Simulations of Possible Phase II System

Phase II Specification and Implementation Meeting

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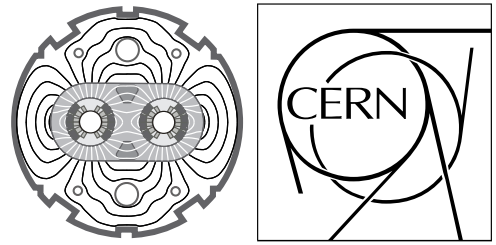
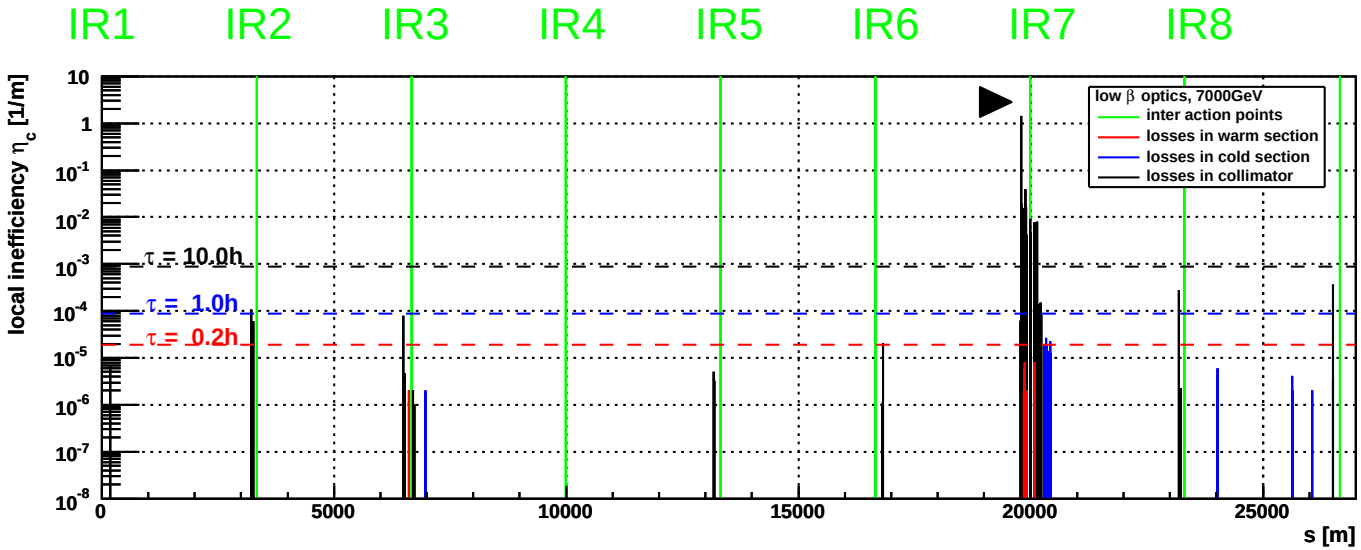
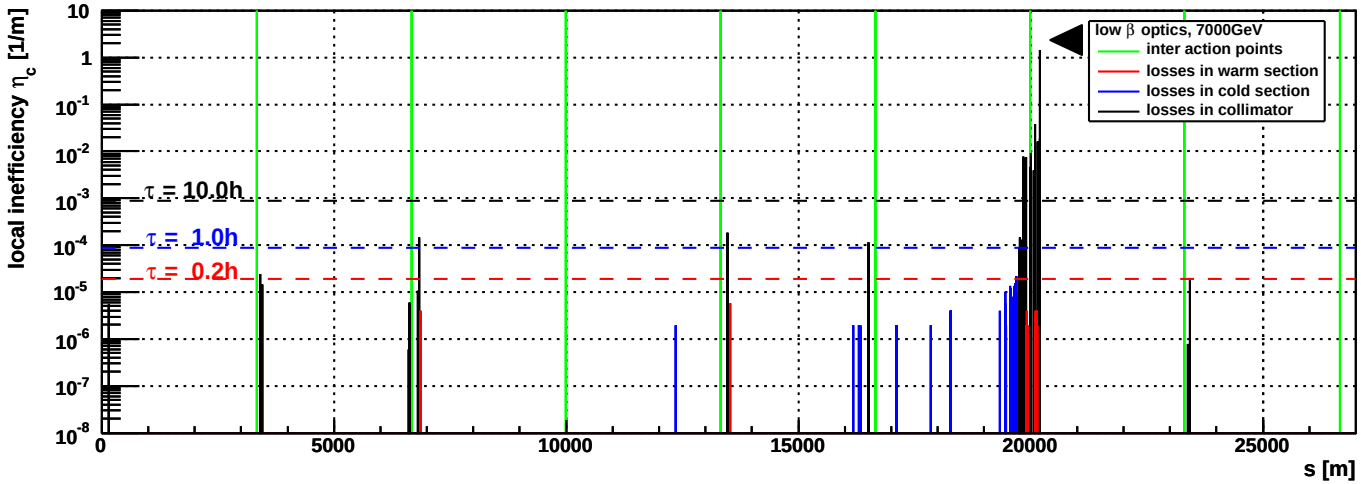


System Performance at 7TeV (Phase1)



beam 1

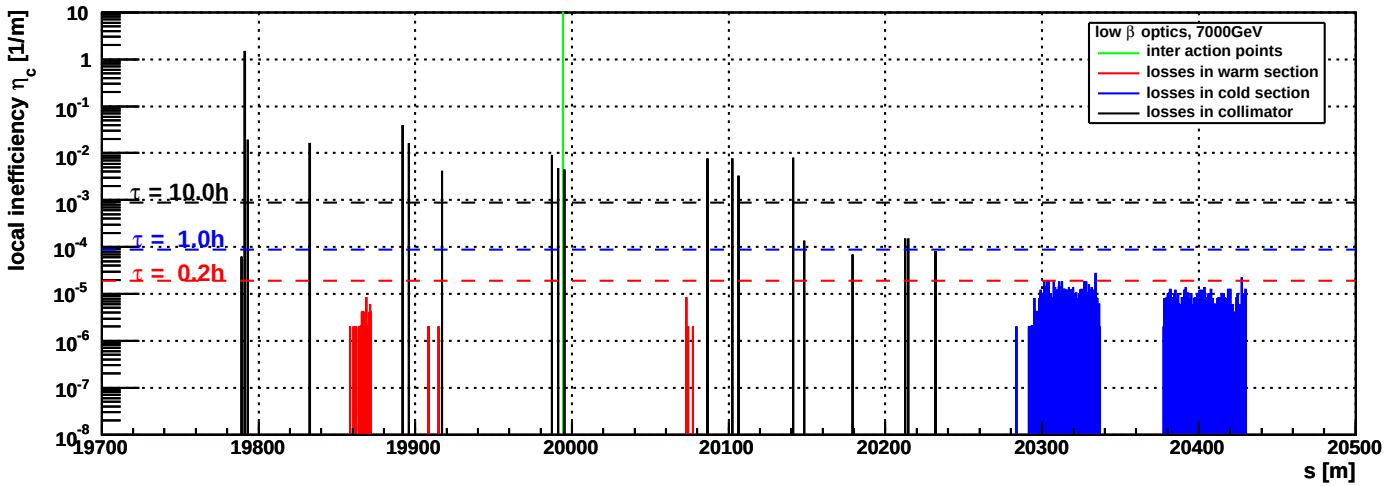
- 7 TeV
- horizontal betatron halo
- standard settings
- ideal machine

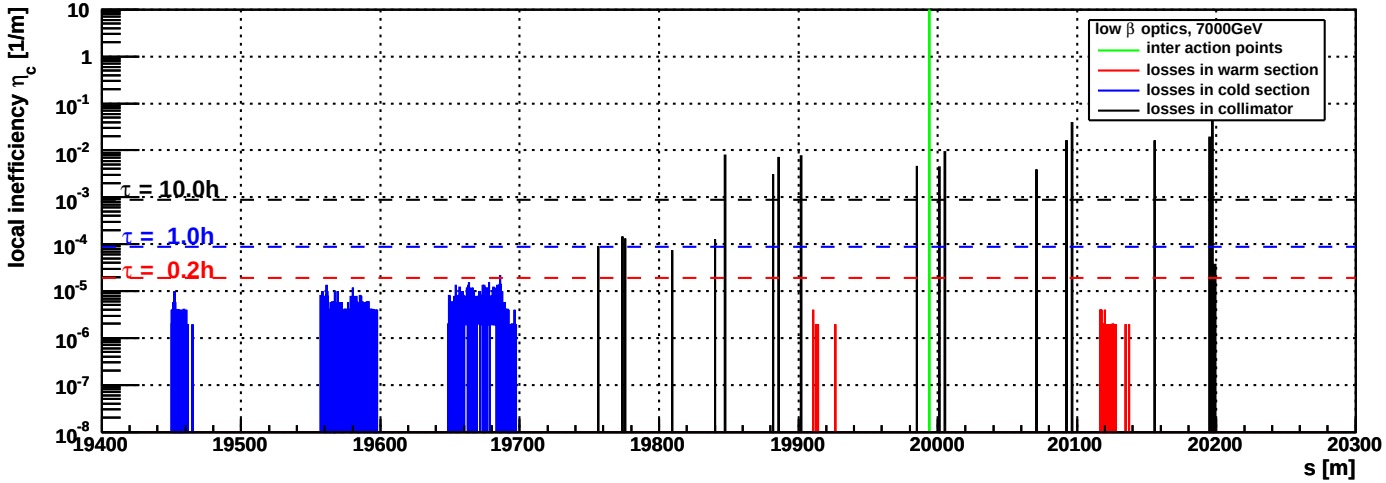


beam 2

- 7 TeV
- horizontal betatron halo
- standard settings
- ideal machine

Zoom to Cleaning Insertion in IR7

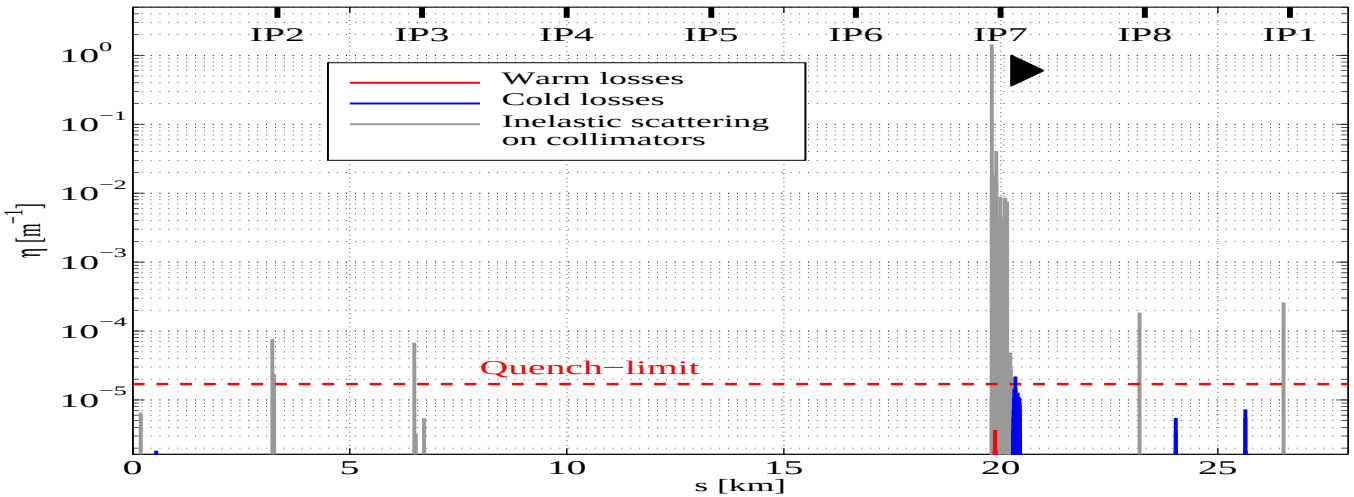




$\Rightarrow \approx 40\%$ limitation

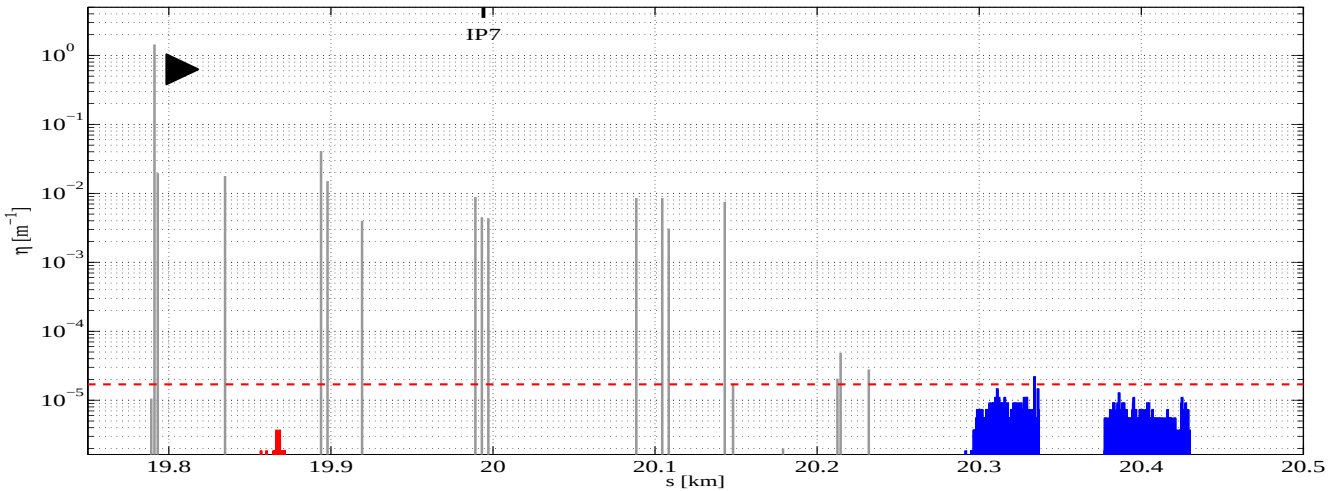
System Performance at 7TeV

(with metallic secondary collimators)



beam 1

- 7 TeV
- CU secondaries
- horizontal betatron halo
- standard settings
- ideal machine



beam 1

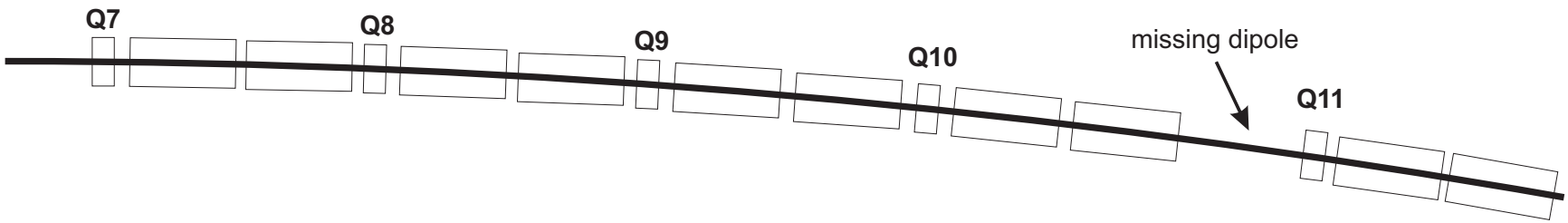
- zoom in IR7
- performance limitation still in dispersion suppressor

C. Bracco

Proposal for Phase2 Efficiency Improvement

Problem from the cleaning efficiency side of view of Phase1 and Phase2 system are the losses in the dispersion suppressor after the cleaning insertions.

Idea for a possible Phase2 system is to add additional collimators in the dispersion suppressor at the location of the loss peaks seen.



$\Rightarrow$ make use of space from missing dipole

Proposal for Phase2 Efficiency Improvement

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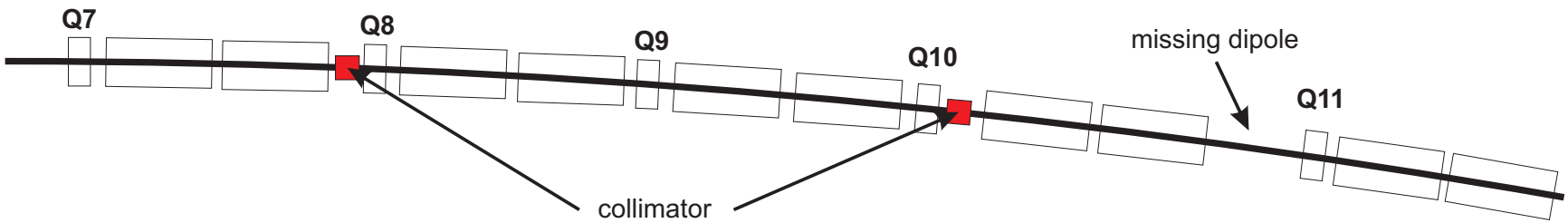
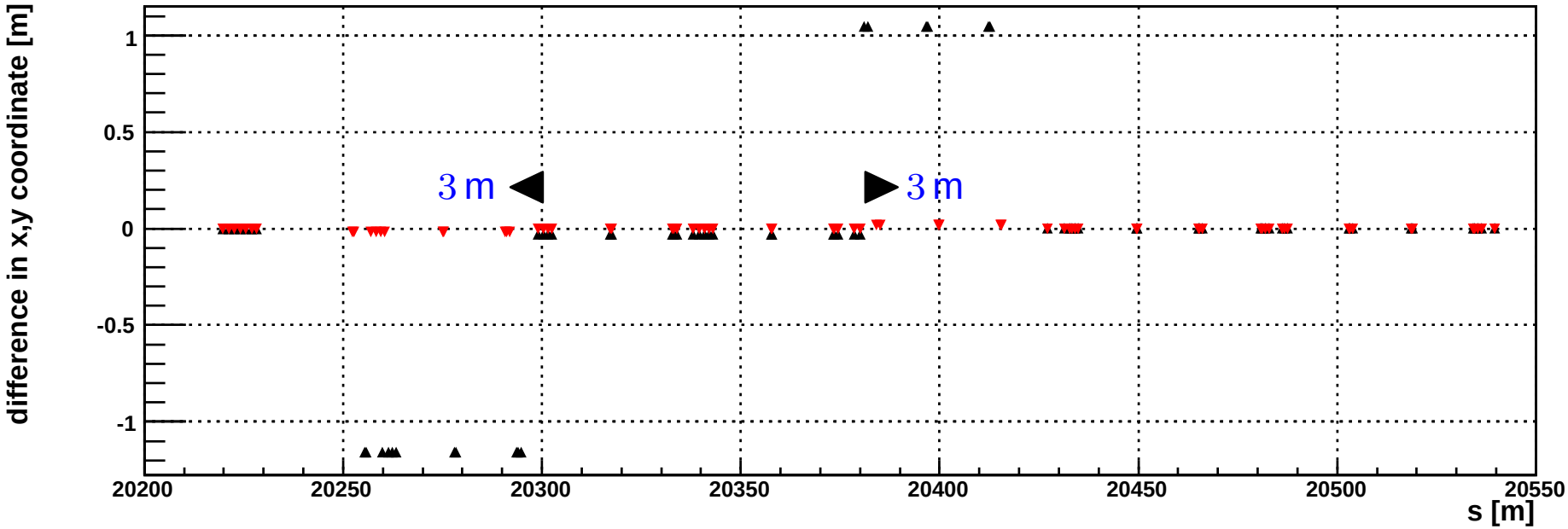


symmetric shift of two dipoles at the beginning and end of the dispersion suppressor by $3\,\mathrm{m}$.

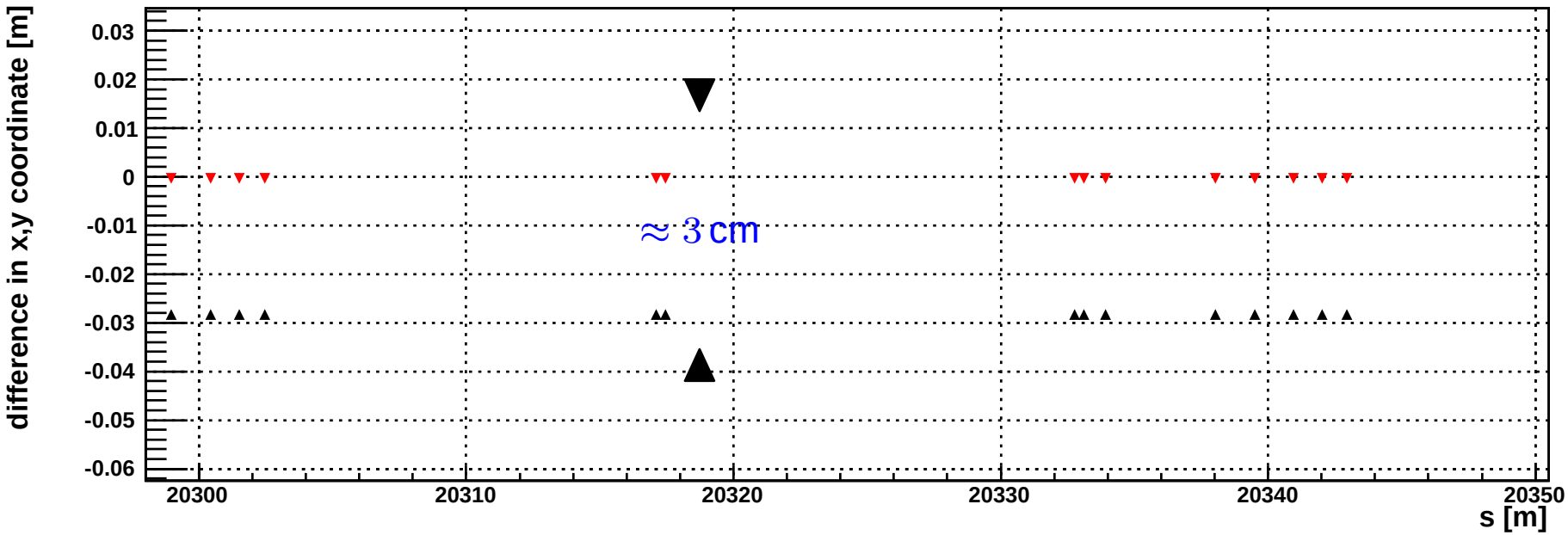
Change in Magnet Position/Survey

Modified region



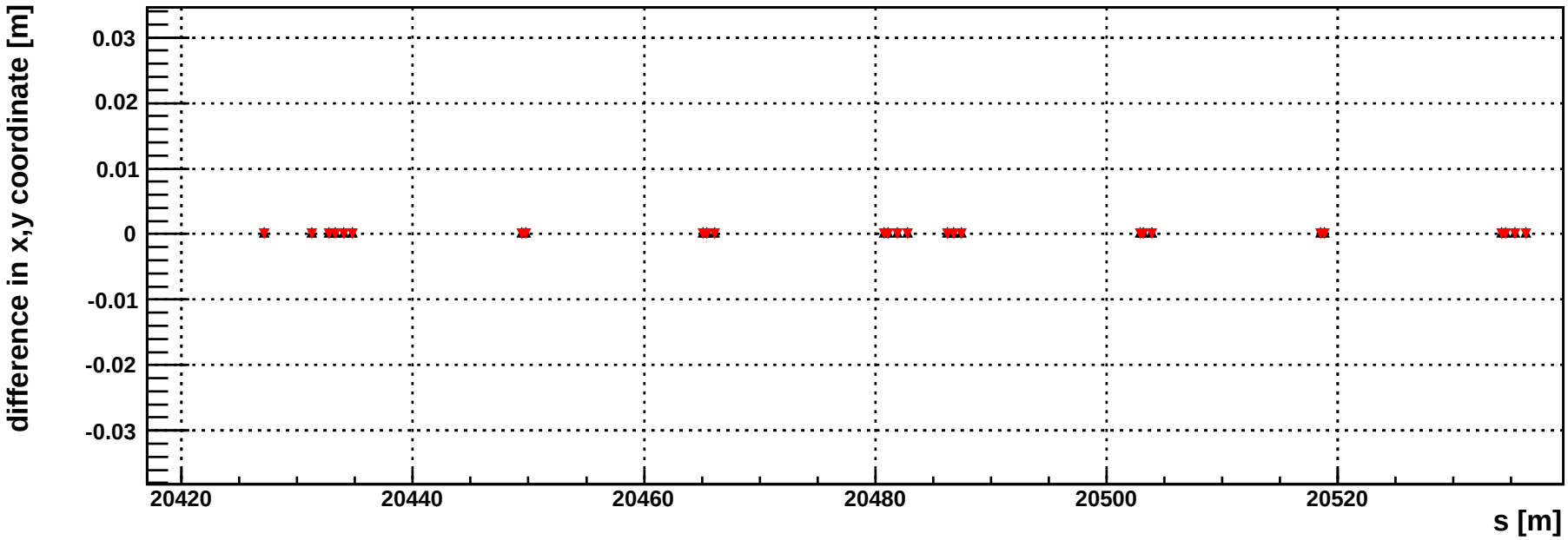
Change in Magnet Position/Survey

Between the moved magnets

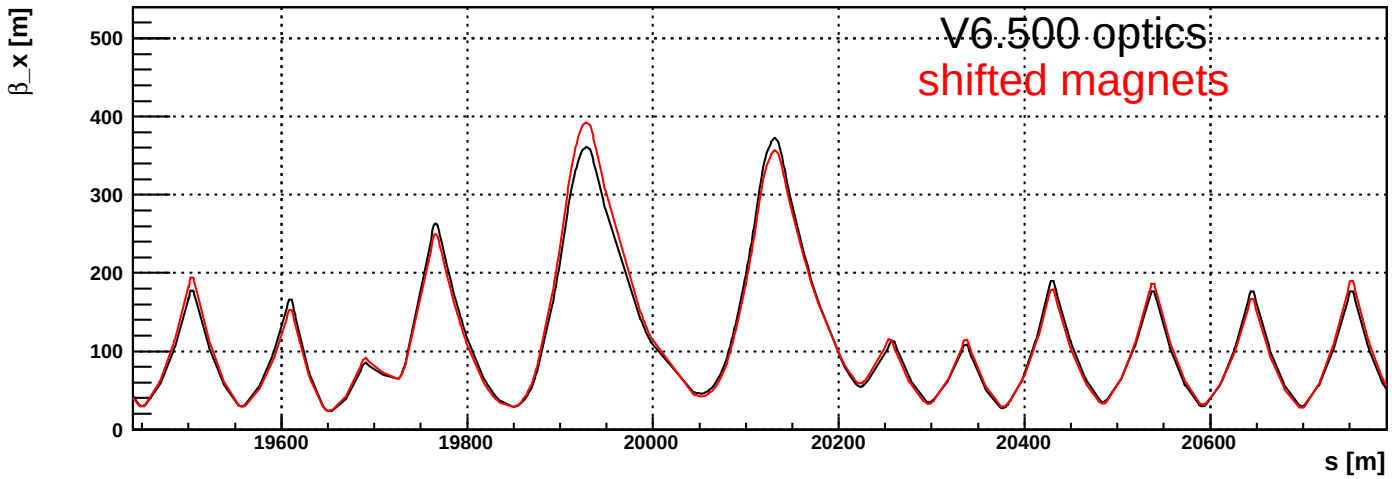


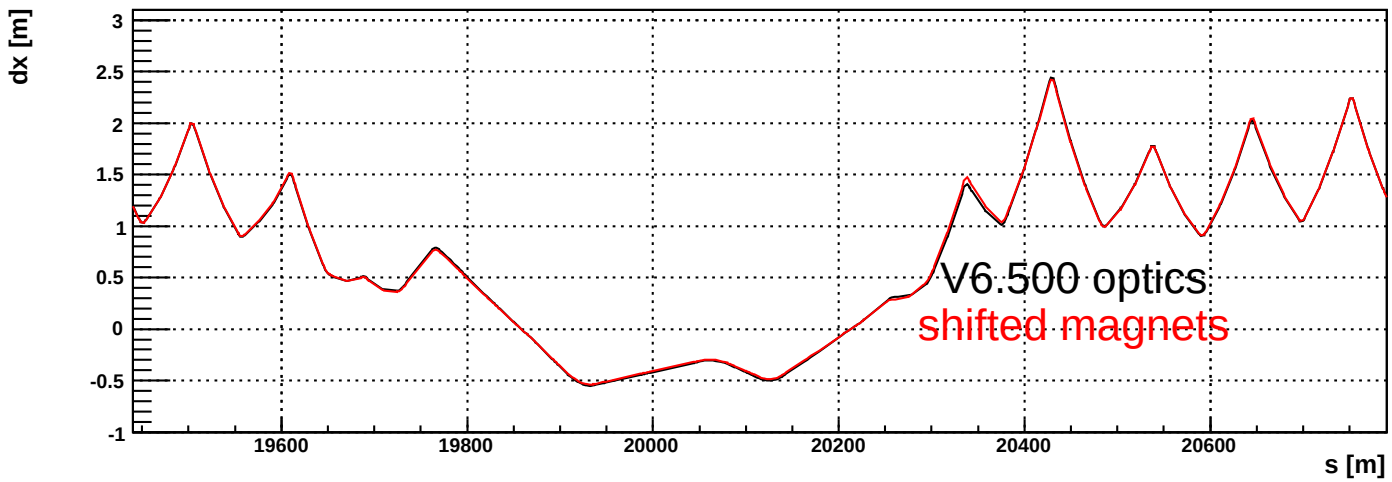
Change in Magnet Position/Survey

Unchanged region (behind Q11)



Changes in Twiss Parameters

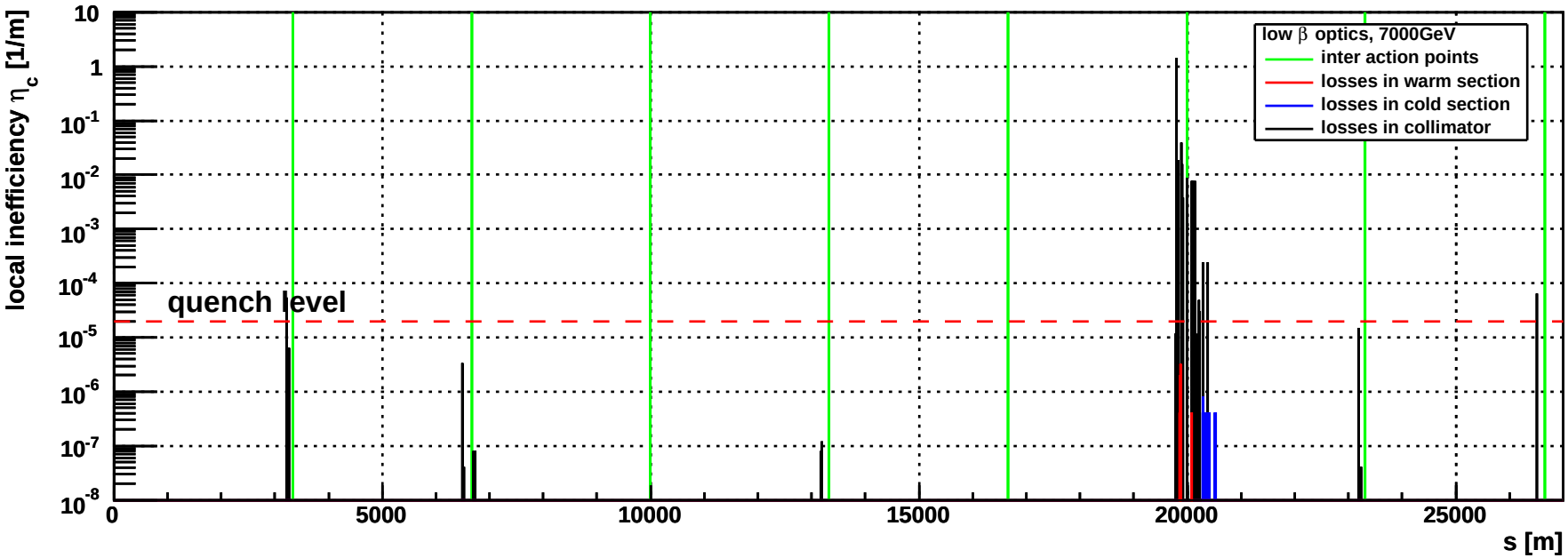




change in
$\beta \approx 10\%$
$d_x \approx 5\%$

Preliminary Simulation Results

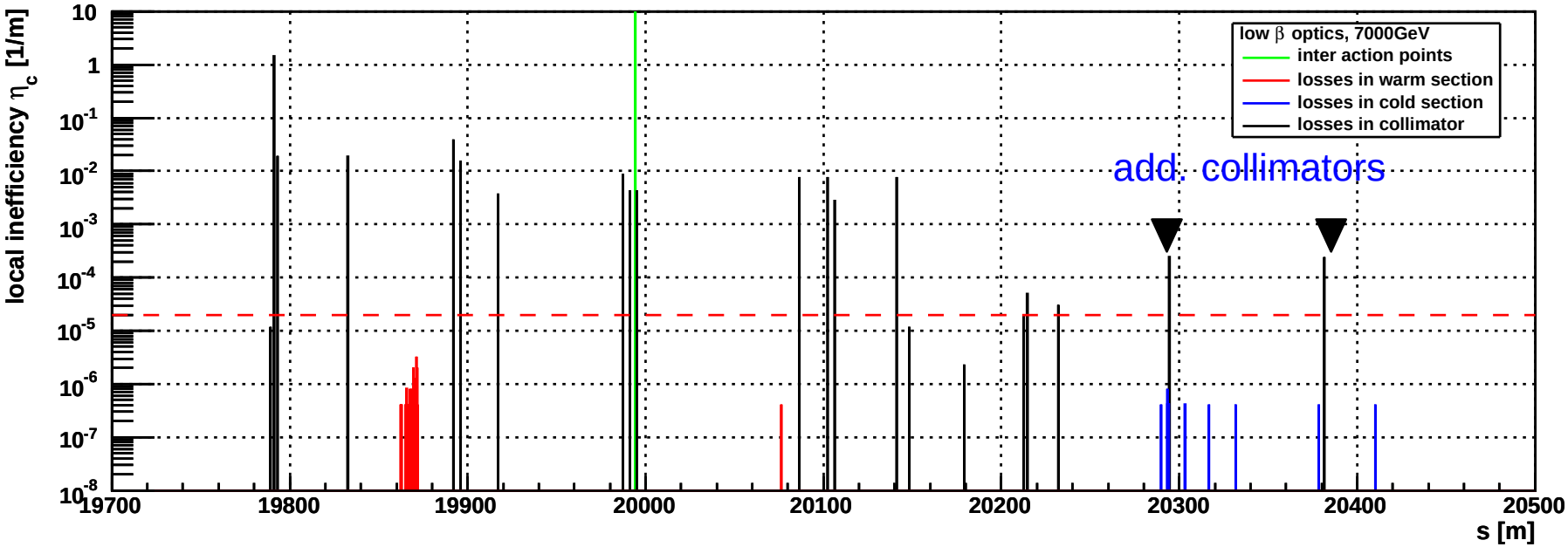
Loss-map around LHC for beam 1 (for 25M particles)



Copper secondaries set to nominal settings, carbon secondaries set to relaxed opening (26.5σ), cryogenic collimators (material copper, length 1 m) placed at 300 m and 387 m from IR7 at 15σ.

Preliminary Simulation Results

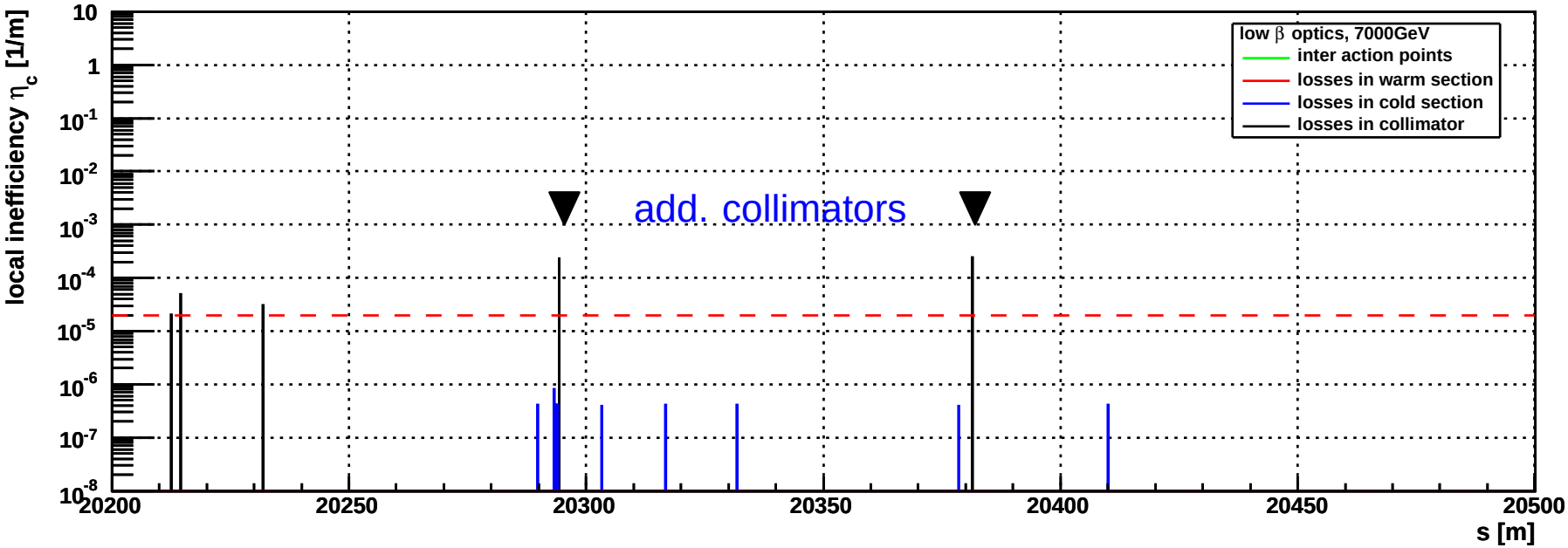
Zoom in IR7 and dispersion suppressor



Copper secondaries set to nominal settings, carbon secondaries set to relaxed opening (26.5σ), cryogenic collimators (material copper, length 1 m) placed at 300 m and 387 m from IR7 at 15σ.

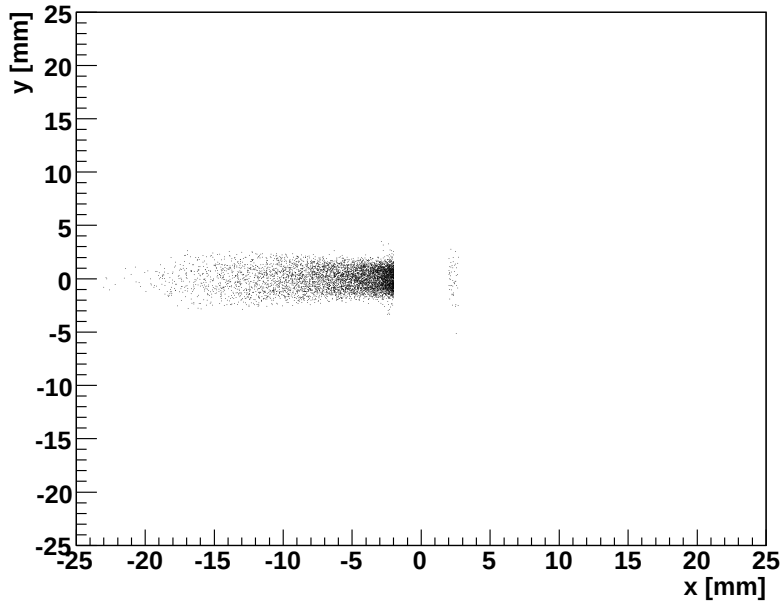
Preliminary Simulation Results

Zoom in the dispersion suppressor region

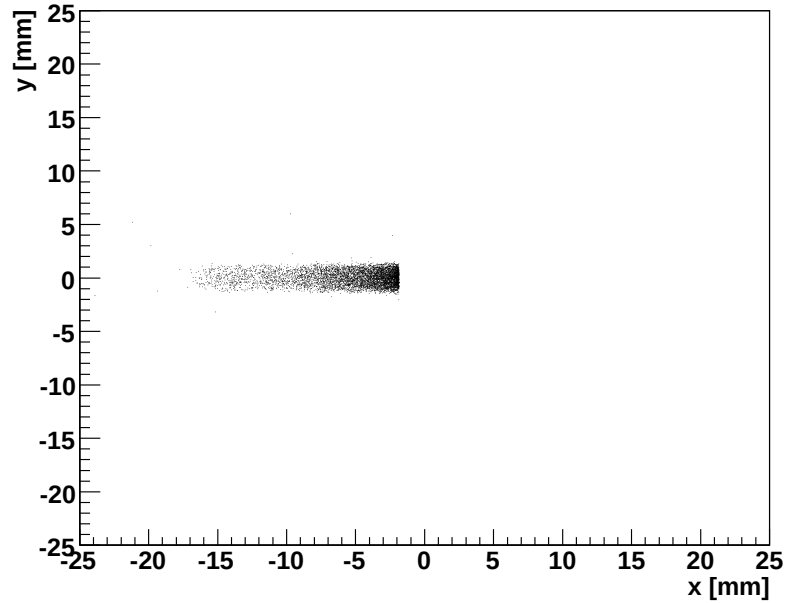


Copper secondaries set to nominal settings, carbon secondaries set to relaxed opening (26.5σ), cryogenic collimators (material copper, length 1 m) placed at 300 m and 387 m from IR7 at 15σ. Peak reduced by a factor > 30.

Impacts Distributions



TCRYO.AR7.B1
at 300m from IR7
opening 15σ
≈ 2.0 mm



TCRYO.BR7.B1
at 387m from IR7
opening 15σ
≈ 1.8 mm

Conclusion

- New concept studied, required heavy simulations (25M particles).
- Gained 3m space per location and placed 1 m copper collimators, shifts horizontal ideal orbit by ≈ 3 cm in dispersion suppressor.
- Solution for gaining ≈ 30 in cleaning efficiency.
- To do:
  - Check feasibility of moving magnets and space availability.
  - Rematch of Optics needed.
  - Sensitivity to errors (orbit, beta beat, ...) has to be studied.
  - FLUKA studies needed to see energy deposition on the downstream magnets and to verify if additional absorbers are needed (therefore additional space needed)
  - New collimator design for dispersion suppressor needed.
  - The same studies still have to be done for beam2, remember the losses are not symmetric (three peaks in dispersion suppressor).