High Performance Computing (HPC) Data Center Proposal

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Scientific & Enterprise Computing Data Centers at BNL

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BROOKHAVEN NATIONAL LABORATORY

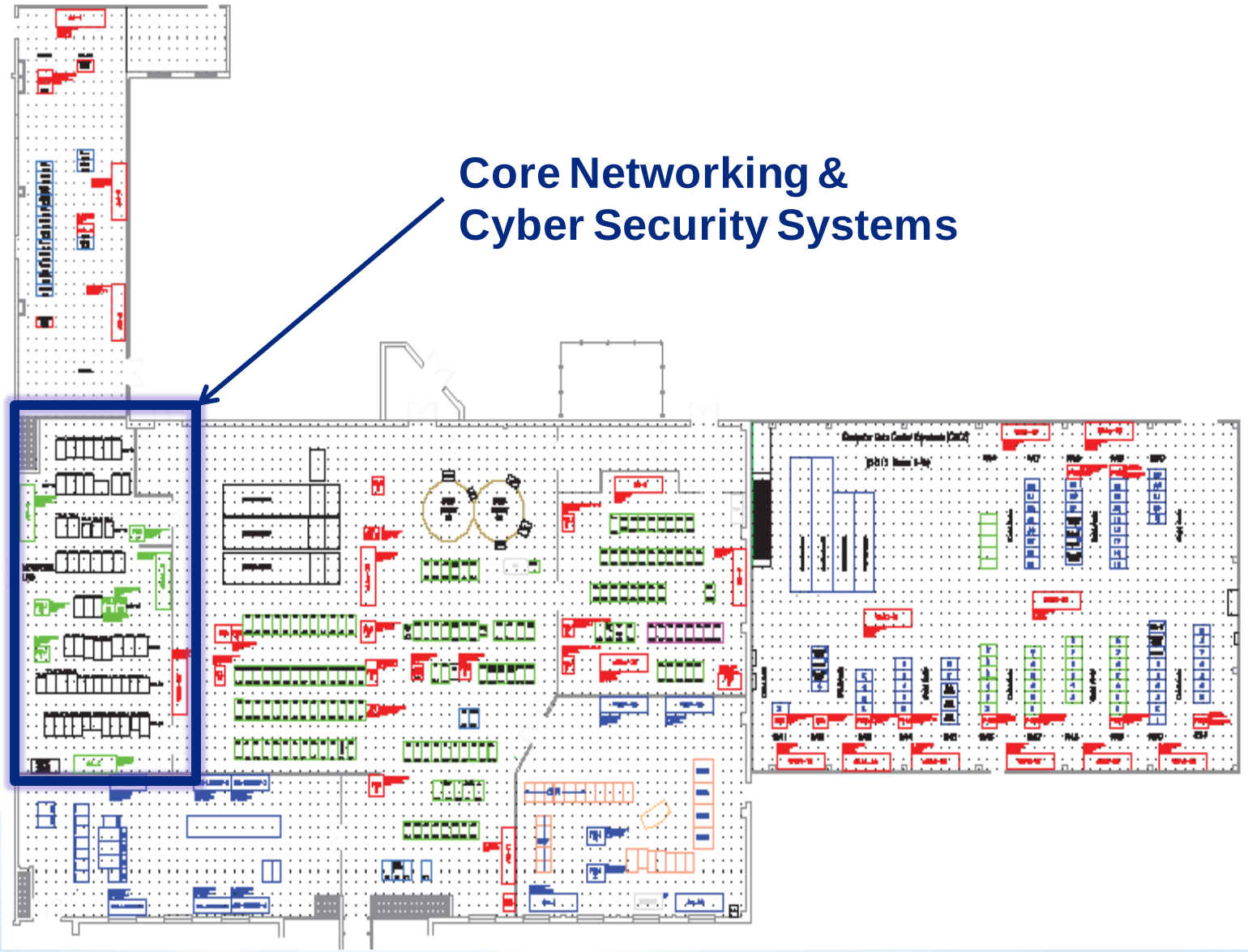
a passion for discovery

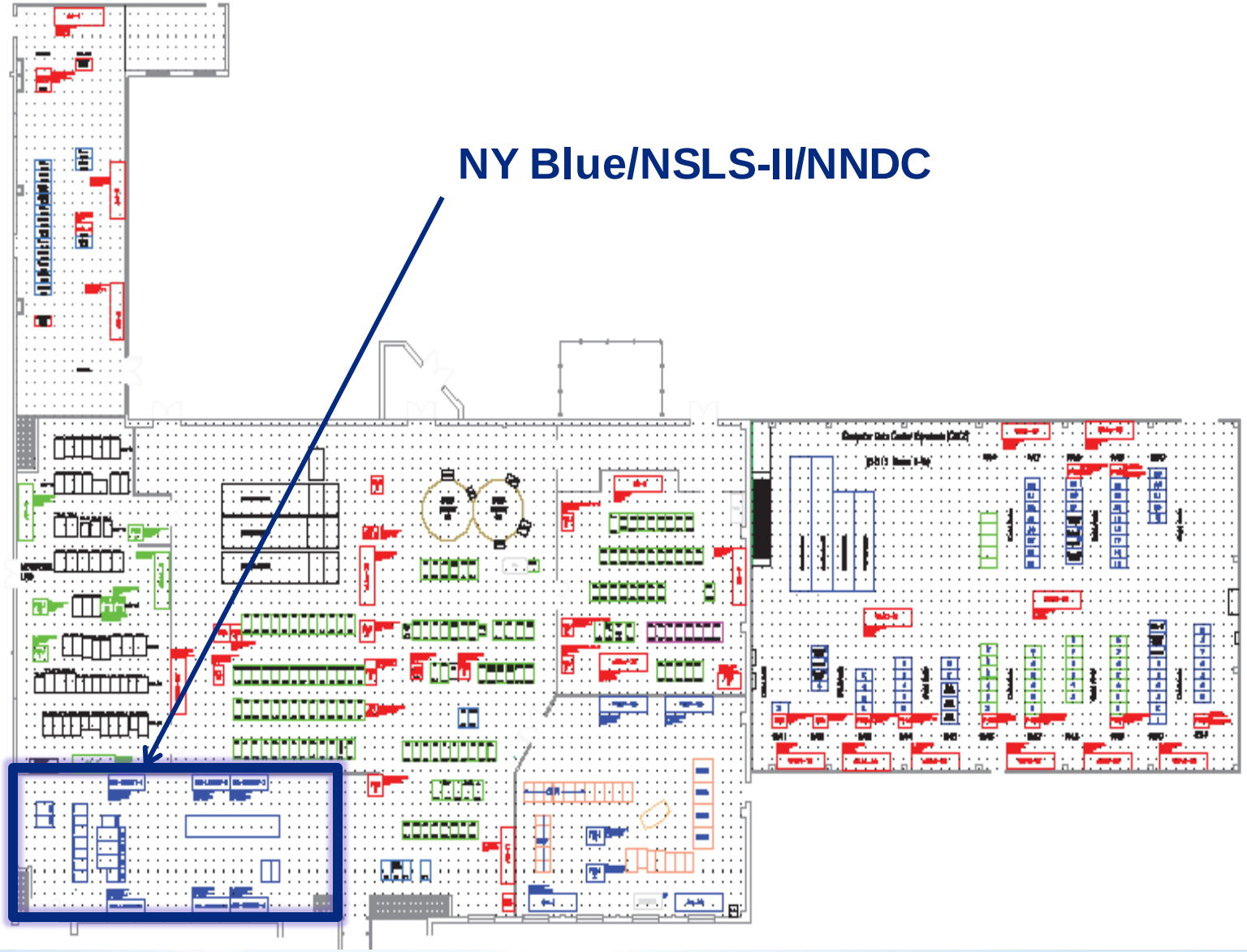
Office of Science
U.S. DEPARTMENT OF ENERGY

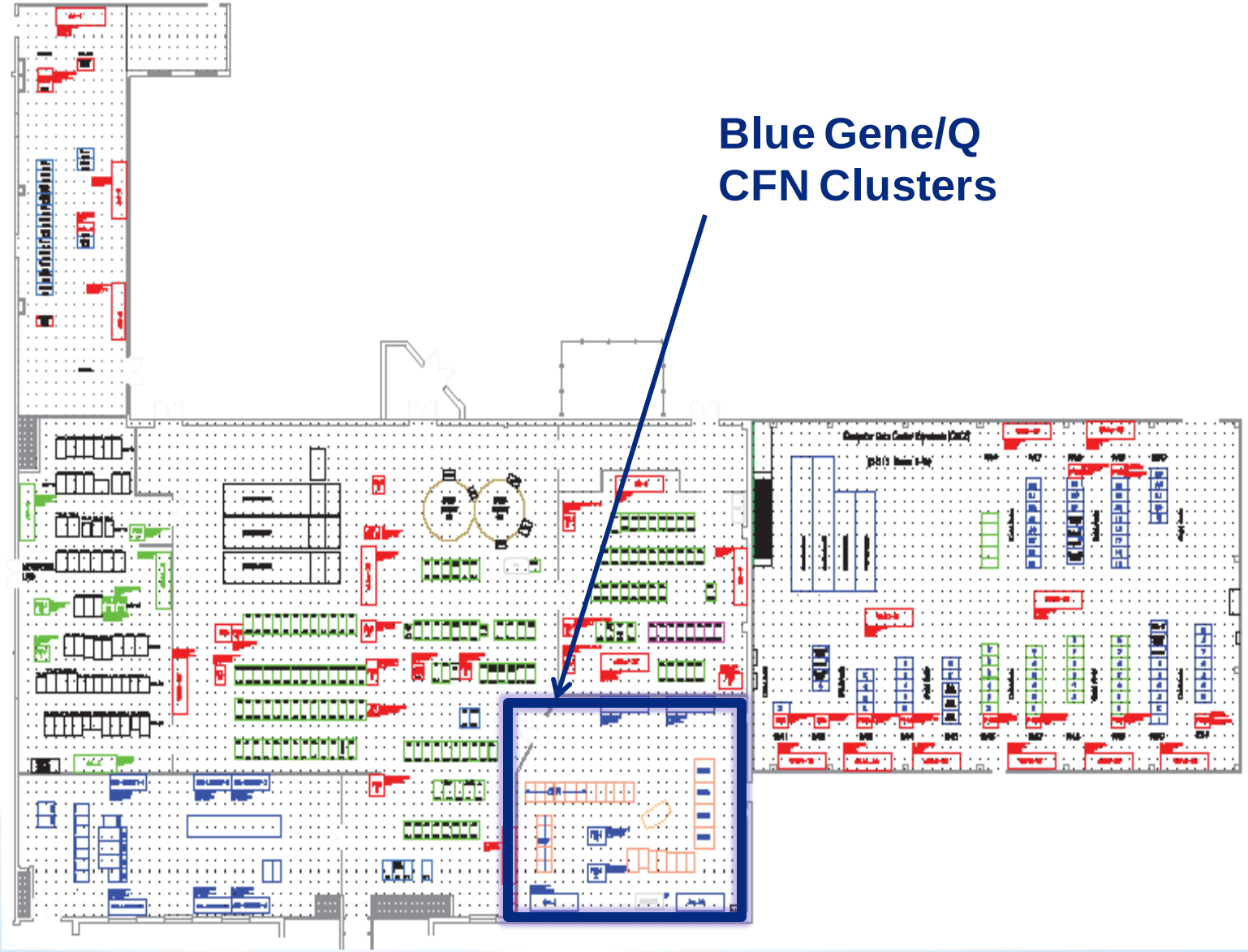
CURRENT BNL DATA CENTER AKA BCF (BROOKHAVEN COMPUTING FACILITY)

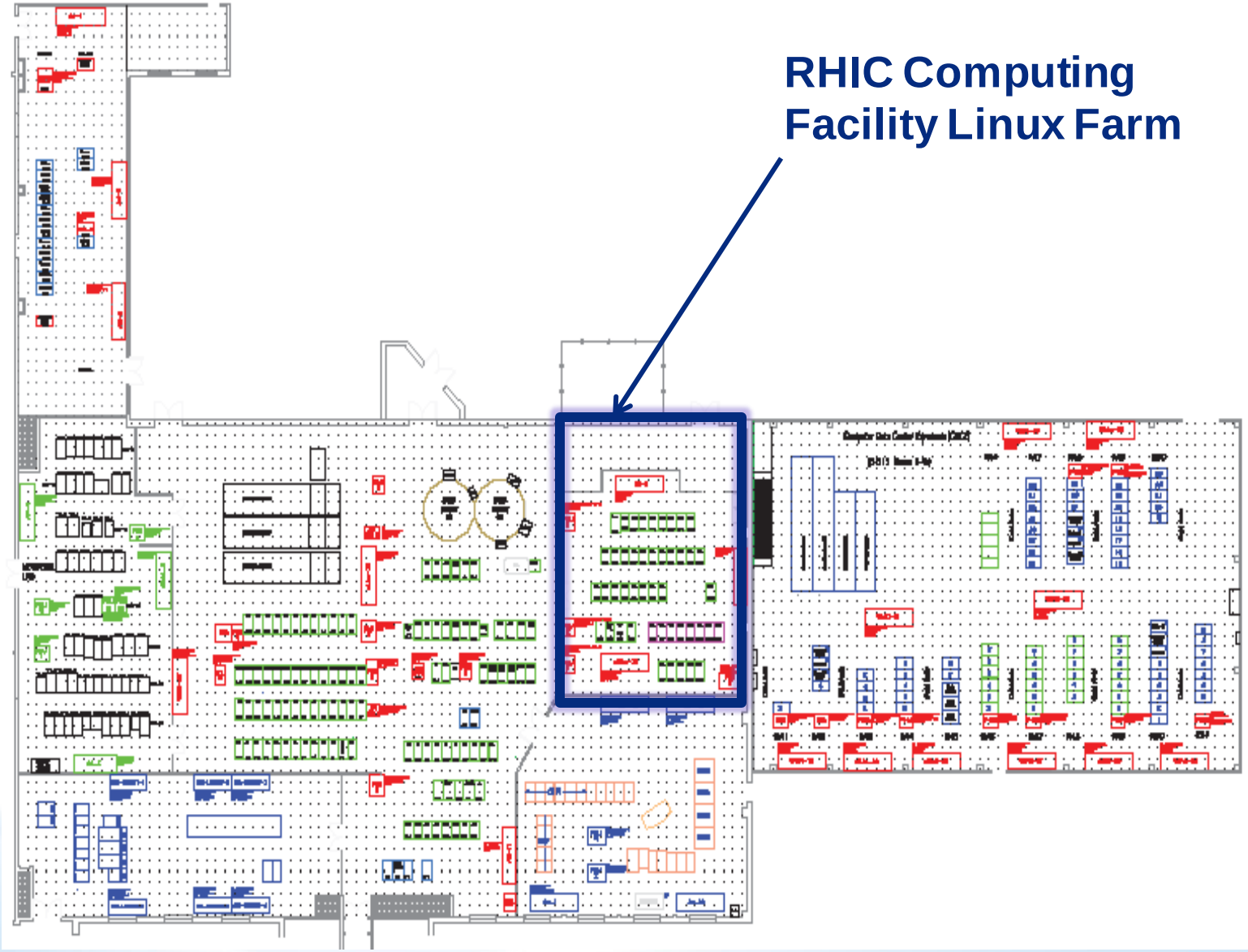
Quick Facts !!

- Located on 1st floor in Building 515
- Built in the 60' to house Mainframe computers at the time
- 22,000 Sq.ft Gross Area
- 24 Million kW-hrs/ Year Energy Usage
  - 60% to Power
  - 40% to Cooling
- 3.2 MW Emergency Back Up Power
  - 1MW Battery UPS (No Generator)
  - 2.2 MW Fly Wheel UPS Coupled with 2.3 MW Diesel Generator
- 1200 Ton Cooling Via Chilled Water CRAH Units
  - 80% Cooling unavailable on back up power
- Calculated PUE 1.9

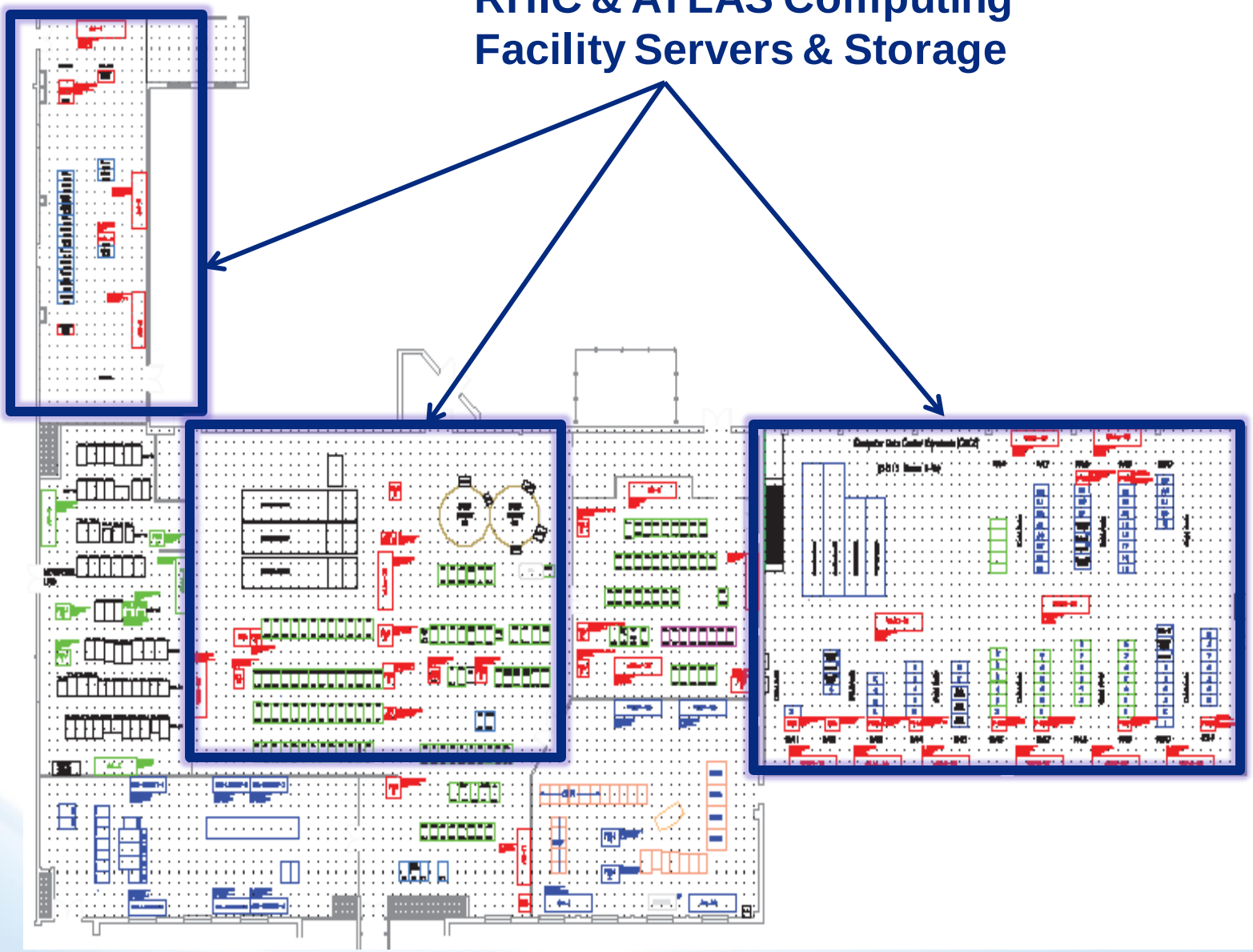

Core Networking &
Cyber Security Systems


NY Blue/NSLS-II/NNDC


Blue Gene/Q
CFN Clusters


RHIC Computing
Facility Linux Farm

RHIC & ATLAS Computing Facility Servers & Storage



Issues and Impacts in current Data Center

✓ Limiting Layout & Cooling Deficiencies

- ❑ The existing raised floor is only 12” deep and highly congested.
- ❑ Evolution of the physically fragmented floor plan contributes to inefficiencies and prevents optimization of space
- ❑ Existing cooling systems are obsolete and unreliable
- ❑ Back-up chilled water service does not exist in B515
- ❑ “Chaos cooling” practices (cooling the room air, not the equipment) result in cooling inefficiencies and wasted energy

Limits ability to meet increasing computing equipment cooling requirements & puts computing equipment & reliability at risk

✓ Power System Deficiencies

- ❑ Total facility power availability is inadequate for increasing modern computing power requirements - no power capacity for growth
- ❑ Existing power infrastructure negatively impacts reliability due to lack of sufficient UPS power distribution.

Limits ability to meet increasing computing power requirements, prevents growth & ability to meet future requirements & puts reliability at risk

✓ Inadequate/Limited Physical Space

- ❑ Inability leverage BNL existing strengths in data-centric and high-throughput computational science and to take advantage of efficiencies and productivity gains by the co-location of the computational support staff with multiple user communities
- ❑ Inability to leverage current and future joint ventures with other institutions and general industry

Limits ability to meet increasing computing power requirements, prevents growth & ability to meet future requirements & puts reliability at risk

Existing Infrastructure Deficiencies

- inappropriately located electrical equipment
- Tape storage (minimal cooling requirements) co-located with high density equipment
- Inefficient location of power distribution equipment on computing floor
- Lack of adequate wire management systems
- Stored materials on data center floor
- Inability to maximize use of available rack space

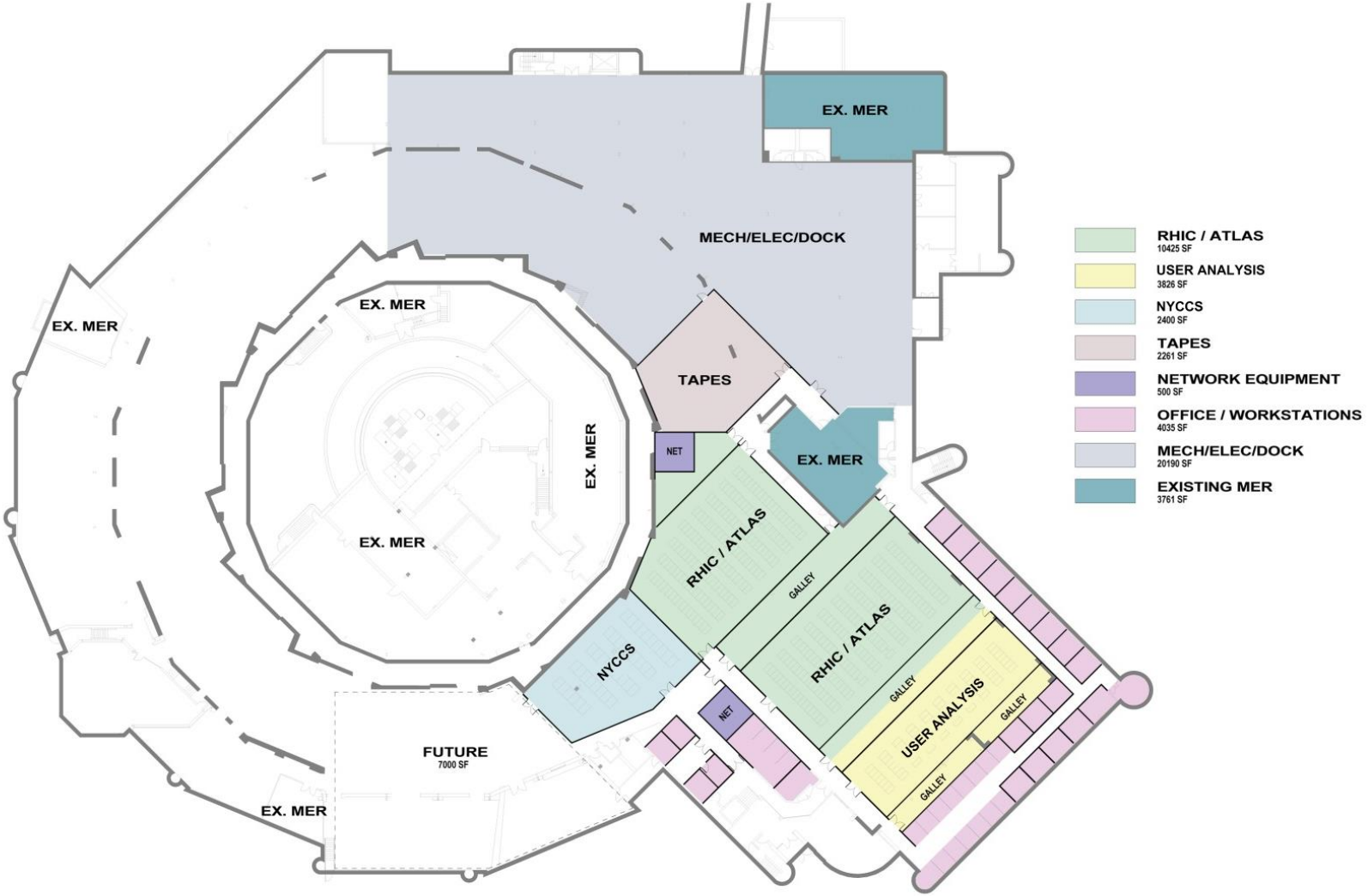
What To Do !!

- A mission need exists to provide computational and data storage support to current and planned particle physics experiments at both RHIC and the ATLAS detector at CERN
- A capability gap exists at the current computing facility as it has become functionally obsolete relative to the ability to meet power, cooling, and reliability requirements of modern mid-scale computing
- Failure to address the capability gap will impact the mission readiness of the RACF and will impose risk on research funded by NP and HEP, as well as other programs that rely on BNL's computational and data storage capabilities

Proposed Data Center Building-725

- **Proposed Scope for B725 Renovation Alternative**
  - New cooling infrastructure and back up cooling capabilities for initial (4-5 yr.) and long term (15 yr. “+”) needs
    - Chillers & cooling towers
    - Secondary chilled water service (for back-up)
    - Internal distribution with provision for incremental growth
  - New electrical infrastructure
    - Switchgear, generators, UPS/Flywheel equipment
    - Internal distribution with provision for incremental growth
  - Architectural Modifications
    - Demolition and removals
    - New roofing and exterior window systems
    - Raised floors, ceilings, lighting, finishes
    - ADA upgrades
  - Life Safety
    - Fire suppression and detection systems
    - Emergency lighting
    - Lightning protection

Proposed Layout -725 Data Center



725 Data Center- Preliminary Schedule

- **Preliminary Critical Decision Schedule**

CD-0 Approve Mission Need	FY 2015
CD-1 Approve Alternative Selection and Cost Range	FY 2016
CD-2/3A Approve Performance Baseline	FY 2017
CD-3B Approve Start of Construction	FY 2018
CD-4 Approve Project Completion	FY 2020

CD-2/3A allows for potential early infrastructure equipment procurements (I.e. chillers, generators, flywheels)

Thank you