







into the operational programme and so can be installed cost effectively later if required. This High Priority item has been successfully concluded and can be taken off the list of HP topics for 2008/2009.

#### 2.4. Determination of life-time of plasma facing mirrors used in optical system

The report of the Specialist Working Group on First Mirrors gave an overview of all activities in the field of first mirrors. Much ITER-diagnostic specific research is in progress at many laboratories worldwide, but in general more solution-oriented research is needed. More refined geometries are being introduced for predictive modelling. The effort in this field should be intensified and accelerated to serve the rising needs. Further progress was reported in the field of deposition mitigation (e.g. by flowing gas in front of the mirror) and mirror cleaning, coated mirrors, mirror manufacturing and irradiation testing of mirrors. Reviewing the progress so far, it was agreed that more emphasis needs to be put on the development of mitigation methods especially for Be deposition.

A roadmap to direct the international R&D in the field of first mirrors has been prepared and has been further detailed and evolved in special break-out sessions during both TG meetings. It is urgent to develop the road map into a tool that can be actively used to direct the international research in this field. As a first step it is proposed to cluster the various diagnostic mirrors in groups with approximately the same functional requirements and operational environment in order to recommend baseline solutions for each group on the basis of present knowledge. Furthermore, it was agreed that candidate mitigation methods against deposition need to be reviewed to identify the most promising ones for further development.

Also attention was paid to the effect of blistering on mirrors. In an overview talk on the likelihood of blistering in ITER it was shown that the surfaces exposed to single-ion species might suffer from blistering under some conditions, while these surfaces did not exhibit any apparent blistering when exposed to multiple-ion species under exactly the same conditions. In addition, the occurrence and degree of blistering seems to depend on the manufacturing method of the material, as well as on the history of the conditions to which UUU/MvS-Ues or i











Measurement Requirement	Motivation and Required Investigation/Development	Progress since June 2007
HIGH		
2. Assessment of the various options for the Vertical Neutron Camera to measure the 2D n/ $\alpha$ source profile and asymmetries in this quantity, and assessment of the calibration strategy and calibration source strength needed	The requirements for measurements of the neutron/alpha source profile along with the related justification for the measurements have to be urgently assessed. The principal technique for measuring the alpha source profile is 2D neutron tomography. Conventionally this measurement is made with a radial and a vertical view neutron camera, but on ITER the coverage of the radial camera has been limited and severe interface difficulties have been experienced in the implementation of a camera viewing from above the machine.	See Section 2.2 of main document.  <b>First part of the HP topic is concluded. The second part on the assessment of the calibration strategy needs to be continued</b>
3. Assessment of the overall measurement performance of all diagnostics (credited and uncredited) with respect to the ITER measurement requirements	The capabilities of most individual diagnostics systems (credited and uncredited) have been compared with the detailed ITER measurement requirements. However, to get an understanding of the overall performance of the ITER diagnostics, it is needed to make a detailed	

Measurement Requirement	Motivation and Required Investigation/Development	Progress since June 2007
HIGH		

Measurement Requirement	Motivation and Required Investigation/Development	Progress since June 2007
<b>HIGH</b> 5. Development of measurement requirements for measurements of dust, and assessment of techniques for measurement of dust and erosion	Measurements of dust are required to ensure that ex	







Measurement Requirement	Motivation and Required Investigation/Development	Progress since June 2007
INTERMEDIATE		
<p>11. Determination of the outgassing rates of mineral insulated cables and develop methods to reduce the outgassing rates.</p>	<p>In ITER up to 80 km of cable will be used, with 1-2 joints in primary vacuum. Potentially about 45 l of trapped gasses could be inside these coils. The coils cannot be sealed, and neither can they be left open. The out-gassing rate of 7.2 m length of coil with both ends open has been measured at DIII-D. The conclusion is that too long a time (in the order of months in ITER) is needed to evacuate the coils. It cannot be proven that leaks will not occur, and keeping the ends open is not sufficient. Therefore ways to reduce the out-gassing rates (e.g. by perforations) are being investigated.</p>	<p>No progress reported.</p>





Measurement Requirement	Motivation and Required Investigation/Development	Progress since June 2007
INTERMEDIATE		

Measurement Requirement	Motivation and Required Investigation/Development	Progress since June 2007
LONG TERM		
15. Demonstration of direct measurement of local electric field	Techniques for measuring the $E_r$ in the plasma core directly and which can be implemented on a BPX are required. 1) Propose and develop a technique for measuring $E_r$ directly inside	

## Attachment 2 Publications by the ITPA TG on Diagnostics 2006-2007

### Publications in peer-reviewed journals

- A. Litnovsky , V. S. Voitsenya , A. Costley and A.J.H..Donné for the SWG on First Mirrors of the ITPA Topical Group on Diagnostics, First mirrors for diagnostic systems of ITER, Nucl. Fusion 47 (2007) 833-838.
- F.P. Orsitto, J.-M. Noterdaeme , A.E. Costley, A J H Donné and the ITPA TG on Diagnostics, Requirements for Fast Particle Measurements on ITER and Candidate Measurement Techniques, Nucl. Fusion 47 (2007) 1311-1317.

### Presented at the 2008 EPS Conference

- L. Bertalot et al., *A strategy for calibrating the Neutron Systems on ITER*, Proc. 35<sup>th</sup> EPS Plasma Physics Conference, Hersonissos, Greece (9-13 June 2008), Paper O-2.001

### Accepted for the 2008 IAEA Fusion Energy Conference, Geneva, Switzerland

- A.J.H. Donné, A.E. Costley, for the ITPA Topical Group on Diagnostics, Key R&D activities for ITER Diagnostics
- M. J. Walsh, M. N. A. Beurskens, T. Hatae, D. Johnson, E.E. Mukhin, R. D. Scannell, G. Vayakis, Performance evaluation of ITER Thomson scattering systems
- A. Litnovsky, V. Voitsenya, T. Sugie, G. De Temmerman, A.E. Costley and A. Donné, Progress in research and development of mirrors for ITER diagnostics