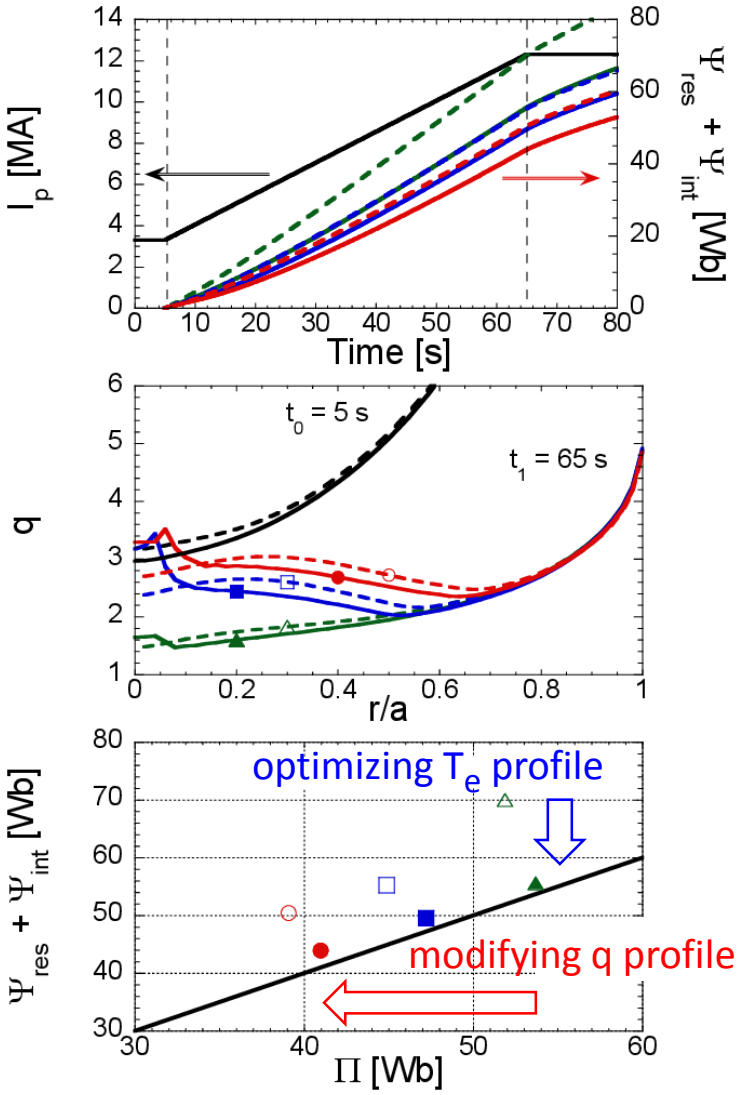
Reduction of CS flux consumption during plasma current ramp-up on DEMO reactor

T. Wakatsuki, et al., EX/P8-38



- We have found a scheme to minimize the poloidal flux consumption to reduce the size of a central solenoid (CS) by only EC heating
  - No EC current drive (CD)
  - DEMO reactor : JA Model 2014 (I_p = 12.3 MA, R = 8.5 m)

$$\int_{t_0}^{t_1} V_{\mathrm{loop}}^{\mathrm{surface}}\,\mathrm{d}t = \int_{t_0}^{t_1} V_{\mathrm{loop}}^{\mathrm{axis}}\,\mathrm{d}t + \int \frac{f\left\langle R^{-2}\right\rangle V'}{2\pi}\left(\frac{1}{q|_{t=t_1}} - \frac{1}{q|_{t=t_0}}\right)\mathrm{d}\rho$$

$= \Psi_{res}+\Psi_{int}$ — reduced to ~ 0 — $\equiv \Pi$ — Lower limit of $\Psi_{res}+\Psi_{int}$ without CD effect

- Flux consumption is reduced without changing time evolution of the q profile by minimizing $V_{\mathrm{loop}}^{\mathrm{axis}}$ through T_e profile optimization
  - cf. open symbols and closed symbols
- The lower limit of reduction is quantified as Π
  - Dependent on q profile at the end of current ramp-up
  - cf. green, blue and red closed symbols
- 10% reduction of CS radius (20% reduction of flux consumption) is possible by EC heating for a weakly reversed shear plasma