NDCX-II Construction Status

Will Waldron
Project Manager

12/8/10 HIFS-VNL Program Advisory Committee Meeting

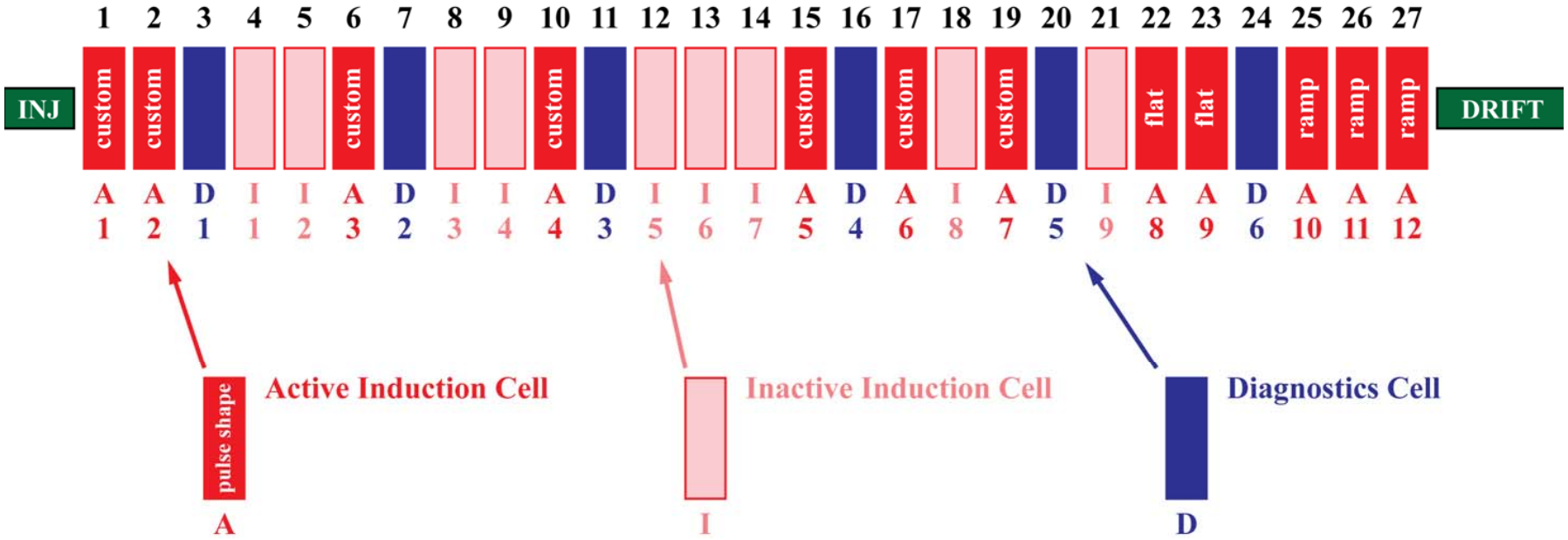
The Heavy Ion Fusion Science Virtual National Laboratory

* This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Security, LLC, Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344, by LBNL under Contract DE-AC02-05CH11231, and by PPPL under Contract DE-AC02-76CH03073.

Project Oversight Status

- **DOE quarterly review took place on 10/6/10**
- **A baseline change proposal has just been approved with the Estimate to Complete presented at the 10/6/10 quarterly review**
- **Expecting a DOE quarterly review in January or early February**
- **Edward Stevens is the new DOE project manager**

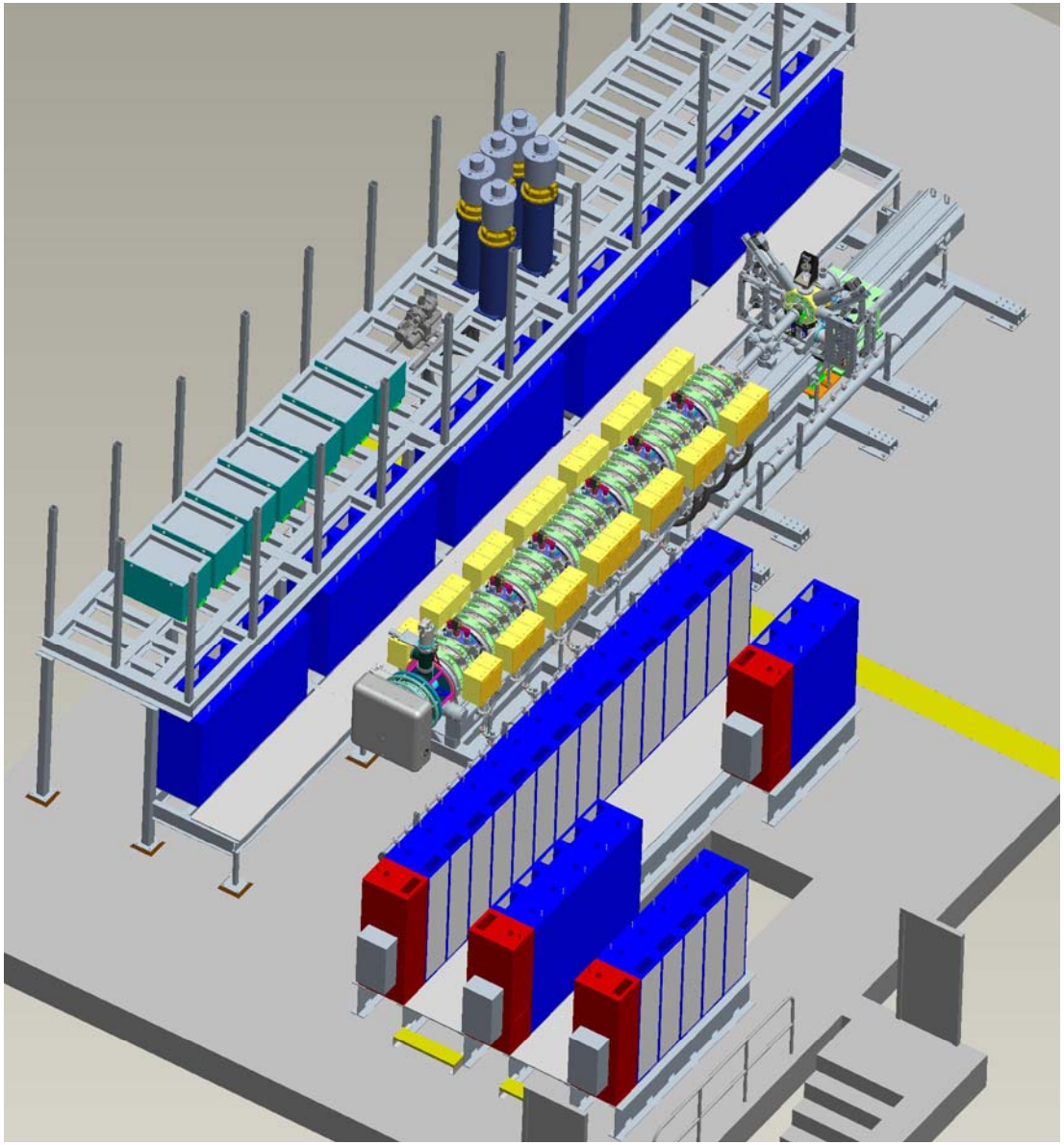
Baseline Hardware Configuration



- 27 lattice periods after the injector
- Includes 12 active induction cells

Extracted Beam Charge ~ 50 nC
FWHM < 1 ns
Energy ~ 1.2 MeV

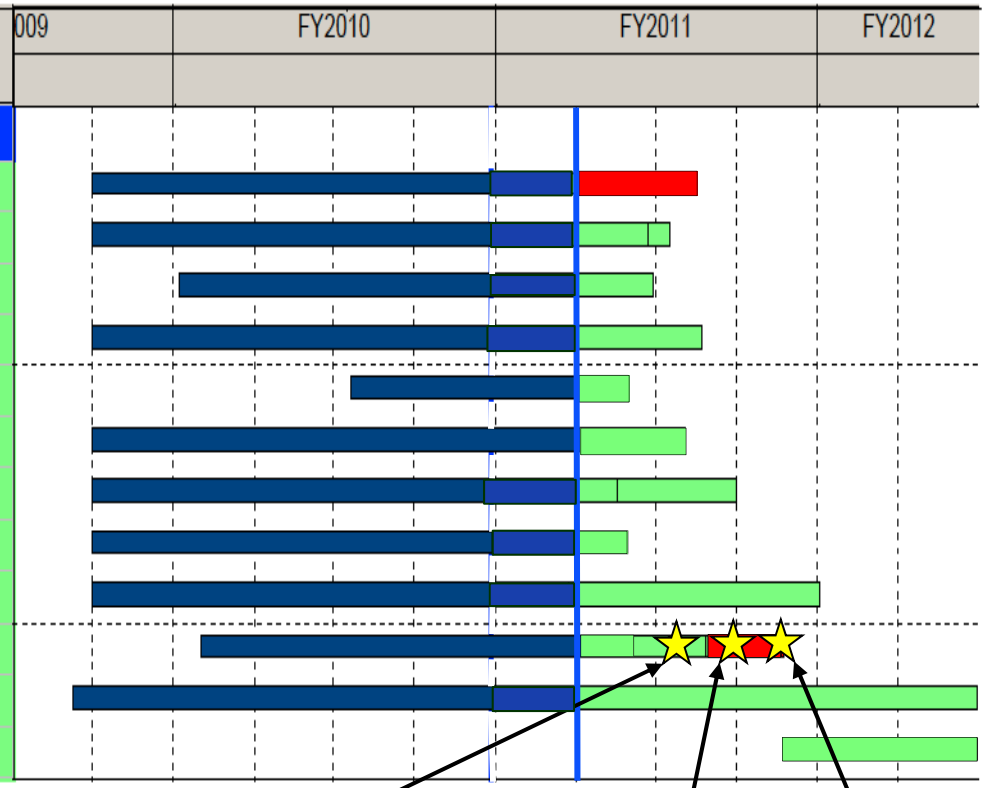
Project Highlights and Detailed Layout



- Equipment platform has been installed
- All cells have been modified to accept production solenoids
- Most solenoids are wound and potted
- Solenoid/cell alignment procedure is being finalized
- Injector design will be finalized in December
- Solenoid pulser rack assembly contract to be awarded in December

Project Schedule – We are at the mid-point of the project. The injector is on the critical path.

Activity Name	Start	Finish
Nr NDCX-II_September BCP	11-Jun-09 A	30-Mar-12
Nr.1 ACCELERATOR HARDWARE	01-Jul-09 A	17-May-11
Nr.2 ACCELERATOR PULSED POWER	01-Jul-09 A	18-Apr-11
Nr.3 DRIFT COMPRESSION	07-Oct-09 A	30-Mar-11
Nr.4 SUPPORT AND ALIGNMENT	01-Jul-09 A	24-May-11
Nr.5 MECHANICAL UTILITIES	20-Apr-10 A	28-Feb-11
Nr.6 ELECTRICAL UTILITIES	01-Jul-09 A	05-May-11
Nr.7 DATA ACQUISITION & CONTROL SYSTEMS	01-Jul-09 A	30-Jun-11
Nr.8 FACILITIES	01-Jul-09 A	28-Feb-11
Nr.9 PHYSICS SUPPORT AND R&D	01-Jul-09 A	03-Oct-11
Nr.10 INTEGRATION	02-Nov-09 A	23-Aug-11
Nr.11 PROJECT MANAGEMENT	11-Jun-09 A	30-Mar-12
Nr.12 CONTINGENCY	24-Aug-11	30-Mar-12



Accelerator Installation Complete

NDCXII Beam Accelerated

Injector Installation Complete Start Integrated Testing

All planned milestones have been met so far and as of 12/10, we forecast an early project complete before the official end date

Milestones	Planned	Actual/Forecast
Complete NEPA Review/Issue Record of Decision	Jul-09	**Jul-09 (A)**
Recovery Act Funds Distribution	Jul-09	**Jul-09 (A)**
Begin Prototype and Refurbishment Activities	Aug-09	**Aug-09 (A)**
Complete detailed engineering design of prototype test cell. Begin equipment procurement.	Sep-09	**Sep-09 (A)**
Establish project Baseline Plan	Dec-09	**Dec-09 (A)**
Conduct Technical Baseline and Management Review, Continue equipment procurement of accelerator components	Mar-10	**Mar-10 (A)**
Complete Pulsed Power Prototypes (Cell and Magnet Pulsers)	Jun-10	**Jun-10 (A)**
Complete First Article Induction Cell	Sep-10	**Sep-10 (A)**
Complete Accelerator Equipment Platform Installation	Dec-10	**Aug-10 (A)**
Complete Injector Design	Mar-11	Dec-10 (F)
Complete Accelerator Cell Refurbishment	Jun-11	Jan-11 (F)
Complete Injector Fabrication	Sep-11	May-11 (F)
Complete Accelerator Installation	Dec-11	Apr-11 (F)
NDCX-II Beam Accelerated, Project Complete	Mar-12	Aug-11(F)

Financial Data $K Through November

TEC	$11,000
TPC	$11,000
EAC	$10,067
ETC	$2,700

Actuals to Date	$5,324
Open Commitments	$2,043
Total Commitments	$7,367
Contingency	$933

Estimated Actual Cost (EAC) = Total Commitments + Estimate To Complete (ETC)

Total Project Cost (TPC) = EAC + Contingency

Project Statistics Through November

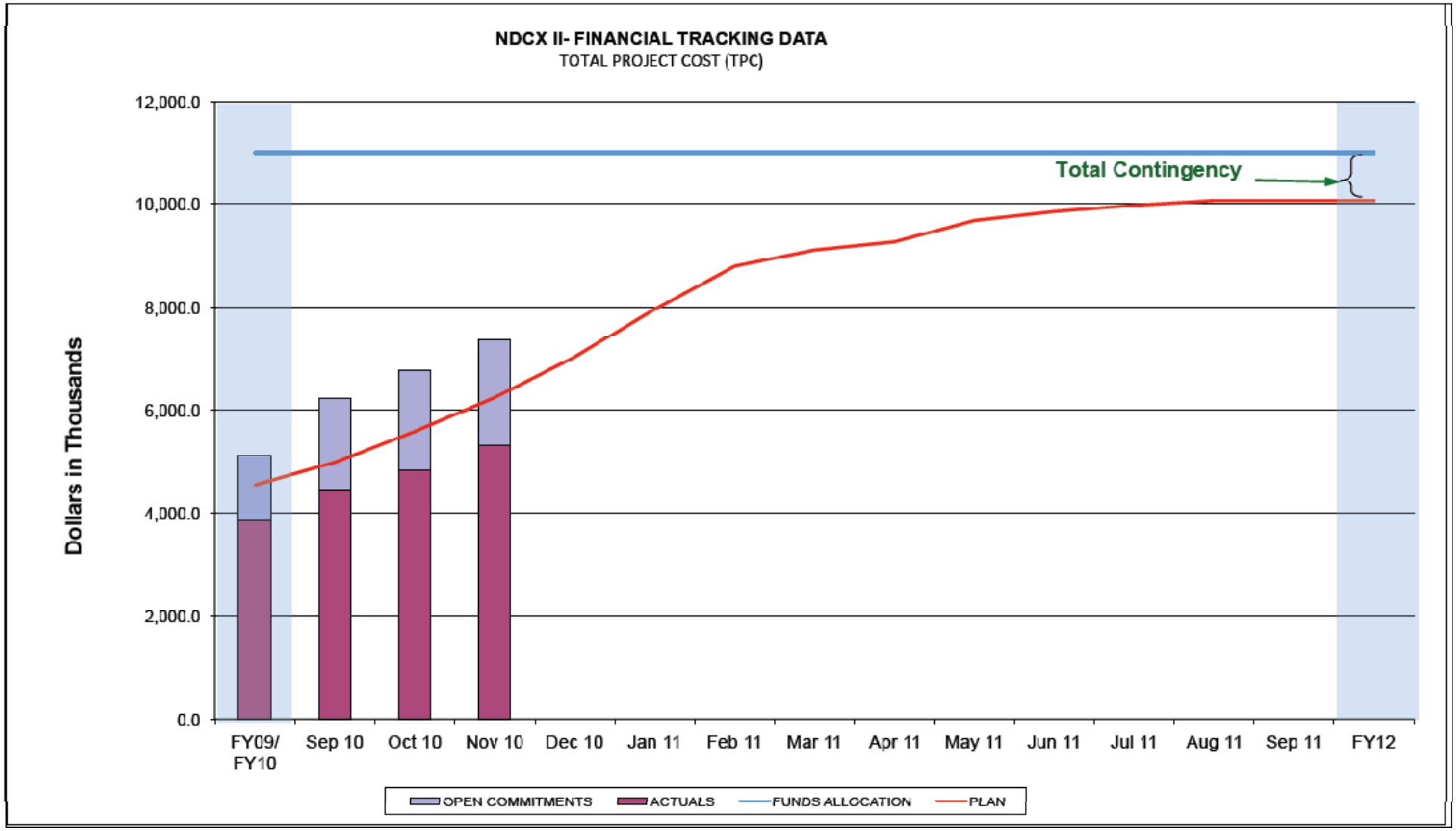
	Current
Overall Scheduled Tasks Percent Complete	56%
Percent of Time Elapsed (32 mo project)	50%
Funds Spent (% of EAC)	53%
Funds Spent plus Funds Committed (% of EAC)	73%
Contingency, in percent of remaining budget	35%

A Baseline Change Proposal (BCP) is now in process to take into account a recent Estimate to Completion (ETC)

Estimated Actual Cost (EAC) = Total Commitments + Estimate To Complete (ETC)

Total Project Cost (TPC) = EAC + Contingency

Spending plan per the Baseline Change Proposal



Project Risks 1

- **Work delays from facilities and outside contractors**
  - **Weekly status meeting with facilities**
  - **Utilize B58 technical staff when possible**

- **Diagnostic cell vacuum chambers (6)**
  - **Original vendor could not meet the specifications**
  - **Fabrication contract was re-bid and awarded**
  - **Schedule is impacted, but scheduled delivery is acceptable**

- **B58A building code compliance issues (e.g., basement stair upgrade for 180k$)**
  - **Building code compliance study identified B58A action items**
  - **We are getting quotes and discussing potential non-project budget sources to address these items with Jim Krupnick (LBNL Chief Operating Officer)**

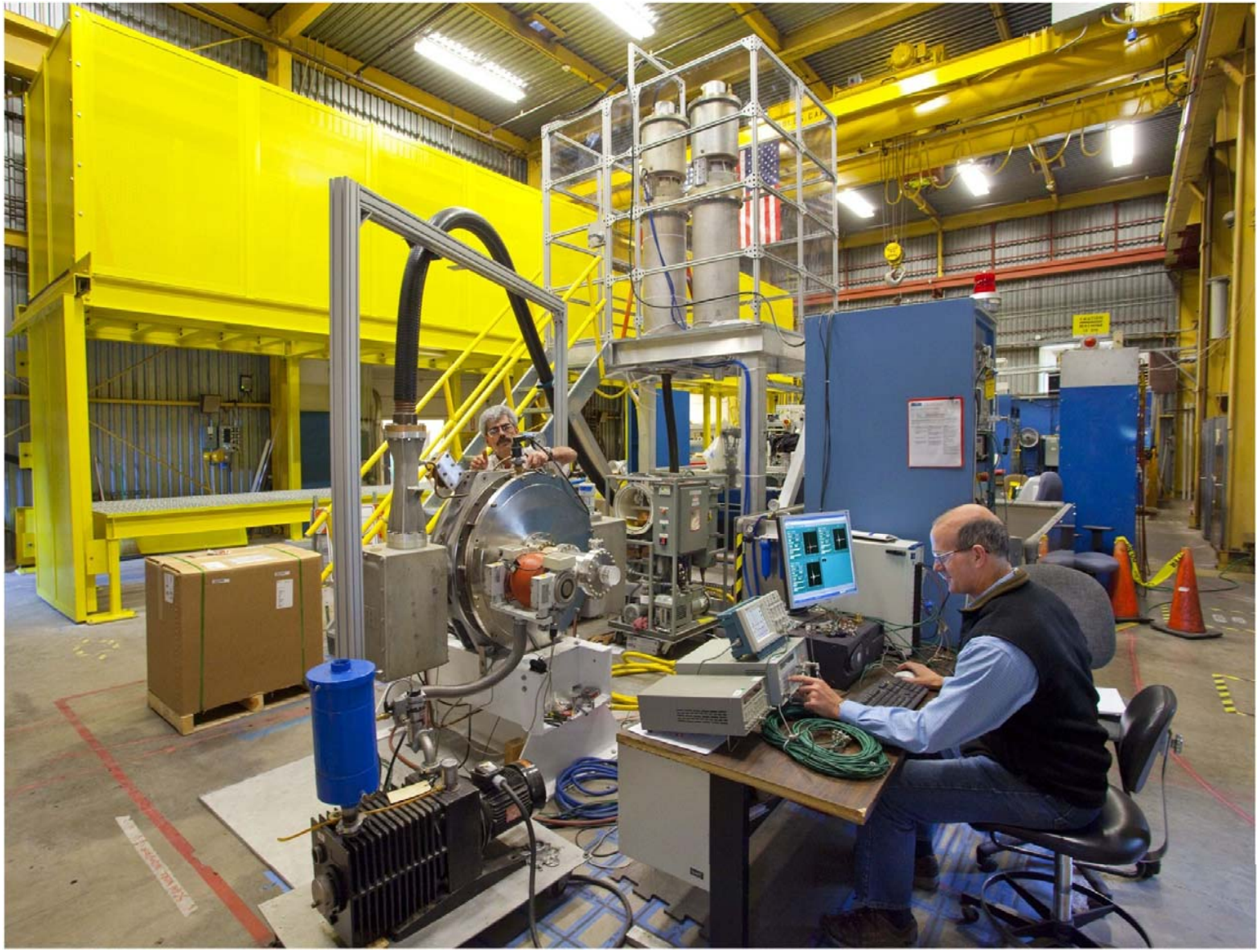
- **Beam position monitor signal-to-noise ratio is a concern because the noise level of the completed facility is unknown**
  - **A grounding and shielding plan is being implemented with the consultation of a LANL retiree (Mike Thuot)**

Project Risks 2

- **Ion source performance**
  - **Defined plan to scale up the ion source from ¼" diameter to 4" diameter**
  - **Working closely with Spectra-Mat who will produce the filament and substrate assembly**

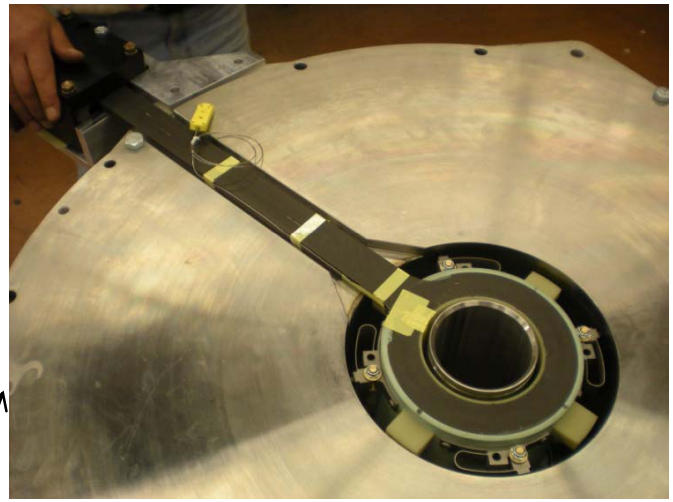
- **High filament and source temperatures in the injector (filament ~1900ºC and source ~1300ºC)**
  - **Thermal modeling has been done to determine the cooling requirements of injector components**
  - **Outgassing tests at elevated temperatures are planned for the epoxy in the ceramic column**

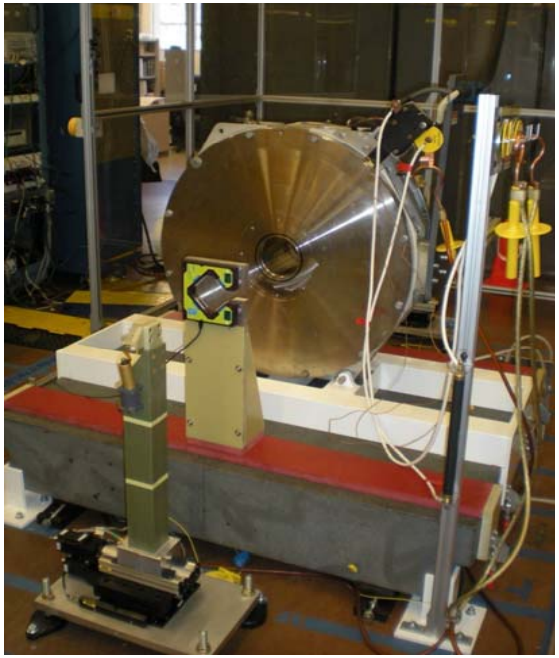
The NDCX-II test stand has been used for the testing of beam position monitors, Blumleins, and compression section pulsers.



Activities in B58 and B58A

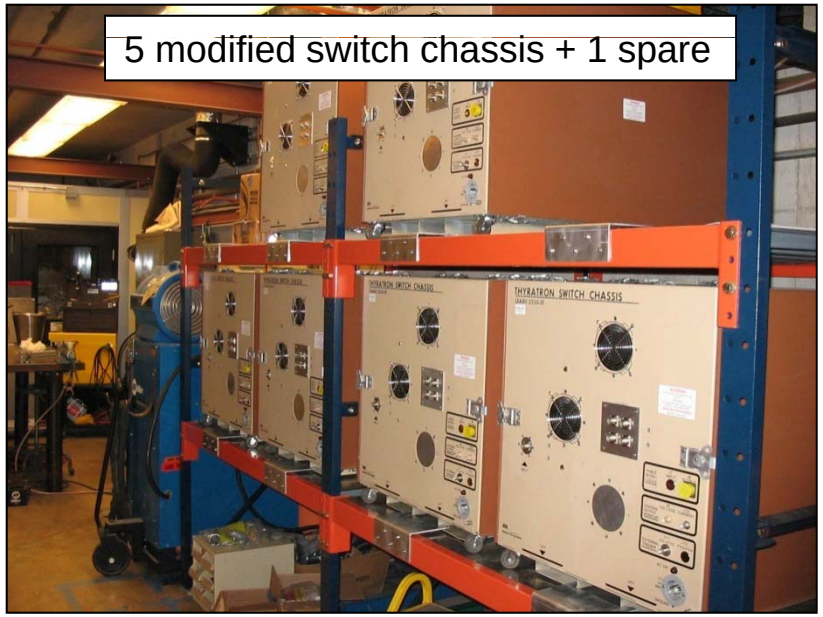
Equipment platform is installed – 20 racks were delivered Tuesday for installation along the platform



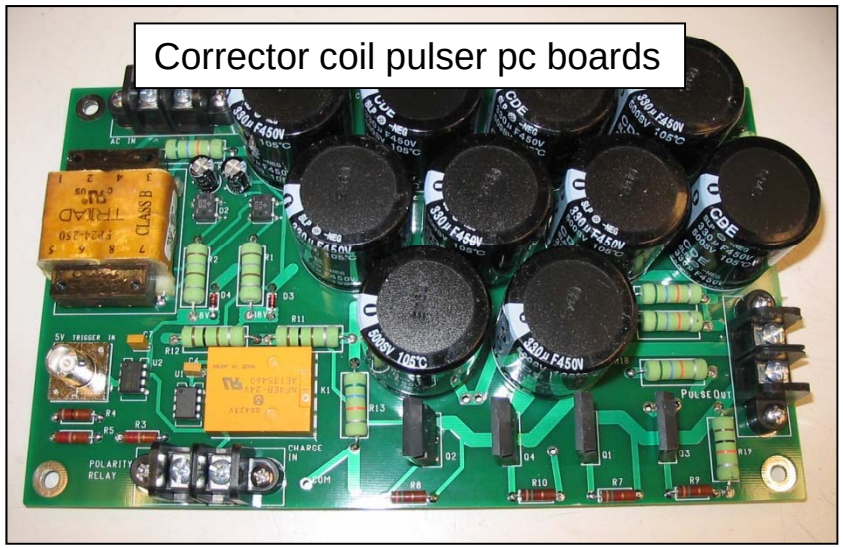


Magnet cooling plans and production alignment procedures are getting finalized on the magnet alignment test stand

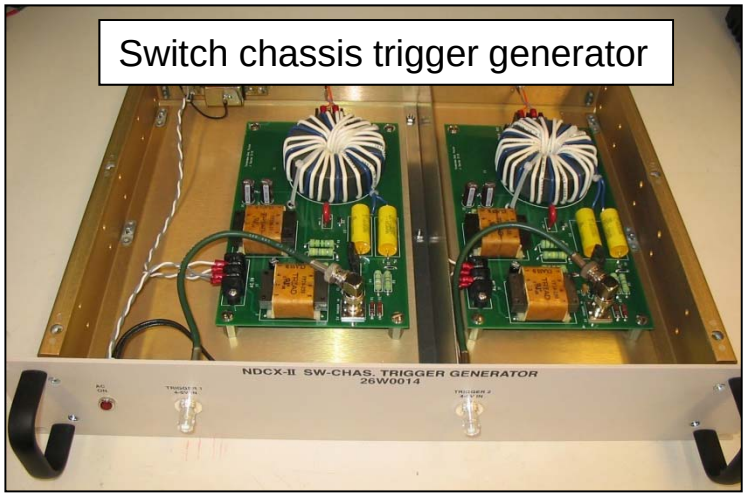
A sample of completed production hardware



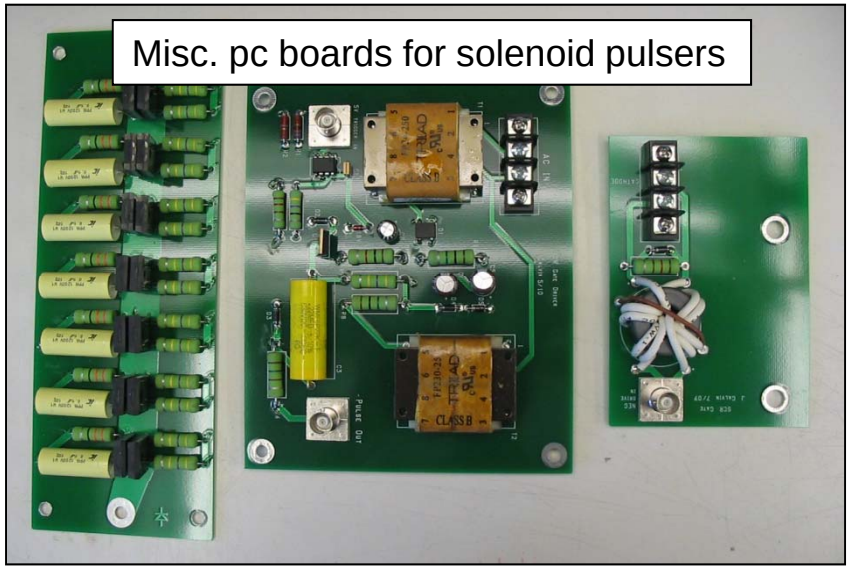
5 modified switch chassis + 1 spare



Corrector coil pulser pc boards



Switch chassis trigger generator



Misc. pc boards for solenoid pulsers

Installation Tasks and General Schedule

- Equipment platform racks – DEC
- Oil secondary containment – JAN
- AC power distribution – JAN/FEB
- Accelerator support structure – JAN/FEB
- Solenoid pulser racks – FEB/MAR
- Cells – MAR/APR
- Pulser tanks and Blumleins – MAR/APR
- Injector – APR/MAY

Conclusion

- **The planned project completion date is the end of August 2011 (allowing 7 months of schedule contingency)**
- **With the present Estimate To Completion of 2.7M$, there is 933K$ in budget contingency (35%) as of the end of November**
- **Work packages which are potential uses of budget and schedule contingency based on their level of maturity**
  - **Injector Fabrication**
  - **Overall Installation**
- **We may consider releasing contingency funds (modify scope of work) at the next quarterly review (JAN/FEB)**