



Contribution ID: 14

Type: **Oral contribution**

Developing a Beam Spectrum for Transient Beams in the CERN Double Quarter Wave Crab Cavities

Wednesday 8 October 2025 09:00 (30 minutes)

As part of the High Luminosity project of the Large Hadron Collider (LHC) at CERN, transverse deflecting cavities (crab cavities) have been developed to compensate for the luminosity reduction caused by the collision crossing angle. Initial estimations of the cavity HOM power in 2018 were not in agreement with measurements of the prototype cavities when tested with beam. Advancements in modelling the beam spectrum have shown to compensate for these discrepancies (up to 20dBm). These studies have highlighted the importance of considering transient effects in beam dynamics when assessing HOM power. Additionally, it has been observed that RF-beam manipulation earlier in the CERN accelerator chain can leave harmonic resonances in the beam spectrum.

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Session Classification: Operation of SRF Facilities

Track Classification: Operation of SRF Facilities