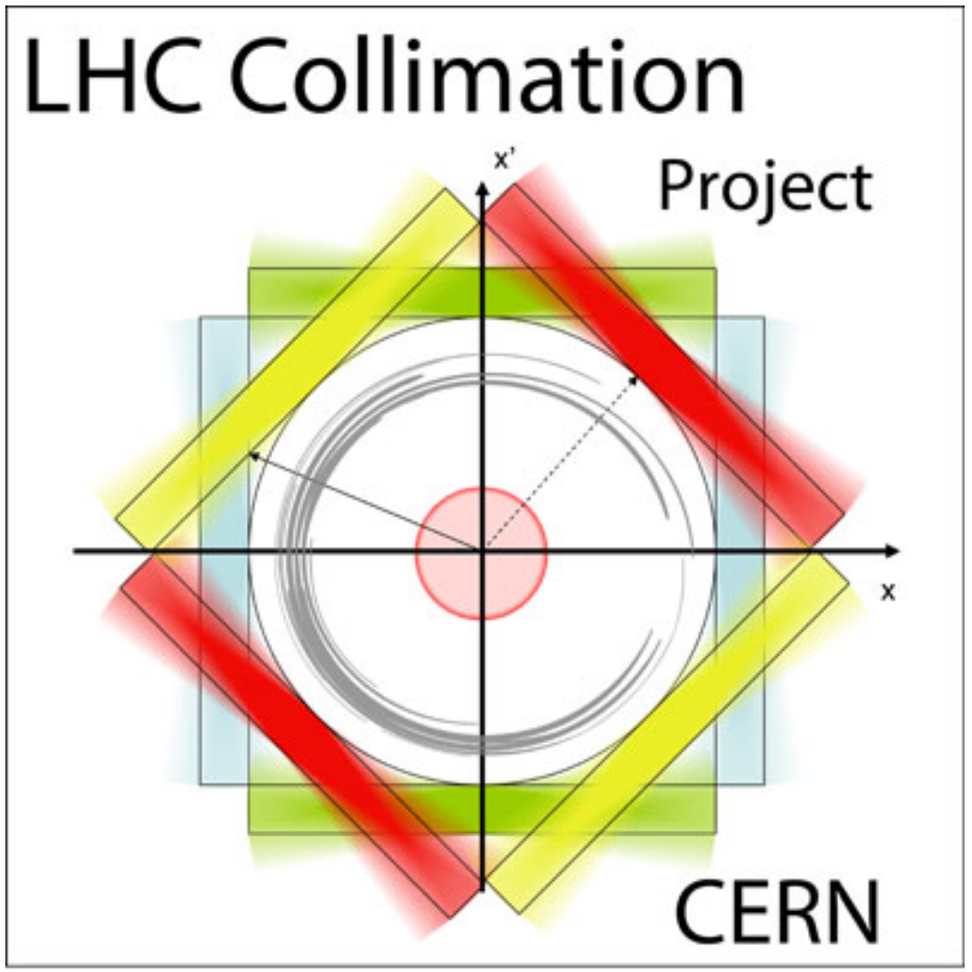
Studies of BLM thresholds for 200kW



B. Salvachua & D. Wollmann

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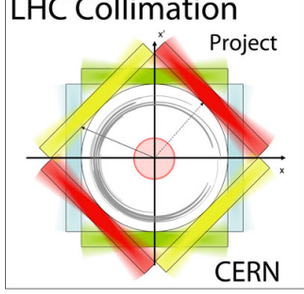
16th May 2012

Introduction



Recently we had some fills dumped by beam loss with losses occurring at primary collimators with ~ 50-60kW

➡Compare losses in these fills with losses during collimation loss maps

➡Calculate new BLM thresholds for higher power loss

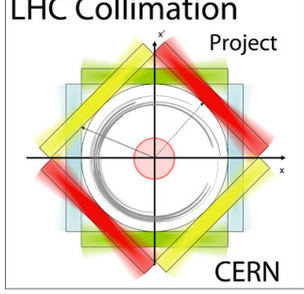
Why can we go up?

➡The collimation system is designed for 500kW losses in IR7 for up to 10 s (100kW continuously)

➡In MD we tested the collimation system for 500kW for 1-2 s without quench

Target value for losses without dump: 200kW, as tentatively agreed at rMPP

Two Physics Fills Analyzed

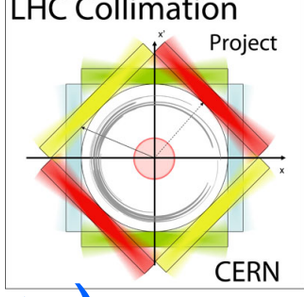


Beam Dump during SQUEEZE		
Date	**Fill**	**Reason**
2012-05-06 12:36:02	2589	Losses in Q4.L6
2012-05-07 04:34:12	2592	Losses in Q4.L6

During these fills the power loss before dump was ~ 50-60kW.
Beam lost at primary collimators and then cleaned away

Leakage to IR6 TCGS resulted in high BLM signal at Q4 which then triggered beam dump.

We verified that these squeeze losses are very close to collimation loss maps. So we can use collimation loss maps to define thresholds.



One Important Difference

(losses in squeeze/physics versus losses in collimation tests)

Expected leakage to IR6 from loss maps is ~ 0.7%

Fill 2589 - SQUEEZE (2012-05-06 12:36:02)

Zoom IR6 and IR7

Cleaning in IR6 = 0.01/0.5 => 2%

IR6 Leakage 3 times higher here

Note: TCSG in IR6 is almost a secondary collimator and sits in exponential drop of halo → *e.g. tiny orbit changes change leakage by up to factor 10!* **We need some margin!**

BLM signal [Gy/s]

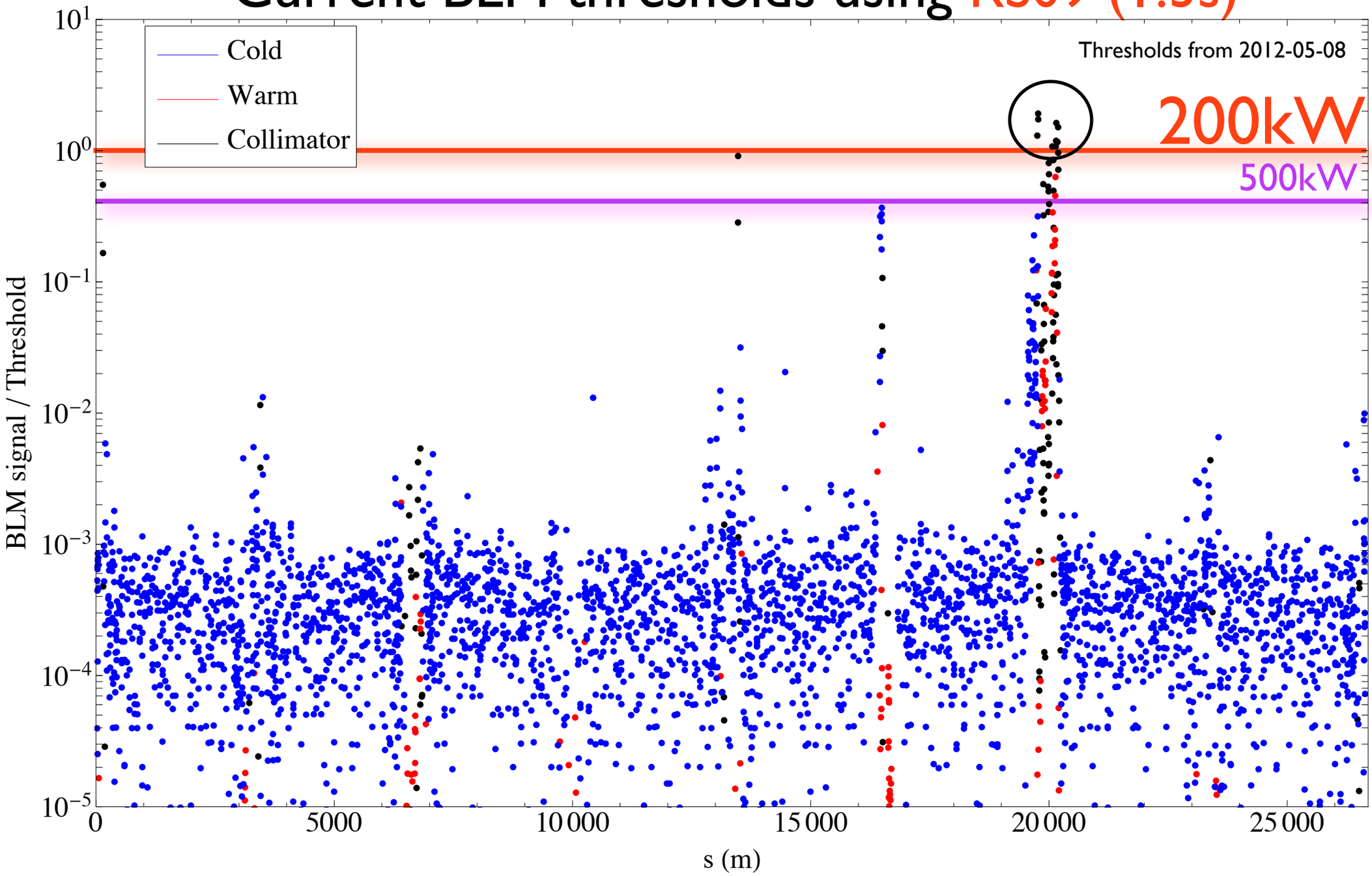
s [m]

Ratio Loss to Threshold

(Loss map B2 HOR)

LHC Collimation Project CERN

Comparison of expected losses for 200kW with Current BLM thresholds using RS09 (1.3s)



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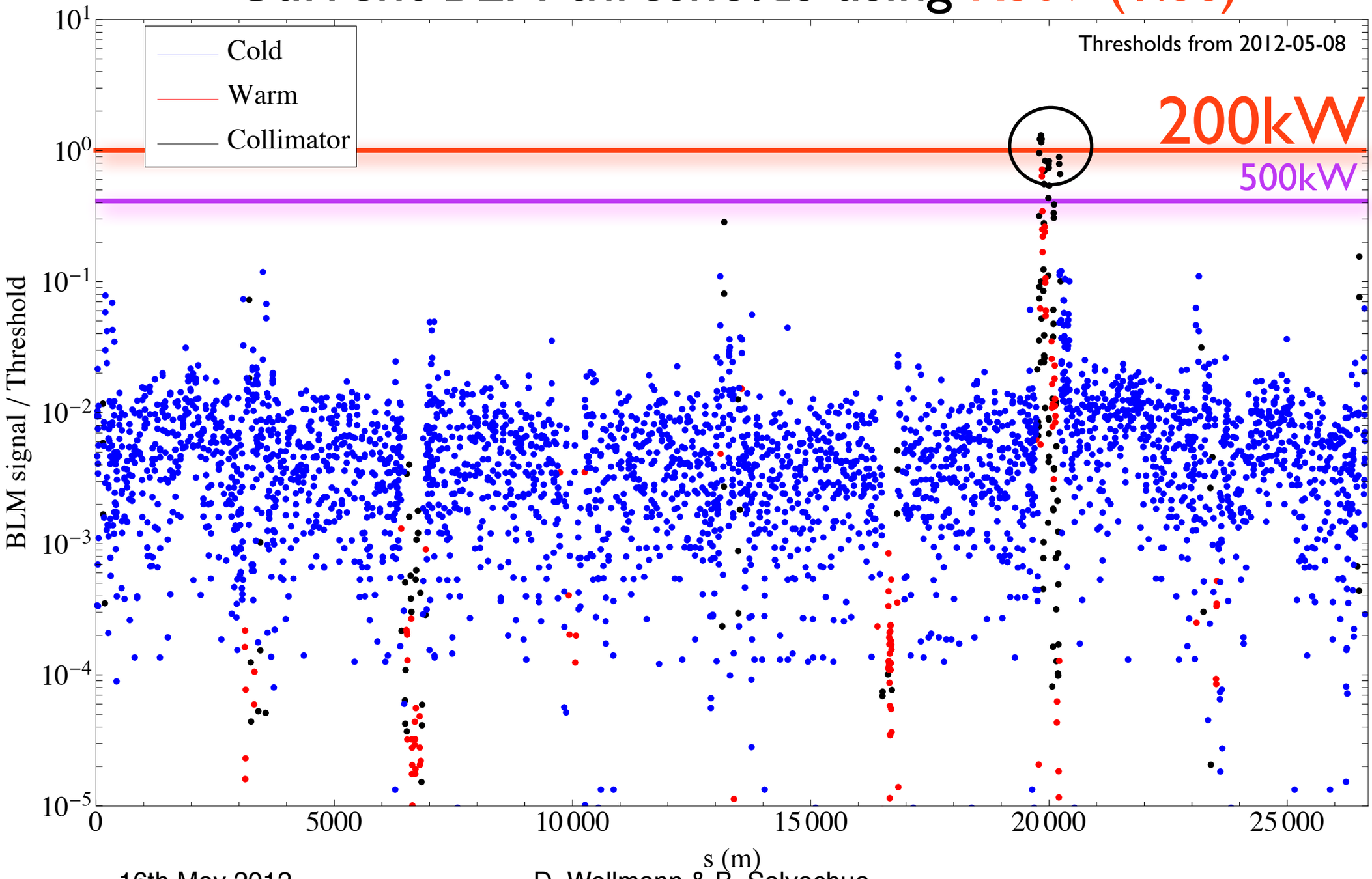
Ratio Loss to Threshold

(Loss map B1 VER)

Comparison of expected losses for 200kW with Current BLM thresholds using RS09 (1.3s)



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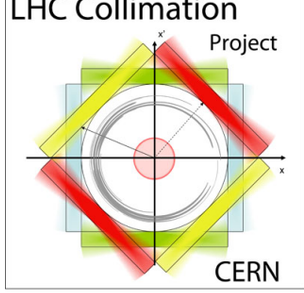
Increase Factors for BLM Thresholds

(200 kW, max B1/2 and H/V)



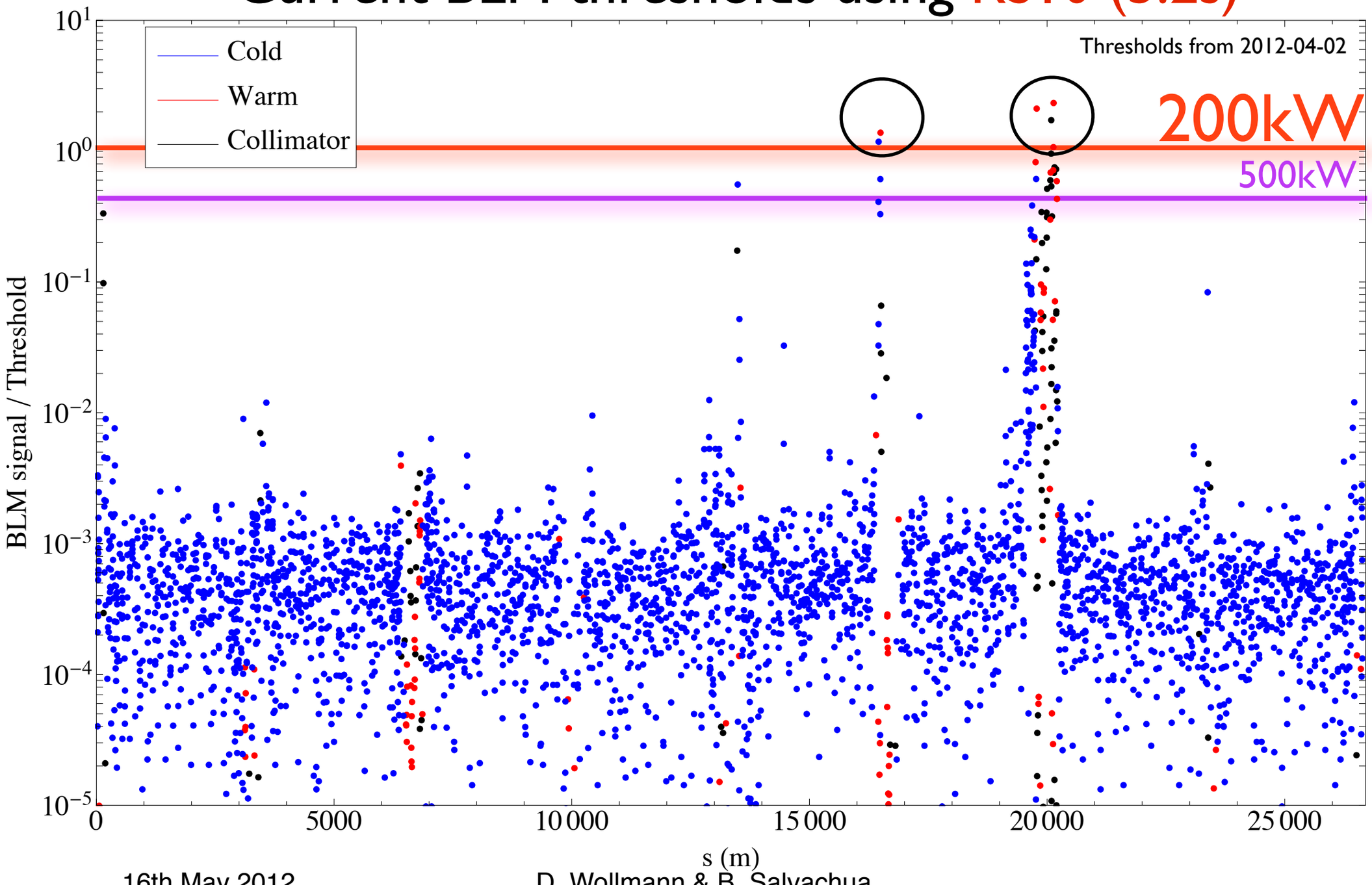
From B1 and B2 loss maps: RS09

Thresholds from 2012-05-08

BLM name	s [m]	Ratio 200kW/Current	Current [Gy/s]
BLMEI.06L7.B2I10_TCLA.D6L7.B2	19773.09	1.92	0.003501531
BLMEI.06L7.B2I10_TCLA.C6L7.B2	19775.09	1.73	0.003501531
BLMEI.06R7.B2I10_TCSG.A6R7.B2	20154.65	1.68	0.8751161
BLMEI.06R7.B2I10_TCP.A6R7.B2	20192.14	1.51	1.750238
BLMEI.06L7.B1E10_TCP.A6L7.B1	19796.18	1.41	1.750238
BLMEI.06R7.B1E10_TCLA.C6R7.B1	20213.23	1.41	0.003501531
BLMEI.06R7.B1E10_TCLA.D6R7.B1	20215.23	1.37	0.003501531
BLMEI.06L7.B1E10_TCSG.A6L7.B1	19833.68	1.30	0.8751161
BLMEI.07L7.B2I10_TCLA.A7L7.B2	19755.46	1.30	0.001750764
BLMEI.06L7.B2I10_TCSG.6L7.B2	19846.3	1.22	0.8751161
BLMEI.06L7.B2I10_TCLA.B6L7.B2	19808.36	1.22	2.187791
BLMEI.06R7.B1E10_TCLA.B6R7.B1	20179.96	1.22	2.187791
BLMEI.07R7.B1E10_TCLA.A7R7.B1	20232.86	1.19	0.001750764
BLMEI.06R7.B1E10_TCLA.A6R7.B1	20149.09	1.19	2.187791
BLMEI.06L7.B2I10_TCLA.A6L7.B2	19839.24	1.16	2.187791
BLMEI.06R7.B1E10_TCSG.6R7.B1	20142.02	1.08	0.8751161
BLMEI.04R7.B2I10_TCSG.D4R7.B2	20070.09	1.08	0.1750286

For long running sums

Comparison of expected losses for 200kW with Current BLM thresholds using RS10 (5.2s)



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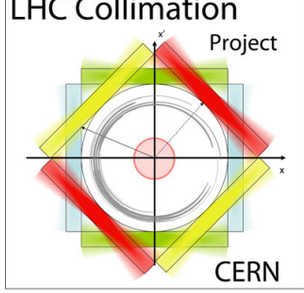
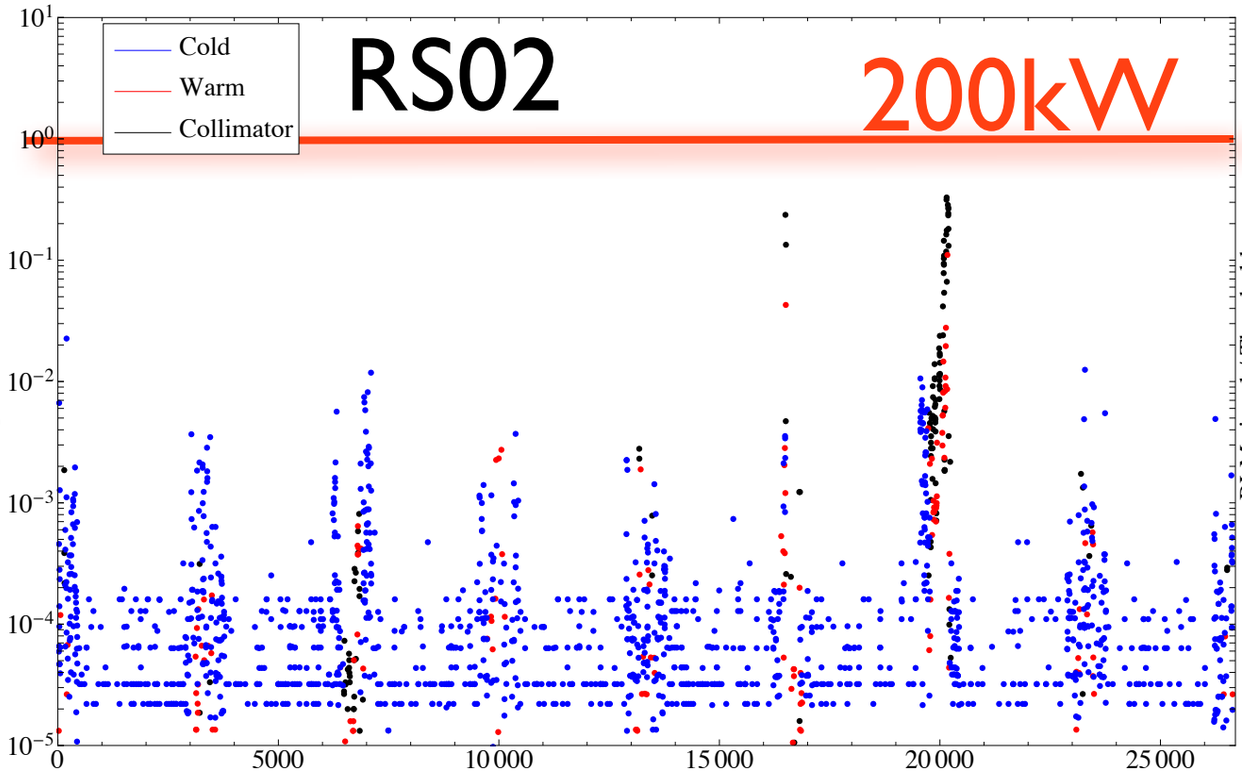
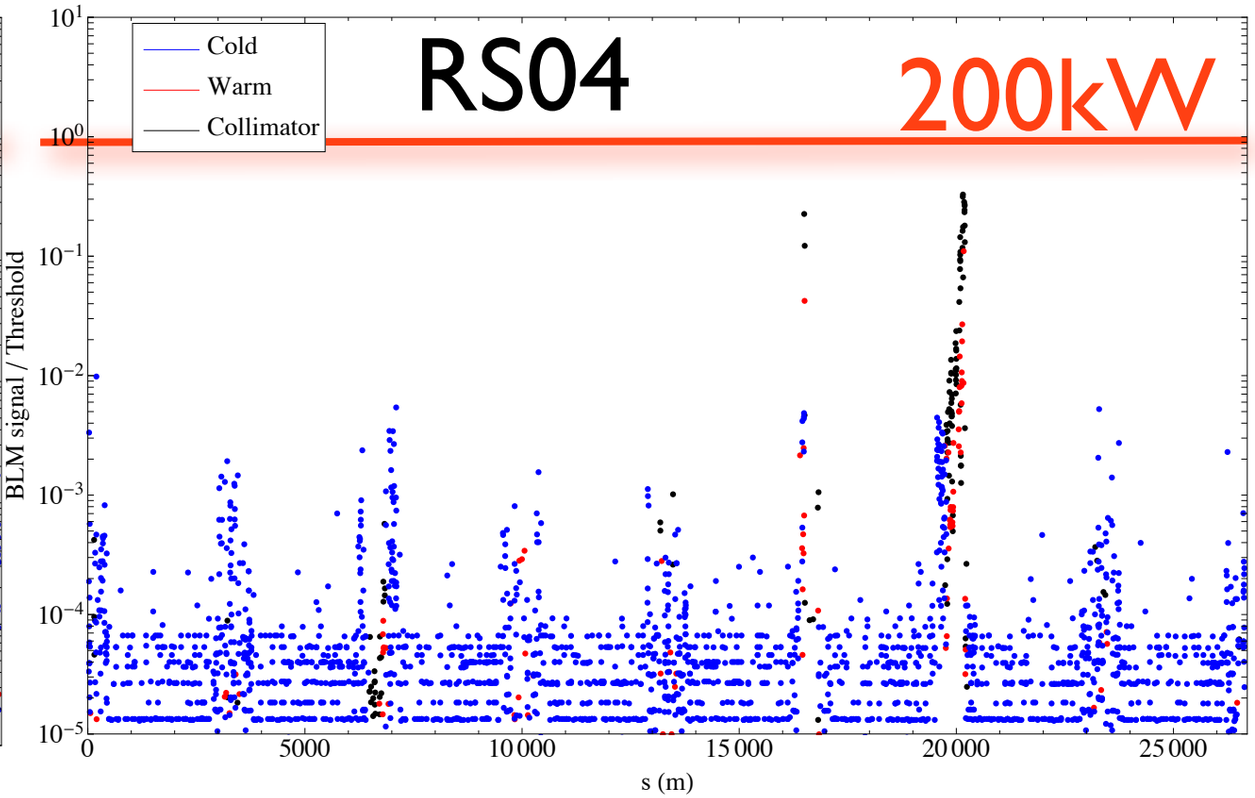
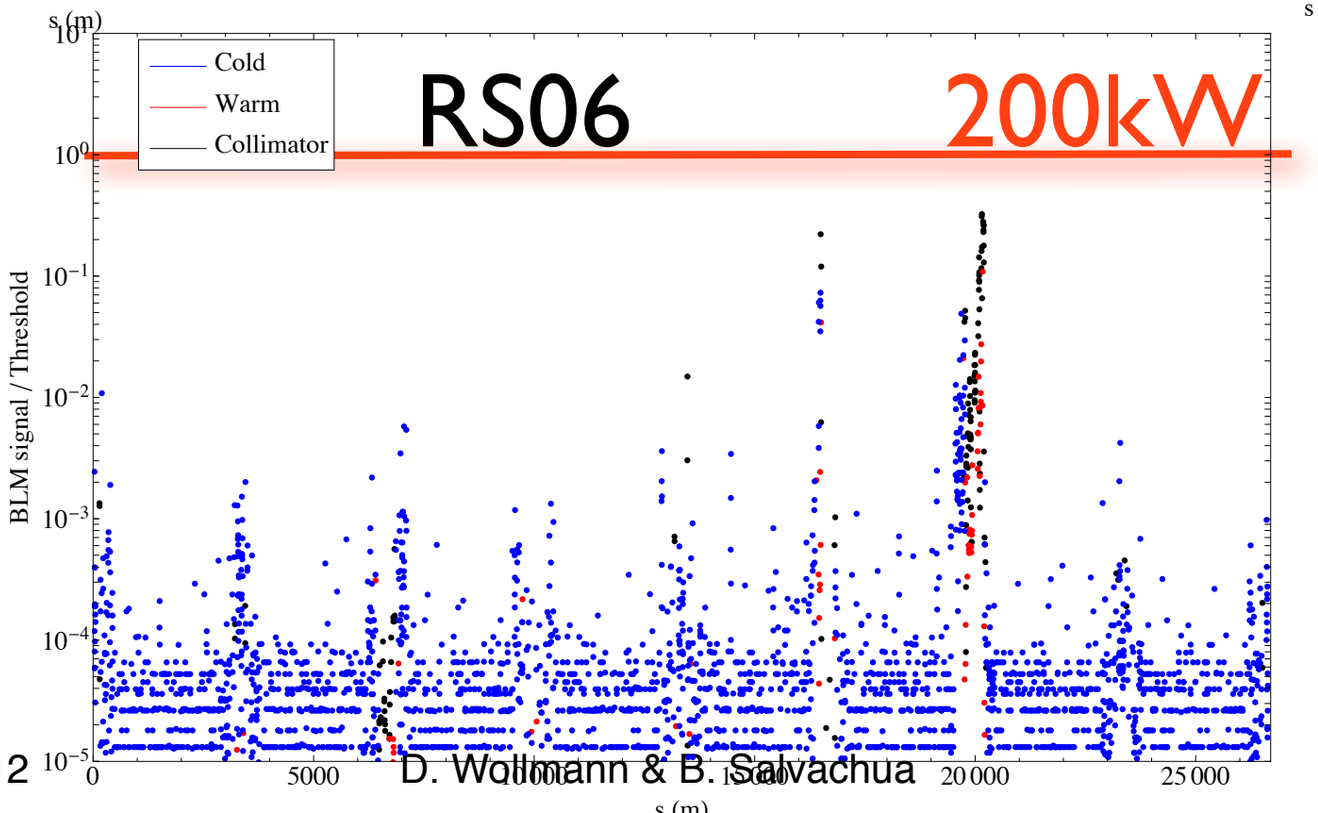
For short running sums









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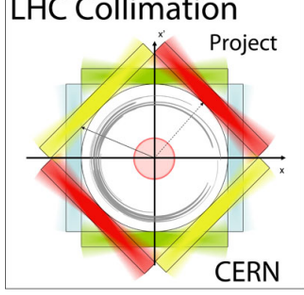
Summary



- Compare losses in Fills 2589 and 2592 with collimation loss maps

➡ **General good agreement** → use collimation loss maps for thresholds

➡ Losses in **IR6** seen 3 times higher than in loss maps → expected and seen before. **Need margin there to cope with up to factor 10.**

- Calculation of new thresholds for 200kW loss at primary collimators was done:

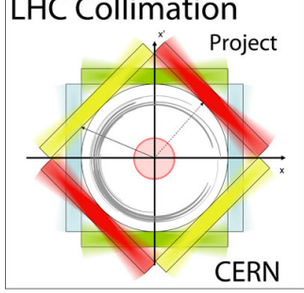
➡ Shorter RS (< 1.3s) do not go above the current thresholds for 200kW.

➡ Only RS09 and above (>= 1.3s) are affected and should be changed

➡ **For 200 kW: 17 collimators in IP7 need an increase of the BLM thresholds (RS09) by up to factor 2**

➡ Discussions this morning: Maybe set up for 500kW and control be monitor factor.

Qualification Loss Map



betatron losses B2 4000GeV hor norm IR6-7 (2012.04.02, 18:14:50)

IR6

IR7

Full map

betatron losses B2 4000GeV hor norm F (2012.04.02, 18:14:50)

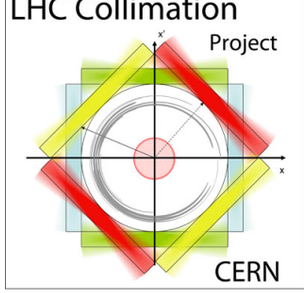
cold
collimator
warm

local cleaning inefficiency

s [m]

Leakage in IR6 ~ 0.7%

Losses before Dump



Notice! this is in Gy/s (not normalized)

Fill 2592 - SQUEEZE (2012-05-07 04:34:12)

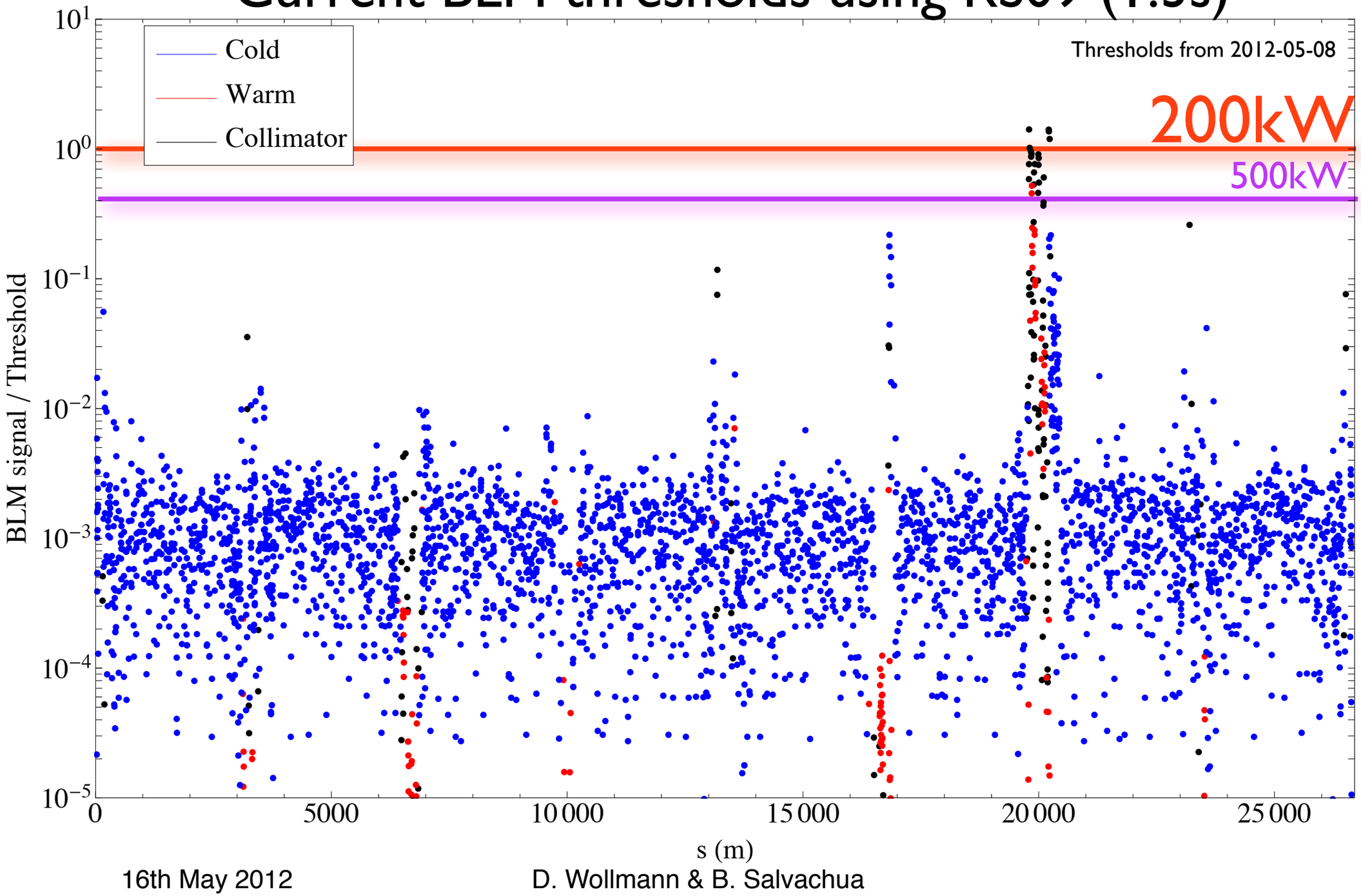
Zoom IR6 and IR7

Cleaning in IR6 = 0.015/0.9 = 0.016

IR6 only 2.2 times higher wrt Qualification lossmaps

BI HOR

Comparison of expected losses for 200kW with Current BLM thresholds using RS09 (1.3s)



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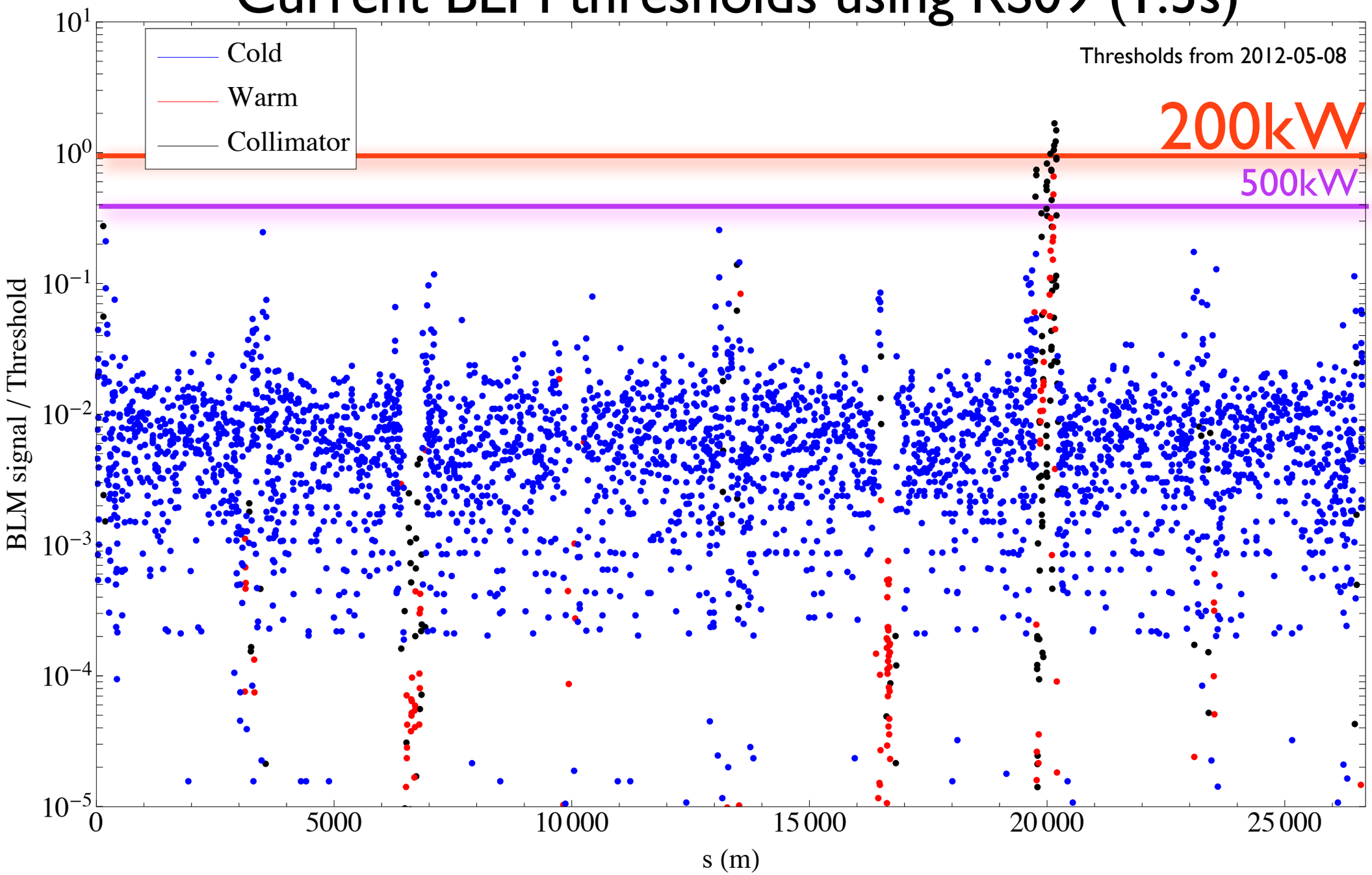
B2 VER

Comparison of expected losses for 200kW with Current BLM thresholds using RS09 (1.3s)



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