SLAC workshop 7-10 July 2009
WP1: microwave based accelerators

Status of CLIC X-band high-power components

G. Riddone, 08.07.2009

(contribution from A. Olyunin and I. Syratchev)
## Overview

<table>
<thead>
<tr>
<th>Areas</th>
<th>Type</th>
<th>Design</th>
<th>Supplier</th>
<th>Ordered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional devices for several areas</td>
<td>50 dB directional couplers</td>
<td>Gycom</td>
<td>Gycom</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>3 dB hybrid</td>
<td>CERN</td>
<td>CIN EL, IH EP</td>
<td>15</td>
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<tr>
<td></td>
<td>3 dB H-plane splitter</td>
<td>CERN</td>
<td>VDL</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Dry stainless steel RF load</td>
<td>CERN</td>
<td>VDL, CIN EL, Heeze</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>W aveguide E/H bends</td>
<td>CERN</td>
<td>Several CIN EL</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>RF flanges (CERN design)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>TBTS</td>
<td>Attenuator/splitter (0-&gt;1)</td>
<td>Gycom</td>
<td>Gycom</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>RF phase shifter (360°)</td>
<td>Gycom</td>
<td>Gycom</td>
<td>1</td>
</tr>
<tr>
<td>Stand alone power source, PSI.</td>
<td>H10 -&gt; H01 mode converter</td>
<td>Gycom/</td>
<td>Both RF and mechanical</td>
<td>CEA/</td>
</tr>
<tr>
<td></td>
<td>RF/vacuum valve (A. Grudiev)</td>
<td>SLAC</td>
<td>design exist at 11.4 GHz</td>
<td>Saclay</td>
</tr>
<tr>
<td>PETS on-off</td>
<td>3 port waveguide junction (T-splitter)</td>
<td>CERN</td>
<td>Under design</td>
<td></td>
</tr>
<tr>
<td></td>
<td>contact free high power movable short circuit</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>tunable reflector RF network</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>CLIC Module</td>
<td>Choke mode flange</td>
<td>CERN</td>
<td>CERN</td>
<td>2</td>
</tr>
</tbody>
</table>

Components needed for several collaborators: KEK and SLAC, as well as PSI (XFEL), Trieste (Elettra), TERA foundation.
Directional couplers

First order completed (10 units)

New specification under preparation (aim at more compact design) for 5 additional units to covers needs from the collaborators

GR, 7/8/2009
Dry stainless steel RF loads

The two halves of the load

10 loads received from CINEL and VDL (material AISI316LN)

To improve performance changed material magnetic stainless steel SS430 – 5 additional loads from CINEL and Heeze under fabrication (2 available at CERN for testing at KEK/SLAC)

3rd order will have to be foreseen for collaborators

GR, 7/8/2009
3 dB H-plane splitters

order completed (10 units)

GR, 7/8/2009
Two-beam test stand in CLEX

A number of RF components: directional couplers, loads, variable splitter and phase shifter have been installed and now under operation in the TBTS, CLEX at CERN.
Attenuator/phase shifter

order completed (3 attenuators and 1 phase shifter)

Attenuator (Variable high power RF power splitter)

Phase shifter (Variable high power RF phase shifter)

S parameters at the position of the max (blue) and min (red) coupling

Frequency, GHz

GR, 7/8/2009
12 GHz stand alone RF power source waveguide network layout

I. Syratchev
GR, 7/8/2009
12 GHz stand alone RF power source
waveguide network layout

11.4 GHz Gate valve
(Grudiev type)
SLAC design - rescaled
to 12 GHz

11.4 H10 -> H01 mode converter
SLAC design

H10 -> H01 mode converter
CERN design (needed for PETS on-off)

GR, 7/8/2009
To allow the independent transverse alignment of the two linacs in CLIC, the special, contact-free choke mode flanges (CMF) are planned to be used.

Dynamic range for the accepted performance (S11 < -45 dB)

- X - shift: ± 0.25 mm
- Y - shift: ± 0.5 mm
- Z - shift: ± 0.5 mm
- Twist: < 5°
CLIC waveguide network

11.424 GHz choke mode flange prototype (2 units) - no adjustment capability

Next step
11.424 GHz choke mode flange with adjustment capability is under design
Conclusions

- An extensive program for X-band RF waveguides components development have been established in CERN.
- We have designed, fabricated and received all the components necessary to start the high RF power operation of the TBTS and the first stage of the TBL. A number of them are already installed and are in operation.
- First loads in SS43 for KEK and SLAC available in the coming weeks.
- New simplified designed for the PETS on-off mechanism (based on proven components) is under way. The test in the TBTS is foreseen 1Q 2010.
- Recently, in Europe, the X-band activity has significantly grown. The number of Labs have expressed their interests in using the X-band technology for their needs. New orders have been launched to cover needs from different collaborators.