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Radiation losses

A 16 channel bolometer array arranged in a pin-hole-camera has been mounted on the equatorial port #3 to measure the radiation losses , over the wavelenghs of λ=0.1-200 nm with a flat spectral response in this range. Spatial resolution is 2 cm and time reolution is 10 ms . The array covers an entire radius of the plasma (fig.1).

The measured data are processed using a numerical filter function either for the recostruction of the signal, i.e. the absorbed radiation power from the detector, and for smoothing.

A software package has been developed to provide the total radiated power and the radial profiles of emissivity, with two different tecniques both assuming a poloidal symmetric emission. One method uses the Zernicke and/or the Abel inversion , considering the nominal and/or the real plasma position , assuming a circular plasma. A more complex and time taking up elaboration has been performed considering the equilibrium reconstruction code (ODIN) : the magnetic flux surfaces are taken as surfaces of constant emissivity.

The use of a metal foil bolometer allows the absolute calibration and delivers the energy loss due to radiation which is the major contribution to the energy balance and an important parameter of the plasma. During the stationary phase of the plasma discharge about 60%-80% of the ohmic input power is lost by radiation almost indipendent of the electron density (fig.2) , as predicted by the self-consistent impurity model [1].

The comparation of two different emissivity profiles is shown in fig.3. The strong emissivity at the center of plasma (fig.3a), due to the concentration of heavy impurities , causes a hollow electron temperature profile while , in presence of light impurities (fig.3b), which are localized near the plasma edge ,the electron temperature profile is peaked and the emissivity is low at the center of plasma.

REFERENCES

[1] C.Ferro, R.Zanino ,"Self-consistent impurity modeling in a limiter SOL", **Plasma Phys**. (to be published)