Blanket-FW Protection Thrust

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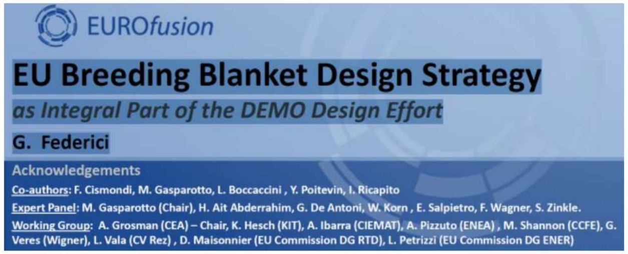

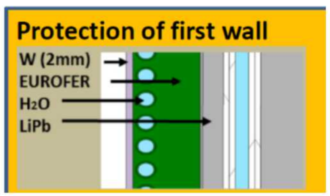

FW protection PFCs likely will displace volume for breeding (a)

Examples of possible program elements

- (a) Develop design concepts/requirements to integrate shaped FW protection schemes with blankets
- Develop solutions that incorporate Advanced Manufacturing and novel technical solutions (e.g., heat pipes)
- (c) Develop US working group and expertise to collaborate with international partners

(a) *also part of another proposed Thrust*

(c) *activities with international partners*

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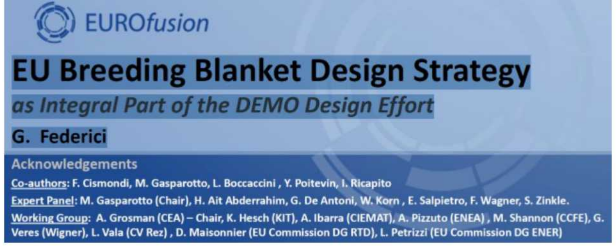
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EU Breeding Blanket Design Strategy

as Integral Part of the DEMO Design Effort

G. Federici

Acknowledgements

Co-authors: F. Cismondi, M. Gasparotto, L. Boccaccini , Y. Poitevin, I. Ricapito

Expert Panel: M. Gasparotto (Chair), H. Ait Abderrahim, G. De Antoni, W. Korn , E. Salpietro, F. Wagner, S. Zinkle.

Working Group: A. Grosman (CEA) – Chair, K. Hesch (KIT), A. Ibarra (CIEMAT), A. Pizzuto (ENEA) , M. Shannon (CCFE), G. Veres (Wigner), L. Vala (CV Rez) , D. Maisonnier (EU Commission DG RTD), L. Petrizzi (EU Commission DG ENER)

Key Lessons learnt during the DEMO pre-CD Phase

1) Still several plasma physics uncertainties that impact the design

   Plasma heat loads on the first wall during normal operation and transients (e.g., VDEs) → ... limiters may be required.

2) Integration of multiple design drivers across different systems

   Blanket vertical maintenance and coolant (LiPb) pipe routing

3a) Many Systems Interdependencies and Interfaces with Key Nuclear Systems

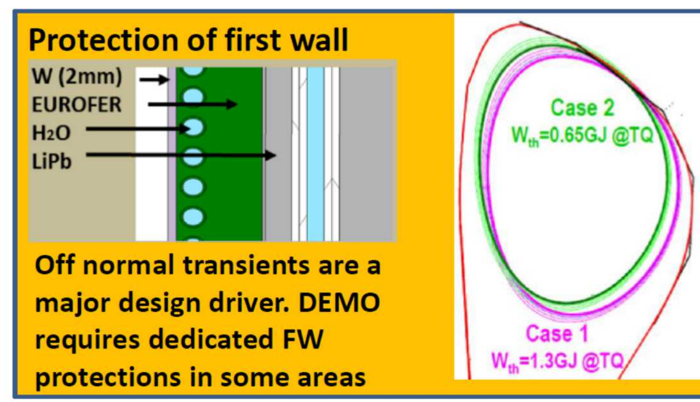
   Design features , e.g., type of coolant, breeder and multiplier, affect the overall design layout . a strong impact on design integration, RH, safety interfaces with key nuclear systems (e.g., PHTS, TER, CPS, WPSS, HeX, ESS, PCS)

3b) Many Systems Interdependencies & Interfaces with Key Nuclear Systems: importance of heat transport systems

   Significant differences: pipe lengths, coolant inventory, HX surface areas, tritium.

4) Global New Nuclear Build

   Lack of expected parallel development in areas of the advanced BoP of nuclear systems and high temperature structural materials from fission industry.



Progressive Approach to Licensing / Blanket CTF

We need and do not yet have a confirmed self-consistent solution for power handling!

- FW protection + how to add power
- Detached divertors + FW power sharing
- Limits on PFCs from tritium inventory
- ... Etc. ...

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1 critical R&D - blanket/fuel-cycle

- *Tritium inventory will severely limit choices for materials and components. Systems integration renders many concepts infeasible.* **feasibility**
- *Evaluations needed to focus the R&D path.* **strategy**

2 cross-cutting & common elements

- *Science of tritium in materials*
- *Heat & mass transfer, systems integration*

3 US focus (elements/strategy) **strategy**

- *Develop metrics for design/systems integration*
- *Evaluate US and foreign designs; share information*
- *Expand critical knowledge of the robustness of particular designs that can be applied to FNSF, e.g., ways to manage fuel cycle and still incorporate (a) primary driver blankets and (b) testing of DEMO modules and materials.*

Why US: US expertise/legacy

- *We still have some expertise in integration of FN systems. We need to engage and train new talent.*

Mantra: Make this real! Make this work!

Why now? Opportunity for engagement wil be lost

- *US expertise is quickly being lost. Regenerating and expanding the knowledge base is critical for developing a credible R&D path leading to FNSF.*

Thank you