



Operations Update March 2015

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*U. S. Department of Energy
Nuclear Criticality Safety Program*



Outline

- Background on NCERC Mission
- NCERC Operations Update
 - Rapid Pneumatic Transfer System Development
 - FY2014 Current Critical and Sub-critical Experiments
 - Non-DOE and International Collaborations
 - Operational Challenges
 - Safety Basis Challenges
- Integral Experiment Request and Approval Process

Mission/Vision

- The Integral Experiments (IE) program element sustains and enhances a fundamental nuclear materials handling capability to conduct subcritical, critical, supercritical, prompt critical, super-prompt critical, and fundamental physics experiments, and training.
- The mission of the National Criticality Experiments Research Center (NCERC) at the Device Assembly Facility (DAF) is to conduct experiments and training with critical assemblies and fissionable material at or near criticality in order to explore reactivity phenomena, and to operate the assemblies in the regions from subcritical through delayed critical. One critical assembly, Godiva-IV, is designed to operate above prompt critical.



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Nuclear Criticality Safety Program*



NCERC Mission

Mission

Nuclear Criticality Safety / Nuclear Material Management

Nuclear Emergency Response

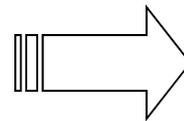
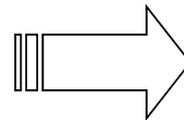
Nuclear Nonproliferation / Safeguards / Arms Control

Support for DHS / DNDO

Support for DTRA / NASA / Naval Reactors / GNEP

Stockpile Stewardship Science

Common denominator for all programmatic missions is the capability to handle and conduct experiments with large quantities of special nuclear material.



Critical Assemblies



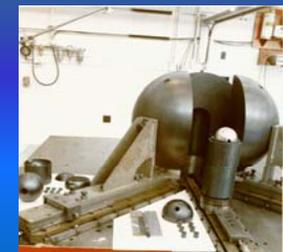
Comet General-Purpose Vertical Critical Assembly



Godiva IV Fast Burst Assembly



Planet General-Purpose Vertical Critical Assembly



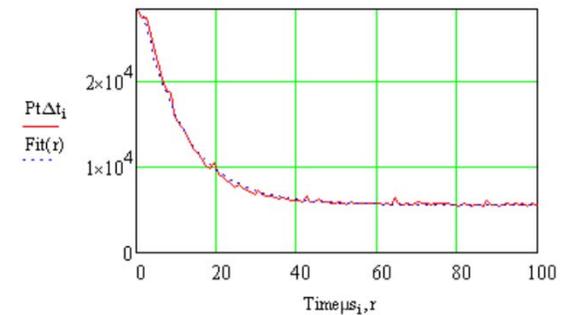
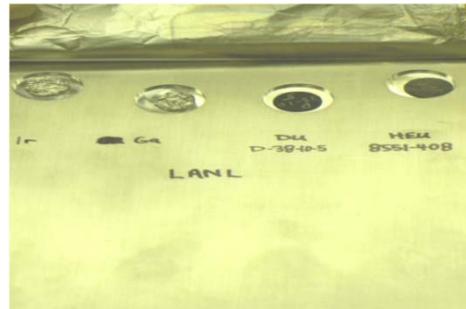
Flat-Top Fast Benchmark Critical Assembly

Newest NCERC Capabilities

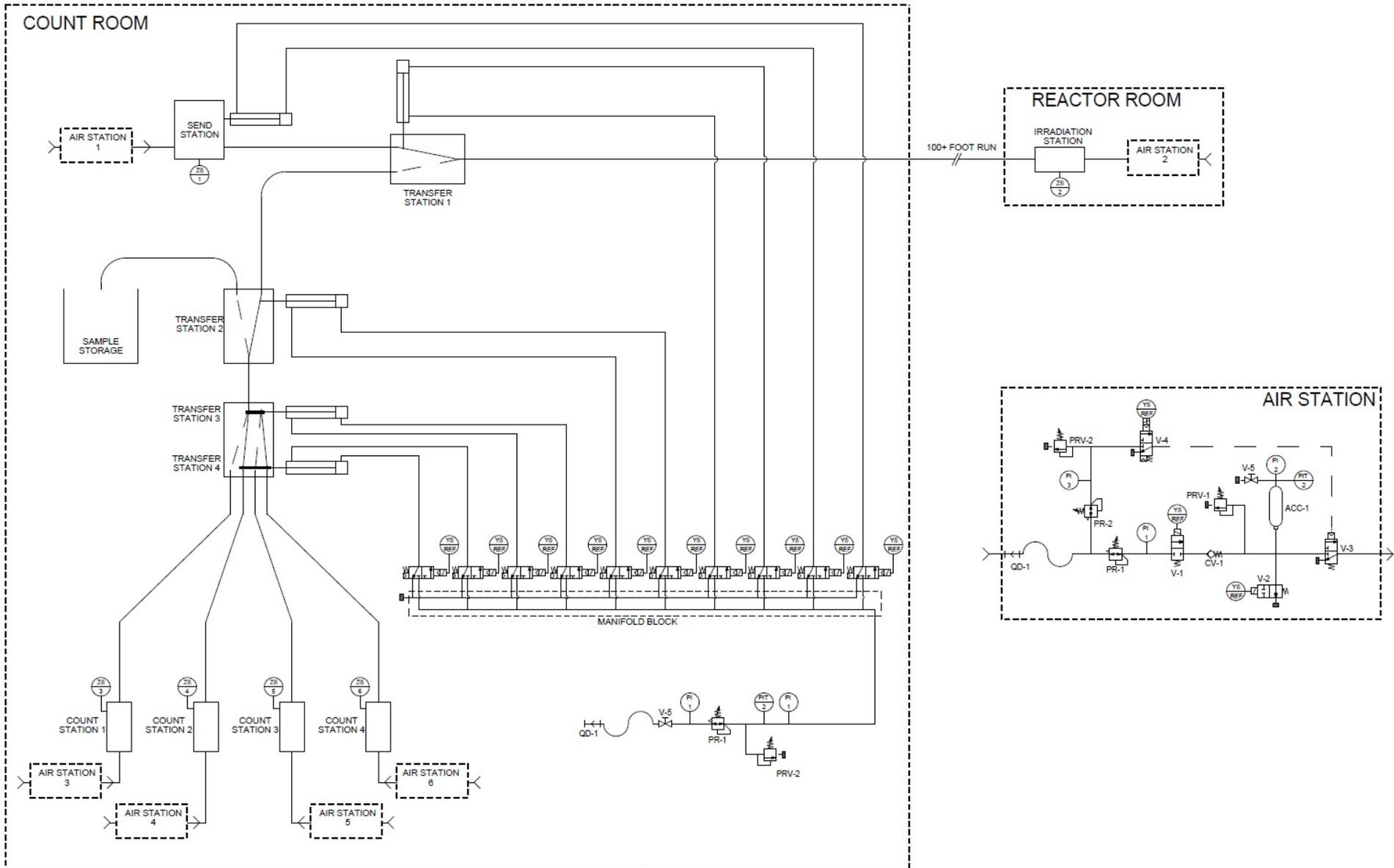
- Designing and gaining authorization to install a rapid pneumatic transfer system to handle small samples during irradiations.



- Modern data acquisition systems are being deployed to perform traditional spectral index and Rossi-alpha measurements

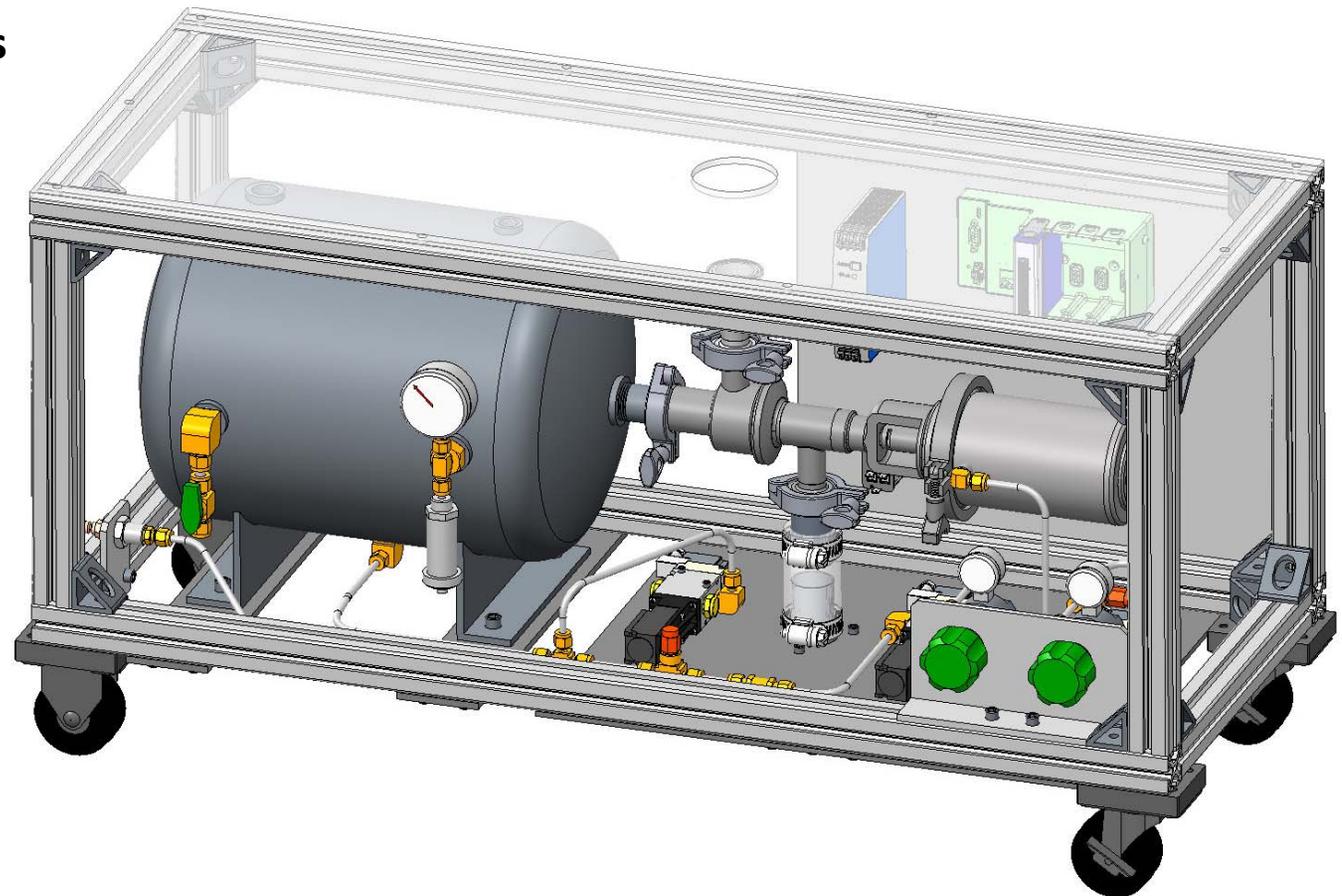


Rabbit System Schematic Diagram

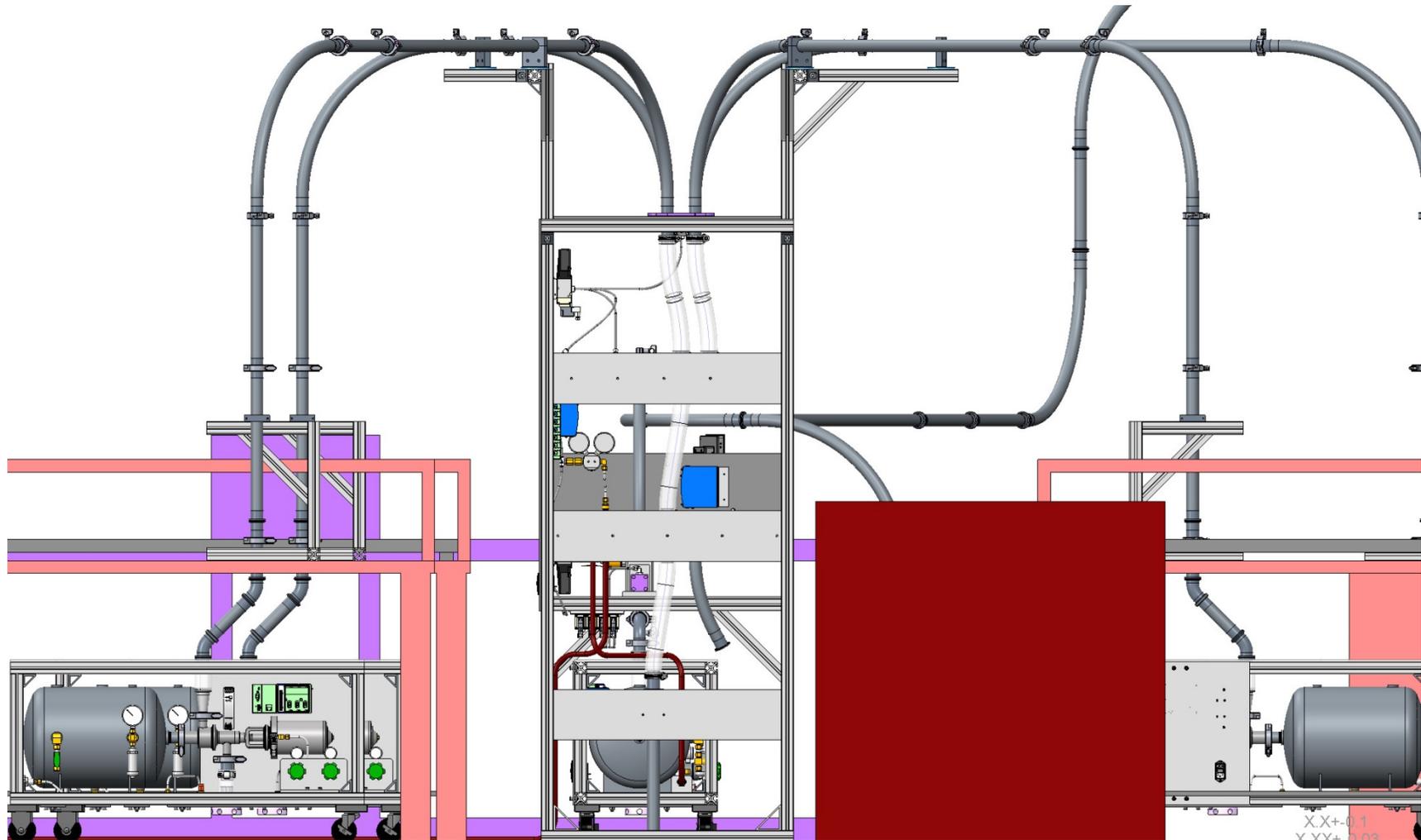


Air Station

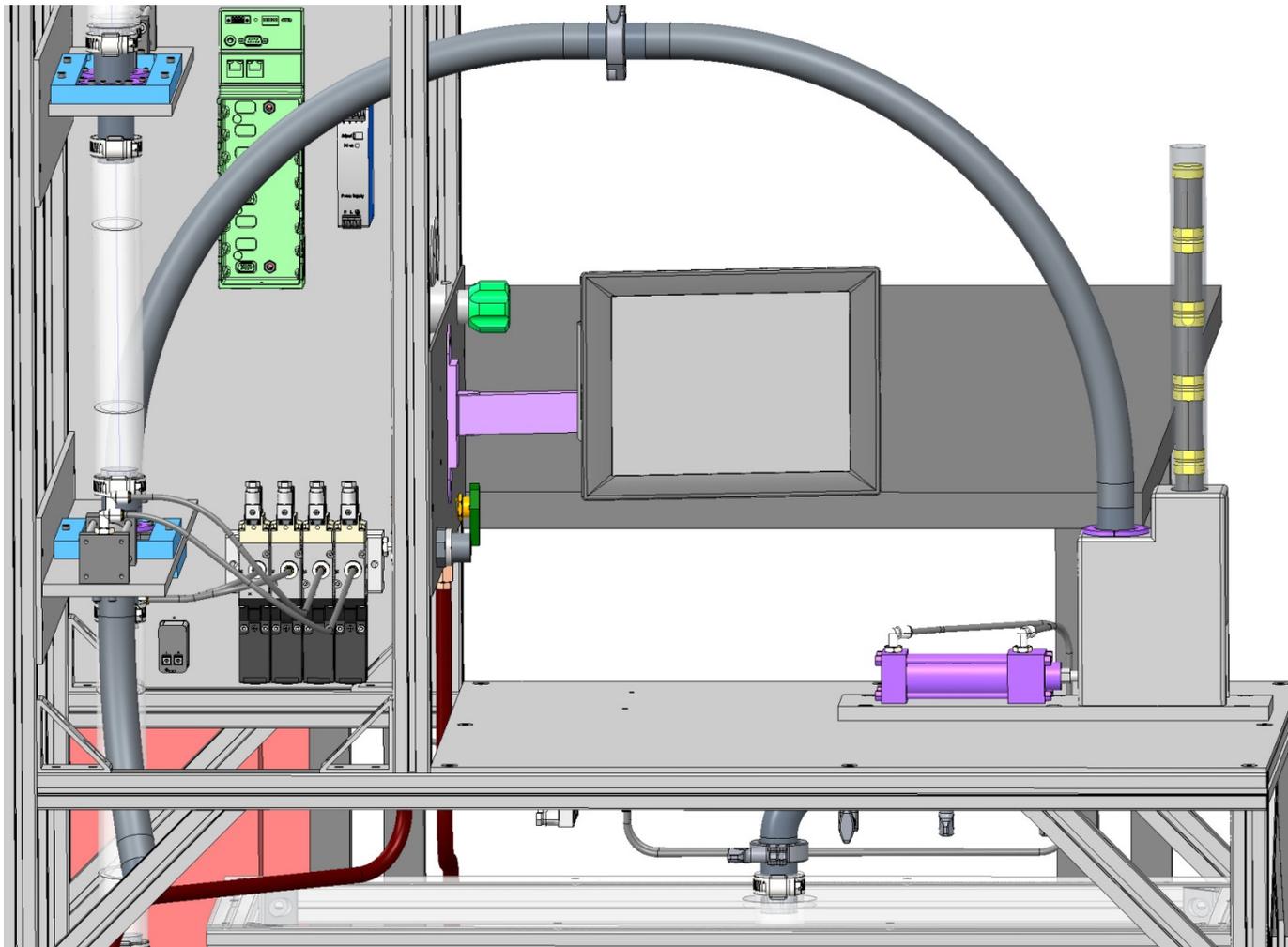
- 1 Send Station
- 1 Irradiation Position
- 4 Count Stations



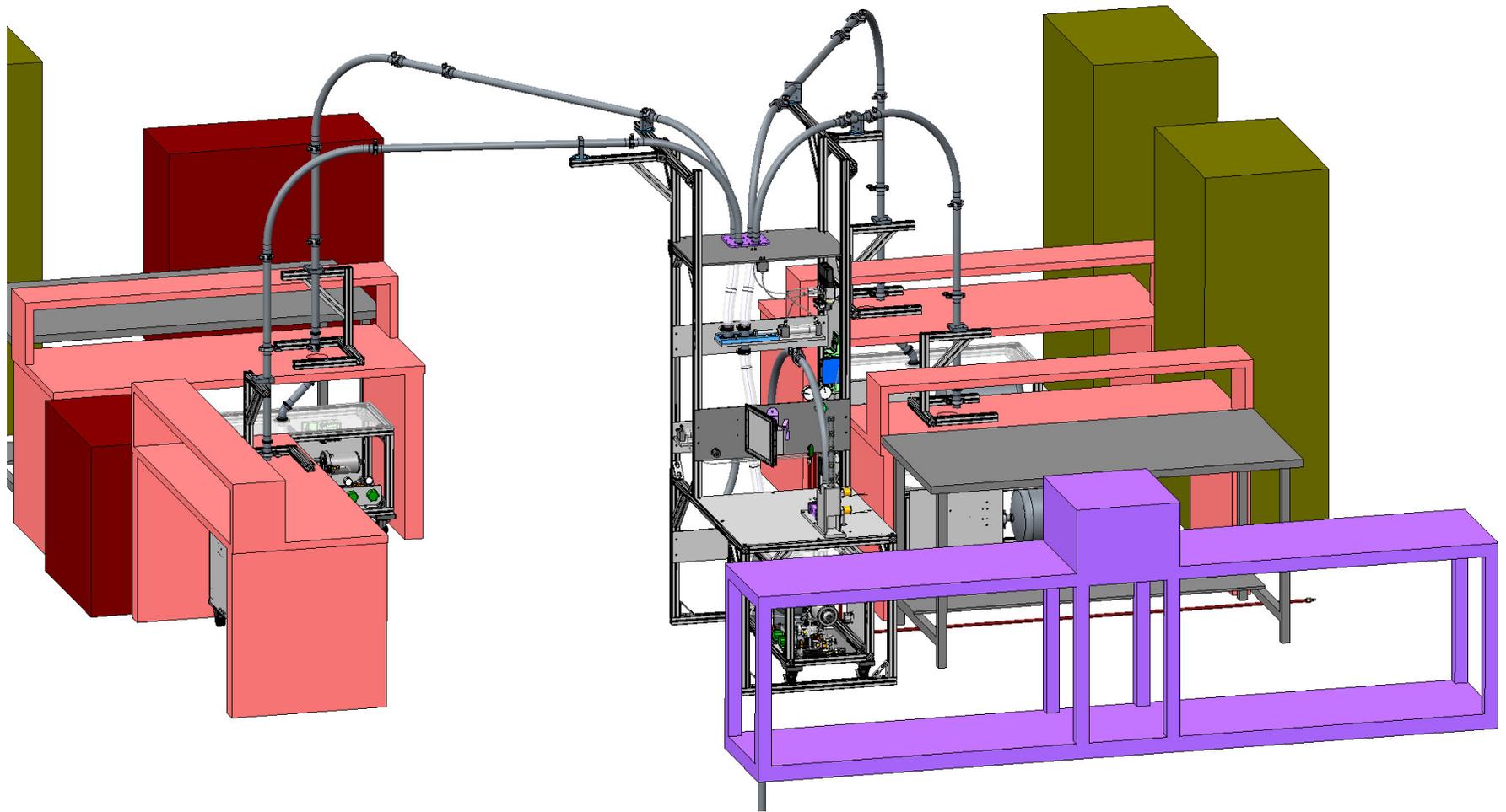
Count Room – Transfer Station



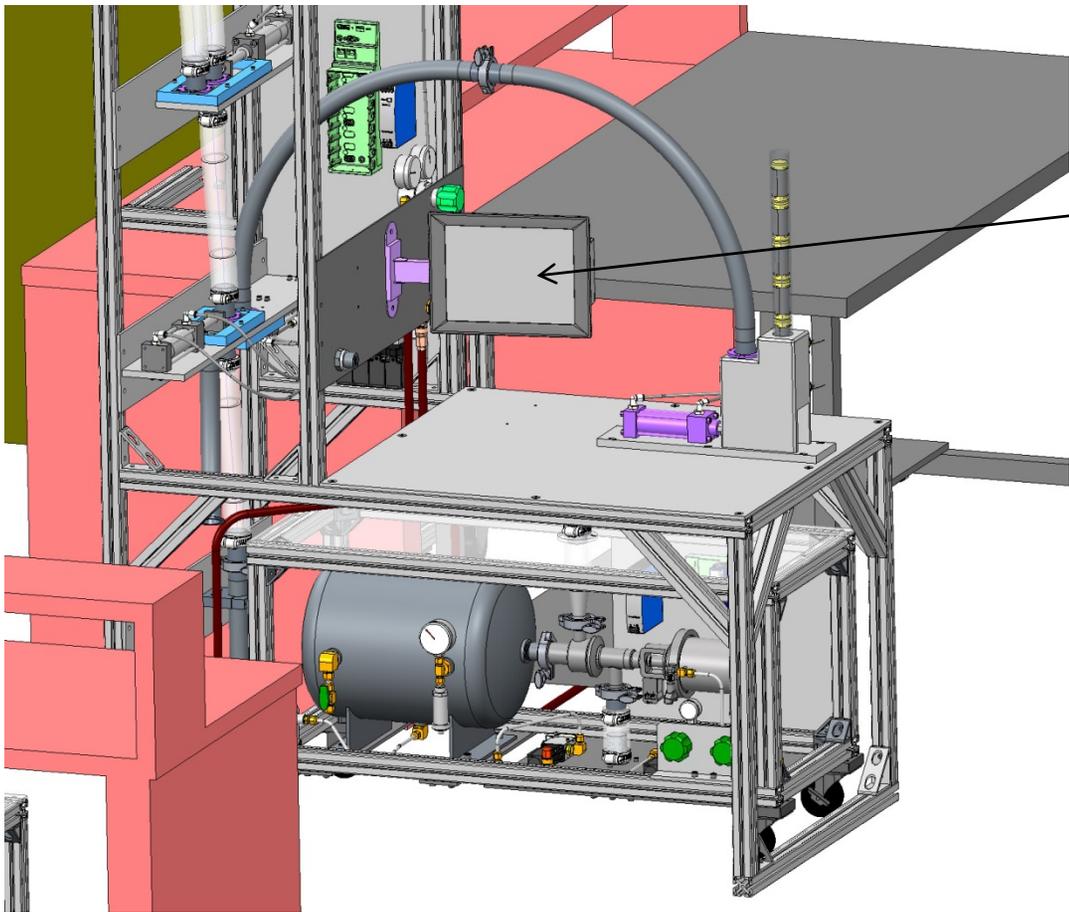
Count Room – Send Station



Count Room – Count Stations



Count Room – User Interface



Rabbit Control Console

Key Present

Power OFF

Unidirectional Bidirectional

Triggering None

Pressure Select (PSI)

Pressure OK

Capsule at Source Position

Destination Position Empty

Ready to Send

Source

Send Station

Irradiation Position

Detector 1

Detector 2

Detector 3

Detector 4

Capsule at Source Position Override:
OFF ON

Destination

Irradiation Position

Detector 1

Detector 2

Detector 3

Detector 4

Storage

Seconds from Trigger to Arrival at Destination

Manual Stop

Green-when-Empty Positions:

Green-when-Good Pressures:

Accumulator Pressures (PSI):

Green-when-Open Valves:

Green-when-Extended Linear Actuators:

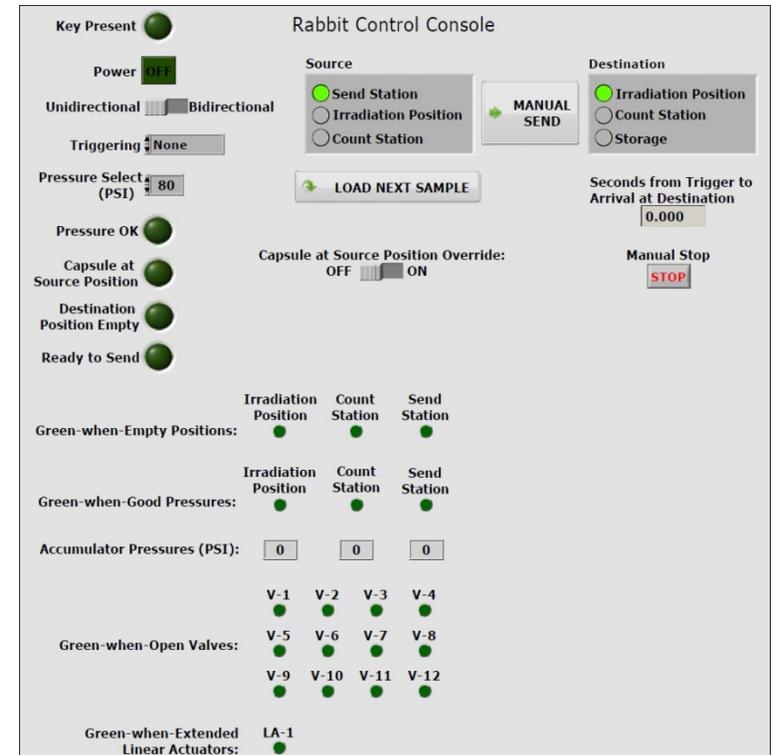
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Green-when-Empty Positions:	<input checked="" type="checkbox"/>						
Green-when-Good Pressures:	<input checked="" type="checkbox"/>						
Accumulator Pressures (PSI):	<input type="text" value="0"/>						
Green-when-Open Valves:	V-1	V-2	V-3	V-4	V-5	V-6	V-7
	<input checked="" type="checkbox"/>						
	V-8	V-9	V-10	V-11	V-12	V-13	V-14
	<input checked="" type="checkbox"/>						
	V-15	V-16	V-17	V-18	V-19	V-20	V-21
	<input checked="" type="checkbox"/>						
Green-when-Extended Linear Actuators:	LA-1	LA-2	LA-3	LA-4			
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			

Mobile System

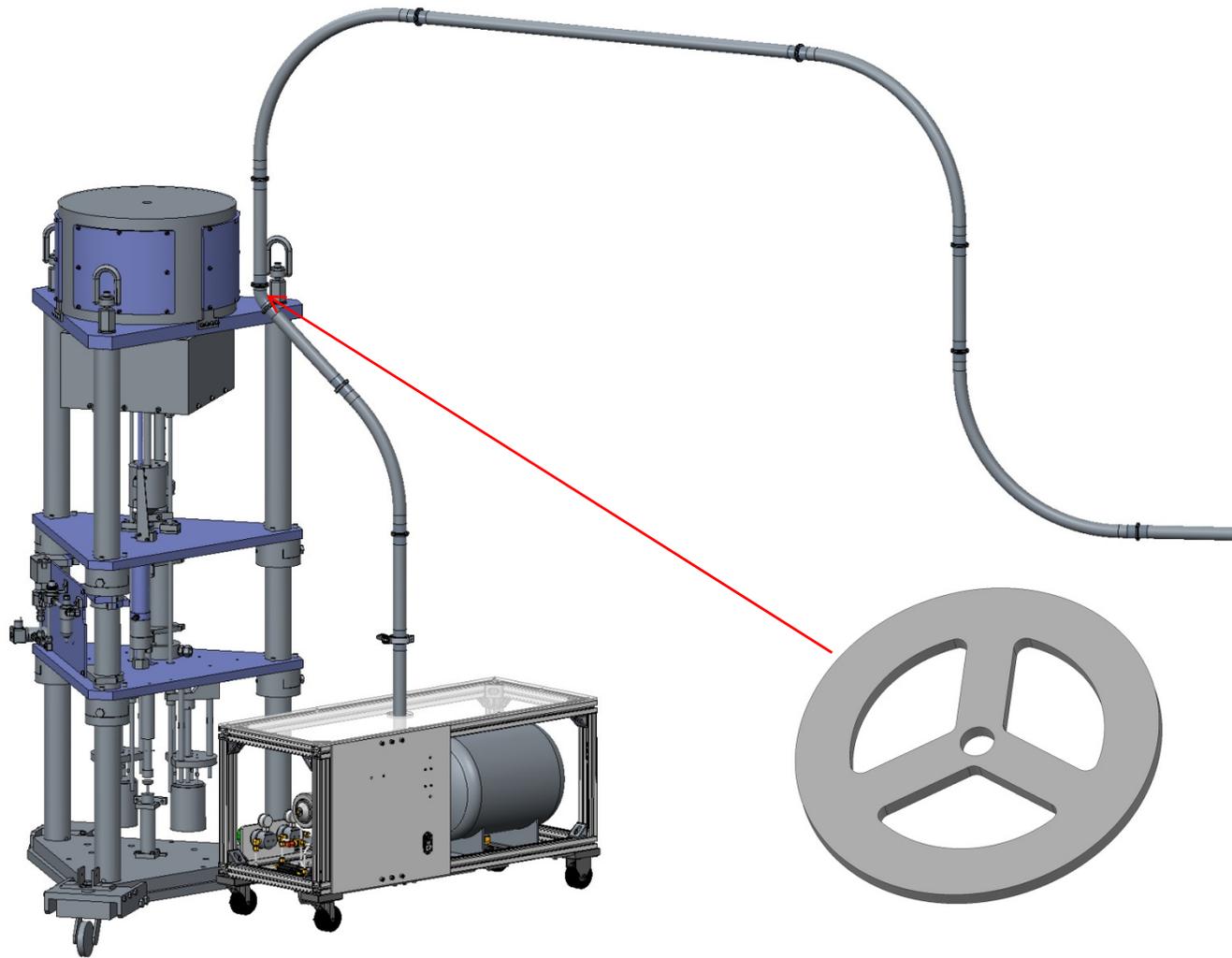
■ Mobile system will be a smaller version

- 4 positions:
 - Send Station
 - Irradiation Position
 - Count Station
 - Storage
- Entire system located inside the building
- Remote operation still possible from control room

■ Provide service to Planet and Flattop

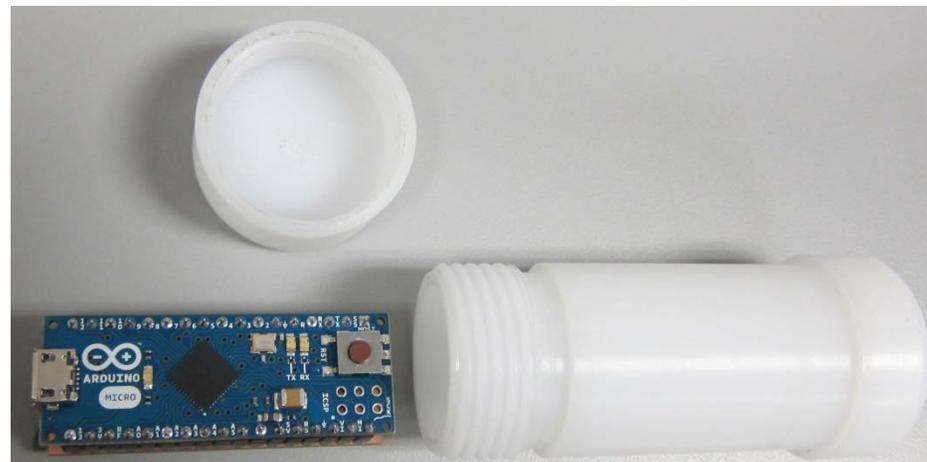
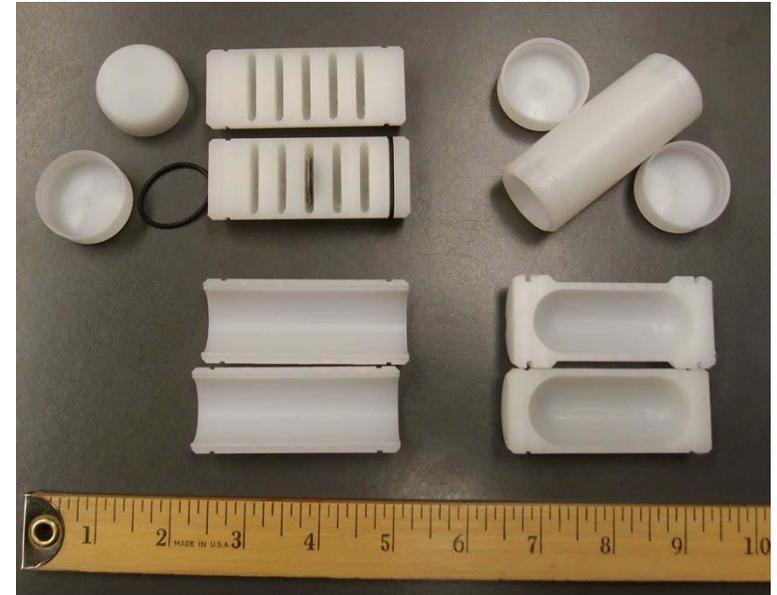
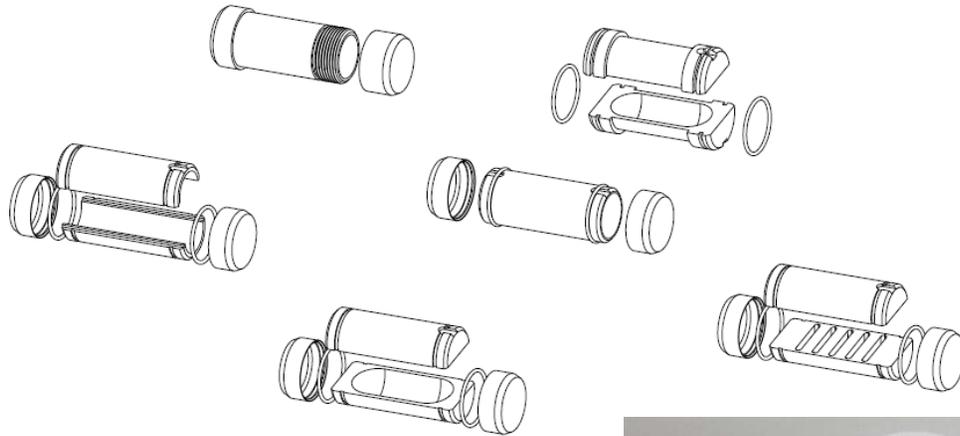


Irradiation Position



Transfer Capsule

- 1.25 in OD x 3 in length
- 5 designs
- Testing with accelerometer



Next Steps

- All SS tubing has been fabricated.
- Framework for all of the stations (i.e. 6 air stations, 1 transfer station, 1 send station, and 4 count stations) has been purchased and some assembly has begun.
- The control system (National Instruments) has been purchased and some programming has been started.
- Initial functional testing will be performed at LANL in NISC machine shop
 - Prove that we can move the transfer capsule 150 ft in ~ 1 s
 - Determine the minimum pressure required to operate
 - Repeatability
- Following testing, the system will be assembled at the DAF.

FY2014 Critical and Sub-critical Experiments (Small Snapshot)

- Class Foils/Lucite moderator experiment used on Planet for demonstrating criticality safety concepts for training criticality safety analysts and managers
- Nickel-reflected plutonium metal sphere subcritical benchmark measurements for International Criticality Safety Benchmark Evaluation Project (ICSBEP)
- **Characterization of Godiva IV radiation fields in preparation for international inter-comparison of nuclear accident dosimetry**
- Irradiation of reaction rate foils for various organizations such as DOE, DHS, DTRA, OGAs, etc.

Non-DOE and International Collaborations

- While the DOE NCSP is the principal programmatic sponsor of NCERC, supporting non-DOE organizations and international collaborations remains one of our highest priorities
 - Including training, R&D, experimentation, equipment testing and data collection where both critical and subcritical configurations of SNM are required
- Non-DOE partners include:
 - NASA, DHS, DTRA, OGAs, universities and commercial partners
- International collaborations include:
 - AWE, IRSN, CEA and JAEA
- Long term vision for international collaborations include hands on work with SNM
 - This does pose some interesting challenges with respect to security clearances, and access and training requirements, but we are confident that it can be achieved

Recent Nevada Operations

Date	Event
Sept 2013	First burst operations on Godiva
May 19, 2014- June 6, 2014	Godiva burst total 17 times in three weeks for experiment that includes LANL, LLNL, NSTec, and other, participants
June 16, 2014	~4000 dpm/100 cm ² contamination found in Godiva room on routine survey
June 19, 2014	Detailed survey plan of Godiva room initiated
July 15, 2014	LANL HP met with LANL NEN management to develop a decon plan
July 17, 2014	LLNL employee on routine LLNL bioassay returns small but positive (for HEU) bioassay
July 21, 2014- Aug 6, 2014	LANL management in conversation with Nevada Field Office (NFO) management on path forward in Godiva room as more data was gathered
Aug 7, 2014	NFO directs pause work in Godiva room
Aug 7, 2014- Oct 21, 2014	Many activities associated with Godiva room resumption (establishing a Causal Team, decon in Godiva room, Extent of Condition in NCERC, etc.)
Oct 21, 2014	Extent of Condition reveals contamination in Flattop room (~3K)
Oct 29, 2014	LANL ADTIR pauses work in Flattop room

Operational Challenges

- Heavy campaign of Godiva IV bursts in May-June 2014 brought to light weaknesses in the NCERC approach to radiological/contamination control practices (i.e., in the type and extent of contamination).
- Weaknesses in the NCERC radiological/contamination control program were highlighted by the Causal Analysis team (Oct-Dec 2014) and the Management Effectiveness Evaluation Team (Jan 2015)
- Recommendations from both were incorporated into a NCERC Corrective Action Plan
- Improvements are in four major areas
 - Management actions (identifying R2A2s, communications)
 - Rad con improvements (Rad Con Plan, Survey Plan, Bioassay Plan)
 - Engineered controls (Top Hat, Air Filtration System)
 - Facility changes (task exhaust, RAMS operations)

Operational Challenges (continued)

- Demonstration of improvements in radiological/contamination control practices led to resumption of operations in the Flattop building on 20 Jan 2015. Note: Contractor had restart authority.
- Similarly, demonstration of equivalent improvements in radiological/contamination control practices for operations in the Godiva IV building should allow resumption of operations in that building during July 2015 (according to the current resumption schedule). Note: NFO has restart authority.

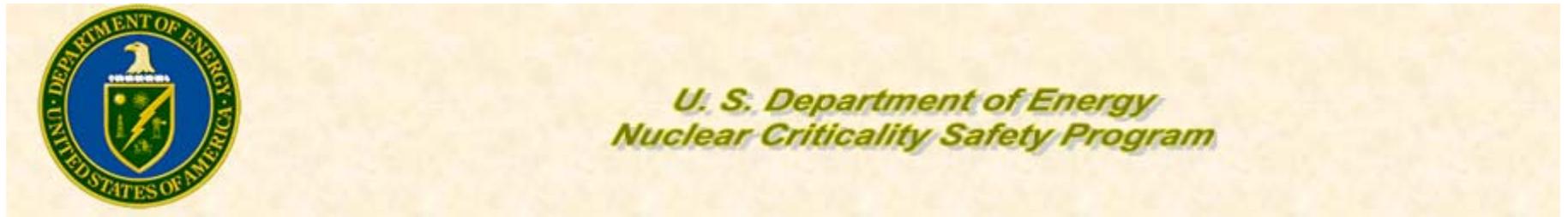
Safety Basis Challenges

- CN8 (Rabbit) Suspended work to support Restart
 - Also includes “de minimis MAR” changes
- CN9 Introduces new “Fire Suppression System Impaired” Mode
- CN4 Implemented FINALLY!
 - Allows Pu operations on Godiva and Flat-Top (Not likely this year...)
- DAF/NCERC DSA Merger working 30% review

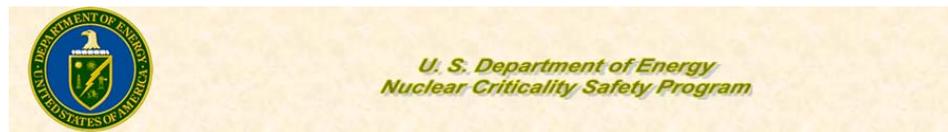
Integral Experiment Request and Approval Process

- The process ensures each requestor's nuclear data needs are well understood and met by integrating all capabilities of the NCSP to design and approve the requested experiment
- The process is divided into five steps called Critical/Subcritical Experiment Decisions (CEDs).
 - Justification (CED-0)
 - Preliminary Design (CED-1)
 - Final Design (CED-2)
 - Execution (CED-3)
 - Publication of Data (CED-4)

Submit an Experiment Request!



<http://ncsp.llnl.gov/>



Acknowledgement

This work is supported by the DOE Nuclear Criticality Safety Program, funded and managed by the National Nuclear Security Administration for the Department of Energy.

