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Progress on the magnetron R&Ds for industrial particle accelerators

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The magnetron as an efficient RF source for a compact industrial SRF accelerator has been proposed [1]. The performance of injection phase lock on two independent magnetron transmitters operated at 915 MHz, in CW mode with maximum power of 75 kW each has been demonstrated to satisfy for this application [2]. This industrial type magnetron has transformer and SCR rectifier on the DC anode power supply. Output power spectrum with phase locking can achieve noise reduction of -21 dBc at the 1st 60 Hz, -29 dBc at 1st 120 Hz with only -22.6 dBc injection power. Solenoid current increase of 16% can increase the magnetron relative natural frequency by $4e-4$. Further solenoid current modulation with feedback control and the 2x75 kW power combining scheme with the WR975 magic-tee are to be further studied. We intend to use one 75 kW power station with InnoSys' switching DC power supplies to drive normal conducting and superconducting RF cavities for an industrial compact linac. We are also going to report on the 4x1.2 kW power combining experiment on the 2450 MHz magnetron system carried out at GA, including the control algorithm with modified magnetron heads with trim-coils and characterized at JLab.

Footnotes

- [1] G. Ciovati, et al, Development of a prototype superconducting radio-frequency cavity for conduction-cooled accelerators, *Physical Review Accelerators and Beams* 26, 044701 (2023)
- [2] H. Wang, et al, Demonstration of Magnetron as an Alternative RF Source for SRF Accelerators, *Proceedings of 21st International Conference on RF Superconductivity, SRF2023, Grand Rapids, MI, USA*, doi:10.18429/JACow-SRF2023-WEPWB131

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