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Effect of plasma squareness on confinement in TCV

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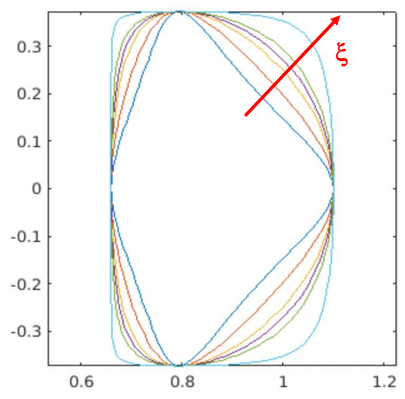
Summary

- Scan in **plasma squareness** ξ achieved in TCV
- Confinement in L-mode: no clear trend within the explored range of ξ
- EPED-CH predicts highest pedestals for low ξ
- Pedestals limited by low n-modes for low ξ
- Confirmed in TCV experiments for a limited dataset

Introduction - Motivation

$$R = R_0 + a\cos(\theta + \delta\sin\theta - \xi\sin 2\theta),$$
$$Z = \kappa a \sin(\theta + \xi\sin 2\theta),$$
[1]



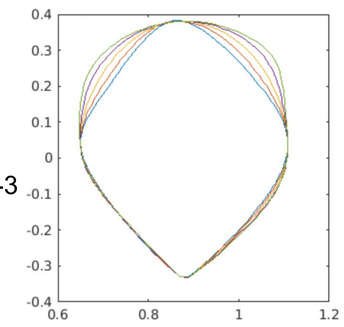
- Operating at large squareness is beneficial [3]:
  - Larger plasma volume
  - Higher q_{95} at given plasma current ➔ good for QCE for instance
  - Increase vertical stability
- **Impact on pedestal structure?**
- **Impact on confinement?**

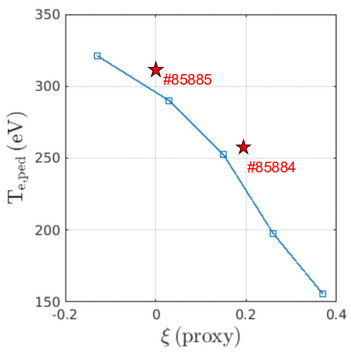
- Previous DIII-D results:
  - It has been shown that access to the second regime of ballooning stability is facilitated by moderate squareness [2]
  - At large squareness, the stability threshold in the edge pressure gradient is predicted to be reduced and the most unstable mode is expected to have higher values of n. [4]
- In practice, it is almost impossible to change squareness independently of triangularity, except at δ=0 (for diverted plasmas)

Predictions of pedestal structure

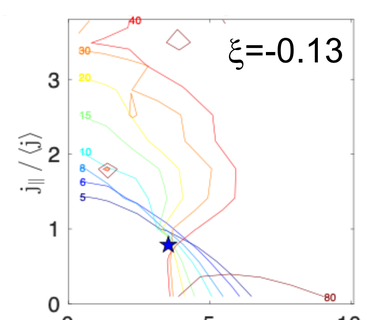
- EPED-CH workflow [5]

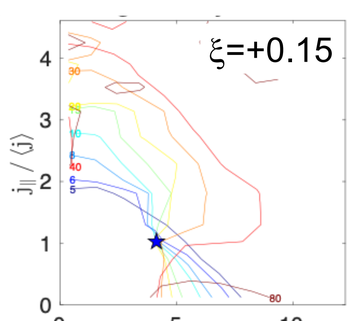
- Input parameters
  - I_p = 210 kA
  - B_T = 1.4 T
  - $n_{e,ped} = 3\text{x}10^{19}$ m^{-3}
  - β_N = 1.6

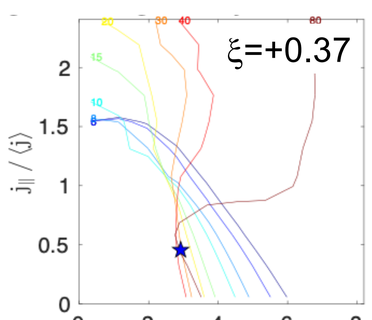




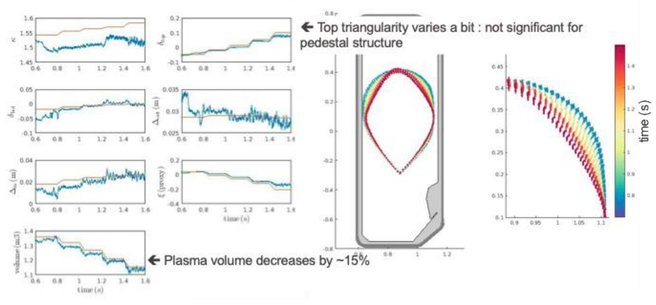
- Pedestal temperature is predicted to decrease when squareness is increased
- At low squareness, pedestal is limited by low n modes



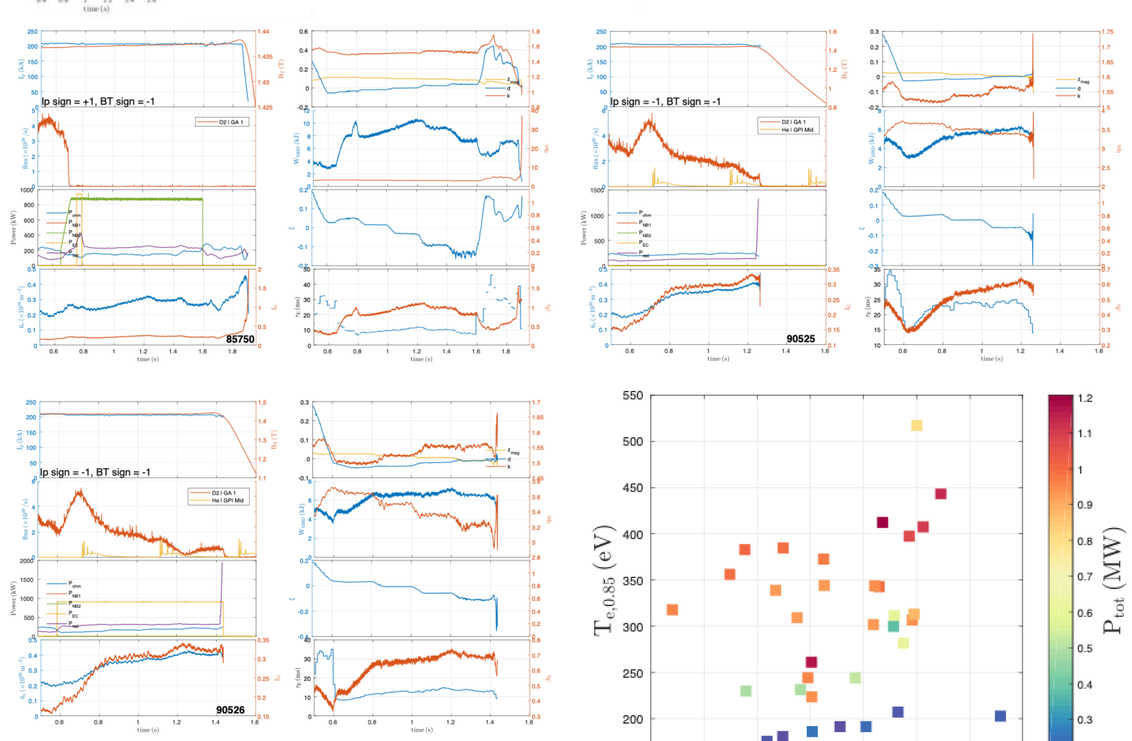




L-mode: confinement

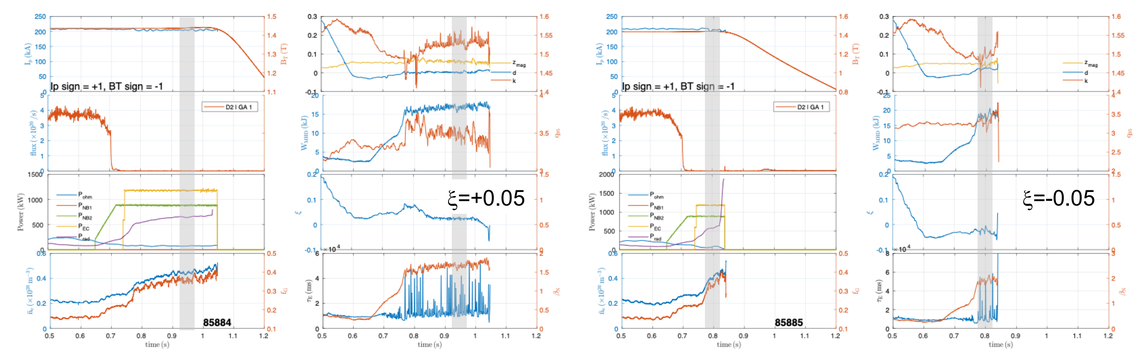


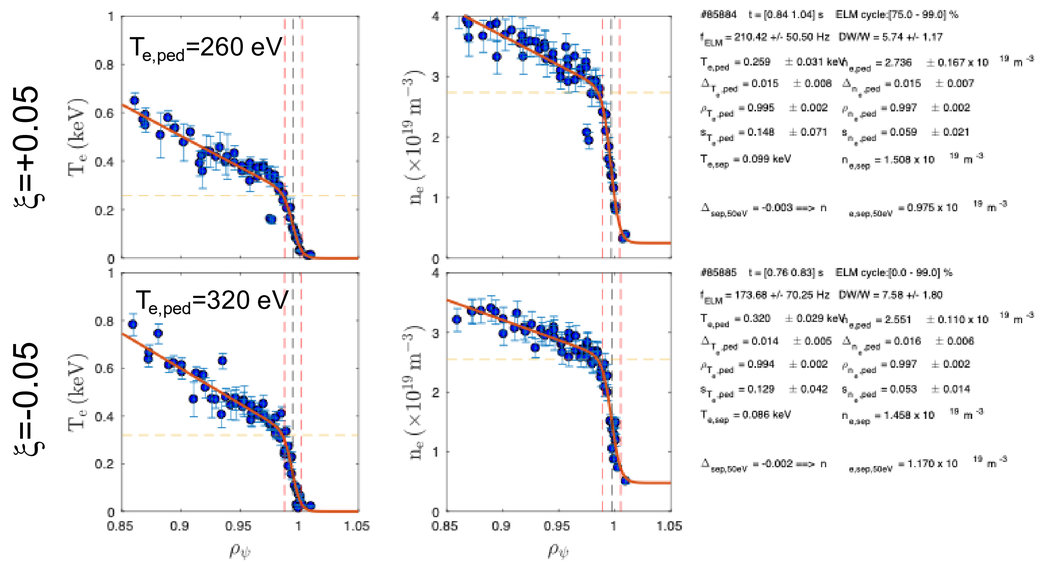
- Experimental strategy
  - ξ scan within a shot at fixed δ (~0) and κ
  - Add heating for H-mode access

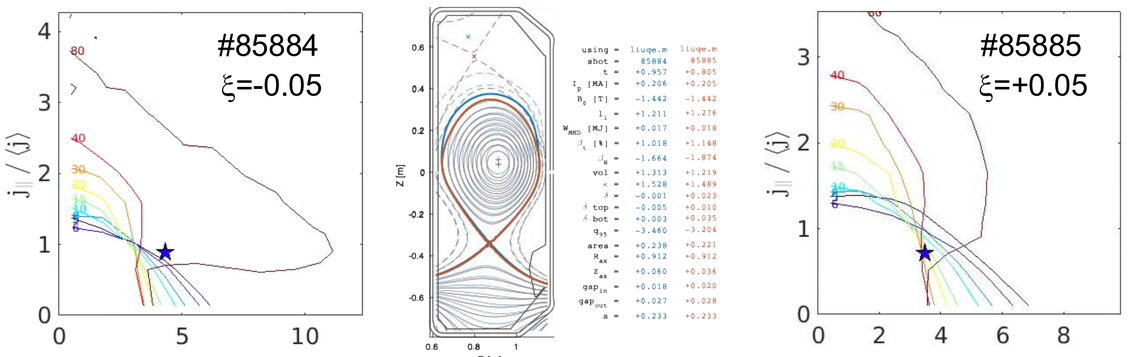


- No clear trend - Further analysis needed

H-mode: pedestal structure







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