

## **EBS features, as seen from beamline**

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The European Synchrotron Radiation Facility - Extremely Brilliant Source (EBS) is a facility upgrade bringing its scientific users a first-of-a-kind, low-emittance, high-energy synchrotron light source and new, cutting-edge beamlines.

On 10 December, 2018, the ESRF stopped the beam after almost 30 years of continuous operation of the original storage ring. An almost 20-month shutdown began with the dismantling of the storage ring and the installation of a new and revolutionary X-ray source. The nuclear resonance beamline ID18 took profit of the extended ESRF shutdown and refurbished all existing mechanics, electronics, optics, and software as well as it took actions to test new setups for the future new nuclear resonance beamline at ESRF.

On 30 January 2020, after reaching stable operation conditions of the EBS storage ring with 100 mA injection current, 65% injection efficiency and steady vacuum conditioning, the nuclear resonance beamline ID18 at ESRF opened its front-end with 5 mA of stored electron beam current and the commissioning phase of the beamline started.

During the commissioning phase the beamline recovered some *old* features, for example the optimum performance of the existing high-heat-load monochromator, and a high energy resolution obtained using the existing high-resolution optics, 0.5 meV at 14.412 keV, for the nuclear resonance energy of 57-Fe. New features were achieved with the existing focusing optics relevant to a small beamsize, [Hx V] 2  $\mu\text{m}$  x 4  $\mu\text{m}$  (for NIS and NFS) and 2  $\mu\text{m}$  x 8  $\mu\text{m}$  (for SMS), and may now routinely be provided in the user operation of the beamline.

In strong collaboration with the Accelerator and Source Division of ESRF the nuclear resonance beamline ID18 voluntarily contributed in selecting the optimum machine emittance and the storage ring cleaning in order to obtain a usable bunch purity for nuclear resonance scattering applications. Soon after the first tests a routine bunch purity between  $10^{-10}$  and  $10^{-11}$  in top-up mode (*i.e.*, refill every 1 h) with the least beam perturbation during refill was achieved.

After the beamline commissioning phase, the nuclear resonance beamline ID18 was open for user operation. Despite the extended shutdown a very high demand for beamtime applications was received. A smooth full semester of remote user experiments (because of the global sanitary crisis) took place in the Fall of 2020.

With the revolutionary new storage ring concept, allowing for an increase in brilliance and coherence by a factor of 100 compared to present-day light sources, ESRF–EBS represents a new generation of synchrotron and an extraordinary new tool for scientists to study the heart of matter using nuclear resonance scattering.