Slow Extraction Optimisation as part of the non-clinical research programme at MedAustron

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MedAustron uses a third-order resonant slow extraction to extract the beam from the synchrotron with spill lengths between 1 and 10s. While the current clinical operation employs acceleration with a betatron core to drive this extraction, alternative slow extraction techniques are available, which offer enhanced opportunities for manipulating the beam during the extraction process.

This presentation offers a comprehensive overview of the alternative extraction methods that have been explored. It highlights their potential advantages in tailoring beam parameters for non-clinical research (NCR) applications or for reducing treatment time, including techniques like dynamic intensity control or multi energy extraction. Our investigations involve both simulations and measurements, which contribute to deepen the understanding of the complex beam dynamics in play and illustrate the potential feasibility of implementation at MedAustron.

Radio-Frequency Knock Out (RFKO) extraction was investigated by applying an RF signal voltage across the horizontal Schottky plates in the synchrotron. Investigation of the synchronous ramping of all synchrotron magnets for extraction via Constant Optics Slow Extraction operation (COSE) was undertaken for a bunched beam to enable multi energy extraction. For Phase Displacement Extraction (PDE), the beam is extracted by sweeping a properly configured empty bucket through the beam stack.

All three alternative extraction methods were tested successfully and can be executed using the existing hardware and software infrastructure at MedAustron. Extraction rates with these methods were observed which meet the clinical requirements and might also be considered compatible with FLASH. However, further research and development are necessary to fully unlock the potential of these methods.