FASC Update

Presented to the NIF User Forum

Kevin Fournier

October 21, 2015

LLNL-PRES-679384

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344. Lawrence Livermore National Security, LLC

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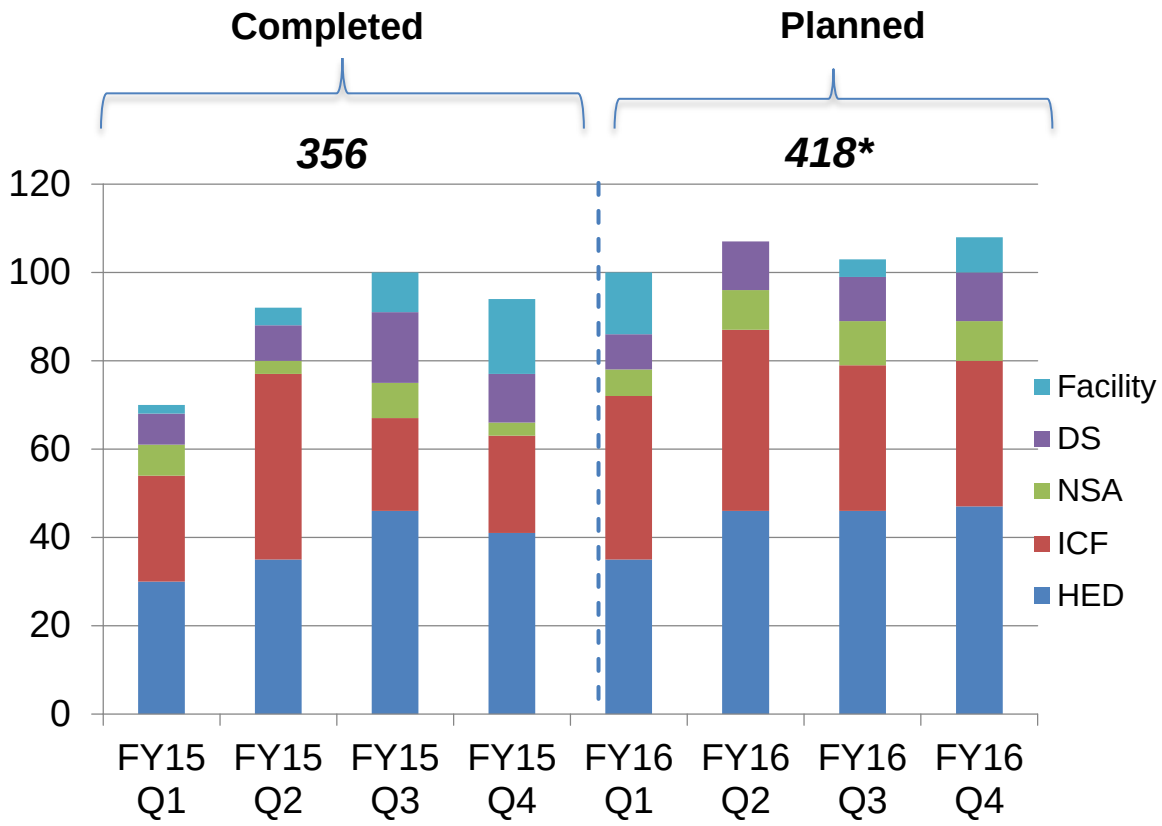
NIF continues to increase shot-rate

Target Shots



*Baseline target shot plan as of 10/16/15

NIF exceeded the 300 shot goal for FY15 with 356 Target shots

NIF is positioned to support The FY16 goal of continued efficiency improvements, consistent with 120 day study recommendations, with over 400 shots Planned + Proposed

Shots scheduled for FY16

Program	FY16Q1	FY16Q2	FY16Q3	FY16Q4	Totals
DS	8	11	10	11	40
Facility	14		4	8	26
HED	35	46	46	47	174
ICF	37	41	33	33	144
NSA	6	9	10	9	34
Totals	100	107	103	108	418

There are approximately 3 weeks held in reserve yet to be scheduled

Schedule Priorities in FY16

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In FY16 we are fully booking the NIF schedule in lieu of fill-in shots

- Opportunity shots:
  - have been a way for the facility to utilize maximum time in FY15
  - by definition have limited complexity and limited potential for advancing learning.
  - often stress the facility and target fabrication planning process if targets are not on the shelf.
  - generally fit into a plan as an extra shot in a planned series of shots
    - stand-alone opportunities are more perturbing to facility operations.

There will be no opportunity shots in FY16

To accommodate more aggressive scheduling in FY16, shot priorities within a week need to be clearly specified

- Shot weeks in FY16 have been “overbooked” as part of the planning process
  - Booked 140 hours of estimated work in 120 hours of available time
  - Shot weeks owned by a single program to first order, so priorities are set within a program’s scope
  - Targets will be built based on shot plan only – exceptional cases worked out with individual programs depending on capacity

- Programs need to clarify their internal priorities three weeks in advanced to be available when the DOS is constructed.
  - Priority: specify which shot(s) is(are) to get bumped if necessary
  - Program priorities will be communicated through written Rules of Engagement (ROE).
  - Independent of whether mixed or single-program week

In aggregate all programs will realize more shots in FY16

Programs are trying to provide a better ROE for the shot director to follow

- Importance of crisp Rules of Engagement will go up in our new paradigm
  - ROE for a week need to capture all stakeholders' interests for that week
- Common-mode failures are different from delays due to shot-specific issues
  - Example: an ARC shot running long causing a delay will have to be accommodated in the ROE, versus a system-wide failure of the TARPOS or the chiller plant – in the latter case, the facility will have as a goal making up the time to the affected program.
- Criterion(a) to invoke a MRB should be part of ROE
  - Daily decisions are made at the 11 a.m. shot CCB
  - A MRB should be called when a shot is within an hour or so of planned firing time, but looks like it will miss the planned firing time by a lot

Be careful what you write, we are going to follow the ROE closely

Proposed process for establishing shot week rules of engagement

- Apply the standard shot durations to each scheduled shot by program
  - Each shot gets the standard 2 hours default contingency
- Roll up the total time by program for each shot week
- Define baseline cutoff times for each program's time block (or blocks as applicable)
- Adjust cutoff times during the ROE meeting by redistributing contingency
  - This is negotiated with all stakeholders for that week, including all participating programs and the facility taking into account shot priorities established by the programs
  - ROE determined the week prior to the shots in the Tue Shot CCB meeting
  - Special conditions may apply to critical milestone shots or special materials
  - Early start gains will be distributed by the Shot CCB following previous consideration
- Shot week decisions are made at the daily shot CCB
- Programs will assign their referee to arbitrate internal program decisions for the shot team at the Tue ROE meeting

Golden Template and SAVI Update

NIF User Forum on 10/21

Richard Bionta

October 21, 2015

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Changes in diagnostic set-up and analysis allow the diagnostic RSs to service more shots

- Golden templates
  - Standard, RS approved templates for setting up diagnostics
- SAVI
  - Analysis of most used diagnostics upgraded for accuracy and robustness
- Phase II
  - Simplified, physics parameter based diagnostic set-up

Diagnostics with Golden Templates

- Selection and submission of (unchanged) of Golden Template leads to automatic approval in most cases.
- Some fields, i.e. SXI pointing, are allowed to be changed. These are not marked you must look in the description or guidance document

Diagnostic	Diagnostic
Dante	NBI
EXHI	NTOF/SPEC
FABS	NTOF/DTHI
FFLEX	SPBT
NAD	SPIDER
SXI	

Shot RIs who repeatedly use the same diagnostic set-up can ask the diagnostic RS to make the setup “Golden.”

SAVI upgraded to now provide:

- Dante - corrected data through temp analysis, upcoming scope change
- Disc - corrected, cross timed data
- FABS/NBI - backscatter energy, also new calibration algorithm in progress
- FFLEX - hot electron temp
- GRH - bang time, C RhoR software available but not calibrated
- NIS - through corrections
- NTOF - neutron yield, also major upgrade in progress with algorithm and hardware updates
- SPBT - integrated energy
- VISAR – data through corrections, also in progress
- GXD/HGXD - pulse timing data
- Image Plate – fade corrections for all locations

Work on other diagnostics will continue

Dashboard Utilities

NIF User Forum

Ed Hartouni

NIF Implosions, Nuclear Science and Diagnostics Group

October 21, 2015

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What dashboard utilities?

Generally, interact with the various database servers *via* WebDav

http://nifitservices.llnl.gov/ArchiveWebDav/

Access requires a username/password combination. (Steve Hahn, hahn21)

This utility can connect you to a large amount of documentation, instructions, and shot data. It is accessible via web utilities which allows for scripts to run automatically to obtain the data.

In general, all the information on the NIF Archive Viewer Dashboard is accessible.

I had originally written scripts in PERL… now my scripts run under IDL…

While indirect, WebDav provides access to the various database servers of NIF shot information.

IDL support routines

FUNCTION

get_WebDav_dir	returns the contents of the specified URL directory
get_WebDav_file	returns the specified file
get_WebDav_text	returns the text at a specified URL

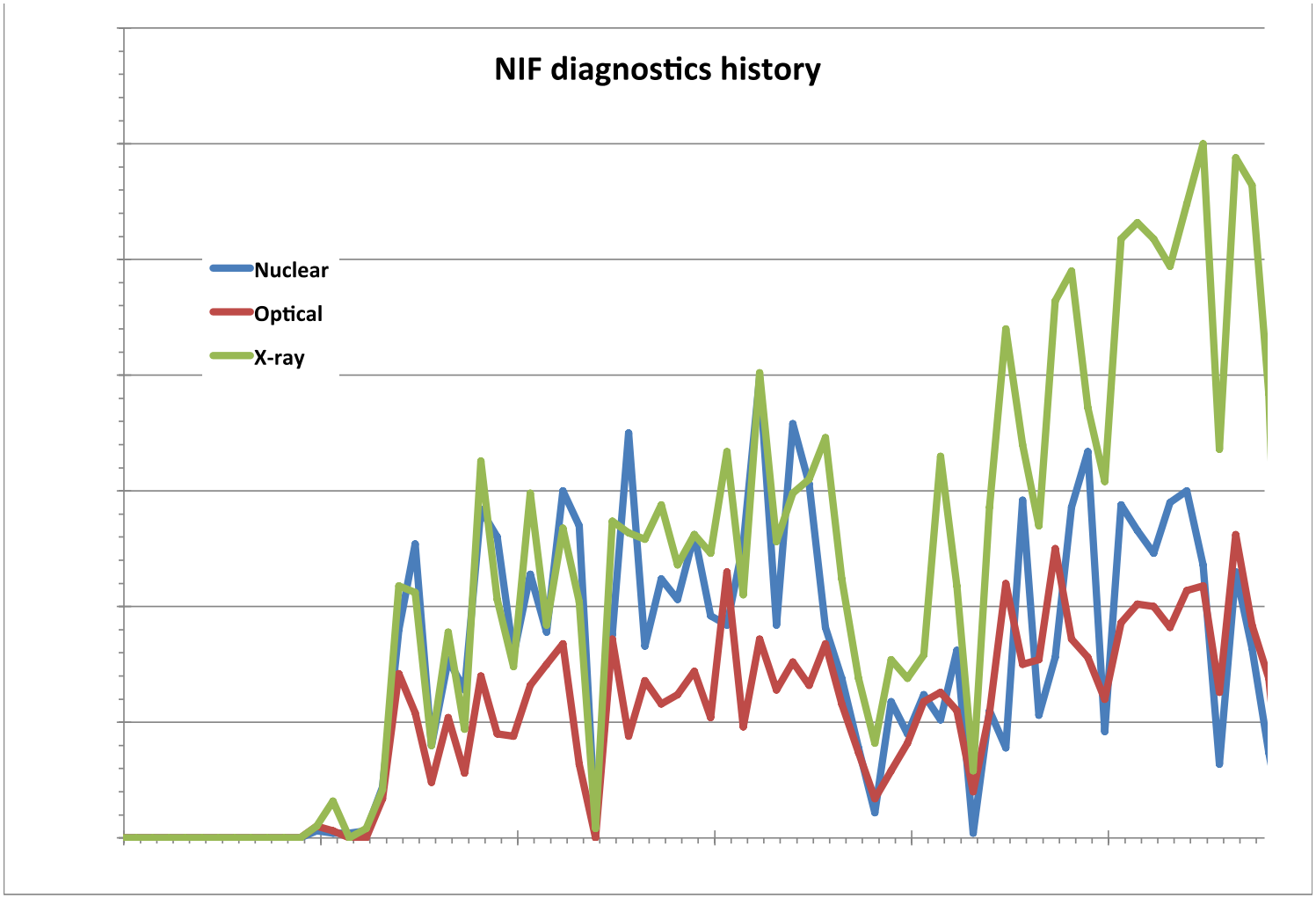
The various files, texts, etc. have to be parsed. Depending on the file type, images, .h5 or .csv other IDL routines exist to read the content. For text, there may exist parsing routines, e.g. for .nxf files…

These three routines are the “elements” used in accessing the data.

Summary box has a full-width bleed.
Delete if not needed.

Example 1

How many diagnostics have run on NIF shots?



Information on Dashboard

- Diagnostics
- Simulations
- Other

Campaign RI	Khan, Shahab
Target?	Y
Cryo?	Y
FLIP ID	H_CVal_2DConA_2Shk_III
CMT Campaign	H_CVal_2DConA_2Shk
CMT Experiment	H_CVal_2DConA_2Shk_S04a
Pulse Shape	H_CVal_2shk_150130_out, H_CVal_2shk_150130_in, ConA2D_BL_2.2TW_2ns_121112
Target Desc	CONA2D_AU_575.943_310_HED3_T_14-104214,TARGET ASS
Description	Partial Fill mini-campaign using 675μm (0.8 scale) 1% Si-doped CH capsule and nominal scale 575 hohlraum with two shock high foot pulse

http://nifitservices.llnl.gov/ArchiveWebDav/export/shotdata/shots/2015/10/N151018-002-999/reports

Diagnostics Used

	Category	Diagnostic	Priority
	Xray	Dante 1 (TC143-274)	SECONDARY
	Xray	SXI Upper	SECONDARY
	Xray	SXI Lower	TERTIARY
	Xray	FFLEX	SECONDARY
	Xray	HGXD DIM(000,000)	SECONDARY
	Xray	HGXD DIM(090,078)	PRIMARY
	Xray	Image Plate DIM (000,000)	USED
	Xray	Image Plate DIM (090,078)	USED
	Xray	PTOF - Position 2 DIM(090,078)	USED
	Xray	EHXI	USED
	Xray	SPIDER	SECONDARY
	Optical	FABS (Q31B)	SECONDARY
	Optical	FABS (Q36B)	SECONDARY
	Optical	NBI(Q31B)	SECONDARY
	Optical	NBI(Q33B)	SECONDARY
	Nuclear	NTOF 18M SPECSP	SECONDARY
	Nuclear	NTOF 20M SPECA	SECONDARY
	Nuclear	NTOF 20M SPECE	SECONDARY

Parent Directory

DANTE
RAGS
TCM
AUTH-INSTR-BANGTIME_N151018-002-999.csv
AUTH-INSTR-BURNWIDTH_N151018-002-999.csv
AUTH-INSTR-DSR_N151018-002-999.csv
AUTH-INSTR-TION_N151018-002-999.csv

```
URN,Shot ID,Experiment Name,Category,Diagnostic,Priority,
urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Xray,SXI Lower,TERTIARY,
urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Xray,SXI Upper,SECONDARY,
urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Xray,"PTOF - Position 2 DIM(090,078)",USED,
urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Xray,EHXI,USED,
urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Xray,SPIDER,SECONDARY,
urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Nuclear,NTOF 20M SPECA,SECONDARY,
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urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Optical,NBI(Q31B),SECONDARY,
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urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Xray,Dante 1 (TC143-274),SECONDARY,
urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Xray,FFLEX,SECONDARY,
urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Xray,"HGXD DIM(000,000)",SECONDARY,
urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Xray,"HGXD DIM(090,078)",PRIMARY,
urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Xray,"Image Plate DIM (000,000)",USED,
urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Xray,"Image Plate DIM (090,078)",USED,
urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Nuclear,NTOF 20M SPECE,SECONDARY,
urn:llnl.gov:nif:archive:unknown,N151018-002-999,H_CVal_2DConA_2Shk_S04a,Nuclear,NTOF 18M SPECSP,SECONDARY,
```

SIM-VALUES_N151018-002-999.csv
SXI-METRICS_N151018-002-999.csv
TARGET-FUEL-MIX_N151018-002-999.csv
TARGET-VALUES_N151018-002-999.csv
TD-USE_N151018-002-999.csv
UNAUTH-BANGTIME_N151018-002-999.csv

IDL "crawled" through **all** the system shots (-999) since 2010, looking at each TD-USE file and extracted the "Category" and "Diagnostic" field information.
This took 20 minutes and produced a .csv file (16898 rows) which Excel could read.

Example 2

Nuclear data for HiFoot shot T_{DT} T_{DD} analysis.

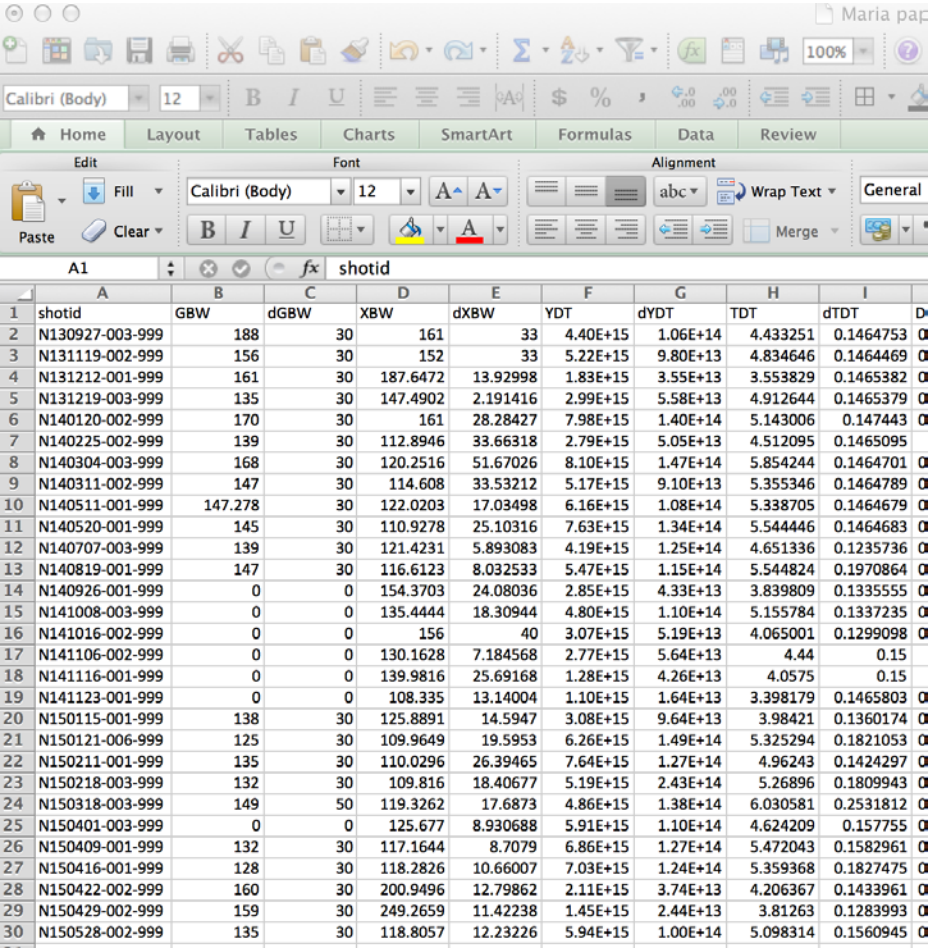
More complex query requires 5 files for each shot:

AUTHORIZED-VALUES_
NEUT-ALLDIAG-VALUES_
EXPERIMENT-VALUES_
SHOT-INPUTS_
TARGET-VALUES_

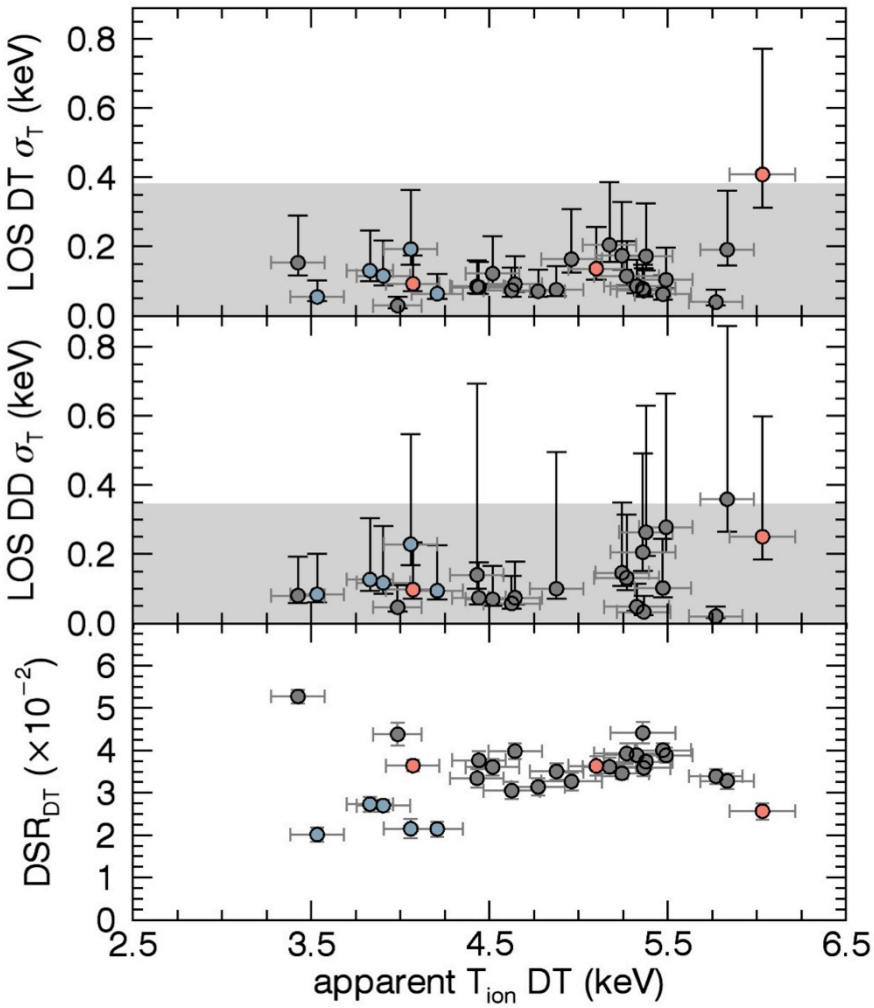
One IDL routine finds the files from a list of shots defining the HiFoot campaign and copies them to a local NIF data folder on my machine organized by shot.

Another routine looks at each folder and creates a .csv file with the desired information.

Data summaries for analysis.



	A	B	C	D	E	F	G	H	I
1	shotid	GBW	dGBW	XBW	dXBW	YDT	dYDT	TDT	dTDT
2	N130927-003-999	188	30	161	33	4.40E+15	1.06E+14	4.433251	0.1464753
3	N131119-002-999	156	30	152	33	5.22E+15	9.80E+13	4.834646	0.1464469
4	N131212-001-999	161	30	187.6472	13.92998	1.83E+15	3.55E+13	3.553829	0.1465382
5	N131219-003-999	135	30	147.4902	2.191416	2.99E+15	5.58E+13	4.912644	0.1465379
6	N140120-002-999	170	30	161	28.28427	7.98E+15	1.40E+14	5.143006	0.147443
7	N140225-002-999	139	30	112.8946	33.66318	2.79E+15	5.05E+13	4.512095	0.1465095
8	N140304-003-999	168	30	120.2516	51.67026	8.10E+15	1.47E+14	5.854244	0.1464701
9	N140311-002-999	147	30	114.608	33.53212	5.17E+15	9.10E+13	5.355346	0.1464789
10	N140511-001-999	147.278	30	122.0203	17.03498	6.16E+15	1.08E+14	5.338705	0.1464679
11	N140520-001-999	145	30	110.9278	25.10316	7.63E+15	1.34E+14	5.544446	0.1464683
12	N140707-003-999	139	30	121.4231	5.893083	4.19E+15	1.25E+14	4.651336	0.1235736
13	N140819-001-999	147	30	116.6123	8.032533	5.47E+15	1.15E+14	5.544824	0.1970864
14	N140926-001-999	0	0	154.3703	24.08036	2.85E+15	4.33E+13	3.839809	0.1335555
15	N141008-003-999	0	0	135.4444	18.30944	4.80E+15	1.10E+14	5.155784	0.1337235
16	N141016-002-999	0	0	156	40	3.07E+15	5.19E+13	4.065001	0.1299098
17	N141106-002-999	0	0	130.1628	7.184568	2.77E+15	5.64E+13	4.44	0.15
18	N141116-001-999	0	0	139.9816	25.69168	1.28E+15	4.26E+13	4.0575	0.15
19	N141123-001-999	0	0	108.335	13.14004	1.10E+15	1.64E+13	3.398179	0.1465803
20	N150115-001-999	138	30	125.8891	14.5947	3.08E+15	9.64E+13	3.98421	0.1360174
21	N150121-006-999	125	30	109.9649	19.5953	6.26E+15	1.49E+14	5.325294	0.1821053
22	N150211-001-999	135	30	110.0296	26.39465	7.64E+15	1.27E+14	4.96243	0.1424297
23	N150218-003-999	132	30	109.816	18.40677	5.19E+15	2.43E+14	5.26896	0.1809943
24	N150318-003-999	149	50	119.3262	17.6873	4.86E+15	1.38E+14	6.030581	0.2531812
25	N150401-003-999	0	0	125.677	8.930688	5.91E+15	1.10E+14	4.624209	0.157755
26	N150409-001-999	132	30	117.1644	8.7079	6.86E+15	1.27E+14	5.472043	0.1582961
27	N150416-001-999	128	30	118.2826	10.66007	7.03E+15	1.24E+14	5.359368	0.1827475
28	N150422-002-999	160	30	200.9496	12.79862	2.11E+15	3.74E+13	4.206367	0.1433961
29	N150429-002-999	159	30	249.2659	11.42238	1.45E+15	2.44E+13	3.81263	0.1283993
30	N150528-002-999	135	30	118.8057	12.23226	5.94E+15	1.00E+14	5.098314	0.1560945



Concluding remarks

I also use the WebDav tools to download shot data, calibration constants, etc, for offline analysis.

WebDav provides support for users to create their own database for analysis.

While most (if not all) the information is available, there is no formal “map” to the data.

Data tools are simple, but provided by the users, in what ever analysis package they chose to use.

Andrew McPhee’s *Mathematica* based data viewer/manipulator provides another way to access data with a different set capabilities. (Left margin bar on the NIF Wiki, ***Summary>NIF Data Trends Tool***)

We're making some improvements to the shot lifecycle

- To facilitate better communication with less effort, the TD Snout Engineering request template has been added to the TALIS viewgraphs, to form a single package that will be submitted to both groups
  - Eliminates the need for the Shot RI to submit the same information to two different groups in two different formats
  - A joint mailing list will be created, so that Shot RIs will have to send it to only one place
  - The new template will be available by the end of this week for use starting next week
  - This does not represent a change to information due dates; if the snout request portion of the package is filled out at T-3 months, the rest of the TALIS slides in the package still do not have to be completed until T-6 weeks

- The Mini-Campaign Rules of Engagement slide has been added to the TALIS/ snout request package to be submitted at T-6 weeks.
  - This requests that information three weeks earlier than current process (which is at the T-3 week setup review)
  - Allows TD reuse information to be reviewed by TALIS ahead of the setup review and included in the initial weekly DOS schedule development

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