ILC RTML Upgrade in SB2009

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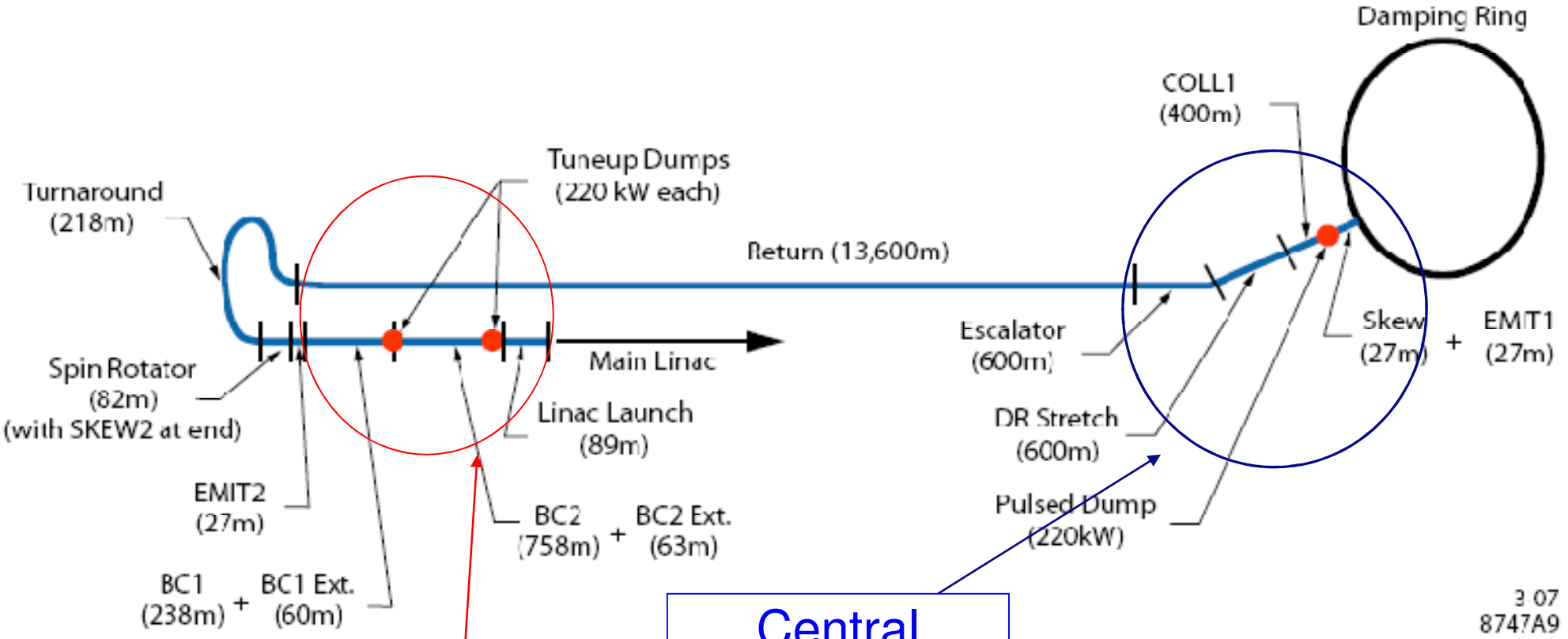
Fermilab

SB2009 vs. RDR

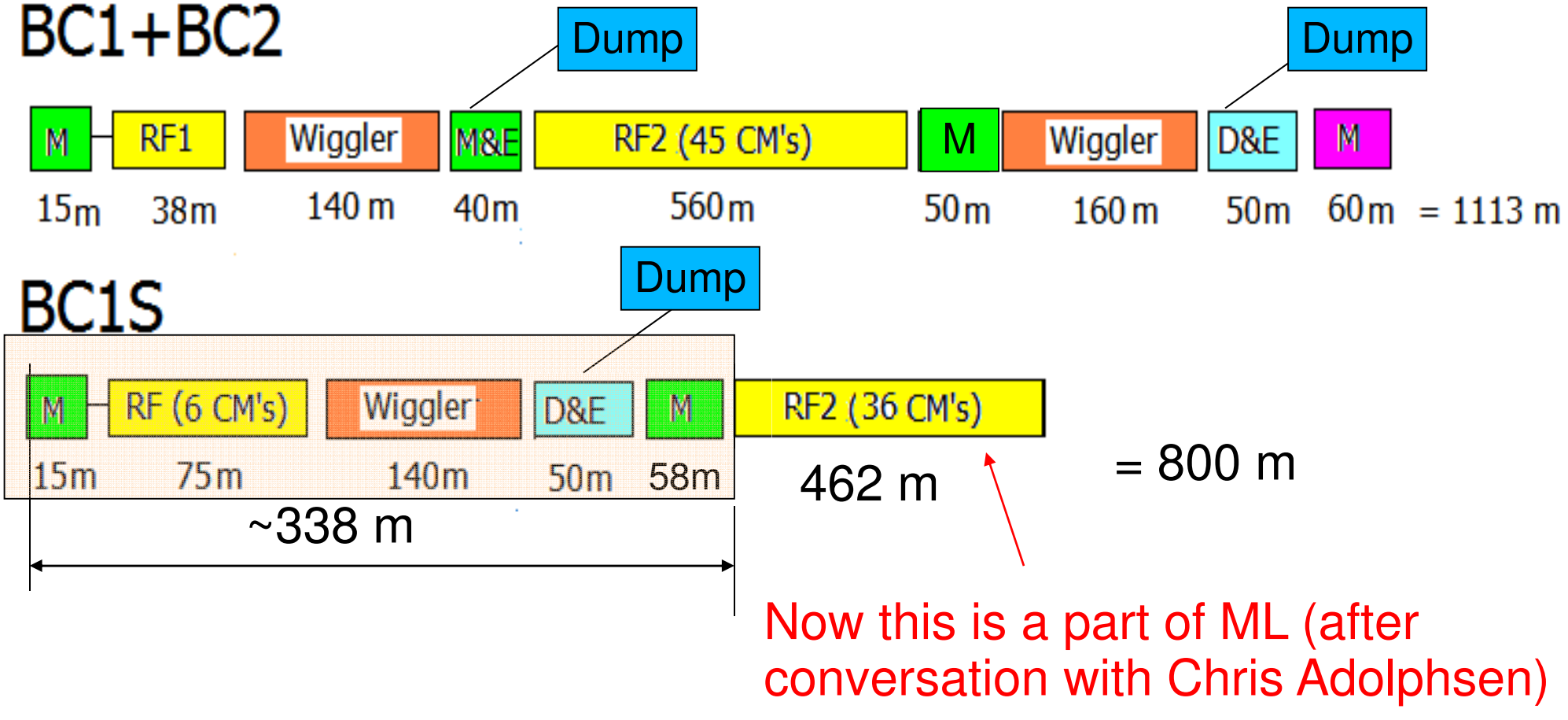


Single-stage BC

Central Integration Area

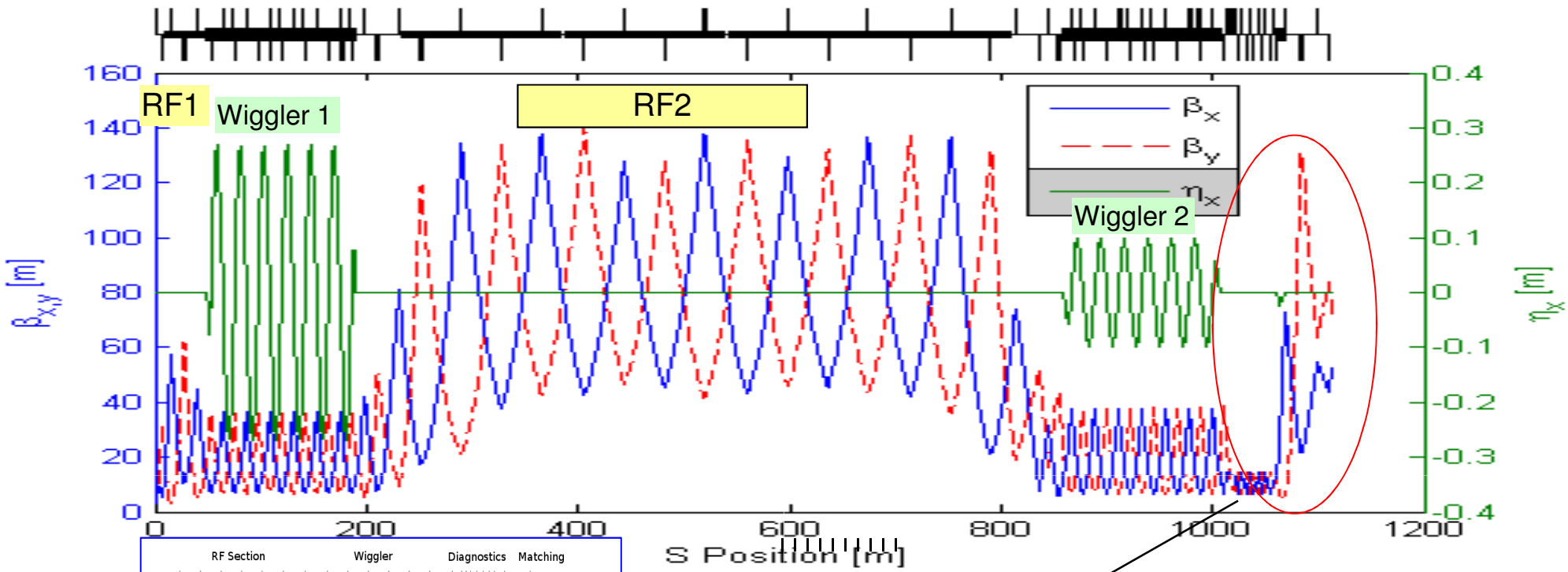
Redesign

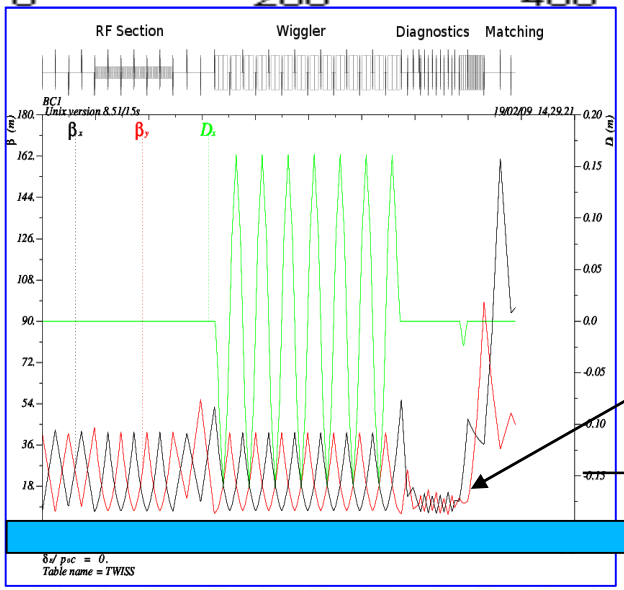
Single stage Bunch compressor



- Length saving: 1113 - 800 ≈ 310 m

ILC Baseline 2-stage Bunch Compressor



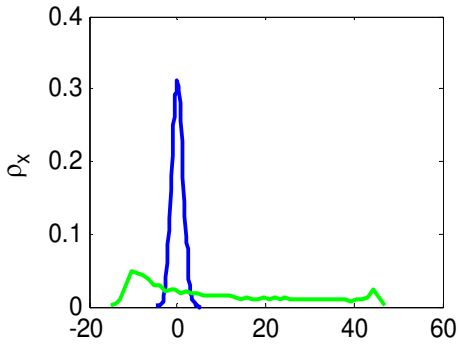


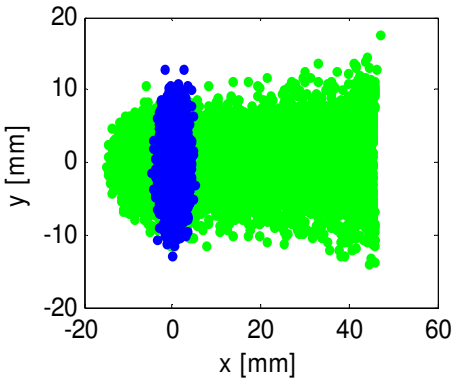
Pre-linac: 4.3→15 GeV – part of ML
36 CM's (12 RF)
Length ~ 460 m

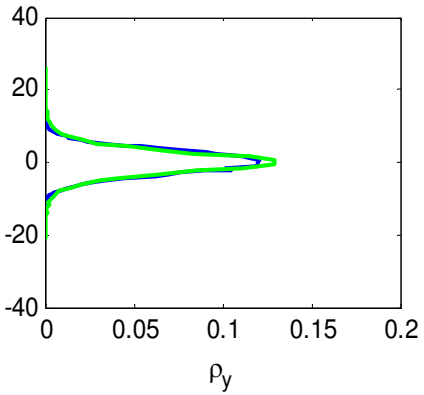
New design for extraction Line

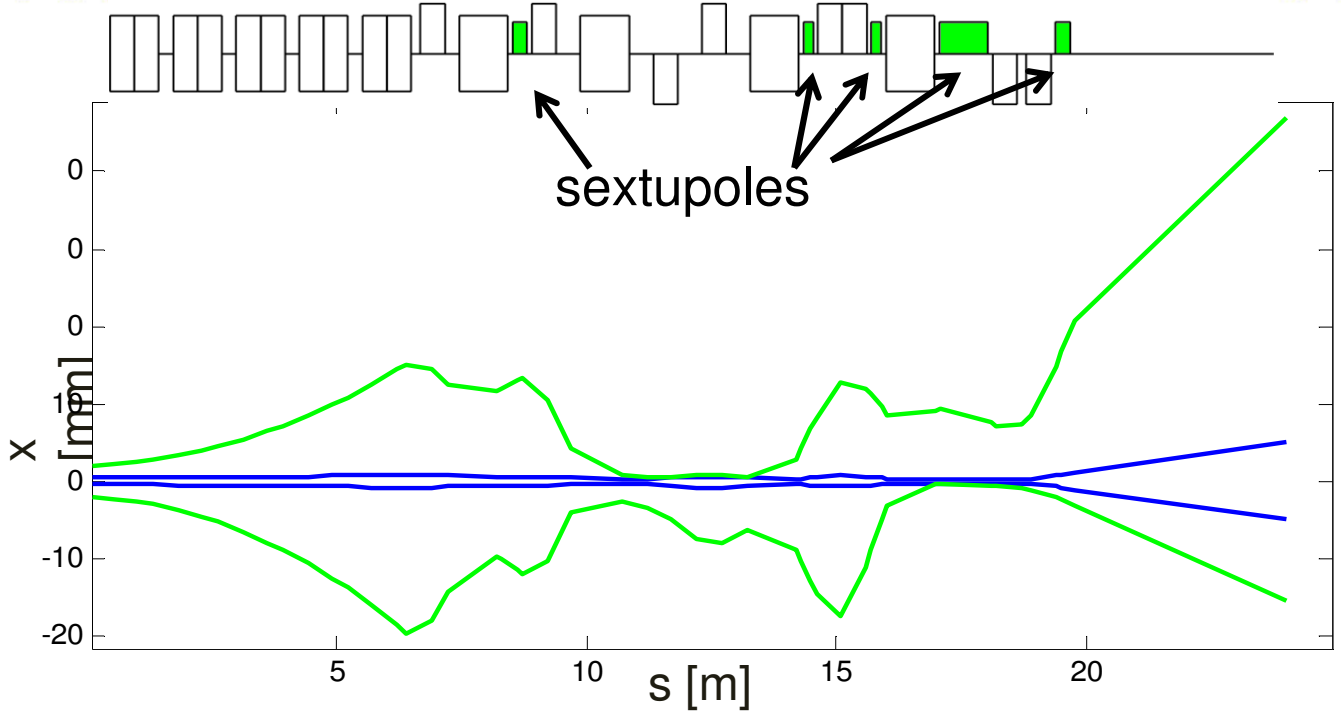
- 5 GeV, 6mm, 0.15% energy spread beam

- 4.3 GeV, 0.3mm, 3.54% energy spread beam









- We found the solution with sextupoles distributed through the extraction line.
- Dump window of nominal 12.5cm diameter is work for both beams
- There is no need in additional collimation, SC magnets or exotic sextupoles.

S. Seletskiy

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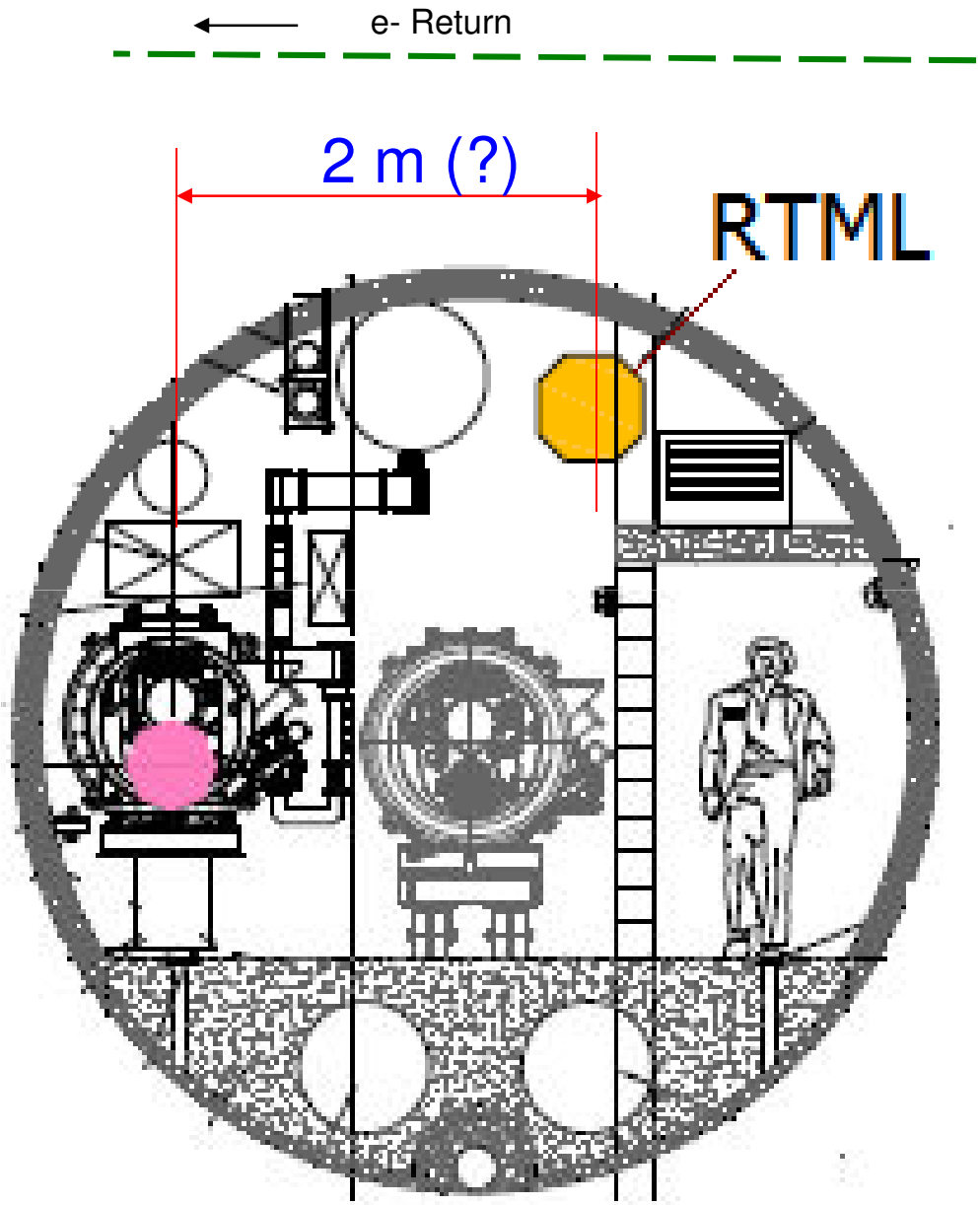
Final EL Design

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					

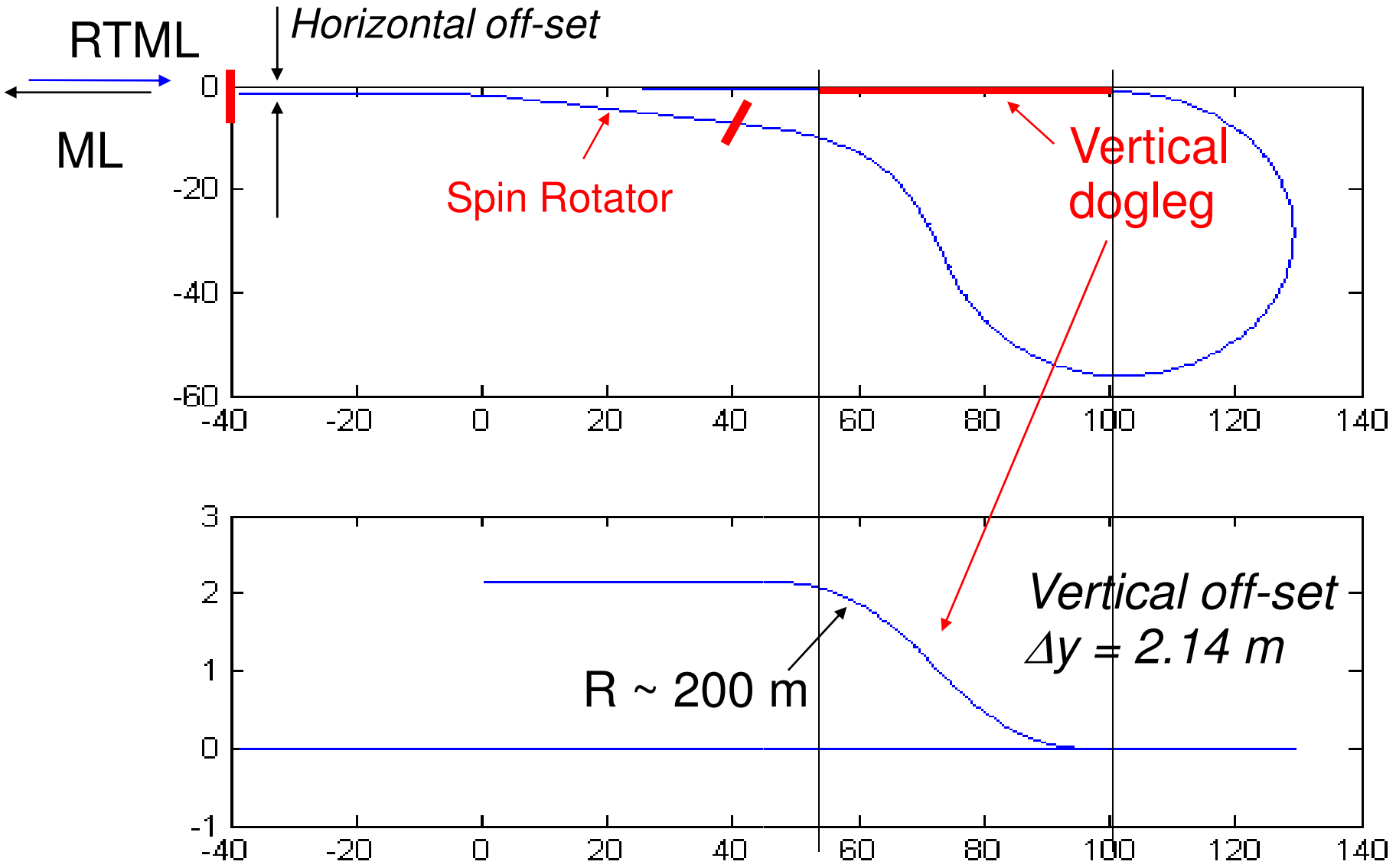
- The Extraction Line is 24m long.
- Beam size on the dump window is 17mm^2 in low energy spread case and less then 70mmx40mm in high energy spread case.
- Dump is separated from the main beamline by 5.1m.

Return Line

- Equal length for both electron and positron lines
- Weak FODO lattice at ML ceiling elevation (1Q/~36m)
- Separated from ML line by ~2m in horizontal and ~2m vertical plane
- Vertically curved tunnel thru ML area
  - **Dispersion matching via dipole correctors**
- Laser-straight tunnel thru BC area

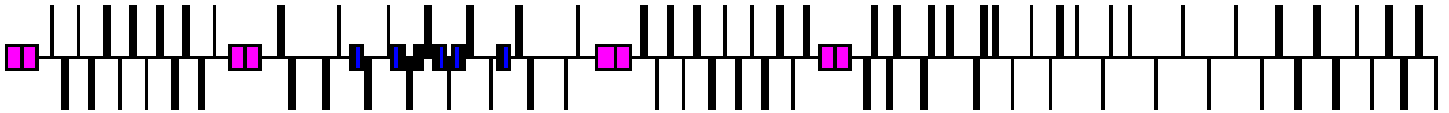


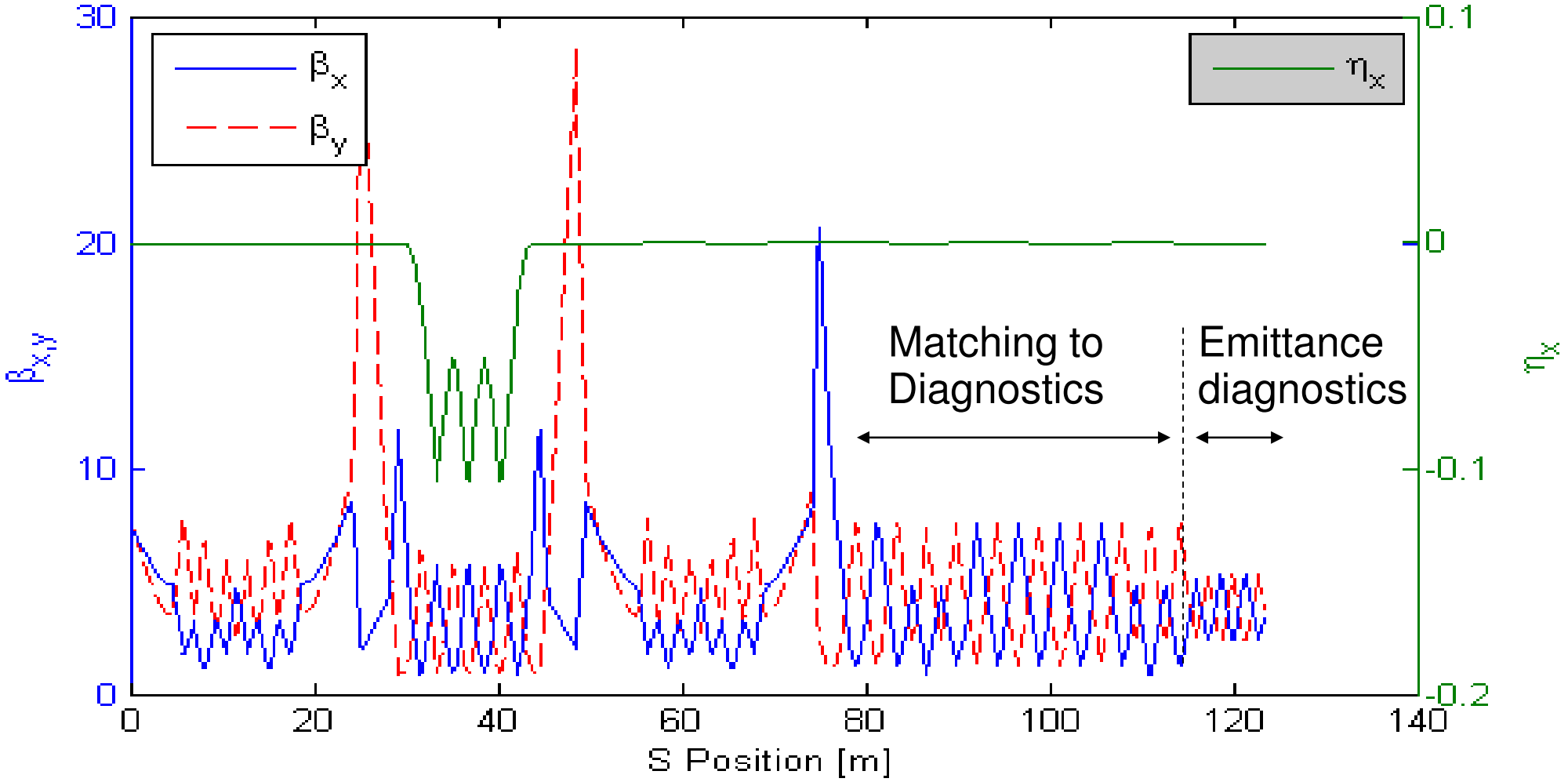
Turnaround with Spin Rotator



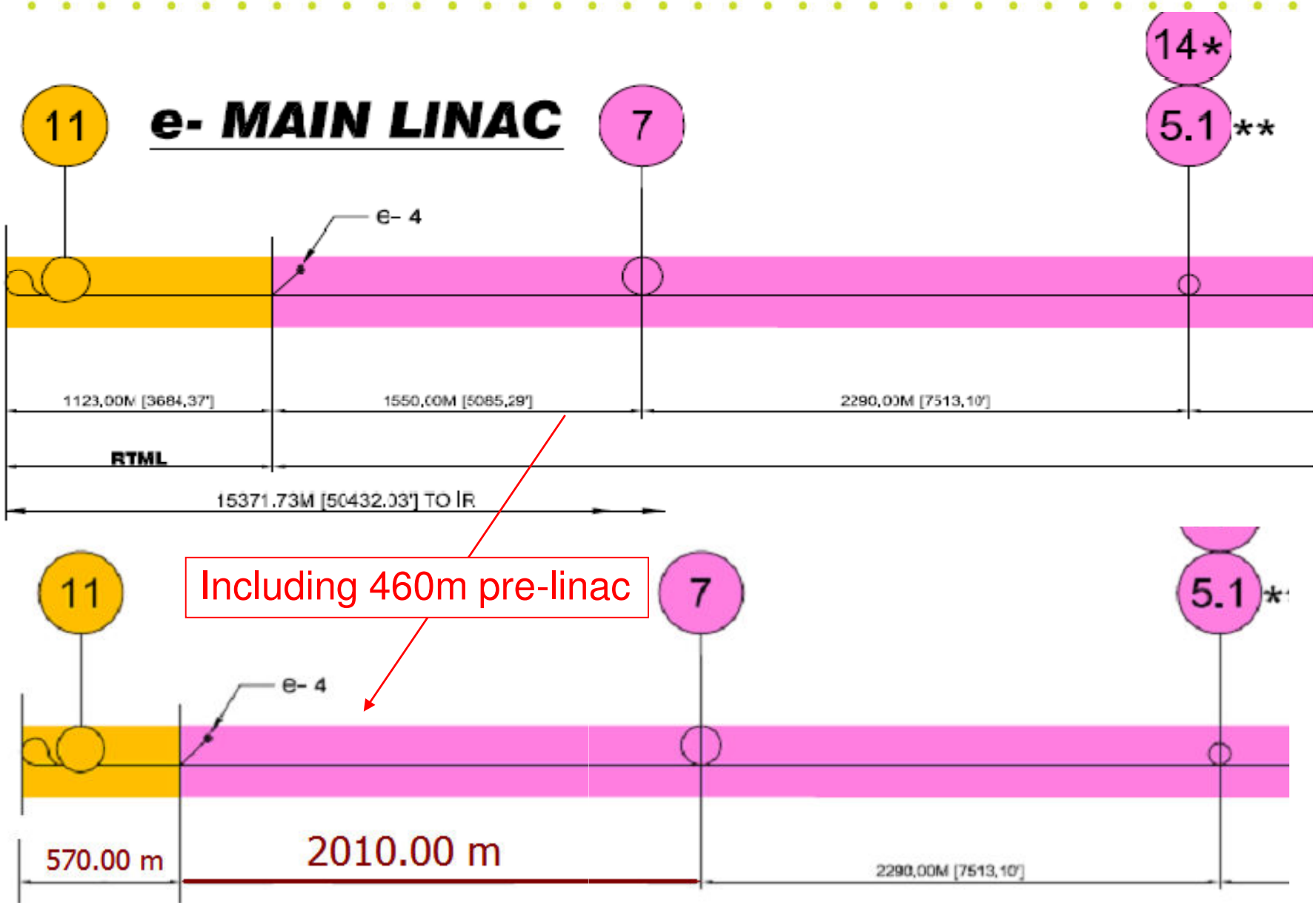
Horizontal off-set between RTML and ML increased to ~2m

Spin Rotation with emittance diagnostics



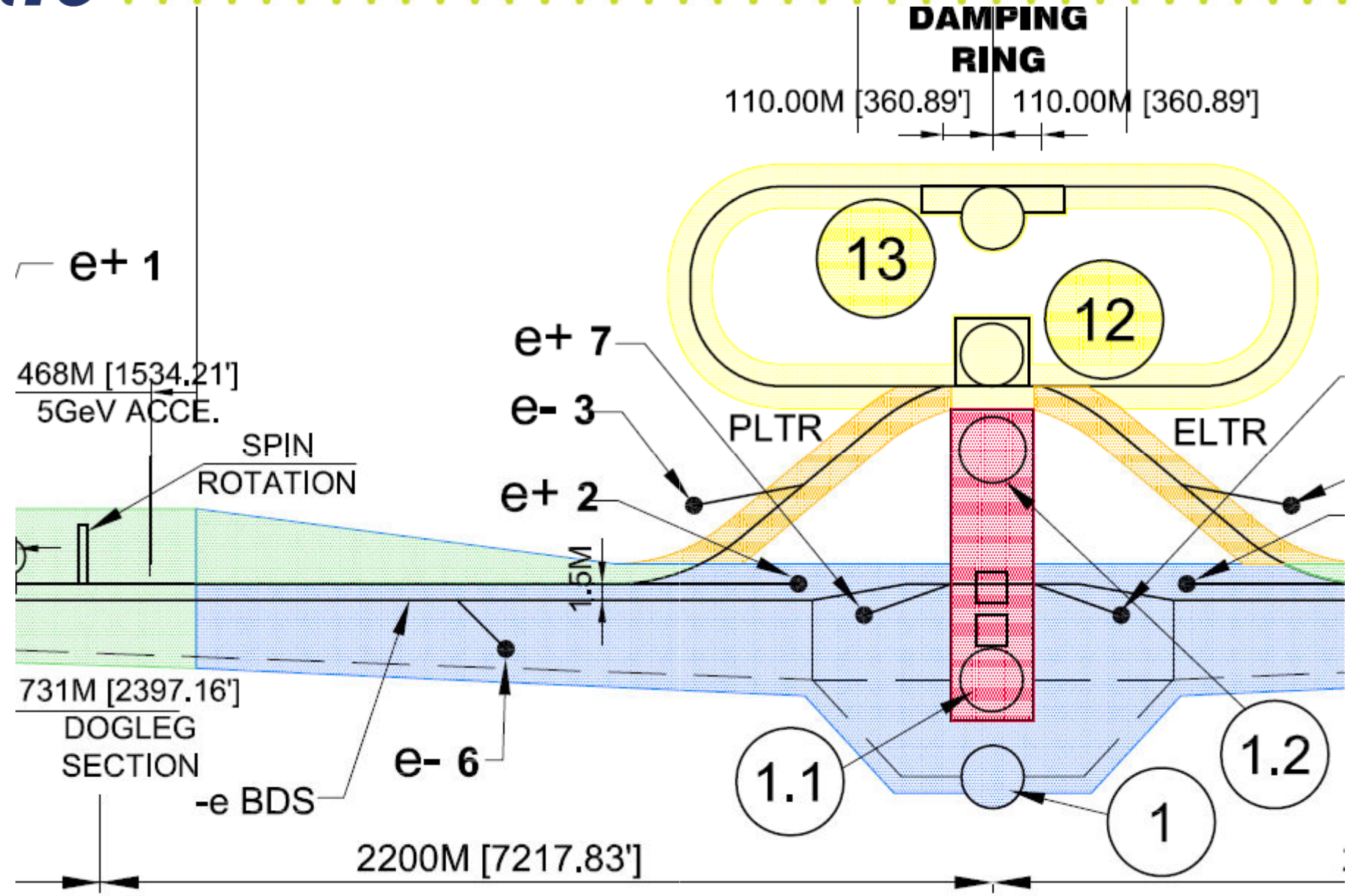


Corrections in CFS drawings

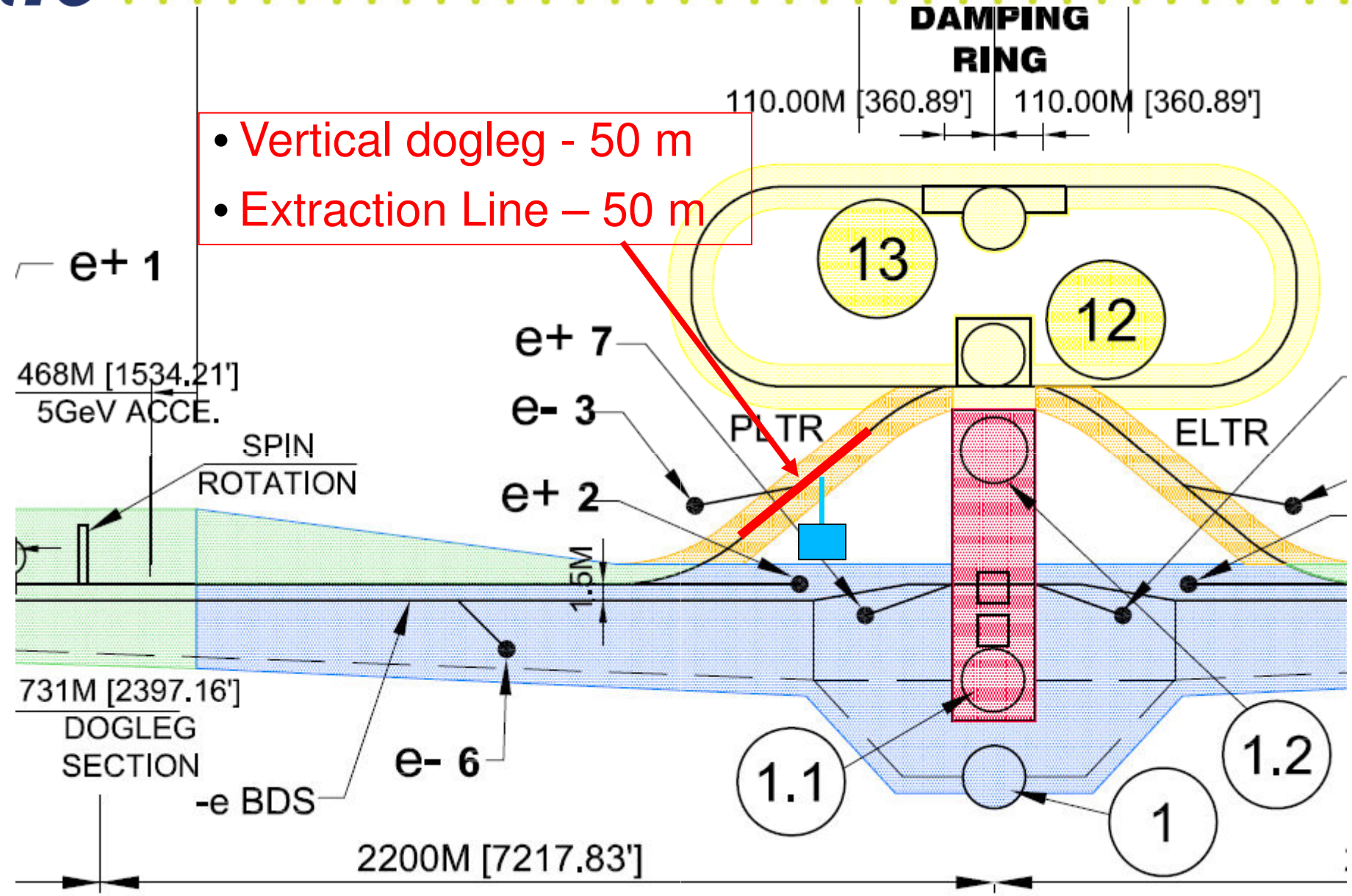


Final length should be agreed with ML area

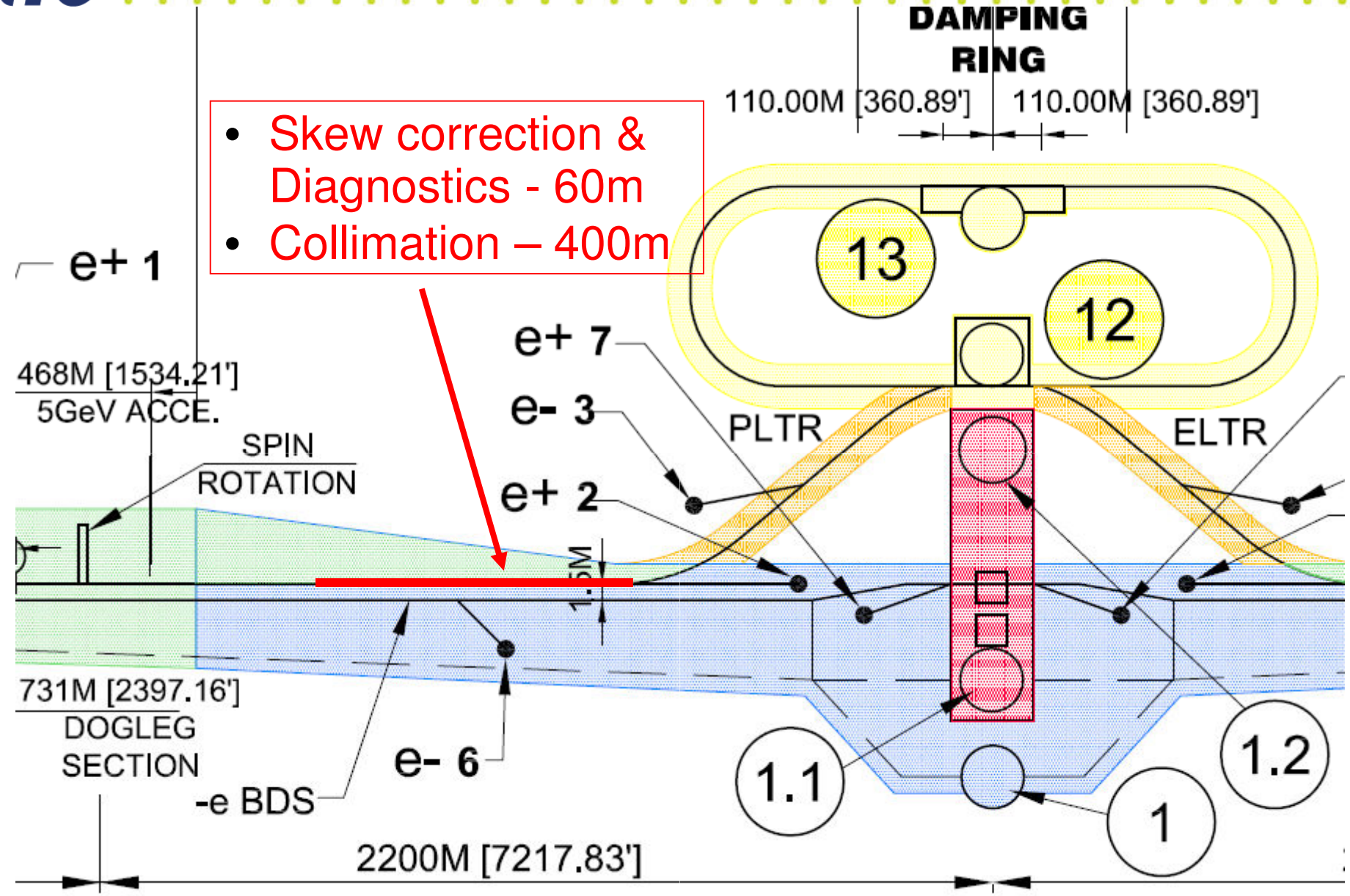
RTML configuration in Central Area



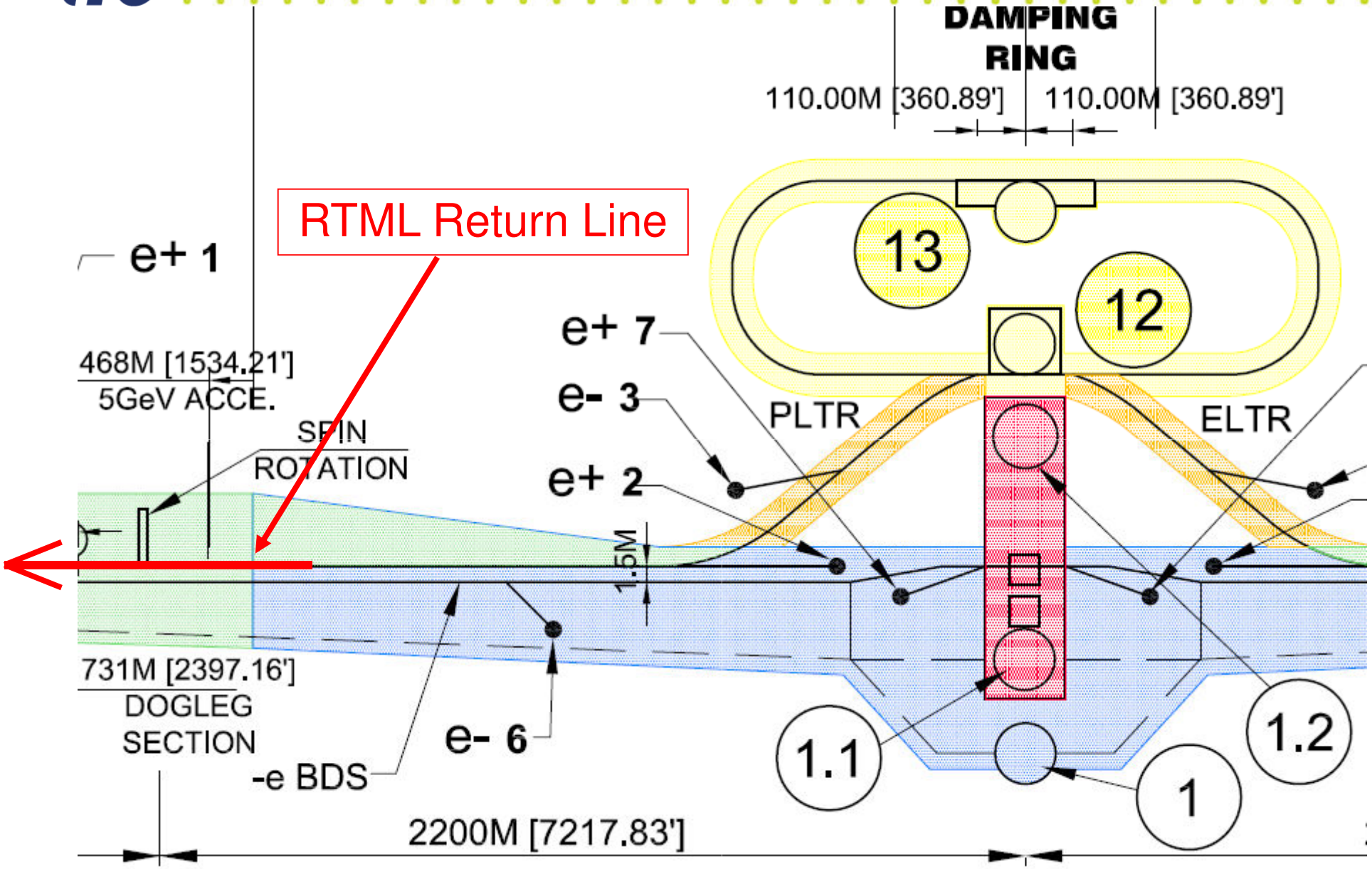
RTML configuration in Central Area



RTML configuration in Central Area



RTML configuration in Central Area



“Getaway” Straight (or “DR Stretch”)

- RDR ~1100 m long

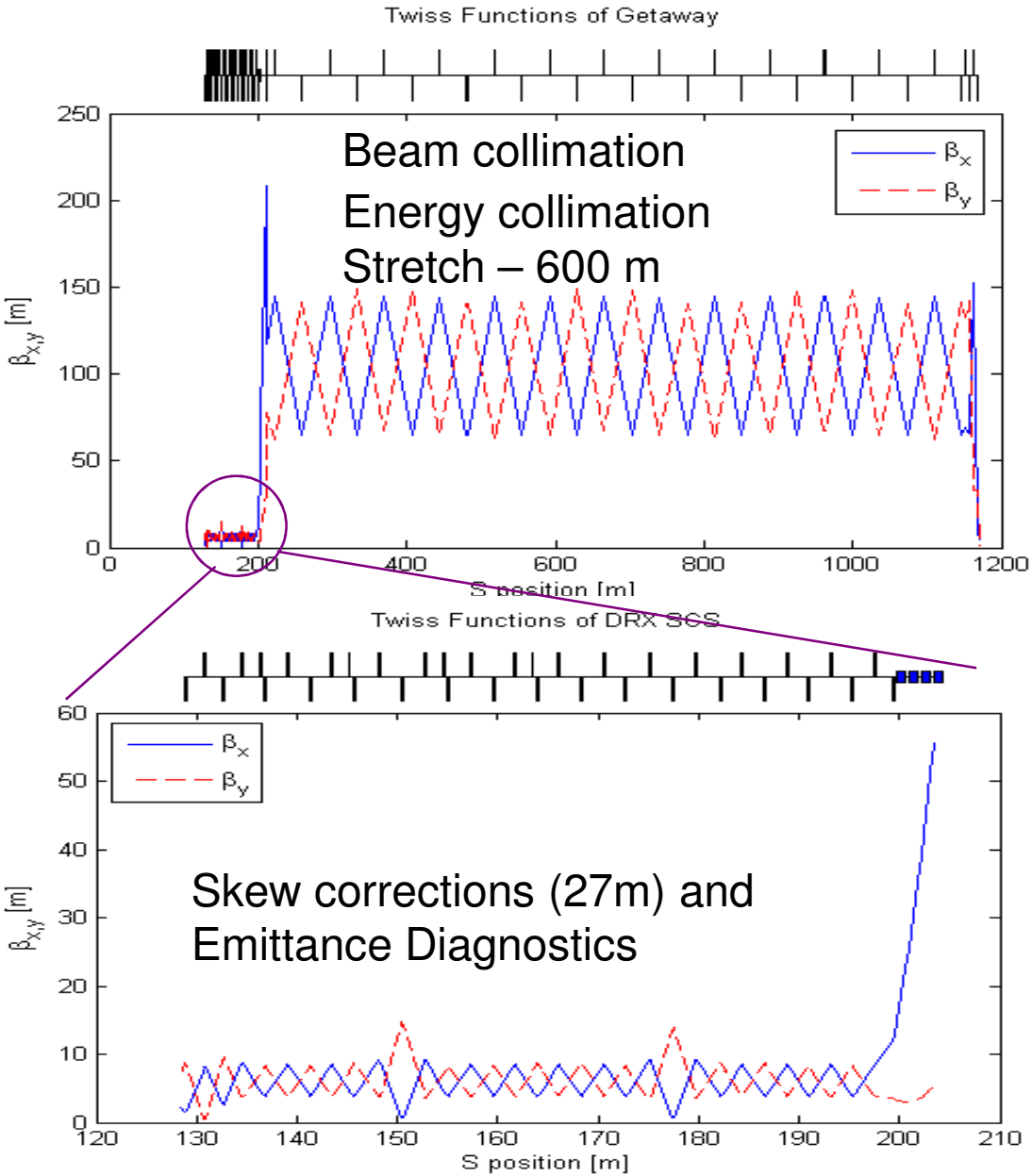
Has two parts

- **“Low-beta” region with decoupling and emittance measurement ~ 60m**
- **“High-beta” region with collimation system,**
  - optics as in Return line

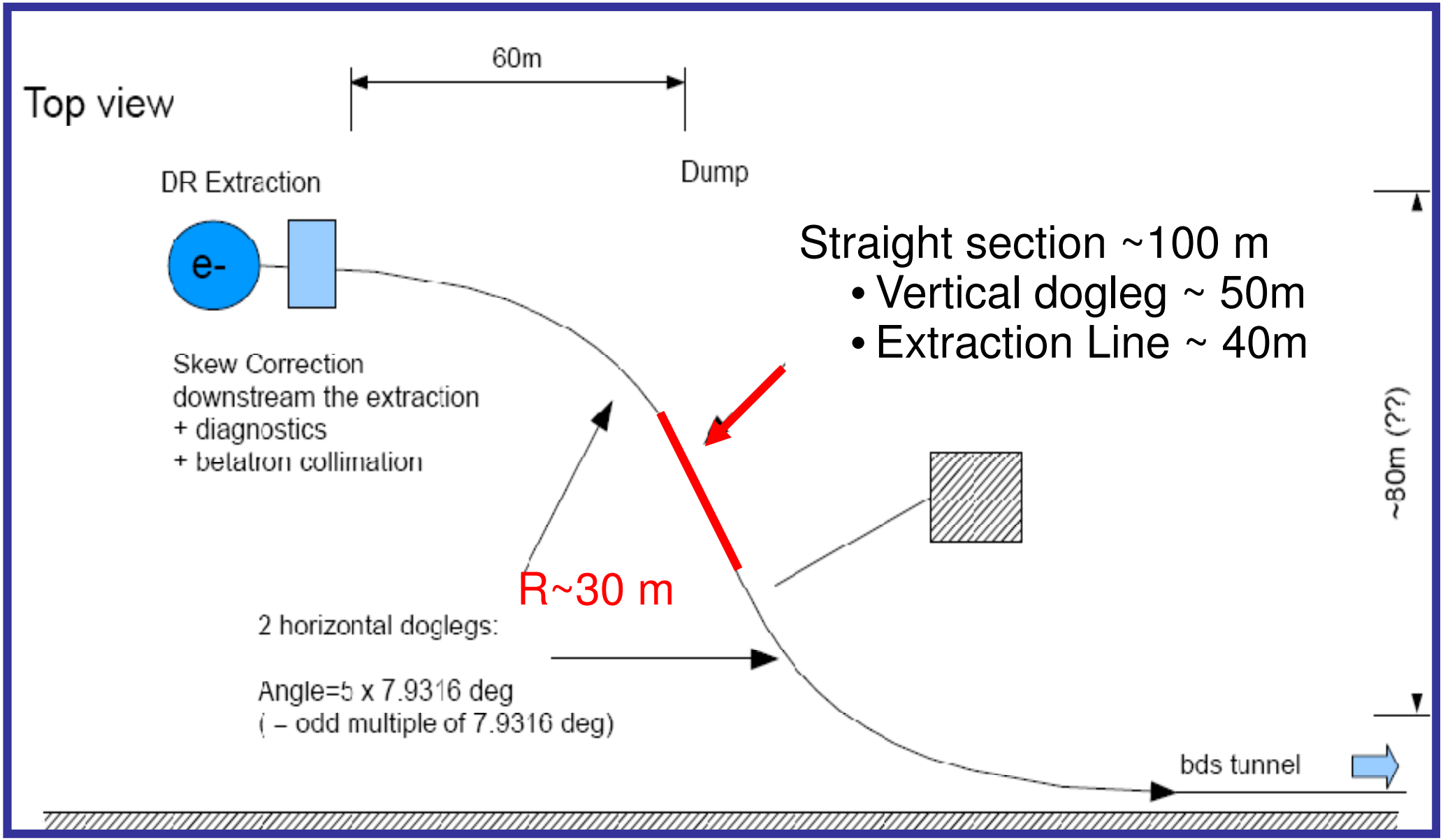
- Includes PPS stoppers

Modification:

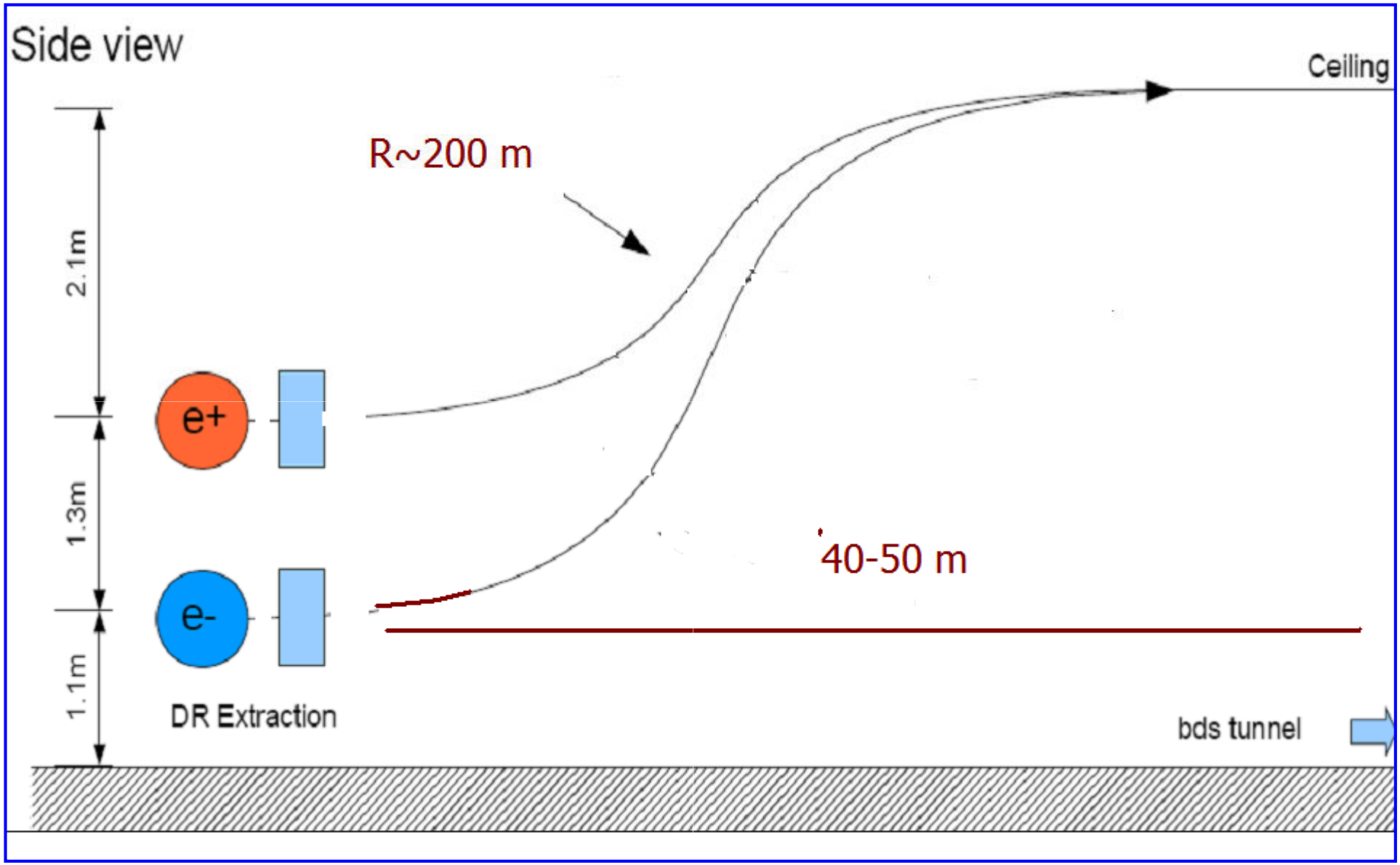
Length can be reduced up to ~500m by shortening of stretching section



RTML Central Area – Horiz dogleg



Vertical dogleg in straight section



Main issues and R&D

- Lattice design for RTML line in central area
  - **Most system can be adopted from RDR lattice**
  - **Matching Sources and SFC constrains**
  - **Draft design in 2-3 months**
- RF power line from cluster for 6 CM's
- Small Cryogenic for 6 CM's and 4 SC solenoids
  - **Cryogenic transfer line in tunnel (~300 m)**
- Alcoves for electronics and PS
- Re-visit heat loads information for CFS
  - **Oct.15 – spread sheet for major components**
- Complete Information for Cost estimation
  - **Oct.9 – magnet spreadsheet for proposed changes in central area**
  - **Final cost after lattice design complete**

Summary

- Single stage Bunch Compressor is designed and studied. Design looks feasible:
  - **Emittance growth in bunch compressor can be effectively controlled, by using movers to adjust tilt of the cryomodules.**
- Extraction line is redesigned to accommodate bunch with a larger energy spread after BC.
- Proposal for changes of RTML lattice in central area. Next step – lattice design. Time scale – 2-3 months
- Cost estimation and CFS design in progress