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Design of the 9-cell superconducting cavity for EUV light source accelerator

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KEK has been designing the 10 mA class ERL-EUV light source accelerator. The main linac uses 9-cell superconducting cavities with beamline HOM damper. The target accelerating gradient is 12.5 MV/m. The 9-cell cavity is designed from experience of the KEK compact ERL (cERL) main linac. The cERL main linac was designed to suppress the HOM-BBU with beam current of 100mA by enlarging the iris diameter to 80mm. This resulted into the high ratio of the peak surface electric field and the accelerating field (Ep/Eacc) of 3. The accelerating gradient is limited from 8.5 to 10 MV/m during the CW beam operation due to field emission. The EUV can accept lower BBU limit than cERL because the target beam current of the EUV is 10 mA. The iris diameter is set to 70mm to lower Ep/Eacc around 2. The target accelerating gradient can be achieved if the surface peak electric field is equal to cERL. EUV end cells were designed to minimize HOM Q factor in the above condition. The optimal shape was designed by matching HOM frequencies of the two end cells and center cells calculated individually. The absorption heat of HOM damper is estimated to about 10 W. The AlN is known as high damping efficiency at cryogenic temperature. The HOM damper was designed using complex permittivity data measured at 80 K for AlN. The performance of the HOM damper combined with the cavity is capable of operating the beam at 10 mA. In this presentation, we will describe the EUV cavity and HOM damper design.

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