

# Crab cavities stability studies: updated model

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# Outline

- 1 Introduction
- 2 Impact of all Crab Cavities on HL-LHC
  - HOMs
  - Growth rates
- 3 Conclusions and Outlook

# Introduction

The DQW and RFD crab cavities HOM table has been recently updated (see on <http://cern.ch/imp/HLLHC.htm>)

→ The stability study campaign is restarted accounting for the new HOM distribution:

- Differences between old and present HOM table.
- Effect of fundamental mode at 400 MHz.
- Effect of spreading the modes within  $\pm 3$  MHz.
- Effect of the HOMs taken one by one versus HLLHC baseline in terms of risetime.
- Effect of all the HOMs versus HLLHC baseline in terms of risetime.
- Effect of all the HOMs versus HLLHC baseline in terms of threshold stabilizing octupole current.

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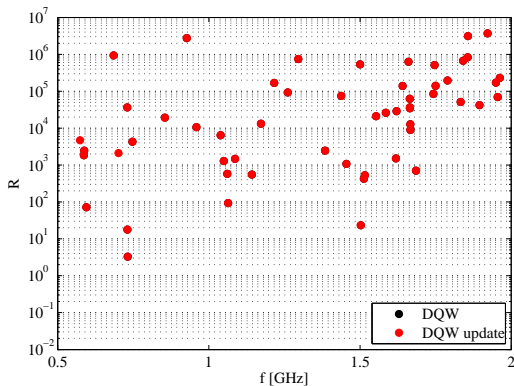
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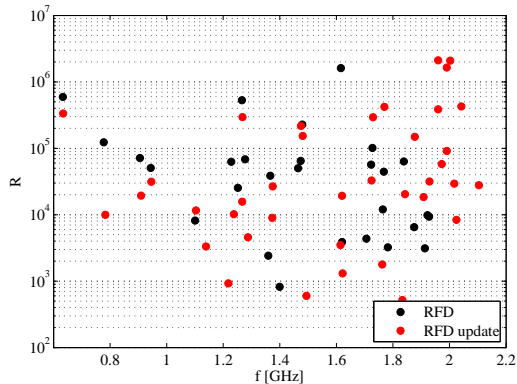
A limited subset of studies has been completed: work still in progress.

PS: the bunch length has been updated to 8.1 cm.

# DQW HOMs

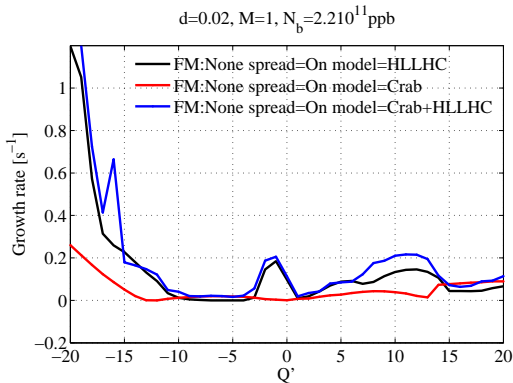


# RFD HOMs



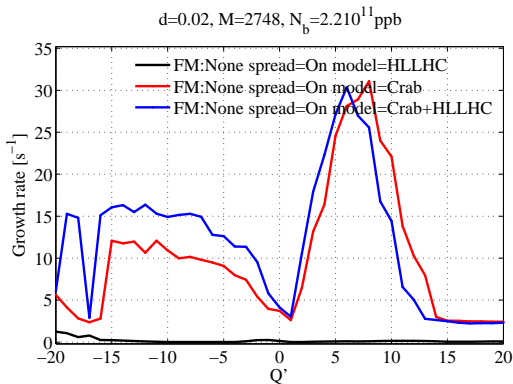
# Growth rates without FM, Single bunch

Single bunch growth rates with updated DQW impedance model and HOM spread, 50 turns damper.



# Growth rates without FM, 2748 bunches

Coupled bunch growth rates with updated DQW impedance model and HOM spread, 50 turns damper..





# Conclusions and Outlook

## Conclusions:

- The Crab cavities impedance generally increases the HLLHC baseline growth rate both in single bunch and coupled bunch.

## Outlook:

- Accurately specify a threshold limit on the R vs frequency plot based on the SD diagram.
- Compare optics of 15cm / 70cm / 45cm. [high priority]
- Study the case of only half of crab cavities (mixed IP1 and IP5). [high priority]
- Check if the  $\beta$  function at the crabs are similar.
- Produce stabilizing octupole currents Vs chromaticity.
- Infer the  $\beta^*$  that grant stability.
- Study the case of stronger damper of 25 turns.