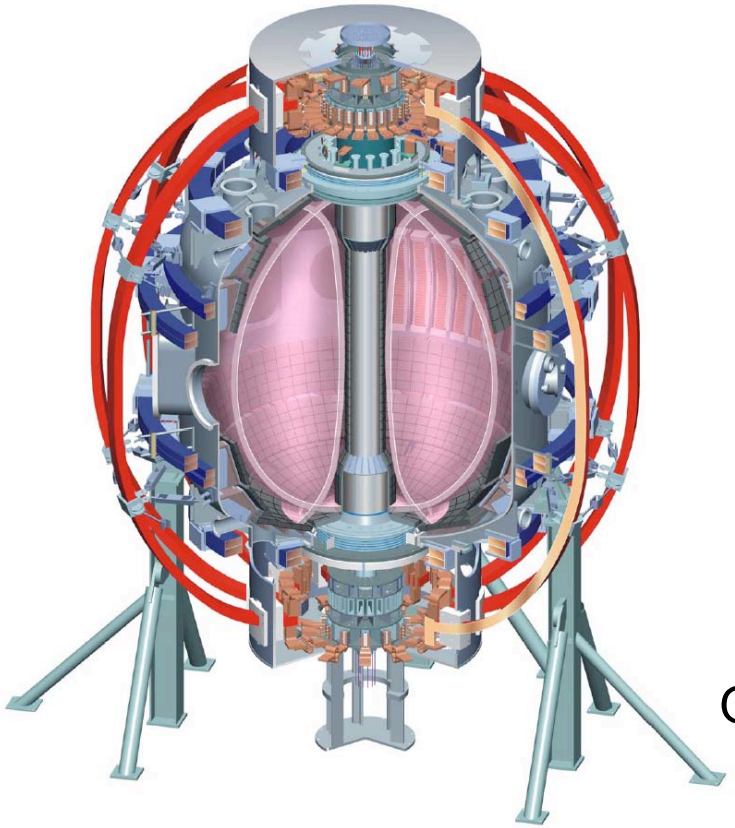
Supported by

NSTX Facility/Diagnostics/Budget Update and Plan for FY 05 - 07 in Support of NSTX Research Plan



Masayuki Ono
For the NSTX Team

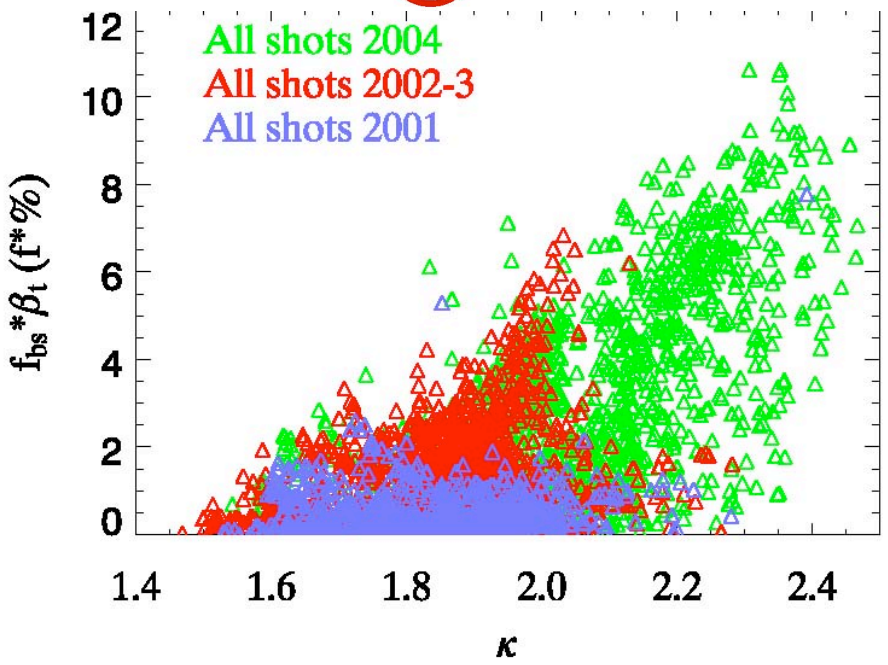
March 15 - 16, 2005

OFES Budget Planning Meeting

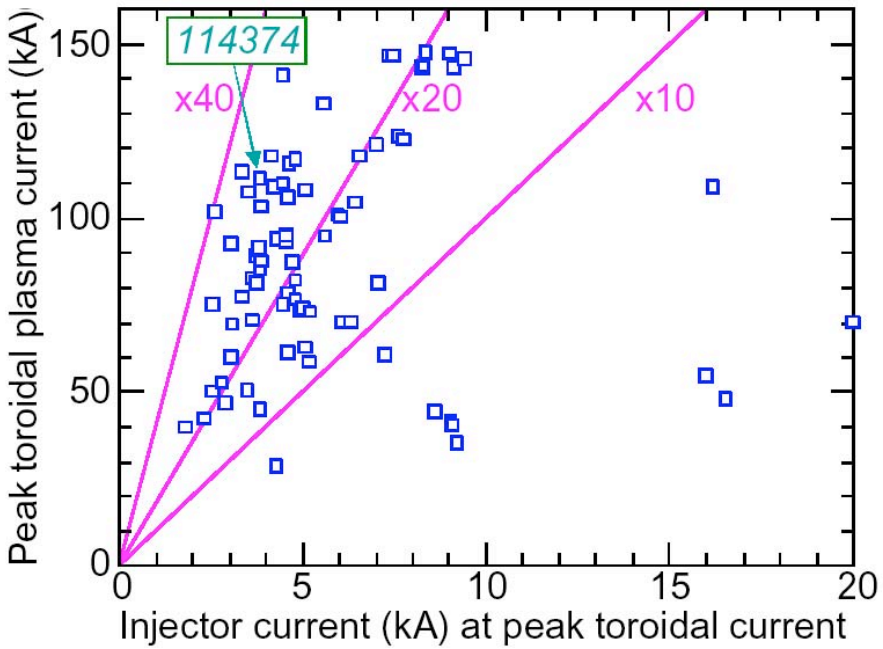
Columbia U
Comp-X
General Atomics
INEL
Johns Hopkins U
LANL
LLNL
Lodestar
MIT
Nova Photonics
NYU
O Dominion U
ORNL
PPPL
PSI
SNL
UC Davis
UC Irvine
UCLA
UCSD
U Maryland
U Rochester
U Washington
U Wisconsin
Culham Sci Ctr
Hiroshima U
HIST
Kyoto U
Kyushu U
Kyushu Tokai U
Niigata U
U Tokyo
JAERI
Ioffe Inst
TRINITI
KBSI
KAIST
ENEA, Frascati
CEA, Cadarache
IPP, Jülich
IPP, Garching
U Quebec

Very successful FY 04 run with new facility tools

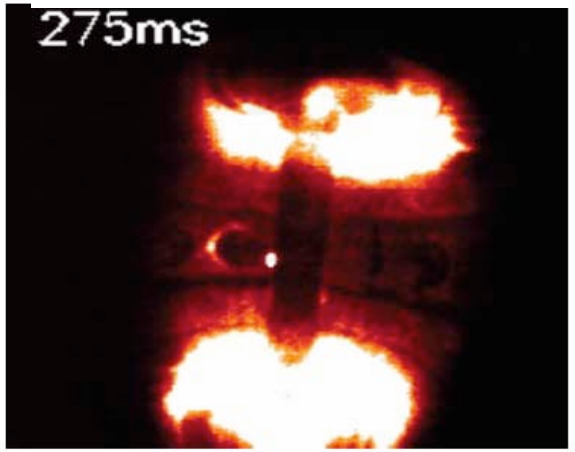
- 21 run weeks achieved
- Faster PCS enabled $\kappa \sim 2.5$ plasmas with expanded operating regimes
- rtEFIT (GA) with PCS controlled precise H-mode plasma shapes

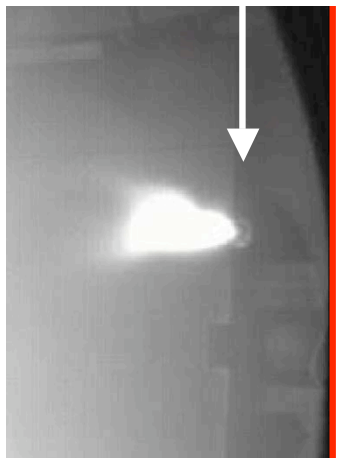


- Transient CHI (U. Wash) capacitor bank got current multiplication of 40



- Particle recycling control tools - Li Pellet Injector and Supersonic Gas Injector (LLNL) introduced





New Diagnostics Enhanced Analyses Capability in FY 04

Kinetic Profiles

- 4ch MSE/CIF (Nova)
- Toroidal CHERS (51 channels)
- Edge Rotation Diagnostic

MHD

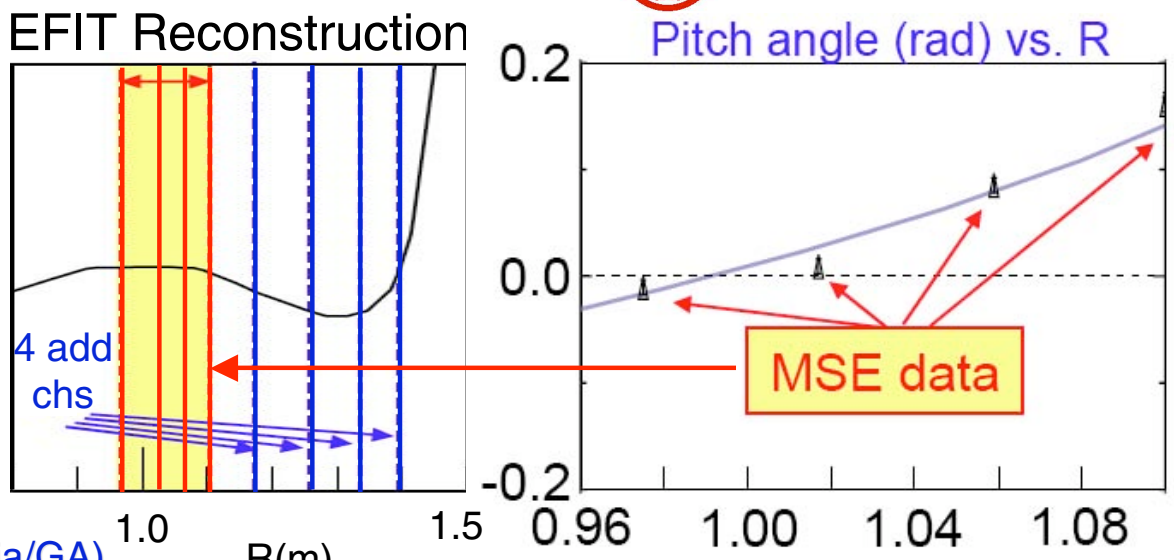
- Wall-mode sensors (Columbia)
- EFIT with Plasma Rotation (Columbia/GA)
- Fast X-ray camera (PSI)

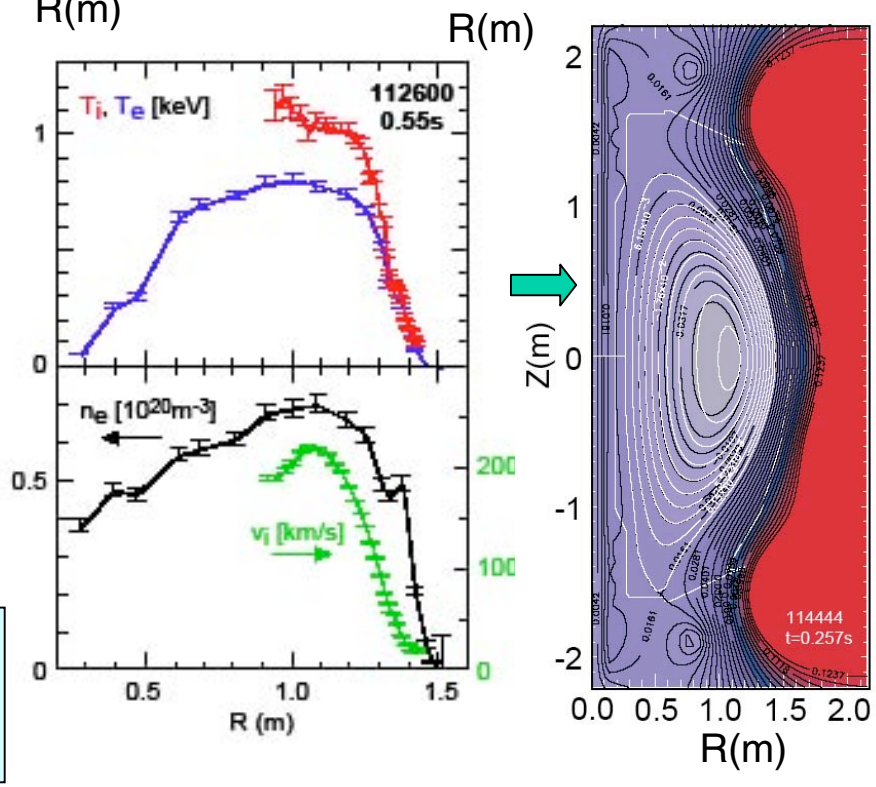
Energetic Particles

- Fast Lost Ion Probes (UCI,JAERI)

Core/Edge Fluctuation

- Low k Reflectometer (UCLA)
- Fast Gas-puff Imaging(PSI, Nova Photonics)
- Fast divertor camera (Hiroshima U)





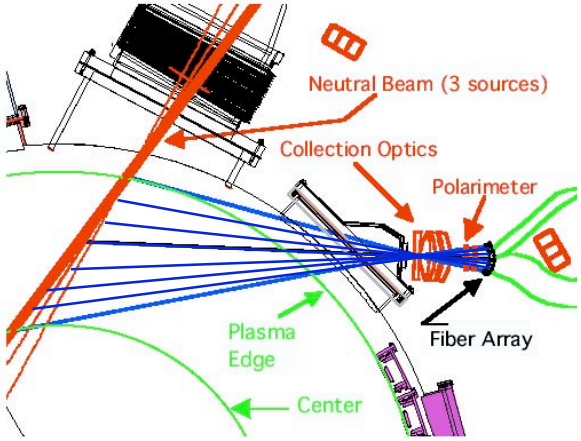
Preparations underway for the exciting FY 05 run

Major Exciting New Tools for FY 05 Run

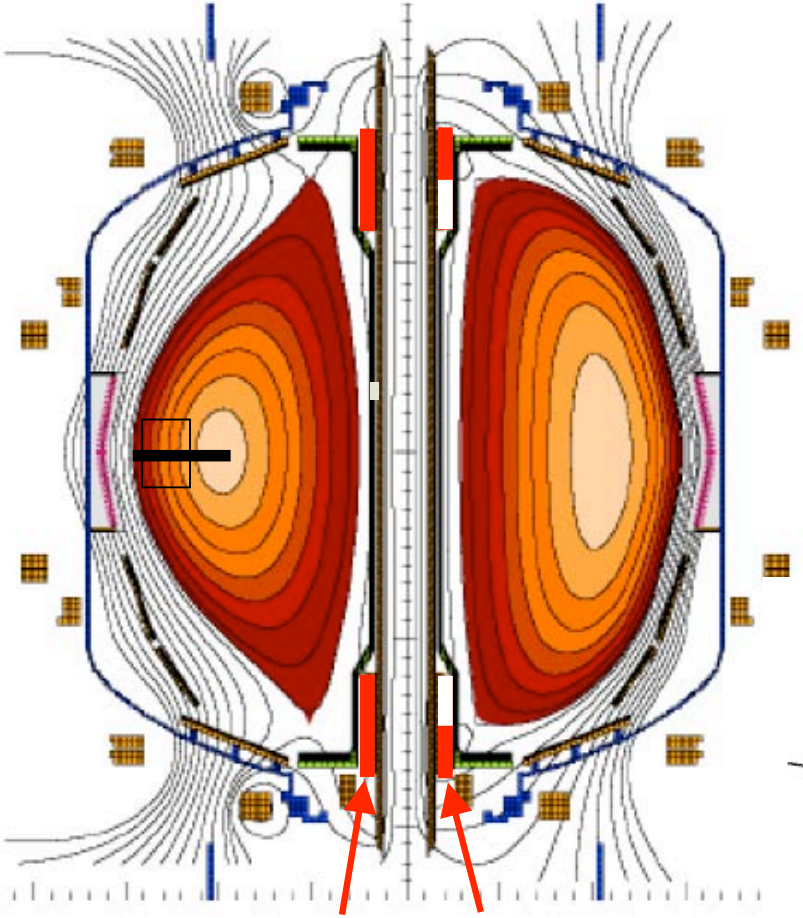
NSTX

8 Ch MSE-CIF for j(r)

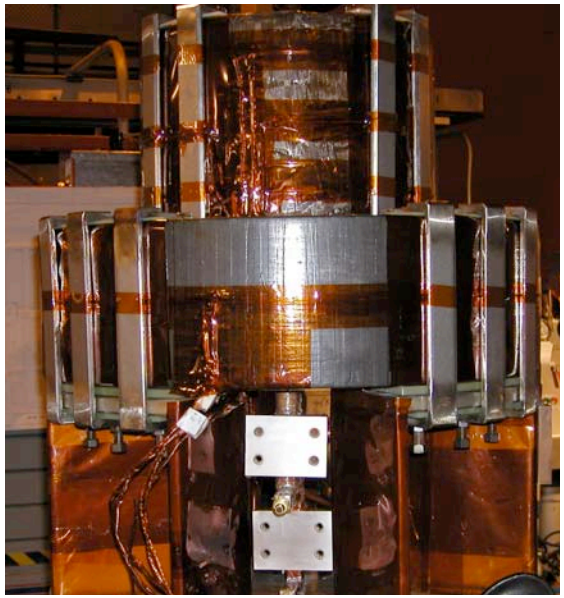
Nova Photonics Inc.



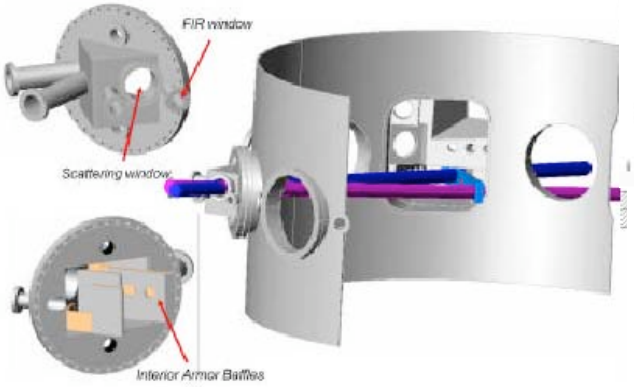
Achieved 2004 → Goal of 2005



New PF1A-L



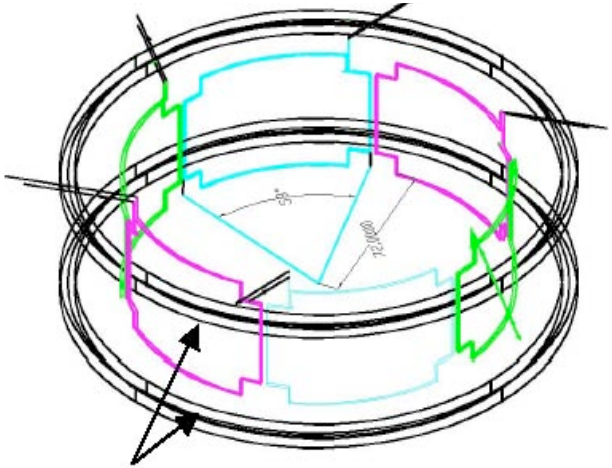
Tangential Microwave High-k Scattering



(a)

UCD

EF/RWM Coils



PF5 coils (main vertical field)

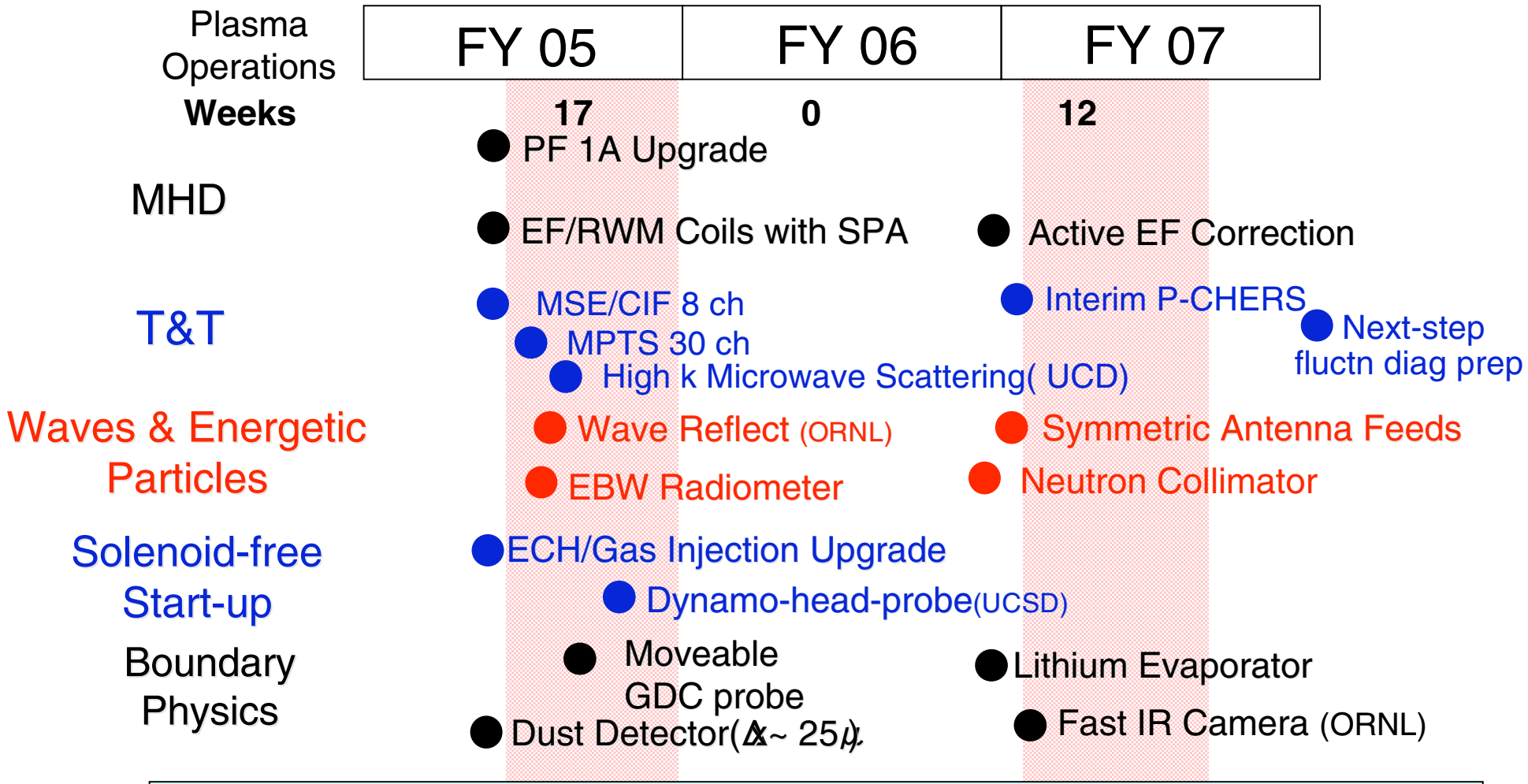
Columbia

Three Cases Considered for FY 06 - 07

	FY 05	FY 06	FY 07
Case 1 (Base - Low)	**17 weeks**		**12 weeks**
Case 2 (Constrained)	**17 weeks**	**12 weeks**	**12 weeks**
Case 3 (Optimized)	**17 weeks**	**17 weeks**	**17 weeks**

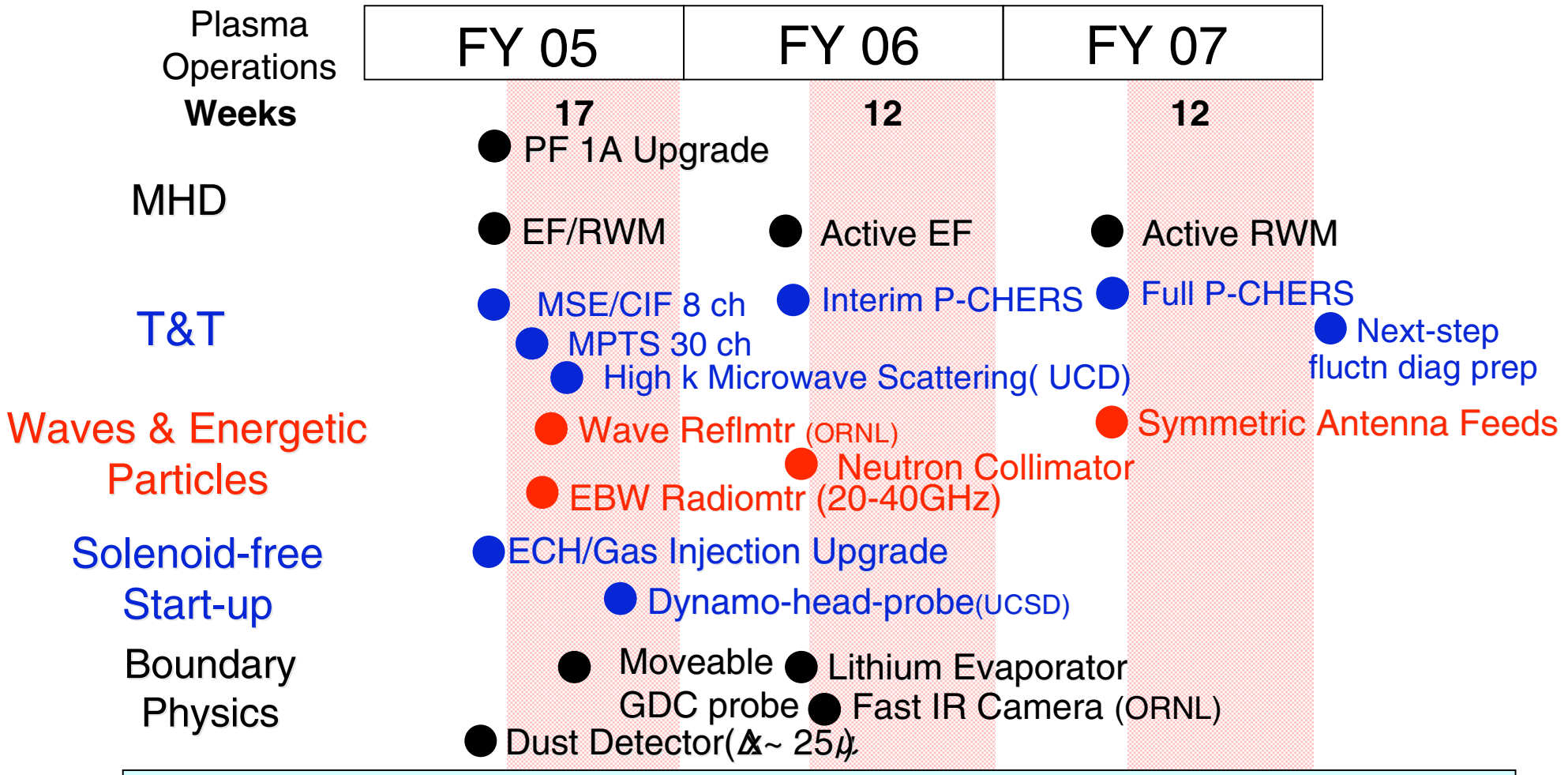
- Case 1- Base case causes delay of one year in experimental progress
- Case 2- Constrained case allows steady experimental progress
- Case 3- Optimized case allows good facility utilization and future investments

Facility/Diagnostic Upgrades: CASE 1



- Significant staff reduction and drastic cut in non-labor funds in FY 06
- Eight months delay in experimental progress relative to case 2
- Maintain key personnel to resume operations in '07 (possibly'06)
- Perform maintenance/repair/upgrades utilizing key personnel

Facility/Diagnostic Upgrades: CASE 2



- Avoids eight month delay in case 1, enables steady progress in research
- Facility utilization emphasis with modest upgrades
- No large upgrades such as 1 MW EBW System

Facility/Diagnostic Upgrades: CASE 3

Plasma Operations

FY 05	FY 06	FY 07
Weeks 17	17	17

MHD
- PF 1A Upgrade
- EF/RWM
- Active EF
- Active RWM

T&T
- MSE/CIF 8 ch
- Full P-CHERS
- 3rd MPTS Laser
- Next-step fluctn diag prep
- MPTS 30 ch
- High k Microwave Scattering(UCD)

Waves & Energetic Particles
- Wave Reflmtr (ORNL)
- Symmetric Antenna Feeds
- Neutron Collimator
- EBW Radiomtr (20-40GHz)

Solenoid-free Start-up
- ECH/Gas Injection Upgrade
- PF 5 Bi-Polar Power Supply
- Dynamo-head-probe(UCSD)

Boundary Physics
- Moveable GDC Probe
- Lith Evaporator
- Divertor Diag
- Adv. Particle Exhaust Decision Point
- Fast IR Camera (ORNL)
- Dust Detector (λ~ 25μ)
- Adv. fueling

1 MW EBW j(r) Control System
- Decision Point
- Complete FDR Begin Site Prep
- Complete Site Prep Begin Antenna Fab.

NSTX Budget Summary ($M)

	FY 05	FY 06			FY 07	
Budget level	Base	Case 1 Base	Case 2 Request 1	Case 3 Request 2	Cases 1&2 Base	Case 3 Request
Run Weeks	17	0	12	17	12	17
Facility Operation	17.34	14.4	16.8	17.8	17.4	18.0
Facility Upgrades	1.10	0.8	1.0	2.0	1.0	2.5
Facility Total	**18.44**	**15.2**	**17.8**	**19.8**	**18.4**	**20.5**
PPPL Research	9.64	9.4	9.9	10.0	10.2	10.3
Diag Upgrades	0.73	0.6	0.8	1.2	0.8	1.1
Coll. Diag. Interf	0.65	0.5	0.6	0.6	0.6	0.7
Collaborations	5.13	5.0	5.1	5.5	5.4	5.5
Science Total	**16.15**	**15.5**	**16.4**	**17.2**	**17.0**	**17.6**
NSTX Total	**34.59**	**30.7**	**34.2**	**37.0**	**35.4**	**38.1**

- No run week case1 in FY 06 results in ~ 18 % staff reduction from FY05
- 12 run week case 2 in FY 06 and 07 emphasizes facility utilization
- 17 run week case 3 in FY 06 and 07 includes 1 MW EBW Upgrade

FY07 Facility Utilization Emphasis Cases

FY 2007 ($M)

Run Week	0	6	12	16	20	25
Facility	15.9	17.8	18.5	19.0	19.5	20.2
Science	16.0	16.8	16.9	17.1	17.4	17.8
NSTX Total	31.9	34.6	35.4	36.1	36.9	38.0

- No run week case retains critical staff and maintenance performed for operations
- No run week case also assumes 10% reduction of staff from the 12 week case
- 6 run week case restores the needed staff level for operations
- Incremental funding covers consumables, very small staff increase, maintenance and spare parts needs, and modest upgrades to maintain research productivity
- Incremental increase in collaboration funding
- High Power EBW system not included

Incremental Funding - Case 3 - will Greatly Enhance NSTX Science Output

- Significantly increase Facility Utilization:
  - 17 run weeks in FY 06 and FY07 (~ 40% increase from Case 2)
- Improve Facility/Diagnostic Capabilities:
  - Implement Advanced Fueling (FY07)
  - Outer PF Start-up System (FY 06)
  - Full P-CHERS (FY06)
  - Implement Critical Boundary Physics Diagnostics (FY 07)
  - Third laser for MPTS to improve time resolution (FY 07)
  - Start construction of EBW 1MW System (FY 06 - 08)
- Improve Facility Reliability and Availability
  - Better Preventative Maintenance and
  - Critical spare parts

Facility and Budget Summary

- Very successful FY04 operations with 21 run weeks:
  - Faster plasma control system allowed higher elongation, new regimes
  - Many new capabilities introduced - 4 ch. MSE-CIF, lithium pellet injector, supersonic gas injector, fast x-ray camera, divertor fast camera
- Planning for exciting FY05 run with new capabilities:
  - 17 run weeks to start in April to August, September as contingency
  - New facility upgrades: New PF 1A coils, EF/RWM coils powered by 3 ch. SPA, ECH/Gas CHI Injector, Moveable GDC
  - New diagnostic upgrades; High k scattering, 30 ch. MPTS, 8 ch. MSE-CIF, Wave Reflectometer, EBW Radiometer, Dynamo CHI probe, Dust Detector
- Three cases presented for FY06 and FY07
  - Case 1 (Base - 0, 12 weeks) causes eight months delay in experiments
  - Case 2 (12, 12 weeks) allows steady facility utilization with some upgrades
  - Case 3 (17, 17 weeks) allows good facility utilization and incorporates required upgrades identified in 5 year plan

In Cases 2, 3, NSTX contribute significantly more to Advance Toroidal Plasma Science, Burning Plasma Physics, and Configuration Optimization