Power exhaust with impurity seeding: vs Ne
ASDEX Upgrade vs ITER
SOLPS-ITER modeling study

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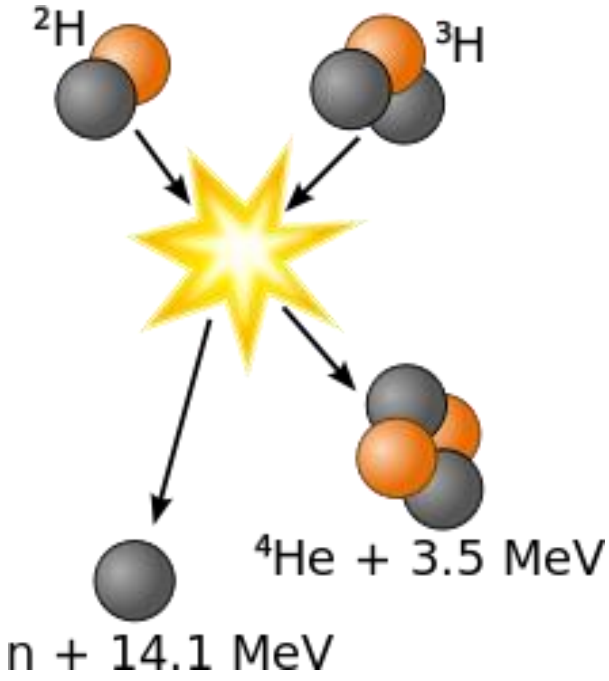
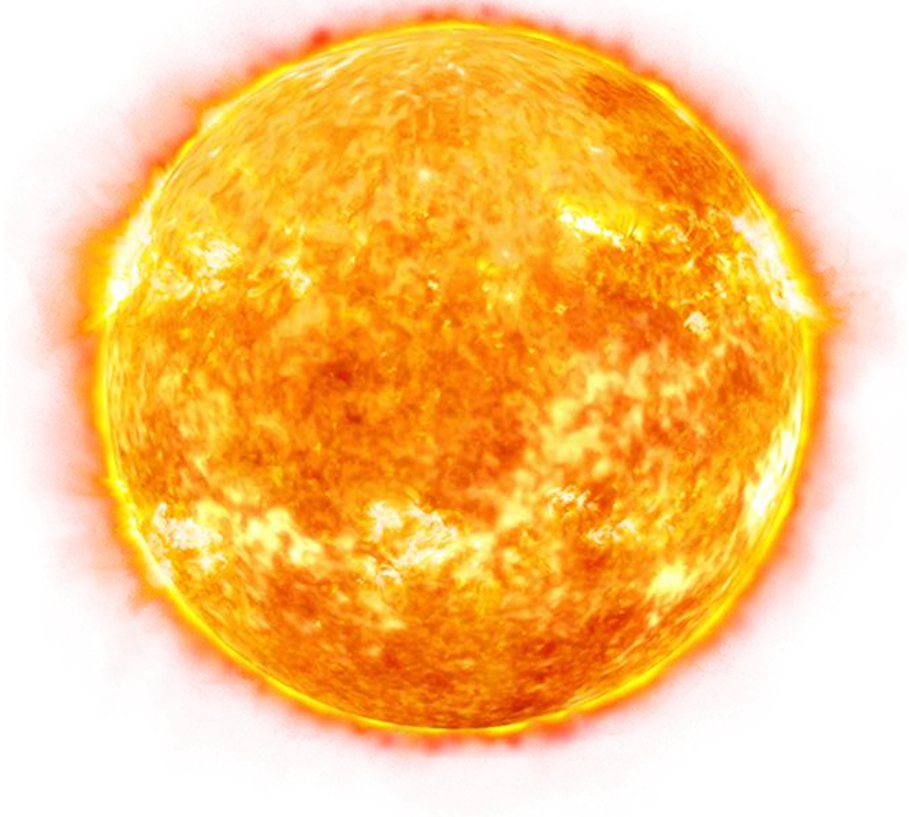
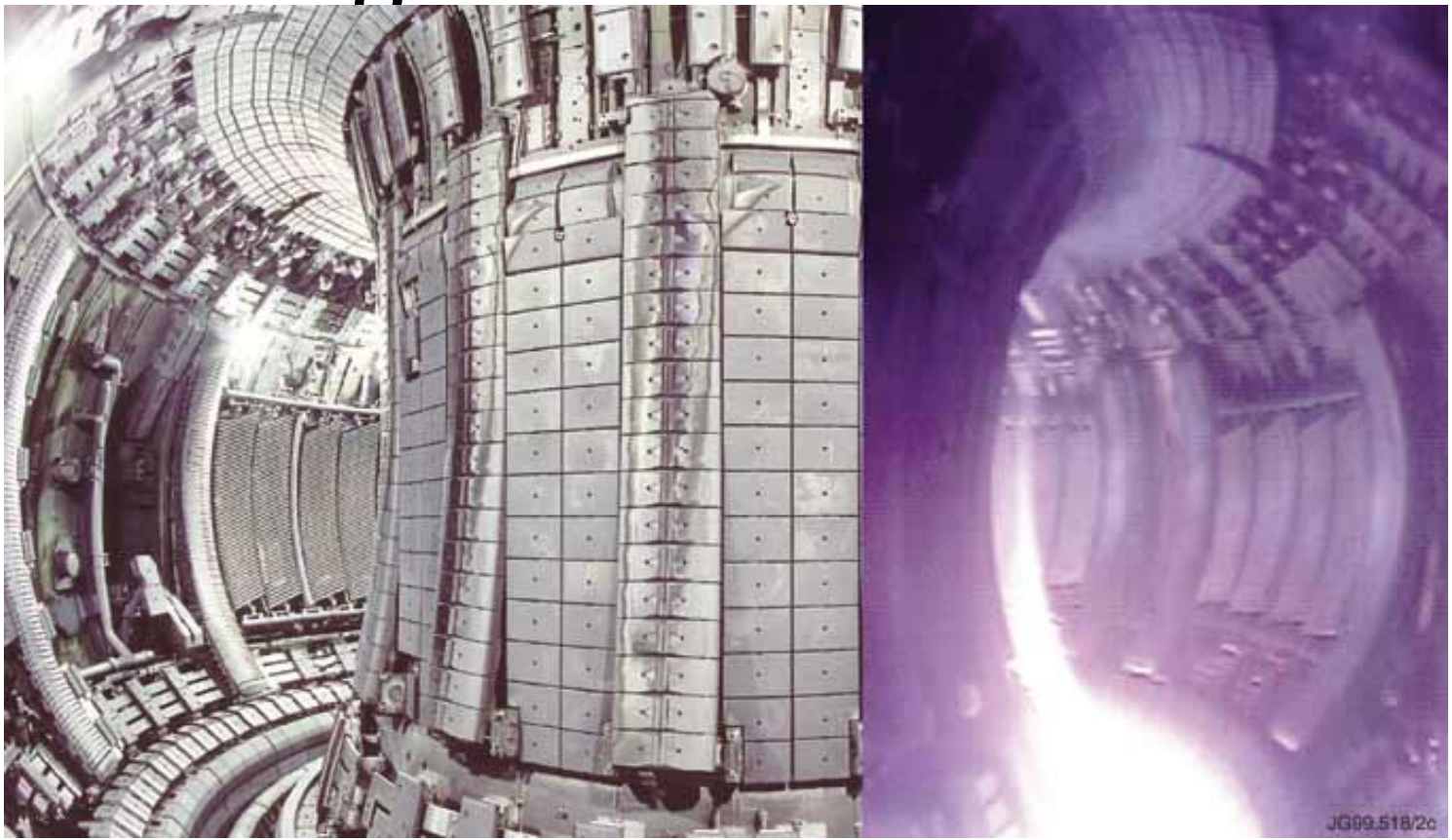
china eu india japan korea russia usa

Nuclear Fusion

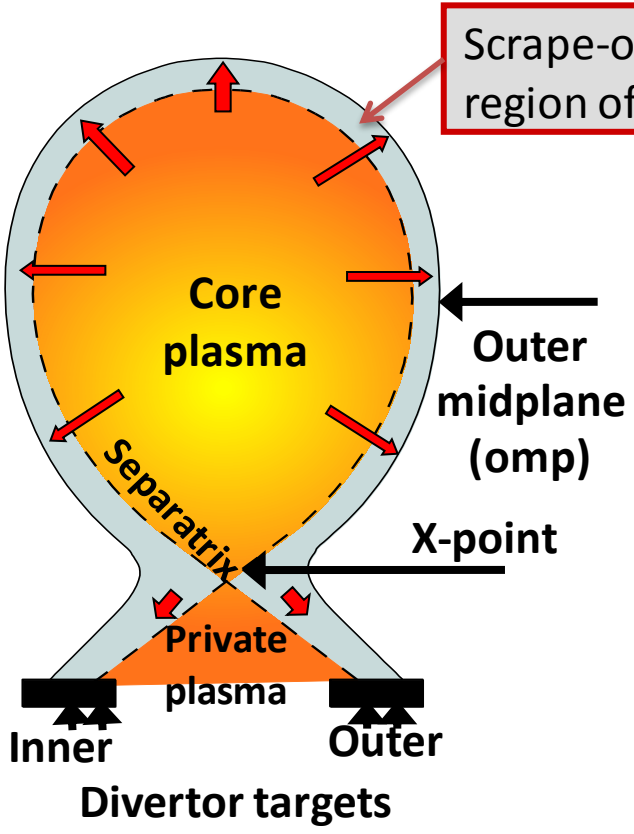




Magnetic confinement



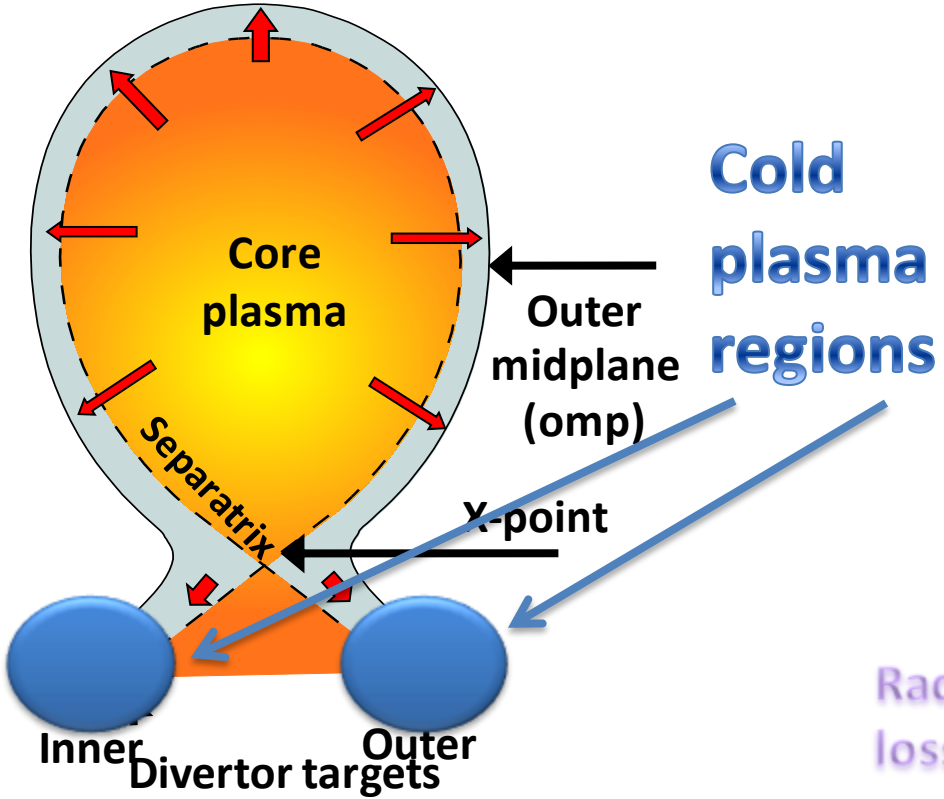
Divertor configuration

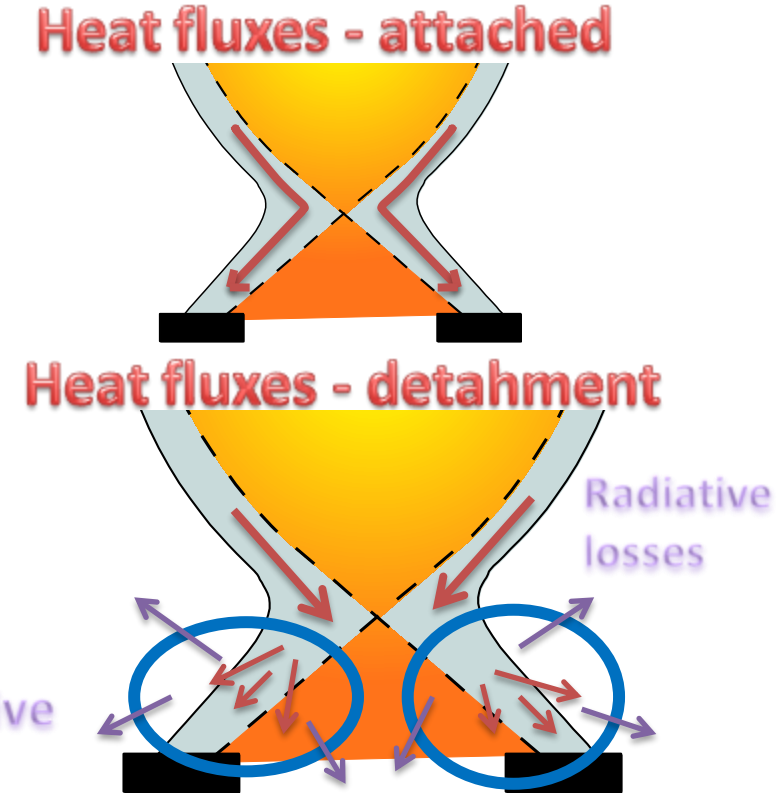


Targets can become a plasma torch!

at P_{peak}>10MW/m^2

Power exhaust – divertor detachment



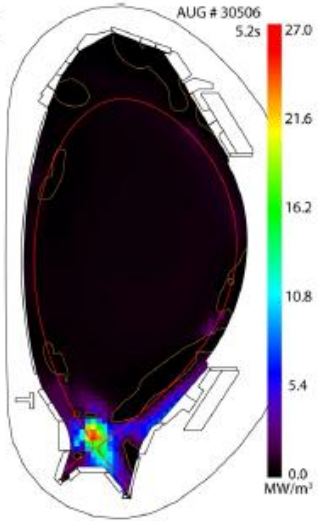


Exhaust with N and Ne seeding on ASDEX Upgrade tokamak

Power exhaust by N seeding

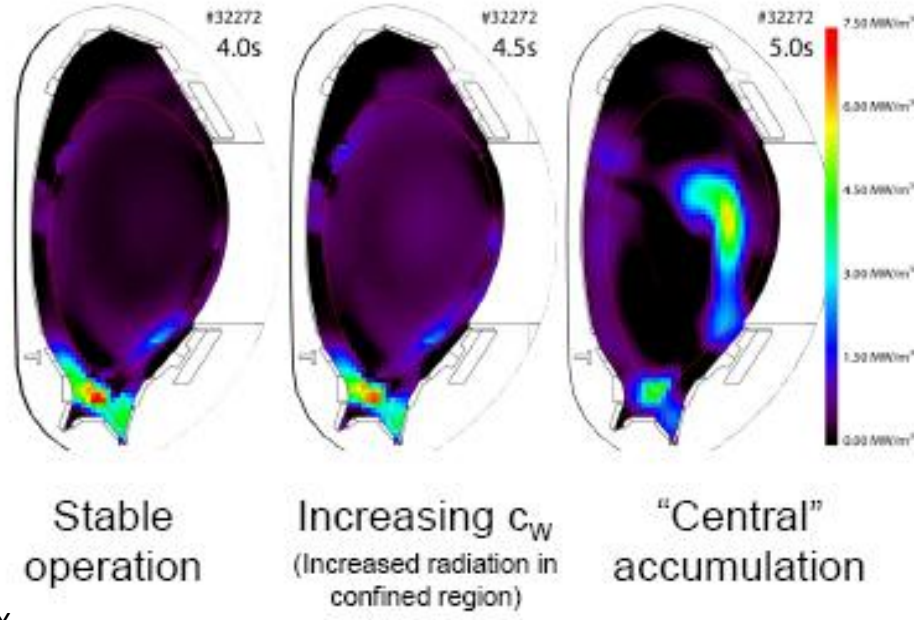
- Fully detached targets
- X-point radiation
- Stable scenarios

AUG:



[M. Bernert et al., Power exhaust by SOL and pedestal radiation at ASDEX Upgrade and JET, Nuclear Materials and Energy (2017)]

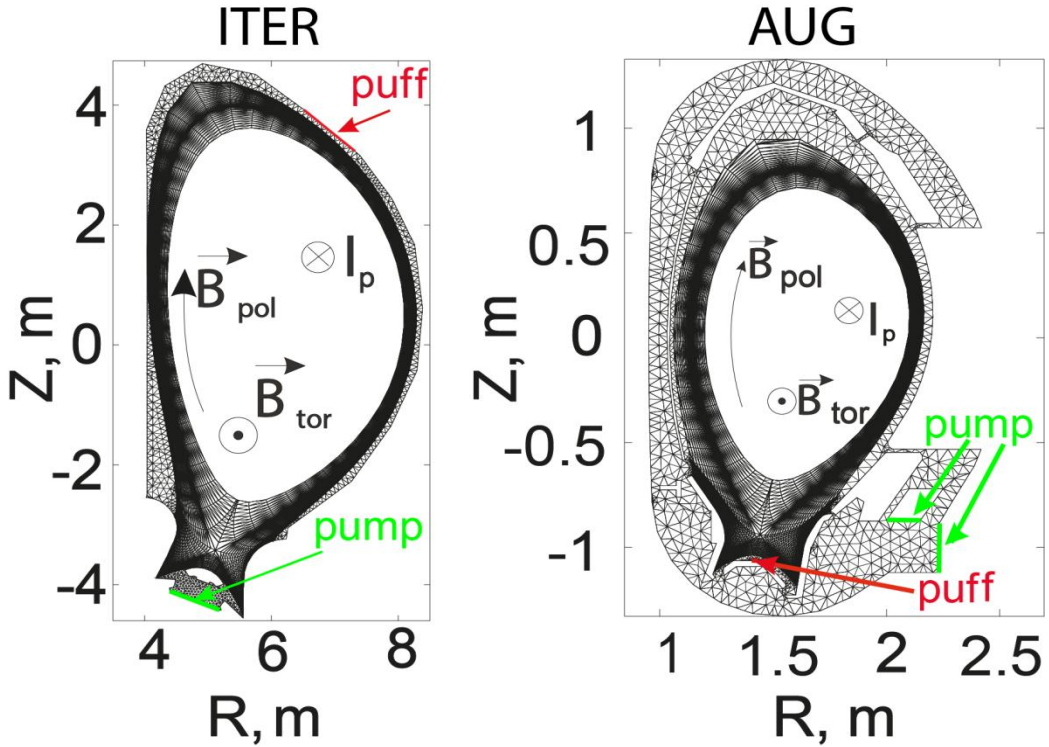
Ne seeding - scenario development



[F. Reimold, 2017, DivSOL ITPA]

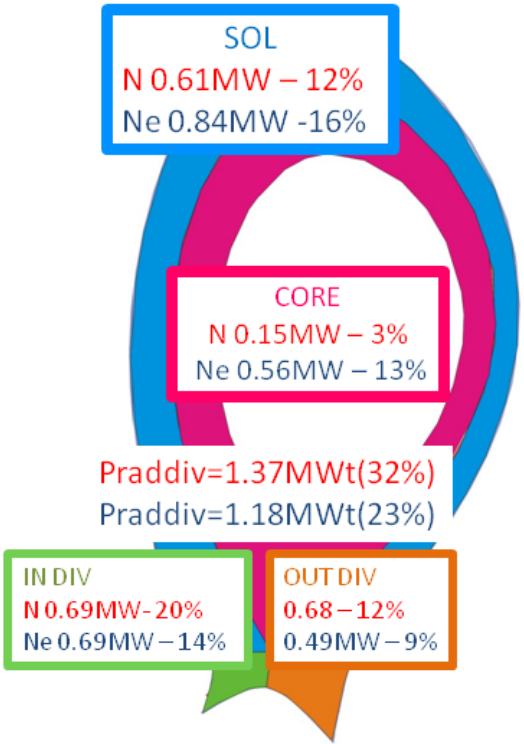
Why Ne doesn’t work for AUG? Will it work at ITER?

SOLPS-ITER modeling study

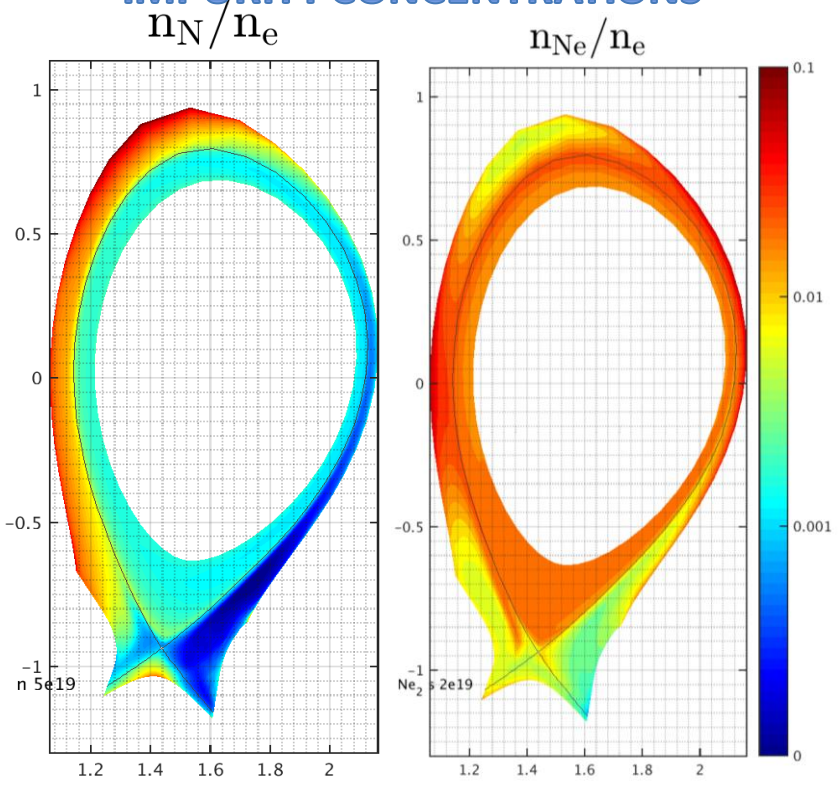


AUG modeling results

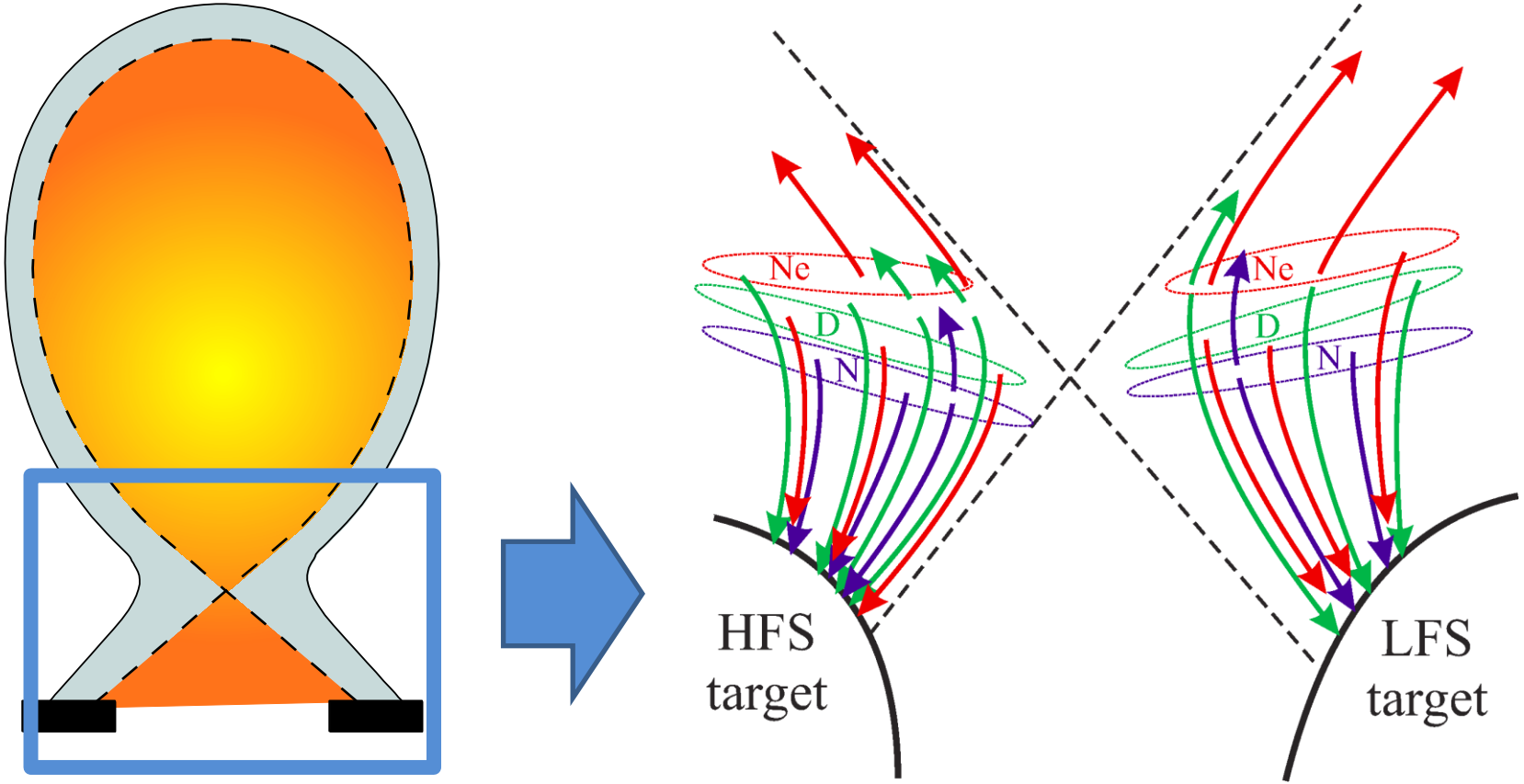
RADIATED POWER DISTRIBUTION



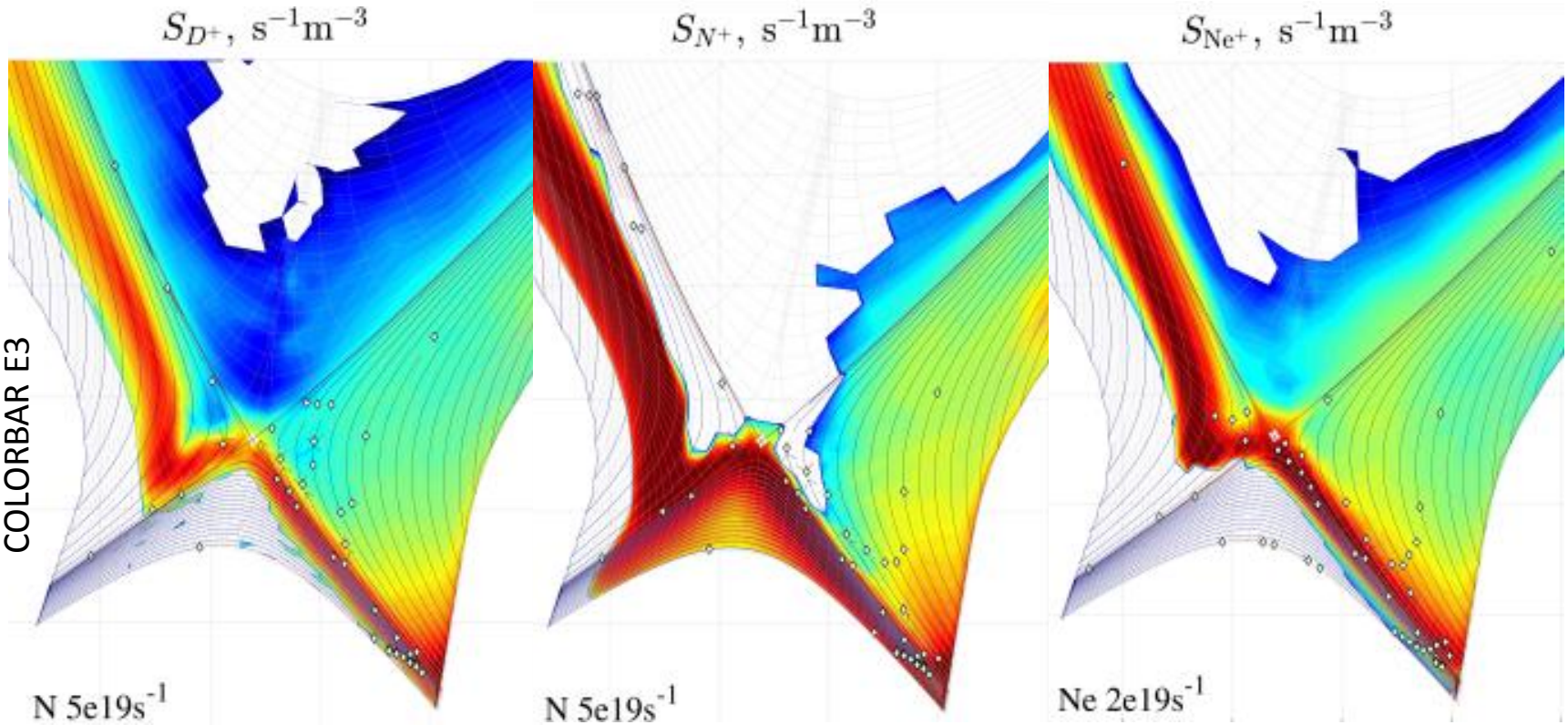
IMPURITY CONCENTRATIONS



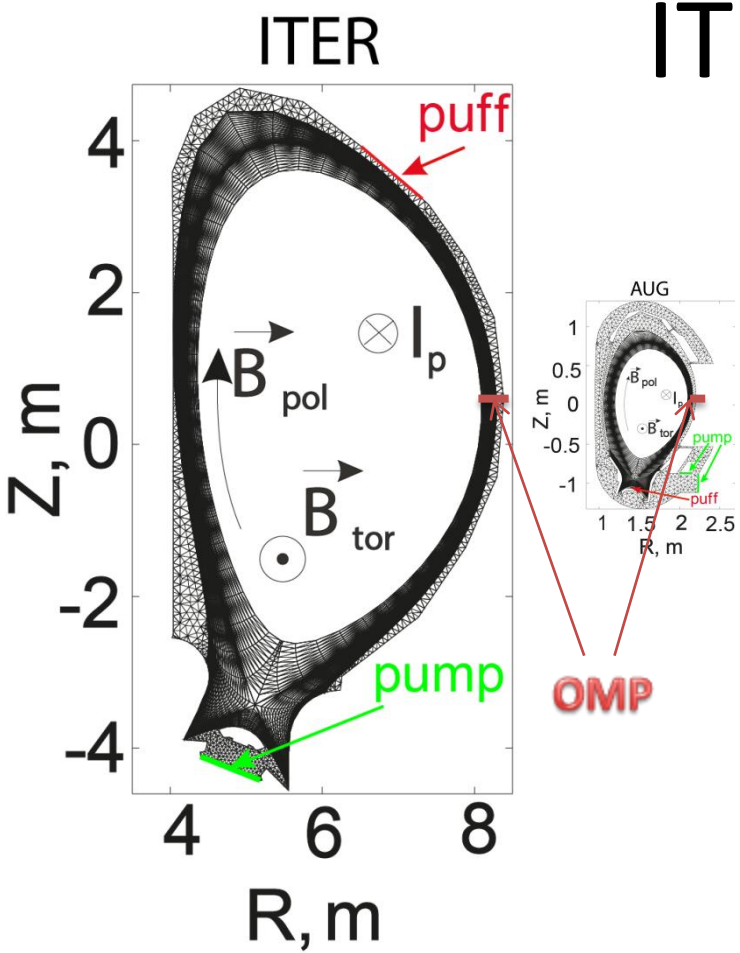
Understanding of AUG modeling results

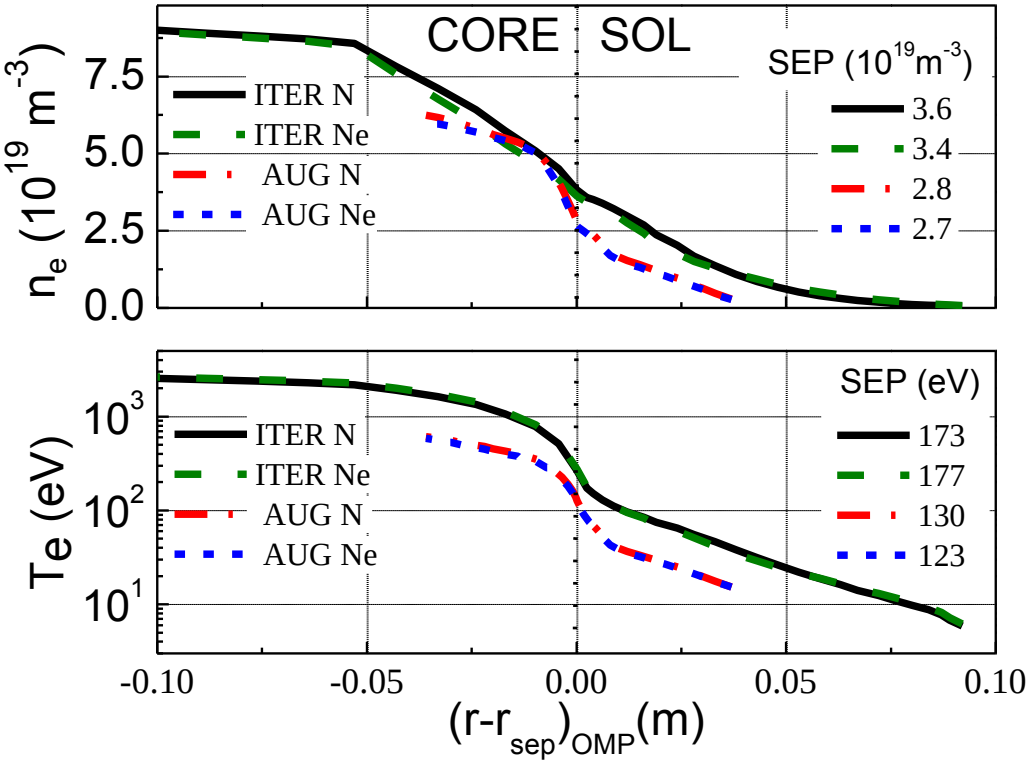


Ionization sources AUG

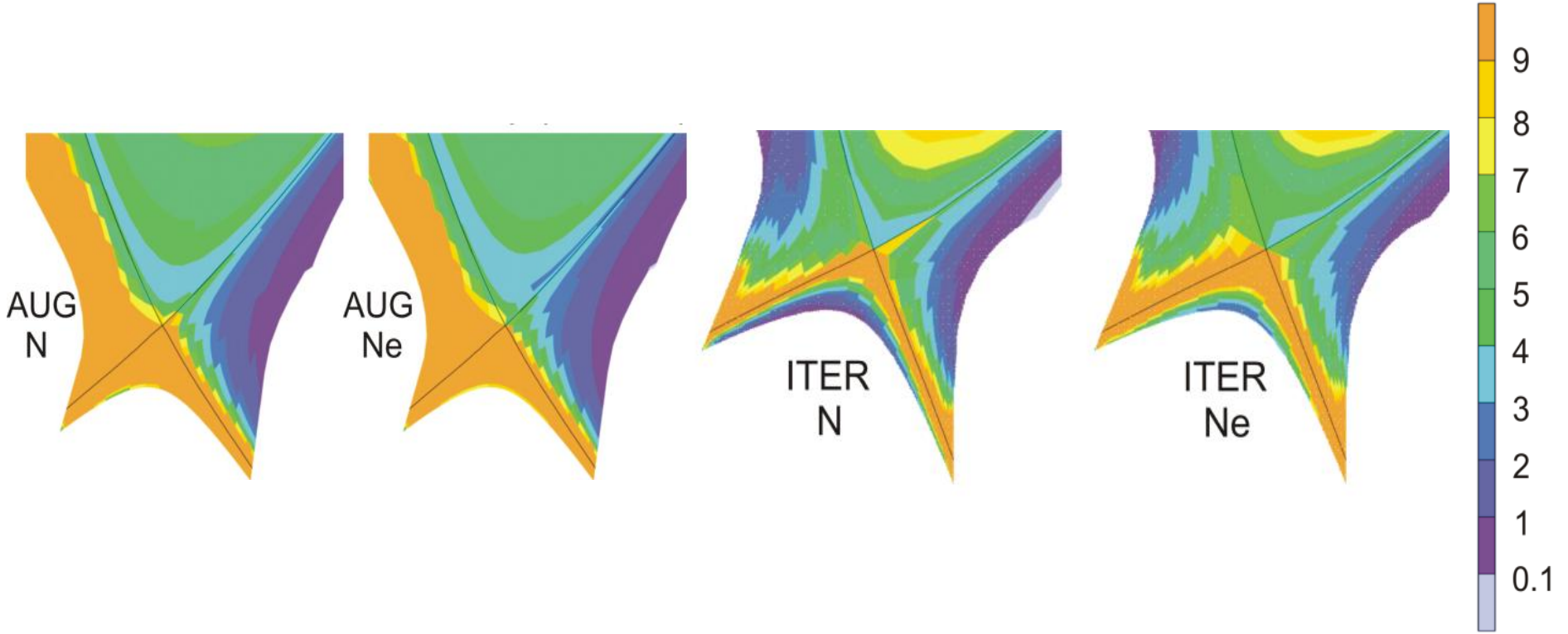


ITER vs AUG

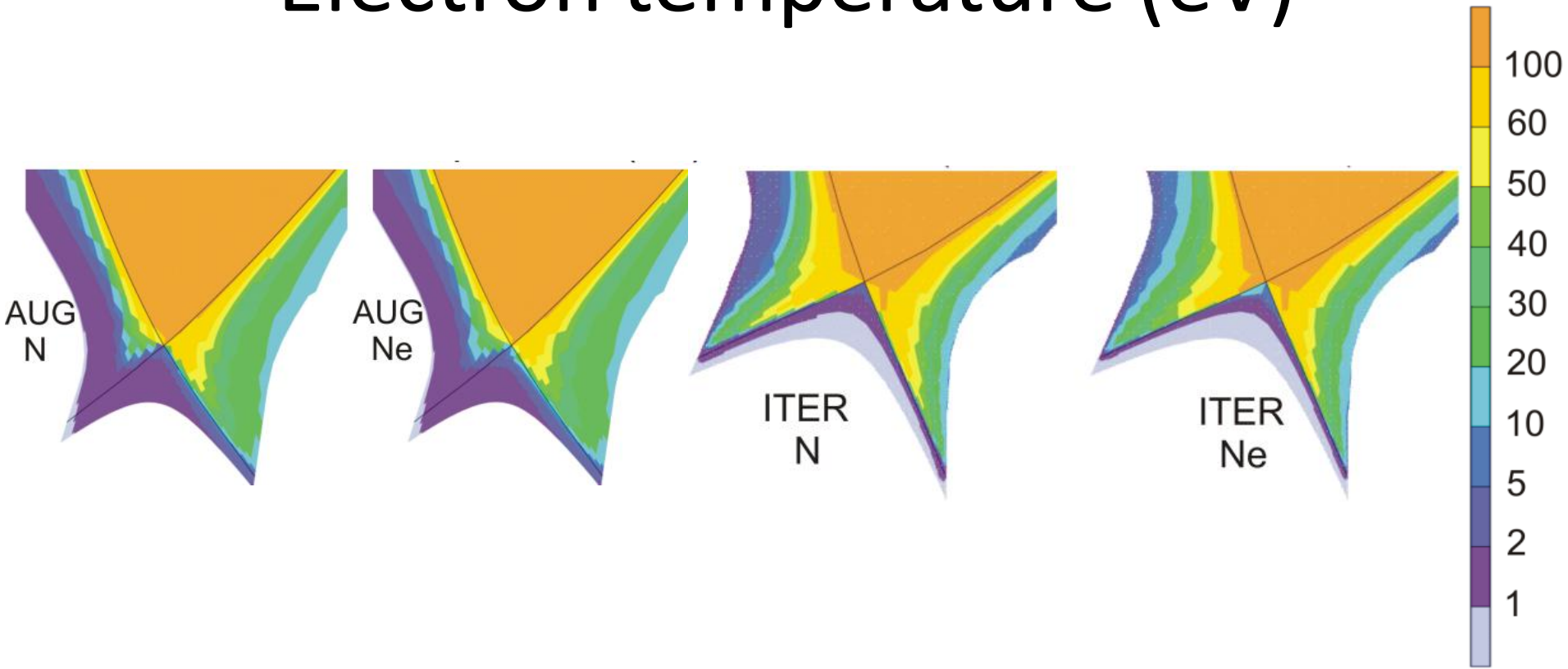

ITER
puff
pump
B_{pol}
I_p
B_{tor}
Z, m
R, m
AUG
OMP


CORE
SOL
SEP (10^{19}m^{-3})
3.6
3.4
2.8
2.7
ITER N
ITER Ne
AUG N
AUG Ne
n_e (10^{19} m^{-3})
SEP (eV)
173
177
130
123
Te (eV)
$(r-r_{sep})_{OMP}$(m)

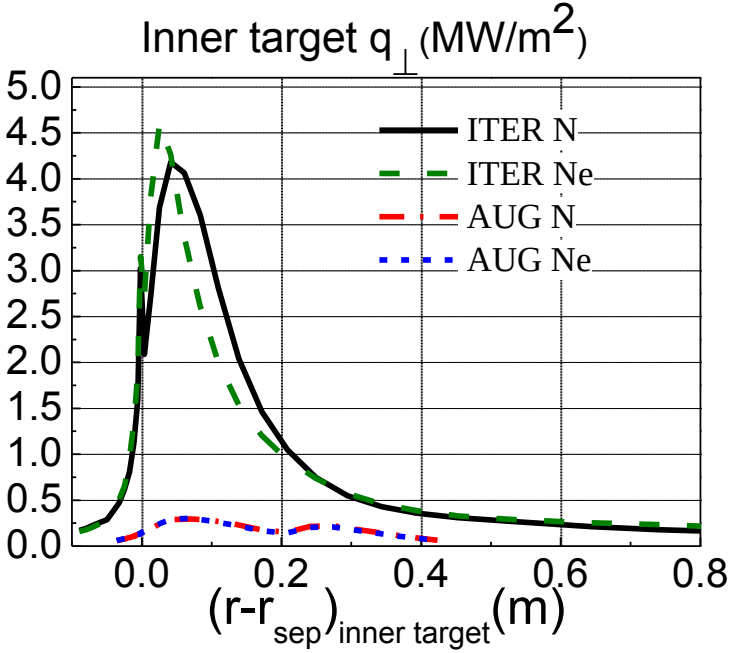
Electron density (m^{-3})

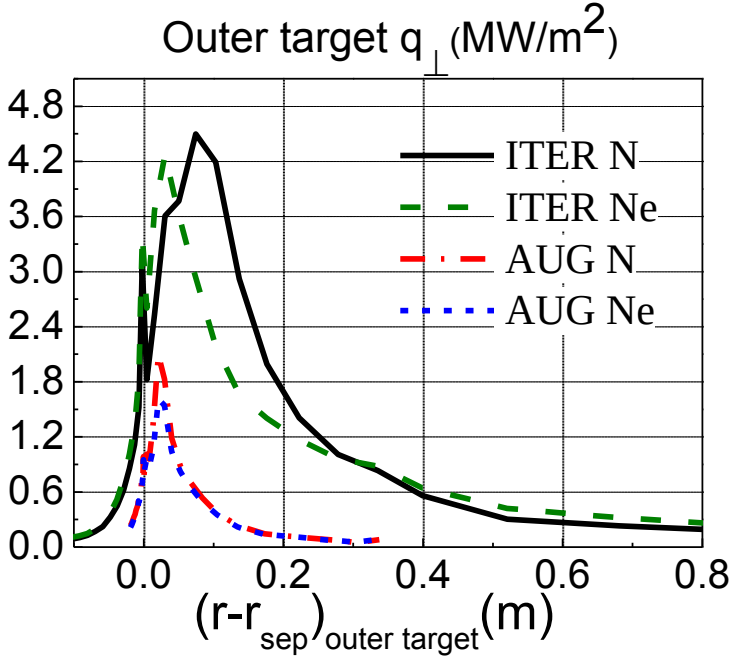


Electron temperature (eV)

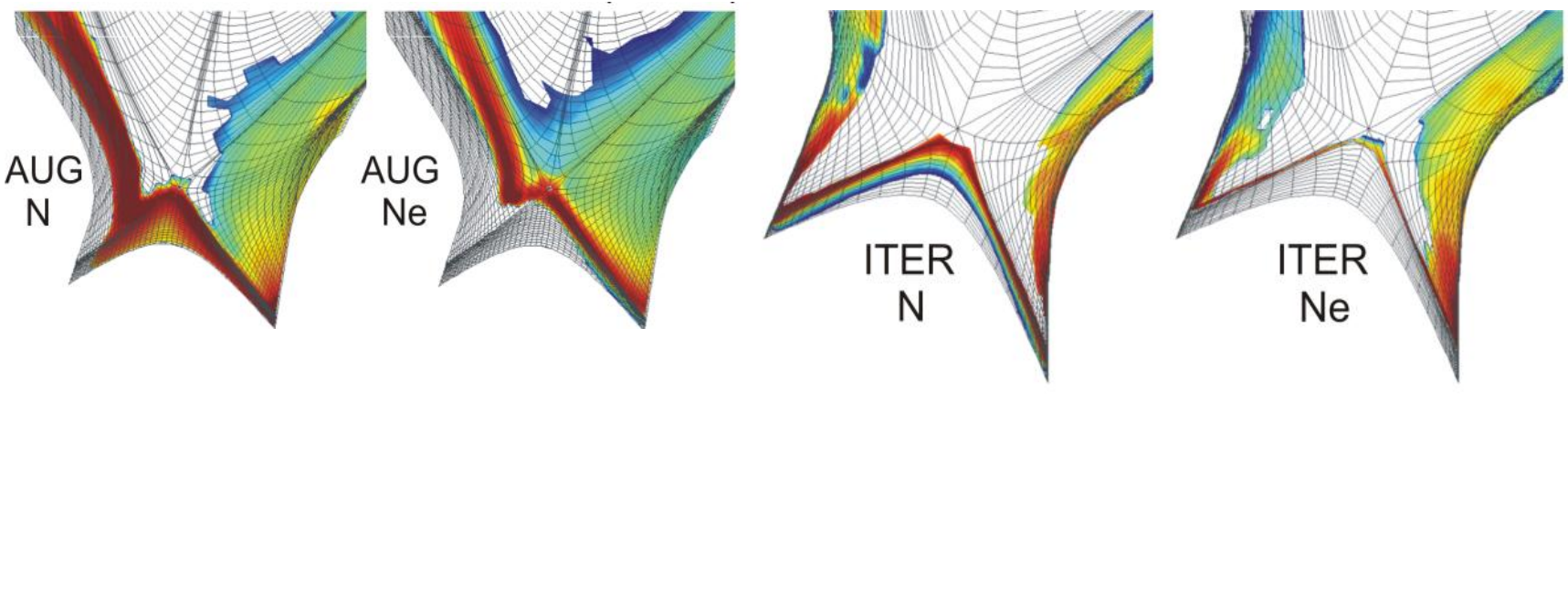


Heat flux profiles





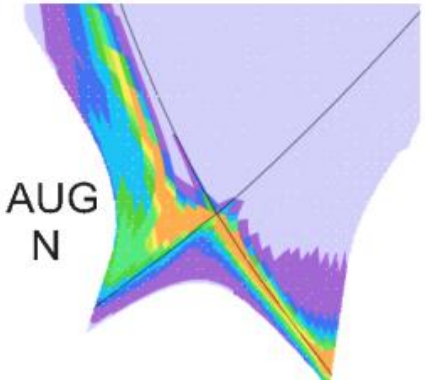
Ionization sources ($m^{-3}s^{-1}$)



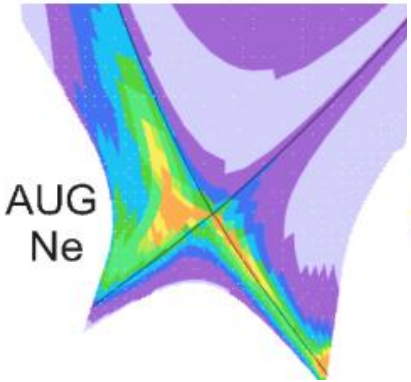
Radiated power

P_{rad_tot}/P_{in}=

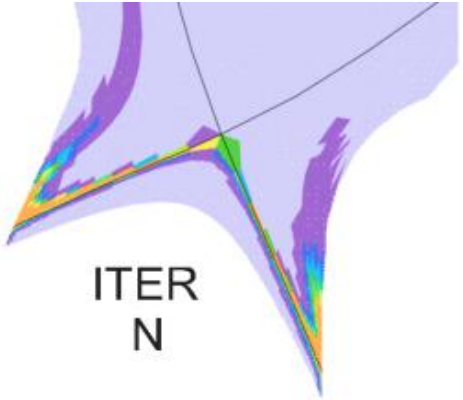
0.48



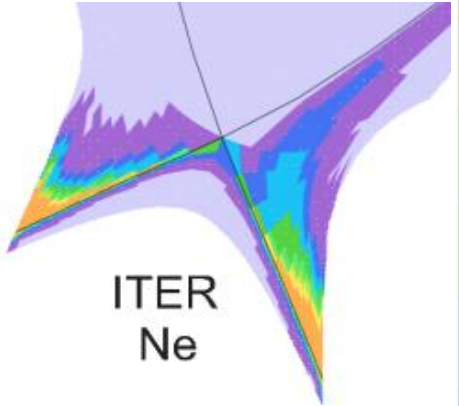
0.52



0.61



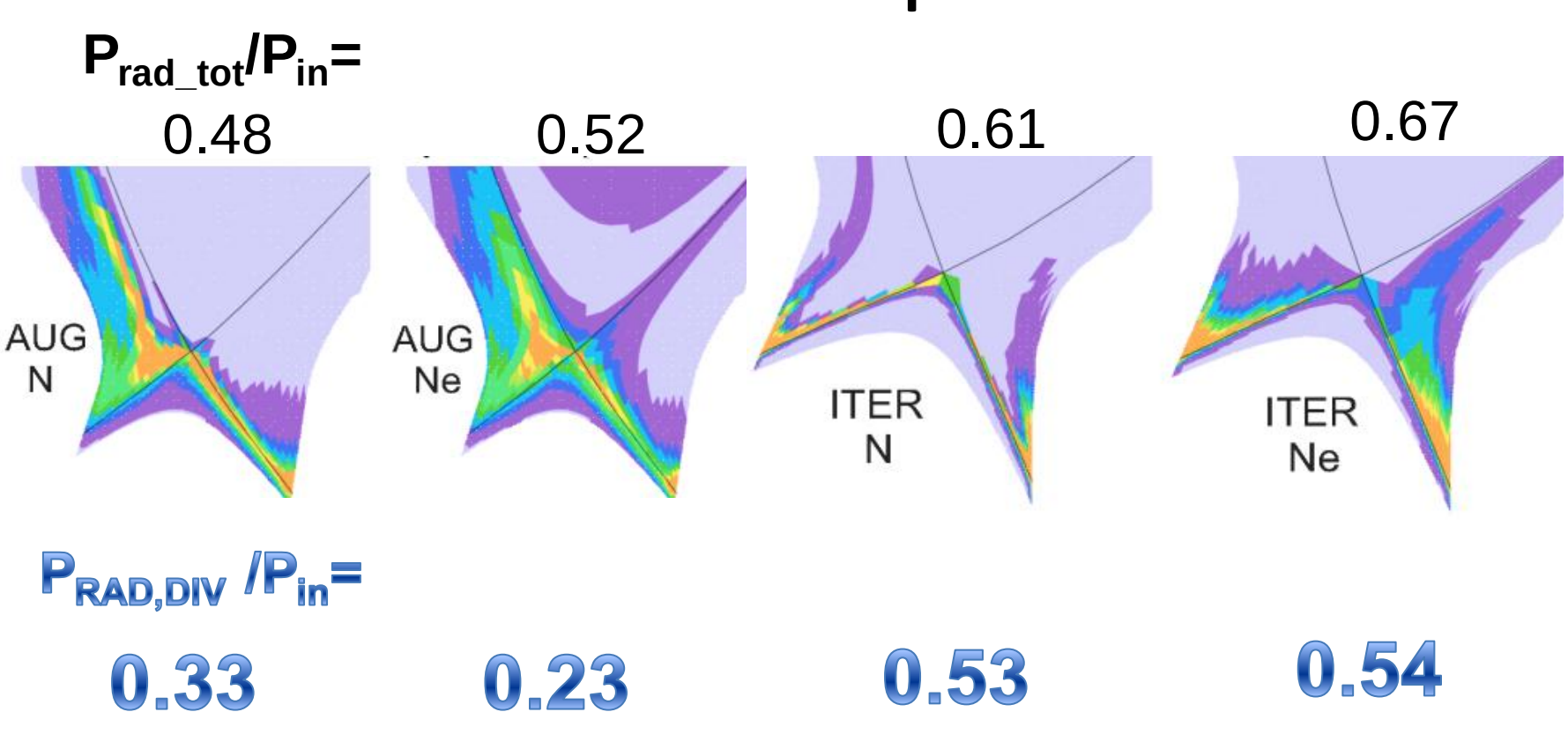
0.67



Radiated power

P_{rad_tot}/P_{in}=

0.48 | 0.52 | 0.61 | 0.67



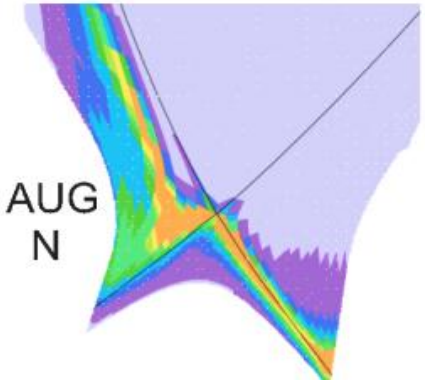
$P_{RAD,DIV}/P_{in}$=

0.33 | **0.23** | **0.53** | **0.54**

Radiated power

P_{rad_tot}/P_{in}=

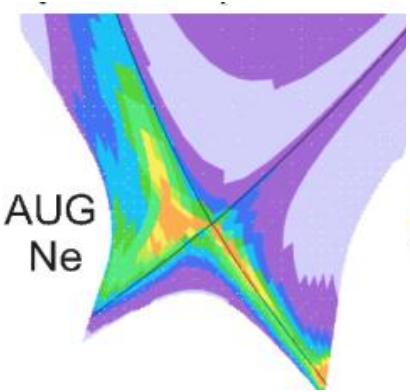
0.48



$P_{RAD,CORE}/P_{in}$=

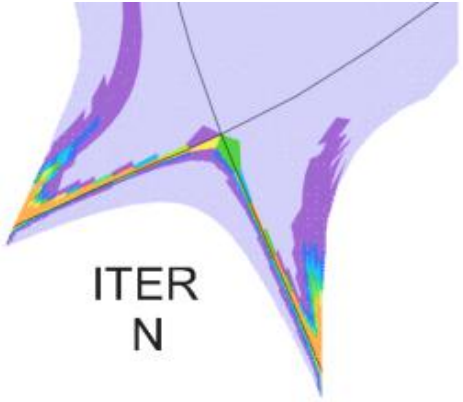
0.03

0.52



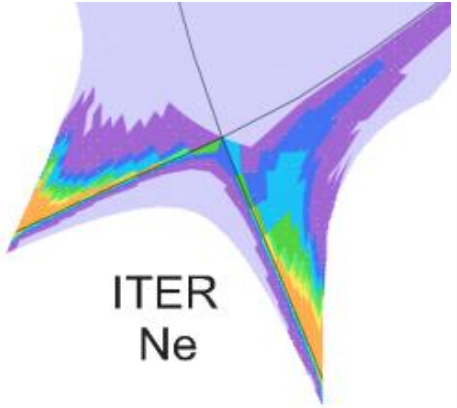
0.13

0.61



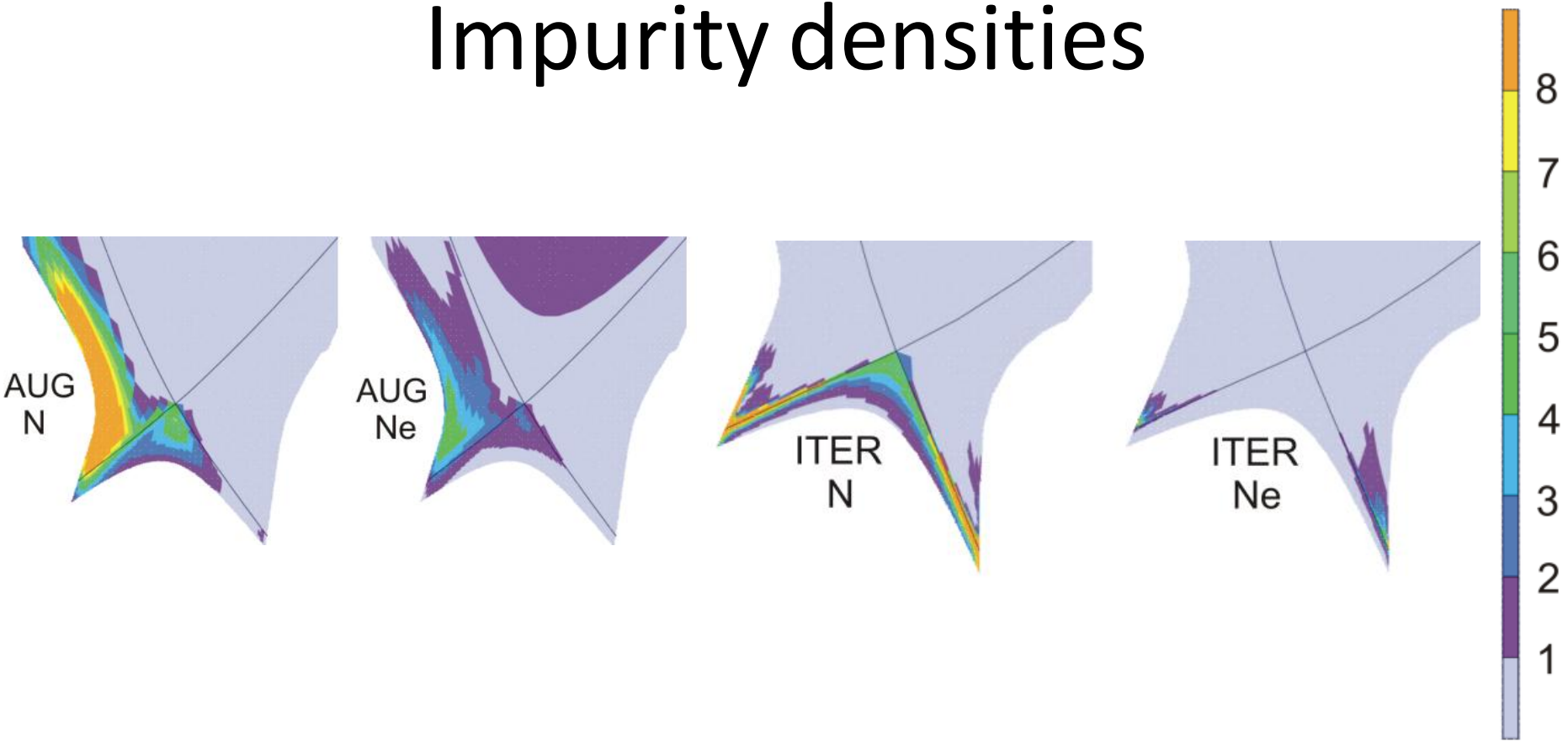
0.03

0.67



0.05

Impurity densities



“Neon exhaust” would be better on ITER than on ASDEX Upgrade