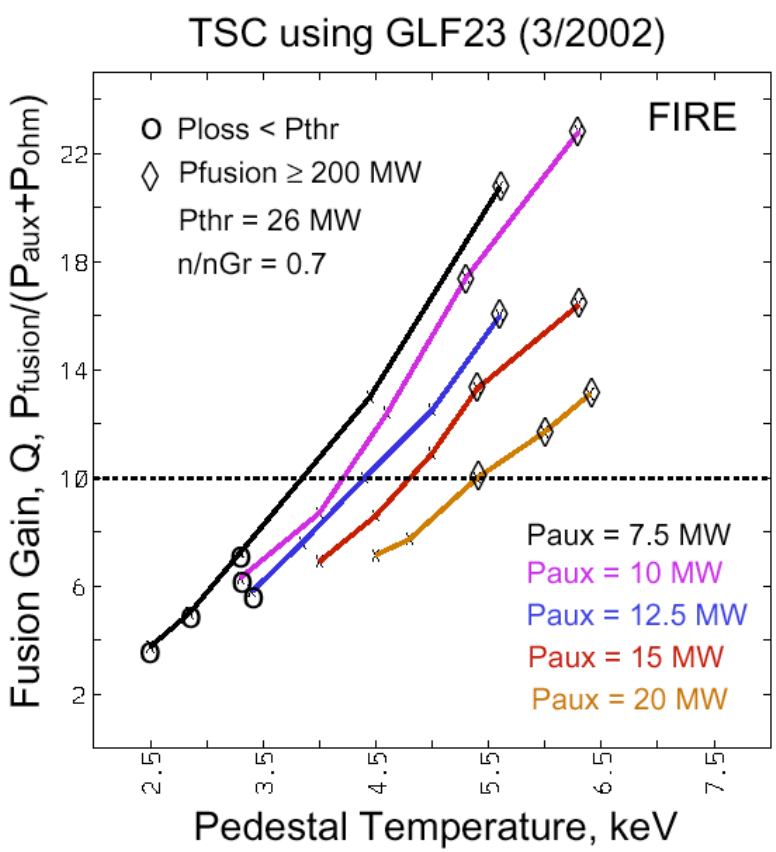
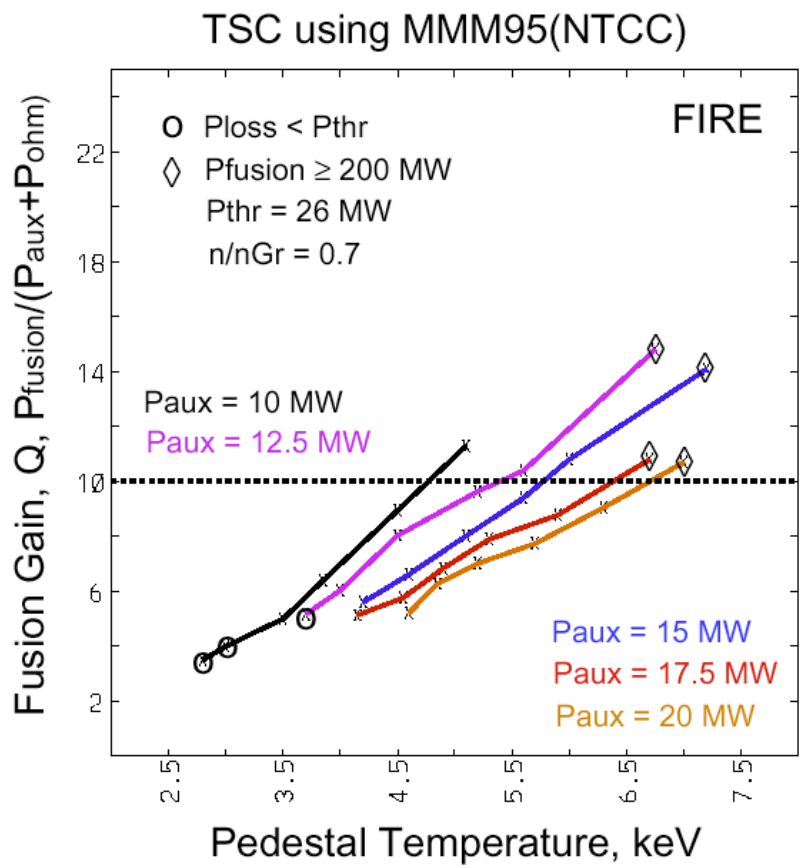
FIRE: OVERALL ASSESSMENT AND REMAINING ISSUES

- Assessment
  - FIRE has significant operating space for burning plasma physics at $Q = 10$.
    - Benefits from triangularity and modest density.
  - Capability to pursue near steady-state AT with current profile and MHD control and extensive (DNB?) diagnostic set for $\tau_{DUR}/\tau_{CR} \approx 1\text{-}3$.
- Remaining issues
  - Pedestal requirements $T_{ped} \approx 3\text{-}6$ keV, but predictive capability is still not firmly established.
    - Partially driven by uncertainties in core transport models.
  - H98(y,2) = 1.1 required in base scenario.
  - Density peaking needed at lower H98(y,2), but no well-founded basis for this peaking.
  - AT operating space assumes high divertor radiation.

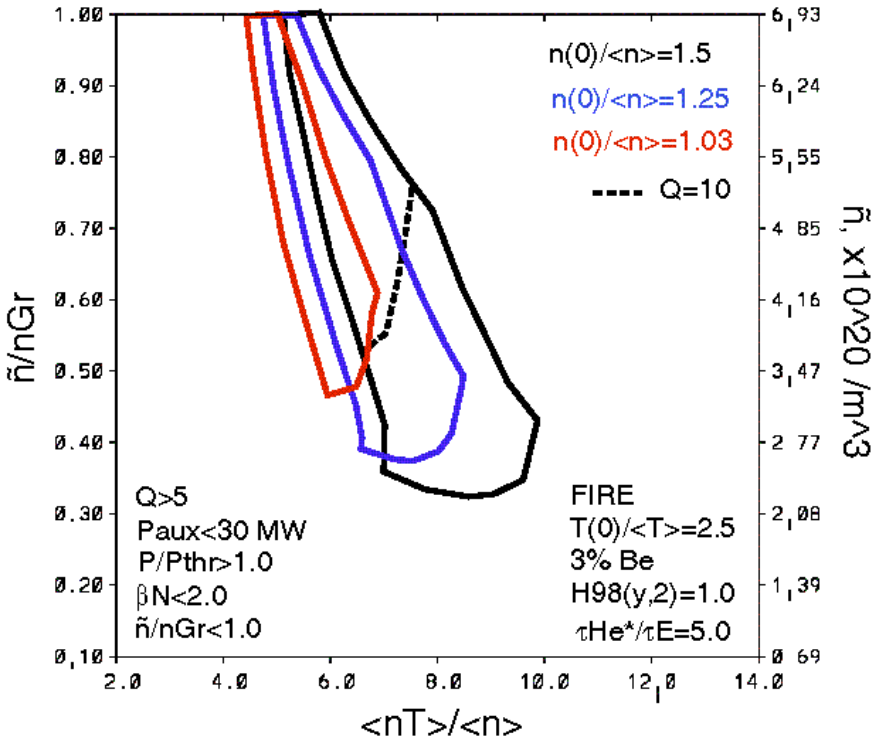
T_{PED} = 3-6 keV REQUIRED FOR Q = 10 IN FIRE

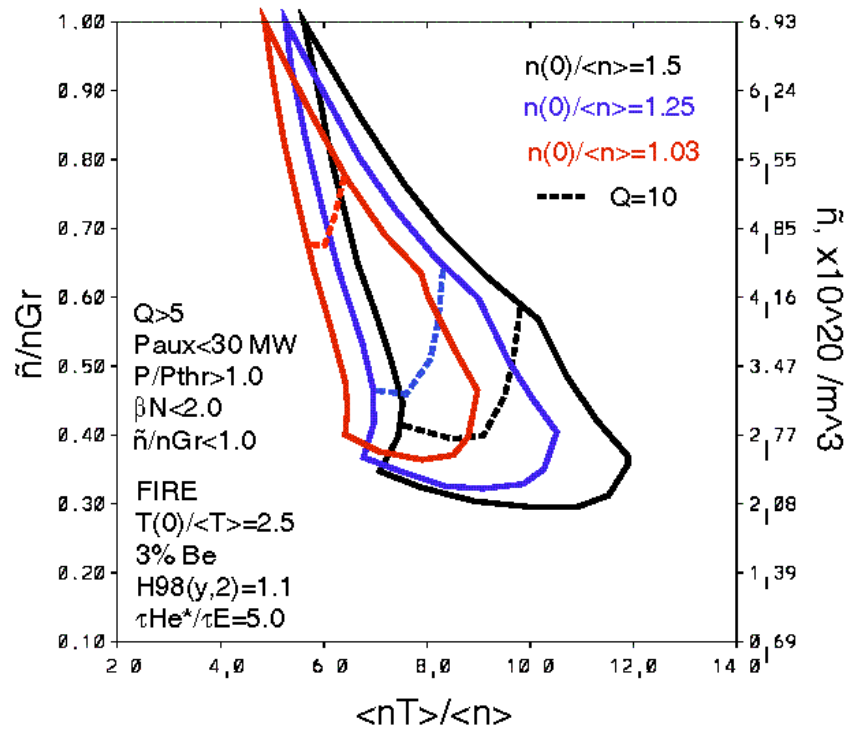




- **Result is robust to model: both GLF23 and MMM95 produce similar result.**

FIRE OPERATING SPACE REQUIRES PEAKED DENSITY PROFILES OR $H_{98(y,2)}$ >1





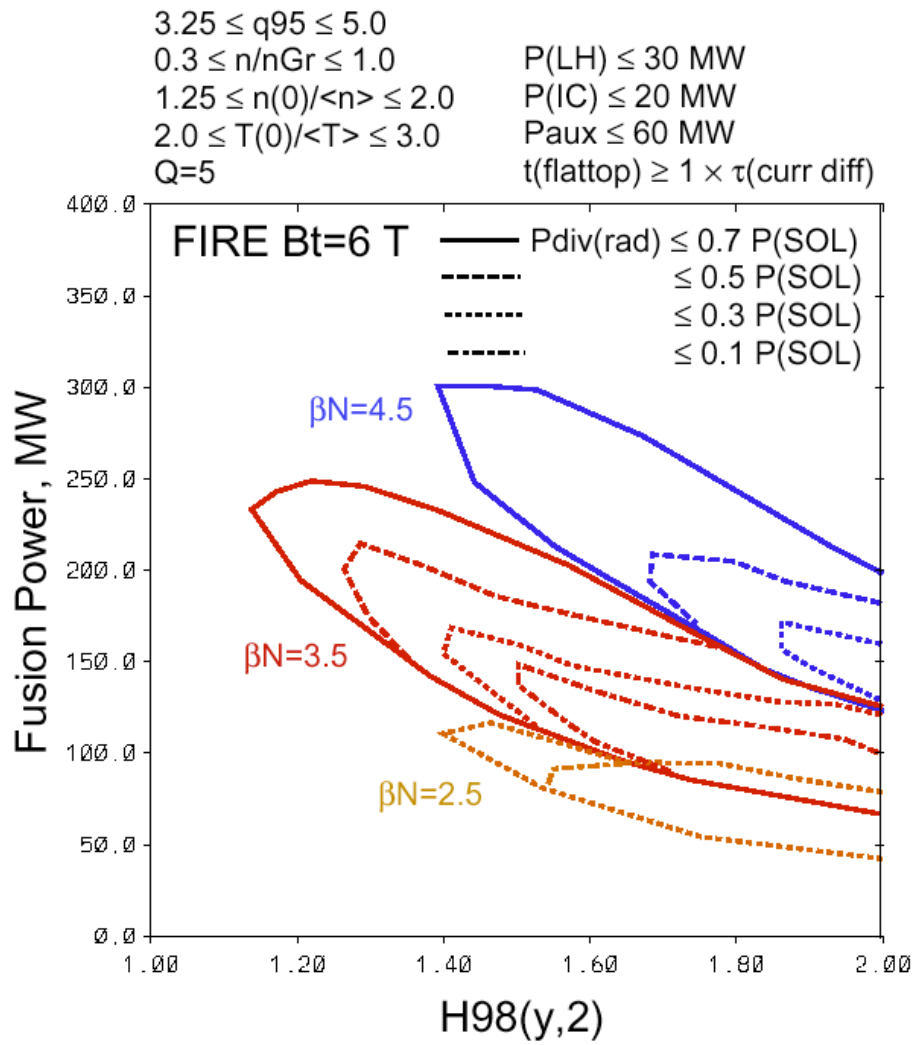
- ***Q***=10 operating space exists without density peaking with $H_{98(y,2)}$ = 1.1.
- With $H_{98(y,2)}$ = 1.0, no ***Q***=10 operating space exists for ***n***(0)/<***n***> < 1.5.

FIRE: OVERALL ASSESSMENT AND REMAINING ISSUES

- **Assessment**
  - FIRE has significant operating space for burning plasma physics at $Q = 10$.
    - Benefits from triangularity and modest density.
  - **Capability to pursue near steady-state AT with current profile and MHD control and extensive (DNB?) diagnostic set for $\square_{DUR}/\square_{CR} \approx$ 1-3.**
- **Remaining issues**
  - Pedestal requirements $T_{ped} \approx$ 3-6 keV, but predictive capability is still not firmly established.
    - Partially driven by uncertainties in core transport models.
  - H98(y,2) = 1.1 required in base scenario.
  - Access to high density peaking needed at lower H98(y,2), but no well-founded basis for this peaking.
  - **AT operating space assumes high divertor radiation.**

LARGE FIRE AT OPERATING SPACE REQUIRES INCREASED DIVERTOR RADIATION

- **Developing radiative divertor solutions for AT operating regimes is a challenge for ongoing research program.**



PULSE LENGTH IN FIRE MAY LIMIT ABILITY TO PURSUE STEADY-STATE

- **Long pulse capability (τ_{DUR}/τ_{CR} > ~1-3) identified as a key requirement for Advanced Tokamak burning plasma experiment.**

- **FIRE is limited to pulse lengths at the lower end of this range:**
  Does this allow for study of steady-state AT regimes?