# Angle Anisotropy and Loss Cone Influence on Nuclear Fusion Power

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A calculation technique was reported recently [1] which allows one to predict the nuclear fusion power of a toroidal magnetic confinement plasma device on the basis of theoretically or experimentally obtained ion distribution functions. The influence of suprathermal ion distribution "tails" on nuclear fusion rate and power was also studied in [1] assuming the angle isotropy. Empirical probability density functions for the nuclei energies can be calculated from neutral particle diagnostic data using the method given in [2].

More profound multi-directional diagnostics provide the information about the pitch angle dependence of the ion distributions. This is especially important for stellarator/heliotron configurations. First measurements of this kind on the Large Helical Device were reported in [3]. Mathematical methods required for the correct interpretation of such data were examined in [4]. These diagnostic data offer a possibility to study the influence of fast ion confinement properties on the fusion rate and the integral power.

A numerical code will be described for the case of angle-anisotropic ion distributions. Particular examples of the fusion rate and power calculations with distribution functions expanded in Legendre polynomial series will be presented. Numerical simulations for NBI-heated plasma and treatment of angle-resolved NPA experimental data on fast ion "tails" will be discussed.

[1] P.R. Goncharov, *Practical Calculation of Nuclear Fusion Power for a Toroidal Plasma Device with Magnetic Confinement*, Plasma and Fusion Research, **4,** accepted for publication (2009).

[2] P.R. Goncharov, T. Ozaki et al., *Ion Distribution Function Evaluation Using Escaping Neutral Atom Kinetic Energy Samples*, Plasma and Fusion Research, **3**, S1083 (2008).

[3] J.F. Lyon, P.R. Goncharov et al., *Spatially resolved measurements of energetic neutral particle distributions in the Large Helical Device*, Rev. Sci. Instrum., **74**, 1873 (2003).

[4] P.R. Goncharov, T. Ozaki et al., *Analysis of Anisotropic Suprathermal Ion Distributions Using Multidirectional Measurements of Escaping Neutral Atom Fluxes*, Rev. Sci. Instrum., **79**, 10F311 (2008).