"Transition" of the Cornell High-Energy Synchrotron Source (CHESS)

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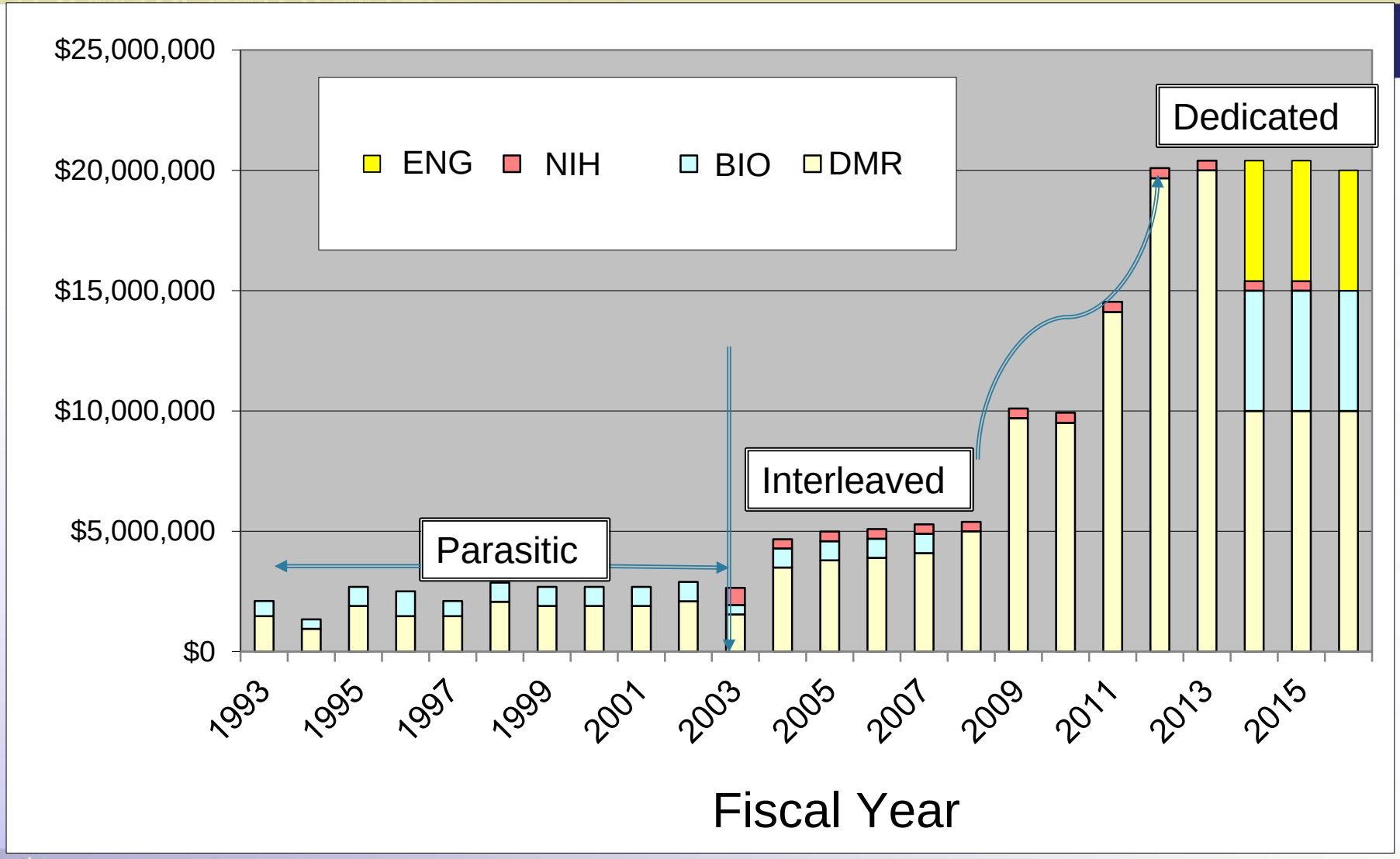
CHESS is a high-intensity, hard X-ray source powered by the Cornell Electron Storage Ring (CESR), buried under the Cornell campus.

- The US has six federally-funded light sources. Two of these are high-intensity, hard X-ray facilities:
  - CHESS
  - The Advanced Photon Source (APS) at Argonne National Lab
- CHESS User Program - 11 experimental stations
- >700 users/yr (~10% of national capacity)
- Stewardship:

  MPS(**DMR**)-ENG-BIO

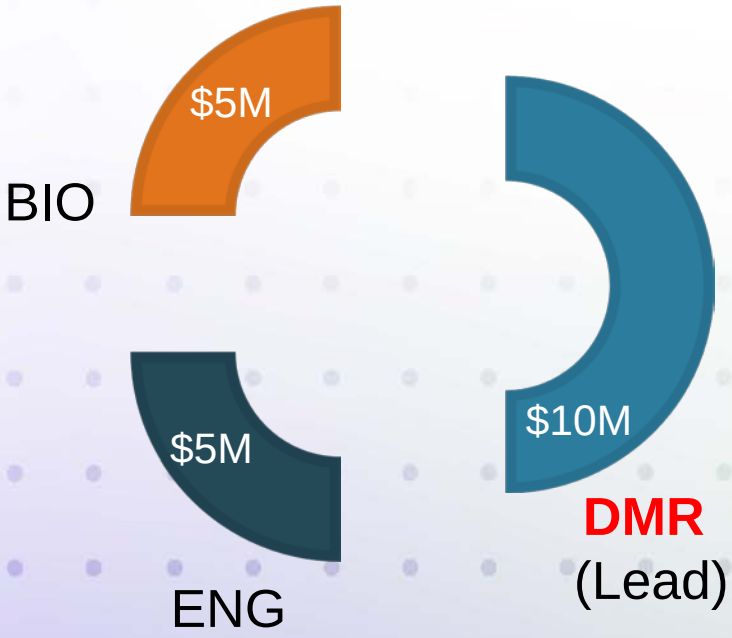
CHESS Budget History 1993-2018



CHESS Current Joint Stewardship & Management

Joint Oversight Group (JOG):

NIH/NIGMS: A Partner



Cooperative Agreement Requirement (2014-2019):

NSF informs NSB annually on progress to:

A. Demonstrate national need

B. Produce and enable unique capabilities

C. Recommend award increment on a year-by-year basis, with a mid-award review to determine the future of CHESS

Path Forward Beyond Current Cooperative Agreement

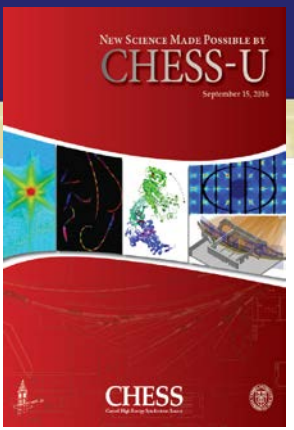
From NSB Information Item:
NSF (NSB/CPP 2016-21)
FY 2016 Update on the Operations of the CHESS and Next Steps

Scenario 1: CHESS secures state-funded upgrades, provides a strong vision and need for high-energy and high-flux synchrotron science in materials research, engineering, and biological science communities that NSF supports.
Action: NSF accepts a renewal proposal. JOG will jointly conduct a merit review of the renewal proposal.

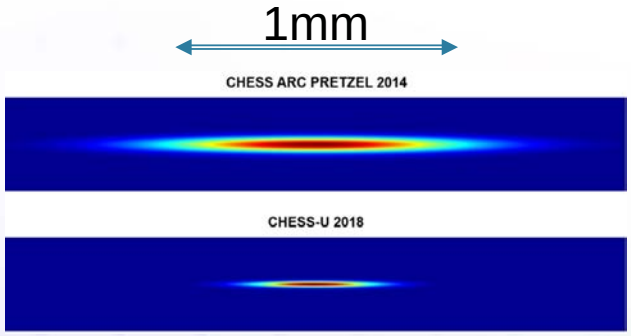
Scenario 2: CHESS secures the state-funded upgrades, but is unable to provide a strong vision and need for high-energy, high-flux synchrotron science that spans all disciplines represented within the JOG.
Action: CHESS and the JOG will put together a "transition plan" that would retain the strongest aspects of CHESS.

Scenario 3: CHESS is unable to secure state funds for the necessary upgrades.
Action: NSF would propose divestment of the CHESS facility.

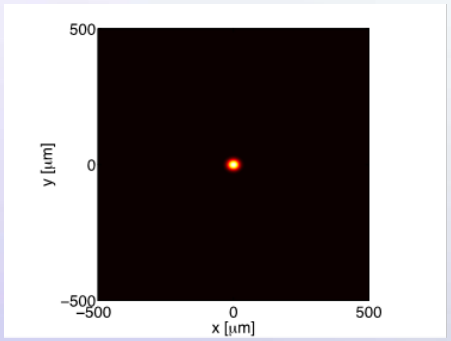
CHESS-U (CHESS-Upgrade)



- **NY State support $15M, 2016-2019**
- Single-particle beam operation optimized for high-flux at high-energy x-rays (20-150 keV photons, 200 mA, energy 6 GeV):
  - **<u>High Energy</u>: high penetration and smaller length scale resolution**
  - **<u>High flux</u>: Detection of weak signals, and short detection time**
- <u>Flexible timing structure</u>, large # of photons/pulse → timing studies
- 11 beamlines powered by separate undulators



CHESS-U – high energy /high flux



Advanced Photon Source (APS)-U – high energy/high coherence

Mid-Award Review/Site Visit Panel 10/16-18/2016

Site-Visit Panel Charge

For each science theme assess:

- Degree of Novelty of Science Theme
- Appropriateness of the Challenges Identified in the Context of Current and Future Developments of the Field
- Uniqueness, and Criticality of the Photon Attributes of CHESS-U in addressing the Challenge(s) Identified. (Consider the national and international context of light sources)
- Relevance of Each Science Theme to Biological Sciences, Engineering, and/or Materials Research
- Current and Anticipated Future Demand of CHESS-U for each Science Theme

Mid-Year Review Conclusions

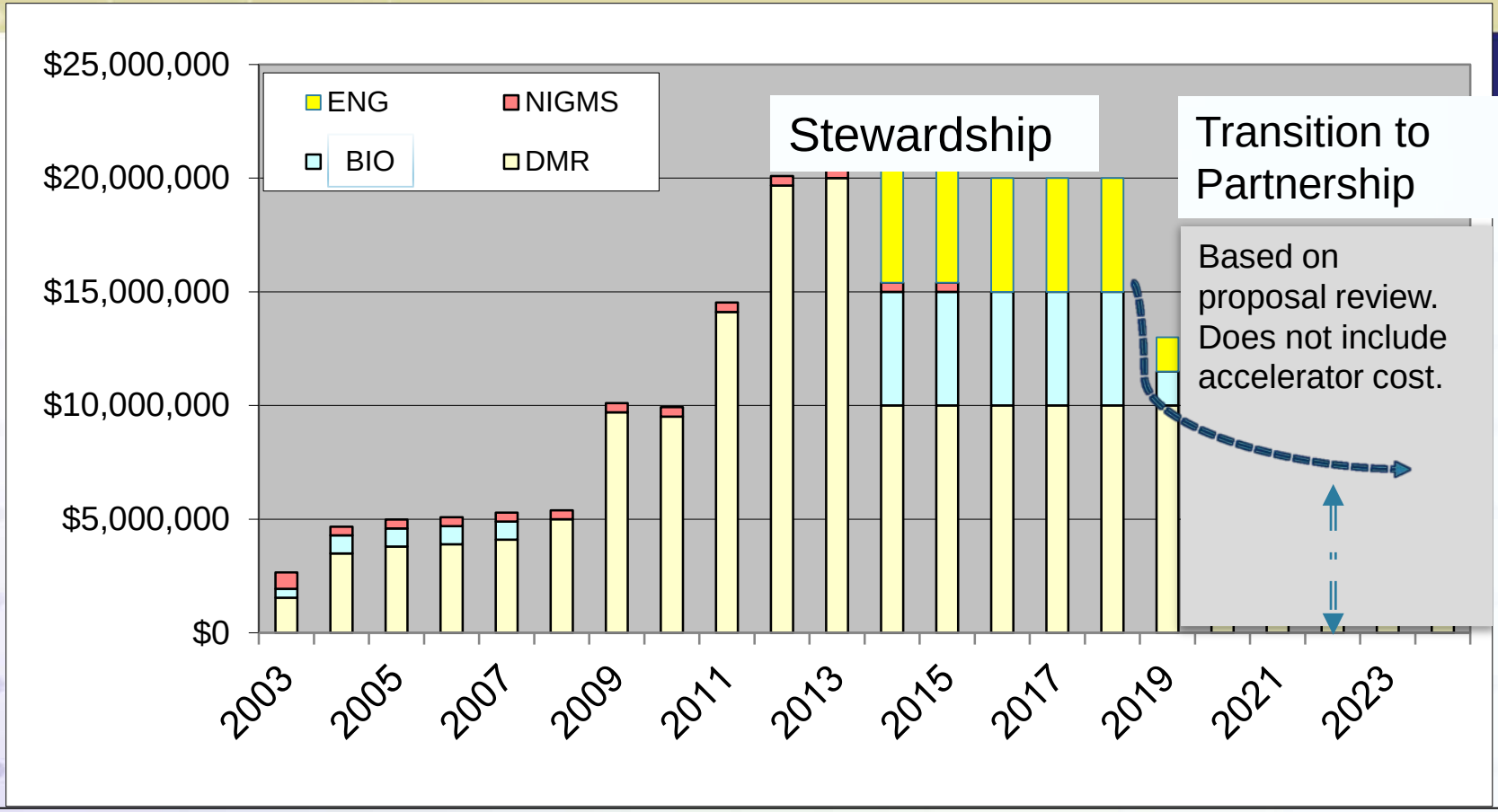
- Science case for CHESS-U
  - Science themes are important.
  - Critical need for CHESS-U is mixed.
  - Breadth of science themes is narrow particularly in BIO ("niche" areas).
  - Representation of NSF awardee "community" (DMR, BIO, ENG) is weak.
- Annual Performance: Satisfactory progress in operation as a national facility, upgrade of new tools, and science output.

JOG Decisions:

Continue support for CHESS at current level through end of current cooperative agreement (03/31/2019).

Immediately begin to develop a transition plan for the period beyond 04/01/2019 with the objective to support the *strongest science* with NSF as a partner vs. a steward.

Transition Planning



- Goal to transition NSF's role from stewardship to partnership.
- Cornell will develop new business plan to support CESR operation.
- JOG develops guidelines for "transition" proposal submission.

NSF Partnership with NIST: The Center for High Resolution Neutron Scattering (CHRNS)

- **NSF-DMR provides support for six instruments ($~3M/yr)**
- **NIST provides the source of the neutrons**
- Operates with ≈ 99% reliability
- Serves ≈ 500 scientists
- Contributes to ≈ 25 PhD's
- Expands the US neutron community
  - Summer School
  - Summer Undergraduate Research Fellowship
  - Summer high school internship program.

"TRANSITION" PLAN

……in progress, but WILL ACCELERATE IN FY2018

Thank you

- Back-up slides

The Future is Bright

- Historic events at June 2017 user meeting:
  - 5 NSF PD, first in the history of this meeting
  - BIO, ENG, workshops funded separately BIO, and ENG
  - Diversity all time high: INCREASE workshop
- NSF commitment to transition gives strong foundation for the pursuit of other partners within and outside NSF.
- Building communities in BIO and ENG bottom up could lead to more sustained support
- Upgraded CHESS creates new opportunities to compete for new Midscale opportunities.

Site Visit Review Results

Science Theme	Review	Relevance
Structural Materials	Meritorious in all aspects	ENG-DMR
High Precision Plant Phenotyping		BIO
Catalysis, Man-Made and Biological		ENG & BIO
Disordered Materials	Meritorious, but do not make the case that they could not be equally well-established at other facilities	DMR- ENG-BIO
Atomically Thin Films and Interfaces		DMR-ENG
In-situ Processing of Organic Semiconductors		ENG-DMR
Nanocrystals Superlattices	Lacks novelty, driven by local interest	ENG-DMR
Unique time structure of CHESS-U	Recognized but not fully exploited	DMR-ENG-BIO

NSF Partnership with the Advanced Photon Source (APS): ChemMatCARS

- ***CHE ($970K)*** **& DMR ($330K) provide support for three experimental stations**
- **APS (DOE) supports the light source**
- Science focus: structure and dynamics over the range of length scales from atomic and molecular to mesoscopic. Techniques span a spatial resolution of sub-angstrom to micrometer and a time resolution from 50 ns to minutes.
- High Precision Crystallography; Scattering From Liquid Surfaces and Liquid-Liquid Interfaces; Small and wide-angle x-ray scattering (SAXS/WAXS)
- Typical annual usage
  - 221 unique users from 60 institutions 117 individual experiments