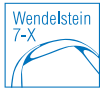


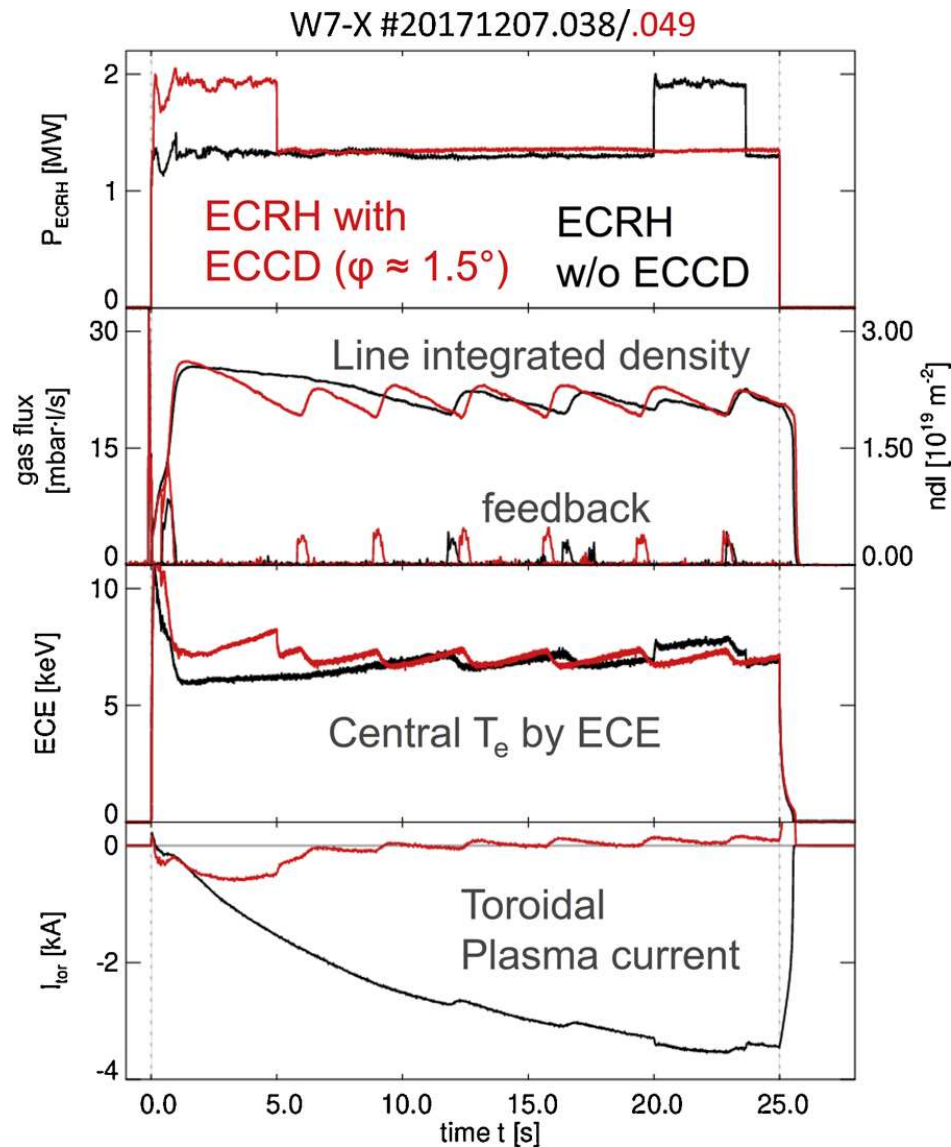
# Use of ECCD to Achieve Steady-State Current Conditions in W7-X

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# Use of ECCD to attain plasmas with $I_{tor} = 0$



T. Stange *et al*, presented at the  
 APS Plasma Physics Conference 2018

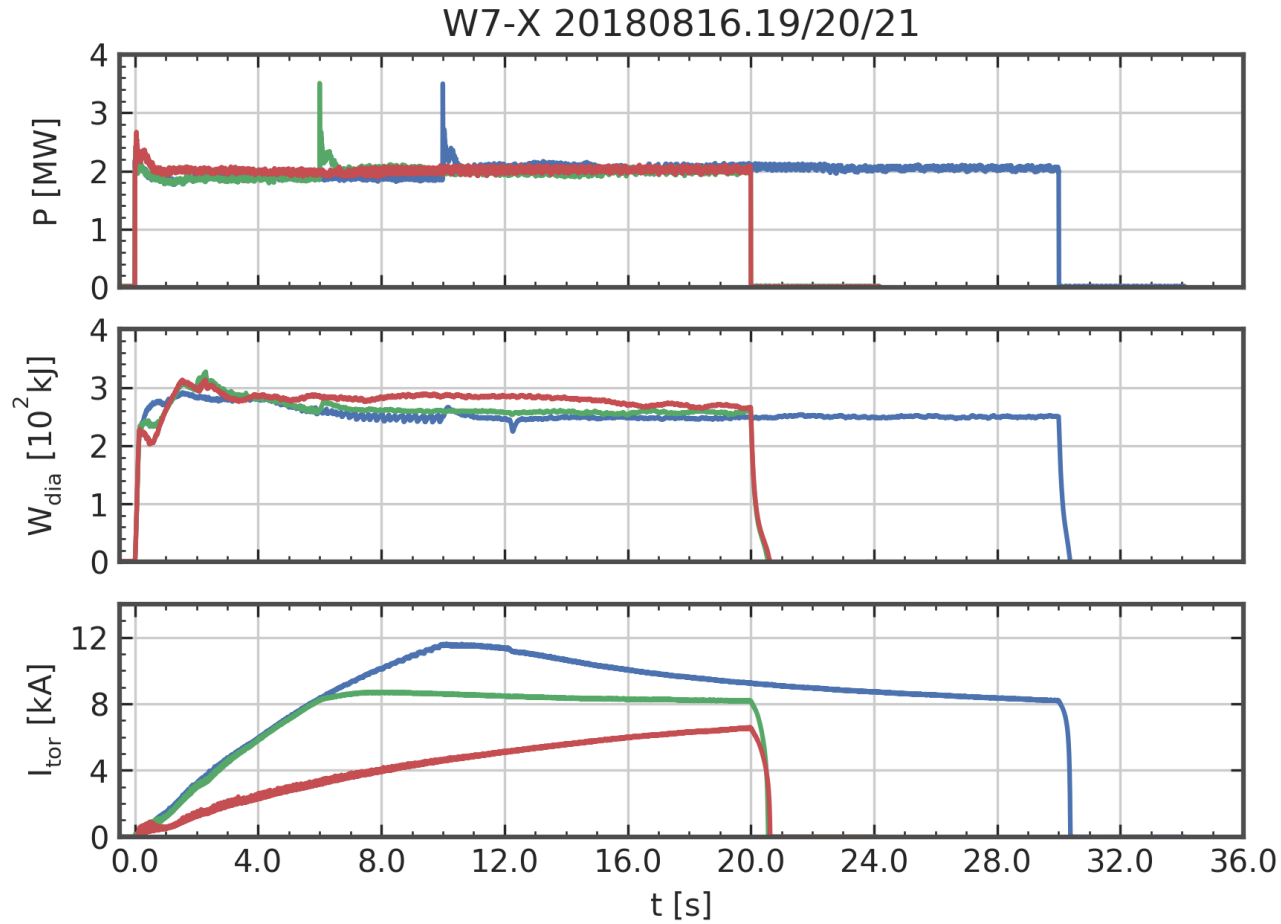
Figure taken from: M. Endler *et al*,  
 Fusion Eng. Des. **167** (2021) 112381



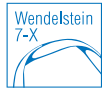
# ECCD-Accelerated Convergence of $I_{tor}$ to $I_{bs}$



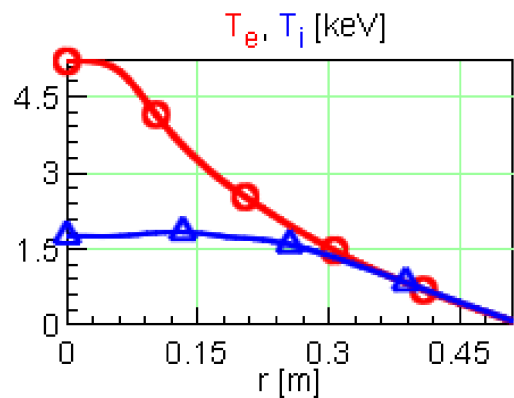
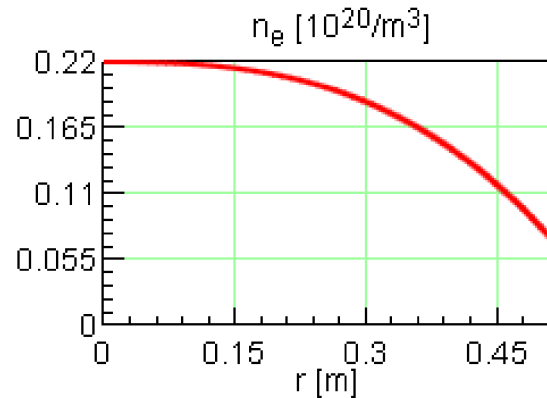
discharges: 20180816.19 20180816.20 20180816.21



ECCD discontinued after: 10 s 6 s no ECCD



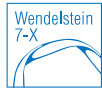
## Bootstrap Current for Discharge 20180816.20



For these profiles in the W7-X standard configuration:

$Z_{eff}$	$I_{bs}$ (kA)	$L/R$ (s)
1	9.08	12.31
1.5	8.03	9.76
2	7.24	8.05
3	6.02	6.07

$I_{bs} = 73$  kA in equivalent axisymmetric tokamak for  $Z_{eff} = 1.5$



## Comments



- More advanced scenarios are described in:
  - Y. Turkin *et al*, Fusion Sci. Technol. **50** (2006) 387.
  - P. Sinha *et al*, Nucl. Fusion **59** (2019) 126012.
- The influence of ECCD-induced “crashes” has not been accounted for in such scenarios as a first-principles model for such events is lacking. Our ability to predict the current evolution in W7-X with quantitative accuracy suffers accordingly.
- Additional ECCD experiments will be needed in OP2; e.g. discharges of longer than  $\approx 5$  s in the low-mirror configuration will require counter current drive to keep  $I_{tor}$  at an acceptable level.