Task:DIV-IDTT.S.07-T005-D001-D002
Progresses on divertor coils

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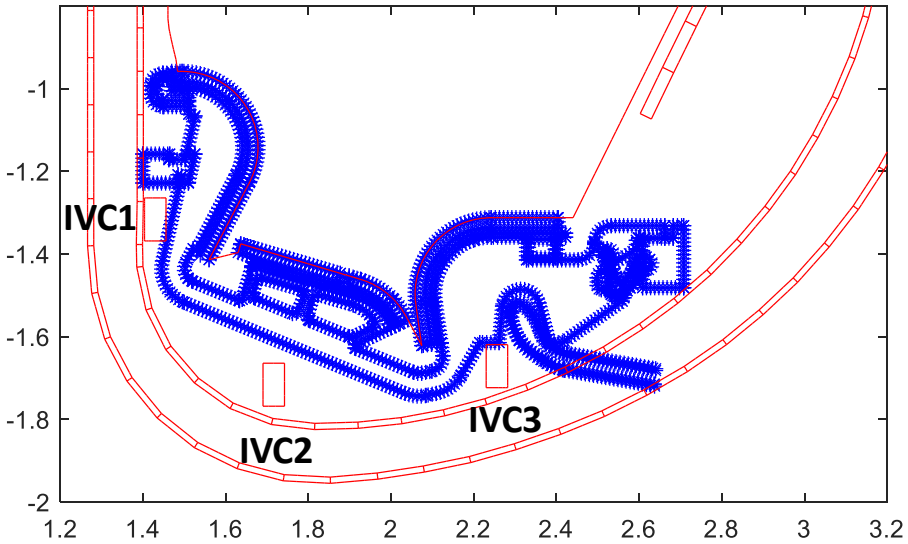
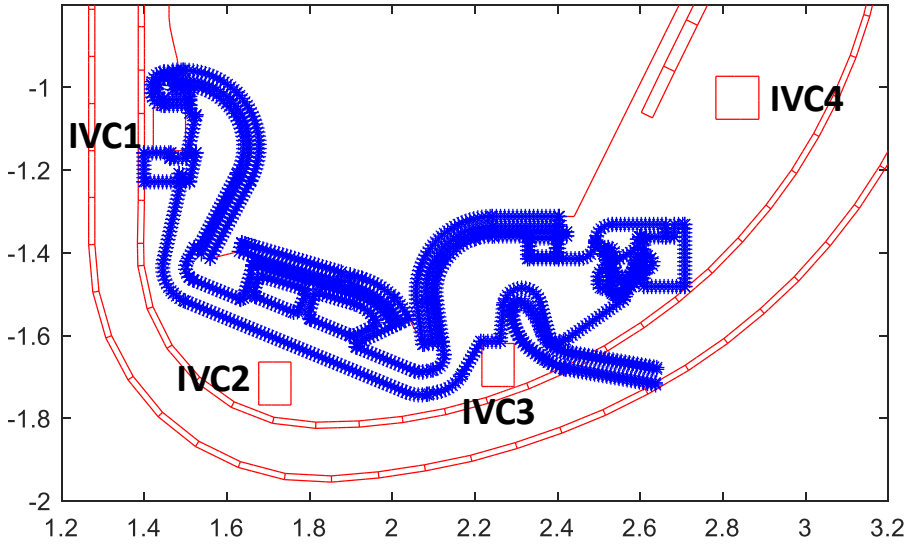
Divertor coils

- Currently, two possible options in terms of numbers, of positioning and dimensioning of divertor coils are under analysis;



	R [m]	Z [m]	Turns
IVC1	**1.429**	**-1.316**	**8**
IVC2	**1.716**	**-1.716**	**8**
IVC3	**2.256**	**-1.671**	**8**



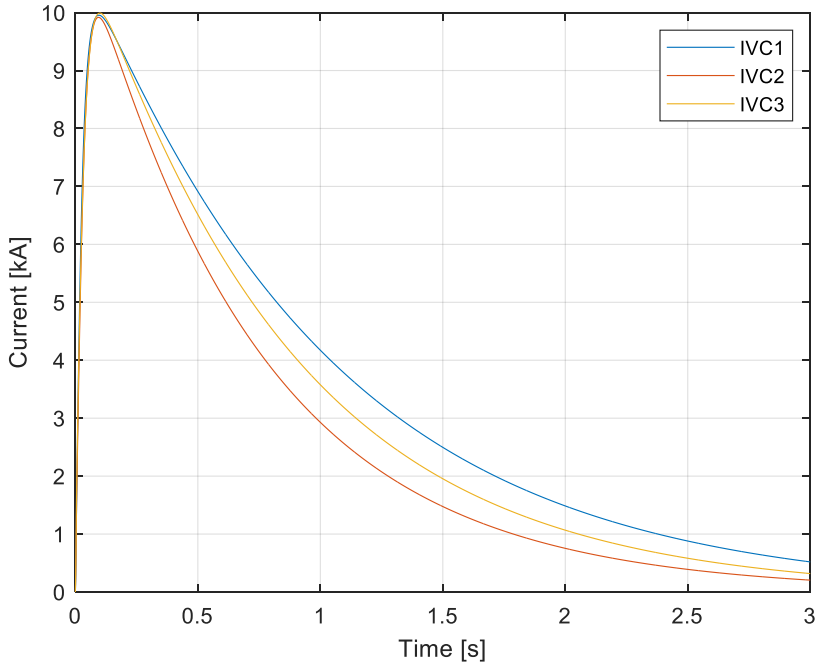
	R [m]	Z [m]	Turns
IVC1	**1.461**	**-1.101**	**12**
IVC2	**1.716**	**-1.716**	**12**
IVC3	**2.256**	**-1.671**	**12**
IVC4	**2.835**	**-1.025**	**16**

- The limits adopted for currents and voltages on divertor coils are 5kA and 500V respectively

Disruption analysis on divertor coils

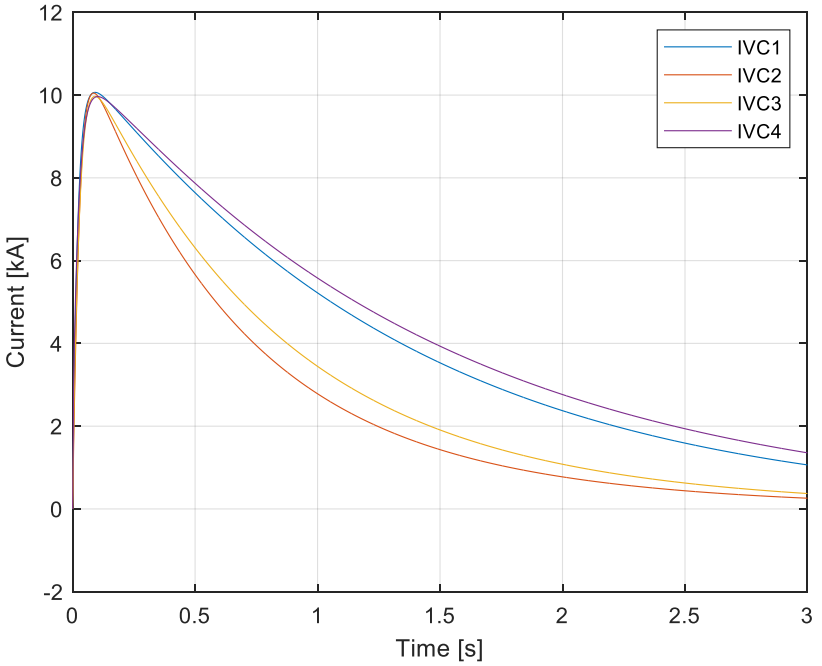
- For both options proposed, a disruption analysis has been conducted in order to evaluate the addition in series of additional inductances on divertor coils to limit the current peak to a maximum value of 10 kA during disruptive events;

3 divertor coils option



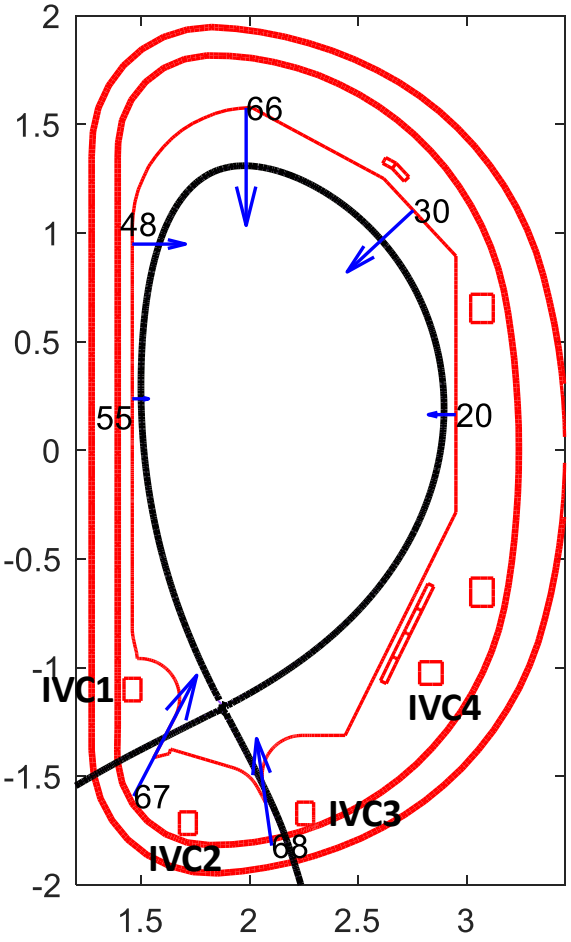
$$L_{IVC1,add} = 2,00\ mH$$
$$L_{IVC2,add} = 1,50\ mH$$
$$L_{IVC3,add} = 2,55\ mH$$

4 divertor coils option



$$L_{IVC1,add} = 3,80\ mH$$
$$L_{IVC2,add} = 1,55\ mH$$
$$L_{IVC3,add} = 2,80\ mH$$
$$L_{IVC4,add} = 10,90\ mH$$

Sweeping control



The sweeping control is a power exhaust strategy whose aim is to enlarge the divertor area affected by the plasma SOL imposing a periodic movement of the plasma divertor legs at a desired frequency with an almost fixed plasma shape.

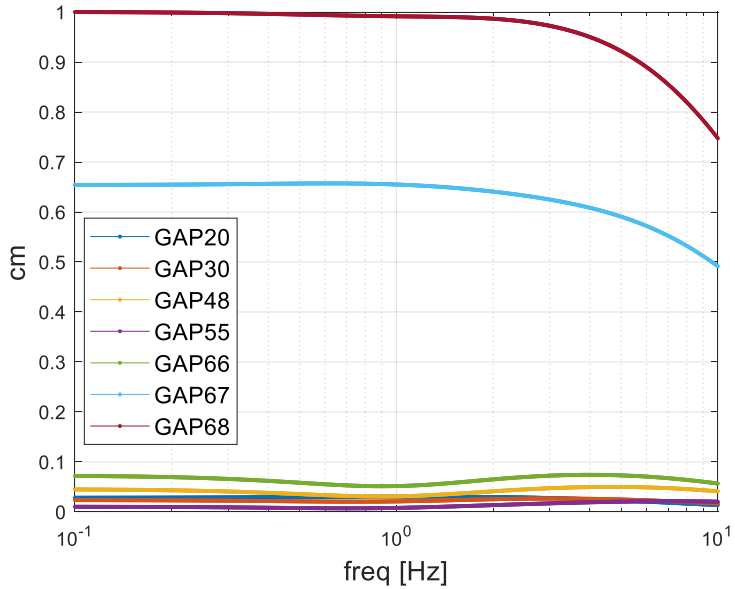
Shape descriptors

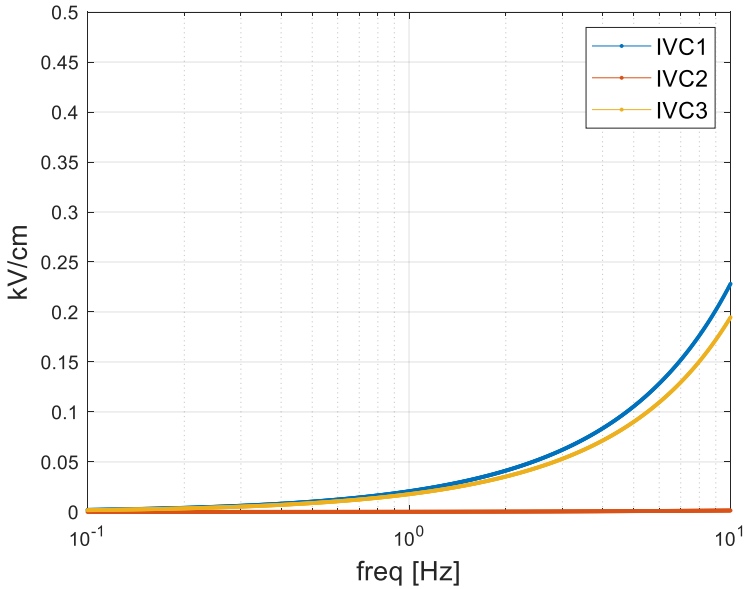
***Shape Gaps**:* [20 30 66 48 55]

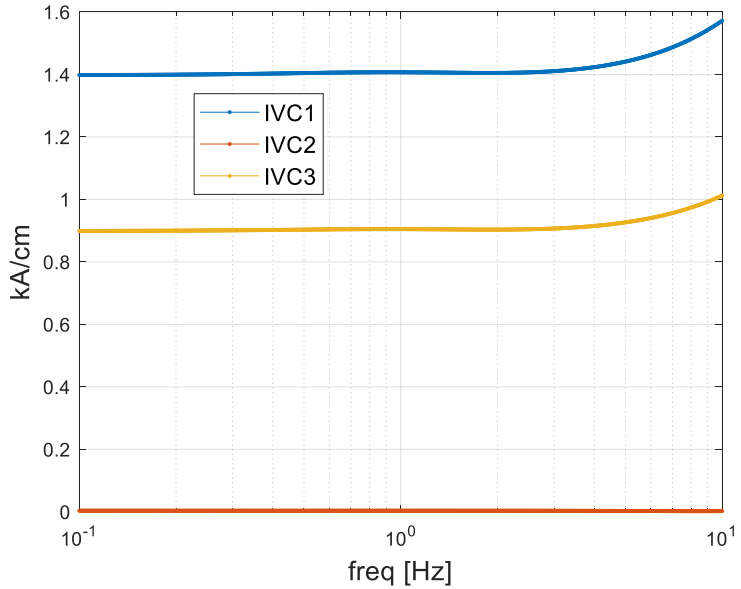
Plasma leg descriptors

***Sweeping Gaps**:* [67 68]

Sweeping control: Results for 3 coils solution

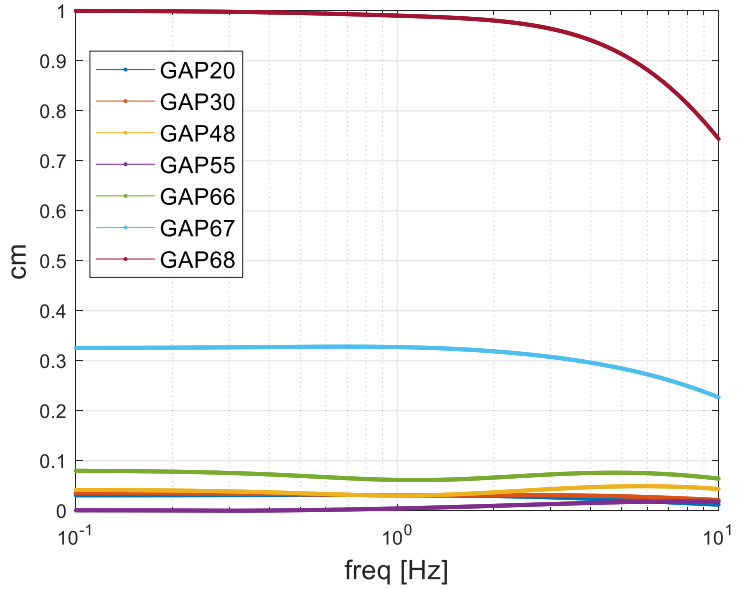


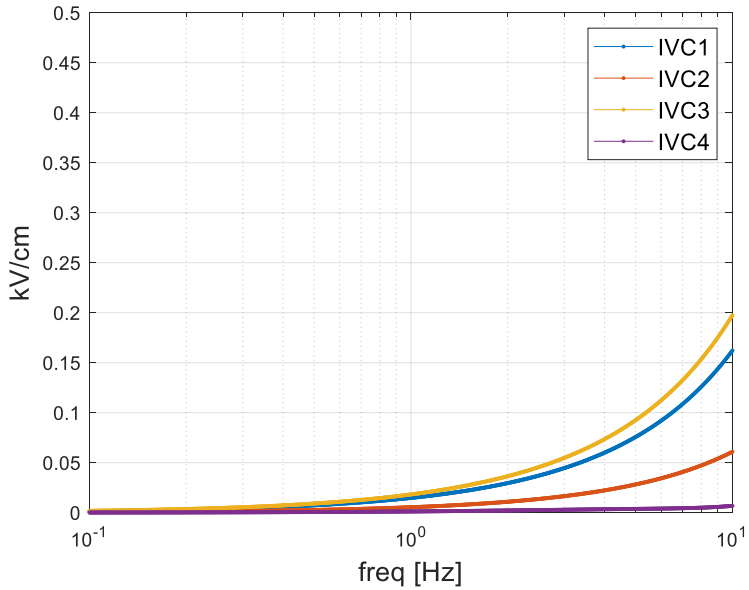


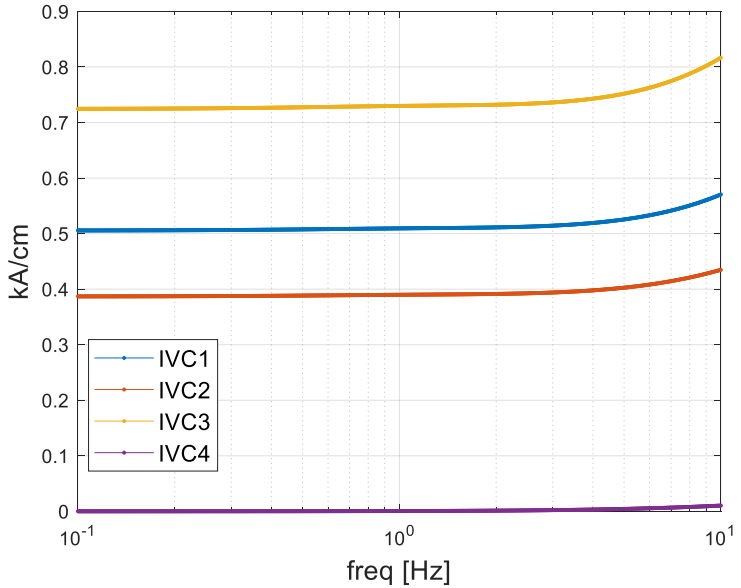


- Note that the sweeping is evaluated along the plate. Considering the poloidal angles on the inner and outer target (35° and 18° respectively), the absolute sweeping of the legs is comparable;
- Good decoupling between sweeping gaps and shape gaps in the frequency range $[1 - 10]$ Hz;
- According to voltage limit a sweeping amplitude of ± 3 cm at 7 Hz can ben imposed on the outer target (± 2 cm on inner target);

Sweeping control: Results for 4 coils solution (no IVC4 usage)

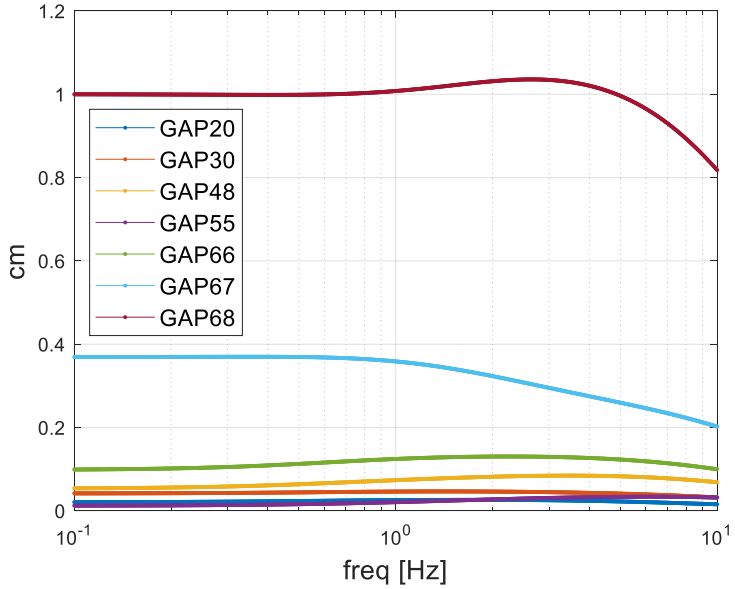


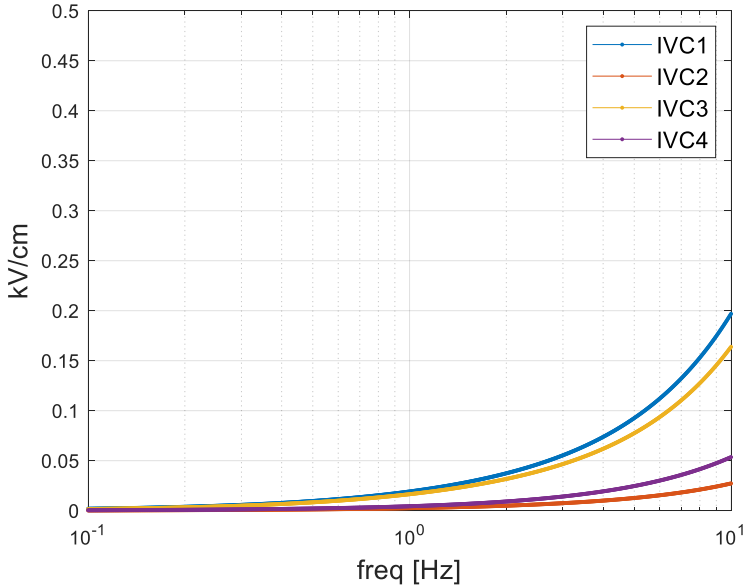


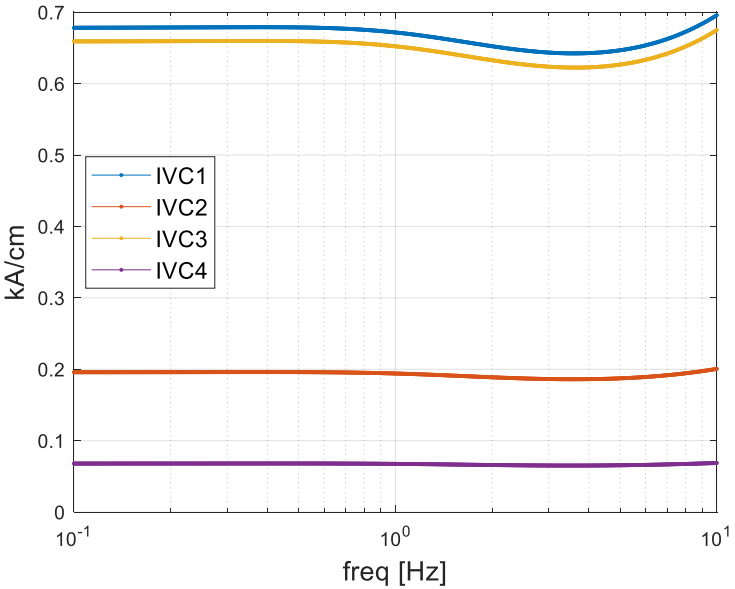


- Fair decoupling between sweeping gaps and shape gaps in the frequency range $[1 - 10]$ Hz;
- Different movement of strike points on inner and outer plates;
- According to voltage limit a sweeping amplitude of ± 3 cm at 9 Hz can ben imposed on external target (± 1 cm on inner target);

Sweeping control: Results for 4 coils solution







- Fair decoupling between sweeping gaps and shape gaps in the frequency range $[1 - 10]$ Hz;
- Different movement of strike points on inner and outer plates;
- According to voltage limit a sweeping amplitude of ± 3 cm at 9 Hz can ben imposed on external target (± 1 cm on inner target);

Conclusions

- According to the results presented, the divertor coils option with IVC1 over the divertor rail offers poor sweeping performance;
- On the contrary, the divertor coils option IVC1 under the divertor rail is the most performing and promising solution in terms of strike points sweeping;
- However, the latter solution is characterized by the assembly problem of IVC1 since its position should be under the divertor rail;
- A possible alternative solution would be to consider IVC1 over the divertor rail with the insertion of an additional divertor coil in the bottom of the divertor;