- Largest Bunch Charge for a Short bunch
  - I = 0.1 A
  - E= 15 MeV
  - $\sigma_s$= 0.9 mm
  - $\Delta E/E = 4.8 \times 10^{-4}$
  - $\phi_{merger}$= 15°
  - P/coupler = 75 kW
  - $N_{cavity}$= 10
  - $L_{injector}$ = 20m

## A.1.6 Main linac (+jac+cem)

### A.1.6.1 Design Criteria

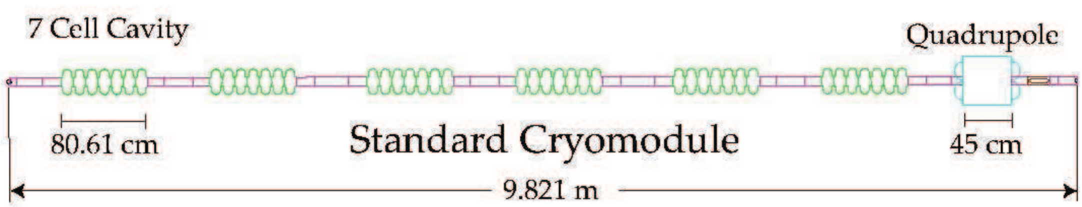


Figure A.1.6.1-1The standard ERL cryomodule.

The ERL linacs consist of 64 identical cryomodule cells divided among LA and LB, with the layout for the standard ERL cryomodule layout shown in Figure A.1.6.1-1The standard ERL cryomodule. Each cryomodule contains six superconducting accelerating cavities and a single quadrupole magnet, along with other elements, e.g. higher order mode absorbers, gate valves, and beam position monitors, that can be considered to be drifts for purposes of the beam optics. Using the dimensions in The standard ERL cryomodule, in order to bring a 10 MeV beam to 5 GeV, each cavity must provide an average energy gradient of 16.12 MeV/m and therefore a single cryomodule can give or take 78 MeV to or from a beam.

Because the ERL has two turnaround loops TA and TB operating at different energies, one linac needs to be longer than the other. In general, for $N_A$ and $N_B$ standard cryomodules in LA and LB, respectively, the changes in energy of the beam in these linacs are

$$\Delta E_{LA} = \frac{N_A}{N_A + N_B}\left(E_{\max} - E_{\min}\right)$$

$$\Delta E_{LB} = E_{\max} - E_{\min} - \Delta E_{LA}$$

where $E_{\min}$ is the injection energy and $E_{\max}$ is the full operating energy of the ERL. For $N_A = 36$ and $N_B = 28$, with energies $E_{\min} = 10\text{MeV}$ and $E_{\max} = 5\text{GeV}$ we get $\Delta E_{LA} = 2.807\,\text{GeV}$ and $\Delta E_{LB} = 2.183\,\text{GeV}$. The beam in TA is therefore has an energy of 2.817 GeV and the beam in