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## Dual Frequency Enhancement of the SuperNanogan Multi-Charged Ion Source at TRIUMF ISAC Facility

In 2008, a SuperNanogan ECR ion source from PANTECHNIK was introduced in addition to an in-house developed microwave ion source and a surface ion source to complement the TRIUMF offline ion source facility to provide highly charged ions to ISAC experiments. Originally, it employed a 400 W Travelling Wave Tube Amplifier (TWTA) for RF heating, but less than 50 W was enough to produce all the multi-charged beams required by the experiments. Later, a 50W solid-state amplifier was added for redundancy purposes but we found a significant improvement when both were switched on at the same time. With the dual frequency, less than ten times of the total power is needed to produce the same charges with more currents than with the single frequency. The beam stability and the ability to extract higher charged ions also improved with the dual frequency enhancement. The operational experience and the results are discussed in this paper.

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