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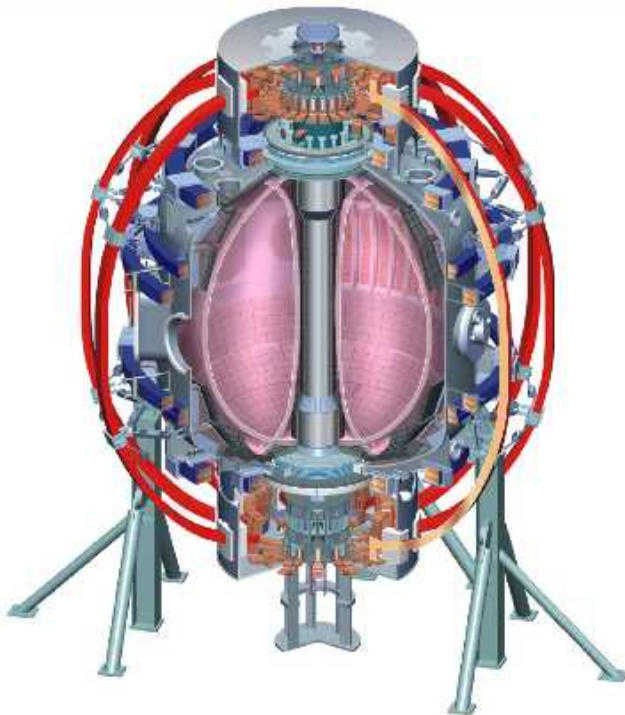


# NSTX Facility/Diagnostic Status

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DOE OFES NSTX Quarterly Review

July 15, 2004



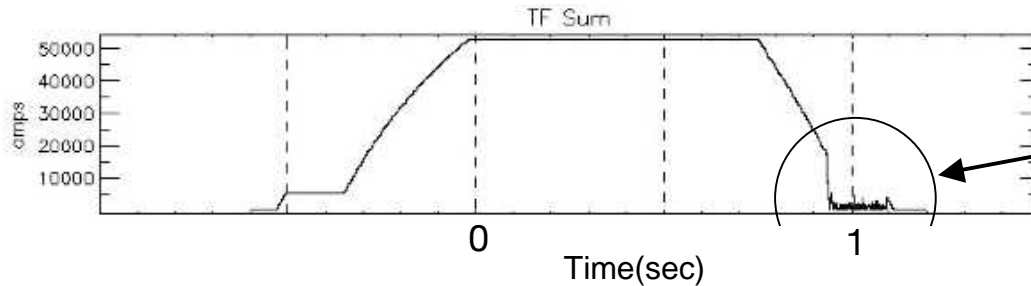
*Columbia U  
Comp-X  
General Atomics  
INEL  
Johns Hopkins U  
LANL  
LLNL  
Lodestar  
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Nova Photonics  
NYU  
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UC Davis  
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U Washington  
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ENEA, Frascati  
CEA, Cadarache  
IPP, Jülich  
IPP, Garching  
U Quebec*

# NSTX Facility/Diagnostic Status Outline



- Facility Issues
  - Review of the TF buswork arc
  - TF joint data and analysis
- Status of facility milestones:
  - Joule milestone - 18 run weeks
  - RWM coil fabrication
  - CHI capacitor bank
  - Other facility upgrade highlights
- Status of diagnostic milestones:
  - MSE implementation
  - Fast x-ray camera
  - Poloidal CHERS fabrication
  - High k scattering fabrication
  - Other diagnostic upgrade highlights
- Summary

# TF Buswork fault occurred on June 25th



- The TF waveforms terminated abnormally
- All other systems were normal

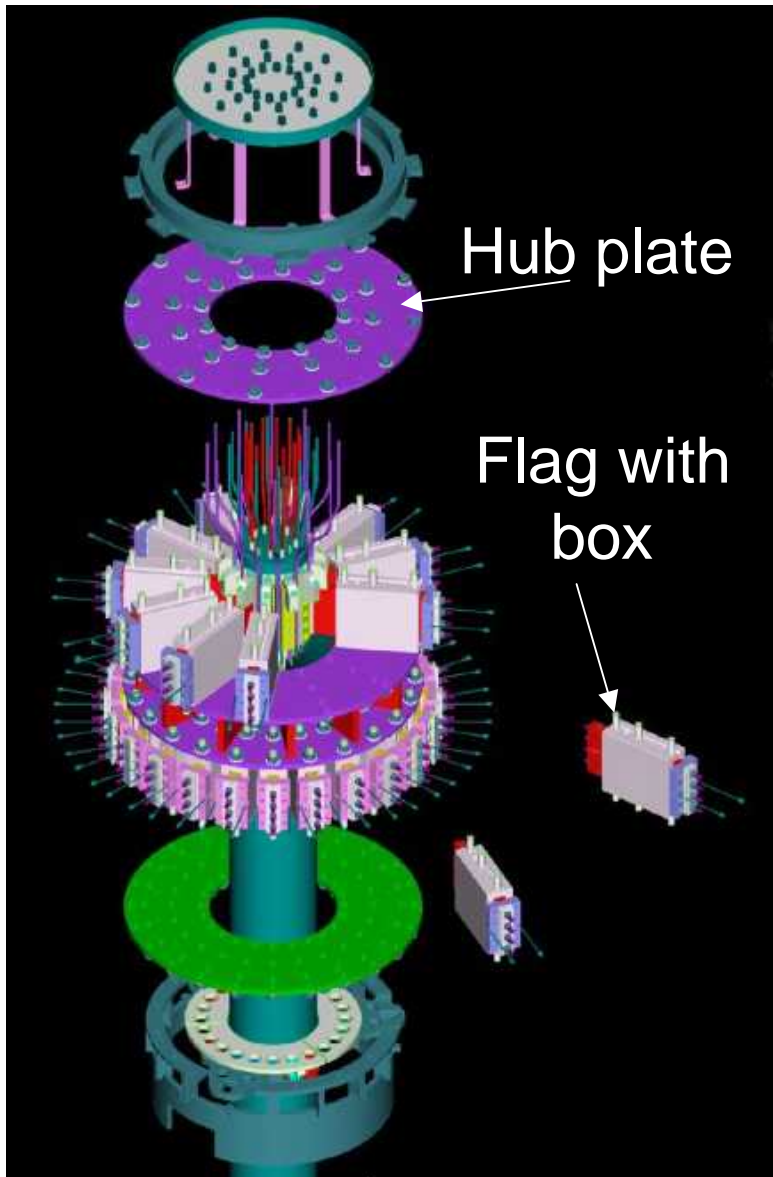


- Fault (arc) occurred between the buswork of two TF turns.
- A circuit model explained the fault behavior
- No damage to coils

Recovery was relatively quick:

- Area cleaned and coils high-pot tested following day
- Arc likely initiated due to a small water leak in the outer TF
- Water leak problem addressed and electrical insulation enhanced including in other similar areas
- Machine back to operation following week.

# TF Joint Behavior Has Been Monitored and Studied Throughout the Run



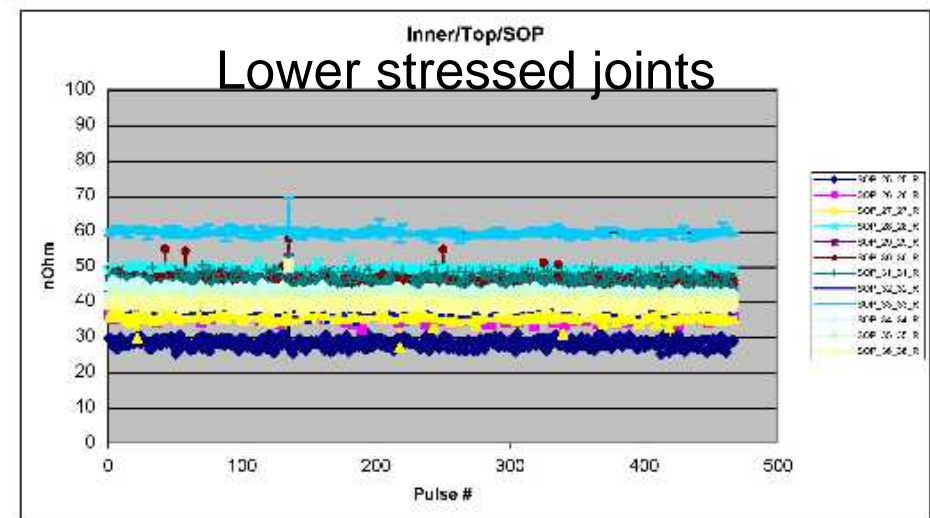
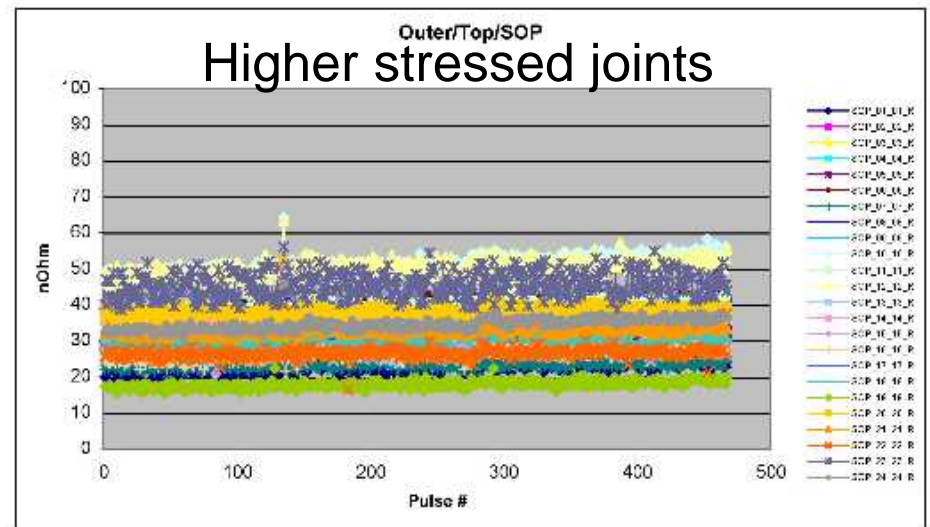
- Resistance of all joints has been monitored throughout the run.
- In January, an integrated system test was conducted to qualify the machine.
- The results of the tests indicated that the resistance of the joints was  $<700\text{n } \Omega$  at 4.5kG and the temperature rise was in accord with expectations.
- However, a closer examination of the data raised some questions requiring further analysis.

# New Data and Analysis Has Identified Some Concerns About the TF Joints



- Small gradual upward drift in the joint resistance has been observed during the past month.
  - Below 700 nΩ.
- Temperature and strain gauge measurement also reveal apparent reduction over time.
- Recent, TF-flag displacement measurements show larger movements compared to design values.
- New simulations and bench test indicate the resistance measurement is consistent with larger than expected joint “lift-off”.

## “Start-of-Pulse” Resistance



# Working to Resolve These Concerns



- Further measurements of the behavior of the hub and flag joints.
  - Is the load being shared between the hub and joint as predicted?
  - Is this an instrumentation issue?
- Refine structural model.
- Develop a plan to improve the joint performance during outage.
- Increased monitoring of the joints for the remainder of the run.

To assure safe device operation, our highest priority, we instituted last week TF operational limit of 3 kG (joint resistance at all time  $< 150 \text{ n}\Omega$ ) until we complete additional analysis.

Q3 facility milestone: Achieve level of facility operation consistent with base line plans and meeting total operating weeks for the FY 2004\*.



FY 04 Joule (SC7-6a) milestone\*: 18 weeks:  
Programmatic goal: 20 weeks

Completed as of July 9, 2004:  
17 weeks\*\* producing 1937 plasmas

\* \*40 operation hours/week

NSTX operations status and other operations information can be access through the NSTX web page.

[http://nstx.pppl.gov/Menu\\_folder/operations.html](http://nstx.pppl.gov/Menu_folder/operations.html)

## *Operations*

*[NSTX Run Log](#)*

- To view the daily Run Log summary

*[NSTX Weekly Reports](#)*

*[Engineering Home Page](#)*

- To view the experimental research summary

*[Engineering COE Logbook](#)*

*[Physics Operations Logbook](#)*

*[Work Planning Procedure ENG-032](#)*

*[XPs and the 2004 Run Schedule](#)*

- to view the experimental proposals and run schedule.

*[Trouble Reporting System](#)*

*[Access Requirements \(.jpg\)](#)*

*[Availability Statistics](#)*

*[Outage Schedule](#)*

*[Control Systems](#)*

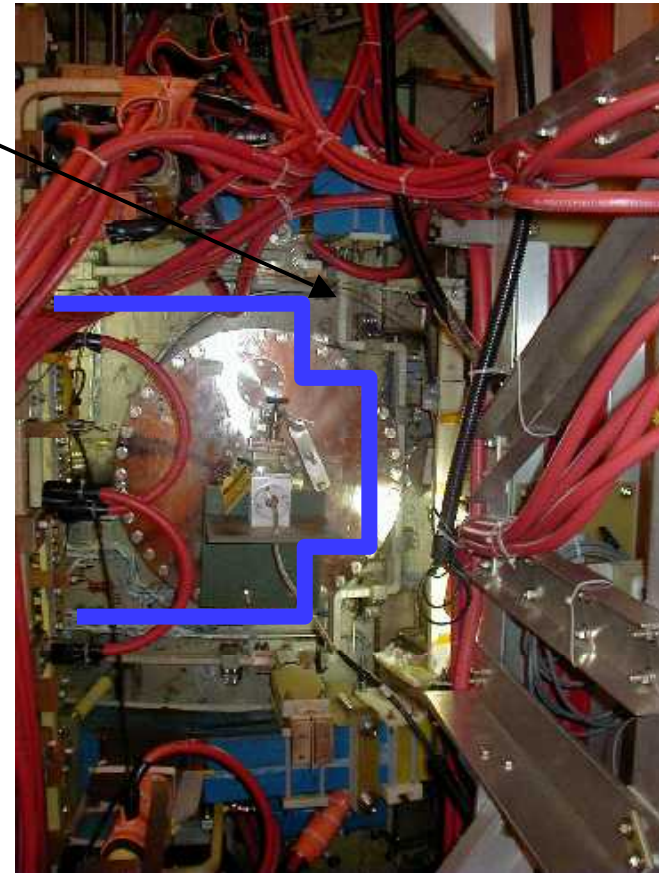


## F(04-2) Fabricate Resonant Field Correction Coil System (September 2004)



Status: On schedule

- Two RWM coils successfully installed and commissioned. Experiments to start shortly.



## F(04-3) Implement Capacitor Bank for Transient-CHI Start-Up (May 2004)



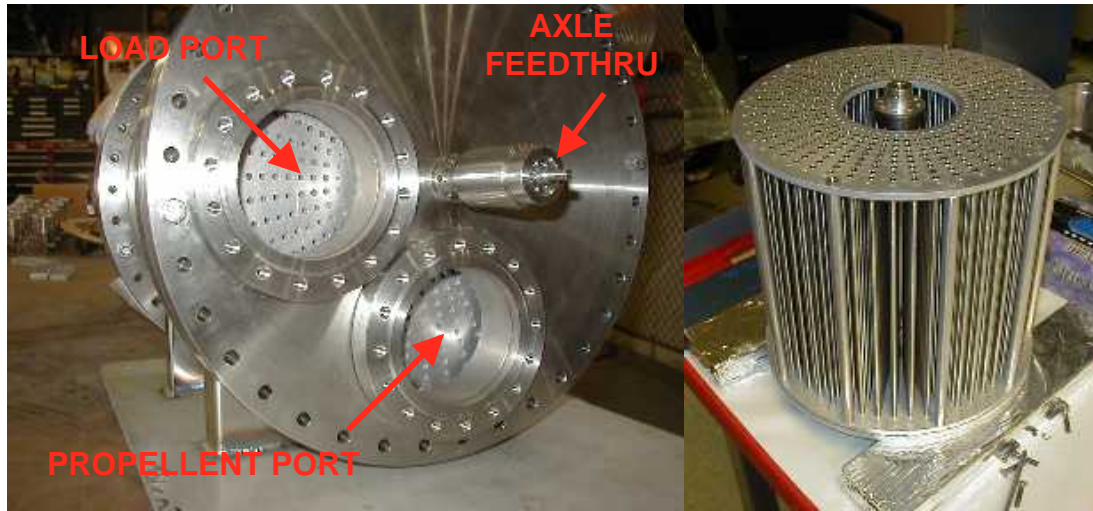
Status: To be completed in July (2004)

- Installation complete.

Power test to begin shortly (this week) and experiments planned next week.



# Lithium Pellets successfully Injected into NSTX NBI and Ohmic Discharges

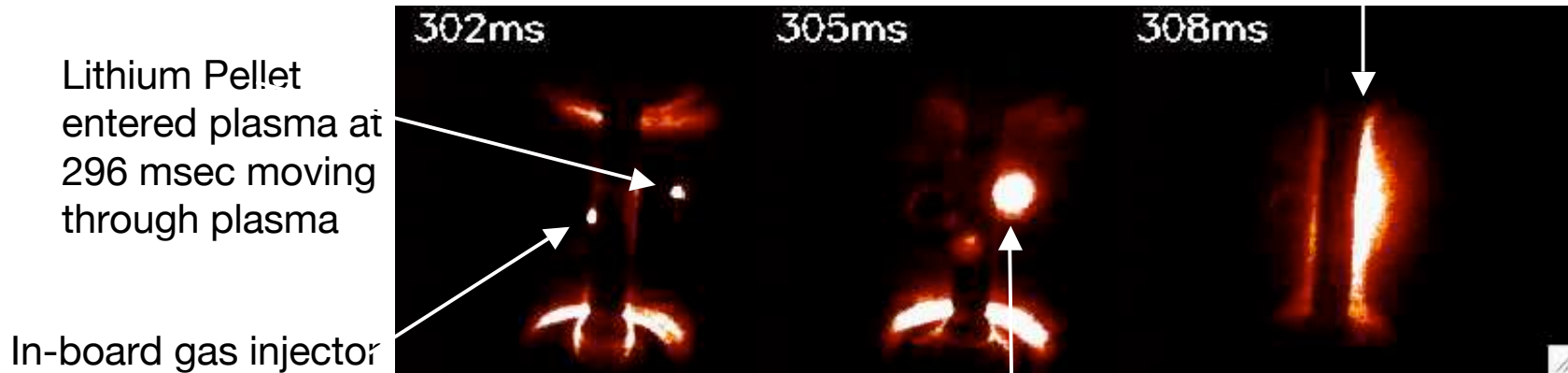


OUTBOARD VIEW

400 BARREL TURRET

- Solid & powder (micro-pellet) injection capability
- Radial injection, 10 m/s to 200 m/s
- Capacity 400 Pellets, 1 to 8 pellets per discharge
- Variable mass per pellet (< 1 mg to 5 mg)

Lithium vapor spreading along the center-stack



Lithium "vapor ball" approaching the center-stack

# Other Facility Upgrade Highlights



## Plasma Control System Development

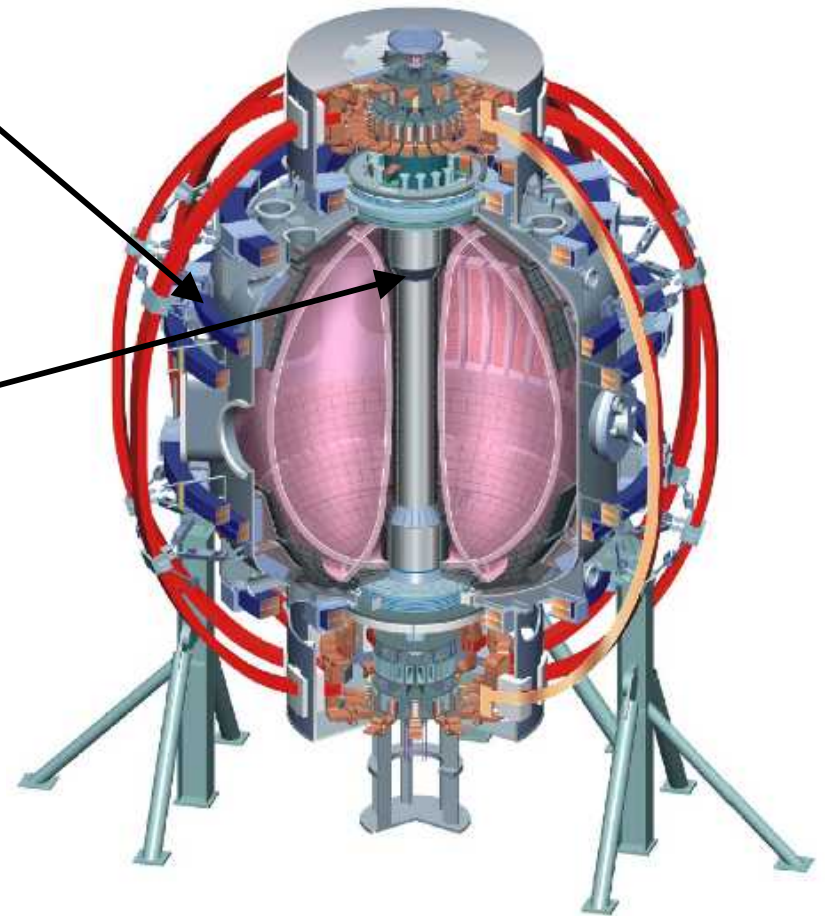
- Achieved higher elongation (up to 2.6) as a result of latency reduction
- rEFIT controls boundary in current flattop for elongation up to 2.5

## PF-4 (previously installed but not energized)

- PF-4 coil energized using RWM power supply. Being utilized for poloidal field coil start-up experiment

## Shoulder Injector

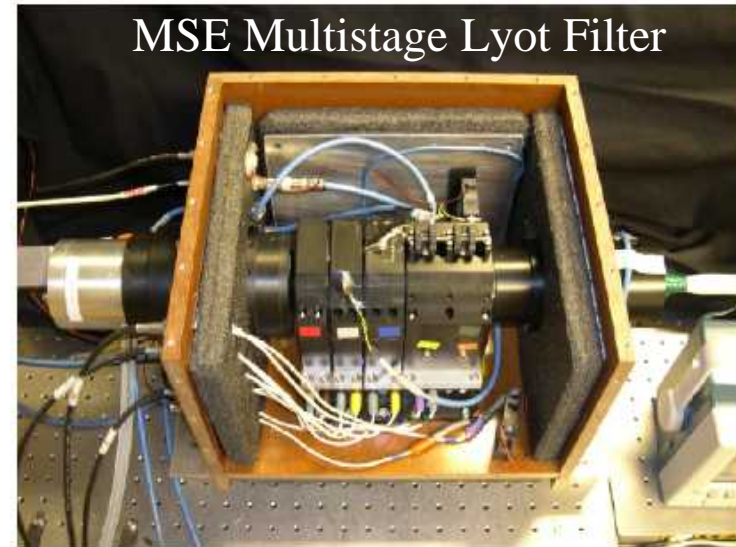
- Successfully utilized for the H-mode studies



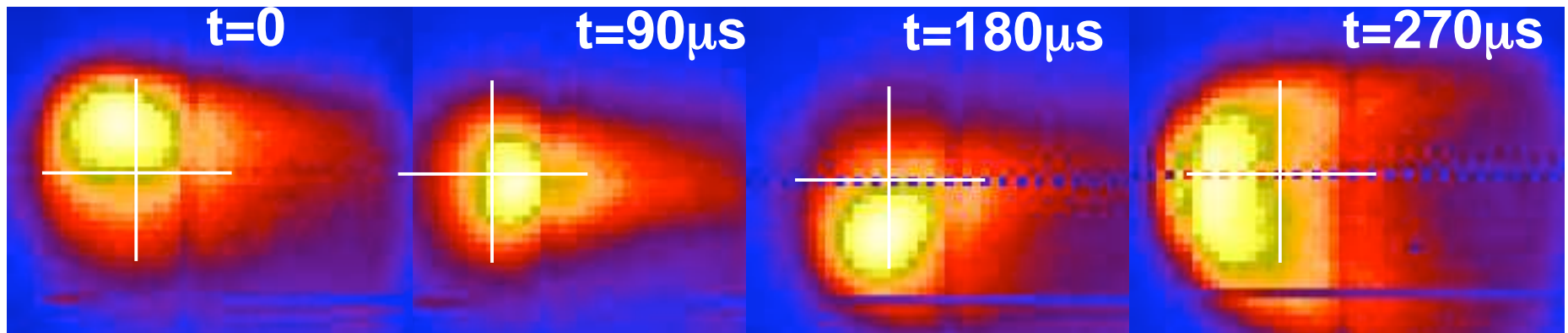
# Diagnostic Fusion Execution Agreements



- D04-1: Install and operate a 10 channel Motional Stark Effect (MSE) diagnostic (Novastar) based on the collisionally induced fluorescence (CIF) from heating neutral beams (September 2004)  
Four channels are presently operational. Currently limited to 4 channels due to a vendor problem.



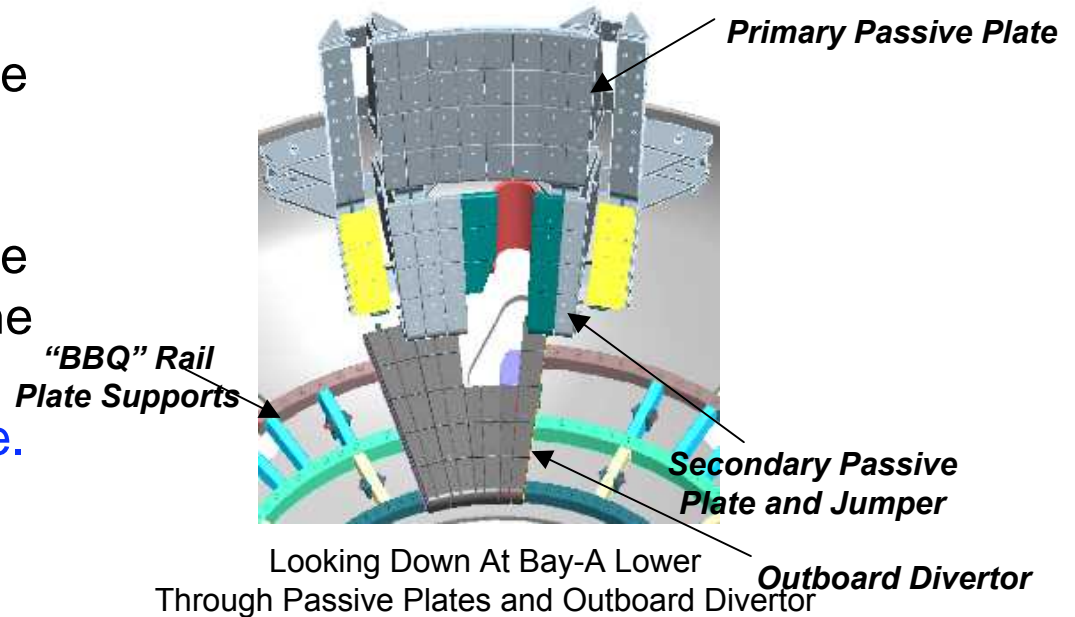
- D04-2: Install a fast camera system to provide two dimensional images of the soft x-ray emission viewed along tangential sightlines (April 2004)  
Completed in March 2004 Producing intriguing images at 10  $\mu$ s frame



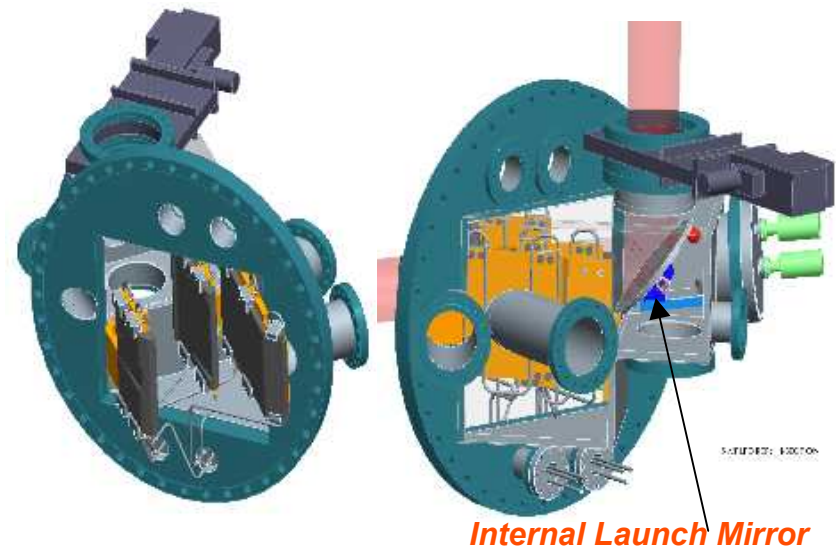
# Diagnostic Fusion Execution Agreements



- D04-3 Prepare for installing the new poloidal charge-exchange spectroscopy (P-CHERS) diagnostic and for upgrading the time and spatial resolution of the edge rotation diagnostic (September 2004) [On schedule.](#)



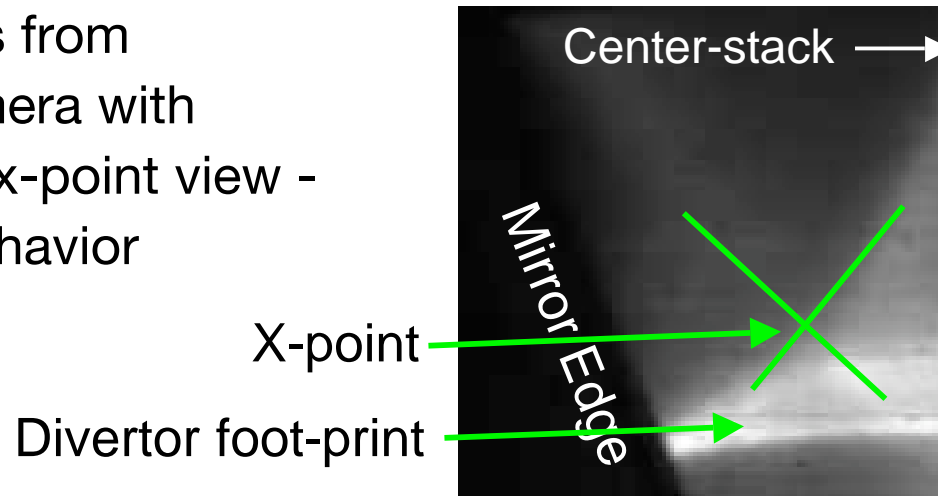
- D04-4 Assemble and test microwave sources and other components for a diagnostic system to measure short-wavelength plasma turbulence by scattering from the plasma density fluctuations. (September 2004) [On schedule - Collaboratrion with UC Davis](#)



# Other Upgraded Diagnostic Highlights



- Obtaining images from Hiroshima fast camera with tangential divertor x-point view - interesting ELM behavior



- Mid-plane bolometer is operational with new detectors providing important power balance information
- PIXCS fast x-ray camera was upgrade by ENEA/Johns Hopkins team and it is taking data.
- Fast probe (UCSD) successfully operated. Yielding detailed edge profile data including L-H transitions

# NSTX Facility/Diagnostic Status Summary



- Facility Issues:

- The TF buswork arc incident was resolved relatively quickly
- New TF joint data and analyses identified some concerns

While working to resolve those concerns, TF operation limited to ! 3 kG maintaining low joint resistance  $< 150 \text{ n}''$  in all joints during pulse

- Facility milestones should be achievable:

- Joule milestone SC7-6a: 18 run weeks. Achieved 17 run weeks
- Should achieve 20 run week program goal in Aug. Operation information is readily available on the NSTX web page
- Two RWM coils installed/commissioned. Expts to start shortly.
- CHI capacitor bank installed/commissioned. Expts to start shortly.
- Other exciting tools (Li pellet, PF4) are now available

- New exciting diagnostics are implemented:

- MSE 4 channels taking data
- Fast x-ray camera is operational
- Poloidal CHERS fabrication continuing
- High k scattering fabrication with UC Davis continuing
- Other diagnostic (fast probe, divertor fast camera, bolometers, PIXCS)<sup>16</sup>