Multi-machine divertor peak heat flux and width scalings are used for extrapolation to ITER

- ITER Divertor Modeling and Database Expert group published scalings in 1998-1999: H-mode pedestal and edge/SOL database (experimental) scalings and 2D modeling (theoretical) scaling
- Theoretical scaling (Kukushkin et al., NF 43 (2003) 716): five major parameters - P_{SOL} (SOL power), p_{DT} (div. pressure), S_{DT} (pumping speed), ζ_c (core fuel. fraction of tot. particle throughput), ξ_{ei} (e-i partition in P_{SOL})
- Exp. scalings (Shimada et al., IAEA FEC 1998, paper P1/12 and ref. therein): one for ohmic and L-mode, one for H-mode
- Experimental scalings derived from 1/ midplane profiles 2/ divertor heat flux profiles (integral power width) as a function of P_{SOL}, n_{SOL}, q_{95}, B_ϕ, R, Z_{eff}
- Data from AUG, C-Mod, JET, JT-60U, DIII-D
- Basis for ITER divertor heat flux estimates
- How meaningful is the comparison to NSTX and NHTX?

Divertor heat flux width scaling in NSTX: possible?

- Midplane integral power width:

$$\lambda_q = \frac{\int_{div} q_{div} 2\pi R \, dr}{2\pi R_{div} q_{div}^{peak}} \frac{R_{div} B_\theta^{div}}{R_{mp} B_\theta^{mp}}$$

- May be able to use midplane Langmuir probe for ohmic and L-mode λ_{ne} and λ_{Te} scalings, limited use for H-mode

For divertor λ_q measurements:

- Divertor Langmuir probe data of limited use because of poor spatial resolution
- IR thermography - need to improve reliability and accuracy (present error bars ~ 20 %)
- Edge/SOL/divertor power balance is not measured - no SOL/divertor P_{rad} measurements
- P_{SOL}, n_{SOL}, q_{95}, B_ϕ, R, Z_{eff} - measured with various degrees of uncertainties
- Outer SOL is in high recycling regime throught most of operational space - wide range of parameters should be covered

Many issues should be addressed in proposed XP to succeed

- Ohmic, L- or H-mode (Ohmic and L-mode SOL width scalings are much better understood than H-mode scalings)
- ELMs should be excluded - restricted operating window
- Role of fueling - HFS puffing of D_2 can reduce divertor peak heat flux, can affect power width (?)
- Role of divertor radiation - no accounting, can significantly affect results
- Role of perpendicular transport - understanding in NSTX is emerging - need 2D code modeling
- Suggest to restrict number of “scanned” parameters to a minimum set