



NSF Physics Division: Particle Physics Perspective

Randy Ruchti

NSF/PHY

DPF2019 Meeting

Northeastern University

1 August 2019



FY19: an interesting and challenging year at NSF

- Merit Reviews
 - NSF CAREER
 - Base Programs
 - MRI
 - Midscale-I and -II
- MREFC Process Underway
- Partial Government Shutdown
- COV





Brief Comments on Particle Physics Programs

- Status of EPP/PA/THY, circa FY18
- NSF Funding Opportunities, FY20
- Research Infrastructure





Experimental EPP Program

- Elementary Particle Physics (EPP) Program, which primarily supports particle physics at accelerators and advances in detector development.
- Range of program coverage:
 - Hadron Collider Experiments (ATLAS, CMS, LHCb)
 - Intensity Frontier Experiments (Neutrinos, accelerator-based)
 - Precision Measurements (Belle-II, Rare K, cross disciplinary experiments)

EPP PROGRAM	FY 2015	FY 2016	FY 2017	FY 2018
Funding (in \$k)	\$19,913	\$19,183	\$18,973	\$20,522
Awards issued	19	12	7	18
CAREER awards	1	2	1	1

Program Directors: S. Gonzalez, R. Ruchti



Experimental Particle Astrophysics Programs

- Underground Physics (PA): This area supports university research that generally locates experiments in low background environments:
 - IceCube Science Program
 - Underground experiments, reactor neutrinos
 - Neutrino mass measurements
 - Searches for the direct detection of Dark Matter
- Cosmic Phenomena (PA): This area supports university research that uses astrophysical sources and particle physics techniques to study fundamental physics:
 - Astrophysical sources of cosmic rays, gamma rays, neutrinos

Particle Astrophysics	FY 2015	FY 2016	FY 2017	FY 2018
Funding (in \$k)	\$19,665	\$18,253	\$18,142	\$18,717
Awards issued	26	16	17	25
CAREER awards	2	3	1	1

Program Directors: J. Whitmore, J. Cottam-Allen



Theory Program for Particle Physics

- Particle Theory is essential to the success of the entire Particle Physics mission. We support cutting-edge investigator-driven research in two programs:
 - **Theoretical High-Energy Physics**
 - **Theoretical Particle Astrophysics and Cosmology**
- Regular interactions with EPP, PA, Gravity Theory, Nuclear Theory, Astronomy, Materials Research, Mathematical Sciences, etc.
- Supporting individuals, RUI's, and special facilities or initiatives (Aspen Center for Physics, TASI summer school, LHC Theory Initiative, etc.)
- Trend: Dramatic increase in number of proposals—factor of two in last 5 years

THEORY PROGRAMS	FY 2015	FY 2016	FY 2017	FY 2018
Funding (in \$k)	\$13,751	\$13,232	\$13,388	\$13,427
Awards issued	28	30	26	32
CAREER awards	2	1	2	1

Program Director: K. Dienes



Physics Division Proposal Preparation & Submission for FY2020

- All NSF proposals must conform to the NSF Proposal & Award and Procedures Guide:
 - Current submissions must follow PAPPG (NSF19001)
 - https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf19001
 - Questions can be referred to cognizant program directors.
- Proposals to other directorates – please refer to the NSF website: www.nsf.gov
- **Intellectual Merit and Broader Impacts - All proposals to NSF PHY must address these two NSF Merit Criteria.**



Physics Solicitation NSF 18-564

Deadlines for FY20

Experiment: Elementary Particle Physics

Proposal Deadline: **Dec 3, 2019**

Program Directors: S. Gonzalez, R. Ruchti

Experiment: Particle Astrophysics

Proposal Deadline: **Dec 3, 2019**

Program Directors: J. Cottam-Allen, J. Whitmore

Theory: Elementary Particle Physics, Particle Astrophysics/Cosmology

Proposal Deadline: **Dec 10, 2019**

Program Director: K. Dienes



NSF Graduate Research Fellowship Program(GRFP)

- Program Solicitation: NSF18-573
- <https://www.nsf.gov/pubs/2018/nsf18573/nsf18573.htm>
 - **The GRFP provides three years of support for the graduate education of individuals who have demonstrated their potential for significant research achievements in STEM or STEM education.**
 - The purpose of the GRFP is to help ensure the vitality and diversity of the scientific and engineering workforce of the United States. The program recognizes and supports outstanding graduate students who are pursuing full-time research-based master's and doctoral degrees in science, technology, engineering, and mathematics (STEM) or in STEM education.
 - NSF especially encourages women, members of underrepresented minority groups, persons with disabilities, veterans, and undergraduate seniors to apply
 - Program funds can support citizens or permanent residents
- **Next proposal deadline is October 25, 2019.**



AGEP/GRS Fellowships in the MPS Directorate

- Dear Colleague Letter: NSF16-125, https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf16125
- AGEP Program Solicitation: NSF16-522, https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5474
- **AGEP-GRS introduces a new mechanism by which a current MPS research awardee is able to support one (additional) Ph.D. student in an ongoing MPS-funded research project. Such supplement requests are possible for Institutions that are current AGEP members or legacy AGEP members.**
- The only allowable expenses in the AGEP-GRS request are: student stipend and fringe benefits, consistent with academic institutional practices, tuition support, and any allowed institutional overhead on these costs.
- Cognizant program directors: Kathleen McCloud (kmcccloud@nsf.gov) and EPP/PA/THY program directors.
- **Supplement requests may be submitted at any time. Interested PI's should contact the cognizant program director before submitting an AGEP request**



Faculty Early Career Development Program (CAREER)

- **CAREER awards are aimed at early-career faculty who seek to integrate research and education. NSF encourages submission of CAREER proposals from early-career faculty at all CAREER-eligible organizations and especially encourages women, members of underrepresented minority groups, and persons with disabilities to apply.**
- Important points to bear in mind....
 - **Not intended as a default proposal mechanism for new Assistant Professors**
 - **Has a specialized purpose which may not be suitable for all PI's--“build a firm foundation for a lifetime of leadership in integrating education and research”**
- Solicitation: NSF 17-537
 - <https://www.nsf.gov/pubs/2017/nsf17537/nsf17537.htm>
 - Program Contacts: Kathleen McCloud and EPP/PA/THY program directors
- Proposal Deadline for FY20 is past.
 - FY20 Proposals are now currently in merit review.
- **Next deadline will be ~17 July 2020 for the FY21 program year.**



Physics Frontier Centers (PFC)

- **The Physics Frontiers Centers (PFC) program supports university-based centers and institutes where the collective efforts of a larger group of individuals can enable transformational advances in the most promising research areas.**
- The program is designed to foster major breakthroughs at the intellectual frontiers of physics by providing needed resources such as combinations of talents, skills, disciplines, and/or specialized infrastructure, not usually available to individual investigators or small groups, in an environment in which the collective efforts of the larger group can be shown to be seminal to promoting significant progress in the science and the education of students.
 - 1 the potential for a profound advance in physics
 - 2 creative, substantive activities aimed at enhancing education, diversity, and public outreach
 - 3 potential for broader impacts, e.g., impacts on other field(s) and benefits to society
 - 4 a synergy or value-added rationale that justifies a center- or institute-like approach.
- **Preproposal deadline: Aug. 1, 2019... Today...!**
- **Full proposal deadline: Jan. 30, 2020**
- Program Directors, Jean Cottam-Allen, Kathleen McCloud



Research Infrastructure



MRI - Major Research Instrumentation

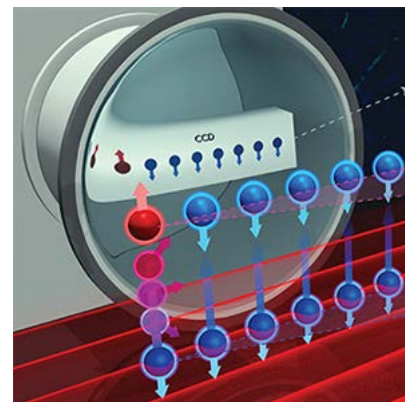
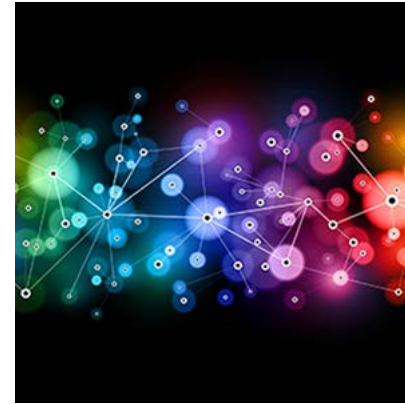
- Increase access to shared scientific and engineering instruments for research and research training
- Improve the quality and expand the scope of research and research training in science and engineering
- Two types of MRI proposals
 - **Track 1: Request for Funds in the range:** $\$100k \leq \text{request} < \$1M$
 - **Track 2: Request for funds in the range:** $\$1M \leq \text{request} \leq \$4M$
 - There is a limit to the number of submissions from a given institution (up to two of Type 1 and only one of Type 2).
- There is no commitment made by NSF to provide either R&D or operations support for the equipment.
- Present solicitation NSF18-513:
 - https://www.nsf.gov/publications/pub_summ.jsp?WT.z_pims_id=5260&ods_key=nsf18513
 - https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5260
 - **Proposal Window: January 1-21, 2020**
 - Proposers need to read the solicitation carefully.
 - Program Contacts: kmcccloud@nsf.gov, rphelps@nsf.gov



NSF's 10 Big Ideas...

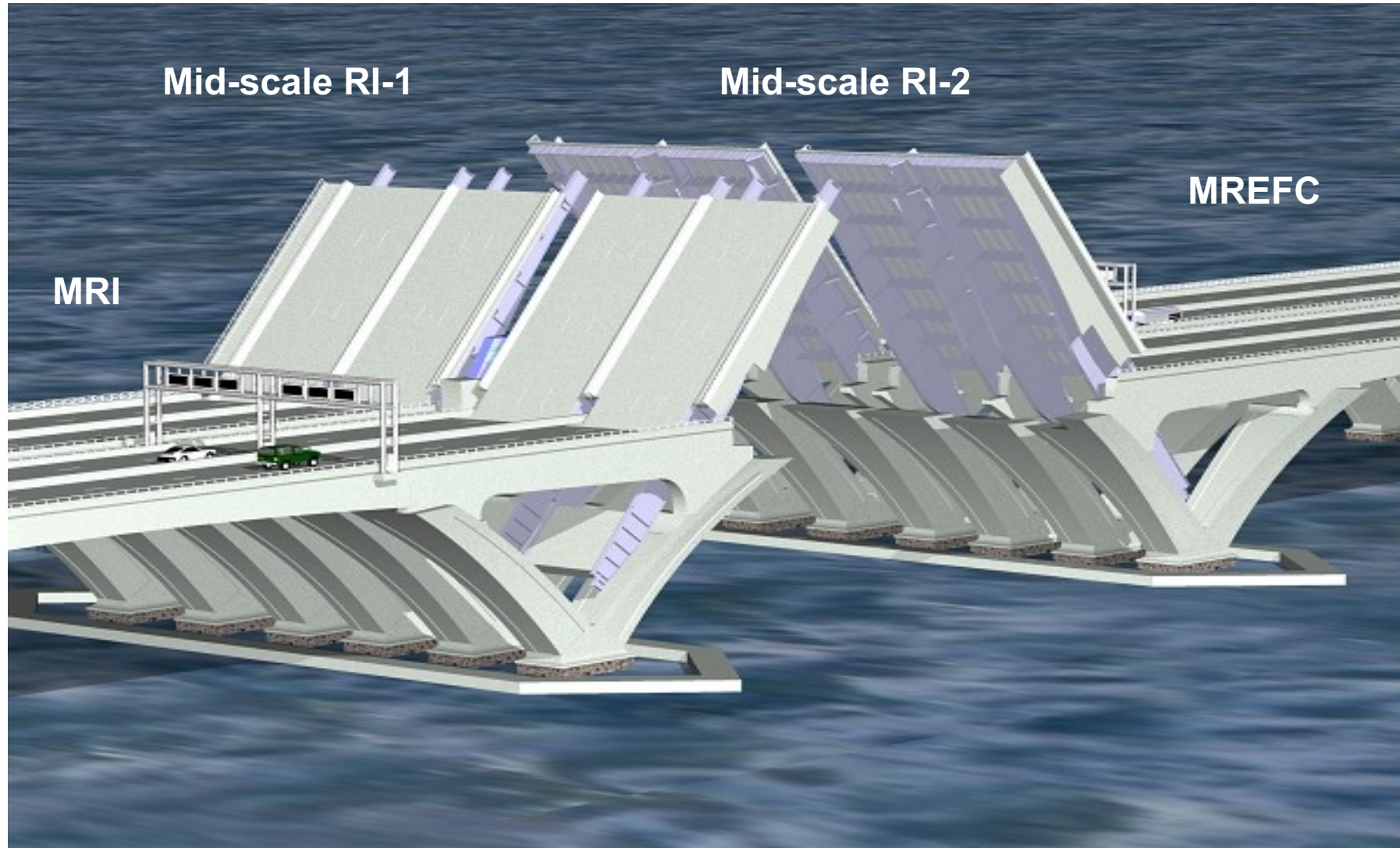
https://www.nsf.gov/news/special_reports/big_ideas/

- Future of Work
- Growing Convergence Research
- Harnessing the Data Revolution
- Mid-scale Research Infrastructure
- Navigating the Arctic
- NSF2026
- NSF INCLUDES
- Quantum Leap
- Understanding the Rules of Life
- Windows on the Universe





Now with Mid-scale Research Infrastructure Opportunities A new span...





Mid-Scale Research Infrastructure

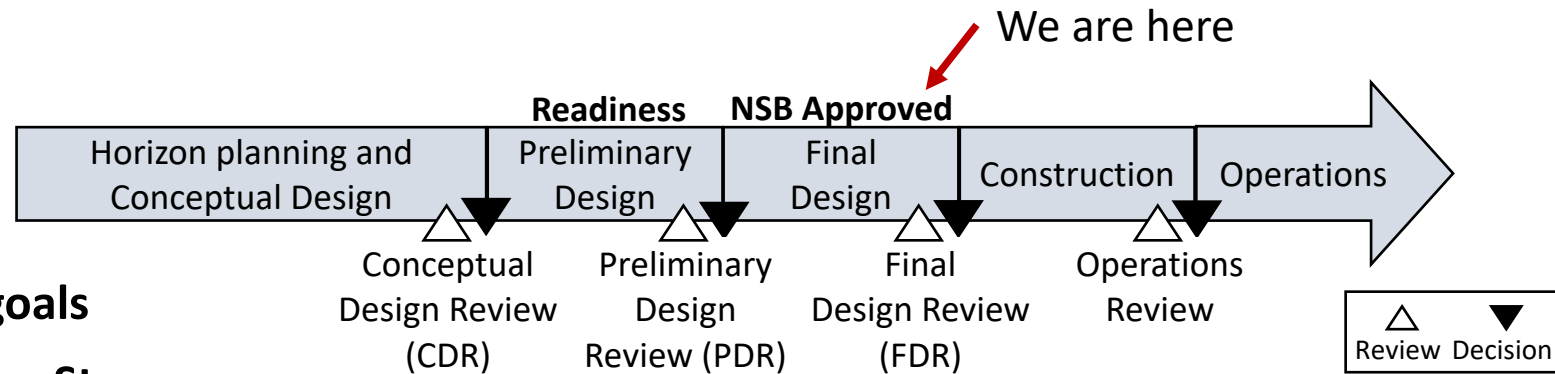
- The overall objective of Mid-Scale RI is to transform scientific and engineering research fields by making available new capabilities, while simultaneously training researchers in the acquisition, implementation, development, design, and/or construction of cutting-edge infrastructure.
- Mid-Scale RI will fund the implementation of experimental research capabilities in the range between MRI and MREFC (Total project costs between \$6 million and \$70 million).
- **There have been two solicitations: one for \$0.6M/6M-\$20M, another for \$20M-\$70M**
- **Solicitations: NSF19-537 and NSF19-542**
- **Merit Reviews in progress**
- Program Contacts: Program Directors





High Luminosity LHC MREFC

- Process underway for the HL-LHC Upgrades for ATLAS and CMS.
- Total request of \$150M, with \$75M for each experiment.

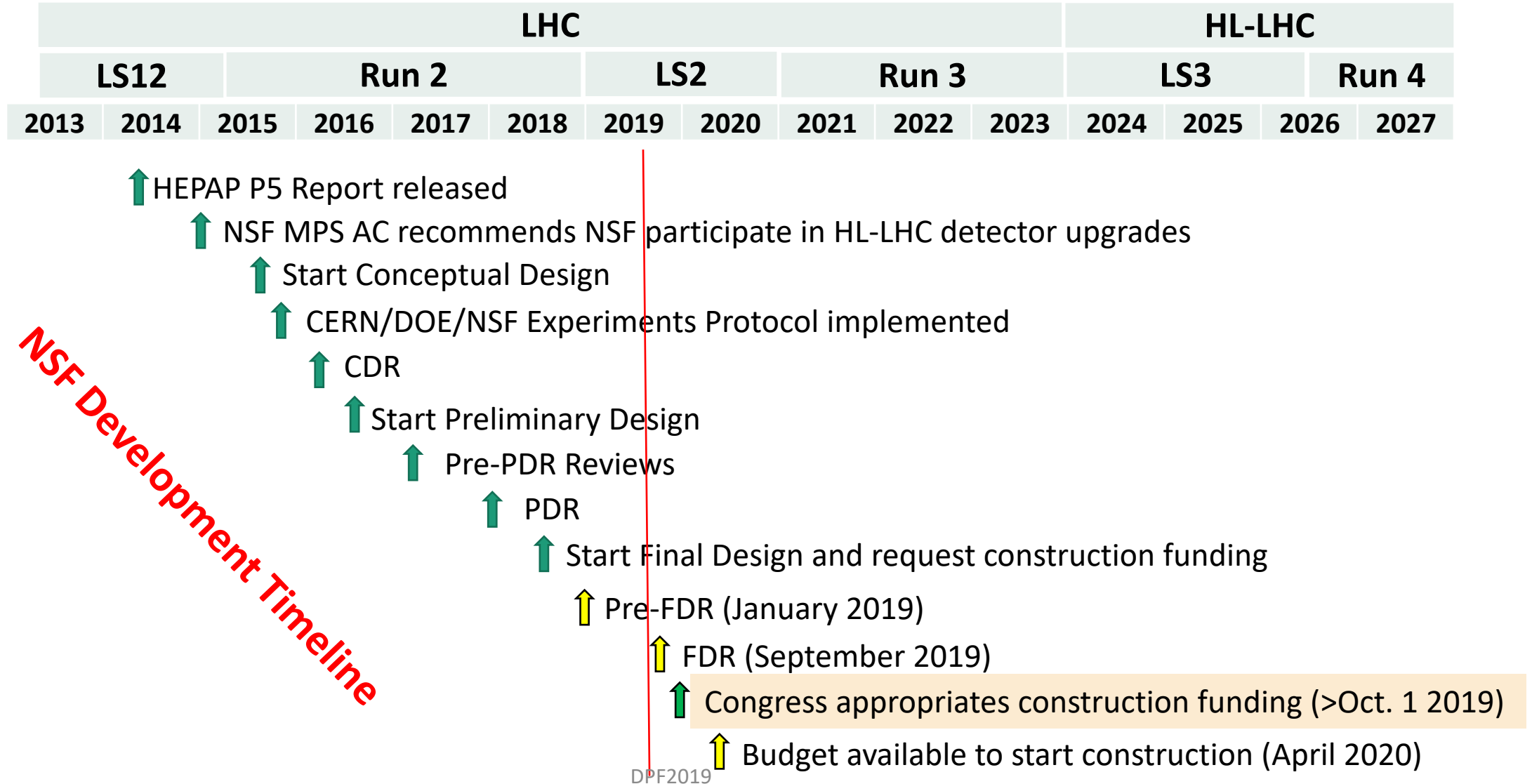


- **Review science goals**
- **Conceptual Design Stage**
 - Requirements, initial estimates of cost (including operations), risk and schedule
- **Preliminary Design Stage**
 - Definition and design of major elements, detailed estimates of cost, risk and schedule, partnerships, siting
- **Final Design Stage**
 - Interconnections and fit-ups of functional elements, refined cost estimates based substantially on vendor quotes, construction team substantially in place

Program Director: M. Coles



MREFC Process for ATLAS and CMS Phase 2 Upgrades





Research Infrastructure (Summary)

Project Cost (approx. in \$million)		Funding Source				
From	To	R&D/Planning	Construction	Operations	Scope of Competition	
0	1.0	EPP or PA	EPP or PA	EPP or PA	Program (within EPP or PA)	
0.2	5.7	n/a	MRI (70%); University (30%)	n/a	PHY (<1.0) NSF (>1.0)	
4.0	15	EPP or PA	PHY Research	EPP or PA	PHY	
New!	0.6-6.0	20	EPP or PA or Midscale RI-1	Midscale RI-1	EPP or PA	NSF
New!	20	70	EPP or PA or Midscale RI-1	Midscale RI-2	EPP or PA	NSF
70	--	EPP or PA	MREFC	EPP or PA	NSF	



NSF/PHY: EPP/PA/THY Planning

- Programmatic Balance
 - Demographic and Geographic
 - Larger Scale and Smaller Scale Programs
- MREFC Process
- Midscale Programs (NSF wide and PHY specific)
- Adding Value
 - Developing opportunities for programmatic support in the context of the NSF Big Ideas
- We are following with interest the community developments through the Snowmass process