BTR CODE UPGRADE FOR EFFICIENT NEUTRAL BEAM SIMULATION IN THERMONUCLEAR DEVICES (BTR CODE) [*)]

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BTR code (*Beam Transmission with Re-ionization*) [1-2] is used for Neutral Beam Injection design (NBI). The 1ˢᵗ version was released in ~2003; the main development tool for BTR is MS Visual C++ for Windows. BTR code is open and free from the very beginning; it is intended for unlimited usage and distribution. Thanks to its user-friendliness and interactivity it resembles a NBI flight-simulator and hence often used for professional training in NBI field.

Beginning from version BTR-2 release (multi-thread, parallel), BTR calculations has become highly efficient when run on multi-processor PCs. BTR code models statistics and degree of detail are still on the top among all known NBI software tools, being the a main reason behind BTR growing popularity and active distribution by users, although at 1ˢᵗ BTR was applied dominantly by ITER scientists and engineers [3] − for heating and diagnostic NBI design. One of the code advantages is in its ability to run on rather old and slow Windows machines and to track up to 10^{10} particles within moderate running time (from few seconds to few hours). All BTR models are deterministic (light-weighted or «lite»), they are verified analytically and easily reproduced. This fact makes BTR a perfect tool for various NB software benchmarking and verification. Numerical models capacity and parameters, input geometry details and the options of loading the geometry data (manual input or CAD files import), as well as the resulting power maps accuracy – all these settings are easily controlled and matched to each specific NBI study. At present, BTR still evolves; the users can always benefit from free support and assistance. The information on BTR upgrades and code manuals can be found online [1].

The general scope of BTR applications is wide: it includes the beam power losses study, the beam formation and transmission capability, analysis of beam species behavior, and calculation of thermal power deposition plots required for further engineering (thermo-structural) research for NBI components design, typically performed with help of dedicated engineering software. The current contribution demonstrates BTR upgrades in 2028-2022 (BTR-5), as well as the overview of the upcoming modifications in the next code version BTR-6, suggested by BTR users and slated for release in 2025.

References

[1]. E. Dlougach, BTR code for neutral beam design. https://sites.google.com/view/btr-code/home

[2]. E. Dlougach, M. Kichik, Beam Transmission (BTR) Software for Efficient Neutral Beam Injector Design and Tokamak Operation. Software 2023, 2, 476-503 https://doi.org/10.3390/software2040022

[3]. ITER Final Design Report; NB H&CD, DDD 5.3; IAEA: Vienna, Austria, 2001.

[*)] abstracts of this report in Russian