# Commissioning Scenario without Initial Tritium Inventory for a Demonstration Reactor Demo-CREST

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In the fusion energy development, the project of the experimental reactor ITER has been started, and the discussion on the next project DEMO is just begun. One of the critical issues for DEMO is how to keep the initial tritium inventory, because of a limited tritium stock in the world. The start-up scenario of D-T fusion power plant without the initial tritium loading has been proposed[1,2]. However, this start-up scenario has not been considered in the DEMO concept yet. In this paper, this start-up scenario is applied to the commissioning of a demonstration fusion power plant concept, Demo-CREST[3], and its critical issues are discussed.

First of all, core plasma operation method from tritium density ratio($fn_T=n_T/n_{DT}$) 0% to 50% was investigated to apply this start-up scenario without initial tritium inventory to Demo-CREST. From the viewpoint of MHD stability and current drive, the operational route from $fn_T$=0% to $fn_T$=50% can be found in the Demo-CREST concept. Then, the period required to attain the full power operation was analyzed without initial tritium inventory for tritium breeding ratio TBR=1.02-1.10. It is found that TBR larger than 1.04 is required for start-up without initial tritium inventory within a year. The commissioning period for fission reactors is about 9 month operation. However, in case of fusion reactor Demo-CREST, large electricity for the current drive about 200MW during commissioning has to be bought from the grid, while the fission reactors do not. Hence, the commissioning period for the fusion DEMO should be as short as possible. The relationship between TBR and the required initial tritium inventory for the commissioning period from 90days to 360days was also made clear. If TBR=1.08 is possible, commissioning without initial tritium inventory would require for commissioning period $T_{com}$=180days. Decrease of TBR results in the longer commissioning period for start-up without initial tritium loading. When the commissioning period has to be shorten within $T_{com}$ =90days, the initial tritium loading of at least 1000g is inevitable. In the presentation, the tritium retention in the first wall and the dust in the reactor chamber is considered from the first principles, and its effect is also discussed.

[1] S.Konishi, et al., J. Plas. Fus. Research 76(2000)1309

[2] Y.Asaoka, et al., 18th IAEA Fusion Energy Conf. PDP-08(2000)

[3] R.Hiwatari, et al., Nucl. Fusion 45(2005) 96-109