

# DELIVERY RECORD

Client: Paul Scherrer Institut

Facility: SwissFEL (Swiss Free Electron Laser)

Location: Villigen, Switzerland

1 October 2018

 **MITSUBISHI HEAVY INDUSTRIES MECHATRONICS SYSTEMS, LTD.**

Machinery Systems Sales Department

MHIMS0115015

- 1. OVERVIEW**
- 2. C-BAND WAVEGUIDE NETWORK PROTOTYPE**

# 1. OVERVIEW

## SwissFEL Main Parameters

Overall length (incl. experimental hall)	740 m
Total electric power consumption	3.8 MW
Electron beam energy	5.8 GeV
Technology of linear accelerator	Normal-conducting copper cavities at 6 GHz
Charge per electron pulse	0.2 nC
Normalized beam emittance	0.4 mm·mrad
Number of X-ray pulses per second	200 (100 at each photon beamline)
X-ray pulse duration	24 fs
X-ray brilliance	$1.3 \cdot 10^{33}$ photons/(s·0.1%·b.w.·mm <sup>2</sup> ·mrad <sup>2</sup> )
Shortest lasing wavelength	0.1 nm

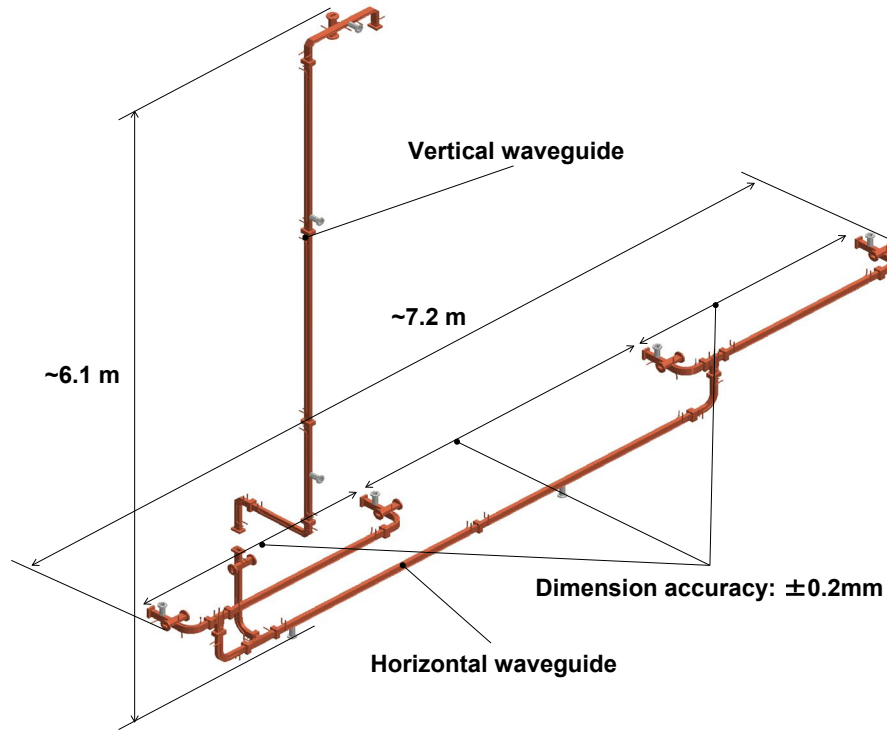


Aerial View of PSI



Aerial View of SwissFEL

# 2.1 C-BAND WAVEGUIDE NETWORK PROTOTYPE



Overview of the C-band waveguide network prototype

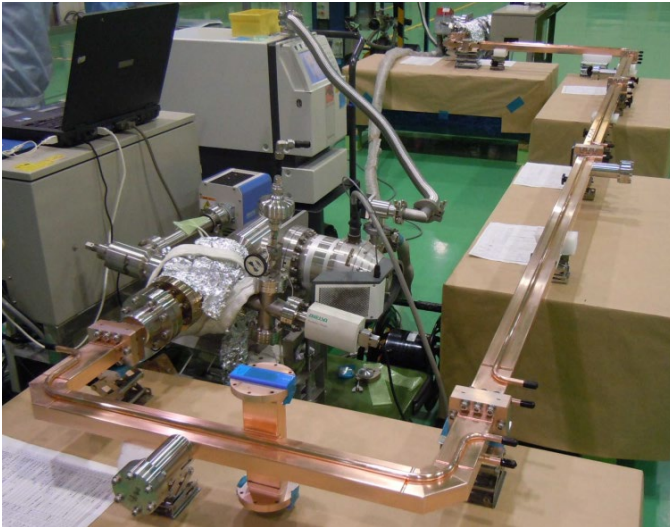
## Main Parameters

Bandwidth	5712 +/- 20 MHz
Peak power	320 MW <sup>1</sup>
Average power	15 kW
Pulse repetition rate	1-100 Hz
VSWR	< 1.04
Operating pressure	< 1x10 <sup>-6</sup> Pa
Waveguide size	WR187
Coupling of the RF monitor	-60 +/- 2 dB (5712 +/- 3 MHz)
Directivity of the RF monitor	> 25 dB (5712 +/- 20 MHz)
RF symmetry error of splitters	< 0.1 dB in amplitude < 3° in phase

<sup>1</sup> Maximum power in between the pulse compressor and the 1st splitter.

# 2.2 C-BAND WAVEGUIDE NETWORK PROTOTYPE

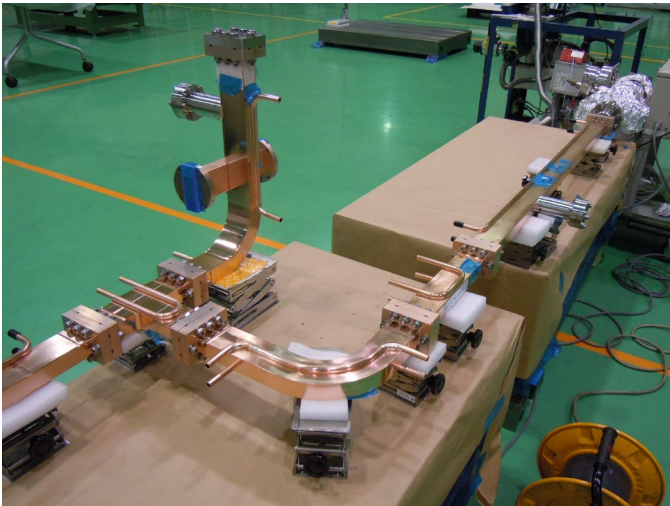
Vertical  
Waveguide



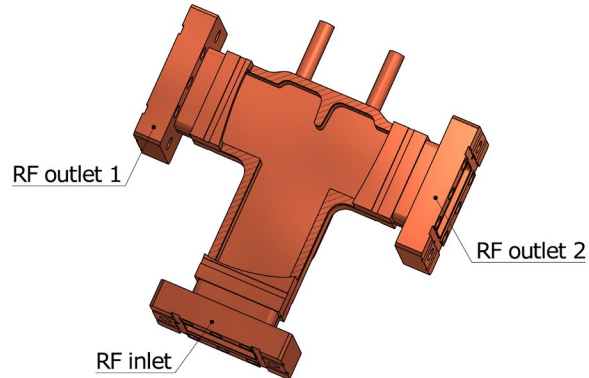
Installed in  
High Power  
Test Stand  
at PSI



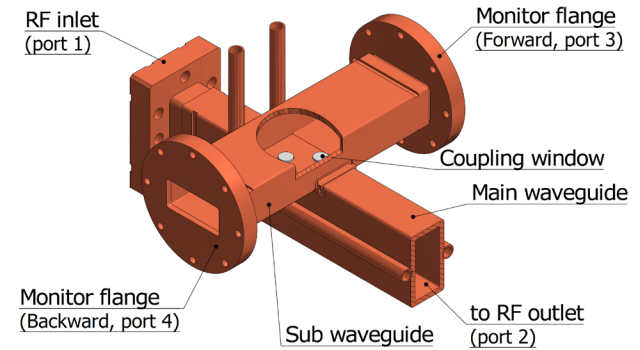
Horizontal  
Waveguide



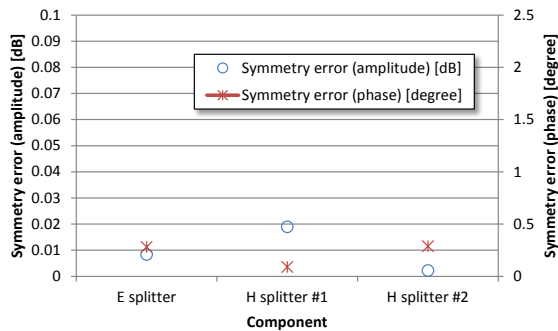
# 2.3 C-BAND WAVEGUIDE NETWORK PROTOTYPE



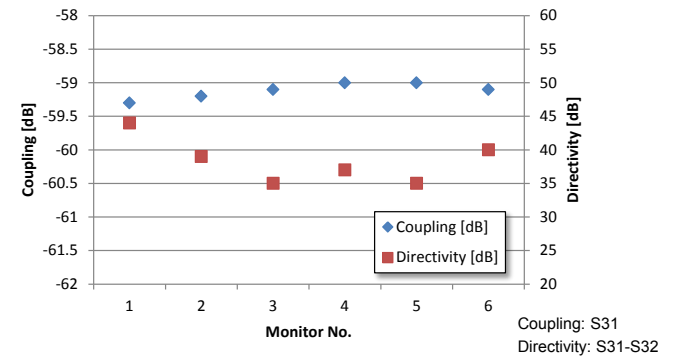
Schematic of the H-plane splitter



Schematic of the RF monitor



Symmetry error of splitters in the prototype module



Coupling and directivity of RF monitors in the prototype module

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