Crystal Collimation Quench Test 2024

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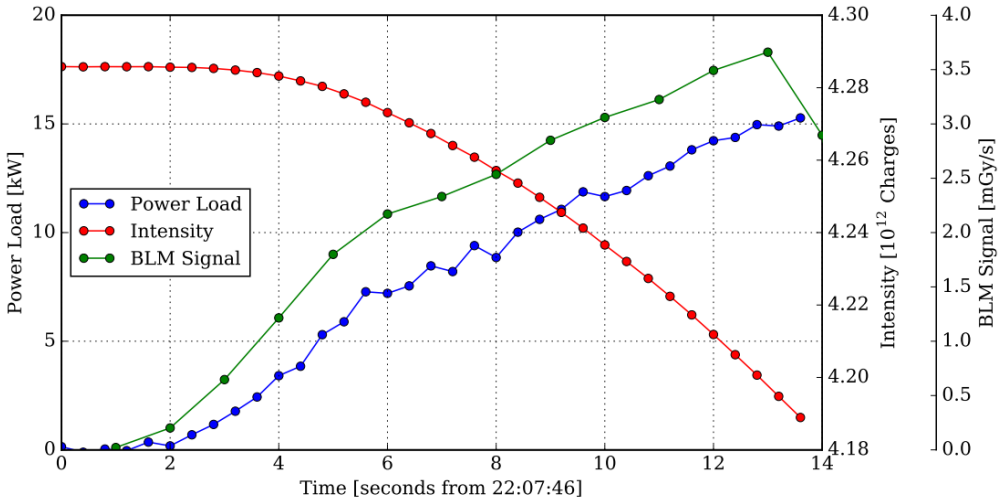
On behalf of BE-ABP-NDC

Acknowledgments to D. Mirarchi, M. Monikowska, C. E. Montanari, S. Redaelli, N. Triantafyllou, D. Valuch

LSWG Meeting on 2024 Ion MDs
01.11.2024

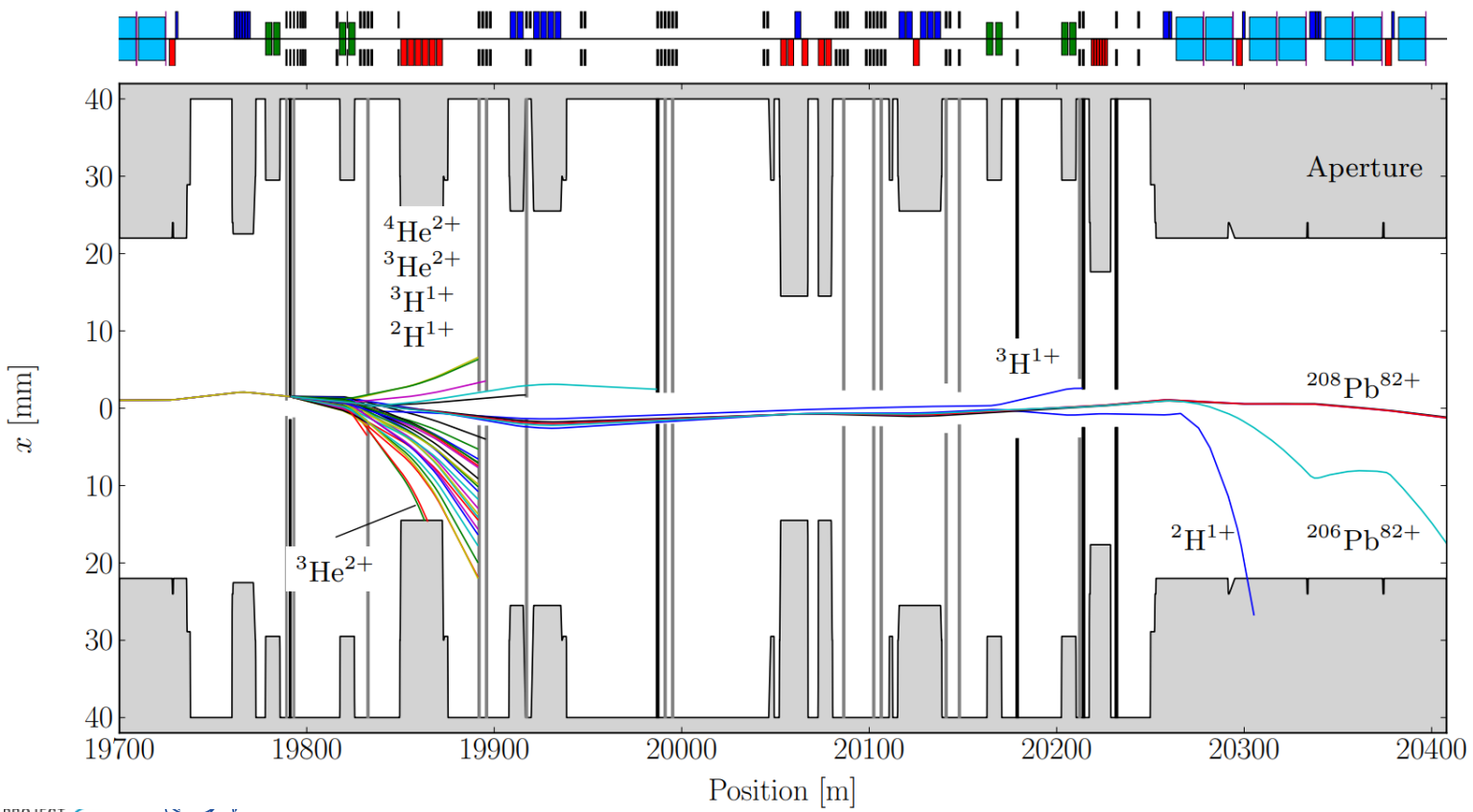
2015 Collimation Quench Test



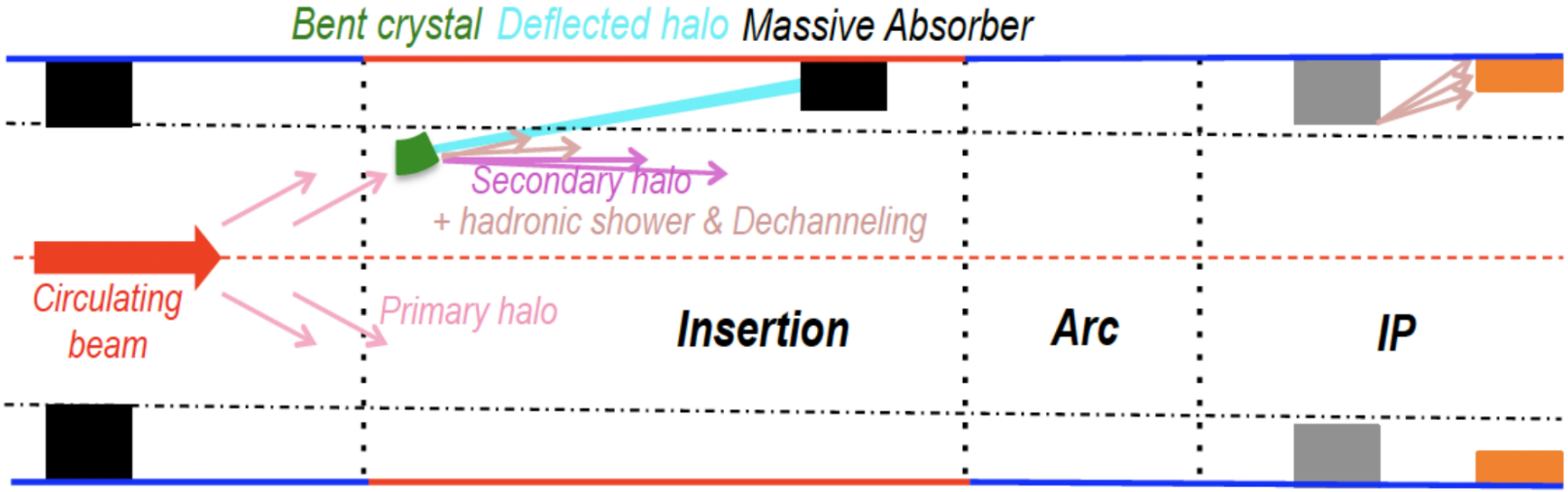
- Collimation quench test 2015 with standard collimation system
- Pb ions at 6.37 *Z* TeV
- Quench at roughly **15kW**
- Max. stored beam energy

  10.8 MJ
- HL-LHC target > 20MJ
- Mitigation needed: crystal collimation!

Standard Collimation of Heavy Ions



Crystal Collimation of Heavy Ions



D. Mirarchi

2015 Collimation Quench Test

2018 Measurements

Crystal	Maximum normalized BLM signal [a.u.]		Global leakage ratio
	Standard	Crystal	
B1H	$(5.81 \pm 1.03) \cdot 10^{-13}$ Q8-9	$(7.30 \pm 0.15) \cdot 10^{-14}$ Q8-9	8.0 ± 1.4
B1V	$(1.95 \pm 0.07) \cdot 10^{-13}$ Q8-9	$(6.39 \pm 0.05) \cdot 10^{-14}$ Q12-13	3.1 ± 0.1
B2H	$(2.76 \pm 0.39) \cdot 10^{-13}$ Q12-13	$(7.89 \pm 0.78) \cdot 10^{-14}$ Q8-9	3.5 ± 0.6
B2V	$(2.25 \pm 0.01) \cdot 10^{-13}$ Q8-9	$(1.46 \pm 0.36) \cdot 10^{-13}$ Q8-9	1.5 ± 0.4

M. D'Andrea

2024 Collimation Quench Test

- Ultimate performance limitation for heavy ions with crystals unknown
- Aim to probe levels of **60kW & 100kW** in LHC design loss scenario (steady state loss rate **over 10s**)
- Could aim for fast loss scenario if limitations observed in run
- Last QT (2015) in B2H plane: **aim for B1H plane here**
- 6.8 *Z* TeV beams at flat top (lower quench limit than 2015)

2024 Collimation Quench Test

- Roughly 2×10^{10} charges per bunch
- Standard injection: 56 bunches
- Roughly 1.25 MJ per 56 bunches
- Proposal: per quench attempt 2x56 bunches – enough margin for 10s
- Two quench attempts per fill: 2x(2x56) + some individuals for tests
- 12h: up to three fills for contingency
- Increase in target loss rate (Fill 1: 60kW → Fill 2+3 : 100kW)

2024 Collimation Quench Test

Collimator Settings

- Nominal collimator settings used & validated with higher intensities

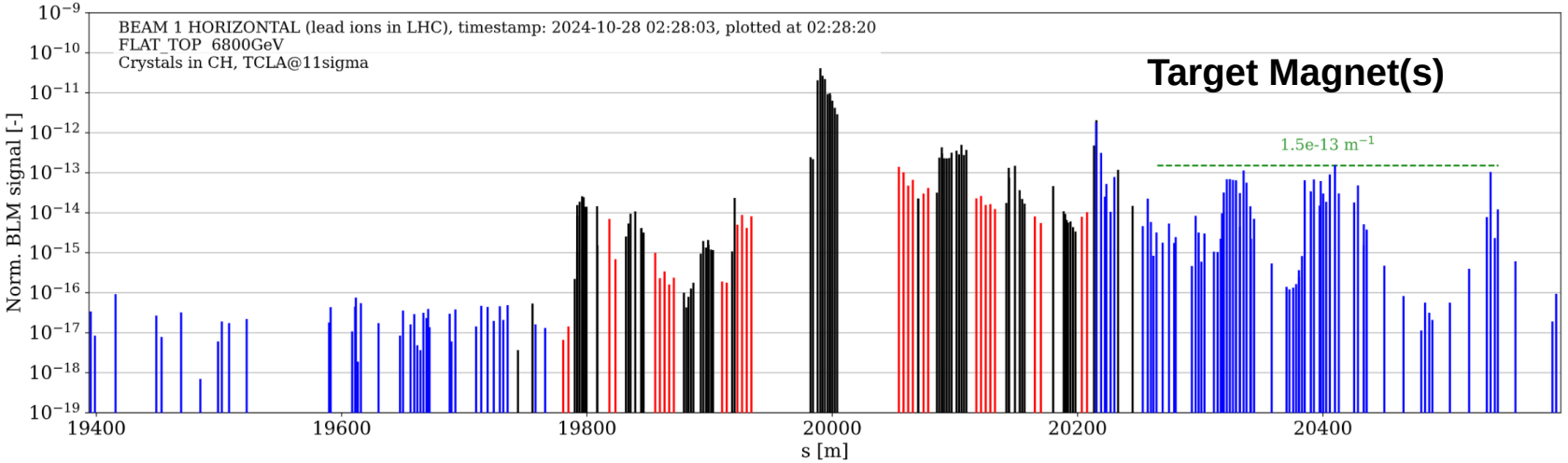
BLM Thresholds

- Nominal OP settings could be used with increased MF (designed with the intent to require just an increase of MF in QT)

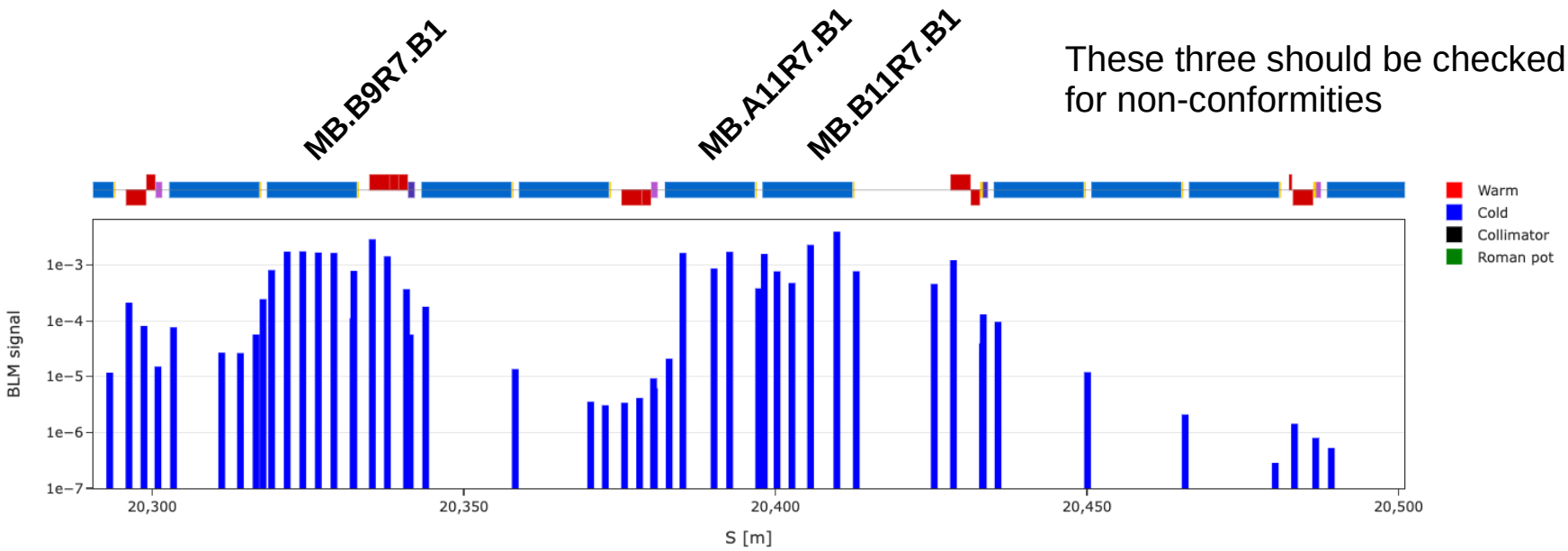
ADT Settings

- Controlled by ADT expert with application successfully used in 2022

2024 Collimation Quench Test



2024 Collimation Quench Test



These three should be checked for non-conformities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