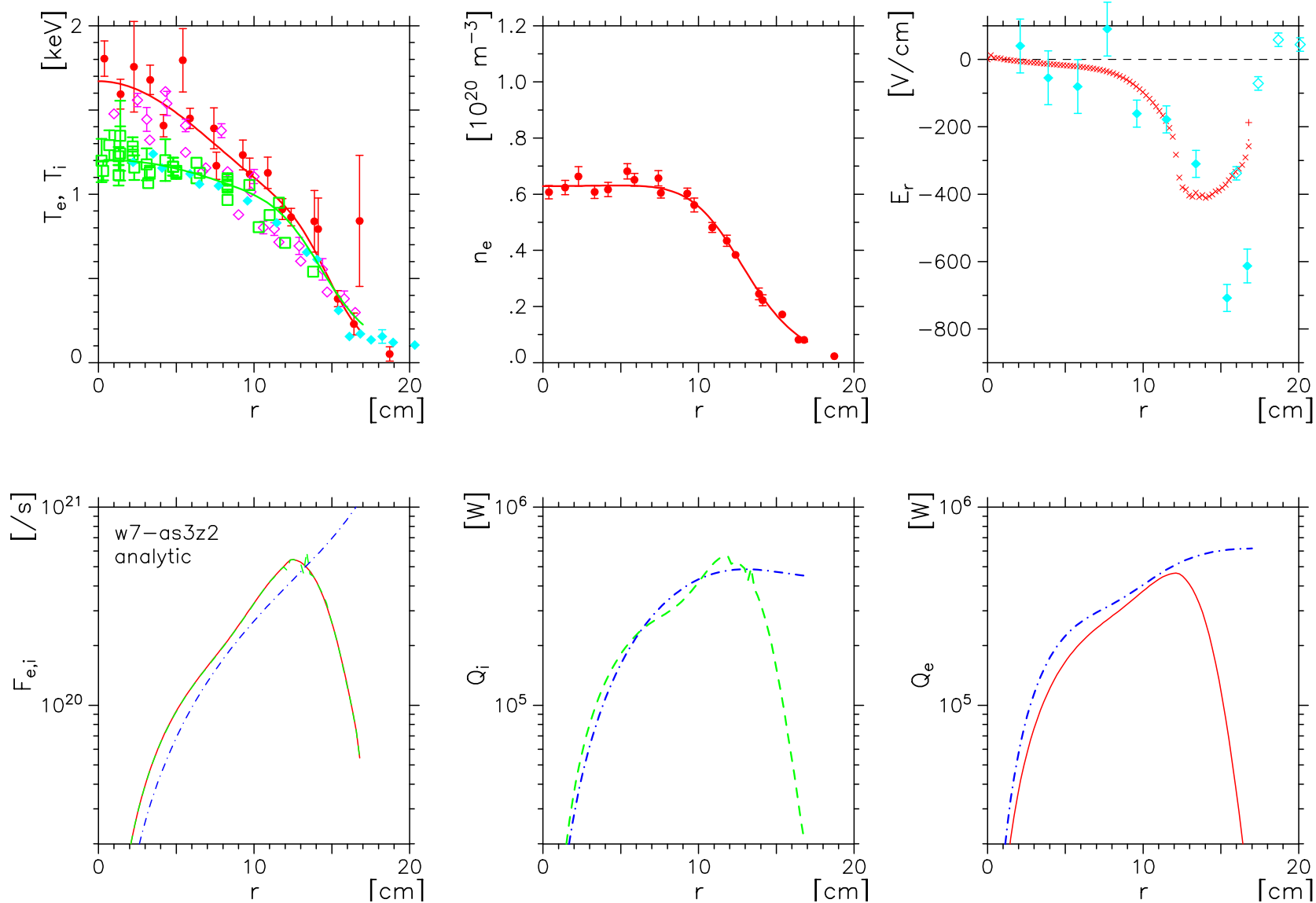


shot 34313: 680 kW NBI, 750 kW ECRH absorbed power



neoclassical **ion** and **electron** fluxes compared to
fluxes from **particle and energy balance**

Scalings of $1/\nu$ Transport with Dimensional Examples



$1/\nu$ transport scales as:

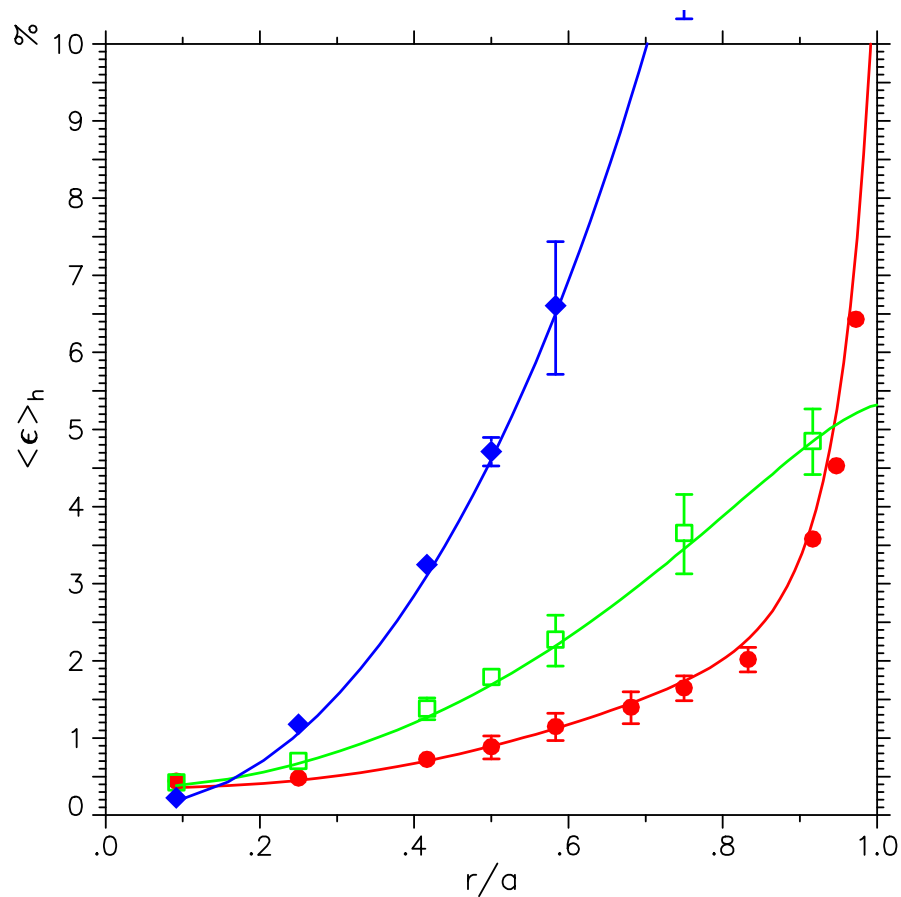
$$D_{1/\nu} \propto \frac{\epsilon_{eff}^{3/2} T^{7/2}}{n R_0^2 B_0^2}$$

Parameters for which $\chi_{neo}^e > 1 \text{ m}^2/\text{s}$ at $r/a = 0.5$

<u>$n (10^{20} \text{ m}^{-3})$</u>	<u>W7-AS</u>	<u>W7-X</u>	<u>LHD-375</u>	<u>LHD-360</u>
0.1	0.90 keV	3.50 keV	1.25 keV	1.75 keV
0.4	1.25 keV	5.20 keV	1.85 keV	2.55 keV
1.0	1.60 keV	6.70 keV	2.30 keV	3.25 keV

where possible effects due to E_r have been ignored.

LHD: effective helical ripple, $\langle \epsilon \rangle_h$ (*lmfp* neocl. transport)



$\langle \epsilon \rangle_h$ from
DKES (symb.) and NEO (lines)

configurations:

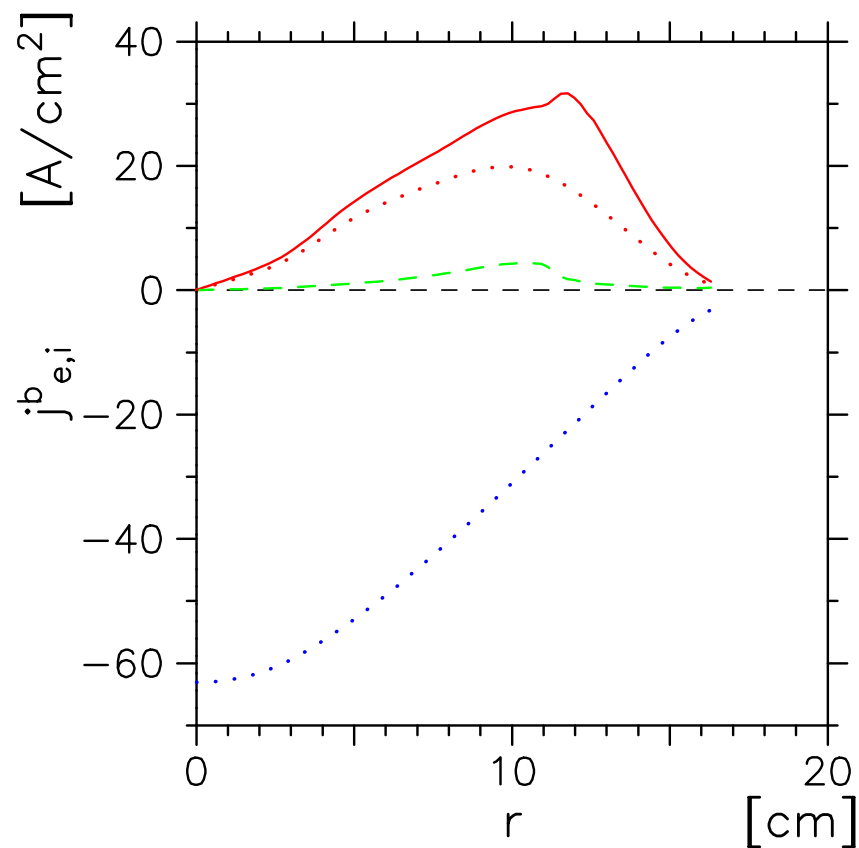
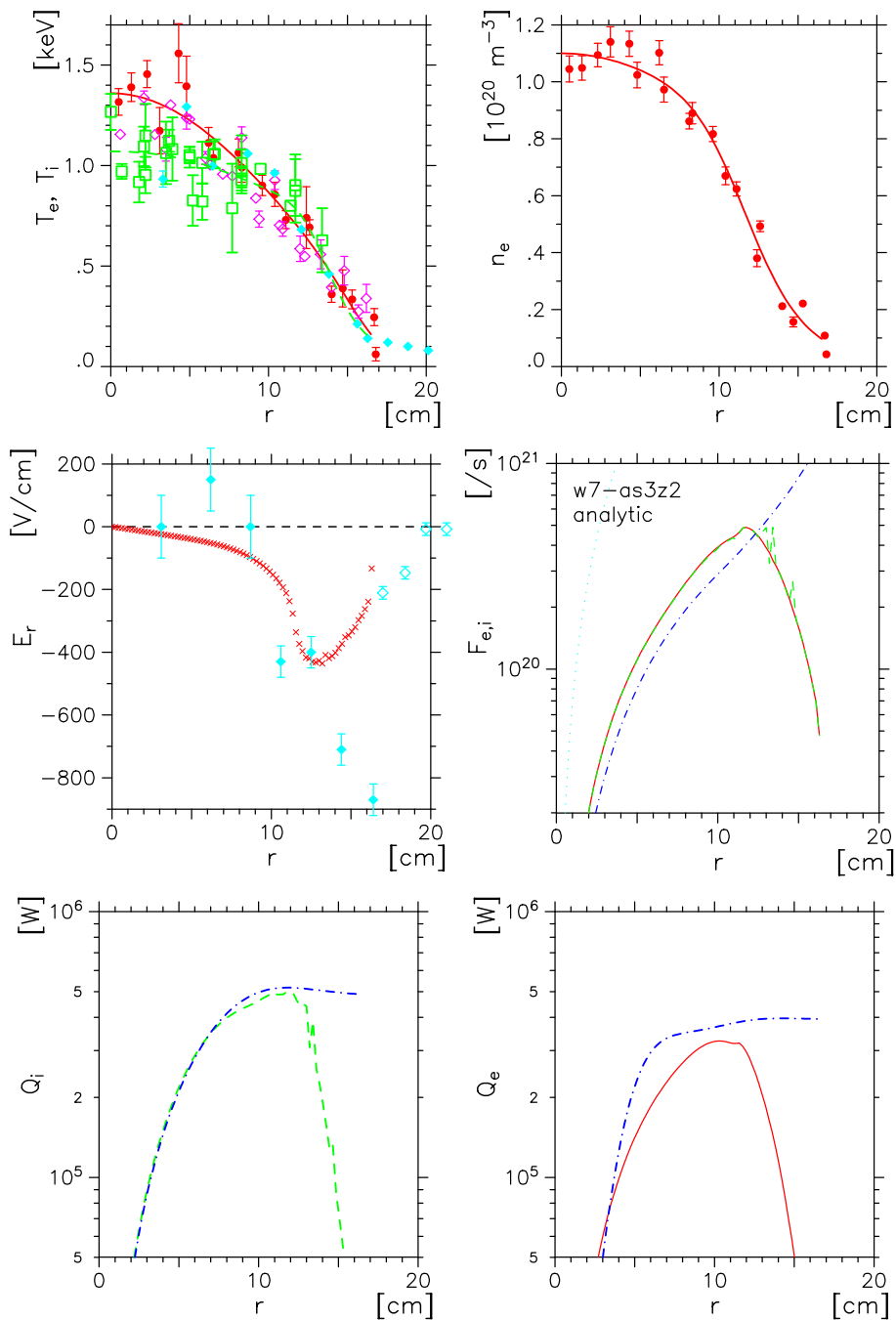
“standard” $R = 3.75$ m

inward-shifted $R = 3.60$ m

inward-shifted $R = 3.53$ m

Shot 34609
830 kW NBI
330 kW ECRH

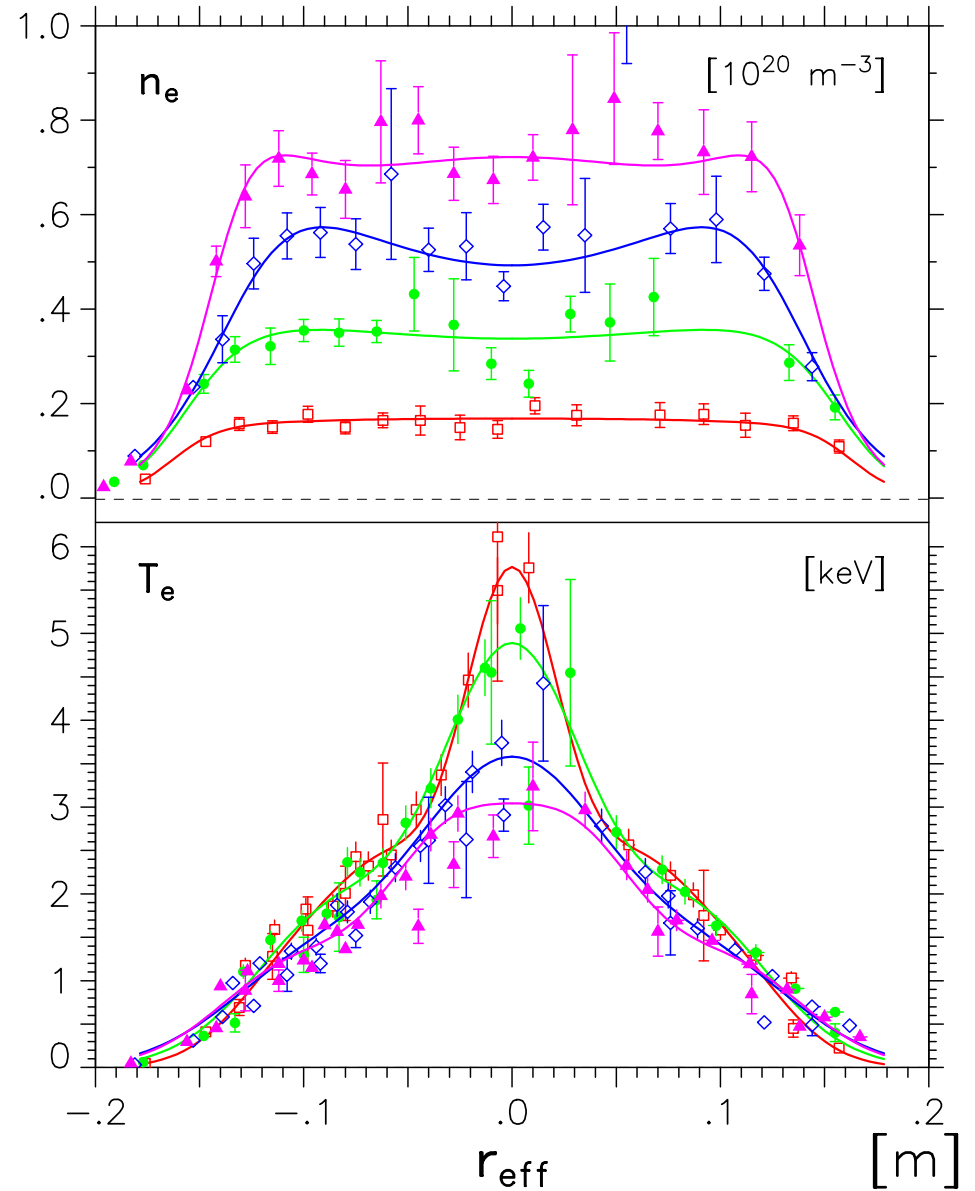
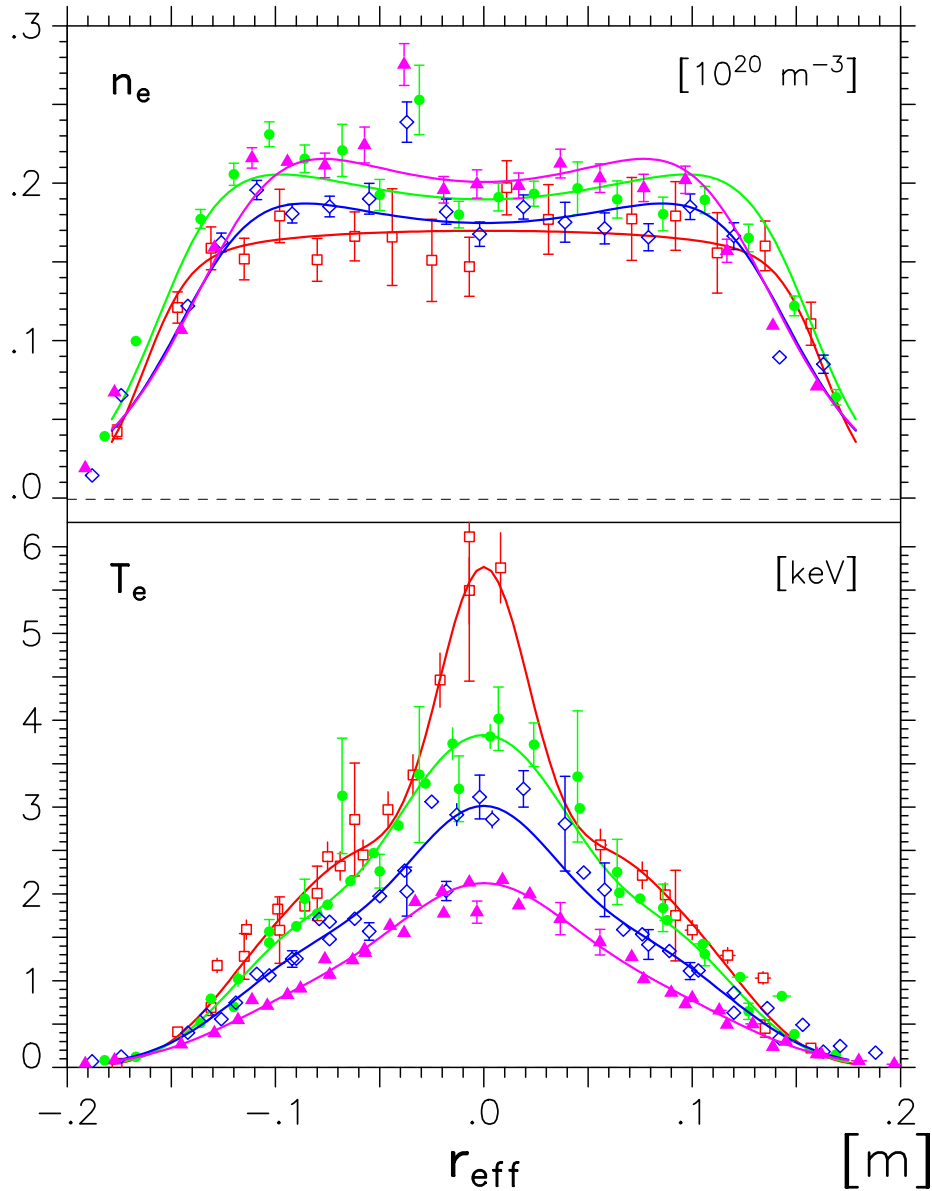
$I_{bs} \approx 20$ kA



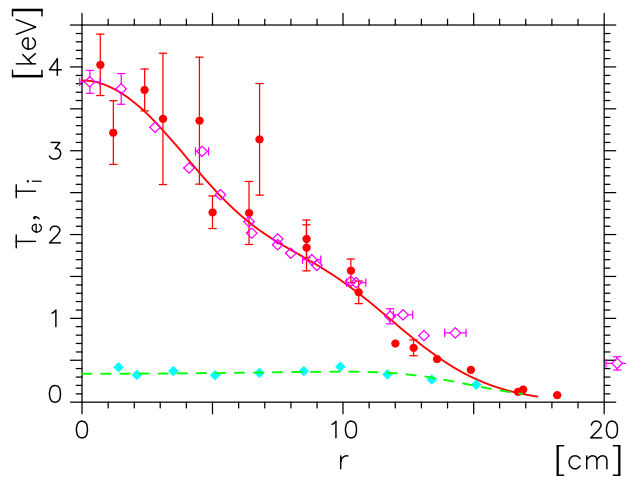
power scan with

$$P_{ECH} = 0.23, 0.46, 0.77, 1.23 \text{ MW}$$

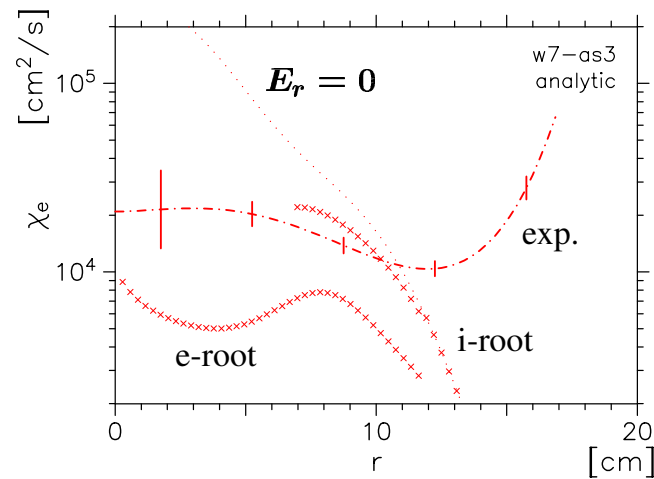
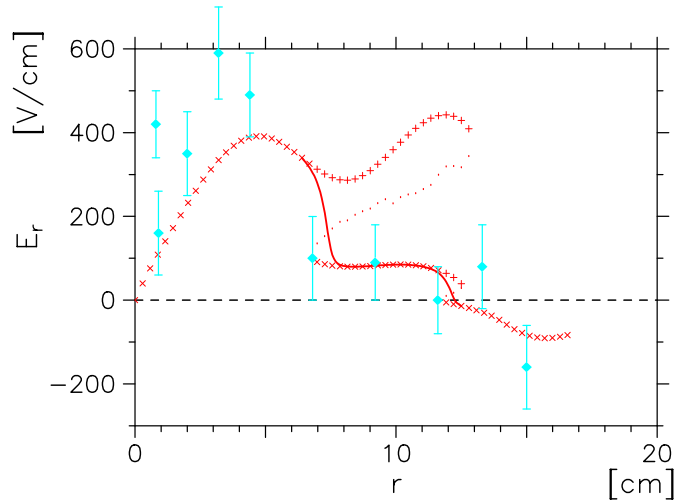
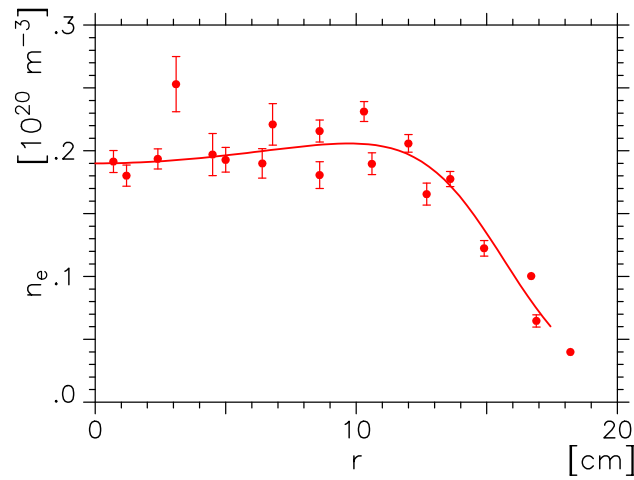
density scan



shots 36908 ...



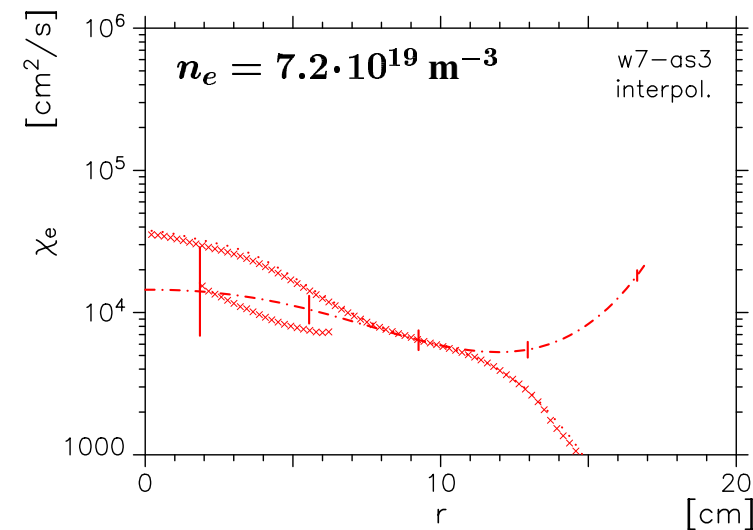
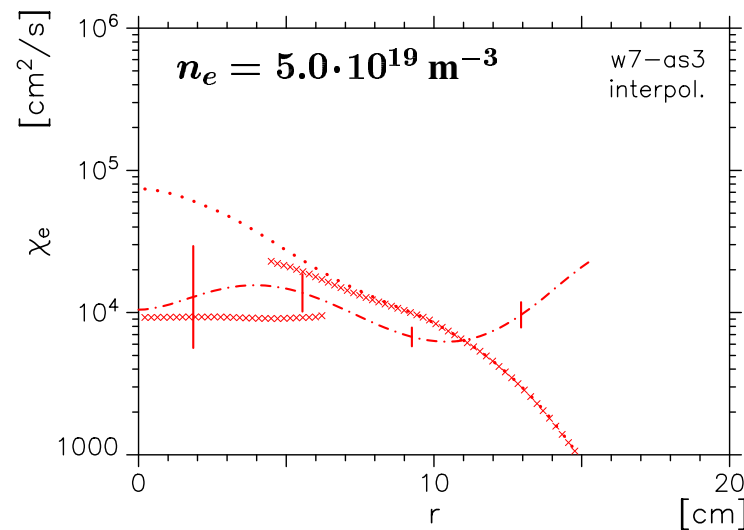
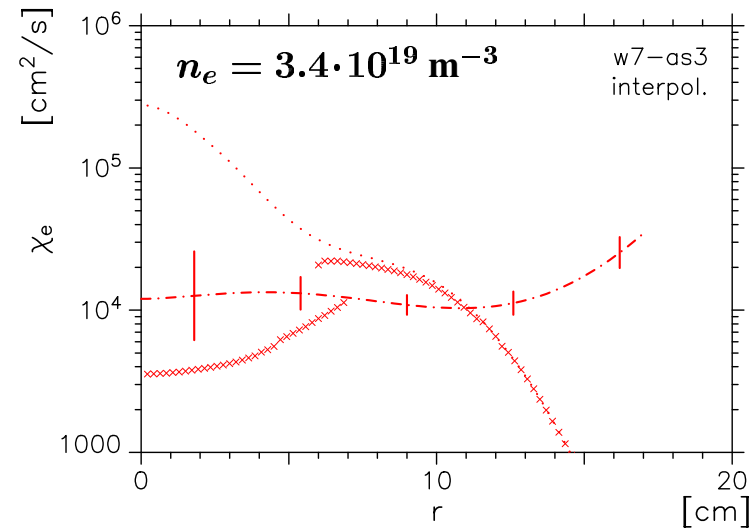
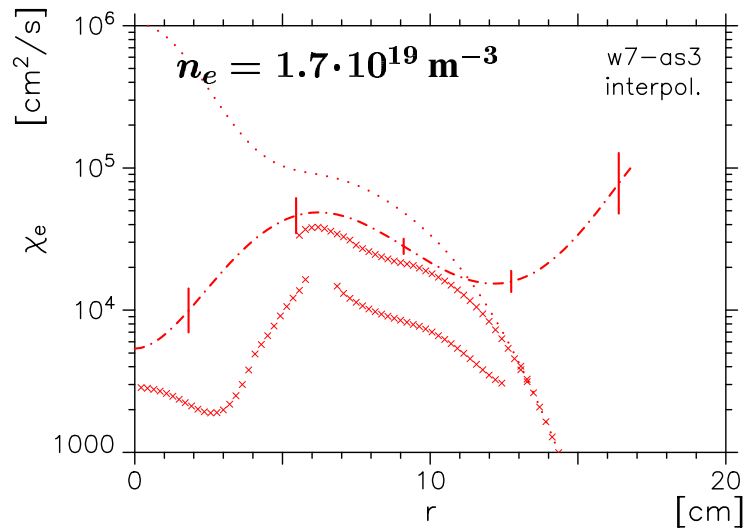
770 kW X2-ECRH discharges



$T_e(r)$ and $T_i(r)$, $n_e(r)$ (upper), ambipolar $E_r(r)$ and $\chi_e(r)$ (lower row)

χ^e in ECRH density scan

$P_{\text{ECRH}} = 1.2$ MW in X2-mode; “standard” conf.; $t_a \simeq 1/3$



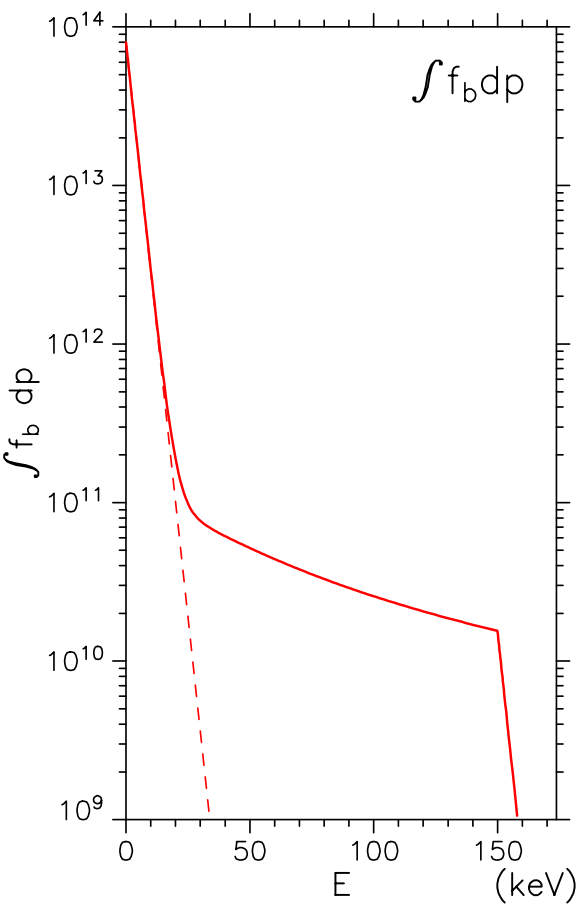
Thermal Plasma with n-NBI at Low Density?



Assumptions:

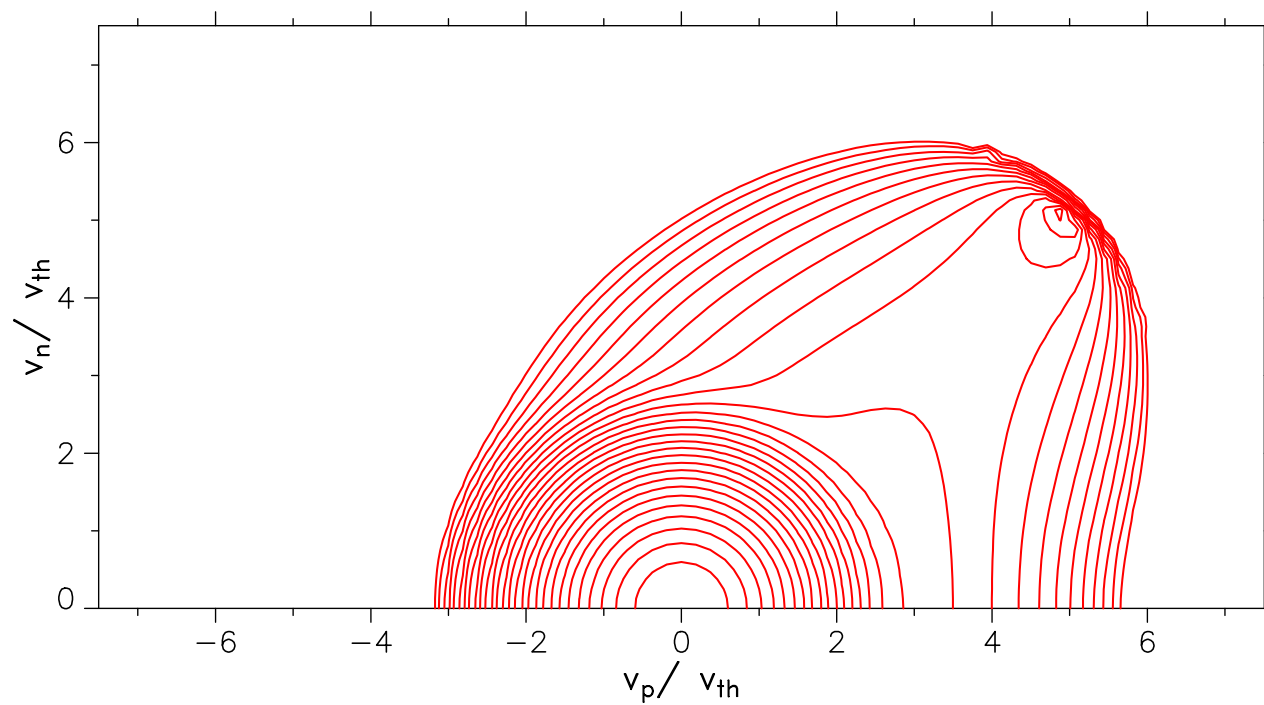
- (only) n-NBI at 150 keV
- deposition volume $\approx 12 \text{ m}^3$ (absorption constant within 0.4 m)
- absorbed power 12 MW (6 MW for lowest density case)
- slowing down on flux surfaces

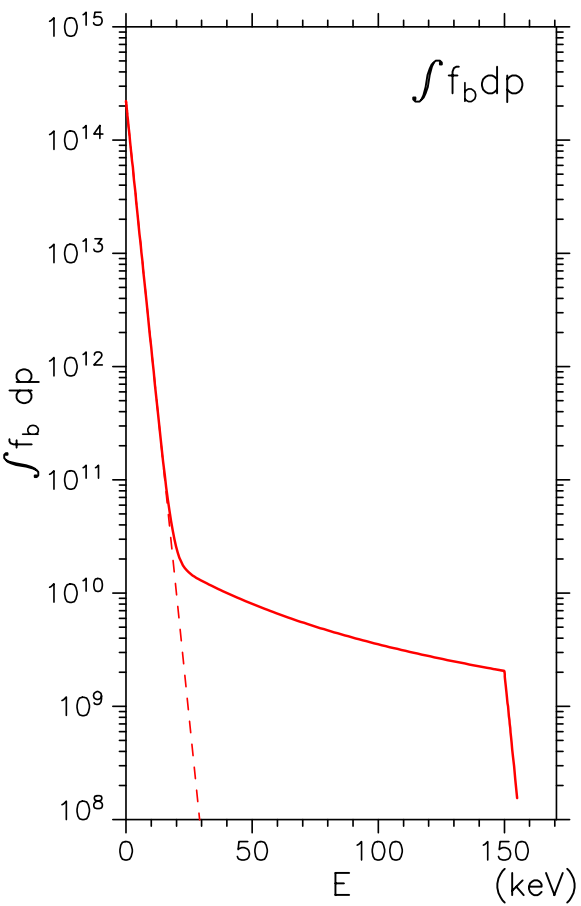
n (10^{20} m^{-3})	T_e (keV)	T_i (keV)	τ_{sd} (s)	n_{sd}/n_e	$m_i \langle v^2 \rangle / 3T_i$
0.12	3.4	5.2	0.36	0.624	6.14
0.40	3.0	3.0	0.10	0.105	2.52
1.00	2.0	2.0	0.03	0.012	1.24



NBI: beam particle distribution function

$T_e = 3.00$ keV $n_e = 4.0 \cdot 10^{13}$ cm $^{-3}$ $P_{\text{NBI}} = 1.000$ W/cm 3
 $T_i = 3.00$ keV $n_0 = 0.0$ cm $^{-3}$ $E_{\text{NBI}} = 150.0$ keV





NBI: beam particle distribution function

$T_e = 2.00$ keV $n_e = 1.0 \cdot 10^{14}$ cm $^{-3}$ $P_{\text{NBI}} = 1.000$ W/cm 3
 $T_i = 2.00$ keV $n_0 = 0.0$ cm $^{-3}$ $E_{\text{NBI}} = 150.0$ keV

