Status of the 7 MeV/u, 217 MHz Injector Linac for the Heidelberg Cancer Therapy Facility

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HICAT – The Heavy Ion Cancer Therapy Facility for the University Hospital in Heidelberg

- Particles: $p$, $^3\text{He}^{2+}$, $^{12}\text{C}^6+$, $^{16}\text{O}^8+$
- Two ECR ion sources
  - 7 MeV/u injector linac
  - 6.5 Tm synchrotron
- Final beam energy:
  - 48 - 430 MeV/u
- 3 treatment stations with rasterscan systems:
  - 2 × fixed horizontal beam lines
  - 1 × isocentric ion gantry
- 1 × quality assurance place for R&D activities
- Building area $\approx 70 \times 60 \text{ m}^2$
- 1000 patients / year
217 MHz, 7 MeV/u Injector Linac

Operating frequency: 216.816 MHz
RF pulse length: ≤ 500 µs @ PRF ≤ 10 Hz
Ion mass-to-charge ratio: $A/q ≤ 3$

B. Schlitt et al., Proc. LINAC 2002, p. 781
### Time Schedule and General Status

<table>
<thead>
<tr>
<th>Year</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>First patient treatment at GSI</td>
</tr>
<tr>
<td>1998</td>
<td>Proposal published</td>
</tr>
<tr>
<td>2000</td>
<td>Technical description</td>
</tr>
<tr>
<td>2002</td>
<td>Call for tenders</td>
</tr>
<tr>
<td>2003</td>
<td>Components ordered from industry</td>
</tr>
<tr>
<td>November 2003</td>
<td>Beginning of excavation activities for the building in Heidelberg</td>
</tr>
<tr>
<td>At present</td>
<td>Production of components in progress, first devices already delivered (to GSI)</td>
</tr>
<tr>
<td>First half of 2005</td>
<td>Beginning of step-by-step installation and commissioning</td>
</tr>
<tr>
<td>2006 / 2007</td>
<td>First patient treatment</td>
</tr>
</tbody>
</table>
400 keV/u 4-Rod Type RFQ

Designed, assembled and tuned at the IAP,
RFQ beam test stand is presently being set up at the IAP


<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy range</td>
<td>8 – 400 keV/u</td>
</tr>
<tr>
<td>Electrode length</td>
<td>1.28 m</td>
</tr>
<tr>
<td>Tank diameter</td>
<td>0.25 m</td>
</tr>
<tr>
<td>Electrode voltage</td>
<td>70 kV</td>
</tr>
<tr>
<td>RF power loss (pulse)</td>
<td>$\approx 165$ kW</td>
</tr>
</tbody>
</table>
20 MV IH-Type Drift Tube Cavity

3 Integrated magnetic triplet lenses
56 Accelerating gaps

Energy range 0.4 – 7 MeV/u
Tank length 3.77 m
Inner tank height 0.34 m
Inner tank width 0.26 m
Drift tube aperture diam. 12 – 16 mm
RF power loss (pulse) ≈ 1 MW
Averaged eff. volt. gain 5.3 MV/m

See also Y.R. Lu et al., MOP11, this conference
Linac Quadrupole Magnets

Yoke outer diameter: 130 mm
Yoke length: 42 / 49 / 67 / 81 / 97 mm
Yoke material: VACOFLUX 50
Magnet aperture diameter: 20 mm
Number of turns per pole: 5
1.4 MW Final Stage Cavity Amplifier

Built by BERTRONIX Electronic GmbH, Munich, Germany
217 MHz, 7 MeV/u Injector Linac

Operating frequency \(216.816\, \text{MHz}\)
RF pulse length \(\leq 500\, \mu\text{s} @ \text{PRF} \leq 10\, \text{Hz}\)
Ion mass-to-charge ratio \(A/q \leq 3\)

B. Schlitt et al., Proc. LINAC 2002, p. 781
20 MV IH-type Drift Tube Cavity

3 Integrated magnetic triplet lenses
56 Accelerating gaps

Tank length 3.77 m
Inner tank height 0.34 m
Drift tube aperture diam. 12 – 16 mm
RF power loss (pulse) \(\approx 1\) MW
Averaged eff. volt. Gain 5.7 MV/m

See also Y.R. Lu et al., MOP11, this conference