Contribution ID: **114** Contribution code: **TUP50** Type: **Contributed Poster**

An XFELO Demonstrator Setup at the European XFEL

Tuesday, 23 August 2022 17:40 (20 minutes)

An X-ray free-electron laser oscillator (XFELO) is a next generation X-ray source promising radiation with full three-dimensional coherence, nearly constant pulse to pulse stability and more than an order of magnitude higher spectral flux compared to SASE FELs. In this contribution, the concept of an R&D project for installation of an XFELO demonstrator experiment at the European XFEL facility is conceptually presented. It is composed of an X-ray cavity design in backscattering geometry of 133 m round trip length with four undulator sections of 20 m total length producing the FEL radiation. It uses cryocooled diamond crystals and employs the concept of retroreflection to reduce the sensitivity to vibrations. Start to end simulations were carried out which account for realistic electron bunch distributions, inter RF-pulse bunch fluctuations, various possible errors of the X-ray optics as well as the impact of heat load on the diamond crystals. The estimated performance and stability derived from these simulations shall be reported and foreseen issues shall be discussed.

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Session Classification: Tuesday posters

Track Classification: Seeded FEL