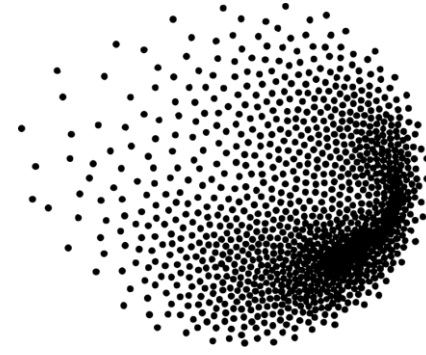
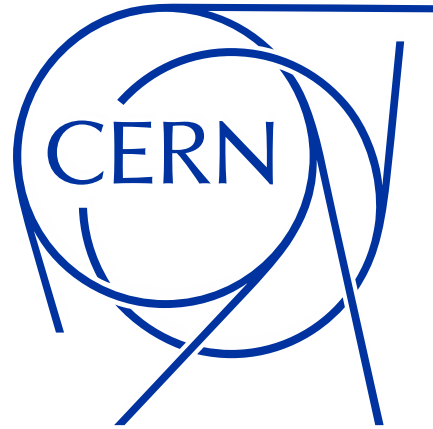




PSI

RF Design of the compact RF power coupler for FCC-ee injector linacs

Pablo Martinez Reviriego, Alexej Grudiev, Adnan Kurtulus

CERN, Geneva, Switzerland

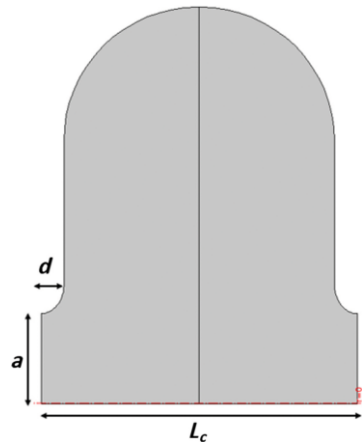
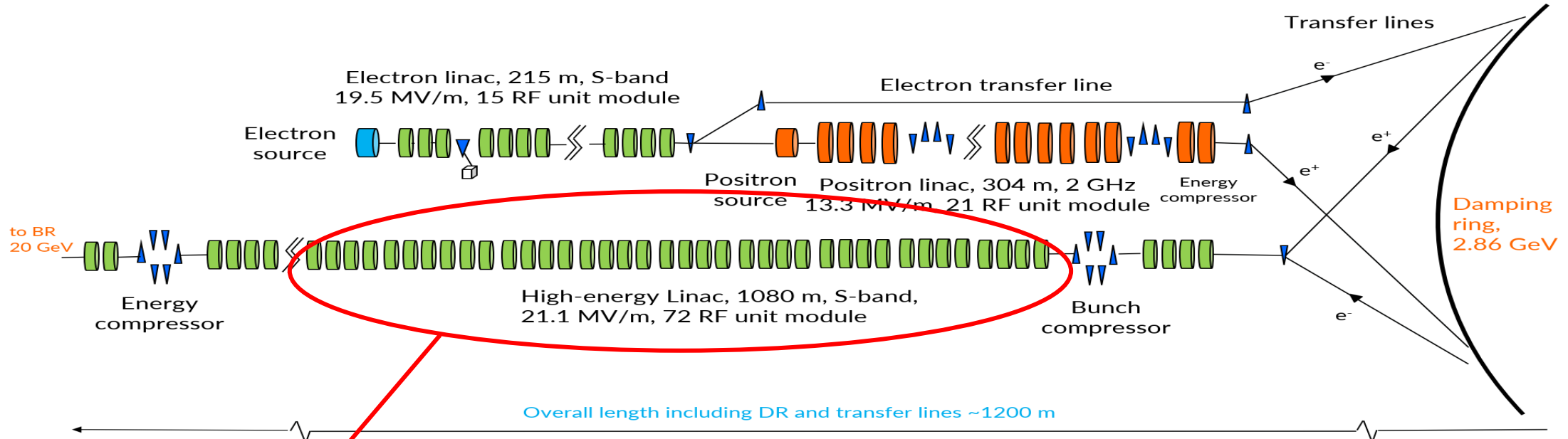
Paolo Craievich, Jean-Yves Raguin, Ricardo Zennaro

PSI, Villigen, Switzerland

LINAC'26, 17 August 2026

Introduction: FCC-ee injector

See talk by Paolo Craievich (TU1P003)



2D design of accelerating structure:

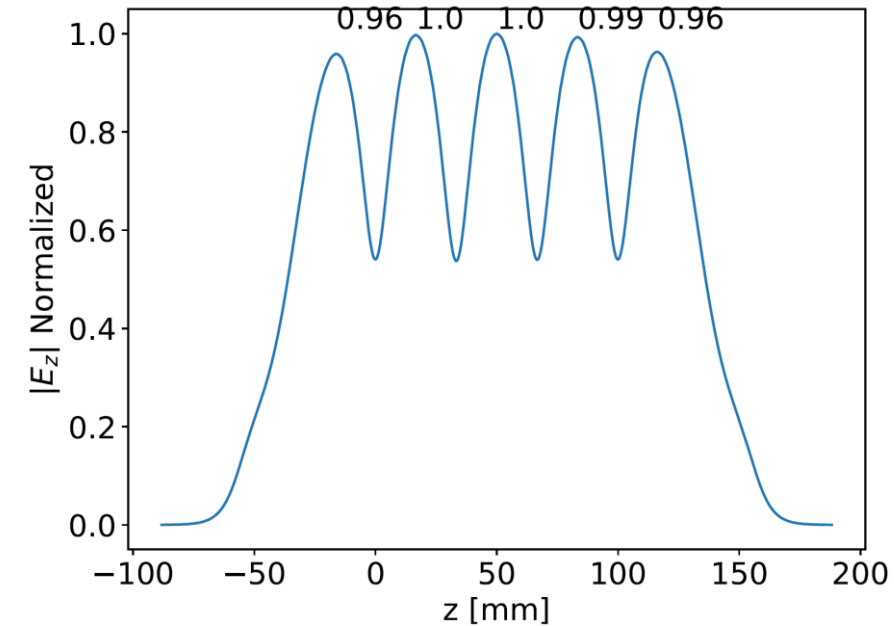
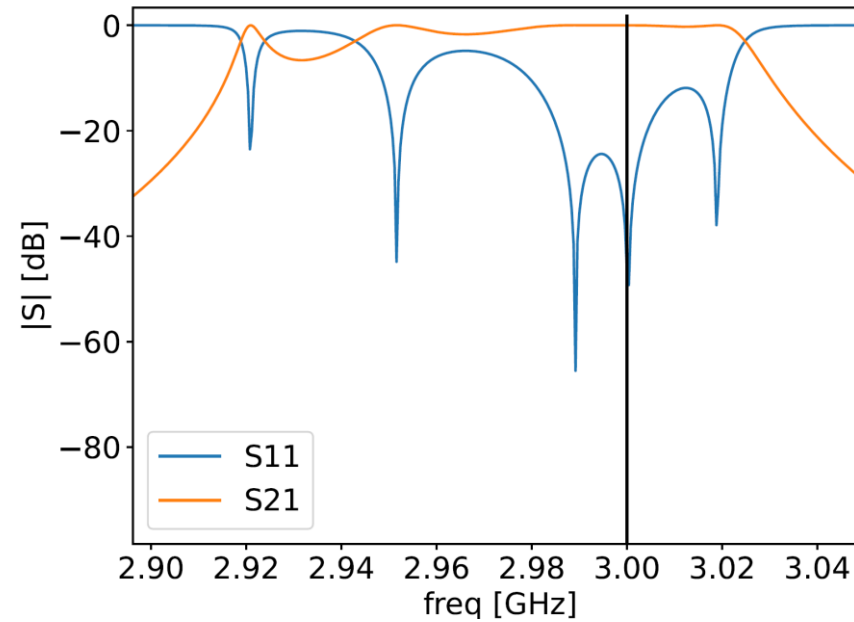
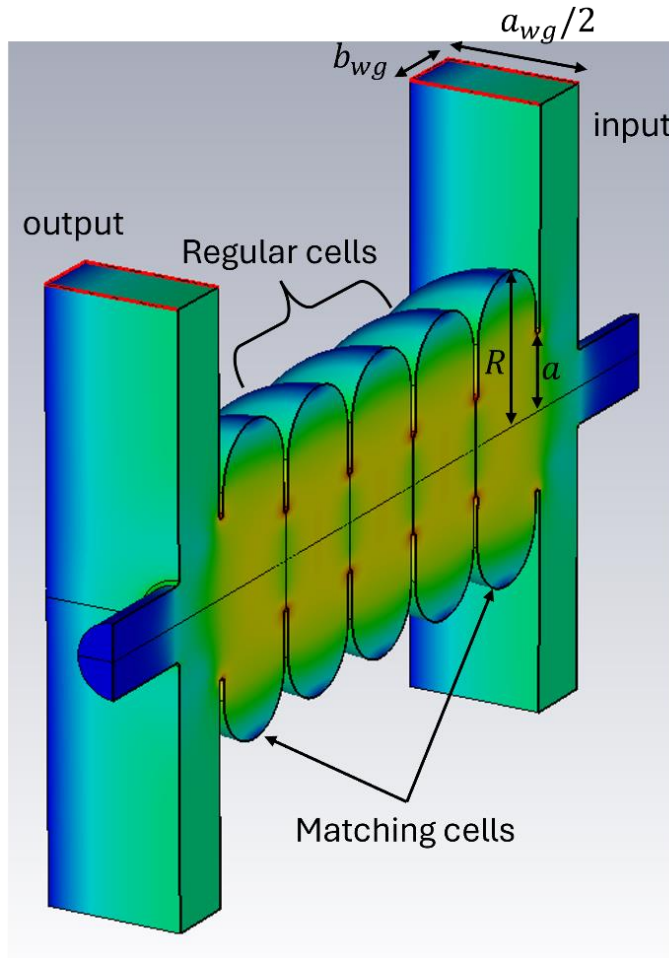
A. Kurtulus, S. Bettoni, P. Craievich, A. Grudiev, A. Latina, and J.-Y. Raguin, "Updated RF Design and Optimization of 3 GHz Traveling-Wave Structures for the FCC-ee High-Energy Linac", presented at the IPAC'26, Deauville, France, May 2026, paper MOP7013.

This work:

- 3D design with power couplers
- Impact of the couplers in the beam dynamics
- Compact power coupler

Double-feed coupler

Optimization is done by adjusting R and a in the matching cells



Standard way of power couplers design:

- ✓ More symmetry
- ✓ Simple rectangular waveguides
- ✗ Requires more elements (splitter and bends)
- ✗ Less compact

Transverse kick induced by the couplers

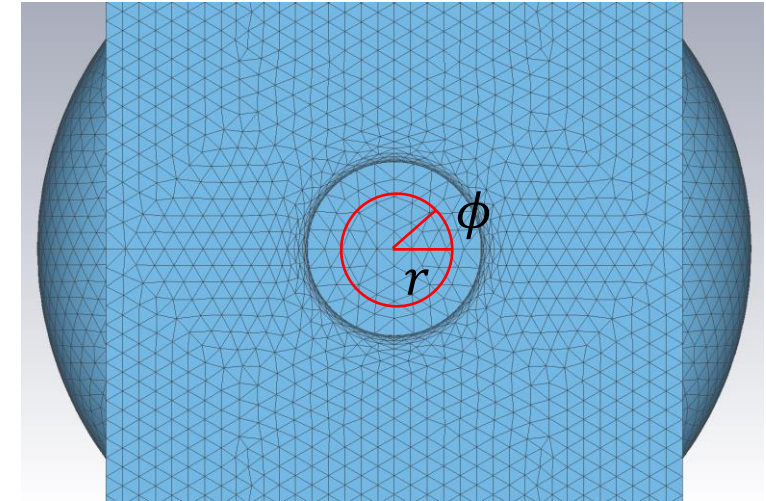
RF couplers break the 2D symmetry of the system:

Multipolar expansion:

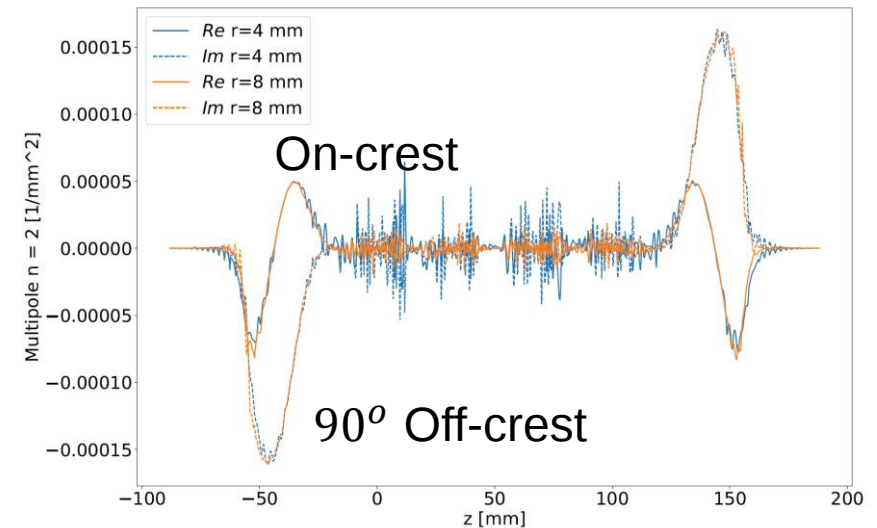
$$E_{acc}(r, \phi, z) = \sum_{n=0}^{\infty} E_n(z) r^n \cos(n\phi)$$

Panofsky-Wenzel theorem: transverse kick induced by the couplers

$$p_{\perp}(r, \phi) = \frac{je}{\omega} \int_0^L \nabla_{\perp} E_{acc}(r, \phi, z) dz$$

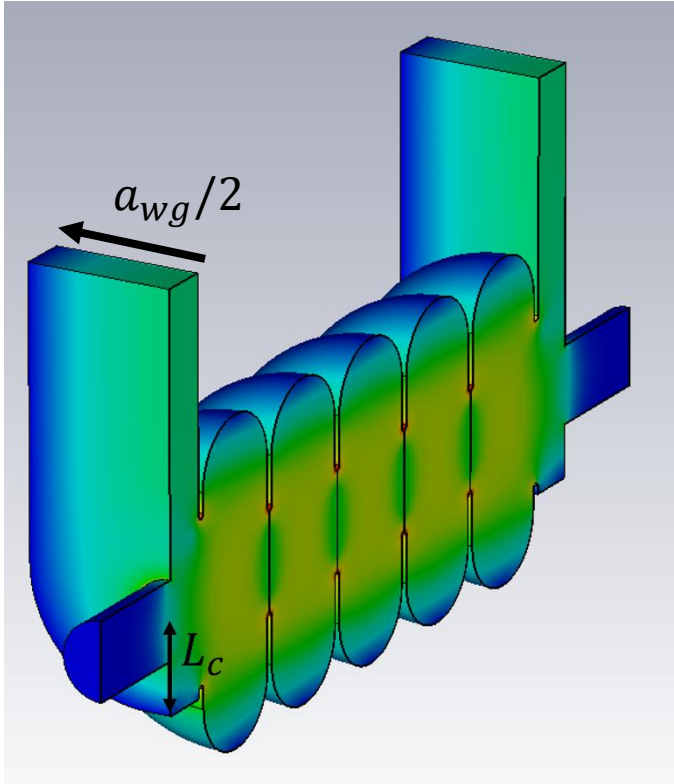


Quadrupolar kick ($n = 2$)



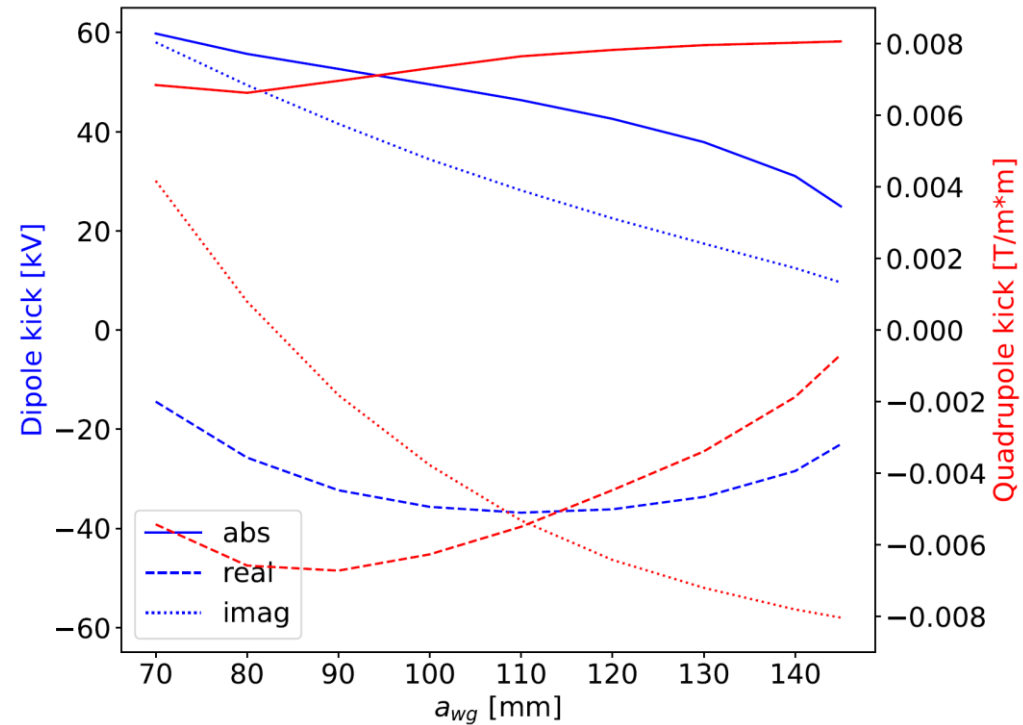
Single-feed coupler

The most compact solution



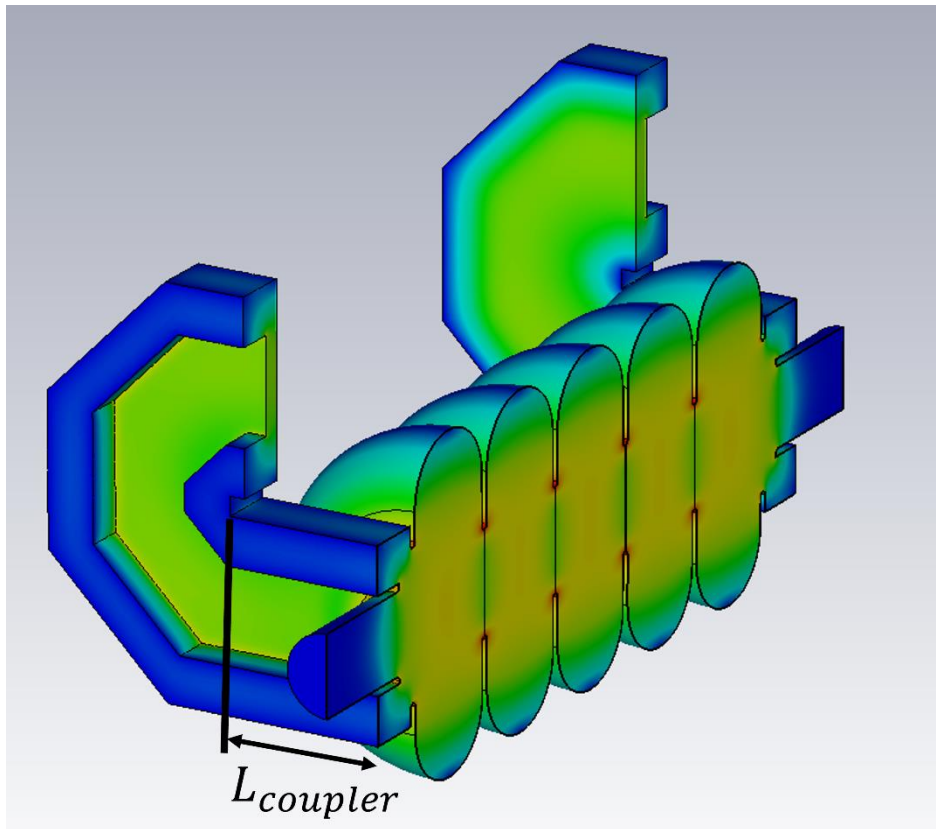
Standard way of power couplers design:

- ✓ Simple rectangular waveguides
- ✓ Requires less elements (splitter and bends)
- ✓ Very compact
- X Less symmetry (dipolar kick induced)



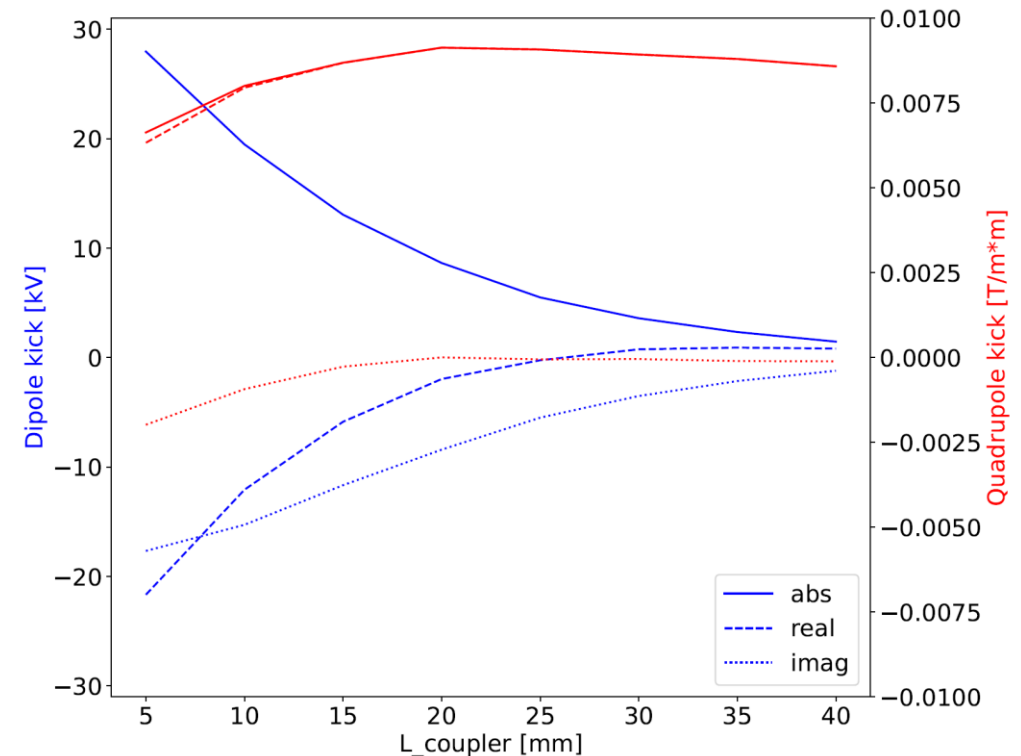
Double-feed ridge coupler

Ridge waveguides allow more compact design by reducing size without altering the equivalent waveguide



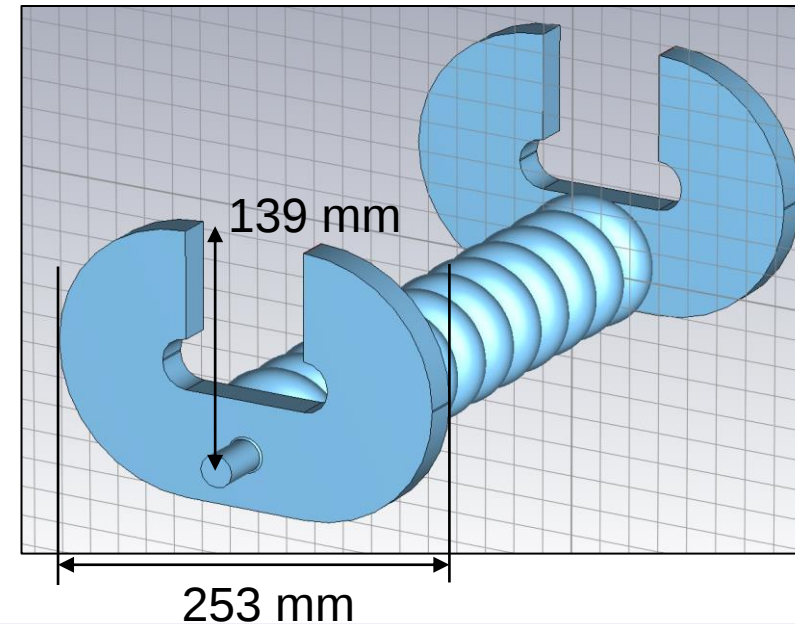
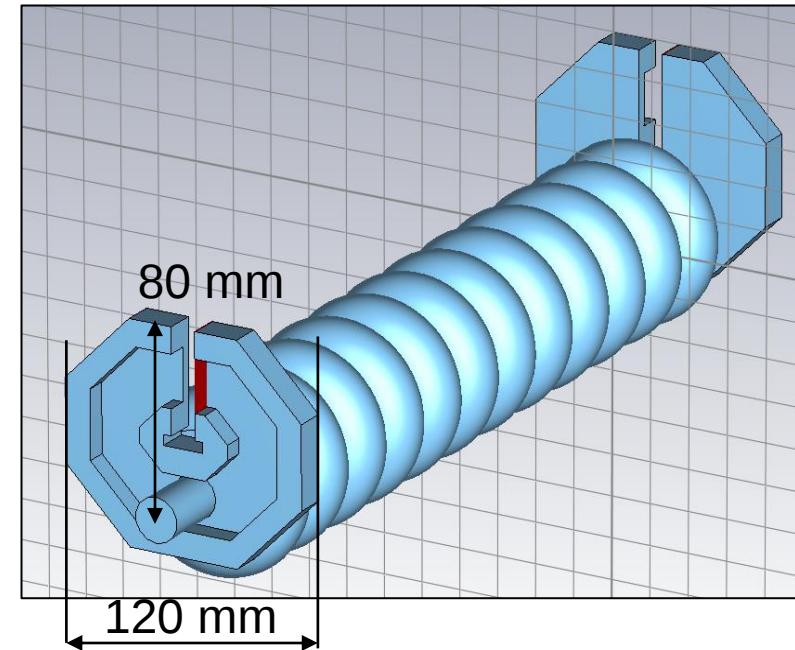
Standard way of power couplers design:

- ✓ Very compact
- ✓ More symmetry
- ✗ Requires more elements (splitter and bends)



Take-home message

- RF couplers break the symmetry of the system, inducing transverse kicks.
- Single-feed couplers offer a very compact solution, but the dipole kick cannot be cancelled.
- Double-feed ridge couplers offer a more symmetric and compact solution.



Poster: **MOPO049**

