Accurate and fast field descriptions for modelling indirect space charge effects

Beam production for HL-LHC and FAIR subject to space charge limits during injection plateaus

- Beam loss and emittance growth to be minimised
- With push for high intensity and high brightness, **interplay** of **direct space charge** and **boundary effects** important

Develop accurate and fast boundary models, add to present simulation suite and investigate effects:

- CERN SPS: space charge induced resonance crossing vs. significant incoherent tune shifts along bunch trains
- FAIR SIS100: heavy-ion beams largely fill aperture, vacuum tube effects on beam loss mechanism at sparge charge limit
- Multi-turn injection / extraction with beamlets close to pipe
- Long-term effects of power supply ripple: finite coherent dipole motion and indirect space charge driven resonances