A necessary condition for high SRF performances in thin film coated cavities is the absence of substrate defects. For instance, in the past, defects originated around electron beam welds in high magnetic field areas have been shown to be the cause of performance limitations in Nb/Cu cavities. Seamless cavities are therefore good candidates to allow an optimization of the coating parameters without the pitfalls of a changing substrate. In this work, we present the first results of two different methods to produce seamless cavities applied to 1.3 GHz copper single cells coated with thin Nb films by means of HIPIMS. A first method consists in electroplating the copper resonator on precisely machined aluminum mandrels, which are then dissolved chemically. As an alternative and a cross check, one cavity was machined directly from the bulk. Both cavities were coated with HIPIMS Nb films using the same coating parameters and the SRF performance was measured down to 1.8 K with a variable coupler to minimize the measurement uncertainty.

Conclusions

We presented the first results of Nb coatings of two seamless 1.3 GHz cavities manufactured at CERN with two different approaches: Electroformed (L1) and machined directly from a bulk billet (BM1). The RF performance shows that the Q-slope has been mitigated in both cases at 4.2 K. The performance of BM1 improved significantly after removing the damaged layer present due to the diamond tooling. However, at 1.85 K it still showed a significant Q-slope which might be explained by irregularities on the surface of the substrate caused during the SUBU. This was removed by electropolishing, and the third coating showed a dramatic improvement of the RF performance. It was also observed a variation of the performance with thermal cycling, and a possible correlation to the flux trapping will be further studied in future tests. Regarding L1, efforts were made on improving the adherence of the coating, but peel-offs have appeared systematically. Nevertheless, results are encouraging, and having removed the unknown of the weld quality, this will allow a systematic work to optimise the substrate preparation and the coating parameters. Albeit still modest, the RF performance was of easier interpretation than in past experiments, and gave a more clear indication on the path forward.