



Contribution ID: 90

Type: **Invited talk**

## Novel Experiments Employing Transverse Resonant Island Buckets (TRIBs)

*Thursday 29 August 2024 16:55 (20 minutes)*

We report here on the new scientific possibilities that have recently been opened up from new accelerator physics developments - the operation of a synchrotron radiation source in a so-called TRIBs mode [1]. Here, the electron beam moves on a different closed orbit in the storage ring, which only closes after several (e.g. 3) turns, but the electrons run on different paths through the storage ring on their way. Apart from the fact that single bunches with correspondingly longer repetition times can now be kicked to such a second orbit for time-resolved experiments, we show here, based on experiments at BESSY II and predictions for 4th generation sources such as BESSY III, how to significantly improve X-ray experiments such as XAS, XMCD and Imaging by TRIBs and by cleverly exploiting the properties of the beamlines and the time structure of the electron beam. By utilizing the full brilliance of the entire multibunch filling pattern we show here experimental results on MHz helicity flips at elliptical IDs [2], MHz pre-edge normalization for XAS, XMCD and Imaging applications [3] as well as I0 normalization from the previous turn for imaging spectroscopy and other methods. Most methods benefit from the fact that the pointing of the electron and, hence, the photon beam stands almost still at consecutive turns of electrons in the ring enabling new approaches to a quantitative characterization of samples. Simulations including ray tracing down to the final focus show the even improved suitability of the method for BESSY III [4] and other 4th generation light sources.

[1] M. Ries et al., Transverse Resonance Island Buckets at the MLS and BESSY II, Proc. IPAC 2015, Richmond, VA, USA, p.138, doi:10.18429/JACoW-IPAC2015-MOPWA021

[2] K. Holldack et al., Flipping the helicity of X-rays from an undulator at unprecedented speed Communications Physics, 3, 61 (2020), <https://doi.org/10.1038/s42005-020-0331-5>

[3] K. Holldack et al., Two-color synchrotron X-ray spectroscopy based on transverse resonance island buckets, Scientific Reports, 12, 14876 (2022), <https://doi.org/10.1038/s41598-022-19100-z>

[4] M. Arlandoo et al., A first attempt at implementing TRIBs in BESSY III design lattice, Proc. IPAC 2022, Bangkok, Thailand, p. 2560, doi:10.18429/JACoW-IPAC2022-THPOPT003

### I plan to submit also conference proceedings

Yes

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