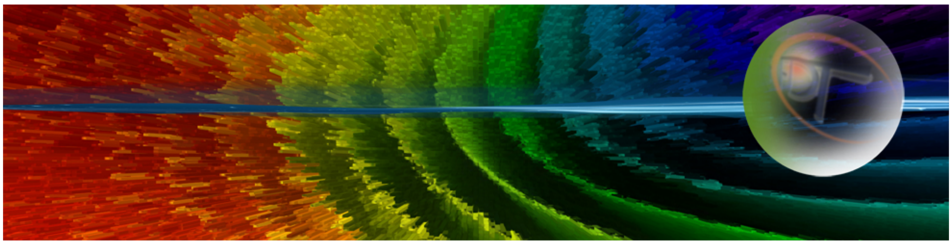

Contribution ID: **59** Type: **not specified**

Last Developments in Tomographic Reconstructions for the Exact Sciences

In thermonuclear plasmas, emission tomography use integrated measurements along lines of sight (LOS) to determine the two-dimensional (2-D) spatial distribution of the volume emission intensity. The technique can be applied to gamma-ray, neutron, soft and hard X-ray emissions. The measurements are line integral data obtained by arrays of collimated detectors looking through the plasma along different LOSs at different orientations. Due to the availability of only a limited number views and to the coarse sampling of the LOS, the tomographic inversion is a limited data set problem. In order to compensate for the lack of experimental data additional a priori information that is usually incorporated in the objective function. Successful approaches in JET are based on different statistical principles (like e.g. minimum Fisher information, maximum likelihood) and on constraints which imposes smoothness of the reconstructed distributions along the magnetic profiles. The problem of evaluating the errors associated with the reconstructed emissivity profile is a still open one. Recently a method for the numerical evaluation of the statistical properties of the uncertainties in reconstructions has been developed. It has been used first for gamma and neutron emissivity reconstruction and further applications to other diagnostics are currently under development. Apart from the noisy data, the final reconstructed image quality also depends on the constraints imposed for the compensation of the restrictive measuring geometry. The occurrence of specific induced artefacts has been assessed in order to avoid wrong interpretations of the results.
In specific experimental conditions, the availability of LOSs is restricted to a single view. In this case an explicit reconstruction of the emissivity profile is no longer possible. However, machine learning classification methods can be used in order to derive the type of the distribution [1-2]. In the present approach, following an idea introduced in [3], the classification is developed using the theory of belief functions which provide the support to fuse the results of independent clustering and supervised classification. The results of the learning in supervised classification depend on the method and on the parameters chosen. Moreover the learning process is particularly difficult when few or imprecise learning data is available. The unsupervised classification is more complex due to the absence of class labels. The synergy of supervised and unsupervised classification provide improved results for the case of JET gamma tomography using one view (measurements provided only by the vertical camera –case specific to DT campaigns) when using a one-vs-all SVM as supervised classifier and KNN as the unsupervised clustering algorithm. The information fusion based on the belief function framework allows to represent the uncertainty of the results of the clustering and supervised classification and to combine the results managing the conflict.

Primary author: Dr CRACIUNESCU, Teddy (1National Institute for Laser, Plasma and Radiation Physics, Bucharest-Magurele, Romania)

Co-authors: Dr MURARI, Andrea (Consorzio RFX); Dr VEGA, JESUS (ASOCIACION EURATOM/CIEMAT); Dr KIPTILY, Vasily (UKAEA Fusion)

Presenter: Dr CRACIUNESCU, Teddy (1National Institute for Laser, Plasma and Radiation Physics, Bucharest--Magurele, Romania)