

ILC-ADI Meeting ML Layout in KCS/DKS

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From TDR Part-2, Chapter 2

drafted by N. Walker

Table 2.1: Summary table of the 200–500 GeV baseline parameters for the ILC. The reported luminosity numbers are results of simulation [REF] and include an approximate 10% enhancement from a small coherent vertical waist shift at the interaction point.

Centre-of-mass energy	E_{CM}	GeV	200	230	250	350	500
Luminosity pulse repetition rate		Hz	5	5	5	5	5
Positron production mode			10 Hz	10 Hz	10 Hz	nom.	nom.
Bunch population	N	$\times 10^{10}$	2	2	2	2	2
Number of bunches	n_b		1312	1312	1312	1312	1312
Linac bunch interval	Δt_b	ns	554	554	554	554	554
RMS bunch length	σ_z	μm	300	300	300	300	300
Normalized horizontal emittance at IP	$\gamma \epsilon_x$	μm	10	10	10	10	10
Normalized vertical emittance at IP	$\gamma \epsilon_y$	nm	35	35	35	35	35
Horizontal beta function at IP	β_x^*	mm	16	14	13	16	11
Horizontal beta function at IP	β_y^*	mm	0.34	0.38	0.41	0.34	0.48
RMS horizontal beam size at IP	σ_x^*	nm	904	789	729	684	474
RMS horizontal beam size at IP	σ_y^*	nm	7.8	7.7	7.7	5.9	5.9
Vertical disruption parameter	D_y		24.3	24.5	24.5	24.3	24.6
Fractional RMS energy loss to beamstrahlung	δ_{BS}	%	0.65	0.83	0.97	1.9	4.5
Luminosity	L	$\times 10^{34} \text{cm}^{-2} \text{s}^{-1}$	0.56	0.67	0.75	1.0	1.8
Fraction of L in top 1% E_{CM}	$L_{0.01}$	%	91	89	87	77	58
Electron polarisation	P_-	%	80	80	80	80	80
Positron polarisation	P_+	%	30	30	30	30	30
Electron relative energy spread at IP	$\Delta p/p$	%	0.20	0.19	0.19	0.16	0.13
Positron relative energy spread at IP	$\Delta p/p$	%	0.19	0.17	0.15	0.10	0.07

ML Cavity/CM/RF Parameters

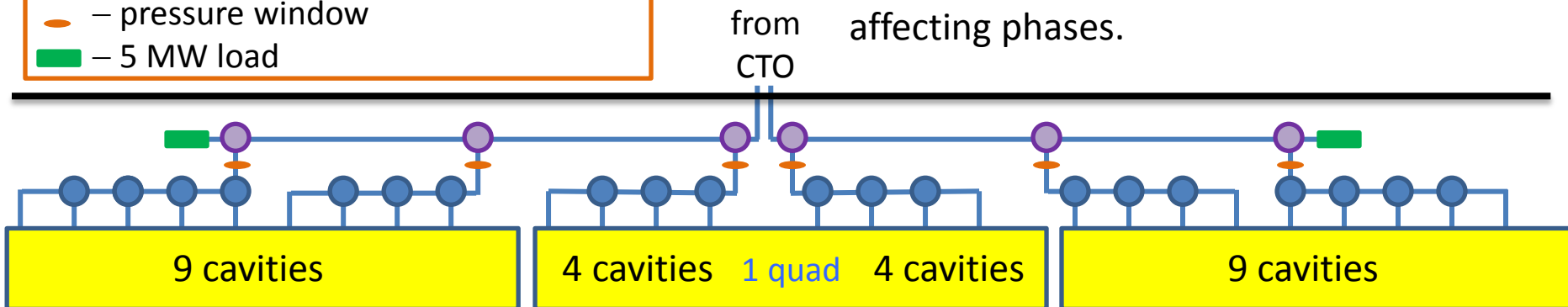
(based on KEK BTR, Jan. 2012)

Main Linacs		Kamaboko		Upgrade (and KCS)	
Required energy gain	GeV	235		235	
Cavities / LPDS		39		26	
Cryomodule & cavity counts					
Cavity					
RF voltage	MV	32.70		32.70	
phase	deg	5		5	
loss factor (beam loading)	MV	0.04384		0.04384	
dE/cavity	MV	32.53		32.53	
DE per LPDS unit	GeV	1.27		0.85	
e+ # LPDS units		186		279	
Energy gain	GeV	235.96		235.96	
e- Required OH for e+ src	GeV	2.6		2.6	
Total e- energy gain	GeV	237.6		237.6	
# LPDS units (rounded)		188		282	
Energy gain	GeV	238.50		238.50	
Overhead (LPDS units)		2		3	
Electron linac LPDS units		190		285	← 9 cm overhead
Positron linac LPDS units		188		282	
Total LPDS units		378	same	567	← original RDR RF units (26 cavities)
Max. e- energy (IP)		253.44	1.4%	253.44	1.4%
Max. e+ energy (IP)		253.50	1.4%	253.50	1.4%

Streamlined PDS

- – pressurizable, 0-100%, phase stable
- – non-press., limited range
- – pressure window
- – 5 MW load

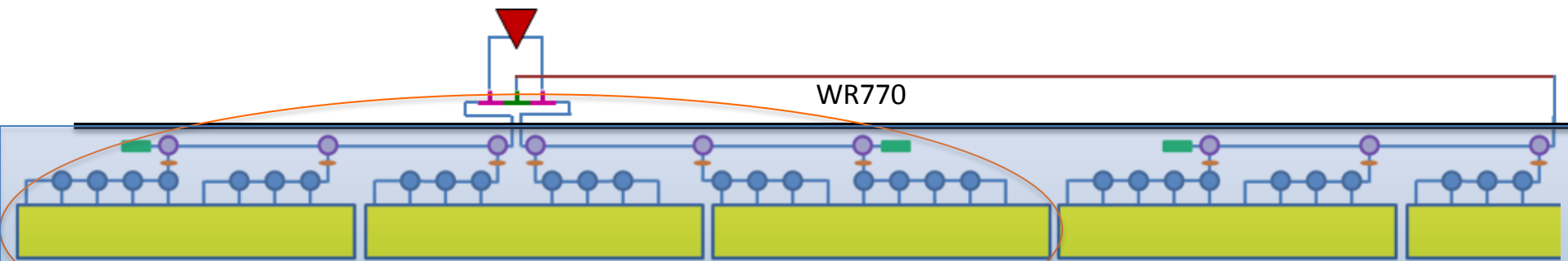
Unused power can be dumped to the loads
 Power to ½ CM's fully adjustable without affecting phases.



phase shifter on each feed, as well as isolator, bi-directional coupler, and flex guide.

RF UNIT: 3 cryomodules (26 cavities)

Common Local power distribution



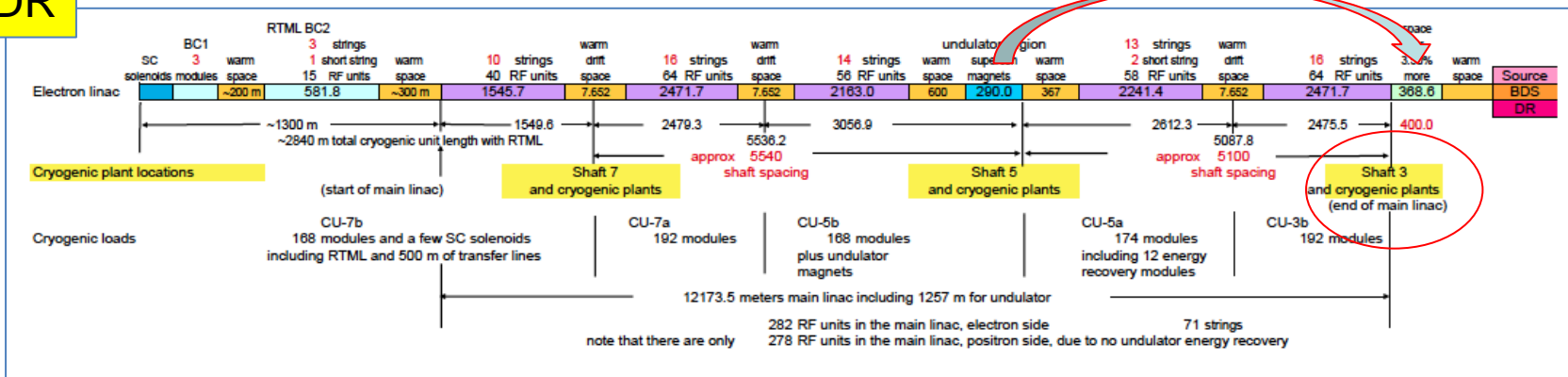
For low power **Kamaboko (DKS)** option, one klystron powers 1 ½ rf units or 4 ½ cryomodules (39 cavities).



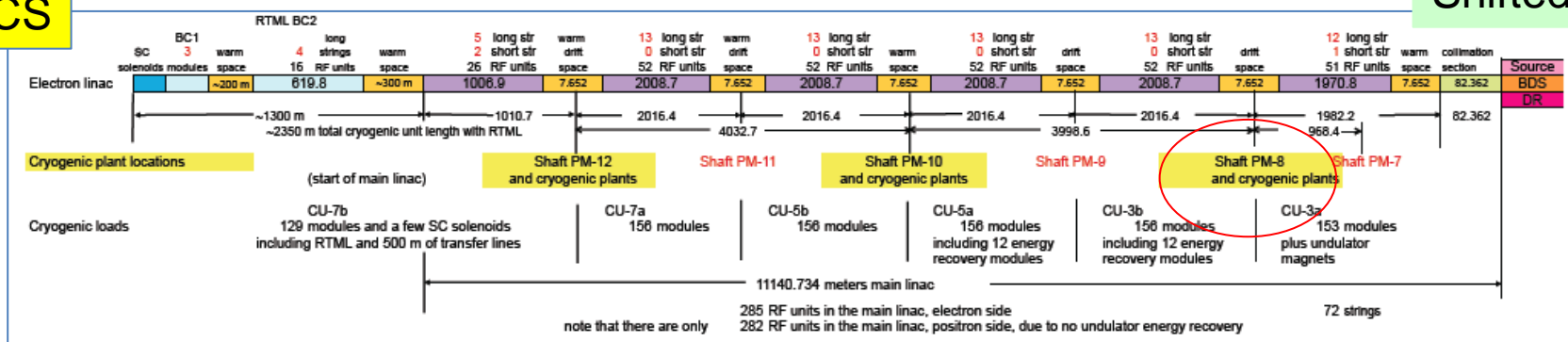
Cryogenics Unit Difference

between RDR (~ DKS) and KCS

RDR



KCS



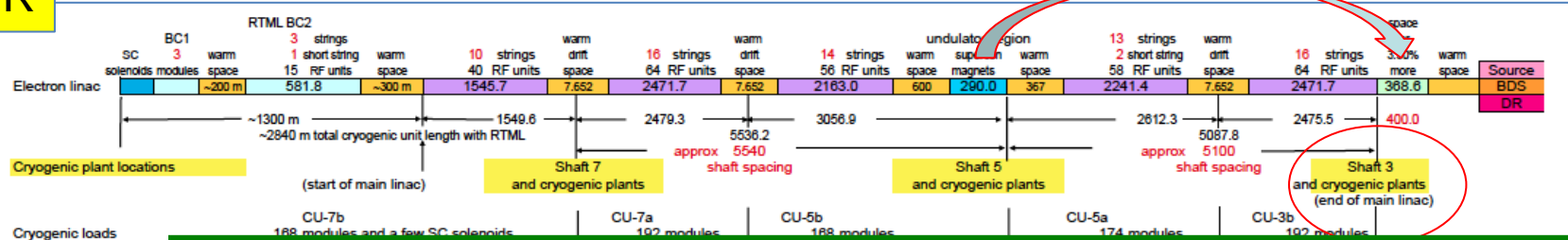
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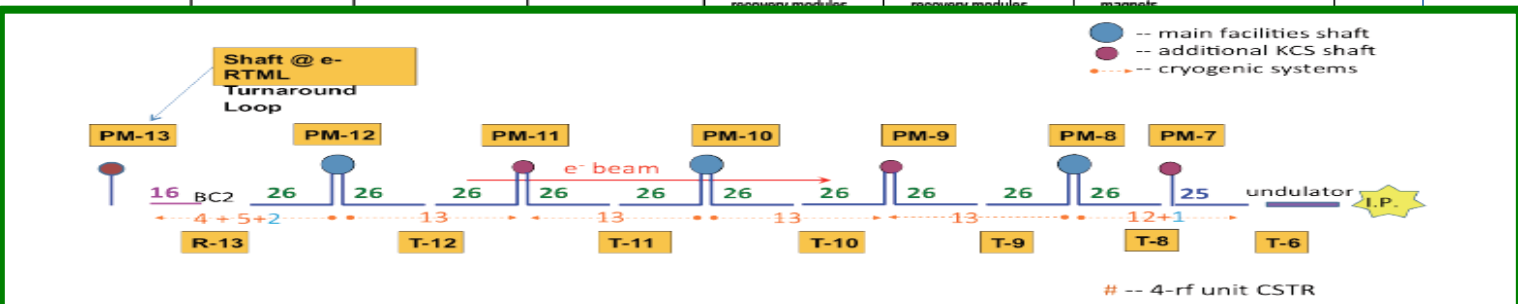
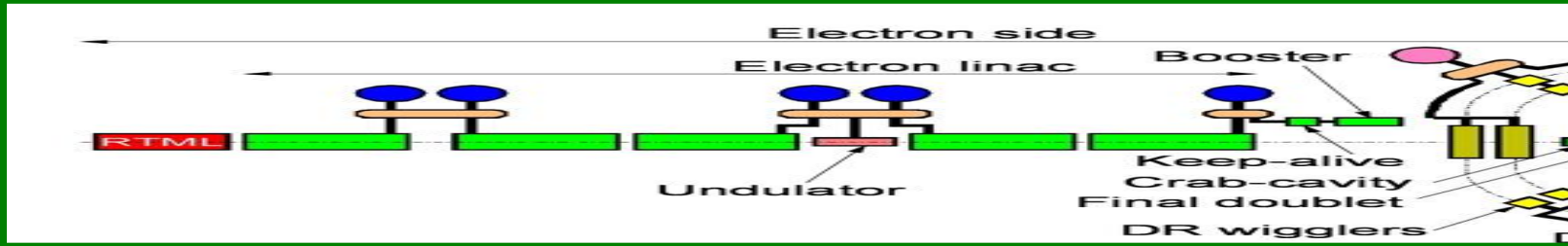
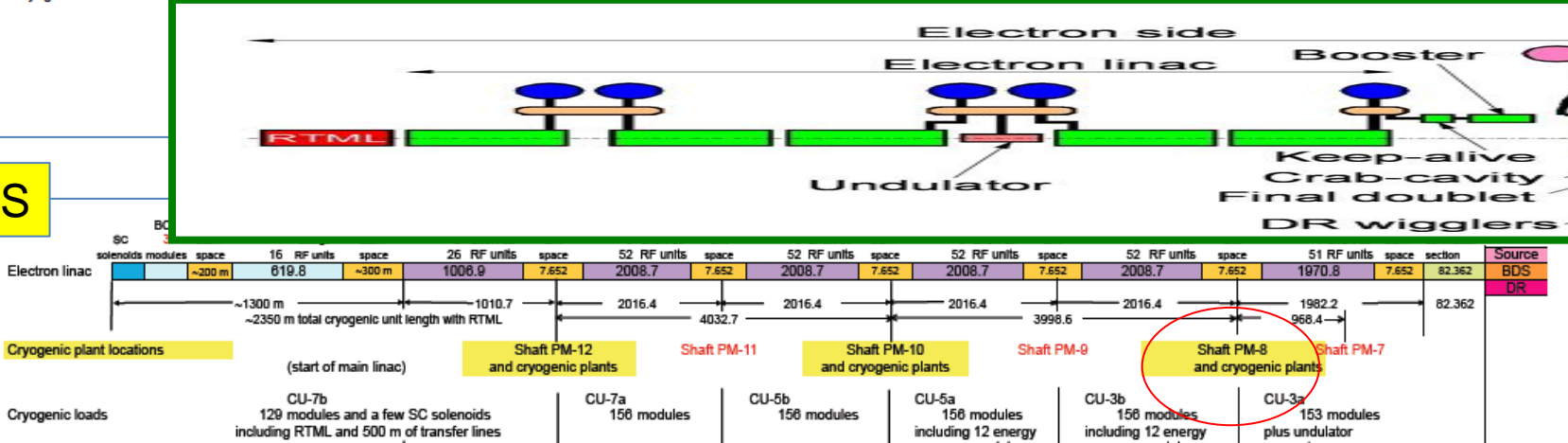
Cryogenics Unit Difference

between RDR (~ DKS) and KCS

RDR



KCS

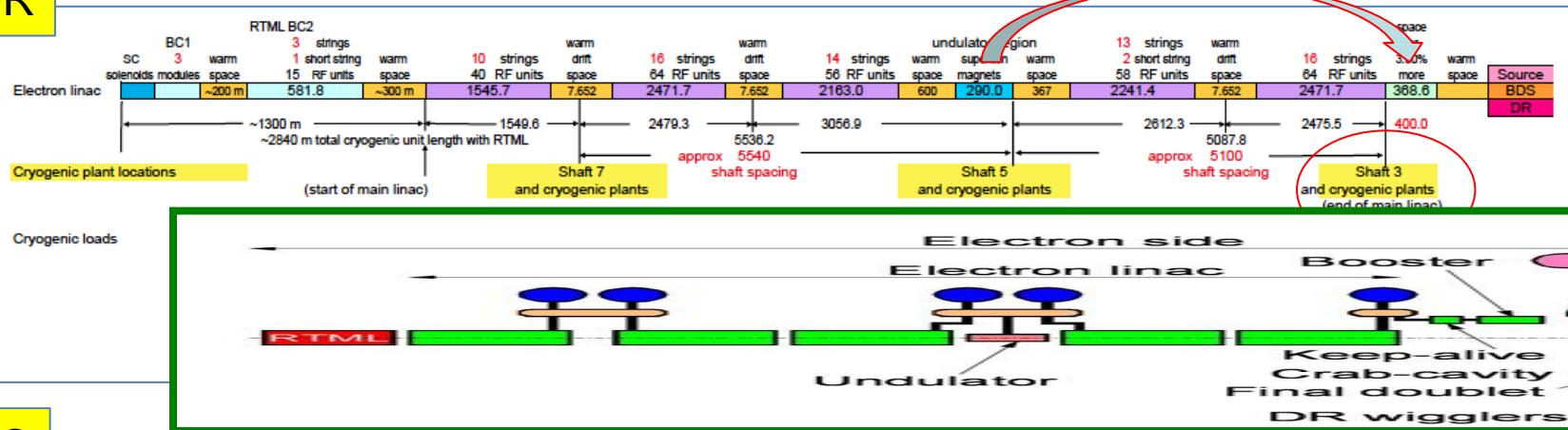




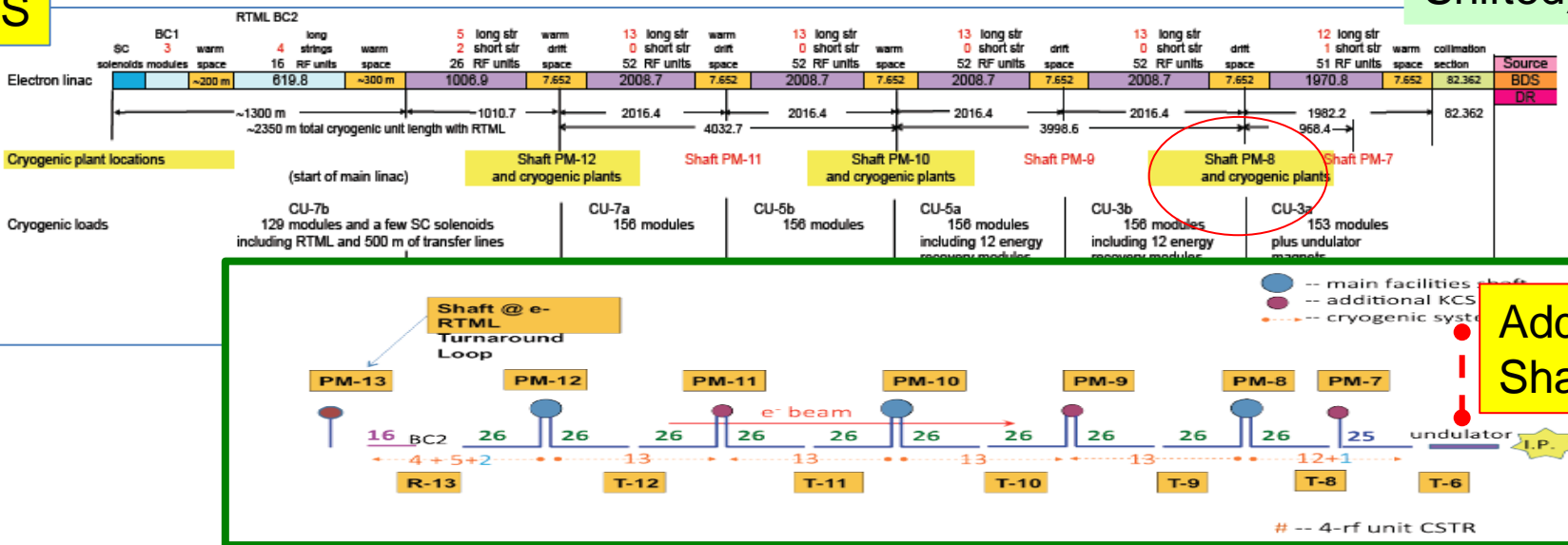
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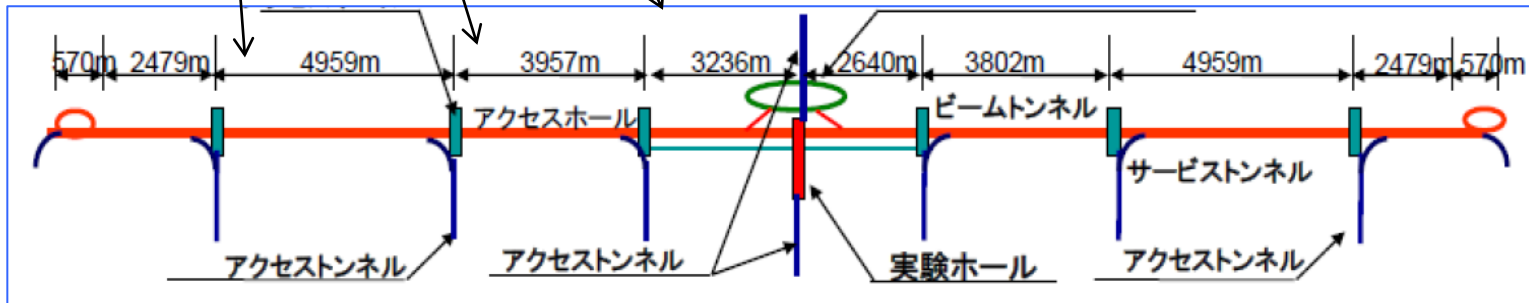
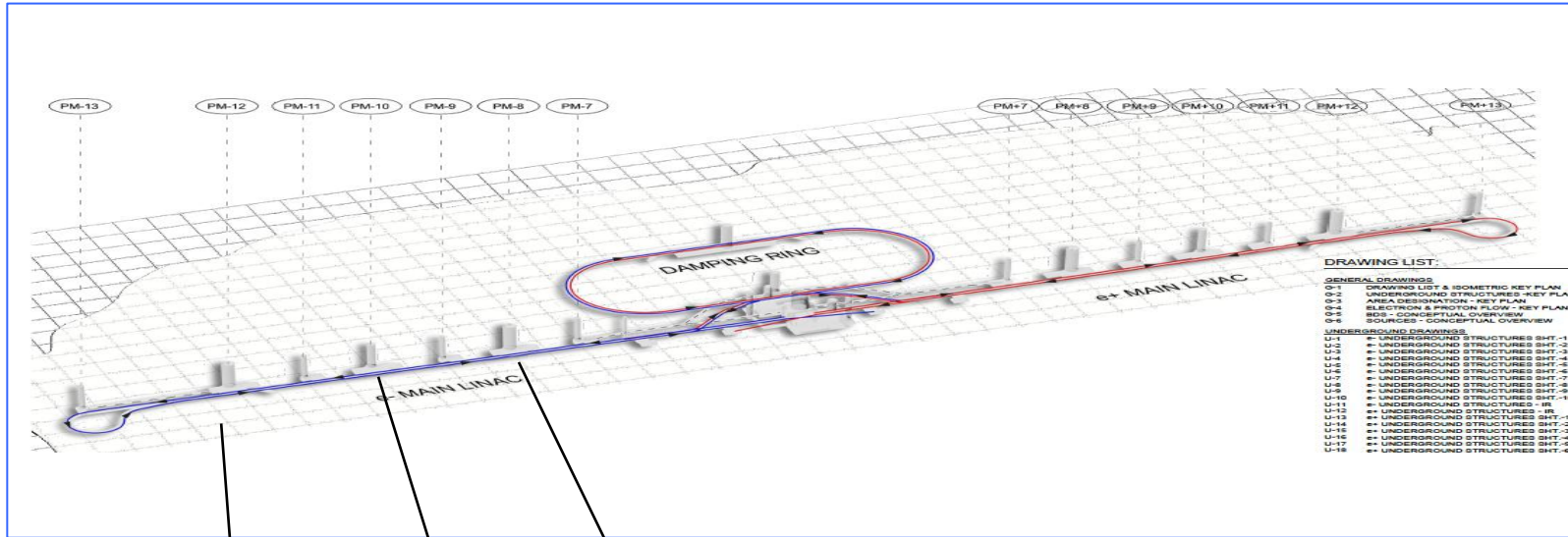
RDR



KCS



Tunnel Configuration





Differences between DKS and KCS

Items	DKS	KCS
klystron / cavities	1 / 39 (26 x 1.5)	To be filled
klystron / CM	1 / 4.5 (3 x 1.5)	To be filled
Cryogenics / Cavities	1 / (26 x 4 =	1 / 186 (62 x 3)
Number of Cryogenics	5	6
Warm section	4	5
Total ML length	$L_{\text{KCS}} - 7.652$	L_{KCS}