

Overview of Brookhaven National Laboratory

*Doon Gibbs
EPSCOR Workshop
July 21, 2009*



SIXTY YEARS
OF DISCOVERY
1947-2007

BROOKHAVEN
NATIONAL LABORATORY



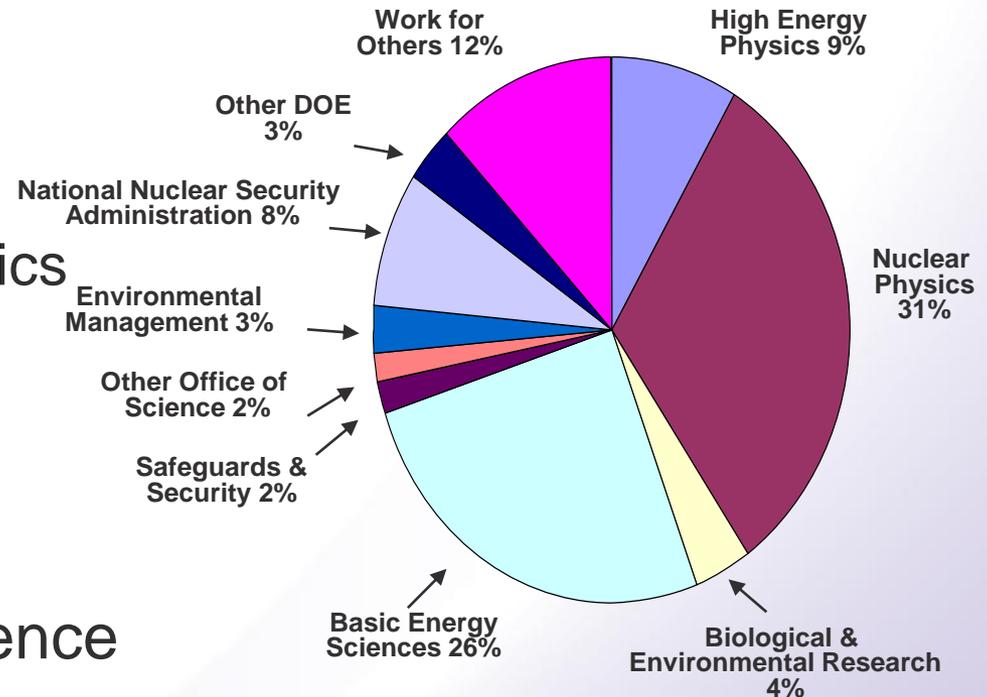
Aerial View of BNL



Snapshot

- BNL is celebrating its 60th anniversary
- ~2750 employees
- >4000 scientific facility users annually
- S&T Portfolio
 - Nuclear & Particle Physics
 - Energy Sciences
 - Physical Science
 - Applied Science
 - Life Science
 - Environmental Science
 - National Security
- Six Nobel Prizes garnered
 - Latest in 2002 and 2003

BNL Funding \$532M in FY2008



2/3 from Office of Science

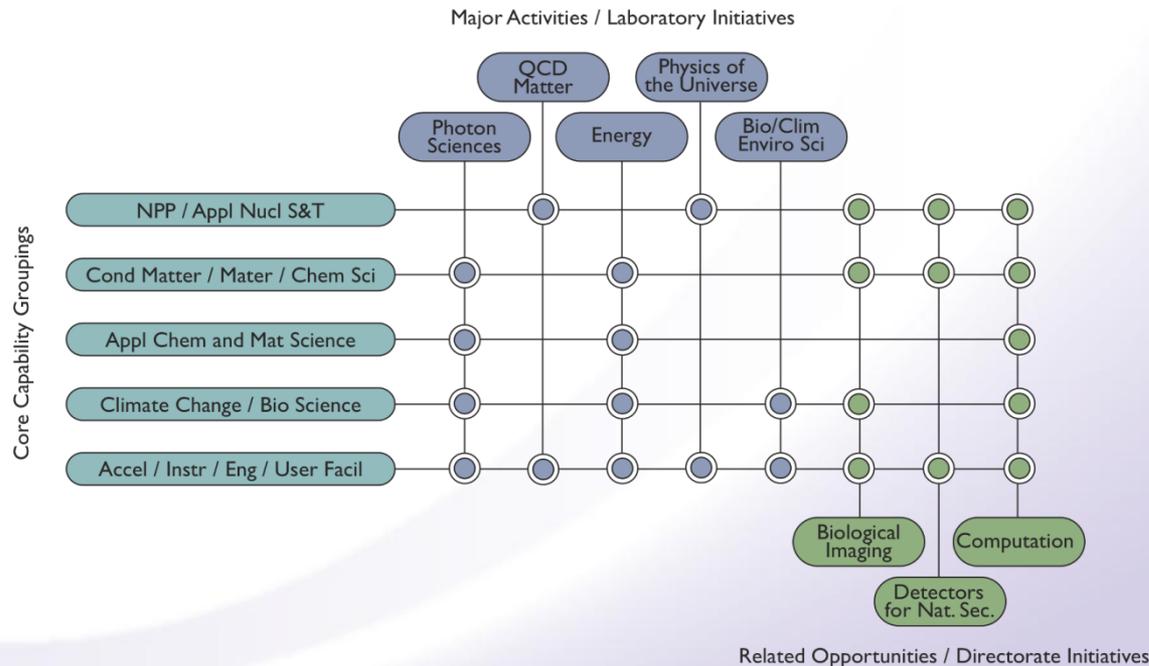
Vision To be the provider of choice for world-class science and facilities in support of the DOE Office of Science's mission to enable breakthroughs that ensure our Nation's future

Mission Advance photon sciences and energy-related research and apply them to 21st Century problems of critical importance to the Nation

Advance fundamental research in nuclear and particle physics to gain a deeper understanding of matter, energy, space and time

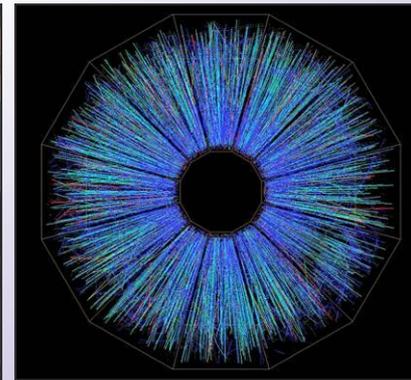
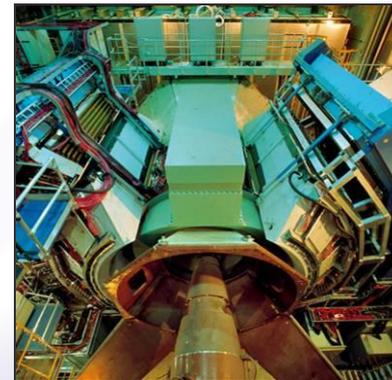
Strategy Position BNL's two largest user facilities - National Synchrotron Light Source (NSLS) and Relativistic Heavy Ion Collider (RHIC) - for continued leadership roles

Focus on four Major Activities built on Business Lines and Core Competencies



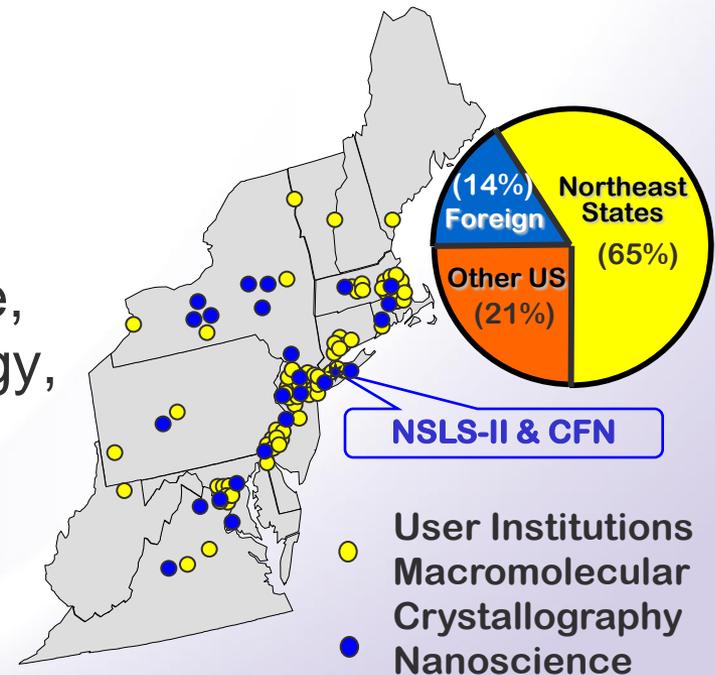
Relativistic Heavy Ion Collider (RHIC)

- Since 2000, the world's highest energy machine for fundamental nuclear physics
 - World-wide collaboration of more than 1000 scientists, engineers and students
- The nature of the Universe at the birth of protons and neutrons
 - 0.00001sec after the Big Bang
 - It's a "Perfect Liquid"!
- Future: RHIC II and e-RHIC



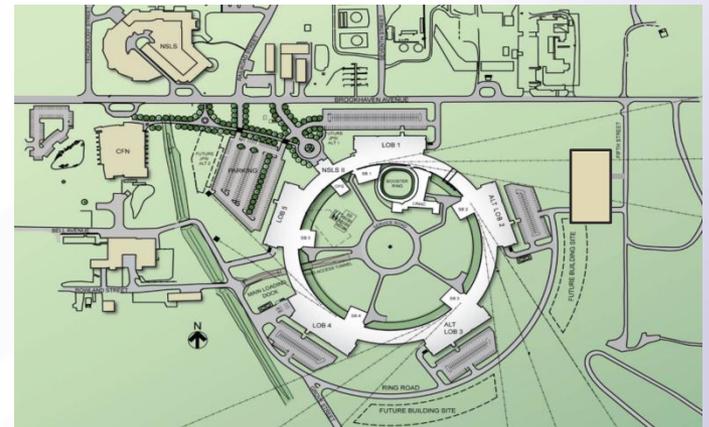
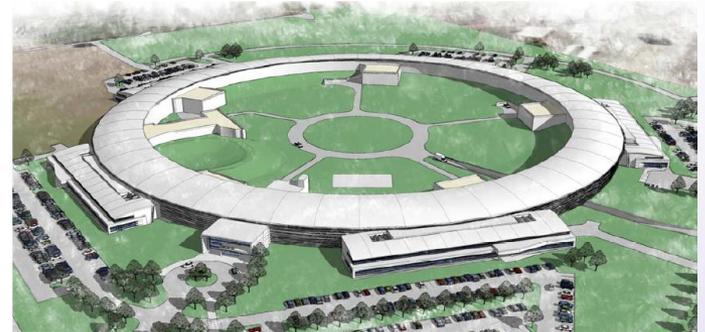
National Synchrotron Light Source

- Crucial resource for the Northeast
 - 2100 Users in FY 2006
 - 400 institutions
 - academic, industrial, government
 - > 900 publications in FY 2006 (a record)
 - ~ 25% in premier journals
- Vital for diversity of programs:
 - Chemistry, Physics, Nanoscience, Energy Science, Structural Biology, Environment and other BNL facilities
- What's next: NSLS-II
 - NSLS ~25 years old



NSLS-II: Enable the Nanoscience Revolution

- World-leading performance
 - 10,000 brighter than NSLS
 - 1 nm spatial resolution
 - 0.1 meV energy resolution
 - Synergy with the CFN
 - Dynamical characterization of new materials, reactions, processes
- Ground breaking June, 2009
 - \$925M TPC
 - Full operations in FY2015
 - Comparable in scope to RHIC operations



Center for Functional Nanomaterials

- **Mission:** To develop and share materials and processes at the nano-scale to address the nation's critical needs
 - User-oriented Facility
 - Focused on Energy
 - Offer materials preparation, characterization, theory and develop new techniques
- **Science Themes**
 - Electronic Nanomaterials
 - Soft/Bio Nanomaterials
 - Nano-catalysis/Interfaces
- **Facts**
 - Full operations: 5/08
 - 50-60 Staff
 - Expect 100s of Users each year



Brookhaven Strategic/Business Plan

BNL Energy Vision: effective use of renewable energy through improved conversion, transmission, and storage

BNL Initiatives



Core Programs:
BES BER
Applied

Energy Strategy

Materials for Catalysis: New nanocatalysts with enhanced loading/activity/tolerance

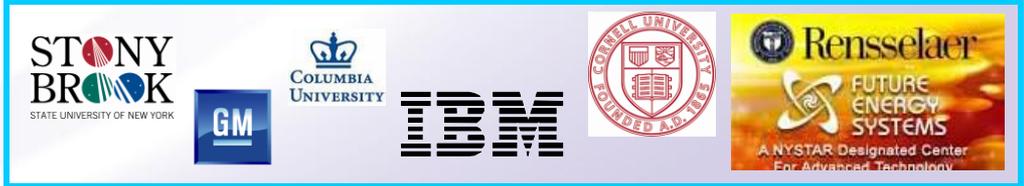
Complex/Correlated electron Materials: Improve our understanding of strong electronic correlations for enhanced physical properties (e.g. Tc, Jc, ZT).

Solar Nano-materials: Create nano-structured *materials and assemblies* for higher efficiency, cost-effective photovoltaic devices/fuel generation.

Biofuels: Lignocellulose breakdown, biomass enhancement, engineered plant production.

Energy Storage Materials: Create and understand materials to increase density and stability of storage

Collaborators/Joint Appointments



BROOKHAVEN

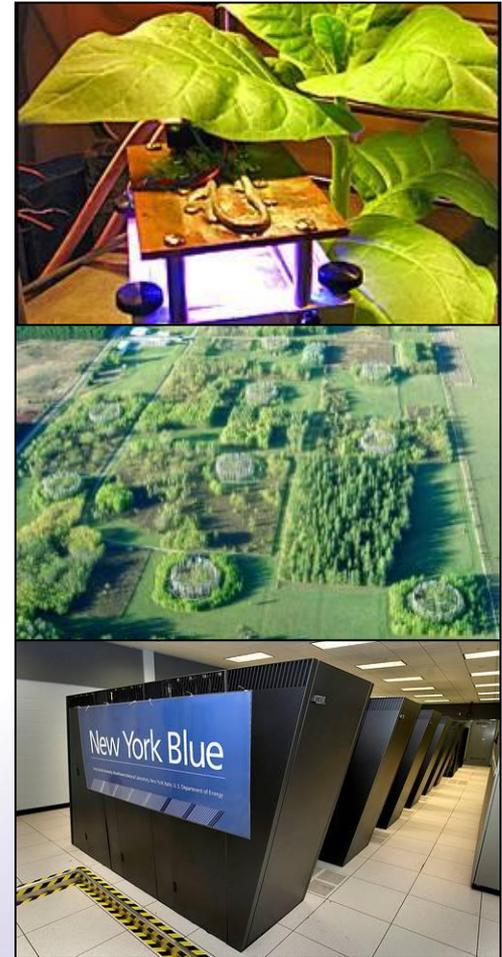
Brookhaven Science Associates

BNL Core Programs



Climate, Environment, Bio-Sciences

- Understand the effects of rising T, CO₂, and O₃ levels → genetic, epigenetic changes in crops
- Multidisciplinary initiative that integrates BNL leadership areas in:
 - Plant biology – imaging, genetics, plant-endophyte systems
 - Climate science – cloud & aerosol science, FACE technology, climate modeling
 - Energy policy – MARKAL program
- Leverages NYCCS, NSLS, NSLS-II
 - Large climate modeling effort recently funded by DOE
- New leadership coming on board
- Enhanced partnerships are key



Translational Biomedical Imaging

Three core elements

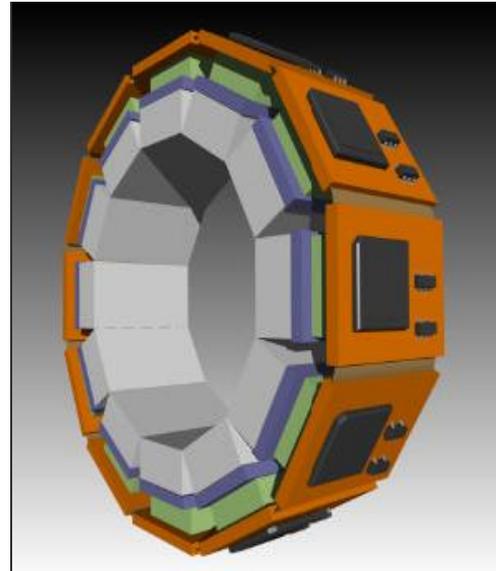
- Radiotracers (developed at BNL)
- Physical sciences, and Clinical and Preclinical Neuroscience
- Instrumentation (with Instrumentation Div., Physics,...)

Notable accomplishments

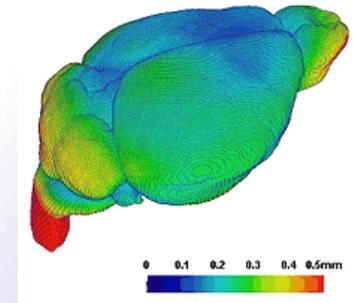
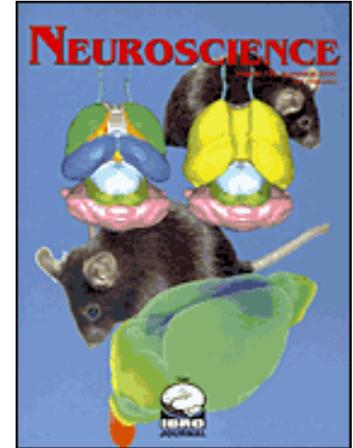
- Imaging the Awake Animal
- Clinical trials of GVG
- 3-D Atlas of Mouse Brain

Important part of the portfolio

- Needs broader support base



GVG
BNL Drug may Fight
Addiction: *LI Business*
News (3/17/2006)



Digital rendering of
genetically-engineered
mouse brain

Nuclear Detector R&D

Goal: Develop improved gamma-ray and neutron detectors for high-resolution spectroscopy and imaging

Core capabilities

- Crystal growth (BNL and its collaborators)
- Unique materials and device characterization tools
- Low-noise electronic read-out circuits (ASICs)
- Integration into portable instruments

Notable accomplishments

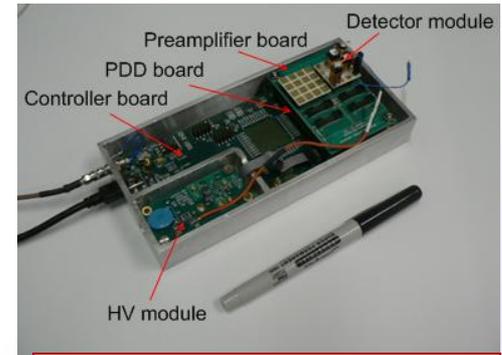
- Improved CZT solid-state gamma-ray spectrometers and imaging arrays
- High-spatial-resolution thermal neutron camera
- Directional fast neutron standoff detector

Benefits of detector program

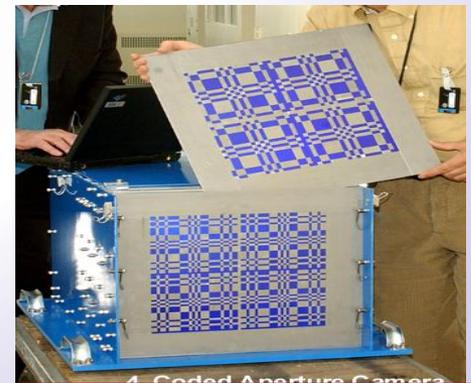
- Detectors and components impacting a variety of nonproliferation applications



CZT Gamma Detector



Gamma Isotope Identifier



Thermal Neutron Camera