

Sensitivity, response and thresholds; first experience during scrubbing and intensity ramp up

17/04/2024

Sara Morales on behalf of the SY-BI-BL section

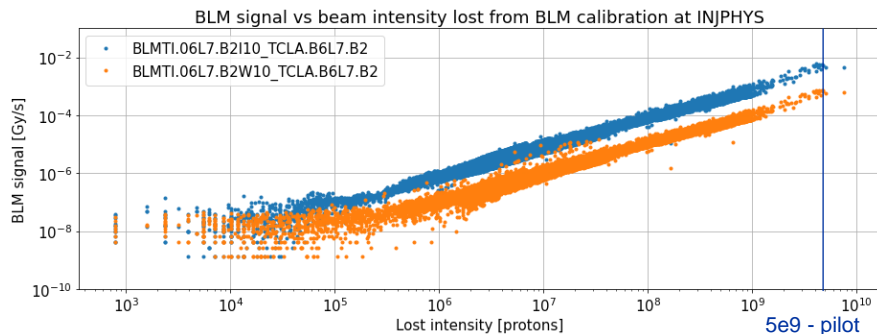
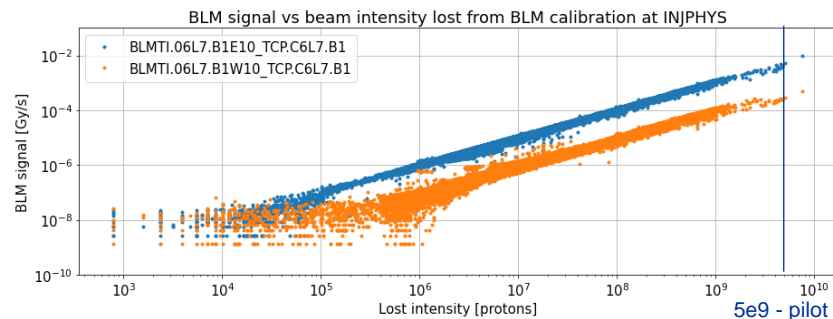
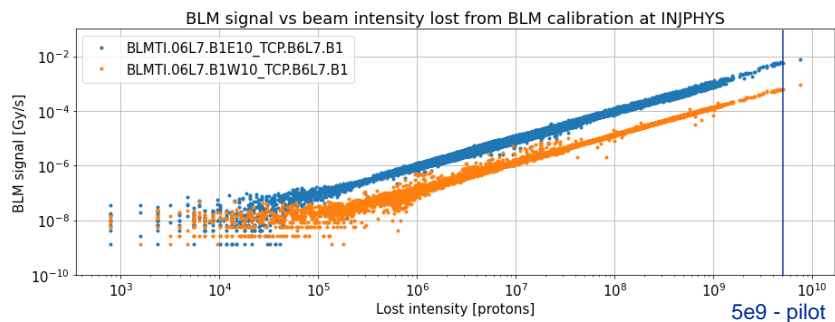
Joint MPP, CoIUSM and BLMTWG

Outline

- Sensitivity of new detectors in the wall (RS09)
 - Top energy
 - Injection energy/scrubbing
- Losses during injection (RS01 and RS09)
- New response factors from betatron lossmaps (RS09)
- New BLM thresholds families

Sensitivity of new detectors on the wall

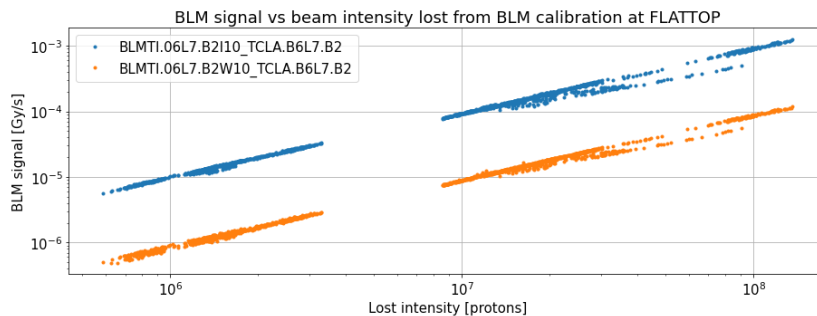
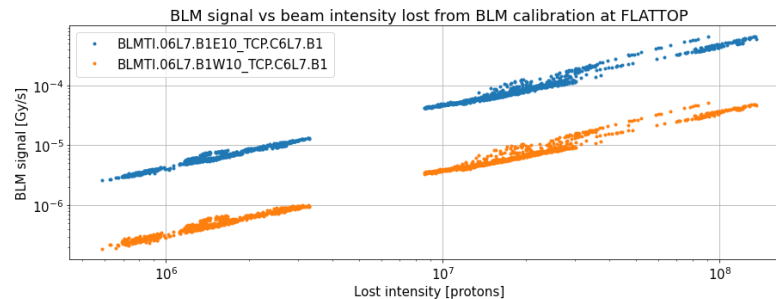
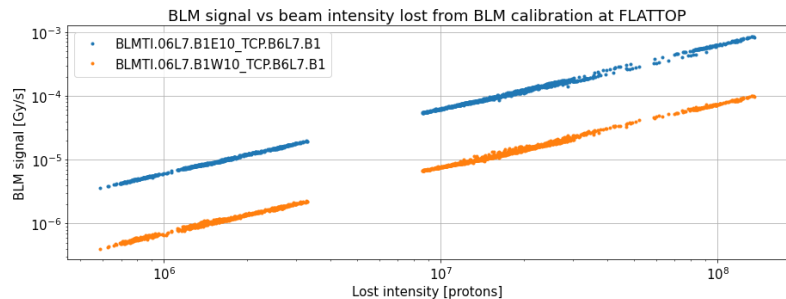
- Comparison of signal of “wall” and “old” BLM vs lost intensity from BLM calibration
- INJPHYS beam modes a minimum of $1e12$ protons per beam in the machine (scrubbing included)



In all cases
signal in new
BLMs visible
from at least
losses around
 $1e6$ protons/s

Sensitivity of new detectors on the wall

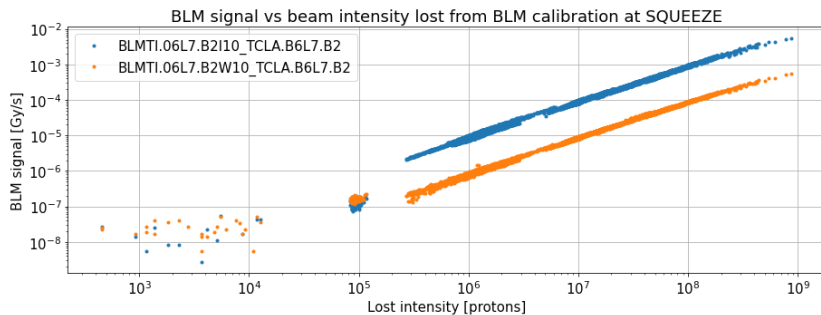
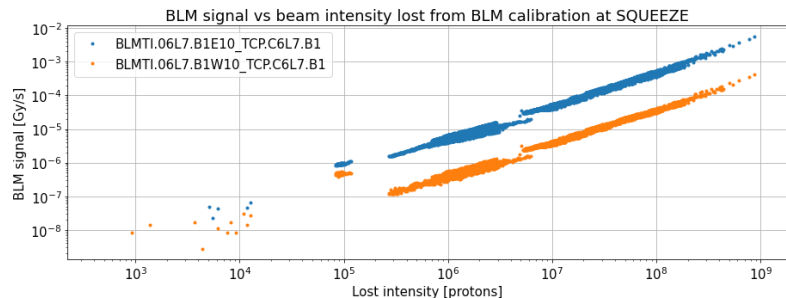
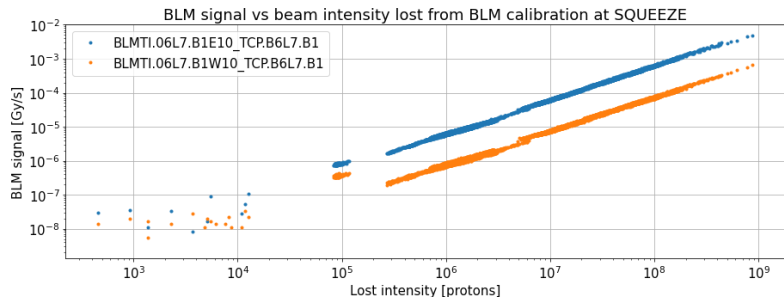
- Comparison of signal of “wall” and ”old” BLM vs lost intensity from BLM calibration
- FLATTOP beam modes with a minimum of $1e12$ protons per beam in the machine (intensity ramp-up from 12 bunches included)



In all cases
signal in new
BLMs visible
from losses
well below
 $1e6$ protons/s

Sensitivity of new detectors on the wall

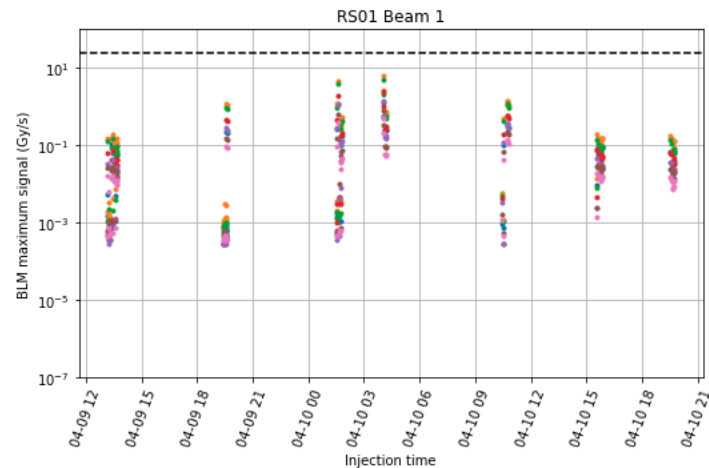
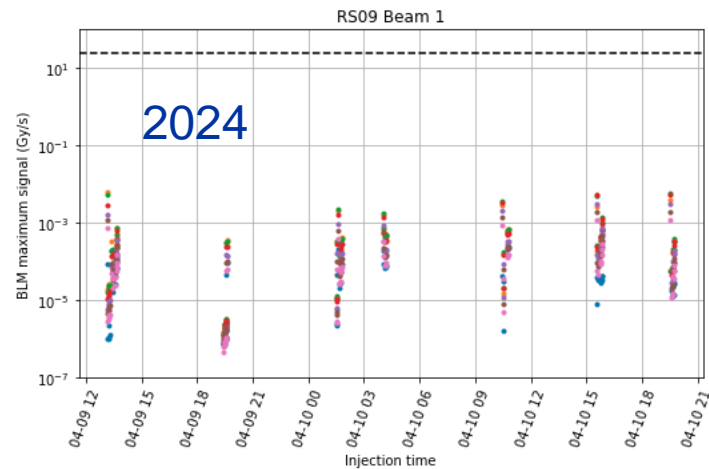
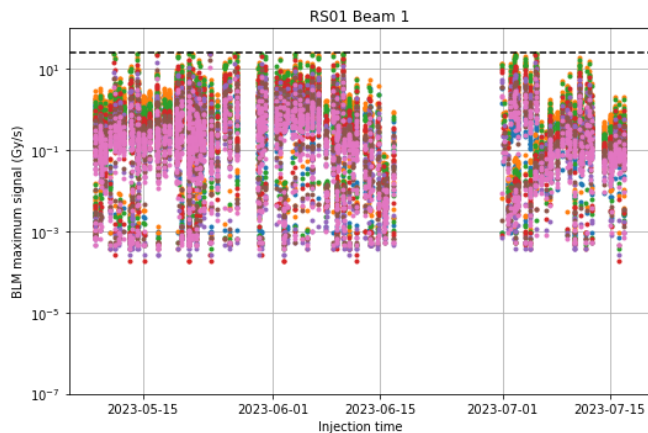
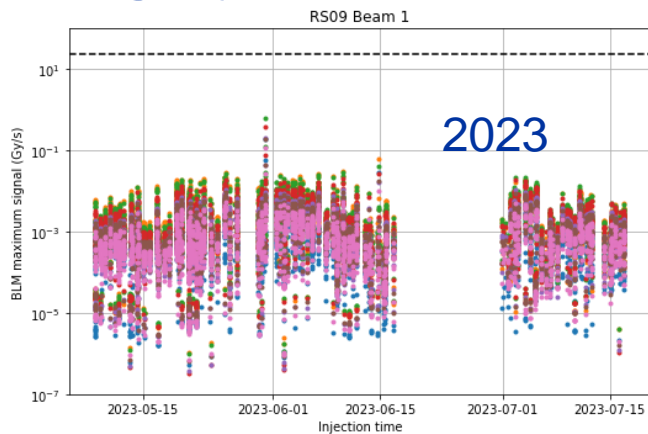
- Comparison of signal of “wall” and ”old” BLM vs lost intensity from BLM calibration
- SQUEEZE beam modes with a minimum of $1e12$ protons in the machine (intensity ramp-up from 12 bunches included)



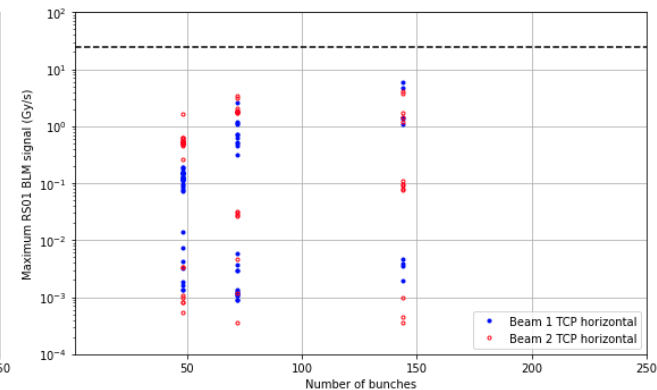
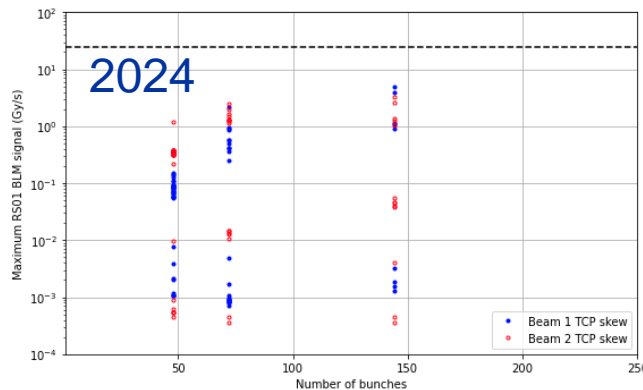
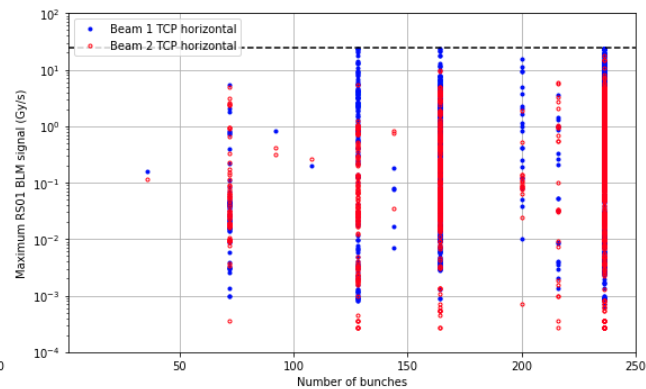
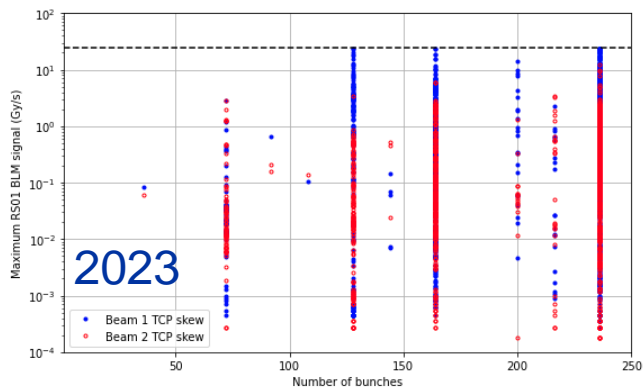
500kW \rightarrow $5.8e11$ protons/s
6 orders of magnitude
below max loss allowed for
RS09

In all cases
signal in new
BLMs visible
from losses
around $3e5$
protons/s

Losses during injection

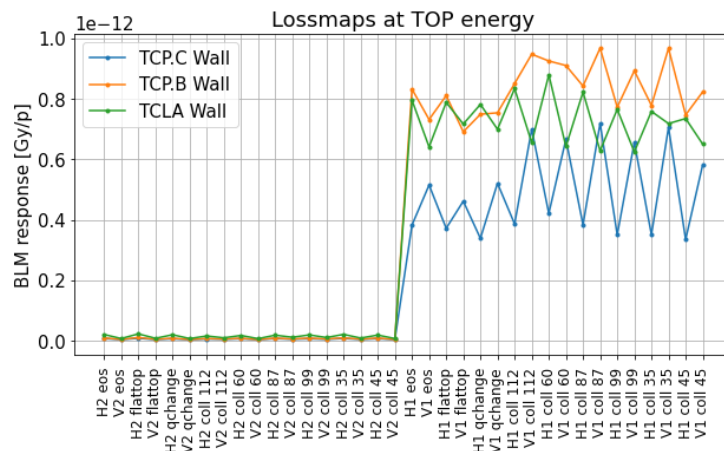
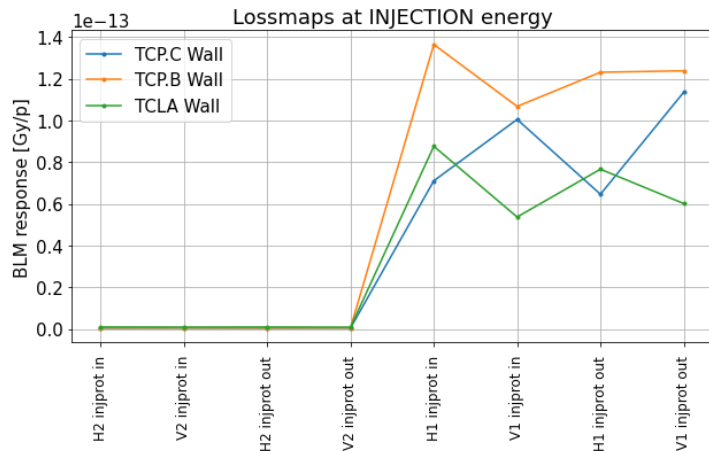


Maximum loss vs number of bunches



Response from lossmaps for new detectors in the wall

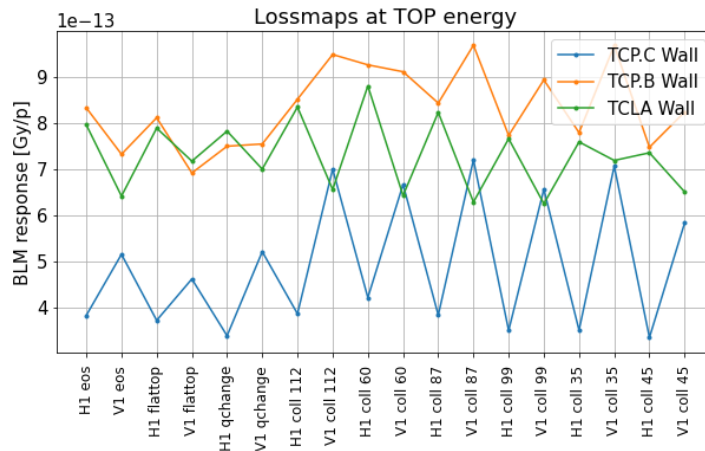
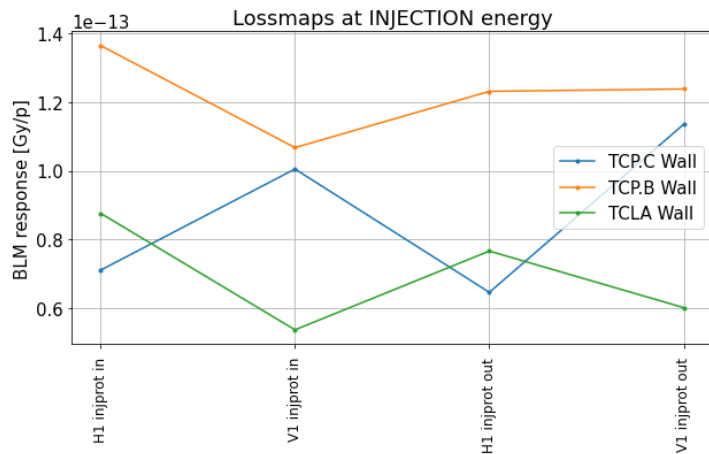
- Response analyzed from 2024 betatron lossmaps with final collimation settings at:
 - INJECTION: INJPROT IN and OUT
 - TOP energy: FLATTOP, EOS, QCHANGE, and during collisions with 6 different beta star values
 - Reduction in response consistent with primary observations by Belen



Response for B2 losses much lower -> We keep only B1 lossmaps

Response from lossmaps for new detectors in the wall

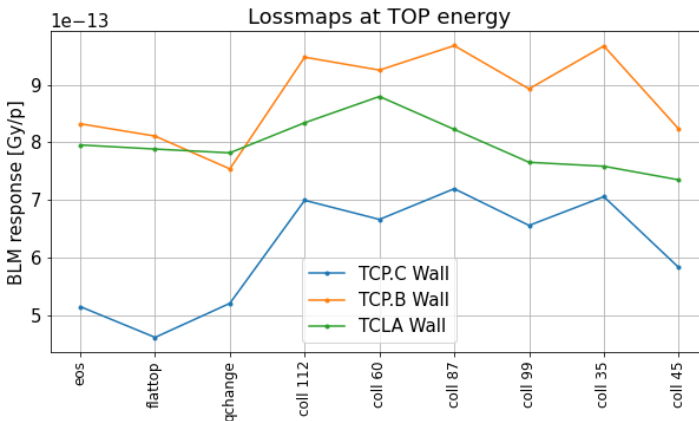
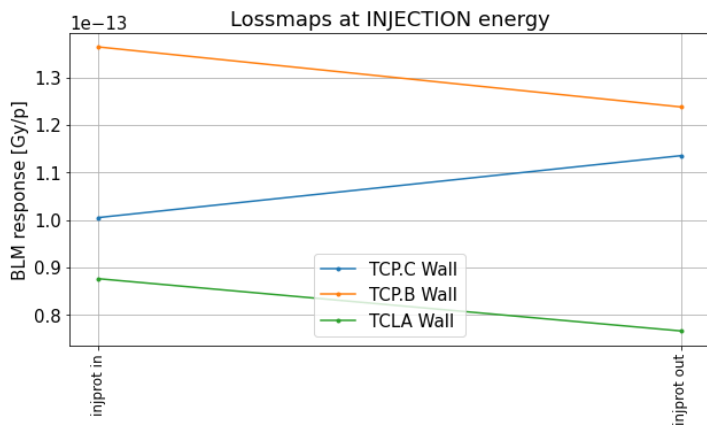
- Response analyzed from 2024 betatron lossmaps with final collimation settings at:
 - INJECTION: INJPROT IN and OUT
 - TOP energy: FLATTOP, EOS, QCHANGE, and during collisions with 6 different beta star values
 - Reduction in response consistent with primary observations by Belen



We keep only the maximum from each set of B1 lossmaps

Response from lossmaps for new detectors in the wall

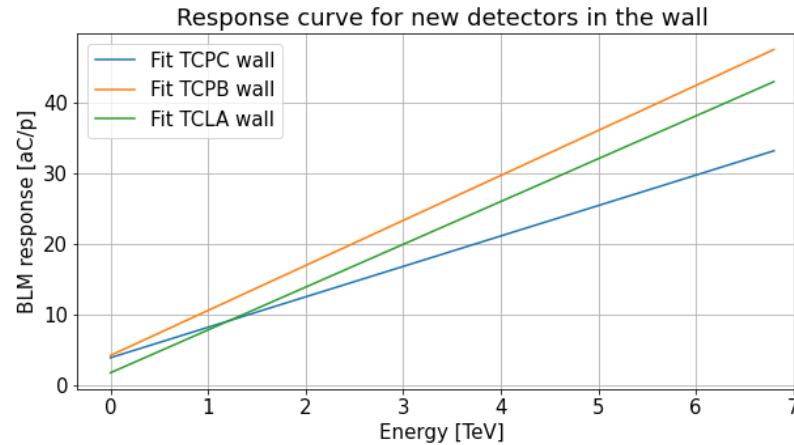
- Response analyzed from 2024 betatron lossmaps with final collimation settings at:
 - INJECTION: INJPROT IN and OUT
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 - Reduction in response consistent with primary observations by Belen



We compute the mean for INJECTION and TOP separately, convert to aC/p and do a linear fit with energy to get response curve

Response from lossmaps for new detectors in the wall

- Response analyzed from 2024 betatron lossmaps with final collimation settings at:
 - INJECTION: INJPROT IN and OUT
 - TOP energy: FLATTOP, EOS, QCHANGE, and during collisions with 6 different beta star values
 - Reduction in response consistent with primary observations by Belen



Proposal of BLM thresholds families for detectors in the wall

Family Name	2022 loss map values per proton [aC, aC/TeV]	Family Name	2024 loss map values per proton [aC, aC/TeV]	Ratio 2024 / 2022 [offset, slope]
THRI_COL_7_TCPPM	[66,44]	THRI_COLL_7_TCPPM_WALL	[3.8, 4.3]	[0.06,0.098]
THRI_COLL_7_TCP	[49, 47]	THRI_COLL_7_TCP_WALL	[4.2, 6.4]	[0.09,0.14]
THRI_COLL_7_TCLA_HI	[6, 88]	THRI_COLL_7_TCLA_HI_WALL	[1.7, 6.1]	[0.3,0.07]

Maximum allowed power loss from loss maps WITHOUT these BLMs:

H1 : 322.5 kW

V1 : 309.8 kW

Conclusions

- Sensitivity of new BLMs in the wall:
 - Injection: capable of observing losses from $1 \text{e}6$ protons/s
 - Top Energy: capable of observing losses below $3 \text{e}5$ protons/s
- Beam losses at injection seem to be of similar order than in 2023 for 144 bunches
- New response factors calculated from loss maps for the 3 new families