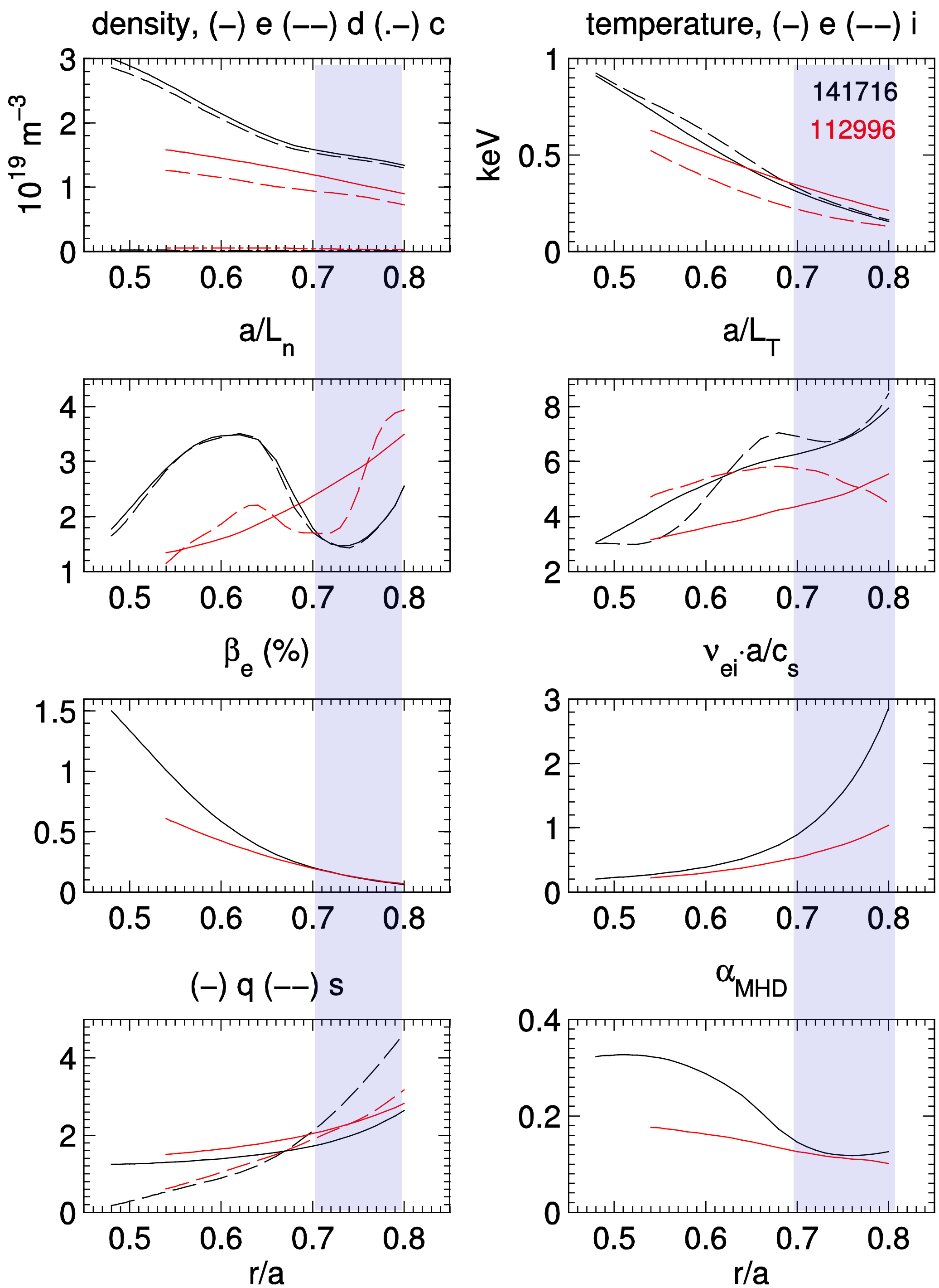
Goal: Identify a standard ST L-mode set of parameters to validate TGLF with linear & nonlinear GYRO

- Many tests already done for:
  - NSTX 141716A48, t=0.448 s (Ren et al., Nucl. Fusion 2013)
  - NSTX 112996A06, t=0.243 s (Staebler et al., IAEA 2008; Stutman, PoP 2006)

- Want to emphasize high trapped fraction & collisionality at low aspect ratio

Profiles from two NSTX L-modes

- Around r/a=0.7-0.8
  - $n_e \approx n_i$ (relatively pure)
  - T_e/T_i=1-1.5
  - a/L_n=1-3
  - a/L_T=4-8
  - β_e=0.1% (EM weak)
  - ν_{ei}=0.5-2 c_s/a
  - q=2-3
  - s=2-4
  - R/a≈1.4 (r/R≈0.5)
  - $\kappa \approx 1.5$
  - $\delta \approx 0.1$



Establishing STL-STD base case around 141716, r/a=0.75

- Creating STL-STD by mostly rounding numbers

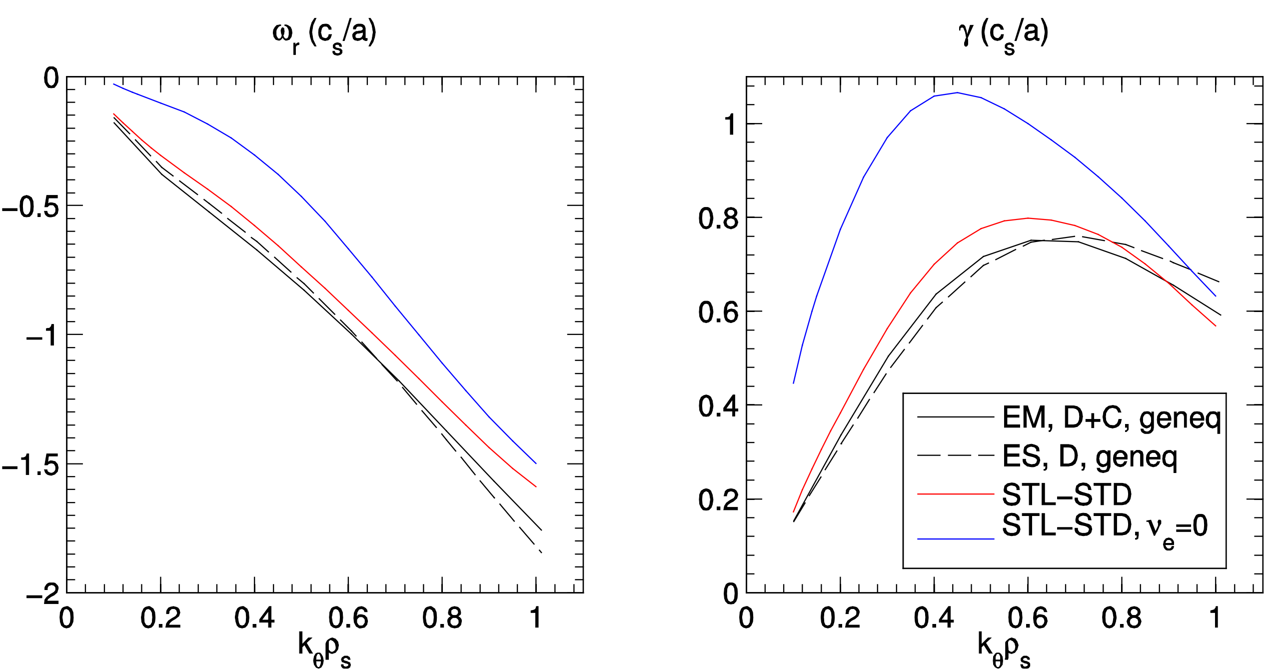
	r/a	q	s	T_e/T_i	a/L_{Ti}	a/L_{Te}	a/L_n	Z_{eff}	ν_{ei}	β_e (%)	γ_E	γ_p	Ma	ρ_*
exp.	0.75	2.06	3.23	0.95	6.84	6.79	1.53	1.15	1.56	0.12	0.25	-0.95	-0.38	0.0031
STL	**0.75**	**2**	**3**	**1**	**6**	**6**	**2**	**1**	**1.0**	**0.1**	**0**	**0**	**0**	**$\rightarrow$0**

	r/a	R/a	Z/a	κ	δ	ζ	dR/dr	dZ/dr	s_κ	s_δ	s_ζ
exp.	0.75	1.404	0.008	1.546	0.104	-0.019	-0.34	-0.002	0.063	0.124	-0.019
STL	**0.75**	**1.4**	**0**	**1.5**	**0.1**	**0**	**-0.3**	**0**	**0.1**	**0.1**	**0**

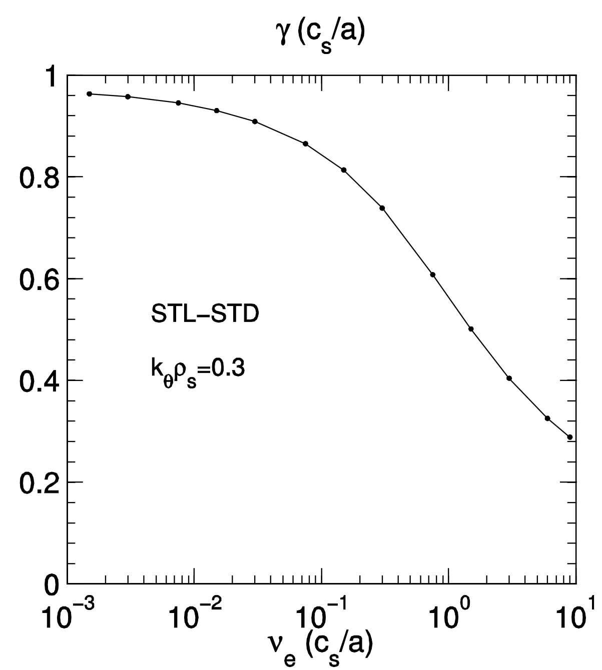
Linear runs – comparing experimental vs STL-STD

- (black solid) experimental parameters with general numerical equilibrium, fully EM and carbon
- (black dashed) electrostatic and deuterium only – small change
- (red) STL-STD parameters - pretty close to experimental case
- (blue) STL-STD but with no collisions

Linear spectra



Collisionality scan

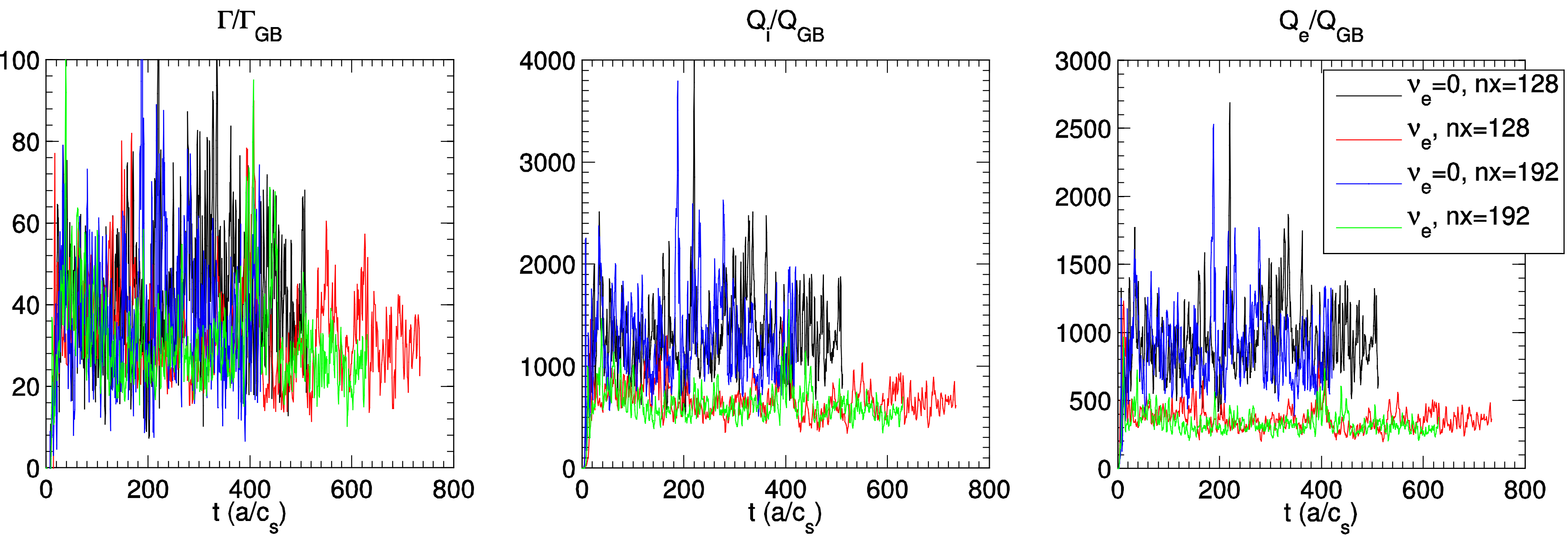


Establish convergence for STL-STD (both ν_e=0 & 1)

- Baseline resolution for ν_{ei}=0 & 1.0 c_s/a:
  - $L_x \times L_y$=126×126 ρ_s, $n_x \times n_y$=128×32, $n_E \times n_\lambda$=8×12, n_θ=14(×2)
- At early times small wings were developing at high (k_x,k_y) so I also started a case with higher radial resolution (n_x=192), but ultimately didn't matter much
- Collisionless case peaks at very low k_y=0.1 (spectra on following slides)
  - Perhaps even bigger box would be in order? (Ly=126, Δk_y=0.05 corresponds to Δn=6 for this case)

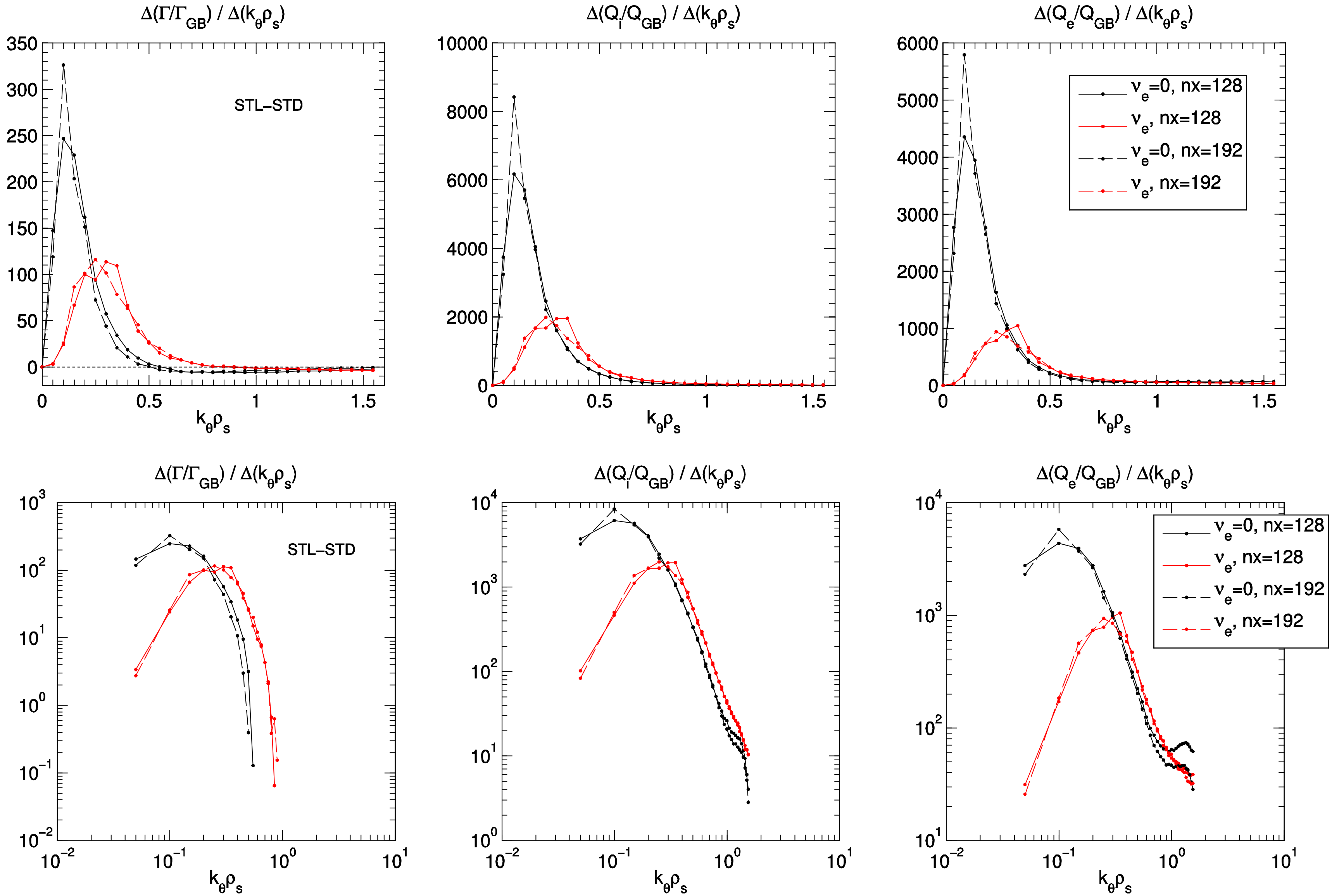
ν_{ei}	L_x (rs)	L_y (rs)	nx	ny	dt (c_s/a)	t_{max} (c_s/a)	**Q_i** (Q_{GB})	**Q_e** (Q_{GB})	Q_e (k_y>1) %	k_y peak
0	126	126	128	32	0.002	~700	**1367**	**989**	4	0.1
0	126	126	192	32	0.002	~420	**1295**	**893**	3	0.1
1	126	126	128	32	0.005	~750	**657**	**356**	2	0.35
1	126	126	192	32	0.003	~630	**623**	**330**	6	0.2

Time series



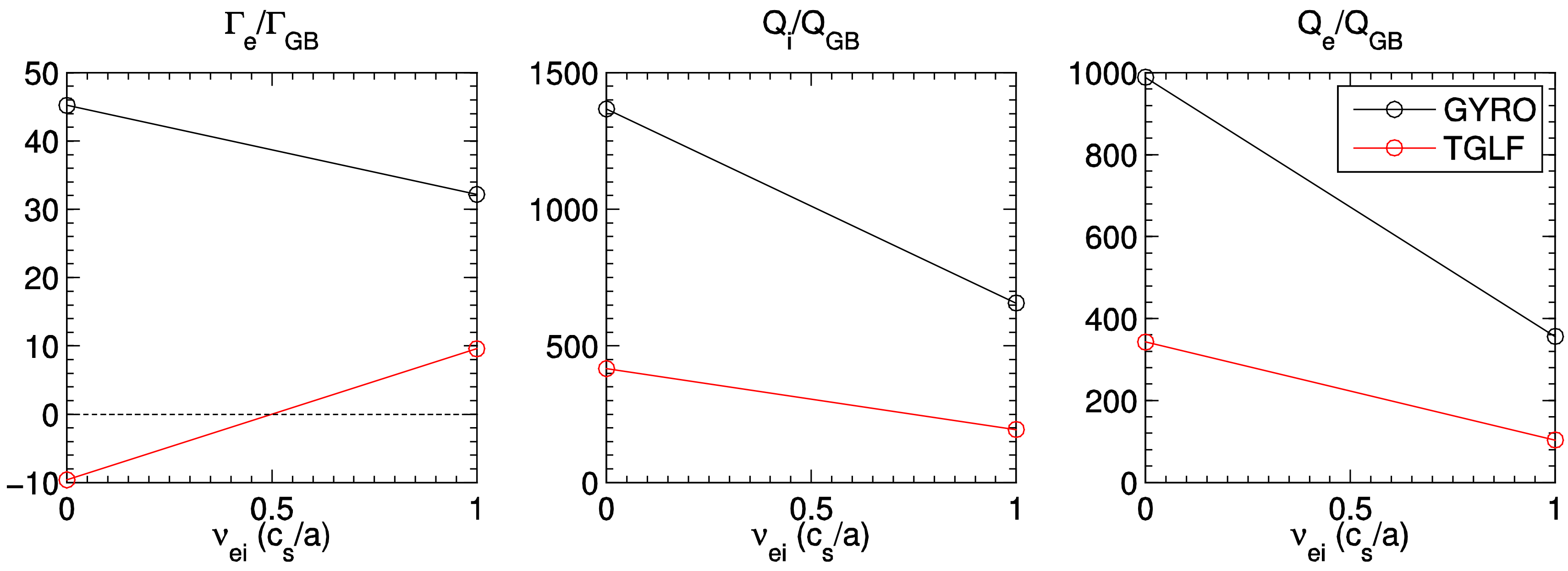
Γ/Γ_GB
Q_i/Q_GB
Q_e/Q_GB
ν_e=0, nx=128
ν_e, nx=128
ν_e=0, nx=192
ν_e, nx=192
t (a/c_s)
t (a/c_s)
t (a/c_s)

Clear peaks in transport spectra (low k_y=0.1 peak for ν_{ei}=0)



Comparison of total fluxes with TGLF

- TGLF heat fluxes ~3× lower than GYRO
- Sign of particle flux opposite for ν_e=0



Comparison with TGLF flux spectra