POSITRON SOURCE DESIGN CRITERIA FOR CFS, for DARESBURY WORKSHOP FEB 10 & 11, 2011

DRAFT

FEBRUARY 7, 2011

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Other Utilities Criteria

DRAFT FEB. 07, 2011

		DATA*	NOTES
1	Power Supply typical water pressure drop	?	
2	Power Supply typical water delta T	12-18°FdT (7-10°C DT)	placeholder
3	Power Supplies maximum allowable temperatures	104°F (40°C)	placeholder
4	Magnet typical water pressure drop	100 PSID (placeholder)	from RDR Magnet group (2006)
5	Magnet typical water delta T	per design. Max 40F dt	
6	Magnet maximum allowable temperatures	140°F (60°C)	
7	Dump typical water pressure drop	N/A	CFS not designing RAW
8	Dump typical water delta T	54°Fdt (30°C deltaT)	placeholder
9	RF system typical water pressure drop	Use ML -RDR data	High Cost Impact
10	RF system typical water delta T	Use ML -RDR data	High Cost Impact
11	RF system maximum allowable temperatures	Use ML -RDR data	High Cost Impact
12	Racks system typical water pressure drop	assume air cooled	High Cost Impact
13	Racks system typical water delta T	assume air cooled	High Cost Impact
14	Racks system maximum allowable temperatures	?	High Cost Impact
15	Max Space/Air Temperature in Beam Tunnel	no reqmnt	
16	Max Space/Air Temperature in ServiceTunnel	85°F (29.5°C)	
17	Max Space/Air Temperature in Cavern/Alcove	85°F (29.5°C)	
18	Air Temperature Stability in Beam Tunnel	no reqmnt	Very High Cost Impact
19	Dew Point Temperature	no reqmnt	Very High Cost Impact
20	Maximum Relative Humidity (%)	no reqmnt	
21	Minimum Relative Humidity (%)	no reqmnt	Very High Cost Impact
22	Process Heat Load to Air	See Heat/Power Load Tables	High Cost Impact
23	Process Load to CHW		High Cost Impact
24	Process Load to LCW		High Cost Impact
25	Ventilation (Numer of Persons in space)	no reqmnt	
26	Ventilation (Cu M/Hr or cfm)	no reqmnt	
27	Space Pressurization (Negative milliBars or inch W.C)	no reqmnt	
28	Space Pressurization Stabilization (+/- milliBar or inch W.C.)	no reqmnt	Very High Cost Impact
29	Shaft/Egress Pressurization (Positive milliBar or inch W.C.)	no reqmnt	Very High Cost Impact
30	LCW Supply Temperature	65F (18C) or 95F(35C)	
31	LCW Supply Temperature Stability	no reqmnt	
32	LCW delta T	18F(10C) or 40F(22C)DT	
33	LCW Pipe vibration impact	no reqmnt	
34	ODH Purge (Y/N - Cu M/ Hr if Y)	no reqmnt	Very High Cost Impact
35	Activated Air Purge (Y/N - Cu M /Hr if Y)	no reqmnt	Very High Cost Impact
36	CHW Cooling for Magnets & Power Supplies (Y/N)	Yes, per design	
37	Dessicant Dehumidification	no reqmnt	Very High Cost Impact
38	Any power quality reqmnt (clean / dirty power?)	no reqmnt	Very High Cost Impact
39	Can you maintain min power factor?	no reqmnt	
40	operating power characteristics KW, KVA, PF?	?	Very High Cost Impact
41	Voltage Regulation/Optimum Utilization Voltage (480V? 208V? etc)	?	High Cost Impact
42	Utiltity (water system) interface	no reqmnt	header with valve
43	Utiltity (electrical) interface	no reqmnt	Panelboard
44	How stable are the positron heat loads? Constant w.r.t BDS?	very stable (placeholder)	Very High Cost Impact
45	Whats the largest equipment in the service tunnel? & in transport?		
46	Penetrations between service tunnel and beam tunnel?		
47	Will the positron source consume power at same time as AUX source		
48	Will we be developing reqmnt for remote handling of Target(s)		
49	What's the shaft for above the target pile?		
50	Is shielding reqd above the target shaft?		
51	Whats the relationshop od the injection from e+ to 3ring DR		

**some items were discussed in CFS 2010 workshop*

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Positron (e+)Source Heat and Power load

DRAFT AUG 27 2010

	Total kW	Rough location	Quantity	Distribution Assumption	Load to Water - LCW: kW heat load	LCW supply temperature (F)	Delta T (F)	Flow (gpm)	Load to Air: kW Heat load	Chilled Wtr	Beam Tunnel Temperature	Notes
1) Pre-Undulator												
Magnets	785.6	Beam Tunnel	52	individual	785.6	Depends on tunnel space temperature. Initial basis is 95F	18	298		?	Follows BDS reqmnt	25 Mattison Magnets omitted - no info (Norbert 8-27-2010)
Cables	85.5	Beam Tunnel		individual					85.5			Includes Rack figures (Norbert 8-27-2010)
Power Supplies	122.9	Cavern	20	Cavern Cluster	87.6		18	33.2	35.4			
Racks	0	Cavern	10	Cavern Cluster								7 Freestanding Racks + 13 Rackmounted PSUs (Norbert 8-27-2010)
Collimator	30	Beam Tunnel	3	individual	30		54	3.8				1 gpm per collimator - 30°C delta T (Norbert 8-27-2010)
2) Fast Abort Dump												
Magnets	633.2	Beam Tunnel	38	individual	633.2	Depends on tunnel space temperature. Initial basis is 95F	18	240.2			Follows BDS reqmnt	
Cables	15	Beam Tunnel		individual					15			Includes Rack figures (Norbert 8-27-2010)
Power Supplies	97.2	Cavern	10	Cavern Cluster	23.1		18	8.8	74.2			
Dumps	240	Beam Tunnel	1	individual	240		54	30.3				
3) Undulator Section												
Magnets	8.4	Beam Tunnel	22		8.4	Depends on tunnel space temperature. Initial basis is 95F	18	3.2			Follows BDS reqmnt	
Cables	1	Beam Tunnel	1	String					1			Includes Rack figures (Norbert 8-27-2010)
Power Supplies	108.7	Service Tunnel	64	individual	14.2				94.5			Includes 63 PSU for 21 Undulator Strings in service tunnel (Norbert 8-27-2010)
Cryocooler	441	Service Tunnel	63	individual	441		45	66.9				Cryocooler can be in Service tunnel. Yellow boxes require info (Norbert 8-27-2010)
4) AUX Source												
Magnets	1	Beam Tunnel	33	individual	1	Depends on	18	0.4				
Cables	7.4	Beam Tunnel		individual					7.4			Info for Bunchers from e- Source (Norbert 8-27-2010)
Power Supplies	11	Service Tunnel	24						11			SW Accel info included in RF (Norbert 8-27-2010)

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	Total kW	Rough location	Quantity	Distribution Assumption	Load to Water - LCW: kW heat load	LCW supply temperature (F)	Delta T (F)	Flow (gpm)	Load to Air: kW Heat load	Chilled Wtr	Beam Tunnel Temperature	Notes
RF	249.8	Service Tunnel	2	30% in Beam Tunnel	207	Depends on tunnel space temperature. Initial basis is 95F	45	31.4	42.8		Follows BDS reqmnt	2 Superconducting Cryomodules + 2 Standing Wave Accelerators (ML info used)- (Norbert 8-27-2010, Emil use MLRF high delta T data)
Bunchers	135	Service Tunnel	3	30% in Beam Tunnel	102		32.4	21.5	33			PSU, Solenoid and RF included (Norbert 8-27-2010)
Dumps	78.5	Beam Tunnel	4	individual	78.5		54	9.9				
Thermionic Gun	1.2	Beam Tunnel	1	individual					1.2			incl. 150kV PSU with 0.2kW heatload into Service Tunnel (Norbert 8-27-2010)
5) Target Area												
RF	124.9	Service Tunnel	1	30% in Beam Tunnel	103.5	Depends on tunnel space temperature. Initial	45	15.7	21.4		Follows BDS reqmnt	3 Travelling Wave Accelerators (Norbert 8-27-2010, Emil use MLRF high delta T data)
Target Stations	0	Beam Tunnel	0									
6) Capture Area												
Magnets	657	Beam Tunnel	62	String	657	Depends on tunnel space temperature. Initial basis is 95F	18	249			Follows BDS reqmnt	
Cables	7.4	Beam Tunnel							7.4			
Power Supplies	25.5	Service Tunnel	7	String					25.5			
Dumps	327	Beam Tunnel	3	individual	327		54	41.3				Assumed 301kW for Photon Dump and 13kW for Electron Dump (x2)-(Norbert 8-27-2010)
7) 400 MeV Pre-Accelerator												
Magnets	166.5	Beam Tunnel	8	individual	166.5	Depends on tunnel space temperature. Initial basis is 95F	64.4	17.7			Follows BDS reqmnt	Estimate (Norbert 8-27-2010)
Cables	90.15	Beam Tunnel		individual					90.15			Estimate (Norbert 8-27-2010)
Power Supplies (HV)	26.4	Service Tunnel	3		26.4		45	4.0				Estimate (Norbert 8-27-2010)
Racks	34.5	Service Tunnel	3		0					34.5		Estimate (Norbert 8-27-2010)
8) Positron Transport Line 1												

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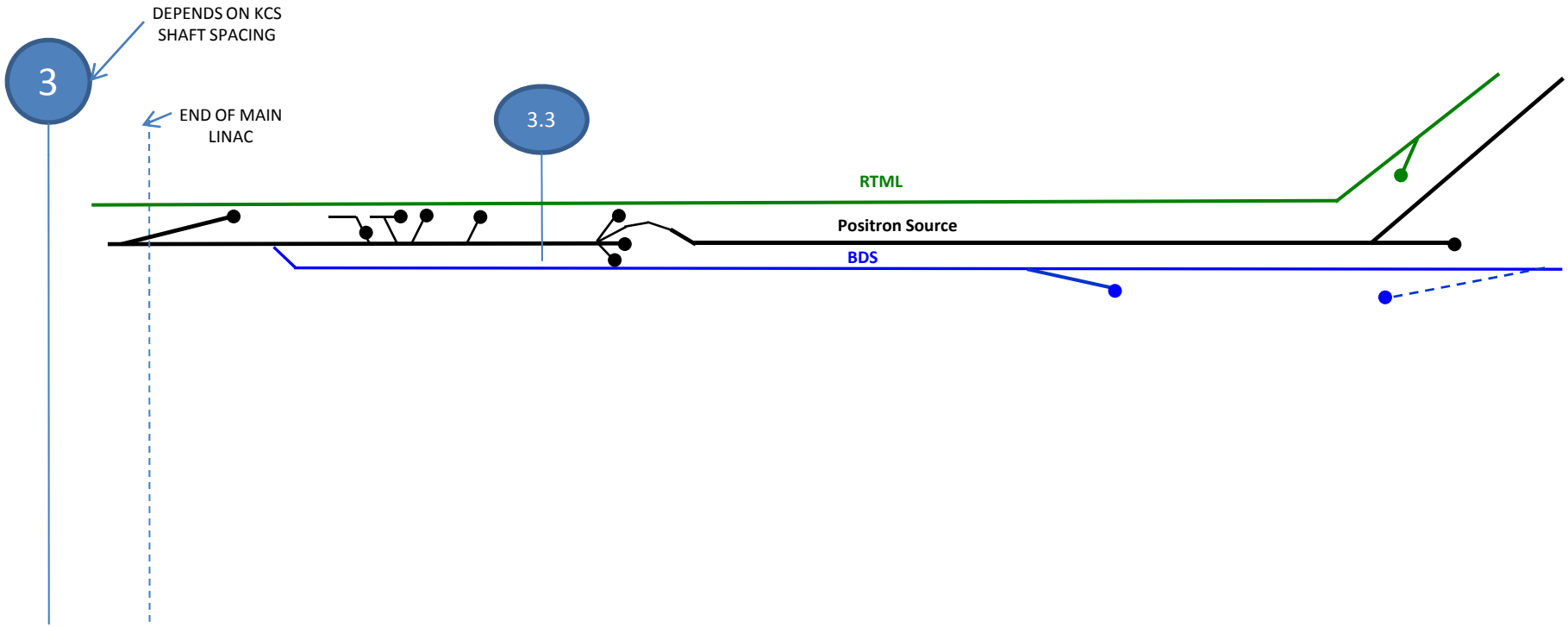
Magnets	14.7	Beam Tunnel	62	String	14.7	Depends on tunnel space temperature. Initial basis is 95F	18	5.6			Follows BDS reqmnt	Estimate (Norbert 8-27-2010)
Cables	0.9	Beam Tunnel							0.9			
Power Supplies	2.3	Service Tunnel	1						2.3			
9) 5 GeV Booster Section												
Magnets	2.1	Beam Tunnel	8	individual	2.1	Depends on tunnel space temperature. Initial basis is 95F	18	0.8			Follows BDS reqmnt	No info for Coldbox available - not included (Norbert 8-27-2010)
RF	828	Service Tunnel	8	30% in Beam Tunnel	828		45	125.6				Info from ML 9-8-9 RDR Water and Air Heat Load 31/10/2007 spread sheet
Racks	92	Service Tunnel	8		0					92		
10) Positron Transport Line 2												
Magnets	29	Beam Tunnel	122	String	29	Depends on tunnel space temperature. Initial basis is 95F	18	11.0			Follows BDS reqmnt	
Cables	1.8	Beam Tunnel							1.8			
Power Supplies	4.6	Service Tunnel	2	String					4.6			
Dumps	226	Beam Tunnel	1	individual	226		54	29				
11) Positron Line Transfer to Damping Ring (PLTR)												
PLACEHOLDER	540	Beam Tunnel	???	uniformly	500	Depends on tunnel	18	189.7	40		Follows BDS reqmnt	**PLACEHOLDER (Norbert / Emil 8-27-2010)**
	6253				**5532**				**595**	**127**		
Misc components												
AC Power Transformers		??										
Emergency Transformer		cavern										
Fancoils		beam										
Dehumidifer		beam										
Water Pumps		cavern										
Lighting		beam										
	0				**0**				**0**			

PROCESS WATER HEAT LOAD DISTRIBUTION

D R A F T SEP 2 2010

Central Region (e- side)

Length shown are approximate for process water distribution purposes only & doesn't reflect the actual beamlength



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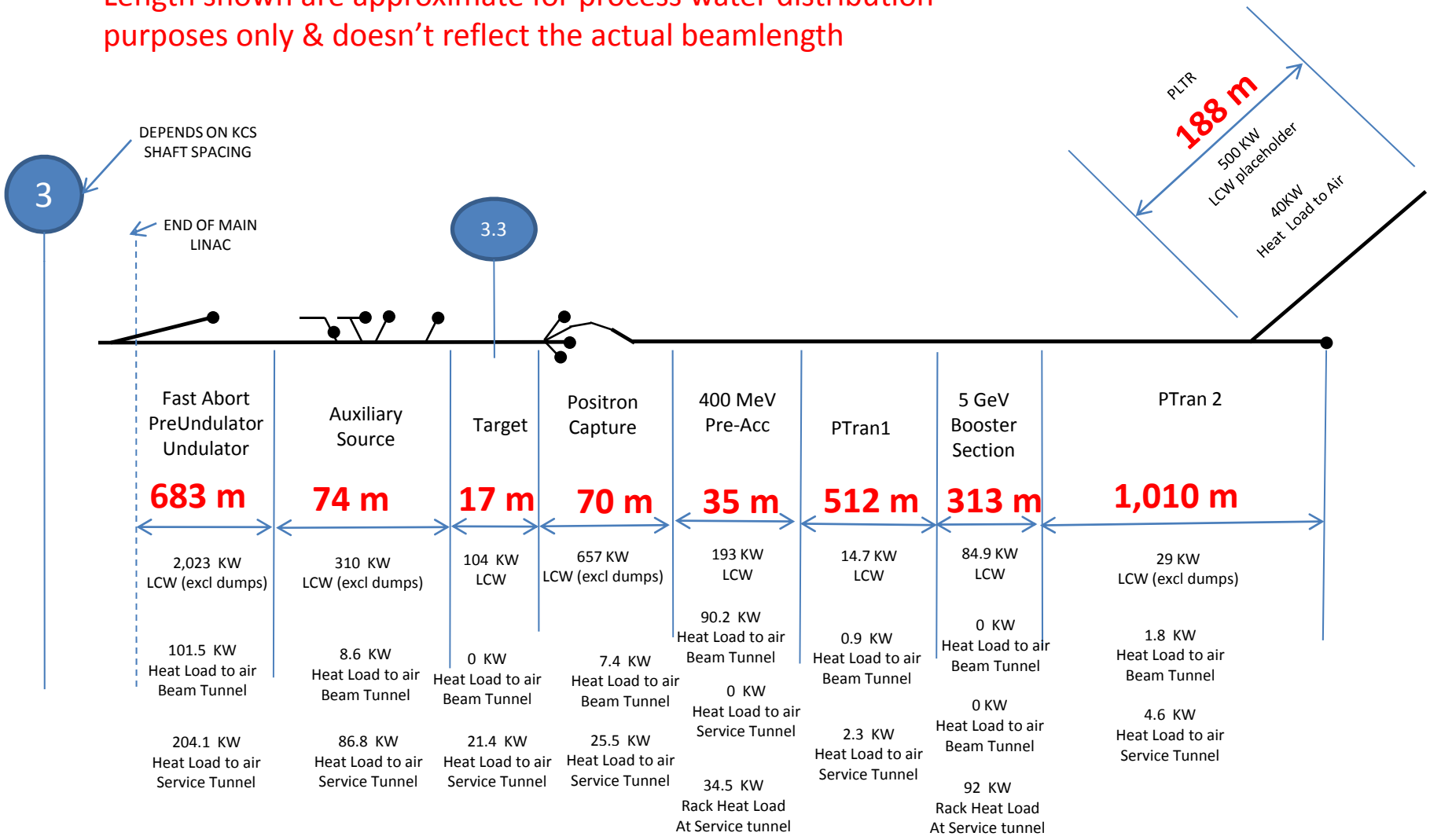
PROCESS WATER HEAT LOAD DISTRIBUTION

D R A F T SEP 2 2010

Positron Source (at e- side of central region)

Length shown are approximate for process water distribution purposes only & doesn't reflect the actual beamlength



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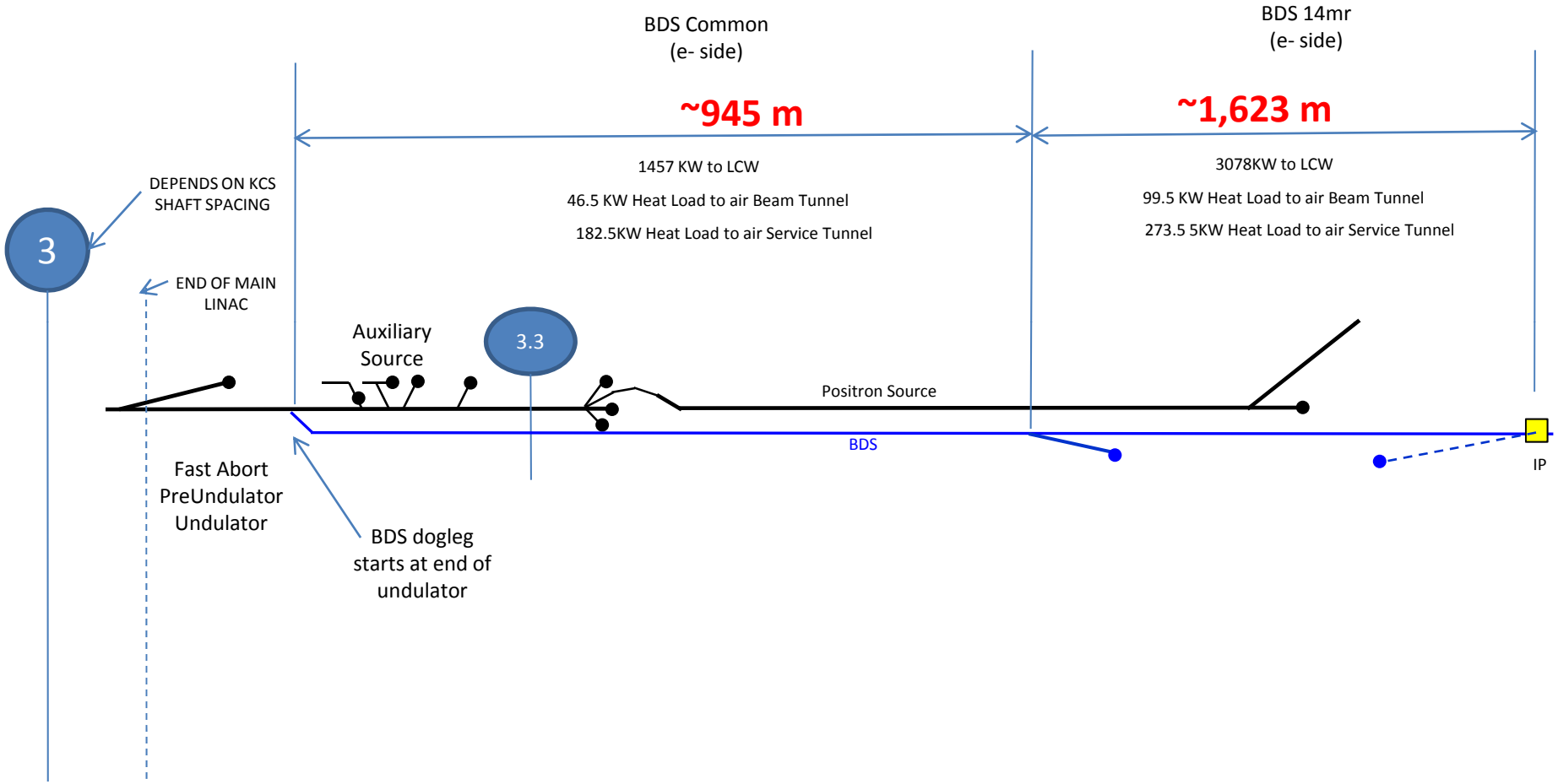
PROCESS WATER HEAT LOAD DISTRIBUTION

D R A F T SEP 2 2010

BDS w/ Positron Source (same on e- and e+ side)



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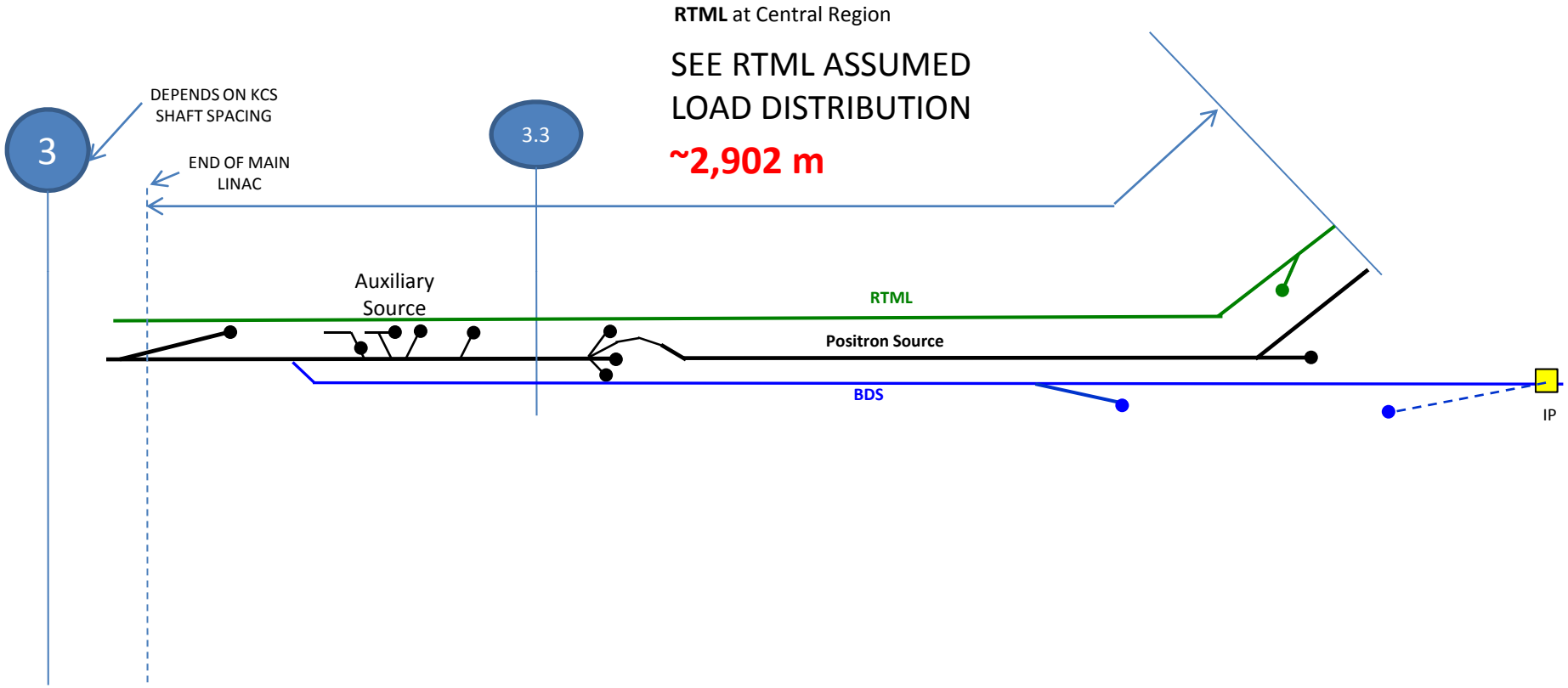
PROCESS HEAT LOAD DISTRIBUTION RTML

@ central region (same on e- and e+ side)

D R A F T SEP 2 2010



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PROCESS HEAT LOAD DISTRIBUTION

DUMPS @ central region (e- side only)

D R A F T SEP 2 2010