Electron Cyclotron Wall Conditioning proposal for OP2.1 – 2.2

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ECWC in OP1.2

Application of He ECWC in OP1.2

Recovery discharge - single long discharges (up to 10 s) at low density and moderate power.

Pulse Train – sequence of short pulses (up to 3.5 s) with a fixed duty cycle.

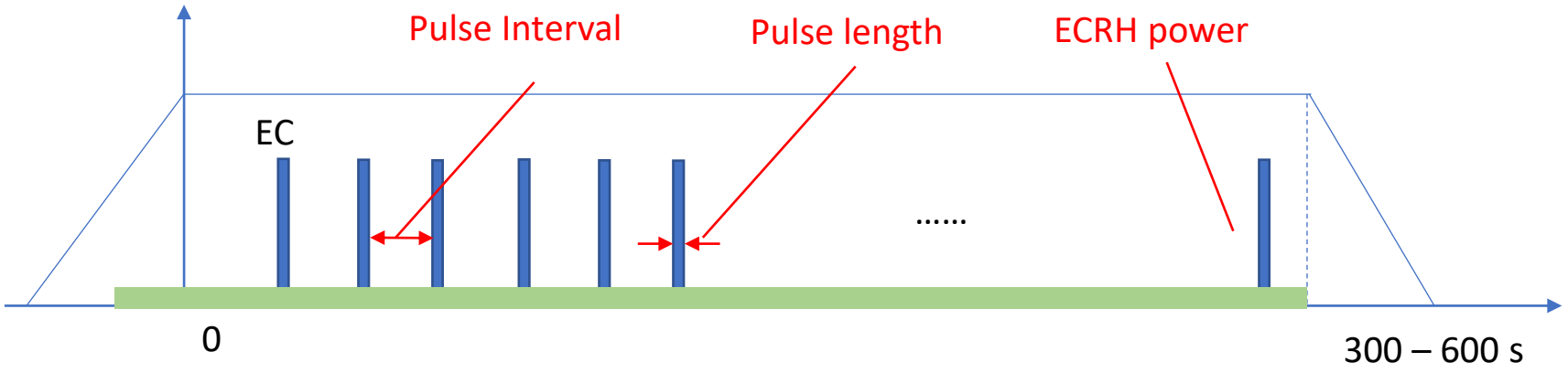
- 10 s recovery discharges remove 30 - 50 % less retained hydrogen in comparison with the pulse trains
- The risk of radiative collapses* is mitigated by applying pulse trains

* Before the first boronization

ECWC for density control

Application of He pulse trains in OP1.2

Pulse Train – sequence of short pulses (up to 3.5 s) with a fixed duty cycle



He pulse train (optimized OP1.2b) ->
pulse length - **3 s**, pulse interval – **30 s**, input power – **2.1 MW**, gas prefill – **15 ms** (75 mbar*l/s)

ECWC for density control

Upgrades in OP2

- Actively cooled divertor made of CFC -> different fuel outgassing and redeposition
- Cryopumps -> increase of the pumping speed

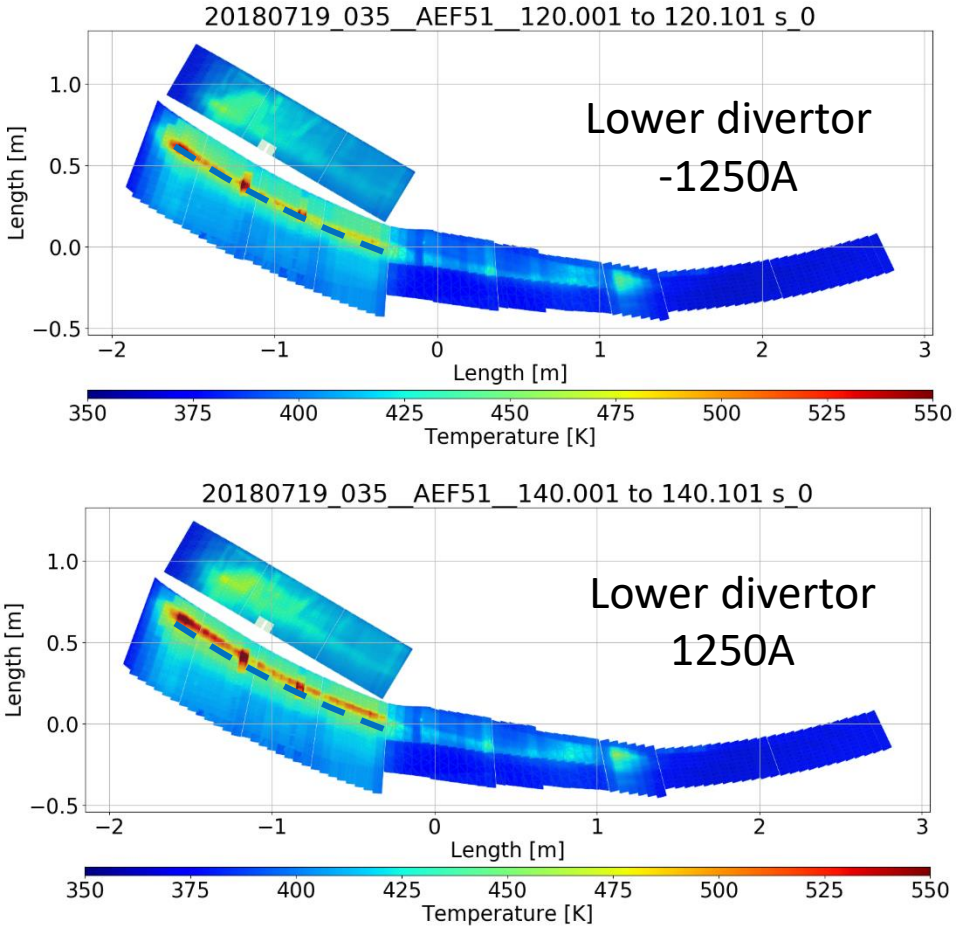
Proposal:

Increase of the hydrogen removal efficiency by optimization of main parameters

- Pulse length variation (1 s -> 2 s -> 3 s -> 4 s)
- Pulse interval shortening (30 s -> 20 s -> 15 s)
- Input power increase (2.1 MW -> 2.5 MW - > 3.0 MW)

Pulse train optimization

Influence of the strike lines sweeping on the optimized pulse train efficiency with actively cooled divertor



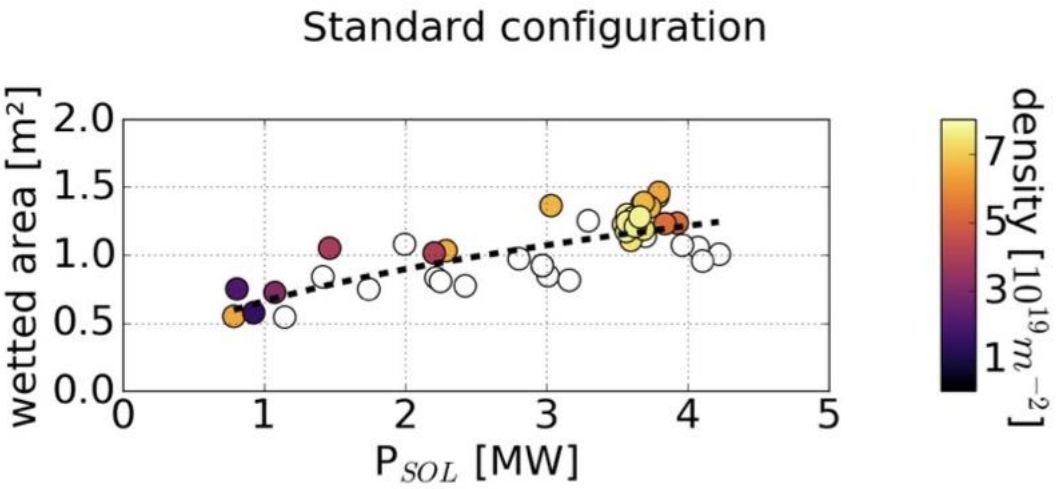
Position of the strike lines at DC -**1250 A** (upper) and DC **1250 A** (lower)

Sweeping positions of strike lines and increases the total plasma wetted area

Pulse trains with strike lines sweep have up to 30 % higher cleaning efficiency (standard configuration)

ECWC (pulse trains)

The wetted area is increasing with the power in the scrape-off layer (SOL)



Plasma wetted area vs He discharge power*

Proposal:

Comparison of fuel removal efficiency improvement ->

Application of the DC (- **2500** A to **2500** A) + AC (**625** A, **20** Hz) using control coils at

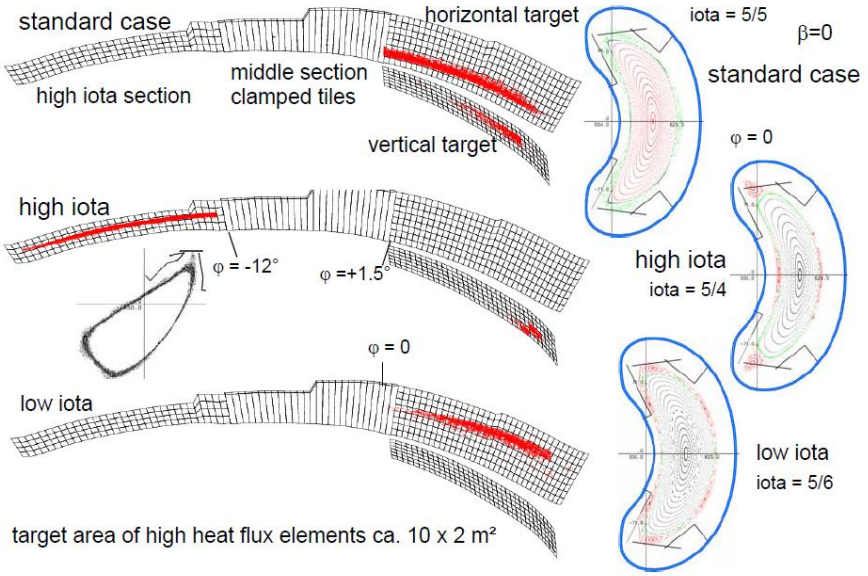
- Different discharge input power

  (**2.1** MW - > **2.5** MW - > **3.0** MW)

* H. Niemann et al 2020 Nucl. Fusion

ECWC with strike lines sweep

Actual plasma operation in different plasma configurations to covers different divertor surface



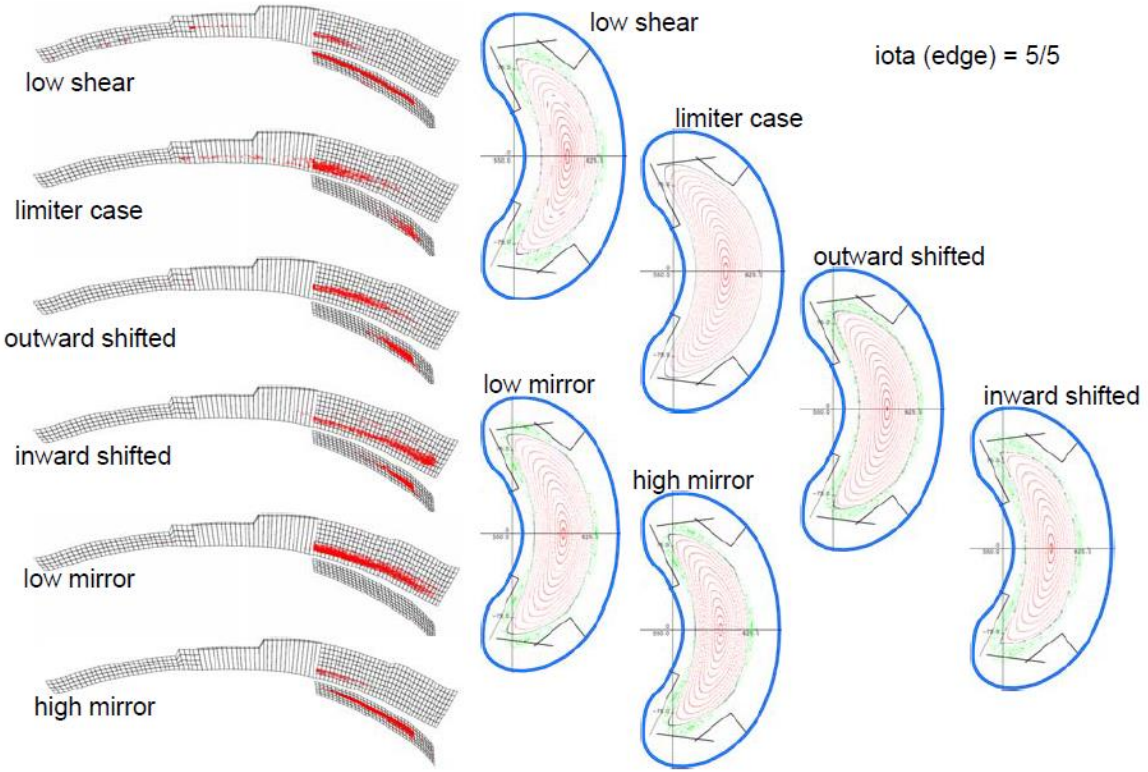
Proposal:

Comparison of fuel removal efficiency improvement at fixed power levels ->

- Different mostly used magnetic field configurations
  - Standard (EJM)
  - High Mirror
  - High Iota
  - Low Iota

ECWC with strike lines sweep

Actual plasma operation in different plasma configurations to covers different divertor surface



Proposal:

Comparison of fuel removal efficiency improvement at fixed power levels ->

- Other magnetic field configurations