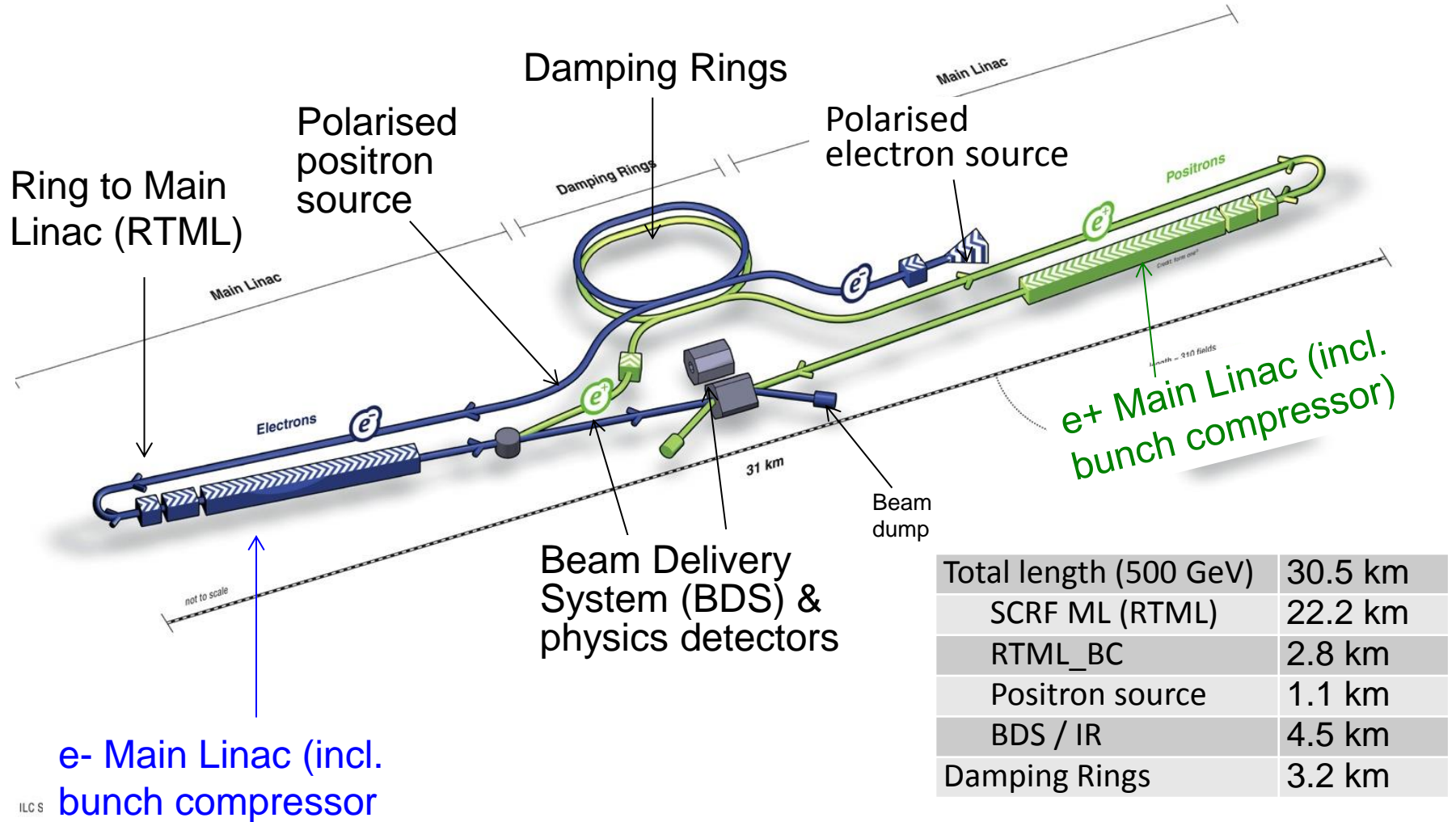




ML (BC) Studies update

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Arun Saini





Outline

- **Discussion of Discrepancies between EDMS Lattice and TDR lattice of Bunch Compressor**
- **An Insight view of Bunch compressor section (BC1 to BC2)**
 - Tracking nominal bunch (3sigma); acceptance plot
 - Aperture limitations. Beam losses at Wiggler in BC1 even for nominal operation during tracking of 4sigma (Gaussian).
- **List of critical failure modes under studies**
 - Discussion of a case of RF Phase errors in Bunch Compressor (BC1) section.



Bunch Compressor : EDMS lattice vs. TDR Lattice

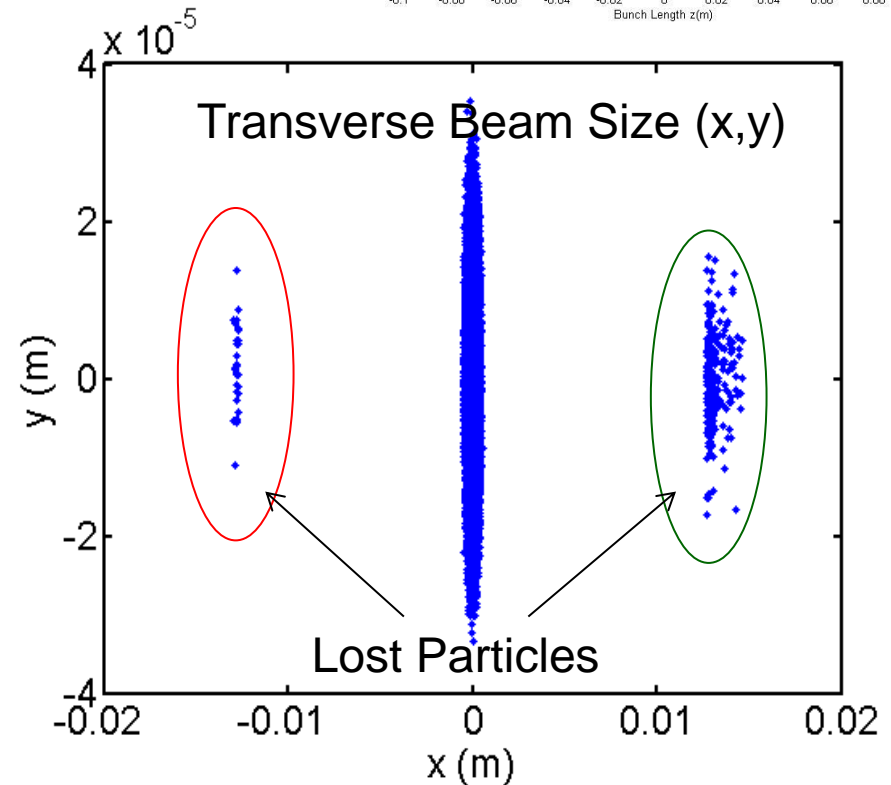
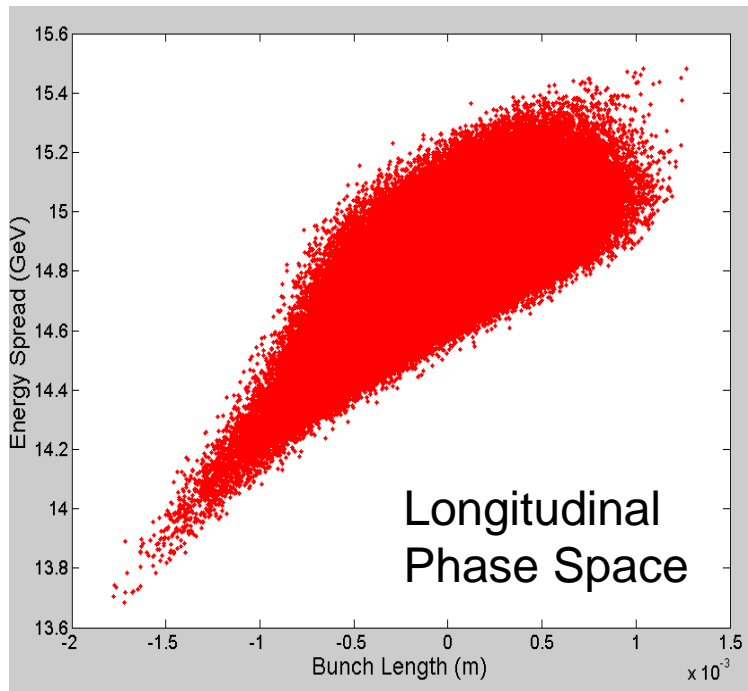
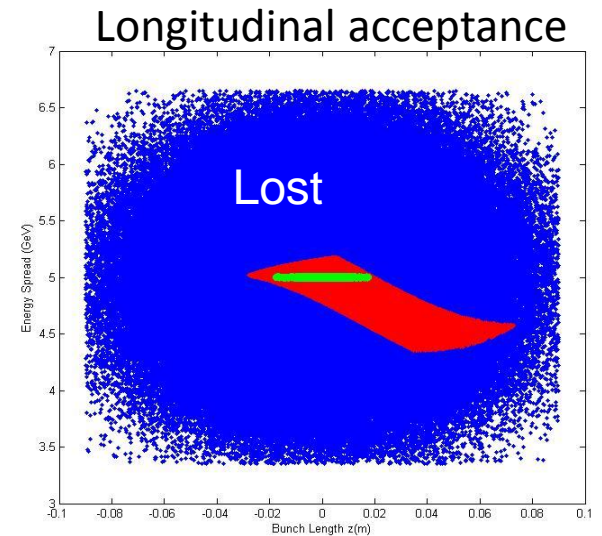
Parameters	EDMS Lattice			TDR Lattice		
	BC1 start	BC2 start	BC2 End	BC1 start	BC2 start	BC2 end
dp/p, %	0.15	2.25	1.95	0.11	1.42	1.1
σ_z , mm	9.6	1.4	0.357	6	0.89	0.324
E (GeV)	5	4.88	15.00	5.0	4.80	14.85
Grad/RF Phase (MV/m)/ deg	18.0 /- 104.9	28.19/- 27.57	-	18.66/-115	25.48/-24.0	-
Total Length	-	230.804	1138.72	-	230.845	1138.772

- EDMS Lattice is received from M.Woodley.
- TDR lattice was used for studies published in TDR report.



Nominal operation of BC

- Tracking of 4 sigma Gaussian Distribution of Beam results in Beam losses at Wiggler in BC1
- Horizontal aperture/ radius of wiggler magnets is 12.7 mm ? (should be X/Y = 400mm x 25mm)



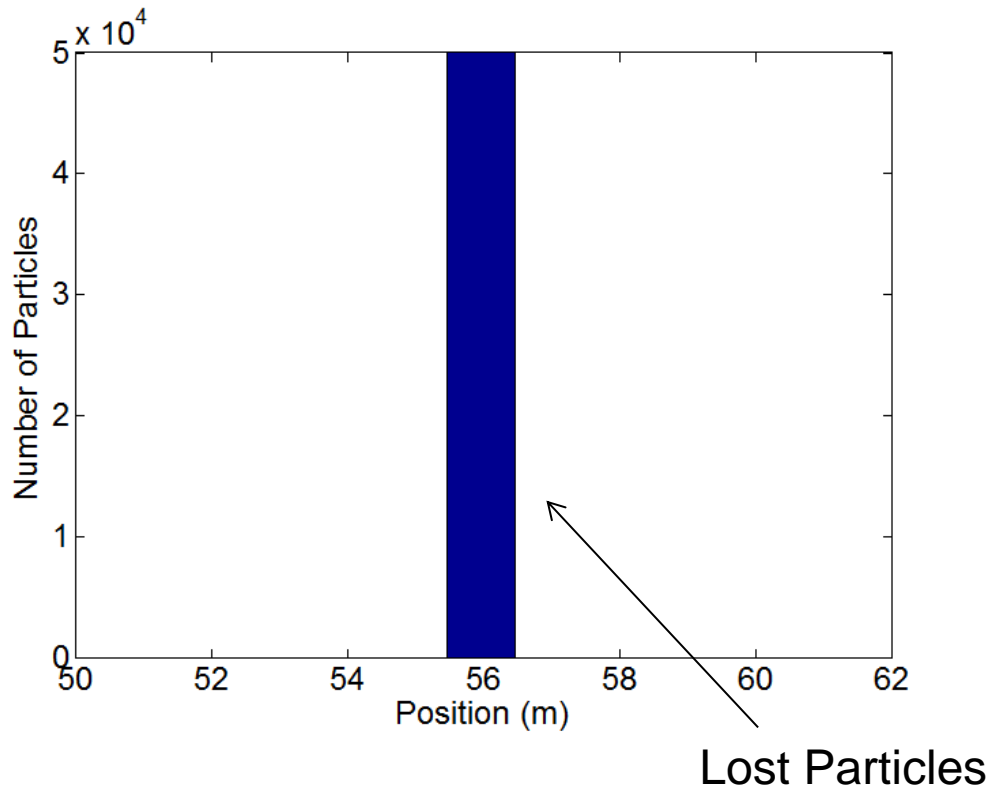


Topics Under Studies: Failure Modes

- **In order to understand single bunch loss scenarios we need to study different failure modes and to quantify their severity at critical locations:**
- **Failure Modes in Bunch Compressor and Main Linac :**
 - RF Phase and Amplitude Errors
 - Magnet failure
 - BPM and steering magnets failure



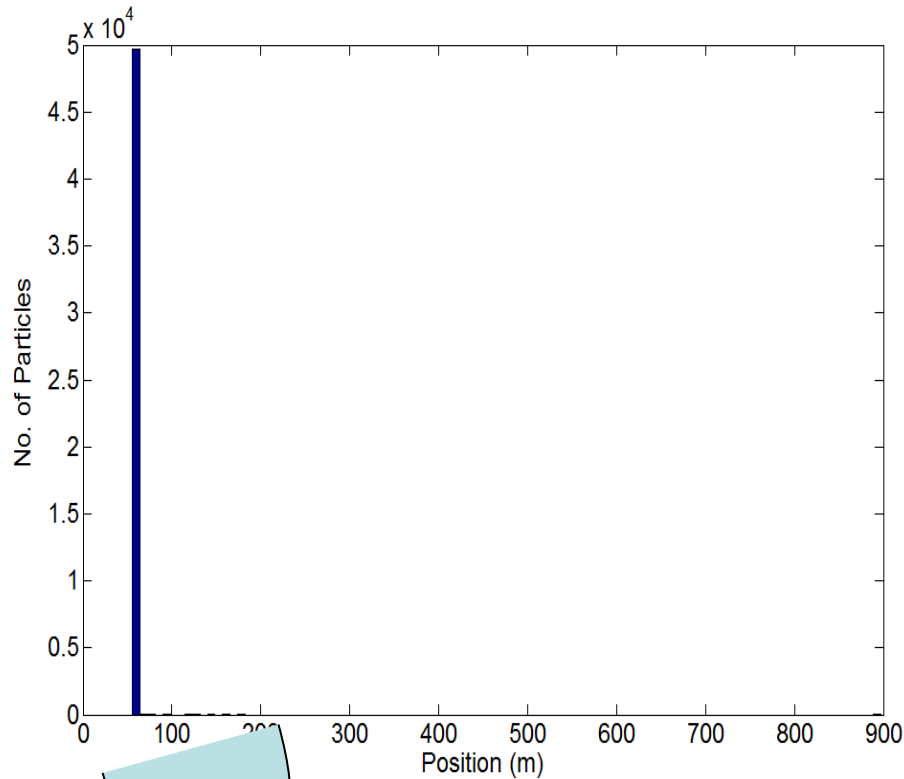
A Case Study: RF Phase errors in BC1-(1)



- RF Phases in all cavities in BC1 are changed from -115° deg to 0° degree.
- Complete beam is lost at wiggler magnet at 56 m in BC1.
- RMS Transverse beam size at lost location : $\sigma_x = 262 \mu\text{m}$ $\sigma_y = 6.1 \mu\text{m}$.
- **Beam power density is lower than critical power density.**



A Case Study: RF Phase errors in BC1-(2)



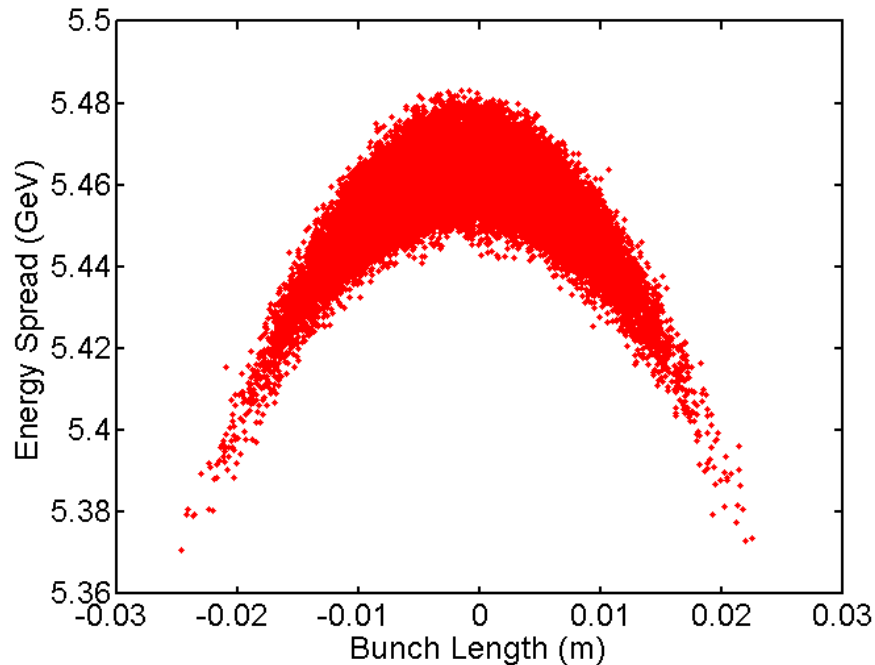
Lost Particles

- RF Phases in all cavities in BC1 are changed from -115° deg to -180° degree.
- Majority of particles are lost in BC1.
- RMS Transverse beam size at lost location : $\sigma_x = 523 \mu\text{m}$ $\sigma_y = 7.8 \mu\text{m}$.
- **Beam power density is lower than critical power density.**

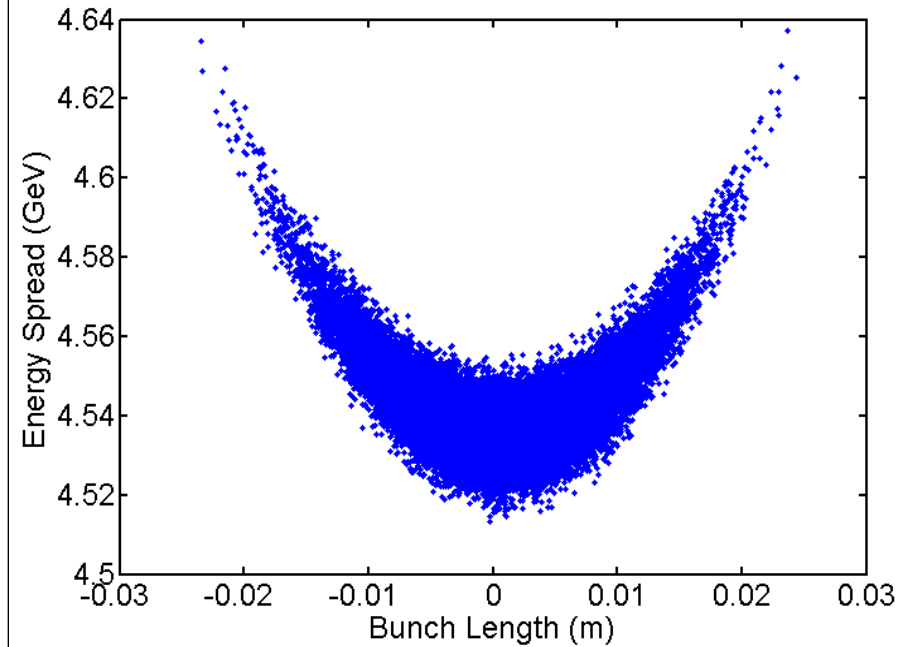


A Case Study: RF Phase errors in BC1-(3)

Longitudinal Phase Space when
RF Phases in Cavities are 0°



Longitudinal Phase Space when
RF Phases in Cavities are -180°



Longitudinal phase space of the beam just before beam get lost



Summary and next steps

- **Need to update Bunch compressor lattice files in EDMS database**
 - M. Woodley will update BC1&BC2 lattices, incl. apertures
 - Treaty point before between RTML and ML (BC)
 - Sergei Seletskiy will perform update in BC2 and extraction dump lines (not highest priority)
- **Extensive studies are required to understand criticality of failure modes. It will help**
 - To quantify various failure modes in terms of their severity
 - To design better Machine Protection System
- **Different scenario of dark current generation in CM is completed (reported). Fluka model of CM will start next (with help of KEK (and SLAC/ M.Santano))**