



# FCC-hh ring design meeting #2

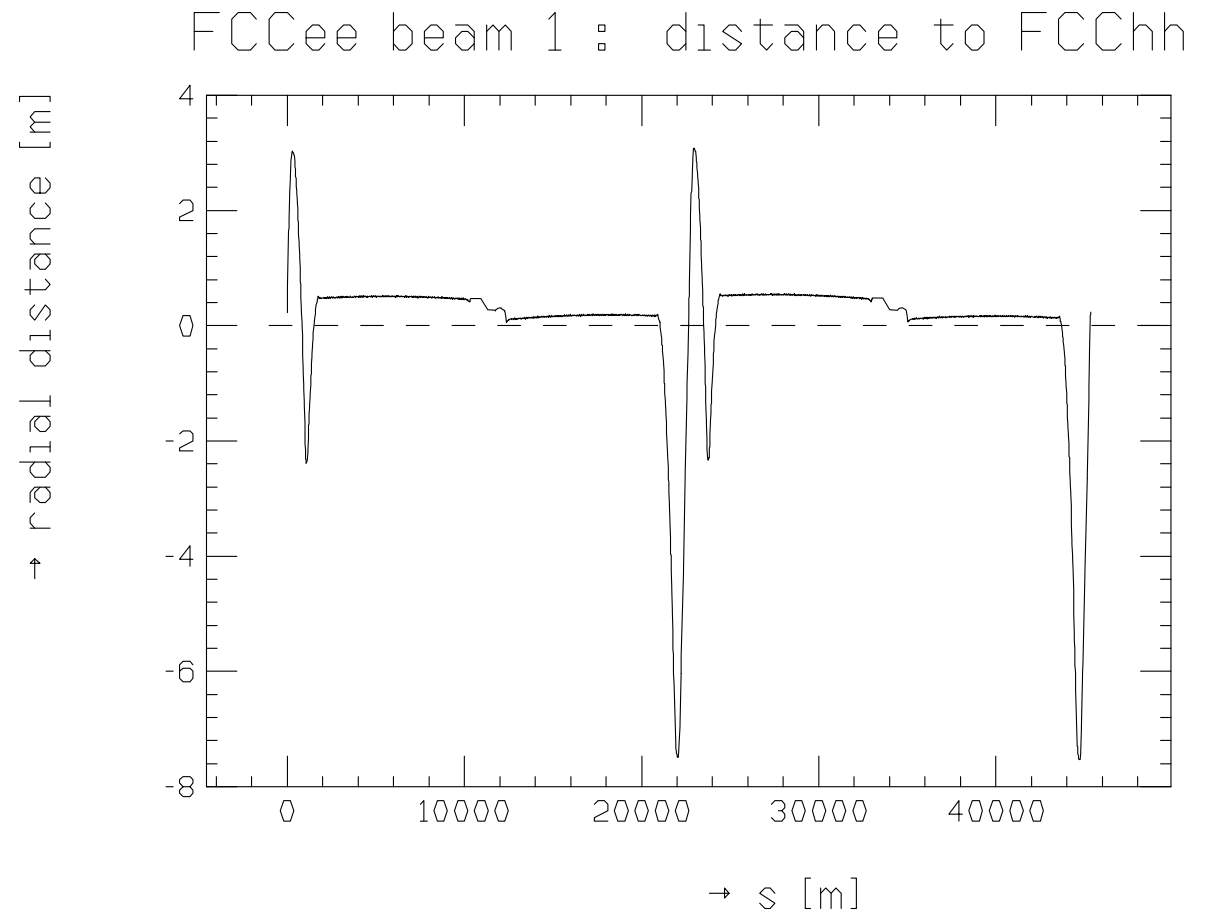
M. Giovannozzi

Acknowledgements: A. Abramov, W. Bartmann, R. Bruce, S. Calatroni, F. Cerutti, R. Lopez, N. Mounet, G. Perez-Segurana, T. Risselada, P. Thonet, E. Todesco

- **On-going activities:**
  - **PA31V3.0**
  - **Optics design**
  - **Transfer lines in ring tunnel**
  - **Operating temperature of beam screen**
  - **General points**

- **New layout**
  - The ring circumference will be further shortened for matching the harmonic number of FCC-hh and its injector and for improving the ring placement.
- **V2.0**
  - $L_{\text{cell}} = 215.294$  m;  $L_{\text{Circ}} = 91104.686$ ;  $N_{\text{cell}} = 42$ ;
  - $L_{\text{ss}} = 1400$  m;  $L_{\text{ss}} = 2143$  m;
  - $\theta_0 = +10.88$  deg;  $PA_{\text{lat}} = 46.2467465$  deg;  $PA_{\text{lon}} = 6.09718737$  deg;
- **V3.0 (beam energy for 16 T is approximately 47 TeV)**
  - $L_{\text{cell}} = 215.294$  m;  $L_{\text{Circ}} = 90657.886$ ;  $N_{\text{cell}} = 42$ ;
  - $L_{\text{ss}} = 1400$  m;  $L_{\text{ss}} = 2032$  m;
  - $\theta_0 = +10.90$  deg;  $PA_{\text{lat}} = 46.2466$  deg;  $PA_{\text{lon}} = 6.0981$  deg;
- **V3.1**
  - Same as V3.0, but with the experimental IPs radially displaced match those of the FCC-ee rings.

- **The comparison of the FCC-hh ring and the corresponding FCC-ee ring showed large displacements that should be fixed in the future.**



riss 10/02/23 16:07

- **V1.0**
  - It includes new optics for collimation insertions and new PB optics.
  - Preparation of a thin lens lattice for collimation studies to validate the new optics.
- **V3.0**
  - Development of a 16-dipole cell design: see presentation by Gustavo.
  - The decision has been taken to injection the beams in the outer channel.
  - Decision to replace normal conducting separation dipoles in experimental insertions with superconducting ones. At present, HL-LHC performance is assumed, but following aperture studies we will better specify the magnets. This would enable gaining useful space in the insertion.

- **Optics design:**
  - Same regular cell as that of the FCC-hh ring. This design will be used also for the part of the transfer lines outside of the ring tunnel.
- **Magnet design:**
  - Two solutions available:
    - Normal-conducting magnets
    - Permanent magnets
  - Overall magnet design available, integration studies to be launched.

- Thanks to the decision to perform a coating of the beam screen (with amorphous carbon) it is possible to operate the beam screen at higher temperature.
- The best choice seems to be 70 K
- Using the information in
  - L. Tavian, Cryogenics, FCC Collider Kickoff Meeting, Univ. Geneva, Switzerland (2014), <https://indico.cern.ch/event/282344/contributions/1630775/>
  - It is possible to estimate the gain with respect to the CDR

	T_CM (K)		Relative gain w.r.t. CDR		
T_BS (K)					
	1.9	4.5			
50	547.5	503.5			
60	488.2	423.1		11	16
70	465.1	373.7		15	26
80	468.1	345.1		14	31
Values in W/m/beam (Total electrical power to refrigerator)					

# General points

- **HTS coating of beam screen**
  - **Excellent progress by the collaboration working on this topic.**
  - **N. Mounet has joined our team to support beam dynamics aspects of these activities.**
- **Collimation and beam dynamics simulations**
  - **Possibility to collaborate with Pakistan Atomic Energy Commission (PAEC). Details are being worked out.**



**Thank you for your  
attention!**

