



Contribution ID: 52

Type: **Oral**

Testing and Validation of High-Efficiency Klystron Technology: an 8MW X-band klystron

Wednesday, 18 October 2023 12:30 (20 minutes)

Operation of high-gradient structures require the delivery of extremely high RF power—from hundreds of kW to MW—by klystrons, usually at the expense of high overall energy consumptions. A collaboration between CERN and Canon Electron Tubes and Devices has been established to optimise the efficiency of commercially available klystrons, resulting in the proposal of novel technological solutions. An existing 6 MW, X-band klystron (Canon E37113) has been redesigned and successfully rebuilt to ensure 8 MW output power and >10% efficiency increase. We will describe the setup, calibration, fine tuning, and results for the acceptance tests performed on this prototype at the CERN X-band facilities. Revealing a remarkable ~60% efficiency, as opposed to the ~40% efficiency of the E37113 model, these results validate the proposed HE klystron technology and represent a significant leap forward in klystron technology. Future work will seek to apply similar advances to the LHC klystron, in preparation for its possible deployment in the high luminosity HL-LHC project.

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Session Classification: Morning session