

CFS GDE Parallel Session with HLRF
Heat Load Table
October 23 2007

Emil Huedem

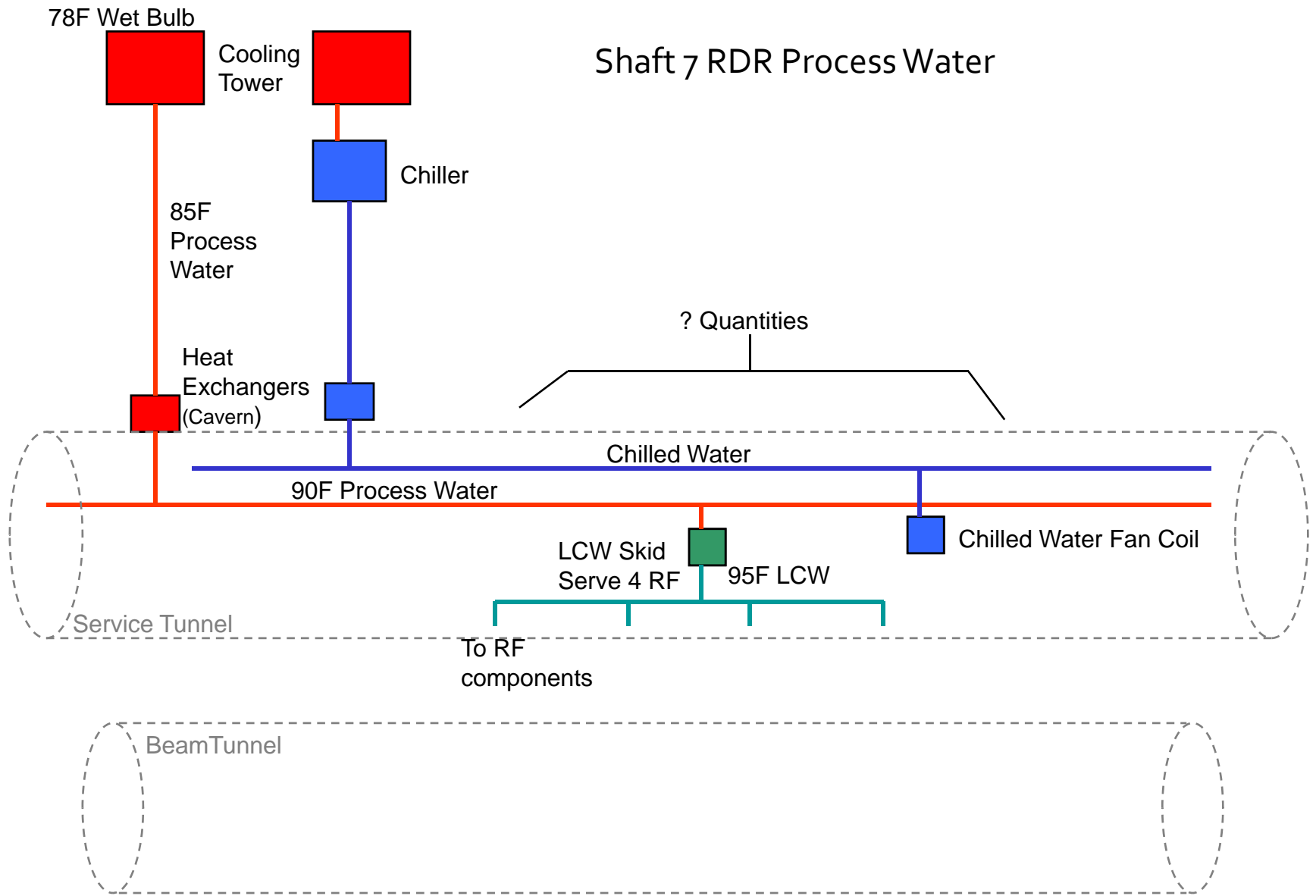
From HLRF KOM

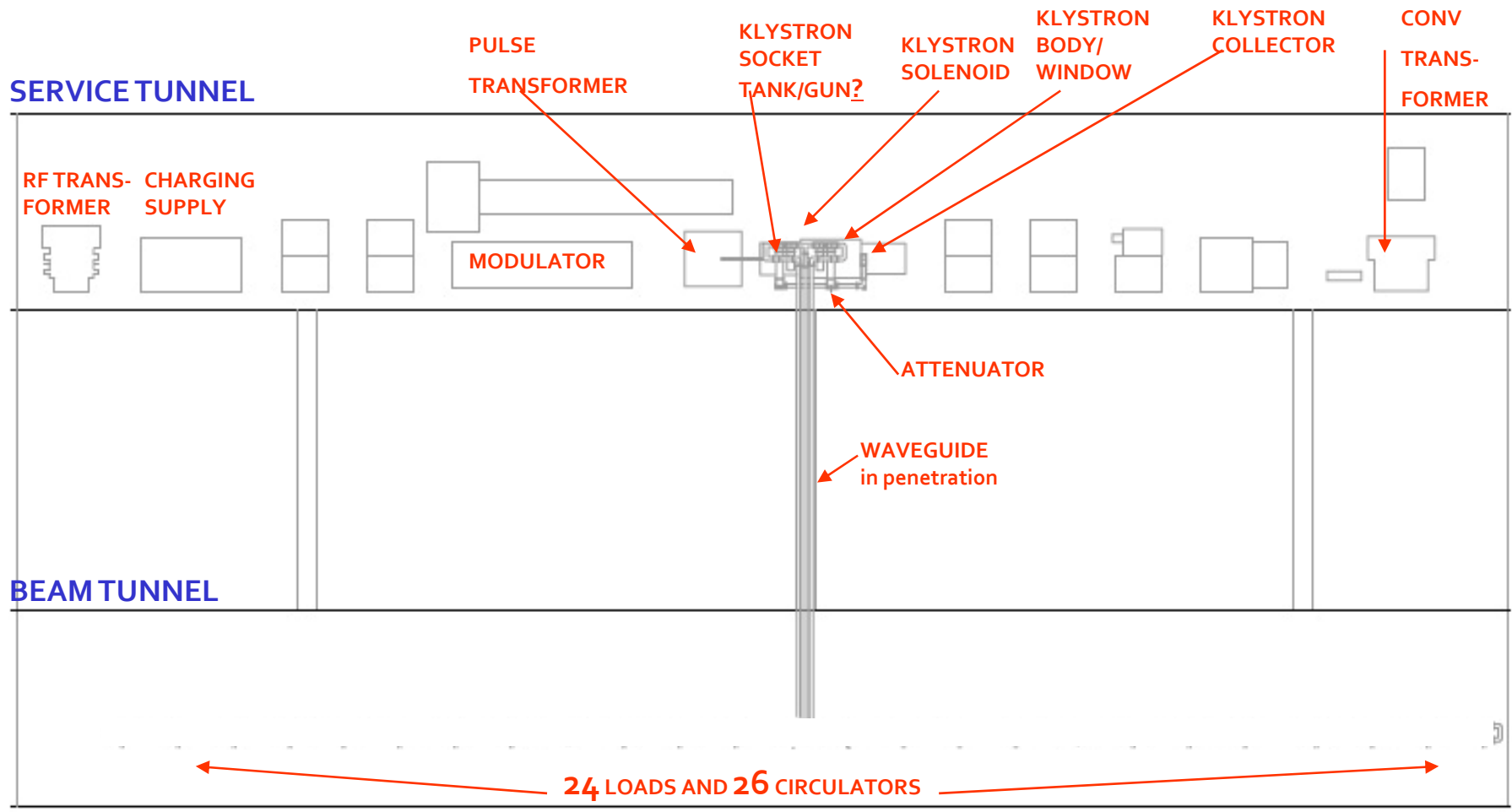
- We're ask to evaluate LCW water system delta T for MLRF.
- In order to evaluate this (and confirm cost savings), we need more info on the water cooled component and we ask your help in updating or getting more information for each of those items.

Getting the table filled will be helpful, **but as minimum,** the following for each water cooled components are needed

- combination of either one of the following (Load/Flow, or Load/Delta T or Flow/Delta T)
- Maximum allowable temperature
- Pressure drop (corresponding to a given flow)

- If possible, information to be given is agreed upon by the group
- We appreciate Shigeki-san's help in getting the information started





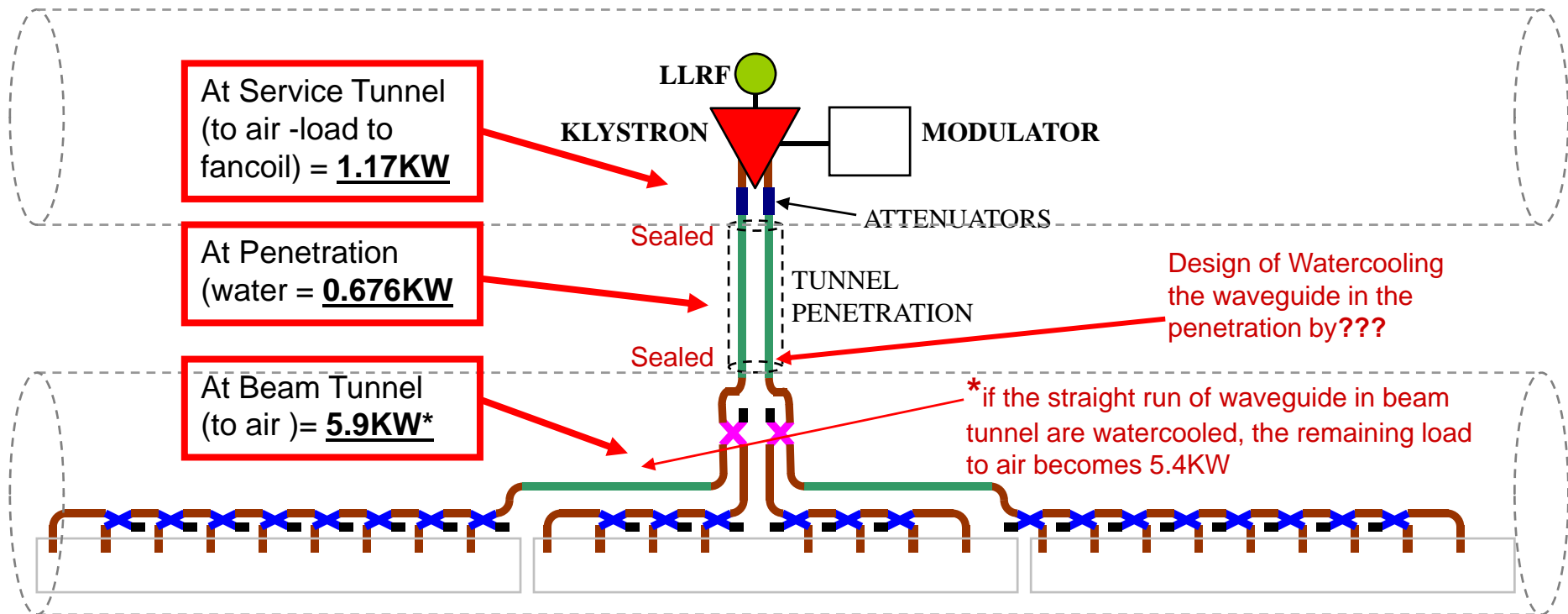
ML RF Water Cooled Components

PLAN VIEW (1 RF)

From HLRF KOM, people were identified to help fill out the tables, the following is an update

- Shigeki (Klystron related items)..... **Ongoing**
- Jensen (Modulator & Pulse Transformer)..... **?**
- Cassell (Charging Supply/RF transformer)..... **Finished**
- Nantista (Waveguide)..... **Waiting**
 - Established Heat Load
 - Waiting on info on loads and circulators
 - Waiting for info on watercooled waveguide in penetrations

WAVEGUIDE HEAT per RF



Heat Loss from Cryo ~5w/m (T.Peterson)	~(-0.18KW)
Heat Loss from RockWall	ignored
Heat Loss (Air) ~38 w/m	~(-1.3 KW)
*15F delta T air at 2.5Km	
Heat Gain (Waveguide) = 5.9 KW	~ +5.9 KW
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NET LOAD to AIR BEAM TUNNEL	+ 4.42 KW

Oct 18 2007

Components	Quantity Per 36m	Location	To Low Conductivity Water								to Chilled Water	Keith Jobe load to air Nov 22 06		Max Space Temp (C)	Source	
			Heat Load to Water (KW)	Max Allowable Temperature (c)	Max Allowable temperature	Supply Temp (variation) (C)	Delta Temperature (C delta)	Water Flow (l / min)	Maximum Allowable Pressure (Bar)	Typical (water) pressure drop Bar	Acceptable Temp Variation delta C	Heat Load to Water (KW)	Power fraction to Tunnel Air (0-1)			Power to Tunnel Air (KW)
RF Charging Supply 34.5 Kv AC-8KV DC	1/36 m	Service Tunnel	2.8			40	40	1.17	18	5	10	0	0.3	1.2	** Clay 5-25-06 LLRF meeting ** Sep 18 move all to LCW per Marc Ross ** Move load to Dirty Water per RCassell Oct 20 2006, **Nov 22 2006 Keith Jobe Wag on load to Air**Nov 27 2006 C. Adolphsen Email ** RCassell email Oct 3 2007	
Switching power supply 4kV 50kW	1/36 m	Service Tunnel	4.5			35	13.6	7.6	13	5	10	0	0.4	3.0	** Move load to Dirty Water per RCassell Oct 20 2006 LCW for now **Nov 22 2006 Keith Jobe wag on load to air **Chris Jensen Post meeting notes 11 16 06 **Nov 27 2006 C. adolphsen Email ** RCassell email Oct 3 2007	
Modulator	1/36 m	Service Tunnel	4.5									28.823	0	0.4	3.0	* Shigeki Fukuda Email 3-1-06 **Shigeki Apr 18 2006**Nov 22 2006 Keith Jobe wag on load to air** 11-27-06 C. Adolphsen Email **12-1-06 Email from Chris Jensen
Pulse Transformer	1/36 m	Service Tunnel	0.7										0	0.3	0.3	**Shigeki Apr 18 2006** Nov 22 2006 Keith Jobe wag on load to air**11-27-06 C. Adolphsen Email
Klystron Socket Tank / Gun	1/36 m	Service Tunnel	0.8										0	0.2	0.2	**Shigeki Apr 18 2006** Marc & Keith -remove load to air/chilled - transfer all load to water**Nov 22 2006 Keith Jobe wag on load to air**11-27-06 C. adolphsen Email
Klystron Focusing Coil (Solenoid)	1/36 m	Service Tunnel	5.5	80.0		55	8	10	15	1			0	0.1	0.4	* Shigeki Fukuda Email 4-05-06 **Nov 22 2006 Keith Jobe wag on load to air** 11-27-06 C. Adolphsen Email
Klystron Collector	1/36 m	Service Tunnel	45.8	63.0		38	22	37	15	0.3			0	0.0	1.4	* Shigeki Fukuda Email 3-1-06 **Nov 22 2006 Keith Jobe wag on load to air** 11-27-06 C. Adolphsen Email
Klystron Body	1/36 m	Service Tunnel	4.2	40.0		15	6	>10	15	4.5	+ - 2.5 C		0			* Shigeki Fukuda Email 3-1-06** Keith Jobe added stability Oct 20 2006 ** HLRF 11/16/06 meeting** 11-27-06 C. Adolphsen Email
Klystron Windows	1/36 m	Service Tunnel											0			* Shigeki Fukuda Email 3-1-06**11-27-06 C. Adolphsen Email
Relay Racks (Instrument Racks)	1/36 m	Service Tunnel	0.0	N/A		N/A	N/A		N/A	N/A	None		11.5	-0.2	-1.5	* Shigeki Fukuda Email 3-30-06 **Shigeki Apr 18 2006 (chilled water) ***Rlarsen email** RayLarsen Email 9-15-06 except reduced by 40% per Marc * Ray HLRF Meeting 11/16/06**11-27-06 C. Adolphsen Email
Attenuators	2/36 m	Service Tunnel	0.0												0.0	*C. Nantista Oct 1 2007
Waveguide (in service tunnel)	1/36 m	Service Tunnel	0.00												1.166	* C. Nantista Oct 3 2007
Waveguide (in penetration)	1/36 m	Penetration	0.676													* C. Nantista Oct 3 2007
Waveguide (in beam tunnel)	1/36 m	Beam Tunnel	0.0								+ - 2.5 C		0		5.9	* Shigeki Fukuda Email 3-30-06** Keith Jobe added stability Oct 20 2006** HLRF 11/16/06 meeting from 4 KW to 5 KW**11-27-06 C. Adolphsen Email **C. Nantista Oct 3,2007
Circulators	26/36 m	Beam Tunnel	2.49								+ - 2.5 C		0		0.0	**Shigeki Email Apr 28 2006**HLRF 11/16/06 meeting update from 24,3 to 29.8 KW** 11-27-06 C. Adolphsen Email **C. Nantista Oct 1 2007
Loads	24/36 m	Beam Tunnel	30.05								+ - 2.5 C				0.0	(a) HLRF meeting Nov 16 2006
Subtotal RF unit Only			96.5													
Total RF			98.0										11.5		21.4	

Total Heat load to Air/Chilled water in service tunnel (per RF)	32.9 KW
Total Heat load to LCW (per RF)	98.0 KW
Total Heat load to air in beam tunnel (ignore rock contribution for now)	5.9 KW

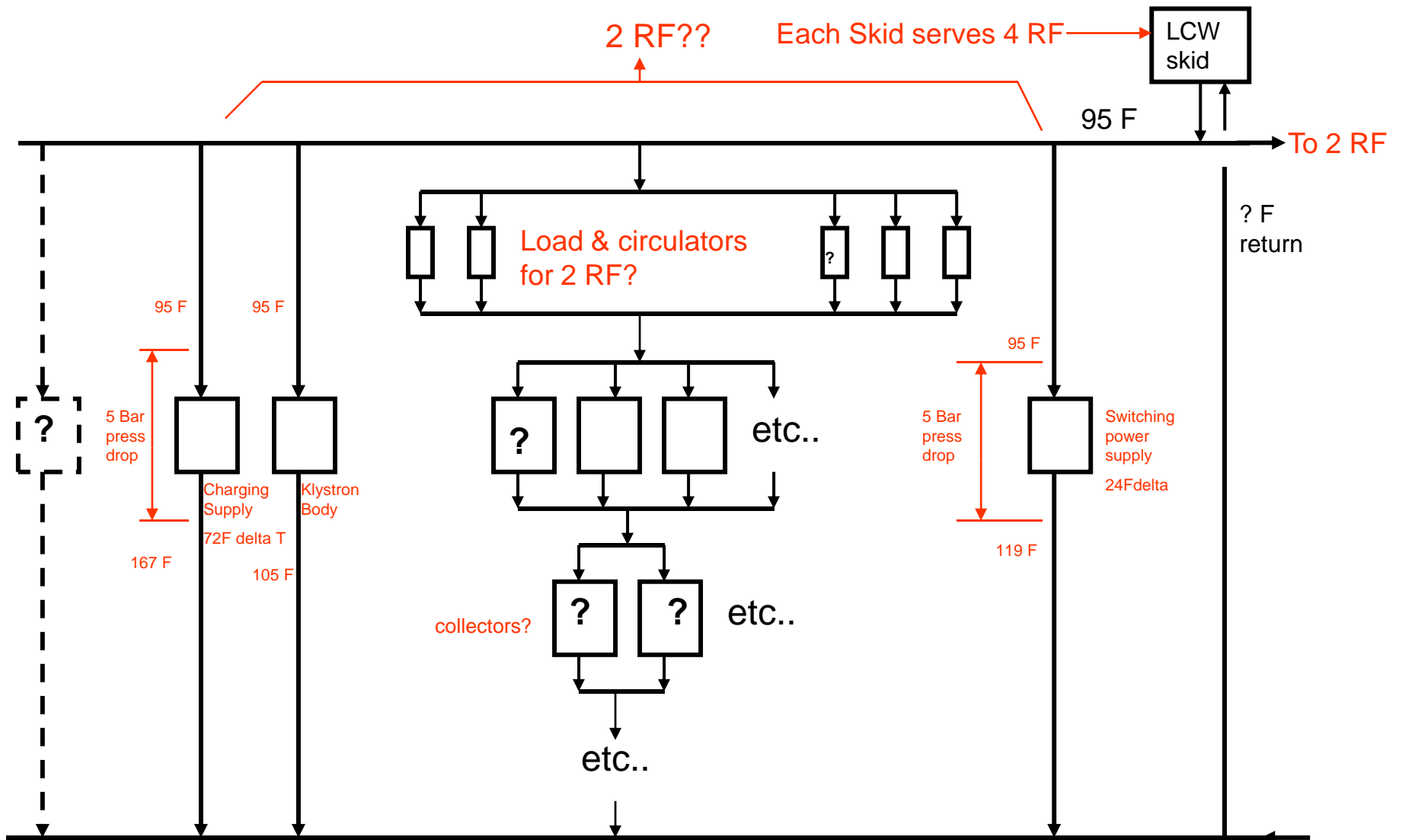
cooled by chilled water
 cooled by low conductivity water
 pending

Components	Quantity Per 36m	Location	To Low Conductivity Water									to Chilled Water	keith Jobe load to air Nov 22 06	
			Heat Load to Water (KW)	Max Allowable Temperature (c)	Max Allowable temperature	Supply Temp (variation) (C)	Delta Temperature (C delta)	Water Flow (l / min)	Maximum Allowable Pressure (Bar)	Typical (water) pressure drop Bar	Acceptable Temp Variation delta C	Heat Load to Water (KW)	Power fraction to Tunnel Air (0-1)	Power to Tunnel Air (KW)
RF Components														
RF Charging Supply 34.5 Kv AC-8KV DC	1/36 m	Service Tunnel	2.8			40	40	1.17	18	5	10	0	0.3	1.2
Switching power supply 4kV 50kW	1/36 m	Service Tunnel	4.5			35	13.6	7.6	13	5	10	0	0.4	3.0
Modulator	1/36 m	Service Tunnel	4.5						28.823			0	0.4	3.0
Pulse Transformer	1/36 m	Service Tunnel	0.7									0	0.3	0.3
Klystron Socket Tank / Gun	1/36 m	Service Tunnel	0.8									0	0.2	0.2
Klystron Focusing Coil (Solenoid)	1/36 m	Service Tunnel	5.5	80.0		55	8	10	15	1		0	0.1	0.4
Klystron Collector	1/36 m	Service Tunnel	45.8	63.0		38	22	37	15	0.3		0	0.0	1.4
Klystron Body	1/36 m	Service Tunnel	4.2	40.0		15	6	>10	15	4.5	+ - 2.5 C	0		
Klystron Windows	1/36 m	Service Tunnel										0		
Relay Racks (Instrument Racks)	1/36 m	Service Tunnel	0.0	N/A		N/A	N/A		N/A	N/A	None	11.5	-0.2	-1.5
Attenuators	2/36 m	Service Tunnel	0.0											0.0
Waveguide (in service tunnel)	1/36 m	Service Tunnel	0.00											1.166
Waveguide (in penetration)	1/36 m	Penetration	0.676											
Waveguide (in beam tunnel)	1/36 m	Beam Tunnel	0.0								+ - 2.5 C	0		5.9
Circulators	26/36 m	Beam Tunnel	2.49								+ - 2.5 C	0		0.0
Loads	24/36 m	Beam Tunnel	30.05								+ - 2.5 C	0		0.0
Subtotal RF Unit Only			98.5											
Total RF			98.0									11.5		21.4
Total Heat load to Air/Chilled water in service tunnel (per RF)			32.9 KW											
Total Heat load to LCW (per RF)			98.0 KW											
Total Heat load to air in beam tunnel (ignore rock contribution for n			5.9 KW											

cooled by chilled water

cooled by low conductivity water

pending



“Potential” ML RF Water Cooled Components in series

Other ways can be considered later

There is a VE (value engineering) session for power/cooling planned around last week of November, where various optimization items can be discussed, BUT FOR NOW, let's continue filling out the heat table, as much as we can.