

# RF Distribution (costing status)

Mike Neubauer HLRF Meeting  
5/25/06

# 1.3 GHz Adjustable Slot Hybrid

<http://www.lns.cornell.edu/public/ERL/2004/>

## AN ADJUSTABLE SHORT SLOT HYBRID FOR PRECISE RF POWER DIVIDER SYSTEM FOR CORNELL ERL INJECTOR CAVITIES

V. Veshcherevich ERL 04-3

## ON POWER SPLITTING FOR CORNELL ERL INJECTOR CAVITIES

V. Veshcherevich ERL 04-1

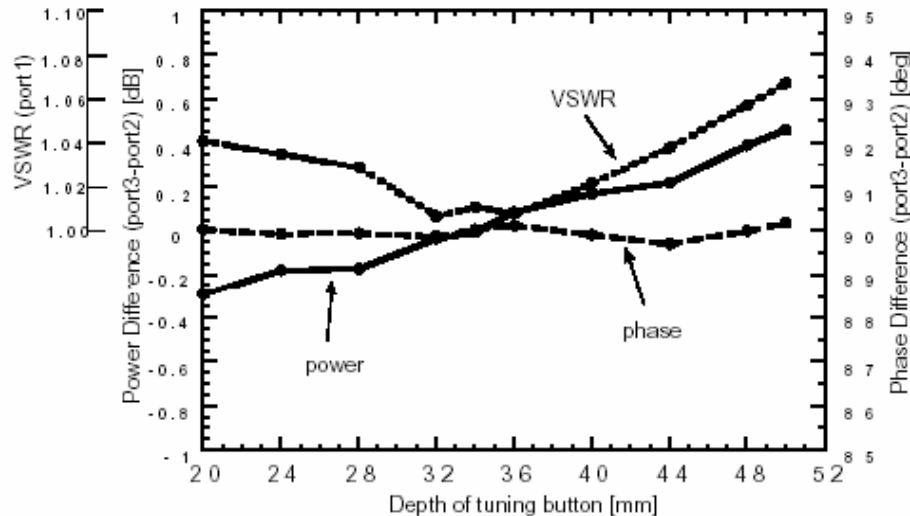


Figure 2: Tuning characteristics of the JAERI/KEK power divider. 324 MHz (0.1 db/4mm)

5/25/2006

Scales ok

M. Neubauer HLRF mtg

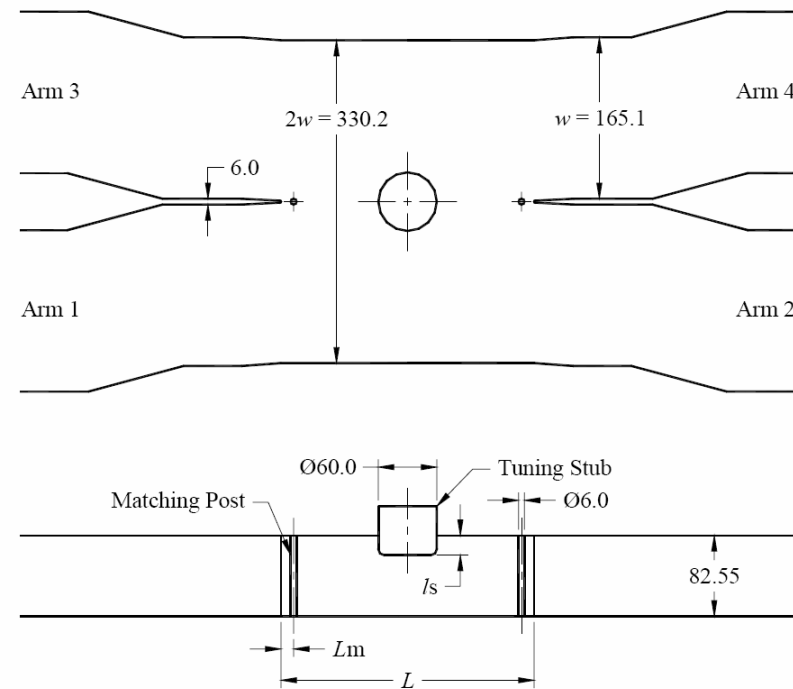


Figure 2: Schematic view of an adjustable short slot hybrid.

The short slot hybrid has its best properties at  $L_m = 10\text{-}12$  mm. By varying the insertion value  $l_s$  of the tuning stub around a value of 15 mm, it is possible to adjust the coupling to output ports at a rate of **0.12 dB/mm** with a rather small change of the phase advance ( $0.2^\circ/\text{mm}$ ). (1.3 GHz)

## Station Counts from RL HLRF Minutes from May 18th 2006

<b>HLRF Area Requirements Summary 051606-rsl-R1</b>											
Area	Main Linacs		Sources		RTML		BDS		Damping Rings		
RF Stations	e-	e+	e-	e+	e-	e+	e+	e-	2xe+	e-	Totals
10 MW RF Station, 1.3 GHz, Cryomodules	315	315	6	7	21	21					685
10 MW RF Station, 1.3 GHz, RT Cavities, 500 MeV Keep alive			8	31							39
<b>Total 10 MW RF 1.3 GHz RF Stations</b>											<b>724</b>
5045 S-Band Stations Un-sledded					2	2					4
5045 S-Band Stations Sledded					1	1					2
<b>Total 5045 S-Band Stations</b>											<b>6</b>
e- Ring CW RF Stations, 650 MHz, 5 GeV, 4MW beam power, 8 - 500kW RF Stations										8	8
e+ Ring CW RF Stations, 650 MHz, 2 Rings for 5 GeV, 4MW beam power, 16-250kW RF Stations									16		16
<b>Total 650 MHz CW RF Stations</b>											<b>24</b>
10 -40kW CW RF Stations, Details TBD (A. Seryi)											

# Jerry Leibfritz (Cryomodule) RF Distribution Parts List

from May 08, 2006

<b>Component Description</b>	<b>Quantity (per RF Unit)</b>	<b>Size</b>	<b>Source of Information/Comments</b>
H-Bend	27	WR650	Mega Industries - USA (90° miter bend)
Directional Coupler	5	WR650	Mega Industries - USA (Reflectometer)
E-Bend	15	WR650	Mega Industries - USA (90° miter bend)
E-Bend with Arc Sensor	2	WR650	Mega Industries- USA and DESY
Flexible Waveguide (long)	2	WR650 x 18" long	Various Sources
Flexible Waveguide (short)	24	WR650 x 6" long	Various Sources
Straight Waveguide	1	WR650 x 66m long	Various Sources - Total length of straight waveguide for one RF Unit = approx. 66m
Hybrid Load	22	WR650	AFT - Germany
Hybrid w/adjustable coupler/tuning knob	22	WR650	Have Sketch from KEK of Hybrid made by RF Technologies Corp. - USA (515mm long. 260mm flange to flange spacing).
Horizontal U-link (180° Bend)	50	WR650	IBFM Catalog & Used at TTF
Series Tee	1	WR650	Mega Industries - USA (E-plane tee)
Shunt Tee	1	WR650	Mega Industries - USA (H-plane tee)
400 KW Circulator w/Directional Coupler	24	WR650 (approx. 440mm x 340mm)	Ferrite Corp.-Russia (1.3 GHz, 400kW peak, 8kW avg.) WR650. Have drawing w/dimensions and picture from KEK.
Circulator Load	24	WR650 (approx. 388mm x 250mm)	Ferrite Corp.-Russia. WR650. Have drawing w/dimensions from KEK.
3-Stub Tuner	24	WR650	Mega Industries - USA

# WBS Worksheet

	A	B	C	D	E	F	G	H	I	J	K	L	O
1	DRAFT 042606 rsl									Engineering Estimates	Engrg. Est.		
2	HIGH LEVEL RF WBS ITEM							Dictionary	Total Quantity N	ED&I-hrs	M&S-K\$	Labor-hrs	1st Mfg Unit Cost (50%) (\$)
3	1.5.1.1	RF System - Main Linacs						All components from the high voltage transformer panel output to the RF power output fed to cryogenic accelerating cavities.					
4		1.5.1.1.1 Klystron						10 MW peak 1.3GHz tube and all supports from modulator input to provide RF output.					
5			1.5.1.1.1.1	Klystron Body				Unit as delivered from Manufacturer	630				\$ 900,000
6			1.5.1.1.1.2	Solenoid				Focussing magnet, mounting hardware	630				\$ 700,000
13		1.5.1.1.2	Modulator										
21		1.5.1.1.3	RF Distribution										
22			1.5.1.1.3.1	WR650 WG				Total meters of WR650 WG per meter cost	41580				\$ 400
23			1.5.1.1.3.2	Directional Coupler					3150				\$ 1,500
24			1.5.1.1.3.3	Circulator				With directional coupler	15120				\$ 8,000
25			1.5.1.1.3.4	H-plane Bend					17010				\$ 1,000
26			1.5.1.1.3.5	E-plane Bend				with and without arc sensor	10710				\$ 379
27			1.5.1.1.3.6	Tee				H-plane and E-plane	1260				\$ 2,600
28			1.5.1.1.3.7	180 degree bend				U-link	31500				\$ 500
29			1.5.1.1.3.8	Flex Waveguide				Long and Short	16380				\$ 598
30			1.5.1.1.3.9	Slot Hybrids				Fixed values and some adjustable	13860				\$ 2,000
31			1.5.1.1.3.10	Hybrid Loads					13860				\$ 2,000
32			1.5.1.1.3.11	Circulator Load				Could be built into circulator	15120				\$ 3,000
33			1.5.1.1.3.12	3-stub tuner				Could be inductive	15120				\$ 2,600
49	1.5.1.2	RF Systems - Sources											
50		1.5.1.2.1	Electron Sources										
51			1.5.1.2.1.1	10MW RF Stations Warm Structures( Rollup)				Use Main Linace numbers for now or 80%?	8				
58		1.5.1.2.2	Positron Source										
59			1.5.1.2.2.1	10MW RF Stations Warm Structures( Rollup)				Use Main Linace numbers for now or 80%?	31				
66	1.5.1.3	RF Systems - Damping Rings											
67		1.5.1.3.1	Electron Damping Rings										
68			1.5.1.3.1.1	CW RF Stations				Use scaled B-Factory numbers per station	8				
77		1.5.1.3.2	Positron Damping Rings										
78			1.5.1.3.2.1	CW RF Stations				Use scaled B-Factory numbers per station	16				
86	1.5.1.4	Ring to Main Linac (RTML)											
87		1.5.1.4.1	Electron RTML Systems										
88			1.5.1.4.1.1	10MW RF Stations				Same as Main Linac	21				
92		1.5.1.4.2	Positron RTML Systems										
93			1.5.1.4.2.1	10MW RF Stations				Same as Main Linac	21				