Tokamak with Reactor Technologies (TRT): concept, mission, main features and the expecting performance characteristics

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Remarkable progress with REBCO high temperature superconductor technology happened during recent years provides possibility to design quasi-stationary Tokamak with Reactor Technologies (TRT) with high (Bt0 = 8T) axial magnetic field. High magnetic field provides to achieve burning (Q > 2) of the tokamak plasma at essentially diminished machine size (R = 2.15m, a = 0.57m) and accordingly cost. TRT will operate in quasi-stationary (100-150s) regimes with hydrogen, helium and deuterium plasmas (ne = 2\*1020 m-3) and with short (t < 10s) trace tritium discharges with Q > 2.

TRT is developing as full size plasma prototype for pure fusion reactor and Fusion Neutron Source for hybrid fusion-fission reactor. Missions of TRT are: development and integration in one machine the key fusion reactor technologies including: high temperature superconducting electro-magnetic system operating at extremely high magnetic field, metal and liquid lithium first wall and advanced divertor, several tens of MW and MeV range Neutral Beam Injection, 260 GHz MW-range gyrotrons, 60-80 MHz MW-range ICRH system, noninductive current drive system, tritium complex, experimental tritium breading blanket modules, remote control technologies, reactor relevant diagnostics, development and studies of the quasi-stationary plasma discharges, development and study of fusion plasma burning regimes with strong domination of alpha-particle plasma heating during trace tritium experiments.

Conceptual design of the TRT main components and its expecting performance characteristics have been developed and will be presented in the paper.