NSTX-U

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Pre-Forum Meeting 2

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DivSOL TSG Meeting
PPPL
21 January 2015

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Columbia U
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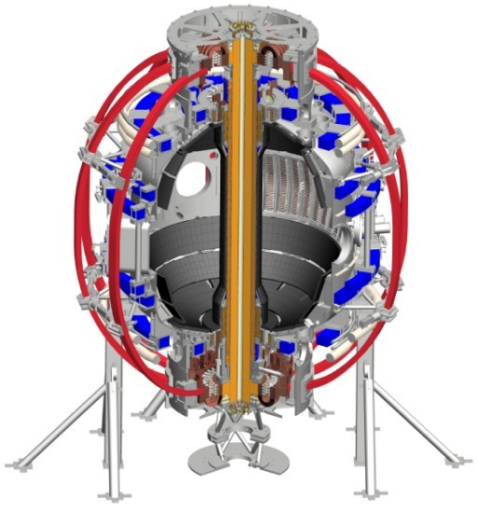
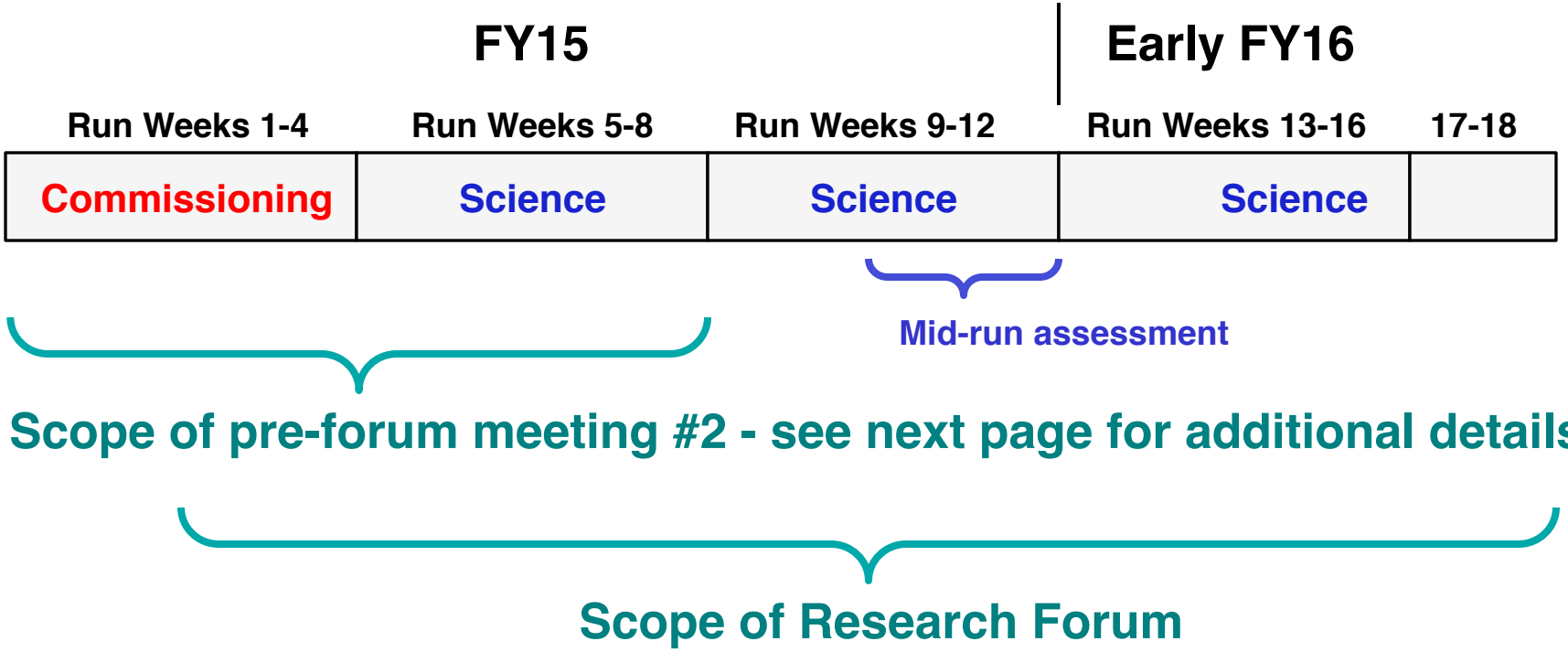
Seoul Natl U
ASIPP
CIEMAT
FOM Inst DIFFER
ENEA, Frascati
CEA, Cadarache
IPP, Jülich
IPP, Garching
ASCR, Czech Rep



Run schedule assumptions



- Pre-forum meeting #2 should emphasize 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

Assumptions for first 2 run-months to use in identifying XMP/XP titles/goals/authors for Jan 29th pre-forum meeting #2

- 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 XMPs
  - **What science (aka XPs) can be done during this phase?**
- 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
  - **What critical XPs can/should be done during this phase?**

DivSOL TSG leads and/or contributes to several milestones in 2015 and 2015

- **FY 2015**
  - **R(15-1)**: Assess H-mode energy confinement, pedestal, and scrape off layer characteristics with higher B_T, I_P and NBI heating power
  - **R(15-3)**: Develop the physics and operational tools for obtaining high-performance discharges
  - **IR(15-1)**: Develop and assess the snowflake divertor configuration and edge properties
- **FY 2016**
  - **R(16-1)**: Assess scaling and mitigation of steady-state and transient heat-fluxes with advanced divertor operation at high power density
  - **R(16-2)**: Assess high-Z divertor PFC performance and impact on operating scenarios

Initial XMPs and enabling activities

- Diagnostic and system commissioning and calibrations
  - Calibrate and commission IR thermography
    - During bakeout, compare to thermocouples, evaluate surface layer effects
    - NBI power scan, I_p scan
  - Commission other SOL and divertor diagnostics (mostly piggy-back)
    - GPI, Langmuir probes, spectroscopy, cameras, bolometers, etc
- Contribute to multi-TSG XMPs
  - Gas injector commissioning, including divertor and SGI (with D_2 and impurity)
  - Calibrate neutral pressure gauges (dedicated shots)
  - Develop fueling scenarios (all LFS, SGI, HFS, divertor, etc)
  - Develop low, medium, high triangularity shapes
    - With X-point and strike point control
  - Develop snowflake divertor configuration with pre-programmed coil currents, and start on feedback control algorithm

Considering initial XPs: 1. SOL and divertor characterization (2-3 days)

- Goal: enable dedicated XP development after 2 months, provide input to R15-1 and R15-3 and initial development for R16-1 and R16-2
- Boundary conditions
  - P_{NBI} = 1-6 MW and 6-12 MW
  - I_p = 0.7-1 MA and 1-1.4 MA
  - $n_e = (0.5 – 0.8) \times n_G$
  - Boron vs Lithium
  - D_2 and impurity seeding
  - 3D fields
  - High triangularity vs low triangularity
- Deliverables
  - Divertor peak heat flux scaling and initial assessment of power balance, in-out assym.
  - ELM type identification and ELM regimes, ELM heat fluxes and profiles
  - Initial assessment of SOL and divertor turbulence
  - Initial assessment of SOL power width scaling (I_p, S, $L_{||}$, …)
  - Characterize operating space of partially detached outer strike point
  - Initial assessment of impact of 3D fields on divertor asymmetries, SP splitting, etc
  - Assessment of divertor conditions and plasma-surface interactions for R16-2

Considering initial XPs:
2. Snowflake divertor (with PED, ASC, PCTF)

- Goal: enable initial data and timely development for R16-1
  - Obtain SF configurations with pre-programmed currents
    - Use X-point or SP control from PCS
    - Use NSTX algorithm and ISOLVER modeling with unipolar PF 1A and PF2, bi-polar PF 1C
  - Develop control algorithm of inter-null distance and segment orientation
  - Evaluate pedestal and divertor plasma characteristics as function of inter-null distance when diagnostics are ready
  - Assess SF utility for ELM control
  - Assess impact of 3D fields on SF
  - Assess radiative SF
  - Assess SOL power width with I_p scaling
  - Etc…