

# Some views on the Fusion programme in the EU besides ITER

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**Status:**

A decision on ITER will directly lead to the need to adjust the European fusion programme („Accompanying programme“) to this new situation.

An Ad hoc group has been established to draft an outline proposal for this programme. This will be the basis for discussions among the European participants in the fusion programme.

This presentation reflects the individual views of one group member.

Discussions until now are made on the presumption that the ITER site will be Europe.

## **Embedding „fast track“ issues into the programme**

**Aim:** Enable the EU to decide on the construction of a first fusion power reactor as soon as possible.

1. How can the exploitation time of ITER be shortened in this regard?
2. Complementary reactor physics studies
3. How can the qualification of materials/technology be accelerated?

# 1. How can the exploitation time of ITER be shortened in this regard?

- a) Establish the necessary physics for optimum ITER experimentation on a relevant suite of divertor tokmak devices.
  - Flexible medium sized machines
  - JET sized device(s)
  - ITER

Issues: plasma stability, control of transients, materials studies (Be, W)....

- b) Establish international operation teams which are highly trained in fusion device operation and can aggressively advance ITER exploitation.

## 2. Complementary reactor physics studies

Support the establishment of the necessary reactor physics  
By operation of a flexible non-nuclear device.

JET-sized D-D device (implications to be defined)

Plasma stability, control of transients, materials studies (Be, W)....

### 3. How can the establishment and qualification of materials/technology be accelerated?

#### **Materials qualification:**

Reduce need for science-oriented experimentation on IFMIF by establishing knowledge base beforehand:

- Support modelling (aim at transition from descriptive to predictive work)
- Besides ongoing fission reactor irradiation, support innovation materials irradiation experiments to bracket fusion irradiation conditions
- Use IFMIF as soon as possible for high dose irradiations of prime
- Candidate materials

#### **Plasma-facing materials and components:**

Non-nuclear component testing (hot wall, hot divertor)

in a high fluence, long pulse tokamak: erosion, heat removal, ageing

(needs assessment: dedicated medium-sized SC tokamak or possibly to be combined with „JET-sized“ device)

Component, material testing in ITER (incl. Divertor test):

integrated test (but low n-dose, low particle fluence)

#### **Superconductivity**

Keep close to developments in superconductivity

## One outline proposal: Accompanying Programme

<b>Physics</b>	Preparation of ITER operation	Enhancement of ITER operation towards reactor	Exploration of alternative concepts & plasma science
<b>Plasma Engineering</b>	Interdisciplinary physics/technology issues: Plasma control, heating, diagnostics, plasma-wall interaction		
<b>Technology</b>	Support of ITER construction	Reactor oriented ITER enhancement	Specific reactor issues
Education and training of young scientists and engineers, forwarding knowledge			

## Technology

### Support of ITER construction

- Needs:**
- enforce knowledge base in strategic sectors
  - optimize interaction between ELE, associations, industry
  - enable Associations to assume their role in ITER procurement packages such as diagnostics, H&CD systems, control...
  - ...

- Means:**
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## Technology

### Reactor oriented ITER enhancement

- Needs:**
- breeding and blanket system function in neutron environment
  - divertor development: system function
  - new radiation resistant diagnostics
  - PFC repair methods
  - optimized maintenance
  - improved H&CD systems
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- Means:**
- ITER TBMs
  - integrated reactor divertor test in ITER
  - ...

**Strengthening of competence by underlying activities**

## Technology

### Specific reactor issues

- Needs (D/P):**
- reactor design studies / reactor design
  - safety, economic assessments
  - materials: development and assessment:
    - structural
    - plasma-facing
    - functional materials
  - PFC technology
  - blanket development
  - optimized maintenance
  - superconductivity
  -

## Technology

### Specific reactor issues

- Means (D/P):**
- reactor design studies / reactor design
  - safety economic assessments
  - structural materials, PFM, functional materials:
    - materials development
    - materials modelling, testing
    - IFMIF: neutron effects
  - wall and divertor: component development and testing
  - blanket development
  - maintenance tool development
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## Technology

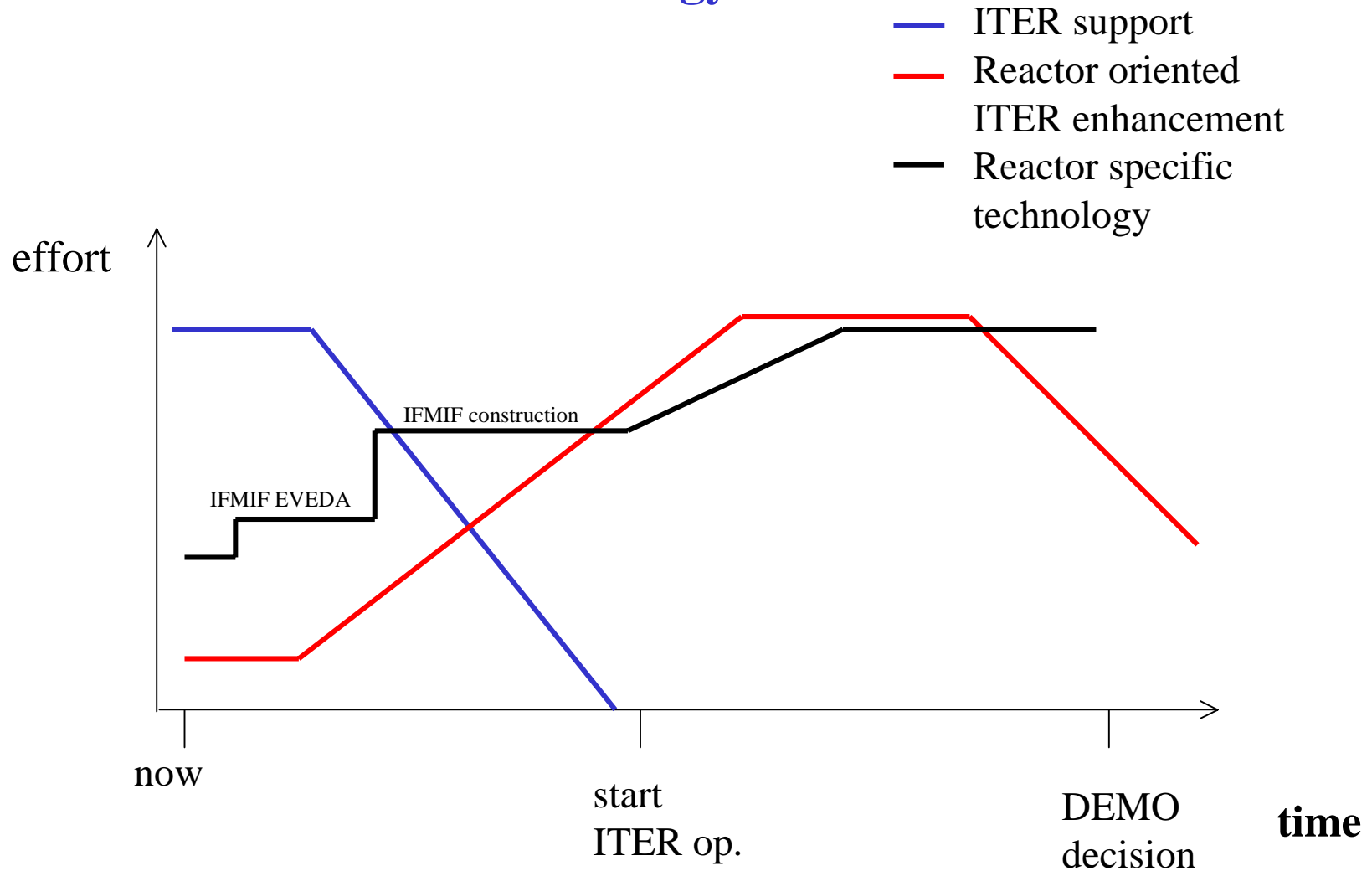
### Required facilities in addition to ITER

IFMIF: consensus

to be assessed: long pulse, high flux tokamak test facility for  
hot DEMO divertor and wall components

to be assessed (long term): integrated volumetric neutron source for  
PFC, blanket testing

## Technology



Qualitative profile of effort

## **Role of international cooperation with regard to the „fast track“**

1. Establish consistent RTD programmes towards fusion power  
(under way in EU, JA)
2. It is very likely that these programmes will have strong similarities
3. Establish joint programmes:
  - IFMIF
  - joint use of existing JET/JT-60 facility
  - international teams
  - work share: e.g. Be-programme in JET; fast W-programme in JT-60
  - new advanced JET/JT-60 size tokamak (reactor oriented plasma physics)
  - non-nuclear PFC test facility (t.b.d.)
  - .....