Status about the optics between the source and ELENA

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Parameters*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>100% $I_0$</th>
<th>90% $I_0$</th>
<th>70% $I_0$</th>
<th>37% $I_0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>mA</td>
<td>0.25</td>
<td>0.22</td>
<td>0.19</td>
<td>0.09</td>
</tr>
<tr>
<td>$\epsilon_{RMS}$</td>
<td>mm mrad</td>
<td>0.81</td>
<td>0.66</td>
<td>0.66</td>
<td>0.32</td>
</tr>
<tr>
<td>$\epsilon_{RMS, normalized}$</td>
<td>mm mrad</td>
<td>0.11</td>
<td>0.09</td>
<td>0.09</td>
<td>0.05</td>
</tr>
<tr>
<td>$\alpha$</td>
<td></td>
<td>-11.46</td>
<td>-6.77</td>
<td>-5.86</td>
<td>-2.63</td>
</tr>
<tr>
<td>$\beta$</td>
<td>m/rad</td>
<td>22.98</td>
<td>13.46</td>
<td>11.91</td>
<td>4.93</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>m/rad</td>
<td>5.76</td>
<td>3.48</td>
<td>2.97</td>
<td>1.61</td>
</tr>
</tbody>
</table>

* Parameters provided by Ralf Gebel
Source-Injection layout

Protons \( \rightarrow \) LNI
Protons (extraction) \( \rightarrow \) LNE00
\( \bar{P} \) (extraction) \( \rightarrow \) LNE50
\( H^- \) ions (extraction) \( \rightarrow \) RING

Operational mode

<table>
<thead>
<tr>
<th>Mode</th>
<th>LNI</th>
<th>LNE00</th>
<th>LNE50</th>
<th>RING</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \bar{P} ) (injection)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Normal operation</td>
</tr>
<tr>
<td>( H^- ) (injection)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Cooling tests</td>
</tr>
<tr>
<td>P (ejection)</td>
<td>NU</td>
<td>+</td>
<td>NU</td>
<td>+</td>
<td>Optics studies</td>
</tr>
<tr>
<td>P (injection)</td>
<td>-</td>
<td>-</td>
<td>NU</td>
<td>-</td>
<td>Cooling tests</td>
</tr>
</tbody>
</table>

+ Normal polarity
- Inverse polarity
NU Not Used

ELENA source meeting
Injection line

Source switch

Monitor

Septum

Injection kicker

Magnetic

Electrostatic

3036 to corrector

17/06/2013

ELENA source meeting
Source to injection (H⁻)

LNSLN1 length = 7.502 m

Aperture limit
With current design

17/06/2013
Source to injection (protons*)

Polarity swap needed

* Assumption: using the same parameters as for H
Injection to extraction (protons*)

* Assumption: using the same parameters as for H

Same strengths as for normal operation
Source to extraction, via ELENA (H⁻)

LNE00_s length=12.75 m

Maximum beam size 25 mm
Beam size vs. beam current

LNSLN1 length = 7.502 m

\[ \sigma_z \text{ [mm]} \]

\[ \sigma_y \text{ [mm]} \]

Longitudinal location [m]

\( I_0 = 0.25 \text{ mA} \)
\( I_0 = 0.22 \text{ mA} \)
\( I_0 = 0.09 \text{ mA} \)
Ion switch-yard
Questions

- How many % beam loss (from the source) do we accept?
- Testing the ion switch-yard:
  - Is it feasible to test the switch-yard in Julich?
  - What timescale, i.e. when do we need to be ready?
Conclusions

- Optics ok, some mismatch with the dispersion.
- Polarity swap of quadrupoles needed in LNS, LNI and LNE (if we want to extract protons).
- Two electrostatic quadrupoles are foreseen in the LNI line.
- The design of the Ion switch-yard is progressing well.