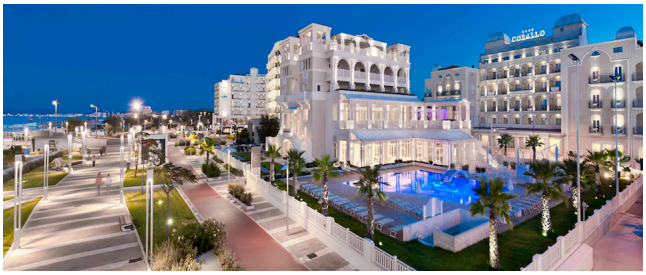

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Bent crystal extraction from DAΦNE storage rings: the SHERPA experiment

Friday, 9 June 2023 10:50 (20 minutes)

The SHERPA ("Slow High-efficiency Extraction from Ring Positron Accelerator") project aim is to develop an efficient technique to extract a positron beam from one of the accelerator rings composing the DAΦNE accelerator complex at the Frascati National Laboratory of INFN, setting up a new beam line able to deliver positron spills of O(ms) length, excellent beam energy spread and emittance.
The most common approach to slowly extract from a ring is to increase betatron oscillations approaching a tune resonance in order to gradually eject particles from the circulating beam.
SHERPA proposes a paradigm change using coherent processes in bent crystals to kick out positrons from the ring, a cheaper and less complex alternative [1]. This non-resonant technique, already successfully used and still developed mainly in hadron accelerators, will provide a continuous multi-turn extraction of a high quality beam [2, 3, 4, 5].
Realizing this for sub-GeV leptons is challenging, however would provide the world's first primary positron beam obtained with crystal extraction. An immediate application of this new extracted beam line would be the PADME ("Positron Annihilation into Dark Matter Experiment") experiment [6], currently strongly limited by the duty cycle. Using the proposed extraction, PADME could increase the statistics by a factor 104 and its sensitivity by a factor 102.
This technology can be applied in general for both negative and positive leptons, including muons, providing a know how that can be applied for several accelerating machine aspects in the next future, as collimation, extraction and beam splitting, contributing to a general improvement in the particle accelerator field.
In the talk will be given an overview of the whole experiment, describing in particular the crystal extraction principle, the accelerator optics studies [7], the crystal prototype and the characterization apparatus. Simulation and experimental results will be reported, together with new future applications.

References:
. [1] M. Biryukov et al, Crystal channeling and its application at high-energy accelerators. Springer Science Business Media, 2013 17
. [2] X. Altuna et al, Phis. Lett. B 357 (1995) 671-677
. [3] A.G. Afonin et al, Phys. Rev. Lett. 87, 094802 (2001)
. [4] W. Scandale et al, Phys. Lett. B 758 (2016) 129-133
. [5] M.A. Fraser et al, 8th IPAC, Copenhagen (2017)
. [6] M. Raggi et al, EPJ Web Conf. 142 (2017) 01026
. [7] M. Garattini et al., Phys. Rev Accel. Beams 25 (2022) 033501

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