

Future Research and Education in Beam Physics at the FAST Linac and IOTA Ring

Z. Huang

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Introduction

- IOTA/FAST is a test facility in GARD thrust area emphasizing Accelerator and Beam Physics
- Well positioned to tackle some of ABP Grand Challenges
- 10-year vision of IOTA/FAST in connection to Snowmass process

- **Grand challenge #1 (beam intensity):** How do we increase beam intensities by orders of magnitude? (nonlinear integrable optics, space charge, electron lens)
- **Grand challenge #2 (beam quality):** How do we increase beam phase-space density by orders of magnitude, towards quantum degeneracy limit? (Optical stochastic cooling, phase space manipulations)
- **Grand challenge #3 (beam control):** How do we **measure** and control the beam distribution down to the level of individual particles? (Single e- experiments, SRF high-order mode diagnostics)
- **Grand Challenge #4 (beam prediction):** How do we develop predictive “virtual particle accelerators”? (Nonlinear dynamics, machine learning)

Connections to Snowmass AF1 Lols

- IOTA and its experimental program
- Beam physics of extreme beams
 - electrons
 - intense protons: rings & linacs
 - intense hadrons
- Advanced Beam Cooling : status and plans
- eLens for space-charge compensation in hadron rings
- DOE traineeship needs for HEP accelerator workforce development
- Center for bright beams
- US Particle Accelerator School