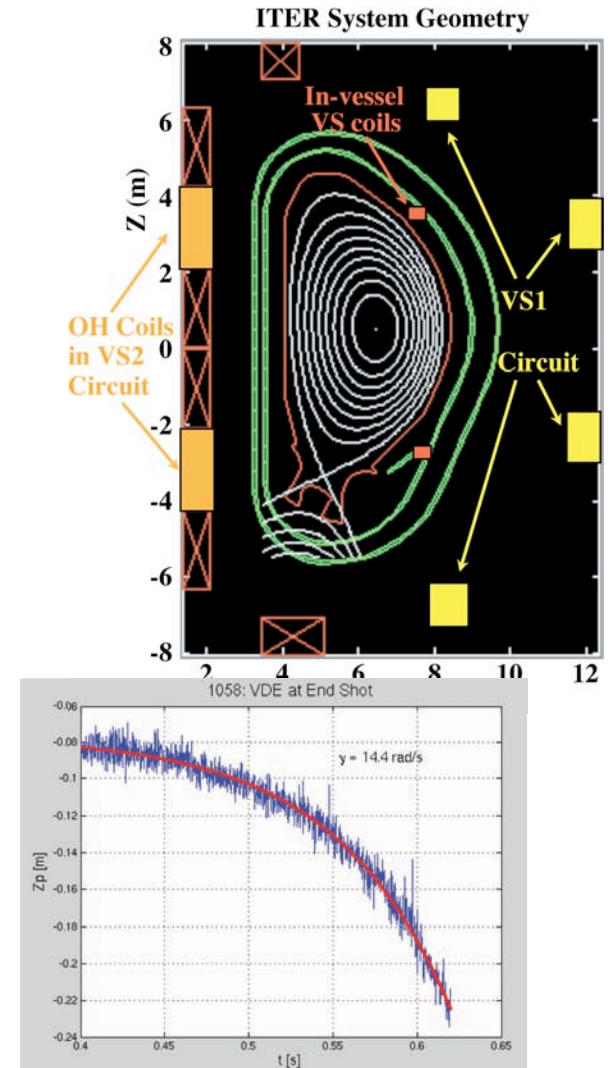
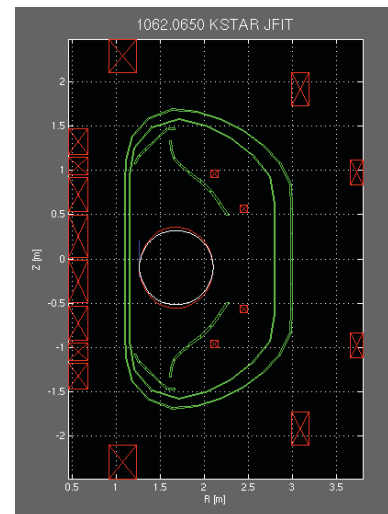
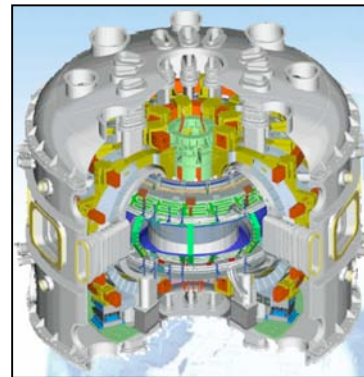


Discussion Points on KSTAR Experiments for Physics, Control, Operations, and ITER

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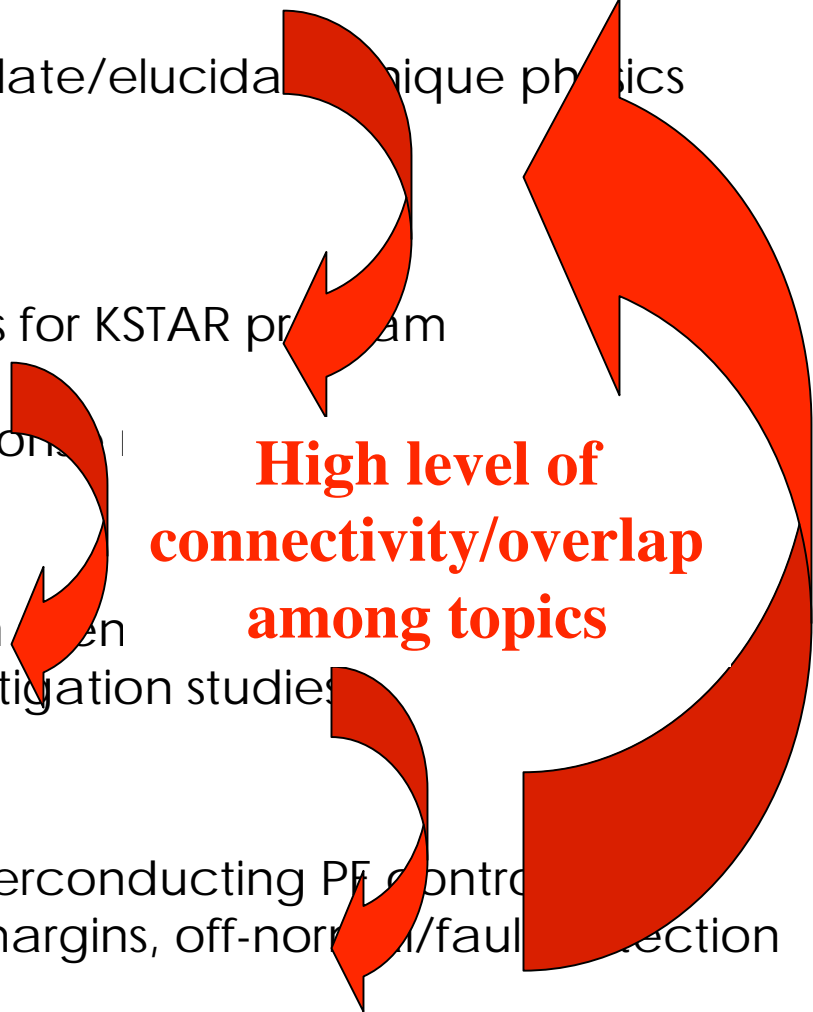
Presented at the
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April 15-16, 2009

KSTAR Can Explore Interesting Physics and Important Operations-Driven Experiments in 2009-10

- General physics studies:
 - Leverage capabilities of PCS to isolate/elucidate unique physics
 - Plasma-wall interaction, MHD, H/CD studies
- Plasma control:
 - Development of control algorithms for KSTAR program
 - Fundamental controllability studies
 - Detailed validation of plasma response models
- Operations Issues:
 - Optimization of startup/rampdown scenarios
 - Disruption characterization and mitigation studies
- ITER Design Support:
 - In-vessel coil use coupled with superconducting PF control
 - Disruption management: control margins, off-normal/fault detection and response, mitigation

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- 
- High level of connectivity/overlap among topics**

General Physics Experiments

- Experiments with non-axisymmetric fields using in-vessel coils (2010)
 - MHD Spectroscopy, magnetic braking
- Sawtooth suppression with ECH (2009/10)
- Puff and Pump density control (2010)
- Error Field experiments
 - Measurement, plasma response (2009?)
 - Open loop compensation (2010)
 - Dynamic (feedback) error field compensation (2010)
- ECH physics experiments (2009/10)
 - Pre-ionization/burnthrough; quantitative Cejima effect
 - Deposition, density pumpout, ...
- ICRF coupling experiments (2009/10)
 - Determine best parameters for coupling for the KSTAR configuration
- H-mode plasma experiments (2010)
 - Using the present H-mode Power Threshold scaling relations, the expected threshold power for KSTAR is about 2.8 MW in deuterium (large uncertainty ~50%; assuming $B=3.5$ T, $n_e=5 \times 10^{19}$ m⁻³, $S=48$ m²)
 - With H-mode access, a large array of higher performance experiments are possible, especially with regard to ELM and divertor behavior.

Control and Operations Experiments

- Axisymmetric magnetic control (2009/10)
 - Assess and improve magnetic diagnostics, reconstruction capability
 - Quantify fundamental PF capabilities and controllability
 - Validate axisymmetric plasma response models
- MHD control (2010)
 - NTM suppression/control island size, locked mode studies
 - RWM control: model validation, stable plasma response
- Disruptions (2009/10)
 - VDE, major disruption physics
 - Varying post-TQ plasma conditions
 - Mitigation by gas injection, nonaxisymmetric fields
 - Off-normal and fault detection/response: begin developing modules for ONF management, pursue operations solutions for disruption-free operation

ITER Design Support

- Controllability studies
 - In-vessel coil operation with SC PF coils (2010)
 - Fundamental controllability limits, quantify role of noise/disturbances (2009/10)
- SXR tomography for magnetics-free reconstruction: (2010)
 - Correlation with magnetic topology
 - Accuracy assessment
 - Methods for dealing with emissivity variation
- Startup/shutdown scenarios: (2009/10)
 - Input to ITER operations plan: develop and document commissioning process
 - Demonstrate/quantify aspects of ITER startup/rampdown scenarios with SC coils
 - Inboard/outboard startup comparisons, quantify accessible operating space and tradeoffs for startup
 - Demonstrate methods for dealing with magnetic materials, error fields
 - Rapid controlled shutdown scenarios: non-terminating mitigation methods, neutral point, control of runaway channel, nonaxisymmetric fields...
- Disruption characteristics and mitigation: (2009/10)
 - Prediction of post-thermal quench plasma conditions
 - Validate and expand models for scaling of forces, halo currents
 - Runaway electron generation physics, rapid uncontrolled shutdown/mitigation strategies appropriate for ITER
 - Useful disruption diagnostics: halo currents, force/displacement, photodiodes for radiation accounting, scintillators for runaway electron detection