# SP-F Task Specifications

**Leena Aho-Mantila**

# Introducing the team and primary topics

**XD, SX**
*F. Subba*
*G. Rubino*
*P. Chmielewski*
*A. Järvinen*

**SF-**
*C. Colandrea*
*O. Pan*

**Reduced models /
connection to experiments**
*A. Järvinen*

**DN**
*L. Aho-
Mantila*

**SN**
WPDES
*F. Subba*
*L. Aho-Mantila*

**Modelling
support**
*M. Blommaert*

Nobody is working in isolation, regular group meetings

# Goals of the 2021 modelling work

➢ Obtain simulation database for missing configurations (SF-, later possibly DDN)

➢ Verification and deeper understanding of observed benefits (XD, SX, CDN)

➢ Guidance for experimental validation

➢ Input to SPL/PL for preparation of spider diagram

Challenges:
• many modellers with small contributions (< 4 ppm/year)
• not much time to complete the studies (1-2 years)
=> Need limited, well-defined tasks, commitment and regular discussions

# Picture to verify

- $P_{sep}$ higher than expected, $f_{rad}$ lower than expected (expected values: $P_{sep}$=150 MW, $f_{rad}$>90%)
- No X-point radiating regime observed in the DEMO solutions (mandatory in e.g. AUG for detachment in H-mode) => possibly a true feature of DEMO edge, but missing physics and possibly inaccurate setups needs to be checked



AUG #30506 @5.2s
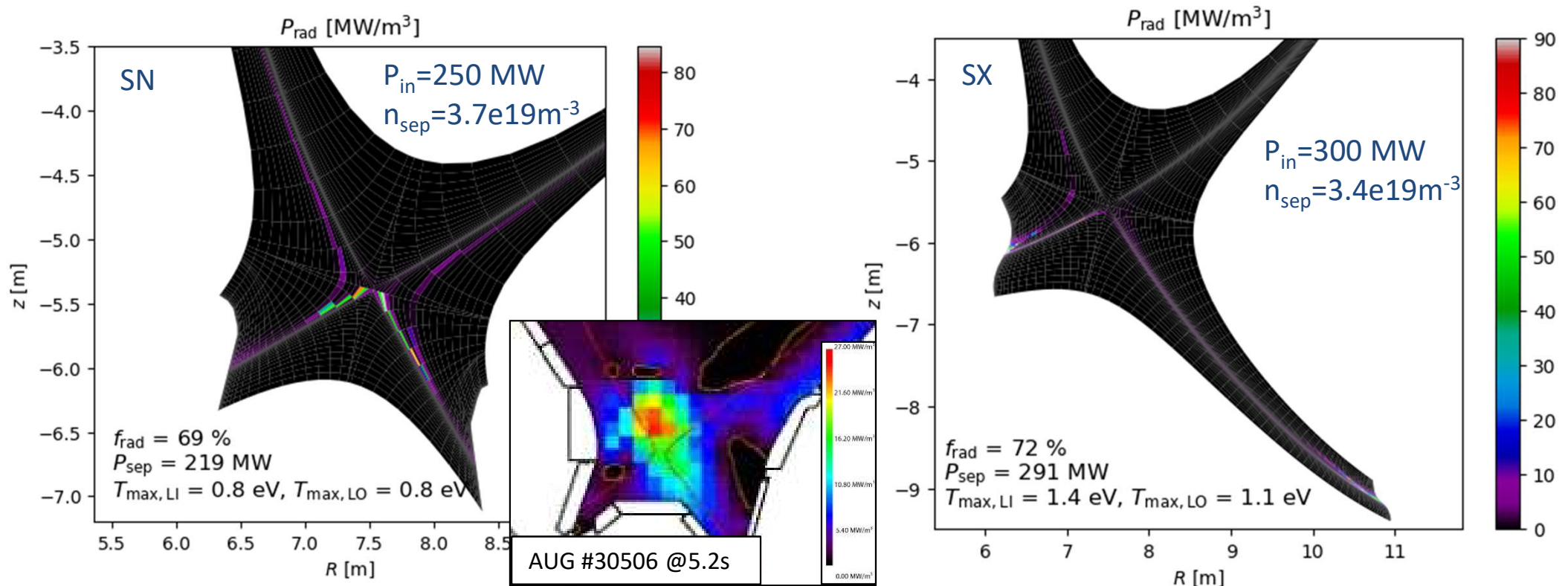
# Study 1: neutrals

- Use advanced neutral fluid models (SN, XD, SX)
- Study effects of leg geometry
- Lessons learned from SN kinetic neutral simulations?
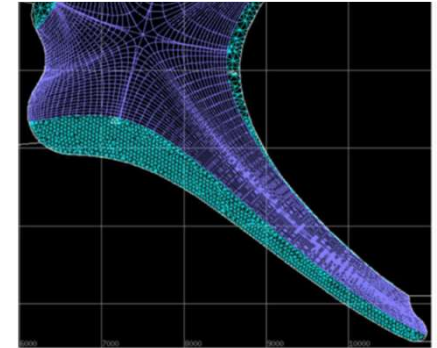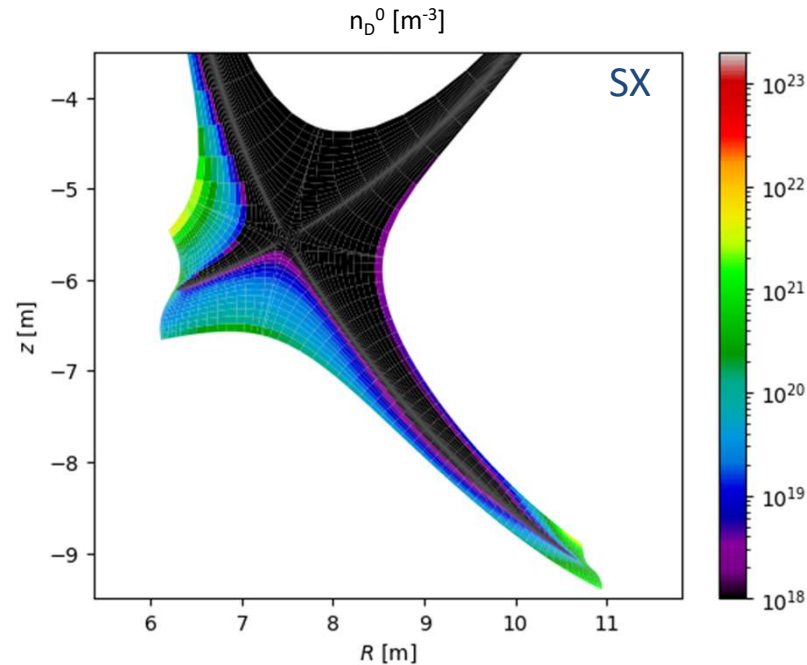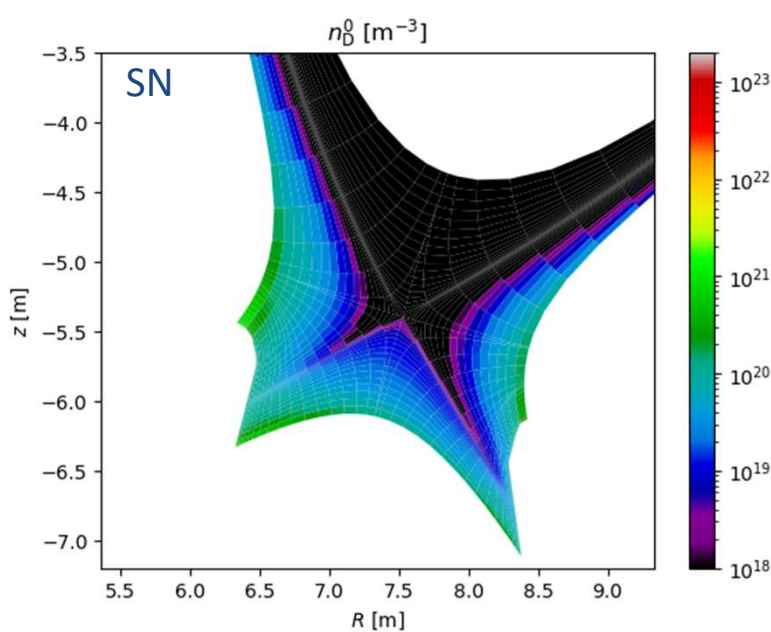






*G. Rubino*
*A. Järvinen*
*L. Aho-Mantila*
*F. Subba*
*M. Blommaert*
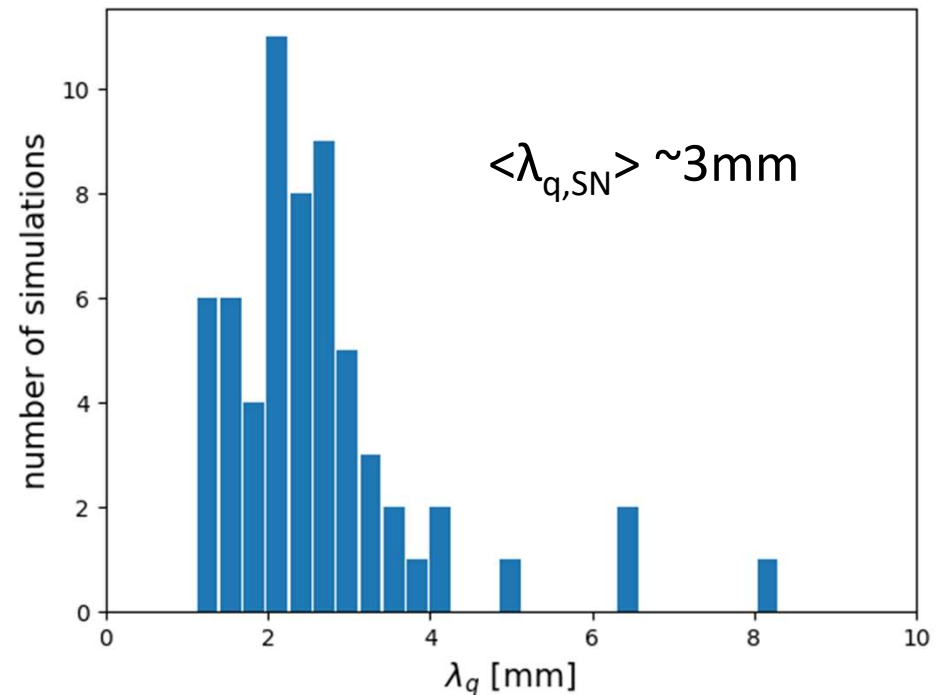
- ➢ Sensitivity of simulation results to the assumed cross-field transport levels (SN,XD,SX)
- ➢ Radiation pattern expected to move upwards from the targets with decreasing $\lambda_q$

*P. Chmielewski*
*F. Subba*

*Example variation of SOL heat flux width with poloidally constant transport coefficients:*
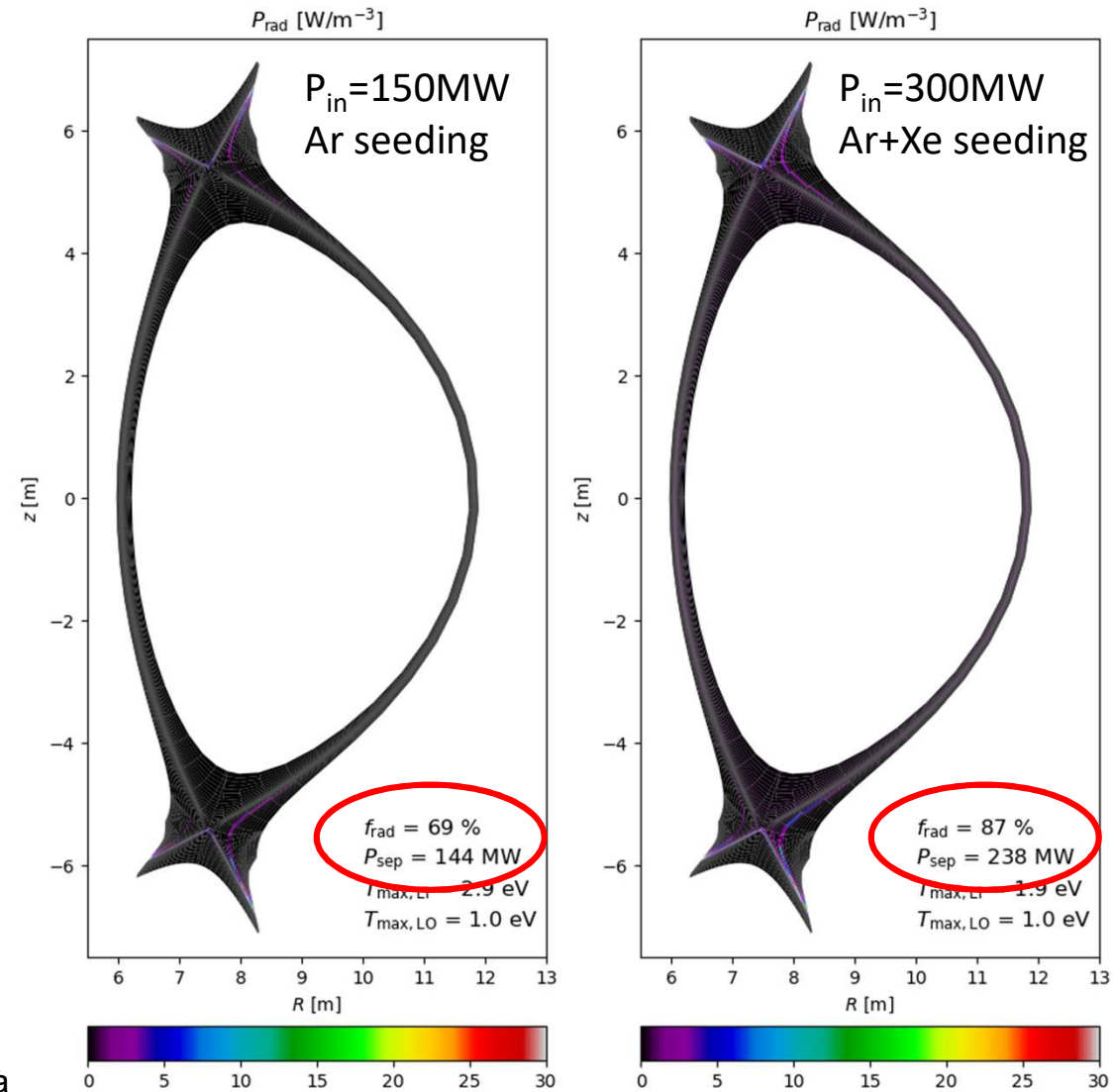
$<\lambda_{q,SN}>$ ~3mm

# Study 3: core radiators

- PROCESS predicts $P_{sep}$=150 MW, ADC simulations suggest higher $P_{sep}$

- How does core radiation modify the radiation pattern near the X-point?

- Do we see benefits in DN when the full heating power is taken into account?

*F. Subba*
*L. Aho-Mantila*
*G. Rubino*

L. Aho-Ma



$P_{rad}$ [W/m$^{-3}$]

$P_{in}$=150MW
Ar seeding

$f_{rad}$ = 69 %
$P_{sep}$ = 144 MW
$T_{max, LI}$ = 2.9 eV
$T_{max, LO}$ = 1.0 eV

$P_{rad}$ [W/m$^{-3}$]

$P_{in}$=300MW
Ar+Xe seeding

$f_{rad}$ = 87 %
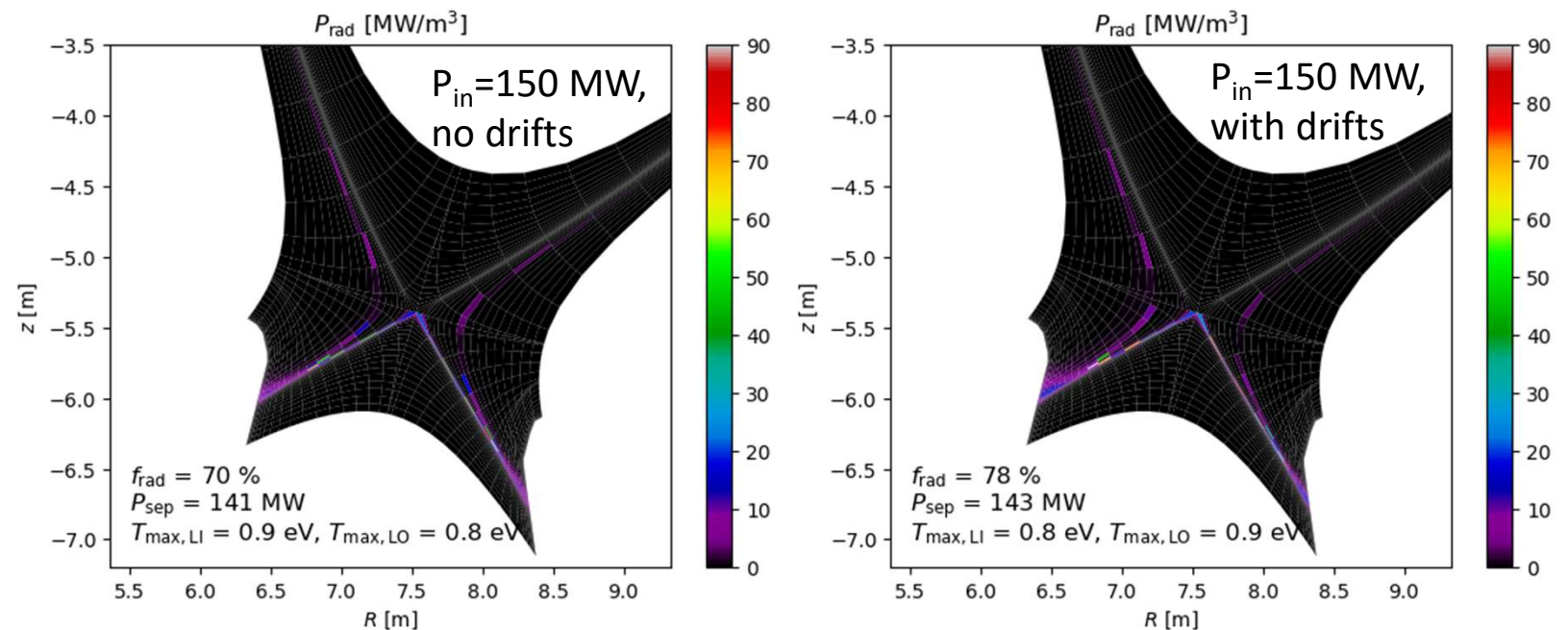$P_{sep}$ = 238 MW
$T_{max, LI}$ = 1.9 eV
$T_{max, LO}$ = 1.0 eV

# Study 4: drifts

- More seeding required in both SN and DN to obtain detached solutions when drifts are activated

- Analysis for SN and DN in 2021, later possibly for other configurations

*L. Aho-Mantila*

# Study 5: comparison with experiments

- ➢ Building reduced models only makes sense if we believe that we model the radiative regime correctly in our DEMO simulations
    - ➢ Parametric dependencies will likely be different for the X-point radiation compared to divertor radiation

- ➢ In the first stage, we should do a cross-comparison between DEMO detached solutions and detached conditions in present-day experiments
    - ➢ Reasons for the differences need to be understood!

- ➢ This is being carried out for SN, but should be extended to the alternative configurations

*A. Järvinen*
*L. Aho-Mantila*

# Organization of work

- Regular zoom meetings
  - Weekly or bi-weekly
  - Joint meetings with SP-G (experiments)
  - Inviting other experts for specific meetings
  - No Slack this time (would not be regularly followed due to the small individual contributions)
- Data exchange, compuational requirements
  - To be discussed, MDSplus for simulation data exchange