UPDATE OF ITER MEASUREMENT REQUIREMENTS

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Have three levels of measurement requirements:

Reference level 0	Level approved by ITER management and included in the official ITER documentation (Plant Integration Document (PID))
Reference level 1	Agreed within the topic group (any disputes decided by TG Chair and Co-chair)
Reference level 2	Working. Integrates all suggestions for changes (managed by AC)

The current situation is the reference levels 0 and 1 are the same.

Outstanding Action Items

- Changes to Level 1 and Approval at ITER done
  (Action item 10a231)

- Discuss with the Pedestal TG the needed spatial resolution in the region 0.8<r/a<0.9. (Action item 11a258) no progress

- In depth analysis of requirements and assessment of the expected performance of the related diagnostics
  (Action item 10a233) Planned for design review. Now an HP topic.

- Measurement of ratio nonthermal/thermal neutrons
  (Action item 10a234) Action with proposers Gorini and Ericsson)
  (Error in mins of ITPA 11 on this)

Changes to Level 1 and Approval at ITER (Changes to Level 0) (Action item 10a231)

At ITPA 10 it was agreed to make changes(additions) to Table 1.

Add RWMs as a 1a parameter

Add NTMs as a 1b parameter

Measurements of turbulence needed

Measurement of fast ions:
- measurement of fast H, D, T and 3He ions
- profile of 3He concentration
- total perp. fast ion energy content

and these changes to Table 2

1. Plasma Current I_p	Include spec. for max. dI_p/dt
4. Plasma Energy	Raise upper limit of βp to 5 for both default and Ip Quench
5. Radiated Power	Raise max. for default to 1GW
7. Neutron Flux and Emissivity	Neutron/α source: Stipulate spectra for 2.5 and 14 MeV neutrons.
8. Locked Modes	Change to "Error Field, Locked Mode and RWM Identification; for RWM need to resolve n=2,3
27. High Frequency Instabilities (MHD, NTMs, AEs, turbulence) (NEW NAME)	Add NTMs, 10 – 100 kHz, spat. res. 10 mm
28. Ion Temperature Profile	Change spat. res. for core Ti to a/30
30. Confined Alphas and Fast Ions	Change description to be for α,p,D,T,He^3 .
31. Escaping Alphas and Fast Ions	Change description to be for α,p,D,T,He^3 .
37. Radiation Profile	Increase spat. res. to a/30.

The Plant Integration Document (PID) has been updated and includes these changes. Hence these are now at level 0.

Measurement of ratio nonthermal/thermal neutrons (Action item 10a234

Giuseppe Gorini and Göran Ericsson have proposed that the ratio of non-thermal to thermal fusion power should be added to the requirements list. This is needed to 'ensure that the physics processes leading to non-thermal fusion are correctly simulated'. They have written a proposal which I circulated for comment before ITPA 11 meeting.

Basically there are three questions here.

1) Should the measurement of this parameter be added to our list of measurement requirements? If so, which group should it be in: basic control and machine protection (1a), additional measurements for control in specific scenarios (1b), or additional measurements for physics evaluation (2)?

2) What is the most relevant parameter? Giuseppe wrote the proposal for the measurement of the ratio of non-thermal to thermal fusion power. But I questioned this and in subsequent discussions Giuseppe has said that the parameters that are actually needed for analysis of plasma performance are the absolute levels of both the non-thermal and thermal components rather than the ratio.

If the answer to these questions is positive then a third question arises:

3) Is it feasible to make this measurement using NES as proposed by Giuseppe? To answer this question some modelling is required and, to get ahead on this matter, I have asked Giuseppe to try to get this done.

In email correspondence Giuseppe Gorini has stressed the feasibility issue.

Feasibility requires that (1) [scientific feasibility] the required information is indeed contained in the neutron spectrum and can be extracted without ambiguities; and (2) [technical feasibility] adequate instrumentation can be designed to perform the measurement.

Re (1). The feasibility of non-thermal fusion power measurements is expected to be addressed as a by-product of an ITER-related task. The present simulation results may be regarded as realistic although based on simple models. There is nothing in the results of the simple simulations indicating that the measurement would

not be feasible. Results of more "realistic" models will come later…..

Re (2) he says that the feasibility assessment depends on the choice of instrument and location/interface..

Therefore an important step is to have the status of NES elevated so that it can have a dedicated interface. However in order to have the status of NES on ITER elevated we need to show that it provides useful - possibly essential - information. Which brings us back to the table of measurement requirements that is used by the ITER Team to approve the deployment of diagnostics on ITER.

AC. It is possible to make an assumption for the interface and then, on that basis, make a prediction as to the performance of the instrument in this measurement. This can done for different interfaces and in this way we can learn what interface the instrument would need. This type of study can be done irrespective of the reference position of diagnostics and interfaces on ITER.

Still waiting for results