

# National Ignition Facility Data Repository

Robert Carey

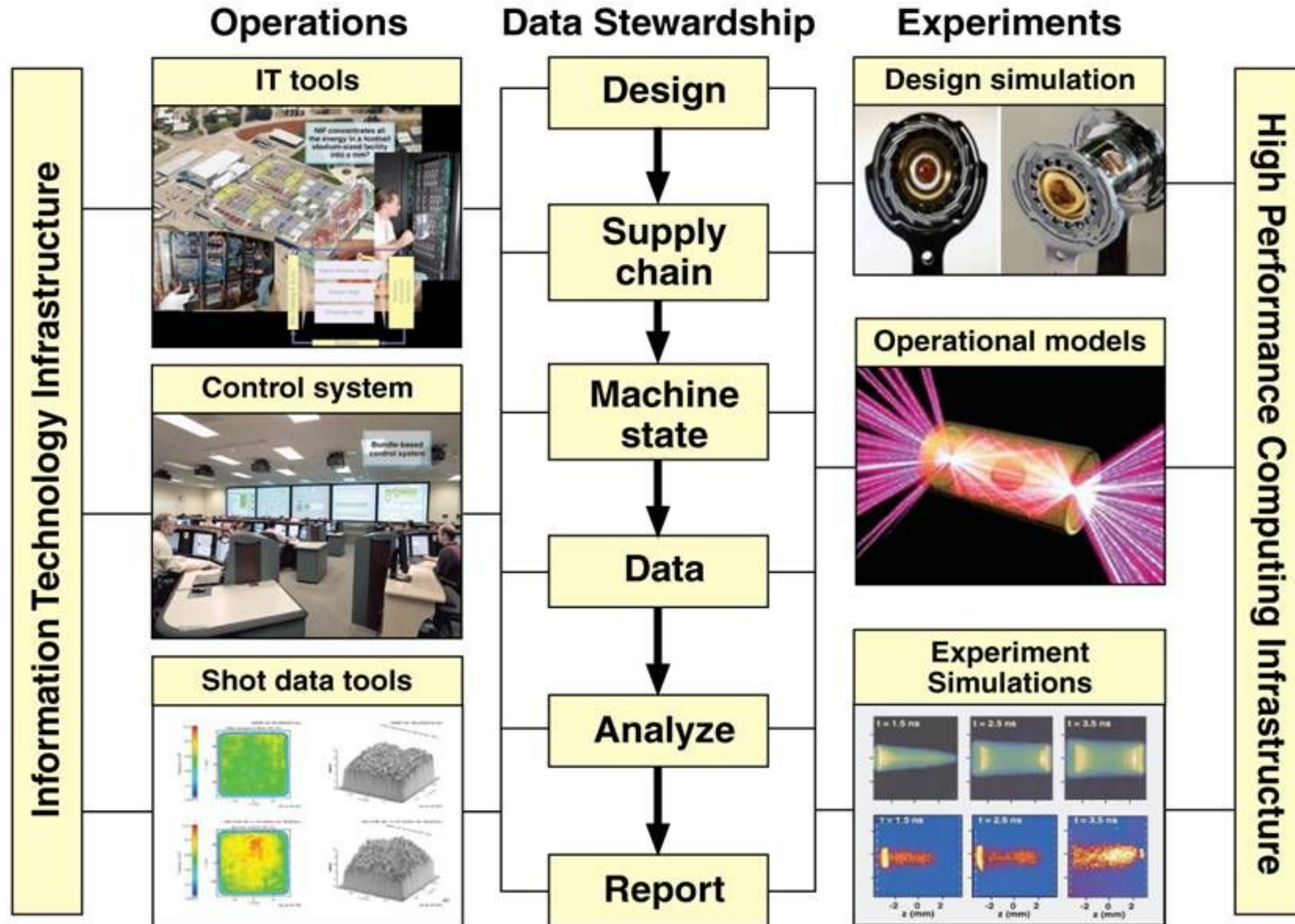


2009 International Conference on Accelerators and Large Experimental Physics Control Systems, Kobe, Japan  
October 13, 2009  
Lawrence Livermore National Laboratory, USA

# NIF Federated Database and Information Systems



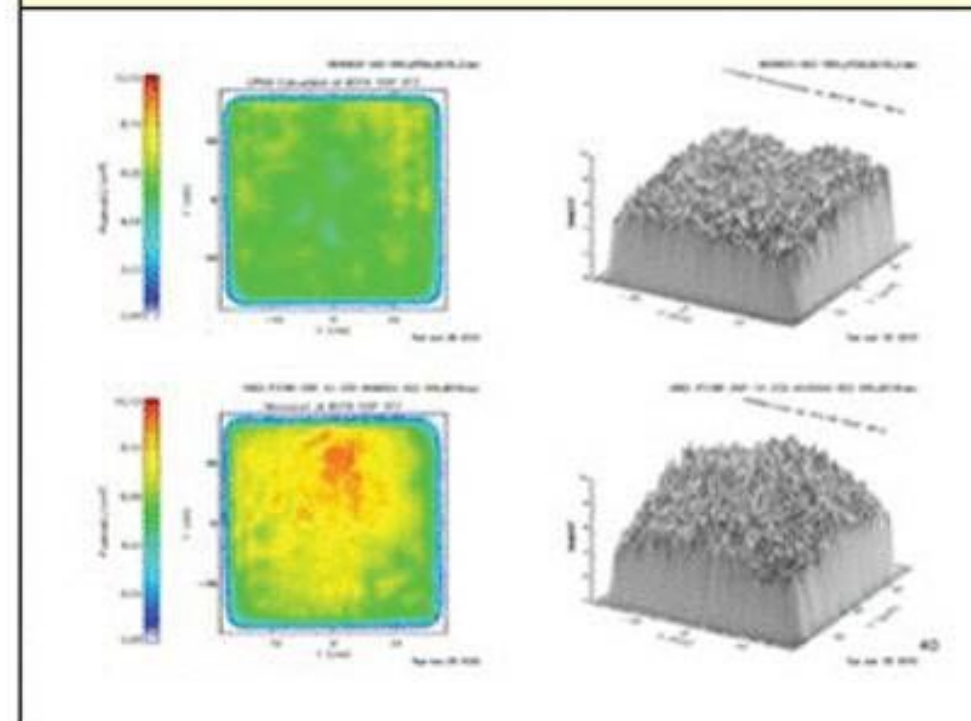
The National Ignition Facility



# Tools are built to manage and integrate:

- Data originate from multiple sources
  - Simulations
  - Machine state
    - Configuration
    - Calibration
    - Instantiation
    - Inspection
  - Experimental shot data
- Data are generated in multiple formats
- Data are analyzed in multiple, parallel work-flows with a strict time budget of 30 minutes
- Data will survive beyond NIF's 30 year lifespan

## Image data provided by analysis and visualization tools





# Work Orders & Supply Chain Produce Transactional Data



The National Ignition Facility



**NF LoCoS** View: FRA2094

Home > Selected Parts PART DETAILS

Sections

- Basic Inspection
  - Vendor Metadata
  - Calendar
  - Related Logs (Instruments)
  - Installation History
  - Work Order History
- Item Properties
  - Type: 999
  - SN: T0117
  - Cur Part: AA05-00714
  - Cur Rev: AA
  - Location: 85AND5141-02
  - Reserve: 240
  - Status: Installed
  - Lot: 4

All Datasets **CMS** VCAT BNC Other COG CO

Datasets

ID	Actions	Inspection Purpose	Calendar Date	WO	WC	Type	Modified Date	Modified By
1933		OPL Clean	2004-10-05 11:24:23	C820D09K29		CMS	2004-10-05 11:51:29	plst1
20043		Fluores Inspect	2006-10-24 14:25:00	FM0542174		CMS	2006-10-24 14:27:17	about102
22274		Inspection Map	2007-01-22 09:55:00			OTHER	2007-01-22 09:55:10	about102
20020		Ergonomics	2007-04-02 14:50:00	FRNC049573		OTHER	2007-04-02 14:53:01	about103
20020		FADLR	2007-04-02 15:07:00	FRNC049573		CMS	2007-04-02 15:09:34	plst1
20022		OPL Coat	2007-04-02 15:08:00	FRNC049573		CMS	2007-04-02 15:09:31	plst1
49070		TD Photo	2007-08-02 06:03:00			OTHER	2007-08-02 06:03:48	guberc35
52195		TD Photo	2007-09-04 07:51:00			OTHER	2007-09-04 07:51:40	guberc35
53172		Clearance Inspection	2008-02-11 08:53:00	FRNC037821		OTHER	2008-02-11 08:54:48	about102
53222		FOAGW	2008-02-11 13:48:00	FRNC049573		OTHER	2008-02-11 13:48:42	plst1
53223		PSA	2008-02-11 13:50:00	FRNC049573		OTHER	2008-02-11 13:50:56	plst1
54036		RVP	2008-02-20 10:49:00			OTHER	2008-02-20 10:49:13	about103
24743		CLEANING	2006-09-26 08:00:00	FM0542174		CLEANING	2006-09-26 09:39:55	about103
24744		CLEANING	2006-09-26 08:00:00	FM0542174		CLEANING	2006-09-26 09:40:08	about103
27783		CLEANING	2006-11-01 08:00:00	FD000644911		CLEANING	2006-11-01 15:03:47	about103
27781		CLEANING	2006-11-01 08:00:00	FD000644911		CLEANING	2006-11-01 15:03:59	about103
20024		CLEANING	2007-04-02 08:00:00	FRNC049573		CLEANING	2007-04-02 14:39:45	about101
20022		CURING	2007-04-02 08:00:00	FRNC049573		CURING	2007-04-02 14:39:04	about101
20023		CLEANING	2007-04-02 08:00:00	FRNC049573		CLEANING	2007-04-02 14:39:32	about101
20025		COATING	2007-04-02 08:00:00	FRNC049573		COATING	2007-04-02 14:55:52	about101


**Location Component State (LoCoS)**

**Supply Chain / Enterprise Resource Planning (Glovia)**


# Calibration Produces Hierarchical Data Format (HDF) & Excel



The National Ignition Facility

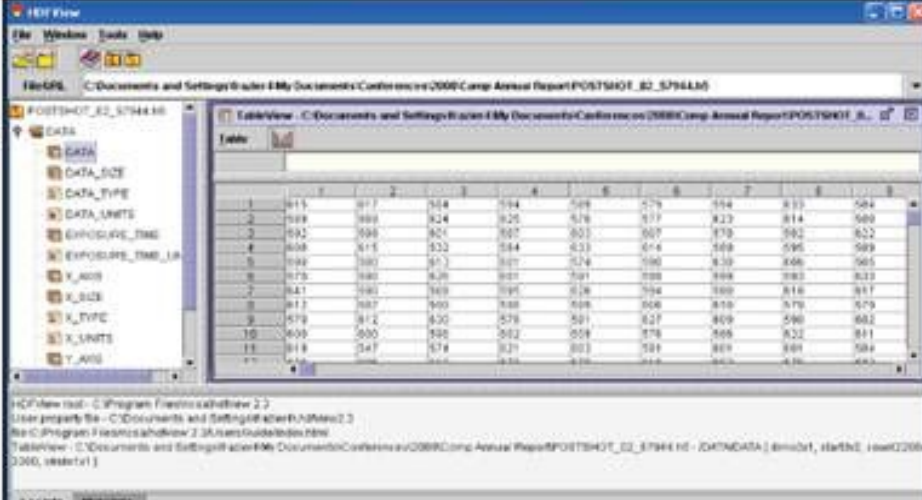


**Calibration Laboratory**



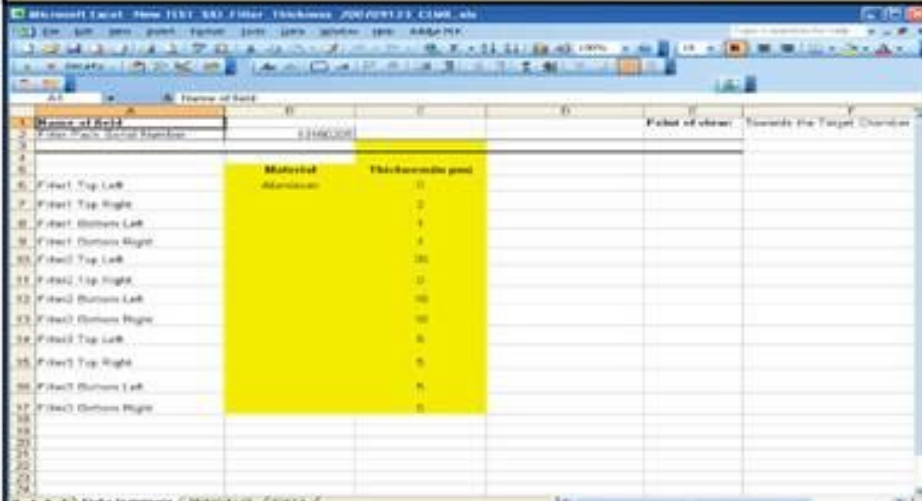
**National Security Technologies LLC**  
Vision • Service • Partnership

**Non-scalar calibration values in HDF**



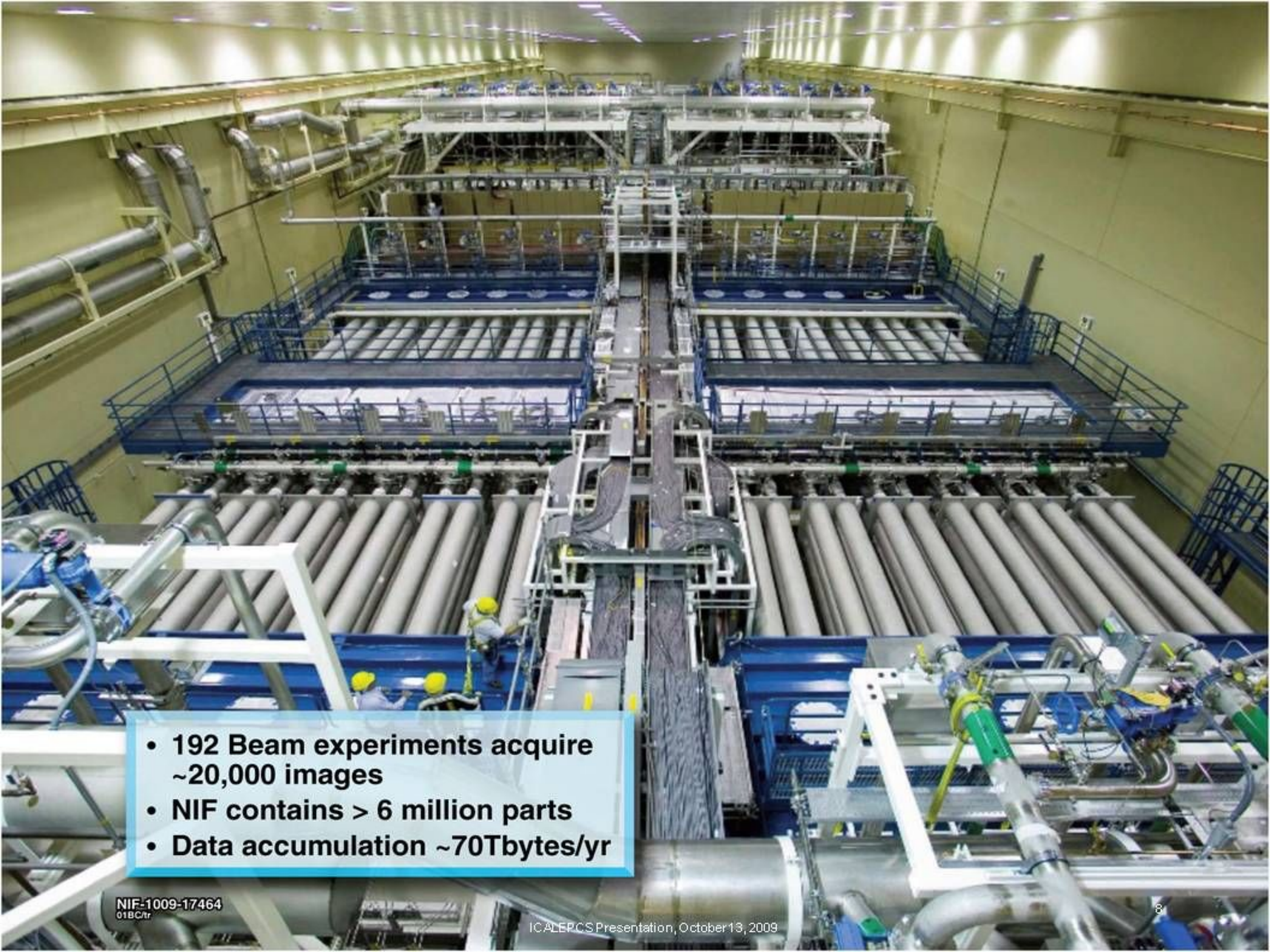
	1	2	3	4	5	6	7	8	9
1	811	817	824	824	828	828	834	833	834
2	819	824	824	825	826	827	827	828	828
3	822	828	828	828	828	828	828	828	828
4	828	828	828	828	828	828	828	828	828
5	828	828	828	828	828	828	828	828	828
6	828	828	828	828	828	828	828	828	828
7	828	828	828	828	828	828	828	828	828
8	828	828	828	828	828	828	828	828	828
9	828	828	828	828	828	828	828	828	828
10	828	828	828	828	828	828	828	828	828
11	828	828	828	828	828	828	828	828	828
12	828	828	828	828	828	828	828	828	828
13	828	828	828	828	828	828	828	828	828
14	828	828	828	828	828	828	828	828	828
15	828	828	828	828	828	828	828	828	828
16	828	828	828	828	828	828	828	828	828
17	828	828	828	828	828	828	828	828	828

**Scalar calibration values in Excel**



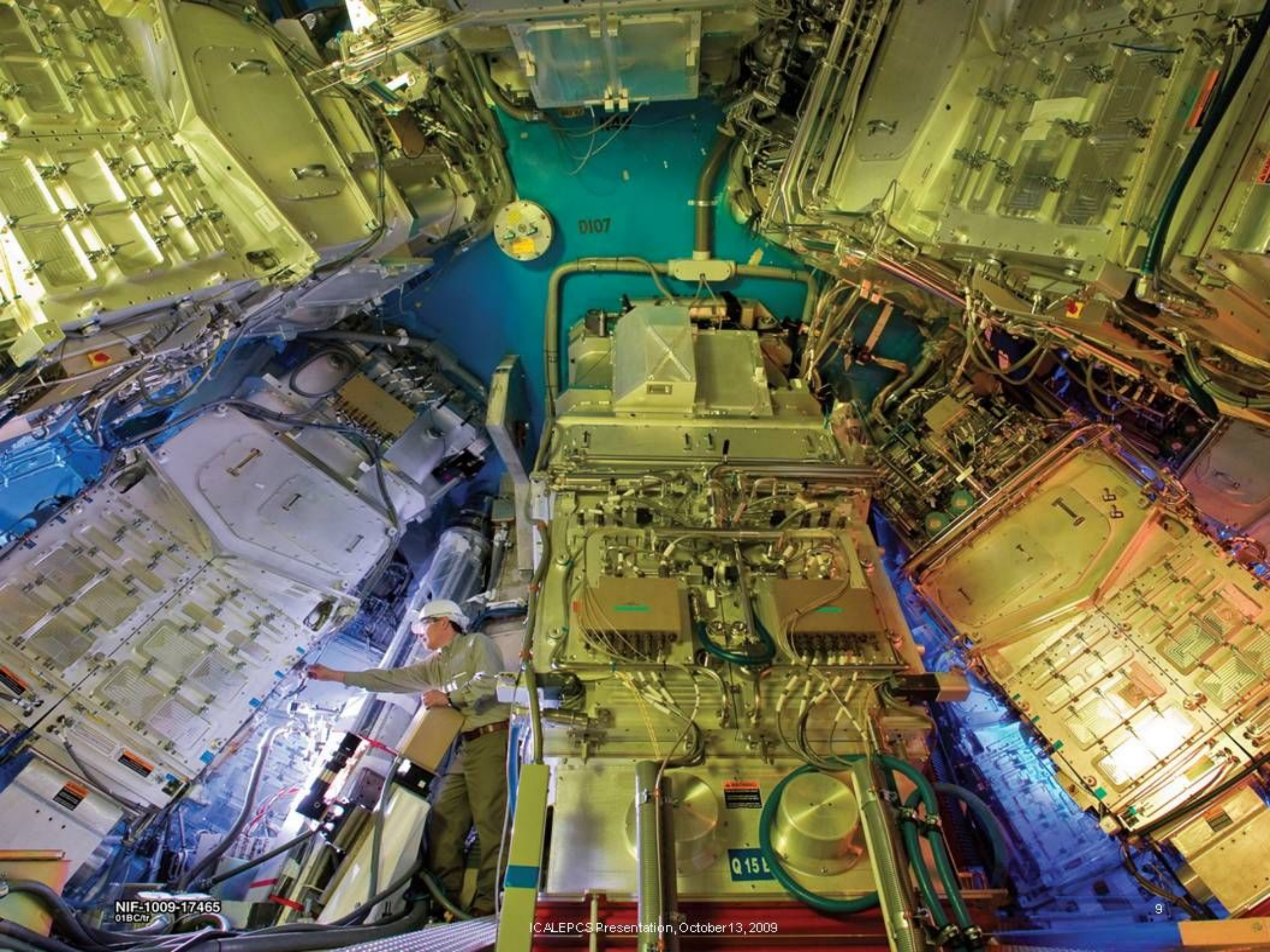
	Material	Material
1	Material	Material
2	Material	Material
3	Material	Material
4	Material	Material
5	Material	Material
6	Material	Material
7	Material	Material
8	Material	Material
9	Material	Material
10	Material	Material
11	Material	Material
12	Material	Material
13	Material	Material
14	Material	Material
15	Material	Material
16	Material	Material
17	Material	Material
18	Material	Material
19	Material	Material
20	Material	Material
21	Material	Material
22	Material	Material
23	Material	Material
24	Material	Material
25	Material	Material
26	Material	Material
27	Material	Material
28	Material	Material
29	Material	Material
30	Material	Material
31	Material	Material
32	Material	Material
33	Material	Material
34	Material	Material
35	Material	Material
36	Material	Material
37	Material	Material
38	Material	Material
39	Material	Material
40	Material	Material
41	Material	Material
42	Material	Material
43	Material	Material
44	Material	Material
45	Material	Material
46	Material	Material
47	Material	Material
48	Material	Material
49	Material	Material
50	Material	Material





- 192 Beam experiments acquire ~20,000 images
- NIF contains > 6 million parts
- Data accumulation ~70Tbytes/yr





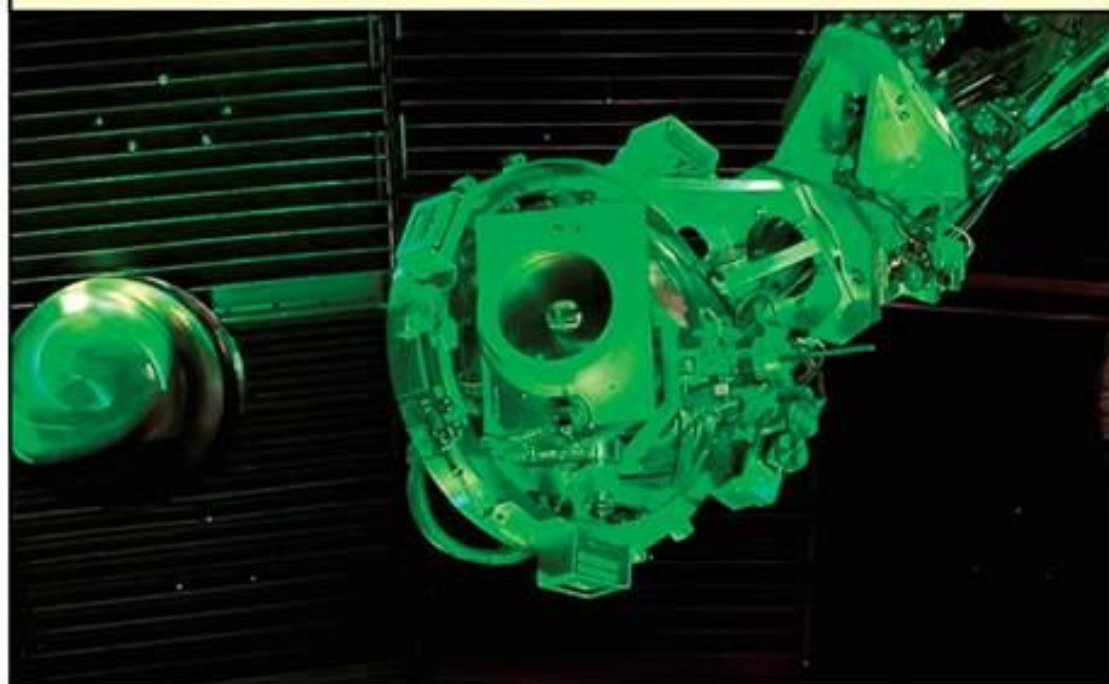
NIF-1009-17465  
01BC/r

# Optics Inspection Produces High-Resolution Images

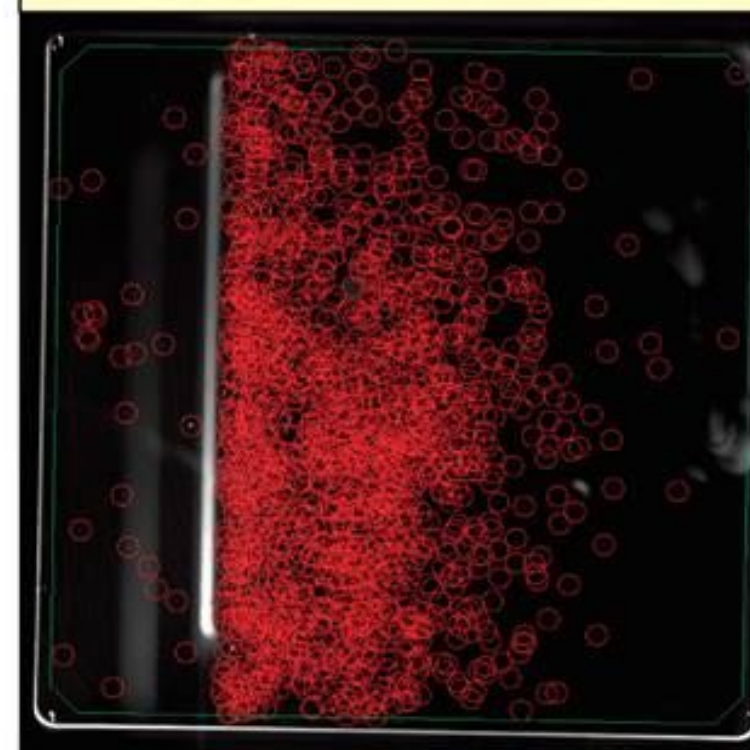


The National Ignition Facility

**Final Optic Damage Inspection (FODI)**



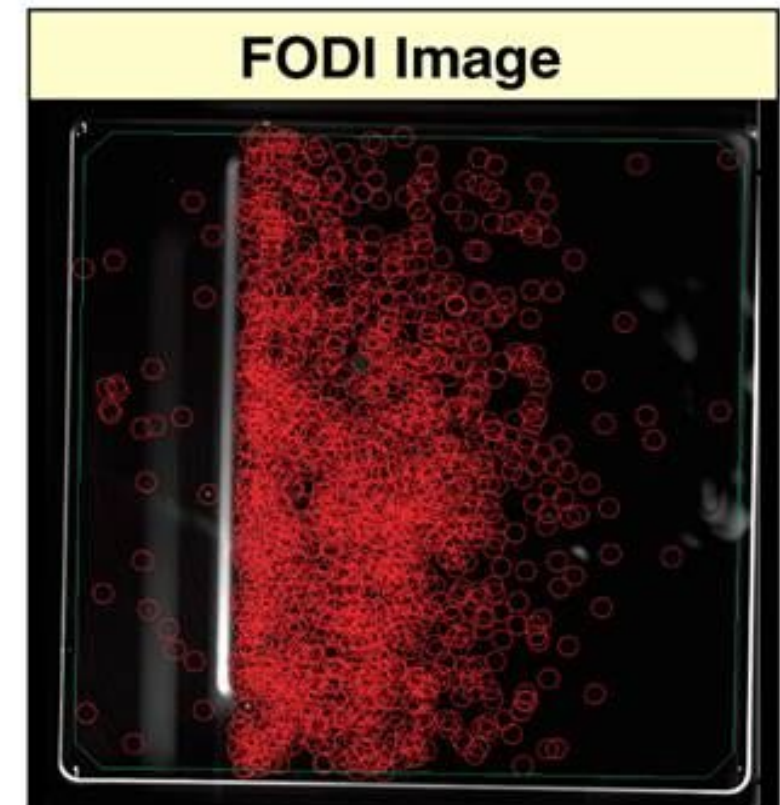
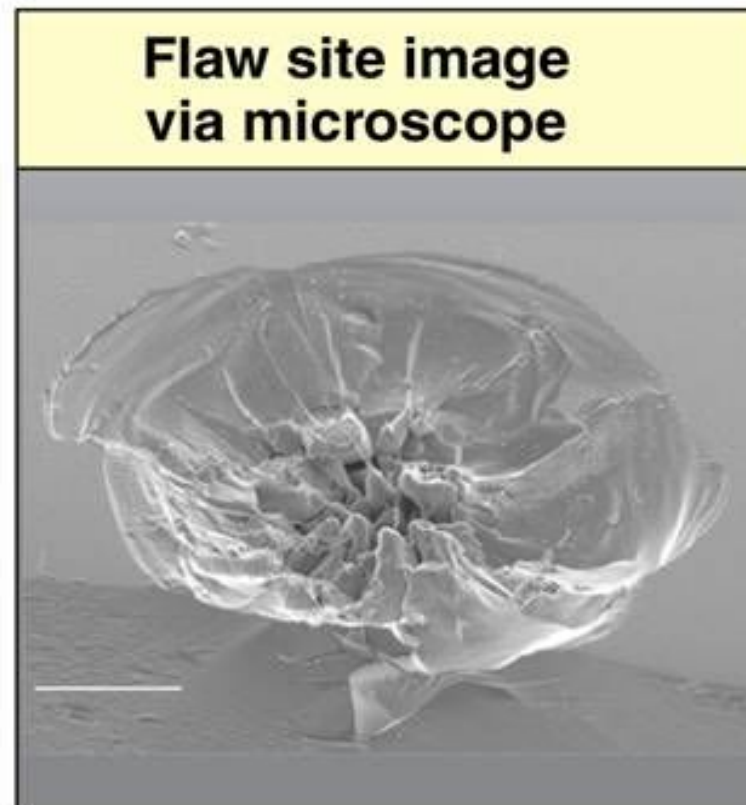
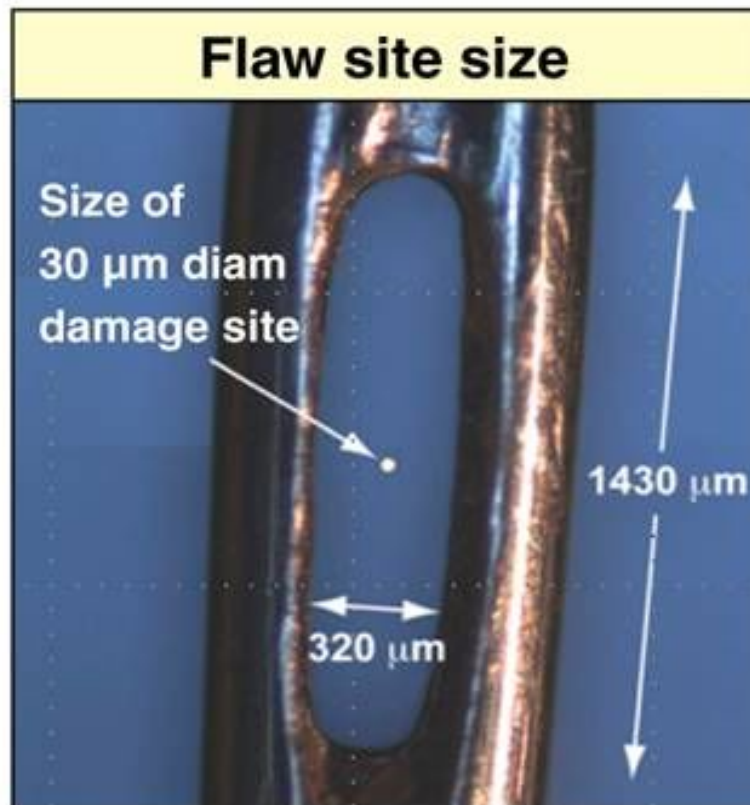
**FODI Image (32MB)**



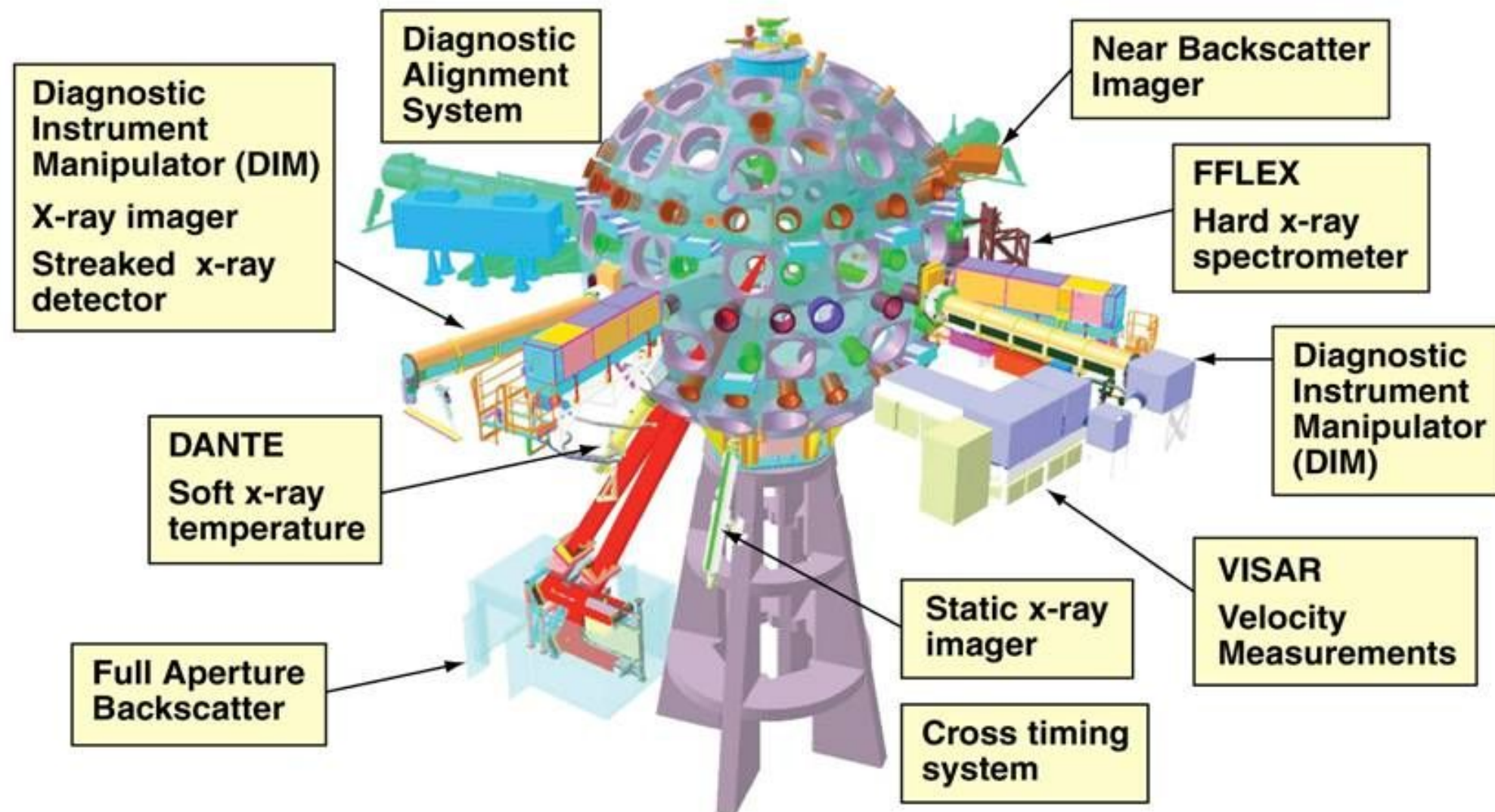
# Optics Inspection Requires Sophisticated Analysis to Identify Flaws



The National Ignition Facility



# Data from each diagnostic is automatically analyzed by a scientific workflow system



# Experiments Produce Hierarchical Data Format (HDF5)

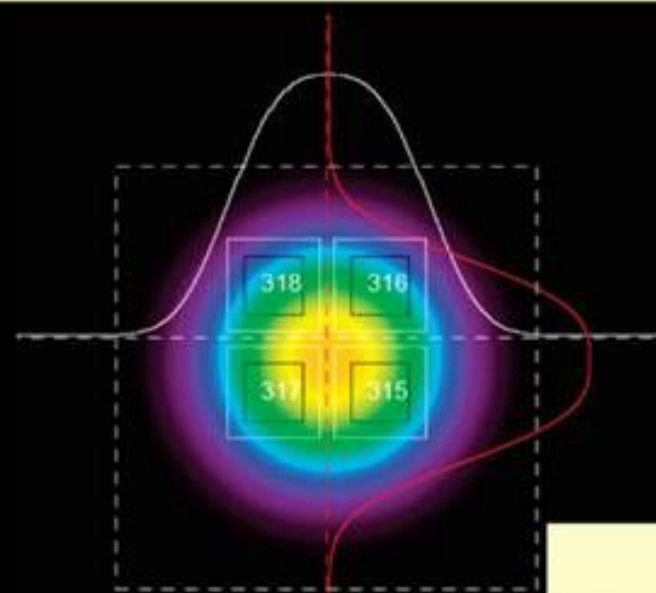


The National Ignition Facility

## Target diagnostics

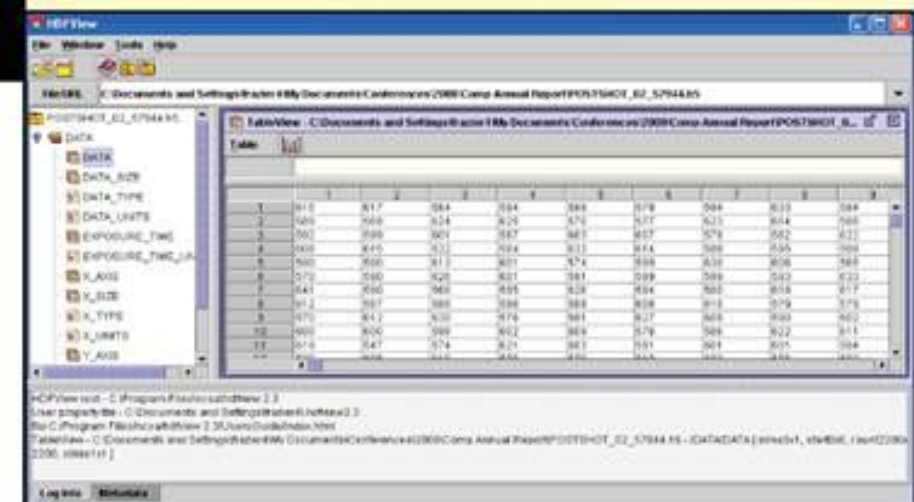


## Target diagnostics data



NDND5.8 + BP350 (T=35%)

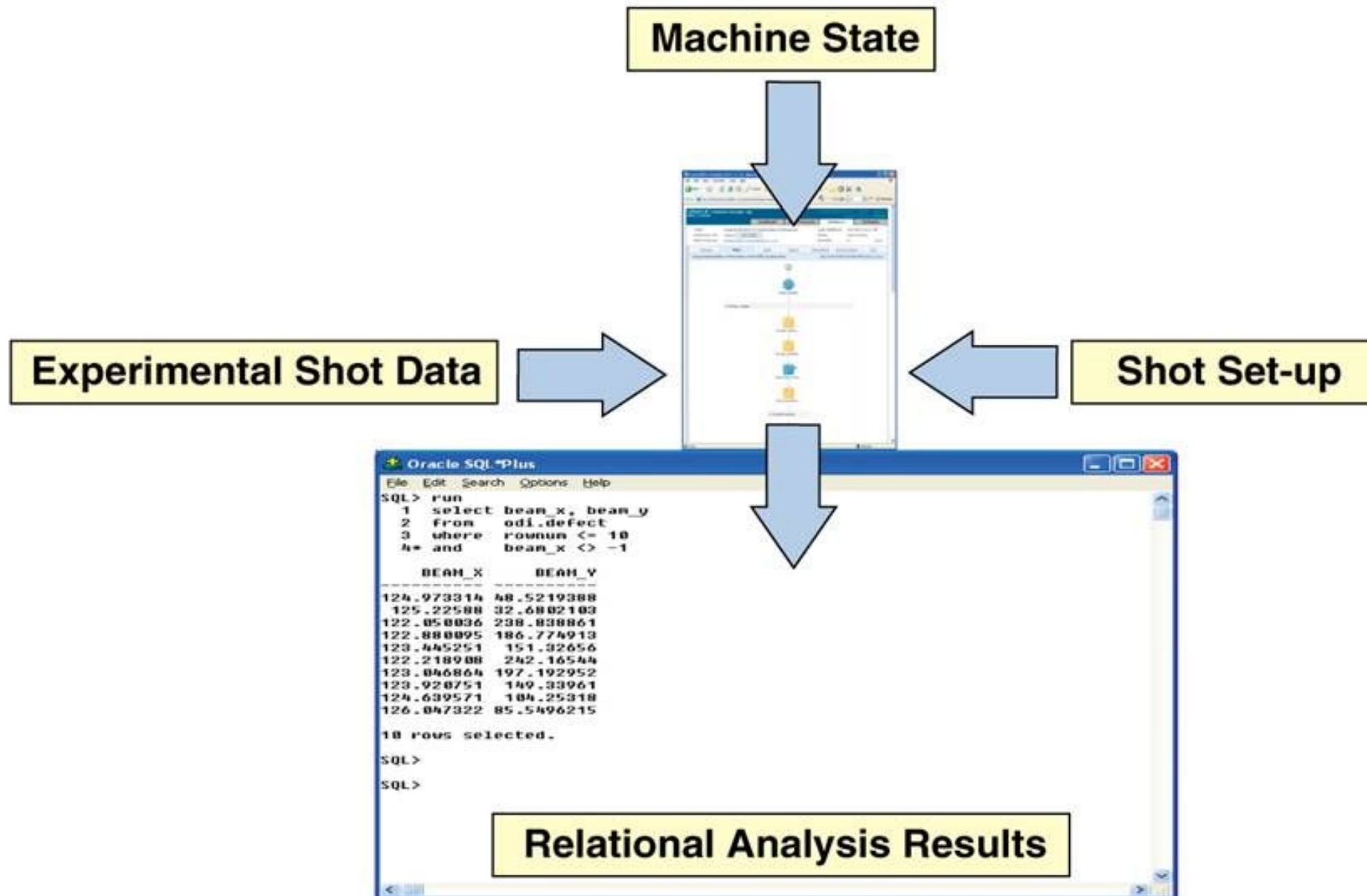
## Results saved as HDF



# Shot data analysis produces relational data and files stored in a content management system



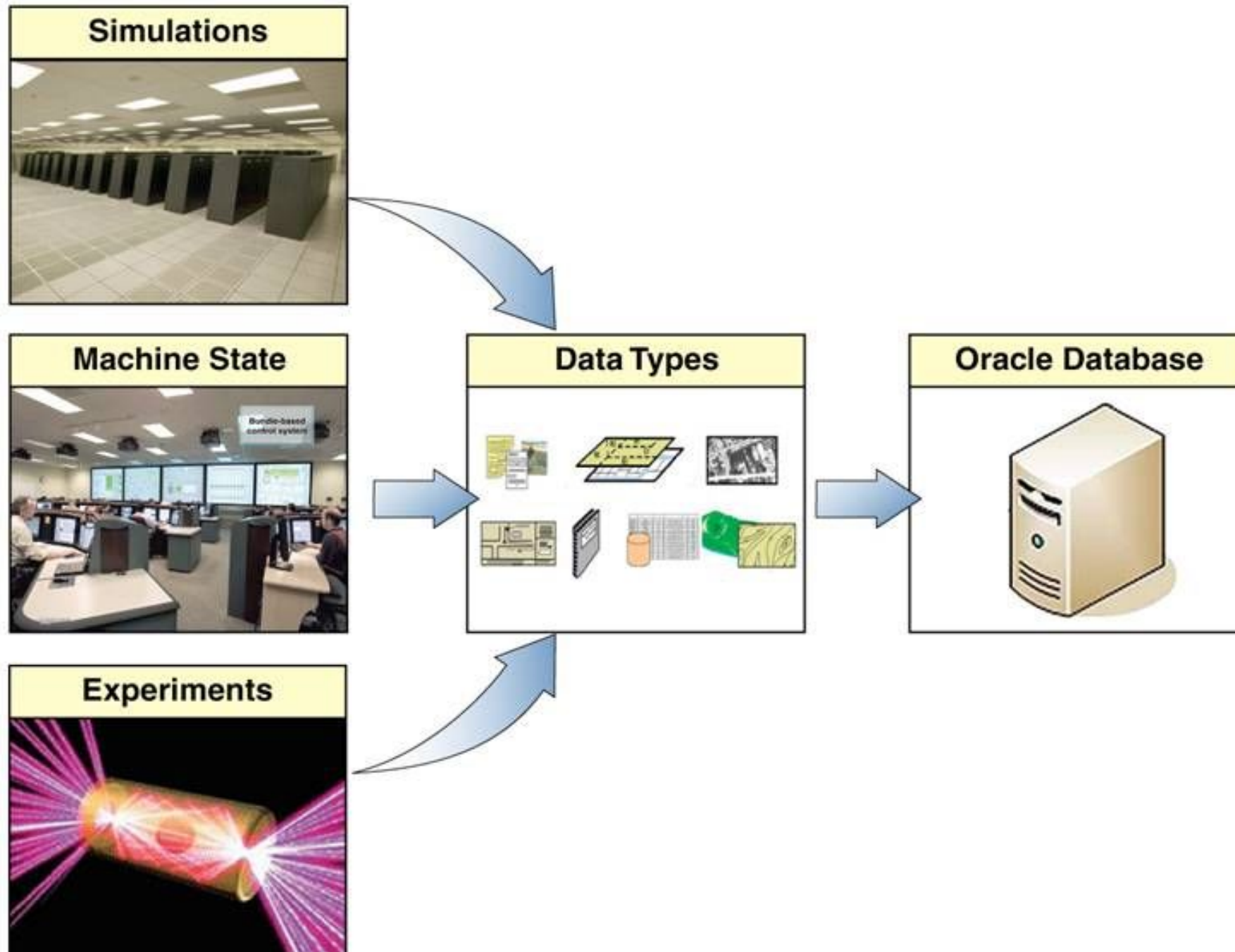
The National Ignition Facility



# A Common Database Platform Enables Integrated Tools



The National Ignition Facility



# NIF Federated Database and Information Systems



The National Ignition Facility

The Systems Engineering approach used to design, build and operate the NIF requires large-scale data integration

- Design documents
- Supply chain
- Machine state

NIF science also depends on the integration of a variety of data

- Simulations
- Machine state
- Experimental shot data

Data integration requires a common platform for data management & analysis tools

- Analysis
- Visualization

