DR 3.2 km Lattice

Webex meeting
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Modification with respect to DCO4

Start with DCO4 with 6.4m circumference

1. Eliminate one of two circumference changing chicanes
2. Eliminate 5 of 12 phase trombone cells
3. Reduce number of wiggler cells from 44 to 27, wiggler period -> 32cm (vs 40cm), 12 poles
4. Modify RF straight so that cryostats for two positron rings are interleaved (12 cavities are required. There is space for 16)
5. Eliminate 4 of 7 FODO cells in injection straight
6. Circumference = 3.2km, straight = 712m, arc = 911m
3.2485km circumference

Phase trombone    rf    wiggler

364m            100m       204m

712m straight

911.6m arc (including dispersion suppresser)

chicane    Injection/extraction

The arc is assembled from 75 FDBDF (focus/defocus/bend/defocus/focus) “TME variant” arc cells.
Cell length = 10.931m
Bend length = 3m
Arc cell - FDBDF

\[ m \]

\[ cm \]
Bmad_7-27wig. – 712m straight

\[ \eta \text{[cm]} \]

\[ \beta \text{[m]} \]

\[ \eta \text{[cm]} \]

\[ \beta \text{[m]} \]

\[ \eta \text{[cm]} \]

\[ \beta \text{[m]} \]

\[ \eta \text{[cm]} \]

\[ \beta \text{[m]} \]
Extraction straight

\[ \beta_x, \beta_y, \text{kickers, quadrupoles} \]
Injection straight

\[ \beta_x \]
\[ \beta_y \]

kickers
quadrupoles

\[ m \]
\[ x \]
\[ y \]

\[ s[m] \]
Circumference changing chicane
32cm wiggler params

12 poles
32cm period
Wiggler length = 3.84
Cell length = 7.56 m

27 wiggler cells
3.248km ring with FDBDF arc cells and 712m straight

<table>
<thead>
<tr>
<th>Parameter</th>
<th>10 Hz (Low)</th>
<th>5 Hz (Low)</th>
<th>5 Hz (High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circumference</td>
<td>3.248 km</td>
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</tr>
<tr>
<td>RF frequency</td>
<td>650 MHz</td>
<td>650 MHz</td>
<td>650 MHz</td>
</tr>
<tr>
<td>$\tau_x/\tau_y$ [ms]</td>
<td>13.5</td>
<td>24.1</td>
<td>24.1</td>
</tr>
<tr>
<td>$\sigma_s$ [mm]</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>$\sigma_\delta$</td>
<td>0.134%</td>
<td>0.11%</td>
<td>0.11%</td>
</tr>
<tr>
<td>$\alpha_p$</td>
<td>$3.3 \times 10^{-4}$</td>
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</tr>
<tr>
<td>$\gamma\varepsilon_x$ [$\mu$m]</td>
<td>2.7</td>
<td>4.4</td>
<td>4.4</td>
</tr>
<tr>
<td>RF [MV] (12 cavities) Total/Per cav</td>
<td>19.7/1.64</td>
<td>14/1.7</td>
<td>14/1.7</td>
</tr>
<tr>
<td>$\xi_x/\xi_y$</td>
<td>-51.5/-44.6</td>
<td>-51.5/-43.9</td>
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</tr>
<tr>
<td>Wiggles - $N_{cells} @B$ [T]</td>
<td>27@2.1</td>
<td>27@1.5</td>
<td>27@1.5</td>
</tr>
<tr>
<td>Energy loss/turn [MeV]</td>
<td>8.0</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td>sextupoles</td>
<td>3.41/-4.34</td>
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</tr>
<tr>
<td>Power/RF coupler @400mA [kW]</td>
<td>267</td>
<td>150</td>
<td>300</td>
</tr>
</tbody>
</table>
The lattice can accommodate 16 RF cavities
If we assume 12 then
  Voltage/ cavity in 10Hz mode is 1.64
  Power/coupler in 5Hz, high power mode is 300kW
Dynamic aperture

5 Hz

Periodic type wiggler model, includes vertical focusing and cubic nonlinearity
Dynamic aperture

10 Hz

Periodic type wiggler model, includes vertical focusing and cubic nonlinearity