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TECHNOLOGY

SUPERKEKB WINS NEW WORLD RECORD FOR BRIGHTNESS

The SuperKEKB accelerator, at the KEK laboratory in Japan, recently set a new world record for brightness, achieving $2,25 \times 10^{34}$ cm⁻² s⁻¹, and thus breaking the previous record of $2,14 \times 10^{34}$ cm⁻² s⁻¹ obtained in 2018 and hitherto held by CERN's LHC accelerator. In order to achieve high brightness,

SuperKEKB adopted an innovative nano-beam scheme, according to which electron and positron beams collide in long and extremely thin packets with a relatively large intersection angle. This brightness record was obtained by integrating the nano-beam pattern with crab-waist, a technique that limits the distribution in space of the phases of the particles in the interacting beams and thus stabilises the collisions. The nano-beam and crab-waist concepts were conceived and developed over ten years ago, thanks to the original approach of the physics group of the accelerators of the INFN Frascati National Laboratories (LNF), at the time led by the Italian physicist Pantaleo Raimondi. The effectiveness of these new concepts in increasing brightness and containing the noise affecting the detector was experimentally demonstrated in the years 2007-2009 on LNF's DAFNE collider, and DAFNE's nano-beam and crab-waist collision patterns were then successfully integrated with the complex apparatus of the KLOE2 experiment, to which DAFNE provided data for three years. The record achieved at SuperKEKB now confirms these techniques to be very promising for future accelerator machine development projects.