

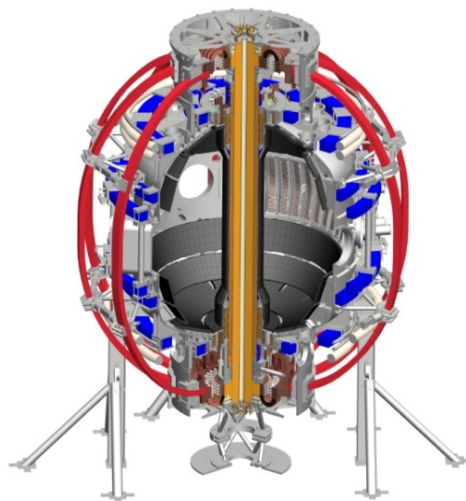
# Advanced Scenarios and Control TSG XMP / XP Planning for Start of FY15

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U Tennessee  
U Tulsa  
U Washington  
U Wisconsin  
X Science LLC*

**Devon Battaglia**  
**Stefan Gerhardt**

*and the ASC Team*

**Pre-Forum Meeting #1**  
**PPPL**  
**December 16, 2014**

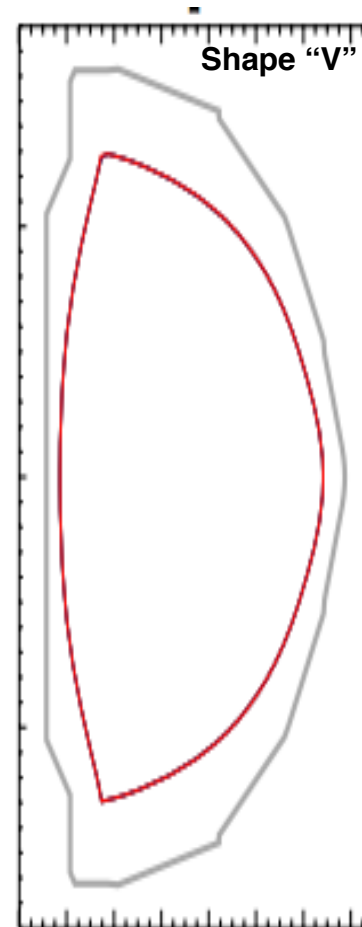


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CIEMAT  
FOM Inst DIFFER  
ENEA, Frascati  
CEA, Cadarache  
IPP, Jülich  
IPP, Garching  
ASCR, Czech Rep*

# NSTX-U Commissioning: ASC Team will Establish a Scenario for Achieving a Physics-Grade Plasma

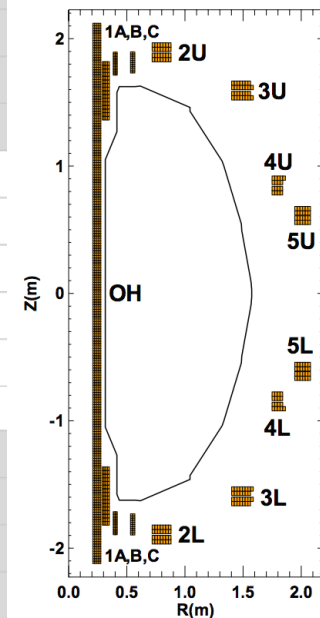
- CD-4 has established:
  - Pre-fill for breakdown
  - Simple pre-programmed currents for null
- Commissioning period target: a scenario useful for physics
  - $B_T \sim 0.5$  T,  $I_p \sim 1.0$  MA
  - Steady flat-top shape control
  - Reliable H-mode timing
  - PFC conditioning recipe
    - Boronization + He GDC
  - Modest  $\kappa$ , near DN
    - PF 3/5 feedback, PF 1 feedforward

May 2015		June 2015			
ISTP	Commissioning	Run Week	Run Week	Maint.	Run Week



# ASC Plan: Divide Commissioning Period into Staged XMPs

<u>Goals</u>	<u>Diagnostic and Machine needs</u>
<b>XMP: Gas Calibration</b>	
Calibrate flow rate valves (LFS critical, HFS desired)	Bake, gas delivery system
<b>XMP: Magnetics Calibration</b>	
Calibrate magnetics and commission EFIT	Magnetics
<b>XMP: Establish initial current ramp</b>	
Establish acceptable null scenario for 2 OH precharge levels	Plasma TV (x2)
Establish $I_p$ ramp to typical rtEFIT handoff	Filterscopes, LLNL EUV (Impurity tracking)
Establish protocols with Deputy Physics Operator	Neutrons
Commission DCPS in plasma conditions	MPTS (desired, not critical) ECH preionization
<b>XMP: <math>I_p</math> and R control w/ beams</b>	
Radial position control with feed-forward PF1 for diverting	MPTS (critical)
High current ( $\sim 1$ MA) flattop with beams	VB
H-mode access in LSN	NBI (x6)
Commission rtEFIT	HFS gas
<b>XMP: Gap and squareness control with ISOFLUX</b>	
Radial and shape control with PF3 and PF5	rtEFIT
Commission ISOFLUX	rtRWM sensors (desired)
Obtain decent wall conditions and dependable H-mode	



# Extending Scenario Beyond 1 MA, 0.5 T, and Modest Shaping will Require XMPs during Research Campaign

## Proposed ASC XMP and XPs for early FY15 campaign

**XP: Variation of q profile with beam tangency**

TRANSP analysis produces paper

**XMP: Beam and beta PCS control**

Demonstrate PCS control of beam power

Demonstrate PCS feedback control of betaN

**XP: Combined betaN and li control**

First demonstration of control produces paper

**XMP: X-point control**

Demonstrate X-point control with PF1-3

**XP: Snowflake control in NSTX-U**

Paper on snowflake capability with new divertor coils

**XMP: Extend operation to 1.5 MA, 0.75 T**

Achieve flattop with engineering constraints

**XP: Scenario Physics in the ST at high Ip, TF**

Extend Ip flattop > 1.5s

**XMP: Vertical control optimization**

Extend vertical control to high kappa shapes

**XP: Establish high non-inductive fraction at BT = 0.75T**

Look for 100% non-induction at ~600-700 kA