

# **X-ray spectrum measurement in WEST plasmas for inferring tungsten impurity distribution**

D. Mazon<sup>1</sup>, M. Chernyshova<sup>2</sup>, Y. Peysson<sup>1</sup>, A. Jardin<sup>4</sup>, A. Wojenski<sup>3</sup>, J. Colnel<sup>1</sup>, D. Guibert<sup>1</sup>, T. Czarski<sup>2</sup>, K. Malinowski<sup>2</sup>, P. Linczuk<sup>3</sup>, D. Colette<sup>5</sup>, G. Kasprowicz<sup>3</sup>, K. Król<sup>4</sup>, K.T. Poźniak<sup>3</sup>, R. Tieulent<sup>5</sup>, M. Walsh<sup>5</sup>, and the WEST team\*

<sup>1</sup> CEA, IRFM F-13108, Saint Paul Lez Durance, France

<sup>2</sup> Institute of Plasma Physics and Laser Microfusion, Hery 23, 01-497 Warsaw, Poland.

<sup>3</sup> Warsaw University of Technology, Institute of Electronic Systems,  
Nowowiejska 15/19, 00-665 Warsaw, Poland.

<sup>4</sup> Institute of Nuclear Physics Polish Academy of Sciences (IFJ PAN), PL-31-342, Krakow,  
Poland.

<sup>5</sup> ITER Organization, Route de Vinon sur Verdon, CS 90 046 - 13067 Saint Paul Lez Durance  
Cedex, France

\* <http://west.cea.fr/WESTteam>

Corresponding Author Email: [Didier.Mazon@cea.fr](mailto:Didier.Mazon@cea.fr)

Since the advent of tungsten walls in ITER, the problem of precisely reconstructing the distribution of tungsten (W) concentration in the plasma has become all the more relevant. Among the different possible approaches, those using Soft X-ray (SXR) measurements seem particularly promising. Indeed, essential plasma parameters can be inferred from X-ray spectrum measurements like magnetic axis, electron temperature, impurity concentration and its spatial distribution after tomographic inversion.

Despite being extremely rich in information, the access to continuous spectral measurements is nevertheless a technical challenge rarely implemented in actual tokamaks.

This talk reports on X-ray spectrum measurements with gas detectors for the WEST tokamak. It is shown that X-ray spectra up to 20 keV which are automatically and continuously acquired by Gas Electron Multiplier (GEM) detectors can be used to deduce W concentration, when coupled to ray-tracing codes. Much in the same way, multi-chamber Low Voltage Ionisation Chamber (LVIC) measurements working in current mode can efficiently be used to reconstruct W concentration thanks to optimized algorithms, as performed at CEA laboratories.

Synthetic diagnostics have been developed for these different gas detectors to validate the measurements and provide prediction for future applications in ITER.