NIF Experiment Analysis and Data Visualization

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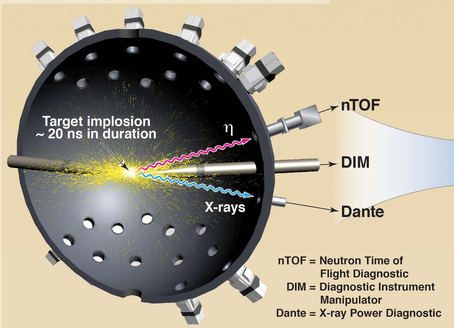
SUMMARY

Our software archives and automatically analyzes experimental data performed on the NIF. A rich web-based toolset is used for immediate visualization.

1. Archive

All data are stored in a Relational Database



nTOF = Neutron Time of Flight Diagnostic
DIM = Diagnostic Instrument Manipulator
Dante = X-ray Power Diagnostic

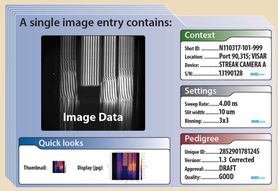
NIF Archive Content Management System is:

- Secure – Heirarchical 30 year-storage: ~60 TB per year expected
- Web-Visible – within 30 minutes after a shot
- Reviewable – approved by a Responsible Scientist (RS)
- Downloadable – to valid NIF users

Diagnostic Instruments record NIF data

1. Sensors on all diagnostics are triggered near shot time (T_0)
2. Instruments capture raw data to a server outside the NIF firewall
3. Raw data is archived in a secure database and analysis is launched
4. Configuration and calibration information are located by port, diagnostic, device or component

CMS maintains *data, metadata*, and much more



Trigger

2. Analyze

IDL-based analysis software computes results

Data-driven Analysis Engine is:

- Launched when data appears
- Flow-customized for each Diagnostic
- Accurate and precise, with error bounds and quality metrics

We work with NIF scientists to ensure that algorithms and results are *pedigreed*, validated and publishable.

We need good data and good pedigree on the data. We want to argue the physics, not the algorithms.

— E. Moses, 2010

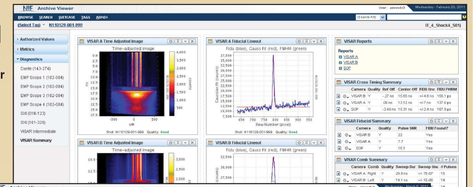
Desktop Analysis is needed also:

- Performance Qualification of algorithms
- Allow "What-if" and Re-run analysis
- Upload of "Authorized" results to CMS

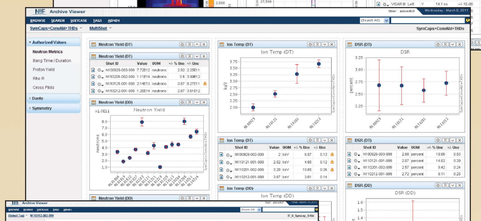
3. Visualize

Web tools provide views into NIF results

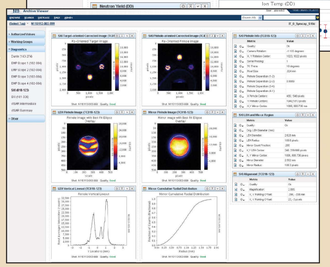
Optical
Velocity Interferometer



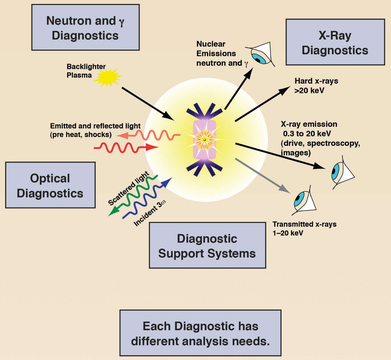
Neutron
Multi-shot Neutron Metrics



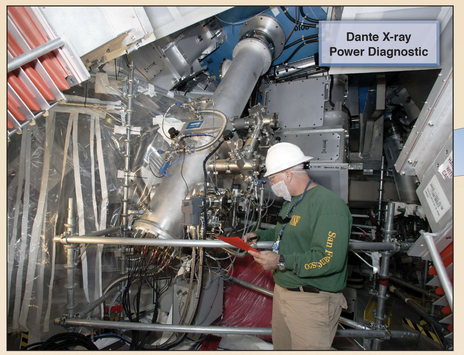
X-ray
Static X-ray Imager



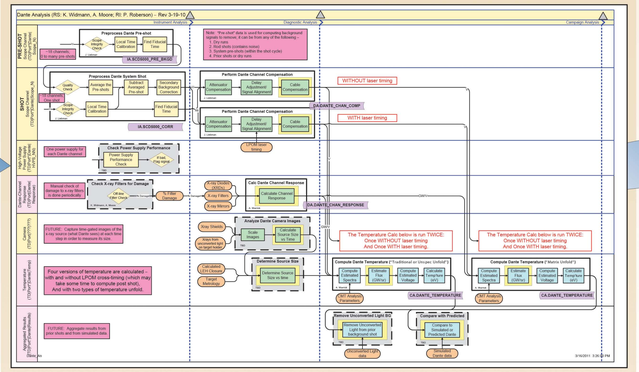
There are over 30 diagnostics on NIF



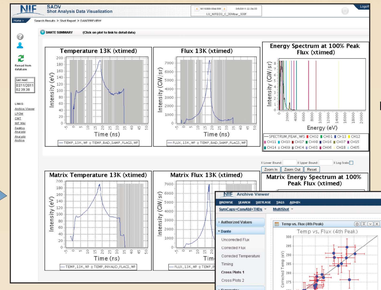
For example, Dante is an 18-channel X-ray spectrometer



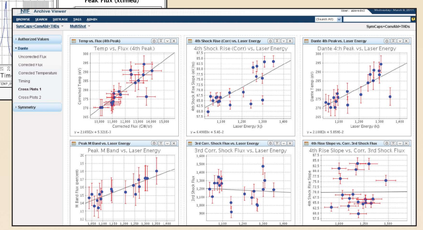
Dante analysis is an automated pipeline



Dante results can be visualized in many ways



Dante X-ray temperature and flux



Dante cross-plots from multiple shots

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