KSTAR Long-term future needs, plans, and opportunities

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Short-term plan (2009 & 2010)

- **Physics target**
  - **International Milestone : IAEA FEC @ daejeon, Korea**
  - **Shape and position control reliability**
  - **Divertor plasma achievement**
  - **Heating research (ICRH, NBI, LHCD)**

- **Needs & opportunities**
  - **Actuator :**
  - **Diagnostics :**
  - **US Collaboration :**
  - **ITER priority :**

Mid-term plan (~ 2012)

- **Physics target**
  - **Achieve knowledge on supeconducting tokamak characteristics for H-mode operation**
  - **H-mode operation control**
  - **Plasma wall interaction**
  - **RWM, FEC operation for ELM control**

- **Needs & opportunities**
  - **Actuator :**
  - **Diagnostics :**
  - **US Collaboration :**
  - **ITER priority :**

Short & Mid-term experiment plan

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Operation (Vac,CD & WU)	**'08. 3 ~ '08. 8 (6 mon.)**	**'09. 8 ~ '09.12 (5 mon.)**	**'10.6 ~ '10. 11 (6 mon.)**	**'11. 4~ '11. 9 (6 mon.)**	**'12. 2 ~ '12. 7 (6 mon.)**
Experimental Goals	• First plasma startup • 2nd Harmonic ECH pre-ionization	• 1st Harmonic ECH Pre-ionization • Startup stabilization	• Shaping control & vertical stabilization • Heating	• Confinement (L-H) • Stabilization • Heating	• Plasma–Wall Interaction • Profile control • RWM, ELM control • Off-axis current drive
Target Operation Parameters	• B_T ~ 1.5 T • I_P > 0.1 MA • t_P > 0.1 s • Te > 0.3 keV • Ti ~ 0 keV • Flux ~ 1 Wb • Shape ~ Circular • Gas : H_2	• B_T ~ 3 T • I_P > 0.3 MA • t_P > 2 s • Te > 0.3 keV • Ti ~ 0.3 keV • Flux ~ 2 Wb • Shape ~ Circular • Gas : H_2, D_2	• B_T ~ 3 T • I_P < 1 MA • t_P ~ 10 s • Te ~ 1 keV • Ti ~ 1 keV • Flux ~ 4 Wb • Shape ~ DN(double null) • Gas : H_2, D_2	• B_T ~ 3 T • I_P < 1.5 MA • t_P ~ 10 s • Te ~ 1 keV • Ti ~ 3 keV • Flux ~ 6 Wb • Shape ~ DN & SN • Gas : D_2	• B_T ~ 3 T • I_P < 2 MA • t_P > 100 s (0.5 MA) • Te ~ 1 keV • Ti ~ 5 keV • Flux ~ 8 Wb • Shape ~ DN & SN • Gas : D_2
PFC & Wall conditioning	• Inboard limiter (belt) • Gas puff	• Inboard limiter (w/o cooling) • Boronization	• Divertor / Passive plate • PFC baking • In-vessel coil	• Cryopump operation • PFC cooling	• PFC cooling • *Pellet*
Magnetic control	• TF : 1.5 T • PF : 4 kA unipolar	• TF : up to 3.5 T • PF : +/-4 kA	• TF : up to 3.5 T • PF : +/-10 kA • IVCC : VS, RS	• TF : up to 3.5 T • PF : +/-15 kA • IVCC : FEC. RMP	• TF : up to 3.5 T • PF : +/-20 kA • IVCC : RMP, RWM
Heating operation	• ECH(84G): 0.5MW, 0.4s	• ECH(84GHz): 0.5MW, 2s • ICRH(45MHz): 0.3MW, 10 s	• ECH(84/110GHz): 0.5MW • ICRH(45MHz): 1MW, 10 s • NBI: 1.0MW, 10s • LHCD: 0.5MW, 2s	• ECH(84/110GHz): 0.5MW • ICRH(45MHz): 2MW, 10 s • NBI: 2.5MW, 10s • LHCD: 0.5MW, 2s • ECCD(170GHz): 1MW, 10s	• ECH(84/110GHz): 0.5MW • ICRH(45MHz): 2MW, 300 s • NBI :5MW, 300s • LHCD : 1MW, 2s • ECCD(170GHz): 1MW, 300s
Diagnostics	• MD (77 Ch)/ MMWI / ECE / Hα / filterscope / VS / TV	• MD/ MMWI / ECE / Hα / filterscope / VS / TV • PD / XCS (1 set) / Bolometer (resistive) / Reflect. / Soft X-ray	• MD / MMWI / ECE / Hα / filterscope / VS / TV • PD / XCS / Bolometer / Reflect. / Soft X-ray • Thomson Scattering / Hard X-ray / Fast neutral / IR TV / ECEI	• MD / MMWI / ECE / Hα / filterscope / VS / TV • PD / XCS / Bolometer / Reflect. / Soft X-ray • TS / Hard X-ray / Fast neutral / IR TV / ECEI • MSE / FIR / CES / neutron	• MD / MMWI / ECE / Hα / filterscope / VS / TV • PD / XCS / Bolometer / Reflect. / Soft X-ray • TS / Hard X-ray / Fast neutral / IR TV / ECEI • MSE / FIR / CES / neutron / VUV • MIR / BES / CI /

Long-term plan (mainly by 2017)

- **Physics target**
  - **International milestone : ITER construction completion**
  - **Role as ITER pilot**
  - **Steady-state operation control**
  - **H-mode plasma stabilization for long pulse**
  - **AT mode (high beta) operation achievement with available heating system**

- **Needs & opportunities**
  - **Actuator :**
  - **Diagnostics :**
  - **US Collaboration :**
  - **ITER priority :**

Long-term experiment plan