Update on collimation study with global crab cavity (CC)

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Contents

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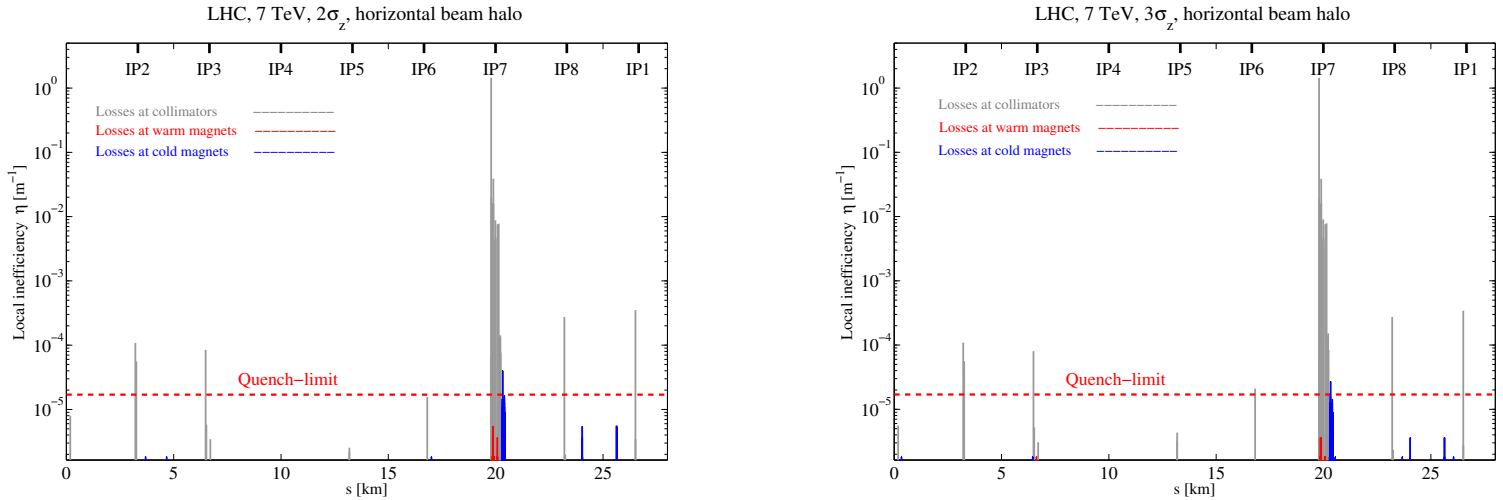
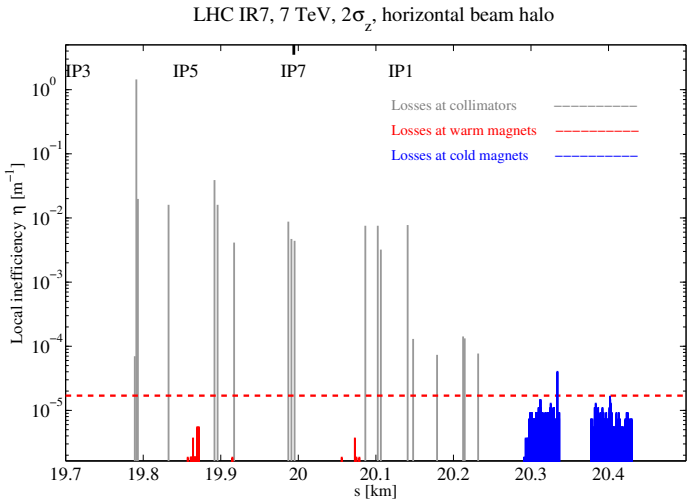
  - 5,760,000 particles in all
- New loss map for 2 and 3 σ_z cut
- Impact parameter (on-momentum & off-momentum)
- Crab dispersion
- Comparison of phase space cut

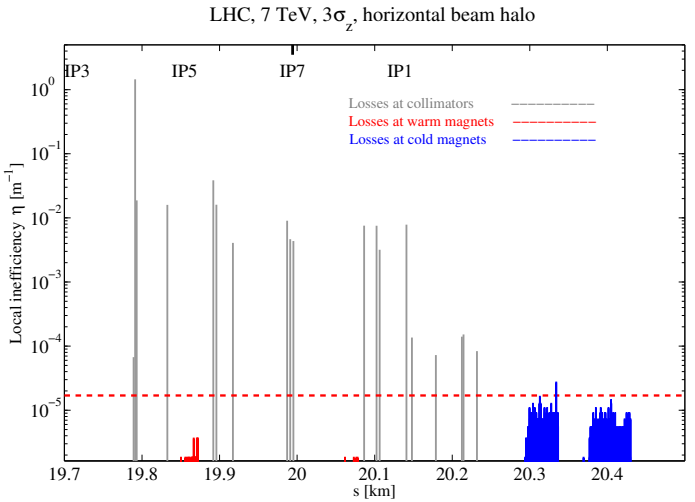
Loss map, hor halo, no CC



Left: 2 σ_z cut; Right: 3 σ_z cut

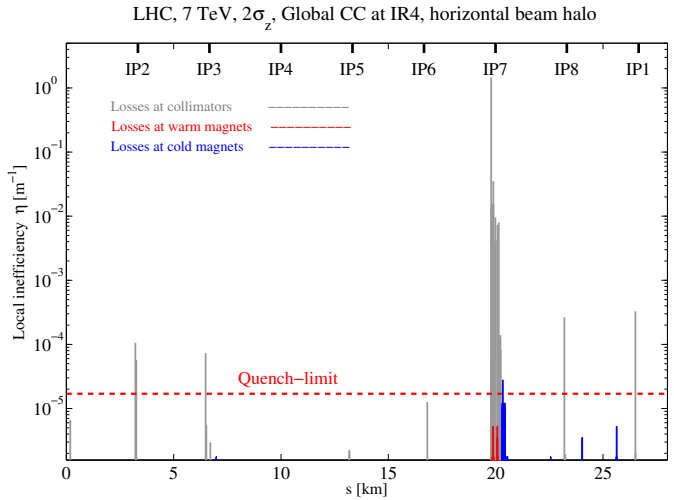
Loss map, hor halo, no CC (Zoom-in)

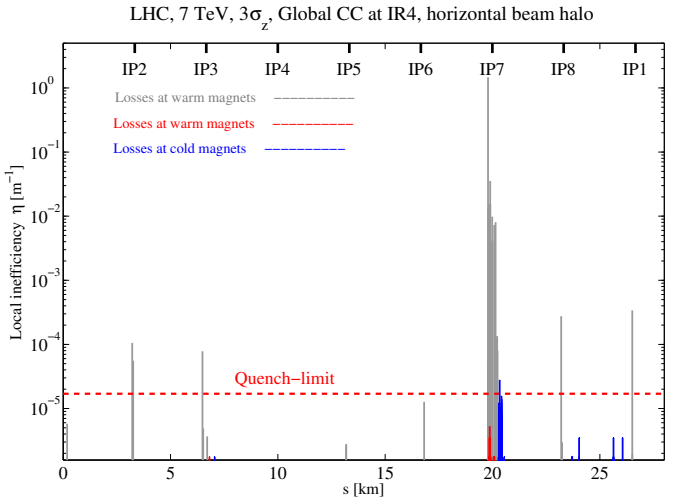




LHC IR7, Left: 2 σ_z cut; Right: 3 σ_z cut

Loss map, hor halo, Global CC

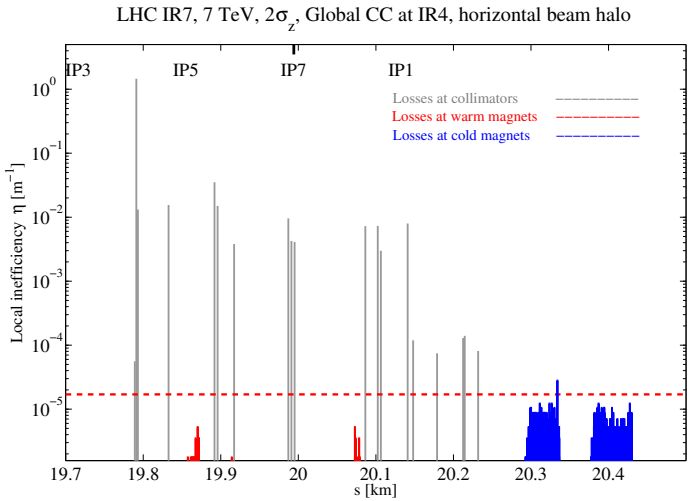


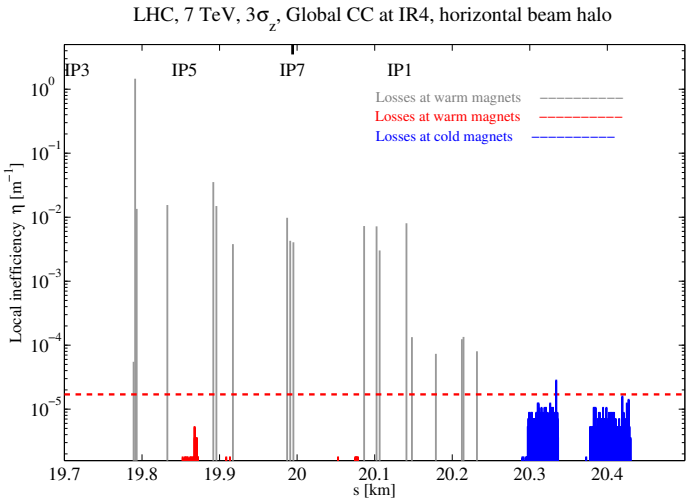


Left: 2 σ_z cut; Right: 3 σ_z cut

For case with CC, ramp CC voltage up for 1000 turns first, collimator is ON from 1002 turn

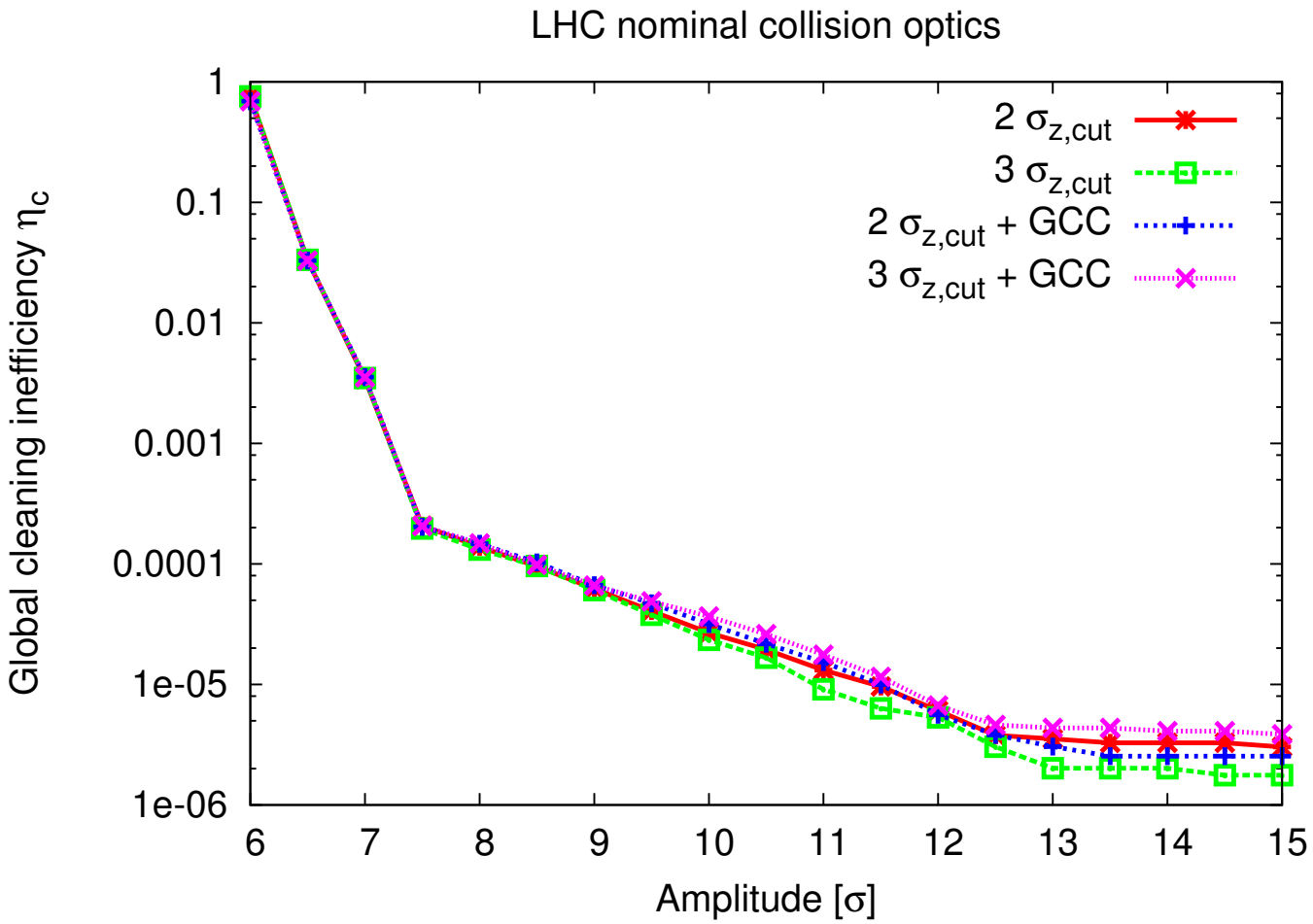
Loss map, hor halo, Global CC (Zoom-in)





LHC IR7, Left: 2 σ_z cut; Right: 3 σ_z cut

Global cleaning inefficiency



Horizontal beam halo, with and without GCC

Impact parameter

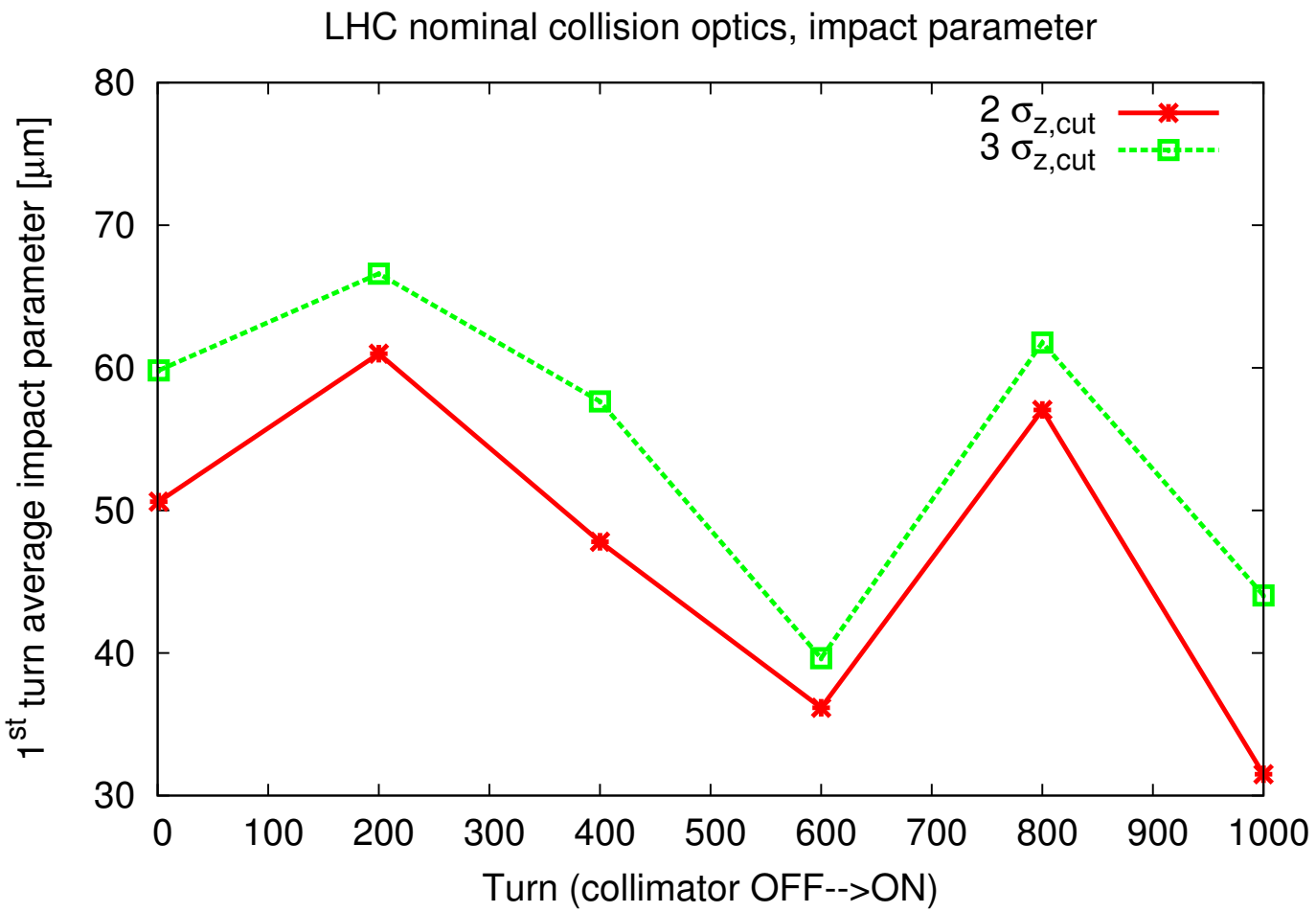
- Horizontal beam halo (5,760,000 particles in all), impact parameter on the primary collimator TCP.C6L7.B1 at IR7, ON-momentum

	$2\sigma_{cut}$	$3\sigma_{cut}$	$2\sigma_{cut}$ + GCC	$3\sigma_{cut}$ + GCC
1^{st} turn [m]	7.80575e-07	7.79811e-07	3.83878e-06	3.8441e-06
All turns [m]	1.53497e-05	1.53724e-05	1.47476e-05	1.47425e-05
Particle absorbed	4041494(70.2%)	4042498(70.2%)	3948082(68.5%)	3945183(68.5%)

- Horizontal beam halo (5,760,000 particles in all), with momentum offset

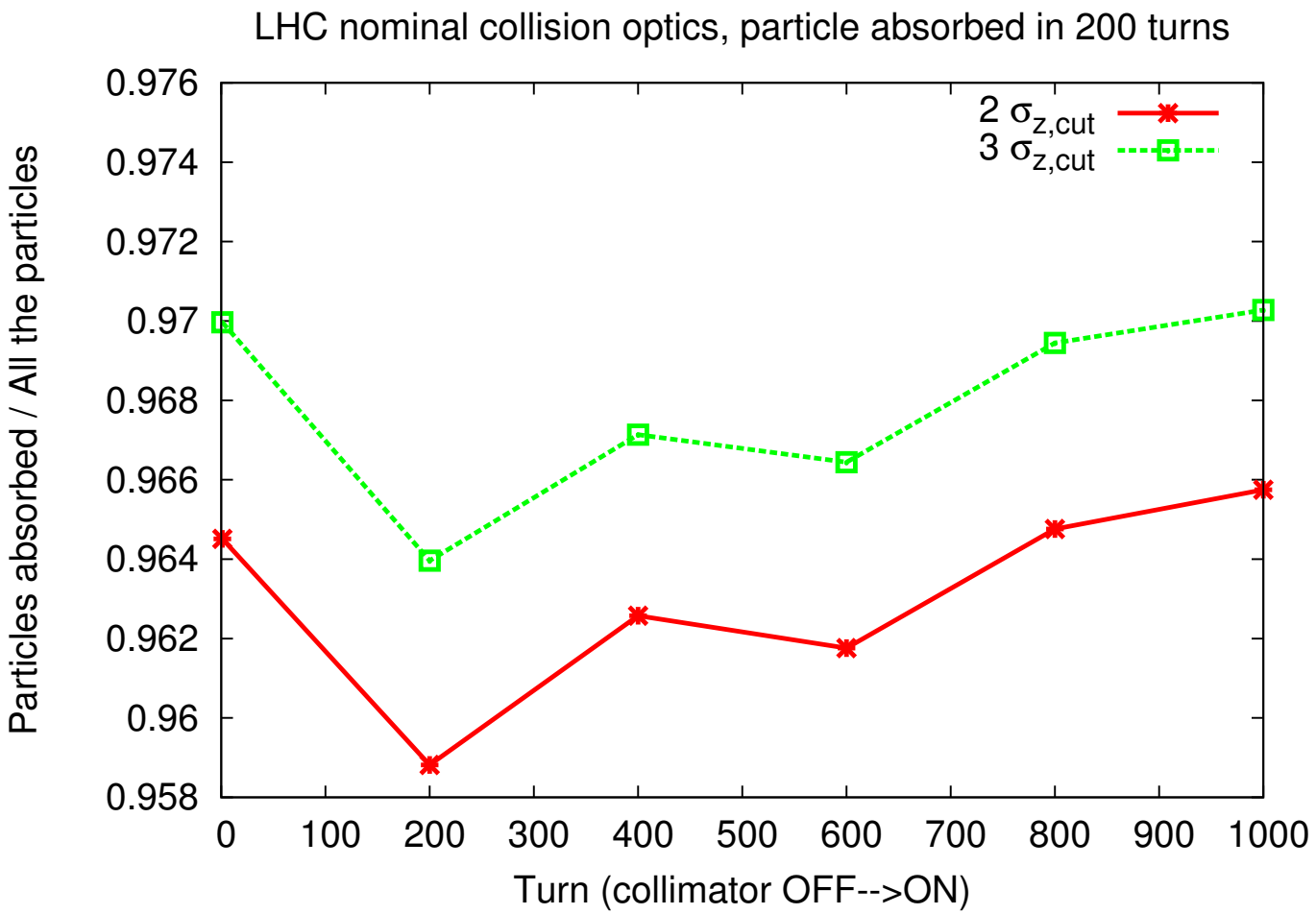
	$2\sigma_{cut}$	$3\sigma_{cut}$	$2\sigma_{cut}$ + GCC	$3\sigma_{cut}$ + GCC
1^{st} turn [m]	5.0612e-05	5.9823e-05	7.61578e-05	7.90344e-05
All turns [m]	3.61064e-05	4.04472e-05	6.64746e-05	6.70366e-05
Particle absorbed	5558825(96.5%)	5587024(97%)	5734694(99.56%)	5734858(99.56%)

Case 1: Impact parameter scan



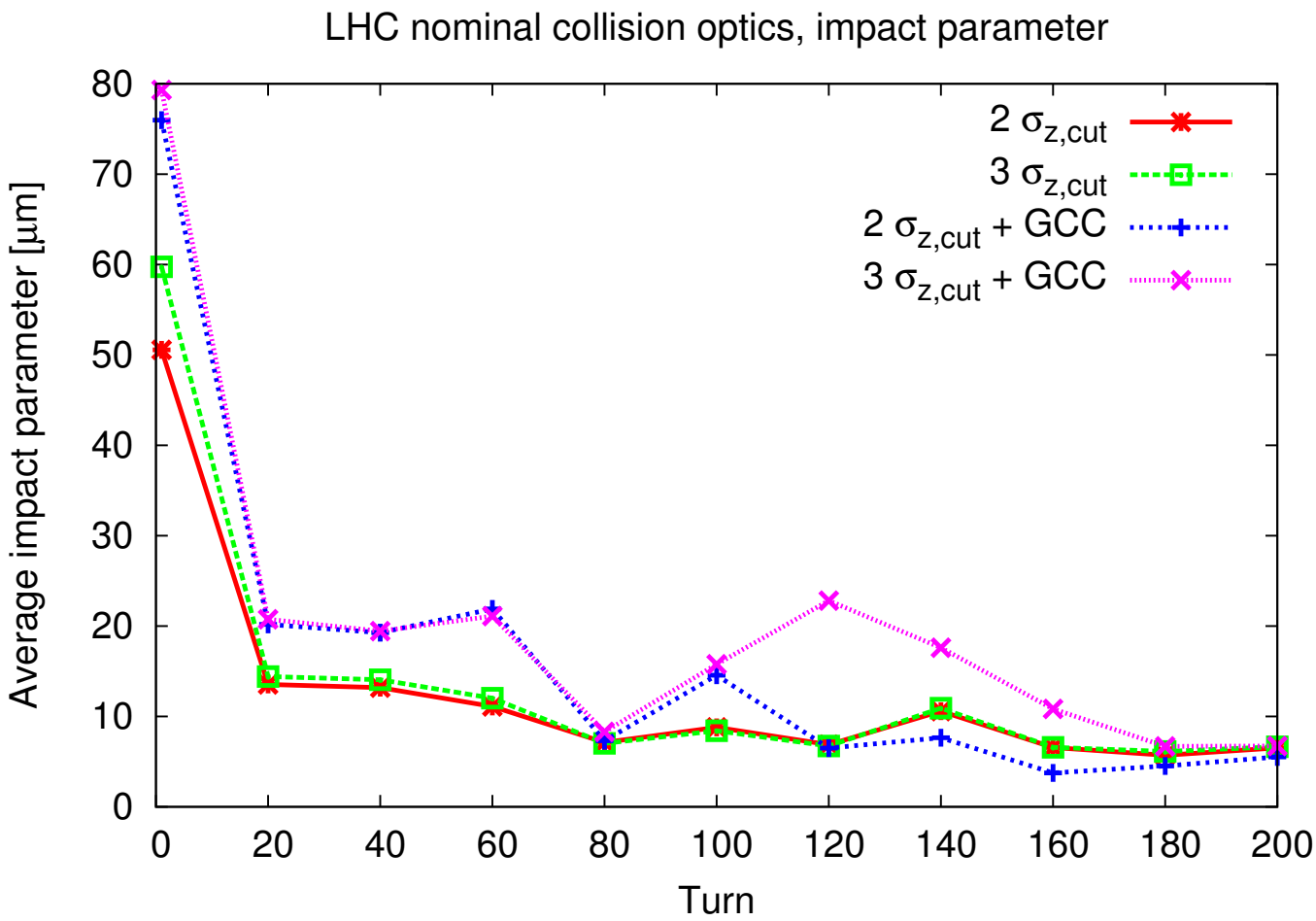
Collimators are turned ON at specified turn, then particles are tracked for another 200 turns, and get the '1st turn' impact parameter, OFF-momentum + no CC

Case 1: Particles absorbed



Same condition with previous slide, OFF-momentum + no CC

Case 2: Impact parameter scan



200 turns, the average impact parameter at 1st, 20th...200 turn, OFF-momentum

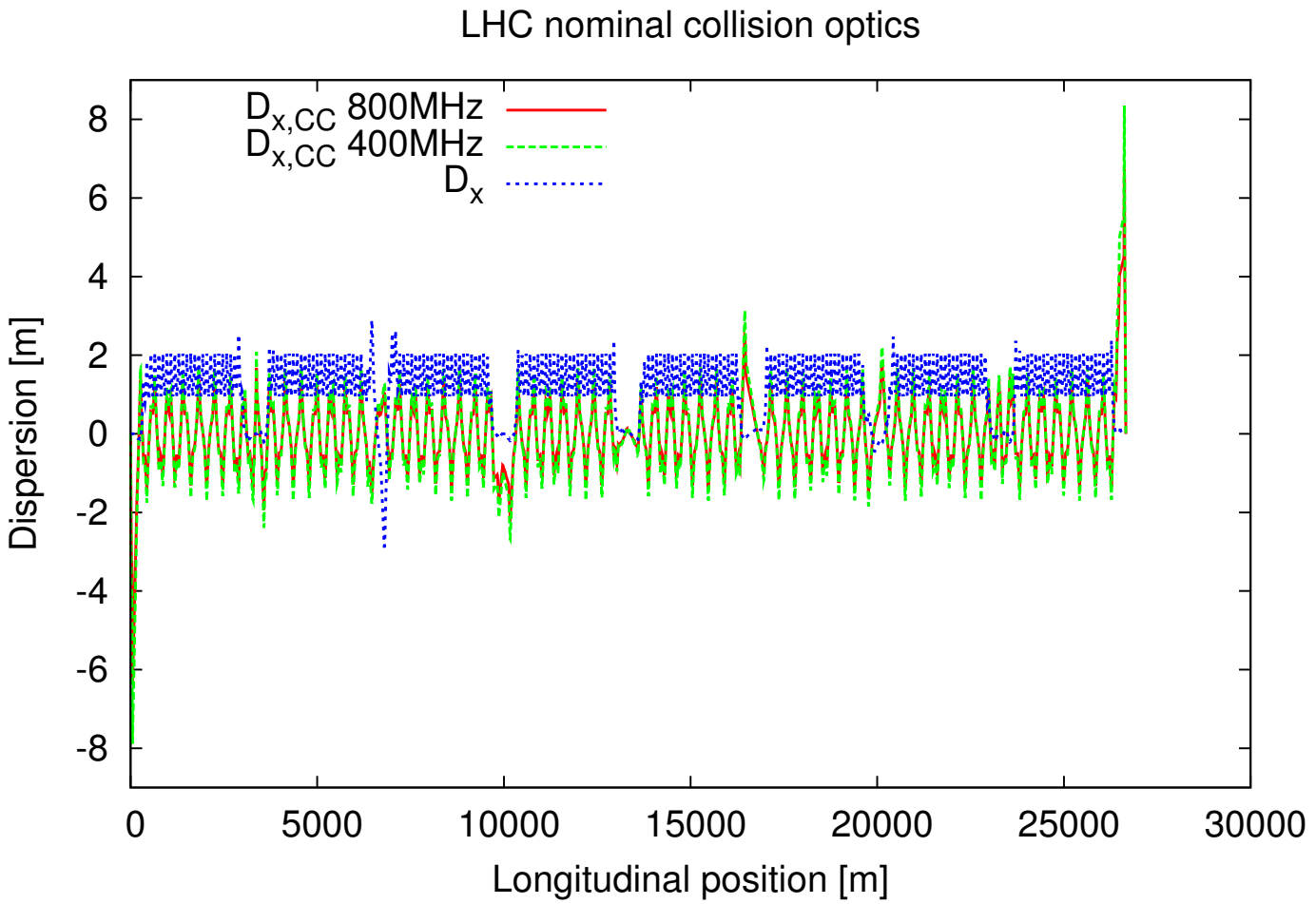
New annulus

To have a $1\ \mu m$ average impact parameter, the annulus in phase space with normalized physical amplitude is adjusted from 5.958σ + $.0015\sigma$ to 5.943σ + $.0015\sigma$

- Horizontal beam halo, $2\sigma_{cut}$ + GCC

	ON-momentum	OFF-momentum
1^{st} turn [m]	1.10621e-06	7.45037e-05
All turns [m]	1.33079e-05	6.41564e-05
Particle absorbed	62.3%	99.4%

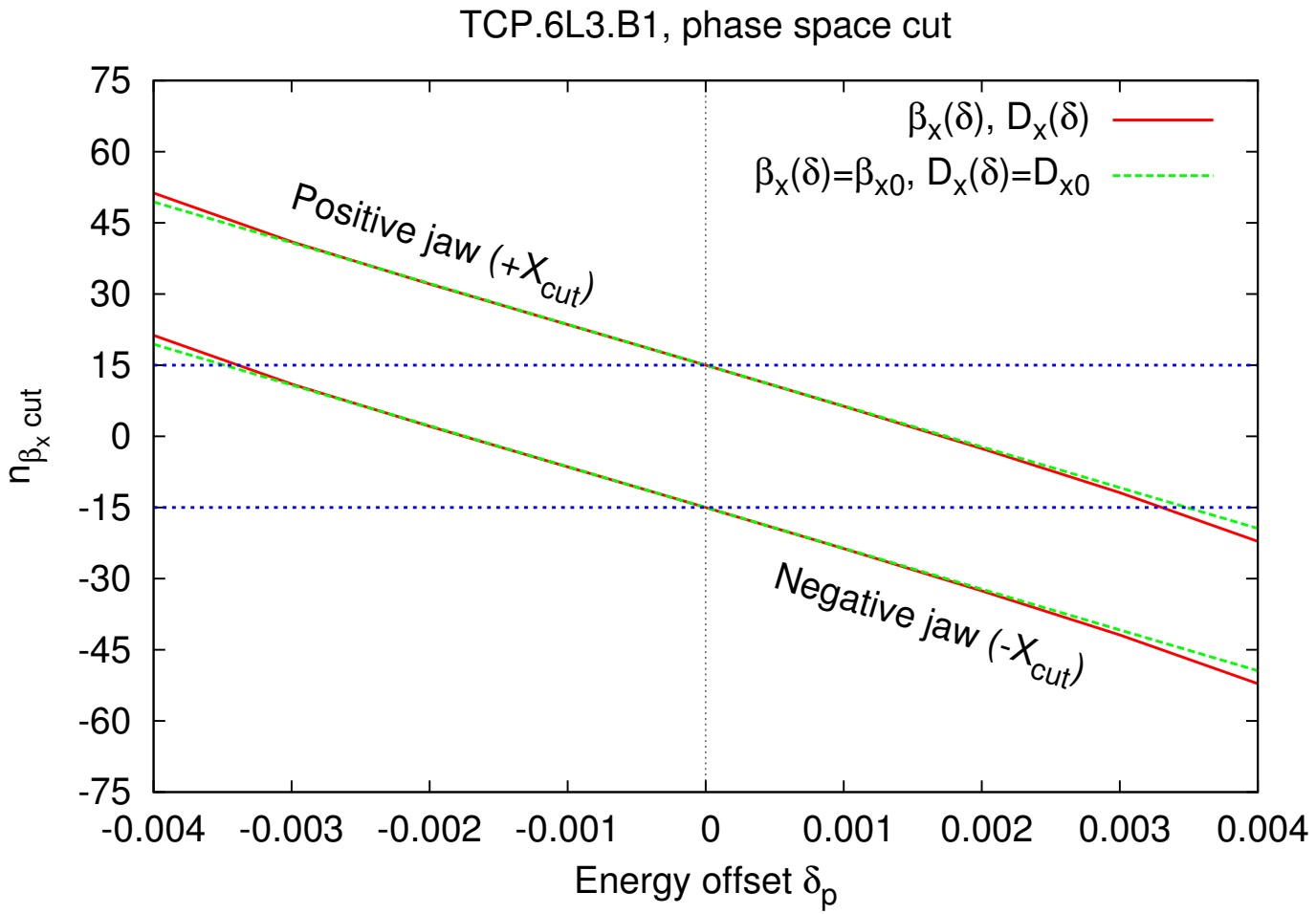
Crab dispersion



LHC nominal collision optics

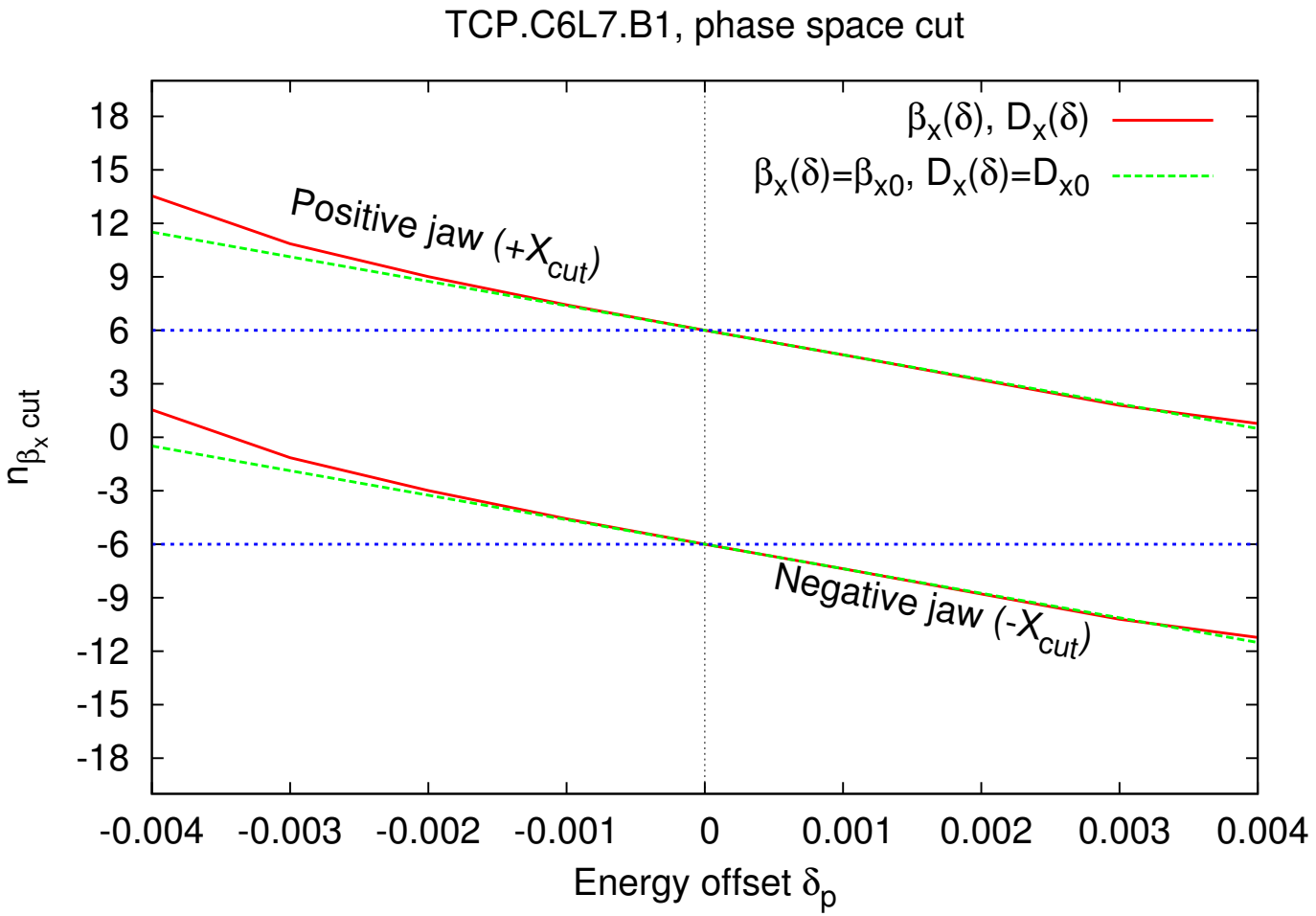
For horizontal CC, defined as $D_{x,CC} = (x_{1\sigma_z} - x_0)/1\sigma_p$

Phase space cut (1): TCP.6L3.B1



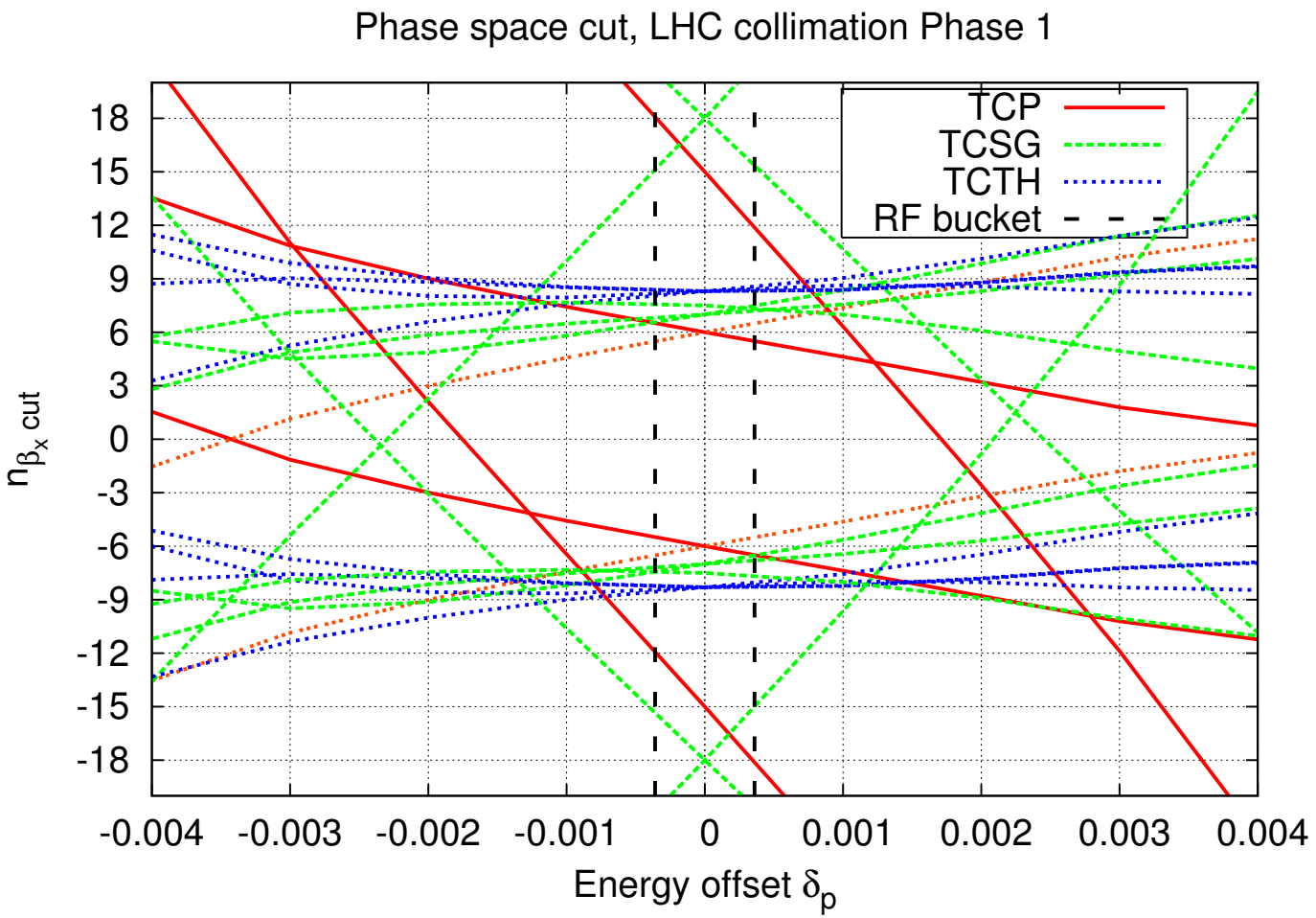
D_x and β_x being dependent and independent of δ_p respectively

Phase space cut (1): TCP.C6L7.B1



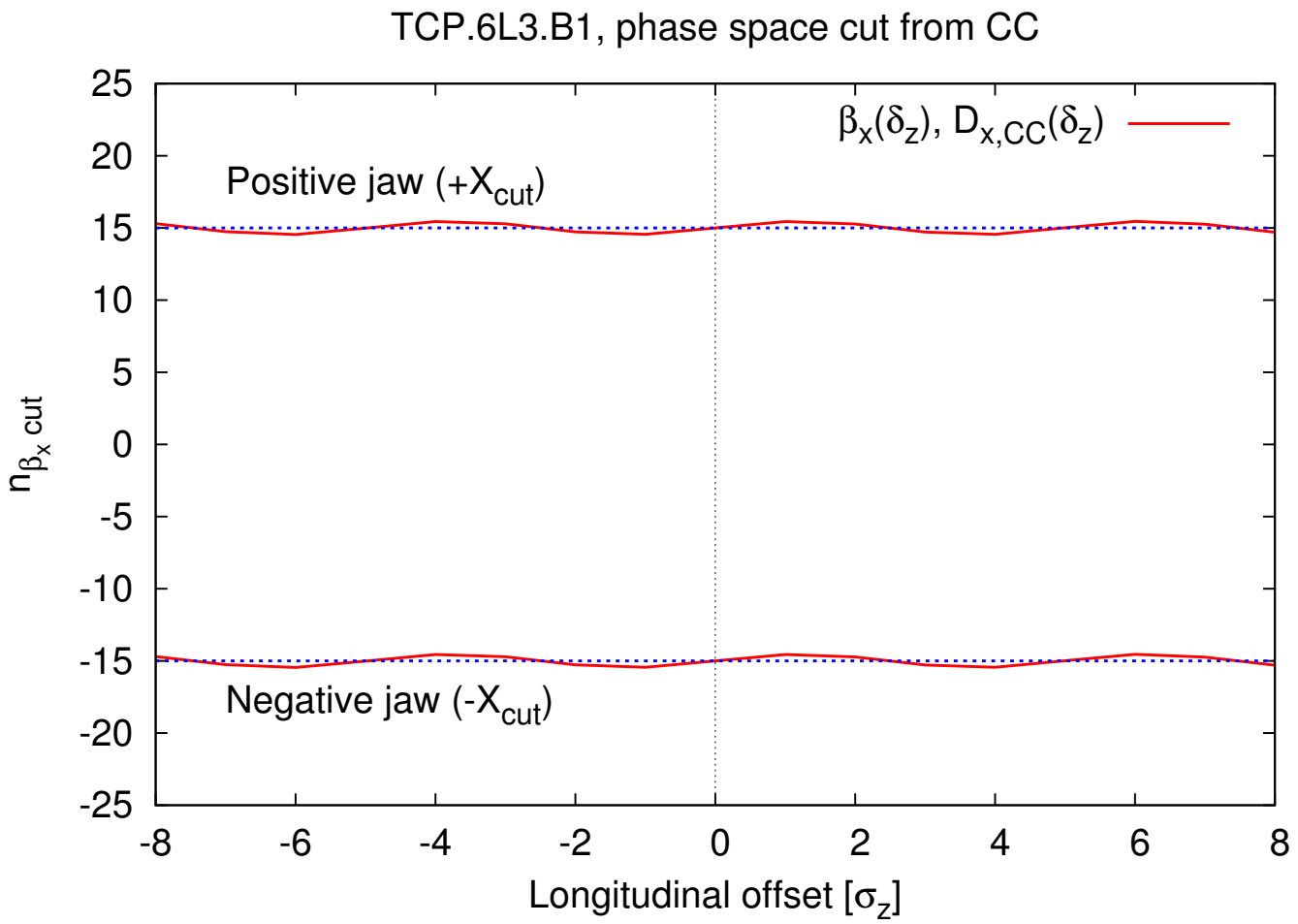
D_x and β_x being dependent and independent of δ_p respectively; $D_{x0} = 0.38m$

Phase space cut (1): All



D_x and β_x being dependent of δ_p , with primary, secondary and tertiary collimators

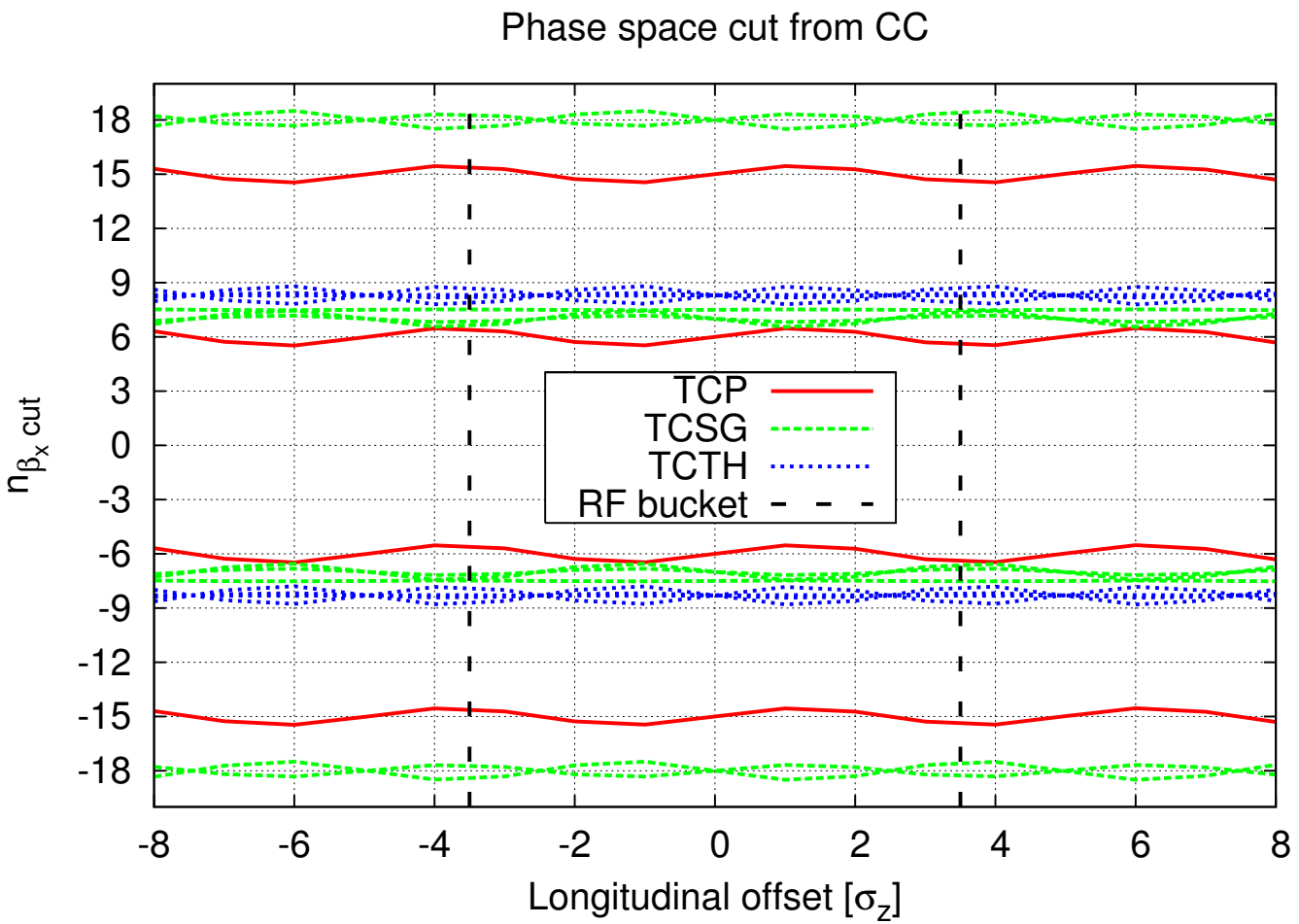
Phase space cut (2): TCP.6L3.B1, from CC



$D_{x,CC}$ and β_x being dependent of δ_z

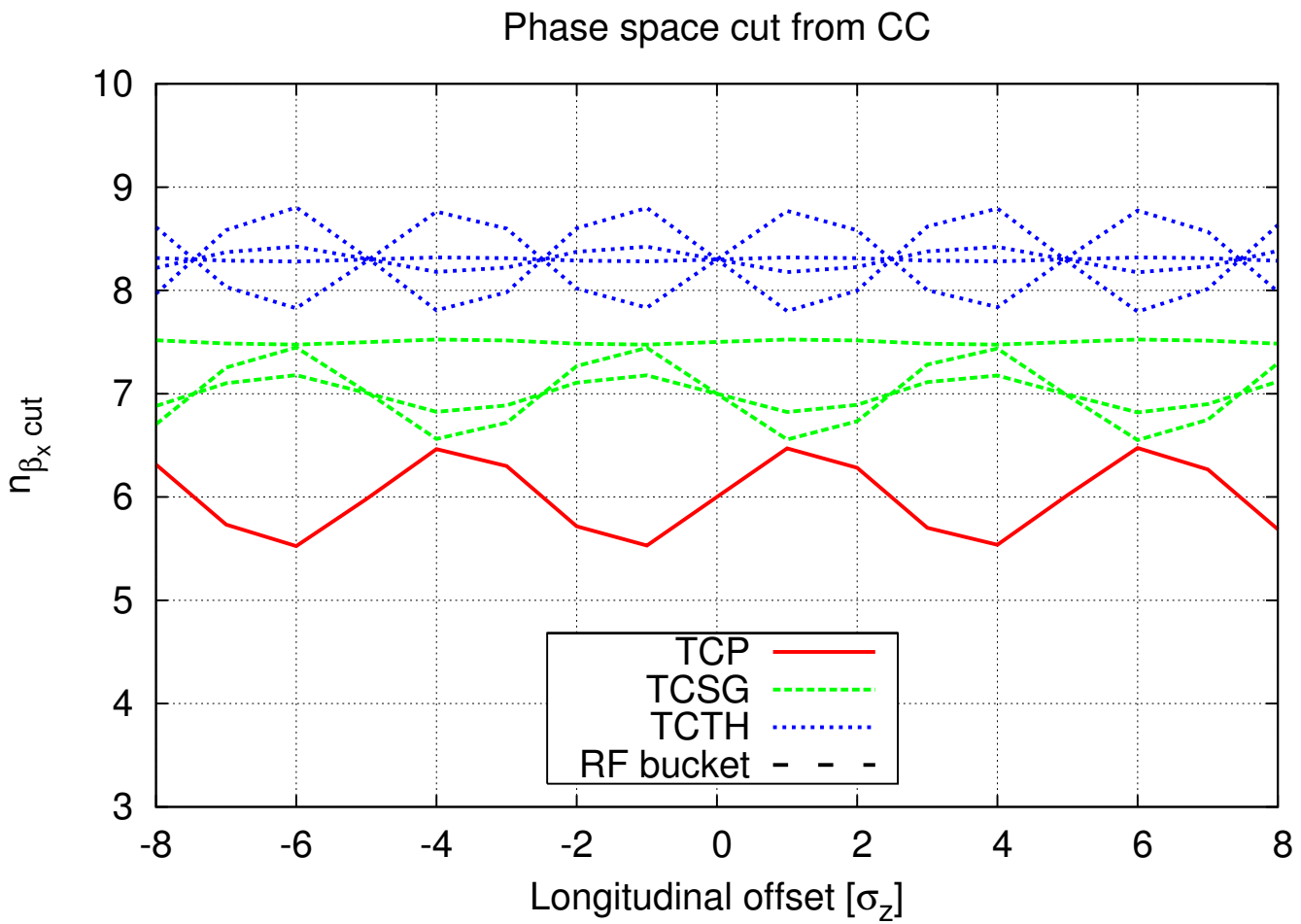
CC replaced by an orbit corrector

Phase space cut (2): All, from CC



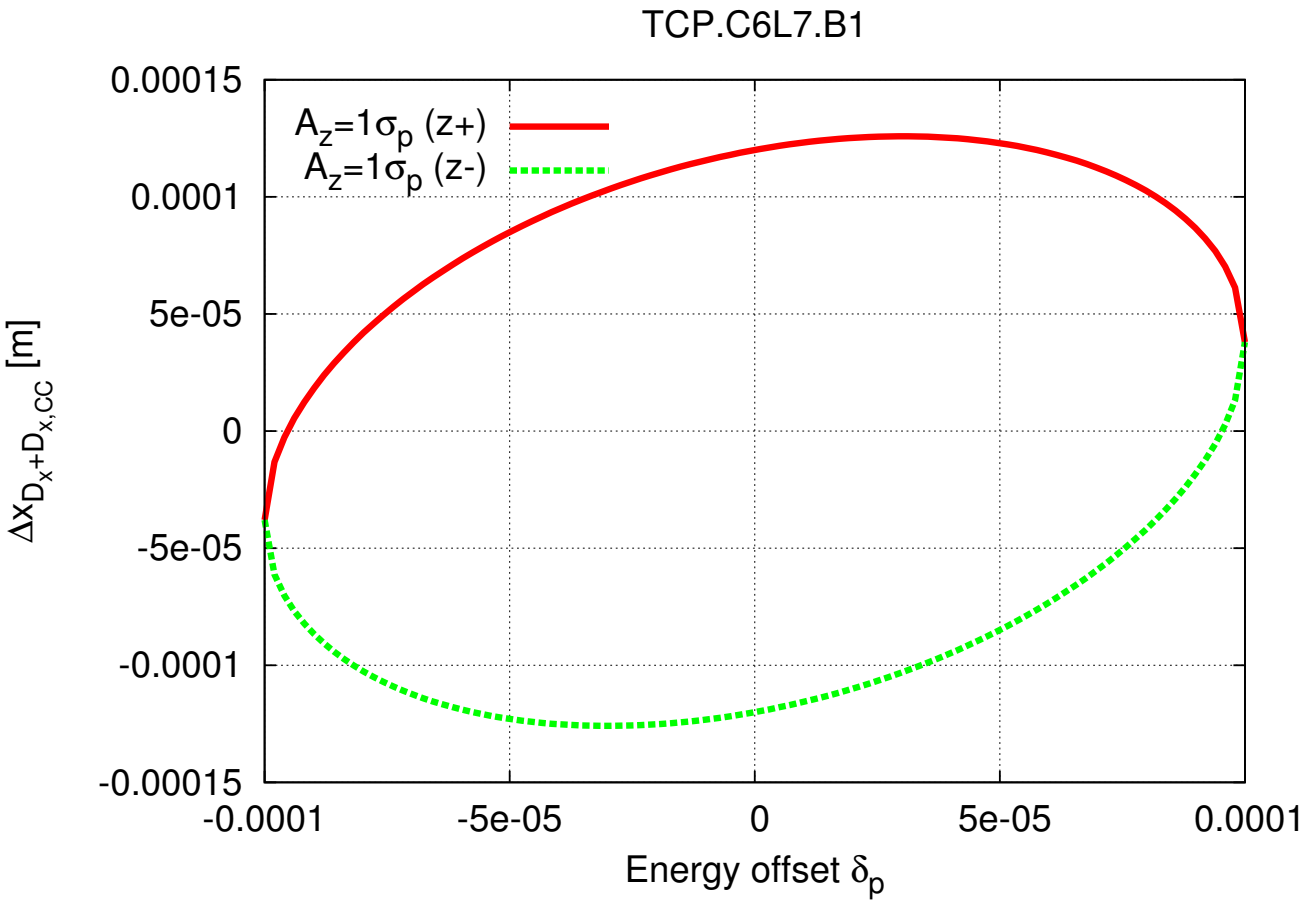
$D_{x,CC}$ and β_x being dependent of δ_z , with primary, secondary and tertiary collimators

Phase space cut (2): All, from CC(zoom-in)



$D_{x,CC}$ and β_x being dependent of δ_z , with primary, secondary and tertiary collimators

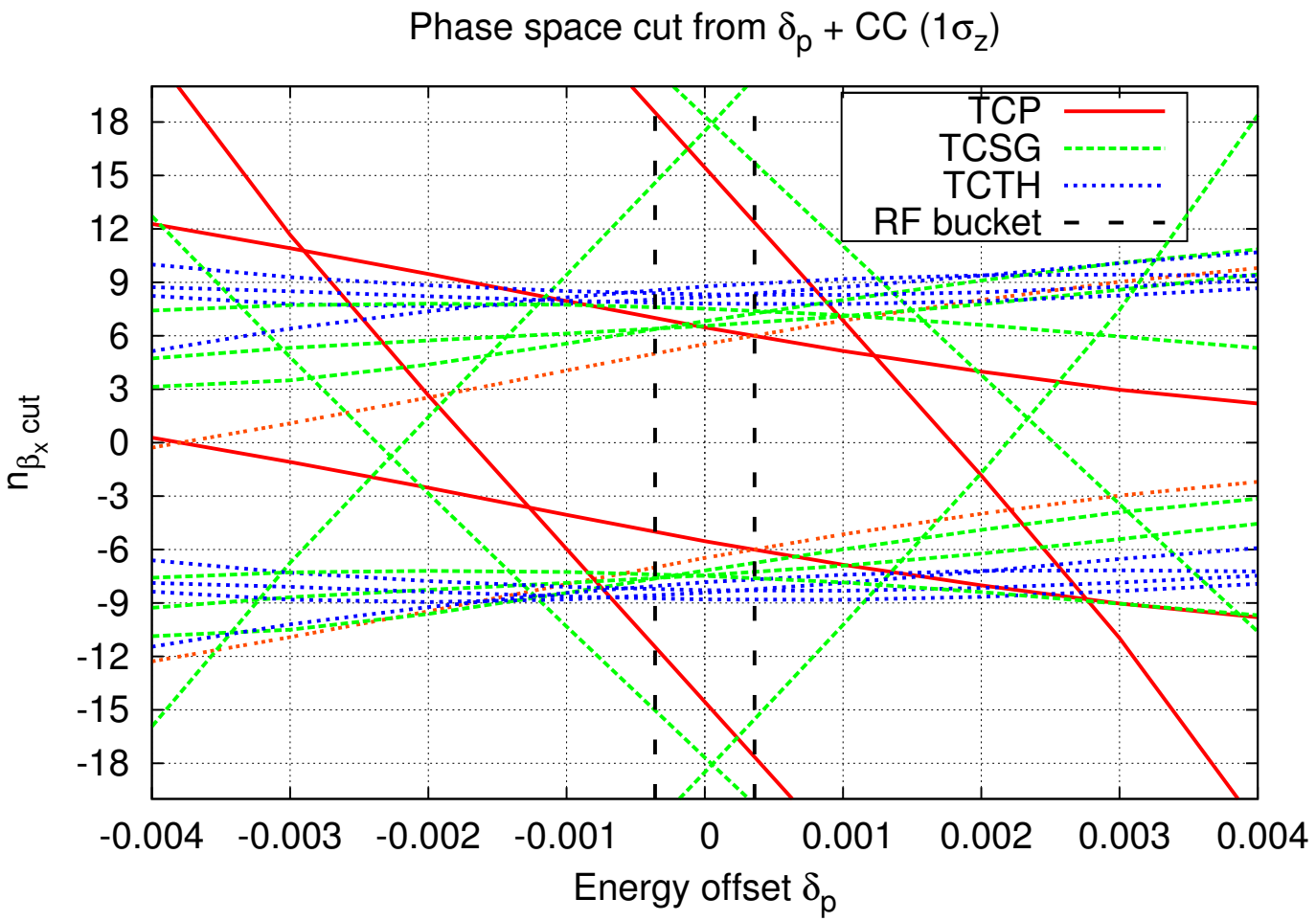
General A_z



$$A_z = \sqrt{\delta_p^2 + \widetilde{\delta_z}^2}$$

At TCP.C6L7.B1 , $D_{x0} = 0.38m$, $D_{x,CC} = -1.2m$

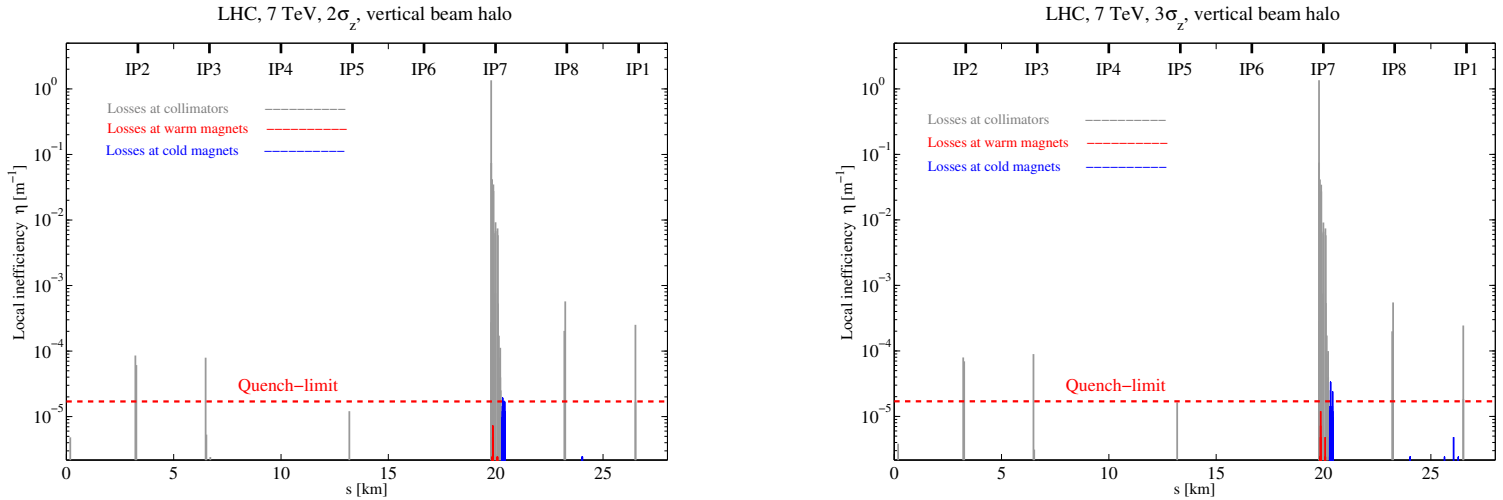
Phase space cut (3): All, δ_p + CC



δ_p + CC @ 1 σ_z , most pessimistic case

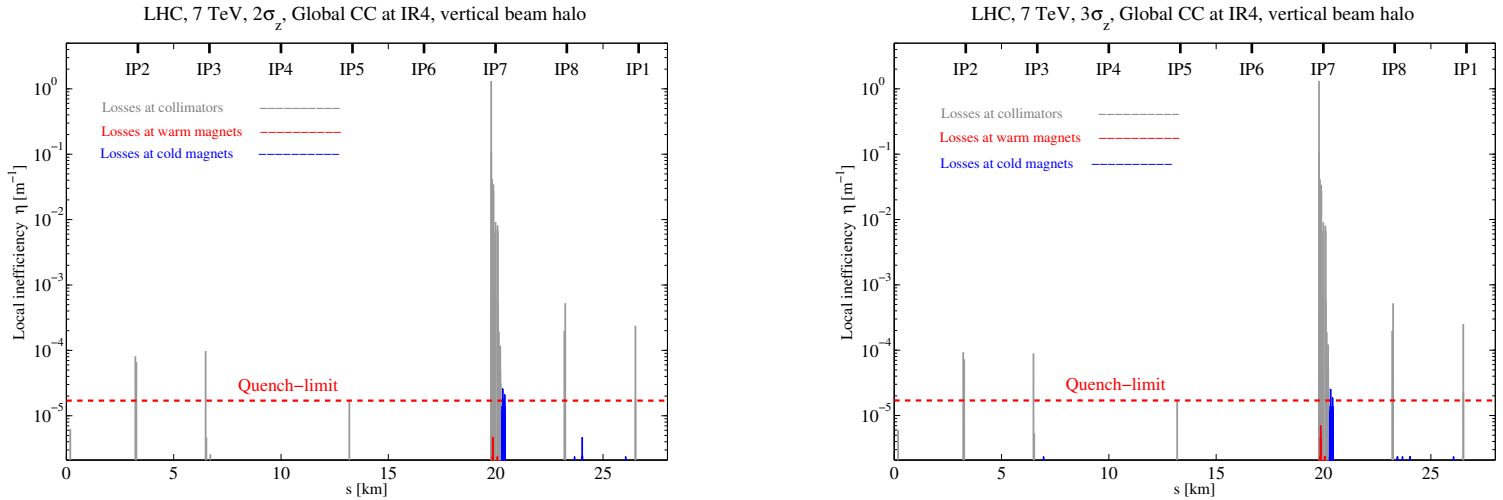
With primary, secondary and tertiary collimators

Backup: Loss map, ver halo, no CC



Left: 2 σ_z cut; Right: 3 σ_z cut

Loss map, ver halo, Global CC



Left: 2 σ_z cut; Right: 3 σ_z cut