# ITER Test Program
# Agenda, Current Issues That Require Resolution, and Agreement on Approach

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Presented at (informal) TPWG Meeting at
Karlsruhe, August 29 - 30, 1994

# Agenda

ITER Test Program (TPWG) Meeting,
August 29 - 30, 1994 at KfK

## Monday, August 29

| | | |
|---|---|---|
| 9:00 am | Review and Agree on Agenda | Abdou |
| 9:15 | Draft and Comments on the Charter for TPWG | |
| 10:45 | Coffee Break | |
| 11:00 | Issues of Coordination,Technical Issues, Agreement on Report Writing | |
| 12:15 | Lunch | |
| 1:30 - 5:30 | Technical Progress Reports | |
| 1:30 | Port 1: SB/He<br>Other presentations on Port 1 | Dalle Donne<br>J/US/RF |
| 3:00 | Coffee Break | |
| 3:15 | Port 2: SB/$H_20$<br>Other presentations on Port 2 | Takatsu<br>ED/US/RF |
| 4:30 | Port 3: Liquid Metal Self Cooled<br>Other presentations on Port 3 | Malang<br>US/J/RF |
| 6:00 | Adjourn | |

Tuesday, August 30

| | | |
|---|---|---|
| 9:00 | Port 4: Separately Cooled Liquid Metal | Giancarli et al. |
| 9:45 | Port 5: Materials<br>EC Materials<br>Other presentations on Materials | Strebkov (?)<br>Roux<br>J/US |
| 10:30 | Coffee Break | |
| 10:45 | Port 6 and Other PFC Tests<br>Other presentations on Port 6/PFC | Abdou |
| 11:30 | Safety, Tritium Processing, and Ancillary Equipment<br>Other presentations | Ying<br>Profiri, Violante, J, RF |
| 12:30 | Lunch | |
| 1:30 | Discussion on Test Program Issues | |
| 3:00 | Coffee Break | |
| 3:15 | Report Outline and Writing Assignments | |
| 5:00 | Adjourn | |

# ITER Test Program
# Organizational Issues

- What should our focus be between now and the time the new TPWG is formed?

- Reports are due for D2 and D3
  Should we write 4 separate reports or one joint report?

  - If a joint report is decided on, need outline and writing responsibilities

- Is the system of Port Coordinates working properly?
  Should we change it? To what?

# ITER Test Program
# Technical Issues and Other Issues

- Fusion Testing can be classified into:

  I. Scoping (~ 0.3 MW.y/m$^2$)
  II. Concept Verification (1 - 3 MW.y/m$^2$)
  III. Component Engineering Development and Reliability Growth (4 - 6 MW.y/m$^2$)

- Overlay of ITER schedule to stages of Fusion Testing:

  A. BPP (0.1 MW.y/m$^2$ for 12 yr )
  B. EPP (1 MW.y/m$^2$ for another 12 yr)

  - Can scoping tests be completed during BPP?
  - Can concept verification be completed during EPP?

# Technical and Other Issues (Cont'd.)

- Is there really enough space for testing within the allocated ports?

  US Results
  For any given concept (e.g. SB/He/$Li_2TiO_3$/Be)
  We need 2 configurations, multiple of 3 for engineering scaling, and multiple of 2 for statistics

  i.e. 2 x 3 x 2 = 12 modules/concept
  i.e. 12 modules per given concept

  If we do separate testing for each party, then we need
  12 x 4 = 48 modules/concept

- Should we go a step further to agree on common test articles for 2 or more parties?

- If we are to agree on common test articles, we need agreement on reference DEMO blanket designs
  Should we do this?
  How?

# Technical and Other Issues (Cont'd.)

- Engineering Scaling

  Testing is for DEMO Blanket. We need to see how the blanket behaves in DEMO.

  Since ITER has a factor of 2 or 3 lower power density than DEMO, we need to alter the test module to "act like" rather than look like DEMO to preserve behavior (e.g. increase thicknesses and module width to preserve temperature and stresses)

  - Can we do a benchmark problem for engineering scaling?

    To do this, we need a specific and detailed reference design for a DEMO blanket to use for test module design benchmark.

# Technical and Other Issues (Cont'd.)

- What is our technical judgment on ITER parameters for testing?

  1. Pulsing (1000 s burn, 1200 s dwell, 45% duty cycle)

  2. COT
     (During BPP ITER operates only for ~ 36 full power days)
     What is COT for ITER?
     (A few hours?)
     Impact on testing?
     How to maintain modules during shut down time?
     (Heating, impurities, leakage, permeation, etc.)

  3. Fluence

- Do we need to do benchmark problems, e.g. effect of pulsing?
  (Suggested benchmark attached)

- What should we do about ITER Testing Parameters?

  - Ask JCT to change ITER?

  - Just accept what we have and inform JCT and MAC that ITER will not be sufficient for DEMO blanket development

# Technical and Other Issues (Cont'd.)

- Safety

  What should we do about safety aspects of the test program (effect on the basic device)?

  - Ask JCT to provide us with guidelines?
  - Develop some guidelines and ask JCT later to assess safety of the test program?
  - Both?

## Example ITER Device Operation Scenarios for Benchmark Problems

- BPP: Total neutron fluence at the first wall 0.1 $MWyr/m^2$ for 12 years (assume 2 years initial hydrogen operation followed by 10 years DT operation)

- ITER neutron wall load = 1 $MW/m^2$

  - 36.5 (~ 40) FPD over a 10-year DT operation period

Case I COT = 1 burn

*(a) 1 hour burn per 3.8 days*

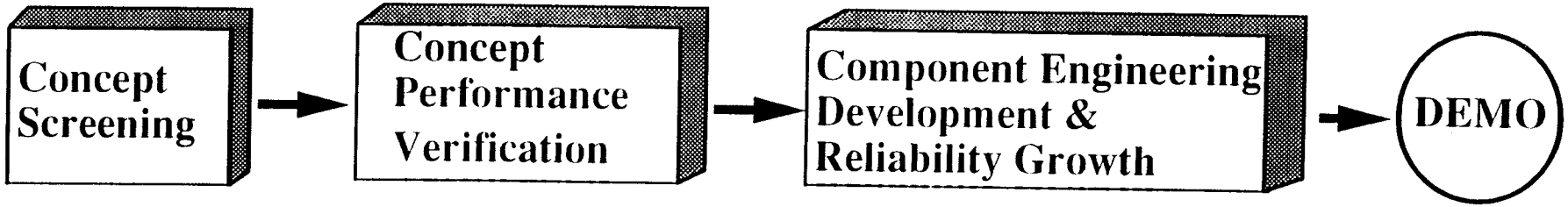
*(b) 20 minutes burn per 1.25 days*

Case II COT (100% availability) = 8 hours

(a) duty cycle = 0.45 (burn time = 1000 seconds, dwell time = 1200 seconds)
*1 COT per month*

(b) duty cycle = 0.8 (burn time = 4800 seconds, dwell time = 1200 seconds)
*1 COT per month*

# Testing in Fusion Devices For Fusion Nuclear Development Can Be Classified Into a Number of Stages




| | | | |
|---|---|---|---|
| Stage | I | II | III |
| Required Fluence $MW.Y/m^2$ | 0.3 | > 1.0 | > 4 - 6 |
| Size of Test Article | Submodules | Modules | Modules/Sectors |

- Reliability Growth Testing is Most Demanding
  - Requires testing of components in real operating environment (n, γ,B,T,V)
  - Requires an aggressive design/test/fix iterative program
  - Requires many test modules and high fluence