FCC-hh Beam-Beam and Collective Effects at the **EPFL**

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EPFL-LPAP and CERN

- More than **10 years of productive and exiting collaboration** on several subjects in accelerator physics, with special emphasis on beam-beam and collective effects for **LHC, LHeC and HL-LHC** … **24 PhD thesis, 6 Master thesis and several stage periods at CERN and outside** (PSI, BNL, SLAC…)
- Consolidated **experience in beam-beam and collective effects**: LHC studies and commissioning, LHeC Conceptual Design Study and HL-LHC Project partner for Task. 2.5 Beam-beam studies (3 post-doc fellows & 4 PhD)
- **Infrastructures** : **High Power Computing** center (1 member in steering committee) and support to CERN **LHC@HOME BOIC** system (1 LPAP scientific collaborator)
- All beam-beam simulations already possible only using EPFL infrastructure (CERN doesn't have this capability)
- **Hands-on LHC machine development studies** (BE/ABP and OP) and follow up of accelerator R&D with external collaborators (BNL e-lenses, LBNL, KEK& Fermilab beam-beam simulations)

Present collaboration on LHC and HL-LHC.

Hands-on machine experience is fundamental!

Proposed contributions: Experimental Insertion Region Design (WP3)

Beam-beam studies for FCC-hh:

- IR set-up (crossing angle operation, bunch spacing…)
- Dynamic aperture studies (WP2 and WP3 arc and IR optics)
- Beam-beam and radiation damping
- Coherent beam-beam
- Noise on colliding beams
- Orbit, chromatic, tune effects for train operation
- Leveling scenarios and beam-beam (Experiments)
- Mitigating techniques (e-lenses, wire compensators, crab cavities)
- Define possible operational scenarios (parameter space exploration)

Collective effects:

- Interplay of beam-beam and machine impedance (WP2 impedance model)
- Stability of colliding beams with transverse feedback

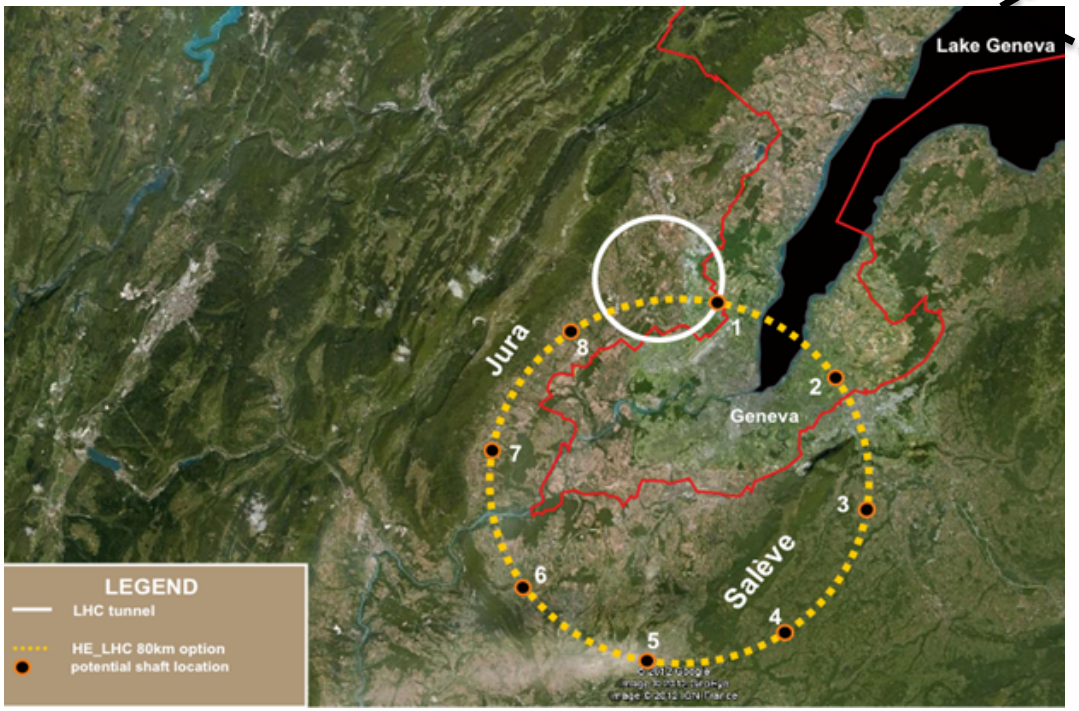
Keep beam-beam effects under control, define IR operation, set parameters to avoid luminosity deterioration and instabilities

Conclusions

Let's continue this synergetic collaboration…

Conclusions

We are ready to devote our experience and enlarge our knowledge to the FCC-hh studies.



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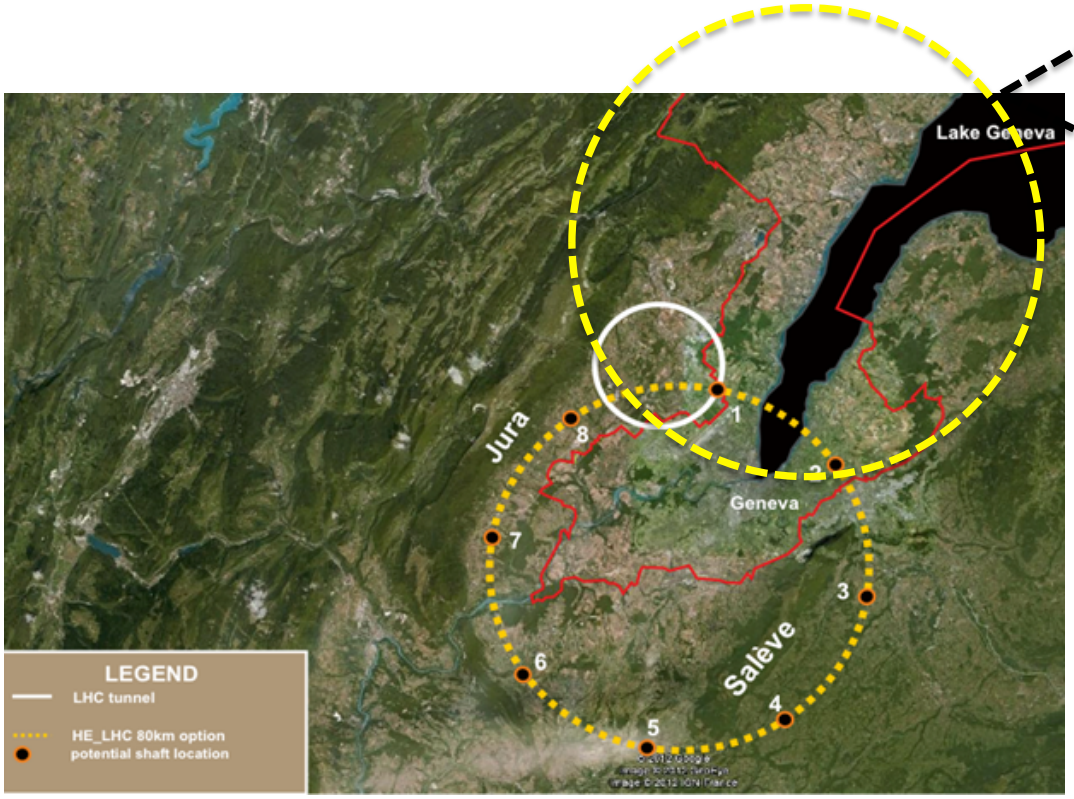

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…and we are ready for even bigger challenges!

Thank you!