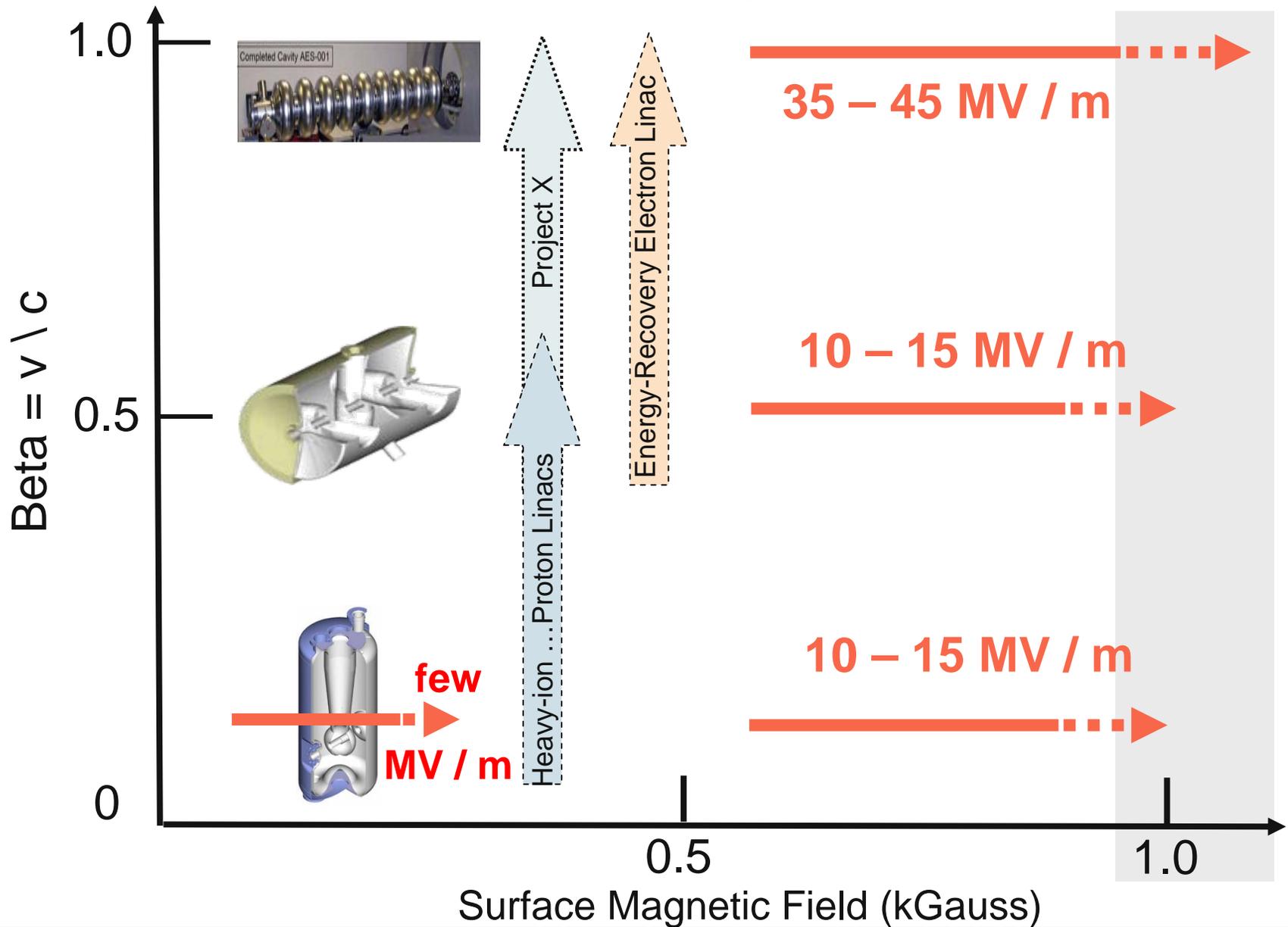


345 MHz
 $v/c=0.5$
Triple-spoke



345 MHz
 $v/c=0.62$
Triple-spoke

Performance Map for Super-Conducting Radio-Frequency (SRF) Cavities



Summary

There is a worldwide, highly competitive effort towards rare-isotope beam (RIB) facilities

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- Strong support for the US facility and its science is reconfirmed in 2006/07 with a National Academy of Sciences (RISAC) Report, a DOE/NSF Nuclear Science Advisory Committee (NSAC) Report and the NSAC Long Range Plan recommendation for highest-priority new construction project
- Argonne has been a key player in the development of the major next-generation Rare Isotope Accelerator for the US, its novel technology and its unparalleled capabilities
- UChicago Argonne, LLC, is preparing for the FOA for a reduced facility (FRIB at 550M\$) with:
 - formation of a proposal project group and management structure
 - facility concept with half the energy but equal beam power as RIA (AEBL)
 - incorporation of further recent technology advances achieved at Argonne
 - dialogue with MSU on partnership
 - setting up collaborations with other DOE groups and laboratories
 - pursuing partnerships with university groups
 - developing outreach activities
 - exploring connections to other sciences and to industry
- The three accelerator projects presently in preparation at Argonne and Fermilab offer attractive synergies in technology and R&D