



Double Quarter Wave Crab Cavity –higher order modes

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on behalf of the DQWCC team

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 - Beadpull for HOM
- SPS
 - Vertical version
 - Issues with vertical version
 - L-shape version
 - Integration to the cavity
 - HOM power for HiLumi
 - Prototype
- Summary

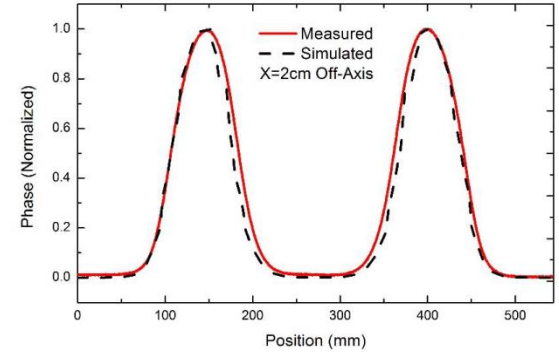
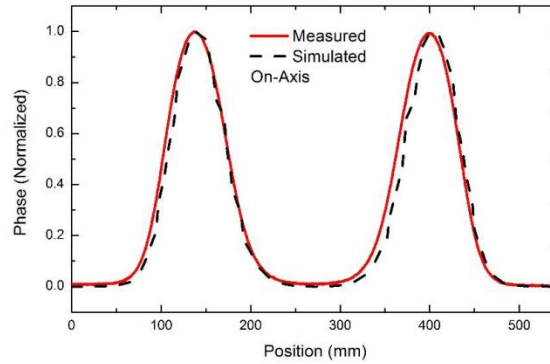
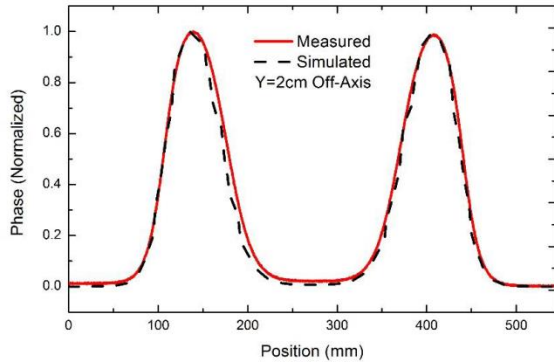


PoP HOM table

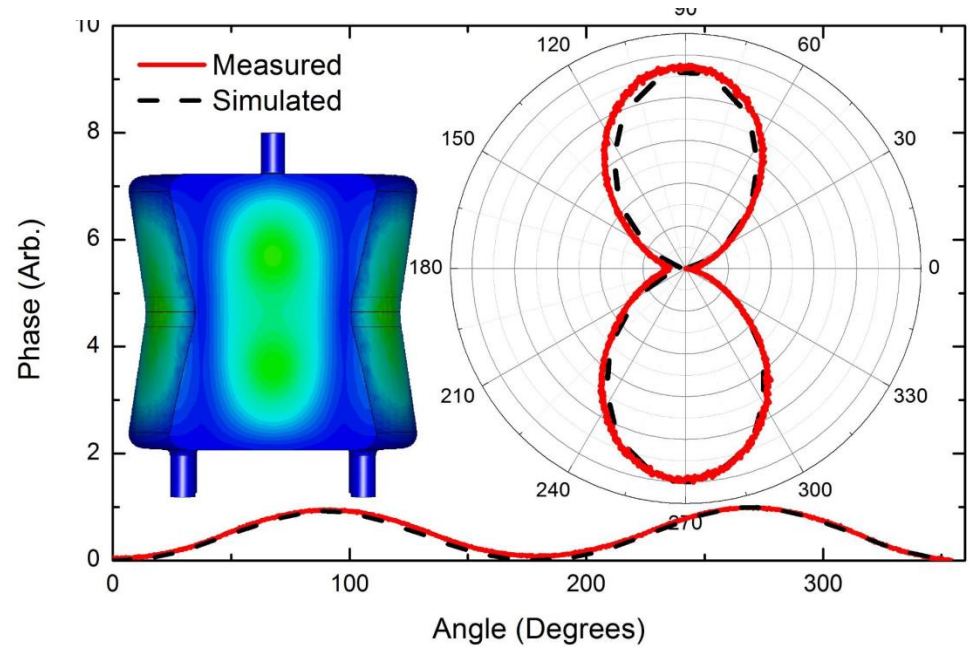
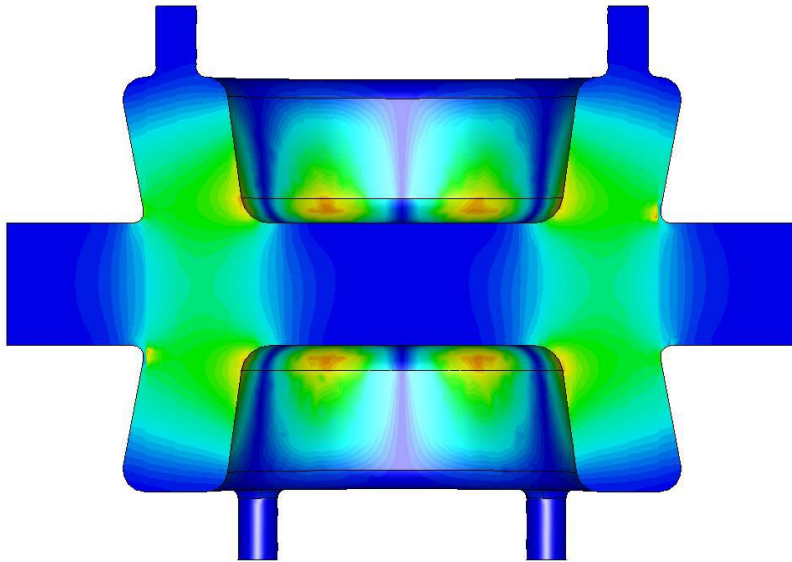


2-port Cold	2-port Warm	4-port Warm	Simulation	Note	2-port Cold	2-port Warm	4-port Warm	Simulation	Note
403.93	403.25	403.25	400	Crabbing	1417.40	1414.25	1415	1408	
581.44	579.9688	580.3375	576	M		--		1409	(Not Coupled)
	--	675.275	670	H			1495.625	1488	H(Missed)
705.24	703.7188	703.95	700	M	1561.97	1558.625	1558.75	1549	
757.05	755.2813	755.4875	752	V	1579.23	1576.156	1576.25	1560	M
	--	803.5375	800			1627.719	1627.5	1626	
		920.5625	915	H(Missed)				1631	(Not Coupled)
958.73	956.375		946	M-shift	1637.41	1633.906	1633.125	1634	
1082.97	1081.156	1080.625	1077	V	/1638.36				
	--	1104.375	1102	(Missed)	1670.46	1665.875	1666.25	1668	M
1120.41	1118.281	1118.125	1113		1720.51	1717.438	1716.875	1706	
	--	1211.25	1202	H(Missed)				1708	(Not Coupled)
1260.72	1258.531	1258.125	1246	M		--	1723.75	1725	
1298.82	1296.688	1296.25	1290	V-mix	1768.65	1764.875	1765	1733	
	--	1358.125	1352	(Missed)	1783.26	1778.281	1779.375	1776	
					1866.27	1861.813	1861.25	1863	H

PoP Bead Pulling

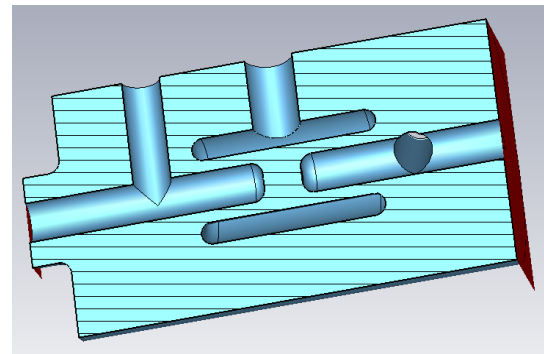


1258 MHz



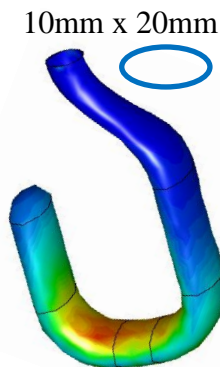
- Filter design

wide stop band (<80dB, several tens of MHz) at 400MHz, high pass at frequency 570MHz~2GHz



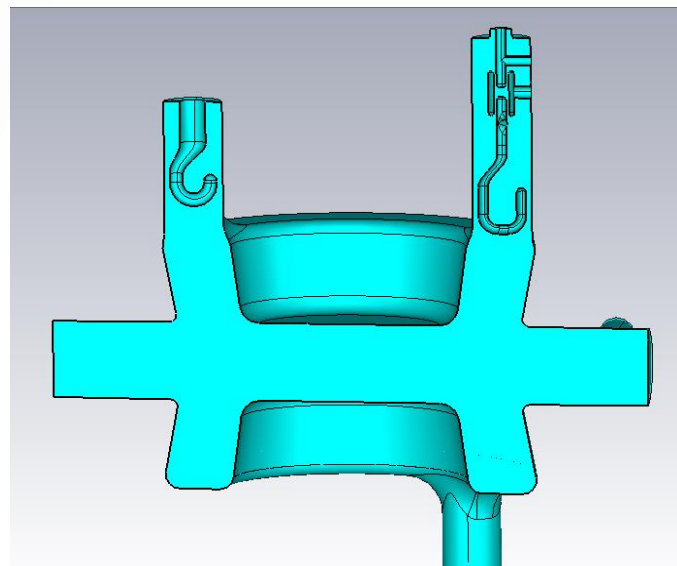
- Hook coupler design

471 Qext at 579.8MHz (1st HOM),
507 Qext at 682.6MHz (2nd HOM)
233 Qext at 697.3MHz (3rd HOM)



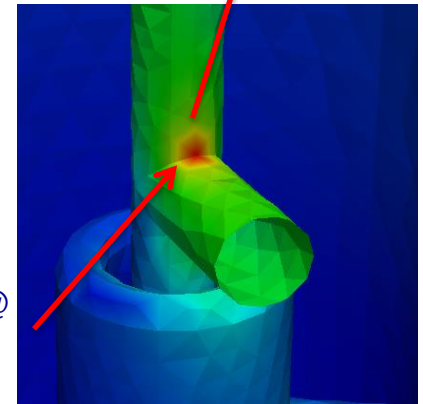
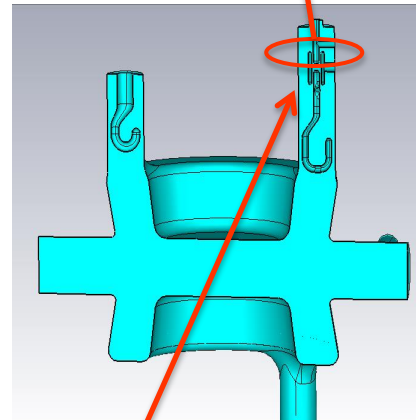
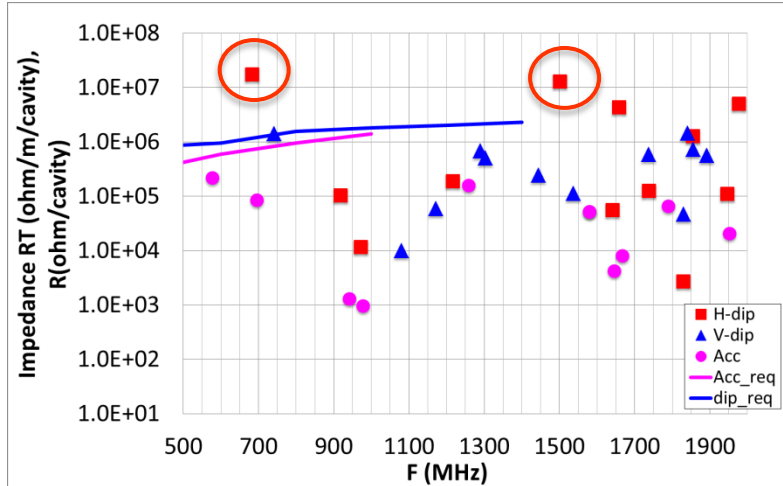
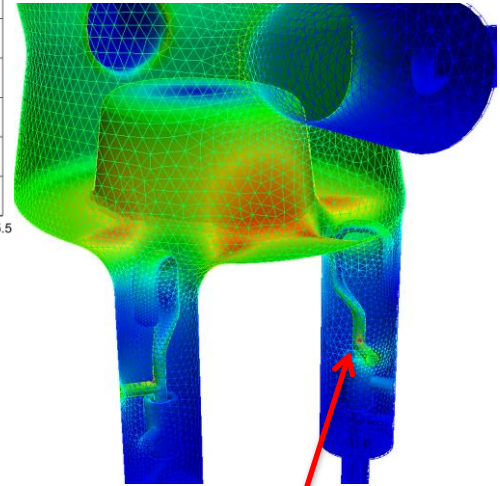
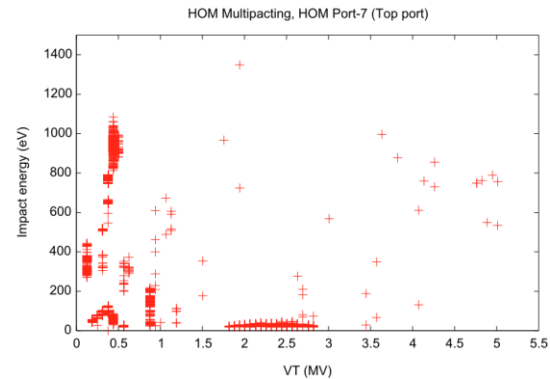
- HOM mapping

frequency, Qext, R/Q, mode configuration etc., up to 2GHz are calculated by Silvia (without filter) and Zenghai (with filter).



HOM System: issues

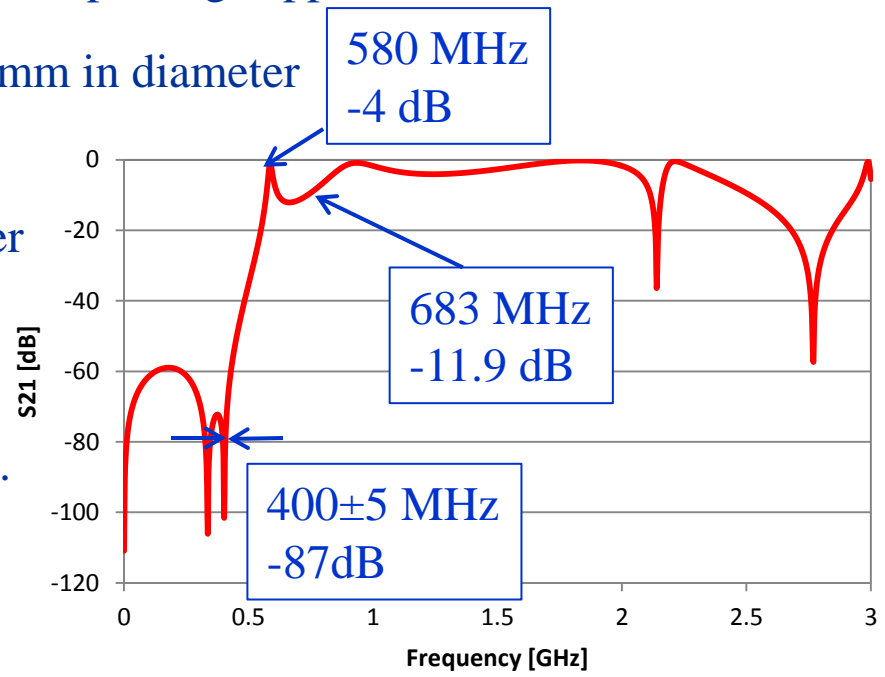
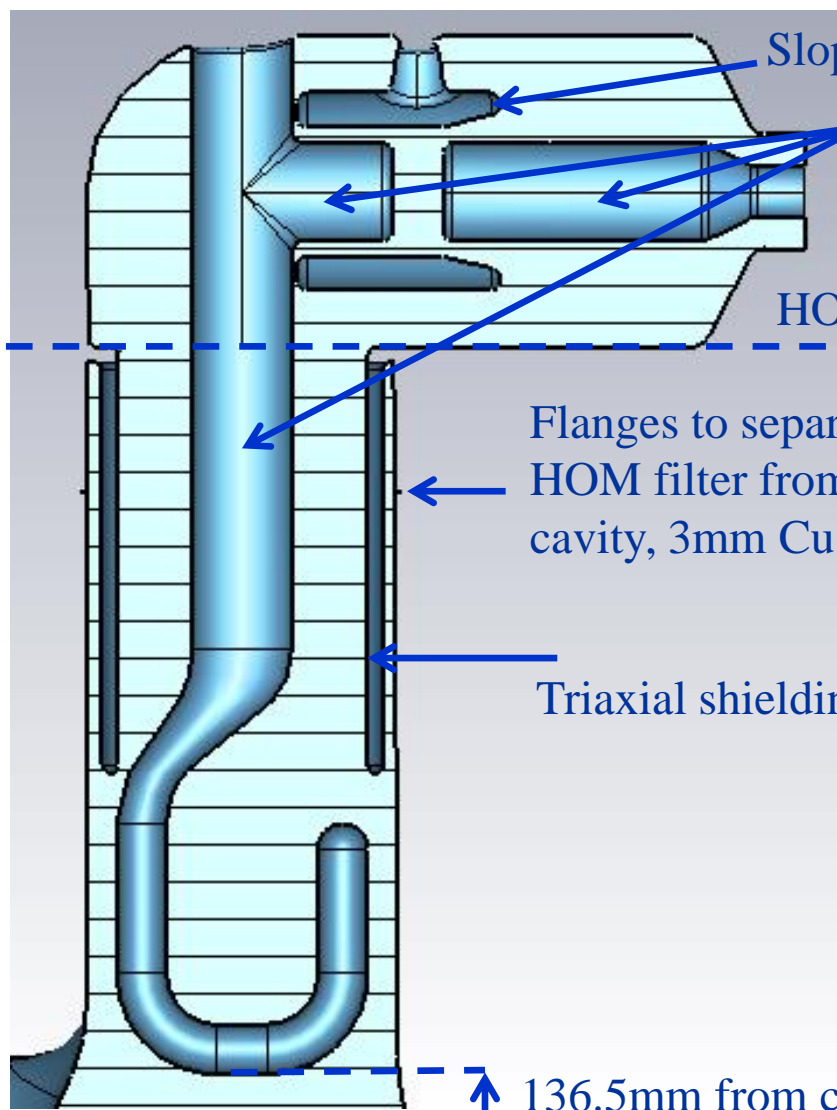
- 3cm longer than required
- Some high Qext modes
- High magnetic field area
- Possible multipacting
- Loss on the gaskets



**3mm thick Cu gasket
7 Watts @3.4MV**

**81mT@
3.4MV**

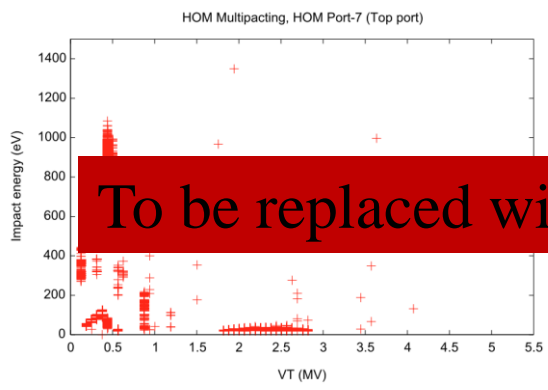
HOM System: L shape filter



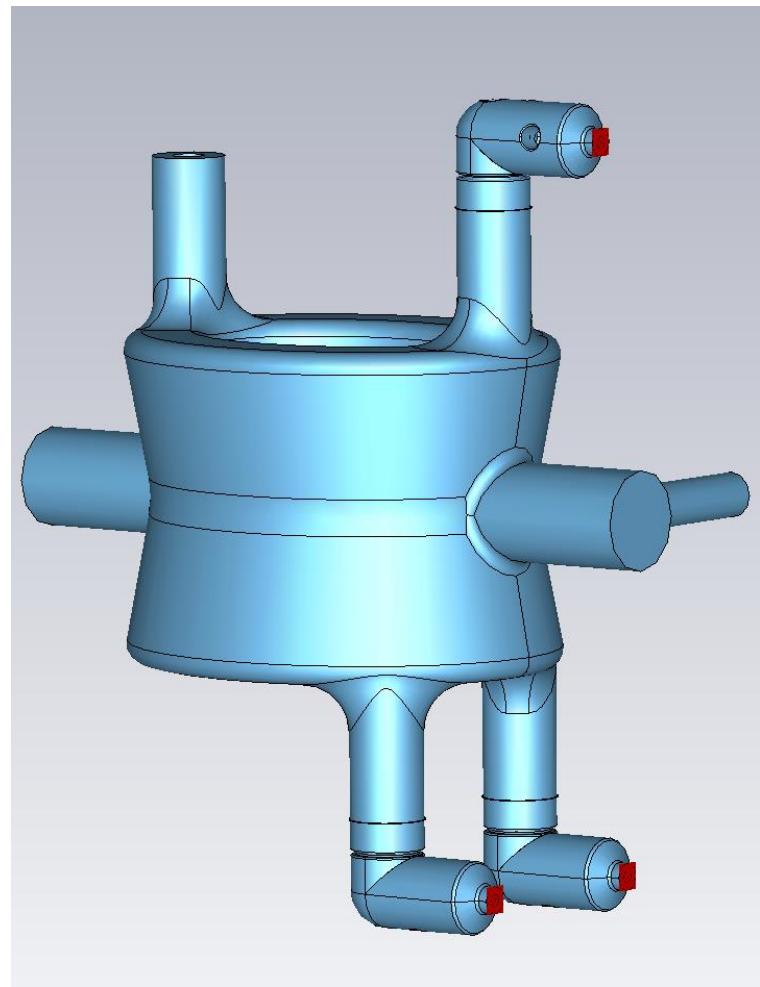
Machine tolerance (on going)

HOM System: Integration

- Compact enough to fit into cryomodule
- Peak magnetic field on HOM is 72% of that on cavity.
- Loss on the Cu gaskets: 150mW@3.34MV
- Multipacting

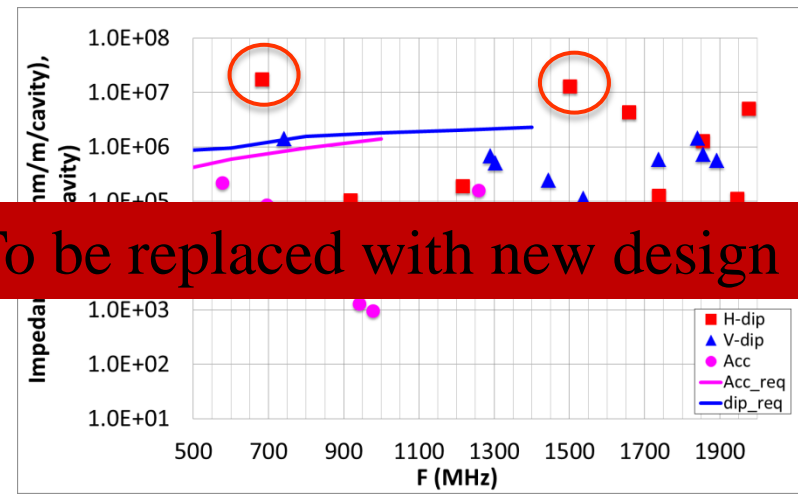


To be replaced with new design





HOM System: Impedance budget



To be replaced with new design

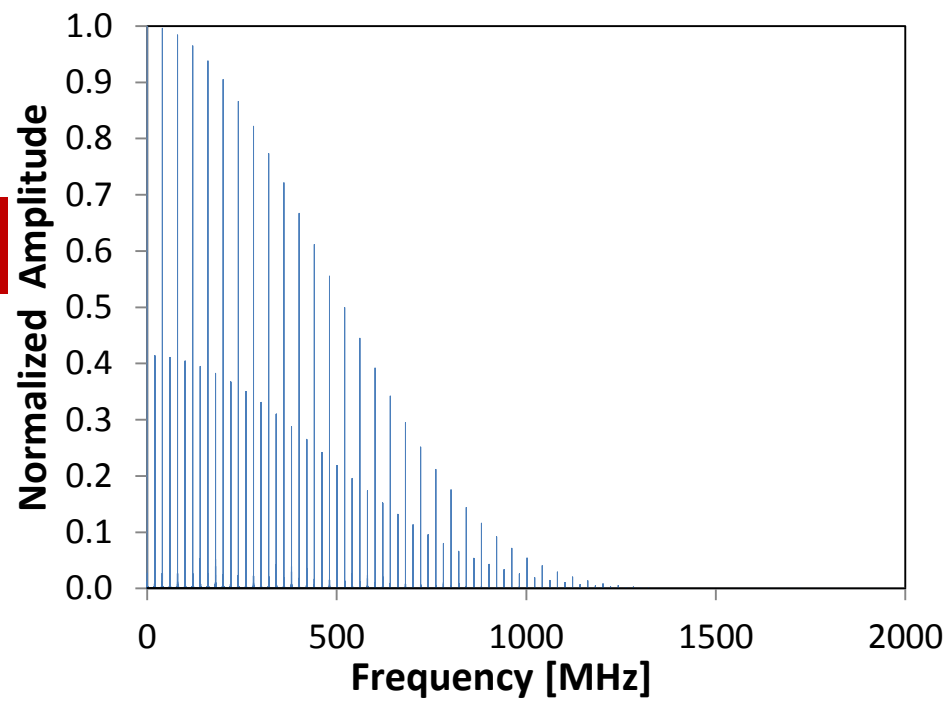


HOM System: Power estimation

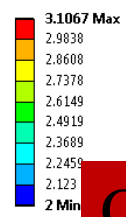
	F (MHz)	579	683	697	742	919	943	973	980
	Mode Type	m	h	m	v	h	m-shift	h-wg-mix	m
	Qext	2119	17858	7034	2422	255	124	89	124
Impedance	Longitudinal	212239		83215			1274		939
	Horizontal		1198213			5360		569	
	Vertical				91161				

- The HOM power is estimated to be 114 Watts.

To be replaced with new design frequencies shift in ± 1 MHz range, in the worst case the power is 1003 Watt, 93% from mode at 742 MHz.



D: Nb supra Hook
 Temperature
 Type: Temperature
 Unit: K
 Time: 1
 19/02/2014 18:30



One slide from Silvia about the cooling calculation



The active cooling design is can handle the thermal breakdown on the HOM hook caused by defect.

A 50mm radius defect on the HOM coupler will cause a 0.3Watt hot spot.
 Cooling design can handle >0.4Watt.

- 3-D printing + Cu coating.
- Acetone etching for smoother surface.
- Evaluating different ways to deal with joint loss.
- Will figure out the ports connection based on new design.





LARP

Summary

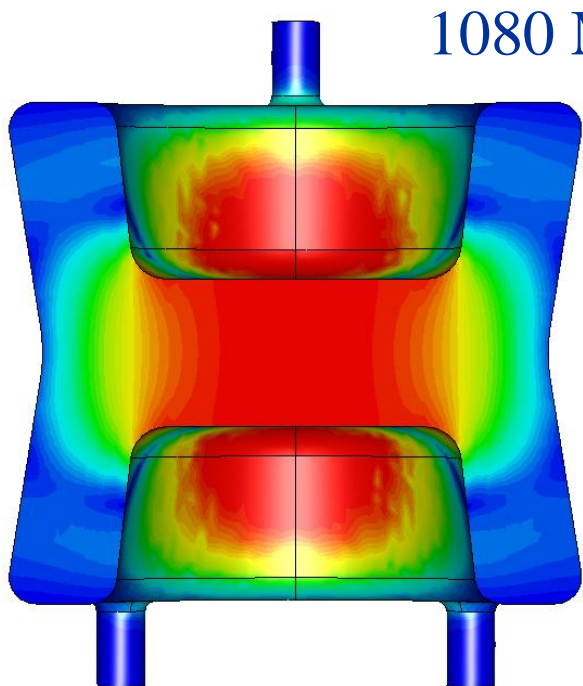
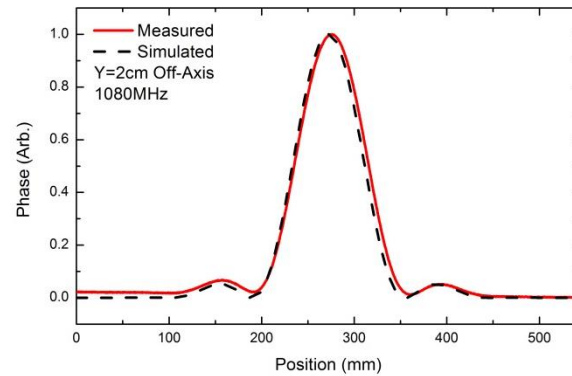
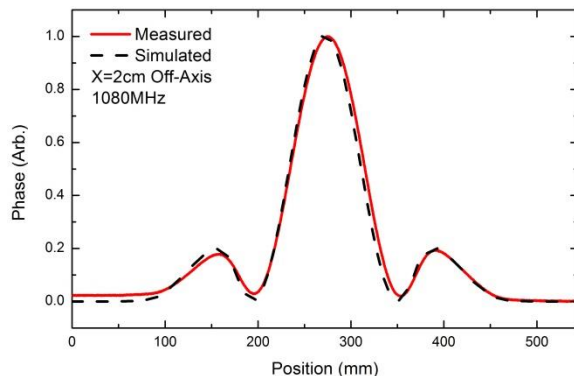
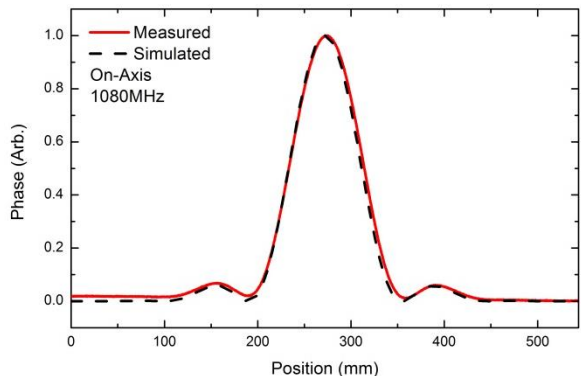


- PoP has been studied to understand the HOMs in DQWCC
- HOM system for SPS has been optimized (clearance, cooling capacitance, peak magnetic field, joint loss, multipacting, impedance budget etc)
- HOM power has been estimated
- Prototyping of the HOM system is on-going



Thank you!

PoP Bead Pulling



1080 MHz

