# Divertor modelling discussion (path forward to improvement of modelling codes towards reactors)

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# Speeding up codes

- Status
  - Various techniques (e.g. hybrid neutrals) ready to be applied to Demo
    - Increased ion-neutral collisionality in Demo leads to more accurate results

- Future steps
  - Need fluid/hybrid model for molecules to cover different collisional regimes?
  - What further speed ups can be made and what factor enhancement?
  - Any other methods of speeding up codes?

# Use turbulence codes to create transport coeff. for use in mean-field codes (Tamain, Baelmans)

- Status
  - Anomalous transport models based on RANS-approach may provide consistent description of mean field transport mechanisms (parallel, drifts, anomalous)
  - Some transport features (ballooning) reproduced inherently by models
  - Successful first comparisons to experiment

- Questions
  - Need improved description of the impact of parallel transport fluctuations (in particular, *drift waves*)
  - Implement effect of neutrals and recycling conditions?
  - Extensive model validation & calibration needed (incl. 2D/3D turbulence simulations) required?

# Code physics and geometry improvement (Borodin, Baelmans)

- Many code improvements are occurring
  - extended grids
  - atomic physics
  - Turbulence code –derived mean field transport coefficients
- Are there other physics  or capabilities that are needed?
  - Recycling physics?
  - More accurate molecular rates?
  - Other?

# Use optimization methods to find the best divertor solution or design (Dekeyser)

- Status
  - Optimization based design has the potential to find the ‘best’ solutions in complex applications
  - Strategies to integrate this optimization into complex workflows exist, but remain to be fully developed for the divertor design case

- Questions:
  - What are the most critical design criteria (i.e. cost functionals)?
    - Power? Steady state or transient? Operational scenario? Other?
  - Can we identify the dominant constraints and quantify model uncertainty?

# Evaluation of 1D models for predicting divertor performance (Järvinen, Cowley)

- Status
  - 1D models are not to be considered *quantitative* predictors of divertor operation or characteristics
  - Such models might be useful in terms of learning what divertor design choices affect divertor operation (e.g., control of detachment location) in a relative sense
- Questions
  - Can enough missing physics be added for more accurate predictions
    - Would such efforts turn into re-creating SOLPS?
  - Are there more applications of 1D models calibrated on SOLPS?

# Validation of modelling codes against current experiments (Ciraolo, Pan)

- What will it take to give us confidence in predicting reactor divertor?
- Are we stuck with the ‘best we can do’?