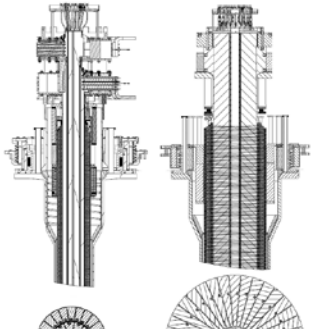
FY2015 (and 2016) research milestones will guide prioritization of eXperimental Proposal (XP) ideas

Incremental (full ops)

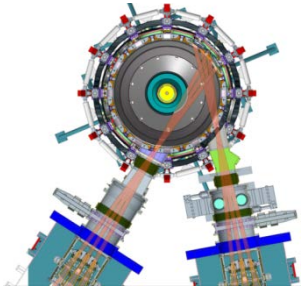
Expt. Run Weeks:

	FY2015		FY2016	
	12	14	15	18

Previous center-stack / New center-stack



Present NBI / New 2nd NBI



Boundary Science

R15-1

Assess H-mode confinement, pedestal, SOL characteristics at higher B_T, I_P, P_{NBI}

Develop snowflake configuration, study edge and divertor properties

IR15-1

R16-1

Assess scaling, mitigation of steady-state, transient heat-fluxes w/ advanced divertor operation at high power density

R16-2

Assess high-Z divertor PFC performance and impact on operating scenarios

Core Science

R15-2

Assess effects of NBI injection on fast-ion f(v) and NBI-CD profile

IR16-1

Assess confinement and local transport and turbulence at low ν^* with full range of B_T, I_P, and NBI power

Integrated Scenarios

R15-3

Develop physics + operational tools for high-performance discharges (κ, δ, β, EF/RWM)

R16-3

Assess fast-wave SOL losses, core thermal and fast ion interactions at increased B_T, I_P

R16-4

Develop high-non-inductive fraction NBI H-modes for ramp-up & sustainment

FES 3 Facility Joint Research Target (JRT)

NSTX-U leads JRT

Quantify impact of broadened J(r) and p(r) on tokamak confinement and stability

C-Mod leads JRT

Assess disruption mitigation, initial tests of real-time warning and prediction techniques

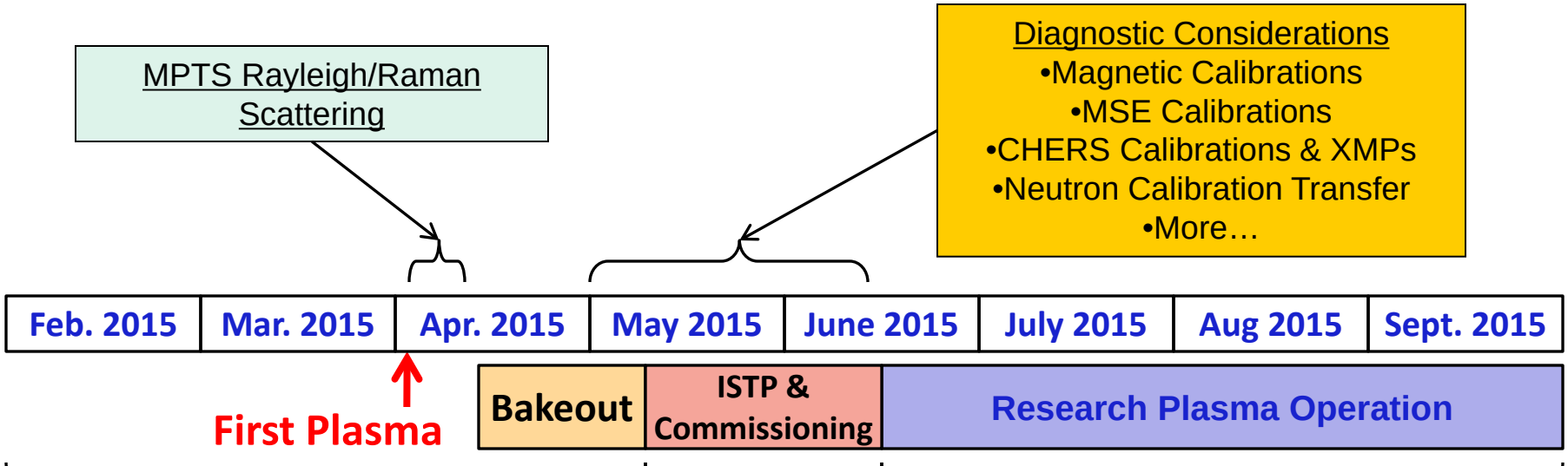
Expected progression of NSTX-U operational performance

	NSTX (Max.)	FY 2015 NSTX-U Operations	FY 2016 NSTX-U Operations	FY 2017 NSTX-U Operations	Ultimate Goal
I_P [MA]	1.2	~1.6	2.0	2.0	2.0
B_T [T]	0.55	~0.8	1.0	1.0	1.0
Allowed TF I^2t [MA^2s]	7.3	80	120	160	160
Longest Likely I_P Flat-Top at max. I^2t, I_P, and B_T [s]	~0.4	~3.5	~3	5	5

Limits to assume for Research Forum idea submissions

- 1st year goal: operating points with forces up to ½ way between NSTX and NSTX-U, ½ design-point heating limit of PF/TF coils.
  - Will permit up to ~5 second operation at B_T~0.65
- 2nd year goal: Full field & current, but still limiting coil heating
  - Will revisit year 2 parameters once year 1 data has been accumulated
- 3rd year goal: Full capability

Provisional schedule for the 2015 research campaign



- Data Acquisition Commissioning for Diagnostics
- Ex-Vessel Diagnostic Installations
- Gas Delivery System Final Checks
- Magnetics Debugging
- Beamline Final Checks and Conditioning
- IR Camera Calibrations
- Rectifier Dummy Load Testing

Commissioning

I_p<=1.0 MA, B_T<=0.5

- Breakdown and current ramp scenarios
- EFIT & rtEFIT Reconstructions
- Shape & position control
- Reliable H-mode
- Diagnostic operations
- DCPS under plasma operations

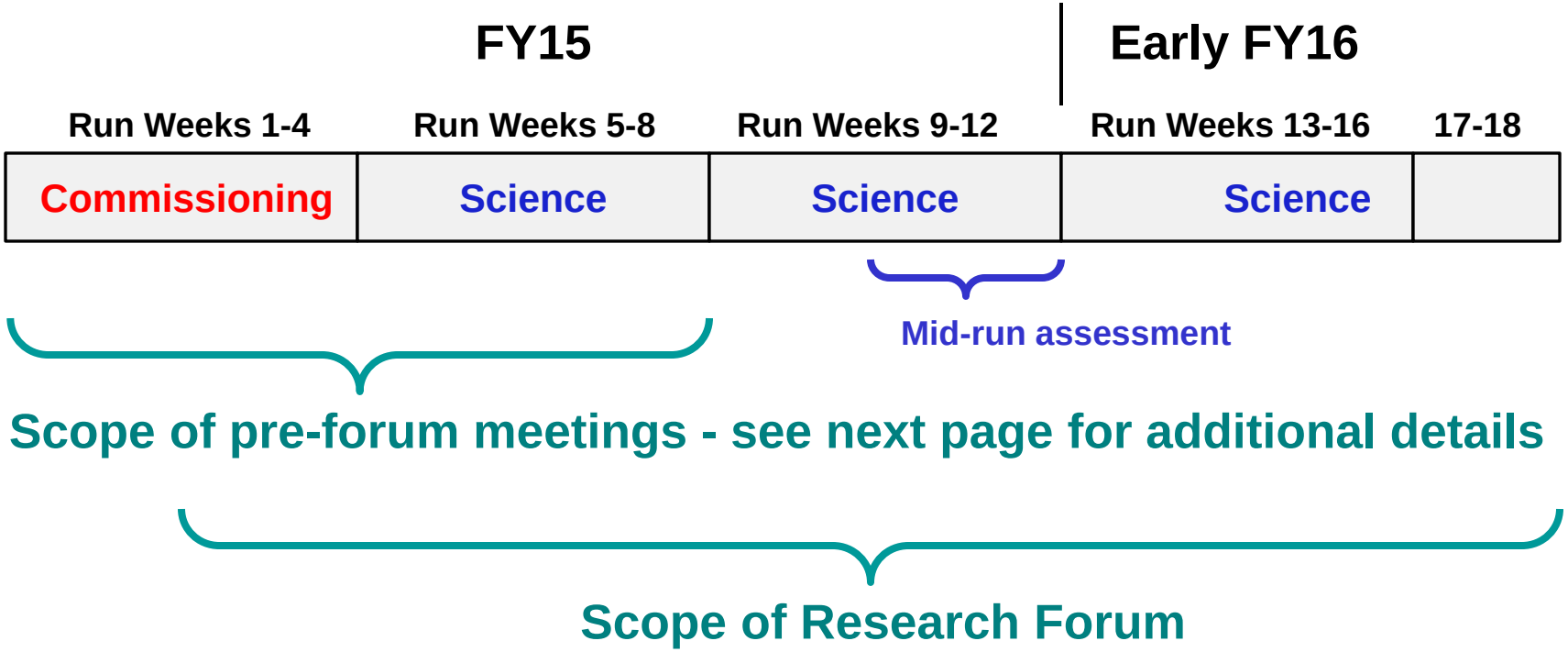
Boronizaton +He GDC for PFCs

Research Operations

LITERs when the operational status allows and physics program desires

Continued discharge, control, and diagnostic commissioning

Run schedule scope of Research Forum



- Pre-forum meetings emphasized XMP/XP title, goal, author identification to cover first 2 run months (weeks 1-8)
- Forum should emphasize prioritization of XPs for weeks 3-18, but also document commissioning XMP/XP goals + run-time
- Mid-run (re-)assessment after first 6-8 Science run-weeks

Operations assumptions for first 2 run-months

- Machine Commissioning…assume 1 month (run weeks 1-4)
  - Develop basic breakdown, current ramp, shape/position control, diverted plasmas, H-mode access, basic fuelling optimizations.
  - Goal: 1 MA, 0.5 T, NBI-heated H-mode (i.e. ~NSTX fiducial levels)
  - Diagnostic commissioning
  - Boronized PFCs
  - Mostly eXperimental Machine Proposals (XMPs)

- 1st Month of Science Campaign (run weeks 5-8)
  - Boronized PFCs, possibly begin lithium coatings
  - Operations and basic profile diagnostics, neutron rate,…
  - Operation up to 1.4 MA and 0.65 T, 2 seconds
  - 6 beam sources up to 90 kV
  - HHFW available for commissioning

Operational tools for density and impurity control

Years 1 & 2 of ops.: Examine Wall Conditioning, Fueling, and ELM Pacing

Boronized PFC Studies

- Plan to start NSTX-U operations with TMB.
- Utilize regimes with natural ELMs to control impurity accumulation
- Between-shot He glow for wall conditioning
- Deuterium inventory likely to rise throughout the discharge

Lithiated PFC Studies

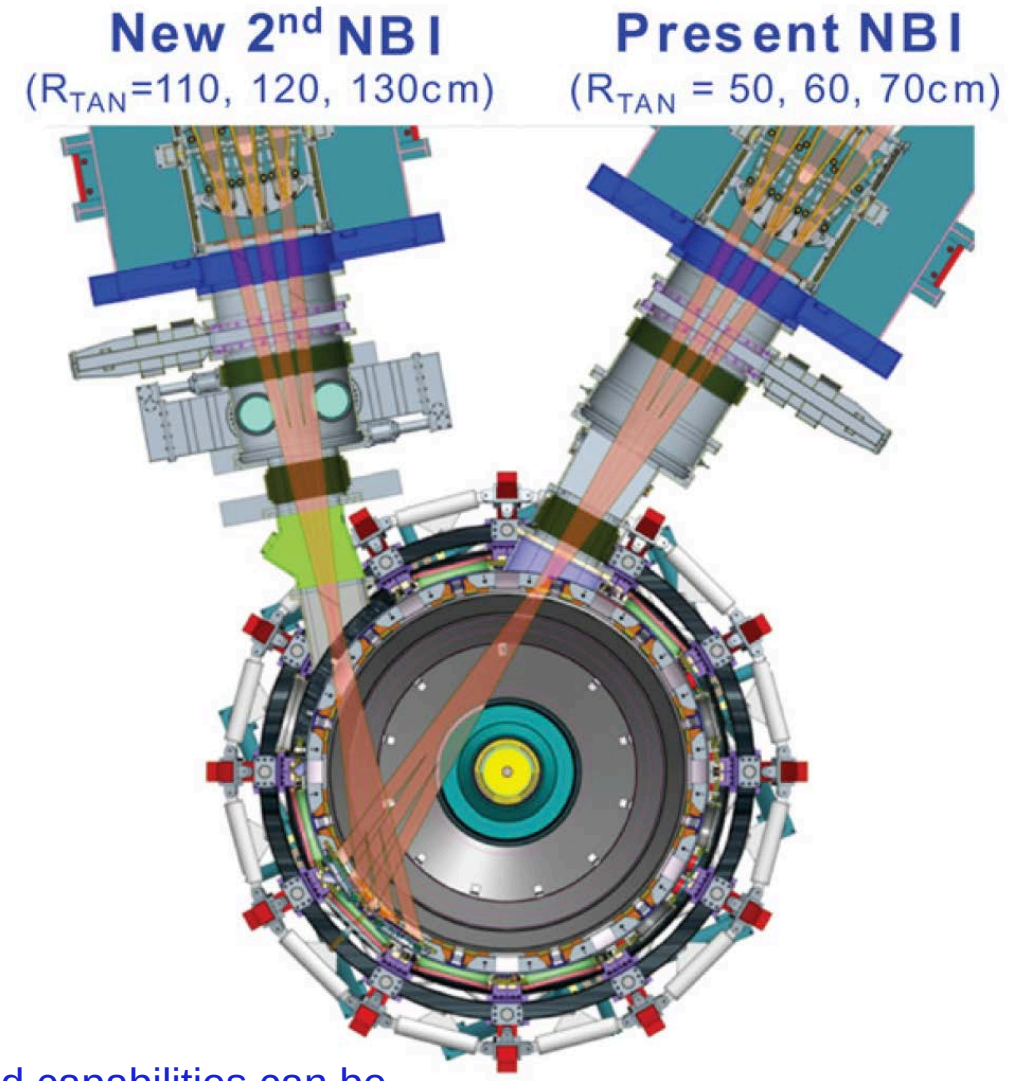
- High-τ_E, ELM-free regimes w/ Li conditioning
- Pulsed 3D fields or lithium granules for ELM pacing to provide impurity control
- Deuterium inventory likely well controlled, but unclear if target Z_{eff}~2 can be achieved

Both Scenarios: Realtime Density Measurements via FIReTIP
Supersonic Gas Inj. for Density Control

Out Years: Utilize Cryo-pumping and Partial NCC

Naming convention for NSTX-U NBI systems

Tangency Radius [cm]	Engineering Designation
50	1C
60	1B
70	1A
110	2C
120	2B
130	2A



Notes:
1. MSE-CIF collects light from the 1A source
2. CHERS collects light from the first beamline
3. Additional information on the NB upgrade and capabilities can be found in J.E. Menard, et al, Nuclear Fusion **52** (2012) 083015