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Compact

Review of Magnetic Bunch Length Compression Schemes for CompactLight

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on behalf of WP3 contributors

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Contents of Report (Deliverable D3.2)

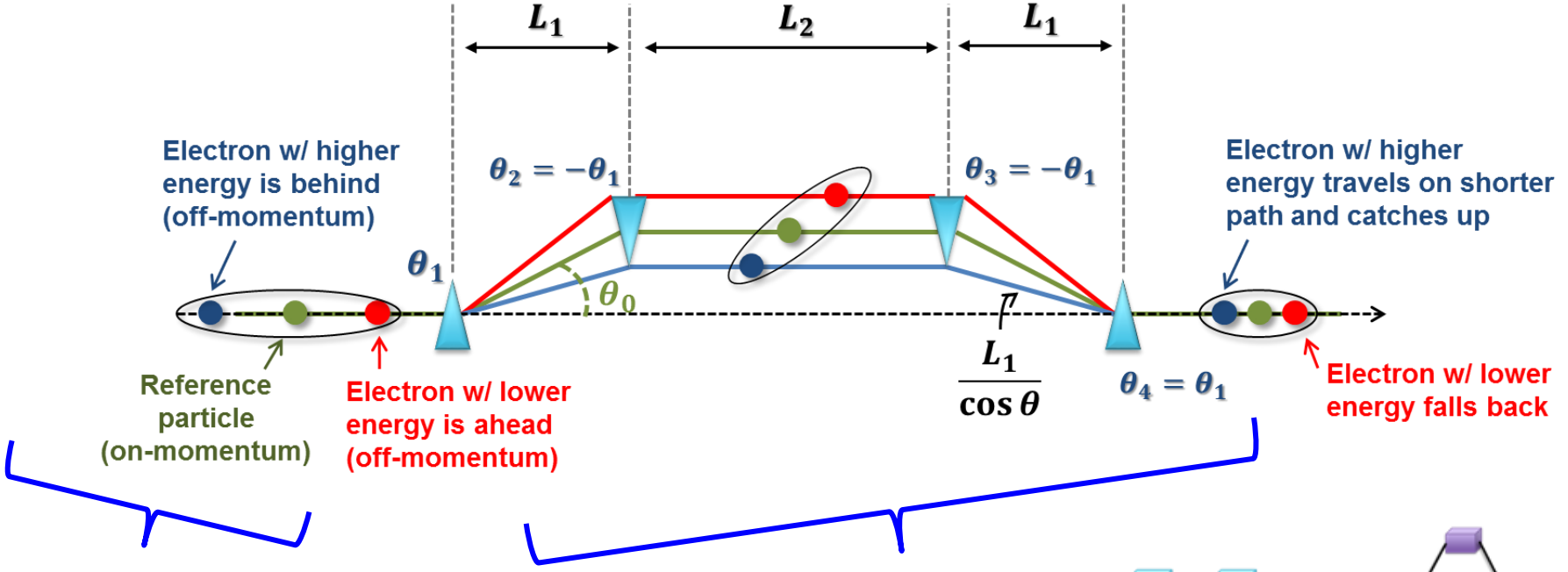
This sets the analytical basis for the compression scheme specifications, and highlights the major physical challenges.

Diverse options are studied, and recommendations for the compression scheme are given (*not* a final choice yet).

Semi-analytical and numerical studies define the injector beam and the compressor(s) parameters in a consistent way, including tolerance budget.

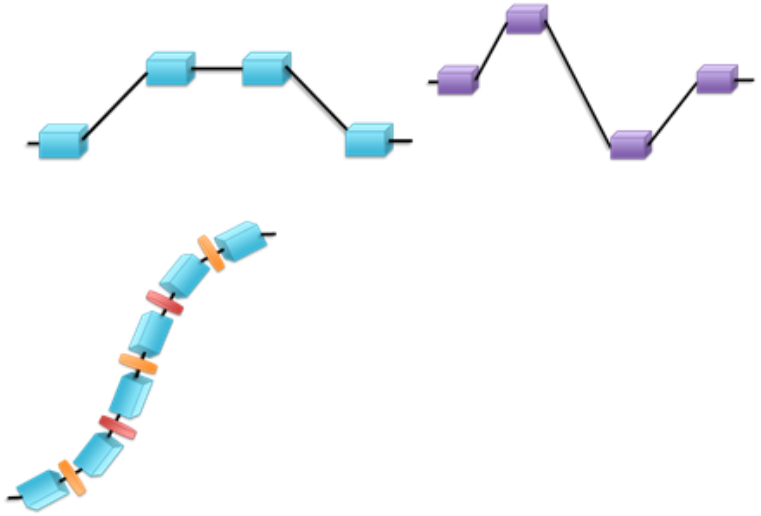
Preliminary hardware design

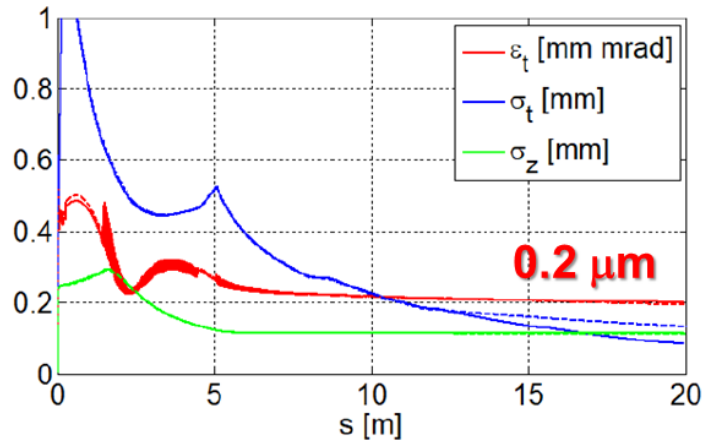
Magnetic Compression

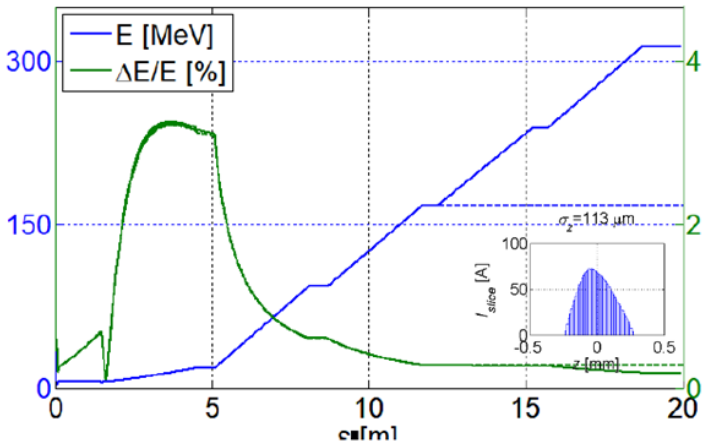


- ❑ Injector Linac + Linearizer:
  - S-band + X-band
  - C-band + X- or K-band
  - X-band + K-band
  - All X-band self-linearizing
- ❑ Velocity bunching (OK)
- ❑ RF phasing (<25º) and jitters (<0.1º, <0.1%)

- ❑ Geometry:
  - Chicane
  - Dog-leg

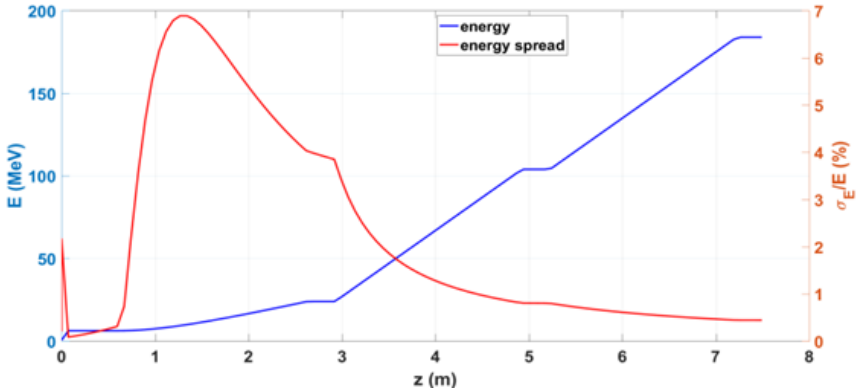


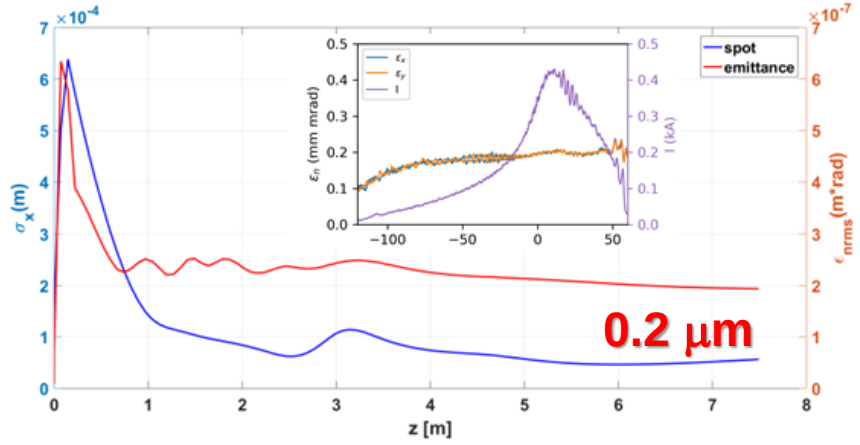




S-band, velocity bunching
~20 m length to **300 MeV**

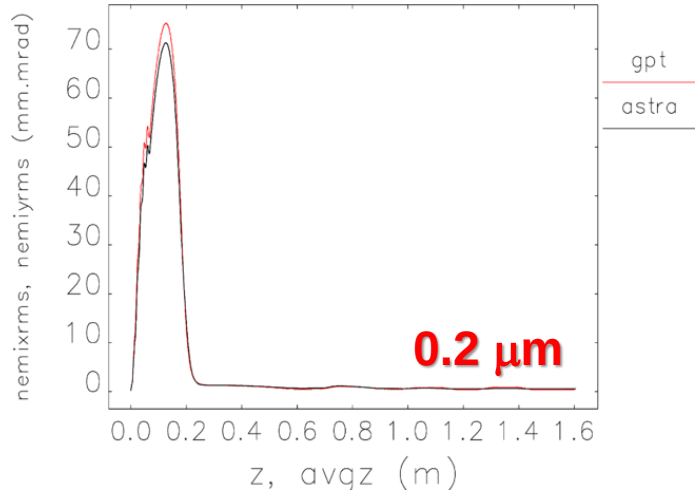
Ref. A. Giribono

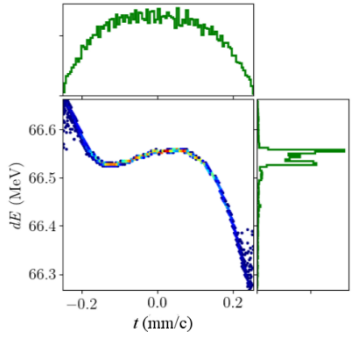




C-band, velocity bunching
~8 m length to **300 MeV**

Ref. M. Croia



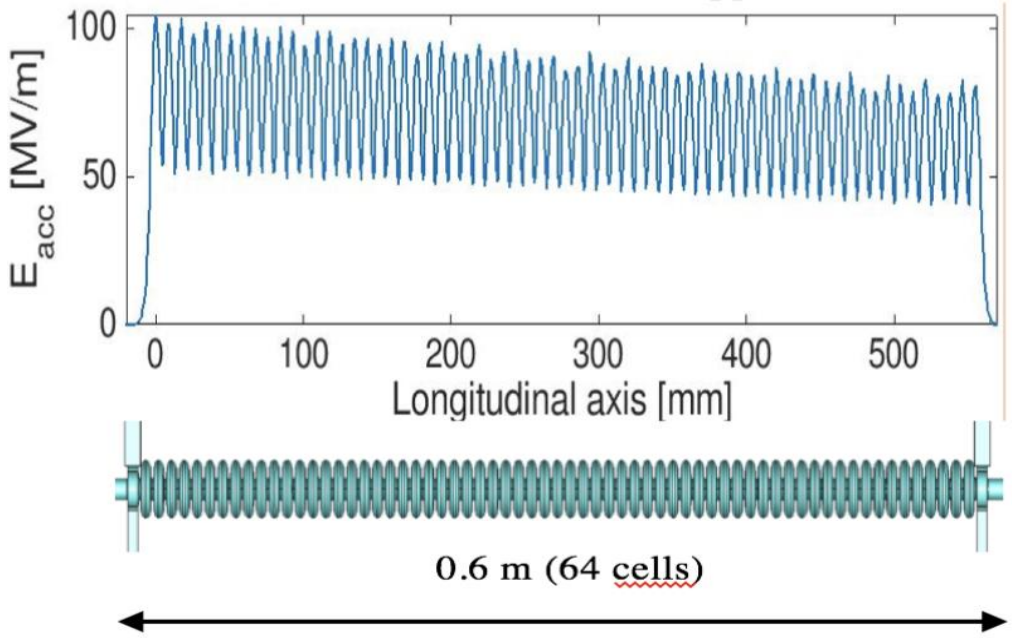


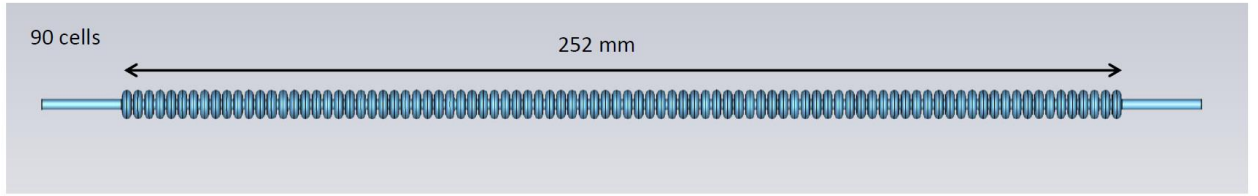
Parameter	Unit	Value
E	MeV	66.530
$\varepsilon_{n,x}$	mm.mrad	0.195
$\varepsilon_{n,y}$	mm.mrad	0.194
ε_z	keV.mm	4.955
σ_x	mm	0.090
σ_y	mm	0.090
σ_z	mm	0.123
σ_E	keV	52.017
$\Delta E/E$	%	0.078

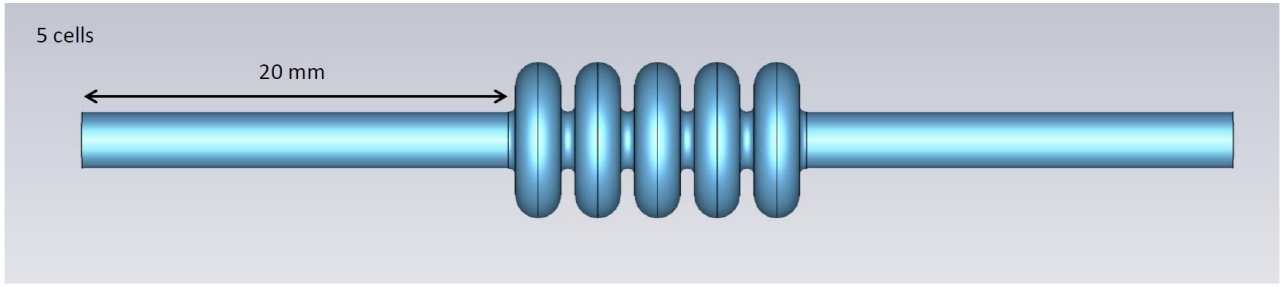
All X-band, velocity bunching
~5 m length to **300 MeV**

Ref. X. Liu, A. Latina, A. Aksoy

X-band & K-band Linearizer







❑ X-band (12 GHz):

Input Power ~ 30 MW
Acc. Gradient ~ 65 MV/m
Acc. Voltage < 30 MV (spec. 20 MV)
Iris radius = 4 mm
Shunt Impedance ~ 90 MΩ/m
Q ~ 7000

❑ Ka-band (36 GHz):

Input Power ~ ?
Acc. Gradient ~ 100 MV/m
Acc. Voltage < 25 MV (spec. 10 MV)
Iris radius = 1.3 mm
Shunt Impedance ~ 160 MΩ/m
Q ~ 4000

Ref. A. Mostacci, J.M. Arnesano, L. Ficcadenti B. Spataro, M. Migliorati, M. Scisciò, M. Bethouei, L. Faillace, A. Variola

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e-Beam Longitudinal Phase Space

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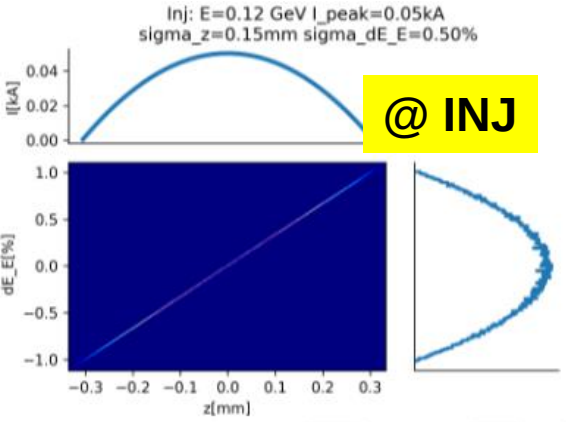

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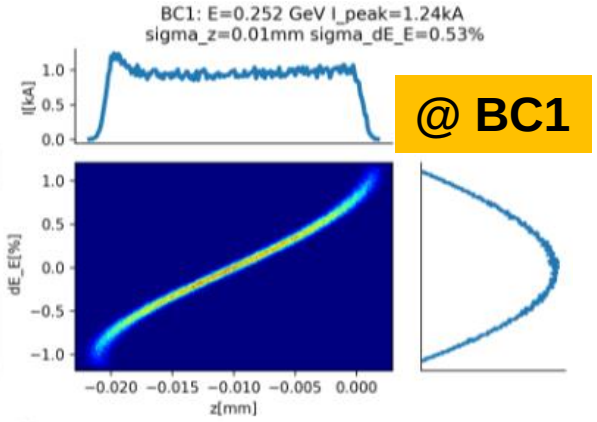
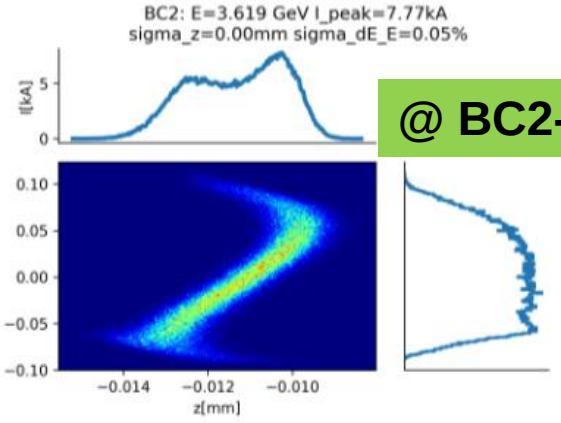
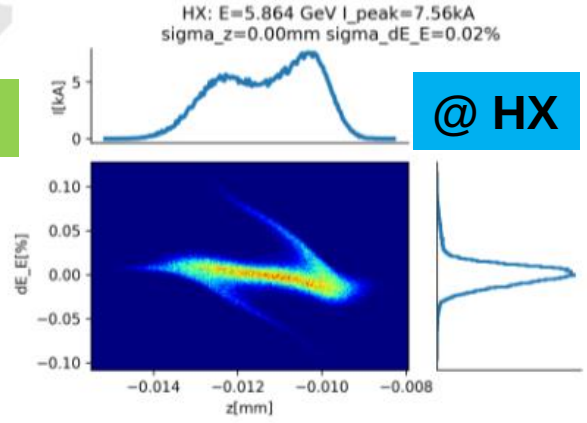


@ BC1



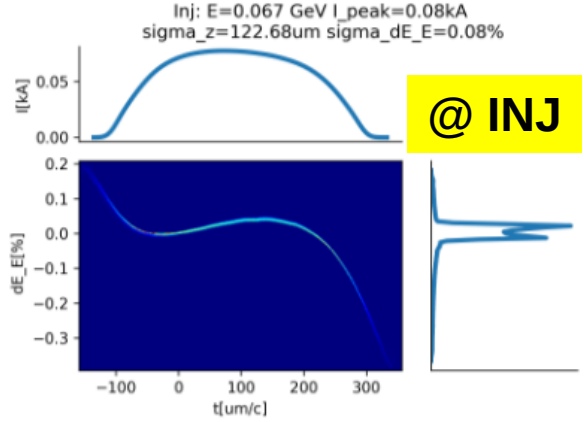
@ BC2-SX



@ HX

S-band + X-band,
1-D LiTrack

Ref. S. Di Mitri (Elettra), E. Marin (ALBA)



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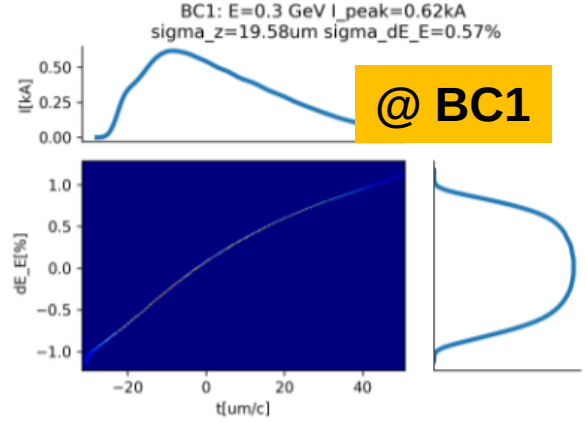

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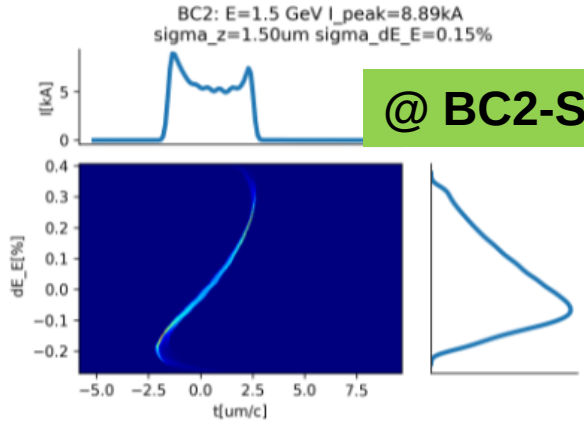
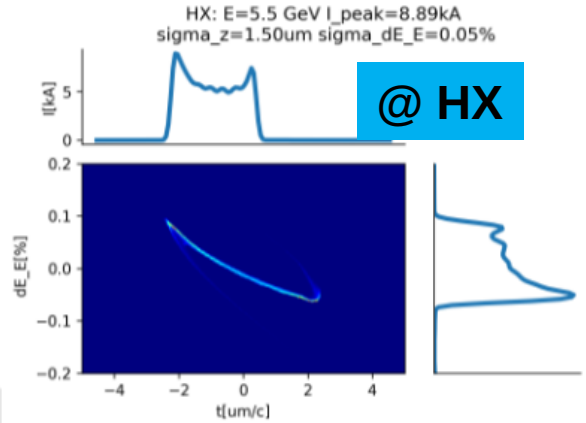


@ BC2-SX



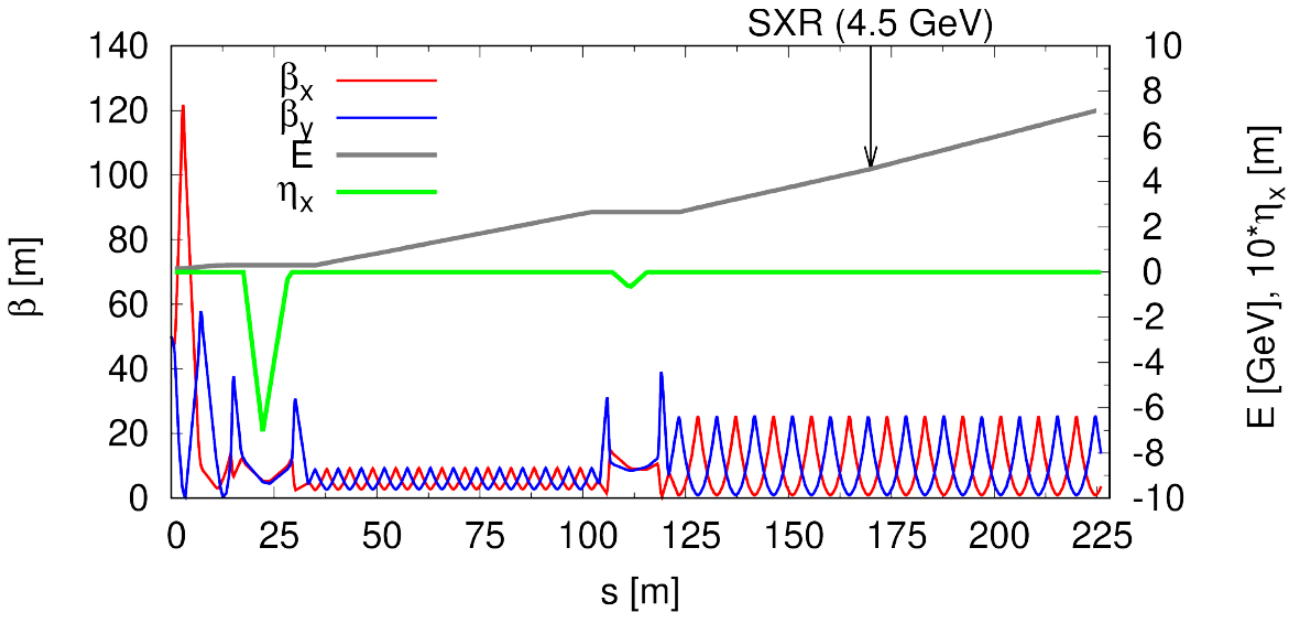
@ HX

All X-band,
1-D Placet

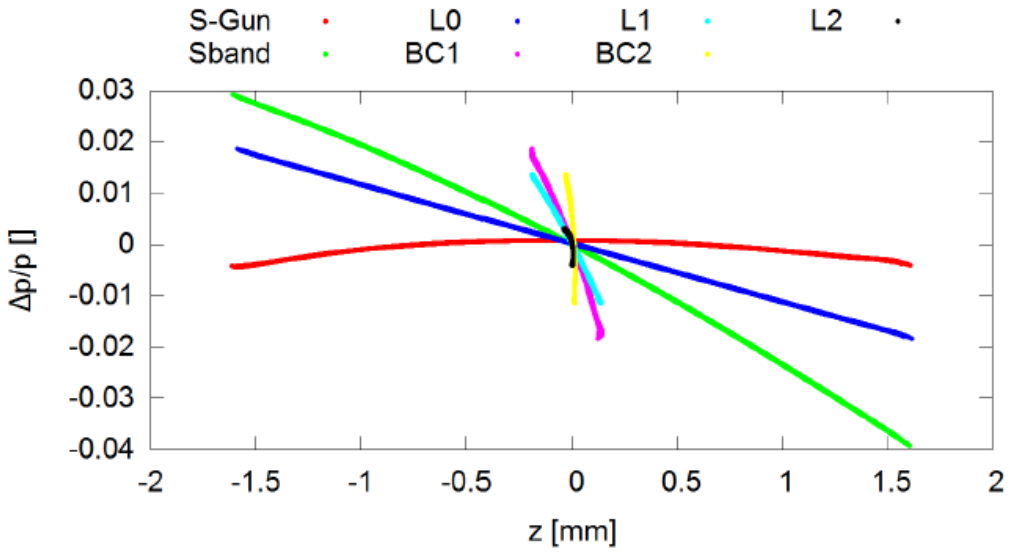
Ref. X. Liu, A. Latina (CERN)

Collective Effects *(to be Continued in WP6 this year)*

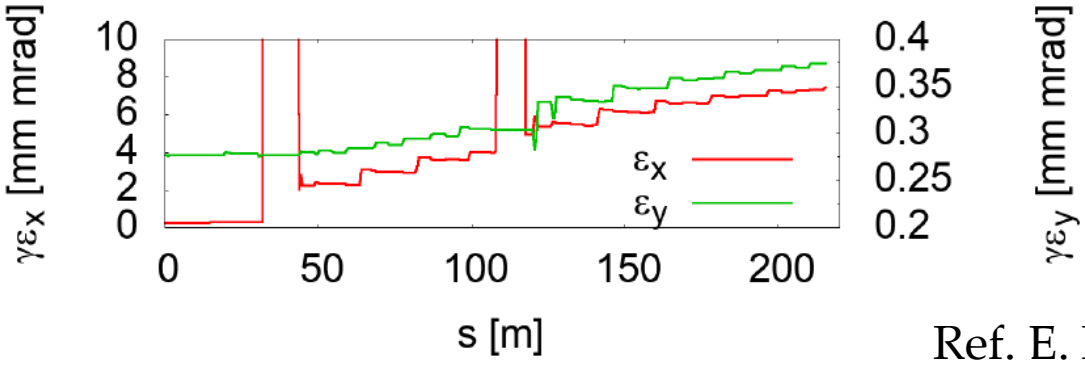
Full Linac Modeling:



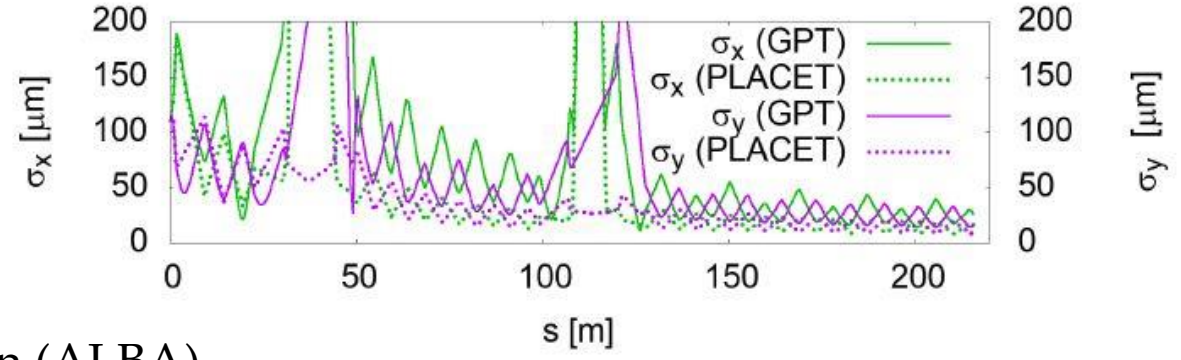
Longitudinal Wakefields, Passive Linearization:



Coherent Synchrotron Radiation:



Codes Benchmarking:



Ref. E. Marin (ALBA)

- Review of Magnetic Compression Schemes – Report completed (D3.2)
- Several options investigated, recommendations provided (→ WP2)
- Set of parameters for S2E simulations identified (→ WP6)

Thank you for your attention