HL-TCC Technical Coordination Committee
September 29th, 2016
CERN, Geneva, CH

Analysis of lifetime drops in 2015 and 2016, in view of the Hollow E-lens review

B. Salvachua and S. Redaelli
on behalf of the collimation team

The HiLumi LHC Design Study is included in the High Luminosity LHC project and is partly funded by the European Commission within the Framework Programme 7 Capacities Specific Programme, Grant Agreement 284404.

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- Introduction — 2012
- Lifetime analysis
- Measurements 2015-16
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Introduction

Loss spikes and drops of lifetime are a concern for operating machine.

Collimation reviews consistently recommended addressing this problem!

Recap: BIG concern for collimation!

- lifetime drops determine maximum loss rates in cold magnets and define the intensity limit for given cleaning
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Our proposed solution: Hollow electron lens to be installed in IR4.

This is the subject of an upcoming international project review (next week!) on the needs for active halo control at the LHC.

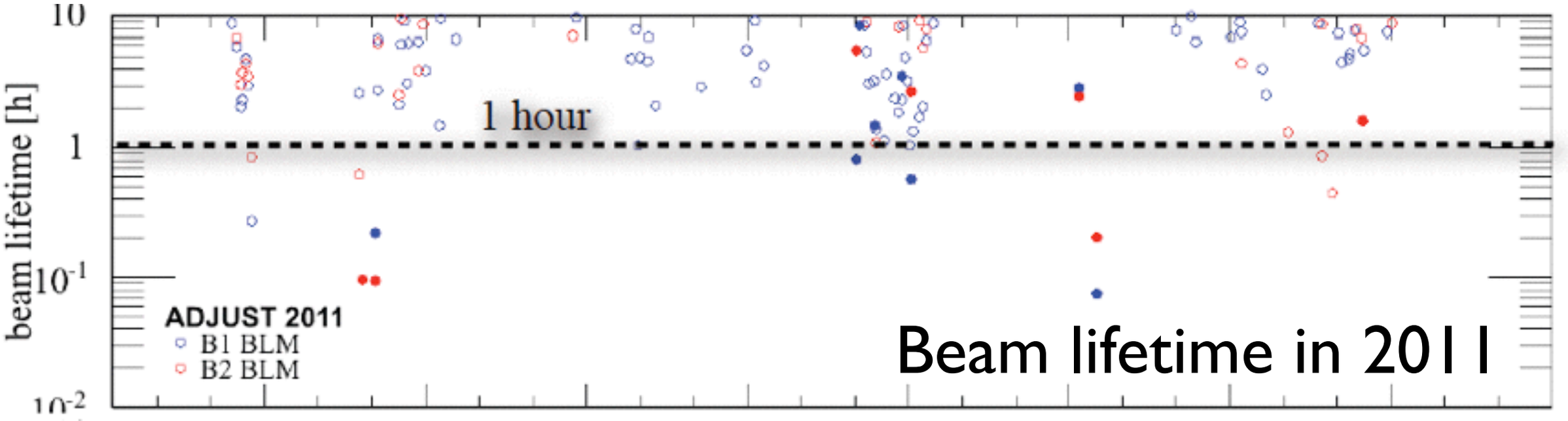
Agenda will cover loss analysis at the LHC as well as in other super-colliders (Tevatron, RHIC, HERA)

Here: preliminary look at what we will present for 2015 and 2016.

Analysis by Belen.

See also, e.g., Belen et al. "Lifetime Analysis at High Intensity Colliders Applied to the LHC", IPAC2013 CWG meeting 207 (https://indico.cern.ch/event/564394/), presentation by M. Wyszynski.

Losses in Run I — i



Beam lifetime in 2011

This result (and other important “good news” form the Run I operation) led to the conclusion that collimation upgrade in the dispersion suppressors around IR7 could wait until LS2.

… then, when we pushed the machine performance (7TeV equivalent gaps of primary collimators, higher bunch intensity, smaller beta* but still NO e-cloud at 50 ns) …

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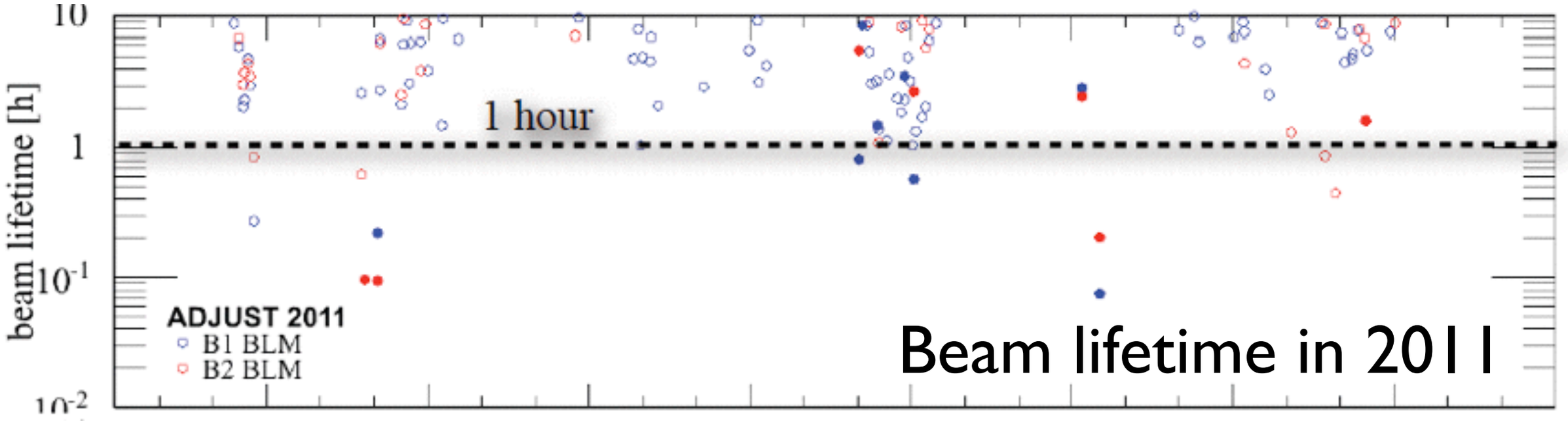

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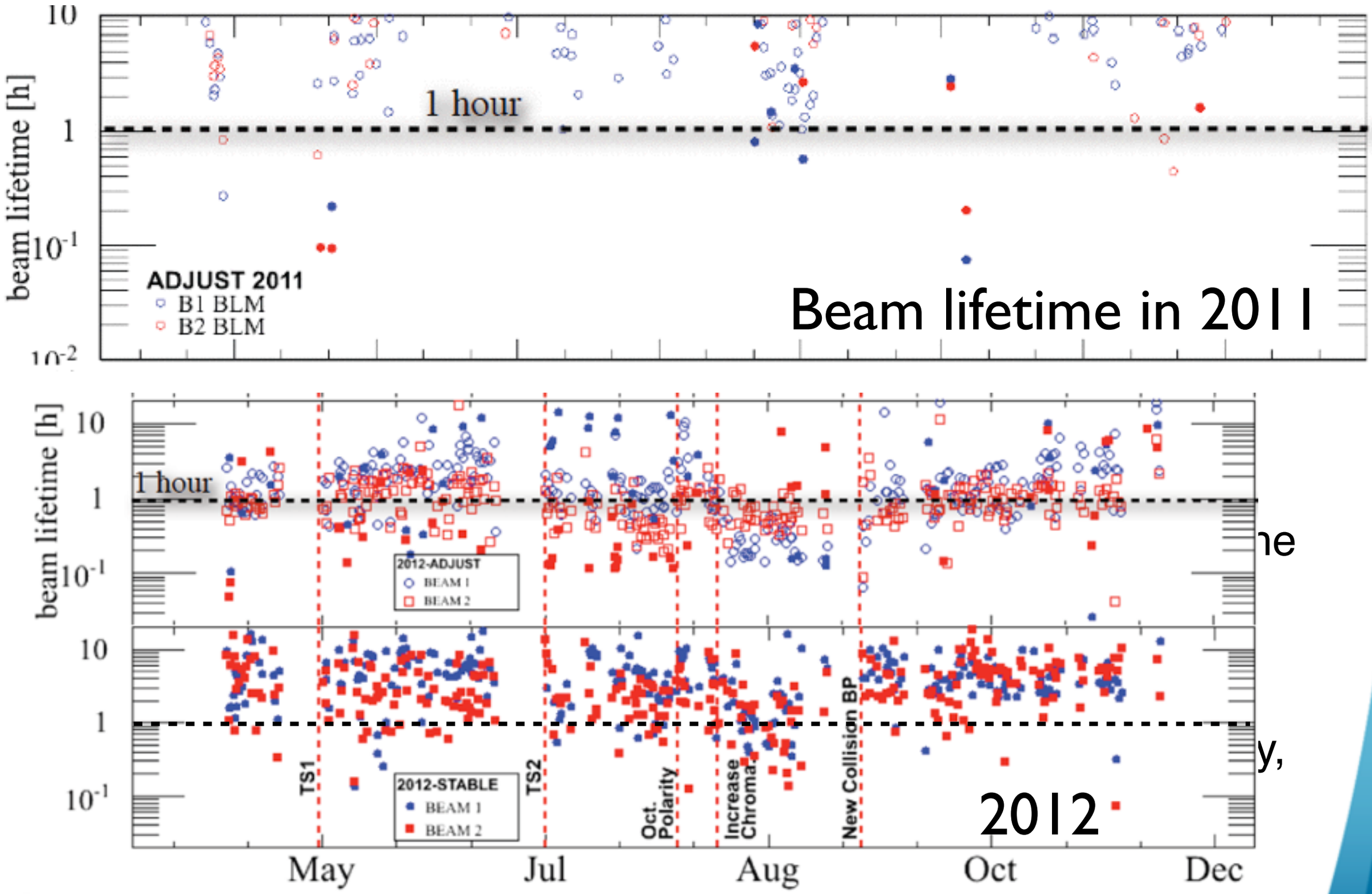

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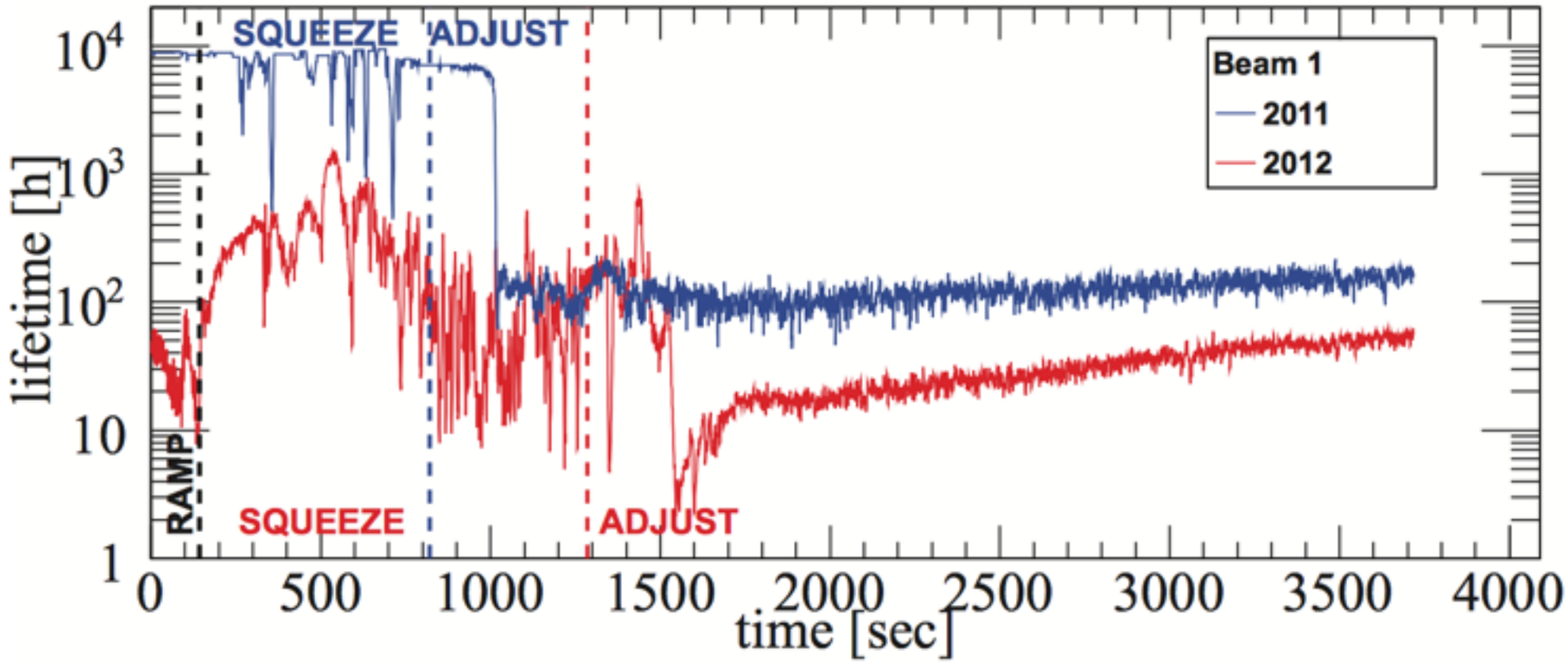

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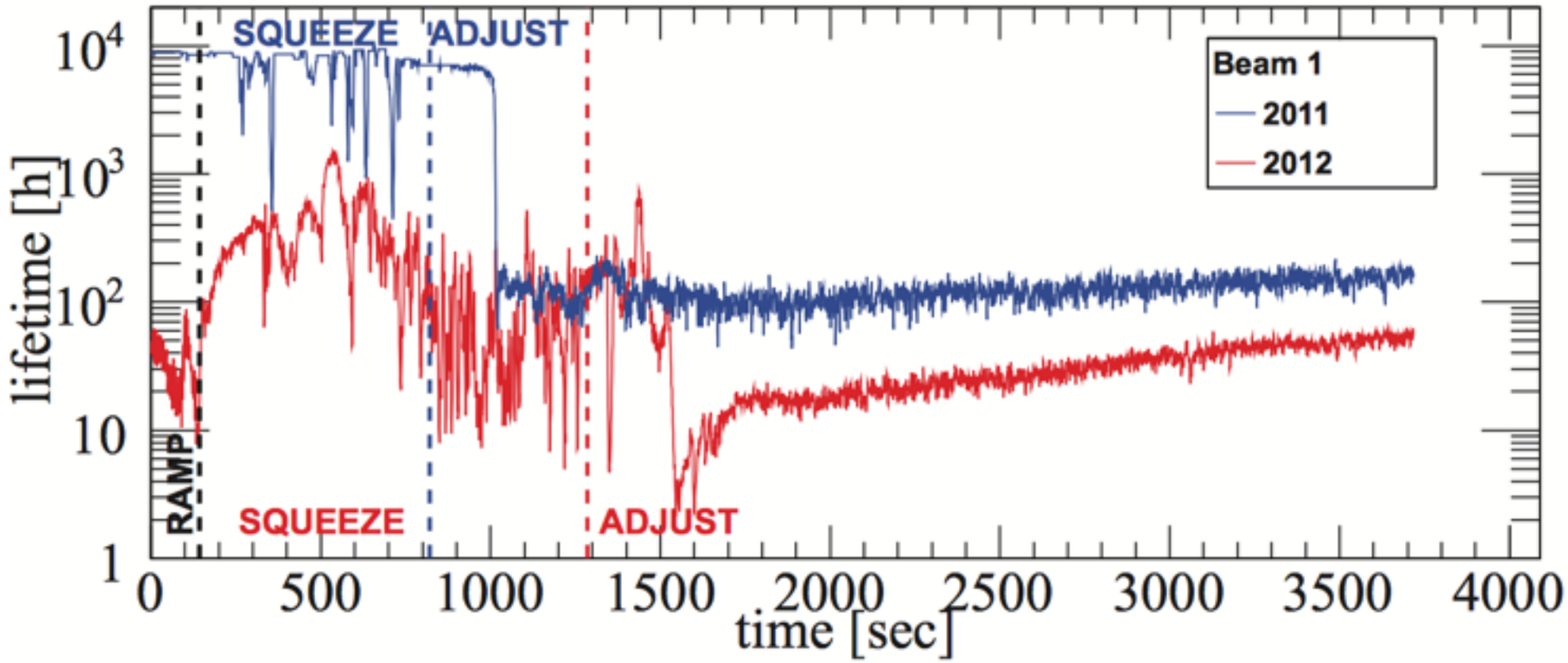

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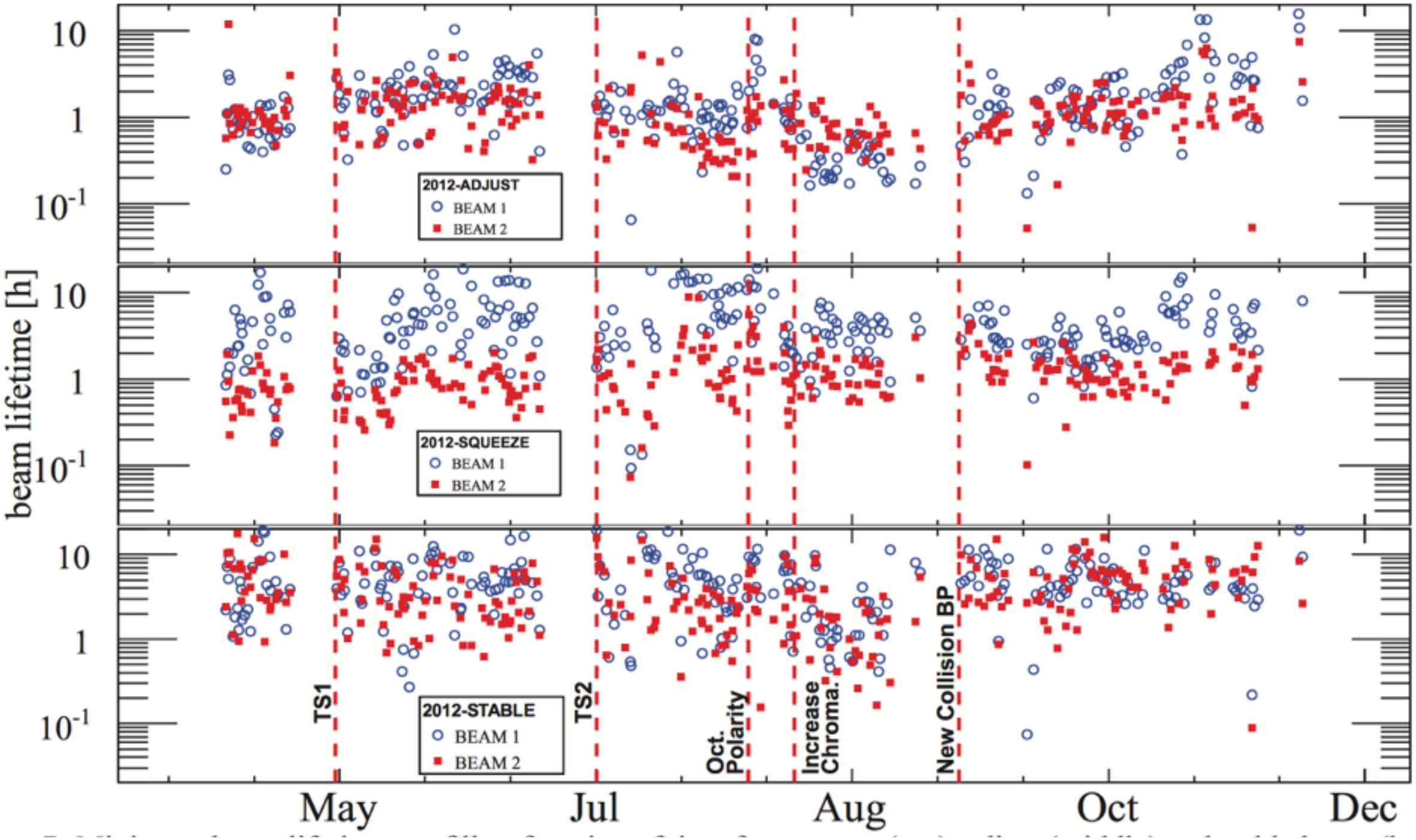

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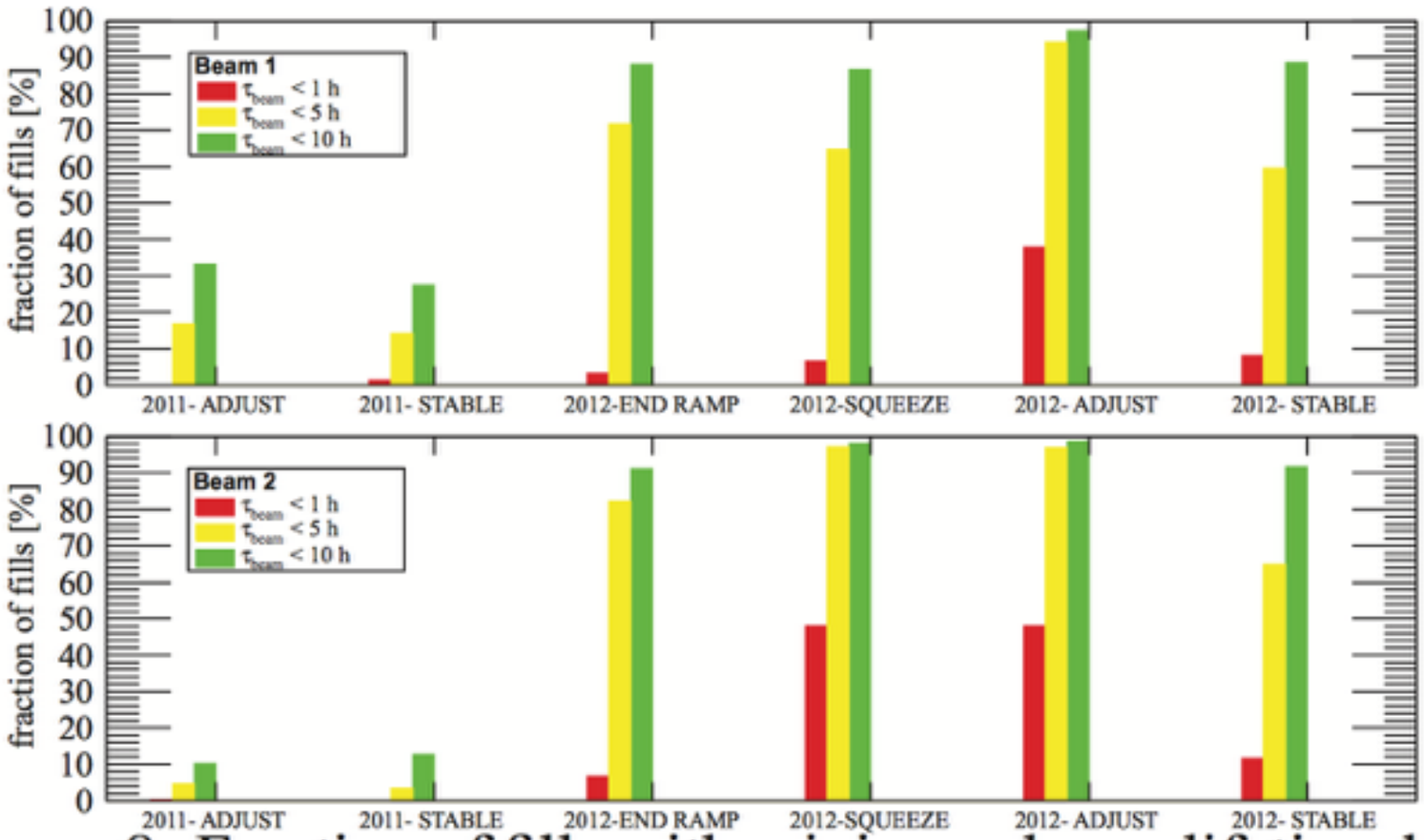

Figure 8: Fraction of fills with minimum beam lifetime below 1, 5 and 10 hours sorted by beam mode.

Estimated some >40 dumps because of losses in 2012 at 4 TeV.

Extrapolated losses from 2012 would not be compatible with a high-efficiency operation of the LHC and HL-LHC!
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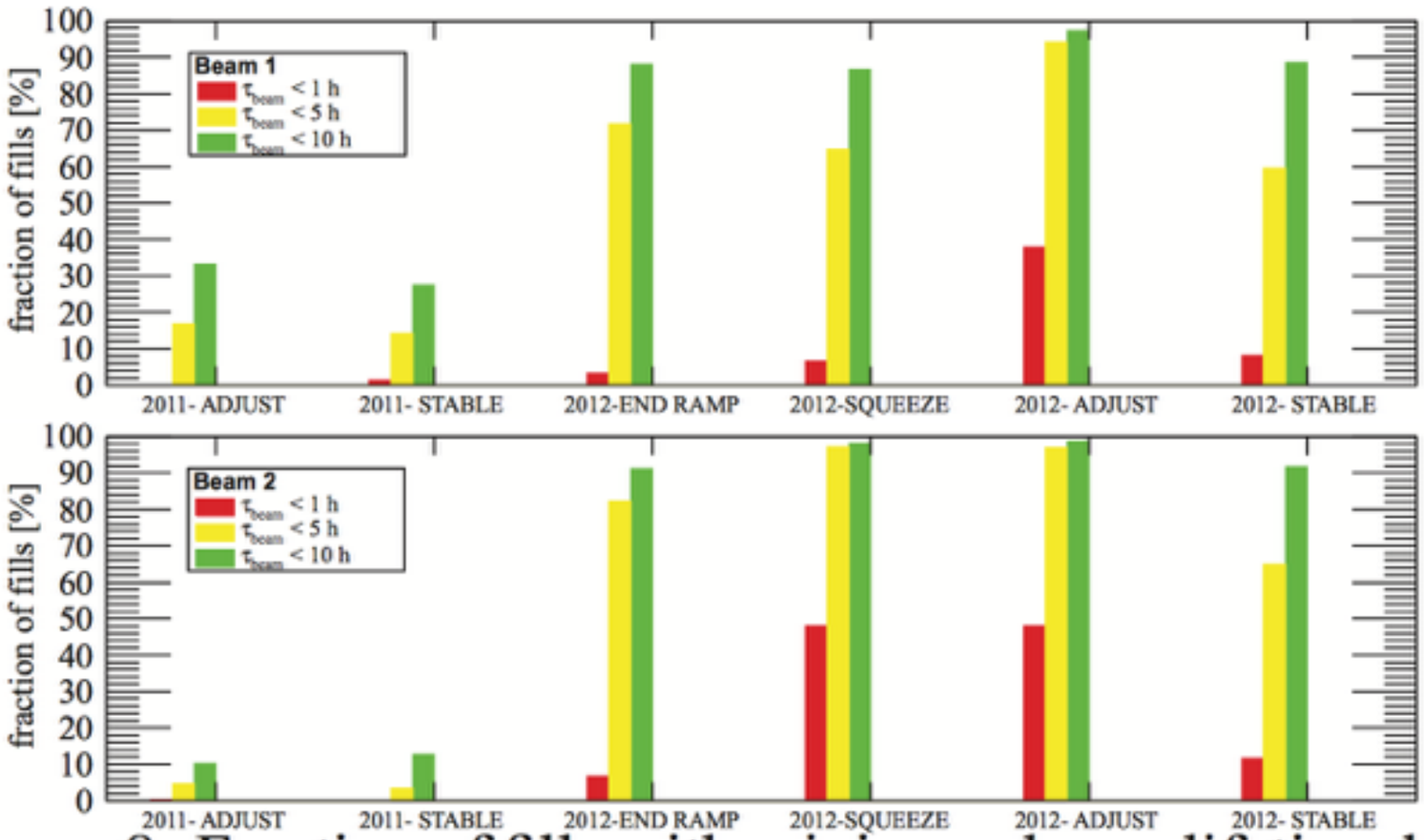

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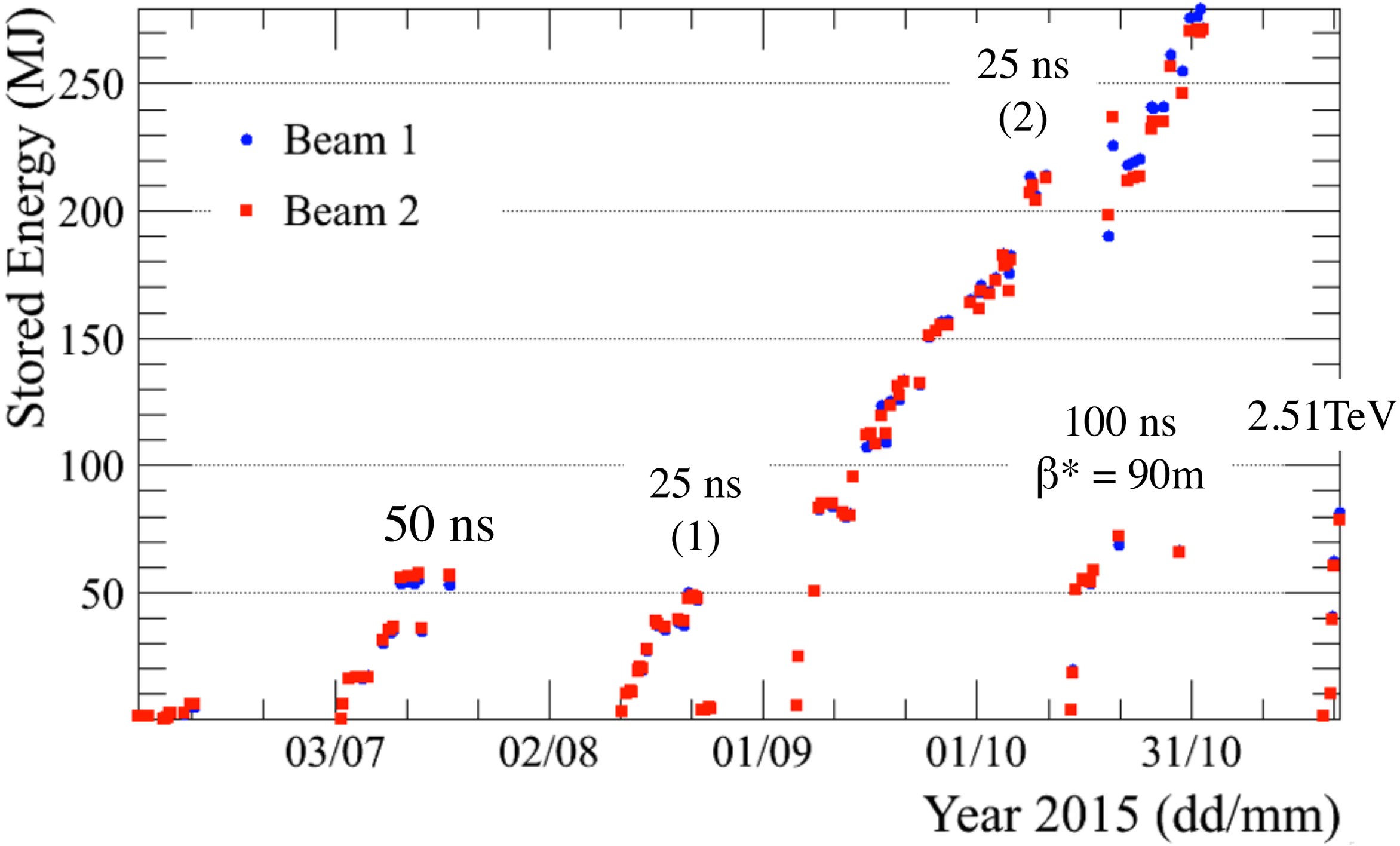

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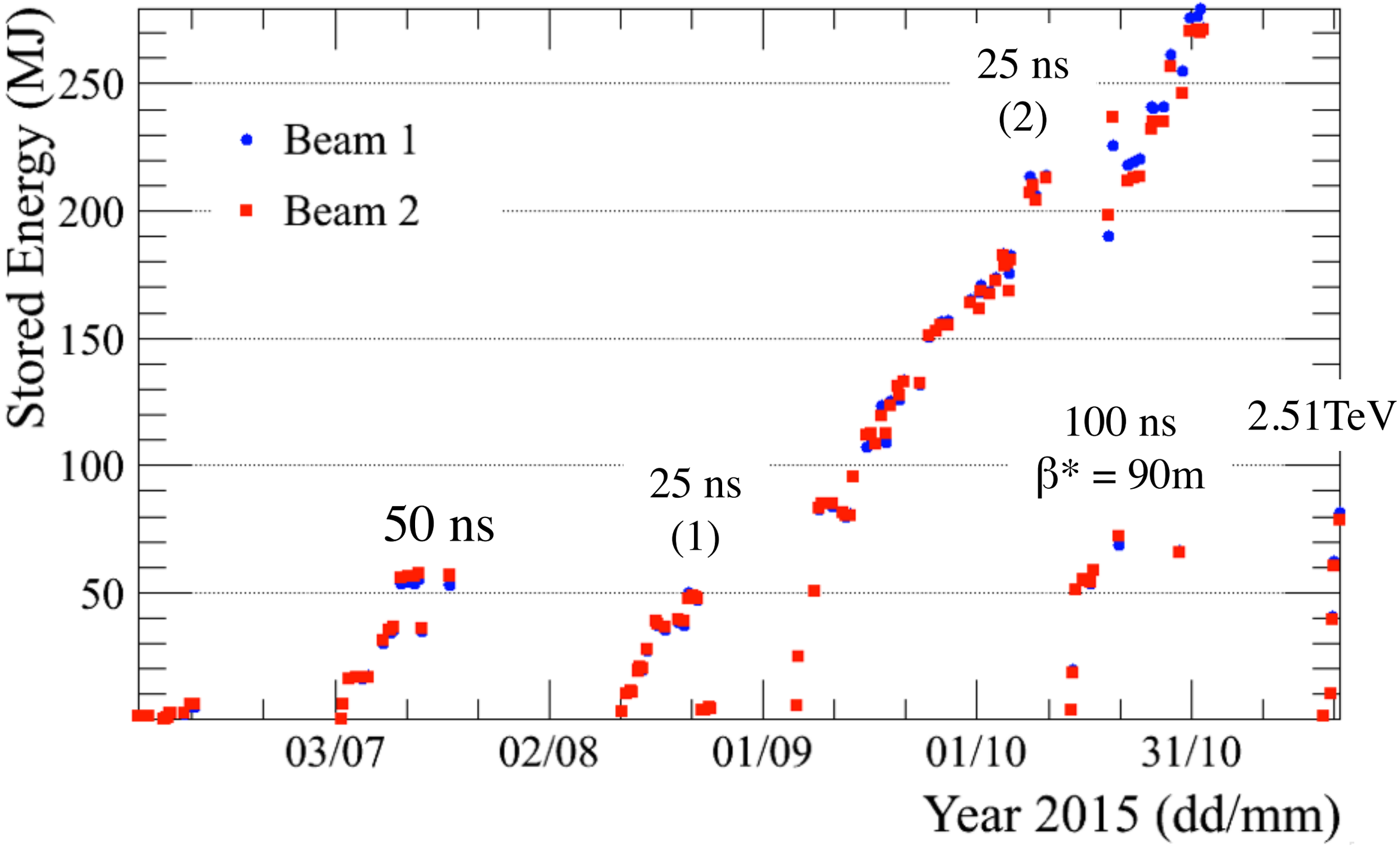

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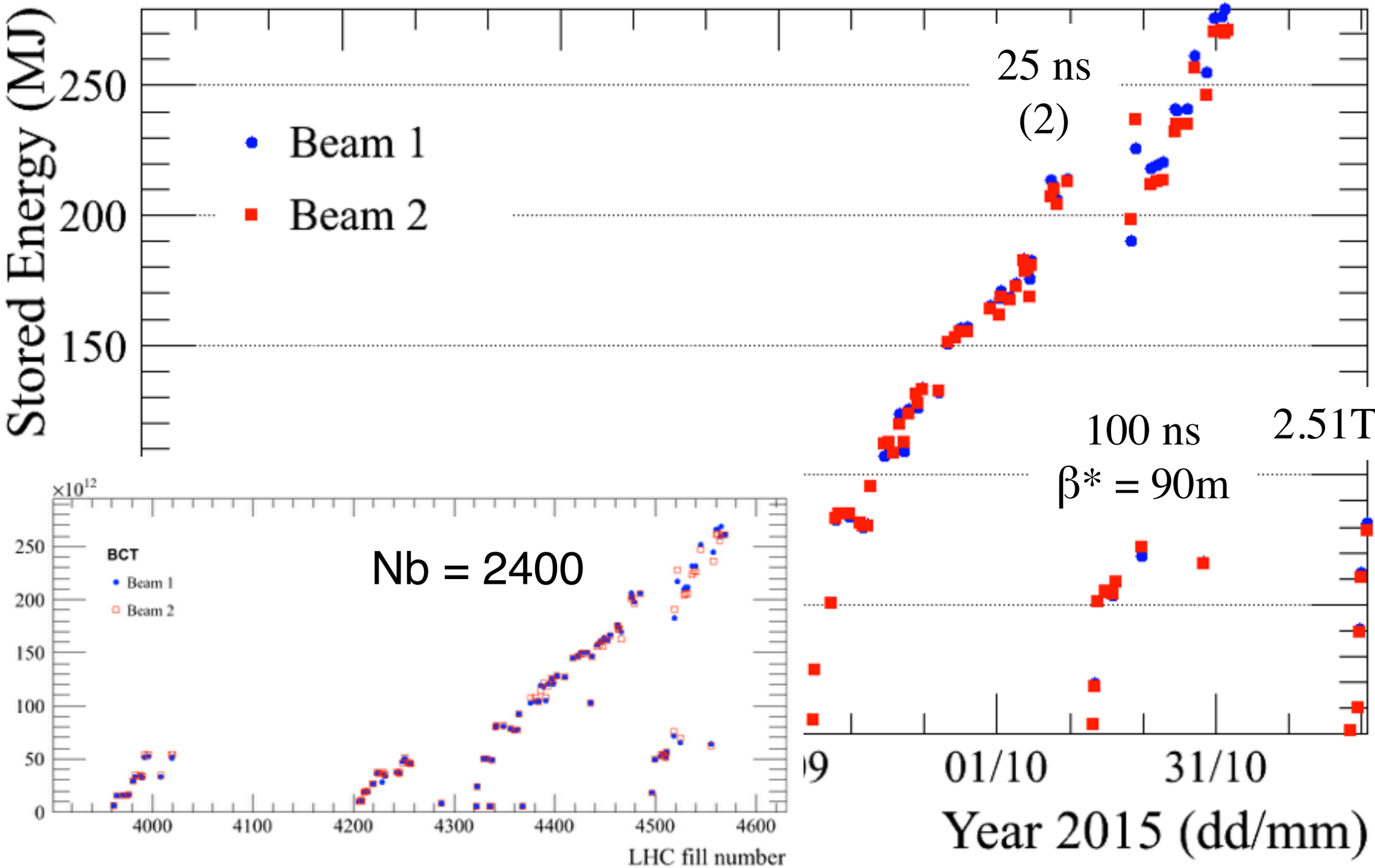

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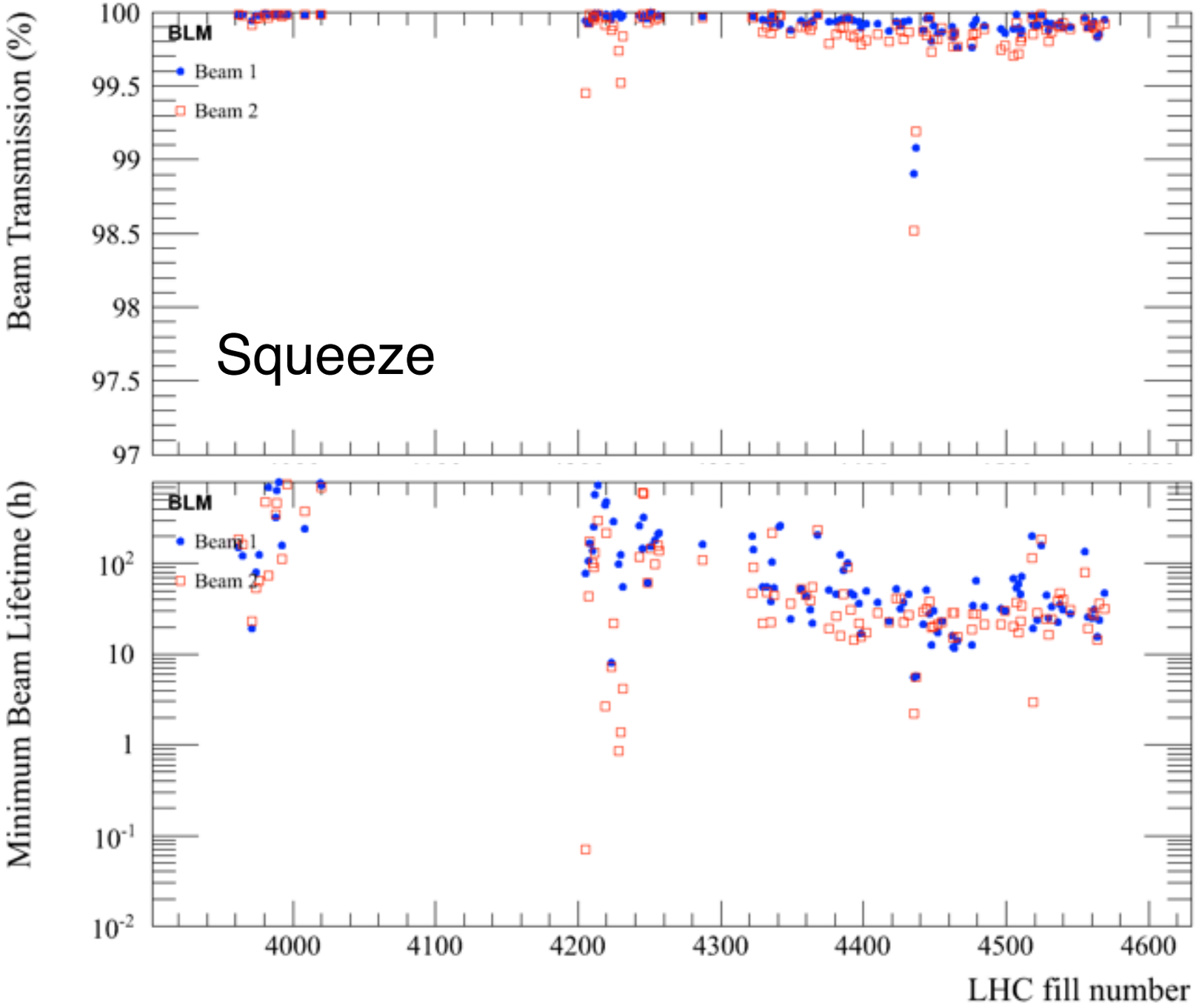

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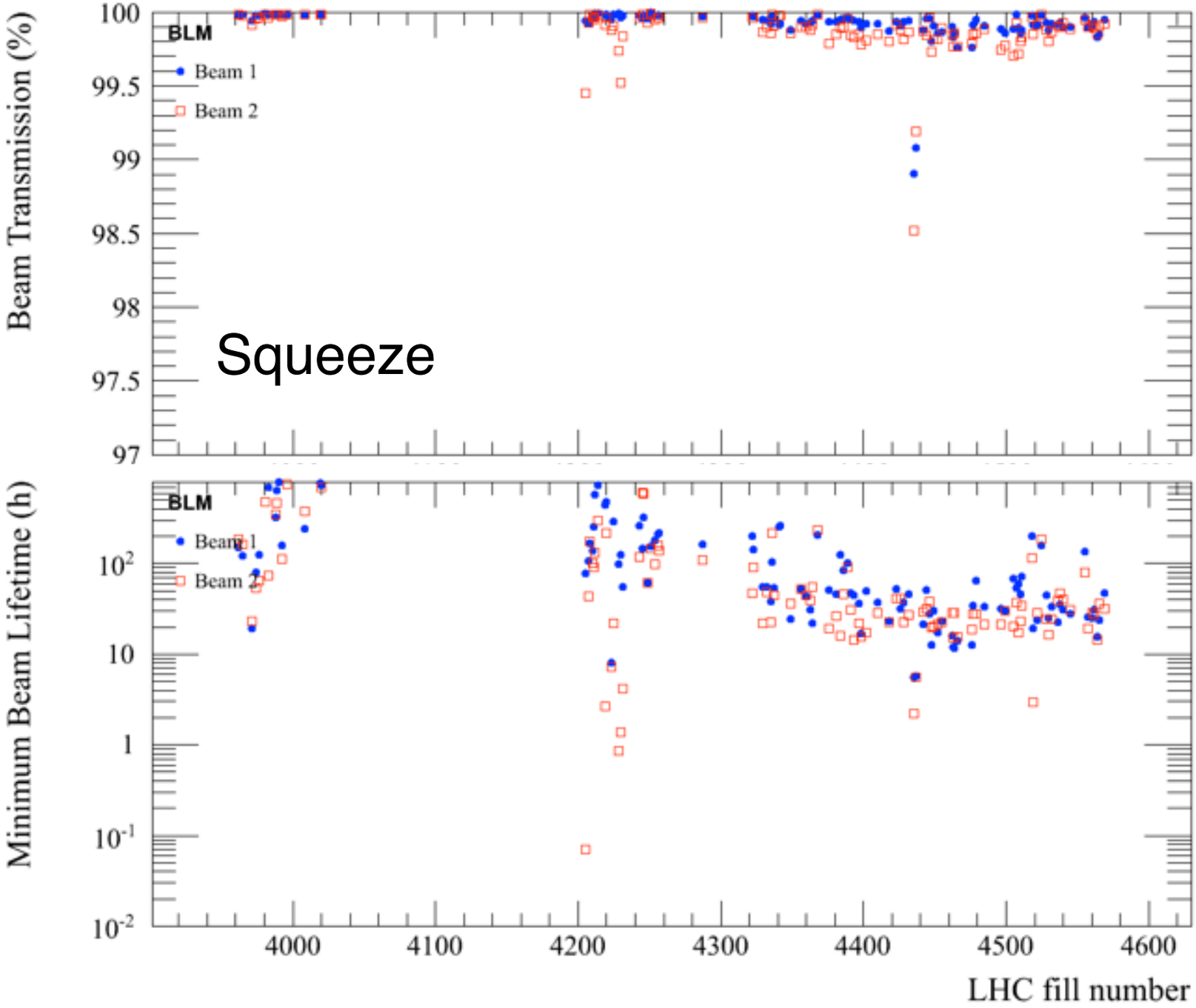

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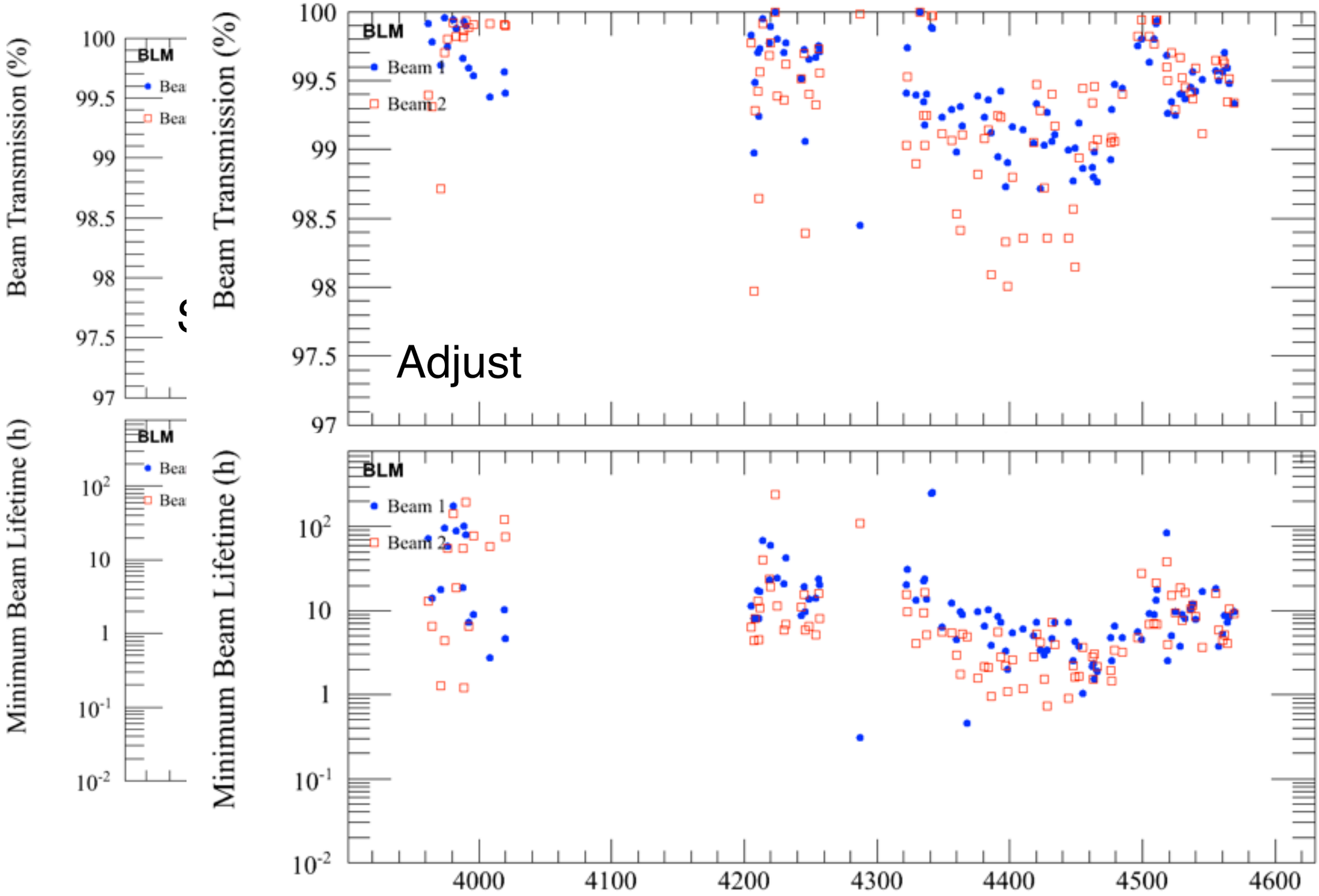

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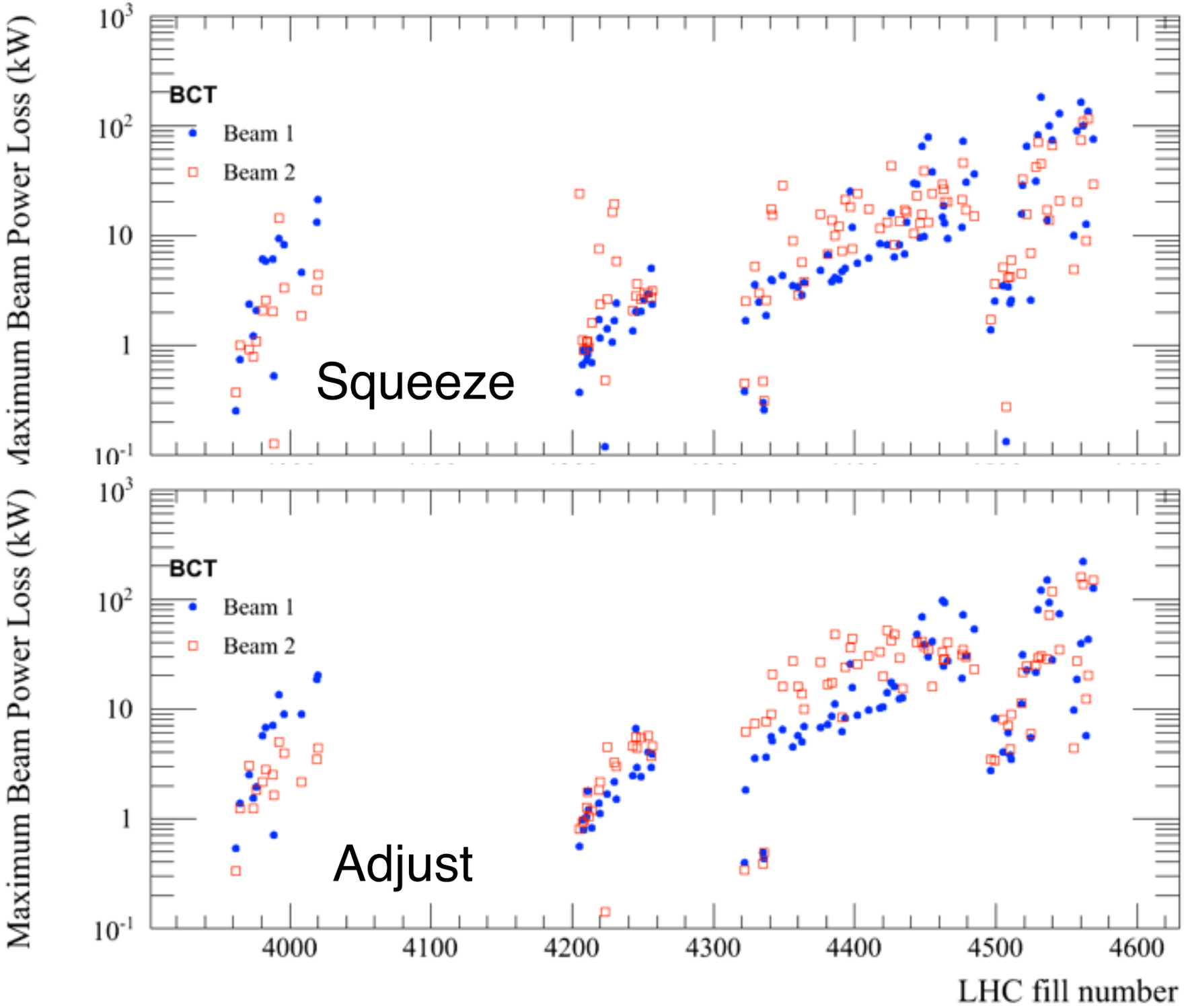

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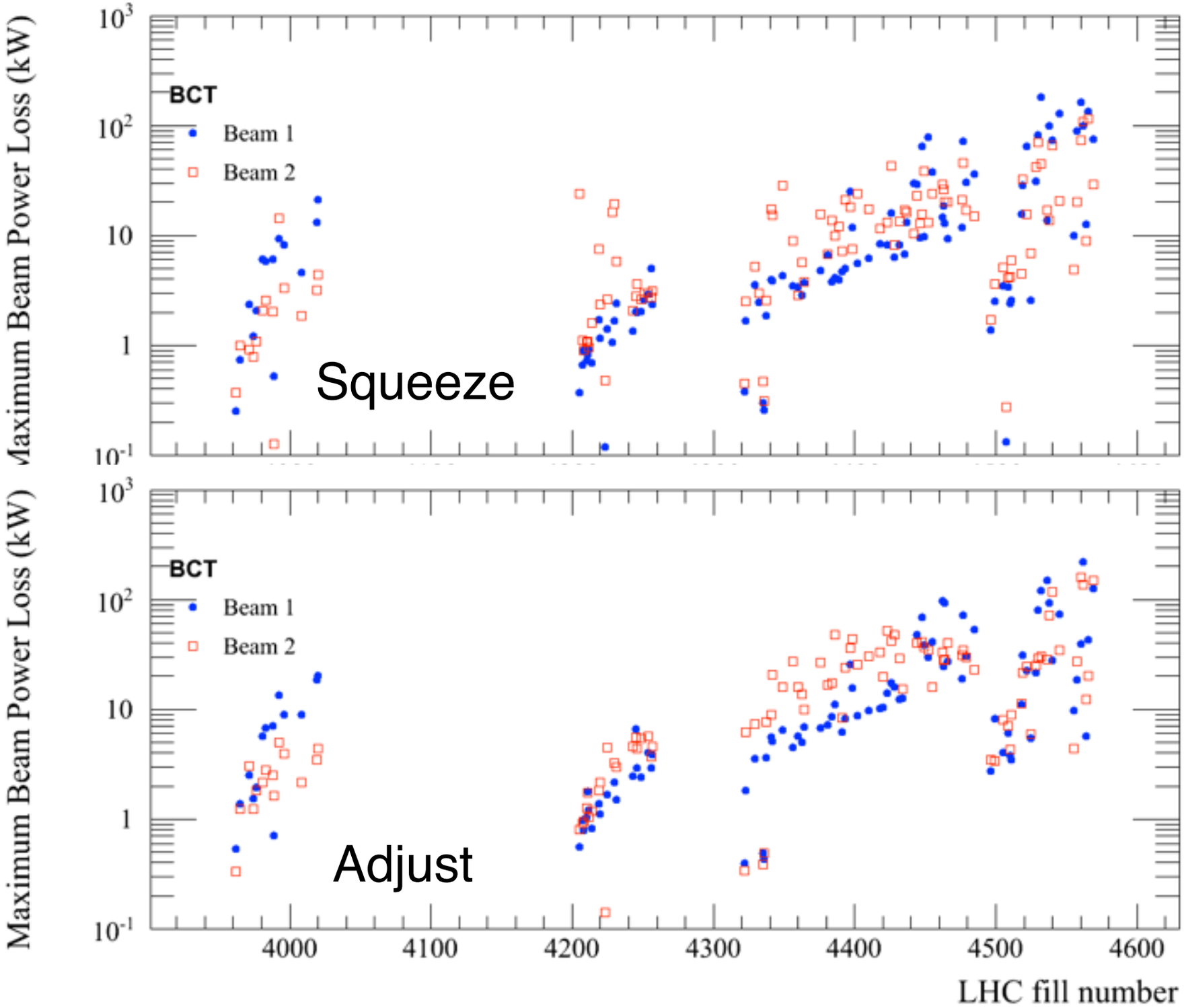

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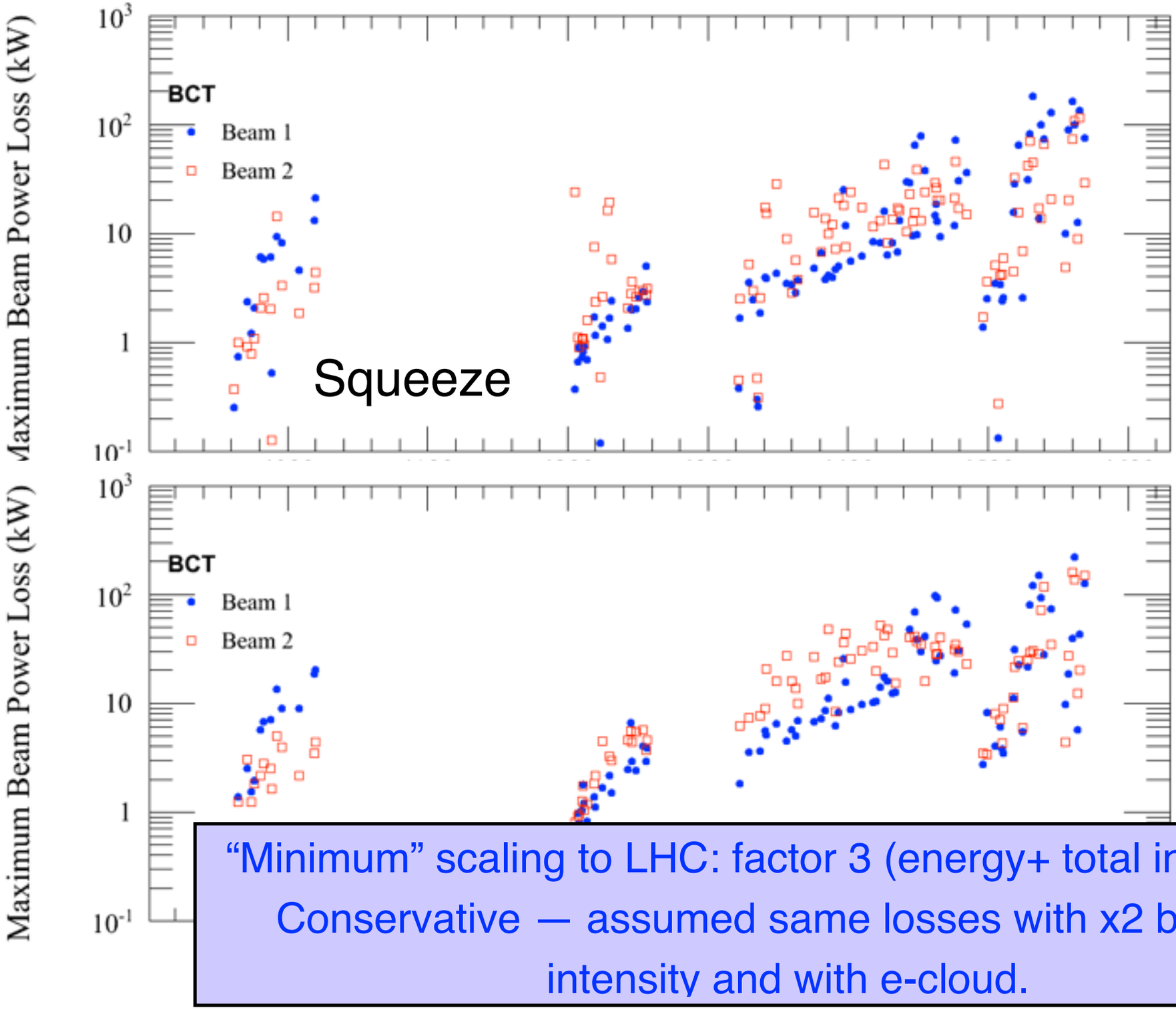

"Minimum" scaling to LHC: factor 3 (energy+ total intensity)
Conservative — assumed same losses with x2 bunch intensity and with e-cloud.

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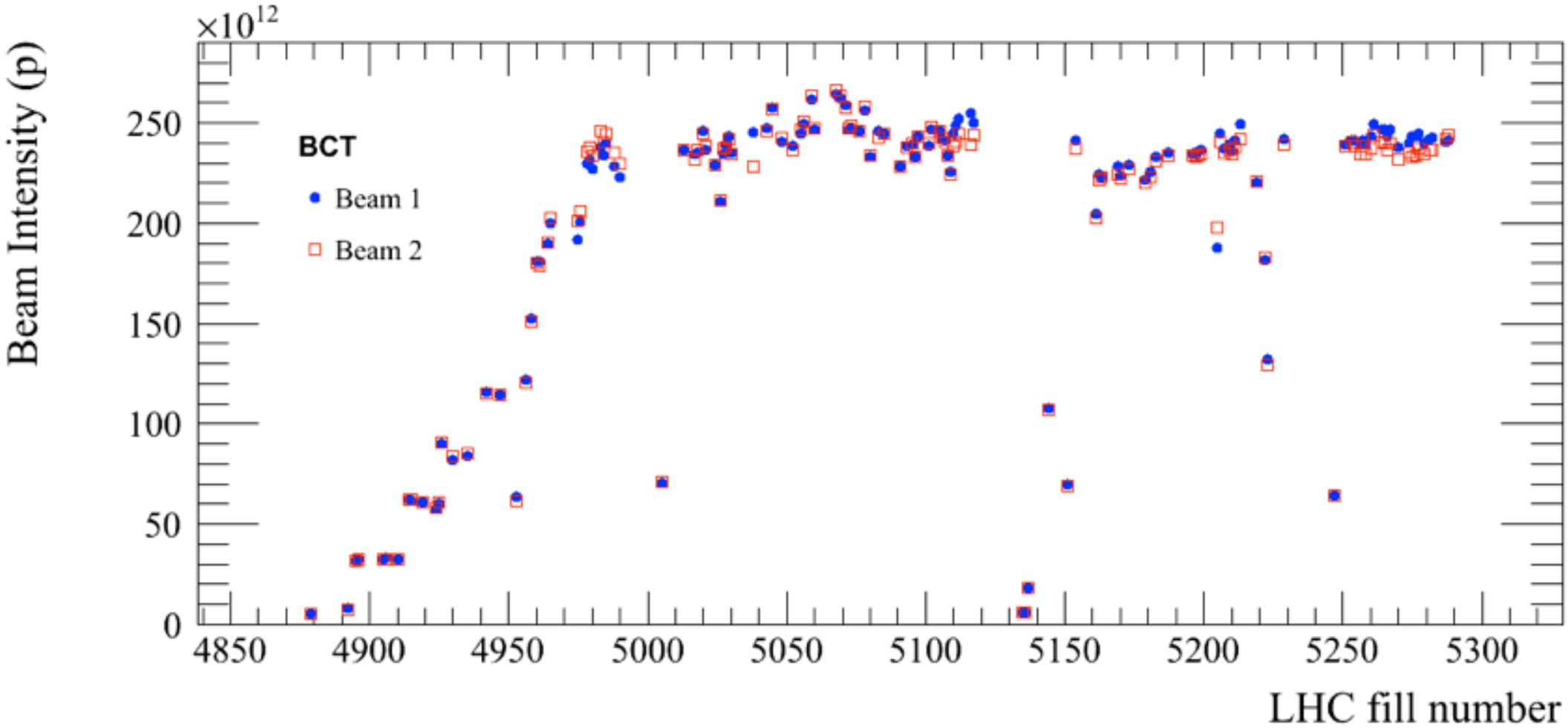

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BUT: betastar 2 times smaller (40cm vs 80cm in 2015)

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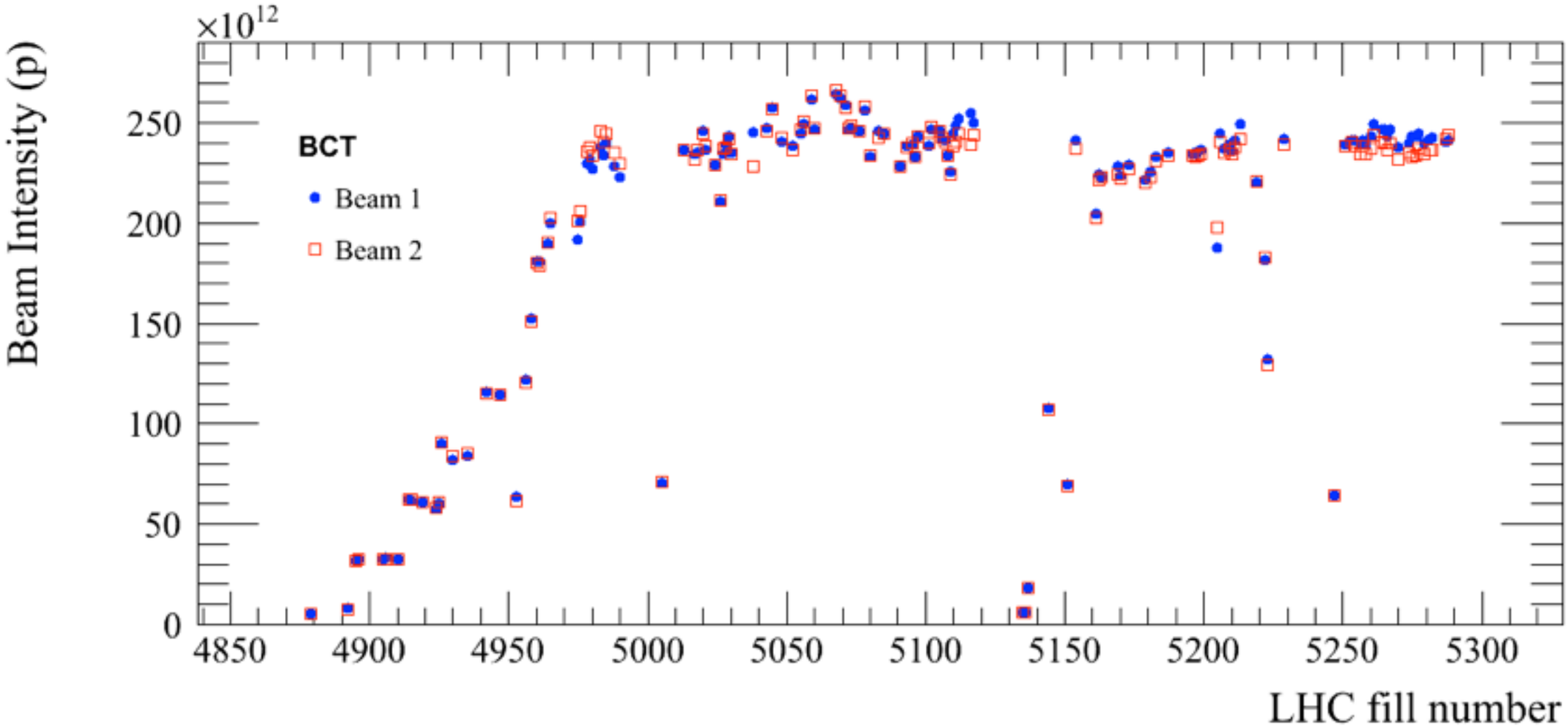

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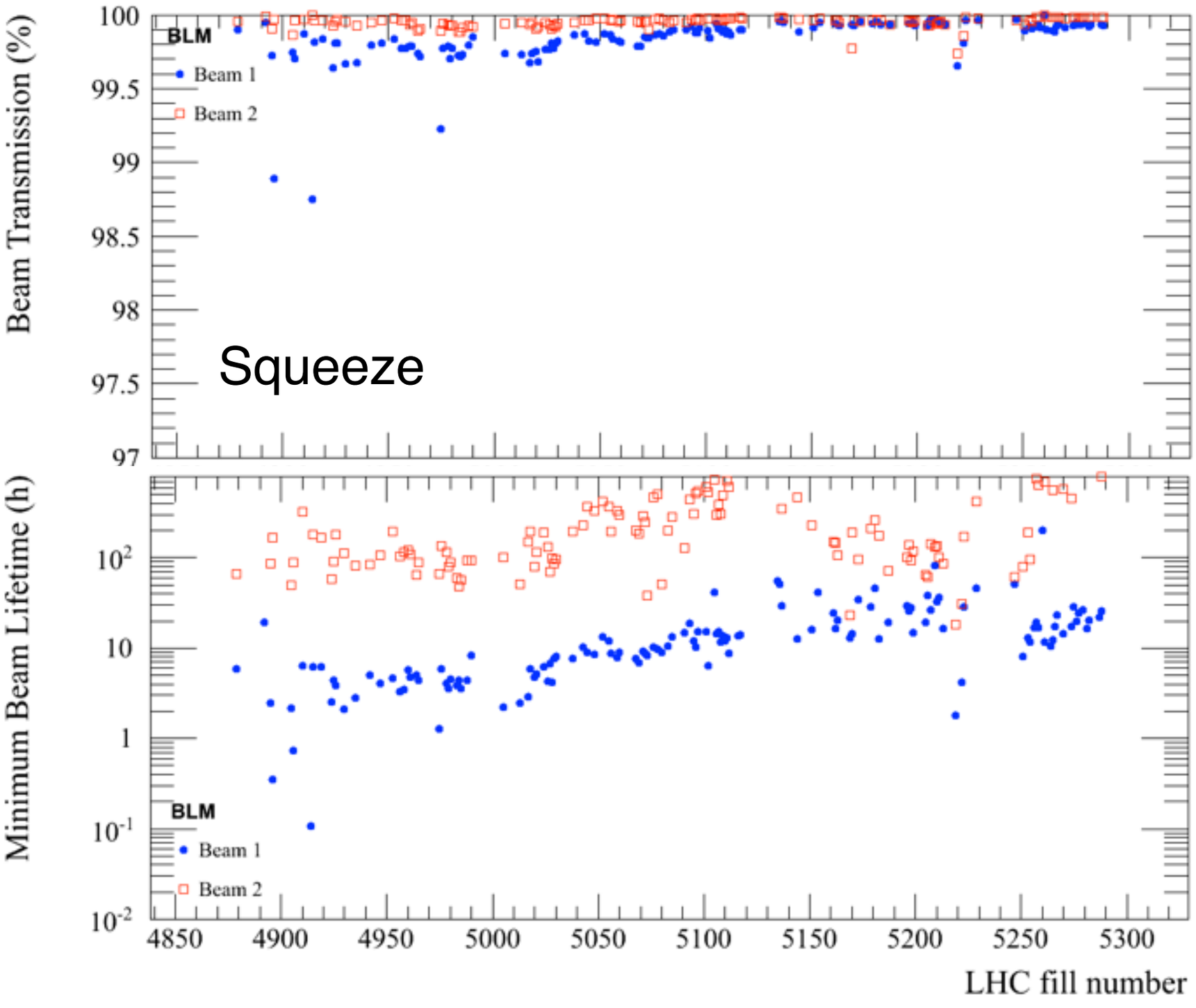

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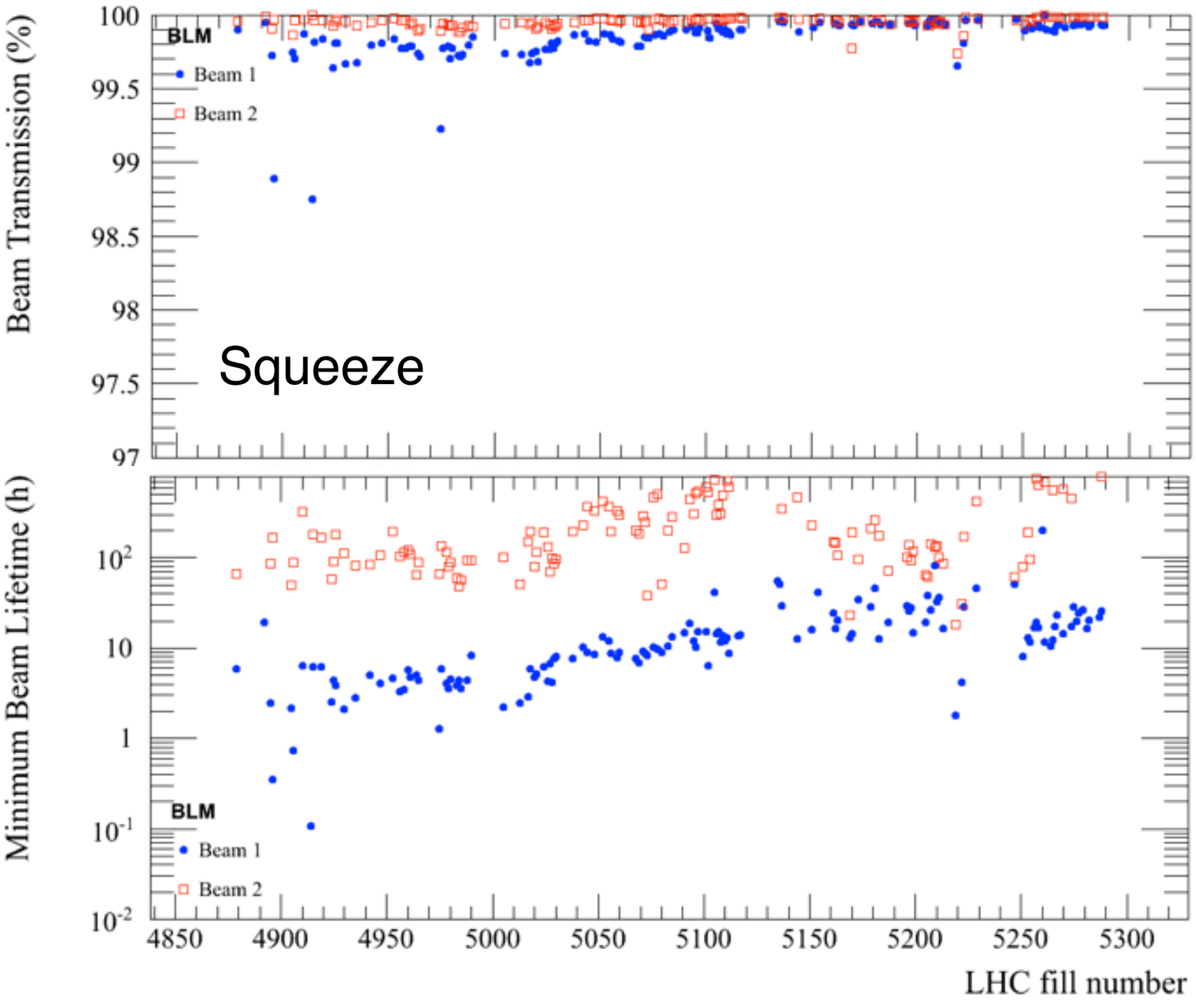

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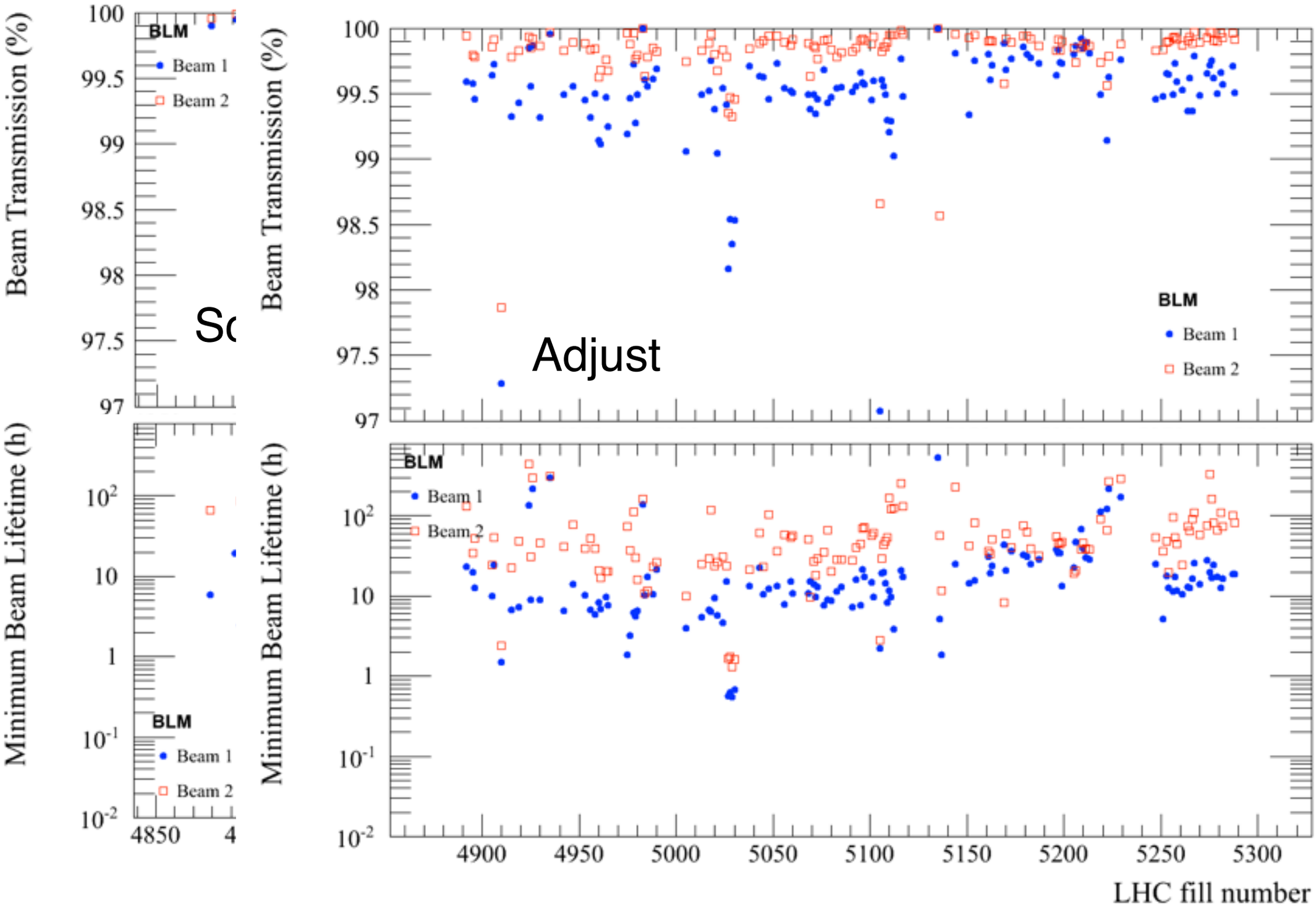

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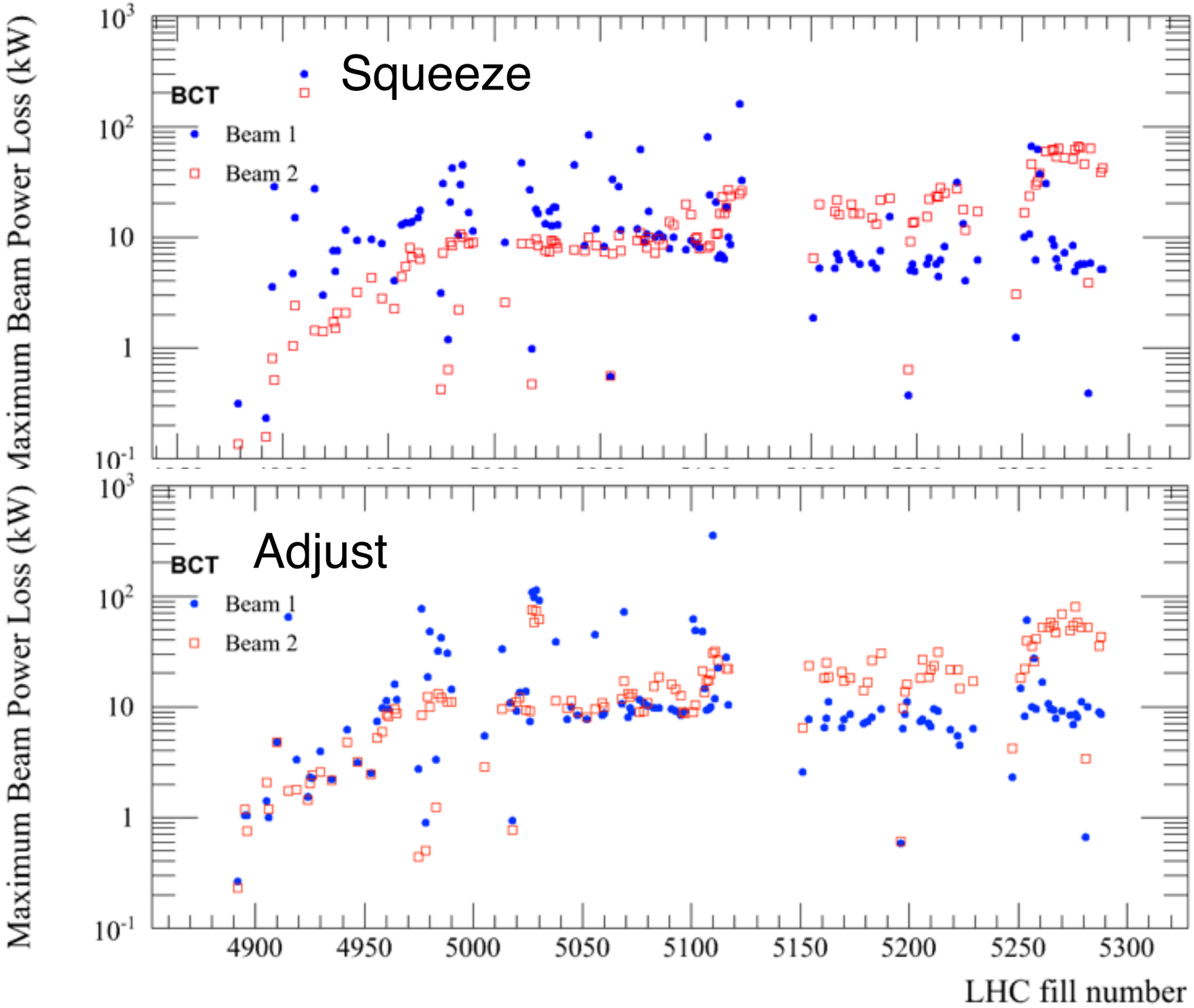

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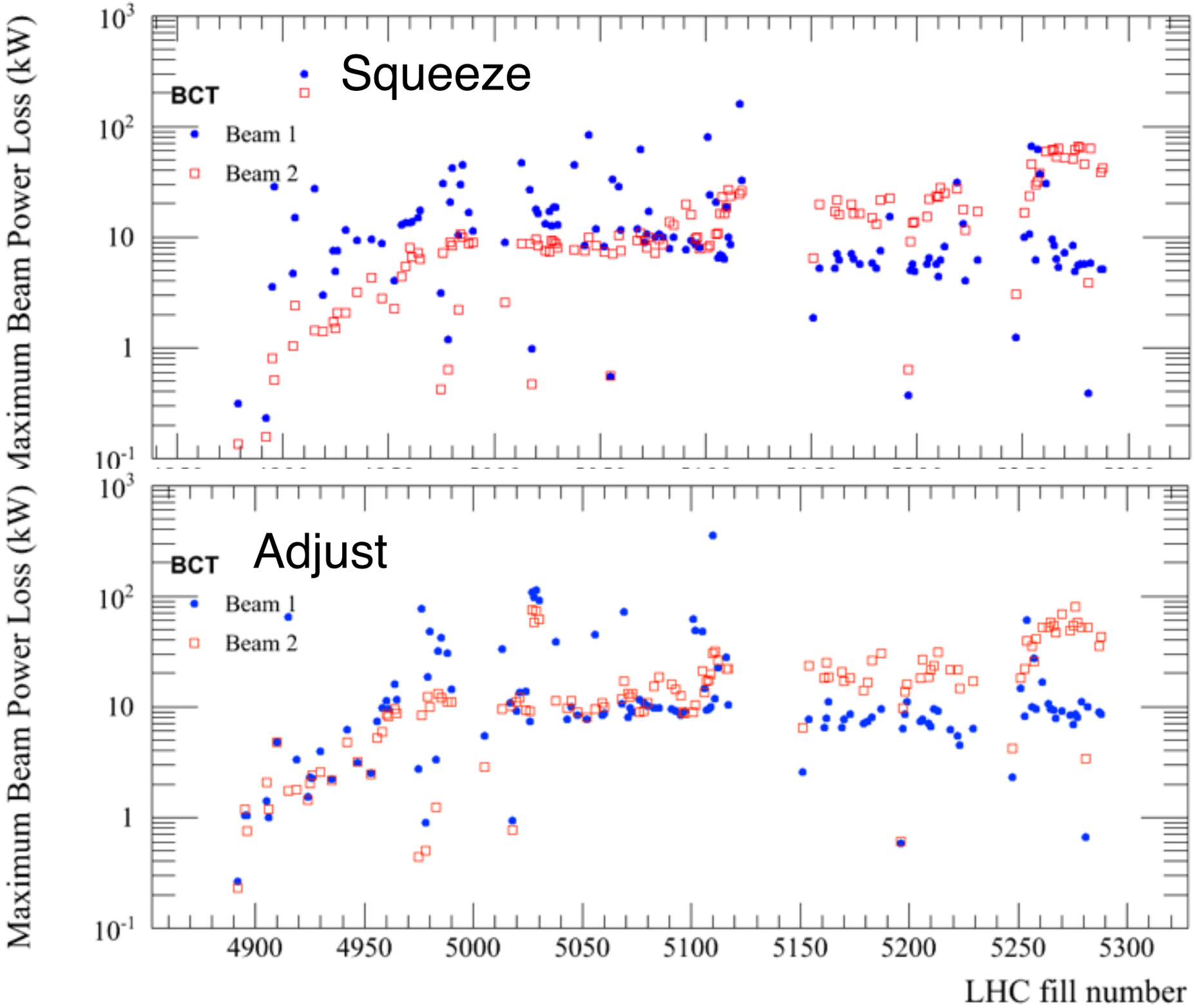

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  Other dedicate talk address specific aspects (halo population, BB, orbit…)
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