Contribution ID: **271** Contribution code: **TUXN1** Type: **Invited Oral Presentation**

Elevating Beam Quality and Stability in Linear Accelerators through High Order Mode Analysis

Tuesday 3 June 2025 09:00 (30 minutes)

The pursuit of optimal beam quality and stability in linear accelerators (Linacs) stands as a cornerstone of accelerator physics. However, the presence of High Order Modes (HOMs) within Linacs, particularly in the context of energy recovery (ERLs), presents formidable challenges to beam quality and stability. In response to this challenge, the development of the Compact HOMEN (High Order Mode Evolution based on Energy budget) model has emerged, providing precise prediction and analysis of HOM effects on beam dynamics within superconducting cavities. This model facilitates meticulous optimization strategies, guiding researchers towards unprecedented advancements in high-brightness accelerated electron beam technology. By comprehensively understanding and managing HOMs, Linacs can achieve enhanced performance and efficiency, crucial for a myriad of scientific and industrial applications.

Through this study, we underscore the constraints posed by high currents and high repetition rate to ensure an optimal energy recuperation. Our findings not only deepen the understanding of ERL facilities but also underscore their transformative potential in shaping the forefront of accelerator technology.

Footnotes

Funding Agency

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Session Classification: TUXN: Beam Dynamics and EM Fields (Invited)