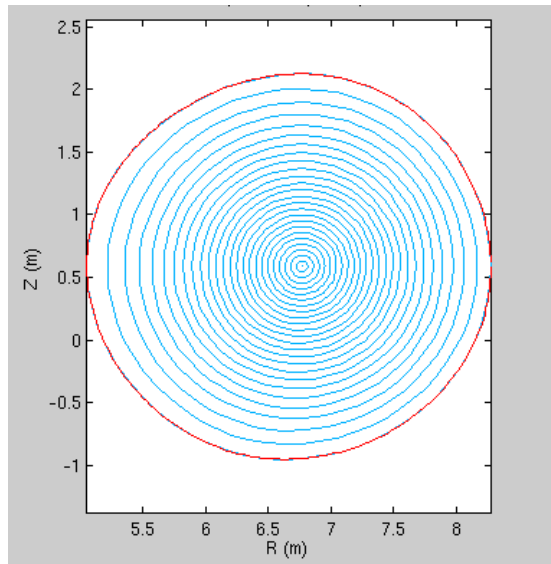


Update on the hybrid scenarios

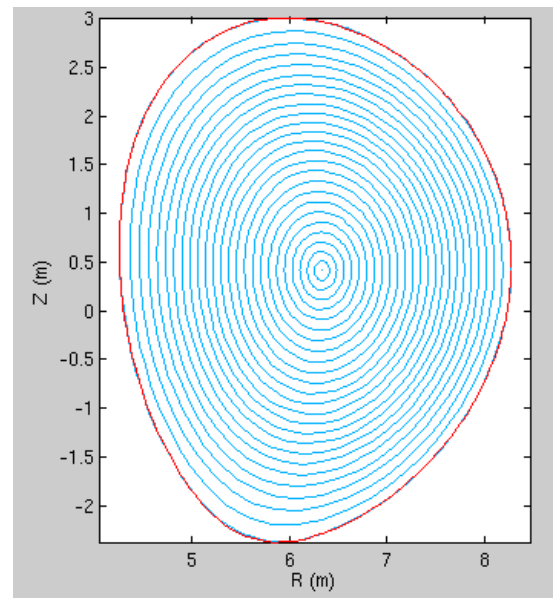
J.Garcia, J.F. Artaud, S. Bremond, F. Imbeaux ,E. Nardon,

• Simulation parameters

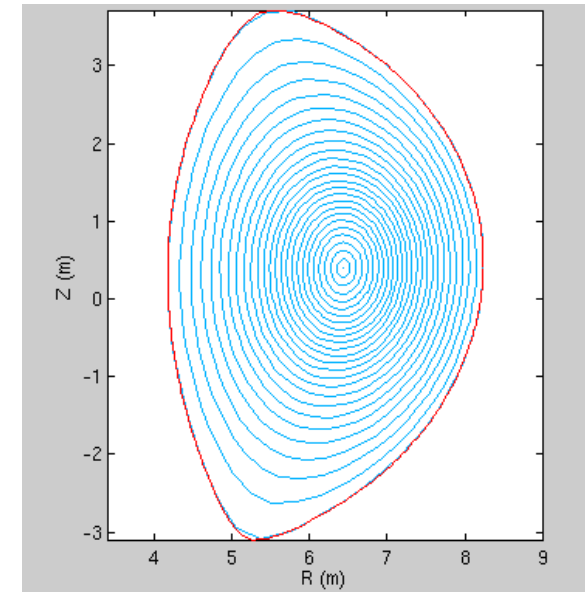
- $I_p = 12 \text{ MA}$, $B_T = 5.3 \text{ T}$
- $di_p/dt = 0.18 \text{ MA/s}$, $B_T = 5.3 \text{ T}$, $f_G = 0.25$ during ramp-up. $f_G = 0.83$ flat-top phase
- **EC wave launch**: equatorial launchers, 8MW during ramp-up, 20MW flat-top
- **ICRH**: 20 MW, **NBI**: 33MW
- n_e profile fixed, picked profile, $n_e(0) \approx 1.0 \cdot 10^{20} \text{ m}^{-3}$
- $\rho_{ped} \approx 0.95$, $n_{ped} \approx 0.5 \cdot 10^{20} \text{ m}^{-3}$, $T_{ped} \approx 4.5 \text{ keV}$
- **Bohm-GyroBohm transpor tmodel during ramp-up**
- $H_{98} = 1.2$ with Bohm-GyroBohm shape for flat-top phase



t=1.5s

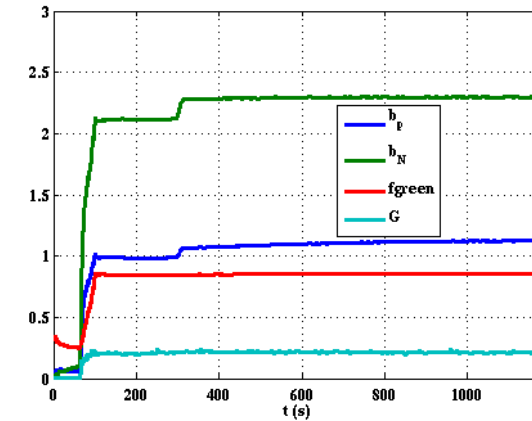
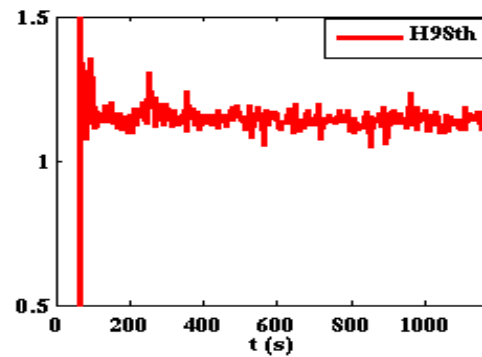
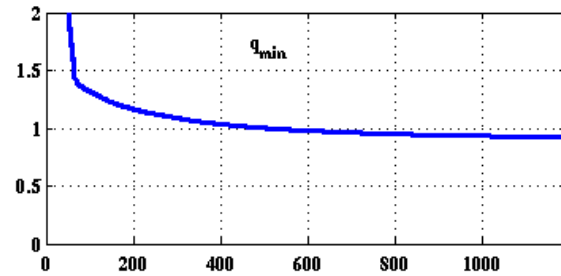


t=10s

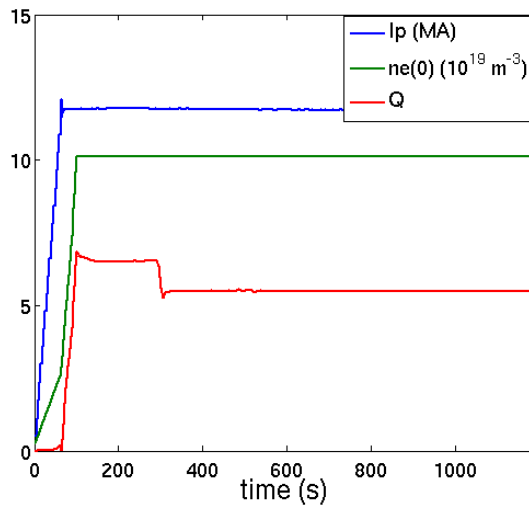
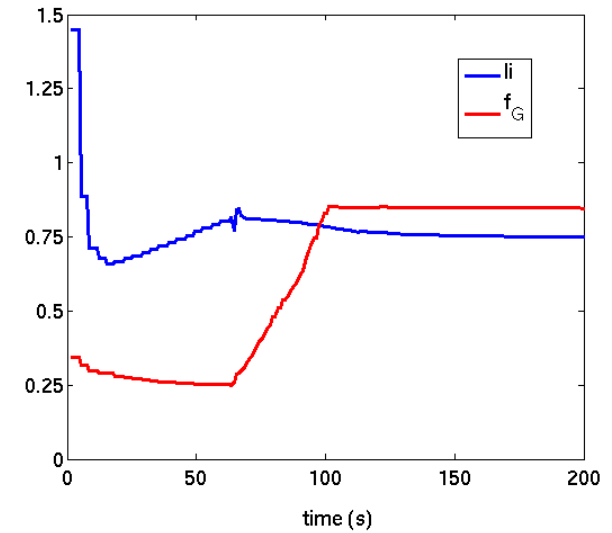
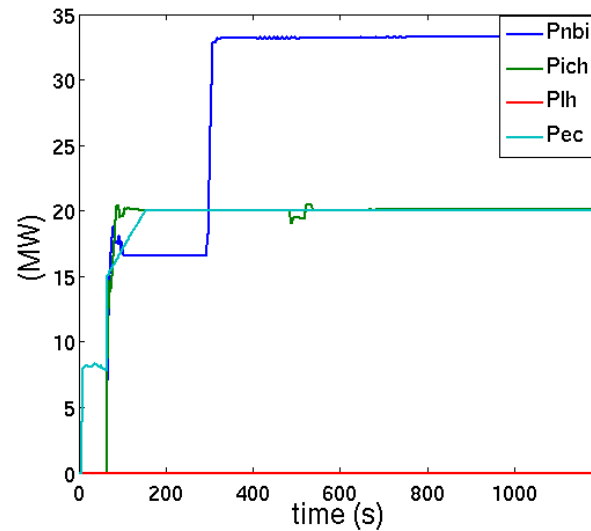
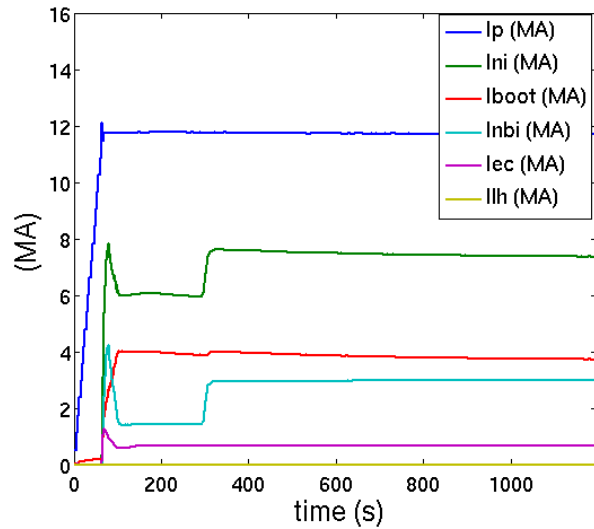


t=20 s

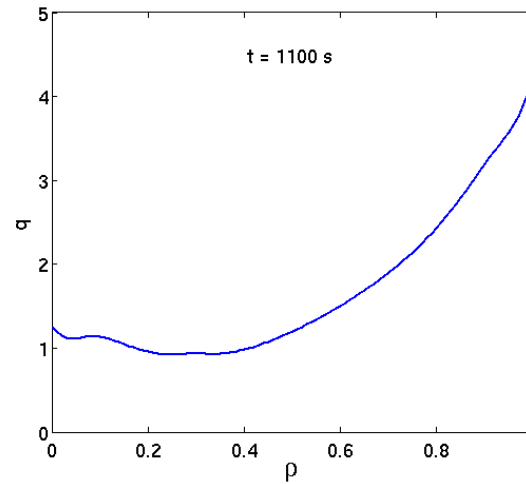
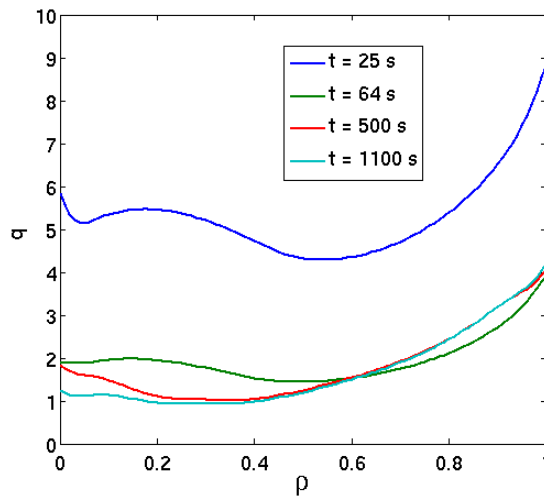
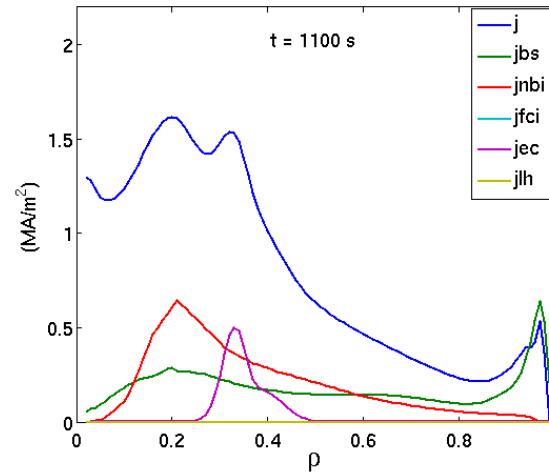
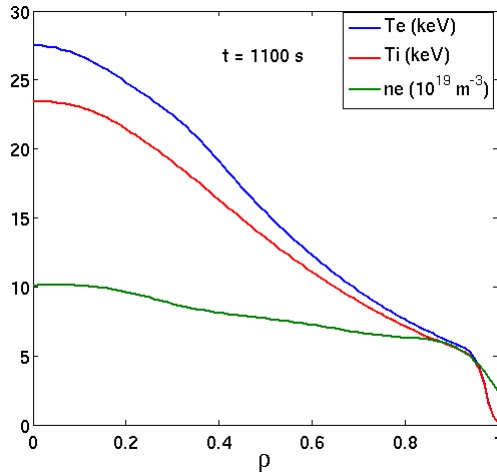
- Plasma shape taken from old DINA-CRONOS simulation
- X-point formation at t=20s



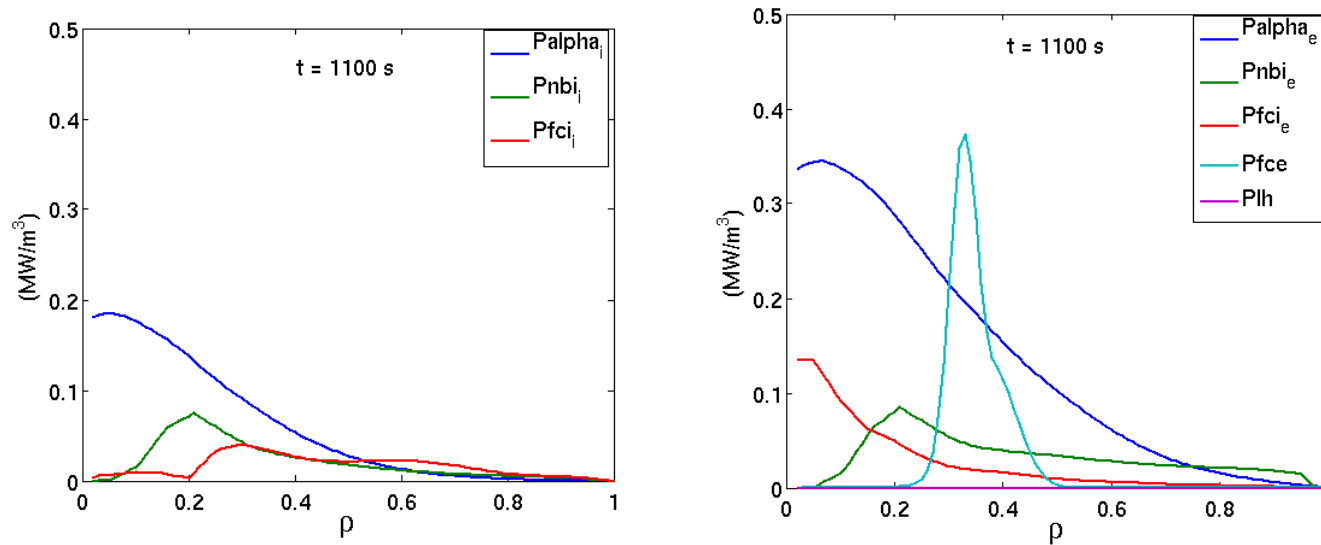
- The $q=1$ surface is quickly achieved at $t \approx 550s$
- $H_{98th}=1.2$
- Still some low performance $\beta_N=2.3$, $\beta_p=1.2$
- $f_G=0.83$



- L-H transition at $t=64s$ when $I_p=12MA$
- $I_{ni}=7.7MA$, $I_{boot}=4MA$, $I_{nbi}=3MA$, $I_{eccd}=0.7MA$
- $li=0.73$ at $t=200s$, $li=0.83$ at $t=1100s$
- Density ramp of 30s
- $Q=5.5$



- Eccd at $\rho \approx 0.35$
- NBCD maximum at $\rho \approx 0.2$
- Bootstrap current maximum at $\rho \approx 0.2$
- $q < 1$ at $0.2 < \rho < 0.4$
- $q_{95} = 3.5$



- ICRH ($f=49\text{MHz}$) on-axis for electrons and off-axis for ions
- **Excessive temperature peaking is avoided**

- First hybrid scenario obtained
- As expected $q=1$ at $t=550s$
- Still some low beta

Following steps:

- Increase H_{98} up to 1.3
- By plasma shaping try to increase q_{95}
- Sensitivity to eccd location
- Increase f_G in the ramp-up to avoid current hole when NBCD is added
- Increase ramp-up rate to avoid $q < 1$