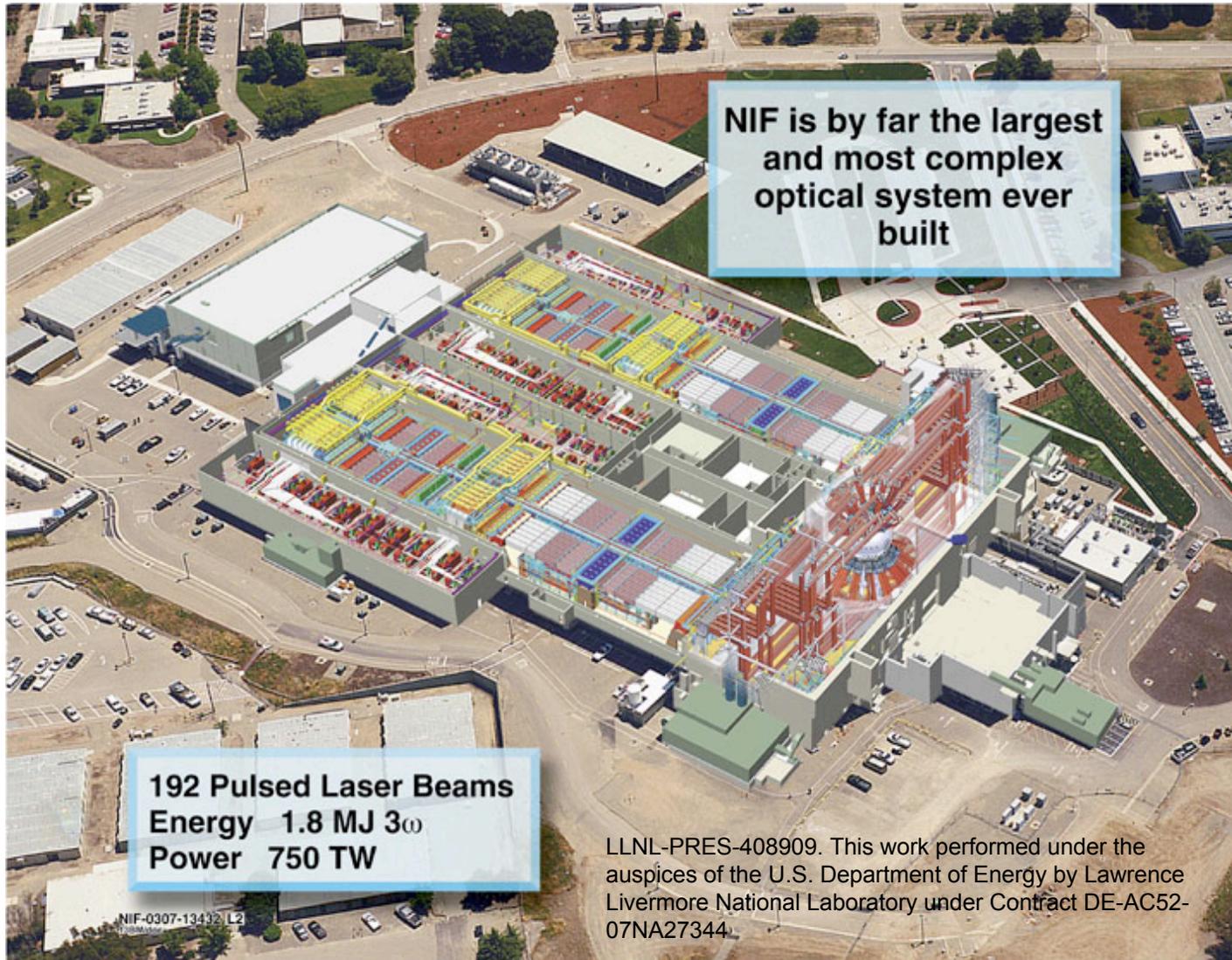
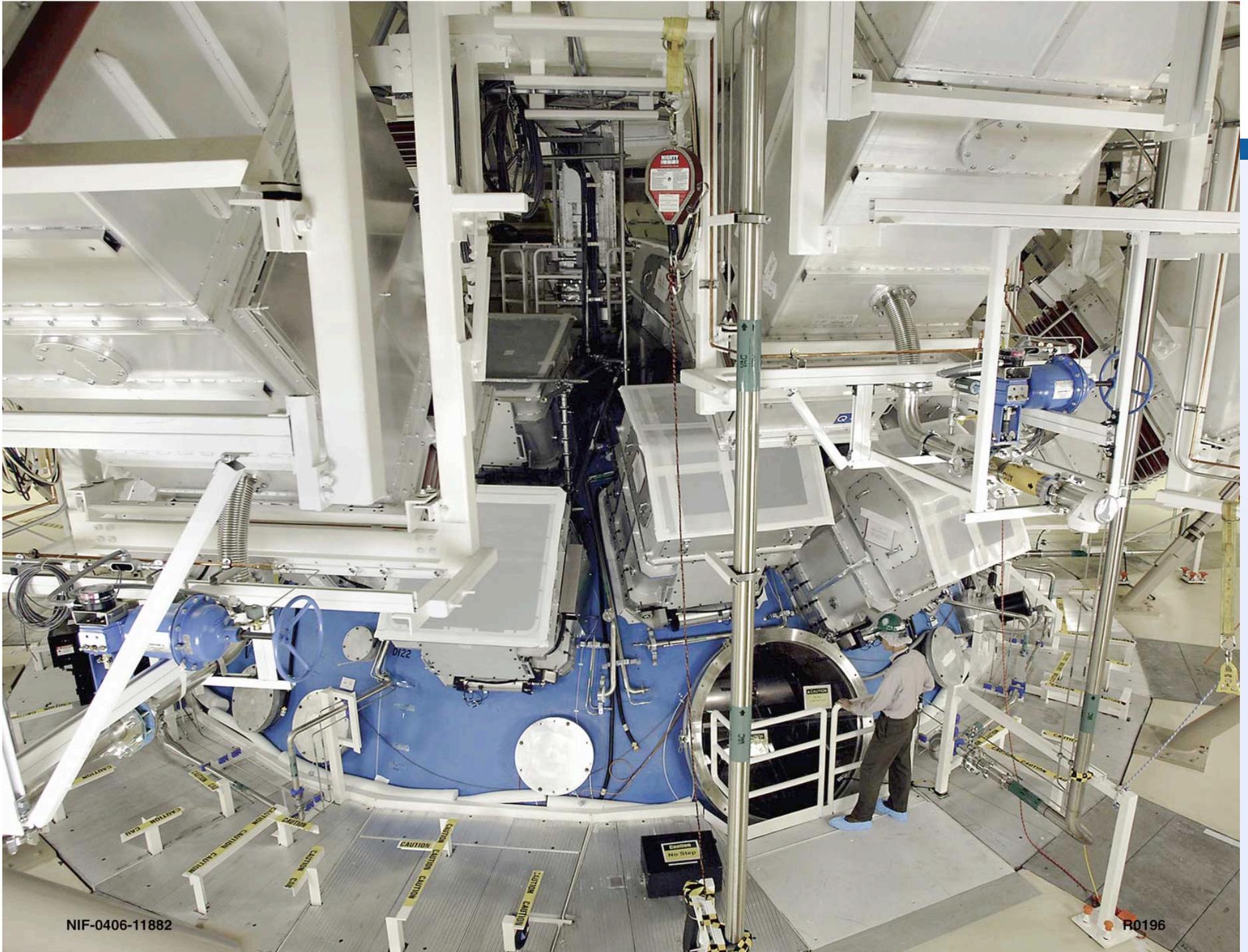


# The National Ignition Facility Data Requirements

Tim Frazier and Alice Koniges, LLNL

SC08 BOF: Computing with Massive and Persistent Data

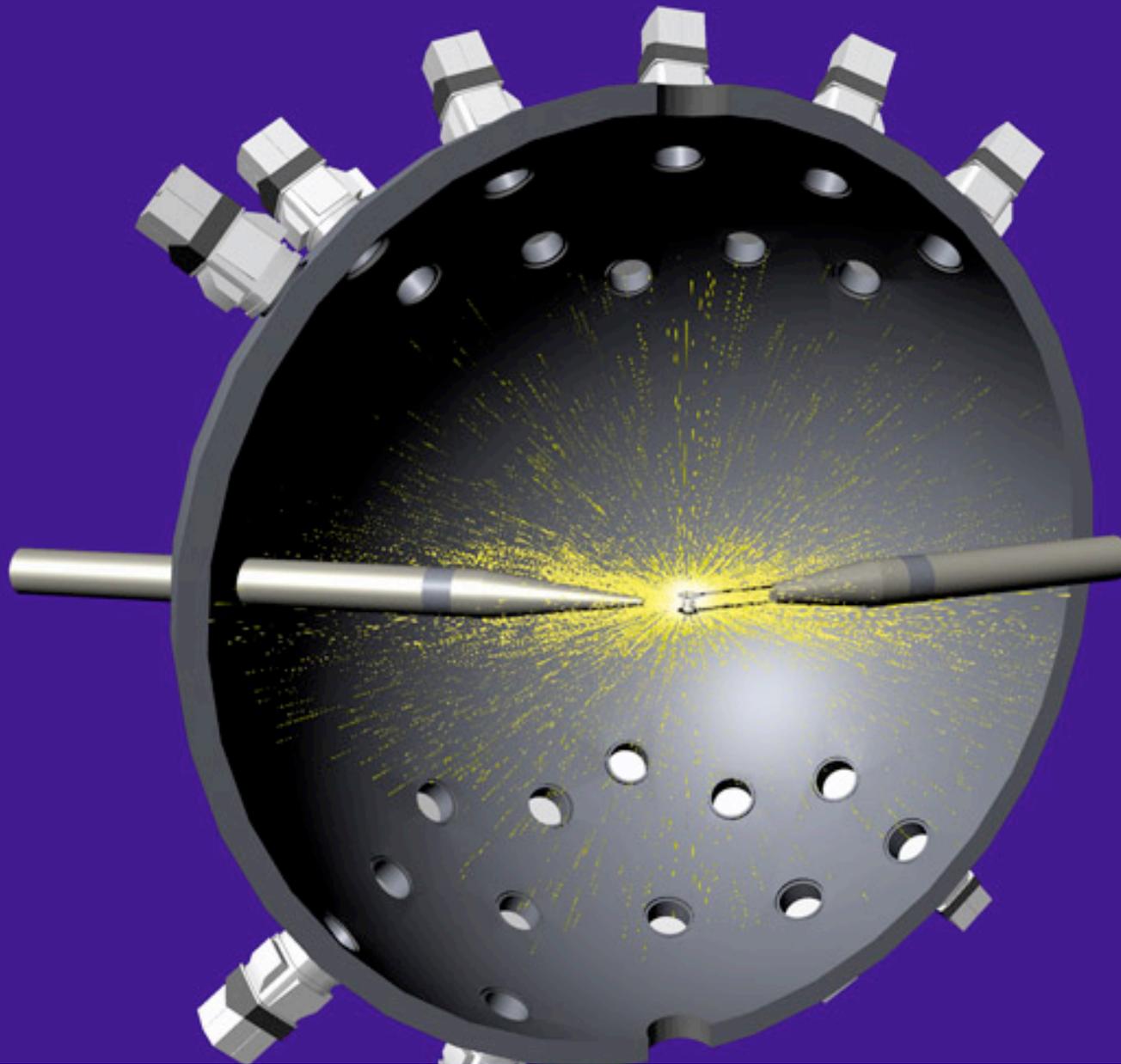




NIF-0406-11882

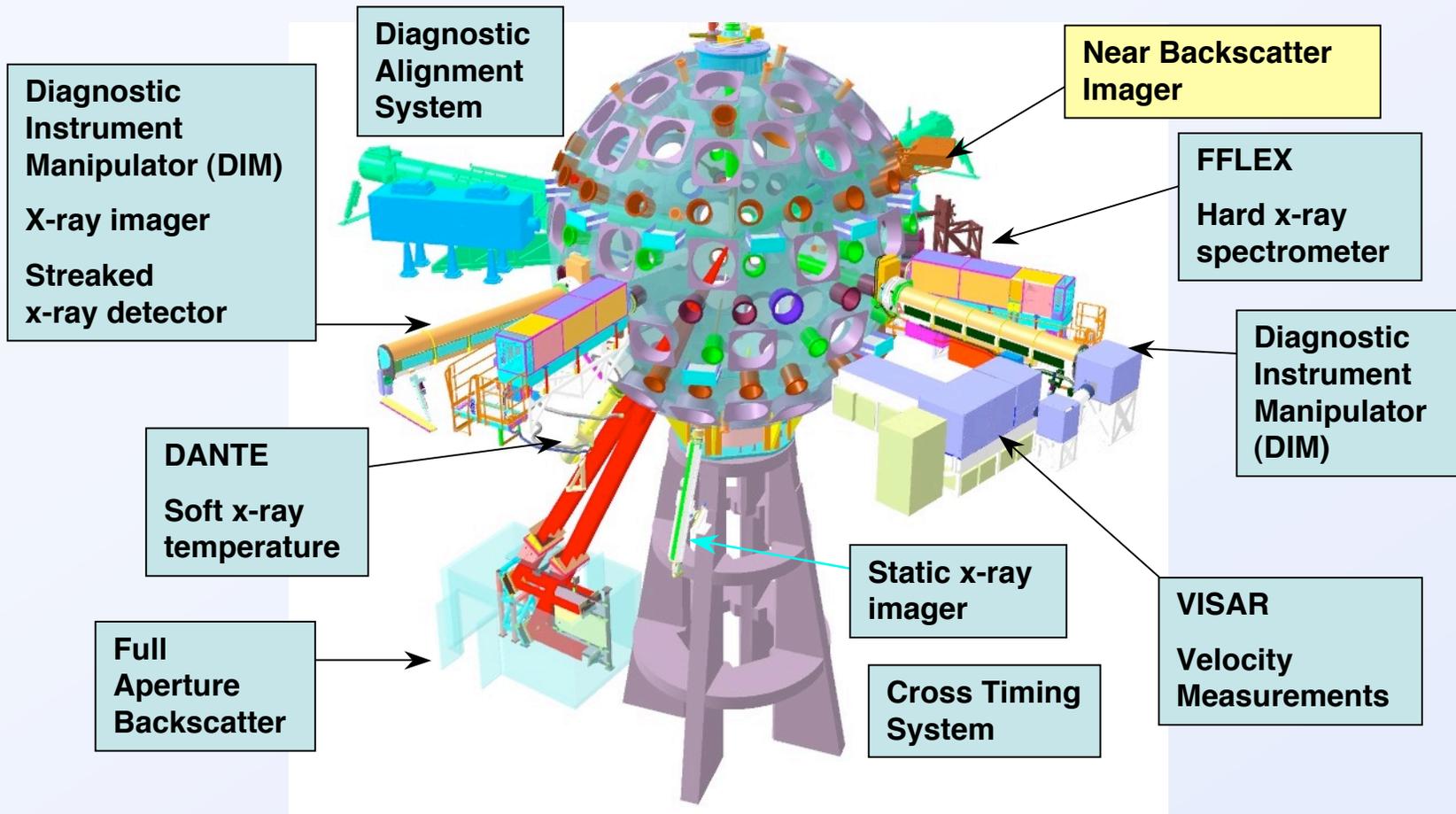
R0196





**One Terabyte of data to be downloaded in ~50 Minutes for each shot.**

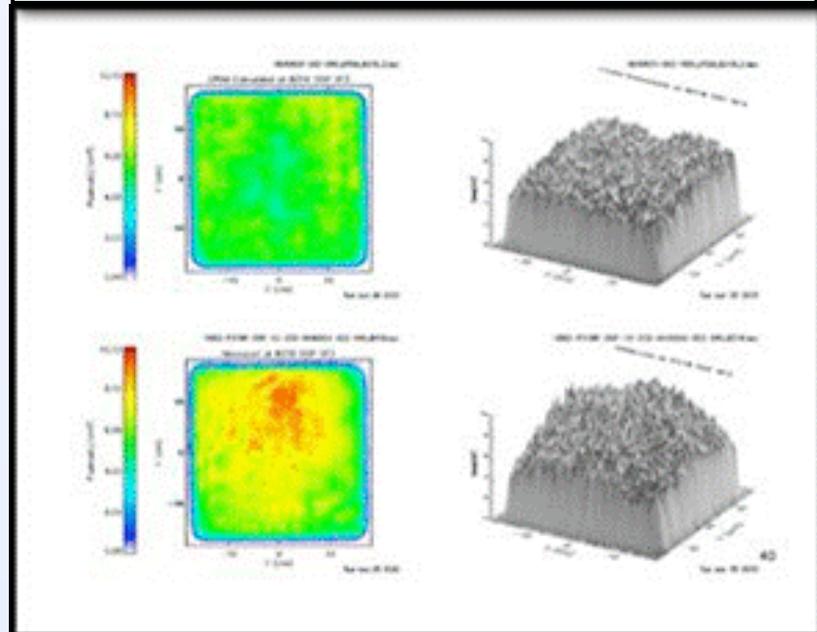
# Each Diagnostic Produces Data that Requires Analysis



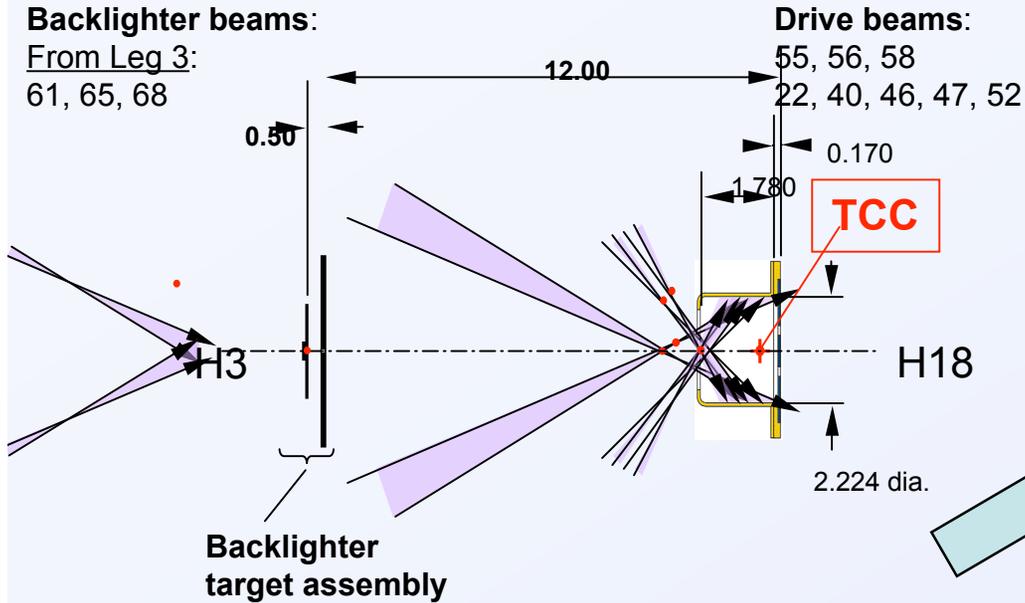
# Tools are being built to manage and integrate: simulations, machine state and experimental shot data

- 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 time budget of ~30 minutes
- Data will survive beyond NIF's 30 year lifespan

Image data provided by analysis and visualization tools



# Calibration Produces Hierarchical Data Format (HDF) & Excel



**Calibration Data**

**HDFView**

File Window Tools Help

File URL C:\Documents and Settings\Frazier4\My Documents\Conferences\2008\Comp Annual Report\POSTSHOT\_02\_57944.h5

POSTSHOT\_02\_57944.h5

DATA

DATA\_SIZE

DATA\_TYPE

DATA\_UNITS

EXPOSURE\_TIME

EXPOSURE\_TIME\_UN

X\_AXIS

X\_SIZE

X\_TYPE

X\_UNITS

Y\_AXIS

	1	2	3	4	5	6	7	8	9
1	615	617	584	594	589	579	594	633	584
2	589	569	624	626	570	577	623	614	588
3	592	599	601	587	603	607	578	582	622
4	608	615	532	584	633	614	589	595	589
5	580	580	613	601	574	590	630	606	565
6	570	590	626	601	591	599	599	593	633
7	641	590	568	595	626	594	580	618	617
8	612	587	588	596	589	606	610	579	579
9	570	612	630	576	581	627	609	590	602
10	600	600	588	602	609	576	586	622	611
11	619	547	574	621	603	591	601	601	584

HDFView root - C:\Program Files\ncsa\hdfview\2.3

User property file - C:\Program Files\ncsa\hdfview\2.3

TableView - C:\Documents and Settings\Frazier4\My Documents\Conferences\2008\Comp Annual Report\POSTSHOT\_02\_57944.h5

Log Info Metadata

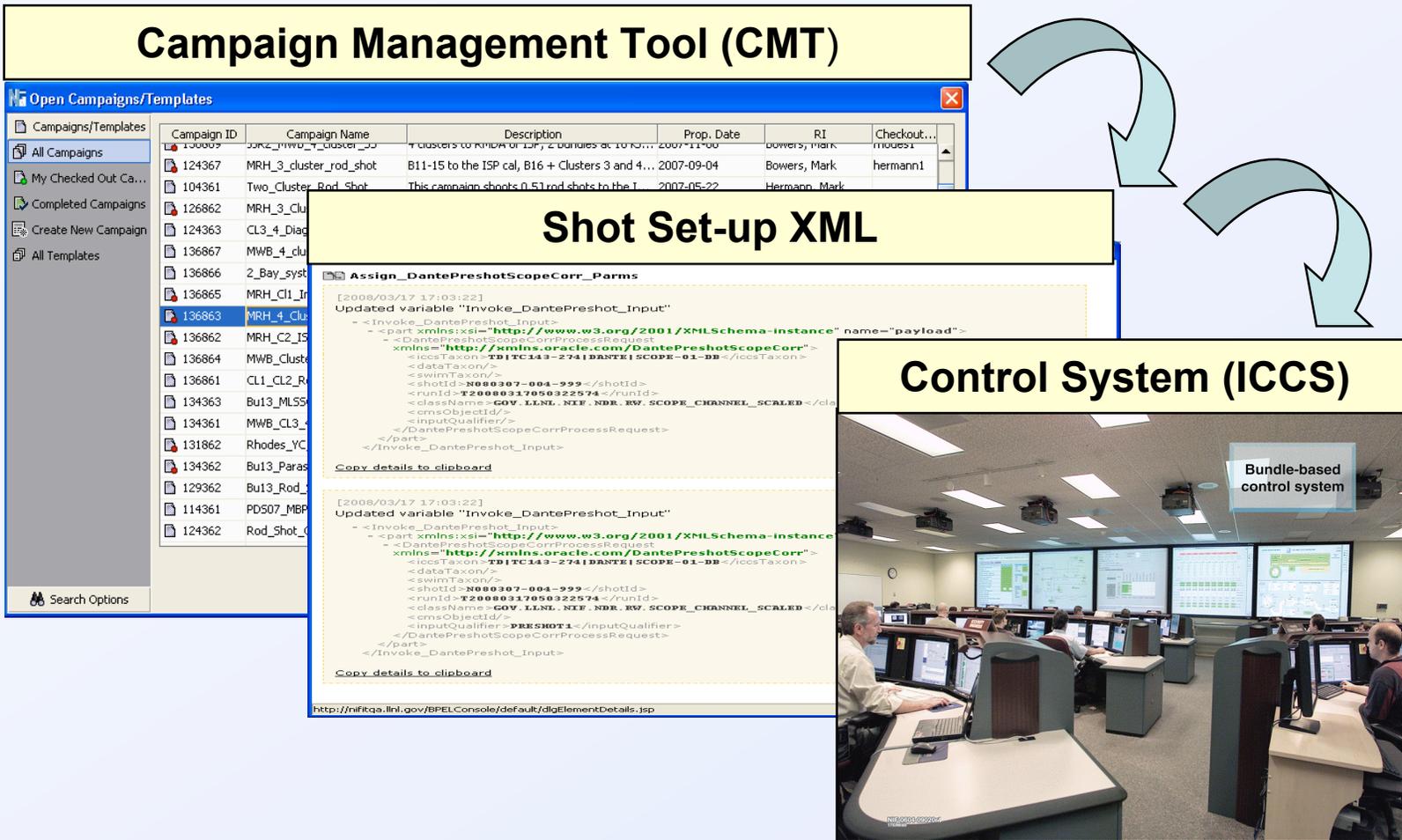
**Non-scalar calibration values in HDF**

**Microsoft Excel - New TEST\_SXI\_Filter\_Thickness\_200709123\_CIMM.xls**

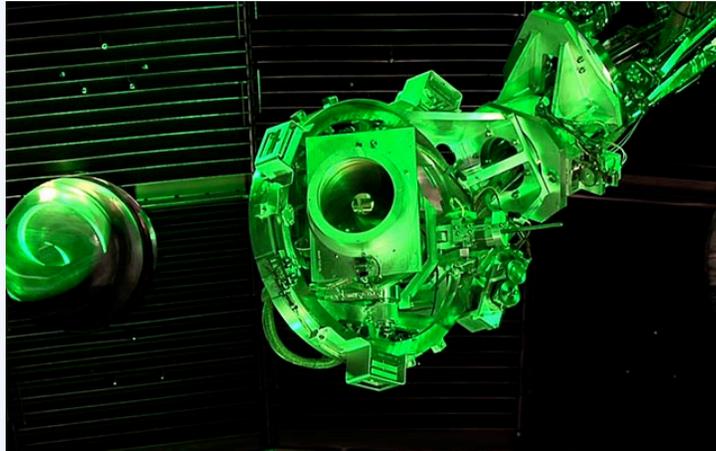
Name of field				Point of view:	Towards the Target Chamber
1					
2	Filter Pack Serial Number	13160205			
3					
4					
5					
6	Filter1 Top Left	Material	Thickness (in $\mu\text{m}$ )		
7	Filter1 Top Right	Aluminum	2		
8	Filter1 Bottom Left		1		
9	Filter1 Bottom Right		1		
10	Filter2 Top Left		20		
11	Filter2 Top Right		0		
12	Filter2 Bottom Left		10		
13	Filter2 Bottom Right		10		
14	Filter3 Top Left		5		
15	Filter3 Top Right		5		
16	Filter3 Bottom Left		5		
17	Filter3 Bottom Right		5		
18					
19					
20					
21					
22					
23					
24					

**Scalar calibration values in Excel**

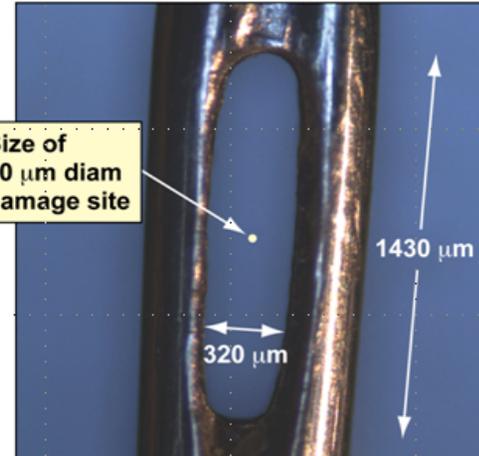
# Shot Set-up Produces XML



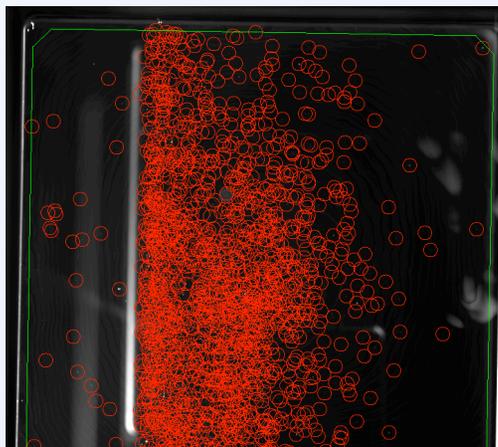
# Optics Inspection Produces High-Resolution Images and Requires Sophisticated Analysis to Identify Flaws



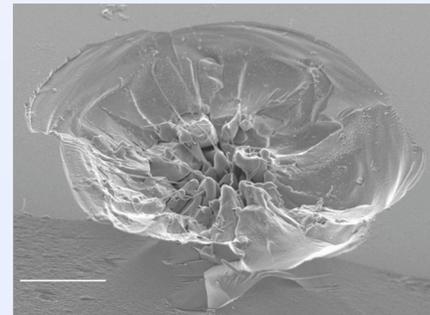
**Final Optic Damage Inspection (FODI)**



**Flaw site size**



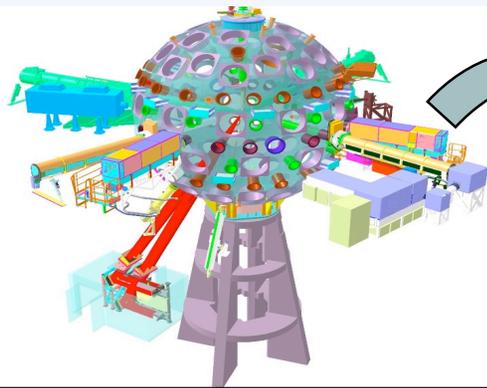
**FODI Image (32MB)**



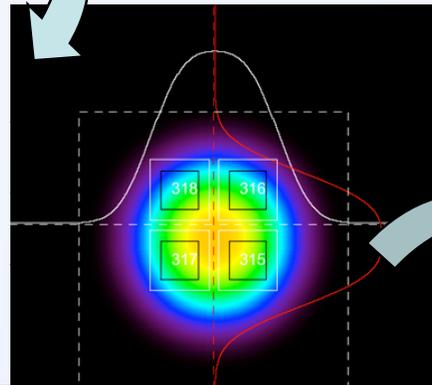
**Flaw site image via microscopy**

**Multiple optics in each of the 192 beams are inspected after every shot**

# Experiments Produce Hierarchical Data Format (HDF5)



Target diagnostics

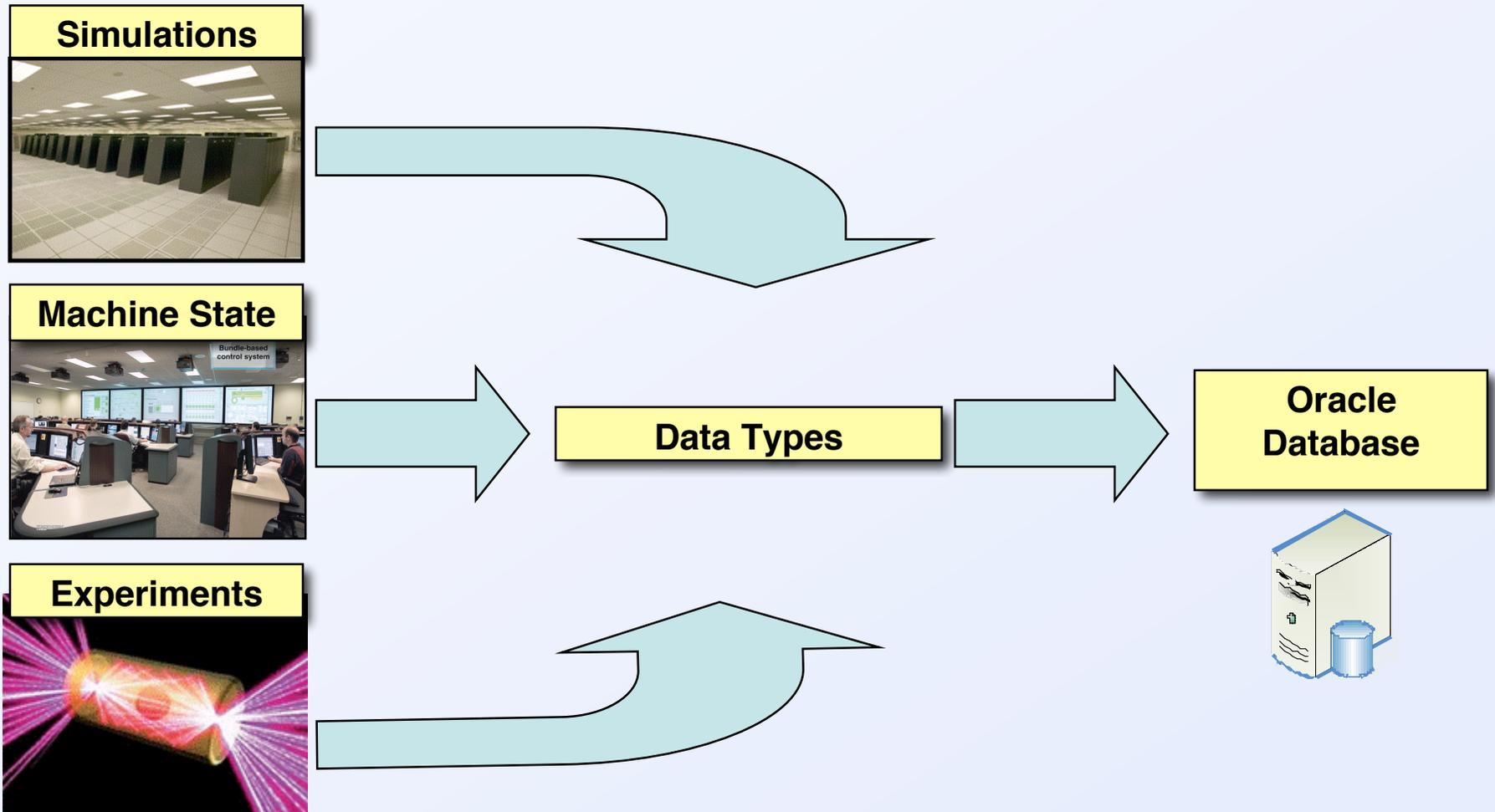


Target diagnostic data capture

	1	2	3	4	5	6	7	8	9	
1	1	1	2	3	4	5	6	7	8	9
2	1	615	617	584	594	589	579	594	633	584
3	2	589	569	624	625	570	577	623	614	589
4	3	592	599	601	587	603	607	578	562	622
5	4	608	615	532	584	633	614	589	595	589
6	5	590	580	613	601	574	590	630	606	565
7	6	570	590	626	601	591	599	599	593	633
8	7	641	590	568	595	626	594	589	618	617
9	8	612	587	588	596	589	606	610	579	579
10	9	570	612	630	576	581	627	609	590	602
11	10	600	600	599	602	609	576	586	622	611
12	11	619	547	574	621	603	591	601	601	584
13	12	606	610	636	636	636	636	636	636	636

Results saved as  
HDF

# A Common Database Platform Enables Integrated Tools



## A 30+ Year Lifetime Creates an Interesting Naming Problem

urn:llnl.gov:nif:archive:534f55c6-2271-487d-9c8d-9cc20d7af3af



- 1 Identifies value as a Uniform Resource Name (URN)
- 2 Identifies the source of the data
- 3 Identifies scientific archive as the holder of the object
- 4 Unique identifier which is guaranteed for the life of NIF and beyond

**NIF has adopted the W3C standard for naming long-lived objects**

## Data management plays a critical role in the success of NIF

- **NIF depends on the integration of a variety of data**
  - Simulations
  - Machine state
  - Experimental shot data
  - Status of optics (damage sites)
  
- **Data integration requires a common platform for data management & analysis tools**
  
- **Between shots (~3/day), data must be quickly and carefully analyzed to properly plan for next shot**
  - Goal is 30 min to process all data
  
- **NIF Data must:**
  - Outlast the 30 year lifetime of the facility
  - Be searchable and navigable with transparent relationships
  - Be stored economically which implies tiered storage
  - Be secure and released for review on a controlled basis