FCC-ee collimation – overview of needed studies

- Updates to collimation system design
  - Collimation optics and settings, Need for additional collimators (shower absorbers, tertiary collimators, Materials
- Studies of performance in various beam loss scenarios
- Beam loss tolerances
  - Damage limits, Equipment tolerances, Background studies
- Code development and code benchmarks

Collimation system design

- Collimation optics and layout: may need revision due to vertical emittance blowup and small momentum acceptance
- Tertiary collimators
  - Giacomo: addition of new collimators upstream of SR absorbers, for now MoGr, Factor ~10 decrease of losses on SR absorbers
    - Need for shower absorbers to be studied
- Shower absorbers
  - Stefano M: Energy deposition study done of IRF for generic halo with pencil beam. Optimized absorber placement 20+20m after TCPH, assuming TMZ (Mo) as for secondaries. Still need more realistic impact distribution
    - Ongoing: Implementation in XSuite (Giacomo, Frederik) to extract multi-turn touches
    - To be checked: peak power on absorber and vacuum chamber. More detailed breakdown of where energy goes.
    - Assuming 2-in-1 model of quadrupole. Feasible for optics of B2? Is it feasible for magnets to have single-beam quadrupoles with 30 cm beam separation to make the beams independent?
- Crystal collimation
  - First studies done by Giacomo, presented at Channeling. With planar channeling, no significant improvement in cleaning over standard system. Axial channeling and dependence on impact distribution to be studied
- Materials
  - Should converge on baseline TCP material for the feasibility report. Strongest constraints from robustness and impedance. To be checked MoGr vs graphite: impedance impact and tolerated number of impacting bunches. Possible other constraints from vacuum and production (weaker argument) in favour of graphite

Beam loss scenarios

- Catalog of losses:
  - Generic halo, global beam-gas, spent beam, top-up injection, instabilities (coupled bunch instability - loss of feedback, loss of beam-beam), Touschek, thermal photon scattering, failures (injection, extraction, power supplies, RF, [SKEKB crazy beam if understood])
- Fast instabilities
  - Giulia has implemented dynamically rising kick in XSuite – parameters to be tuned based on feedback from Xavier, then produce loss map
- Spent beam
  - Finalized implementation of spent beam tracking - contribution by Giacomo to beam-beam workshop
  - Open point: fast vertical emittance blowup – to be understood. Drives low lifetime and high losses on SR absorbers from IP just upstream. If confirmed, would need to re-think about system design (e.g. add TCLDs)
  - Also low momentum acceptance (0.5%) with collimation insertion – to be understood and tuned

Beam loss tolerances

- Anton: A few bunches on the aperture without damage

Code development and benchmarks

- Implementation of touches ongoing: Giacomo and Frederik
- XSuite-FLUKA coupling under study - Kyriacos, Frederik, Giacomo
- Benchmark with SuperKEKB data
  - Giacomo has data
  - Potential showstopper: modelling of SuperKEKB interaction region
    - Good progress made for XSuite modelling by Jack S. and Gianni – missing only solenoid