

RTML layout in SB2009

Nikolay Solyak

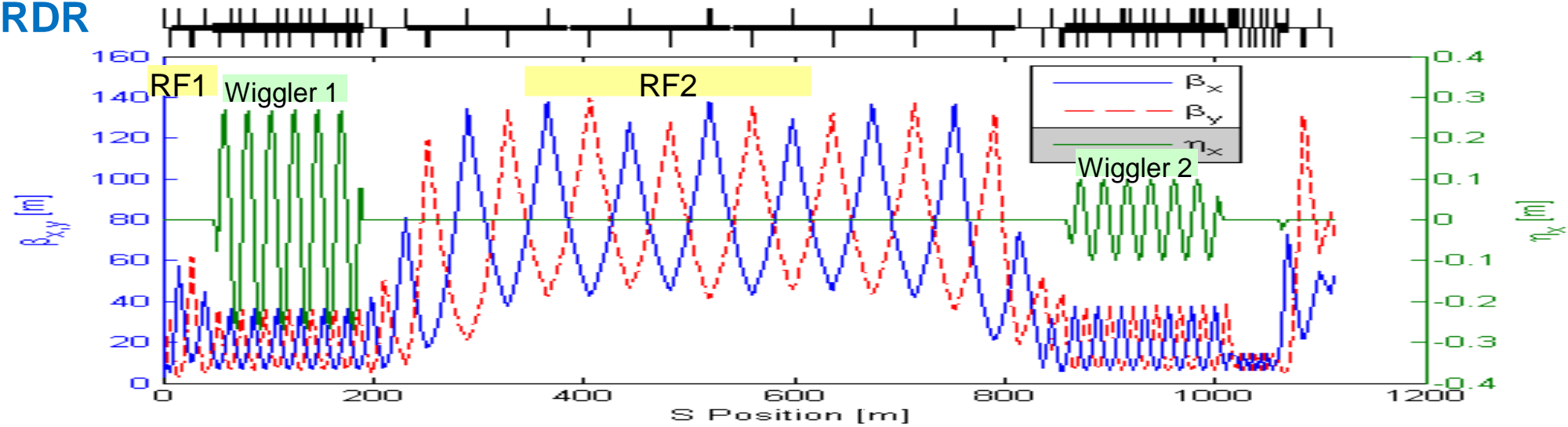
CFS/Area system Workshop 2,
SLAC, August 2-3, 2010

Major modifications to the RTML lattice are:

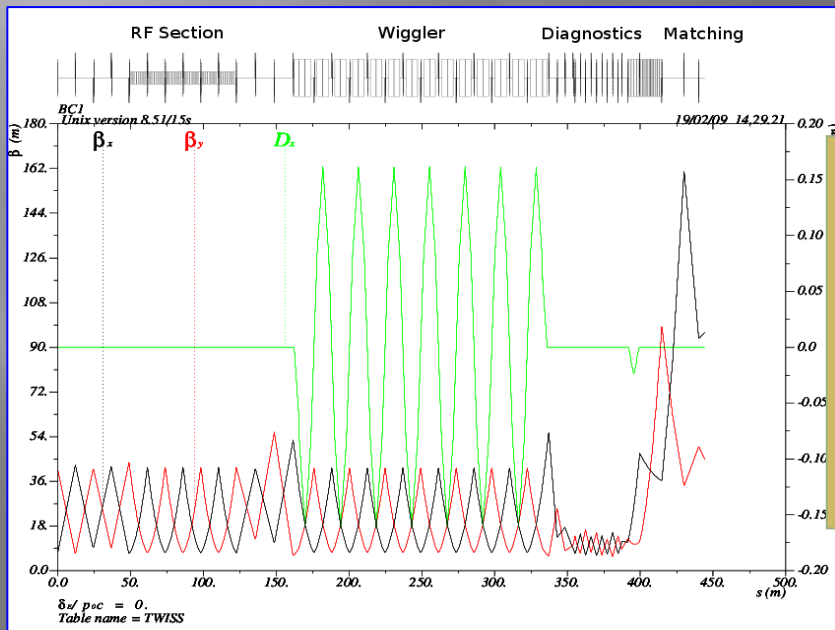
- Single-stage bunch compressor (shorter by ~314 m)
- Remove 15 GeV extraction line and beam dump (ELBC2)
- Redesigning of the second extraction line (after single-stage bunch compressor) to accommodate larger energy spread (4% vs. 2.5%)
- Re-designing of the RTML lattice in central integration area, associated with new layouts of the DR, electron and positron sources and BDS
 - *S-shape curved DR-to-Linac transition (in horizontal plane)*
 - *Vertical dogleg (different for e^+ and e^-)*
 - *Extraction line in*
 - *Correction, Diagnostics and Collimation sections in BDS straight tunnel*

RDR 2-stage BC vs. SB2009 single-stage BC

RDR



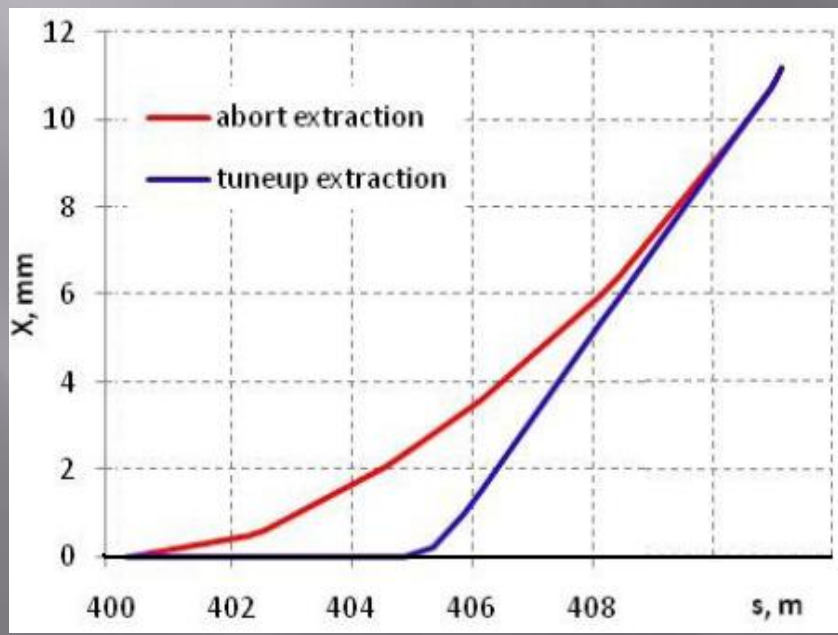
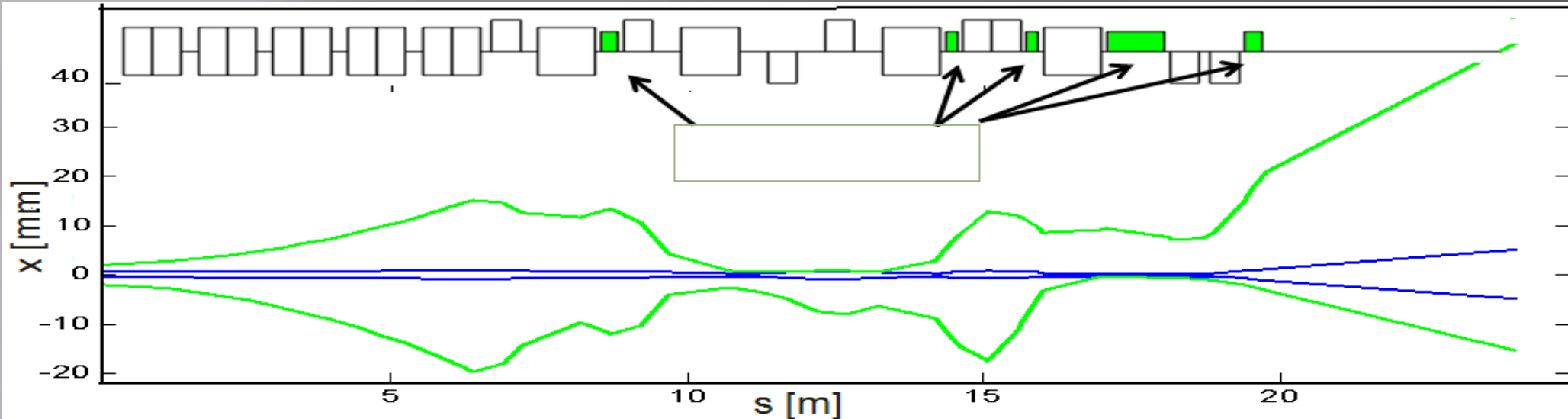
SB2009



Pre-linac is now part of ML:

- Length ~ 460 m
- Acceleration: $4.3 \rightarrow 15$ GeV
- 36 CM's (12 klystrons)

ELBC1 - Extraction Line



Length = 24 m

Class	# of magnets	Length [m]	Maximum pole tip field [kG]	Aperutre [cm]	Comments
Abort kickers	4	2	0.035		charged to 35G each in 100nS
Tune-up bend	1	1	0.28		
Septum bends	5	1	0.5	5	
Bends	4	1	15	5	
Quadrupoles	1	0.5	10	5	figure-8
	8	0.5			
	1	1			
Sextupoles	1	0.3	5	5	
	2	0.2	10		
	1	1	10		
	1	0.3	10		

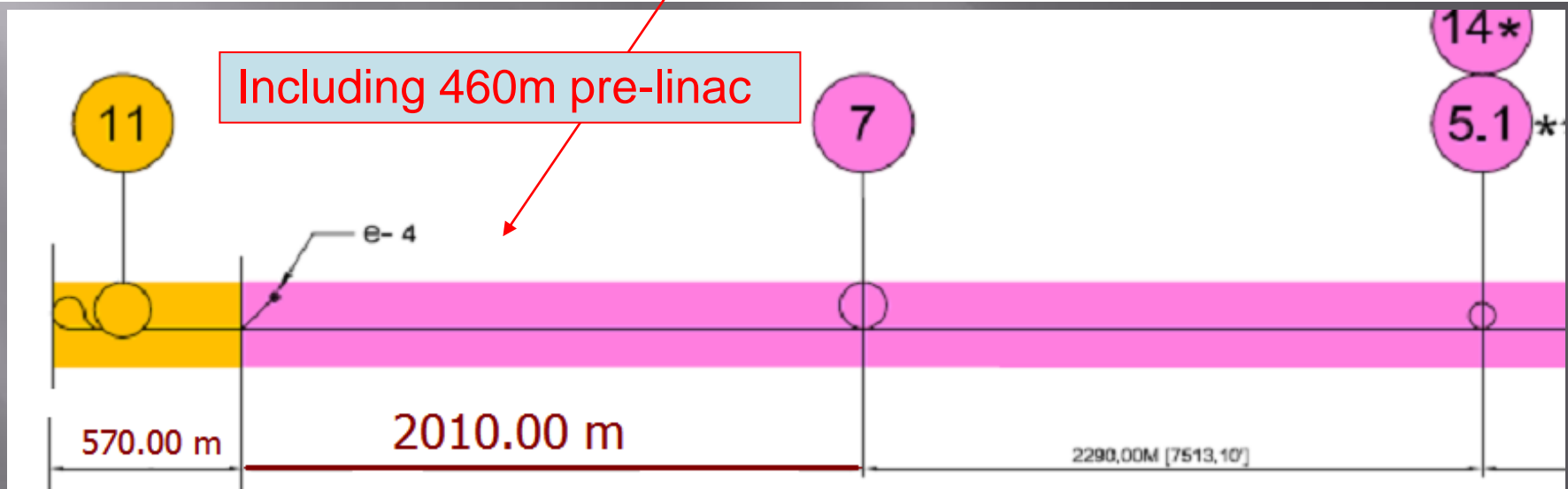
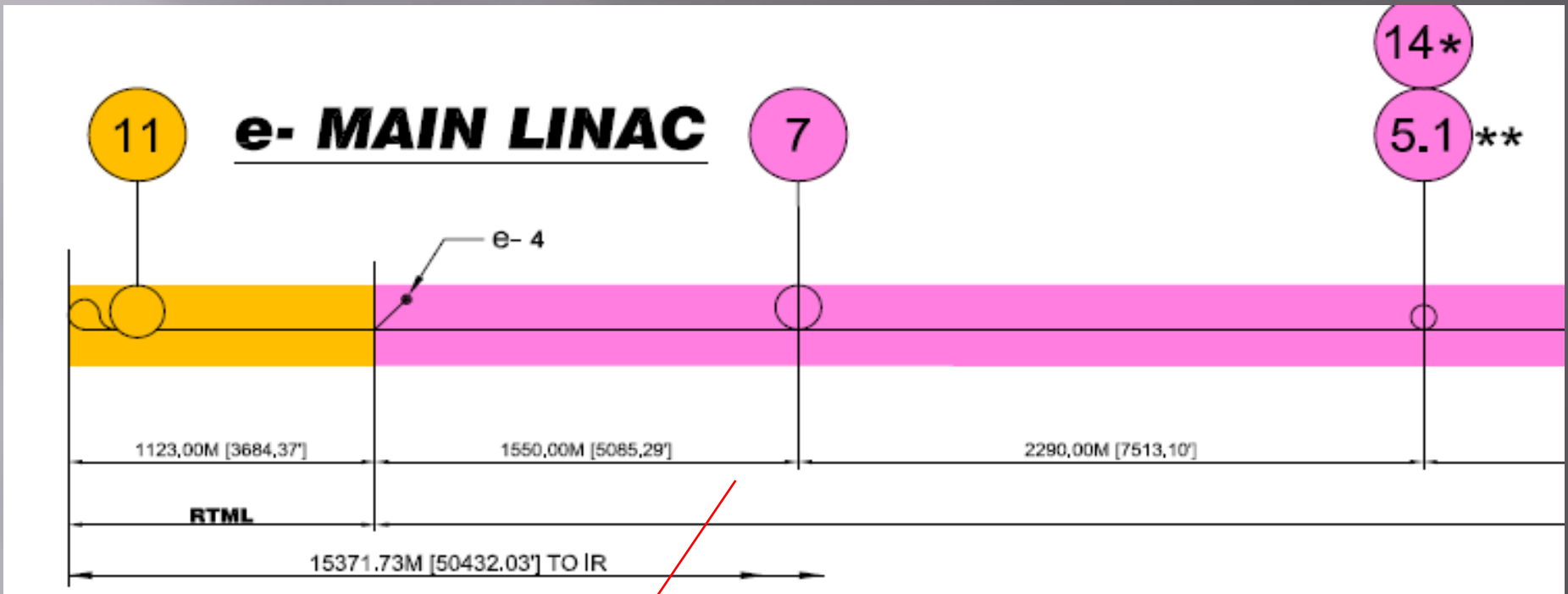
Aluminum Ball Beam Dump: maximum acceptable power is 220MeV/train; beam dump window diameter is 12.5cm

Two-stage vs. single-stage BC (BC1+BC2) vs. (BC1S + pre-Linac)

	BC1+BC2	BC1S+preLinac
Length [m]	1114	800
RF units/klystrons	16	14
Cryomodules	48	42
Cavities	414	360
Quadrupoles	88	61
BPMs	84	59

BC1 Instrumentation	BC2 Instrumentation (BC1S)
phase monitor, bunch length monitor, LOLA profile monitor	phase monitor, bunch length monitor, LOLA profile monitor
	4 laser wires

Corrections in CFS drawings (LCWS 09)



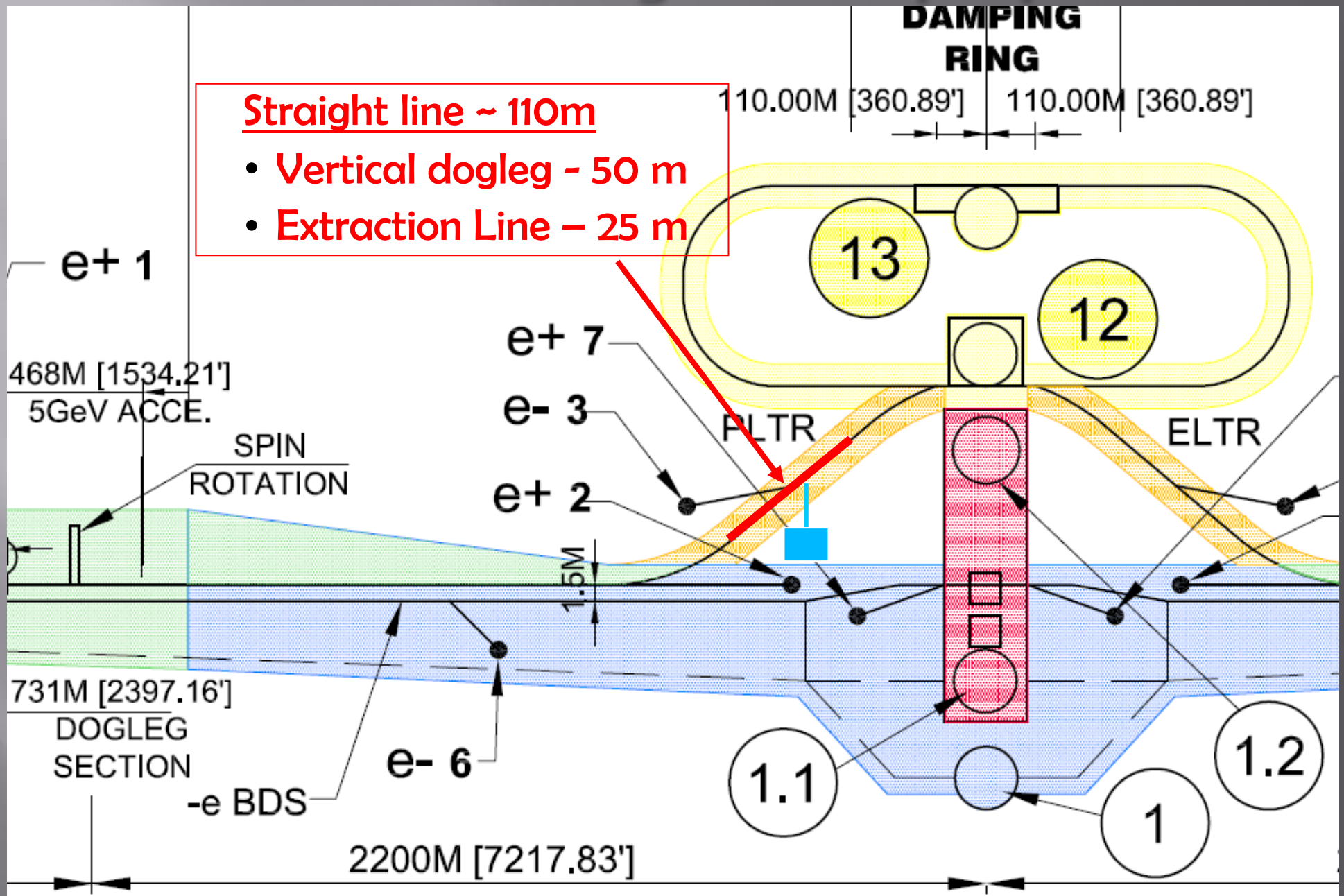
Final length should be agreed with ML area

N.Solyak, RTML

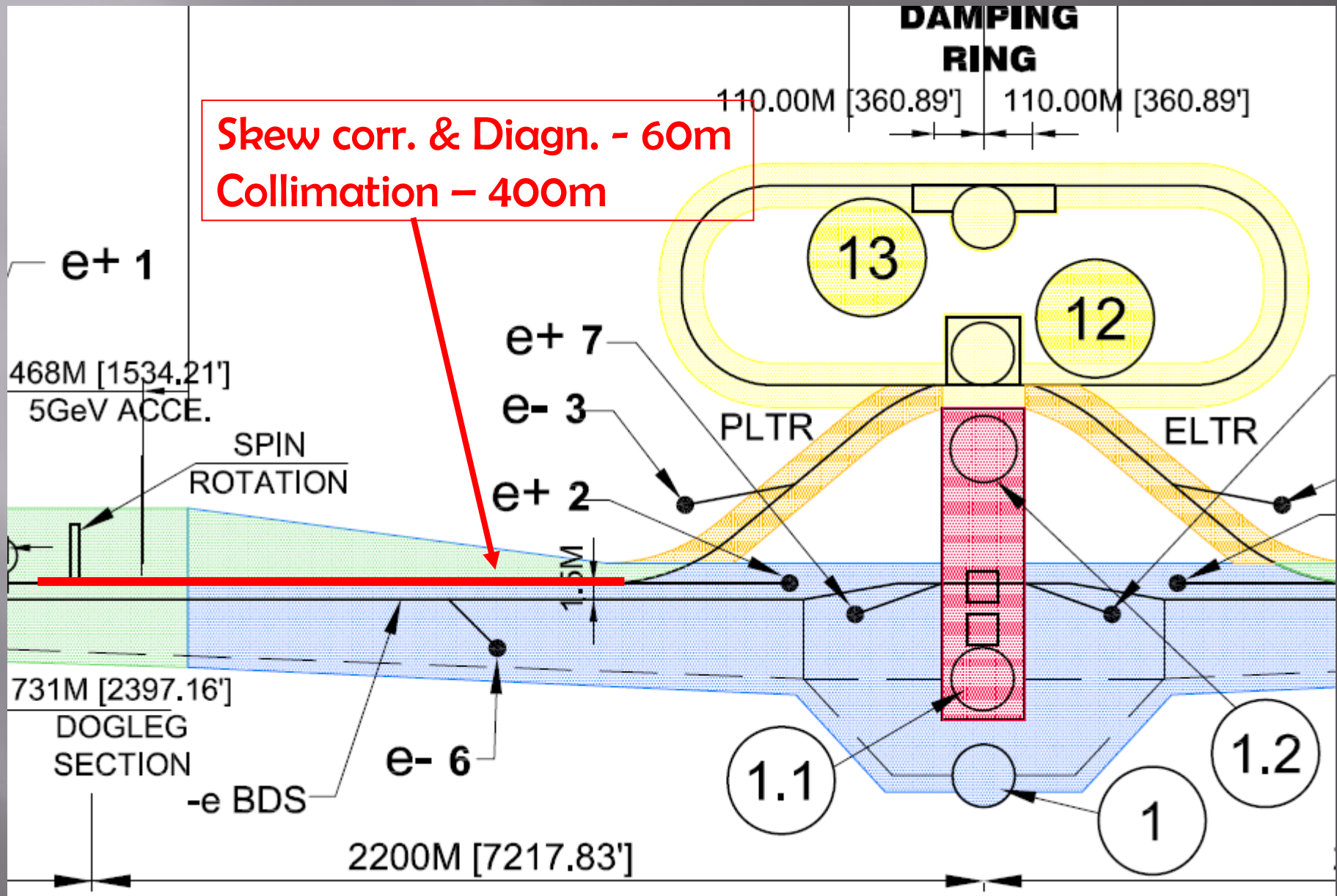
RTML in Central Area

- In SB2009 DR circumference has been scaled down to 3.2 km
- RDR design foresaw an extraction at about 1 km from the central plane (IP location) in the direction of the turnaround, now the DR exit is located at about 100 meters from the central plane → RTML system longer by ~900 m, more RT magnets.
- It requires redesign of the RDR beamlines. Possible simplification of overall layout due to DR in same elevation. Preliminary lattice exist, no matching and optimization done yet.
- Possible risks might arise from the performances of the new system from the point of view of the low emittance transport

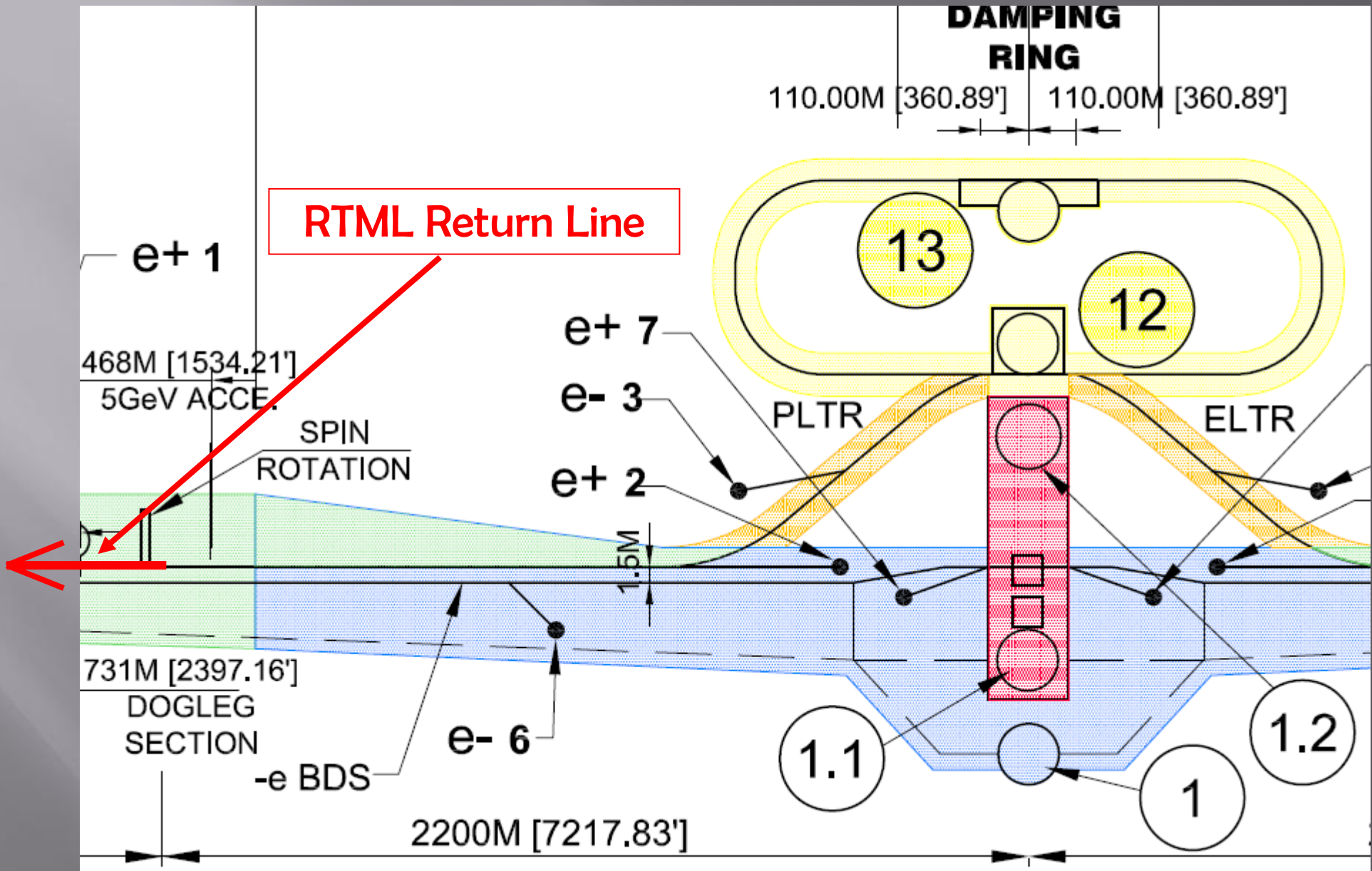
RTML configuration proposal



RTML configuration proposal (2)



RTML configuration proposal (3)



RTML in DR-BDS Transfer tunnel (SB2009)



Science & Technology
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ILC – Central Integration SB 2009 Layout

Quite a bit of guess work going on at this moment. There are 9 Beam Dumps in the Transfer Tunnel?

Positron Elevator
($Y = 0\text{m}$ to 1.3m)

Positron Energy compression
(best guess)

Positron Spin Rotation relocated.
(400MeV version shown, 5GeV requires larger Solenoids and Dipole magnets, will NOT change tunnel arrangement)

$R=30\text{m}$, all Arcs,
with Dipoles at
 7.9316° spacing

Need more details on RTML beam-line in this Area:
Extraction line and Dump?

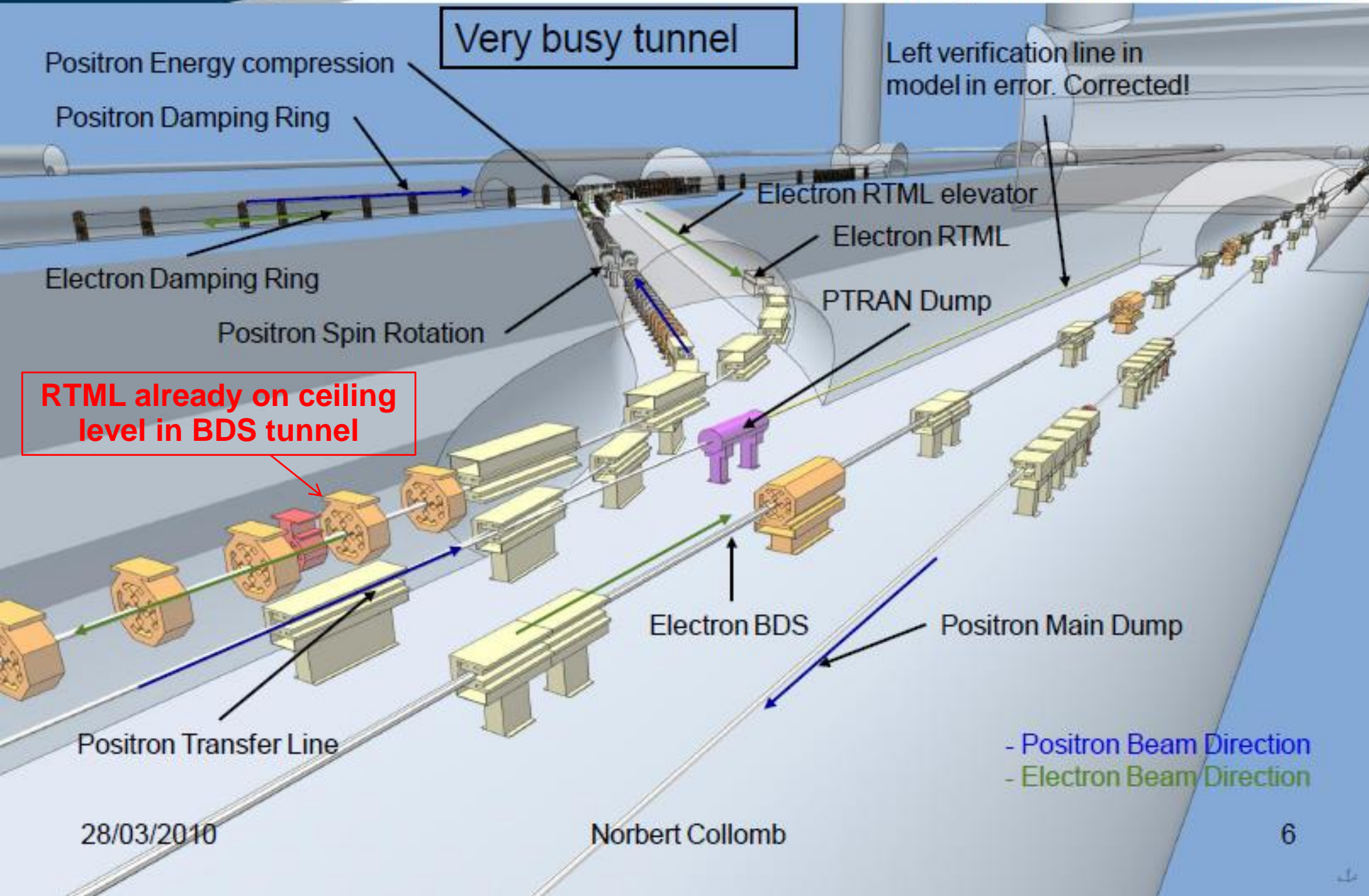
Electron Elevator
($Y = 0\text{m}$ to 2m)

110 m between Dipoles

Damping Ring offset change since Albuquerque

- Positron Beam Direction
- Electron Beam Direction

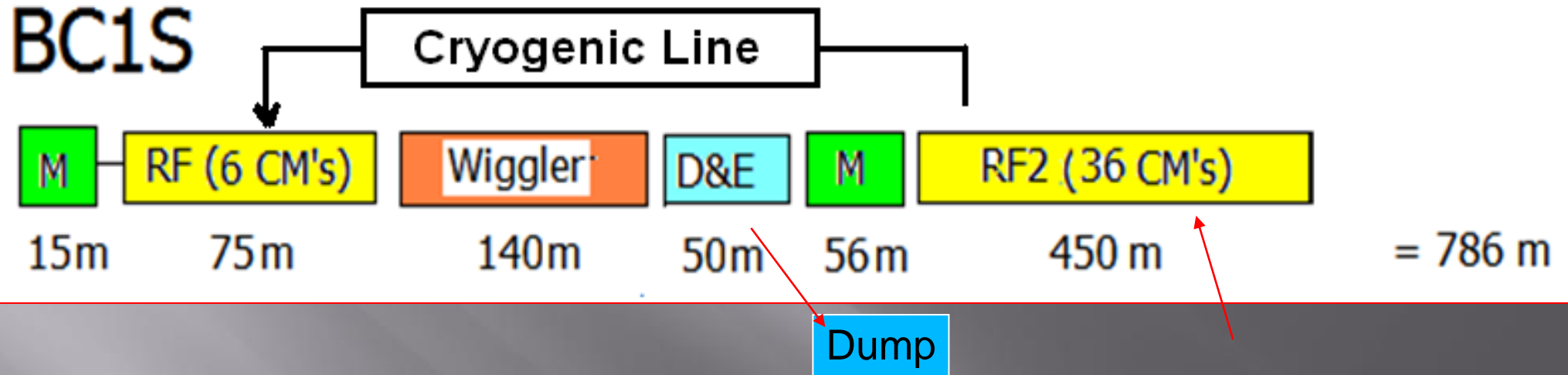
ILC – Central Integration SB 2009 Layout



Power, water, Cryo Tables

- ▣ Some discrepancy in RTML tables were found in the table, distributed by Vick on Daresbury Workshop, July 12-13, 2010
 - RF scaled properly from RDR, but our proposal is include pre-linac (36 CM's/side) to ML budget. Only 6 CM/side needed for single stage BC. (Total RF power ML+RTML still the same)
 - Same for Cryo
 - Number of conventional RT magnets was increased in SB2009 because of longer RTML line. Table with magnet counts was distributed in Oct.28, 2009.

Single stage Bunch compressor



Now this is a part of ML (after conversation with Chris Adolphsen)

- Length saving: $1114 - 800 \approx 314$ m
- Cryogenic line for 6 CM in Bunch compressor
- 4 SC solenoids in Spin rotator are locally cooled by cryo-head, same as undulator (no need for cryo-line)

RTML Magnet Count (Oct.28,2009)

		Length [m]	Family	Magnets Count	Length [mm]	Apertur e [mm]
DRX	Total Length	161	Q20L200	50		
	X footprint	136	D25L2300	36		
	Y footprint	-80.5	D20L50	80		
	Z footprint	2.15	BPM	50		
			Abort Kicker	4	2000	?
			Extraction Bend	1	1000	25
DRX – Dump Line						
http://tdserver1.fnal.gov/Project/ILC/RTML/AllRTMLStuff/Lattice	Total Length	25.5	Septum Bends	4	1000	50
			Regular Bends	6	1000	50
			Quadrupoles	5	300	50
			“Figure 8” Quad	1	300	50
Diagnostics & Stretch						
	Total Length	1018.5	Q20L100	4		
			Q20L200	61		
			D20L50	91		
			D25L900V1	4		

TOTAL ELEC POWER LOAD

RDR							
Area System	RF Power	Conventional Power				Emerg Power	Total
		Conv	NC Magnets	Water Systems	Cryo		
e-sources	1.05	1.19	0.73	1.27	0.46	0.06	4.76
e+sources	4.11	7.32	8.9	1.27	0.46	0.21	22.27
DR	14	1.71	7.92	0.67	1.76	0.23	26.29
RTML	7.14	3.78	4.74	1.34	0	0.15	17.15
Main Linac	75.72	13.54	0.78	9.86	33.9	0.404	134.21
BDS	0	1.11	2.57	3.51	0.33	0.2	7.72
Dumps	0	3.83	0	0	0	0.12	3.95
IR	0	0	0	0	0	0	0
TOTALS	102.0	32.5	25.6	17.9	36.9	1.4	216.3

SB2009 (KlyCluster) Full Power -DRAFT FEB 2 2010							
RF Power	Conv	NC Magnets	Water Systems	Cryo	Emerg Power	Total	
							1.05
3.08	5.49	6.68	0.95	0.46	0.16	16.82	
6.05	0.74	3.42	0.29	1.76	0.10	12.36	
6.12	3.24	4.06	1.15	0	0.13	14.70	
75.72	8.12	0.78	8.87	33.9	0.4	126.90	
0	1.01	2.34	3.20	0.33	0.18	7.07	
0	3.83	0	0	0	0.12	3.95	
0	0	0	0	0	0	0	
92.0	23.6	18.0	15.7	36.0	1.1	187	

Discrepancies in RTML table:

- No cryo power (RDR / SB2009)?
- NC power increases in SB2009
- Same for water

Proposal: move all cryomodules (except 6 in each side, needed for single stage BC) with RF to ML budget.

SB2009 (DRFS) Full Power -DRAFT FEB 2 2010							
Area System	RF Power	Conventional Power				Emerg Power	Total
		Conv	NC Magnets	Water Systems	Cryo		
e-sources	1.05	1.19	0.73	1.27	0.46	0.06	4.76
e+sources	3.08	5.49	6.68	0.95	0.46	0.16	16.82
DR	6.05	0.74	3.42	0.29	1.76	0.10	12.36
RTML	6.12	3.24	4.06	1.15	0	0.13	14.70
Main Linac	75.72	13.54	0.78	9.86	33.9	0.404	134.21
BDS	0	1.01	2.34	3.20	0.33	0.18	7.07
Dumps	0	3.83	0	0	0	0.12	3.95
IR							
TOTALS	92.0	29.0	18.0	16.7	36.9	1.2	194

RTML tables, need correction accordingly

for total (2) RTML

	Total KW	rough location	Qty	Distribution Assumption	KW heat load	LCW supply temperature (F)	Delta T (F)	or Flow (gpm)	KW heat load	temperature	Notes
RTML components											
Magnets	3176	beam	4334	equally distributed in RTML area? & negligible in ML from DR area	3176	95	20	1084	0	104F (40C)	Qty and KW from P.Bellomo 5/9/2007
Cables	942	beam		equally distributed?	0	95	N/A	N/A	942		KW from P.Bellomo 5/9/2007
Power supplies	618	??	3832	equally distributed?	8	95	N/A	N/A	610		P.Bellomo 5/9/2007
RF	3570	beam			3570	95	45	542	0		Jul 14 2009 Nikolai & Marc (50% from RDR)
Racks	550	beam			0	95	N/A	N/A	550		Old Table Oct 2006
Dumps	220	beam		one location (in rtml)	220	95	56	27	0		{RDR showed 250 KW each AL ball dump with 30 gpm } Jul 14 2009 Nikolai & Marc (50% from RDR)
	0	beam		one location (near DT-LTR)	0	95	56	0	0		from dump list 2009 - not used?
	9076				6974				2102		

Misc components											
AC Power Transformers		??								104F (40C)	
Emergency Transformer		cavern									
Fancoils		beam									
Dehumidifer		beam									
Water Pumps		cavern									
Lighting		beam									
	0				0				0		

Summary

- ▣ Some changes in table are needed to accommodate changes in RTML layout proposed for SB2009 baseline.