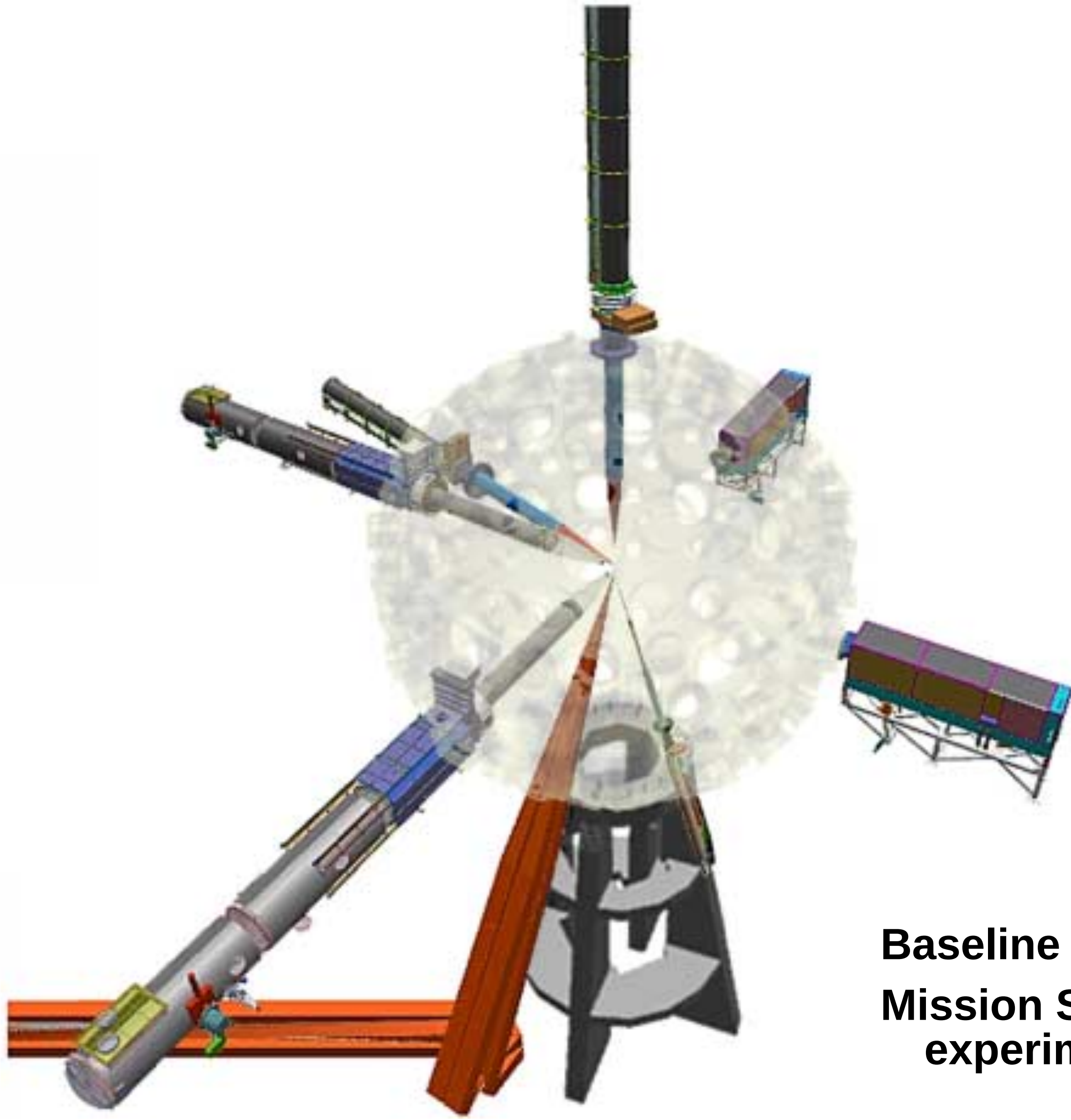
Planning for NIF experiments



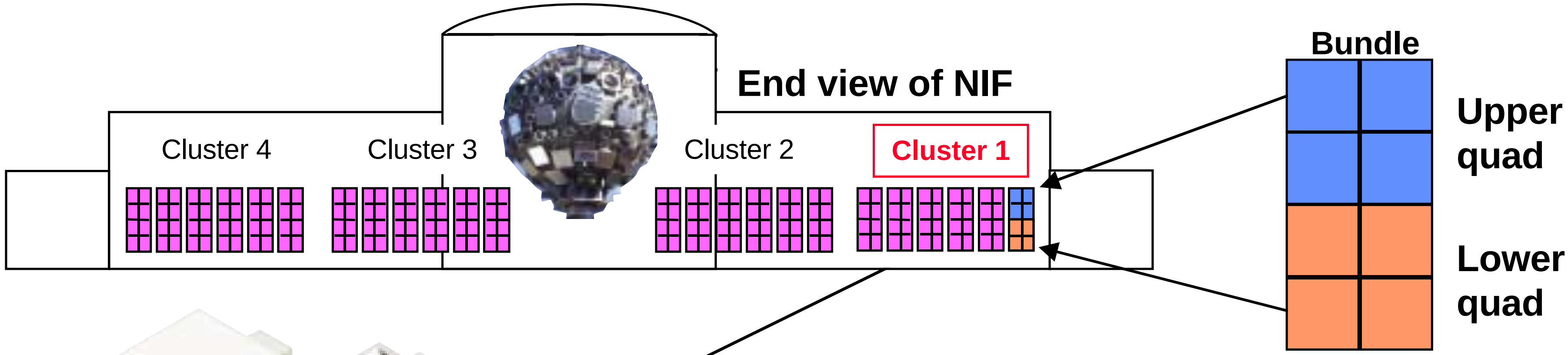
ARIES-IFE Meeting
UC San Diego, CA
1/11/02

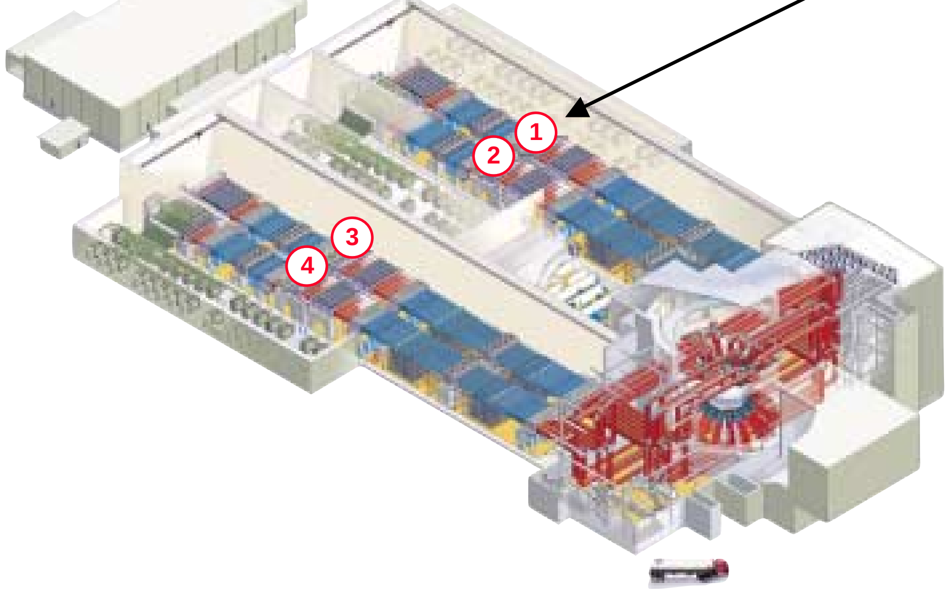
Brian MacGowan
NIF Diagnostics Program
Manager (acting)
APM NIF Mission Support

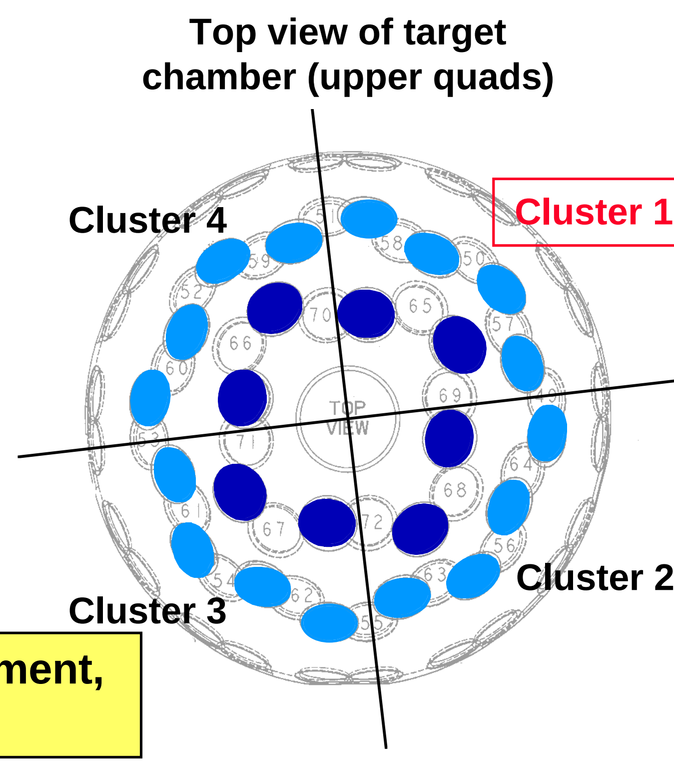
Baseline plans including diagnostics

Mission Support and planning of experiments

NIF is a 192 beam laser organized into “clusters”, “bundles” and “quads”







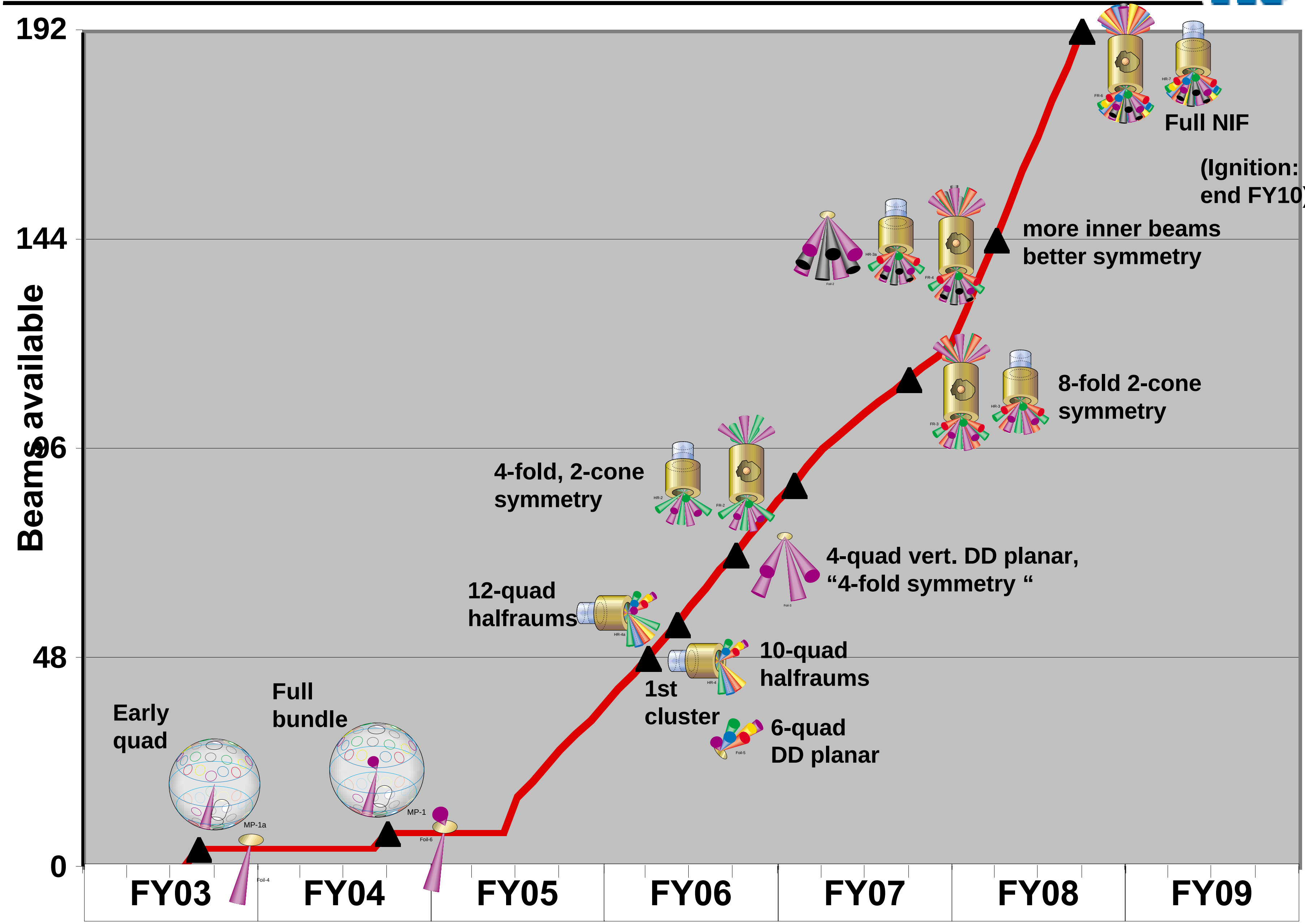
“Quads” are the basic building blocks of a NIF experiment, 4 beams with the same pulse shape and time delay

The NIF start-up strategy includes early deployment of a quad of 4 beams in 2003

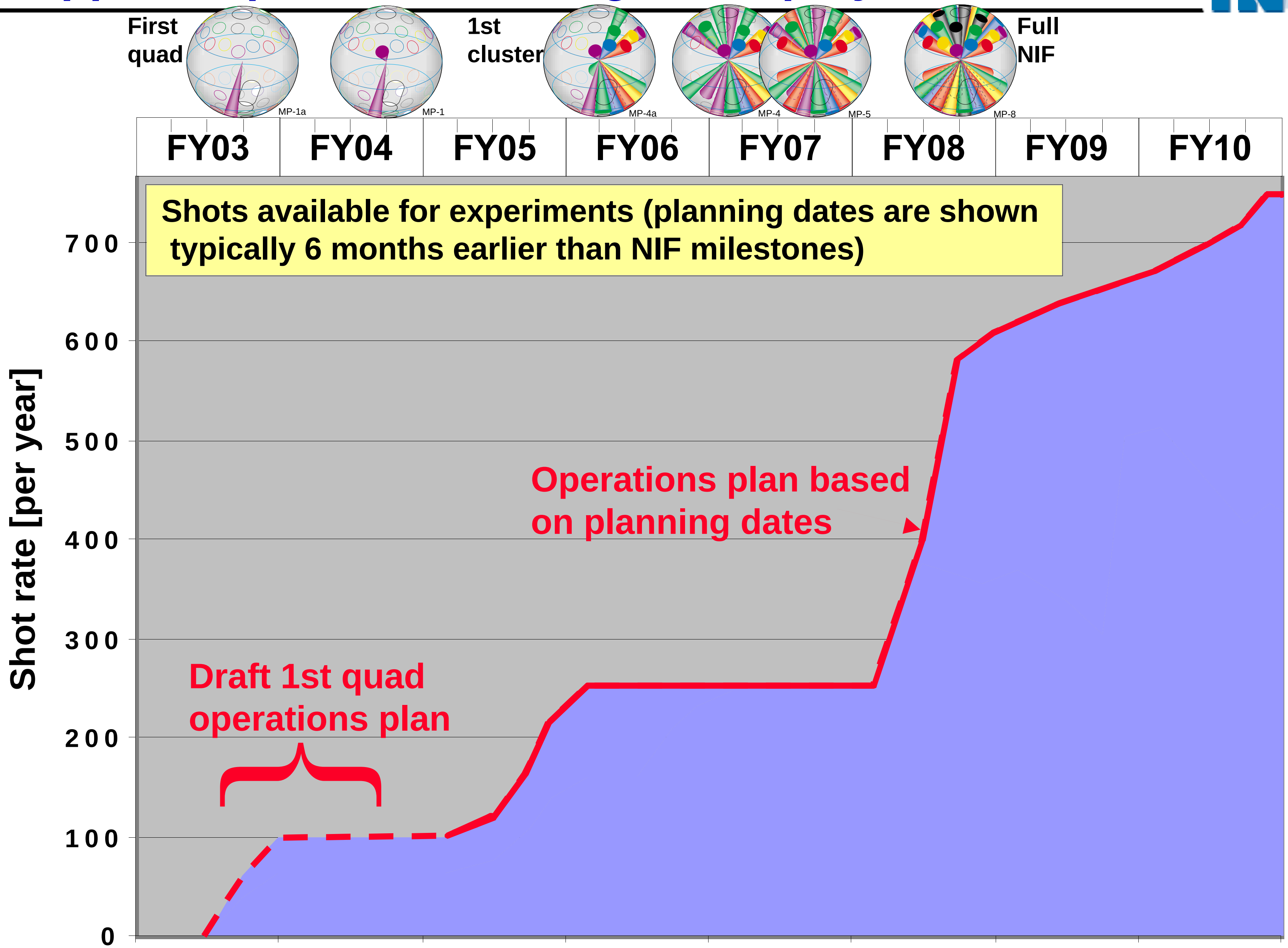
- The first quad should be commissioned in FY03
- All other milestone dates unchanged
- The deployment of the remaining beams follows the “Mission First” strategy of
  - a first cluster for early single-sided half hohlraum experiments for High Energy Density Science
  - then incremental addition of symmetry for convergent experiments requiring symmetry

The strategy is to optimize the configuration of the facility for experiments throughout the deployment, of NIF

NIF will support experiments during the deployment of new beams (NIF planning dates shown)



We are developing an operations plan that will support experiments during the deployment

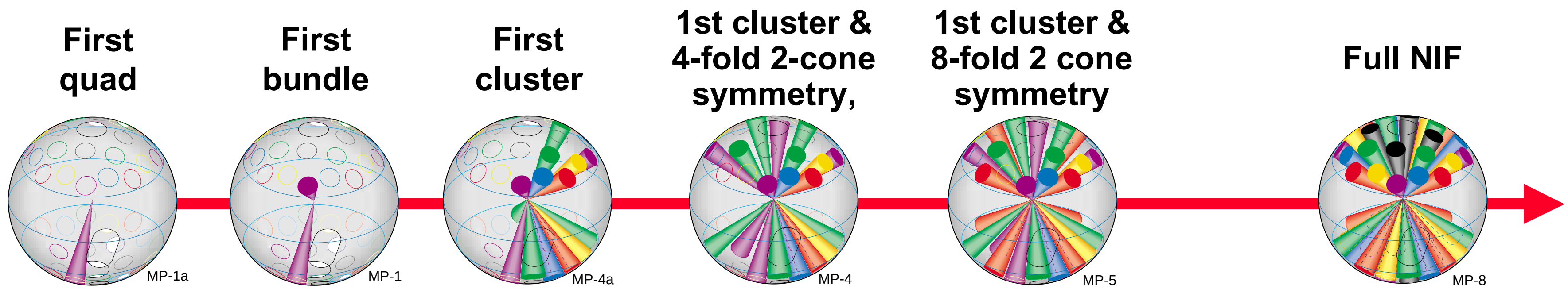


Operation of NIF in the '03 - '08 timeframe will involve a delicate balance between multiple activities

- Commissioning shots to activate new beamlines (not shown in previous slide) will be interleaved with experiments
- Operations and maintenance activities
- Major installation and commissioning work
- Experimental campaign priorities

- An integrated management team has been set up to optimize the interfaces between these activities - beginning with first quad

The specific needs and impacts of experiments must now become part of the planning process for NIF

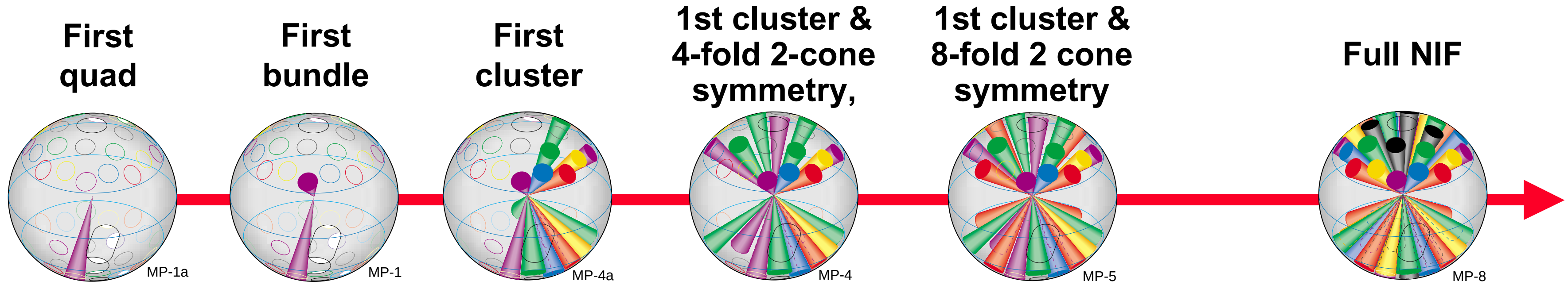


Equipment needs driven by experiment plan
Shots, performance, numbers of beams
Diagnostics and support systems
Targets
Optical Phase Plates
Classified operations

Facility Impacts driven by experiment plan
Target Debris/Shrapnel
Target materials:Environmental protection
Yield

Strategy: 1) Take experiment plans as they are evolving and evaluate total demand
2) Propose a baseline delivery plan include budget/schedule/ capacity realities
3) Evaluate impact on experiments
4) Iterate

The specific needs and impacts of experiments must now become part of the planning process for NIF



Equipment needs driven by experiment plan
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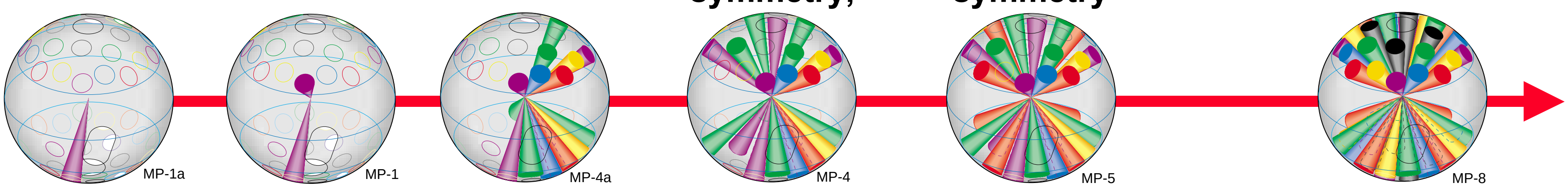
Diagnostics and support systems
Targets
Optical Phase Plates
Classified operations

Facility Impacts driven by experiment plan
Target Debris/Shrapnel
Target materials:Environmental protection
Yield

An important part of this process is communication of the baseline plan to the user community to facilitate experiment planning
- This is one of the roles of Mission Support

We are developing an integrated plan that ties needs and impacts to the experiment plan

First quad | First bundle | First cluster | 1st cluster & 4-fold 2-cone symmetry, | 1st cluster & 8-fold 2 cone symmetry | Full NIF



Horizontal halfraums

- DD planar exps (16-20kJ)
- DD planar exps with B/L (40kJ)
- horizontal halfraums (230kJ)
- vertical exps
- 96 smoothed beams (450kJ - 900kJ)
- 192 smoothed beams (1.8MJ)

- Room temp. targets
- Pre-ignition cryo targets
- tritium
- cryogenic capsules
- facility yield-capable

- Basic diagnostics
- Core diagnostics
- More Core diagnostics

Phase 2 diagnostics

There is a core set of diagnostics that will be operated by the facility

Basic Diagnostics
Diagnostic Instrument Manipulator(DIM) (6 ea)
Streaked X-ray Detector(SXD) (2 ea)
Gated X-ray Detector(GXD) (4 ea)
Streaked Optical Detector(OSD) (multiple)
Static X-ray Imager(SXI) (2 ea)

Snouts and spectroscopy
X-ray imaging snouts(HXRI) (multiple)
Transmission grating snouts(ITGS) (multiple)
Soft x-ray imager(SXRI)
X-ray spectroscopy snout(SPEC) (2 ea)
Survey spectrometer(HENEX)

Drive Diagnostics
Soft X-ray Power(Dante/DMX)(2 locations)
Hard X-ray Spectrometer(FFLEX/HXRD)

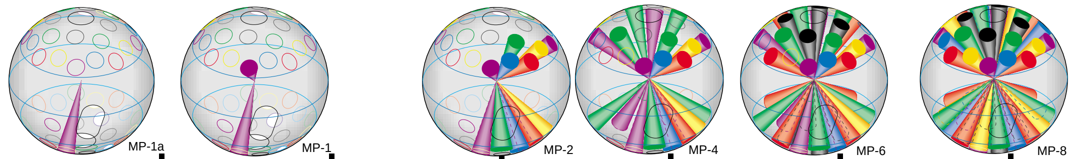
Optical Diagnostics
Velocity Interferometer(VISAR)(3 locations)
Passive Shock Breakout(PSBO)
Full Aperture Backscatter(FABS) (2 ea)
Near Backscatter Imager(NBI) (2 ea)

Nuclear diagnostics
Neutron Spectrometer(Tion)
Neutron Bang Time(bt)
Neutron time of flight(NTOF)
Neutron Yield(yn)(4 lines of sight)
Rad-chem Debris diagnostic

Core diagnostics are built with known technology and have broad utility to user missions

There will be a process to have other (Phase 2) diagnostics become facility diagnostics

The schedule for core diagnostics is set by that of the experimental campaigns:e.g. ignition physics



FY01 02 03 04 05 06 07 08 09 10

Optical backscatter

WBS 1 Hohlraum Energetics

Soft x-ray drive

Gated x-ray imagers

WBS 2 Hohlraum Symmetry

Streaked x-ray imagers

WBS 3 Shock Timing and Ablator Physics

Visar

Neutron yield Neutron spectroscopy

WBS 4 Ignition Campaign

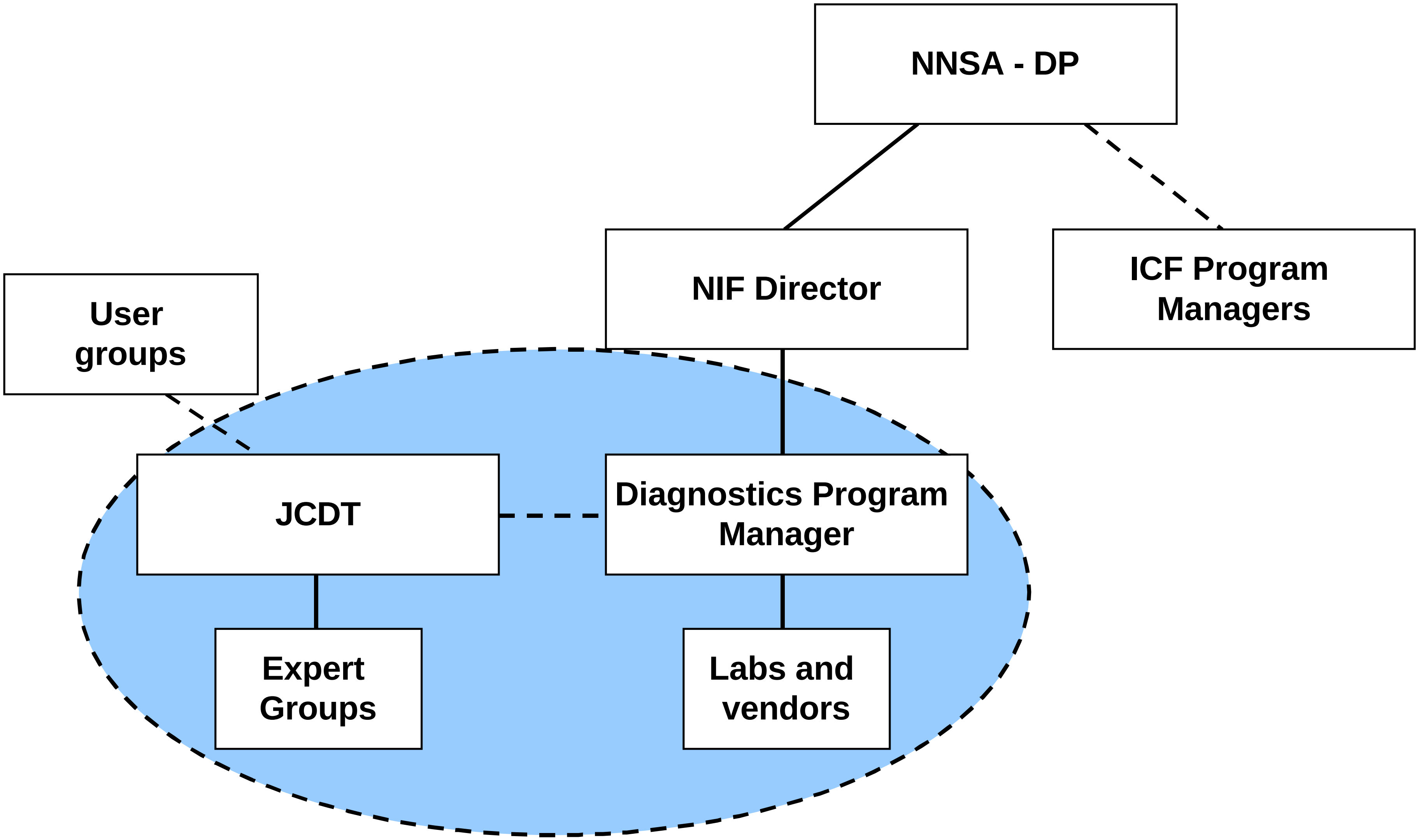
Burn history

ID Ignition

WBS 5 Direct-drive ignition

O Landen

Responsibility for Facility Diagnostics is centralized as a National Program under the the NIF Director



National NIF Diagnostics Program

A National Diagnostics Program has been set up by the NIF Director to build the diagnostics for NIF

- **The Program will:**
  - **Define and maintain the requirements for the core diagnostics based on user requests and priorities balanced against available funds**
  - **Fund and manage diagnostic design, procurement, assembly, testing and initial operation on NIF**
  - **Hand the diagnostics over to NIF Operations with appropriate documentation and training after initial operation by design teams**
  - **Maintain scientific support as appropriate**

NIF diagnostics are divided into two categories

- Core diagnostics have a wide user base, strong programmatic requirements and require minimal R&D
  - These are the diagnostics that will be built by the National Diagnostics Program and operated by the facility
  - 32 core diagnostics & manipulators (19 different) plus multiple snouts

- Phase 2 diagnostics requiring significant R&D or are of utility to a single user are not part of the scope of the National Program
  - These are the responsibility of individual user programs

- Phase 2 diagnostics can become defined as core and can be added to the scope of the National Diagnostics Program
  - Developers should remain aware of NIF facility requirements in order to expedite integration

The baseline scope of the program is the core set of diagnostics that will be operated by the facility

Basic Diagnostics

- Diagnostic Instrument Manipulator(DIM) (6 ea)
- Streaked X-ray Detector(SXD) (2 ea)
- Gated X-ray Detector(GXD) (4 ea)
- Streaked Optical Detector(OSD) (multiple)
- Static X-ray Imager(SXI) (2 ea)

Snouts and spectroscopy

- X-ray imaging snouts(HXRI) (multiple)
- Transmission grating snouts(ITGS) (multiple)
- Soft x-ray imager(SXRI)
- X-ray spectroscopy snout(SPEC) (2 ea)
- Survey spectrometer(HENEX)

Drive Diagnostics

- Soft X-ray Power(Dante/DMX)(2 locations)
- Hard X-ray Spectrometer(FFLEX/HXRD)

Optical Diagnostics

- Velocity Interferometer(VISAR)(3 locations)
- Passive Shock Breakout(PSBO)
- Full Aperture Backscatter(FABS) (2 ea)
- Near Backscatter Imager(NBI) (2 ea)

Nuclear diagnostics

- Neutron Spectrometer(Tion)
- Neutron Bang Time(bt)
- Neutron time of flight(NTOF)
- Neutron Yield(yn)(4 lines of sight)
- Rad-chem Debris diagnostic

Core diagnostics are built with known technology and have broad utility to user missions

There will be a process to have other (Phase 2) diagnostics become core

Role of JCDT

- Joint Committee on Diagnostics Technology advises the Program Manager on changes of scope and schedule and validates individual diagnostic requirements – meets once a month by videoconference

- Members or designees from expert groups review diagnostic designs at Requirements Review, CDR, 65% and 100% point

- Membership:
  - 1 - 2 people from each lab plus extras (e.g. LLNL will have HEDE, Ignition, A Prog and NWET representatives)
  - 1 - 2 representatives from CEA
  - Diagnostic engineers

- Configuration controlled documents will be archived on the NIF Diagnostics website and/or the NIF Project database

The Joint Committee on Diagnostic Technology has expert-groups to focus on areas of diagnostic technology

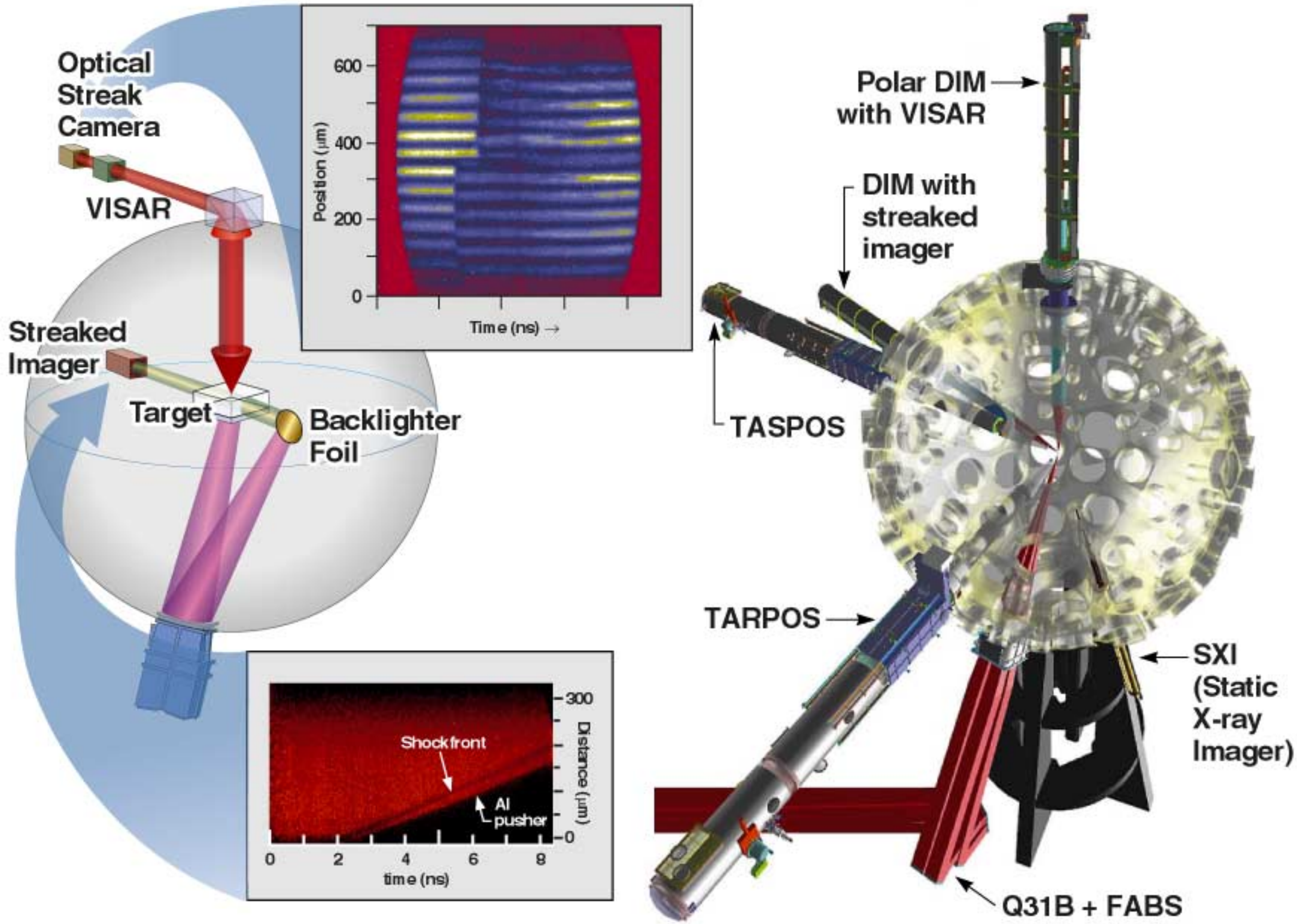
Group	Leader	Facility contact
X-ray Imaging	Jeff Koch	John Celeste
X-ray Spectroscopy	Tina Back	Perry Bell
Detectors	David Bradley	Perry Bell
Shock diagnostics	Peter Celliers	Dean Lee
X-ray power	Bob Kauffman	Jerry Chael
Optical	Bob Kirkwood	John Celeste
Nuclear	Craig Sangster	Dean Lee

The groups represent the diversity of the user community and understand its requirements

Each group has responsibility for advising on facility and phase 2 diagnostics and technology development in a particular area

Contact the leader of a particular group for more information

First quad will have a basic set of diagnostics to commission the laser and support experiments

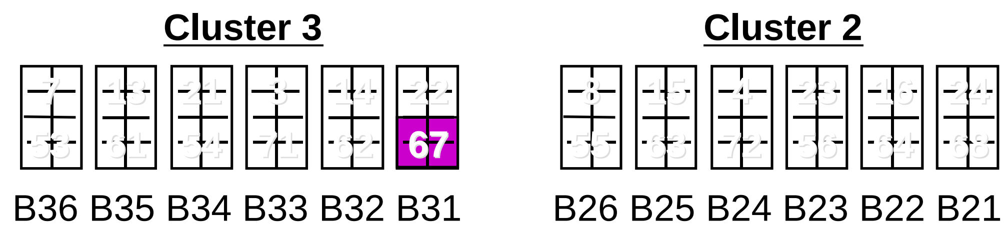


Why would experiments on a NIF quad be attractive in the FY03 timeframe?

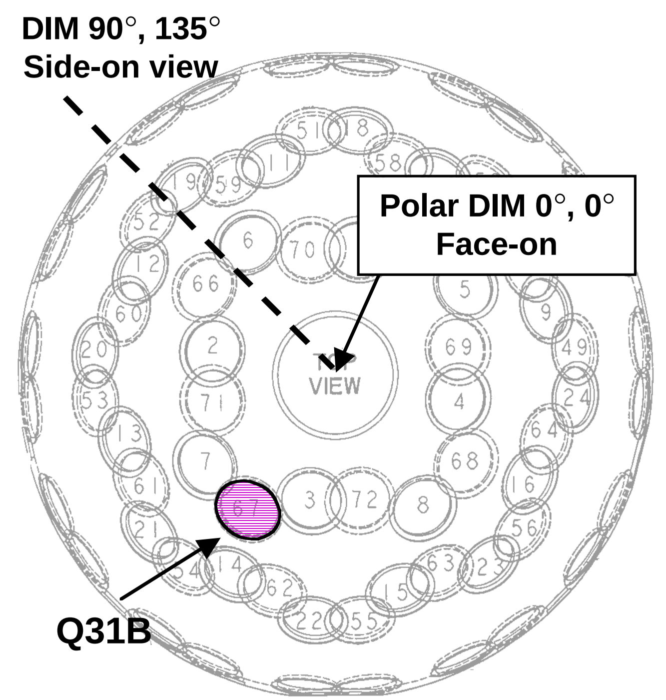
- A single quad is the same class of laser as Omega (10s of kJ), but:
  - A NIF quad has 16 - 20kJ grouped in small solid angle
    - good coupling for planar direct drive experiments, can drive foils further and longer before 2D effects dominate
    - can get all energy into halfraum
    - high intensity single "beam" for
      - LPI exps with beam smoothing
      - x-ray source development
  - A NIF quad will have very flexible pulseshaping and capability for longer pulses
  - A NIF quad has the <u>potential</u> for shots at 40kJ

- **First quad experiments will test the facility**

First quad will have diagnostics to allow laser commissioning and early experiments



- **Q31B at (150°, 236°) (Target foil oriented with normal at Θ = 0°)**
- **SXI-1 (Static X-ray Imager) (161°, 236°) for beam pointing**
- **SXD (2 each Streaked X-ray Detectors) in DIM (90°, 135°) for beam timing and side-on target view/radiography (re-use Nova imaging snouts)**
- **FABS backscatter diagnostic on Q31B to assess back scatter threat**
- **Polar DIM (0°, 0°) for face-on view and VISAR for EOS**



- **Early quad available for experiments 7/1/03 (target date), diagnostics available for first light before then**

Top view of chamber

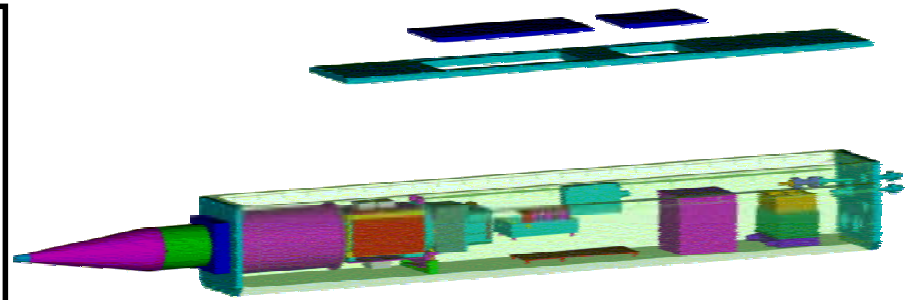
For each diagnostic there is a set of requirements and baseline schedule, example: DIM-based Streak Camera

Primary Mission: Resolve and measure the synchronization of NIF beamlines.

Secondary Mission: Will be used on experiments such as: spectral emission from targets, spatially resolved foil trajectories, hydrodynamic instability growth information shock front propagation, and time history for ignition physics.

Basic Physics Requirements*:

Energy range of operation	0.1 - 20 keV
Temporal resolution	0.5% of temporal window
Energy resolution	N/A
Dynamic range	200
Signal-to-noise	10:1
Field-of-view	function of snout
Data acquisition	Electronic



Milestone Dates:

M1	CDR	Aug-00
M2	65%design review	Jan-02
M3	100% design review	Mar-02
M4A	Fabrication and Assembly	Sep-02
M4B	Offline Acceptance Tests	Jan-03
M5	SXD1 Dry Run Review	Jan-03
M5	SXD2 Dry Run Review	Feb-03
M6	SXD1 1st Use on NIF	Feb-03
M6	SXD2 1st Use on NIF	Mar-03
M7	Functional Operation	Jul - 03
M8	Facility Accept Review	Oct- 04

Cost Drivers: The 20 keV energy range and 50 ns pulse, dynamic range, full computer control and CCD readout.

Differences from Nova/Omega:

Greater energy range, temporal window to 50 ns, computer control and CCD readout.

Equipment Reuse:

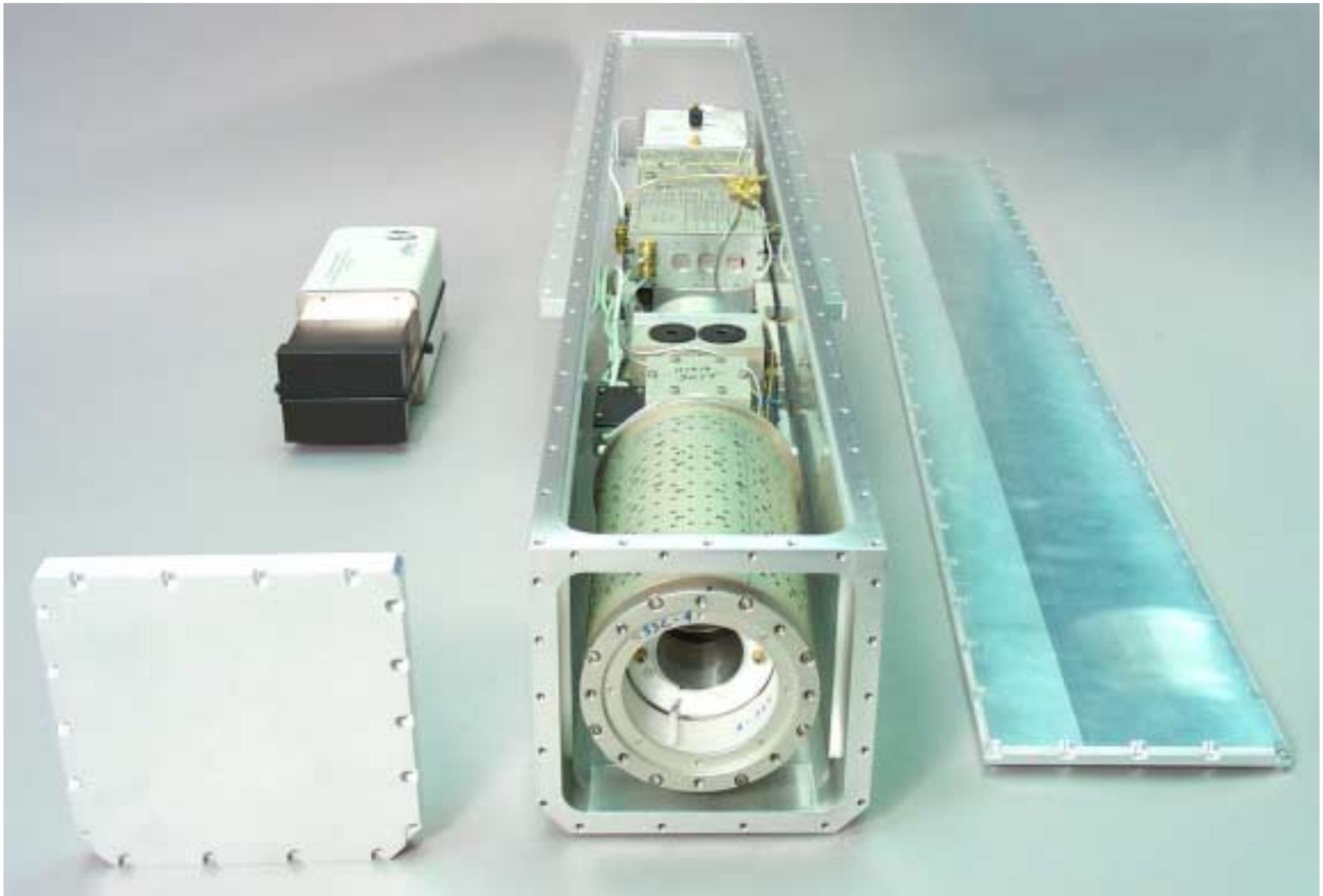
None.

Technology Development Required:

CCD readout system developed by supporting program or CCD camera provided by vendor. Facility needs to provide a fiducial system. Airbox.

***The full and detailed requirements for the facility diagnostics are available in a spreadsheet for review (Perry Bell, bell11@llnl.gov or on the diagnostics web site at LLNL)**

The streak camera is contained in an air-box to shield it from the chamber environment

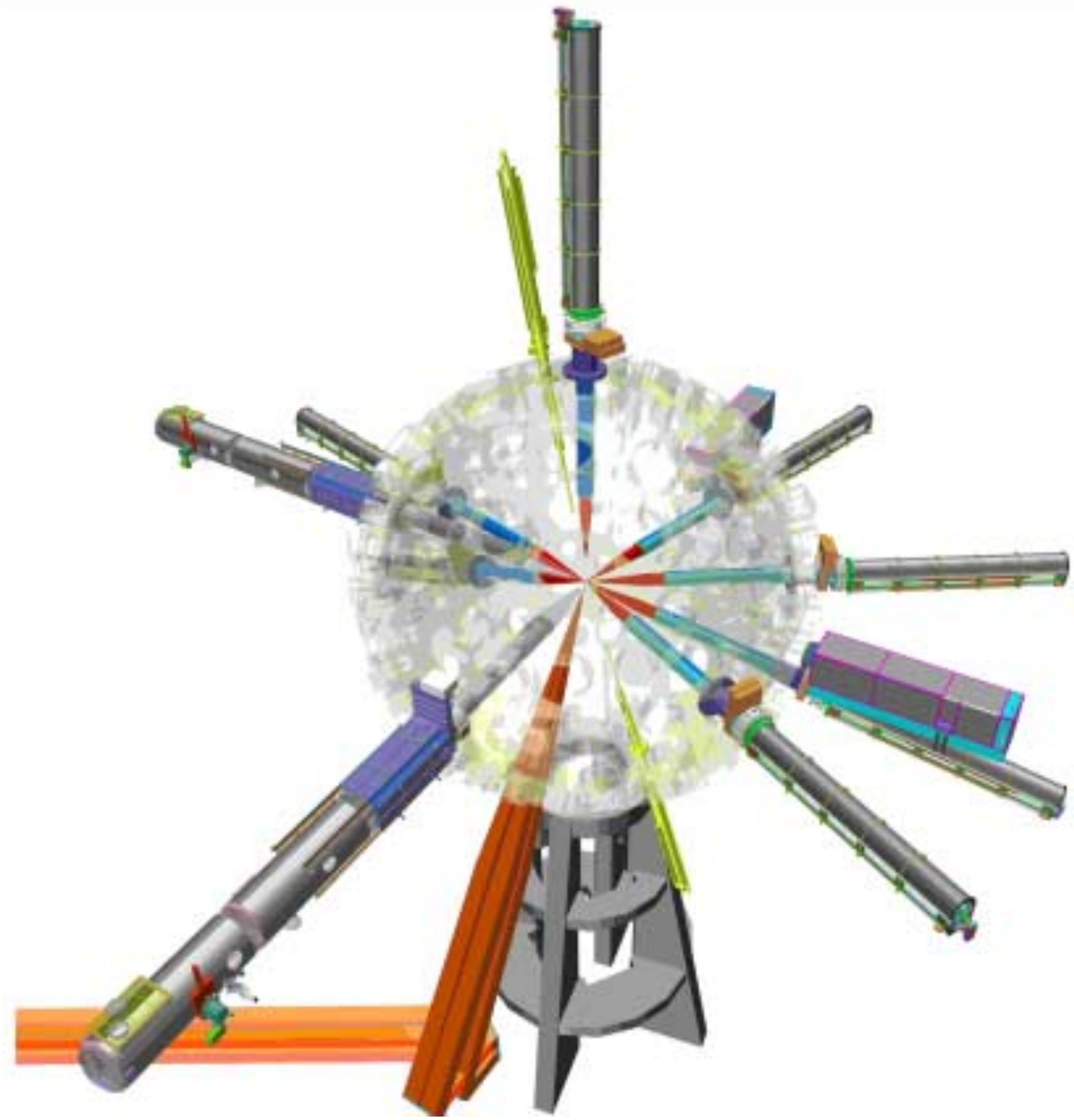


Air-box shown here with a Nova streak camera with conventional film pack and the newer CCD camera

The Diagnostic Instrument Manipulators(DIMs) will provide a platform for multiple diagnostics

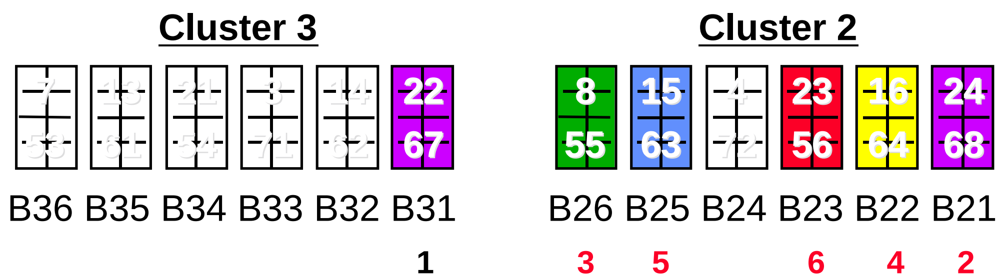
First article DIM being tested at LLNL

Multiple DIMs will be available FY03 - FY08

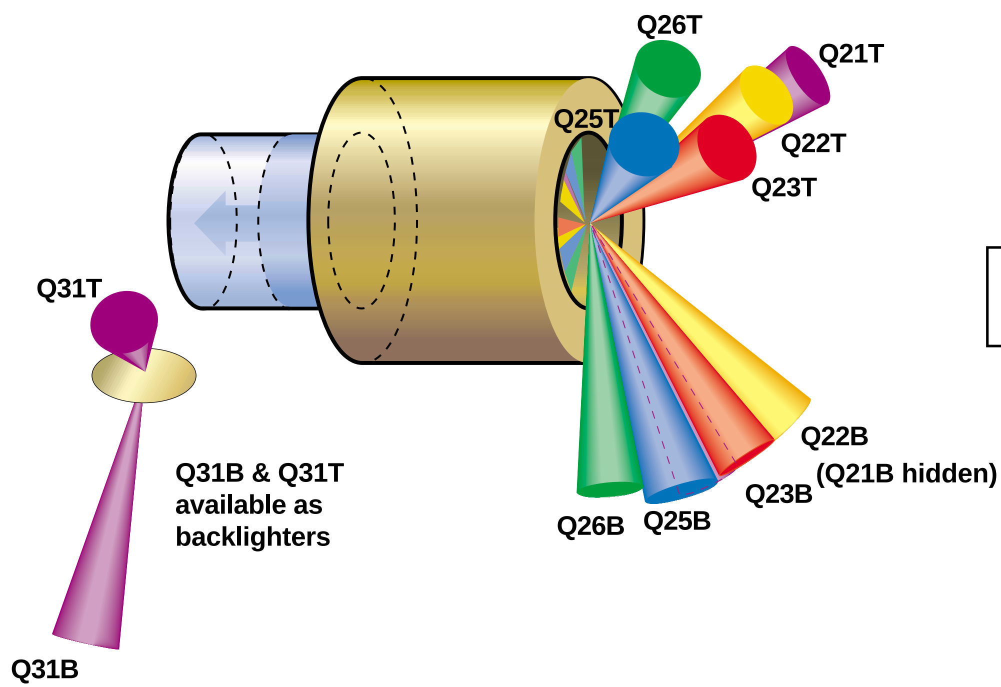


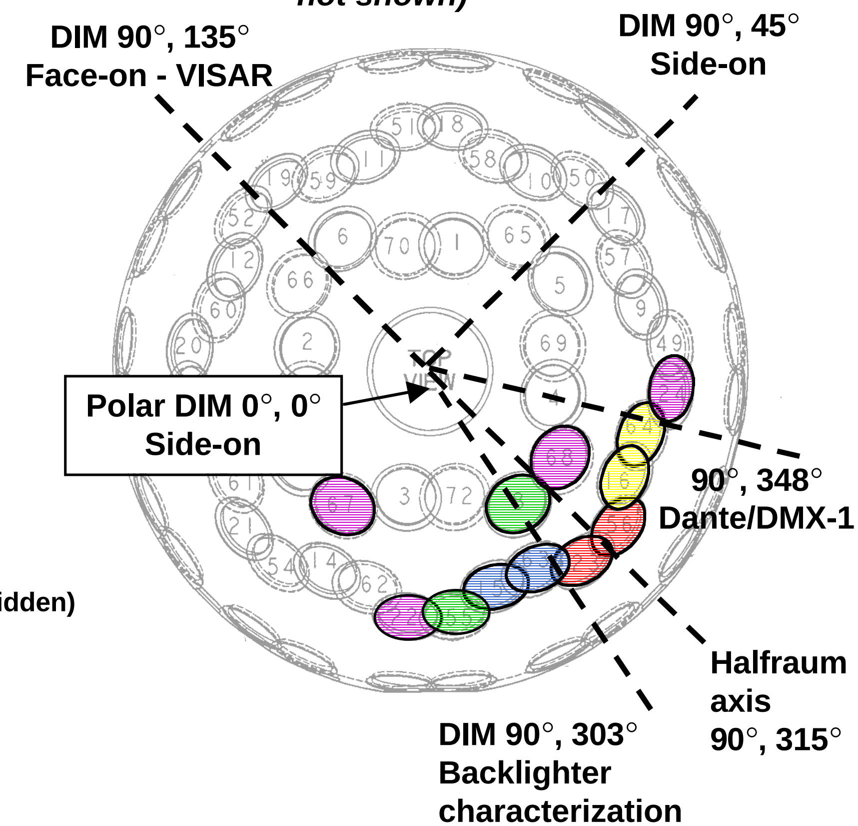
First cluster will allow halfraum experiments with 10 quads plus backlighters & multiple lines of sight

- 10 quads 200kJ @ 3ns plus 2 quads for backlighters
- Maximum beam angle less than 61° to hohlraum axis
- 10 quad halfraums available 1/1/06 (target date)



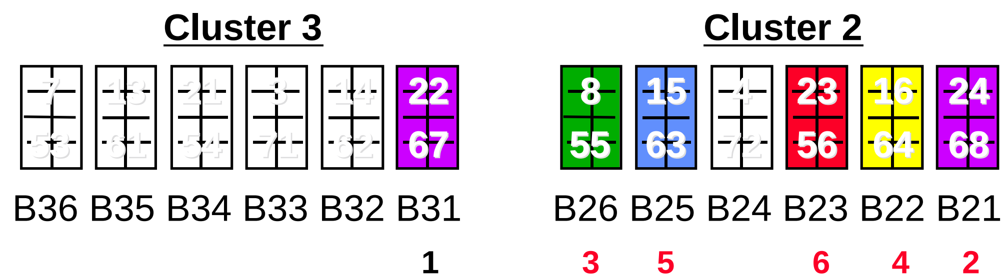
(DIM 116°, 129° Face-on - VISAR not shown)



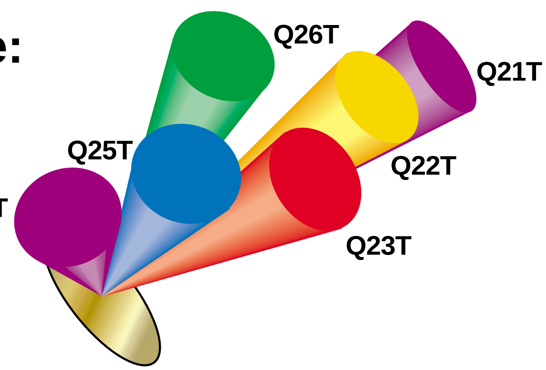


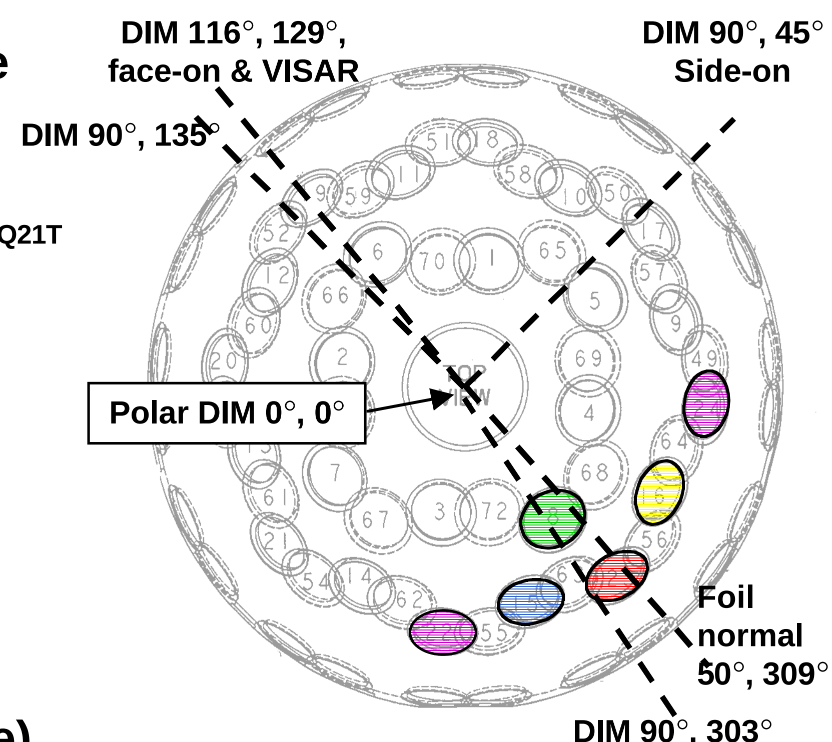
Top view of chamber shows upper and lower quads superposed

First cluster will allow DD planar exps with upper quads



- 50° and 44.5° quads can be used for DD experiments with DIM at 116°,129° close to opposing, one 30° quad may also be used
- Install in sequence:
  - — B23
  - — B25
  - — B22
  - — B26
  - — B21
- 6 quads 120kJ @ 3ns, available for DD planar
- Upper quads available1/1/06 (target date)





Top view of chamber shows upper quads only

Minimum DIM set has commonality during experiment phases - minimizes DIM moves

DIM(Θ, Φ)	Activation (OTPs)	Quad 31B (planar DD)	B31 1st bundle	cluster 2 upper quads (6-quad DD)	cluster 2 (horiz. halfraum)	full NIF (planar DD exps)	full NIF (v. halfraum exps)	full NIF (v. hohlraum exps)
(90°, 135°)	x-ray SC timing	side-on view	side-on view		face-on & VISAR			VISAR
(0°, 0°)		face-on & VISAR	face-on & VISAR		side-on view	face-on VISAR	face-on VISAR	
(90°,3°)	FODI	FODI	FODI	FODI	FODI	FODI	FODI	FODI
(90°, 303°)			2nd side-on view		B/L characterization			
In diagnostic bldg								
(90°, 45°)				side-on view	2nd side-on view	side-on view	side-on view	side-on view
(116°, 129°)				face-on & VISAR				
(116°, 335°)					GXD/SXRI			GXD/SXRI

Avoiding movement of DIMs between phases ensures that deployment is always additive, i.e. experiments from earlier phases can always be repeated

The diagnostics plan has been synchronized to the experimental need

M7 date (priority 1 diagnostic on shots)

Diagnostic	1st light (4/1/03)	1st quad exps (6/1/03)	1st bundle (7/1/04)	phased in before 1st cluster (7/1/04 - 1/1/06)	after first cluster (1/1/06 - 10/1/06)	phased in before symmetry (10/1/06 - 5/1/07)	as symmetric beams added (5/1/07 - 7/1/08)
SXD1	Apr-03						
Nova imaging snouts (HXRI)	Apr-03						
sxi1	Apr-03						
DIM4		Jun-03					
SXD2		Jul-03					
visar		Jul-03					
Nova/Omega KB imaging snout		Jul-03					
FABS31 (partial, one beamlet)		Jul-03					
henway/henex			Jul-04				
FABS31 (full)			Jul-04				
GXD-1			Jul-04				
DIM5				Jul-04			
DIM6				Jul-04			
GXD-2				Jul-05			
sxi2				Jul-05			
tspec (SPEC snouts)				Jul-05			
DIM7				Jul-05			
NBI31				Dec-05			
dante/dmx-1				Jan-06			
ITGS (grating snouts)				Jan-06			
extension tubes for HXRI snouts				Jan-06			

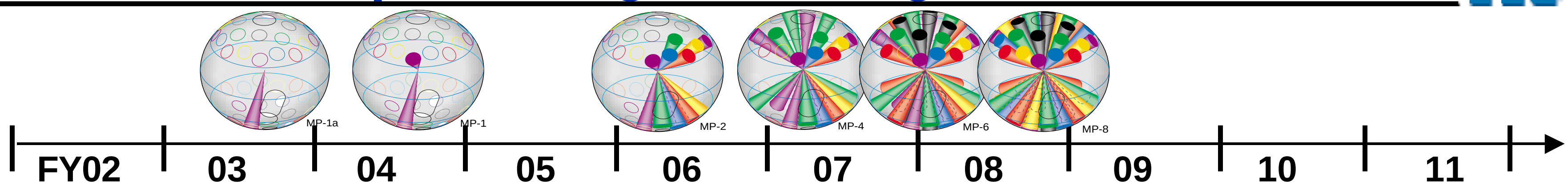
We believe that this is the right schedule for diagnostics to support experiments on early NIF

The diagnostics plan has been synchronized to the experimental need

M7 date (priority 1 diagnostic on shots)

Diagnostic	1st light (4/1/03)	1st quad exps (6/1/03)	1st bundle (7/1/04)	phased in before 1st cluster (7/1/04 - 1/1/06)	after first cluster (1/1/06 - 10/1/06)	phased in before symmetry (10/1/06 - 5/1/07)	as symmetric beams added (5/1/07 - 7/1/08)
Soft x-ray imaging snouts (SXRI)					Jan-06		
psbo					Jan-06		
tion					Feb-06		
bt					Feb-06		
yn (low)					May-06		
fflex/chxd					May-06		
2nd VISAR (or Visar transportable)					Jul-06		
FABS25					Jul-06		
NBI25					Jul-06		
DIM8					Oct-06		
dante/dmx-2						Nov-06	
GXD-3						Jan-07	
GXD-4						Feb-07	
Manipulator for SXRI at 143°						Apr-07	
ntof						May-07	
Additional HXRI snouts and extensions						May-07	
Extension tubes for ITGS snouts						May-07	
High power SXRI snouts						May-07	
High power SPEC snouts						May-07	
sxpd							Jan-08
debris							Jan-08
yn(high yield capability)							Jan-08

ICF/HEDE users are planning phase 2 diagnostic needs* - example: Energetics for ignition



WBS 1 Hohlraum Energetics and LPI

Plasma characterization — **4ω Thomson Scatter+ Optical spectrometer Pr 1 (≈Core)**; **Advanced streak camera, visible/UV Pr 2**

Total Drive (vs angle) — **PCD Pr 2**

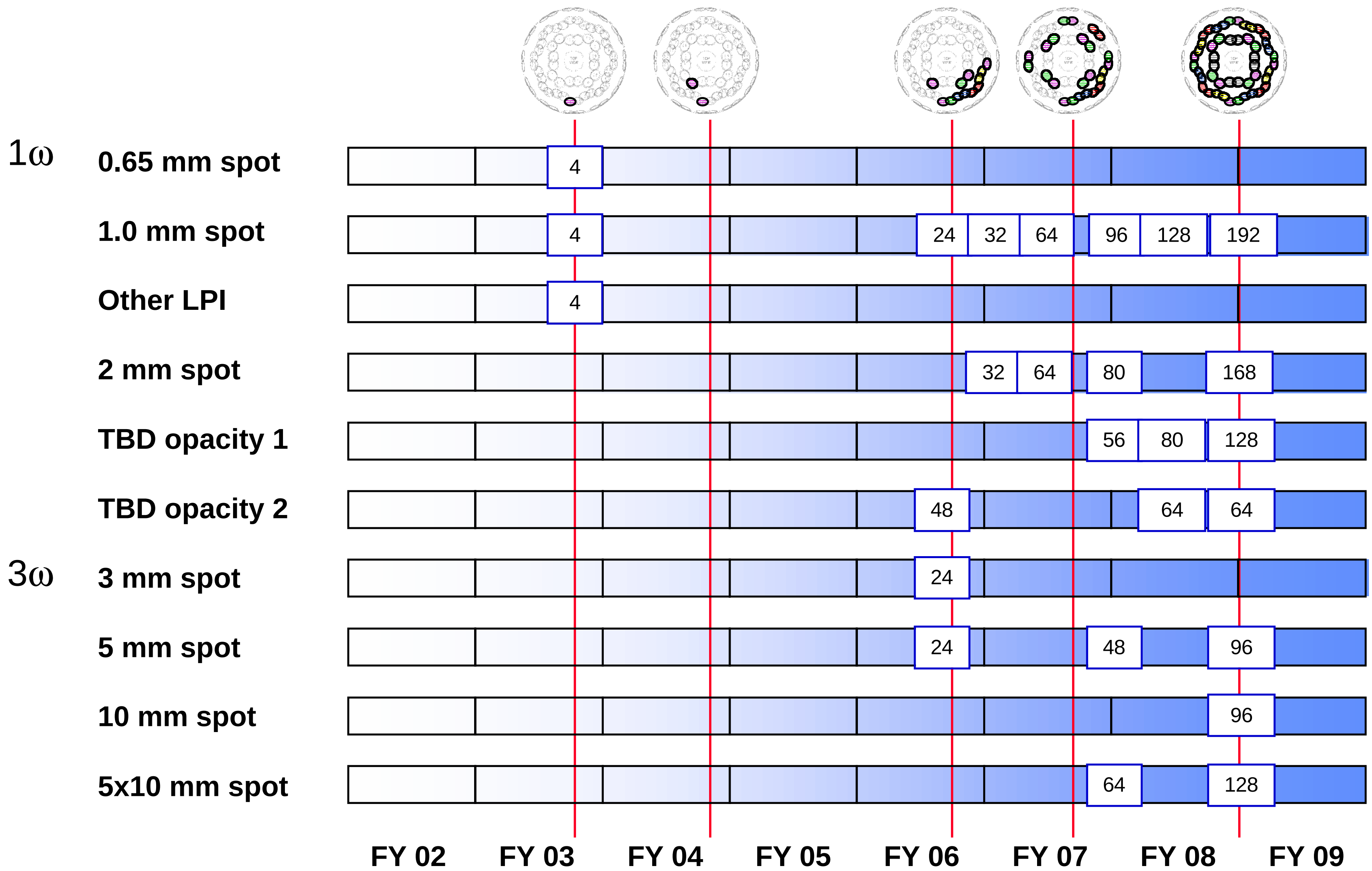
Soft x-ray absolute spectroscopy — **Soft X-ray Power Diagnostic Pr 2**

Detailed imaging of LEH closure — **Soft x-ray imaging array Pr 1**

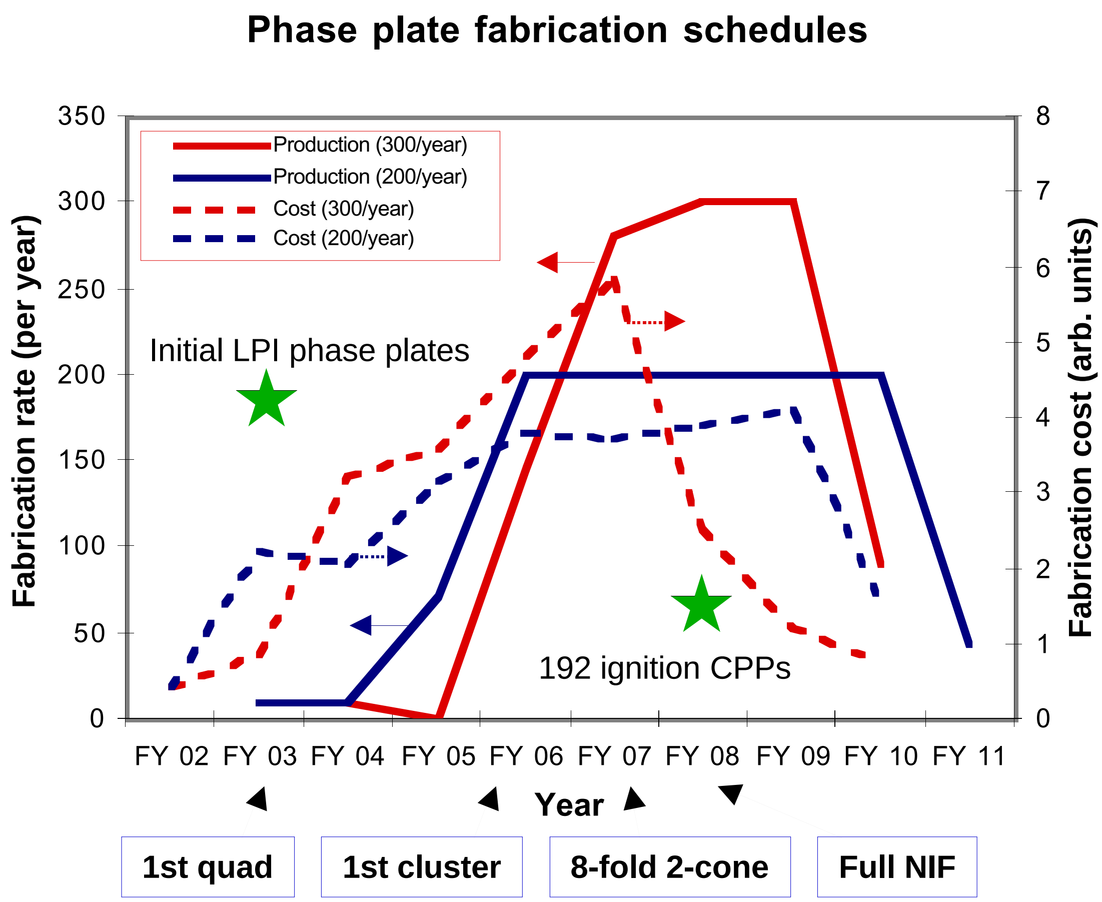
Transmitted energy, backscatter on 2 other cones — **2-3 more Full Aperture and Near Backscatter Stations Pr 1**

***An integrated plan including resource and technology needs is being developed by Otto Landen and Warren Hsing**

The cumulative demand for phase plates (CPP) to modify the focal spot is tied to the experiment plan



We are evaluating different fabrication scenarios to meet the demand for phase plates



Availability of phase plates may pace some experiment campaigns and will be an important planning issue for EPAC

The NIF schedule process will facilitate high quality experiments with well understood facility impacts

Guidance

1 - 2 years
NNSA sets balance between diverse user groups (shot and facility resource quota to meet goals agreed in Program budget submissions) every year as part of budget process

Governance

6 months - 1 year
User group generates prioritized list of experimental campaigns with major, facility upgrades identified

6 - months - 1 year
Experimental Program Advisory Committee consider Programmatic priority, Scientific merit, Facility Impact
Major Facility upgrades

Long term facility schedule

Readiness

1 - 2 months
Experiment readiness review **(NIF Scheduling Committee)**

Shot evaluation/ specification sheet

- Laser performance check
- Shrapnel/debris assessment
- Verify “cost per shot”minimization
- Safety assessment
- Review classification needs
- Laser/chamber configuration
- Review Diagnostic plan
- Review Diffractive optics plan
- Assess Backscatter threat
- Assess Radiological impacts
- Assess potential for interleaving
- Response to Special needs

Operations

Every week
NIF Scheduling Committee generate and optimize 1 - 2 month schedule balancing shots, maintenance and facility upgrades

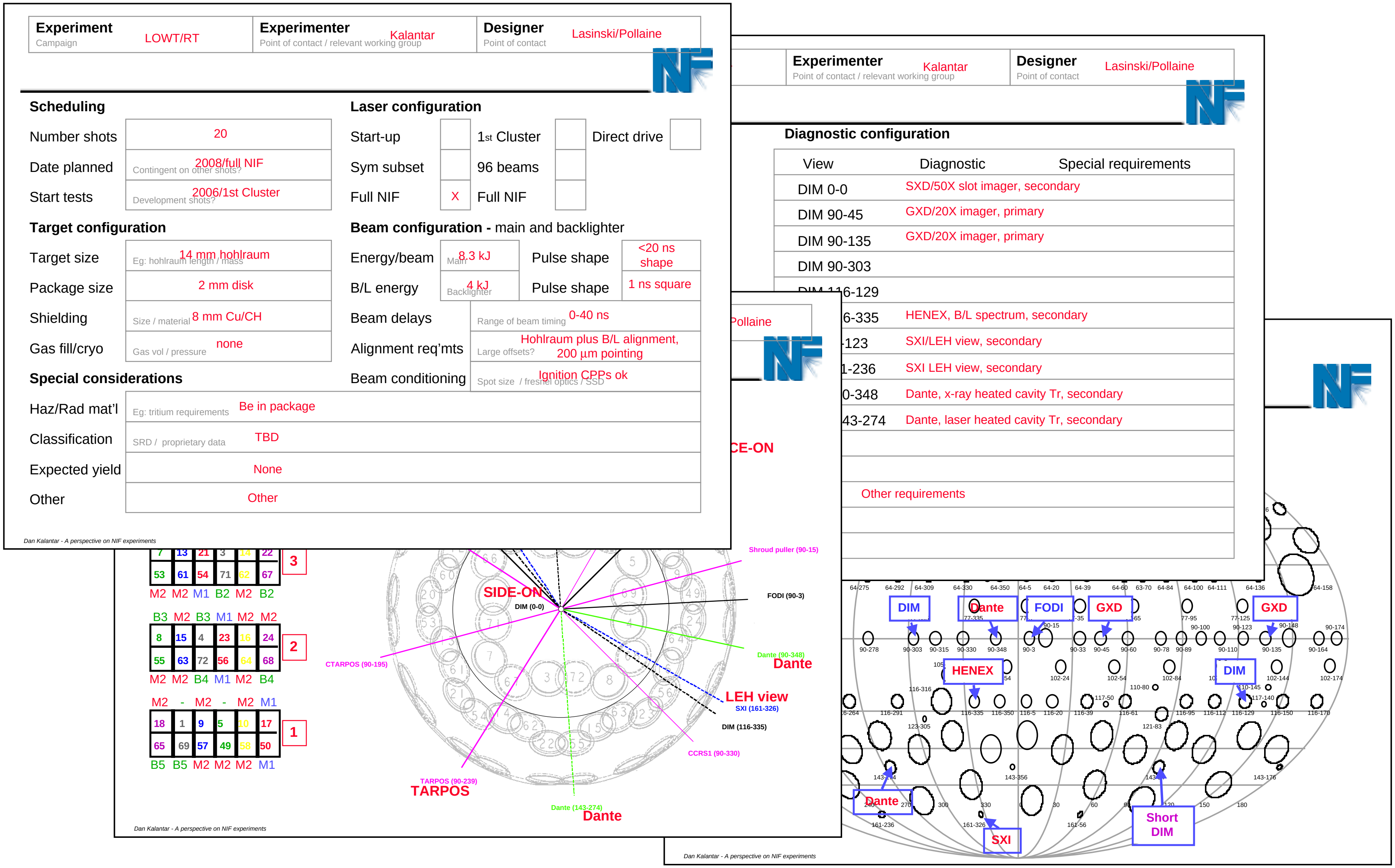
- Maintenance schedule
- Upgrade schedule
- Diagnostics schedule
- Optics schedule
- Target Fab schedule
- Shot schedule

NIF Mission Support, Systems Engineering and Operations will support the scheduling process

- Providing information to users during the proposal stage
- Evaluating facility impacts as proposals mature, feeding that information back to the proposers and the EPAC
- Coordinating scheduling of experiment support resources (diagnostics, phase plates, targets……) after experiments are approved by EPAC
- Assessing and approving facility impacts as part of the final experiment readiness process
  - Includes detailed performance modeling
  - Includes target chamber configuration control
  - Includes shrapnel/debris impacts

NIF Mission Support web site includes a User Manual with further information relevant to experiment design

Shot configuration sheets are used to aid experiment design and collect configuration information



Experiment Campaign	LOWT/RT	Experimenter Point of contact / relevant working group	Kalantar	Designer Point of contact	Lasinski/Pollaine

Scheduling

Number shots	20
Date planned	Contingent on other shots? 2008/full NIF
Start tests	Development shots? 2006/1st Cluster

Laser configuration

Start-up		1st Cluster		Direct drive	
Sym subset		96 beams			
Full NIF	X	Full NIF			

Target configuration

Target size	Eg: hohlraum length / mass 14 mm hohlraum
Package size	2 mm disk
Shielding	Size / material 8 mm Cu/CH
Gas fill/cryo	Gas vol / pressure none

Beam configuration - main and backlighter

Energy/beam	Main 8.3 kJ	Pulse shape	<20 ns shape
B/L energy	Backlighter 4 kJ	Pulse shape	1 ns square
Beam delays	Range of beam timing 0-40 ns		
Alignment req'mts	Large offsets? Hohlraum plus B/L alignment, 200 µm pointing		
Beam conditioning	Spot size / fresnel optics / SSD Ignition CPPs ok		

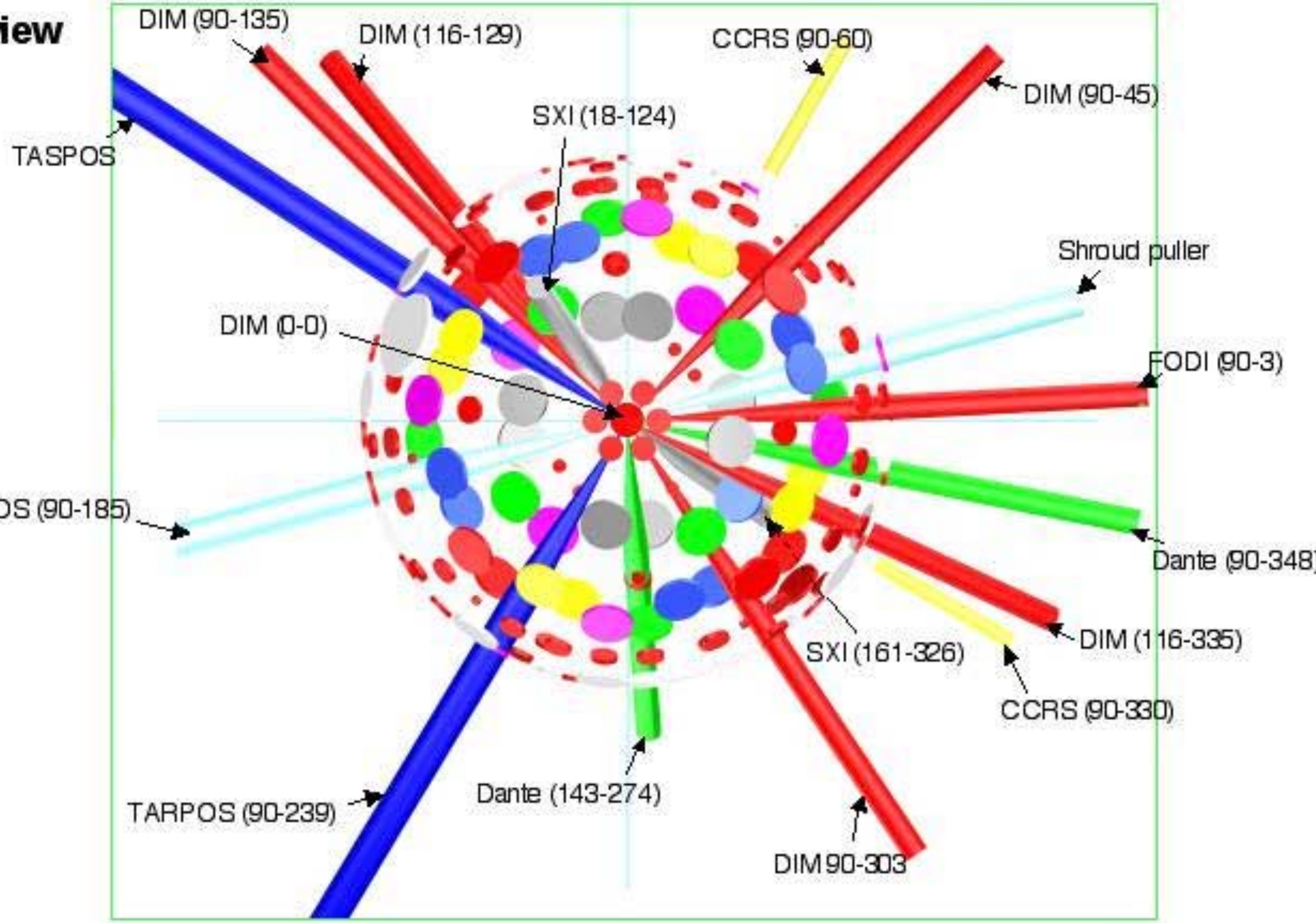
Special considerations

Haz/Rad mat'l	Eg: tritium requirements Be in package
Classification	SRD / proprietary data TBD
Expected yield	None
Other	Other

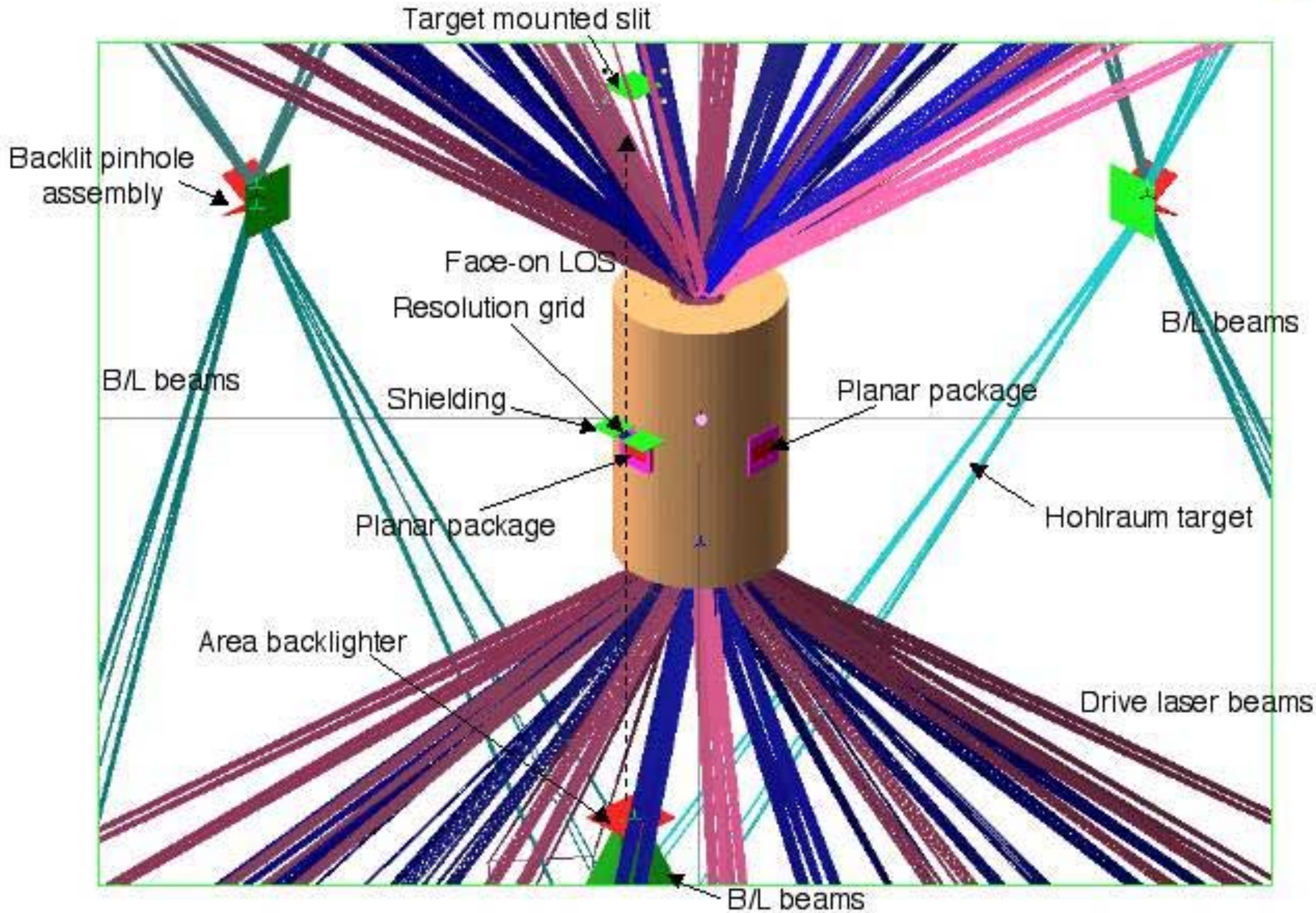
Dan Kalantar - A perspective on NIF experiments

A VectorWorks 3D CAD model is available with chamber port and diagnostic locations

Top view



Example target details from Dan Kalantar using VectorWorks model



Excel spreadsheet is used for scoping pulse shape capability and energy/damage limits

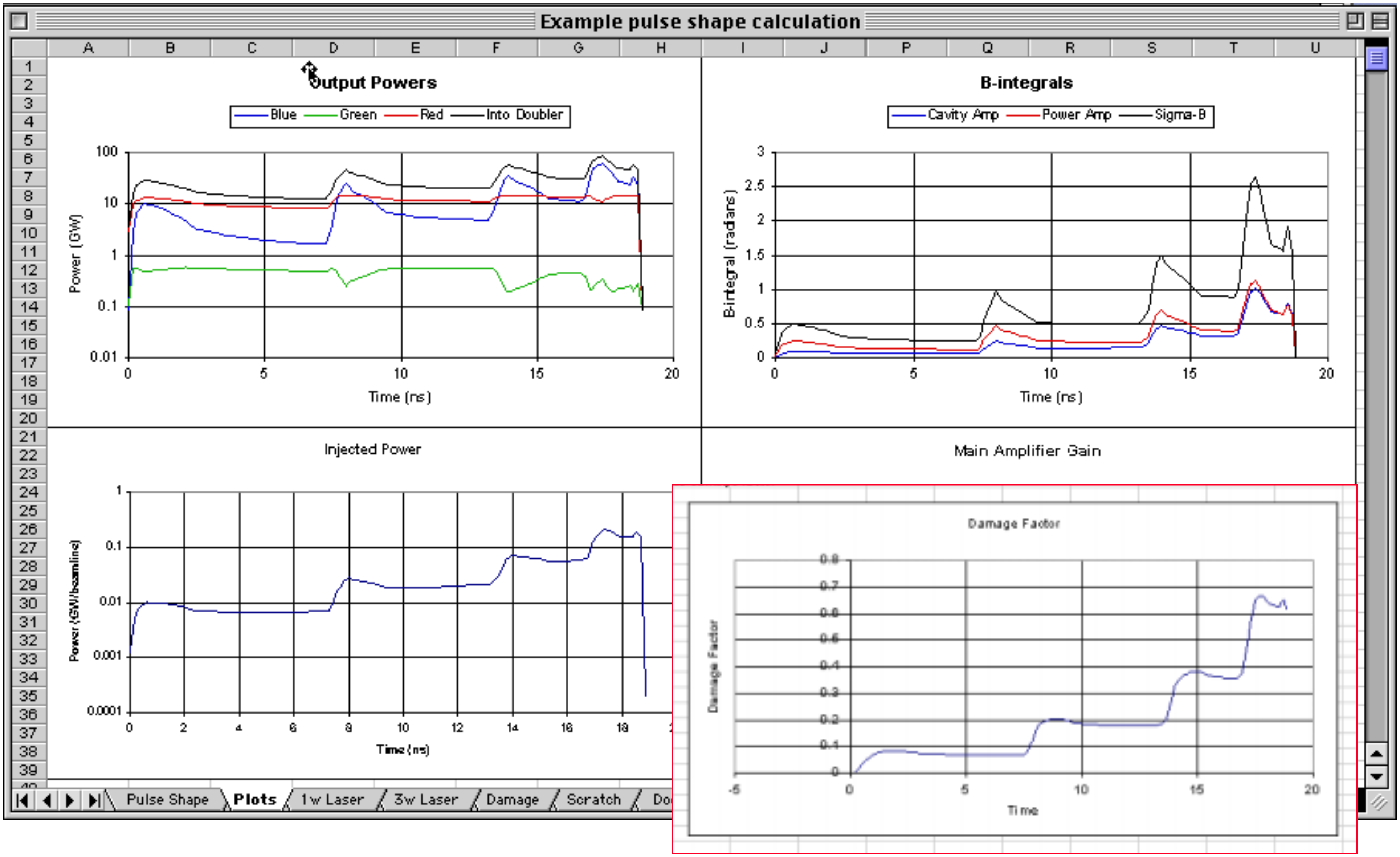
- LPOM will provide final assessment of pulse impact

Example pulse shape calculation

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	**Beam Parameters**			18.45	68.58				**Computed Values**				Compute Pulse		
2															
3	Beam area (cm2)		1250		1250 cm2 is nominal beam area										
4	Number of beams		32		use 1 beam with 1000 cm2 if				Injected energy (J/beam)			0.70149361	redline: 3 J/beam		
5					power is GW/cm2 instead of TW				B-integral, cavity amp (radians)			1.01794064	redline: 1.8 radians		
6	Time slices		128		number of times for computations				B-integral, power amp (radians)			1.12729642	redline: 1.8 radians		
7				**Pulse Parameters**					B-integral, sigma (radians)			2.64799535	redline: 3.6 radians		
8	Pulse Type						fix								
9	○ Haan (Indirect Drive)			Energy (kJ)		209.702734				On Target		Into Doubler			
10	○ Verdon (Direct Drive)			Peak Power (TW)		62.9768			blue	green	red	1w			
11	○ Gaussian			Duration (ns)		18.85		Energy (kJ)	209.3204	8.668515	221.1036	526.350211		Slight difference from	
12	○ Square/Exponential							Energy (kJ/beam)	6.541261	0.270891	6.909487	16.4484441		Pulse Parameters is	
13	◉ Custom			Damage Factor		0.900		Fluence (J/cm2)	5.233009	0.216713	5.527589	13.1587553		due to finite number	
14								Peak Power (TW)	60.26009	0.575033	14.69466	85.1278109		of time slices.	
15					Sample Points			Peak Power (TW/beam)	1.883128	0.01797	0.459208	2.66024409			
16	0. Adjust Beam Parameters				time (ns)	power (TW)		Peak Flux (GW/cm2)	1.506502	0.014376	0.367366	2.12819527	redline: 3.125 GW/cm2		
17	1. Select Pulse Type (option buttons)				0	0.0652304									
18	2. Adjust Pulse Parameters				0.1	1.41456		Damage (J/cm2/sqrt(ns))	5.615529						
19	(place x in "fix" column				0.3	6.468		Damage (J/cm2)	6.177081				redline: 8 J/cm2		
20	to override precedence) 3. Click Compute Pulse				0.6	10.3136		(3 ns Gaussian equiv)					startup redline: 4 J/cm2		
21	4. See Documentation sheet for more				1.2	8.208							1w fluence	Injected	Inj Power
22					2.426	3.2904		time (ns)		flux (GW/cm2)			(J/cm2)	energy (J)	(GW)
23	Custom Pulse				3.652	2.36256		0	0.001631	0.002642	0.071036	0.09115108	0	0	0.001201
24					4.878	1.97		0.148425197	0.065953	0.013675	0.236325	0.38038529	0.034994	0.000462	0.00504
25	You can set an arbitrary pulse shape using				6.104	1.7456		0.296850394	0.15971	0.013957	0.30126	0.57078437	0.105583	0.001403	0.007656
26	the Sample Points time and power columns				7.33	1.66336		0.445275591	0.208256	0.013067	0.320383	0.65074825	0.196236	0.002629	0.008865
27	to the right. The times must increase				7.4	2.1852		0.593700787	0.255821	0.01204	0.334186	0.72295741	0.298182	0.00403	0.010024
28	monotonically. Between your sample				7.7	13.2		0.742125984	0.245371	0.01227	0.331436	0.70744046	0.404336	0.005515	0.009989
29	points, power will be a linear function of				8	24.912		0.890551181	0.232349	0.012554	0.327873	0.68793762	0.50789	0.006991	0.009889
30	time. The first and last power need not be				8.2	17.8472		1.038976378	0.219327	0.012832	0.323855	0.66787415	0.608509	0.00845	0.009769
31	zero, but the pulse will be zero outside the				9.4625	6.77096		1.187401575	0.206305	0.013105	0.319678	0.64761476	0.706134	0.00989	0.009633
32	first and last times.				10.725	5.44024		1.335826772	0.19158	0.013397	0.314357	0.62396011	0.800501	0.011305	0.009434
33					11.988	5.07168		1.484251969	0.176696	0.01367	0.308507	0.59946028	0.891295	0.012688	0.009207
34	Pulse Parameters				13.25	4.80424		1.632677165	0.161812	0.013925	0.302205	0.57439388	0.978409	0.014036	0.008956
35	Once you set the sample points, you can				13.55	10.3784		1.781102362	0.146929	0.014122	0.294907	0.54806362	1.06171	0.015345	0.008669

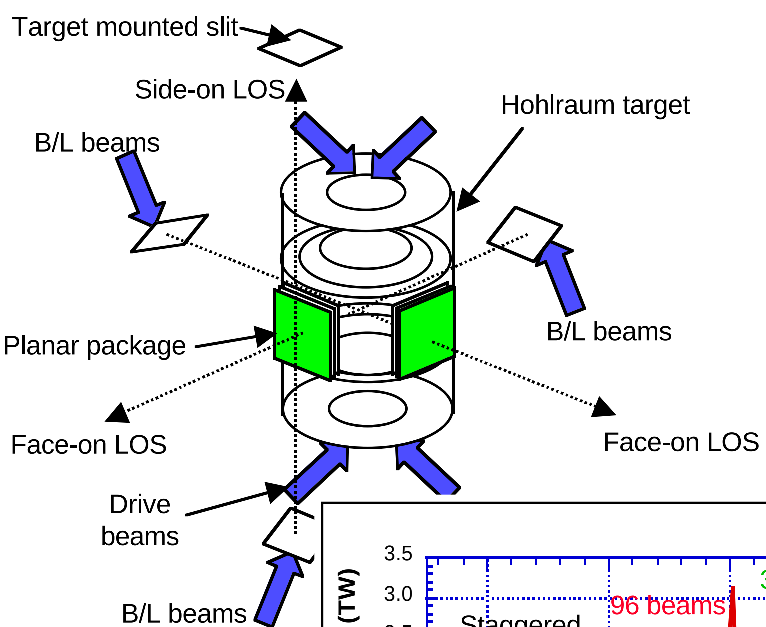
Pulse Shape / Plots / 1w Laser / 3w Laser / Damage / Scratch / Documentation

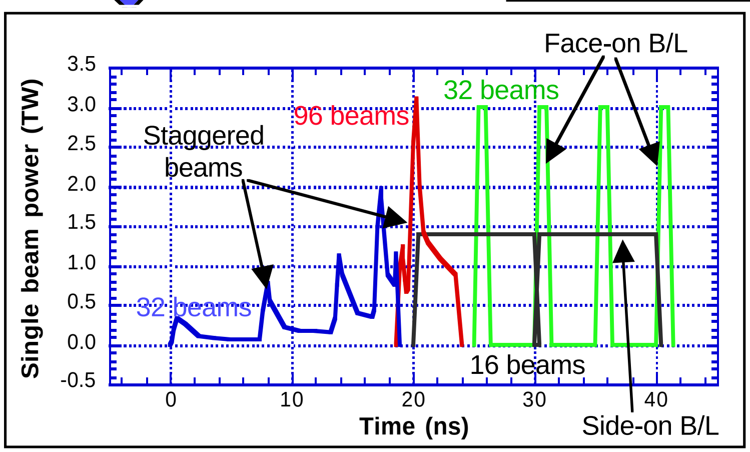
The Excel spreadsheet calculates pulse shapes and provides an estimate of the damage integral

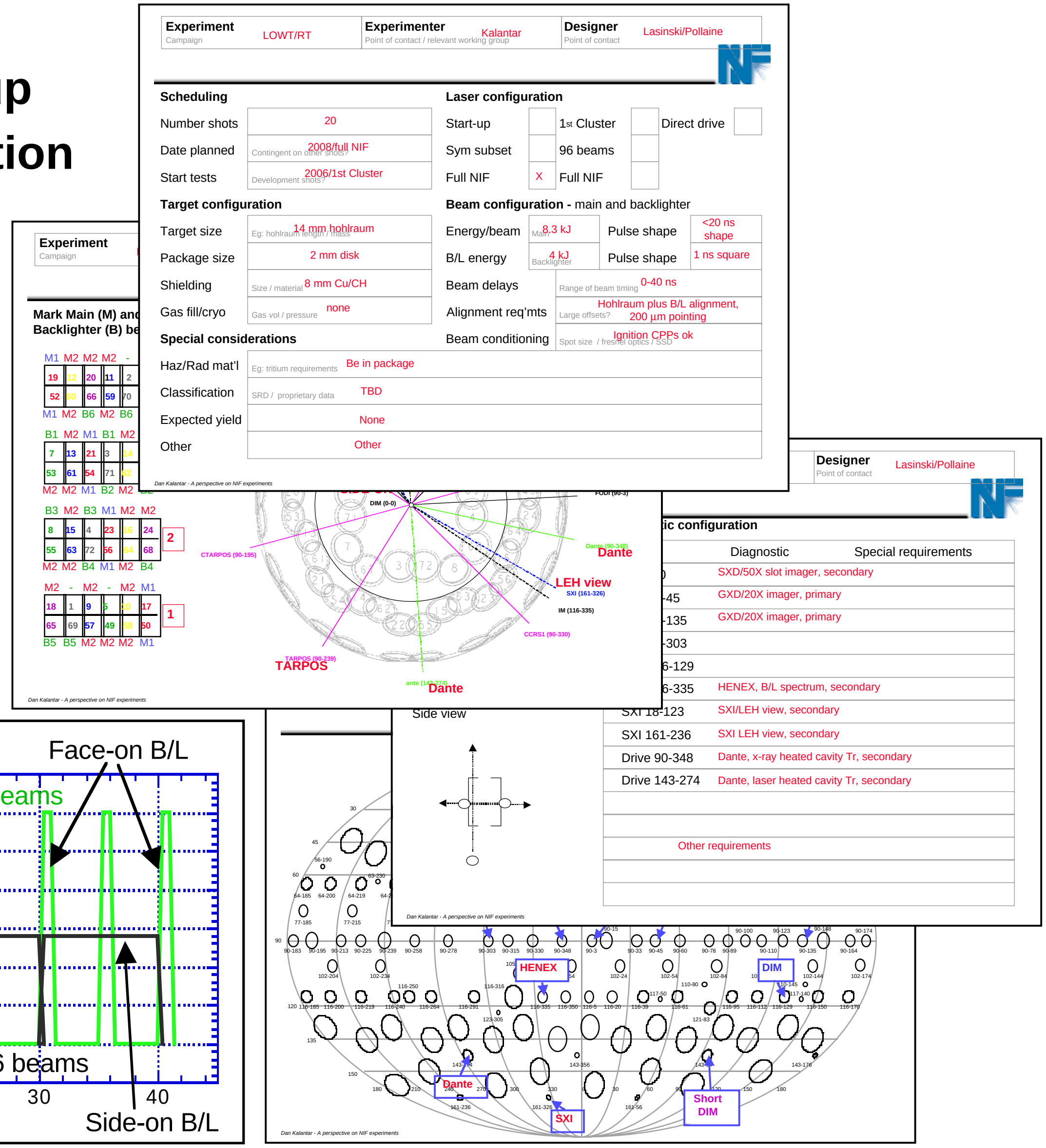


We are starting to use these tools to prepare detailed experimental configurations in order to evaluate support systems

- **Target design**
- **Pulse shape and timing setup**
- **Target diagnostic configuration**







NEL experiment proposal summary

Experiment:	Principle investigator:	NIF programmatic point of contact:
--	--	--

Description:

--

Justification:

--

Scheduling

Number shots	--	Date required	--
Rel'd campgns	--		
How integ'd	--		

Target configuration

Target size	--
Package size	--
Shielding	--
Gas fill/cryo	--
Source of targets	--

Special considerations

Haz'd mat'l	--
Classific'n	--

Laser configuration

NEL (NIF Early Light)	--	1st Quad	--	1st Bundle

Beam configuration

Pulse shape	--	Pulse shape	--
Energy	--	Energy	--
Delay	--	Delay	--
Spot size/CPP	--	Spot size/CPP	--
Alignment req's	--	Alignment req's	--
SSD	--	SSD	--

Expt'd yield	--
Other	--

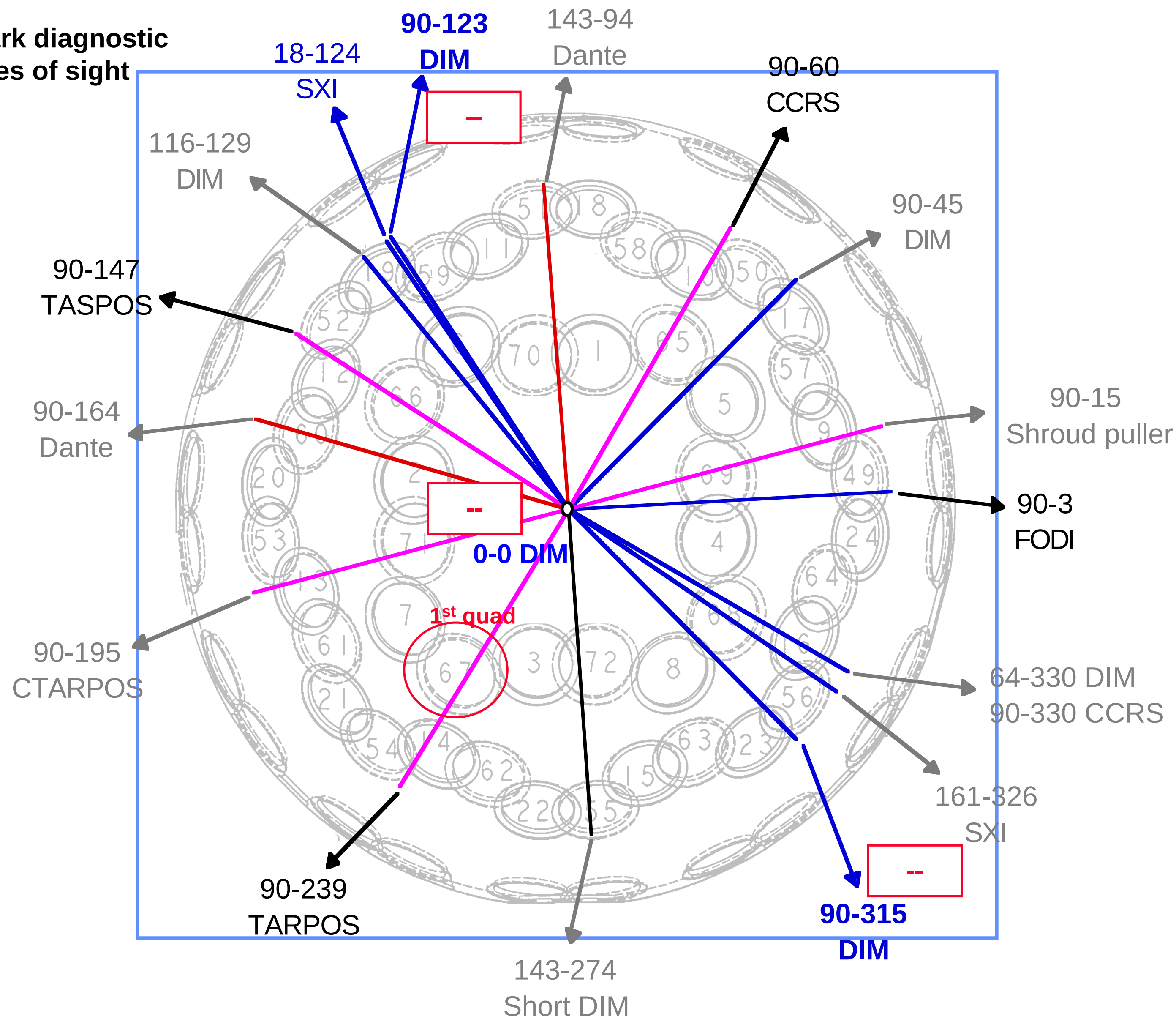
NEL experiment proposal summary

Experiment:	Principle investigator:	NIF point of contact:
--	--	--

Target configuration

Top view

Mark diagnostic lines of sight



Side view

NEL experiment proposal summary

Experiment:	Principle investigator:	NIF point of contact:
--	--	--

Target configuration

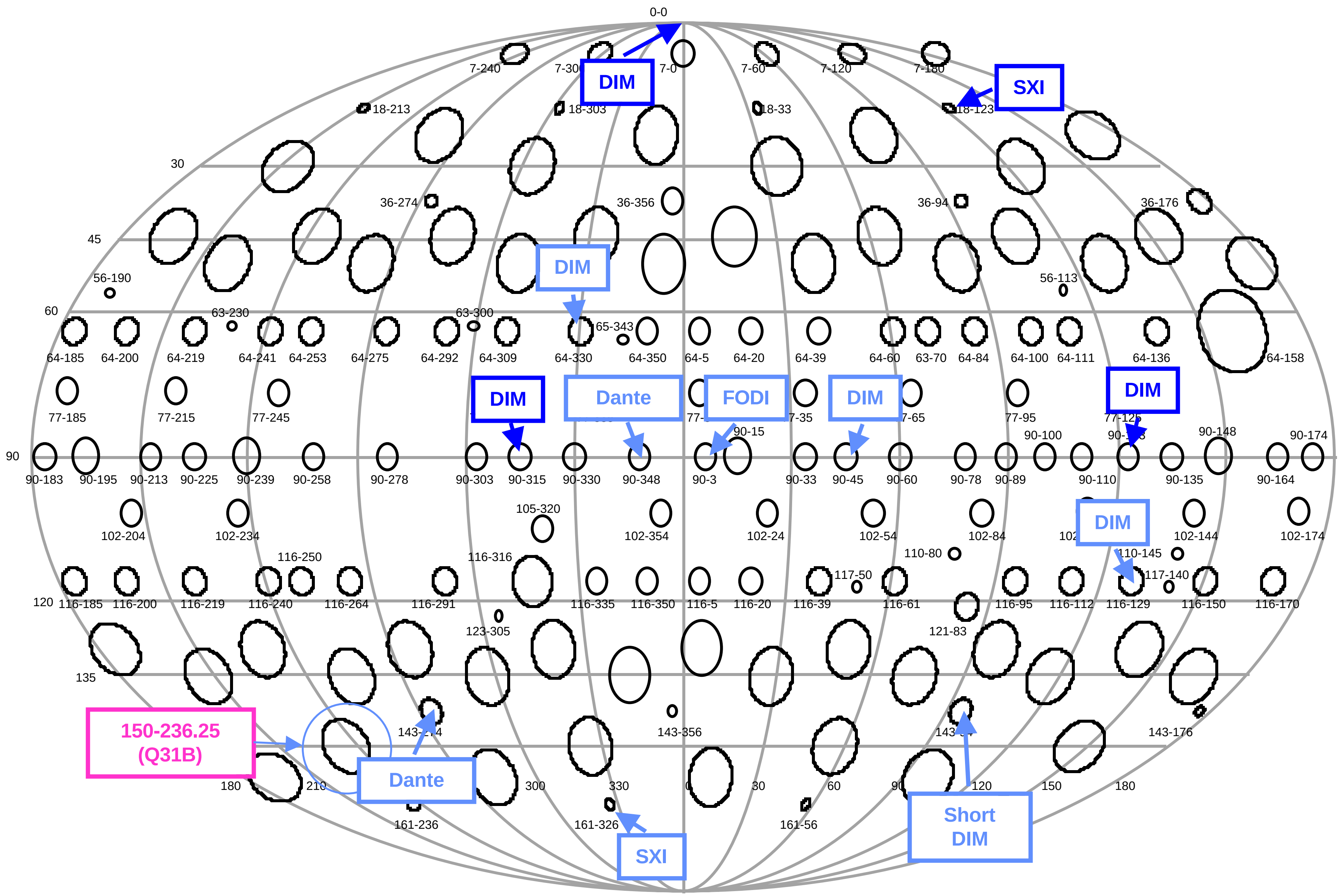
Top view

Side view

Diagnostic configuration

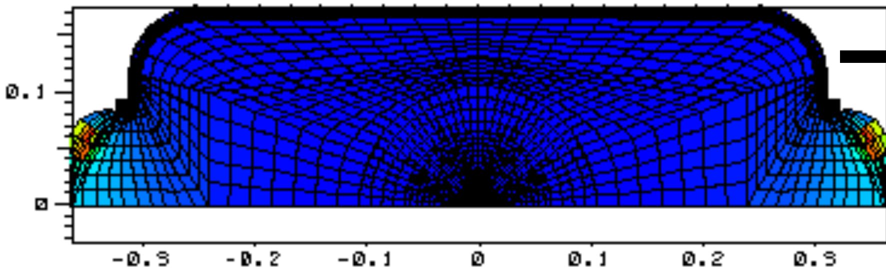
View	Diagnostic	Special requirements
DIM 0-0	-	
DIM 90-45	-	
DIM 90-123	-	
DIM 90-315		
DIM 116-129		
DIM 64-330	-	
SXI 18-123	-	
SXI 161-236	-	
Drive 90-348	-	
Drive 143-274	-	
	- other comments -	

Flat chamber view

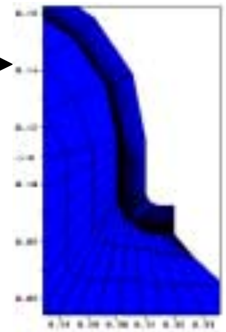


Chamber studies aim to control experiment impacts and reduce debris shield costs - may provide areas of collaboration with IFE

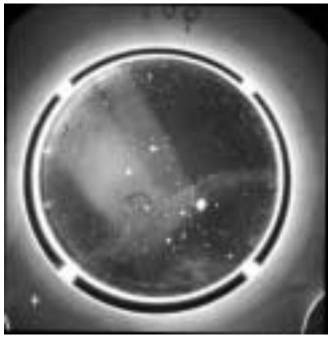
- X-ray Emission, Ablation, and Condensation (Shrapnel also a concern)

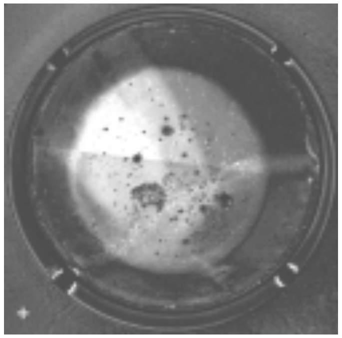


Late time evolution of targets,
for x-ray source prediction



- Optics Damage Growth after contamination





- These studies may have synergy with NIF IFE Chamber Experiments
  - X-ray emission, debris emission, large area ablation studies, ??

Conclusion

- As the experiment plan for NIF becomes better defined we are able to do a better job of planning
  - the associated support equipment needed by those experiments
  - the equipment to deal with the impacts of those experiments

- The governing body for NIF experiments is about to solicit experiment proposals for the first quad of NIF in FY03

- NIF Mission Support, Systems Engineering and Operations are developing tools to help experiment design and campaign planning and the assessment of the facility impacts of experiments