



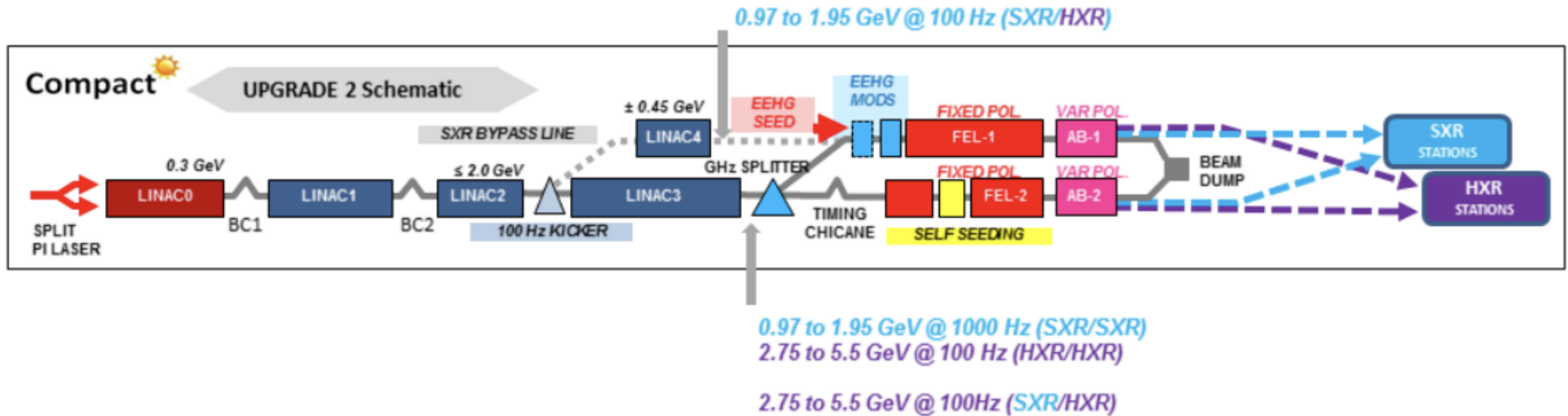
WP6 Summary

Avni Aksoy

On Behalf of WP6 team



- WP6: XLS simulation from cathode to linac end



- Operational modes
 - Hard X-rays mode
 - Soft X-rays mode
 - Simultaneous Soft + Hard X-rays



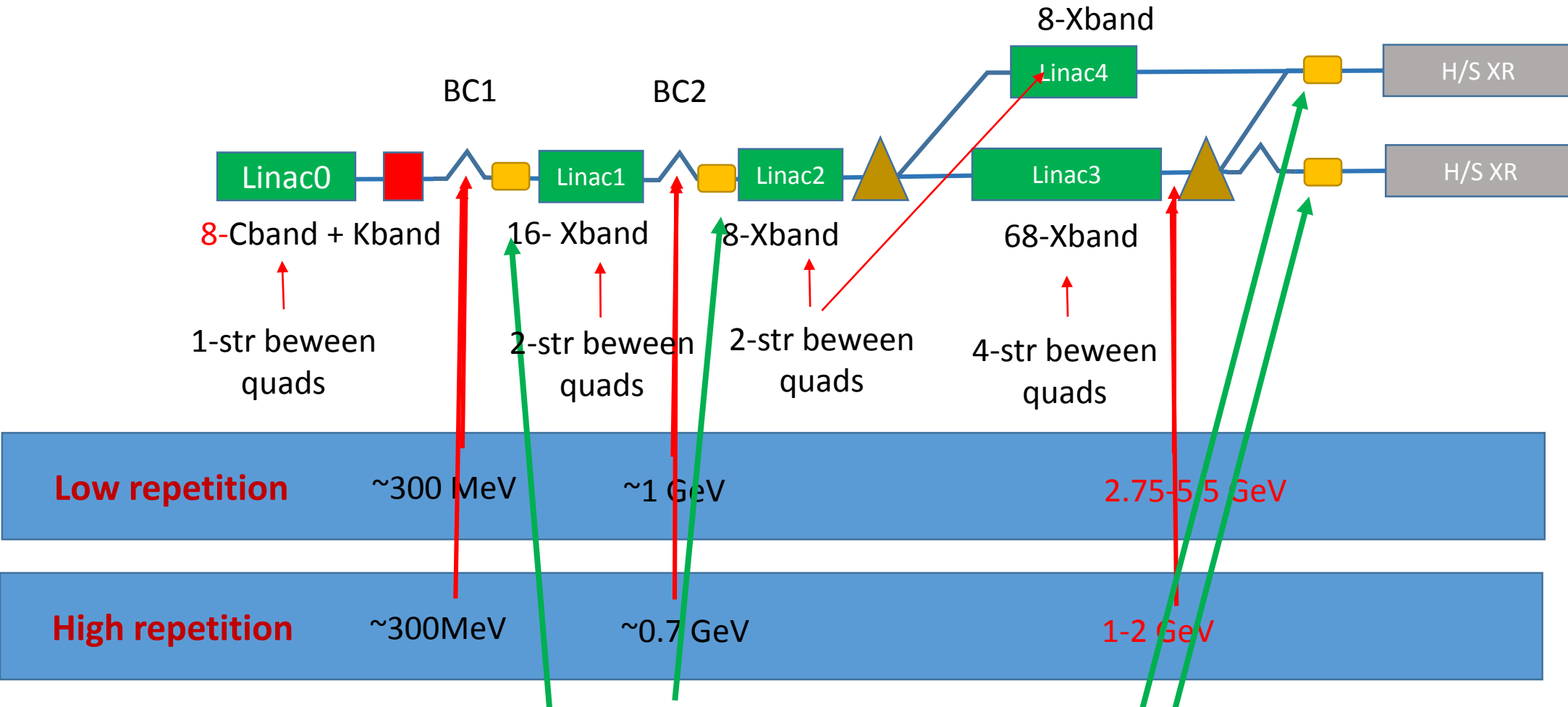
Main Electron Beam Parameters

Parameter	Unit	100 Hz	250 Hz	1000Hz
Beam Energy	GeV	2.75-5.5	1-2.5	1-2
Bunch Charge	pC	75	75	75
Number of bunch per RF pulse	#	1-2	1-2	1-2
RMS Slice Energy Spread	%	0.01	0.02	0.02
Minimum Electron bunch length rms	fs	15	30	30
Peak Current	kA	5	1	1
Normalised Emittance	mm-mrad	0.2	0.2	0.2

When we operate low rep-rate bunch length will be defined by HXR requirement
The second bunch going to SXR BL will have same bunch length



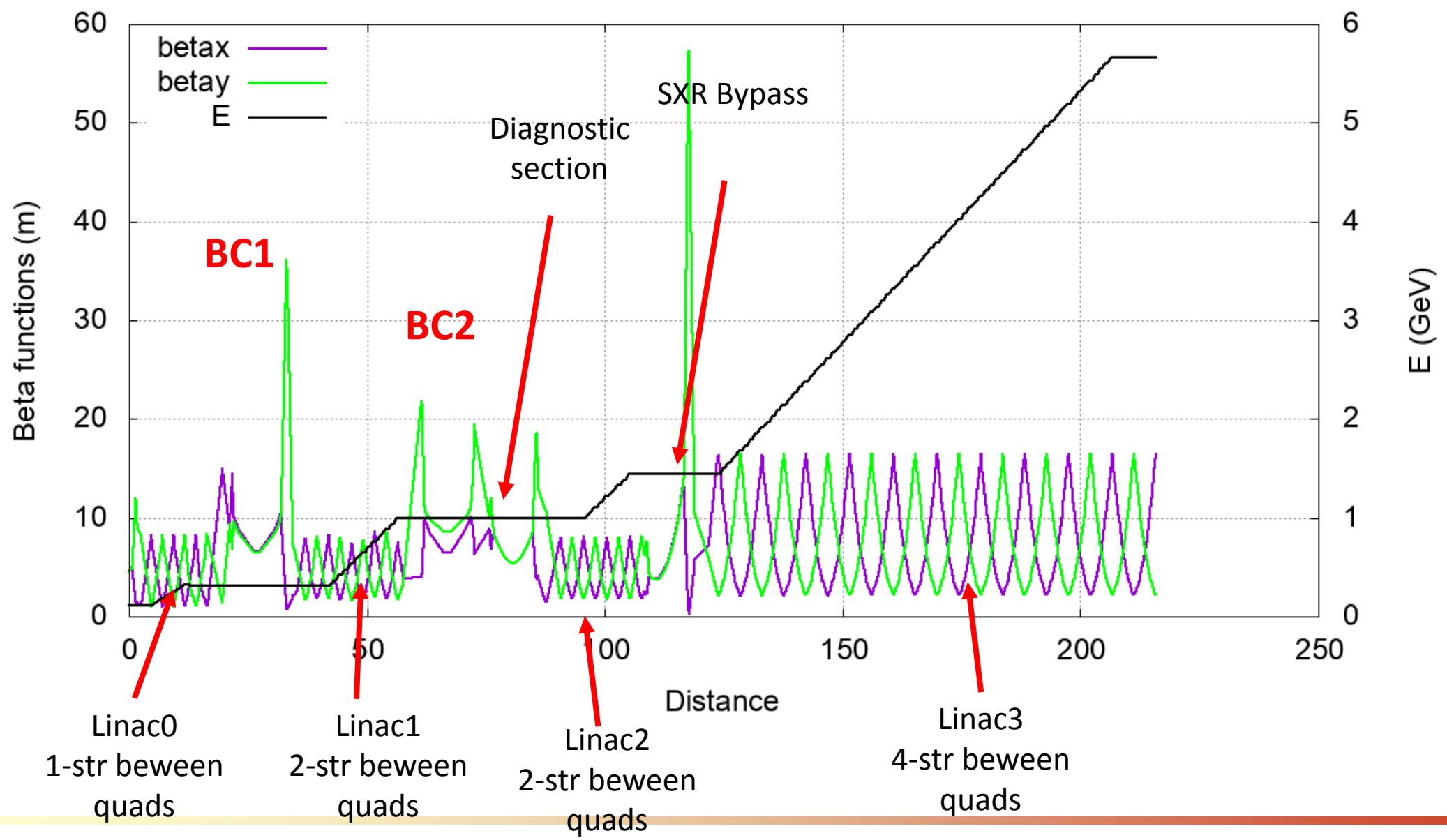
Machine Layout



Dedicated 4 diagnostic sections would be suitable for control off all beam parameters



Twiss Functions Along Hard Xray

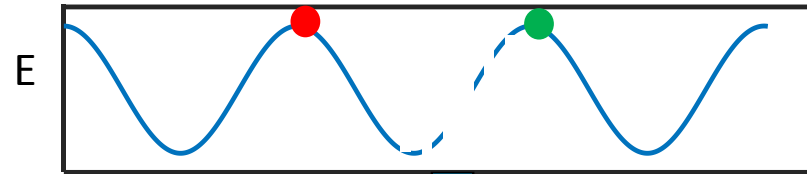




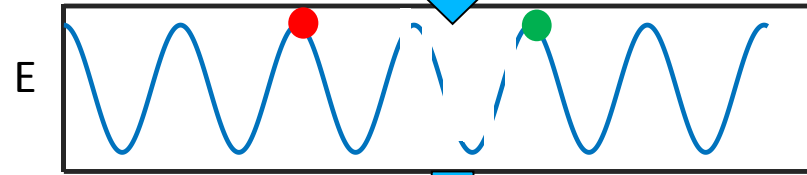
SXR bypass Line

$$\Delta t = n \tau_{\text{gun}}, n = 1, 3, 5 \dots$$

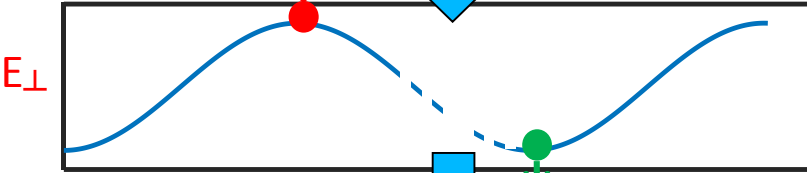
$$\Delta s = n \lambda_{\text{gun}}$$



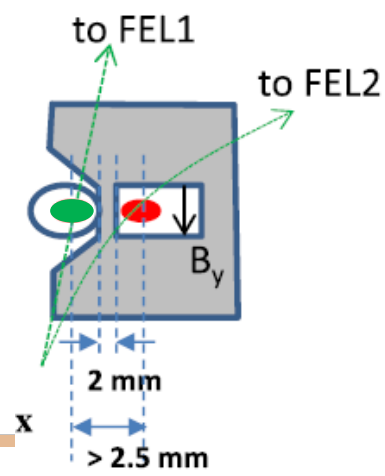
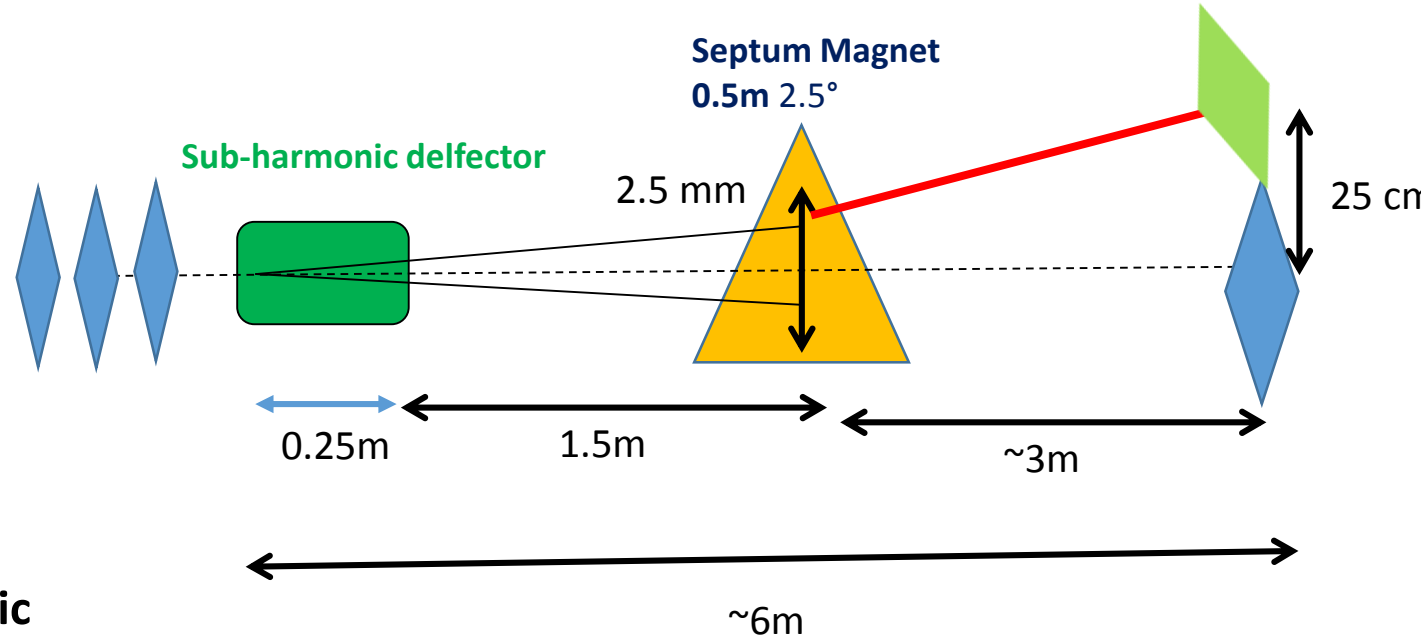
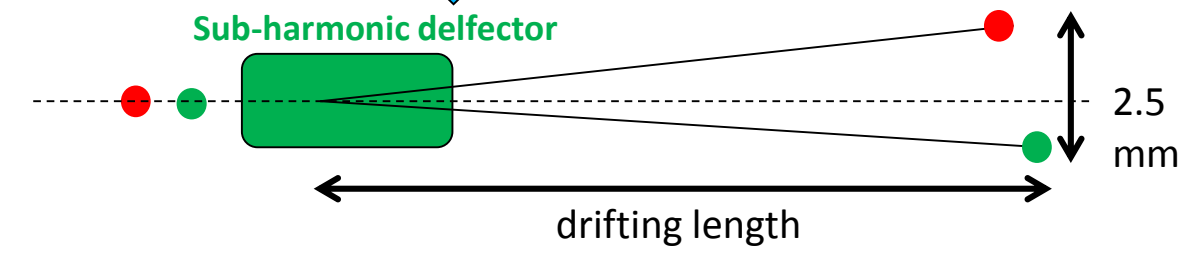
Gun
6 GHz
C-Band



Linac
12 GHz
X-Band



Sub-harmonic deflector
3GHz
S-band

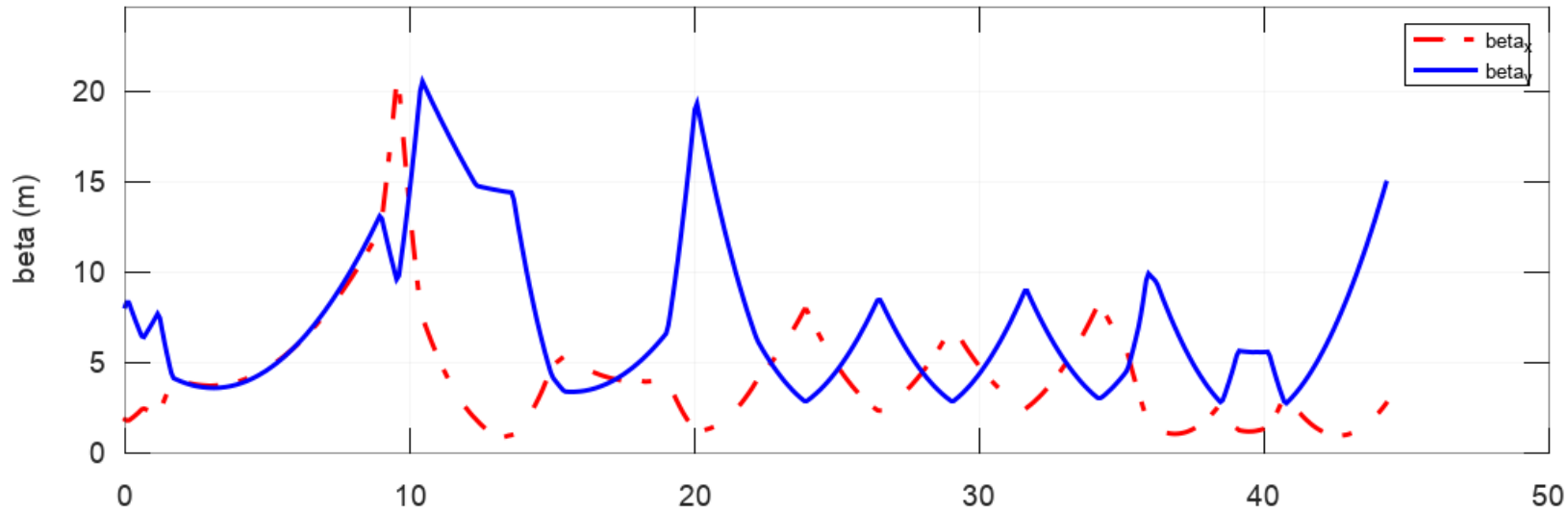


Xiaowei Wu





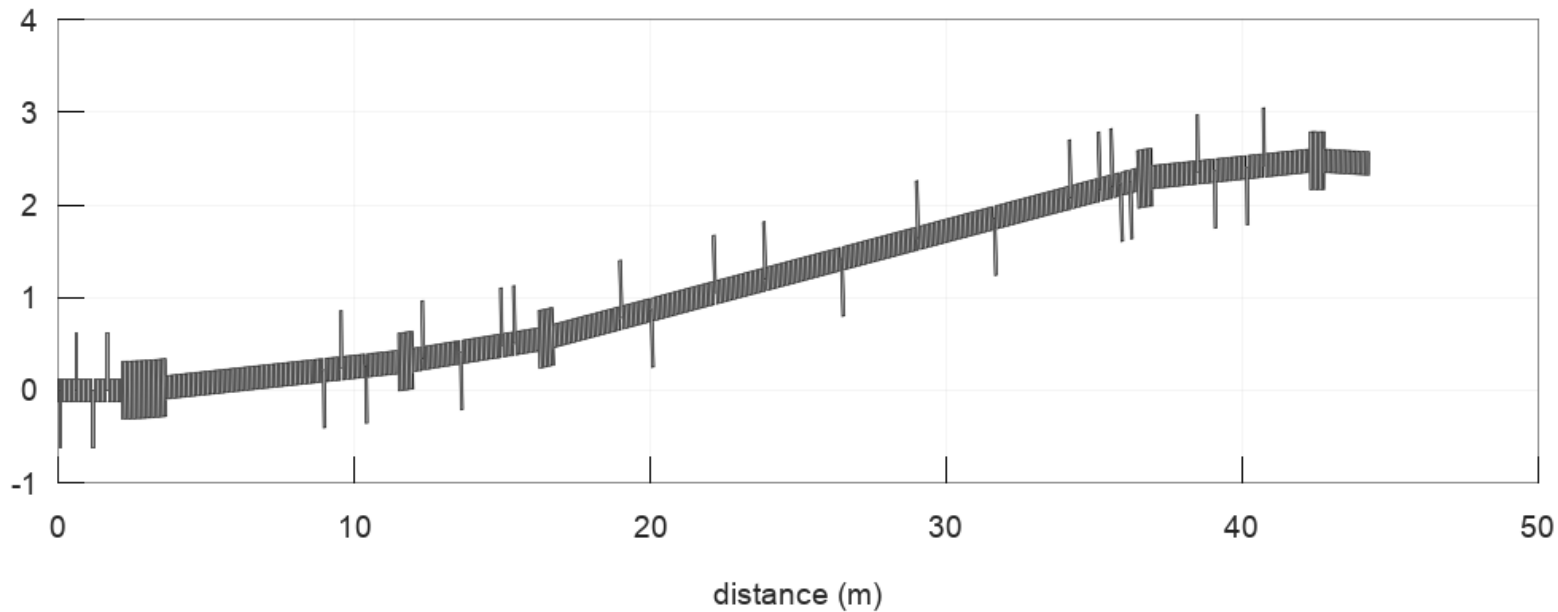
SXR by-pass Line



Needs to be reoptimized

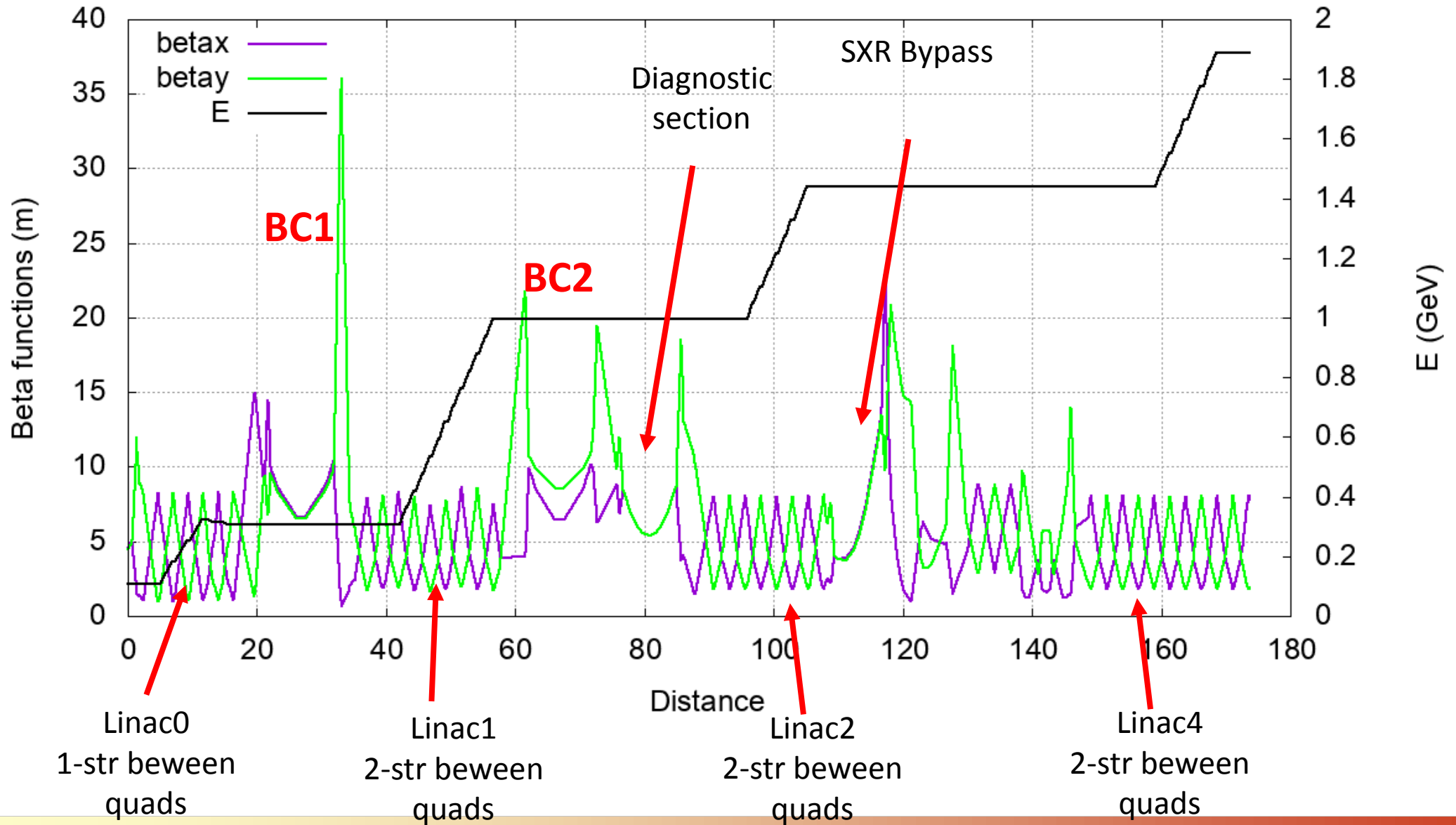
iscocronous beamline
identical bending
magnets

Opposite R56 to avoid
CSR?





Twiss Functions Along Soft Xray



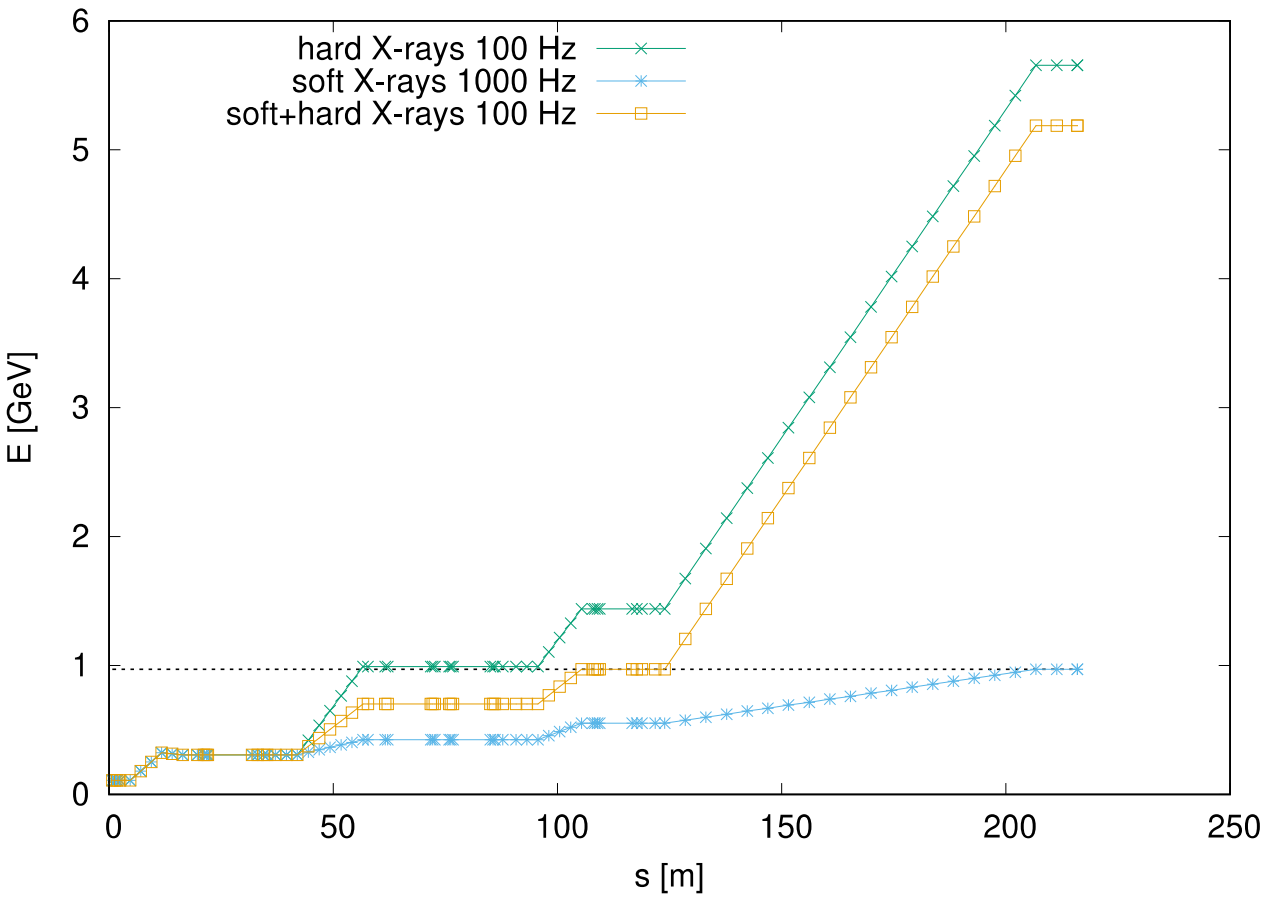
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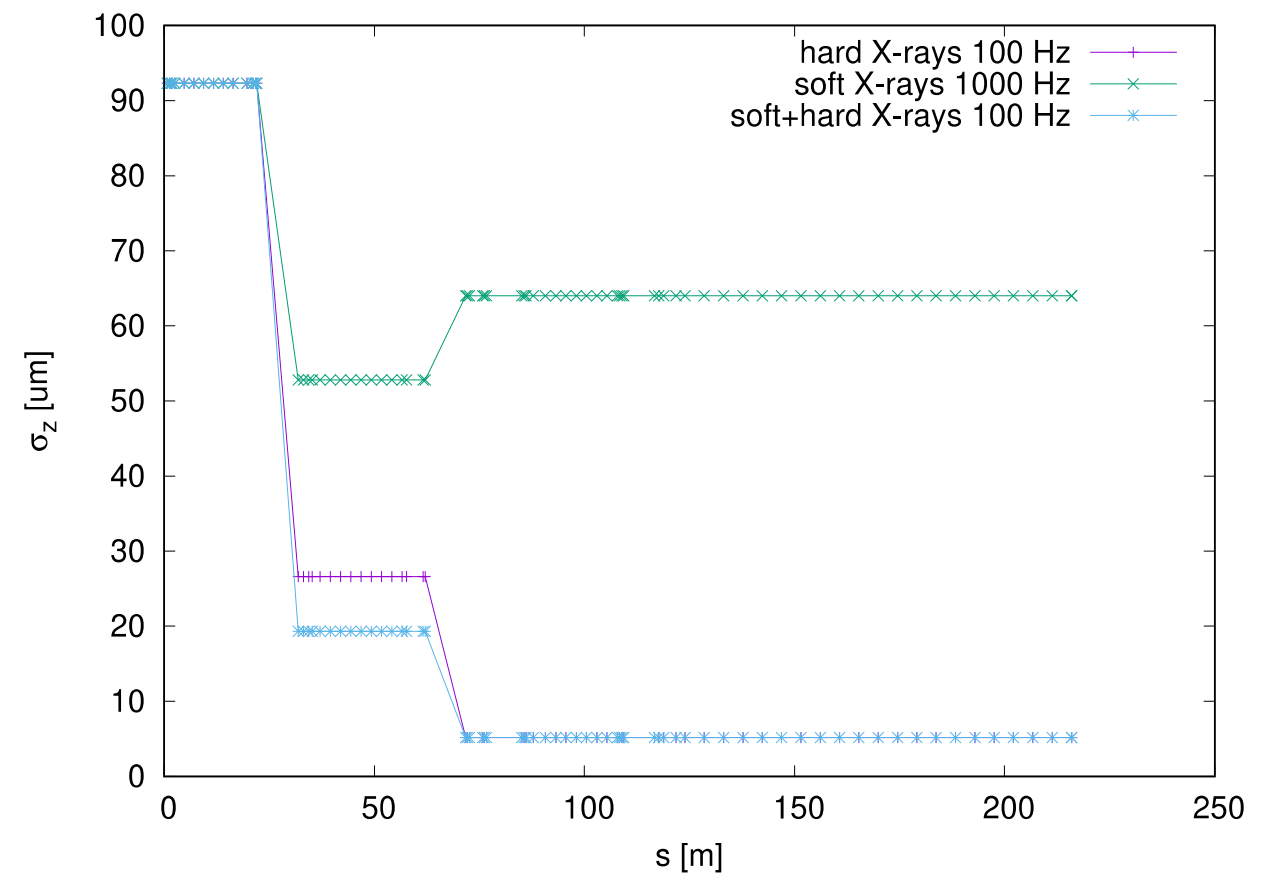


Operation Modes for HXR BL

• Energy



Bunch Length



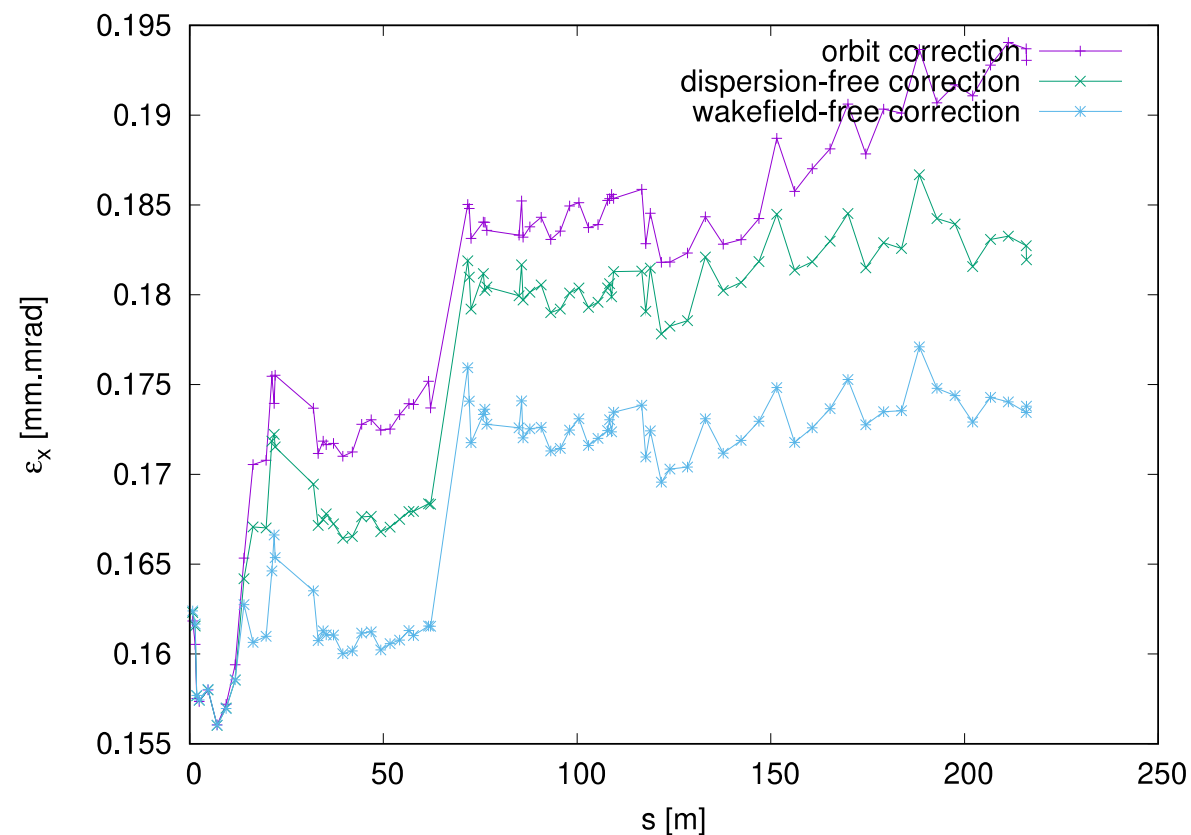
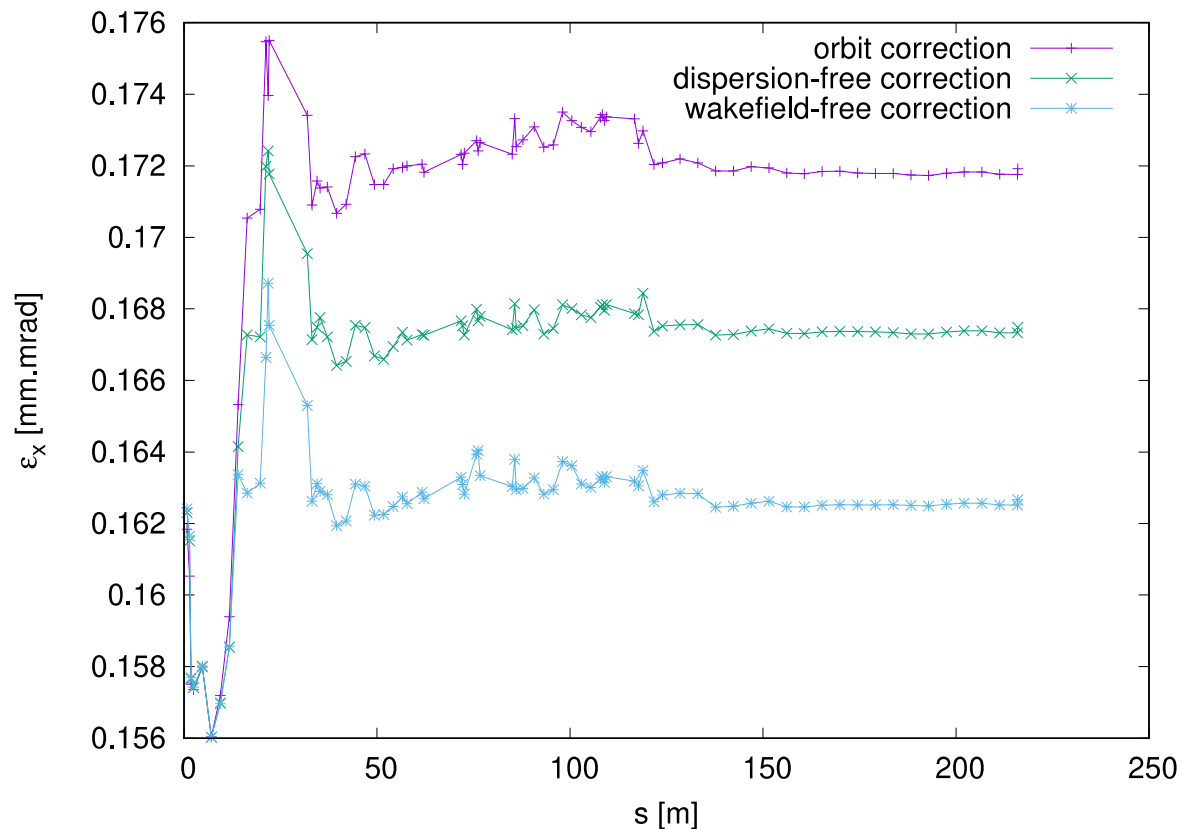
A.Latina



Beam Based Alignment (HXR BL)

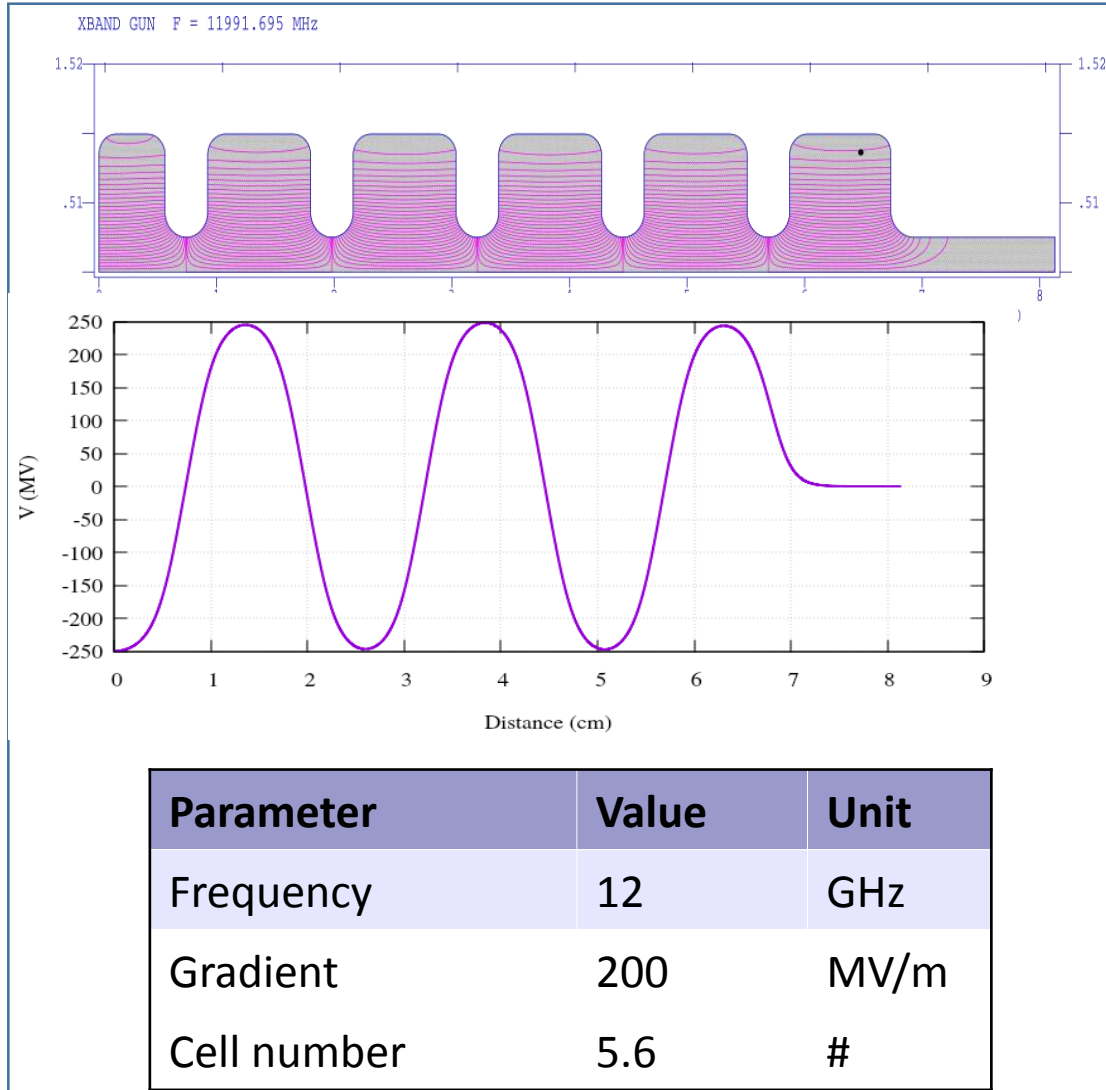
- Hard X-rays (5.5 GeV @ 100 Hz)

- Soft X-rays (0.97 GeV @ 1000 Hz)

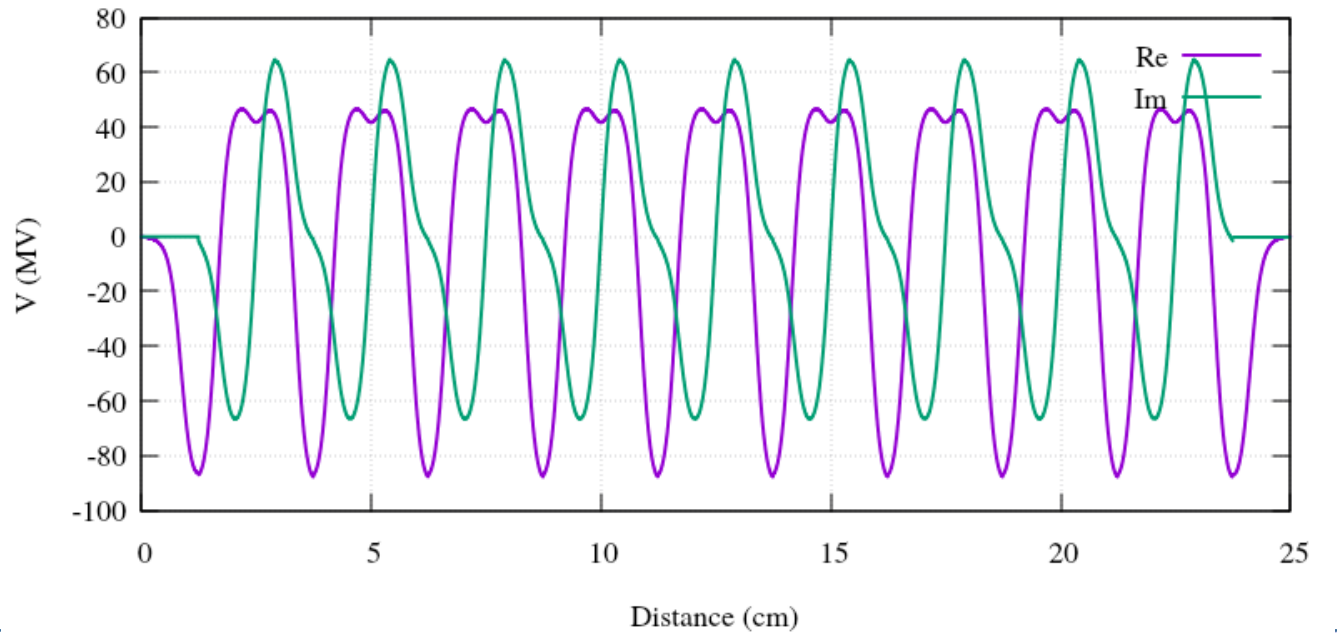




X-band based Injector

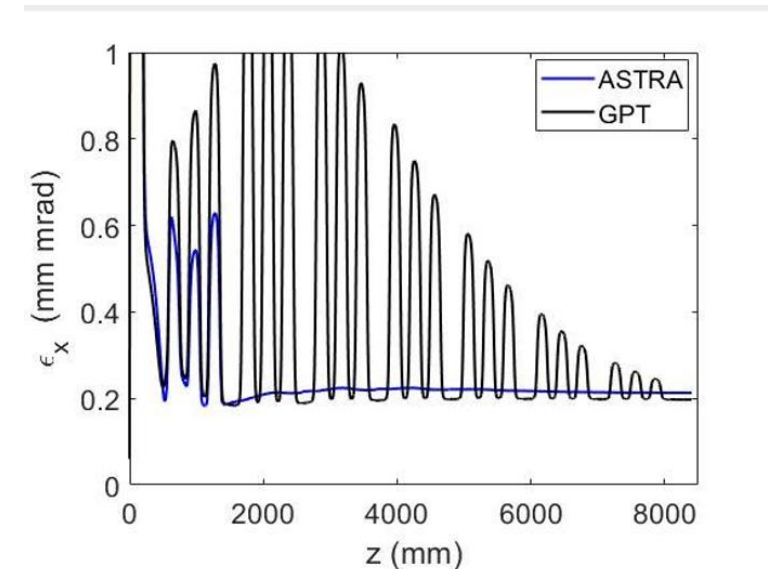


Parameter	Value	Unit
Frequency	12	GHz
Gradient	65	MV/m
Total length	~1	m
Cell number	108	#

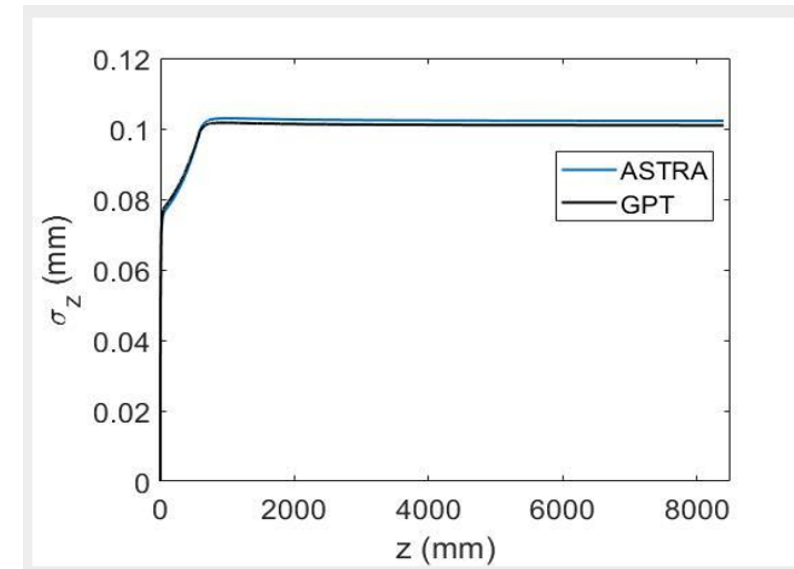




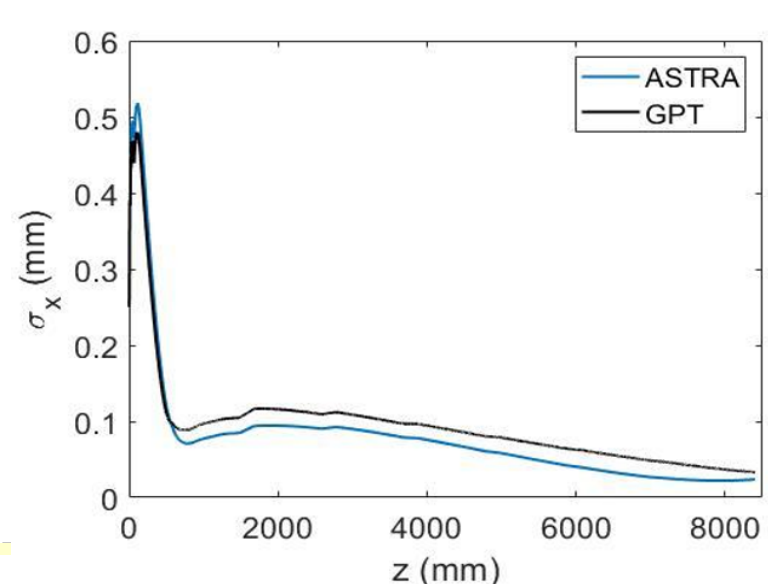
Beam From X-Band Gun



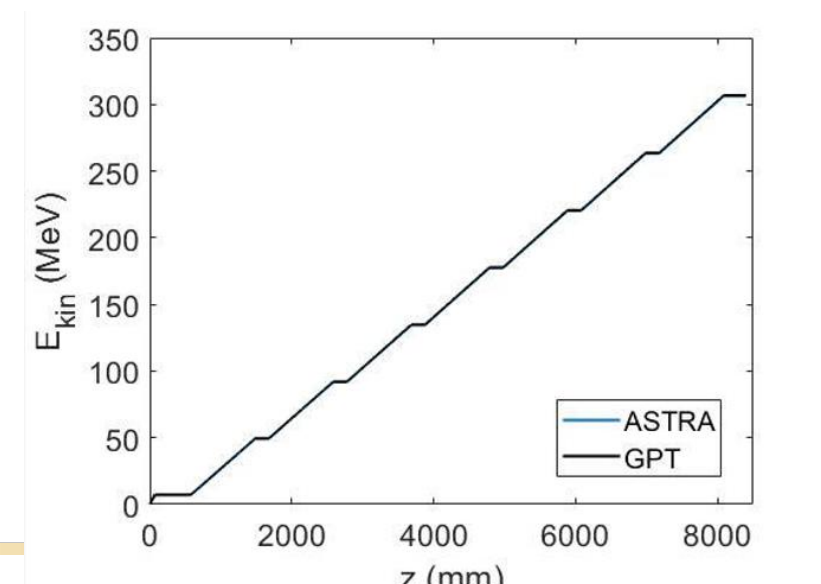
Beam emittance along axis



Longitudinal standard deviation along axis



Transversal standard deviation along axis



Average beam kinetic energy along axis

Beam parameters at photoinjector output

	GPT	ASTRA
Beam energy (E_{avg})	307 MeV	306 MeV
rms bunch length (σ_t)	337 fs	341 fs
rms energy spread ($\Delta E/E_{avg}$)	0.5 %	0.56 %
Peak current ($Q/\sqrt{12} \sigma_t$)	64 A	64 A
rms norm. emittance	0.20 mm mrad	0.21 mm mrad
Transverse size (σ_x, σ_y)	0.03 mm	0.02 mm

Daniel González-Iglesias₁



To-do list, urgent items

1. The layout of C-band injector
 - Simulation runs for beam manipulation in main linac and BCs
 2. Designing final bunch compressors including high order corrections
 3. Reshape the beamline in accordance with diagnostic...
 4. Design the high energy transfer line(s)
 5. CSR effects, microbunching instability, and laser heater
 6. 2-bunches simulations including long range wakefields, machine errors and BBA
 7. Consistent S2E run from cathode to FEL emission
 8.
- Shall we repeat same for X-Band based injector?



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Thank you!



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