Effects of pulsed hollow electron lens operation on the beam core in HL-LHC: First experimental studies and simulations.*

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In the HL-LHC a considerable amount of energy is stored in the beam tails due to the high beam intensity and an overpopulation of the tails compared to a Gaussian distribution. To control and clean the tail population, the installation of two hollow electron lenses, one per beam, is considered. Beside the DC operation, also a pulsed operation of the hollow electron lens is considered, which would considerably increase the diffusion speed by putting noise on the halo particles. In the ideal case, that is in case of no field at the beam core, only the halo particles are excited while leaving the core unperturbed. The picture though changes, if a residual field is present also at the location of the beam core putting noise also on the beam core. In this paper we present for estimates of the residual field at the beam core expected from the HL-LHC hollow electron lens and first experimental results of the effect of this excitation on the beam core together with the supporting simulations.

I. INTRODUCTION

Looking back and forward at the last, current and future high energy and intensity accelerators, each new machine represents a considerable leap in stored beam energy with rising values for future accelerators and Colliders (see Table I)

- why do we need active halo control -¿ refer to different methods -¿ say that e-lens is superior as shown in review
- layout

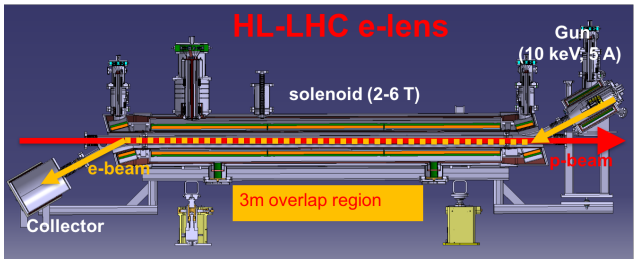

FIG. 1. Layout of HEL **Ask Diego how to acknowledge correctly**.

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Appendix A: Appendixes

[1] S. Holmes, R. S. Moore, and V. Shiltsev, Journal of Instrumentation **6**, T08001 (2011).

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TABLE I. Stored beam energy for different past, present and future colliders. Each new machine represents a leap in stored beam energy.

Collider	Tevatron (protons) [1]	LHC 2016	LHC nominal	HL-LHC	FCC
Beam energy [GeV]	980	?	?	?	
Number of bunches	36	?	?	?	
Number of particles per bunch	2.9×10^{11}	?	?	?	
Stored beam energy [MJ]	1.6	?	?	?	