

Beam Dynamics of Multi-Turn ERLs and Investigations on Transversal Beam Break Up



TECHNISCHE
UNIVERSITÄT
DARMSTADT

Support of  **PERLE** | Powerful energy recovery linac experiments and ERL based future options after HL-LHC

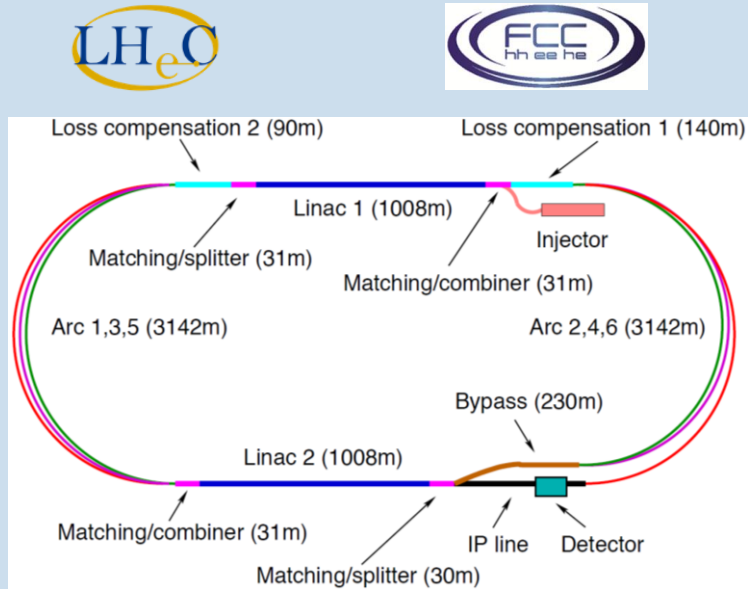


PERLE as ERL prototype



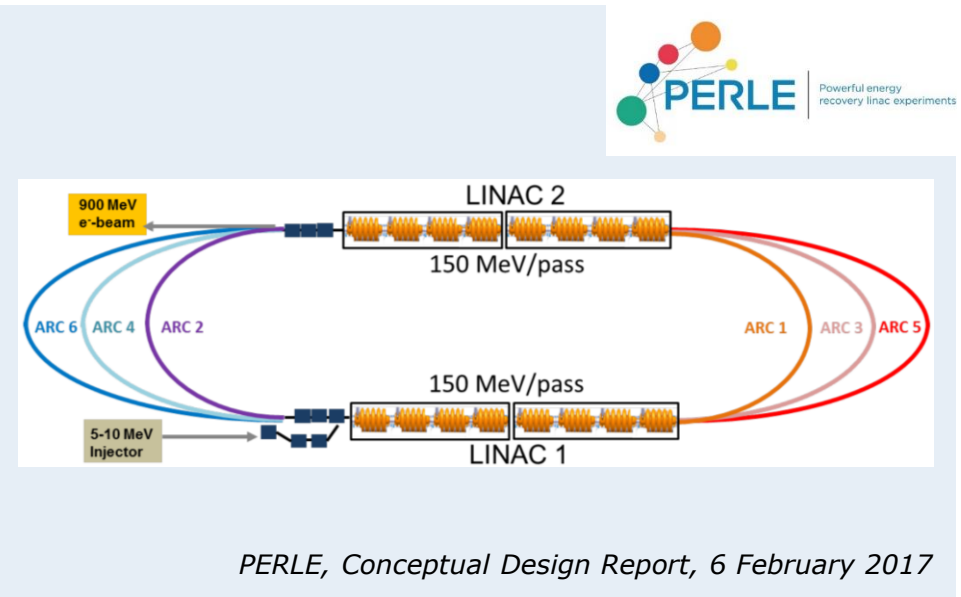
FCC-he based on a multi-turn sc ERL

Motivation

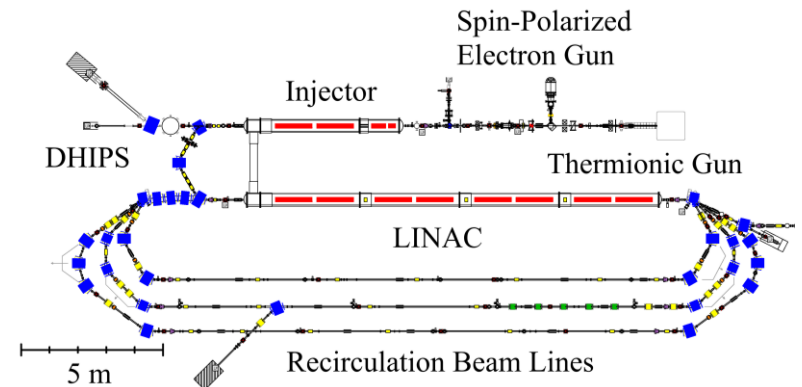


Future Circular Collider Study - FCC-he
Baseline Parameters, 6 April 2017

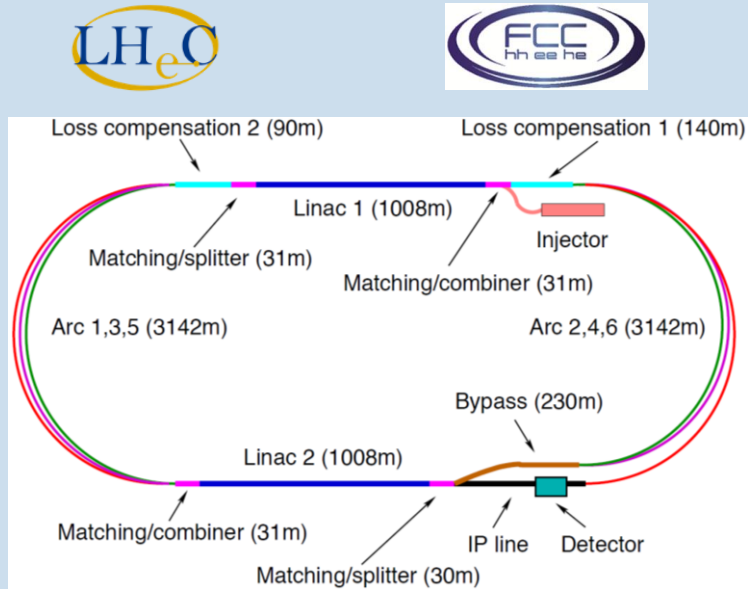
Schematic view of default LHeC
configuration
Also default FCC-he configuration



PERLE, Conceptual Design Report, 6 February 2017

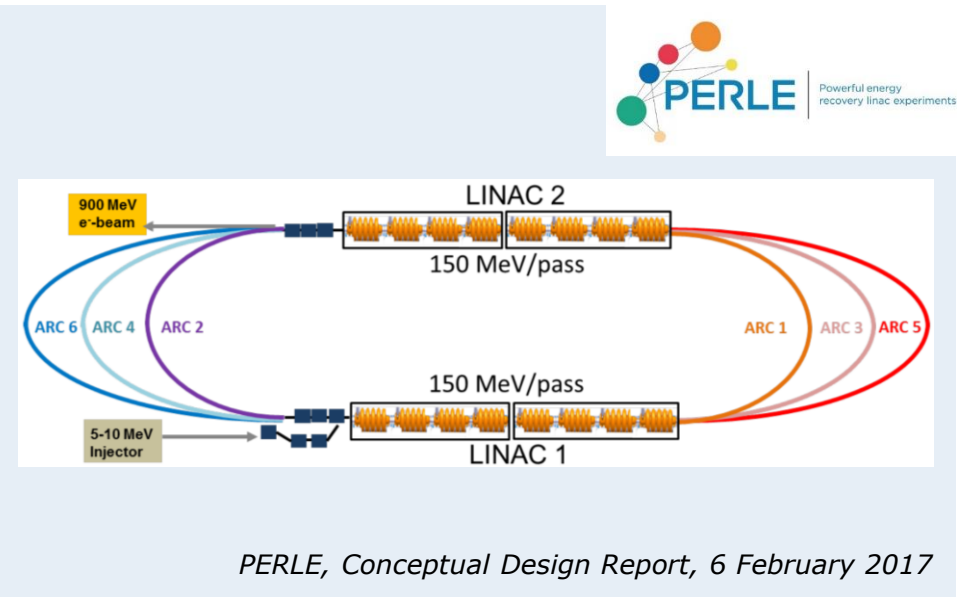


Motivation

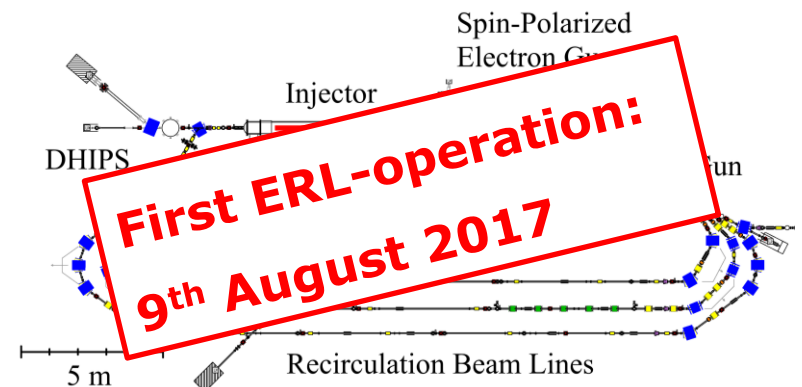


Future Circular Collider Study - FCC-he
Baseline Parameters, 6 April 2017

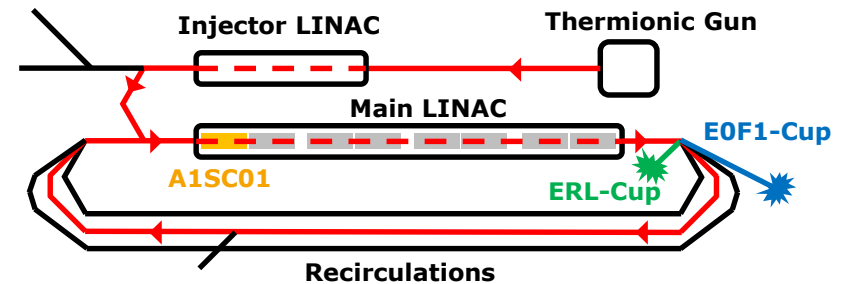
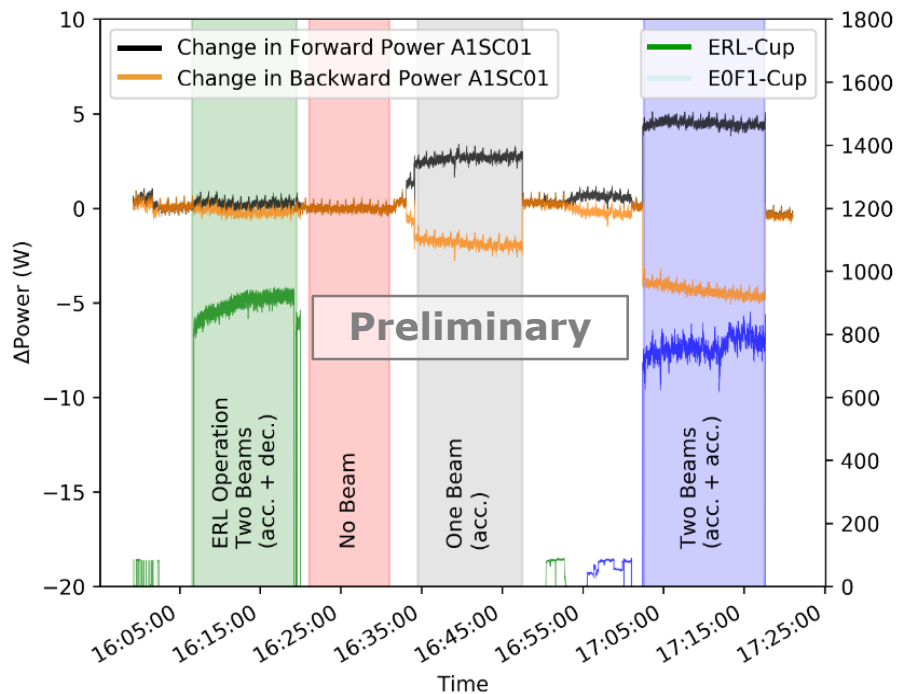
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PERLE, Conceptual Design Report, 6 February 2017



First ERL-Operation: 9th August 2017

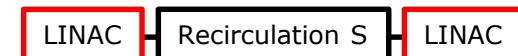
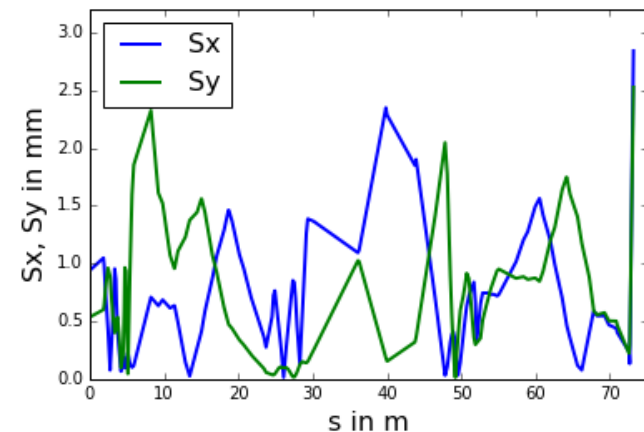


Publication in preparation

Beam Dynamics of Multi-Turn ERLs

- Simulations of
 - Multi-turn ERL operation

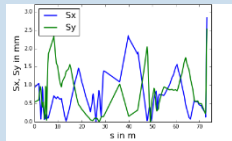
Once recirculating ERL (S-DALINAC)



*M. Arnold et al., Proceedings of ERL
2017, CERN, in press*

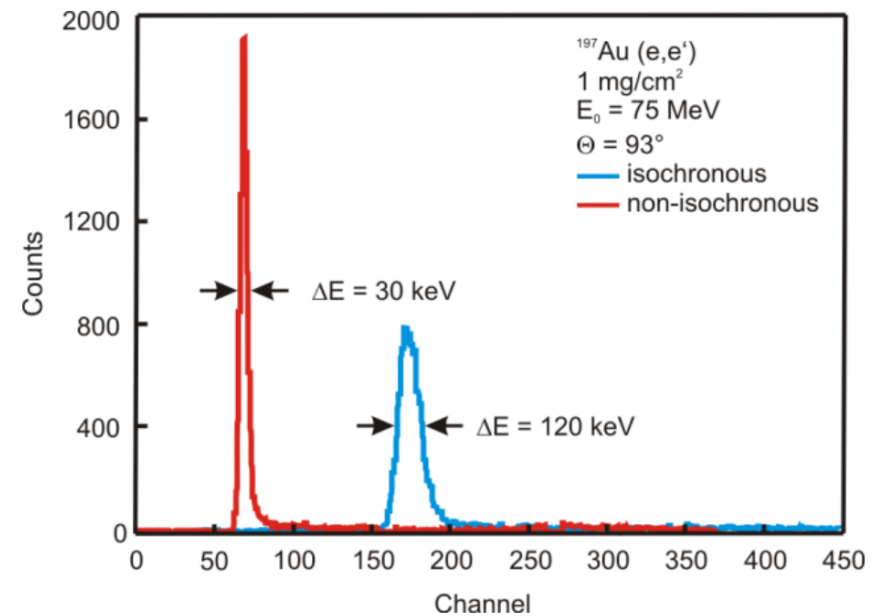
Beam Dynamics of Multi-Turn ERLs

- Simulations of
 - Multi-turn ERL operation



- Isochronous/non-isochronous operation

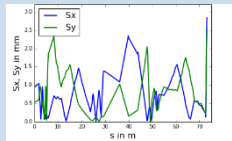
Non-isochronous operation of twofold S-DALINAC (conventional mode)



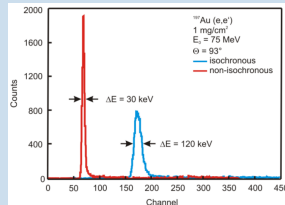
F. Hug et al., Proceedings of IPAC 2016, Busan, Korea (2016) 3222.

Beam Dynamics of Multi-Turn ERLs

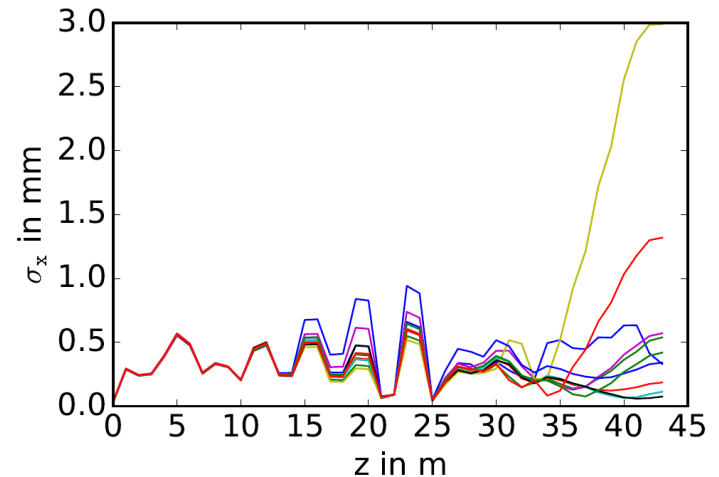
- Simulations of
 - Multi-turn ERL operation



- Isochronous/non-isochronous operation
- Stability (tolerances, precision of controlling,...)



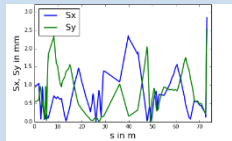
Investigation of misalignment of lattice (first recirculation)



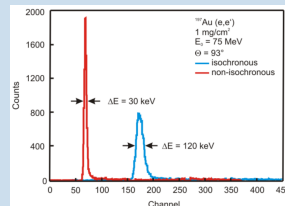
M. Arnold et al., Proceedings of IPAC 2017, Copenhagen, Denmark (2017) 1384.

Beam Dynamics of Multi-Turn ERLs

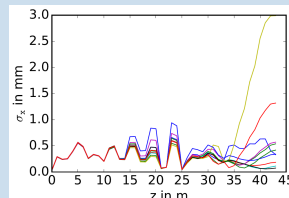
- Simulations of
 - Multi-turn ERL operation



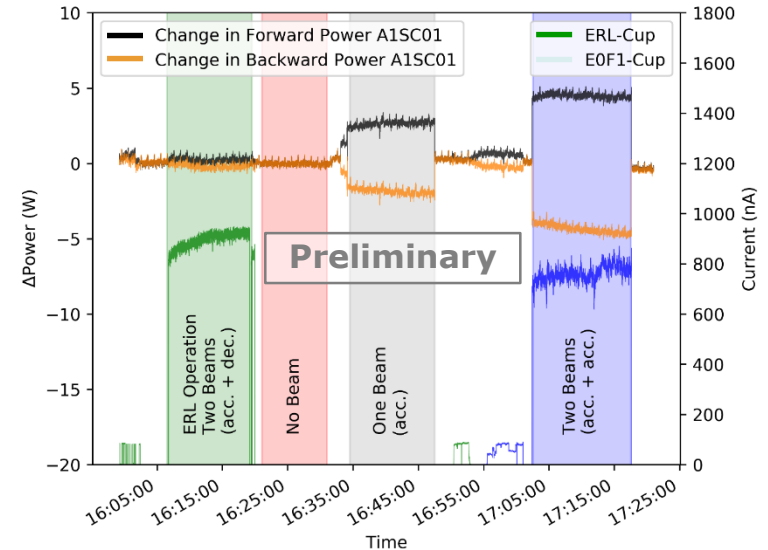
- Isochronous/non-isochronous operation



- Stability (tolerances, precision of controlling,...)



- Measurements/tests at S-DALINAC



- First ERL in Germany
- Potentially first sc multi-turn ERL world-wide

Publication in preparation

Support for ERL-Activities of Strategic German Interest (→ CERN)

- ERL simulations (multi-turn, isochronous/non-isochronous, stability)
- ERL measurements and tests of simulations at S-DALINAC
- Investigations at the event of BBU (HOMs, beam parameters)

Needs (3 year total)

- | | |
|---------------------------------|--------|
| • 2 PhD positions (2/3) | 254 k€ |
| • Computational hardware | 10 k€ |
| • Alignment of modified lattice | 16 k€ |
| • Diagnostics | 50 k€ |
| • Travel | 18 k€ |

Total	348 k€
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Thank you for your attention