Integrated modeling of fuel flows in the plasma and in the injection and pumping systems for the DEMO-FNS fusion neutron source [[1]](#footnote-1)\*)

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To calculate the fuel isotope flows in the DEMO-FNS fusion neutron source [1], the "FC-FNS" fuel cycle model [2] is used, which provides integrated description [3] of the gas, solid-state and plasma flows in the main and divertor plasma regions in conditions of neon injection into the divertor [4]. An approach to modeling the main plasma is developed, which takes into account the difference of the confinement times for the particles originated from different fuel sources. The "FC-FNS" code has been modified to fully match the architecture chosen in the analysis of the fuel cycle (FC) candidate technologies [5] for DEMO-FNS. The model is supplemented with a new scenario of supplying the gas for the heating injectors, which allows *D0+T0* neutral beam injection with a closed gas cycle. Fuel flow simulations in the FC are carried out, where the parameters of fuel injection are selected to ensure the specified conditions in the main and divertor plasmas for various heating injector scenarios (the isotopic composition of the source gas). The working range is found for the isotopic composition in the divertor plasma, at which the required tritium fraction in the main plasma can be ensured. It is found that the injection of pellets for the ELM control is possible by different isotopic composition in the divertor without negatively affecting the main plasma parameters. It is shown that to ensure a 50% tritium fraction in the main plasma, it is necessary to maintain the tritium fraction in the divertor plasma within the range from 47% to 53% for the *D0+T0* heating beam and from 54% to 60% for the *D0* beam. The selected value of the tritium fraction in the divertor plasma (that is, in the pumping system) determines the permissible frequency of *D2* pellet injection from the low magnetic field side for the ELM control (from 5 Hz to 110 Hz). The value of the total tritium inventory in the facility is evaluated as 850 to 1150 g.

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References

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