LINAC4 COMMISSIONING OVERVIEW

ALESSANDRA LOMBARDI
1) Preinjector
- 3 MeV Source(s)
- 2 solenoids
- RFQ
- 11 EMQ
- 3 Cavities
- 2 Chopper units
- dump

2) Drift Tube Linac
- 50 MeV
- 3 Tanks
- 3 Klystrons
- 1 EMQ
- 2 steerers
- 114 PMQ
- 19 m

3) Cell-Coupled Drift Tube Linac
- 100 MeV
- 7 Modules
- 7 Klystrons
- 7 EMQ
- 7 steerers
- 14 PMQ
- 25 m

4) Π-mode Structure
- 160 MeV
- 12 Modules
- 8 Klystrons
- 12 EMQ
- 12 steerers
- 23 m
## COMMISSIONING STAGES

<table>
<thead>
<tr>
<th>Energy</th>
<th>Key issue</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>3MeV</td>
<td>RFQ transmission Choppping</td>
<td>Done</td>
</tr>
<tr>
<td>12 MeV</td>
<td>Matching to DTL</td>
<td>Imminent</td>
</tr>
<tr>
<td>30-50 MeV</td>
<td>Transporting in PMQ channel</td>
<td>Dec 2014</td>
</tr>
<tr>
<td>100 MeV</td>
<td>Setting the RF phases</td>
<td>Mar 2015</td>
</tr>
<tr>
<td>160 MeV - DUMP</td>
<td>Final energy</td>
<td>End 2015</td>
</tr>
<tr>
<td>160 MeV</td>
<td>Reliability + sector tst</td>
<td>2016</td>
</tr>
<tr>
<td>160 MeV - LBE LBS</td>
<td></td>
<td>T0+8months</td>
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</table>
FOUR IMPORTANT RESULTS

• The RFQ behaves as expected and we can reproduce the transmission curve. The mechanics, RF and the dynamics design are validated
• The integrated chopper dynamics (premier) works and the chopper rise/fall time is adequate
• The through-beam emittance is the same as the chopper-off emittance
• The through-beam can be matched to the DTL (and soon the DTL will tell us how well)
RFQ Transmission vs. RF power for different pressure in the LEBT (neutralisation)
2-BEAM CHOPPING

![Graph showing BCT.004040 (mA) vs. L4L.QFC.03130 (A) with data points for measurements on 14.05.2013 and 14.5.2013.]
Emittance measured with chopper off (left) and with chopper on (right) downstream the inline dump
95% transmission.
As predicted by the simulation codes (TraceWin and Travel)
IN SUMMARY

What has been done

- The LEBT, RFQ, and chopper line have been commissioned in their final set-up.
- The model have been fine-tuned and are an excellent guide to commissioning endeavours.
- So far so good....

What needs to be done

- The final source needs to be installed (Jacques).
- The DTL, CCDTL, PIMS and transfer line need to be installed and commissioned.
- A reliability run is planned for 2016
## NOMINAL BEAM AT PSB

<table>
<thead>
<tr>
<th>Intensity</th>
<th>40 mA</th>
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<tbody>
<tr>
<td><strong>Transverse</strong></td>
<td>E = 0.3-0.4 π mm mrad norm rms</td>
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<tr>
<td></td>
<td>Alpha = 0</td>
</tr>
<tr>
<td></td>
<td>Beta x = 5, 2.5, 10 m</td>
</tr>
<tr>
<td></td>
<td>Beta y = 4, 2, 8 m</td>
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<tr>
<td></td>
<td>Dispersion = 0 or 1.2 m</td>
</tr>
<tr>
<td><strong>Longitudinal</strong></td>
<td>±100 keV rms energy spread (100-800 KeV possible)</td>
</tr>
<tr>
<td></td>
<td>160 MeV ± 1.2 MeV (dynamically over 20 µsec)</td>
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<tr>
<td><strong>Chopped</strong></td>
<td>1 µsec for the distributor rise time</td>
</tr>
<tr>
<td></td>
<td>1 MHz frequency of the PSB</td>
</tr>
<tr>
<td></td>
<td>as low as just letting few µbunches (50 nsec)</td>
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