UC-XFEL

- Current XFELs: ~km, ~10 GeV, ~$1B
  - Nation-state scale
  - Scaling previously infeasible
- UC-XFEL: 40 m, 1 GeV, $40M
  - University scale
  - Still offers the unique benefits of flagship XFELs

- Careful combination of state-of-the-art techniques and technologies
  - Ultra-bright beams
  - Short period undulators
  - Advanced beam transport and manipulation
- Quasi-CDR published in NJP (2020)
• UCLA hosted a conference in July 2021
  • ~40 speakers, representing interested parties from the photoinjector all the way through photon end-users
  • Led to the formation of a consortium to advance UC-XFEL development

• Formalized stepping stone FELs for development at UCLA
  • Considered different funding cases and objectives
  • FIR FEL project currently underway

• Continued progress with cryogenic half-cell beamline
  • Developing technologies and expertise required for UC-XFEL

![Diagram of beamline components: 1.5-m linac, 30-MeV Beam Diagnostics, Transverse diagnostics, 18-MeV FIR-FEL Test Beamline, UCLA-KIAE Undulator, Passive de-chirper, Small chicane (Seed injection, possible future upgrade), 13 μm photons.](bottom-figure:A.Fukasawa)
Emittance exchange for advanced PWFA

- By transversely masking the beam before the EEX beamline, the final current profile is controlled.
- Shaping drive and witness bunches with this approach has yielded record-breaking transformer ratios [2].
Multileaf collimator masking

• Propose replacing the laser cut tungsten masks in EEX beamline with a multileaf collimator (MLC)

• MLCs are commonly employed to shape radiotherapy beams

• Real-time, nearly arbitrary drive and witness beam shaping

• Highly synergistic with machine learning

• Extension of UCLA/AWA collaboration to study exotic shaped beams for HTR PWFA
32 leaf, log-spaced MLC

Laser cut mask [1]

MLC replication

Final current profile

32 leaf MLC functionally equivalent to existing AWA masks