Report from NSF

Ken Hicks

- Budget
- Physics Division Personnel
- Physics Highlights
- NSF Funding Opportunities

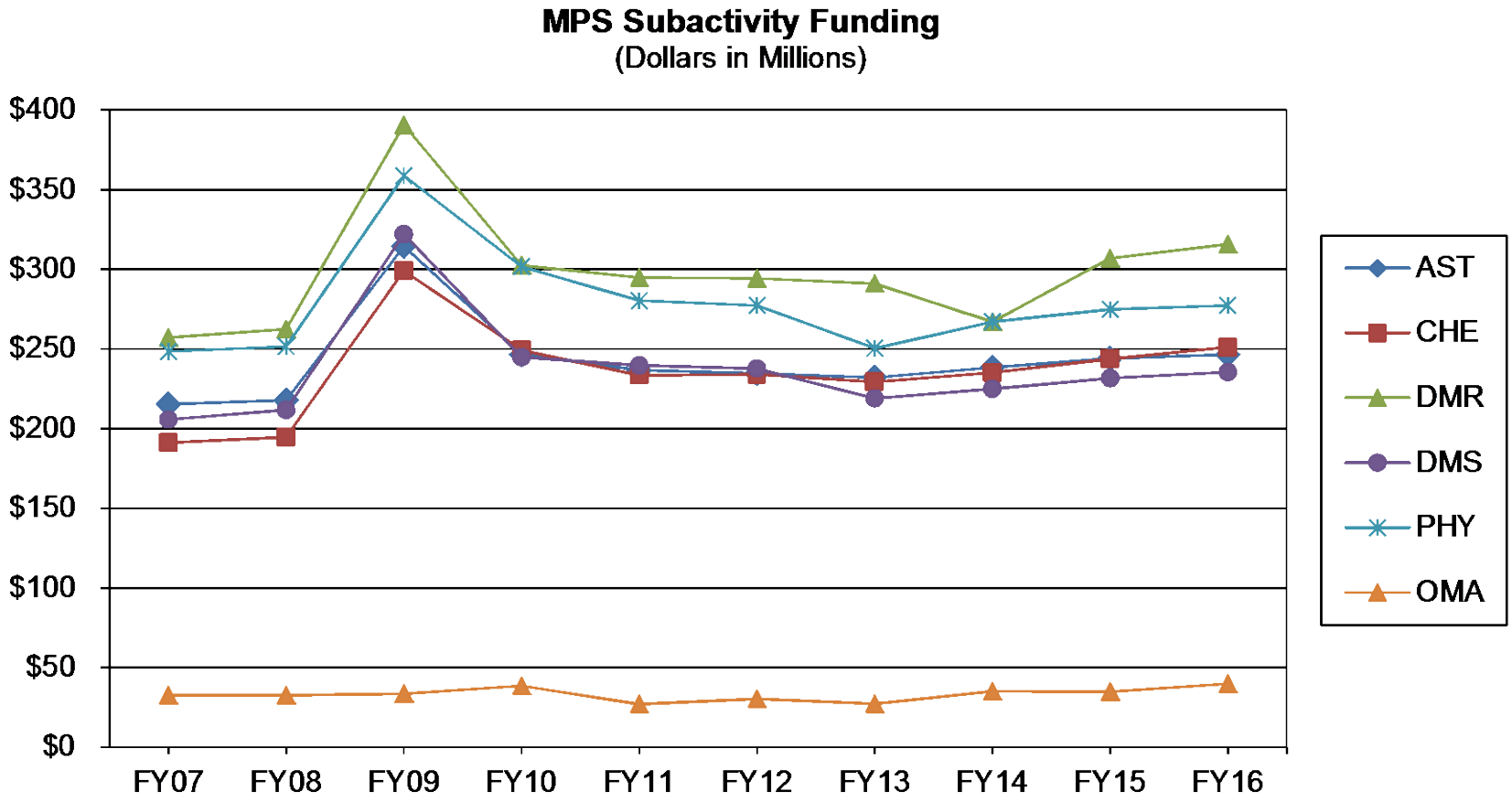
NSF FY15 Budget & FY16 Request

	FY 12 (M$)	**FY 13 (M$)**	**FY 14 (M$)**	**FY15** Estimate **(M$)**	Change from **FY14**	**FY16** Request **(M$)**	Change from **FY14**
NSF Total	7,105	6,902	7,131	7,344	+2.9%	7,724	+8.3%
R&RA	5,758	5,559	5,775	5,934	+2.7%	6,186	+7.1%
MPS	1,309	1,249	1,268	1,337	+5.4%	1,366	+7.8%

R&RA: Research and Related Activities (includes directorates)
MPS: Mathematical and Physical Sciences

NSF Priority Areas in which PHY participates:
Brain, **CIF21**, Optics and Photonics

NSF MPS Funding Trends



FY 2009 funding reflects both the FY 2009 omnibus appropriation and funding provided through the American Recovery and Reinvestment Act of 2009 (P.L. 111-5).

NSF PHY FY15 Estimate & FY16 Request

Physics (PHY) Funding

(Dollars in Millions)

	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	Change Over FY 2015 Estimate Amount	Change Over FY 2015 Estimate Percent
Total, PHY	**$267.09**	**$274.99**	**$277.37**	**$2.38**	**0.9%**
Research	**163.82**	**176.05**	**176.19**	**0.14**	**0.1%**
CAREER	8.57	7.44	7.45	0.01	0.1%
Centers Funding (total)	0.02	0.02	-	-0.02	-
Nanoscale Science & Engineering Centers	0.02	0.02	-	-0.02	-
Education	**5.38**	**5.56**	**5.32**	**-0.24**	**-4.3%**
Infrastructure	**97.89**	**93.38**	**95.86**	**2.48**	**2.7%**
IceCube Neutrino Observatory	3.45	3.45	3.45	-	-
Large Hadron Collider (LHC)	17.37	18.00	18.00	-	-
Laser Interferometer Grav. Wave Obs. (LIGO)	36.43	39.43	39.43	-	-
National Superconducting Cyclotron Laboratory (NSCL)	22.50	23.00	22.50 ?	-	-
Research Resources	11.56	-	-	-	N/A
Mid-scale Research Infrastructure	6.58	10.00	12.48	2.48	24.8%

Totals may not add due to rounding.

Budget Trends – NSF Nuclear Physics

FY	Hadrons & Light Nuclei (k$)	Structure & Heavy Ions (k$)	Fund. Sym. (k$)	Nucl. Astro. (k$)	Theory (k$)	Program Total (k$)	NSCL (k$)	JINA JINA -CEE (k$)	MRI (K$)	Mid-Scale (K$)	Total Nuclear Physics (k$)
2009	7,663	4,734	5,572	N/A	5,825	23,794	20,500	2,000	8,058	9,524	65,877
2010	6,421	6,863	5,532	1,078	3,855	22,672	21,000	2,150	1,134		46,956
2011	5,349	6,485	5,336	1,994	3,719	22,883	21,500	2,150	729		47,262
2012	7,657	3,375	5,855	1,610	3,829	22,326	21,500	2,150	2,744		48,720
2013	5,218	4,259	5,304	1,754	3,474	20,008	21,500	2,150	2,996	490	47,144
2014	5,275	4,215	5,250	2,475	3,514	20,728	22,500	2,280	1,038	1,188	47,733
2015	X,XXX	X,XXX	X,XXX + $0\nu\beta\beta$	X,XXX	X,XXX	YY,YYY	23,000	2,280			YY,YYY

MRI: competes each year; supplemental one-time acquisition/development funds
Mid-scale: ad hoc competition; supplemental construction funds

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2015	5,946	3695	6,953 includes 1,320 for $0\nu\beta\beta$	2,267	4,183	23,043	23,000	2,280		1,367	49,690 + Any MRIs

PRELIMINARY – INCLUDES ONE-TIME FUNDS

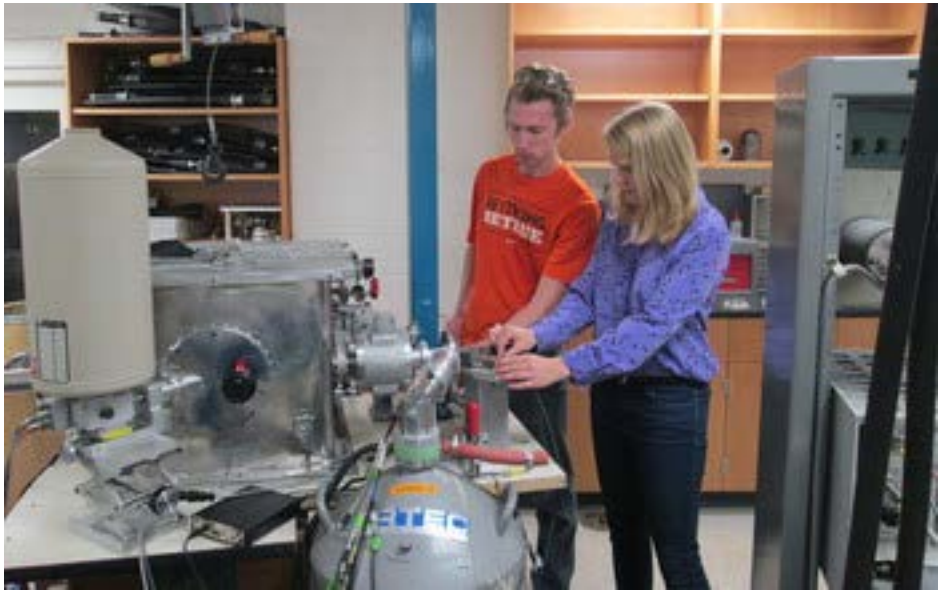
MRI: competes each year; supplemental one-time acquisition/development
Mid-scale: ad hoc competition; supplemental construction funds

NSF People

- France Cordova – Director (started in 2014)
- Fleming Crim – Associate Director for MPS
- Denise Caldwell – Physics Division Director
- Brad Keister – Deputy Division Director
- Bogdan Mihaila – nuclear theory program officer (permanent)
- Jim Whitmore – particle astrophysics program officer
- Jean Cottam – particle astrophysics program officer
- Allena Opper – nuclear experiment program officer (permanent)
- Ken Hicks – nuclear experiment program officer (rotator)*

*term ends in August 2016. Anyone interested in applying?

Nuclear physics technique helps companies detect dangerous compound



Hope College students David Lunderberg and Evelyn Ritter adjust the target wheel and detectors near a beam outlet.

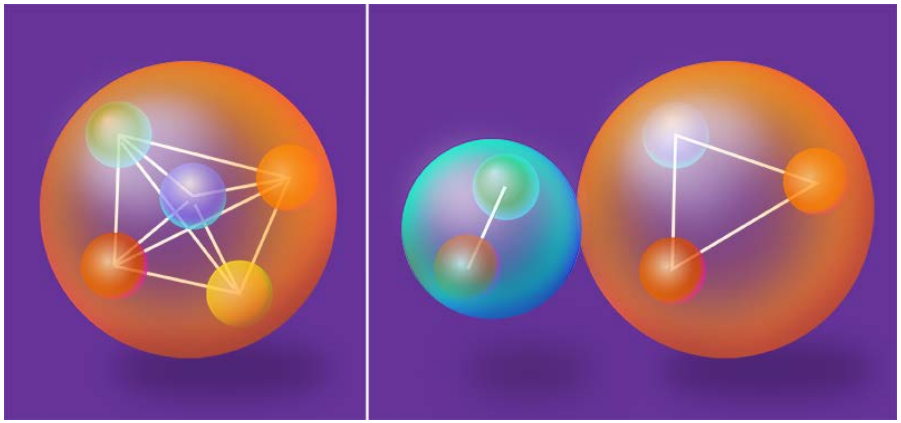
Chemical compounds with a strong carbon-fluorine bond, or perfluorinated compounds, were valued for their ability to help make everyday materials stain- or water-resistant.

But industry was forced to reevaluate its use of these compounds almost a decade ago, when scientists learned they were toxic, and didn't break down in the environment.

Peaslee used a non-destructive and relatively quick technique by applying a PIGE, or Particle Induced Gamma Emission, to detect these compounds.

See http://www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=135957

Physicists discover long-sought 'pentaquark' particle



Reported by LHCb Collaboration at CERN, led by NSF PI Sheldon Stone at Syracuse U., is the pentaquark, a new combination of five quarks that consists of a proton and a pair of heavy charm-anticharm quarks

http://physics.aps.org/articles/v8/77

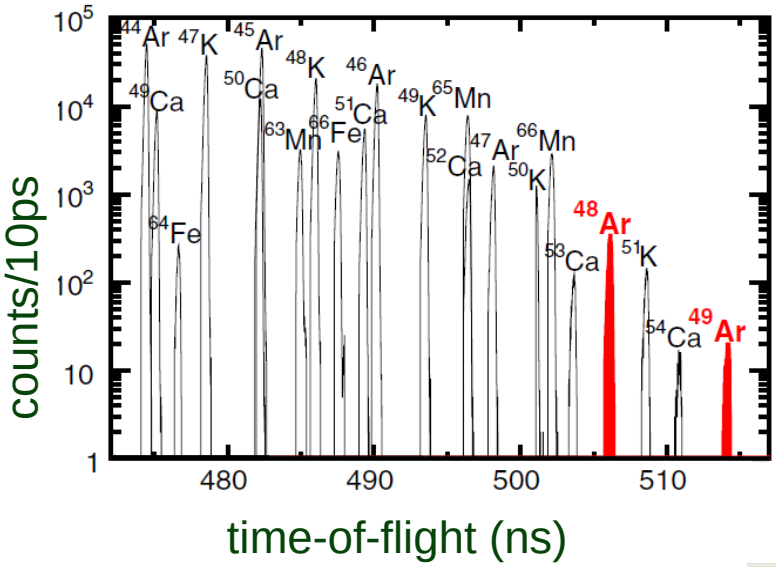
"While existence of pentaquarks was speculated on since the beginning of the quark model in 1964, it has taken 51 years to find a solid experimental evidence for their existence," said Tomasz Skwarnicki (also from Syracuse).

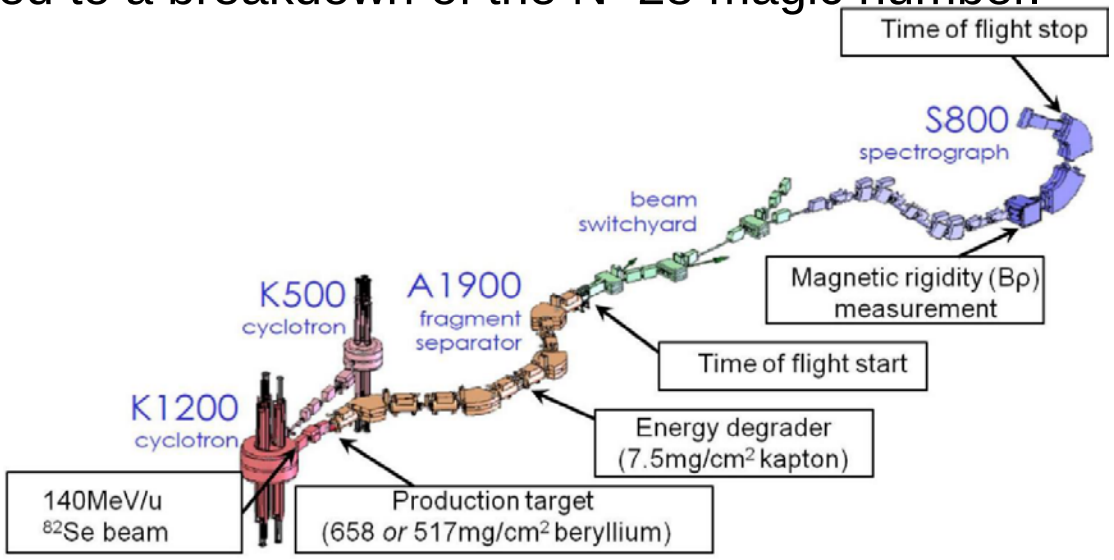
http://www.nsf.gov/news/news_summ.jsp?cntn_id=135680&org=NSF&from=news

Mass Measurements at NSCL Demonstrate a Strong *N*=28 Shell Gap in the Argon Isotopes

The nuclear mass is a fundamental observable that is critical for understanding the forces that bind nucleons into nuclei. Time-of-flight mass measurements with fast isotope beams allows the determination of masses of very short-lived isotopes with $\delta m/m<10^{-5}$ for only ~1000 isotopes detected.

First measurement of masses of exotic ^{48,49}Ar ($t_{1/2}$<0.5 s) with mass excesses of -22.280(310) MeV and -17.8(1.1) MeV, respectively. Results show that Argon is the lightest element with an N=28 nuclear shell-closure and suggest that the long-standing puzzle of ^{46}Ar is not related to a breakdown of the N=28 magic number.



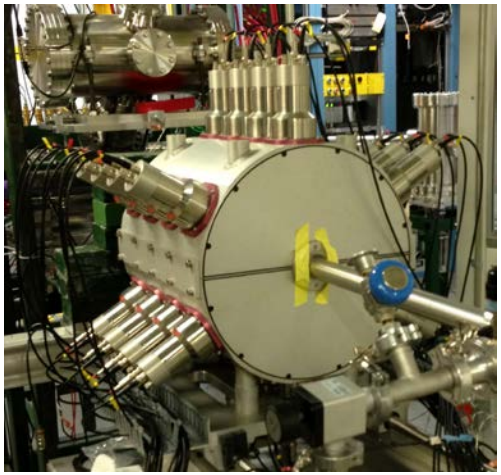


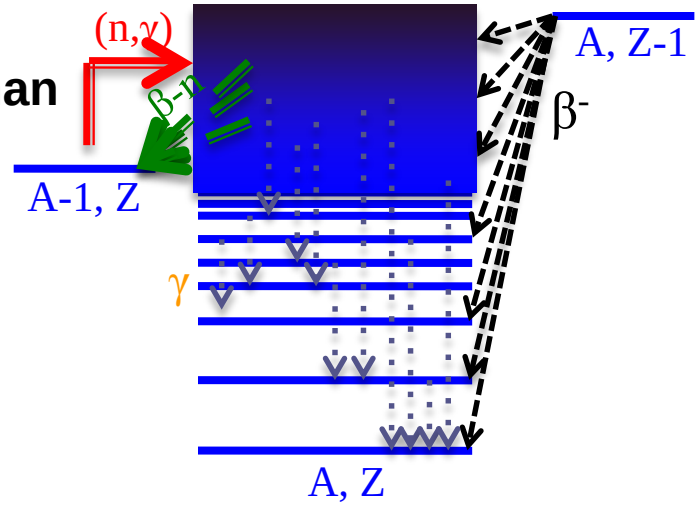
Z. Meisel et al., PRL 114, 022501 (2015)

New Technique Constrains Important Neutron-Capture Rates in r-Process Nucleosynthesis

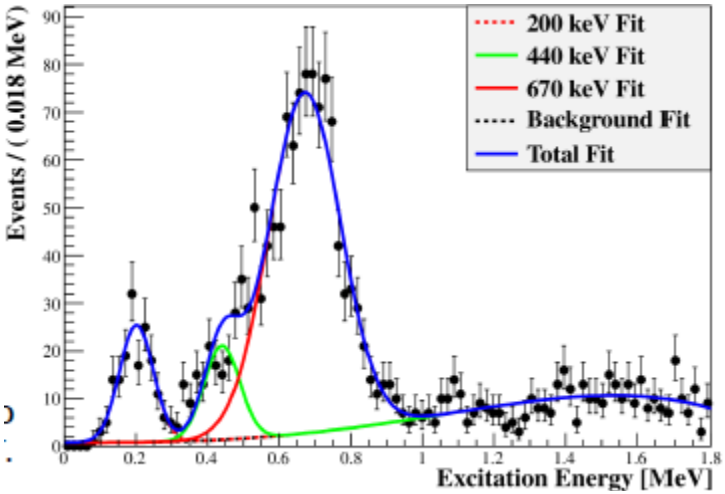
- For many cases uncertainties > x 100
- Technique uses β^- decay to populate the same nucleus as an (n,γ) reaction → determine its level density and γ-strength function. Knowledge of these can reduce the uncertainty of (n,γ) reaction rates to factors of 2-3. Makes measurements on relevant nuclei possible.
- Addresses one of the most important issues in nuclear astrophysics: **The origin of the elements heavier than iron (r process path and site)**

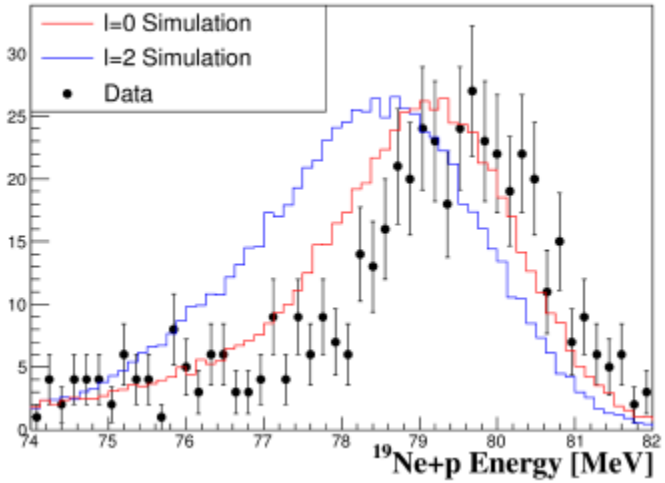
The Summing NaI (SuN) detector





rp-Process Nucleosynthesis





- **The ^{19}Ne(p,γ)^{20}Na reaction is the first (p,γ) reaction in rp-process nucleosynthesis.**
- Measured (d,n) to resonances with a radioactive beam of ^{19}Ne at FSU's RESOLUT facility
- Unambiguous spin-parity & energy determinations:
- 670 keV 1+ (l=0) resonance, at higher energy than reported
- 440 keV 3+ (l=2) resonance with (l=0) excited state proton-branch
- Astrophysical (p,γ) rate is higher than assumed, because of ^{19}Ne excited state capture
- No “bottleneck” for X-ray bursters
- FSU graduate student J. Belarge

FLORIDA STATE UNIVERSITY

Computational Physics

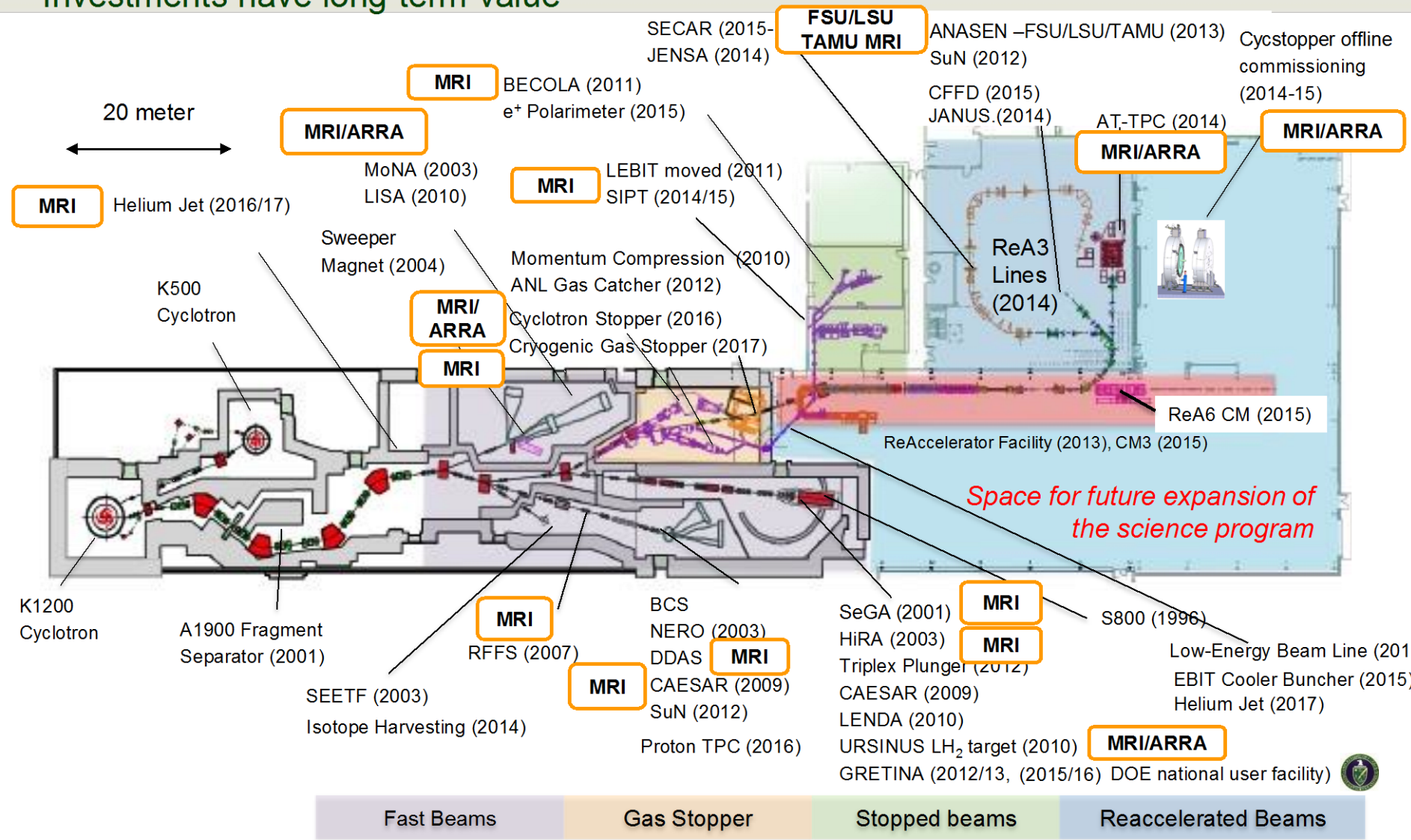
- MPS, ENG, and OCI have recently established a new cross-directorate program in Computational and Data-Enabled Science and Engineering. The goal of the CDS&E program is to identify and capitalize on opportunities for major scientific and engineering breakthroughs through new computational and data analysis approaches. (See solicitation 15-579)
- In Physics this program is implemented in the Computational Physics program, which includes support for data-enabled science, community research networks, and new computational infrastructure, as well as for next-generation computing.
- Contact Bogdan Mihaila for more information

Major Research Instrumentation (MRI)

- Two types of awards: development and acquisition
- Contact program officers well ahead of submission to discuss (avoid pitfalls)
- Limited submissions from each university
- Maximum award is $4 million; awards above $1 million must compete across the entire foundation
- Will be judged in part by merit of science that will be done with instrument
- Deadline: Jan. 13, 2016

NSCL Facility Layout

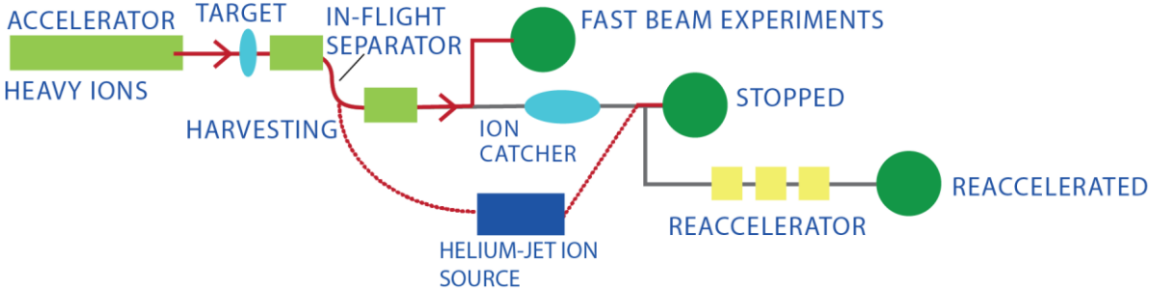
Developments and equipment enable forefront science and will be useful for FRIB – Investments have long-term value

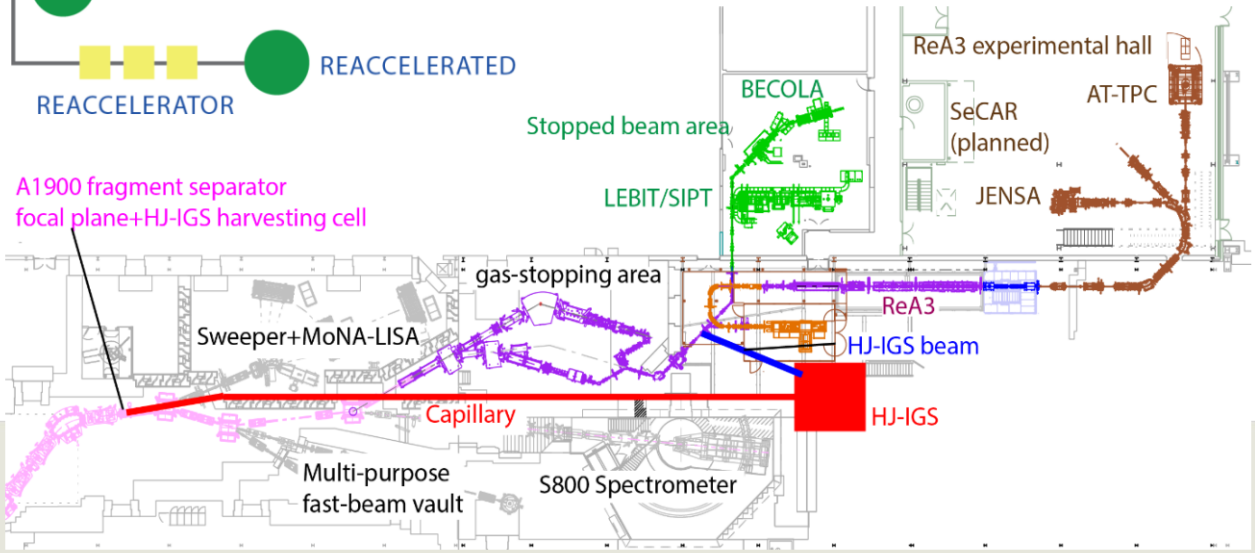


Helium-Jet Ion-Guide System (HJ-IGS) for commensal (multi-user) operation at NSCL

- Rare isotopes that would otherwise be lost are caught in a high-pressure cell filled with a helium-aerosol mixture placed off-axis in the fragment separator
- Harvested isotopes are transported through a capillary to the helium-jet ion source, where helium is pumped away and the rare isotopes are ionized
- Rare isotopes are accelerated to 60 keV, purified and delivered to experimental stations in the stopped and reaccelerated beam areas, while a fast beam experiment is simultaneously conducted

COMMENSAL OPERATION AT NSCL





Mid-Scale Instrumentation

- The Physics Division has established a mid-scale instrumentation fund. The intention is to fund projects above $4 million (the MRI limit).
- This funding is NOT available for “operations” so program funds are used to run the experiment.
- Contact us for more information. You cannot apply to mid-scale directly; all proposals must go through the program.
- A priority of the division (and the directorate) is to increase the resources available for mid-scale.

Final Remarks

- Experimental Nuclear Physics Proposals
  - Solicitation 15-579
  - Due Date: November 13, 2015 (second Friday of Nov.)
  - Please follow the Grant Proposal Guide checklist!
- Other requests (conf. support, supplements, etc.)
  - Please talk with us first (email or phone)
  - Submit at the same due date as above
  - Priority goes to summer schools and APS/CEU.

Tips on how NOT to get funded

- Who needs broader impacts??
  - Referees never pay any attention to this, right?
- What is a postdoc mentoring plan?
  - My postdoc doesn't listen to my advice anyhow…
- Cram as much as possible into the text.
  - The longer I make it, the more referees love it!
- Don't put your work in context.
  - I don't care what the PAC says, my research is brilliant.
- Don't proofread or spell check your text.
  - Any respectable referee doesn't care about grammar…

Backup Slides

Accelerator Science

- The Physics Division is accepting proposals to a new program in accelerator science. Proposals have been received for consideration in FY15.
- Next target date is February 3, 2016.
- Intended to fund accelerator science, not R&D for specific projects. Collaboration with a national lab (e.g., prototyping) is OK.
- Program Solicitation is posted (14-576).

Merit Review Principles

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.

- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These broader impacts may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.

- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to:
   a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
   b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

NSF FY16 Request Summary

National Science Foundation
Summary Table
FY 2016 Request to Congress
(Dollars in Millions)

NSF by Account	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	FY 2016 Request over: FY 2014 Actual Amount	FY 2014 Actual Percent	FY 2015 Estimate Amount	FY 2015 Estimate Percent
BIO	$720.84	$731.03	$747.92	$27.08	3.8%	$16.89	2.3%
CISE	892.60	921.73	954.41	61.81	6.9%	32.68	3.5%
ENG	833.12	892.31	949.22	116.10	13.9%	56.91	6.4%
Eng Programs	*673.13*	*715.20*	*754.86*	*81.73*	*12.1%*	*39.66*	*5.5%*
SBIR/STTR	*159.99*	*177.11*	*194.36*	*34.37*	*21.5%*	*17.25*	*9.7%*
GEO	1,321.32	1,304.39	1,365.41	44.09	3.3%	61.02	4.7%
MPS	1,267.86	1,336.72	1,366.23	98.37	7.8%	29.51	2.2%
SBE	256.84	272.20	291.46	34.62	13.5%	19.26	7.1%
OISE[1]	48.31	48.52	51.02	2.71	5.6%	2.50	5.2%
IA[1]	433.12	425.34	459.15	26.03	6.0%	33.81	7.9%
U.S. Arctic Research Commission	1.30	1.41	1.48	0.18	13.5%	0.07	5.0%
Research & Related Activities	**$5,775.32**	**$5,933.65**	**$6,186.30**	**$410.98**	**7.1%**	**$252.66**	**4.3%**
Education & Human Resources	**$832.02**	**$866.00**	**$962.57**	**$130.55**	**15.7%**	**$96.57**	**11.2%**
Major Research Equipment and Facilities Construction	**$200.00**	**$200.76**	**$200.31**	**$0.31**	**0.2%**	**-$0.45**	**-0.2%**
Agency Operations and Award Management	**$305.95**	**$325.00**	**$354.84**	**$48.89**	**16.0%**	**$29.84**	**9.2%**
National Science Board	**$4.25**	**$4.37**	**$4.37**	**$0.12**	**2.8%**	**-**	**-**
Office of Inspector General	**$13.84**	**$14.43**	**$15.16**	**$1.32**	**9.5%**	**$0.73**	**5.1%**
Total, NSF	**$7,131.39**	**$7,344.21**	**$7,723.55**	**$592.16**	**8.3%**	**$379.34**	**5.2%**

Totals may not add due to rounding.

[1] This table reflects the realignment, expected in FY 2015, of the Office of International Science and Engineering (OISE) and Integrative Activities (IA) as separate budget activities. All data are presented in the FY 2015 structure for comparability.

Career Life Balance

- Instituted in 2012, NSF's Career-Life Balance (CLB) Initiative is an ambitious, ten-year initiative that will build on the best of family-friendly practices among individual NSF programs to expand them to activities NSF-wide. This agency-level approach will help attract, retain, and advance graduate students, postdoctoral students, and early-career researchers in STEM fields.
- See the Dear Colleague Letter: NSF 13-075 for information about requesting supplements to CAREER awards.
- The Physics Division will consider such requests from all awardees. Contact your program officer for information.
- There is a small pot of money available to encourage broadening participation and address these types of issues.