Validation of electron-scale GK simulations and comparisons with a synthetic high-k diagnostic

Summary

- Systematic validation study of electron-scale turbulence using high-k scattering.
- Outer core of NSTX NBI-heated H-mode (r/a~0.7).
- Combined comparisons between exp. and simulation (NL GYRO)
  - e- thermal transport P_e [MW]
  - e- scale f-spectra
  - e- scale k-spectra shape.
  - Fluctuation level ratio between strongly and weakly driven ETG-turbulence conditions.
- Comparisons are quantified via validation metrics to discriminate between sims.

Main result:

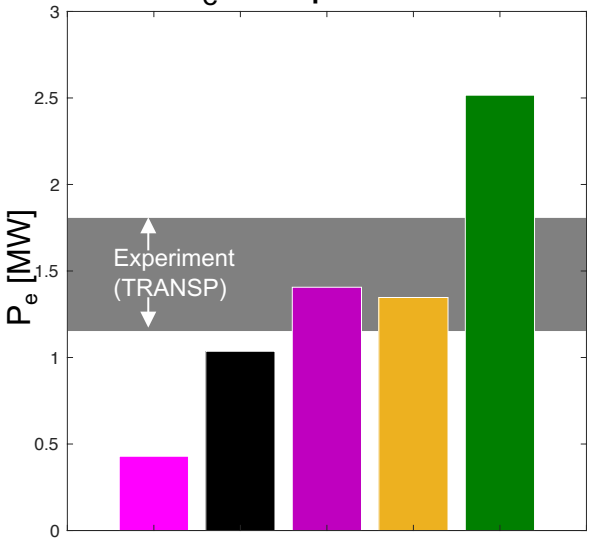
1st simultaneous agreement between exp. & sim. of P_e, f-spectra, k-spectra of e- scale turbulence ➔ strongest experimental evidence suggesting ETG-driven turbulence dominates in core-gradient region of NSTX NBI-heated H-modes.

Upcoming publications:

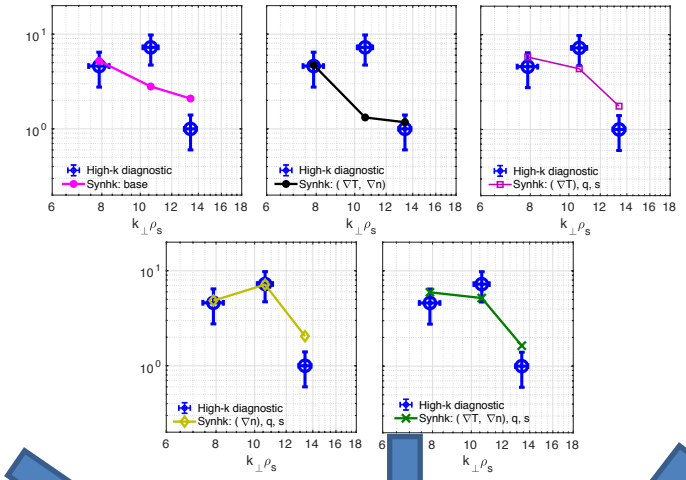
- Validation of e- scale turbulence PPCF 2019 [submitting this week].
- Synthetic high-k diagnostic [submitting in < 1 month].

All comparisons are condensed via a composite metric for discrimination between simulations

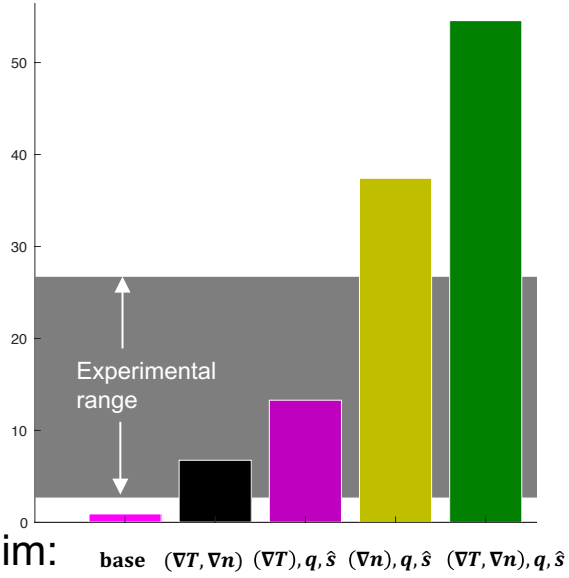
P_e comparisons



k-spectra shape comparisons



Fluctuation level ratio comparisons



- Composite validation metric M_1 [*]:

Scans:	M_1
Base	0.672
$\sigma(\nabla T,\nabla n)$	0.472
$\sigma(\nabla T), q, \hat{s}$	**0.397**
$\sigma(\nabla n), q, \hat{s}$	**0.402**
$\sigma(\nabla T,\nabla n), q, \hat{s}$	0.762

1 = bad
0 = good

[*] Holland PoP 2016