

DELIVERY RECORD

Client: RIKEN / JASRI

Facility: SACLA

(SPring-8 Angstrom Compact Free Electron Laser)

Location: Hyogo, Japan

1 October 2018

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

Machinery Systems Sales Department

MHIMS0115007

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Photo courtesy of RIKEN

List of Main Supplies

Pre-Buncher

Booster Cavity

L-band Correction Cavity

L-band Accelerating Structure

S-band Detuned Accelerating Structure

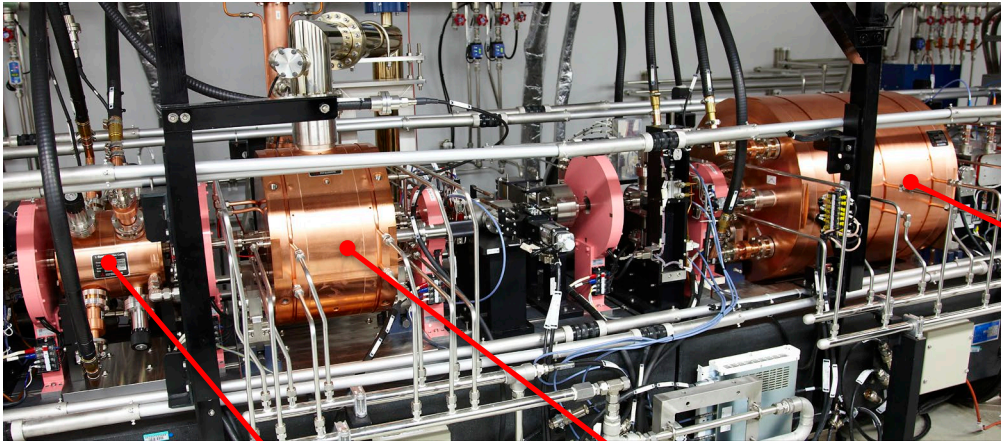
C-band RF Pulse Compressor

C-band Choke-mode Accelerating Structure

C-band Disk-loaded Accelerating Structure

C-band Deflecting Structure

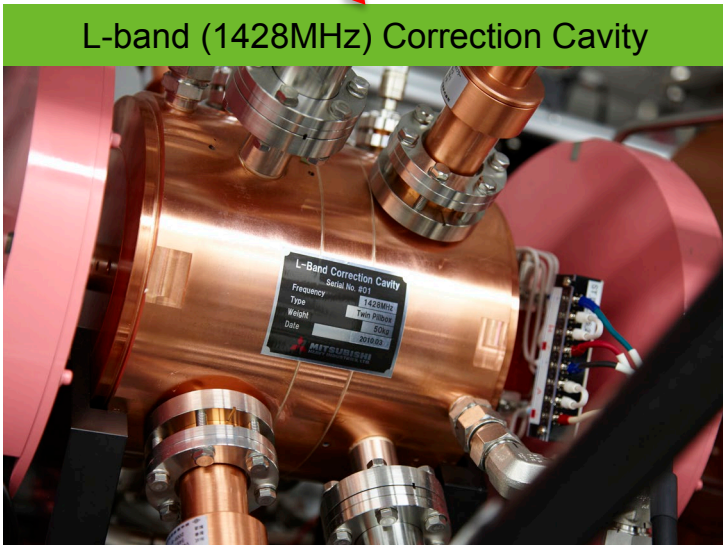
2. INJECTOR SECTION



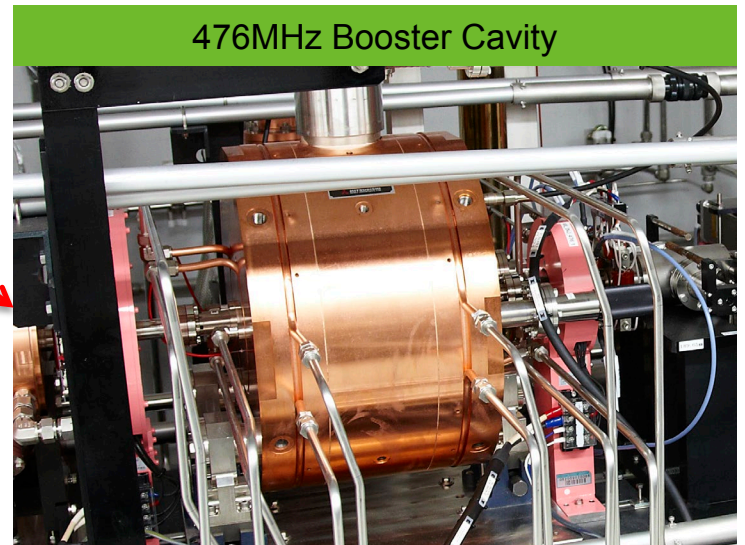
238MHz Pre-Buncher



L-band (1428MHz) Correction Cavity



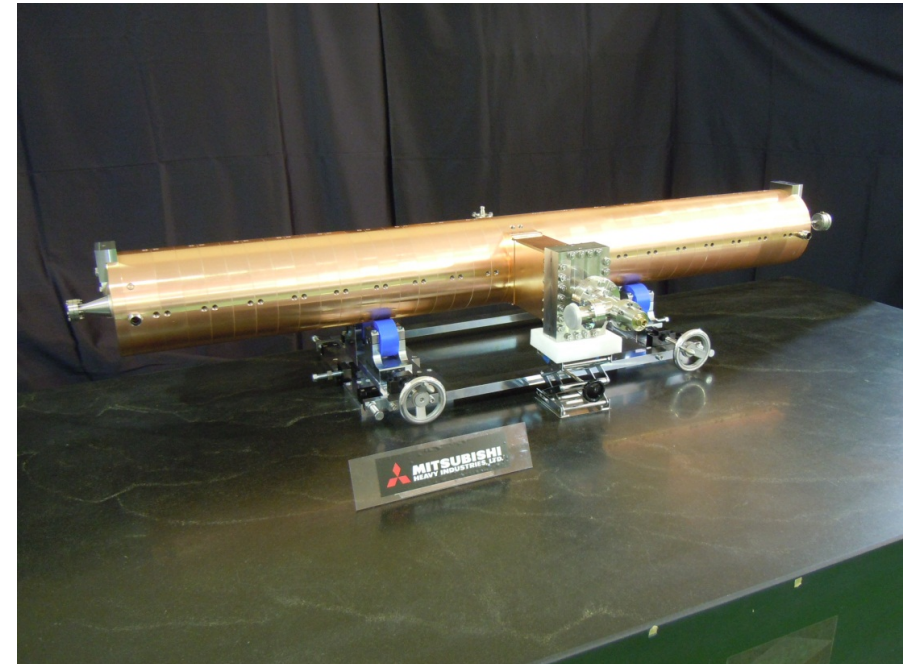
476MHz Booster Cavity



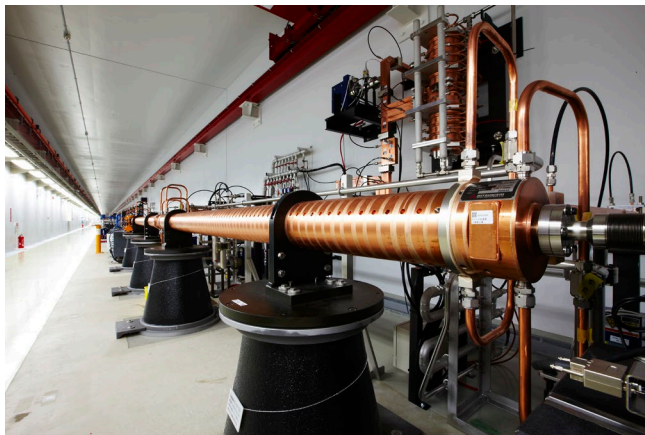
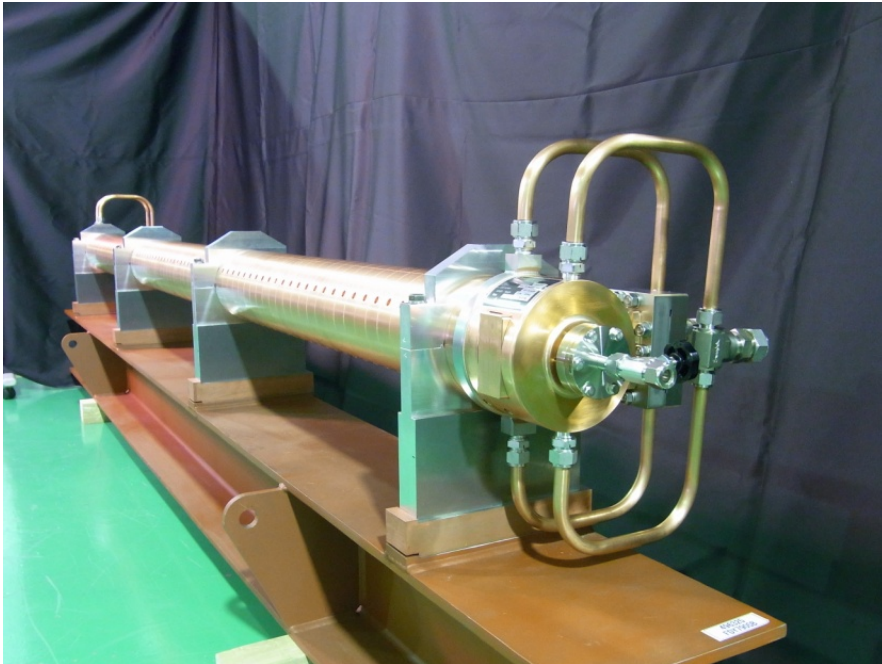
3. L-BAND ACCELERATING STRUCTURE

Main Parameters

Resonance Frequency	1428 MHz
Accelerating Type	Alternating Periodic Structures
Phase Shift per Cavity	$\pi/2$
Unloaded Q	20000
β	1.5
Number of Cells	18 + 1 Coupler Cells
Length	2.3 m
Waveguide	WR-650
Waveguide Flange	A-DESY Flange



4. S-BAND DETUNED ACCELERATING STRUCTURE



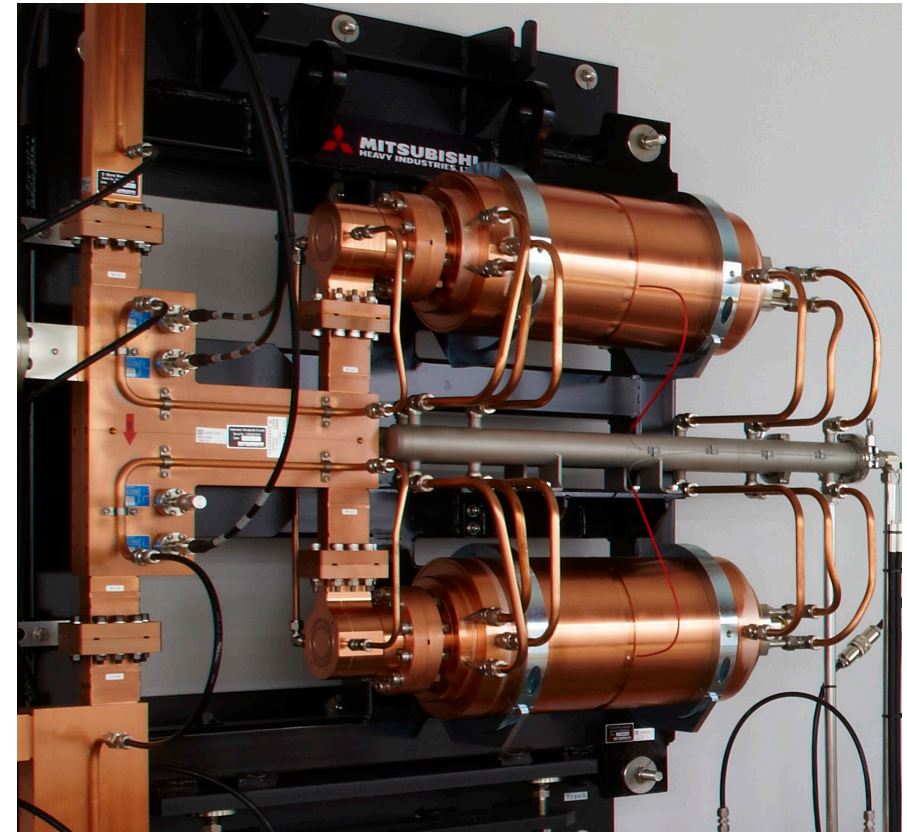
Main Parameters

Frequency	2856MHz
Structure	Disk-loaded Detuned structure
Accelerating Type	Traveling Wave Quasi Constant Gradient
Phase Shift per Cavity	$2\pi/3$
Attenuation Constant (τ)	0.3
Filling Time	0.45 μ s
Number of Cells	84 + 2 Coupler Cells
Length	3.0 m
Waveguide	WRJ3
Waveguide Flange	A-DESY Flange

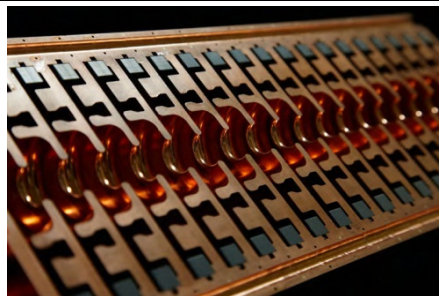
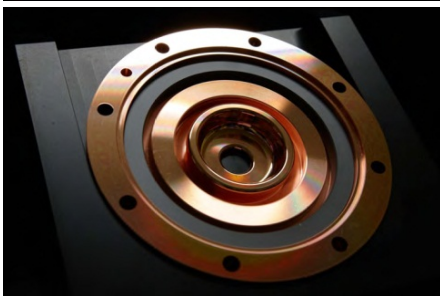
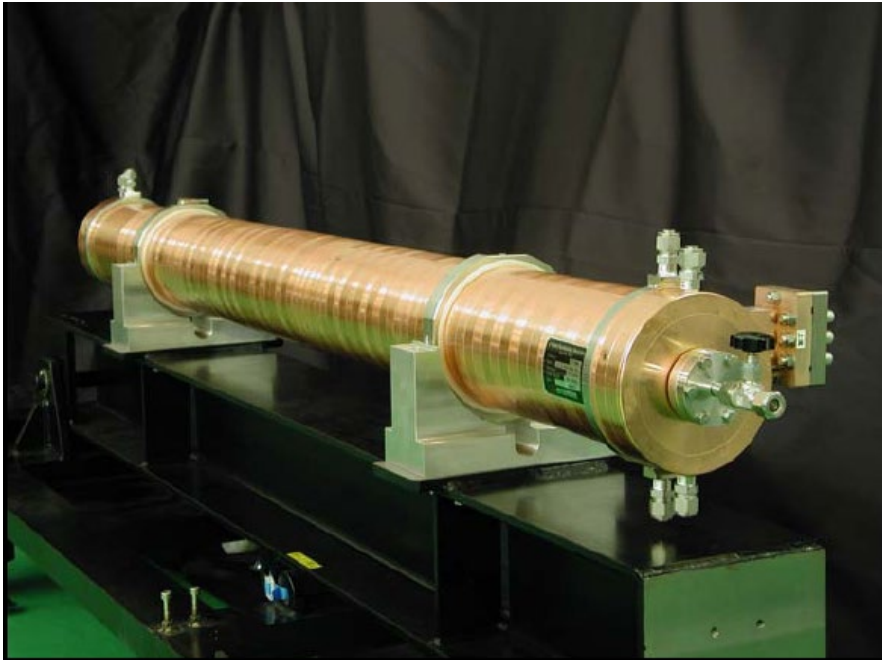
5. C-BAND RF PULSE COMPRESSOR

Main Parameters

Composition	Resonant Cavity x 2 Mode Converter x 2 3dB Coupler, Mounting Frame
Material	Oxygen-free Copper (OFC-Class 1 & 2) SUS304, SS400
RF Flange	A-DESY Type
Resonant Frequency	5712MHz (30°C in Vacuum)
RF Mode	TE _{0,1,15}
Quality Factor	≥ 180,000
Coupling Factor	$\beta = 9 - 9.5$
VSWR	≤ 1.10
RF Power	Input: 50MW Pulse Width: 2.5 μ s Repetition: 60Hz
Tuning Mechanism	Diaphragm Structure with Differential Screw
3dB Coupler	3dB Coupler: Coupling 3dB, Isolation ≥ 25dB RF Monitor: Coupling 60dB, Isolation ≥ 25dB



6. C-BAND CHOKE-MODE ACCELERATING STRUCTURE



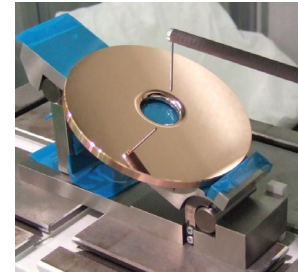
Main Parameters

Frequency	5712MHz
Structure	Disk-loaded Choke Mode Type
Accelerating Type	Traveling Wave Quasi Constant Gradient
Accelerating Gradient	35MV/m (Design Value)
Phase Shift per Cavity	$3\pi/4$
Attenuation Constant (τ)	0.53
Quality Factor	10200 - 9900
Group Velocity	0.031c - 0.013c
Shunt Impedance	49.3 - 60.0M Ω /m
Filling Time	0.3 μ s
Number of Cells	89 + 2 Coupler Cells
Length	1.8m
Waveguide	WRI48
Waveguide Flange	A-DESY Flange

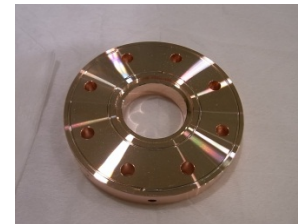
7. C-BAND DISK-LOADED ACCELERATING STRUCTURE

Main Parameters

Frequency	5712MHz +/- 0.2MHz
Structure	Disk-loaded J-type double-feed coupler
Accelerating Type	Traveling Wave Quasi Constant Gradient
Accelerating Gradient	50.1MV/m (Achieved)
Phase Shift per Cavity	$2\pi/3$
Attenuation Constant (τ)	0.56
Quality Factor	$8000 \leq$
VSWR	≤ 1.1
Shunt Impedance	$55\text{M}\Omega/\text{m} \leq$
Filling Time	$0.27\mu\text{s}$
Number of Cells	100 + 2 Coupler Cells
Length	1.8m
Waveguide	WRI48
Waveguide Flange	A-DESY Flange



Disk



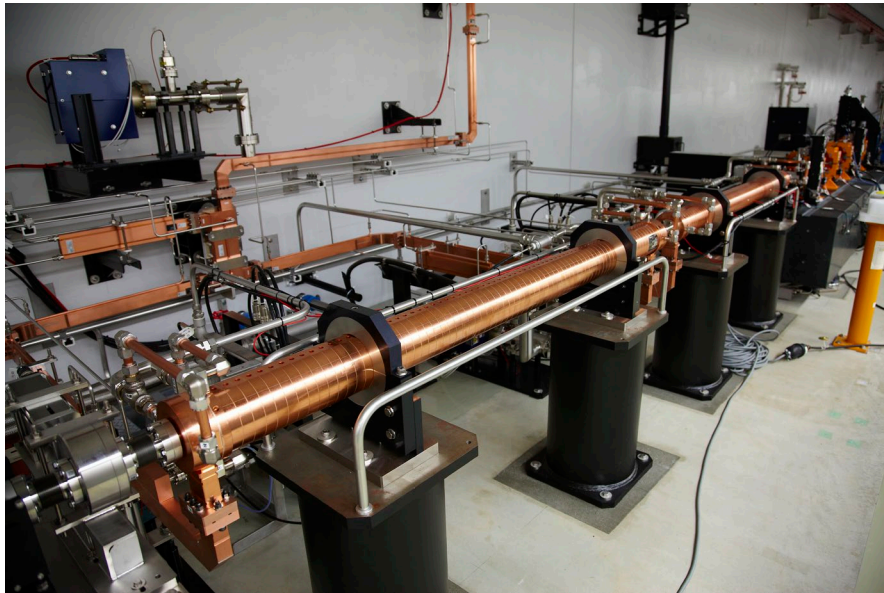
Cylinder



Coupler



8. C-BAND DEFLECTING STRUCTURE



Main Parameters

Resonant Mode	HEM11
Phase Shift per Cavity	$5\pi/6$
Structure	Disk-loaded cylinder type with racetrack-shaped beam hole
Accelerating Type	Constant Impedance, Backward-Wave
Operation Frequency (28°C in Vacuum)	5712MHz
Unloaded Q (Q_0)	≥ 7500
Effective Shunt Impedance	$\geq 20\text{M}\Omega/\text{m}$
VSWR	≤ 1.1
Attenuation Constant (τ)	$0.54 \pm 0.02\text{Np}$
Group Velocity	0.021c
Filling Time	$0.27\mu\text{s}$
Weight	130kg
Number of Cell	77 + 2 Coupling Cells
Waveguide	WRI48
Waveguide Flange	A-DESY Flange

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