



NP Accelerator R&D Principal Investigators Exchange Meeting

DOE Office of Nuclear Physics

M. Farkhondeh

November 14, 2016

Room A-410

Germantown, MD



Outline:

- This Meeting
- Office of Science Accelerator R&D categories
- FY16 FOA : Proposals and funding
- Review Criteria and Program Policy Factors
- 2015 Long Range Planning and the EIC
- EIC Design Concepts
- NP Accelerator R&D Beyond FY 2016
 - NP Community EIC Accelerator R&D Review Panel
 - FY17 and out-years
- Presentation Guidelines
- Meeting Agenda



This Meeting

- Presentations on current status of work by all Principal Investigators (PIs) who received awards under funding opportunity announcements DE-FOA-0001556 and DOE: LAB 16-1556 (or under a similar FOA since FY2010) : **“Research and Development for Next Generation Nuclear Physics Accelerator Facilities.**
- This is not a review and no review panel is involved. Presentations will be made to NP Office Program Managers and Division Directors, and possibly a few PMs from HEP and BES Program Offices.
- To facilitate exchange of information between PIs and the NP Office and among PIs and institutions on all current and past EIC-related Accelerator R&D funded efforts.
- A timely meeting on NP supported Accelerator R&D after the rollout of NP 2015 Long Range Planning Report and before the planned NP Community EIC Accelerator R&D panel review later this month.



SC Accelerator R&D Categories

Categories of Accelerator R&D at DOE Office of Science

- **Short Term Accelerator R&D-** Accelerator R&D with the potential for improved performance and/or new capabilities to existing NP scientific user facilities that will lead to new capabilities or improved operations. This is supported by NP and other program offices
 - **Mid-Term Accelerator R&D:** Accelerator R&D with the potential for the development of the future generation of NP accelerators not under construction. This is supported by NP and other program offices.
 - **Long-Term or generic Accelerator R&D:** This is directly supported by the Office of High Energy Physics (HEP) although NP work often relevant.
- Total annual NP investment in accelerator R&D through a) competitive funding opportunity announcement (FOA) and b) National Laboratory Accelerator R&D is on the order of \$9-10M per year. This does not include project specific (FRIB and 12 GeV) R&D.



Proposals and Funding for last FOA published in FY16

FY 2016 FOA	No of proposals	Categories	(\$k)
Total Lab Proposals	10	Total Lab Request	3,487
Total University Proposals	13	Total University Requ	2,134
Total Industry Proposals	3	Total Industry Reques	324
Total Proposals	26	Total All Requests	5,945

As a result of a panel Review in June 2016:

- **~\$1870 K** Appropriated FY 2016 funds was allocated and distributed.
- Accelerator R&D awards **ARE FOR ONE YEAR** only with possibility of second year renewals. FOA has been published every other year. This may change in FY 2017.



Proposal Review Criteria

This FOA is in support of pre-conceptual accelerator R&D aimed at technological challenges for the next generation NP facilities. Accelerator R&D intended for this announcement should fall in the following general categories: **(National Labs, Universities and Industry are competing)**

This FOA Supports :

- Accelerator R&D with the potential for the development of future generation of NP accelerators not under construction or design.
- Accelerator R&D with the potential for improved performance and/or upgrades to existing NP scientific user facilities that will lead to new capabilities

Merit Review Criteria

Reviewers are requested to evaluate proposals and comment on: **(Criteria)**

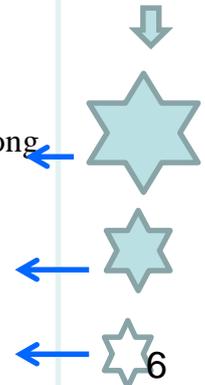
- Scientific and/or Technical Merit of the Project;
- Appropriateness of the Proposed Method or Approach;
- Competency of Applicant's Personnel and Adequacy of Proposed Resources; and
- Reasonableness and Appropriateness of the Proposed Budget

Program Policy Factors

In addition, each application should also address these **program policy factors**:

- Relevance to compelling scientific opportunities identified in the 2007 and 2015 NSAC Long Range Plan.(LRP)
- If appropriate, relevance of proposed electron-ion collider efforts to the R&D priorities identified in the EICAC report (See priority list later).
- The opportunity for training junior accelerator physicists in accelerator science and Technology.

Relative Importance





Program Policy Factor #2

Priority List for EIC Accelerator R&D published in the Electron-Ion-Collider Advisory Committee (EICAC) report (November 2-3, 2009)

(Duplicated from page 6 of EICAC report)

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The EIC proponents presented a joint list of priorities for accelerator R&D. The subsequent lists of EICAC are to a high degree identical to those with the exception of the first item (which encompasses some of the JLAB items in the table).

Funding



Highest priority:

- Design of JLab EIC
- High current (e.g. 50 mA) polarized electron gun
- Demonstration of high energy – high current recirculation ERL
- Beam-Beam simulations for EIC
- Polarized 3He production and acceleration
- Coherent electron cooling

High priority, but could wait until decision made:

- Compact loop magnets
- Electron cooling for JLab concepts
- Traveling focus scheme (it is not clear what the loss in performance would be if it doesn't work; it is not a show stopper if it doesn't)
- Development of eRHIC-type SRF cavities

Medium Priority:

- Crab cavities
- ERL technology development at JLAB



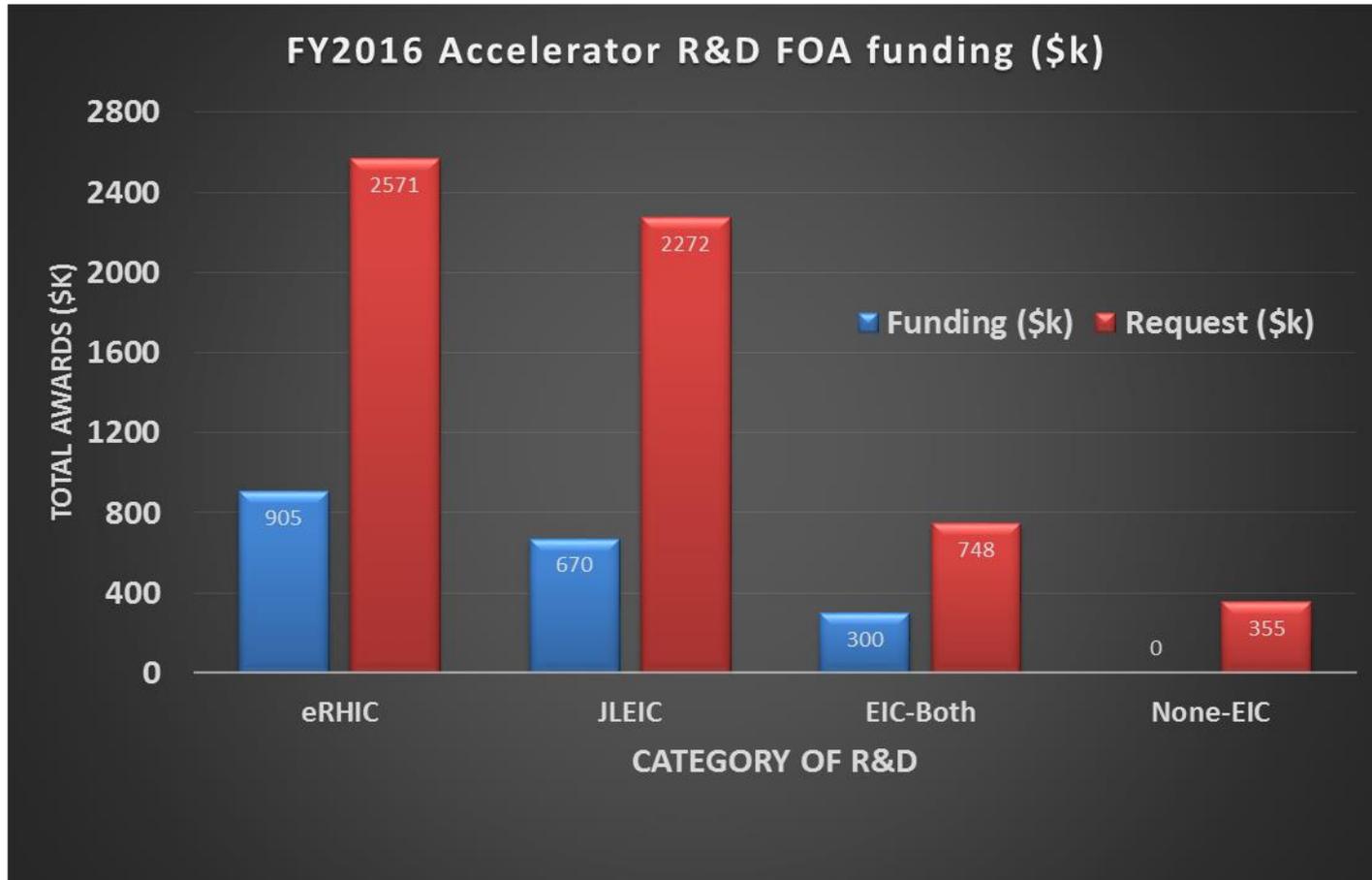
Electron Ion Collider

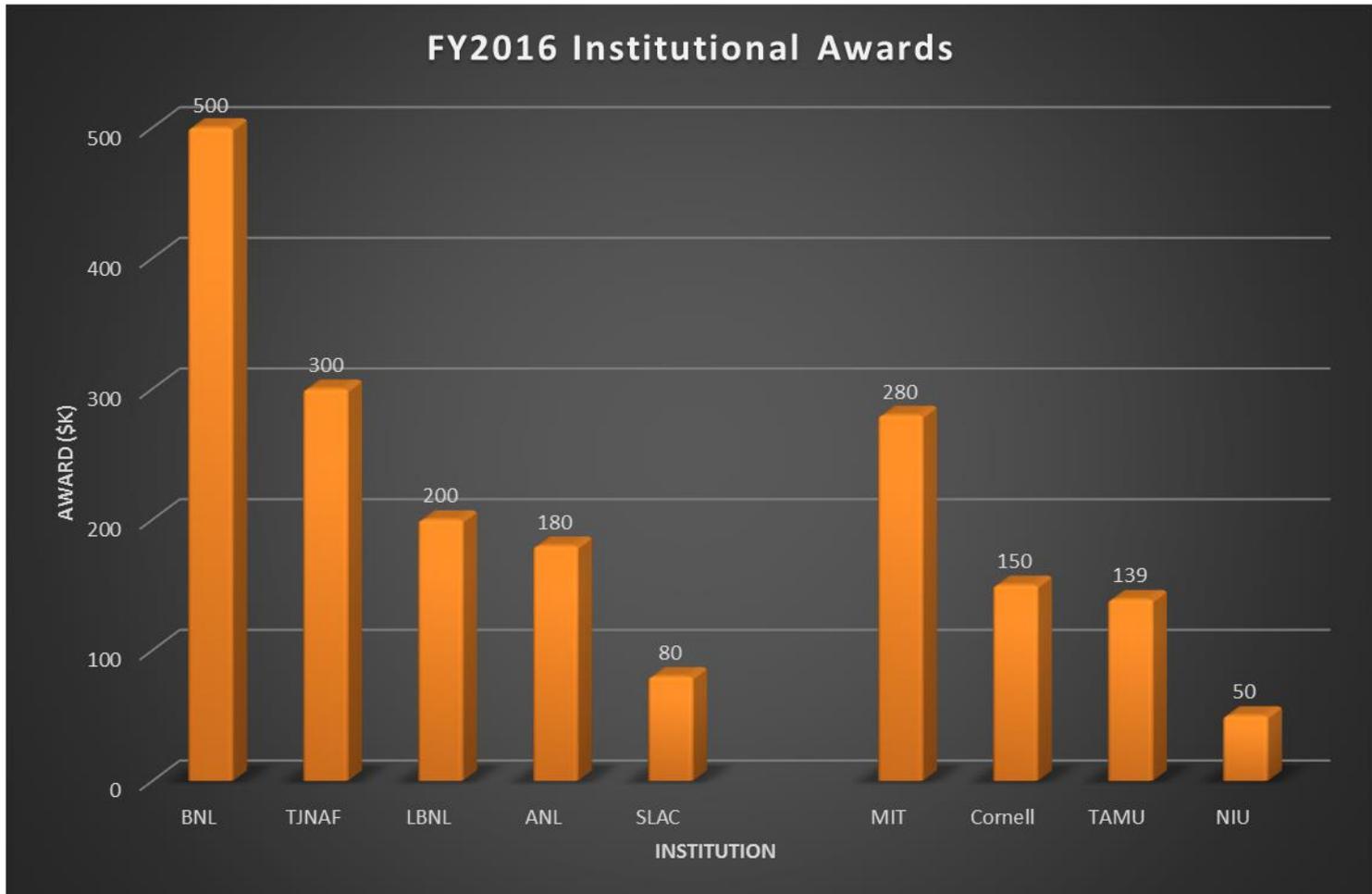
EIC Design Concepts: (prior to 2016)

- **BNL:** eRHIC staged approach (eRHIC) based on a Linac-Ring concept using FFAG transport line.
- **TNJAF:** MEIC/JLEIC: staged approach (MEIC) based on high repetition rate Ring-Ring concept.

EIC Accelerator R&D:

- In 2009, EIC Advisory Committee (EICAC) established priorities to the joint list of EIC accelerator R&D:
 - **Highest priority**
 - **High priority, but could wait until decision made**
 - **Medium Priority**
- First Accel R&D FOA in FY10-FY11 (~4M). Most funding went to “Highest priority EIC”. Small amount went to deuteron EDM. Last FOA was published in FY2016 and funds distributed.







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U.S. DEPARTMENT OF
ENERGY

Office of
Science

2015 LRP Reports

REACHING FOR THE HORIZON



The Site of the Wright Brothers' First Airplane Flight



The 2015
LONG RANGE PLAN
for **NUCLEAR SCIENCE**





The 2015 Long Range Plan for Nuclear Science

RECOMMENDATION III (Page 4)

Gluons, the carriers of the strong force, bind the quarks together inside nucleons and nuclei and generate nearly all of the visible mass in the universe. Despite their importance, fundamental questions remain about the role of gluons in nucleons and nuclei. These questions can only be answered with a powerful new electron ion collider (EIC), providing unprecedented precision and versatility. The realization of this instrument is enabled by recent advances in accelerator technology.

We recommend a high-energy high-luminosity polarized EIC as the highest priority for new facility construction following the completion of FRIB.

INITIATIVES : (Page 5)

A:

B: Initiative for Detector and Accelerator Research and Development

U.S. leadership in nuclear physics requires tools and techniques that are state-of-the-art or beyond. Targeted detector

- We recommend vigorous detector and accelerator R&D in support of the neutrinoless double beta decay program and the EIC.*



EIC Machine Concepts

Current Machine Concepts for EIC:

eRHIC:

- Two concepts based on RHIC:
 - Linac-Ring collider requiring further R&D
 - Ring-Ring collider based on existing technology

JLEIC:

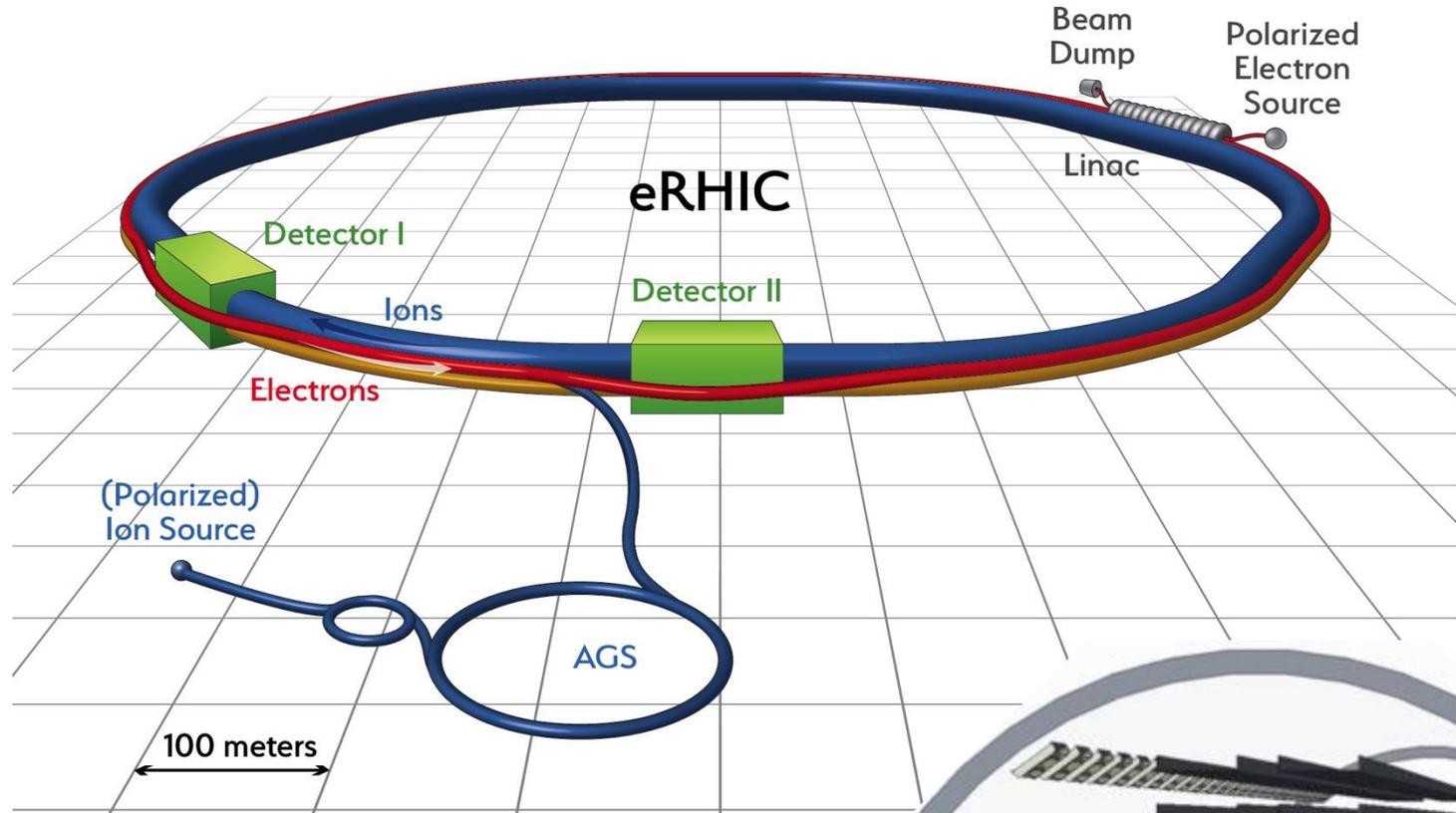
- Ring-Ring collider using CEBAF and two figure-8 storage rings.



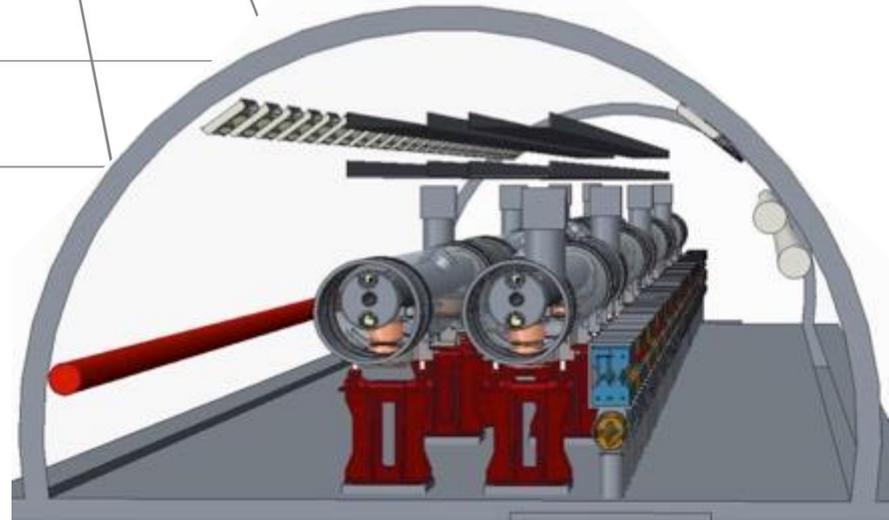
Ultimate eRHIC design

Highly advanced and energy efficient accelerator

Thomas Roser
BNL



- Peak luminosity: $2 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$
- ERL and permanent magnet arcs greatly reduce electric power consumption to about 15 MW!





Planning for an Electron Ion Collider

2015 LRP Recommendation III: “We recommend a high-energy high-luminosity polarized EIC as the highest priority for new facility construction following the completion of FRIB.”

In view of this recommendation on the realization of an EIC, NP has developed a strategic plan in discussion with EIC stakeholders:

- A science assessment of a US-based EIC by National Academy of Sciences
- A major NP Community EIC Accelerator R&D Panel Review this year
- A mechanism for increased accelerator R&D funding for FY17 and beyond



NP Strategic Planning for EIC

NP Strategic Plan for realization of an Electron Ion Collider

- **National Academy of Sciences (NAS) Study:** Initiated an eighteen-month NAS study entitled: “*US-BASED ELECTRON ION COLLIDER SCIENCE ASSESSMENT*” Grant processed and funding started in July 2016.
- **FY16 FOA:** Published a competitive FOA (“Accelerator R&D for Next Generation NP Facilities”) this year. A review panel helped NP select university and Lab proposals for one year funding. *NP has been funding competitive accelerator R&D since 2010 at ~\$2M/year.*
- **NP Community Panel Review:** Conduct an NP community EIC R&D panel review charged with generating a report as the basis for FY17-FY20+ EIC accelerator R&D funding. *Dr. Kevin Jones of SNS is chairing this international panel. First face-to-face meeting scheduled for November 29-December 2. Panel Report expected by first week of January 2017.*
- **Bi-Annual FOA Starting FY17:** Publish bi-annual FOA for competitive accelerator R&D based on R&D priorities established in the EIC panel report.
 - **Funding level:** Aiming for \$7M per year
 - **Funding sources:** Combination of NP competitive accelerator R&D funds (~1.9M) augmented with a percentage tax to RHIC and CEBAF Accelerator Operations budget (~2.6% in FY17 President’s request for each Lab).



FY17 FOA and Funding

Current NP plan

- NP Community EIC R&D panel review to generate a report with EIC R&D priority list: **January 2017**.
- Subject to FY2017 funding constraints, NP to publish a new FOA based on EIC R&D priorities set by the Review Report above: **March-April 2017**
- Proposals to be reviewed by a new Review panel and awardees selected: **May-June 2017**.
- Planning for **~\$7.0 total funding for FY17** and finalized after enactment of an appropriation.
- Considering publishing this FOA for 2-year funding. This would require dealing with upfront funding of university awards that are over \$1M.



FUNDING OPPORTUNITY ANNOUNCEMENT (FOA)

Research and Development for Next Generation Nuclear Physics Accelerator Facilities

Funding Opportunity Number : DE-DE-FOA-0001556

Announcement Type: Initial

CFDA Number: 81.049

ISSUE DATE: March4, 20116

Presentation Guidelines

- Each PI's presentation has been allotted a specific time depending on the size of their grant.

- Each presentation should include the following information:
 - Description of the project and the current status;
 - The main goal of the project for which you received the award.
 - A table showing annual budget and the total received to date;
 - A table showing major deliverables and schedule; andRelevance to the NP Accelerator R&D for EIC (eRHIC or MEIC/JLEIC).



Meeting Agenda

DOE-NP Accelerator R&D PI Meeting							
Monday, 11/14/2016							
DOE Headquarters, Germantown, MD, Room A-410							
Meeting Agenda							
Time	Dur. (min)	Presentation Title	Speaker	Institution	Topic	Grant Status	
8:30 AM	5	Welcome and Introductory Remarks	Gillo, Jehanne	NP	-		
8:35 AM	30	NP Accelerator R&D Program Overview	Farkhondeh, Manouchehr	NP	NP Accelerator R&D		
1	9:05 AM	0	Novel Plasmonic Photocathodes for electron-ion colliders	Lukaszew, Ross	W&M	Photocathode	year 4, No Cost Ext.
2	9:05 AM	45	High Intensity Polarized Electron Gun	Redwine, Robert / Tsentelovich, Evgeni	MIT	High current Pol source /eRHI	Year 6, active
3	9:30 AM	35	Physics and technology of high-brightness high-power photoinjectors for beam coolers and electron ion colliders	Bazarov, Ivan/ Cultrera, Luca	Cornell	High current Photoinjector	Year 2, active
	10:25 AM	15	Coffee Break				
4	10:40 AM	45	Coherent Electron Cooling Demonstration Experiment at RHIC	Litvinenko, Vladimir	BNL	CeC - cooling /eRHIC	Year 6, active
5	11:25 AM	40	Development of a Polarized ⁴ He Ion Source for RHIC	Milner, Richard	MIT	Pol ion source /eRHIC	Year 6, active
	12:05 PM	60	Lunch Break				
6	1:05 PM	45	Critical Accelerator R&D for Achieving High Performance of a Polarized Medium Energy Electron Ion Collider (MEIC/JLEIC Collaboration)	Pilet, Fulvia	TJNAF	MEIC design	Year 6, active
7	1:30 PM	30	Critical Accelerator R&D for Achieving High Performance of a Polarized Medium Energy Electron Ion Collider (MEIC/JLEIC Collaboration)	Sullivan, Michael	SLAC	MEIC design	Year 4, active
8	2:20 PM	35	Critical Accelerator R&D for Achieving High Performance of a Polarized Medium Energy Electron Ion Collider (MEIC/JLEIC Collaboration)	Mustapha, Brahim/ Ostroumov, Peter	ANL	MEIC Design /ion injector	Year 6, active
	2:55 PM	15	Coffee Break				
9	3:10 PM	35	Design Studies and Prototyping of Superferric Magnets for MEIC ((MEIC Collaboration))	McIntyre, Peter	TAMU	MEIC design	year 2 active
10	3:45 PM	30	Studies of Conventional and ERL-Based Recirculator Electron Cooling for an Electron Ion Collider	Erdelyi, Bela	NIU	e cooling software /MEIC	Year 6, active
11	4:15 PM	30	300KV DC High Voltage Inverted Gun with Load-Locked CsK ₃ Sb Deposition Chamber	Poelker, Matthew	TJNAF	High current Pol source	FY2010-FY2013
	4:45 PM		Adjourn				

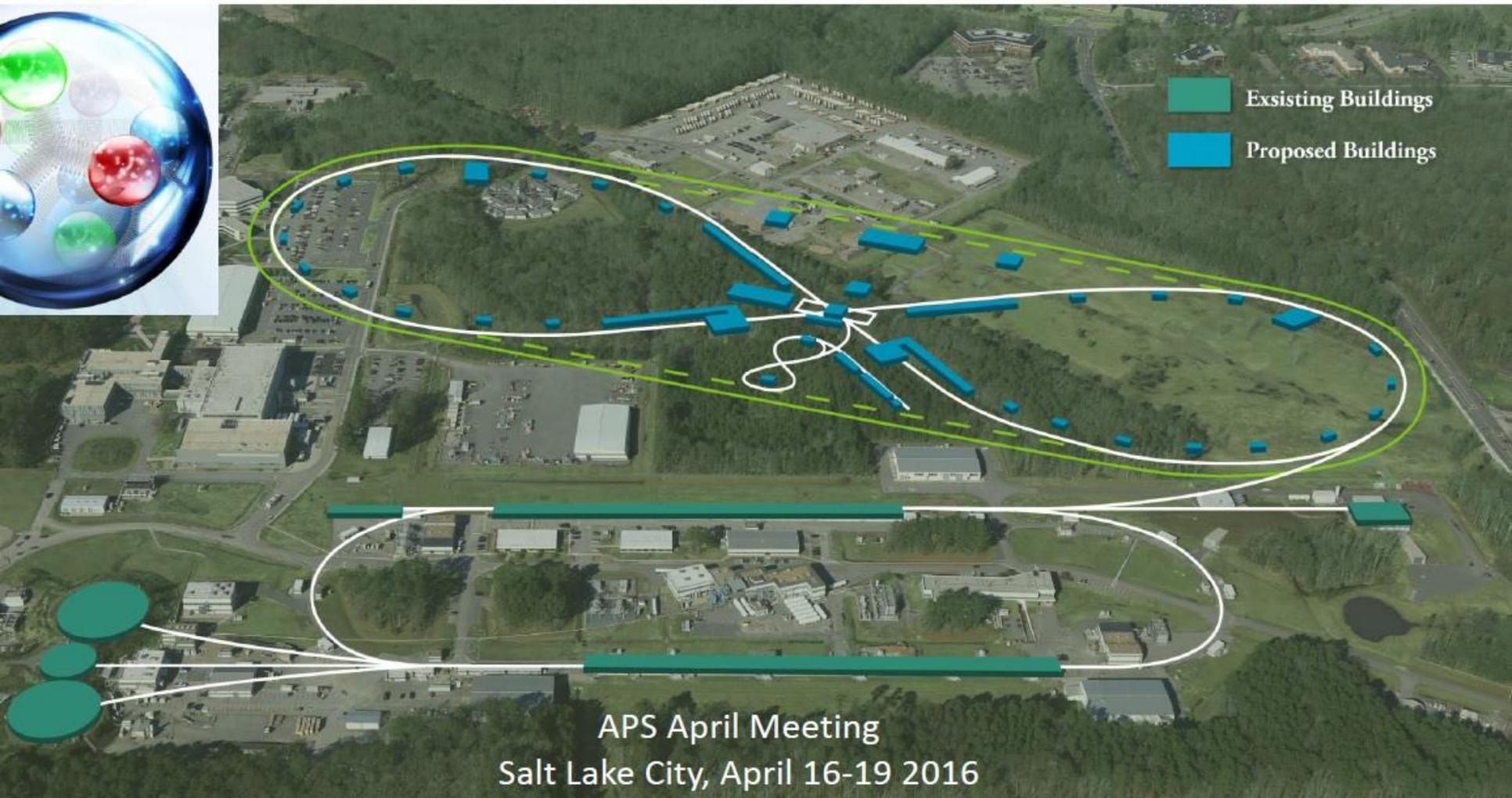


END



JLAB Design for a future Electron-Ion Collider

Fulvia Pilat



APS April Meeting
Salt Lake City, April 16-19 2016