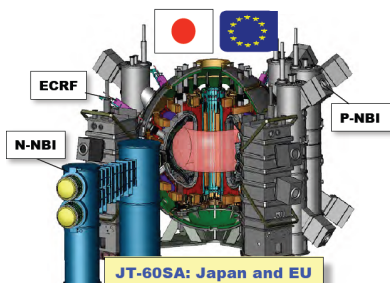


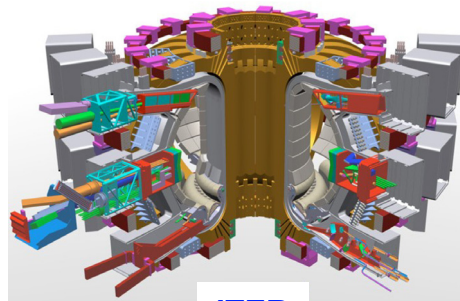
Should we add NHTX to NSTX Mission Elements?



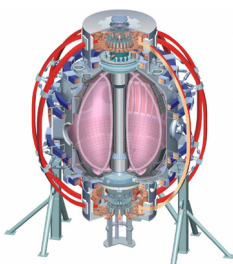
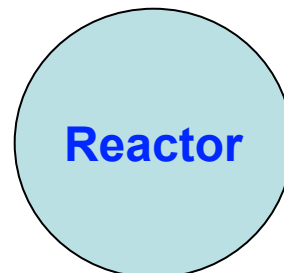
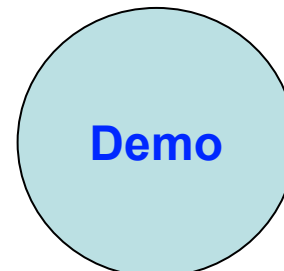
R/C Tokamaks



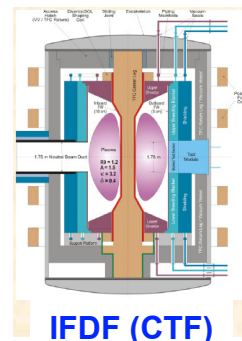
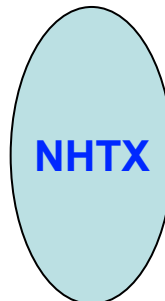
S/C Tokamaks



ITER



NSTX



IFDF (CTF)

- **Establish critical data base for design of NHTX?**
- **Enable attractive CTF to ensure Demo success, by addressing unique ST development issues and benefiting from common ST-tokamak database for burning plasma operation and control.**
- **Support and benefit from USBPO-ITPA activities, using the physics breadth provided by ST in preparation for burning plasma research in ITER.**
- **Complement and extend toroidal plasma science, by maximizing synergy in investigating key scientific issues of toroidal fusion plasmas.**

Need #1: solenoid-free start-up data to enable projections to high plasma current



Sustained Parameters	CTF(1-2 MW/m ²) ($\tau > \text{week}$)	NSTX long pulse ($\kappa \leq 2.5, \tau \sim \tau_{\text{skin}}$)
Start-up $\mu_0 \ell_i R I_p$ (Wb)	2.3 – 3.6	~ 0.13 (goal)
I_p/aB_T (MA/m-T)	4.0 – 6.0	3.8
Safety factor, q_{cyl}	4.6 – 3.1	3.3
β_N (%-m-T/MA)	3.0 – 4.3	5.1
β_T (%)	15 – 25	19
a/ρ_i (= $1/\rho_i^*$)	~ 50	~ 30
$H_{98\text{pby}2}$	1.3	≤ 1.3

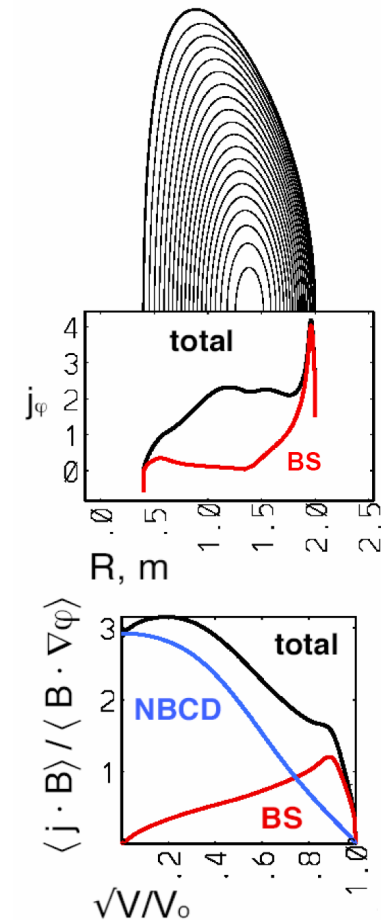
- Progress: basis for baseline CTF stability somewhat beyond no-wall β limits and ion confinement established; **Demo will need with-wall database**
- Feasibility proven on NSTX (CHI), MAST (merging compression), Pegasus (plasma gun) & LATE, TST-2, JT-60U (RF+VF swing, then NBI up to 0.6MA)
- NSTX to investigate combining CHI, EBW, HHFW, NBI & VF swing

ST Need #2: steady state high-heat-flux divertor physics data to enable projections to CTF / Demo



Sustained Parameters	CTF (1-2MW/m ²) ($\tau > \text{week}$)	NSTX long pulse ($\kappa \leq 2.5, \tau \sim \tau_{\text{skin}}$)
P/R (MW/m)	40 – 70	≤ 9
SOL expansion factor	~ 10	~ 5
$V_{\alpha}/V_{\text{Alfvén}}$	3 – 6 ($V_{\alpha}/V_{\text{Alfvén}}$)	1 – 4 ($V_{\text{NB}}/V_{\text{Alfvén}}$)
$I_{\text{BS}}/I_{\text{CD}}$ fractions	$\sim 0.5/0.5$	0.3-0.5/0.3-0.1

- Progress: basis for NBI & bootstrap current drive physics established
- High priority for ITER (P/R ~ 30 MW/m), large tokamaks, S/C tokamaks (KSTAR: P/R ~ 16 MW/m), and new ST in Japan
- NSTX to investigate physics solution of liquid lithium divertor targets



stable CTF plasma shape & current profile using NB & Bootstrap