Contribution ID: 609 Contribution code: SUSB034 Type: Student Poster Presentation

## Accelerating structures for the FCC-ee pre-injector complex: RF design, optimization, and performance analysis

Sunday 25 August 2024 16:00 (2 hours)

The Future Circular Collider electron-positron (FCC-ee) pre-injector complex demands high-performance RF accelerating structures to achieve reliable and efficient acceleration of beams up to 20 GeV. In this study, we describe an analytical approach to RF design for the traveling-wave (TW) structures including a pulse compression system to meet the rigorous specifications of the FCC-ee pre-injector complex. The fundamental mode at 2.8 GHz and Higher Order Mode (HOM) characteristics were determined through the utilization of lookup tables and analytical formulas, enabling efficient exploration of extensive parameter ranges. Optimization of the structure geometry and in particular the iris parameters was performed to address key challenges including maximizing effective shunt impedance, minimizing surface fields, and effectively damping longrange wakes through HOM detuning. Moreover, we investigated the impact of beam-loading effects on the bunch-to-bunch energy spread. Comprehensive thermal and mechanical analyses were carried out to evaluate the impact on the accelerating structure performance during operation at a repetition frequency of 100 Hz.

## **Footnotes**

## **Funding Agency**

**Primary author:** KURTULUS, Adnan (European Organization for Nuclear Research)

**Co-authors:** GRUDIEV, Alexej (European Organization for Nuclear Research); LATINA, Andrea (European Organization for Nuclear Research); RAGUIN, Jean-Yves (Paul Scherrer Institut); CRAIEVICH, Paolo (Paul Scherrer Institut); BETTONI, Simona (Paul Scherrer Institut)

Presenter: KURTULUS, Adnan (European Organization for Nuclear Research)

Session Classification: Student Poster Session

Track Classification: MC2: Electron Accelerators and Applications: MC2.2 Electron linac projects