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Validation of ITER magnetic diagnostic algorithms by using JT-60SA magnetic measurements

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Introduction

The successful Integrated Commissioning (IC) of JT-60SA [1] gives the possibility to validate the ITER diagnostic algorithms against the data collected in 2023 during the IC campaign. The experimental data were used to test and tune reconstruction algorithms for plasma current, plasma centroid position and plasma shape.



Reconstruction algorithms overview

A filamentary-based code [2] reconstructs the flux map from which relevant plasma quantities can be derived. Moreover, three sets of weights for the estimation of plasma position and current have been computed

It is important to notice that, due to highprecision sensors, measurement noise has been neglected. Considering a gaussian noise on the magnetic measurement as in [3] $(\sigma_{\psi} = 0.17 mWb, \sigma_B = 0.33 \times 10^{-4}$ T), the



Reconstruction results

















• **Plasma current** The reconstruction of the plasma current is very accurate, during FT phase the error is below 1% and satisfies ITER constraints. During RU and RD in most cases the reconstruction error is below 10 kA.

• Centroid position Regarding the plasma centroid position, each algorithm does not satisfy the ITER requirements to have a maximum error of 1cm. This is mainly due to the few magnetic sensors used during the IC. During OP-2 more sensors will be installed and significant improvements are expected.





• Shape As for the shape reconstruction, the obtained precision is in the order of few centimeters during the Flat-top phase, therefore also in this case the ITER requirements are not met. It is important to notice that the filamentary algorithm is a simplified one and analysis with the envisaged full equilibrium reconstruction code are ongoing,



References

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