ERL activities in PHOENIX

KOMITEE FÜR BESCHLEUNIGER-PHYSIK KfB

- Multi-turn SRF ERL is an emerging field, perfectly suited for collider applications
- Reliable SRF-ERLs with high energies (→ multi-turn) and currents needed for future machines/colliders
- JGU and TUDa will be running the only European ERL projects within the upcoming funding period
- Possibility to explore longitudinal beam dynamics and collective effects in ERLs and studies of ERL operation and application as collider
- Findings useful as R&D effort for future large scale facilities

- *Project 1 (JGU): Beam Dynamics for ERLs*
  - Non-isocronous beam dynamics for future ERLs with higher energies
- *Project 2 (TUDa): Proof-of-Principle of a multiturn SRF-ERL - Collider*
  - Longitudinal ERL Beam Dynamics for High Efficiency Injection @ S-DALINAC (first performant multi-turn SRF ERL)

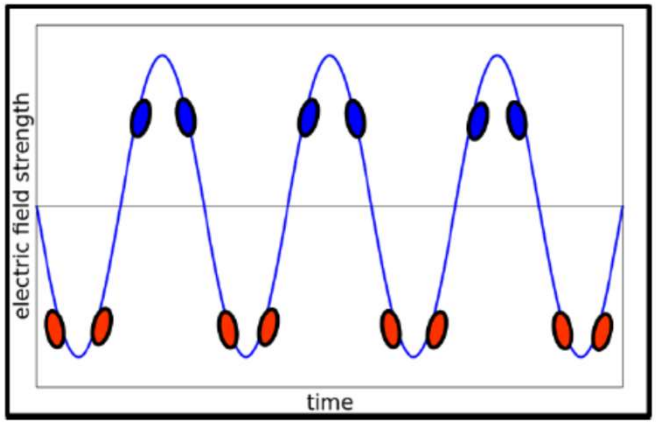
Beam Dynamics for ERLs (F. Hug)

Years of operating MAMI and S-DALINAC (conventional mode) show tremendous beam stability and energy spread using off crest acceleration and non-isochronous beam transport

Main question: Is a non isochronous scheme in ERL operation possible, reaching **best energy spread** at the experiment and **still full beam transport** to the dump?

- Ongoing studies are using **double sided design** of MESA and look promising
- Might be possible with acceleration on **either crest** of the accelerating field (alternative approach (e.g. TU Darmstadt) use separated beam transport for accelerating and decelerating beams)

On vs.Off crest acceleration



$\Delta E_{rms}/E = 2 \cdot 10^{-4}$ (21 keV @ 105 MeV)
$\Delta E_{rms}/E = 8.9 \cdot 10^{-5}$ (9.3 keV @ 105 MeV)

(Off crest acceleration: Significant smaller energy spread)

For this call: how can this concept be useful **for future ERLs** and is it possible at **higher energies** as well, when synchrotron radiation comes in (e.g. at LHeC)?

Further investigations: how does efficient HOM damping developed in the present funding period (Nb_3Sn coated HOM adsorbers) affect beam stability, in particular beam breakup instabilities