

Beam dynamics studies of C³ main linac

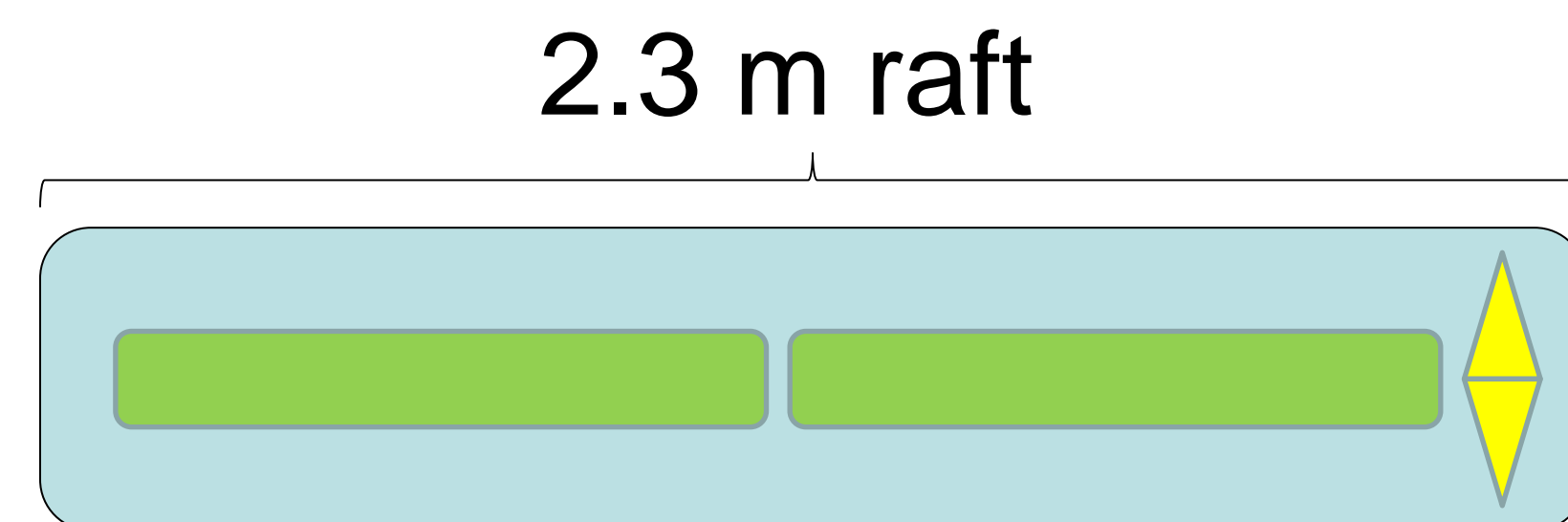
Wei-Hou Tan*, Glen White, Emilio A. Nanni

*whtan@slac.Stanford.edu

Introduction

The Cool Copper Collider (C³) is a proposed e⁺e⁻ collider for the study of the Higgs boson. We are preparing preliminary beam dynamics studies of the main linac. These studies aim to understand and optimize the beam parameters of the main linac and determine alignment and vibration tolerances.

Main linac design and assumption [2]

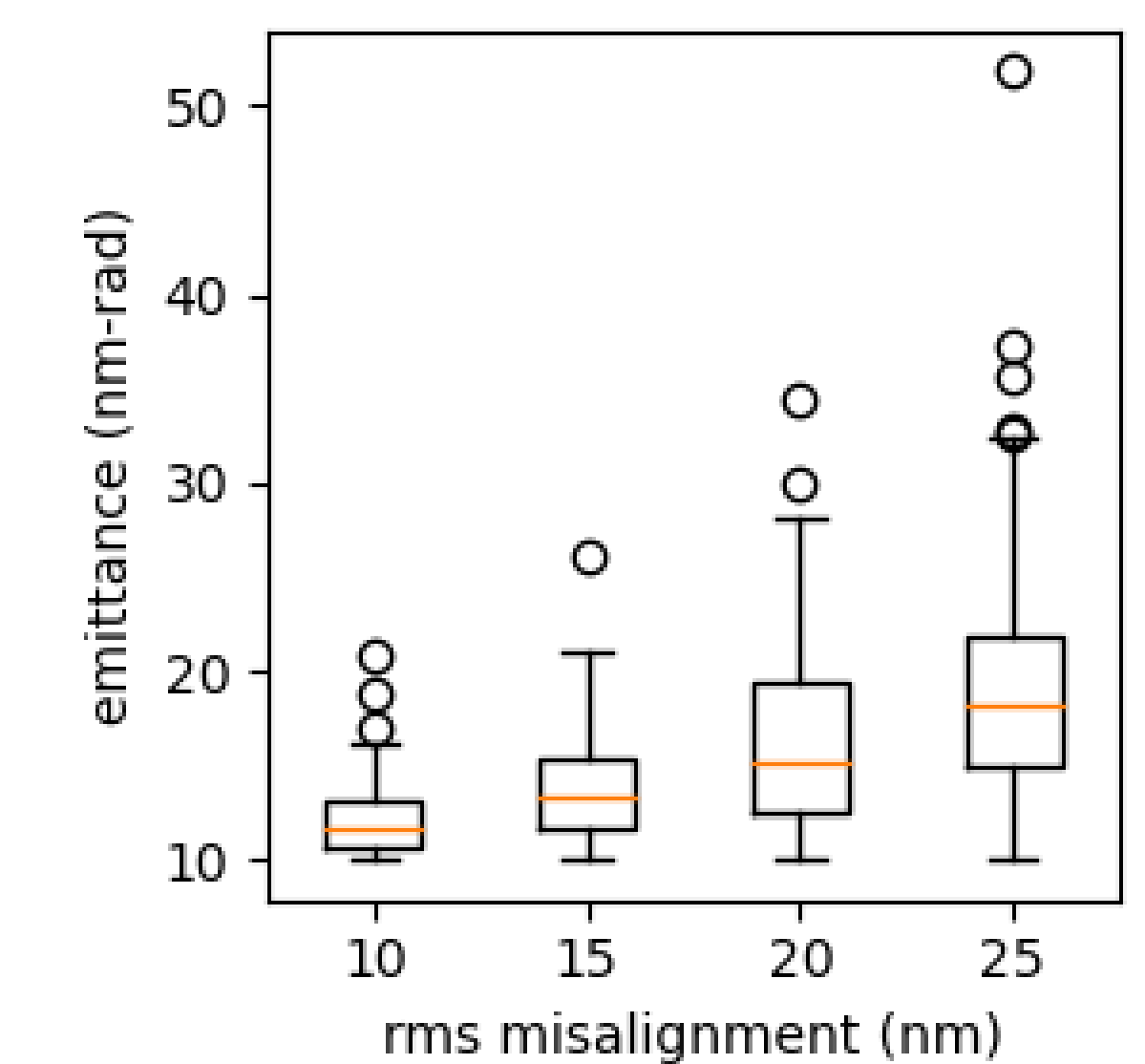


- Total length = 2.3 km
- 1 raft has 2 accelerating structures and a quad
- Beam initial parameters were assumed to be obtained downstream of damping ring

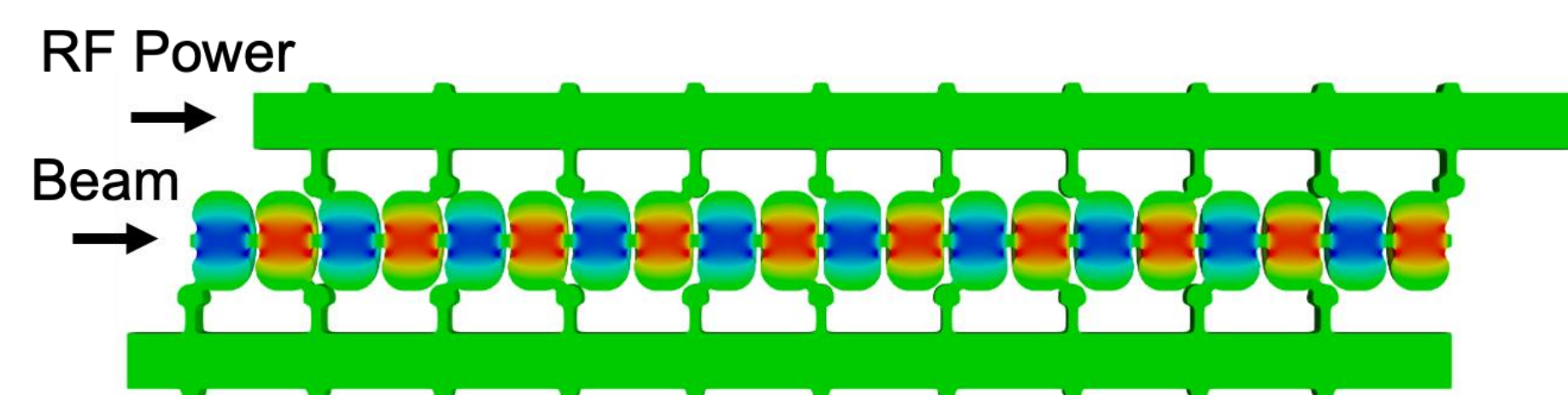
Parameter	Initial value	Target value
Beam energy	10 GeV	125 GeV
Emittance x, y	775, 10 nm-rad	900, 20 nm-rad
Energy spread	0.15%	0.36%
Bunch length	100 um	100 um
Charge	1 nC	1 nC
Field gradient	70 MV/m	N/A

Vibration misalignment of quads

- RMS misalignment of quads in x, y were applied to study the tolerance of final emittance



Cryogenic cooled cavity with distributed coupling design



C³ uses cryogenic cooled normal conducting radio frequency (NCRF) accelerator concept to achieve high gradient and efficiency at relative low cost and compact size. It uses the distributed coupling design to power each cell separately.[1] Please check Z. Li talk on Wed for details

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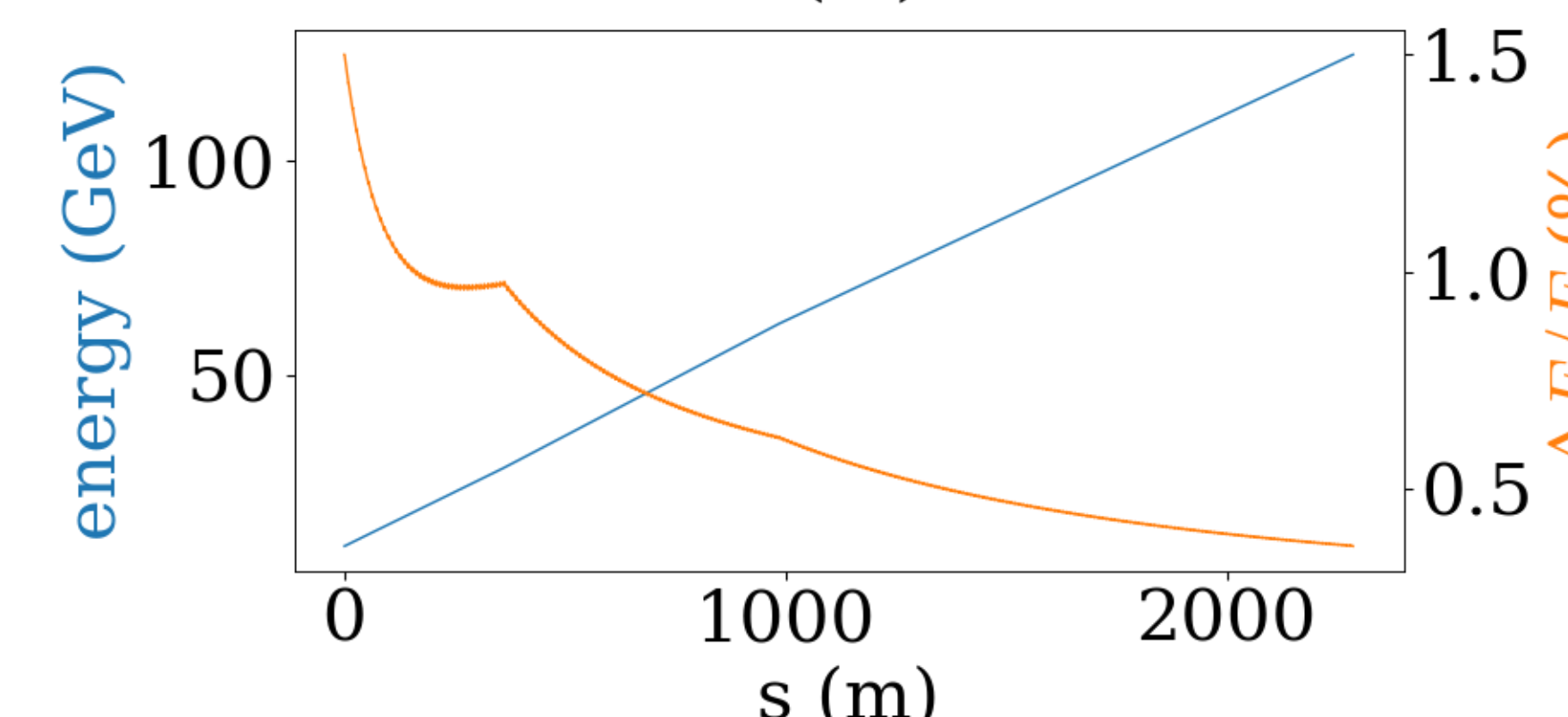
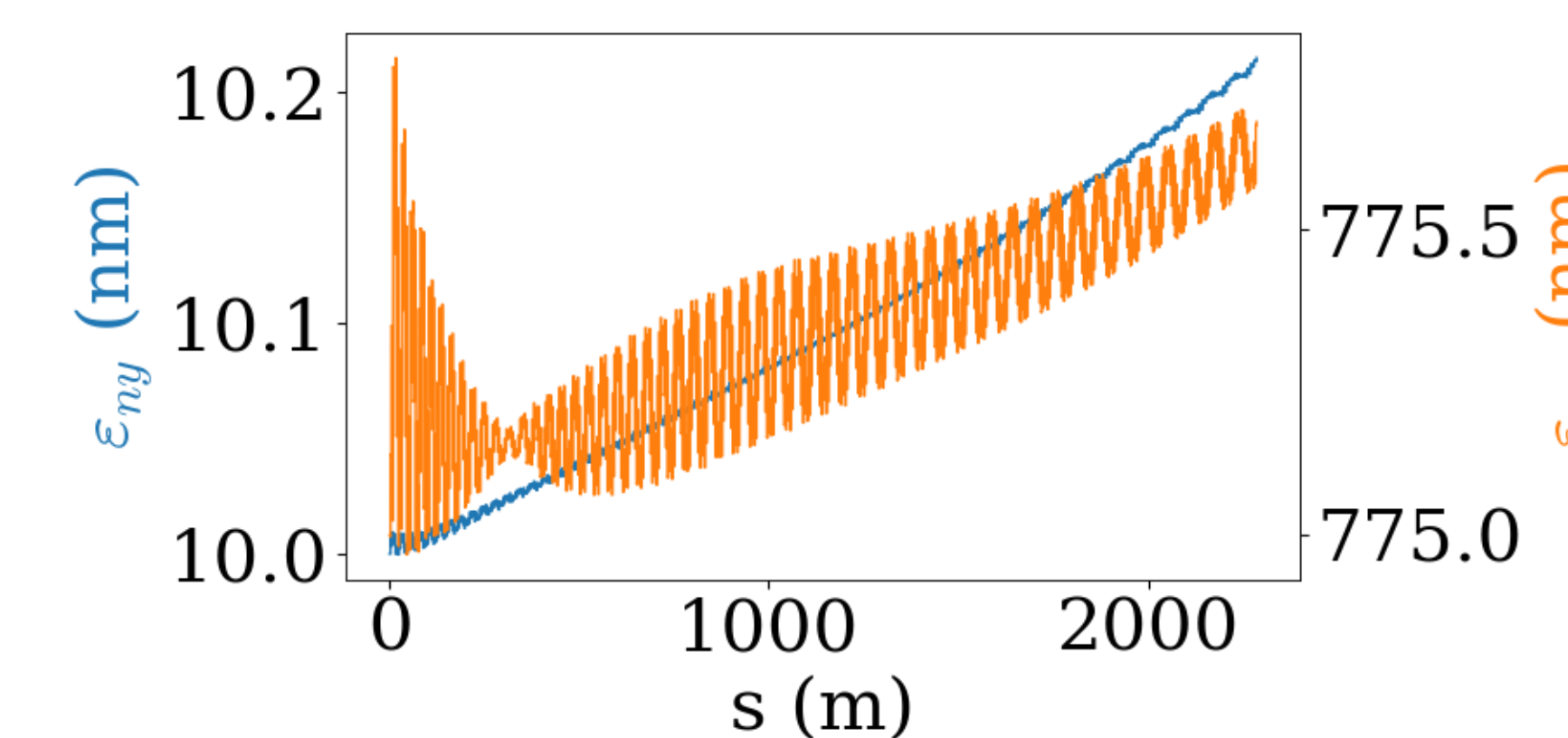
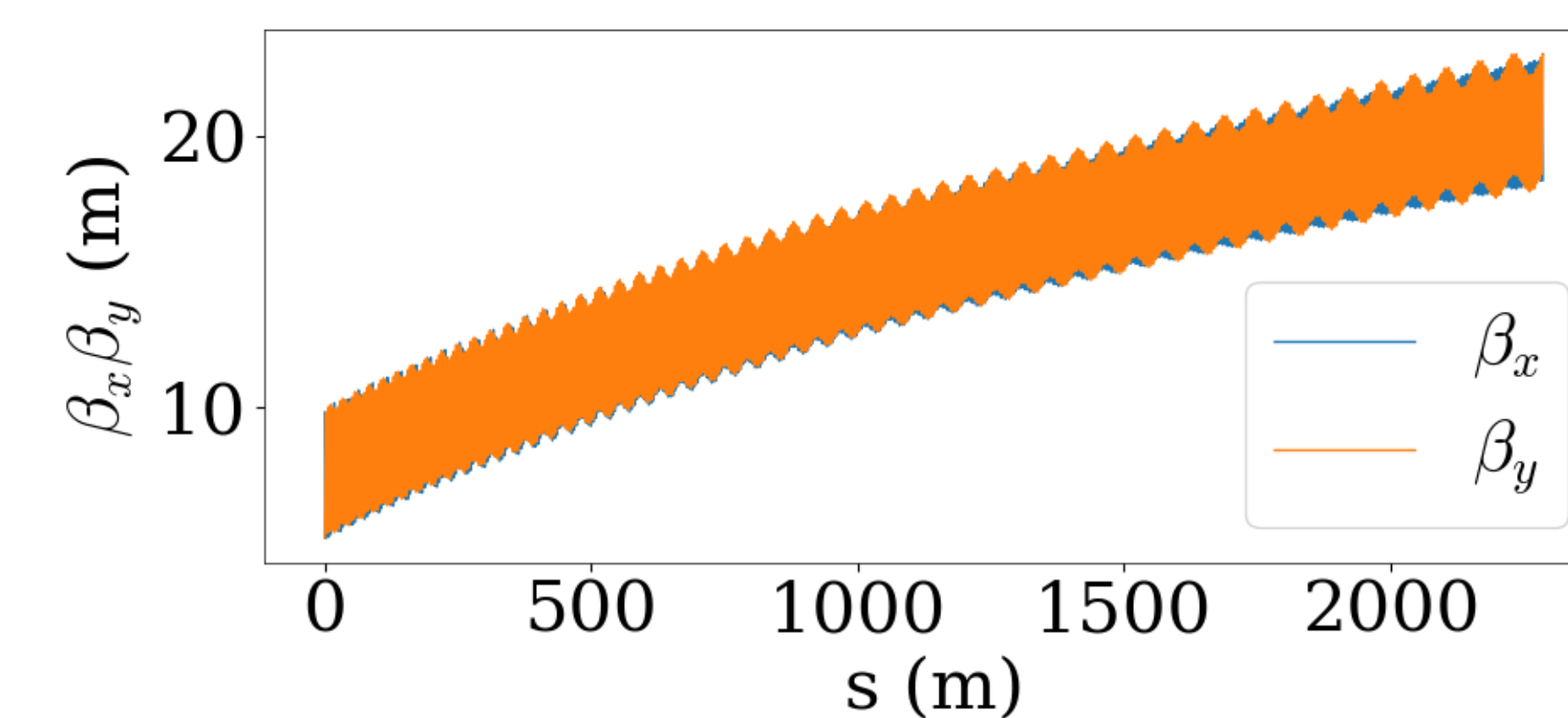


Beam dynamics studies and results

- Simulations were performed using Elegant
- The design is based on FODO lattice with adaptive quad strengths account for the scaling of energy
- Accelerating phases were adjusted to provide chirp for BNS damping
- Please also check G. White presentation on Wed 10:30 a.m.



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Conclusions and plans

- We presented the preliminary studies of beam dynamics of the main linac of C³.
- Further studies on error tolerance are planned
- Design of beam transport are planned

Acknowledgments

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 [1] Tantawi, Sami, et al. *PRAB* 23.9 (2020): 092001.
 [2] Bai, Mei, et al. arxiv: 2110.15800, 2021