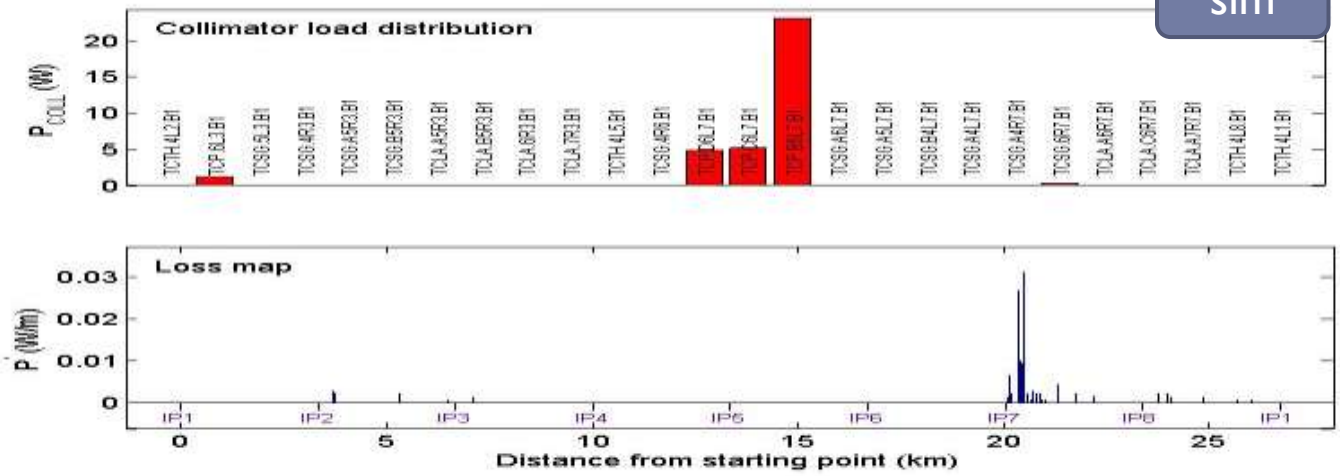
LHC ion loss maps:

First observations and simulation references

G Bellodi / BE-ABP-HSL / CWG 8 Nov 2010

Injection Beam1, betatron collimation

sim



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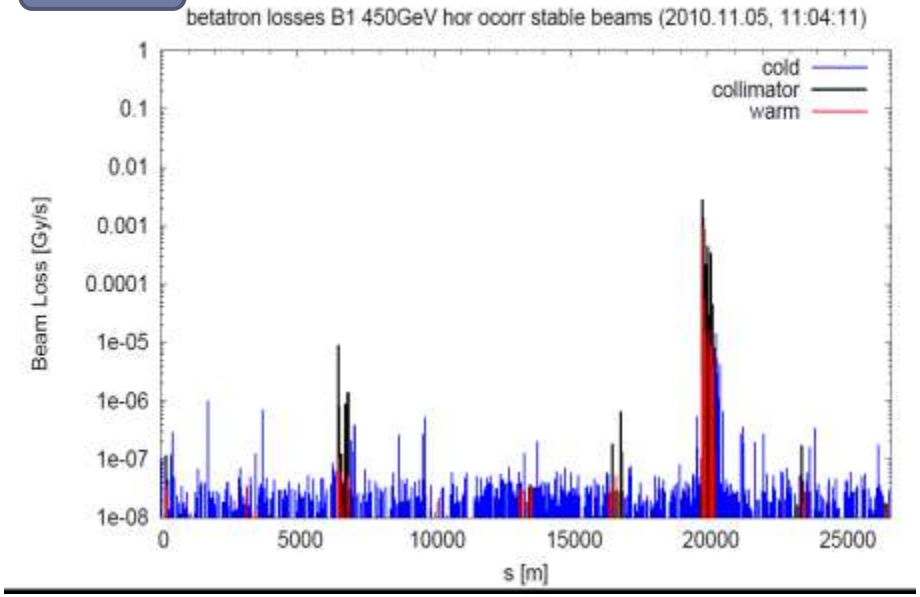

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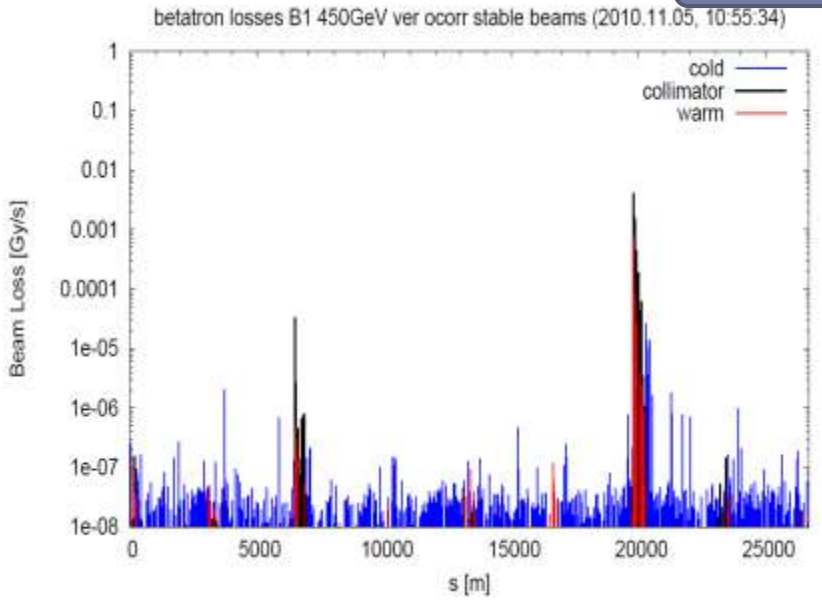
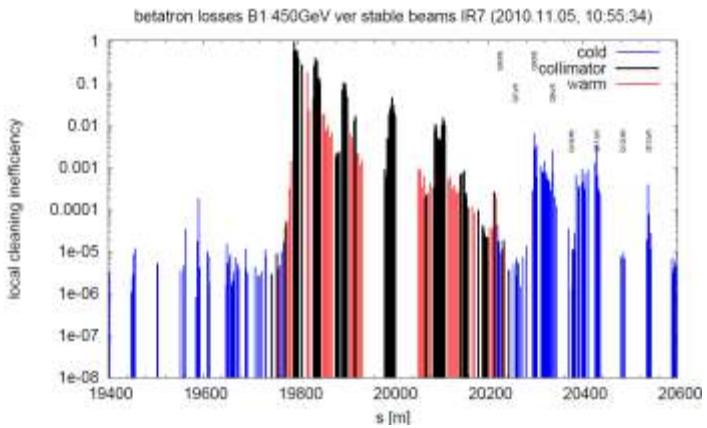
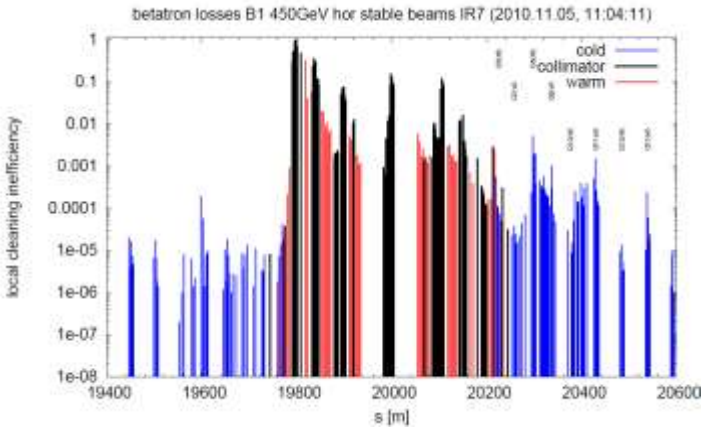
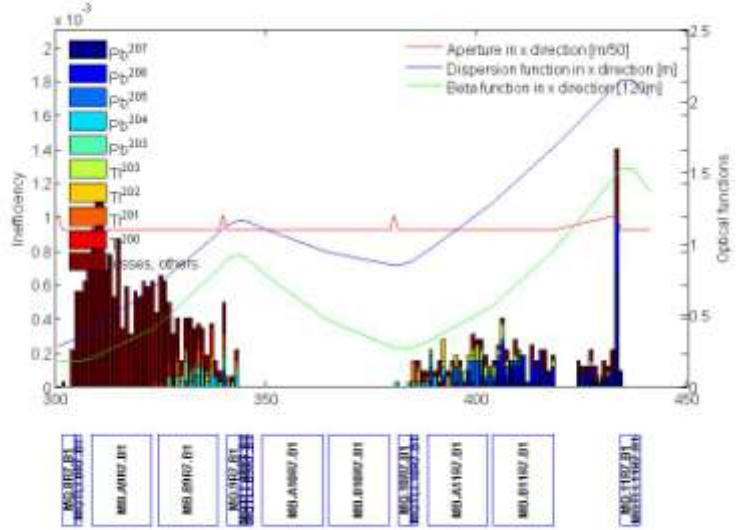
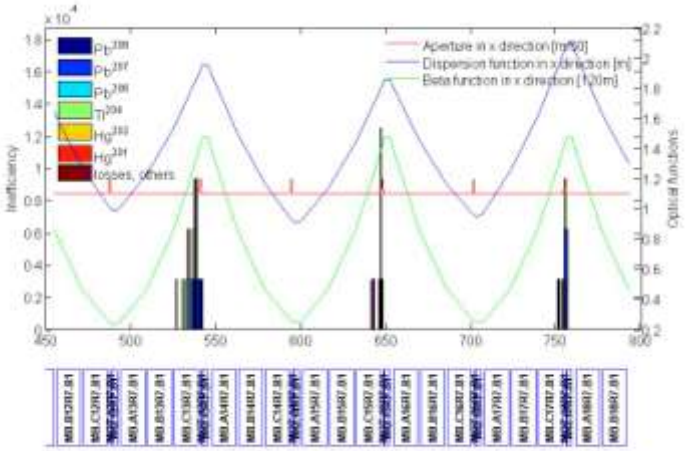


Injection Beam1: losses in IR7

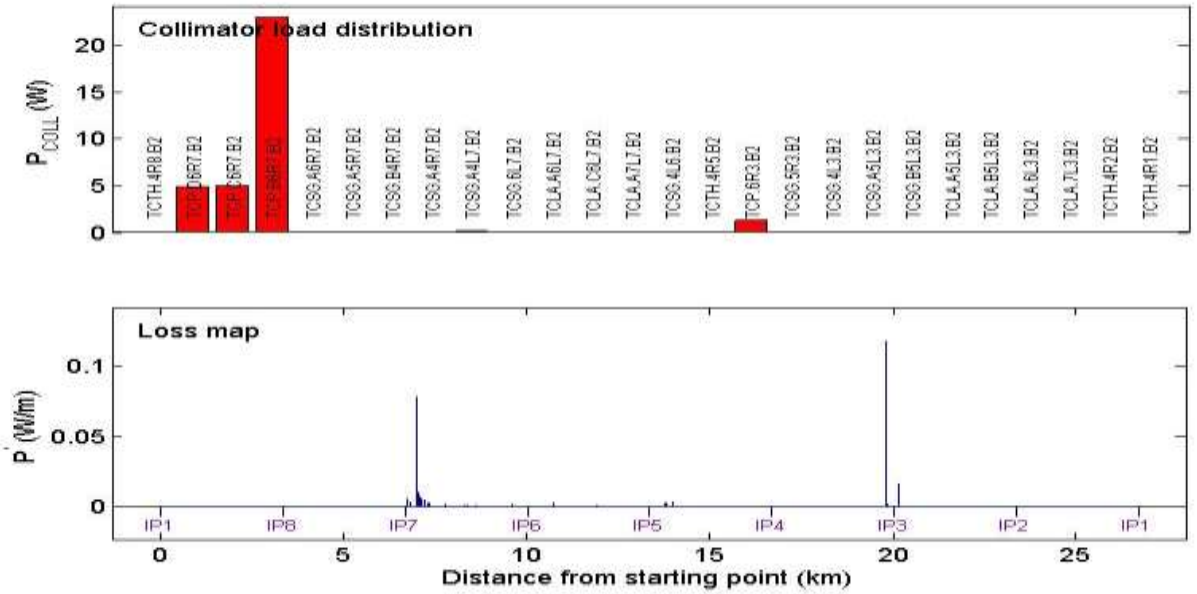


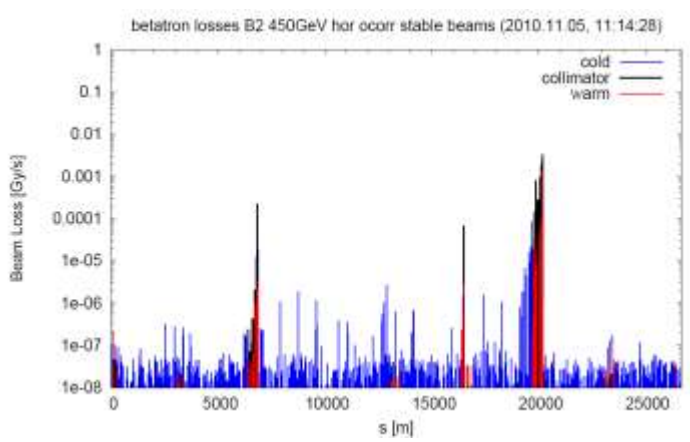


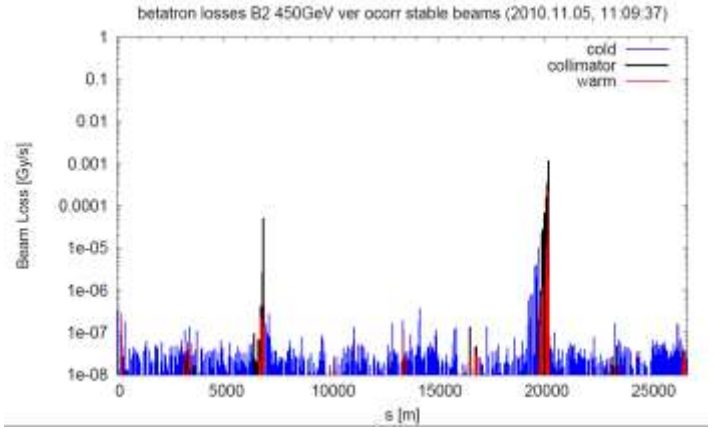




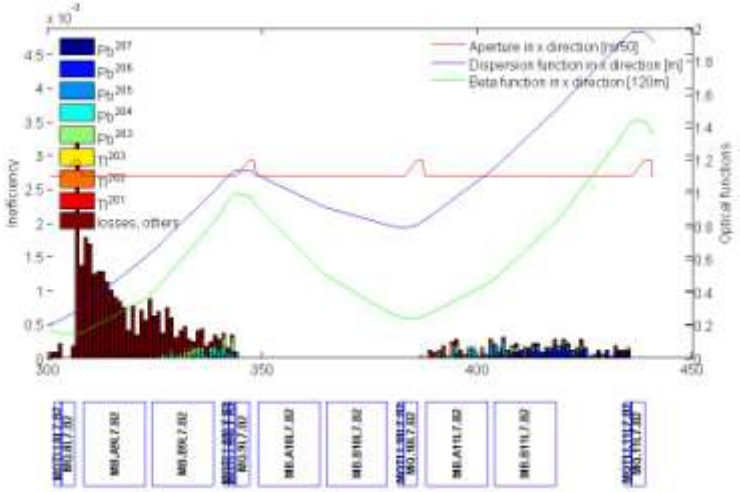
Injection beam2

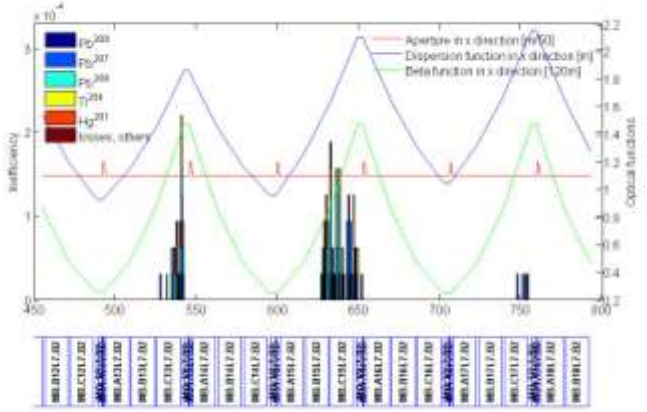


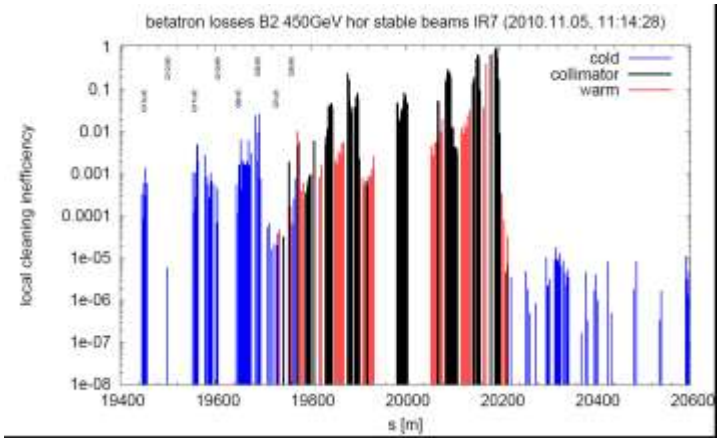


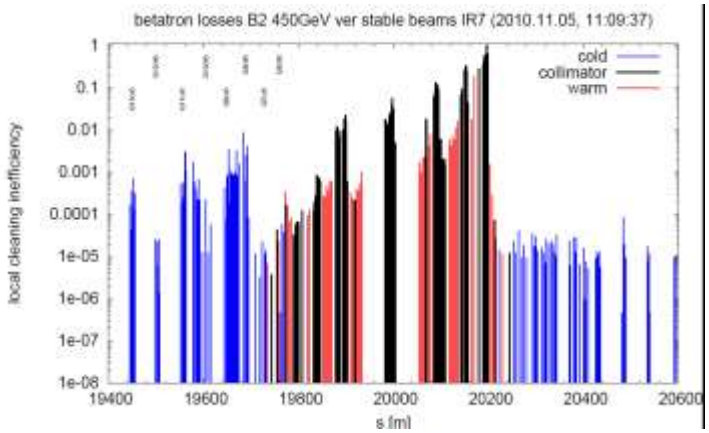


Injection beam2, IR7 DS



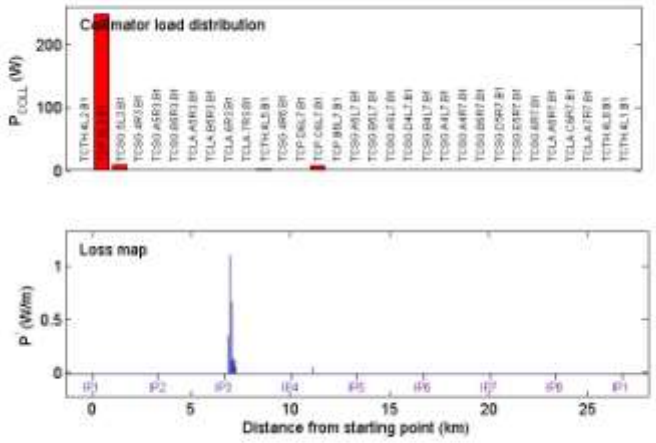




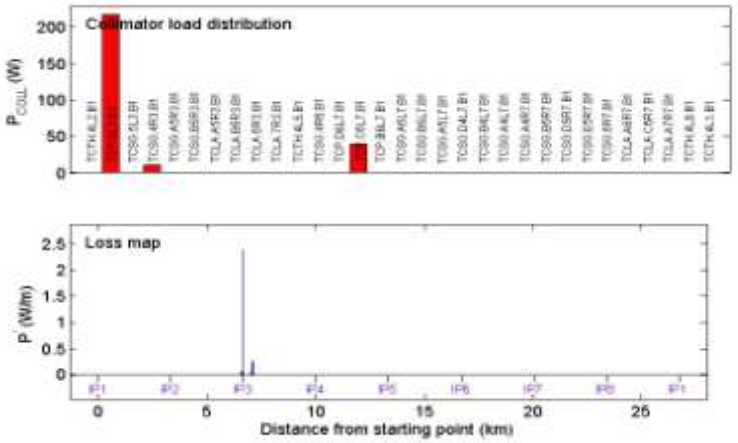


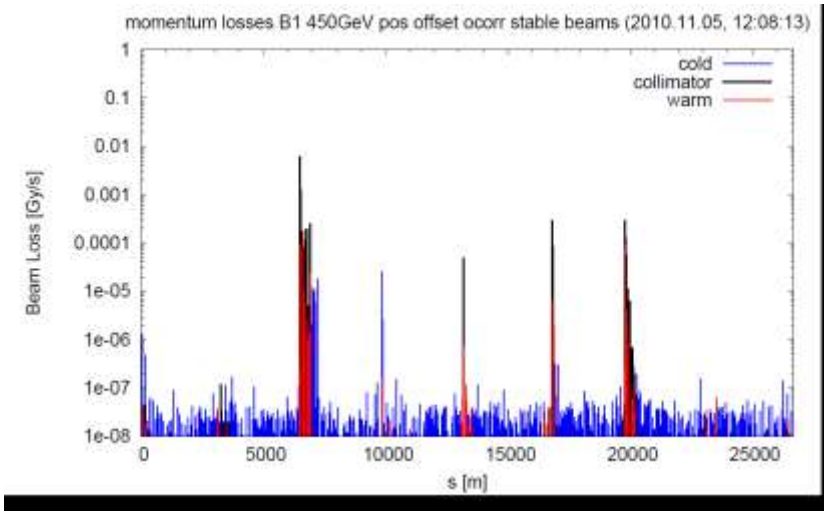
Beam1 momentum collim. @450GeV

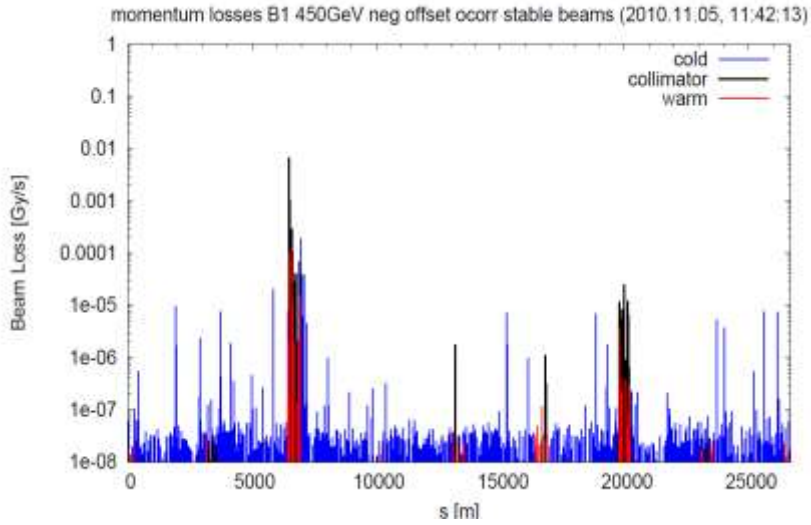
+ve



-ve

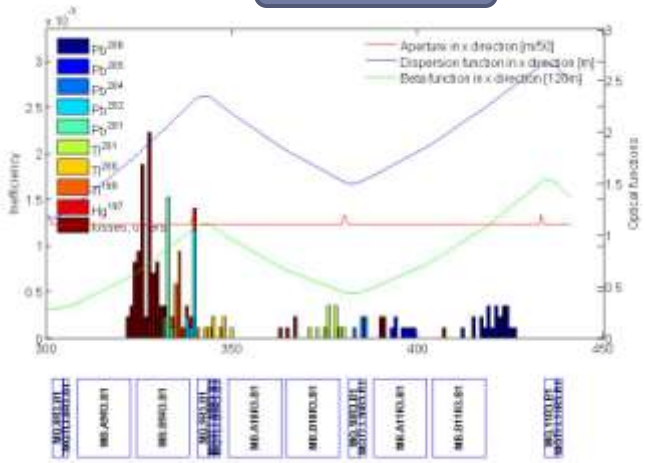


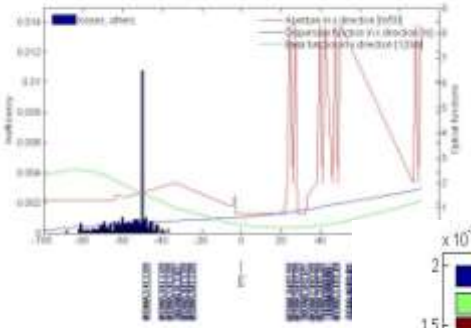




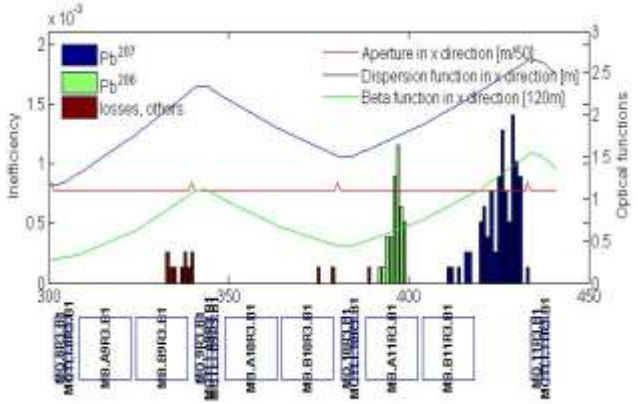
Beam1 450GeV Loss maps IR3

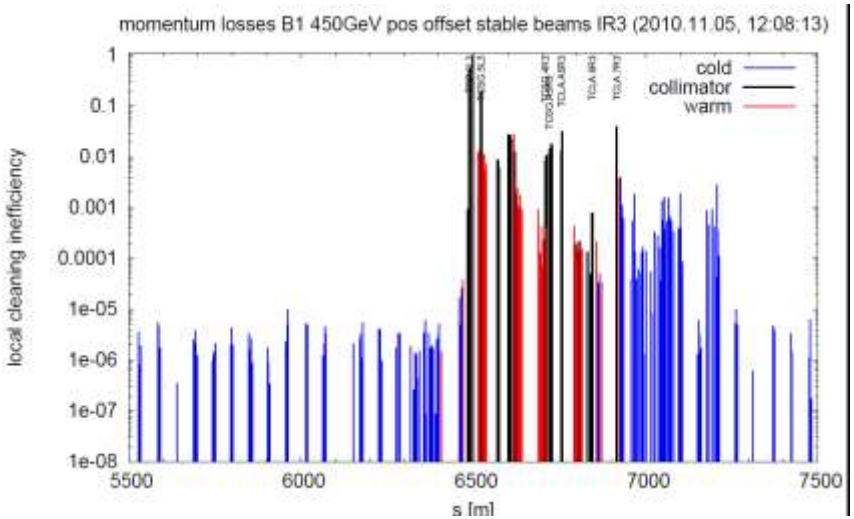
+ve

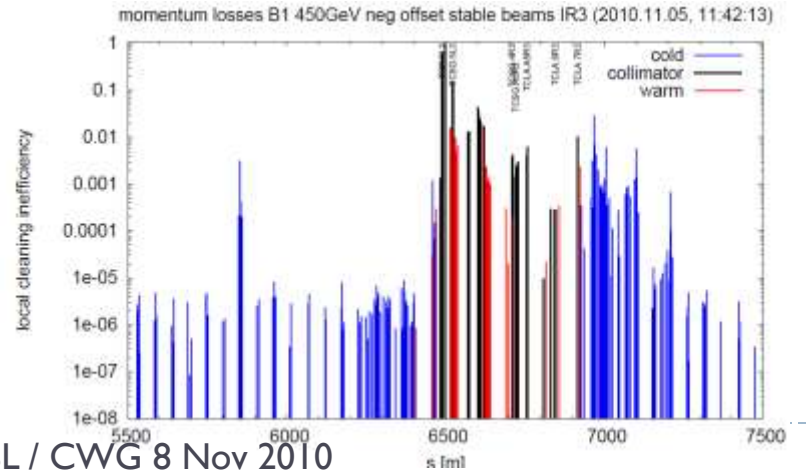




-ve

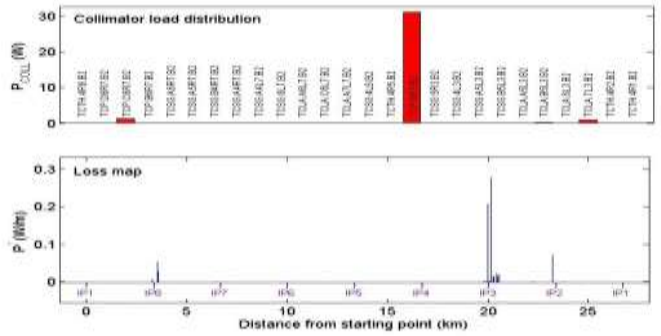


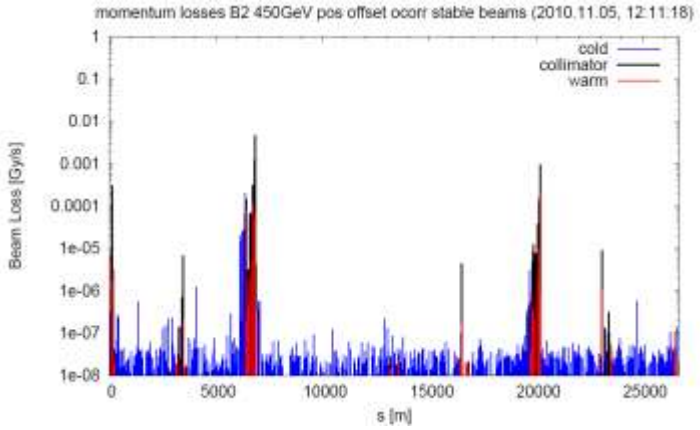




Beam2 momentum collim. @450GeV

+ve





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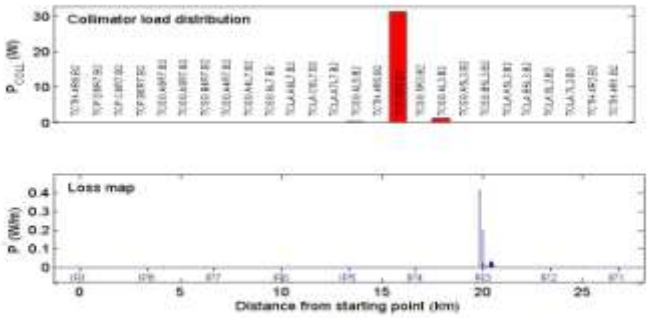
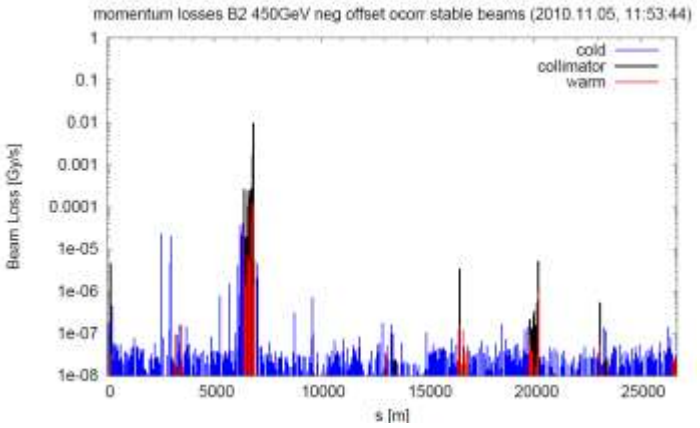
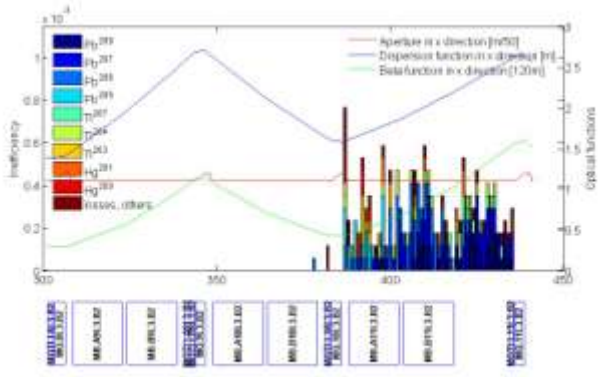


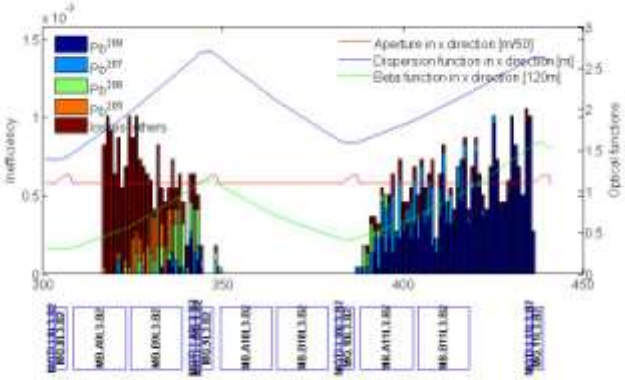


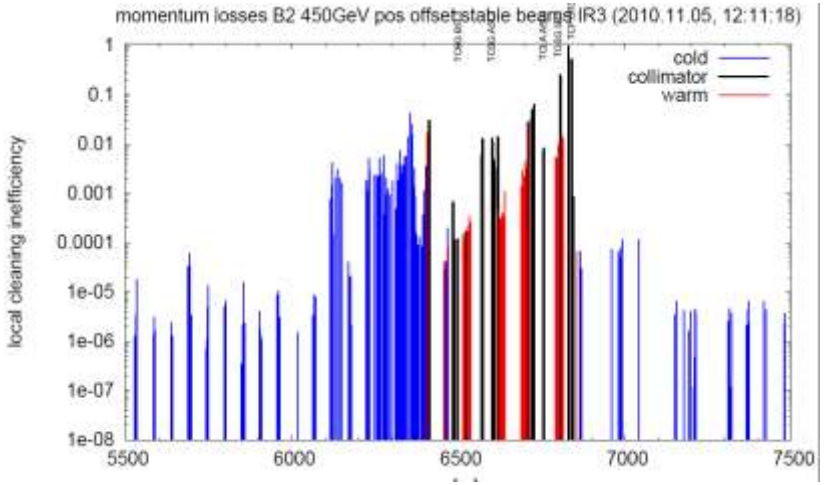
Beam2 450GeV Loss maps IR3

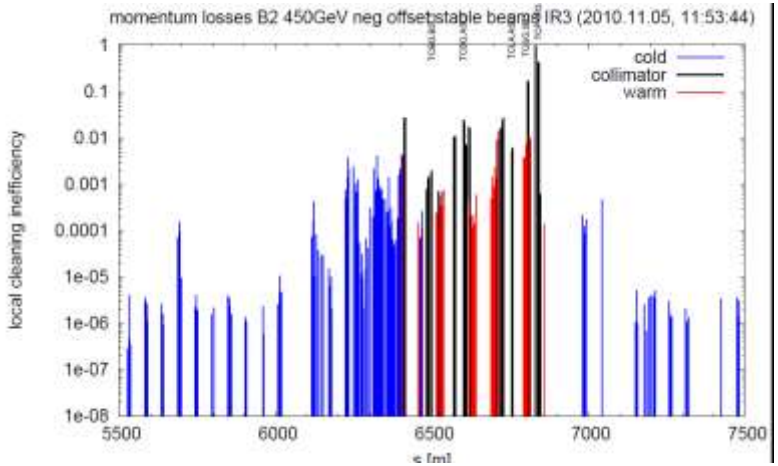
+ve

-ve









First observations/ injection

Betatron cleaning inefficiency:

- Leakage to dispersion suppressor: 0.5% - 2%

- Experimental IR's: clean

- Arcs: 0.1%

- RF: clean

Momentum cleaning inefficiency:

- Leakage to dispersion suppressor: 0.5% - 4%

- Experimental IR's: 10% (TCTH in IR1, b2), 1% (TCTH in IR5, b1)

- Arcs: 0.3%

- RF insertion: 0.5%

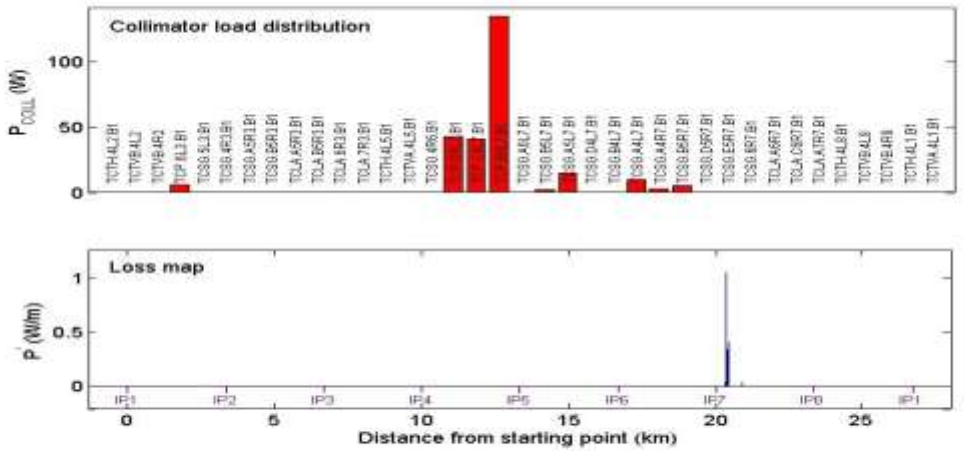
Assessment:

- Loose about factor 50-100 in cleaning efficiency for ions, compared to protons. This is expected (ion fragmentation and dissociation).

- Main losses in predicted locations, namely the dispersion suppressor magnets. Maybe losses occur somewhat earlier in space than expected.

- We see a large 10% leakage into IR1 from IR3 losses for beam 2. It is not clear what ion species escapes IR3 and travels to IR1. To be analyzed in detail.

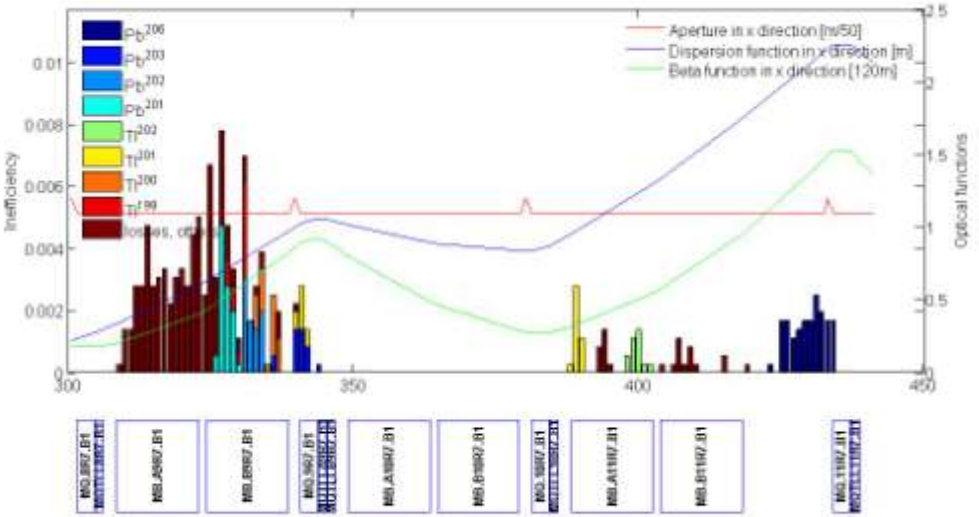
Betatron cleaning, Beam1, 3.5TeV

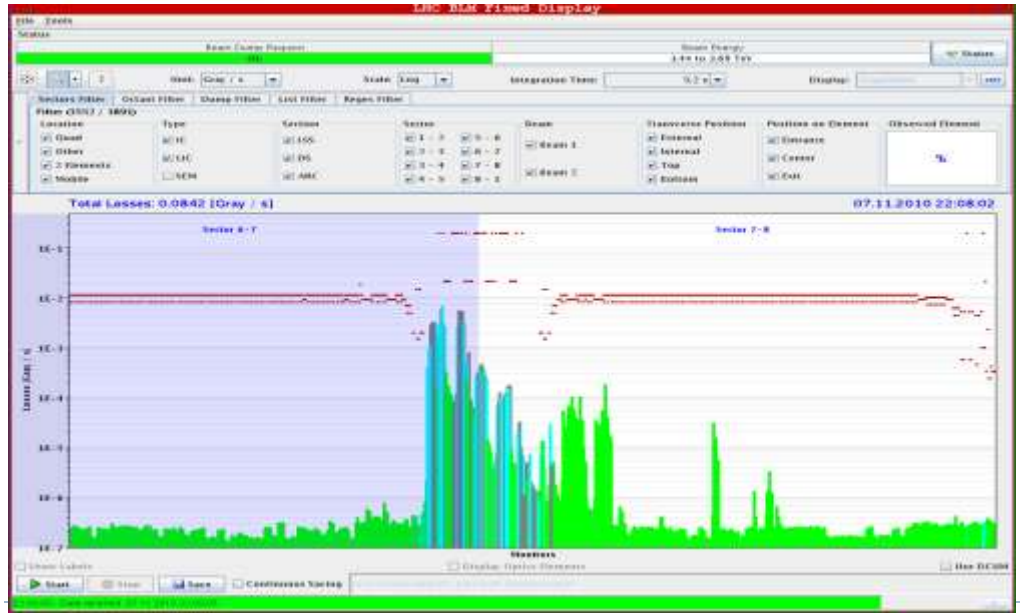


V

H

Betatron cleaning, Beam1, 3.5TeV

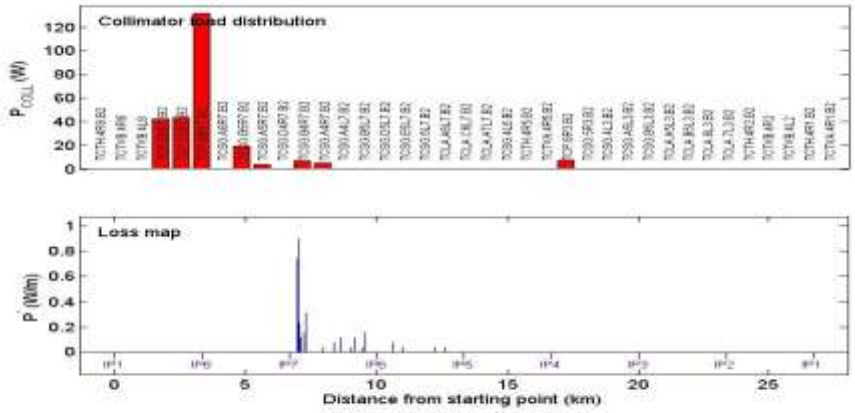




Leakage to IR3: 15%

- see also Q10 in R2: 2e-4 leakage to this quad

Betatron cleaning, Beam2, 3.5TeV



very small losses at TCT: only TCTH in IR5 at 1e-5 level

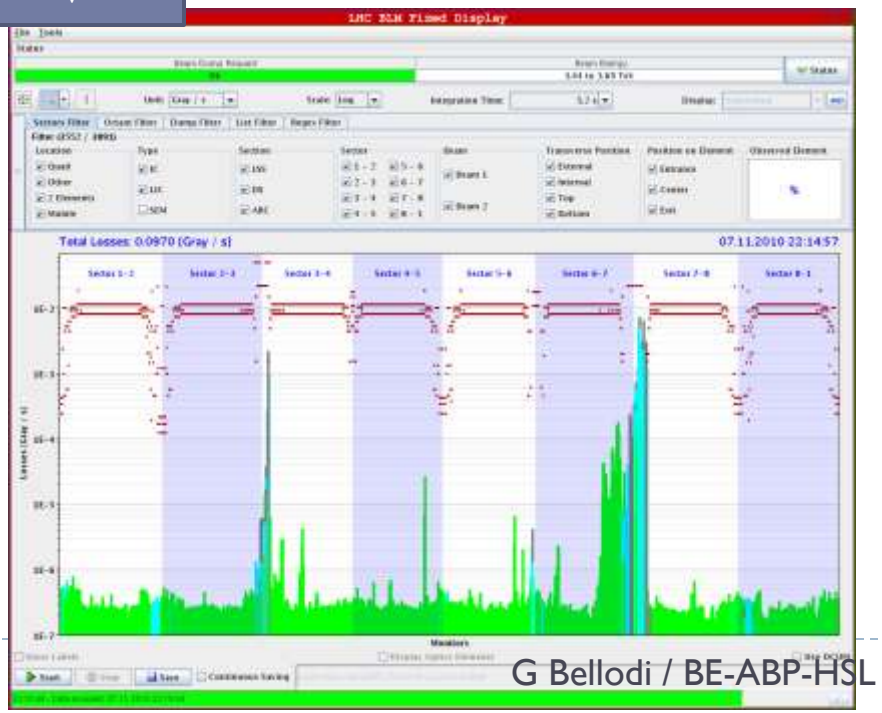
- Leakage into DS: up to 3%

- Leakage to IR3: 30%

- Leakage into arc: 0.4% (Q11.L5)

- indication for breakdown of hierarchy

V



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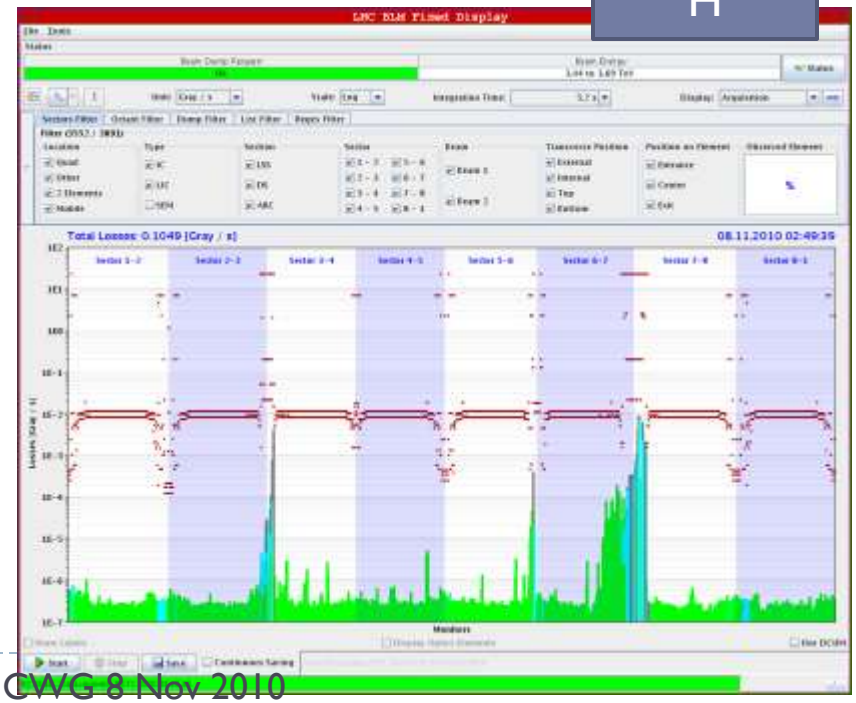
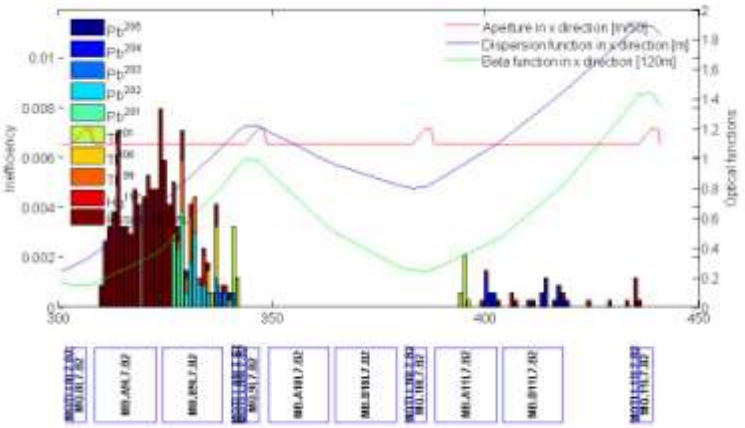
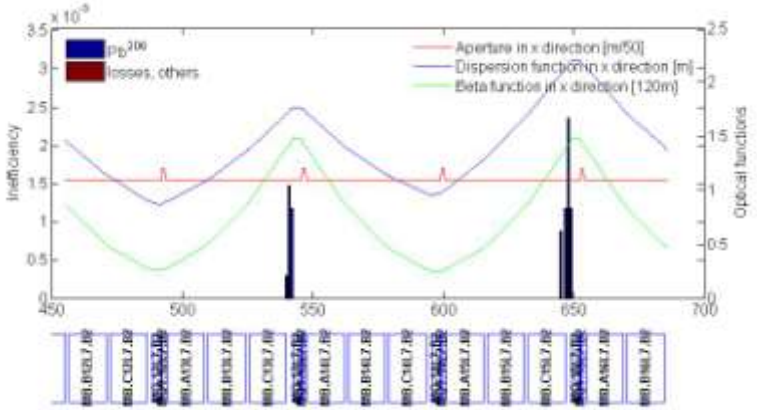
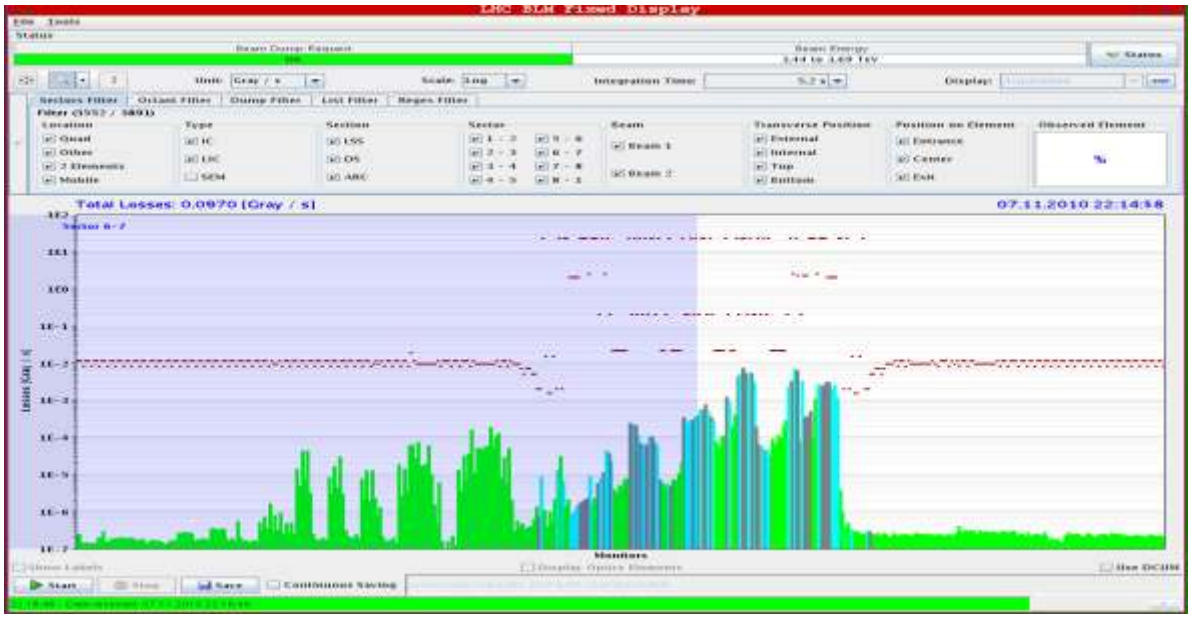


Betatron cleaning, Beam2, 3.5TeV

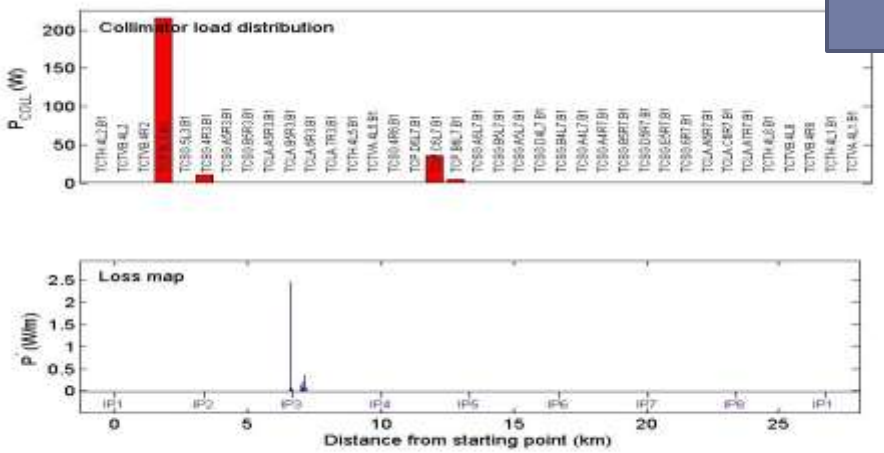






B1+B2 negative momentum

B1



observations off-momentum ion loss map 1000 Hz:

leakage to the dispersion suppressor IR3 3%

leakage to IR7 0.1%

TCTH.4R1 0.5% leakage

TCTH.4L5 0.3% leakage

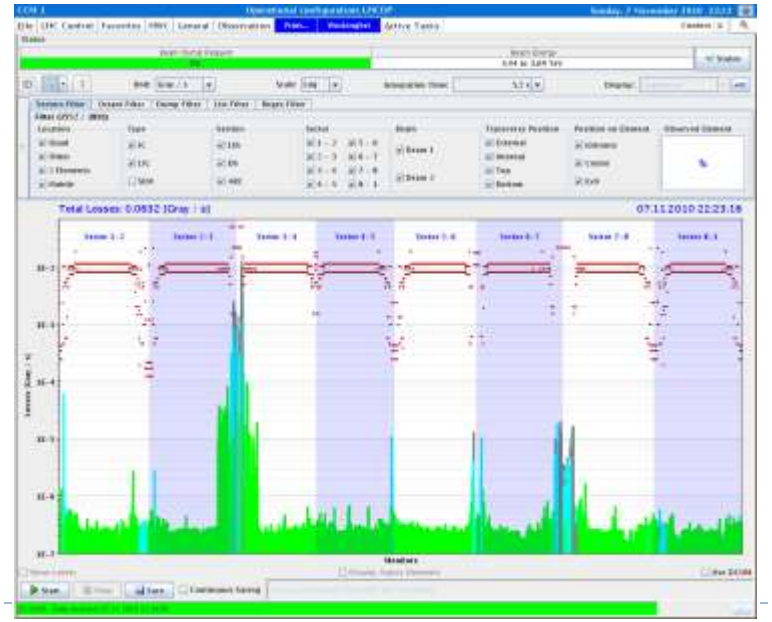
TCTh.4R2 0.02% leakage

TCSG in IR6 0.3% leakage

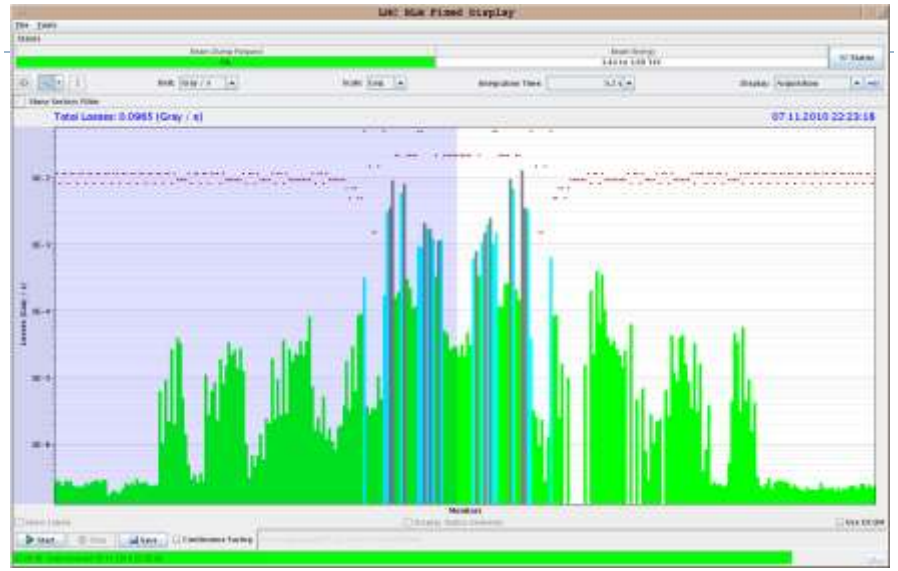
Q10.L2 0.02% leakage

Q20.L5 0.01% leakage

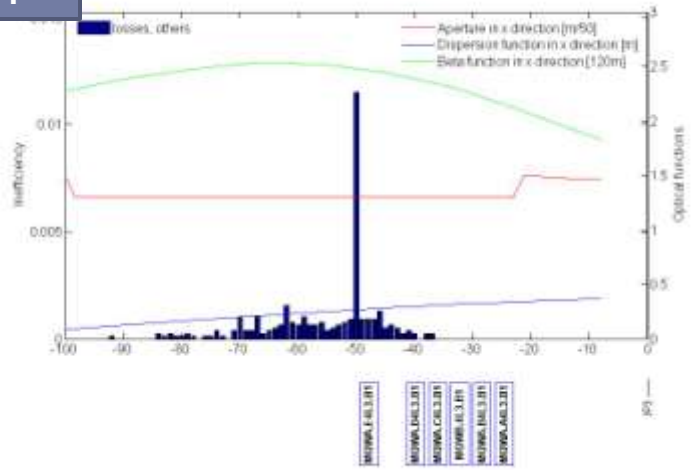
dispersion suppressor of IR7: 0.01 % leakage



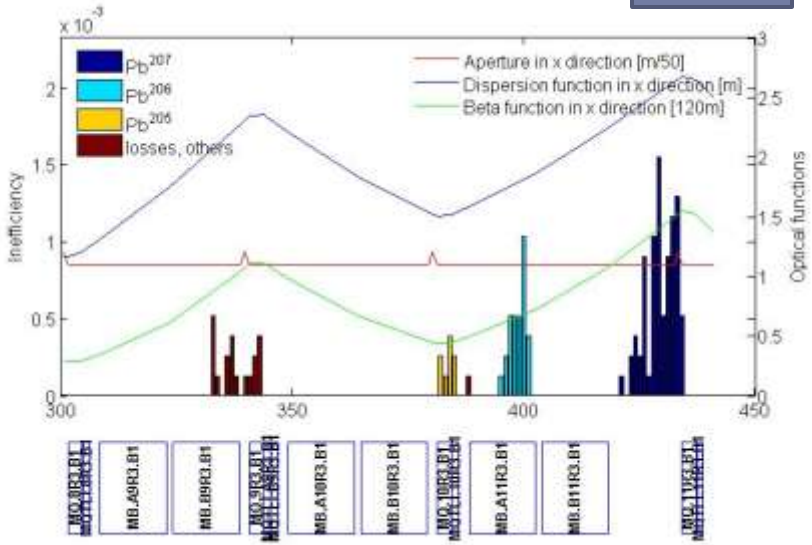
B1+B2 negative momentum



B1



B1



B1+B2 positive momentum