Operations Breakout Overview

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Research Accelerator Division

SNS Accelerator Advisory Committee
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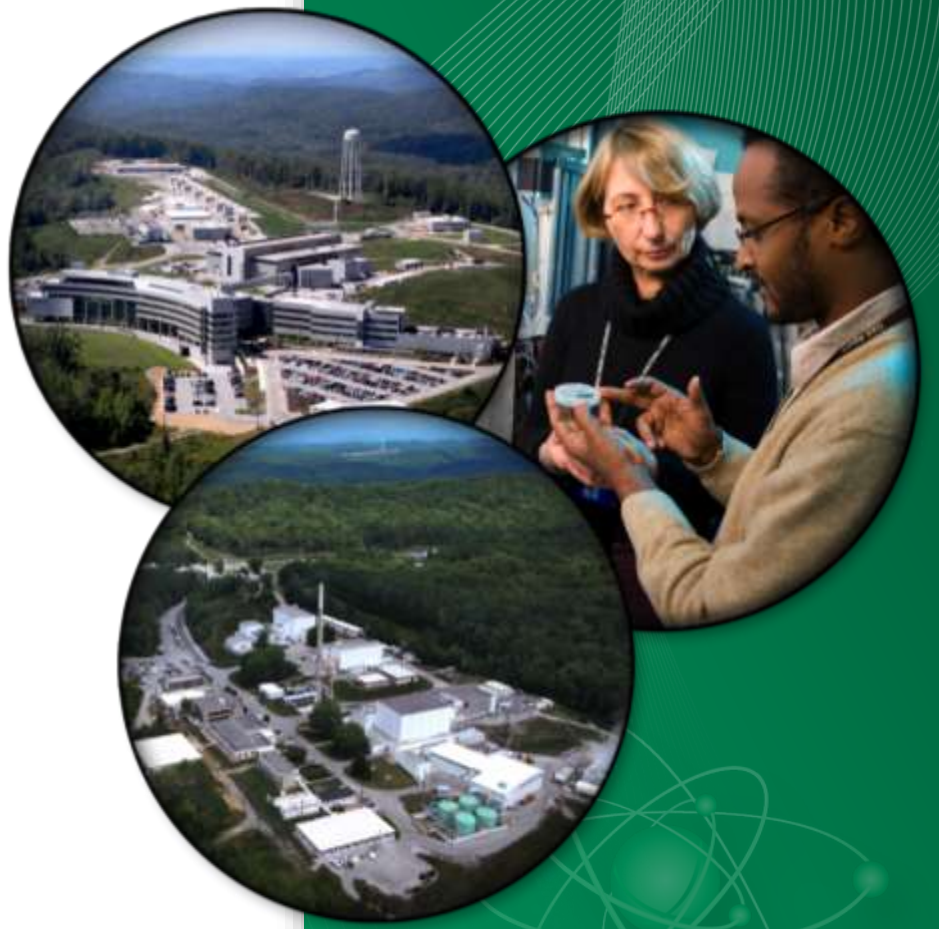


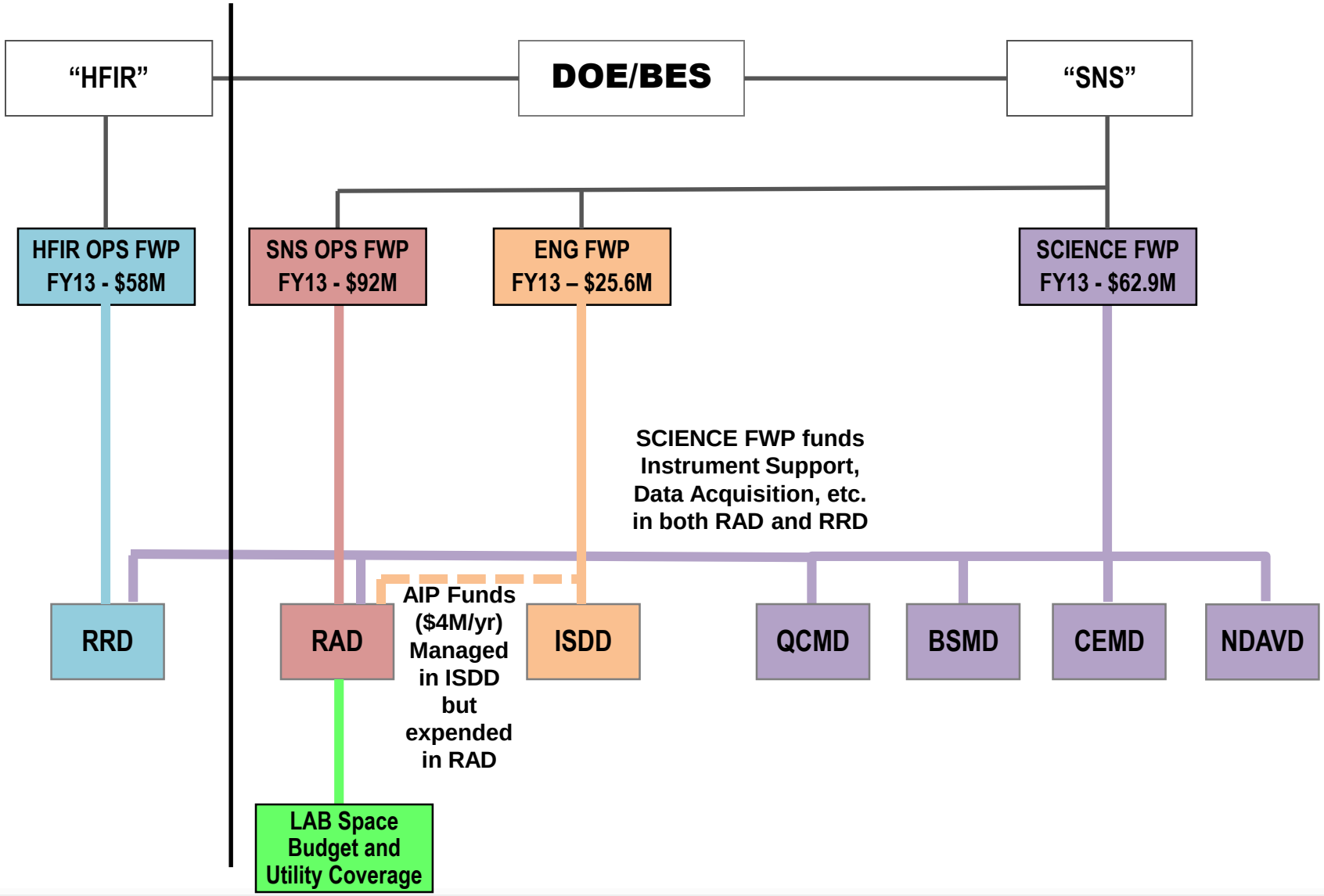
Our sponsor has very high expectations for both neutron source performance and quality/quantity of science produced

- SNS represents a government capital investment of over $1.4 Billion
- SNS is considered a high-profile facility with BES and the Office of Science
- SNS does not provide a unique new probe (e.g. LCLS) but significantly extends frontiers in flux/spectrum with sophisticated chopping and some polarized neutron capability
- The sponsor's expectations include:
  - Highly reliable, predictable operation of the neutron source at 1.4MW
  - >1,000 unique users per year with 18 instruments in the user program (excluding the Fundamental Neutron Physics Beam Line)
  - A number of publications commensurate with instrument throughput, including a substantial fraction of high-impact publications
  - Very high user satisfaction
  - A world-leading internal neutron scattering based science program
  - An effective and robust accelerator science and development program
- The SNS operating budget is the largest single programmatic element in the Office of Basic Energy Sciences, and invites scrutiny
- The sponsor has judged source performance to be satisfactory, but has expressed concerns regarding:
  - Scientific output quality and quantity
  - Support for instruments (detectors, sample environment, data acquisition, data visualization and analysis
  - Decisions to run a powers lower than 1 MW for target and budget conservation (2011)

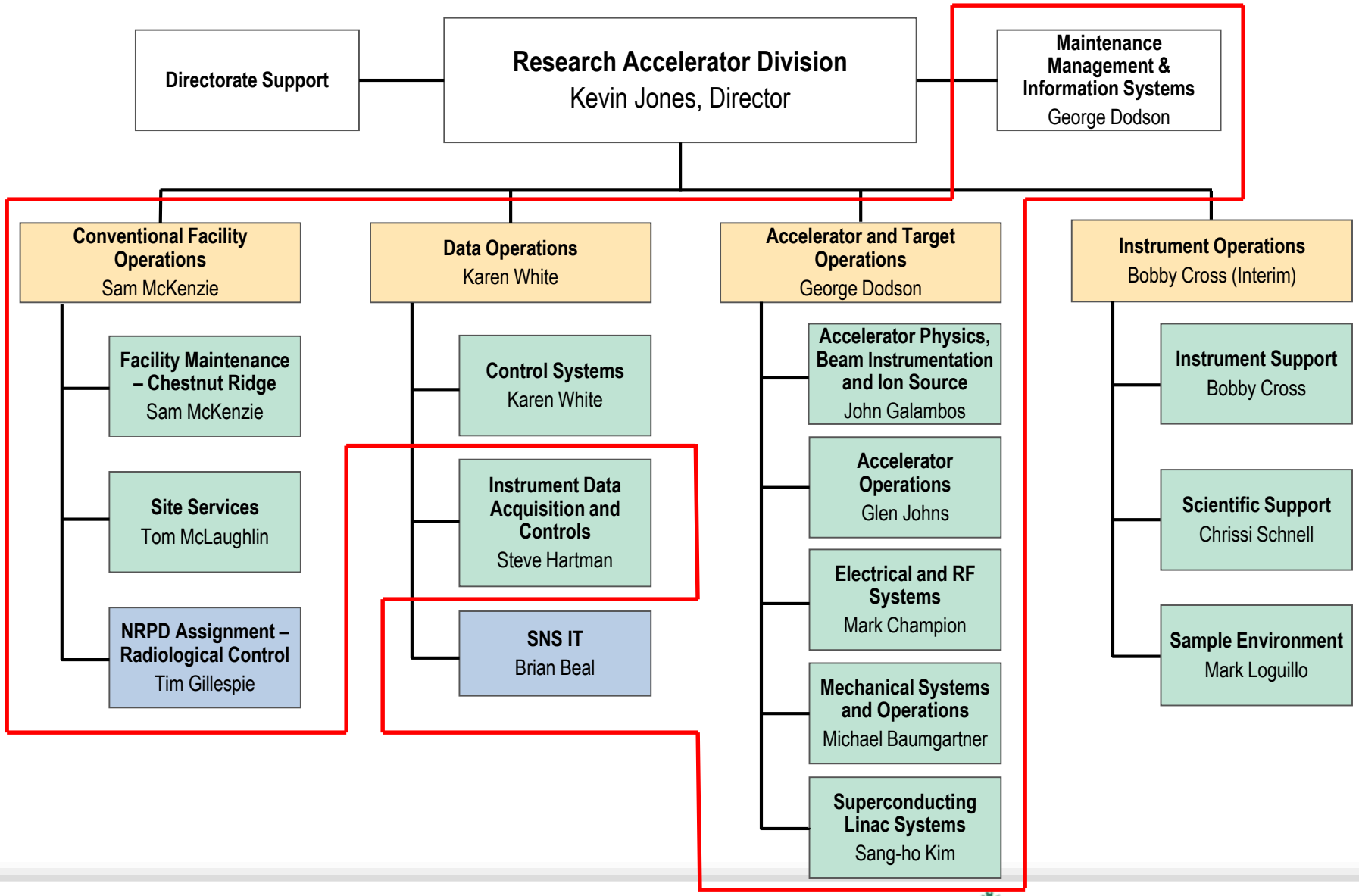
Is our organization cost effective and efficient?

- Do we understand the scope of work that we are accountable for, particularly to meet sponsor expectations?
- Do we have the right staffing level?
- Do we have the right staffing mix?
- Do we have a sensible maintenance strategy?
- Do we have a sensible inventory (spares) management strategy?
- Do we have a sensible obsolescence mitigation strategy?
- Do we have a sensible investment/improvement strategy?
- Are we responding appropriately to internal budget pressure?

Office of Science/Basic Energy Sciences funding flow for the Neutron Sciences Directorate is complex



Operations funding touches many aspects of the Research Accelerator Division organization



The FTE cost model for an ORNL employee is similar to that at other national laboratories

- Labor costs are based on a Wage Pool number for the employee job classification and salary range
- Example: Consider an employee with a base salary of $110,000

  Laboratory productive hours: 1,792

  Base hourly cost: $61.38

  Total Wage Pool = Base Salary + Holiday/Vacation + Other Absence + Variable Pay + Fringe

  $189,559 = $110,000 + $15,345 + $2,824 + $1,666 + $59,724

  Wage Pool Rate = Total Wage Pool/Productive Hours = $189,559 / 1792 = $105.78

- Each Directorate collects an Organizational Burden based on an hourly recovery rate to cover annual indirect expenses

  Based on productive hours within the organization (based on experience) – for NScD ~1,831 hours

  Costs are estimated for space, utilities, administration, matrix support (ESHQ, IT, HR, Finance, etc.), telephones, stipends, IT infrastructure, desktop computing, office supplies and non-program travel.

  Hourly recovery rate set by total estimated budget divided by total productive hours worked

  For SNS this is $22.60 per hour (lowest programmatic org. burden at ORNL)

- Total Burdened Labor Rate is then calculated as follows:

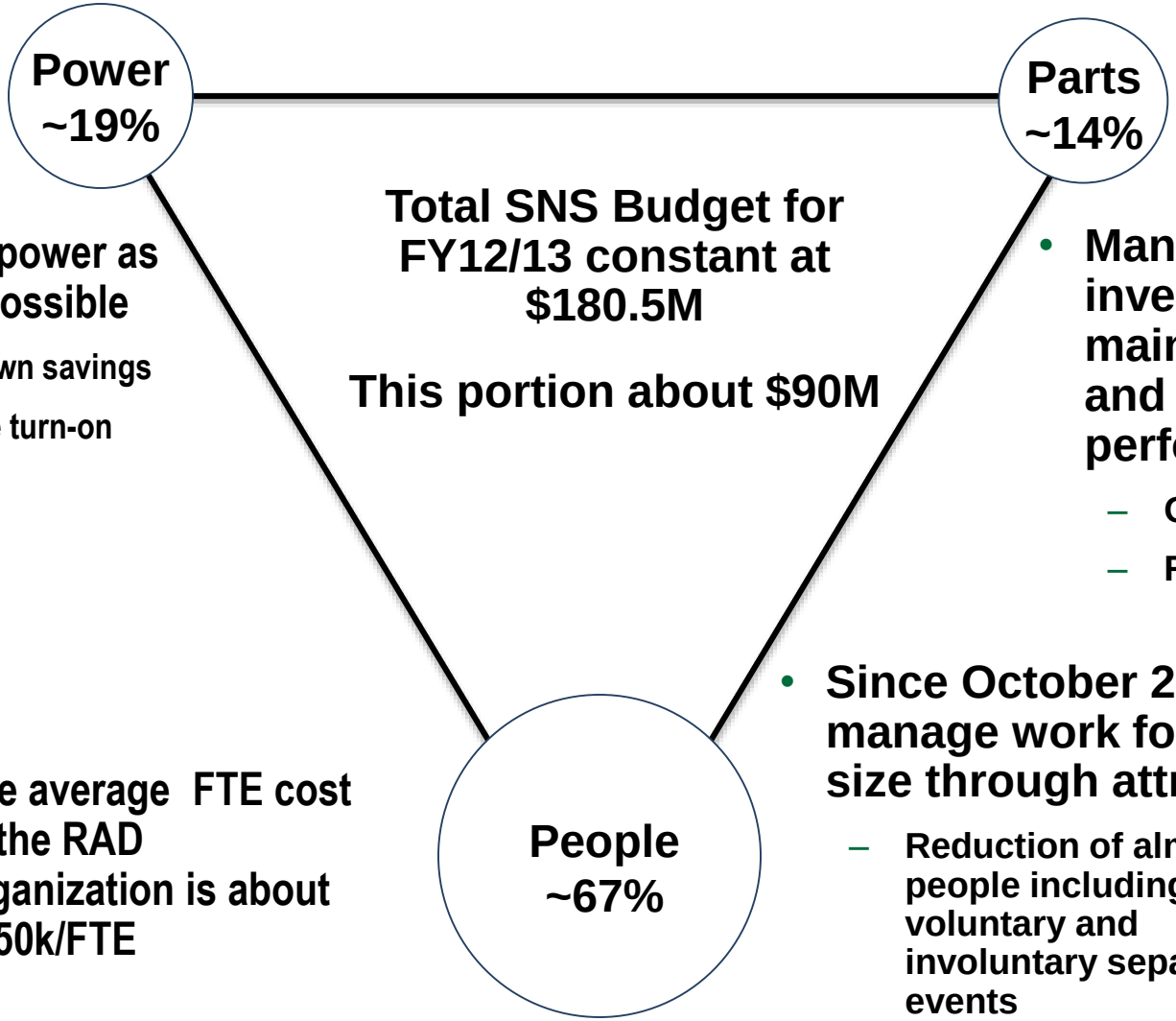
  Burdened Labor Rate = (Wage Pool Rate + Organization Burden Rate) x Laboratory Overhead Factor

  For example above: $174.60 = ($105.78 + $22.60) x 1.36

  Where the Laboratory Overhead Factor (36%) = G&A (27.1%) + Institutional Pool (3.4%) + LDRD (4.5%) + Fee (1.0%)

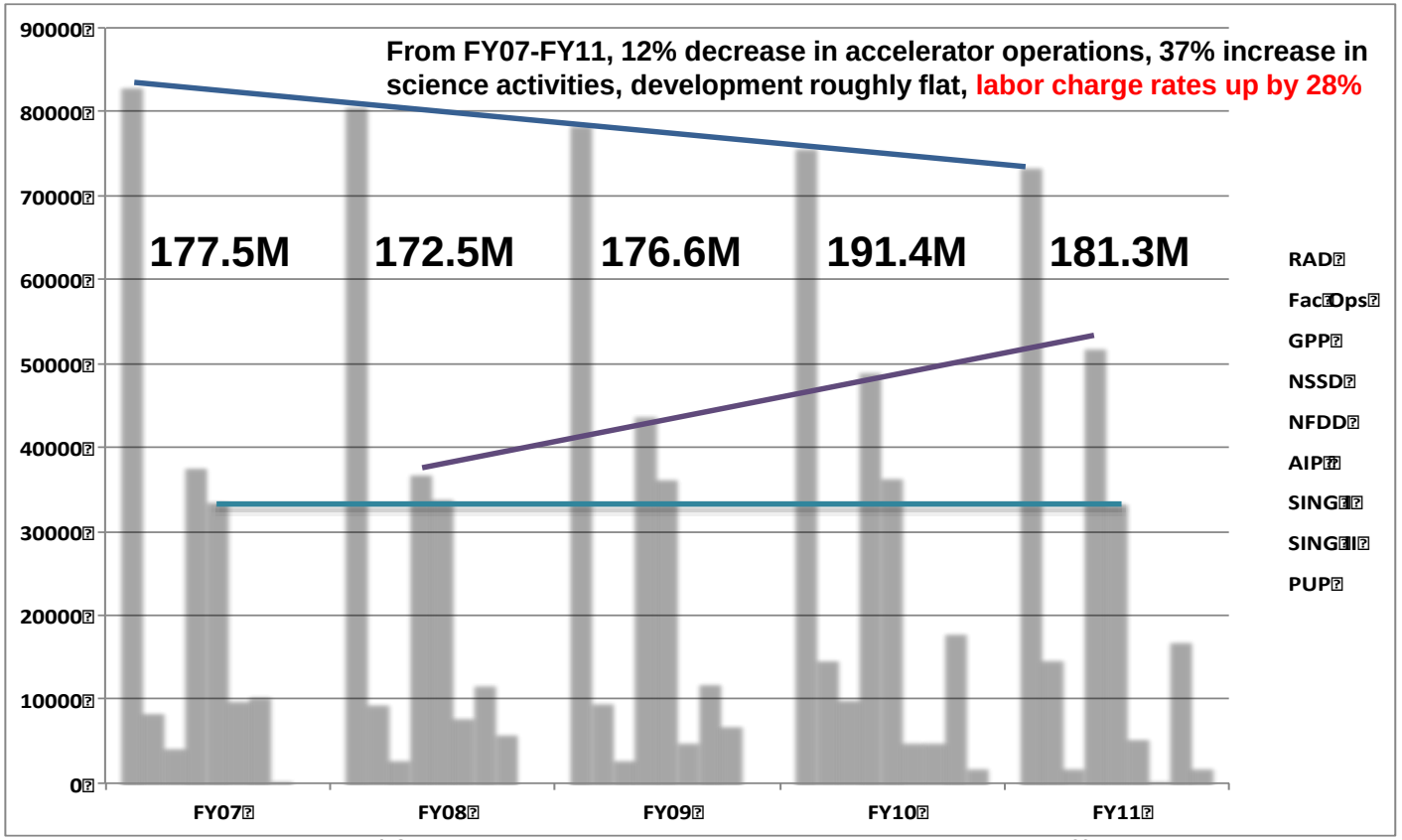
- Ratio of Burdened Labor Rate to Base Salary Hourly Rate is 174.60/61.38 = 2.84

For accelerator, target and conventional facility operation and related activities we must balance people, parts and power



- Conserve power as much as possible
  - Shutdown savings
  - Manage turn-on
- Manage spare parts inventory based on maintenance history and system performance
  - Obsolescence?
  - Risk Management
- Since October 2010, manage work force size through attrition
  - Reduction of almost 60 people including voluntary and involuntary separation events
- The average FTE cost in the RAD organization is about $250k/FTE

The accelerator/target/infrastructure budget is under pressure because budget allocations since FY09 reflect investment priority for neutron science



- Major reorganization in early FY12 renders ongoing direct comparison difficult
- FY12 and FY13 Budgets for SNS constant at ~180.5M
- FY13 budget for Science now at $63M (+$11M since FY11); for Engineering now at $25.6M (-$6M since FY11)
- Labor charge rates reduced by about 8% since FY11

The scope of work required to support the sponsor's expectations is substantial

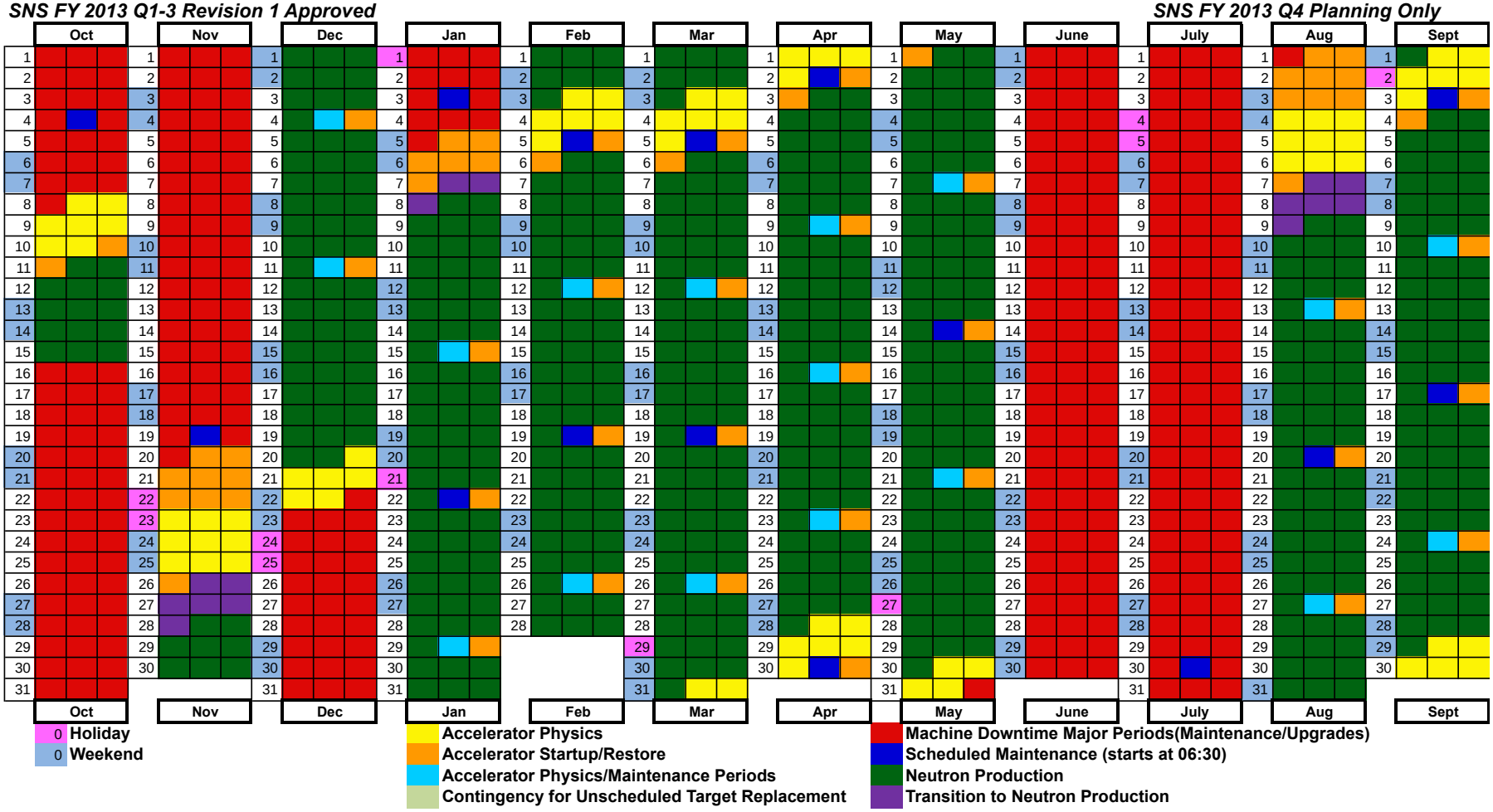
- From a functional perspective our organization is the design agency for all elements of the accelerator complex except the proton beam window, target/moderator/reflector systems and associated support infrastructure
- We perform the following functions:
  - Design engineering (Electrical, Mechanical, Electronic, Civil, Cryogenic, Industrial, System)
  - Product specification
  - Procurement
  - Assembly
  - Testing
  - Installation
  - Operation
  - Maintenance
  - Software development
  - Research and Development

Our organizational structure is a conventional model based on technical disciplines to take advantage of common technical knowledge and skill

- Facilities Management
- Accelerator Science and Beam Measurement
  - Includes ion sources
- Electrical and RF Systems
- Mechanical Systems
- Cryogenic and Superconducting Systems
- Control Systems
- Information Technology Systems
- Operations

An important component of what we do (in several parts of the organization) is to provide technical support to instrument operations and scientific endeavors – this effort is not included in the SNS Science FWP

Our staffing levels must reflect the "peak loading factor" associated with the two long maintenance outages each year



- Management of overtime during outages is challenging
- The two mandatory maintenance days each month have helped to reduce accumulation of small maintenance tasks
- There are opportunities to improve outage management, particularly looking forward to integrating major upgrade activities (e.g. STS/PUP) with ongoing facility maintenance

Our maintenance philosophy is based on a reliability-centered approach, although analytical modeling is not yet fully implemented

- Use the sophistication of the available data and controls to manage automated restart for very short faults, and to limit errant beam events
- Have a responsive corrective and predictive maintenance approach
  - Weekly maintenance opportunities are essential
- Do not accumulate deferred maintenance on an annualized basis
  - Manage tasks on a weekly basis and incorporate into next available outage based on resource limitations
- Implement a strategy that defends against failures of 3 or more hours duration
  - Greatest impact on scientific throughput
  - Drives overall structure of down time / reliability
  - Invest in test facilities to limit likelihood of infant mortalities when upgrades are installed
- Be aggressive in recognizing and addressing obsolescence, particularly for electronic systems
  - Utilize COTS hardware as much as possible, avoid in-house custom hardware unless no effective solution exists
- Function as a complete entity – each functional discipline manager should appreciate the vulnerabilities of others, and be willing to support decisions that minimize overall facility risks

The budget process has been highly uncertain given the federal appropriations methodology and BES funds disbursement

- Match staff with planned scope of work
- Establish priority system for procurements, contracts and new hires – current budget only includes priority 1 requests (must do or significant impact on operations)
- Allocate budget sub-elements for:
  - Contract support
  - Spares
  - Instrument support
  - Recurring operations costs
  - Facility repairs and improvements
  - Power upgrade
  - Upgrades for availability
  - Maintenance and GPP planning
  - Materials and Supplies
  - Travel
  - Miscellaneous
  - Utilities
  - Capital equipment
- Iterate, iterate, iterate