STATUS AND OPERATING EXPERIENCE OF THE TTF COUPLER

Poster MOP49

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# RF high power couplers in the VUV-FEL

<table>
<thead>
<tr>
<th>Coupler type</th>
<th>FNAL</th>
<th>TTF 2</th>
<th>TTF 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>cold window</td>
<td>conical</td>
<td>cylindrical</td>
<td>cylindrical</td>
</tr>
<tr>
<td>warm window</td>
<td>flat wave guide</td>
<td>flat wave guide</td>
<td>cylindrical</td>
</tr>
<tr>
<td>bias</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>fabricated totally</td>
<td>16</td>
<td>20</td>
<td>62</td>
</tr>
<tr>
<td>tested</td>
<td>16</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>used in TTF modules</td>
<td>12</td>
<td>19</td>
<td>11</td>
</tr>
<tr>
<td>assembled in modules</td>
<td>ACC 1, 2</td>
<td>ACC 2, 3, 4</td>
<td>ACC 1, 5</td>
</tr>
</tbody>
</table>
The latest TTF Coupler Design

**TTF III coupler**

- waveguide to coax transition
- room temperature window
- light detector (PM)
- warm vacuum pumping port
- warm coax Ø 62 mm Z= 50 Ohm
- cold coax Ø 40 mm Z= 70 Ohm
- cold window
- 4.2 K point
- bias voltage feedthrough
- e−3 pickup
- Qext tuning knob
- isolating Kapton foil
- room temperature isolation vacuum flange
- e−2 pickup
- 70 K point
- e−1 pickup
- 1.8 K flange to cavity

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Processing times of TTF Couplers

- **Coupler test stand:** 70 - 125 h
  two at a time, baked in situ

- **Horizontal Cryostat:** 20 - 120 h
  one at a time, baked in situ

- **Module:** 900 - 1200 h
  8 - 16 at a time, not backed
  dominated by the older coupler design
High Gradient Test

- An electro polished cavity & TTF3 coupler have been operated at 35 MV/m for more than 1100 hours
- Forward power was above 600 kW (due to the not compensated Lorentz Force detuning)
- No degradation in the performance of cavity or coupler (During setup of LLRF system breakdowns in coupler and quenches in cavity were caused)
Conclusion

- All couplers in the VUV-FEL could be processed and operated on the needed power level
- Parallel processing and no backing increases the conditioning time
- Handling and storage has to be improved

- TTF3 couplers are successfully tested together with cavities up to 35 MV/m (600kW)
- Next steps: industrial studies for mass production and price reduction