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Divertor Tokamak Test Facility: Science Basis and Status of the Project

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ABSTRACT

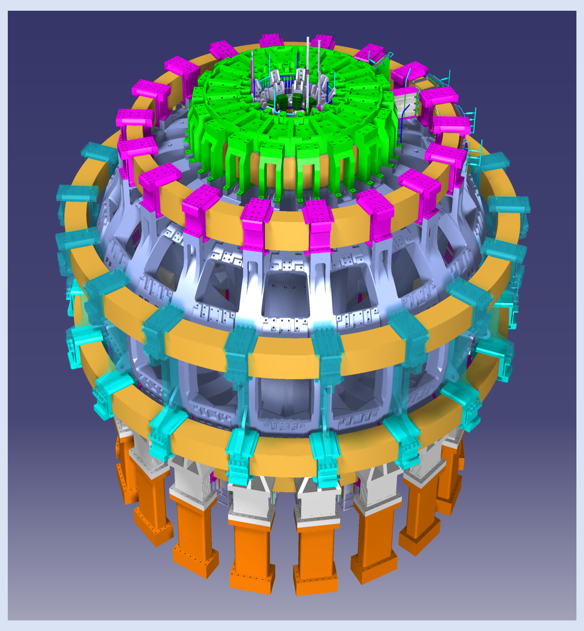
- The Divertor Tokamak Test facility (DTT) is a new fusion device under construction in Frascati, Italy. It is a compact, superconducting tokamak (R=2.19 m, a=0.70 m, average triangularity 0.3) with 6 T on-axis maximum toroidal magnetic field and plasma current up to 5.5 MA. Its main goals are to support the science and technology of plasma exhaust in view of ITER and DEMO and to provide a facility for high performance tokamak physics and to address core confinement and stability issues also in negative triangularity configurations, and the management of transient events like disruptions and ELMs.

DTT CONSTRUCTION HAS STARTED

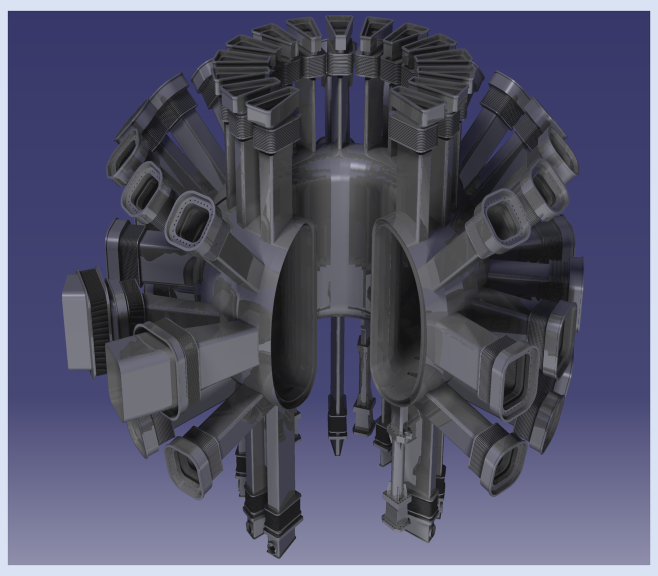
- The 45 MW auxiliary heating power allows matching the P_{SEP}/R values with those of ITER and DEMO, where P_{SEP} is the power flowing through the last closed magnetic surface. DTT is a divertor facility, i.e., it is designed to accommodate a variety of divertor configurations.
- In addition to its primary mission dedicated to plasma exhaust in regimes where core and edge are integrated and in conditions of reactor relevant power flow, DTT will be a facility for high performance tokamak physics and to address core confinement and stability issues also in negative triangularity configurations, and the management of transient events like disruptions and ELMs.
- **Since the last FEC the design has progressed steadily, the legal entity for the DTT construction has been established and a management structure is in place, the 250 M€ loan from the European Bank of Investment given within the EU Juncker Plan has been activated, the first large procurements have been assigned and others will be assigned soon.**
- New partners (CNR, Consorzio RFX, INFN, Polytechnic of Turin, University of Milano Bicocca, University of Rome Tor Vergata, University of Tuscia, are soon joining the three original DTT Consortium founding Partners: ENEA, ENI and CREATE Consortium)

DTT ENGINEERING AT A GLANCE

Magnetic system



Vacuum vessel



CONCLUSION: DTT IS GROWING

- **Construction started, physics studies being performed, team growing, collaborations welcome!**

PHYSICS SCENARIOS

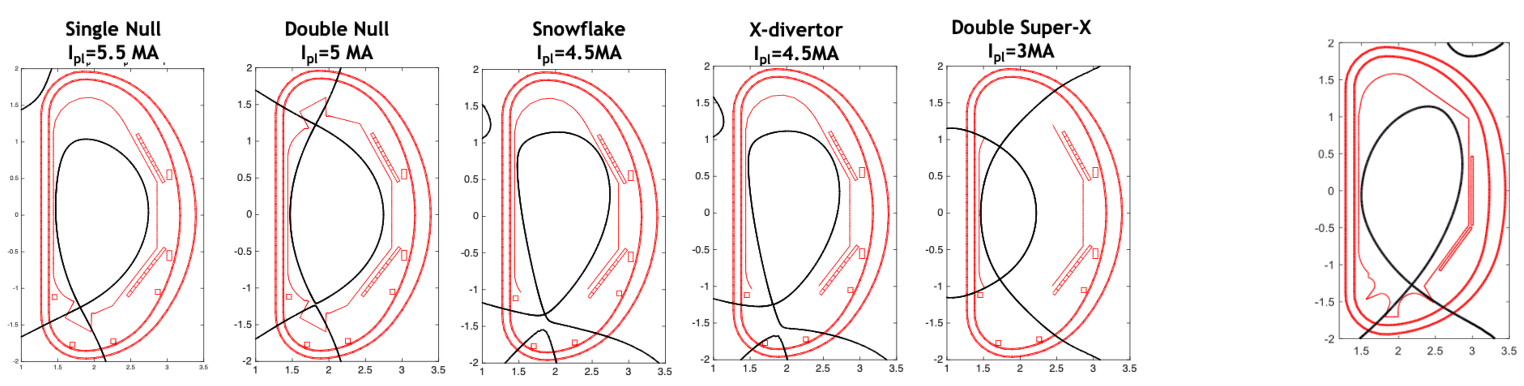
(see also Casiraghi/Mantica and Zonca papers at this conference)

HEATING

The auxiliary heating power coupled to the plasma at maximum performance will be 45 MW, shared between ion and electron cyclotron resonance heating and negative ion beams. In particular DTT will use 170 GHz ECRH, 60-90 MHz ICRH and 500 keV negative ion beam injectors.

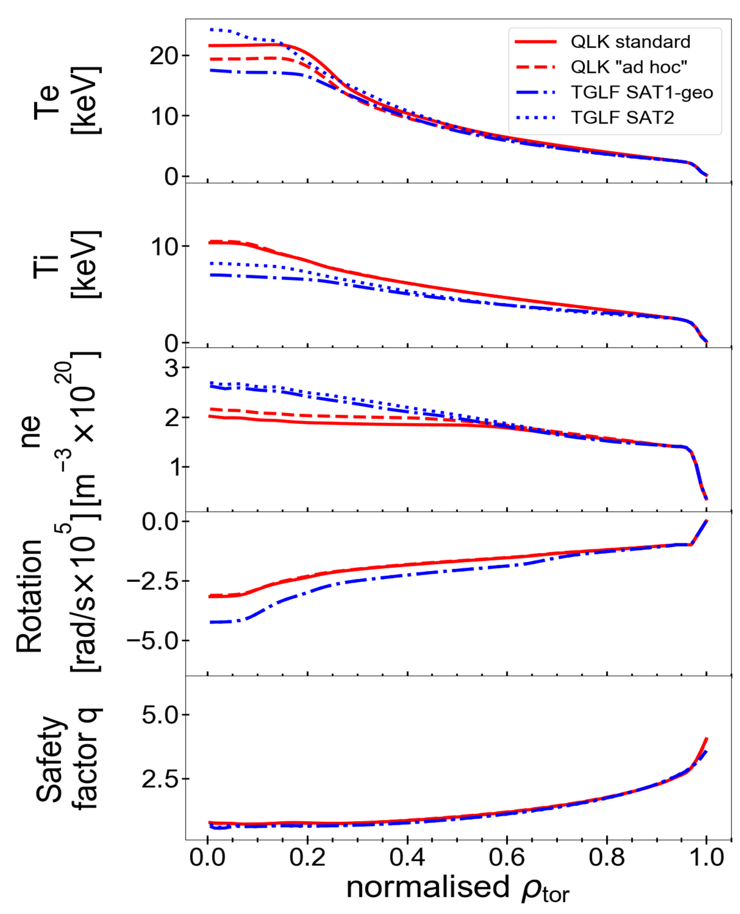
DIVERTOR MAGNETIC CONFIGURATIONS

DTT is being designed with a high level of flexibility. The reference configuration is the Single Null with Ip =5.5MA. The reference double null and snowflake configurations can be produced at (or close to) 5.5 MA. DTT allows for negative triangularity scenarios with proper divertor. Figure shows a 4 MA single null scenario with $\delta_{95\%}$ = - 0.13, $\delta_{upper95\%}$ = - 0.30, $\delta_{lower95\%}$ = 0.05.



TRANSPORT INTEGRATED MODELLING

The integrated modelling of DTT plasmas has been carried out with the JINTRAC or ASTRA suite of codes (Casiraghi this conference)



FAST PARTICLES

One crucial issue for the DTT integrated physics approach is the role of energetic particles (EP) as mediators of cross-scale couplings. A strong supra-thermal ion population, due to NNBI and ICRH, is foreseen in the full power DTT scenarios. In the inner core region, with low/negative shear feature, RSAE and BAE are found to be dominant. In the outer region TAE and EPM are present (see Zonca this conference)

EDGE and PLASMA EXHAUST MODELLING

The DTT edge modelling activity has proceeded along two different directions: the comparison between the standard single null and alternative divertor configurations in terms of power exhaust and the first assessment on the effects due to the inclusions of drifts in edge modelling. Single Null Divertor configuration has been takes as reference and compared in terms of power exhaust to the Double Null Divertor, Snow Flake + and Snow Flake - Power exhaust has been analysed both in pure deuterium and with neo and argon seeding at full power. The code SOLEDGE2D-EIRENE has been used.

ACKNOWLEDGEMENTS / REFERENCES

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