Nominal and ATS Loss Maps Calculation with Merlin

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Summary

- Collimation system setup

- Main simulation parameters

- Comparison between MADX and Merlin optics calculation for nominal LHC

- Loss maps comparison between nominal and ATS scheme: beam 1

- Loss maps comparison between Merlin and Sixtrack

- Loss map ATS PreSqueeze beam 1

- Loss map nominal case beam 2

LHC Collimation Setup

IR1	Nom	ATS	IR6	Nom	ATS
TCL	8	8	TCDQA	8	8
IR2			TCSG	7.5	7.5
TCT	8.3	12	IR7		
IR3			TCP	6	6
TCP	15	12	TCSG	7	7
TCSG	18	15.6	TCLA	10	10
TCLA	20	17.6	IR8		
IR5			TCT	8.3	8.3
TCTH	8.3	8.3			
TCL	10	10			

Different settings in IR2 and IR3
Note: TCDQA is still two sides collimator

Simulations setup

- Energy: 7TeV, nominal emittance, no dp/p, no beam length

- 6.4M particles tracked for 200 turns

- Halo: 6σ (Flat distribution); Impact parameter: $1\mu m$; Bin: 10cm

- First collimator beam 1: TCP.C6L7

- First collimator beam 2: TCP.C6R7

- MADX repository for nominal LHCB1: V6.503

- MADX repository for nominal LHCB2: four_beam.seq

- MADX repository for ATS LHC: HLLHCV1.0

- Note(ATS): No spurious dispersion correction applied, no crossing, no separation

- Note(Nominal): crossing and separation applied

MADX vs. Merlin beta functions

- MADX input V6.503 for nominal case

- Both thick optics

- Note: log scale in y
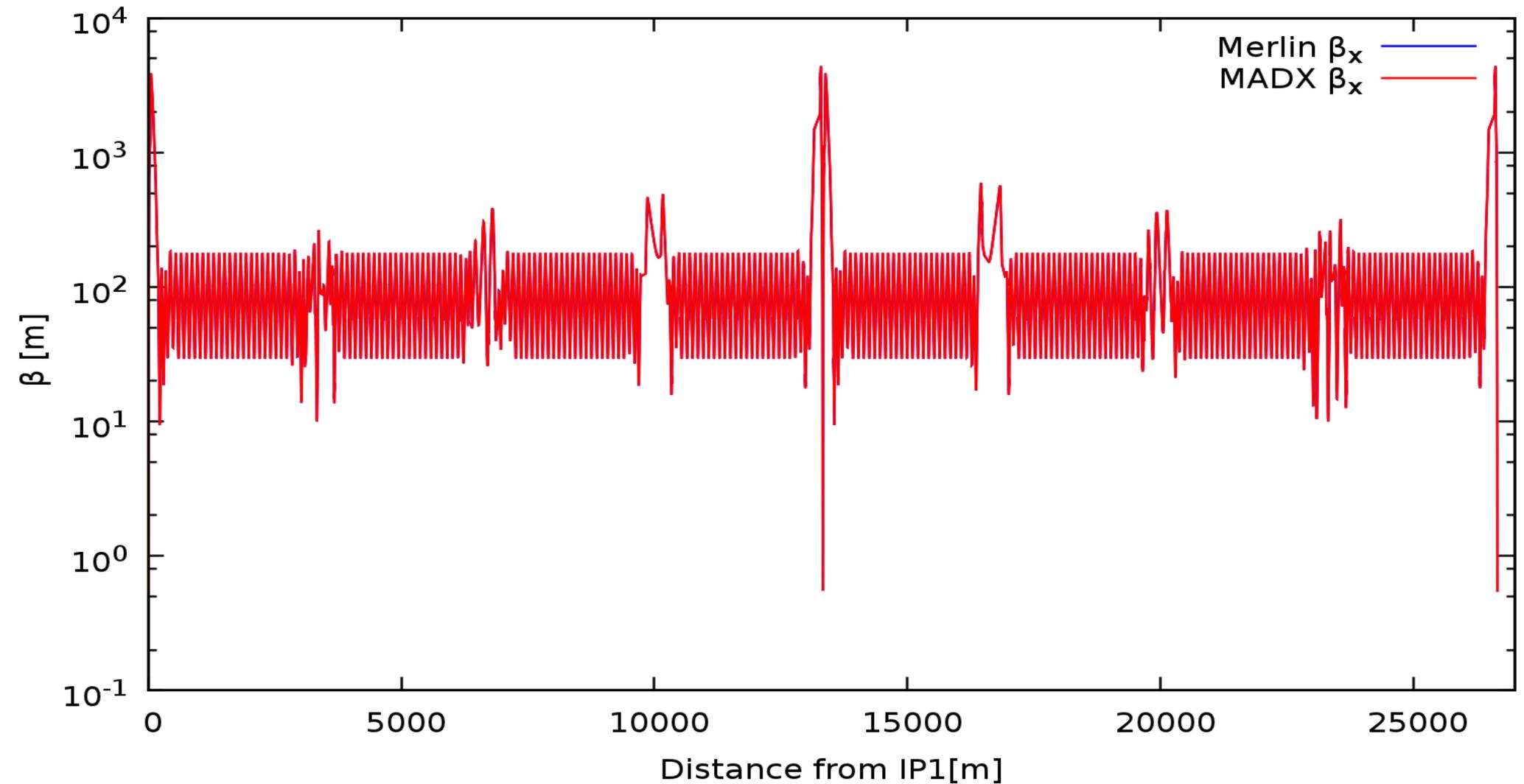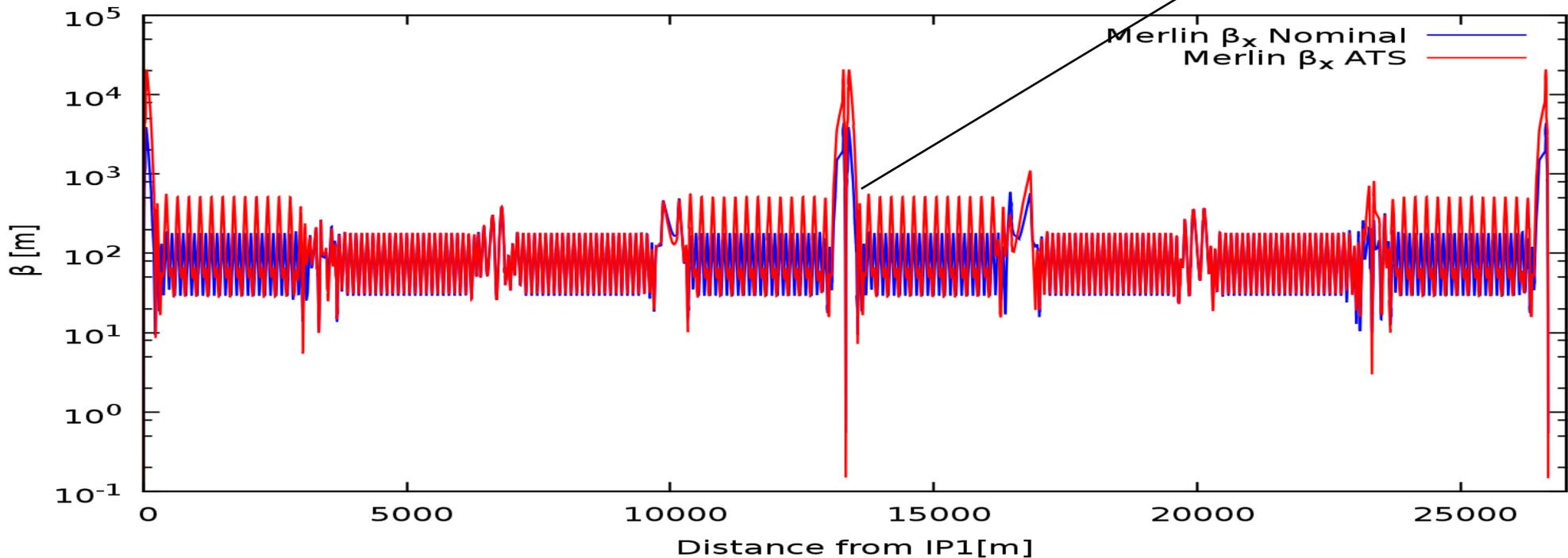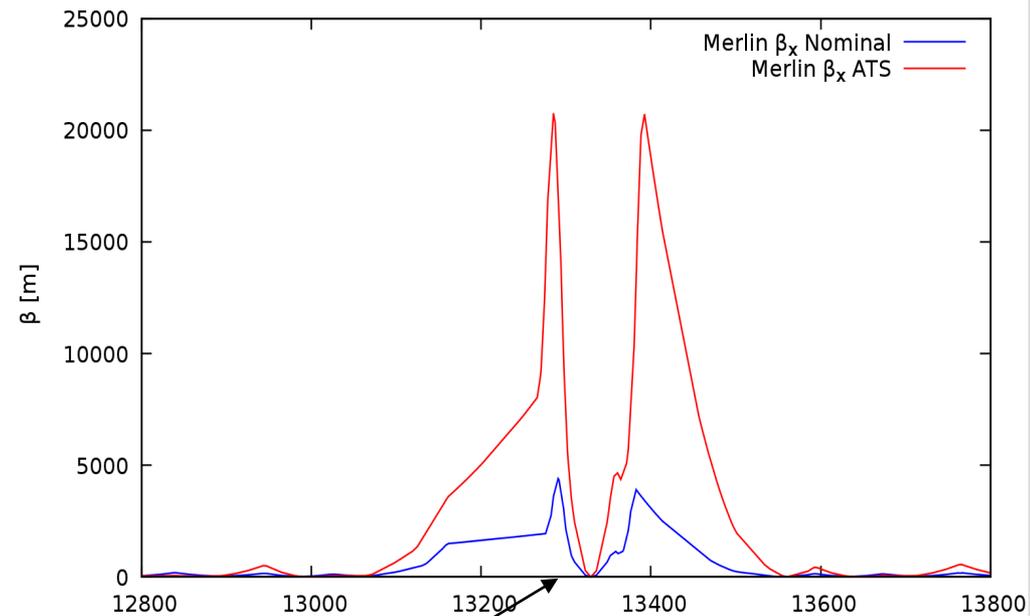
MADX vs. Merlin dispersion functions

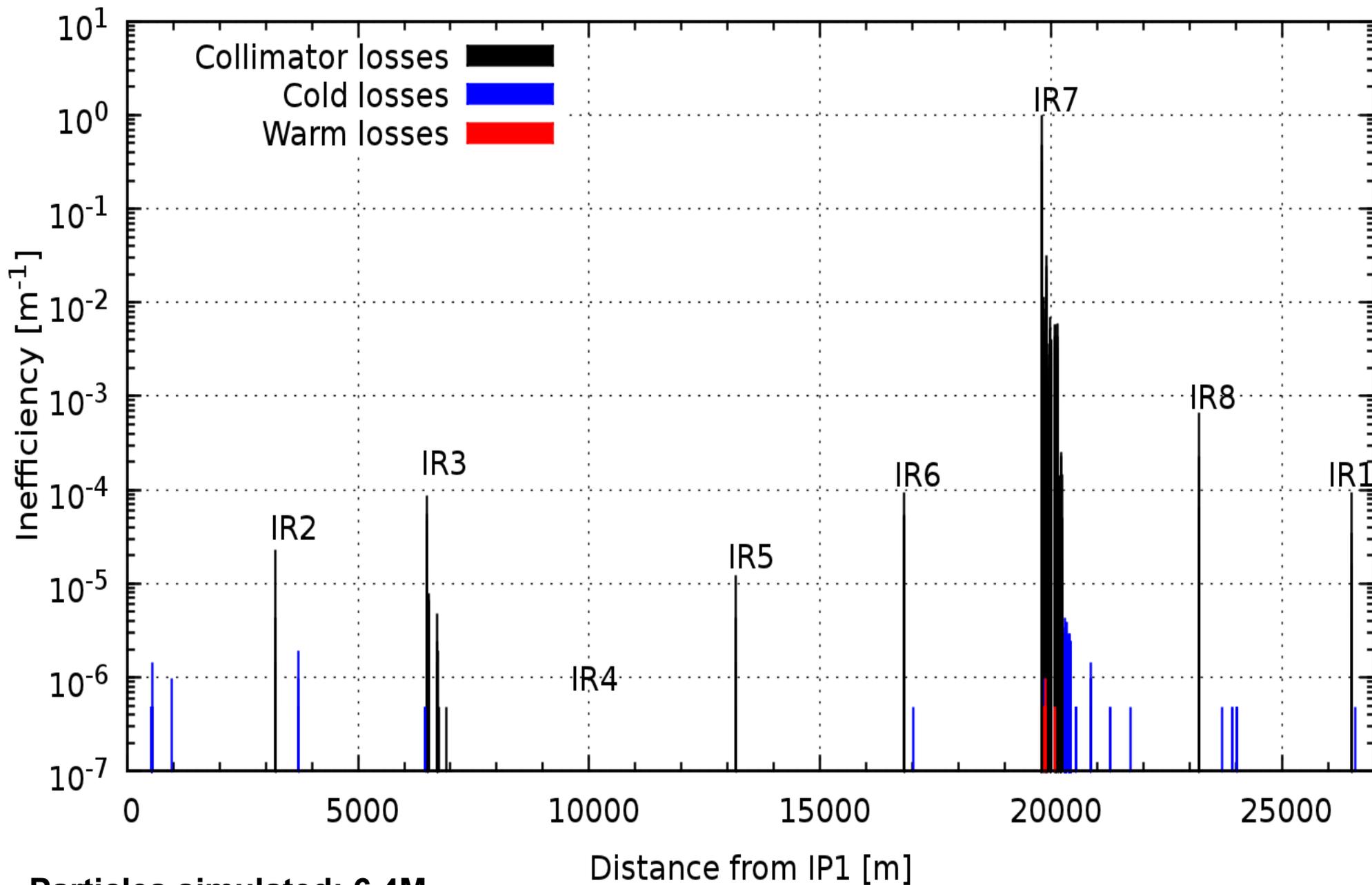- MADX input V6.503 nominal case

- Both thick optics
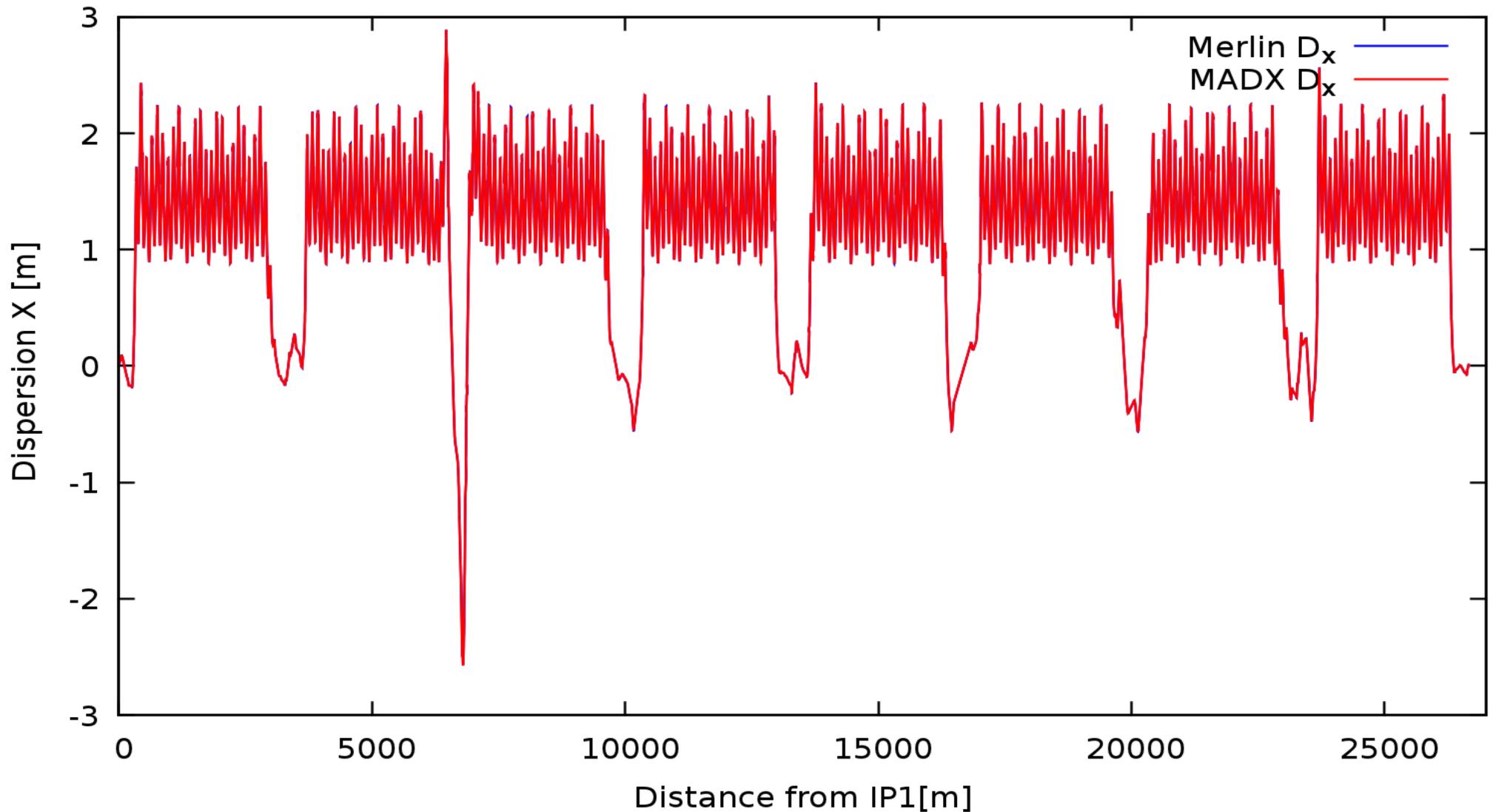
Nominal vs. ATS scheme: Merlin results
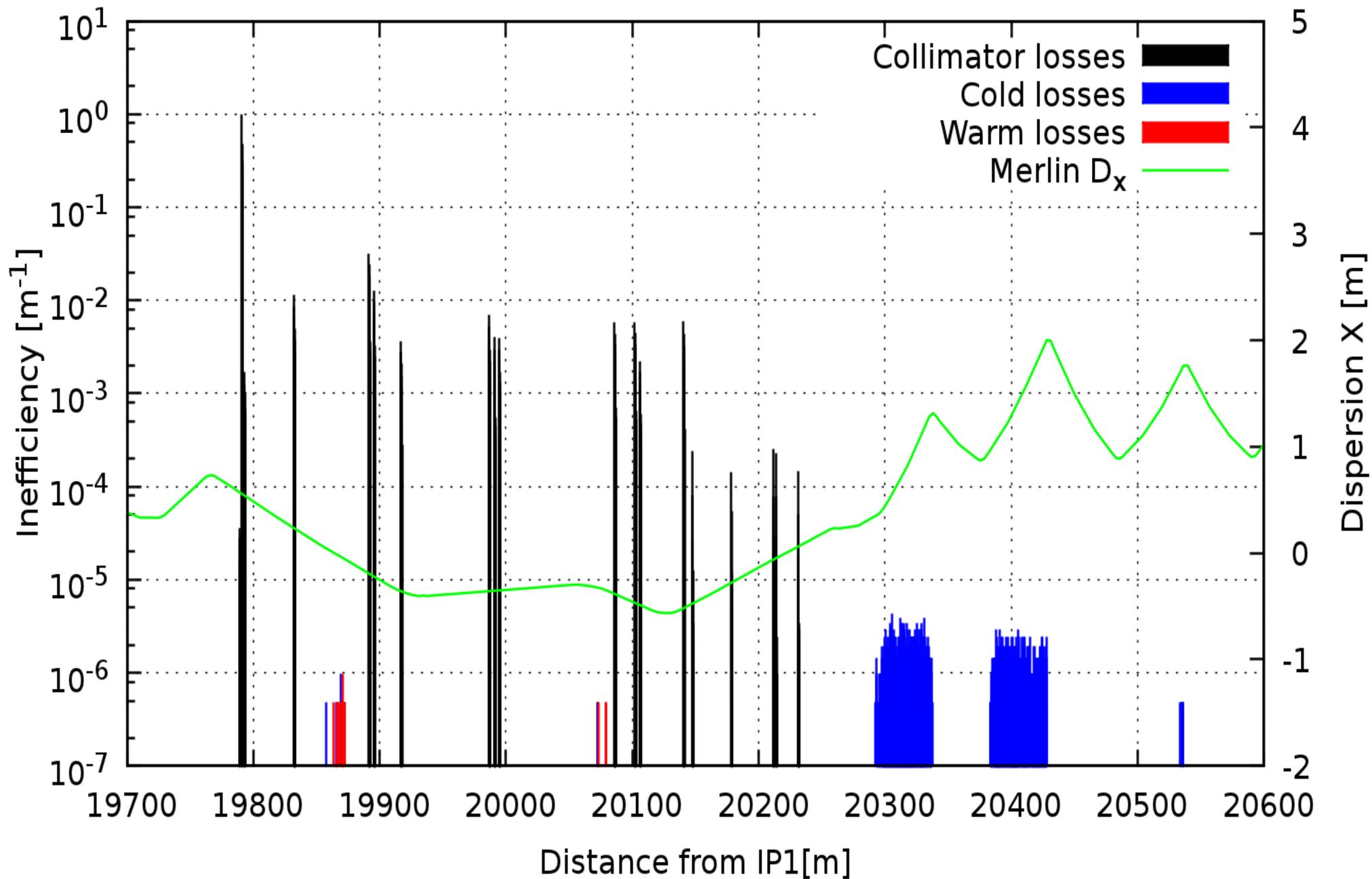
Nominal $\beta^* = 55$cm

ATS $\beta^* = 15$cm (opt_round)

Horizontal Loss map at 7 TeV - Nominal B1

Particles simulated: 6.4M
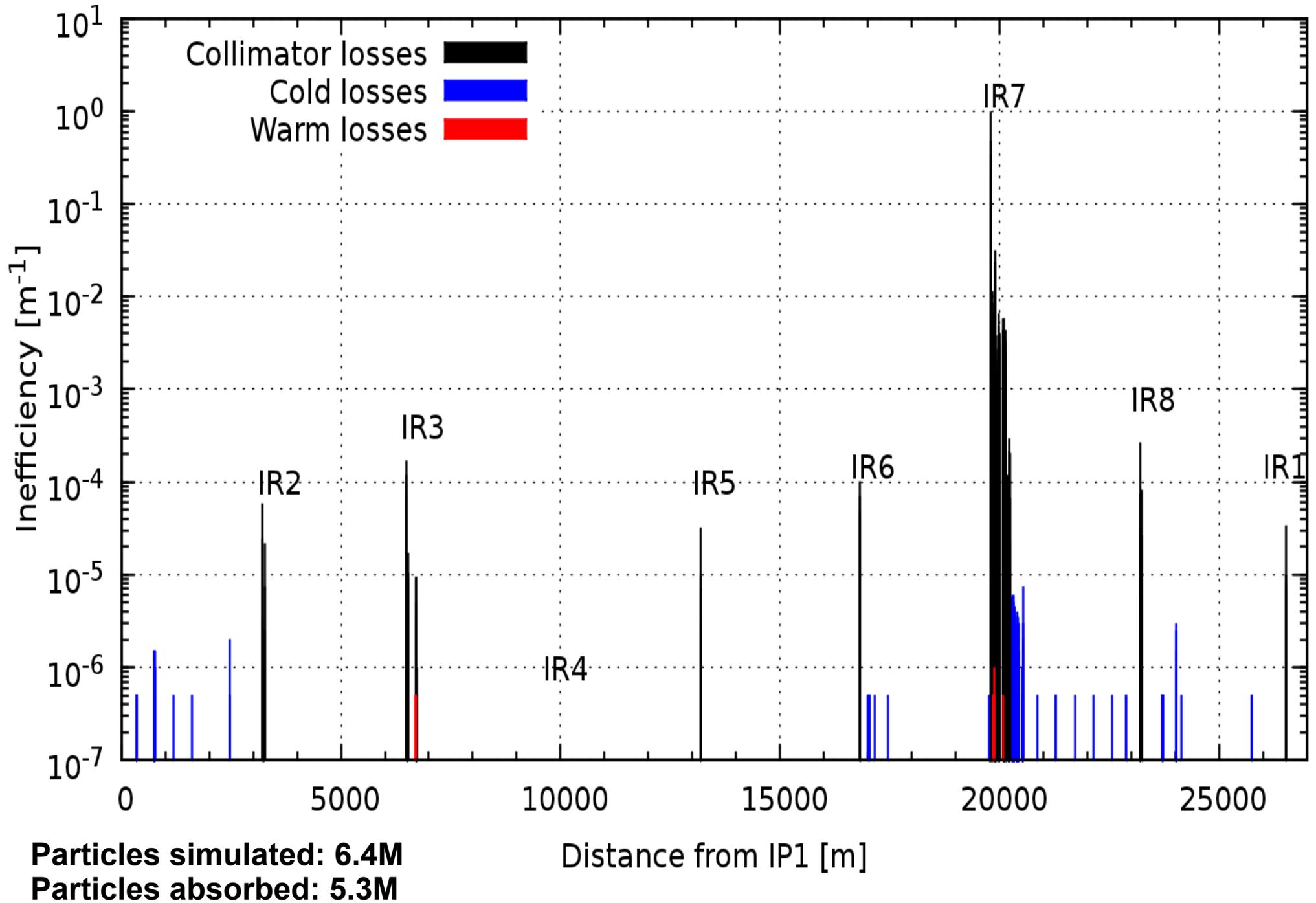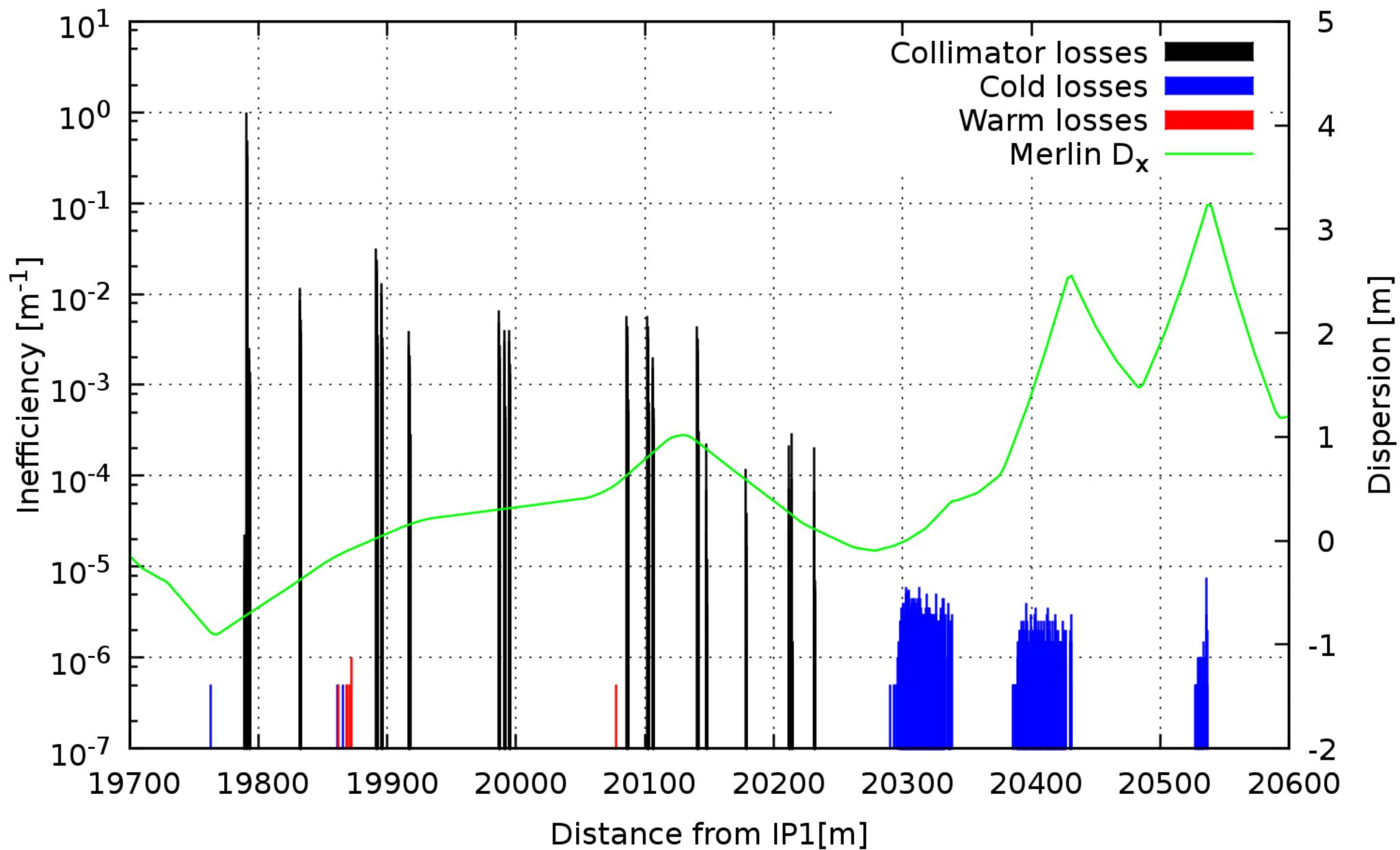Particles absorbed: 5.4M

Horizontal Loss map at 7 TeV - Nominal B1 - IR7 zoom

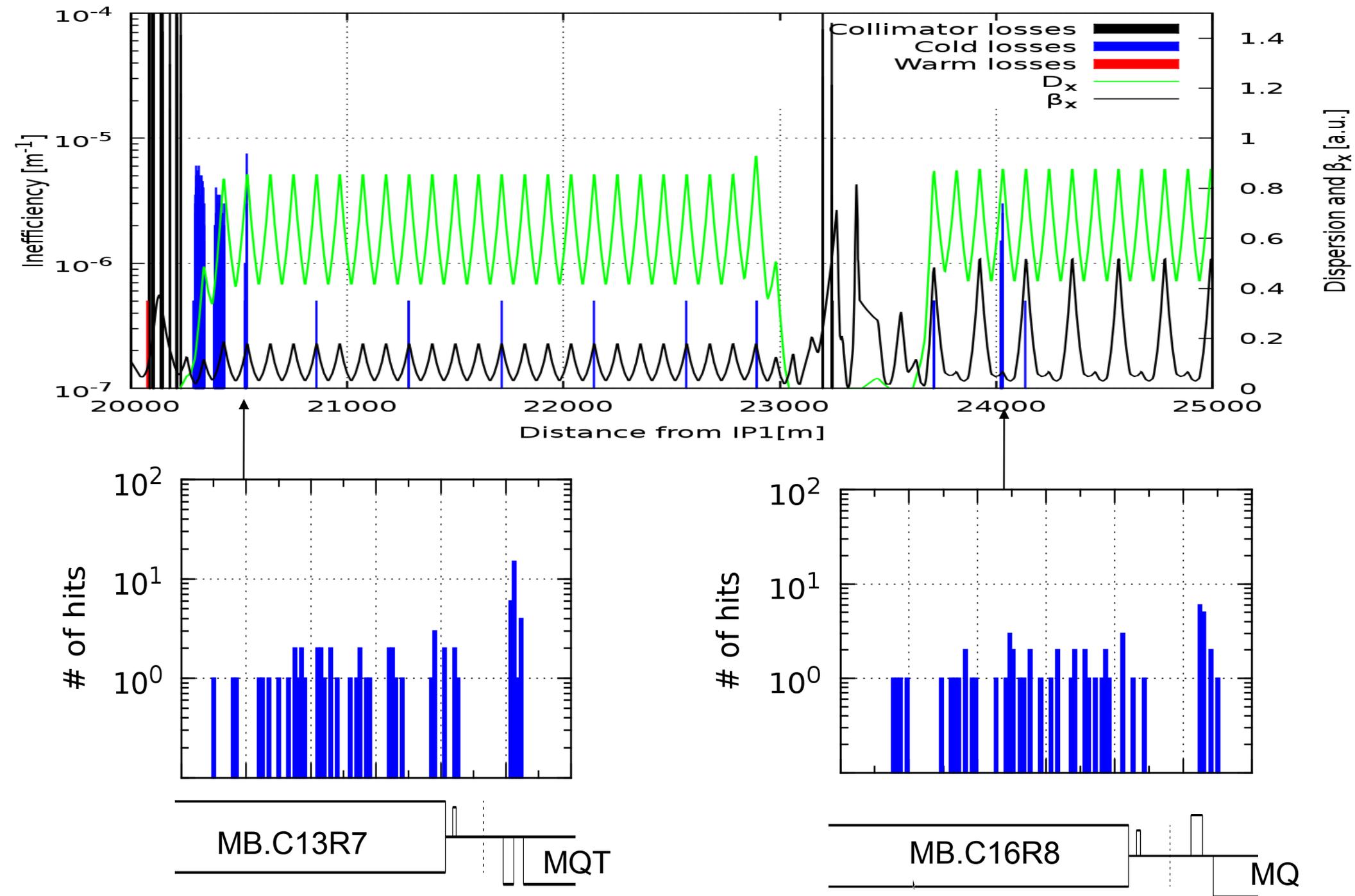Horizontal Loss map at 7 TeV - ATS B1
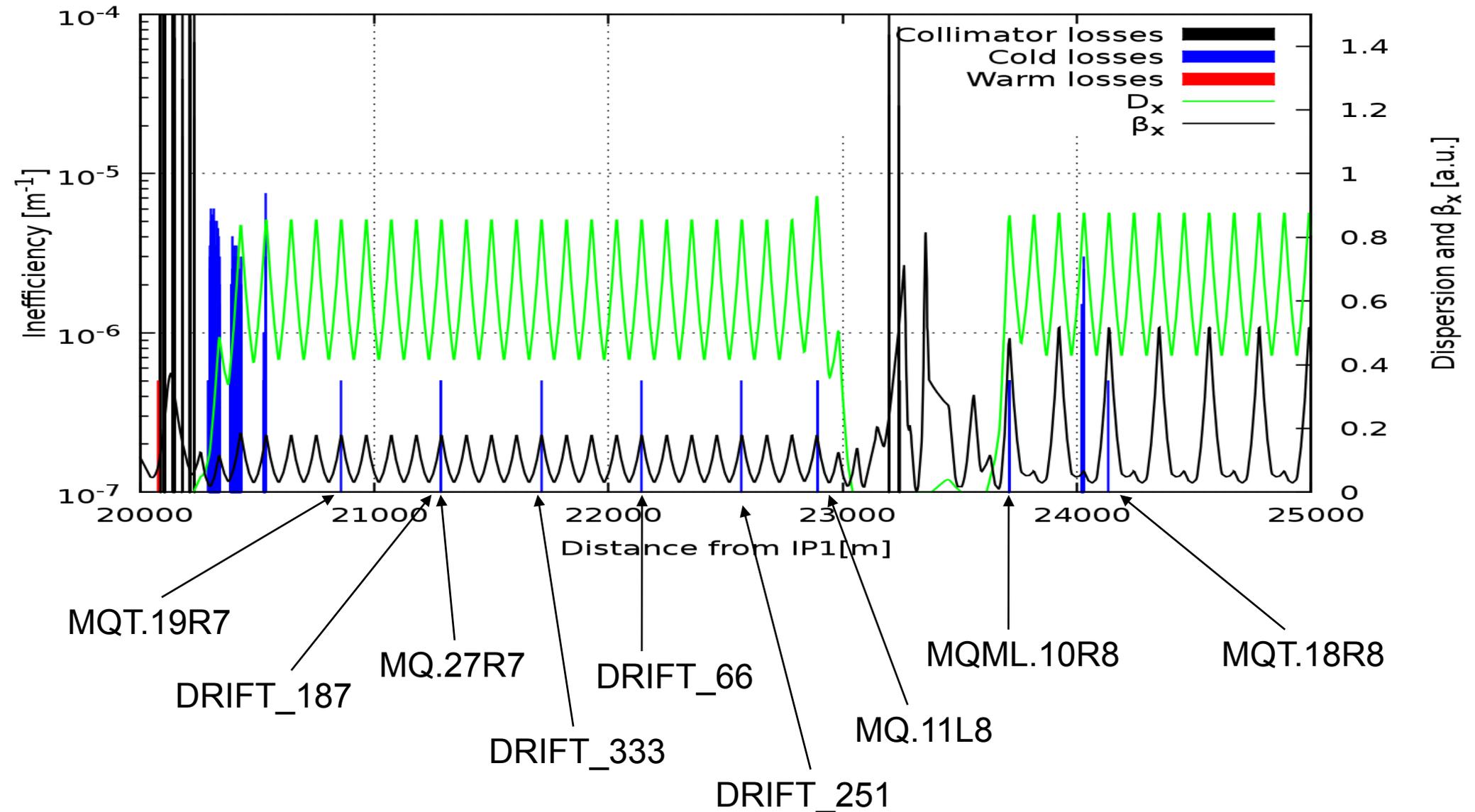
Particles simulated: 6.4M
Particles absorbed: 5.3M

Merlin loss map and dispersion for ATS case: IR7 zoom

Merlin loss map and dispersion for ATS case: IR7-IR8 zoom

Merlin loss map and dispersion for ATS case: IR7-IR8 zoom

The losses occur in correspondence of the local maxima of the horizontal beta-dispersion. It is just one proton loss for each spike. A simulation with higher number of particles is needed in order to evaluate the impact of this losses.

LOSS MAP comparison between Nominal and ATS cases
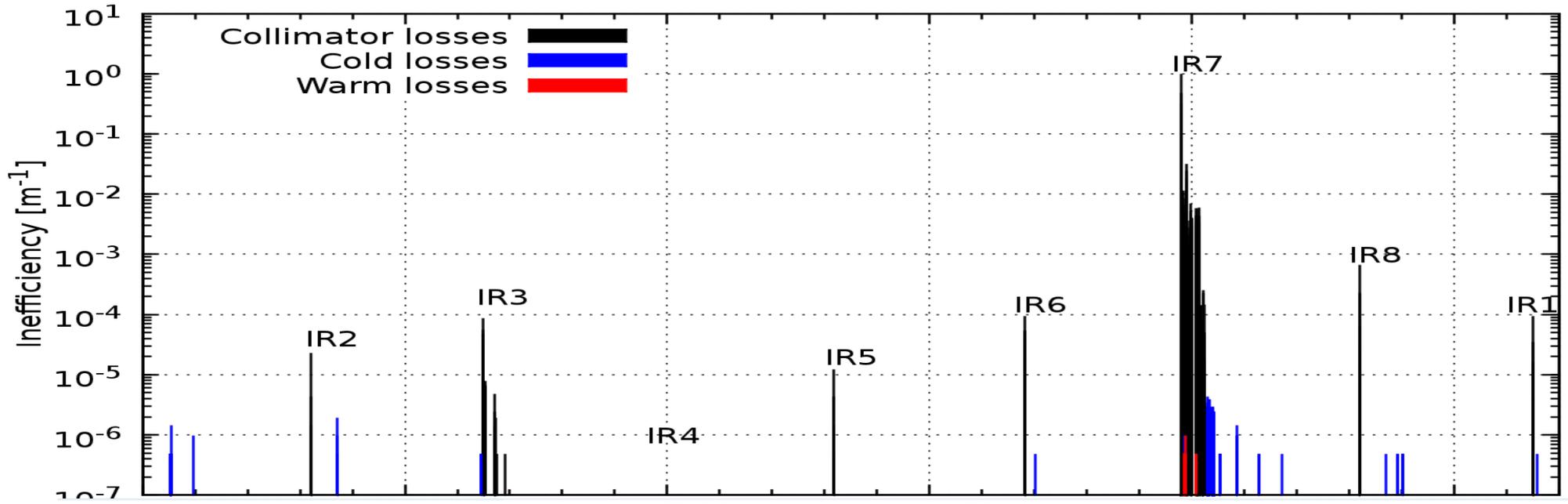

Horizontal Loss map at 7 TeV - Nominal B1
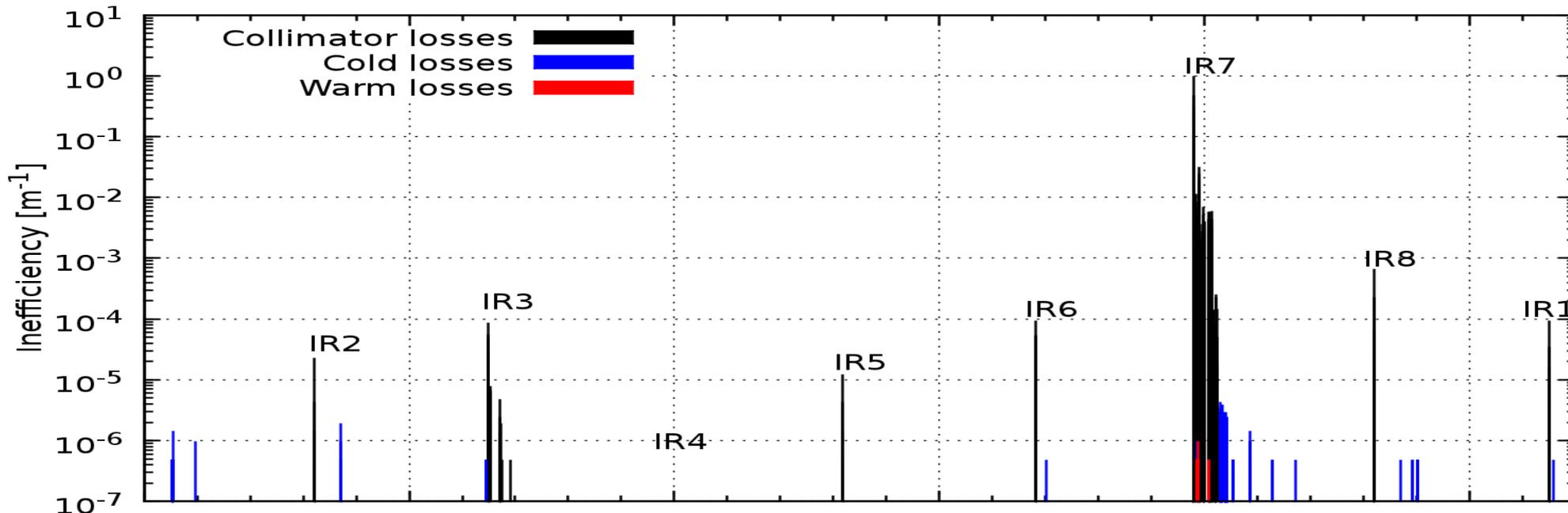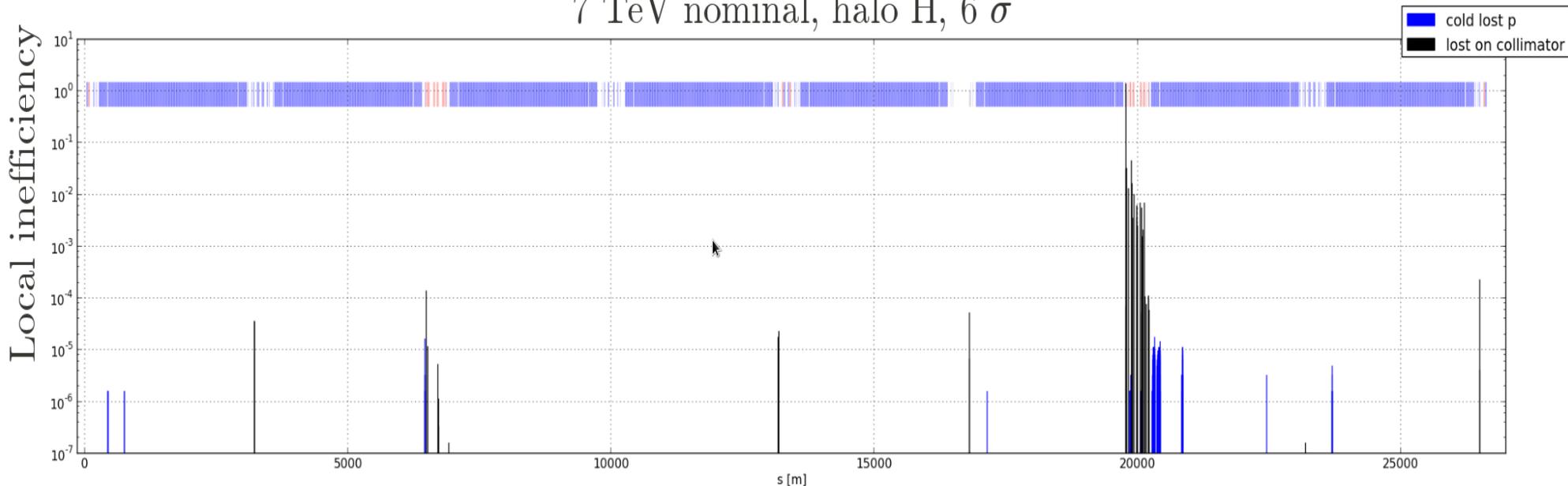
Horizontal Loss map at 7 TeV - ATS B1
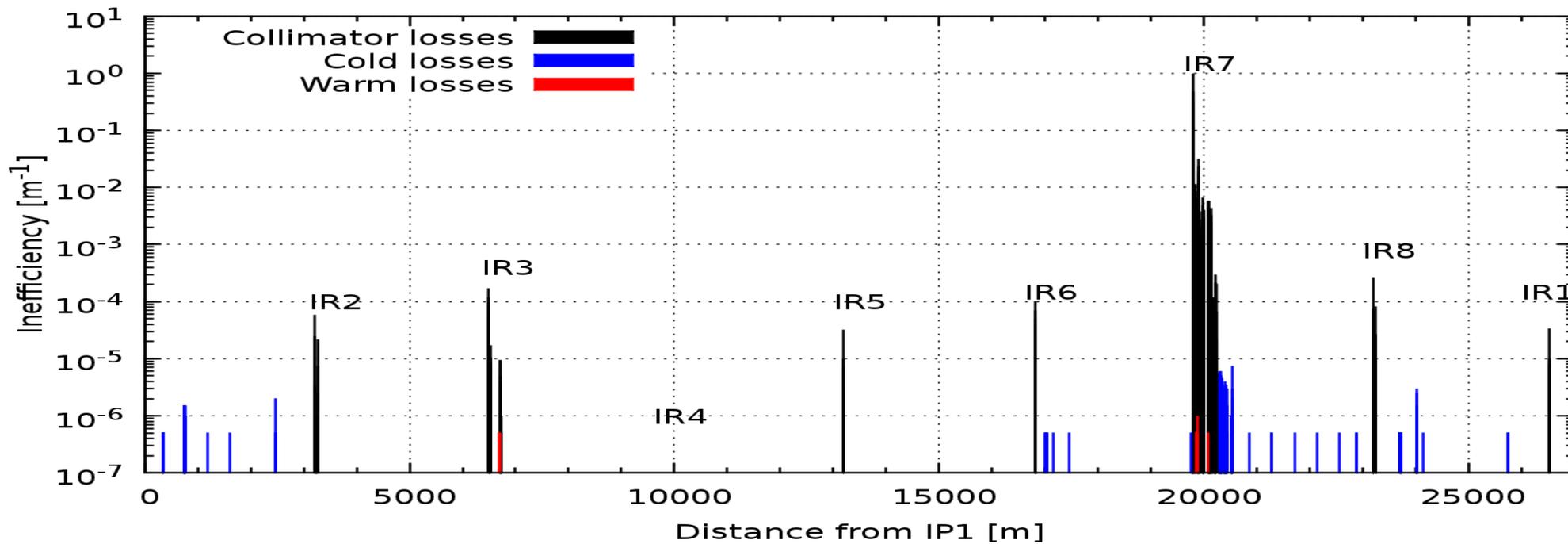
LOSS MAP comparison between MERLIN-SixTrack: Nominal case
Note: SixTrack Loss Maps from Aurelien presentation at HiLumi 2012

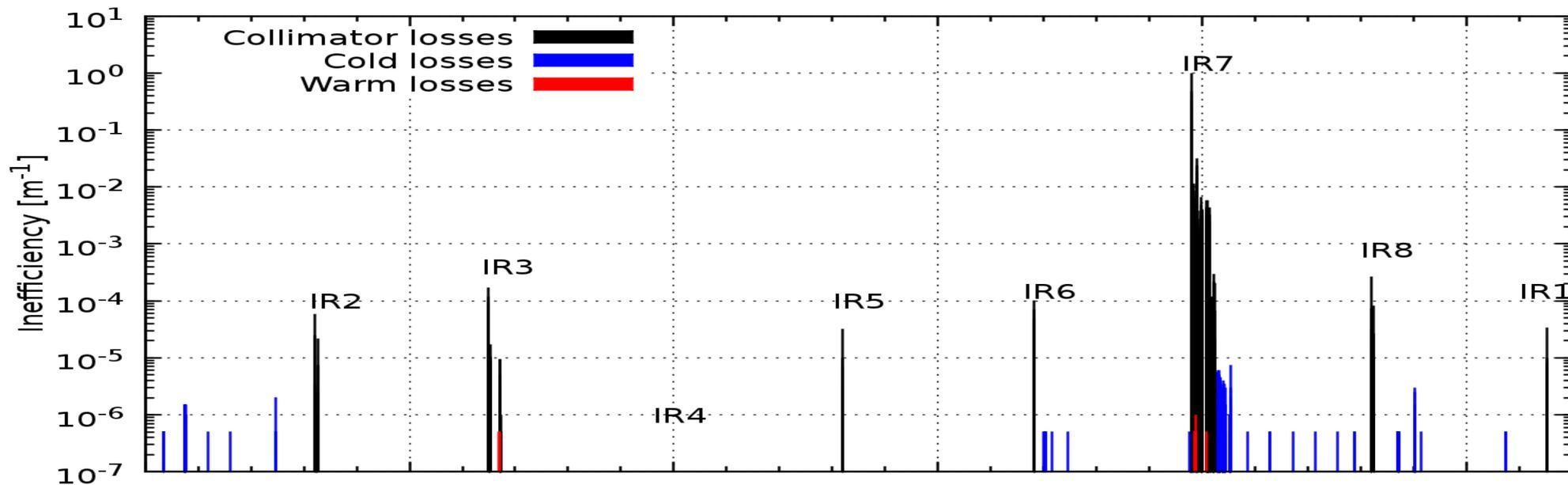Horizontal Loss map at 7 TeV - Nominal B1
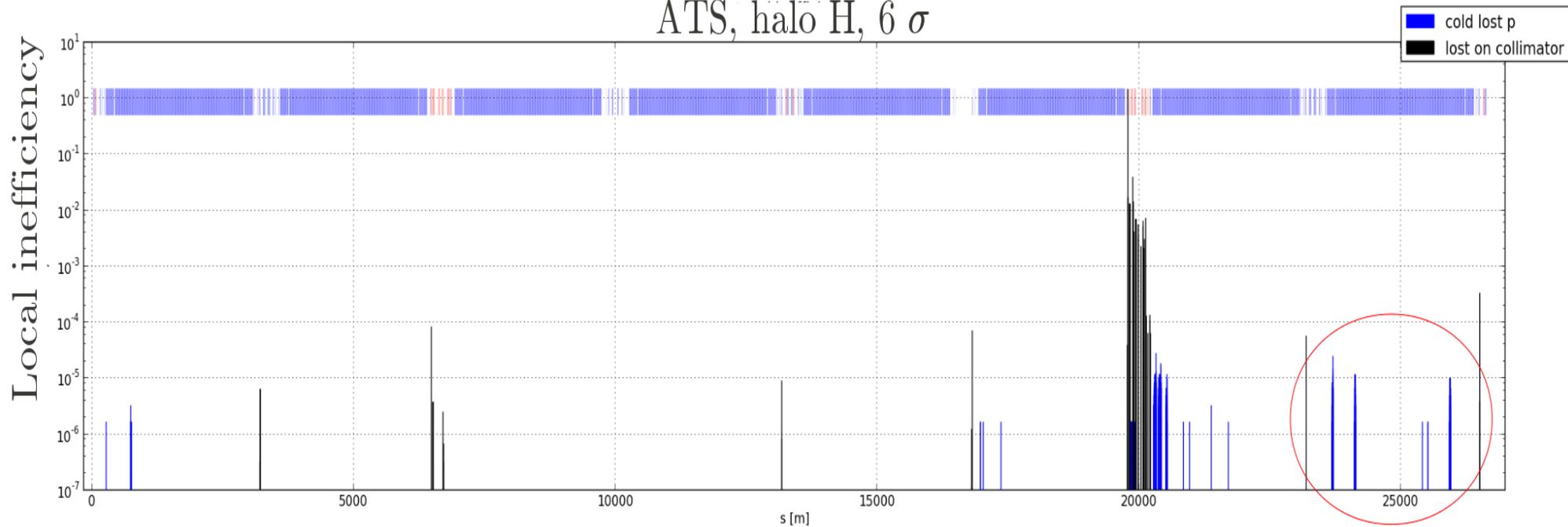
7 TeV nominal, halo H, 6 σ

Similar losses except in IR8 where it appears to be a difference of almost 4 order of magnitude

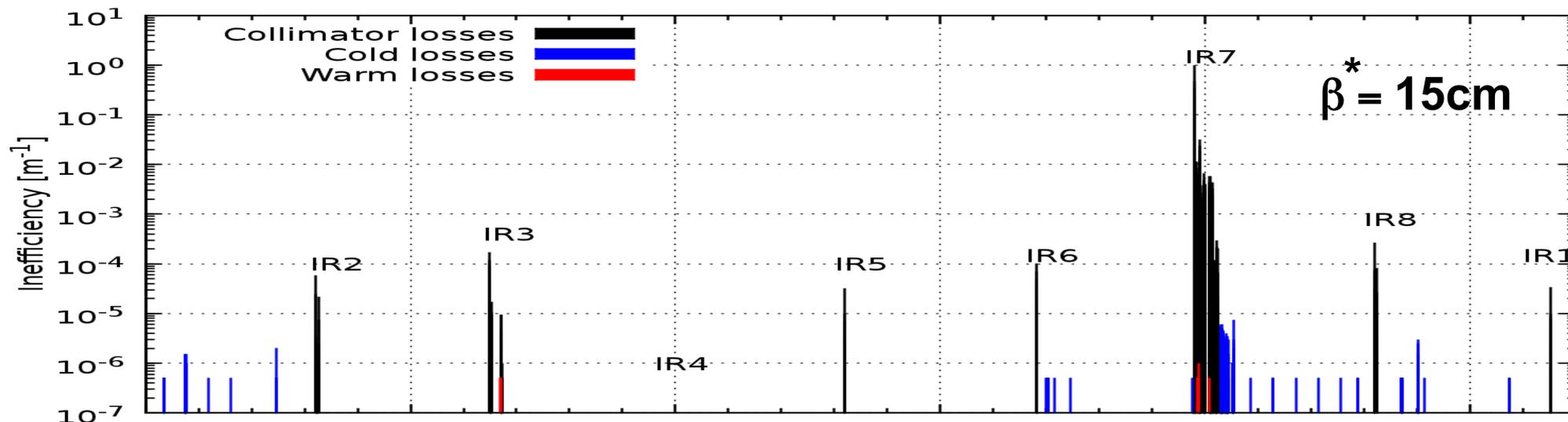# LOSS MAP comparison between MERLIN-SixTrack: ATS case
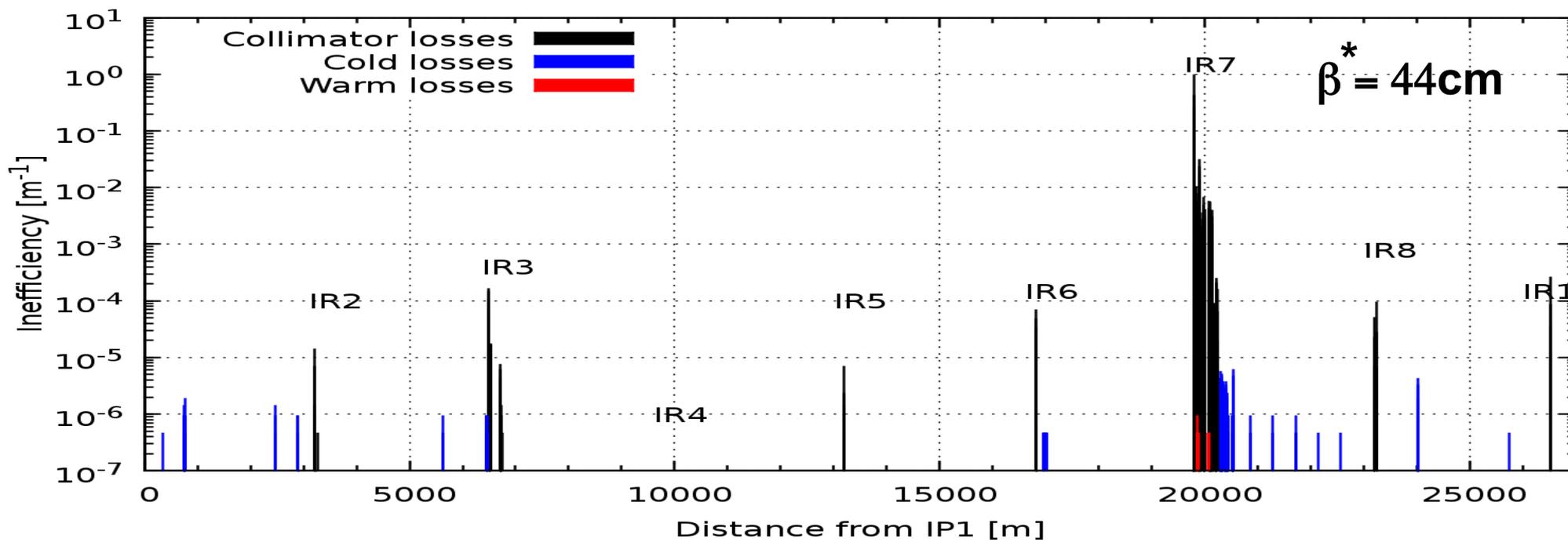

Horizontal Loss map at 7 TeV - ATS B1

ATS, halo H, 6 σ
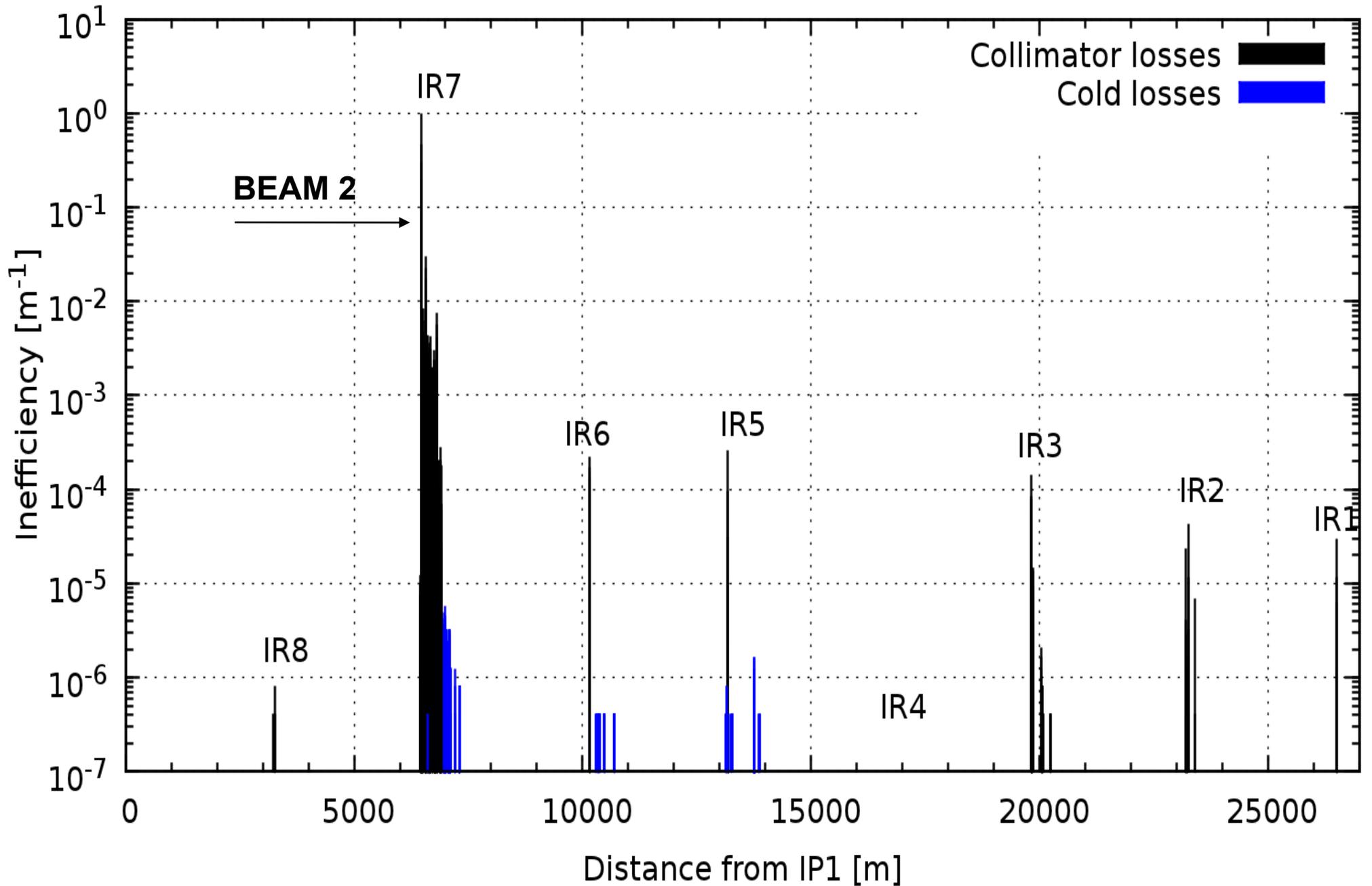
Horizontal Loss map at 7 TeV - ATS B1
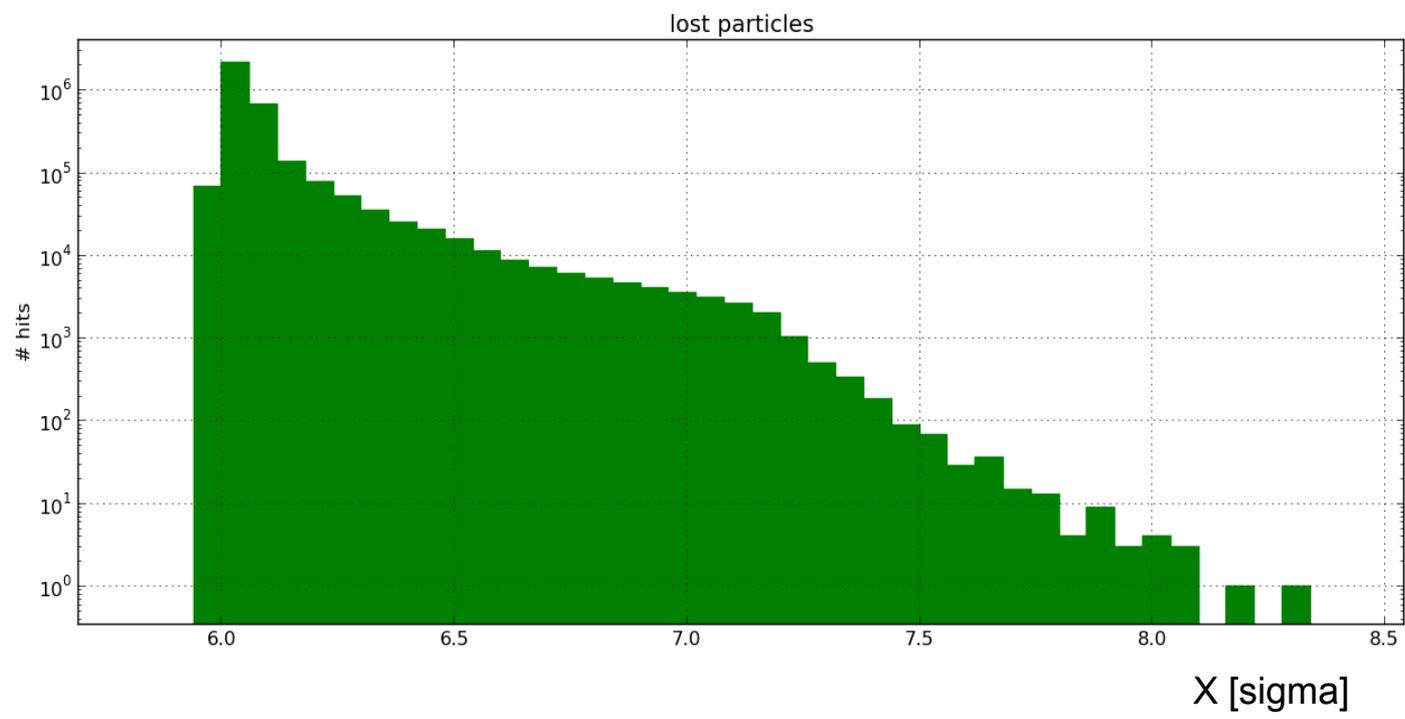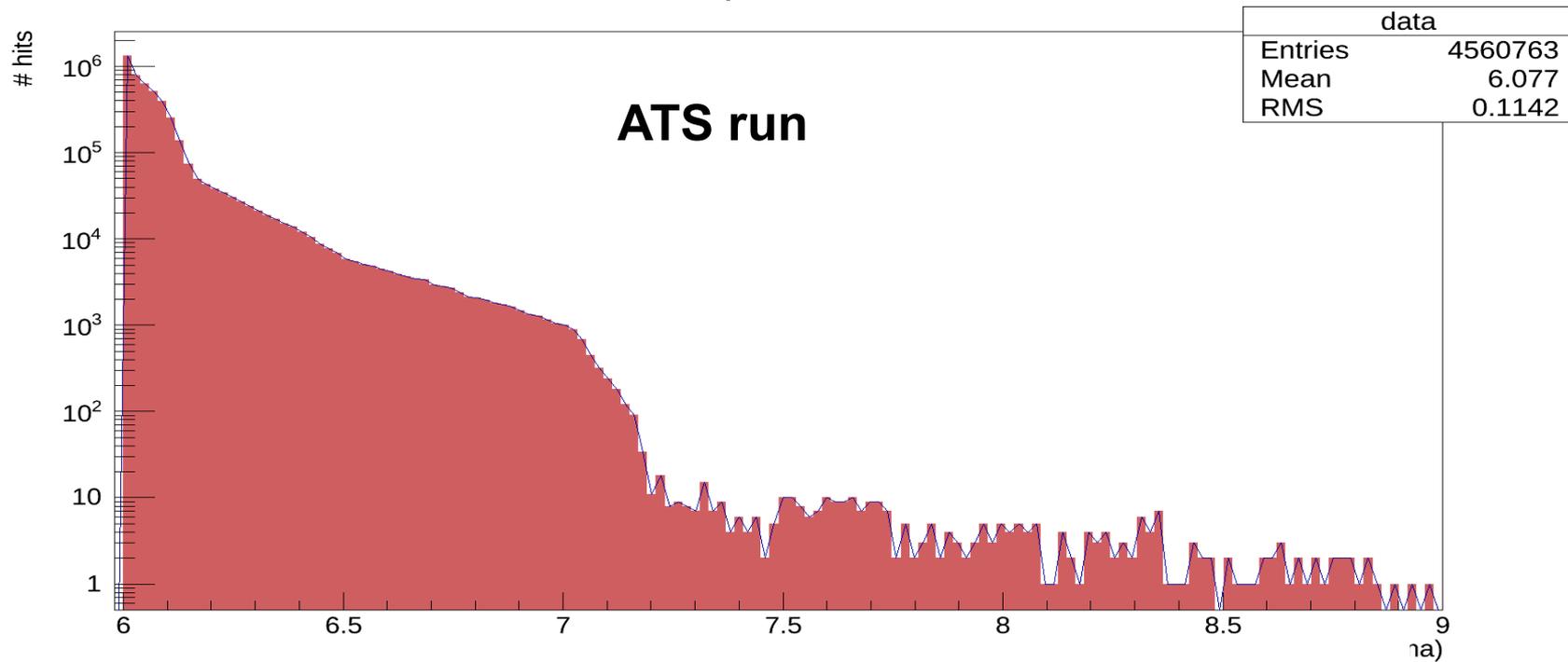
Horizontal Loss map at 7 TeV - PreSqueeze ATS B1

The ATS PreSqueeze Loss map seems reasonable and there are no critical losses expect the cold peak in the ARC81

Horizontal Loss map at 7 TeV- Beam 2

Nominal LHC case, Beam injected in TCP.C6R7

Losses distribution of all protons absorbed in TCP.C6L7

Conclusions

The MERLIN simulations results are in a good agreement with SixTrack.

Further investigations needed to clarify the cold losses differences.

Check apertures, collimator and accelerator parameters

Working on:

- ATS loss map B1 with crossing on

- Octogonal aperture

- One side TDCQ aperture

- Loss map with the new scattering classes

- ATS beam 2 and vertical loss map

ANY COMMENTS AND SUGGESTIONS ARE WELCOME!