MonPE17

Modification to the Accelerator of the NBI-1B Ion Source for improving the Injection Efficiency

T. S. Kim[a], S. H. Jeong[a], D. H. Chang[a], S. R. In[a], M. Park[a], B. K. Jung, K. W. Lee[a], S. J. Wang[b], Y. S. Bae[b], J. S. Kim[b], H. T. Park[b], W. Cho[b], and D. J. Choi[b]

[b]*Korea Atomic Energy Research Institute, Daejeon, Korea*
[b]*National Fusion Research Institute, Daejeon, Korea*

Email address: tskim@kaeri.re.kr

Neutral beam injection (NBI) heating experiments in Korea Superconducting Tokamak Advanced Research (KSTAR) have demonstrated that the injection energetic neutral beam is one of the most effective and powerful methods for heating a tokamak plasma since 2010 KSTAR campaign. As a request for the additional neutral beam power of 2.0 MW so as to support advanced plasma experiments of KSTAR, a NBI-1B ion source was developed and installed at NBI-1 System of KSTAR in 2012. Maximum 100 keV/50A deuterium ion beam by NBI-1B ion source was successfully extracted, beam power transmission efficiency, however, was discovered to be poor (below than 70 %) during 2012 and 2013 experimental campaign of KSTAR. Minimizing power loss of a neutral beam through KSTAR NBI-1 beamline is required to keep high injection efficiency to the tokamak plasma. The long beamline with limited area of the beam duct diminishes the effectiveness of neutral beam injection to the tokamak plasma, and imposes modification of the accelerator of the ion source for further improvement of the beam optics. A technique to steer ion beamlets by aperture displacement appear to be the most powerful and practical method to focus the beam and to improve the injection efficiency considering the cost efficiency. In this paper the injection efficiencies and the heat loads on the beamline components by steering of ion beamlets are investigated numerically to find optimum modification of the accelerator design of the NBI-1B ion source and the experimental results with the modified accelerator of NBI-1B ion source are described.