Simulation of local object/vacuum bump in SixTrack

MPP

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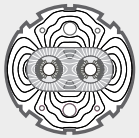
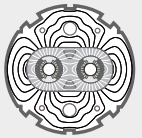
Simulation parameters



What simulation tool has been used?

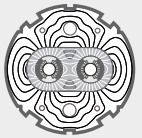
- Sixtrack with added beamgas module.
- DPMJET used to generate collision events, which is read into Sixtrack.
- Read in pressure maps and distribute collisions around the ring according to these maps.
- Can also add one or a few collision points manually ->
  - To simulate pp collision residues from the IPs (ongoing)
  - **To simulate pressure bumps/local obstacles** (presented here)
- More details:
  - The LHC Background Study Group
  - `http://cern.ch/project-LHC-bkg-sim/`

Simulation parameters



- $\beta^* = 2$ m in all IPs.
- 3.5 TeV beam energy, beam 1.
- Collimator at "nominal" settings for 2 m -> no imperfections, beta-beat etc.
  - TCTs at 12.8 σ
- Beam collide with proton particles at rest in one specific location in each simulation
  - Dust particle falling through the beam [1]
  - Other local object suddenly touching the beam
  - Local vacuum bump
- Assume $\mathbf{10^7}$ total proton interactions [2]
- Looked at case #3 and #4, which are (most likely) losses from beam 1.

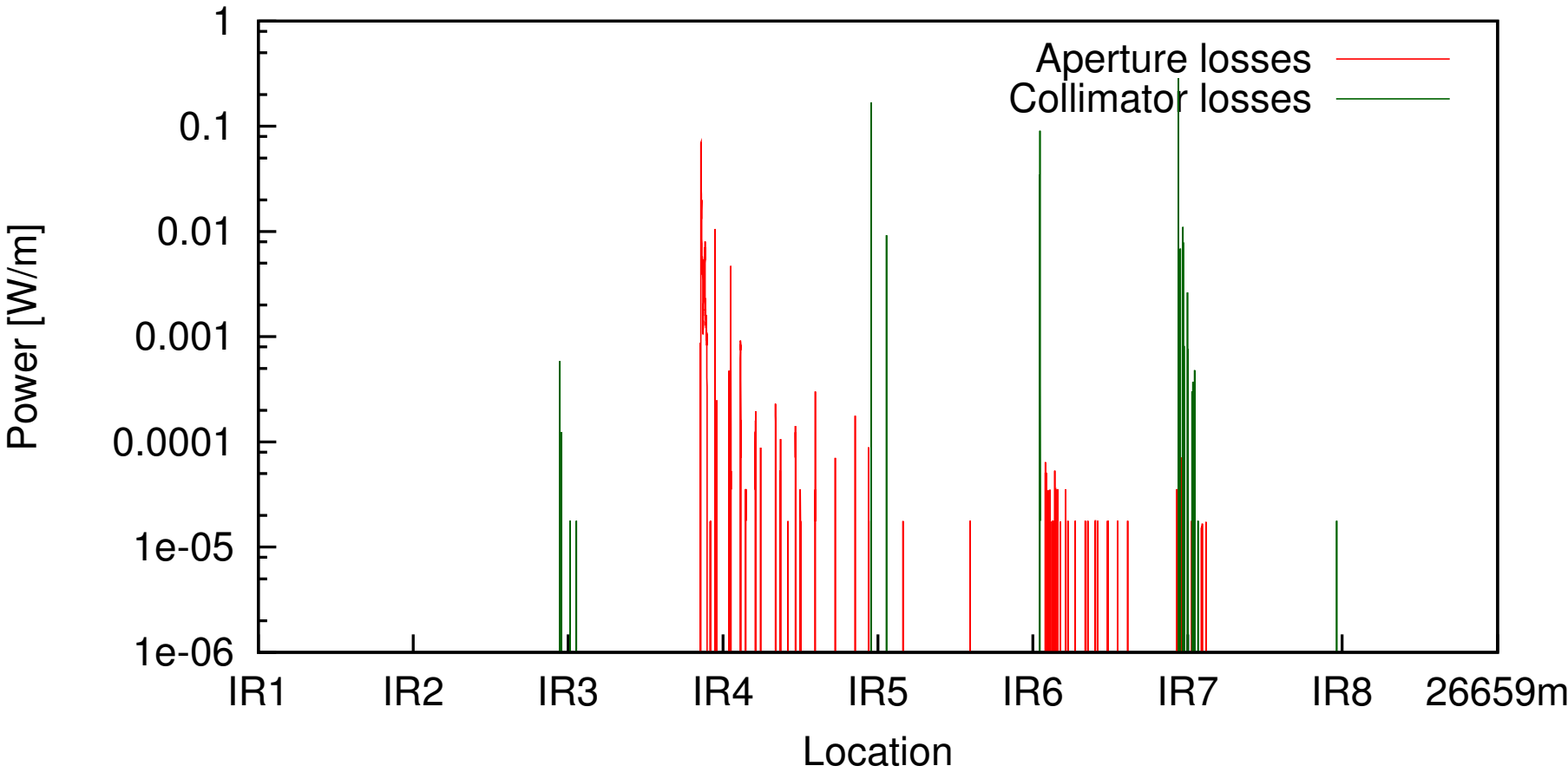
Simulation parameters



Please take into account that:

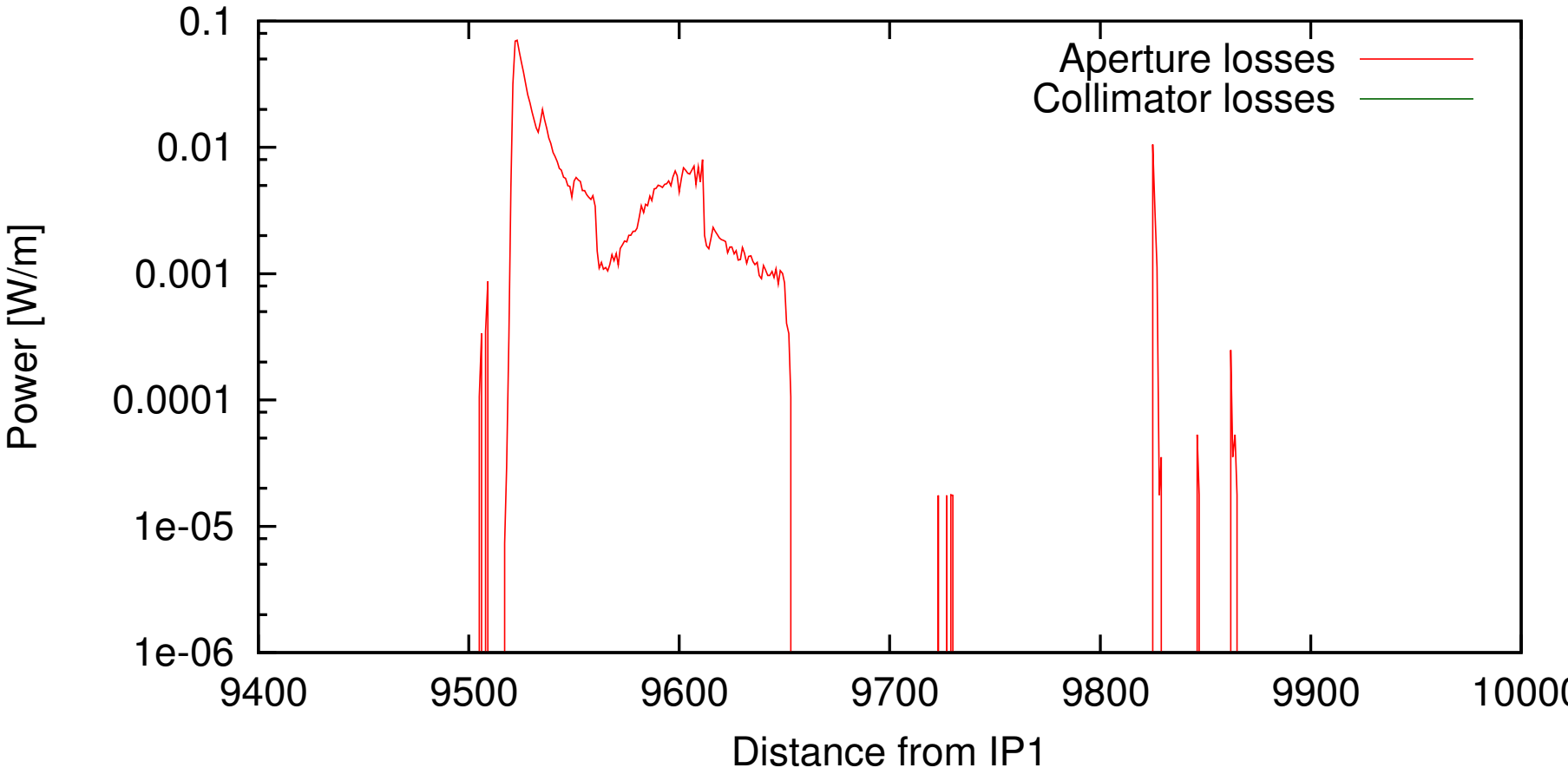
- Sixtrack uses an expanded Hamiltonian, which means that tracking of **heavily** off-momentum is not as precise.
- Sixtrack can only track protons.
- These two points means that you should expect the first local peak to be higher than in the simulation.
- $\beta^* = 2$ m instead of 3.5 m. This means you should expect less losses on the TCTs than what the simulation predicts.
- Loss maps gives the point where the proton collides with an aperture restriction, in terms of its energy.

Case # 3



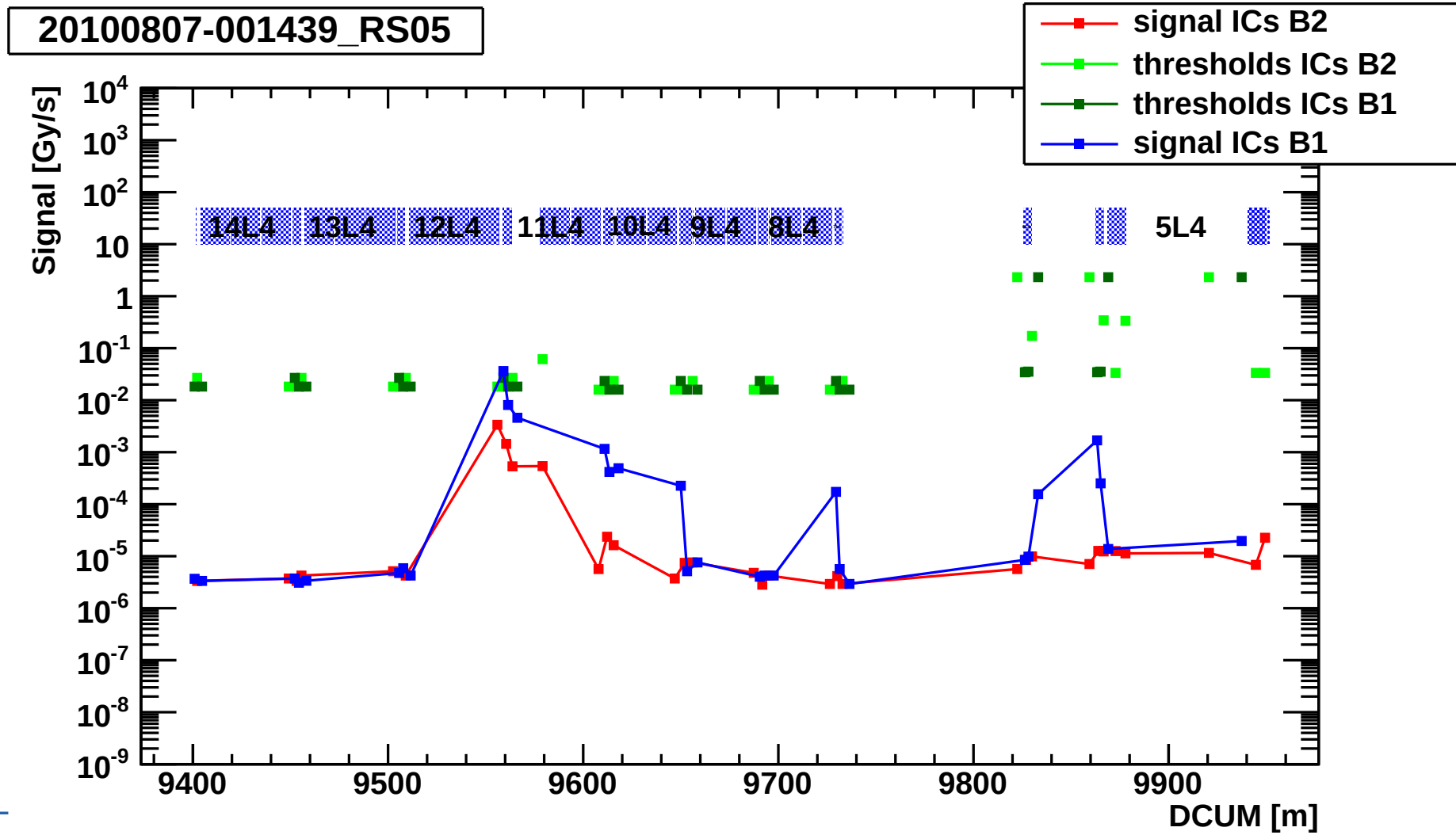
Global losses around the ring

Case # 3



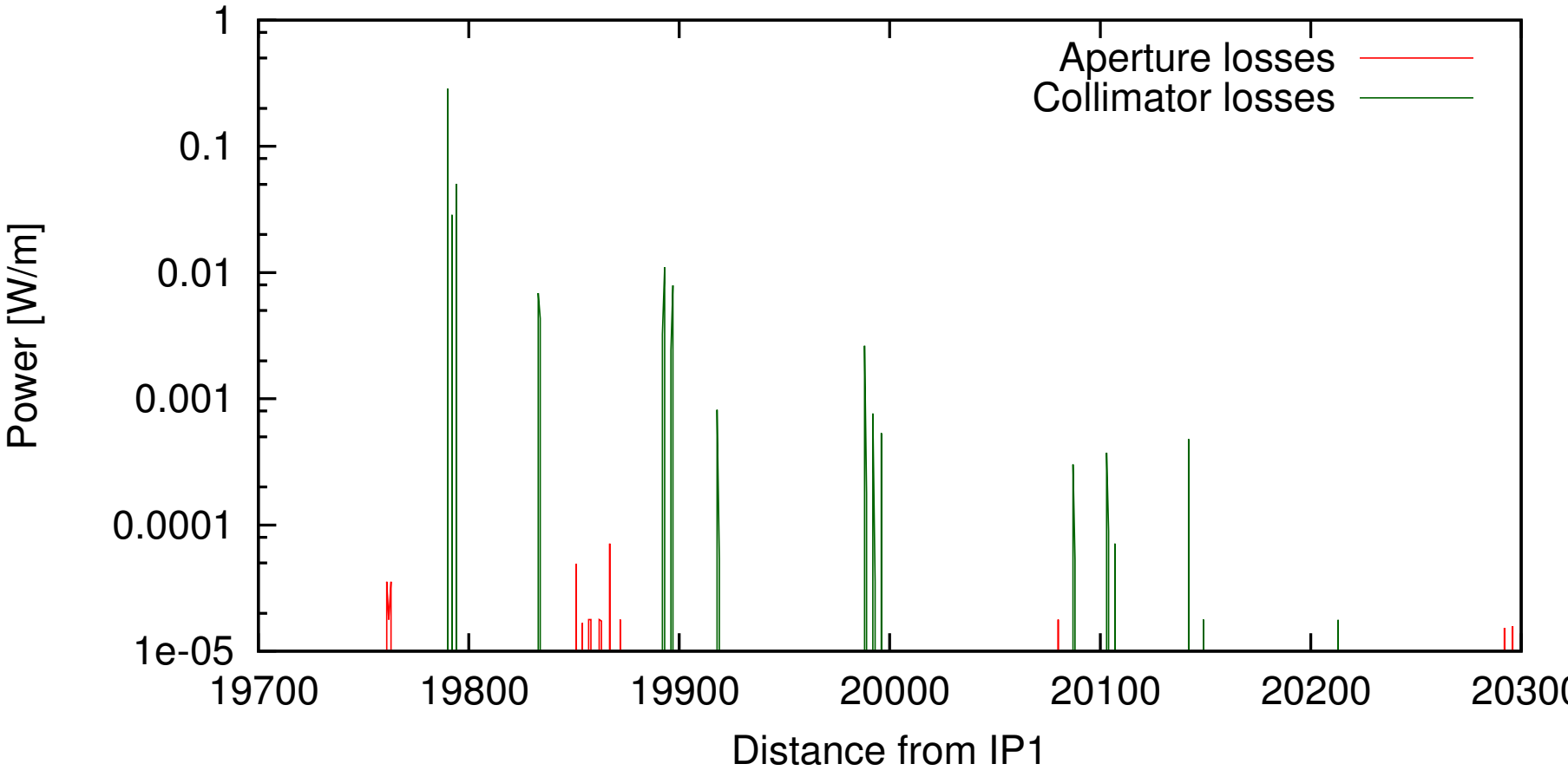
Local losses downstream of “obstacle point”

Case # 3



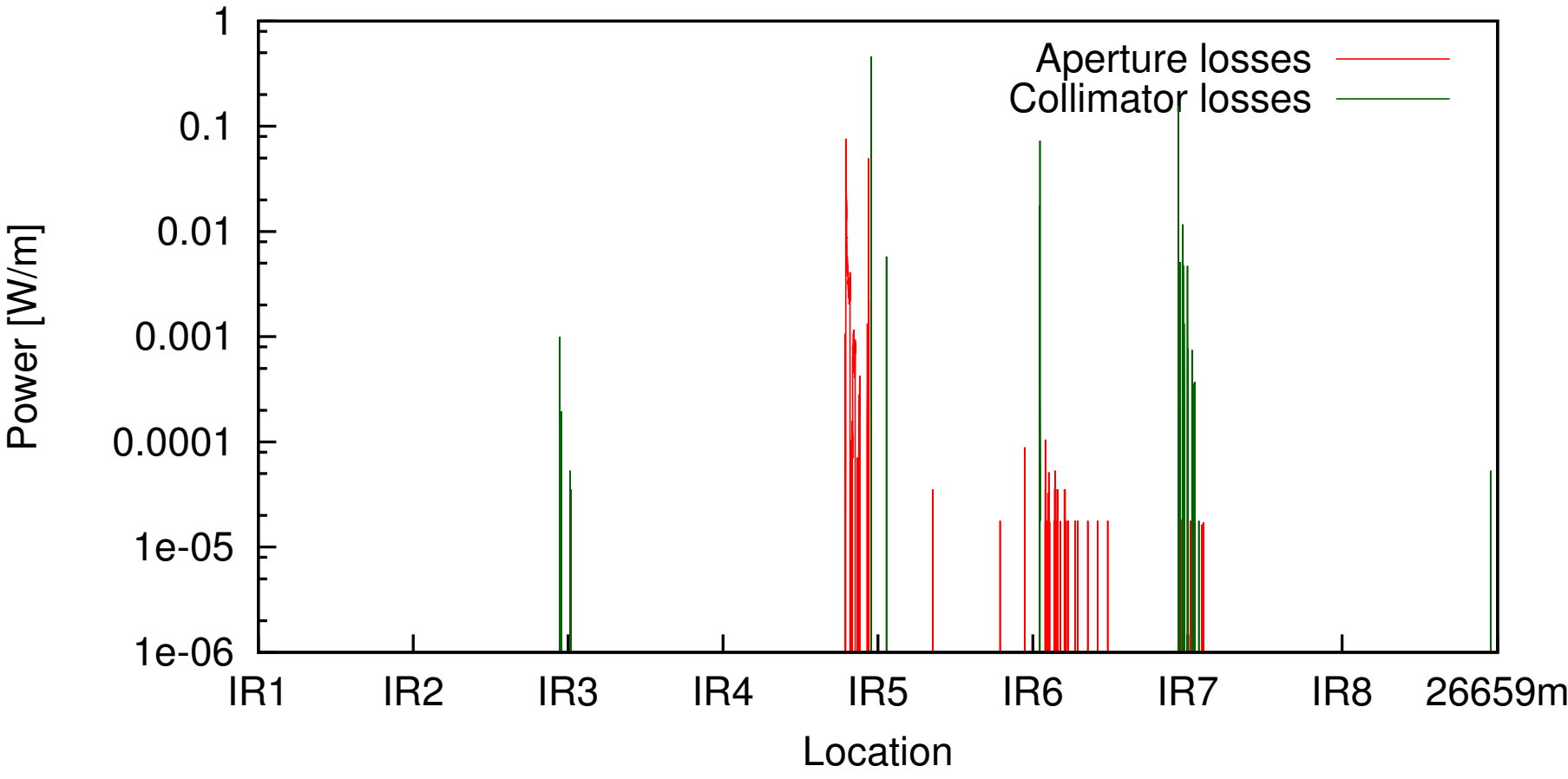
Measurement (Annika Nordt)

Case # 3



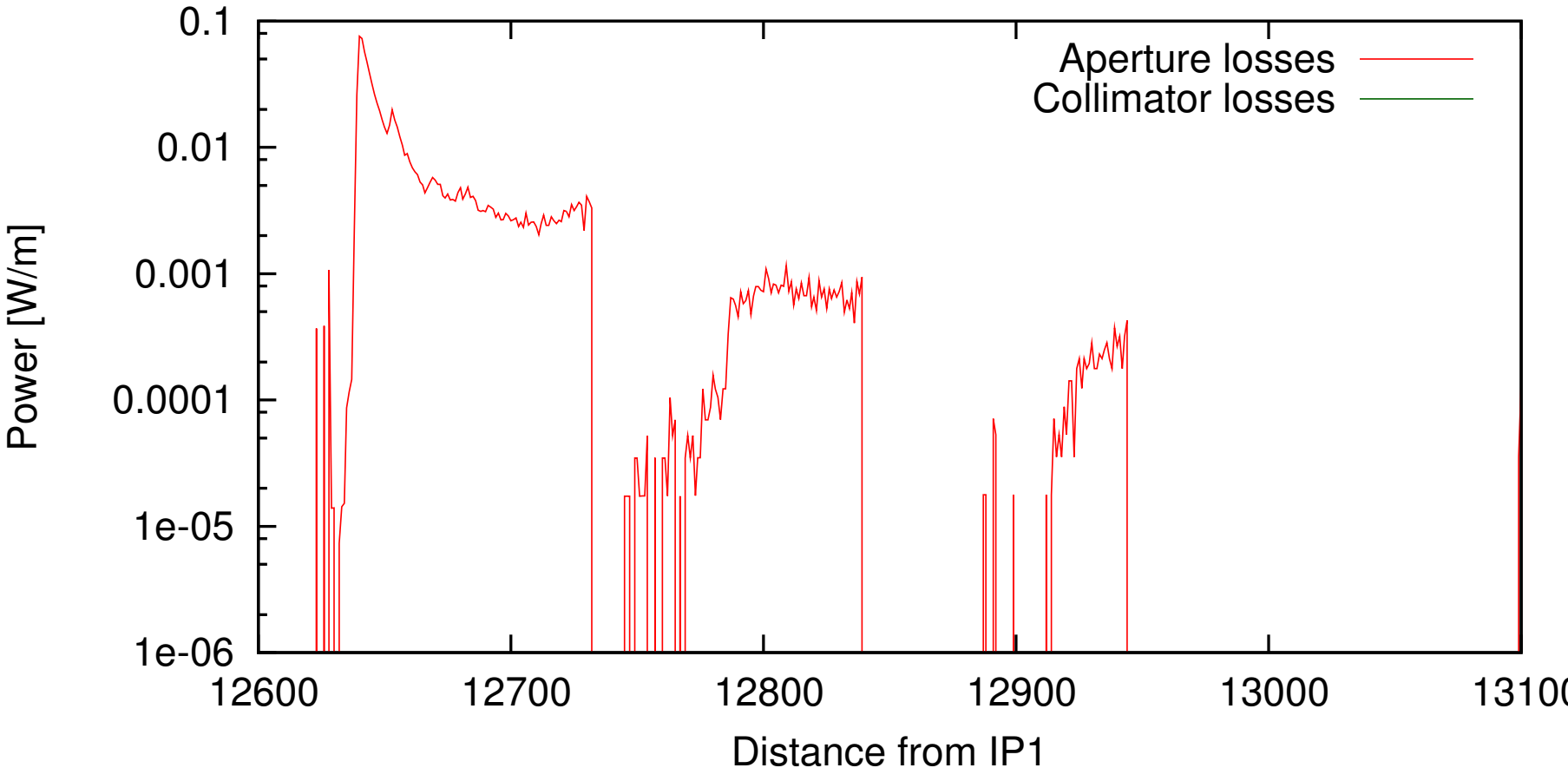
Losses in IR7

Case # 4



Global losses around the ring

Case # 4



Local losses downstream of “obstacle point”

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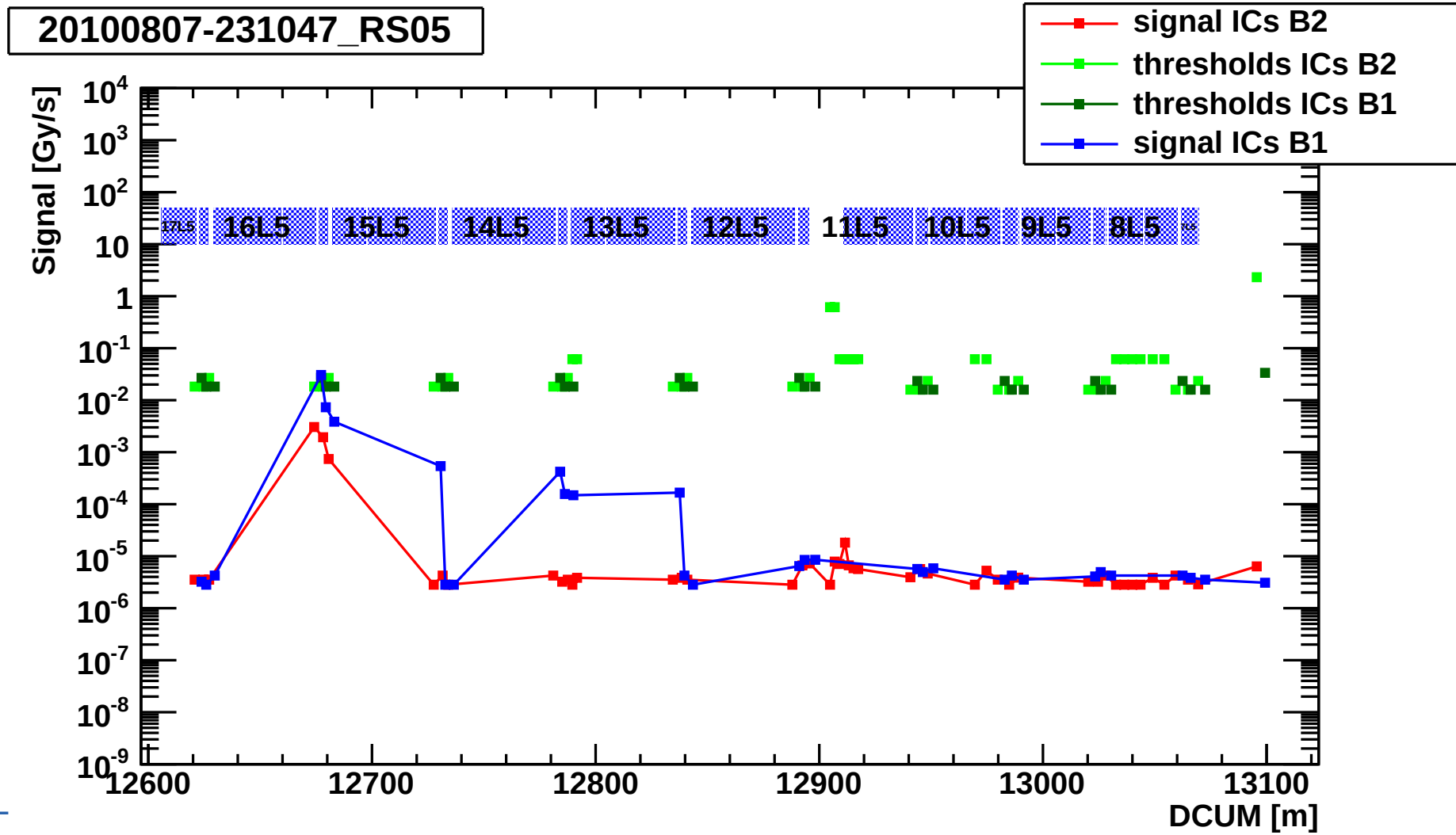

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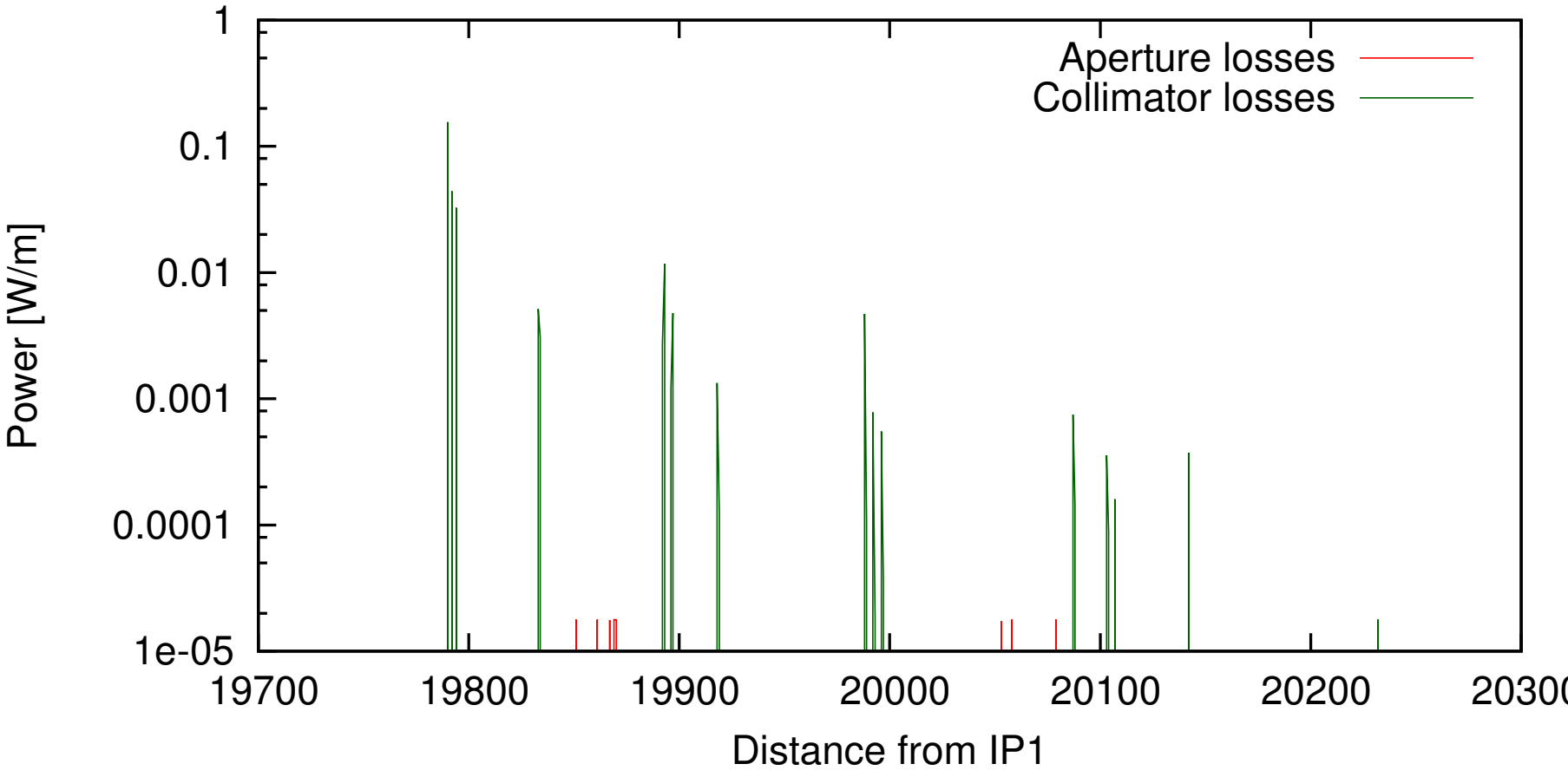

Losses in IR7

Summary

- Case #3 and #4 have been simulated (so far).
- First local peak expected (relatively) higher in the measurement than in simulation, TCT losses expected lower than in simulation.
- Comparing the local losses to measurement, it looks similar, excluding perhaps the last peak in the simulation of case #4.
- Collimators that get most of the radiation in the simulation:
  - TCPs in IR7, where TCP.D6L7.B1 is about one order of magnitude higher than the two others.
  - TCTs in IR5, where in case #4 **only** TCTH see losses.
  - TCSG.4R6.B1 in IR6.
  - Momentum collimation does not see much.

References

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Technical Report ATS-2010-051, CERN, Geneva, Jun 2010.

M Brugger, F Cerutti, A Ferrari, and V Vlachoudis.
Fluka estimations concerning obstacles in the LHC magnets.
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