

DELIVERY RECORD

Client: Pohang Accelerator Laboratory

Facility: PLS-II (Pohang Light Source-II)

PAL-XFEL (PAL X-ray Free Electron Laser)

Location: Pohang, Republic of Korea

1 October 2018

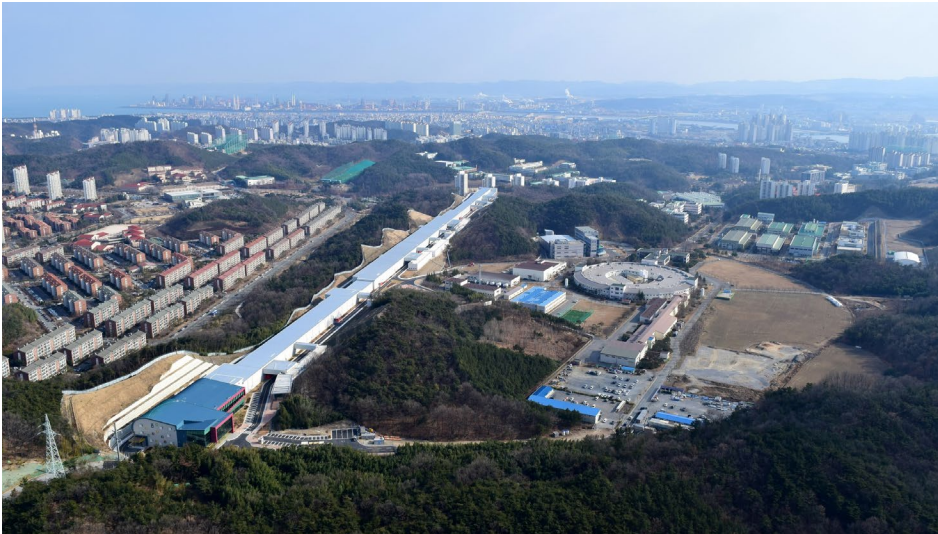
 **MITSUBISHI HEAVY INDUSTRIES MECHATRONICS SYSTEMS, LTD.**

Machinery Systems Sales Department

MHIMS0115012

- 1. OVERVIEW**
- 2. S-BAND ACCELERATING STRUCTURE
(SINGLE FEED COUPLER)**
- 3. S-BAND ACCELERATING STRUCTURE
(J-TYPE DOUBLE FEED COUPLER)**
- 4. S-BAND ACCELERATING STRUCTURE
(QUASI-SYMMETRICAL SINGLE FEED COUPLER)**

1. OVERVIEW



Aerial view of Pohang Accelerator Laboratory

PAL X-ray Free Electron Laser (PAL-XFEL, left)

Pohang Light Source-II (PLS-II, right)

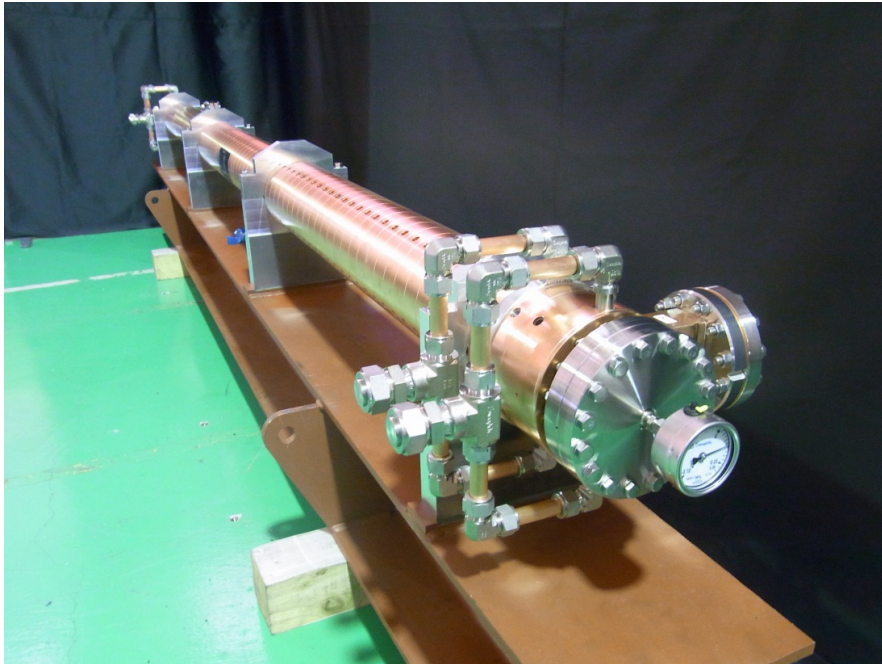
Linac Parameters

Item	PLS-II	PAL-XFEL
Beam Energy	3GeV	10GeV
Linac Length	170m	780m
Storage Ring Circumference ⁽¹⁾	(1)	(2)
Total Length ⁽²⁾	280m	1110m
Number of Accelerating Structures	46	174
Frequency	2856MHz	

List of Main Supplies

S-band Accelerating Structure

- Single feed coupler
- J-type double feed coupler
- Quasi-symmetrical single feed coupler



Installed in PLS-II

Photo Courtesy of PAL

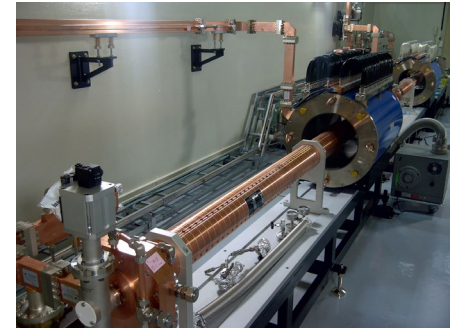
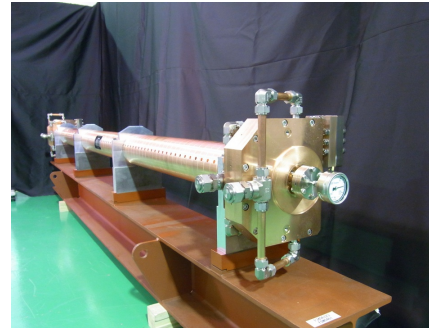


Main Parameters	
Frequency	2856MHz
Accelerating Type	C. G.
Phase Shift per Cavity	$2\pi/3$
Quality Factor	13000
Attenuation Constant	0.57
Input / Output VSWR	< 1.05
Phase error	< ± 2.5 degree
Number of Cells	82 + 2 coupler cells
Filling Time	0.83 μ s
Length	3m
Coupler Type	Single feed

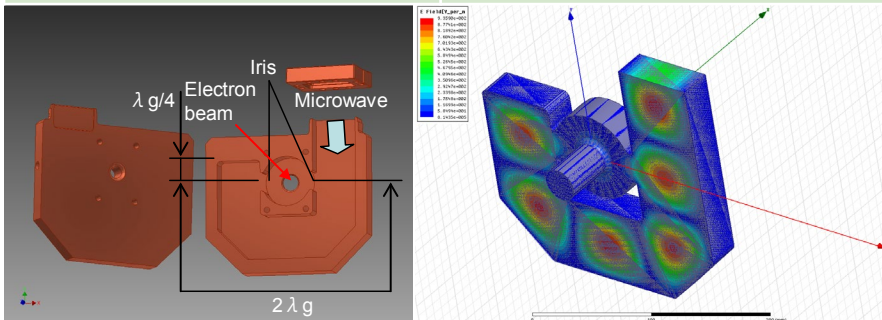
3. S-BAND ACCELERATING STRUCTURE

Main Parameters

Frequency	2856MHz
Accelerating Type	C. G.
Phase Shift per Cavity	$2\pi/3$
Quality Factor	13000
Attenuation Constant	0.56
Input / Output VSWR	< 1.05
Phase error	< ± 2.5 degree
Number of Cells	82 + 2 coupler cells
Filling Time	0.84 μ s
Length	3m
Coupler Type	J-type double feed



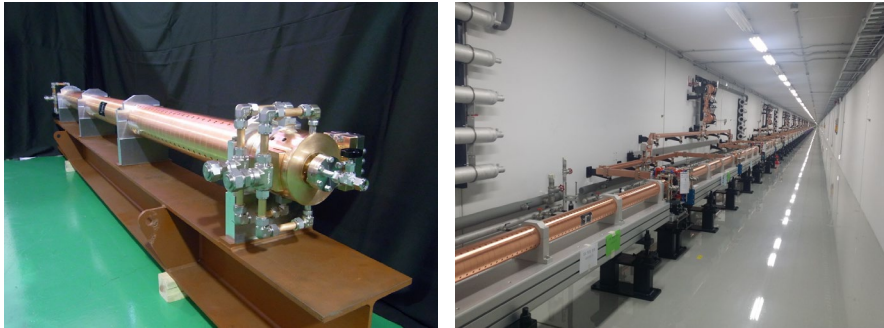
Installed in Injector Test Facility at PAL



J-type double feed coupler

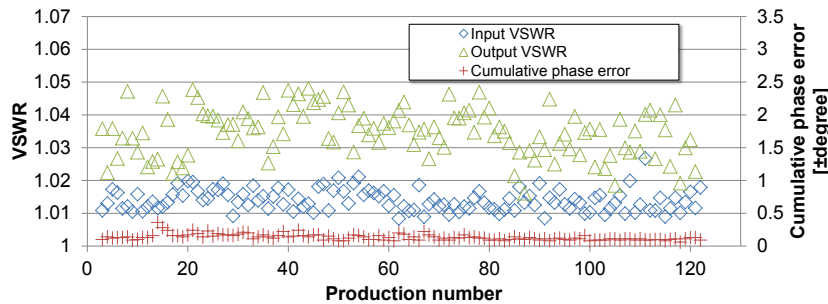
Item	Structure No.	
	001	002
Input VSWR	1.032	1.021
Output VSWR	1.023	1.037
Phase error	± 0.17 deg	± 0.18 deg
Quality Factor	13668	13265
Group Velocity	0.012	0.012
Attenuation Constant (τ)	0.551	0.567
Filling Time	0.84 μ s	0.84 μ s

Low Level RF Results

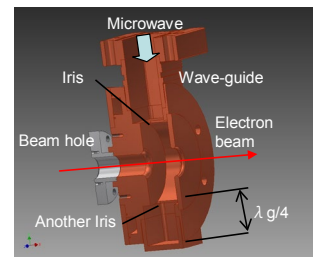


Installed in PAL-XFEL Linac
 Photo courtesy of PAL

Main Parameters	
Frequency	2856 MHz
Accelerating Type	C. G.
Phase Shift per Cavity	$2\pi/3$
Unloaded Q	13000
Attenuation Constant	0.56
Input / Output VSWR	< 1.05
Phase error	< ± 2.5 degree
Number of Cells	82 + 2 coupler cells
Filling Time	0.84 μ s
Length	3m
Coupler Type	Quasi-symmetrical single feed



Input/Output VSWR and cumulative phase error of 120 S-band accelerating structures after tuning



Quasi-symmetrical single feed coupler

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