IFMIF DONES GRANADA

DONES Preparatory Phase

EUROfusion

CAPABILITIES OF IFMIF-DONES AND STATUS OF THE PROJECT

A. Ibarra (IFMIF-DONES España, WPENS PL)

Together with J. Aguilar, F. Arbeiter, F. Arranz, D. Bernardi, S. Becerril, M. Cappelli, P. Cara, J. Castellanos, M. García, J. Gutiérrez, W. Królas, J. Maestre, A. Maj, F. Martín-Fuertes, J.C. Marugán, G. Micciché, F.S. Nitti, T. Pinna, I. Podadera, Y. Qiu, M. Weber, **and the full IFMIF-DONES Teams**

IFMIF-DONES ESPAÑA

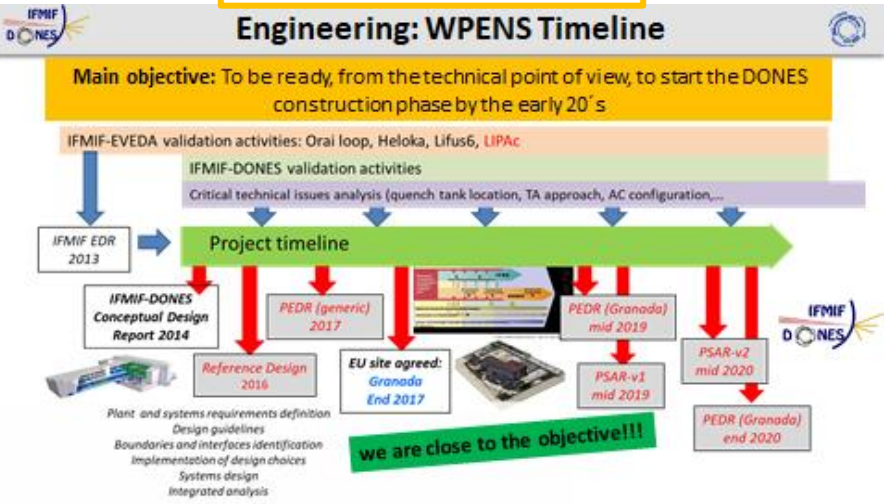
FUSION FOR ENERGY

This work has been carried out within the framework of the EUROfusion Consortium, funded by the European Union via the Euratom Research and Training Programme (Grant Agreement No 101052200 — EUROfusion). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the European Commission can be held responsible for them.

IFMIF-DONES status

IFMIF-DONES is the EU proposed research infrastructure to irradiate the materials to be used in a fusion reactor. The facility would provide a unique neutron source of energy spectrum and flux level representative of those expected for the first wall of the future fusion reactors

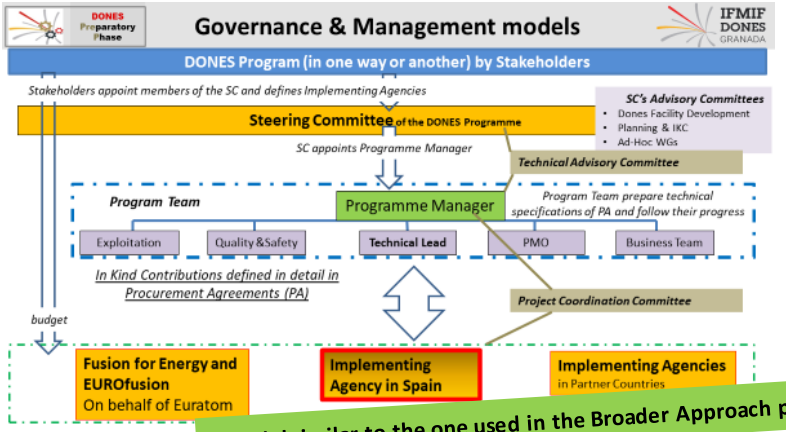
Engineering design



- Developed for IFMIF (and a generic site) up to 2013 in the framework of IEA and BA (IFMIF/EVEDA)
- Developed for IFMIF-DONES from 2015 in the framework of the ENS WP of EUROfusion

Implementation

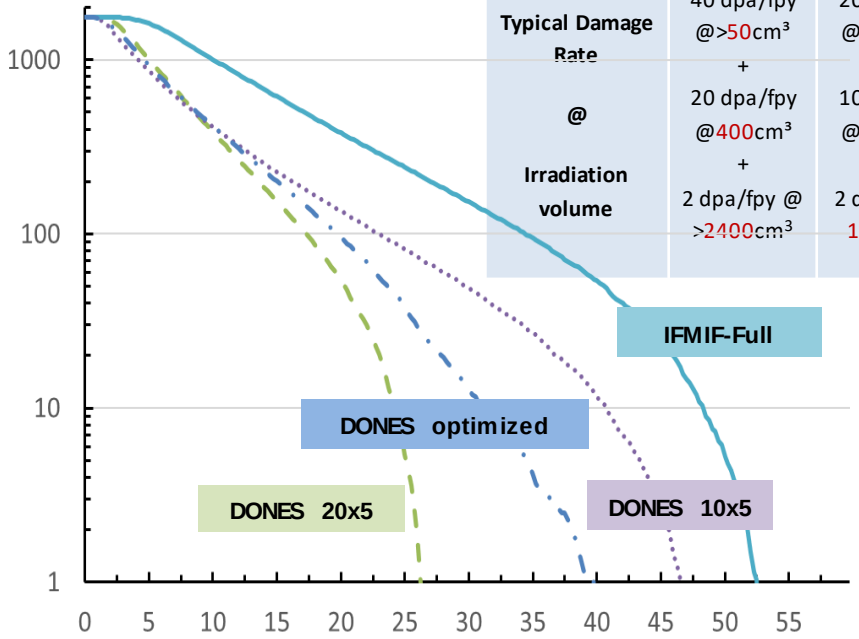
- A complete planning of the project has been prepared (Project Plan, Time Schedule, Cost Estimate, Risk Analysis, Quality, Project Lifecycle, Licensing…)
- Proposals for Project implementation, governance and management, sharing of contributions… have also been agreed



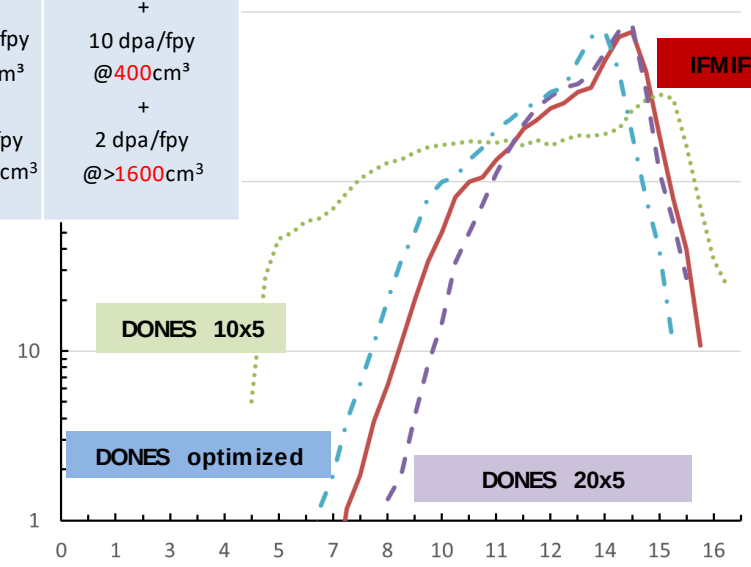
IFMIF-DONES capabilities (high flux region, steel)

	IFMIF-Full	IFMIF-DONES		
Beam footprint	20 x 5 cm²	20 x 5 cm²	10 x 5 cm²	Optimized (15 x 5 cm²)
Typical Damage Rate @ Irradiation volume	40 dpa/fpy @>50cm³ + 20 dpa/fpy @400cm³ + 2 dpa/fpy @ >2400cm³	20 dpa/fpy @>50 cm³ + 10 dpa/fpy @400 cm³ + 2 dpa/fpy@ 1800cm³	20 dpa/fpy @>130cm³ + 10 dpa/fpy @400cm³ + 2 dpa/fpy @>1500cm³	20 dpa/fpy @>90cm³ + 10 dpa/fpy @400cm³ + 2 dpa/fpy @>1600cm³

Available Irradiation Volume (cm³) vs DPA (dpa/fpy)



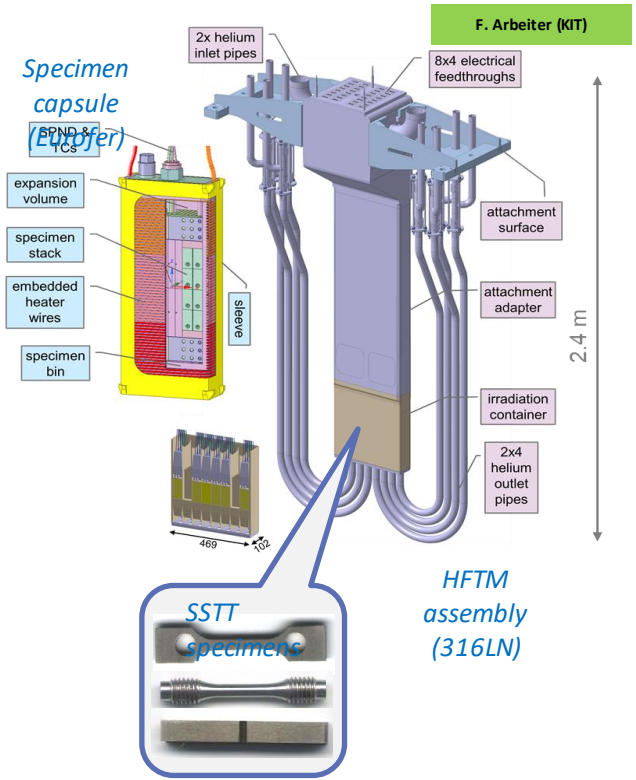
Available Irradiation Volume (cm³) vs He/dpa ratio (HE appm/dpa)



High Flux Test Module (HFTM)

Objective: to irradiate a large volume of SSTT samples in the high flux region of DONES
First-to-be-installed irradiation experiment (critical path).

- Heating: Nuclear **2.3 W/g peak**, 17 kW tot.,
  1.5 kWe per capsule
- Cooled by **low pressure helium** gas (0.3MPa, 50°C), **Sodium** heat transfer filler
- Lifetime: 1year / 2.5 years (**53 dpa**).
  Body made from **316LN** (acc. RCC-MRx)
- Masses: Total 680 kg, 40 kg irradiation capsules with specimens



Steel irradiation

- 12–25 dpa/fpy in 306 cm³ (~ 850 specimens)
- 13 appm He / dpa, 53 appm H / dpa.
- 250 – 550 °C, sodium immersed specimens

Copper irradiation (divertor heat sink)

- 5–30 dpa/fpy
- 6–8 appm He/dpa is (~DEMO), 48–50 appm(H)/dpa (~1.4x DEMO)
- >100°C, helium immersed specimens

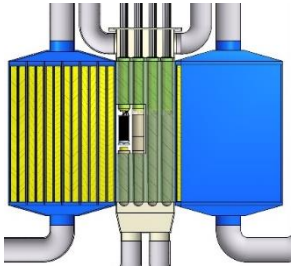
Tungsten irradiation (armor)

- Up to 800°C, assisted by self-heating
- 8x20 cm³ (cylindrical HT capsules)
- 1–3 dpa/fpy in W
- 9–10 appm He / dpa, (2x of DEMO), 20–29 appm H / fpy, (3x of DEMO)

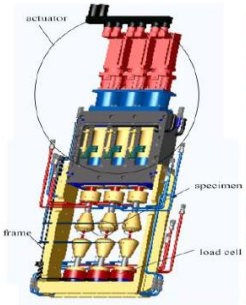
Prospective test modules

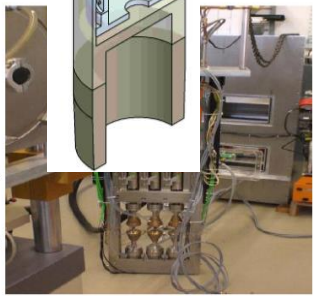
Other materials or other irradiation modules can be also installed (sequentially or simultaneously to the HFTM)

A “catalogue” of possible irradiation modules has been developed and preliminary conceptual designs are available for some of them:



In-situ ceram. breeder testing KIT concept





- In-situ Creep Fatigue
- In-Situ Tritium Release
- Liquid breeder validation Module
- Diagnostics irradiation
- “Model Blanket Module”
- Tritium permeation / coatings
- Corrosion, IASCC

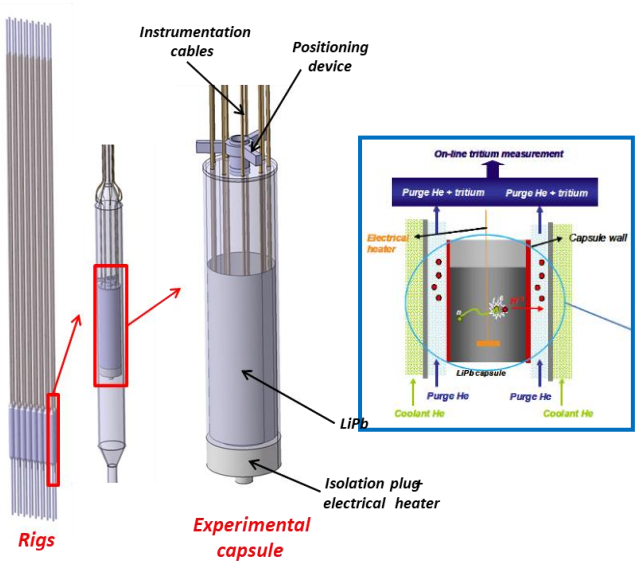
Superconducting magnets

Radioisotope production

…

In-situ creep-fatigue EPFL concept

In-situ liquid breeder testing, CIEMAT concept



Several capsules with Pb-Li eutectic inside

Conclusions

IFMIF-DONES Program is expected to start Construction Phase in short time