



RTML progress 2008

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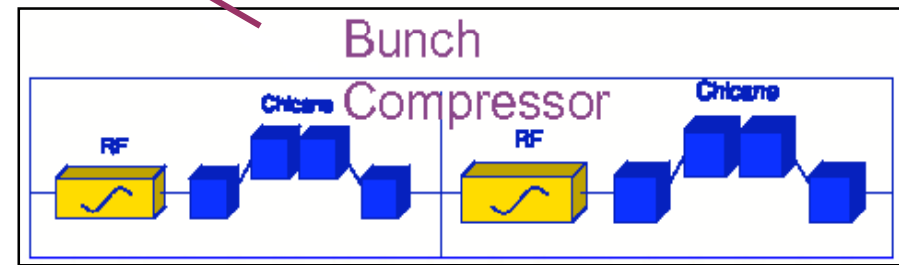
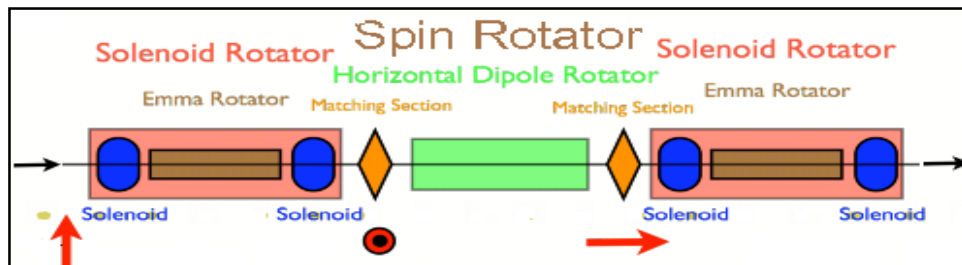
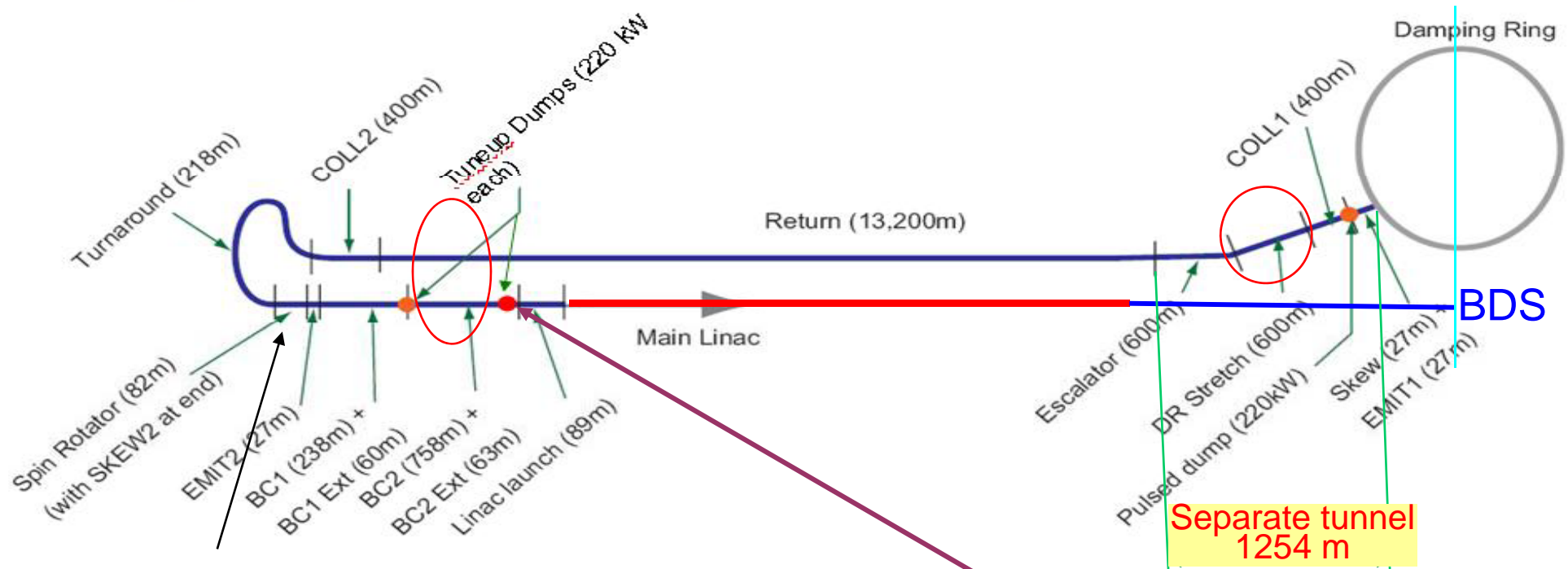
RTML status

- Very limited resources available in FY08 due to funding cut
- R&D plans and milestones, discussed at SLAC LET meeting, Dec.2007 were delayed.
- Nevertheless few important studies were accomplished.
- New task: Support Minimum Machine configuration – Single-stage Bunch Compressor studies



RTML Schematic

Note: e- and e+ RTMLs have minor differences in Return line (undulator in e- linac side) and Escalator (DR's at different elevations); they are otherwise identical.





RTML Progress in FY2008

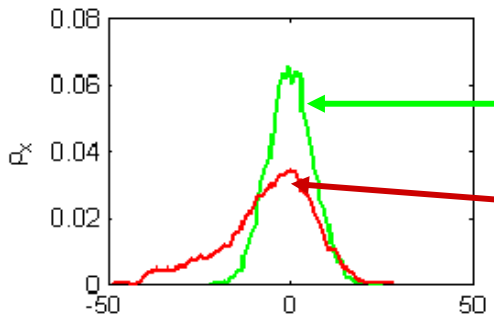
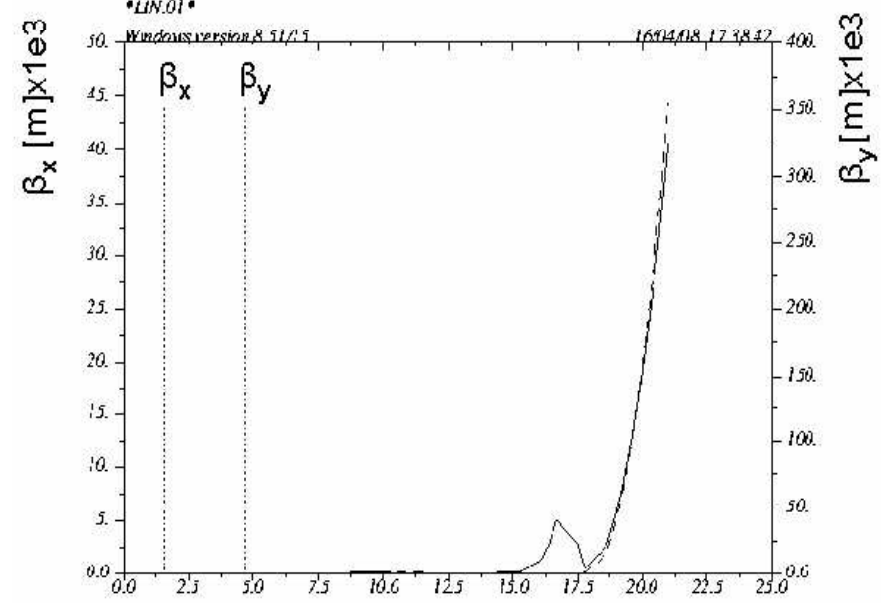
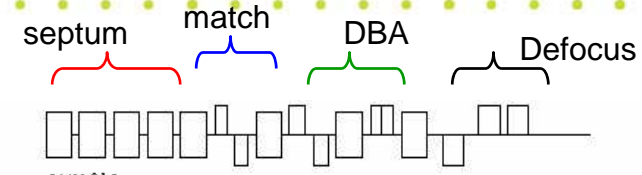
Technical Systems

- Design and preliminary studies of three Pulsed extraction lines for emergency beam abort (MPS) and tune-up (*S. Seletskiy talk*)
 - **Different beam parameters and requirements**
 - **Specifications for all elements (magnets, kickers, septum magnets, collimators, etc.**
 - **Documentation: Report, SLAC preprint, EPAC08**
- Re-evaluation of the Vacuum system for RTML return line (*Xiao Qiong, IHEP/China*)
 - **Conceptual design of vacuum system and specs for SS passivated and non-passivated tubes.**
 - **Component counts and Cost estimation.**
- Magnetic Stray field studies (tight requirements for return line) – (*D.Sergatskov talk*)
 - **ILC: $H < 2 \text{ nT}$ ($f > 1\text{Hz}$); CLIC: $H < 0.2 \text{ nT}$ ($f > 10\text{Hz}$)**

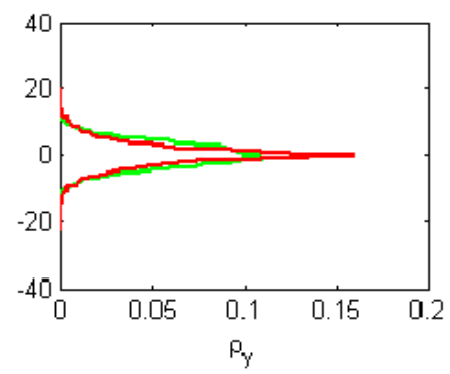
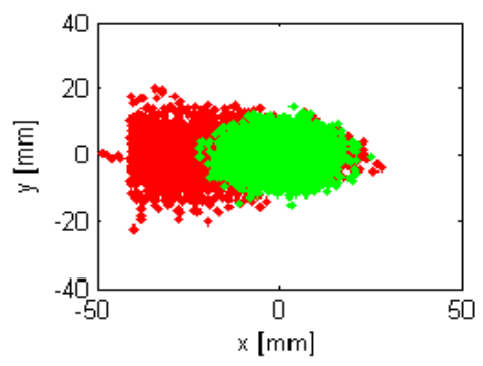


EL_BC1 Line Design

- Separation of the two lines at CM location (14m down) - 2m;
- Separation of the dump and the ML ~5 m;
- DBA to decouple dispersion and beam size issues
- Beam size on the dump window ~15 mm²
- Length = 20.7 m



0.15% energy spread
2.5% energy spread

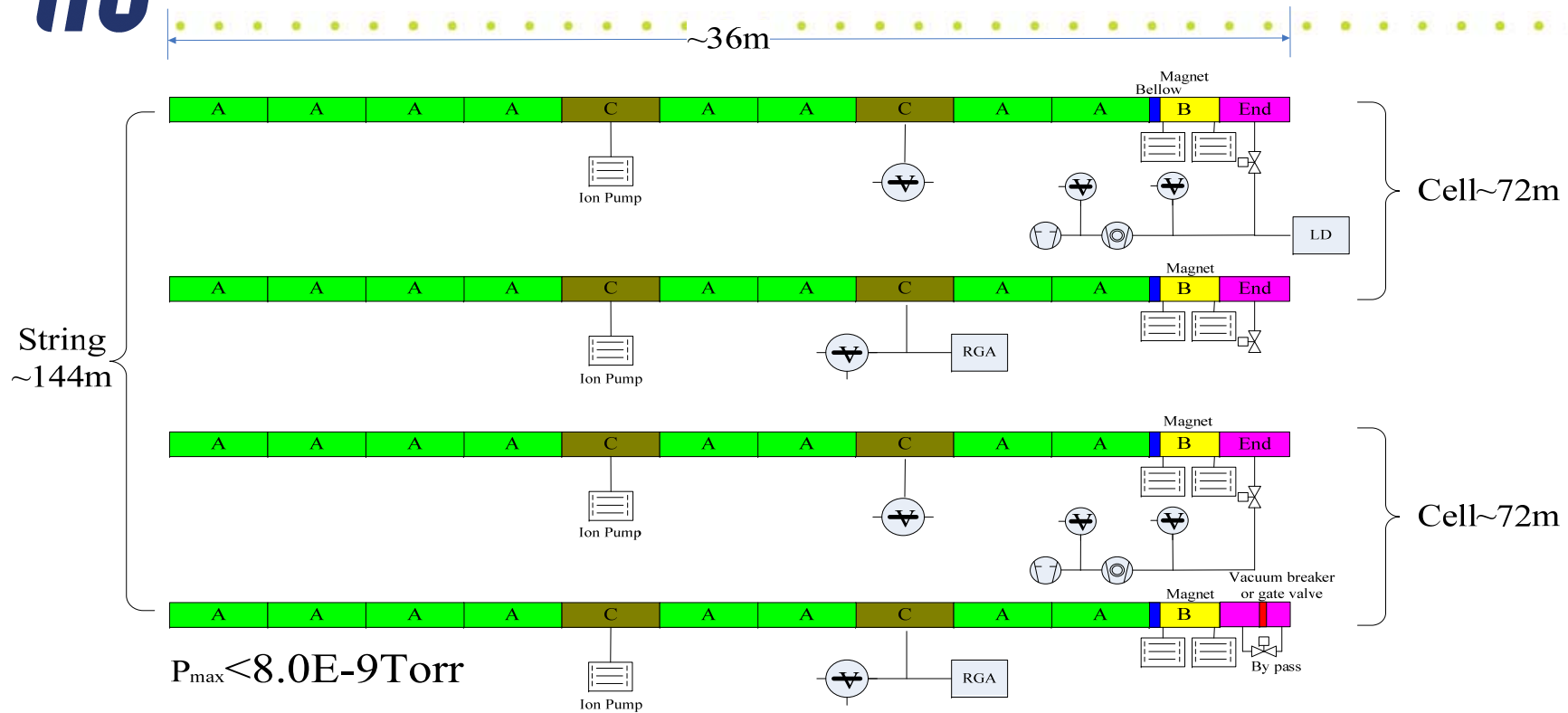


- Two collimators to protect downstream triplet
- intercepts 3.9 kW/train and 18.8 kW/train

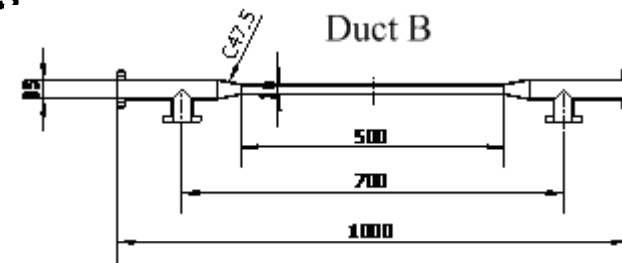
(Details in S.Seletskiy talk)



Return line Vacuum system (Xiao Qiong, IHEP/China)



- 86 curved strings followed by 8 straight strings
- 1 bellow/1 quadrupole magnet,
- If one string uses vacuum breaker, the next string uses gate valve.
- passivated SS, ID=35mm, in magnet ID=16mm





Lattice design and Beam physics simulations

1. Effect of RF kick and wakefield effect from cavity couplers

- Simulations of the coupler induced RF kick and wakefields (FNAL, DESY, SLAC) – *(S.Yakovlev talk)*
 - **in ILC baseline cavity with different configurations of HOM couplers**
 - **In coaxial coupling section (new proposal) - ongoing (S.Yakovlev)**
- Effects of couplers in ML (FNAL, DESY) – *(D.Kruecker and A.Latina talks)*.
- Effect of couplers in 2-stage baseline Bunch compressor and 1-stage BC (FNAL) – *(A.Latina talk)*



Summary: RFKick + Wakes

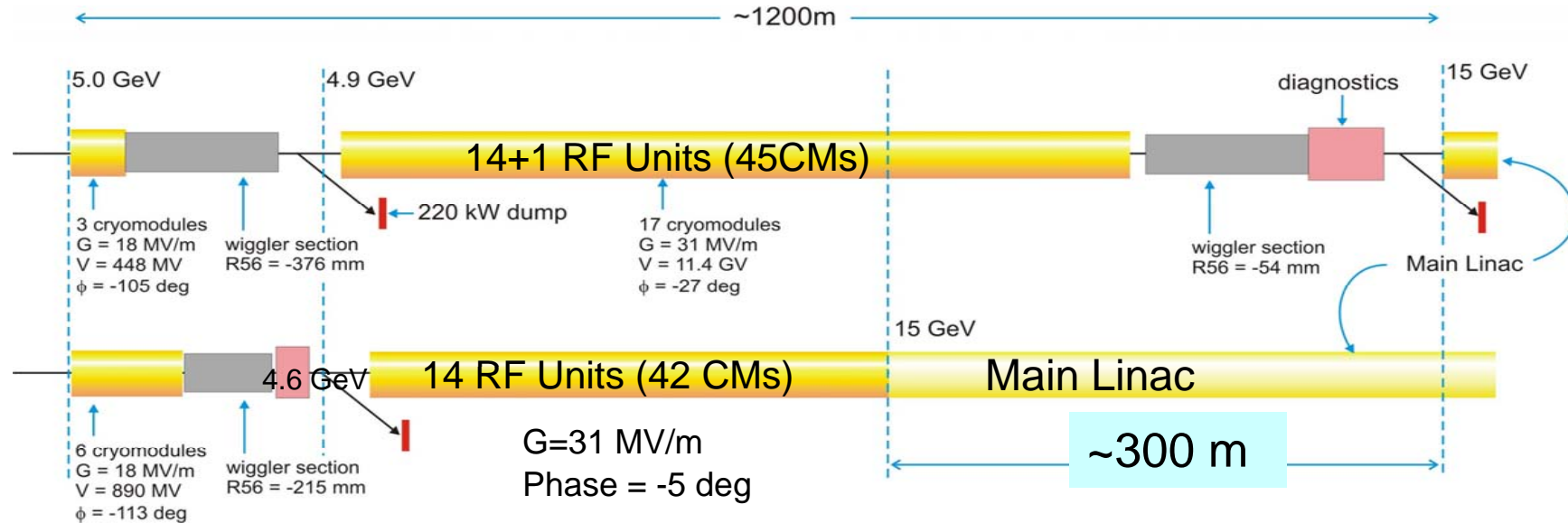
ML	old	new	alternate
no correction	50.168	7111.7	611.17
1-to-1	0.66957	11.429	0.95280
1-to-1 disp free	0.61000	3.3888	0.27690
BC1	old	new	
no correction	5.3064	96.867	
1-to-1	3.1481	103.64	
1-to-1 disp free	0.83140	15.444	
BC2	old	new	alternate
no correction	9.0382	7147.8	547.6
1-to-1	3.2798	26.009	5.336
1-to-1 disp free	3.2798	26.012	3.424

- Emittance growth in nanometers
- Unacceptable emittance dilution in BC
- R&D on symmetrical coupler to reduce RF kick



RTML in Minimum Machine Configuration

The RTML two-stage Bunch Compressor (top) and a possible short single-stage compressor (bottom). Lengths compared for 15 GeV.



Single-stage BC is possible, if not support flexibility of parameter set

Changes: 9(6)mm → 0.3(0.2)mm to 6mm → 0.3mm (20 compression)

- ❑ Reduction in beamline and associated tunnel length by an equivalent of ~300 m (including some in SCRF linac)
- ❑ Removal of the second 220 kW dump and dump line components
- ❑ Possible shortening of the diagnostics sections (lower energy)

Higher energy spread → study emittance dilution in RTML and ML



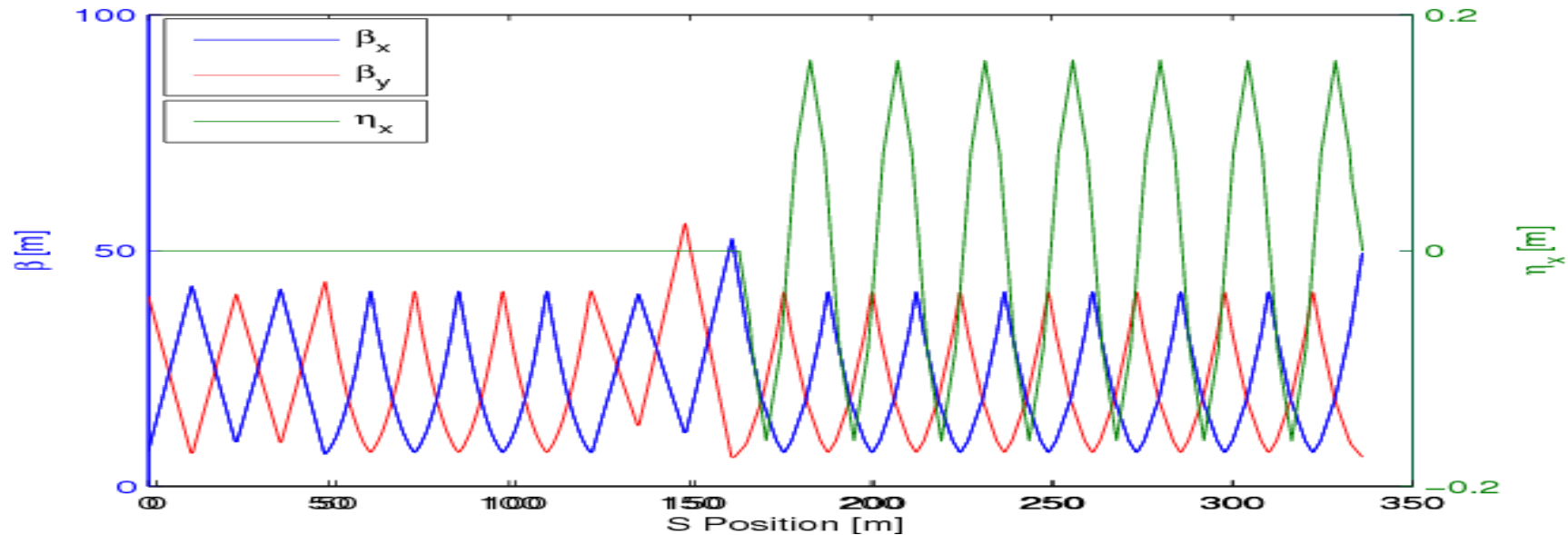
Single stage bunch compressor for (Minimum Machine configurations)

- Studies of 1-stage BC (PT-AW-TR, 2005) configuration (*A.Latina talk*):
- Alternative short 1-stage (lattice design and performance studies. (*E-S. Kim talk*))
- Re-design of matching section to launch beam to ML
- Future Studies
 - **Re-evaluation of diagnostic section design**
 - **Performance studies and optimization for both single-stage BC**
 - **Tolerances and emittance dilution studies**



Single-stage bunch compressor

Start with lattice of A. Wolski, T.Raubenheimer and P. Tenenbaum -2005

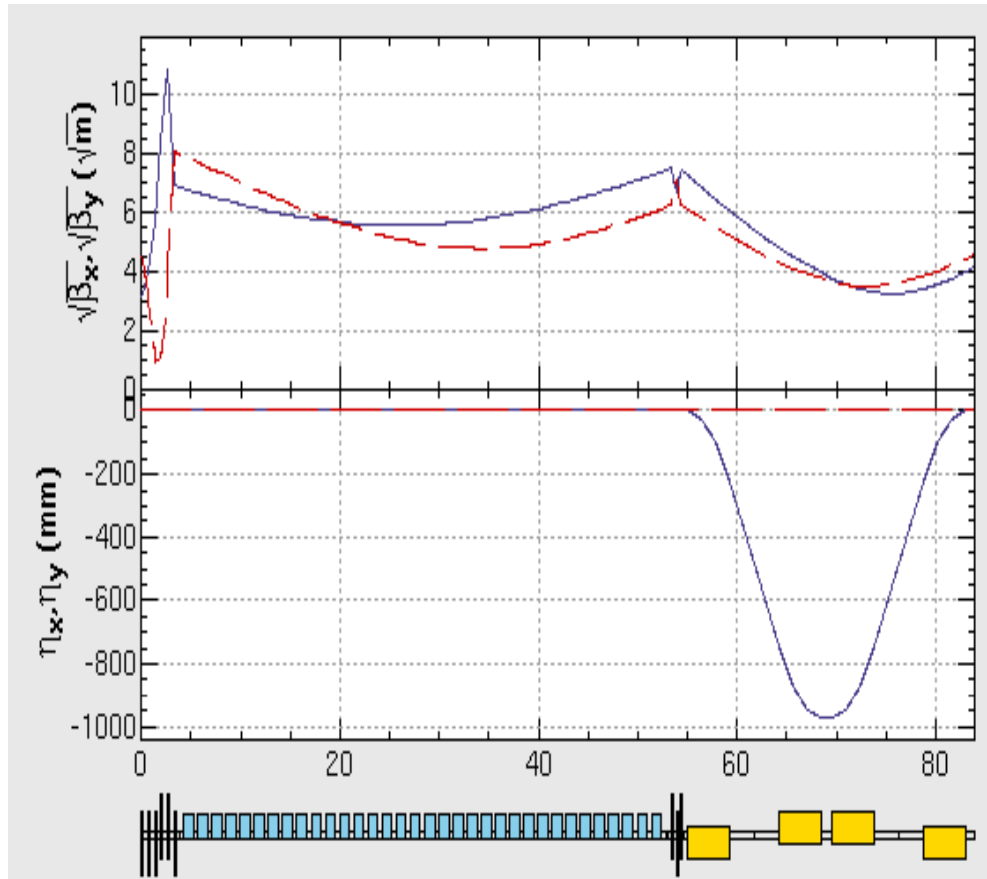


Beam energy	5 GeV	4.5 GeV
Energy spread	0.15%	~4.1 %
Bunch length	6 mm	0.3 mm

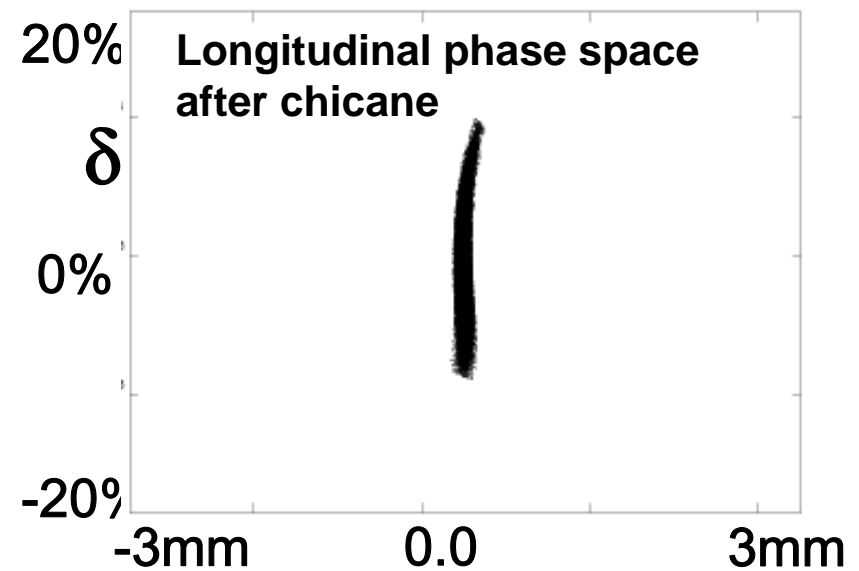
- Large energy spread → bigger emittance dilution in ML
- Possibly more sensitive to alignment errors ?
- Long system ~300m → optimization to reduce length (?)



Performances of the Short 1-stage BC



	Initial	Final
Beam energy, GeV	5	4.57
bunch length, mm	6	0.3
energy spread, %	0.15	3.46
X-Emittance, um	8.00	8.28
Y-Emittance, um	0.02	0.02



(Details in Eun-San Kim talk)



Future work (resources ?)

- Baseline design (CLIC/ILC collaboration):
 - **Static emittance preservation studies**
 - **Implement alignment model and stray-field models**
 - **Design of FB system. Start Dynamic simulation in RTML**
 - **Study of magnetic stray-field**
 - **Study amplitude-phase stability at FLASH (9-mA studies) -?**
- Support MM studies:
 - **Complete design, optimization and single-stage BC emittance preservation studies in both lattices:**
 - PT/AW/TR 2005 design
 - Short (alternative) design with chicane
 - **Re-evaluation of diagnostics section and matching sections**
 - **Emittance dilution in ML with the beam parameters, provided by 1-stage BC**
 - **RE-design EL_BC1 (if resources will be available)**
- Code development
 - **CHEF; complete cross-checking, implementation of RF kick/wake**
 - **Lucretia and Placet – same; AML lattice file.**
- Technical system
 - **Re-evaluation of RTML vacuum system**



Conclusion

- Design of all three extraction lines are completed
- Re-evaluation of vacuum system for return line ($P < 10$ nTorr) is done
- First results from magnetic stray field measurement
- Study effect of coupler induced RF kick and wake on emittance dilution in RTML and ML completed
- New results from studies of two lattices for 1-stage BC
- Code development new results

- Future Plans are presented