Abstract

The MESA project is currently under construction at Johannes Gutenberg-Universität Mainz. The main accelerator of the multi-turn ERL is based on TESLA/XFEL type SRF cavities in two modified ELBE-style cryomodules. Cavities are running in cw on a design gradient of 12.5 MV/m. The modules have been delivered as turn-key systems by industry and recently passed the acceptance tests performing on design specifications. The complete process of cavity and module construction and necessary modifications for high current cw operation has been accompanied by the MESA group. While SRF Technology has matured tremendously in the last decades, it remains challenging to produce reliable turn-key systems for labs/applications that may not have long-established SRF experience. In the case of MESA, SRF technology was established successfully at the lab from scratch within six years. The ELBE-style modules with a number of design modifications are a first example of successful technology transfer to industry of a fully turn-key system operating at high gradient.

MESA Overview

- ERL project under construction at Mainz university
- Beam energy up to 155 MeV (105 MeV in ERL mode)
- Beam current up to 1 mA (cw) in ERL mode, 10 mA upgrade envisaged
- 2 cryomodules built by industry

Enhanced ELBE Type Cryomodules

- Tested 4 cavities in 2 cryomodules from 2018-2020
- 1st module passed SAT at first try reaching specifications
- 2nd module (CAV 009 and 010) needed retreatment after 1st test in Nov 2018
- Increased performance close to design value but still some degradation with respect to vertical test
- Module 2 could be accepted as full cryogenic losses (including static losses) were within specification

SAT Results

- Successful industry-university collaboration with 2 working modules at Mainz

SAT Setup

Heavily shielded (concrete blocks) area for testing cryomodules (< 10 m)

MESA module in test stand (ceiling removed, during installation)