Low-risk Beginning of the Density Feedback Control in KSTAR

June-Woo Juhn[a]*, Sang-hee Hahn[a], Yong-Seok Hwang[b], K. P. Kim[a], Y. O. Kim[a], Y. U. Nam[a] and J. I. Song[a]
[a] National Fusion Research Institute, Daejeon, Korea, [b] Seoul National University, Seoul, Korea
*jwjuhn@nfri.re.kr

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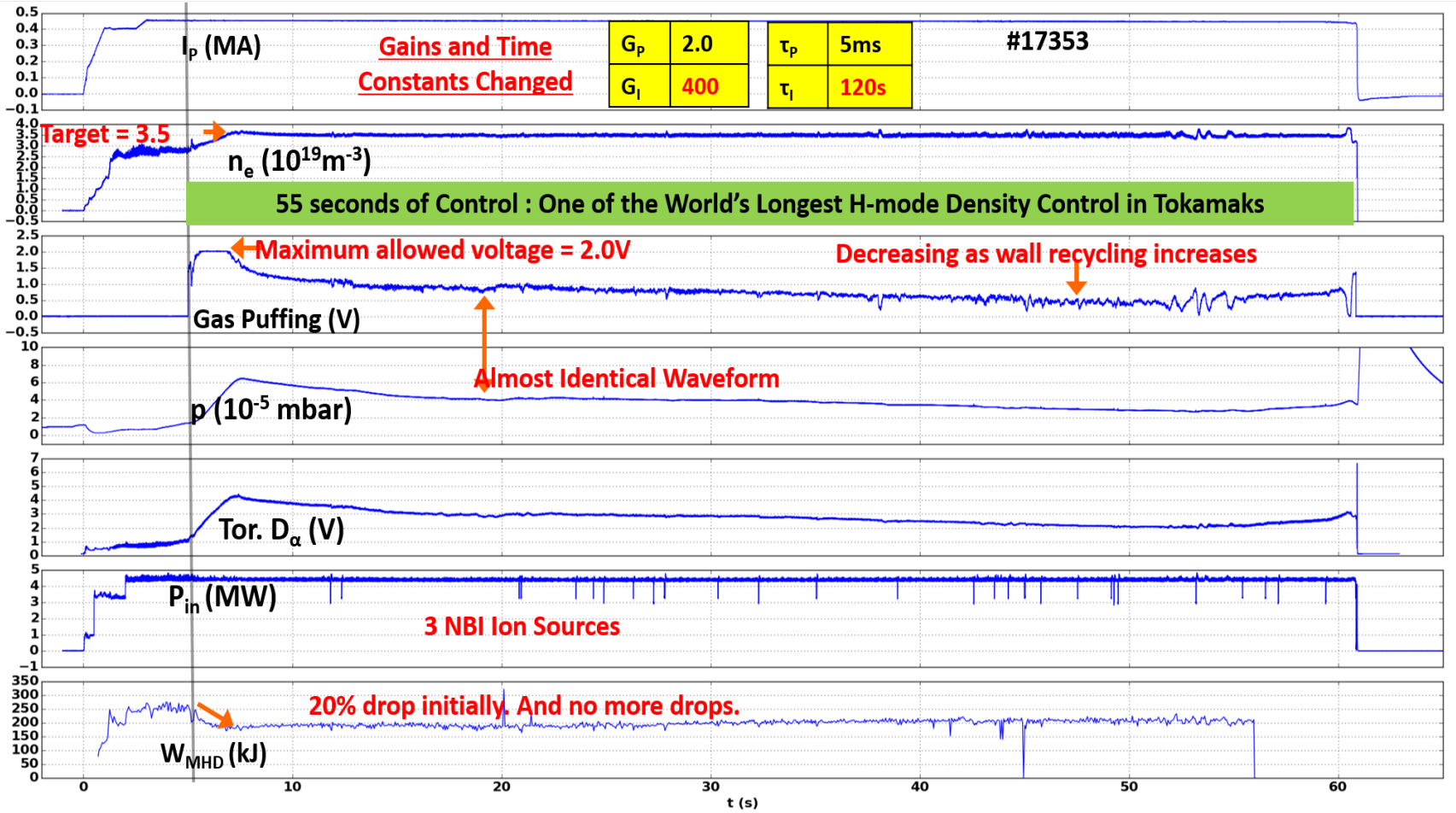

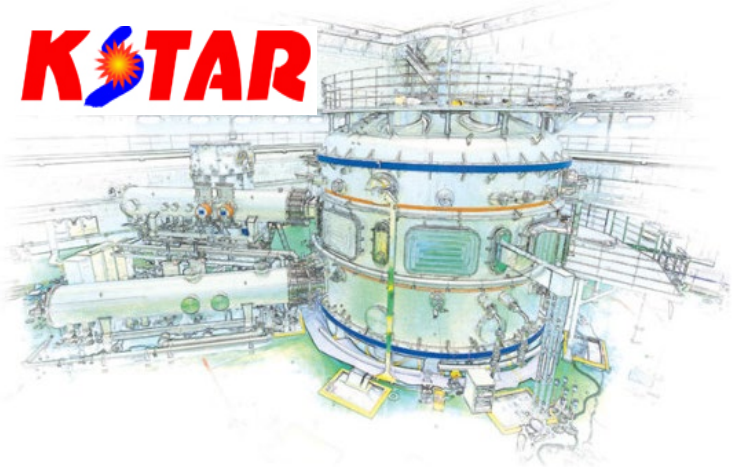

Now, density control is widely used for plasma physics experiments such as…

- L/H power threshold experiments
- SOL characteristics analysis with FRPA
- Mode locking with RMP
- Rotation reversal experiments
- MGI-based disruption-mitigation experiments
- And more …

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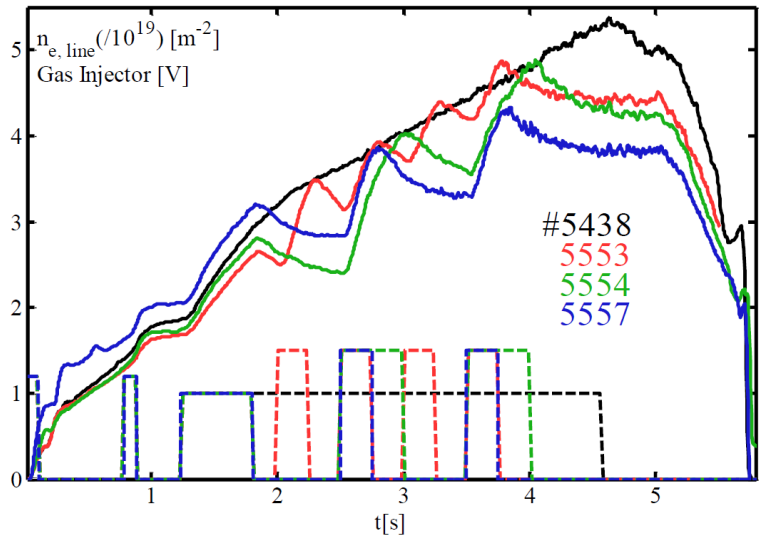
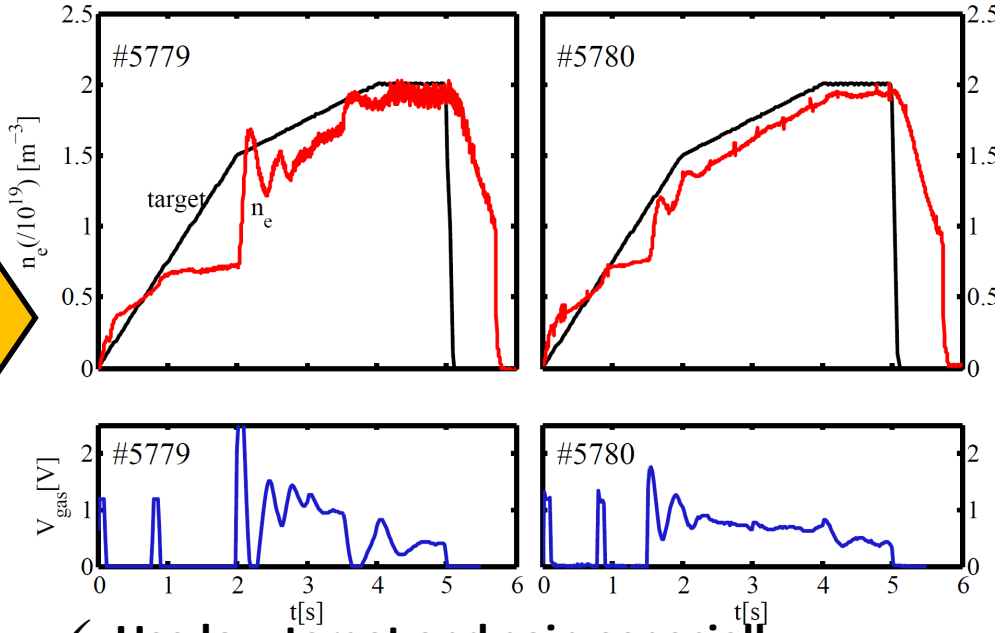


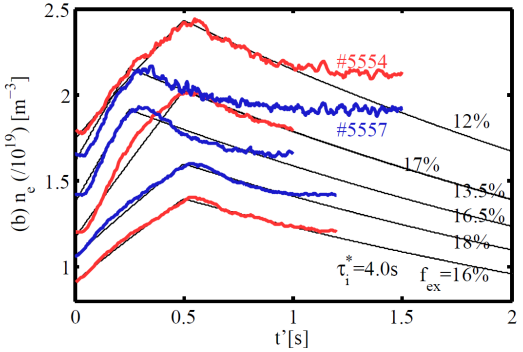
Performance Estimation

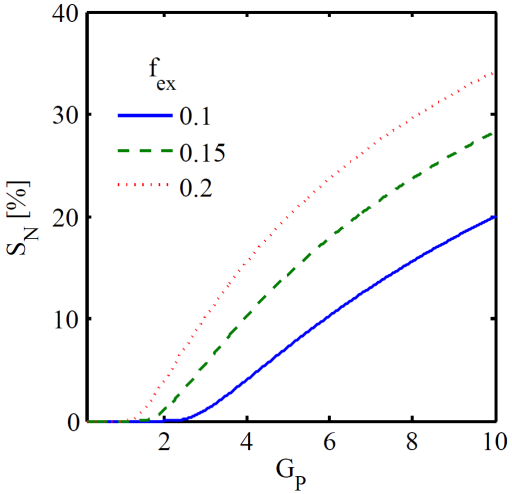
- Natural Frequency
- Damping Ratio
- Settlement Time (s)
- Overshoot Ratio (%)
- Critical Gain
- Rising Time (s)



$$\frac{dN_i}{dt} = -\frac{N_i}{\tau_i} + R\frac{N_i}{\tau_i} + f_{ex}\Phi = -\frac{(1-R)}{\tau_i}N_i + f_{ex}\Phi$$

$$= -\frac{N_i}{\tau_i^*} + f_{ex}\Phi \ ,$$





- ✓ **Use low target and gain especially in the beginning of the feedback**
  - Not to overshoot too much
- ✓ **Avoid to use integral gain**
  - For simple and intuitive results
  - Instead, increase gain to reduce s.s. error
- ✓ **No use of derivative gain in the first try**
  - signal noise may amplify the actuator