



# HL-LHC 7 TeV instabilities: impedance model with crab cavities – continued

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- We extend the previous wake table by the full table of specified HOMs

## HL-LHC impedance webpage

- [Current impedance model](#)

### Current impedance model:

- Contributions taken into account, with the corresponding parameters used:
  - Collimators: [parameters, settings and beta functions](#) (from R. Bruce),
  - Resistive-wall impedance from beam-screens and warm vacuum pipe: [parameters, weld factor applied to RW impedance for the new triplets beam screens](#) (from C. Zannini), [weld factor applied to RW impedance for the other beam screens](#) (from C. Zannini),
  - Broad-band contributions in the new triplets: [parameters for resonator models](#).
  - Higher order modes (resonator models): [general parameters](#), HOMs for the new **ATLAS** & **CMS** cavities (from R. Wanzenberg and O. Zagorodnova), HOMs for **ALICE** & **LHCb** cavity (from B. Salvant), HOMs for **RF cavities** (from CERN note SL 98-008),
  - Pumping holes in the beam screens: [parameters](#).

### 16 crab cavities:

Type	before revision	after revision	comparison
ODU crab cavities	<a href="#">HOM table</a>	<a href="#">HOM table (edms page)</a>	R, R/Q, Q
RFD crab cavities	<a href="#">HOM table</a>	<a href="#">HOM table (edms page)</a>	R, R/Q, Q

### NB:

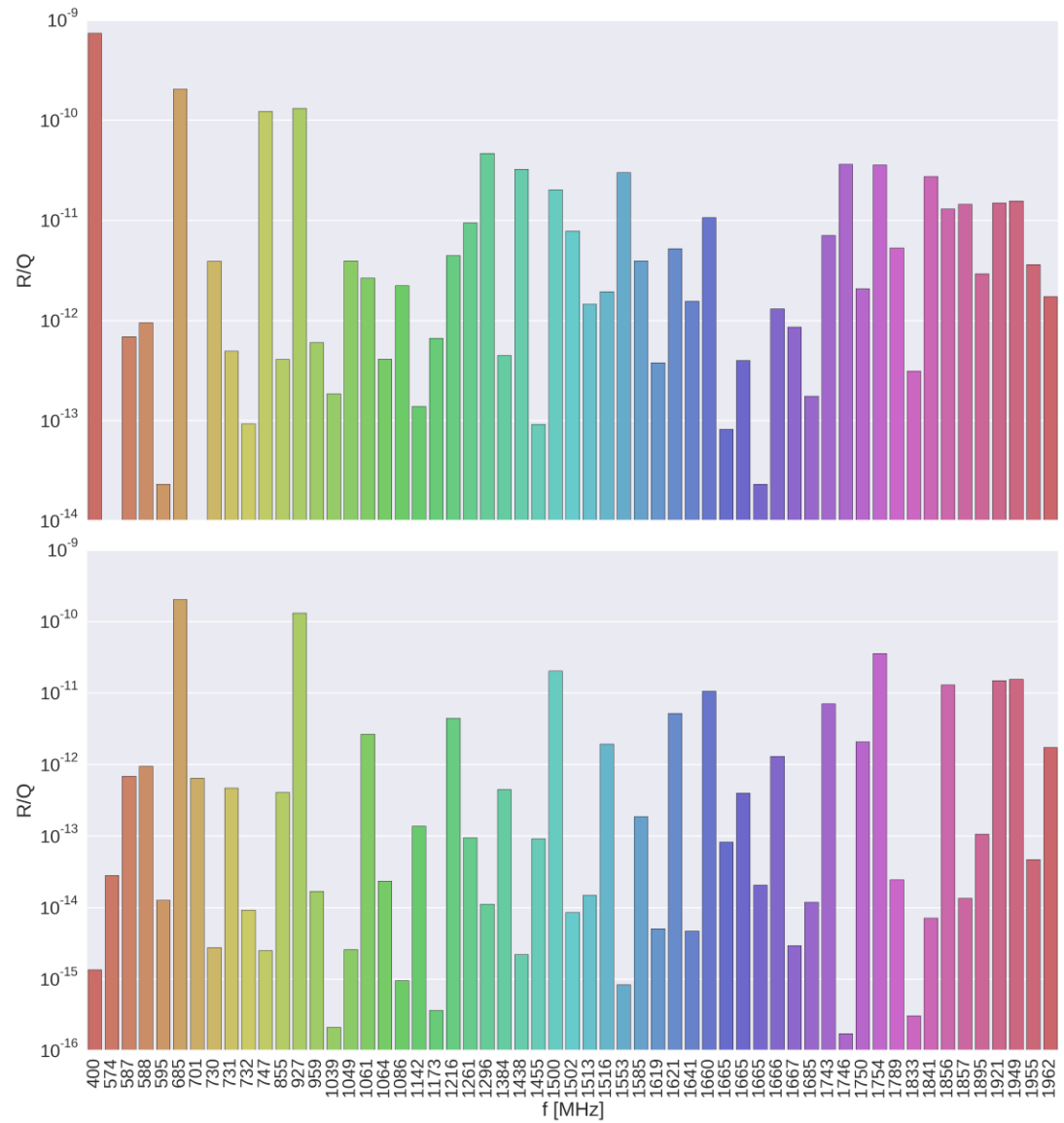
- the tables account for longitudinal and dipolar modes (R, Q, f).
  - the shunt impedance is divided by half since we have crabs kicking in both H and V planes and the HOMs would get exchanged. Therefore having N crab cavities we have N/2 H modes and N/2 V modes which is the same as having  $N \cdot (H+V)/2$  modes.
  - the fundamental mode at 400 MHz is feedback-ed.
  - the updated HOMs values are rearranged from the EDMS files. For the SLAC cavity we assumed that the fundamental mode is unchanged.
- Wire compensator (embedded in a tertiary collimator - cf. R. Steinhagen): [parameters](#).

# HOMs for BNL and SLAC crab cavities

BNL

R/Q

BNL updated

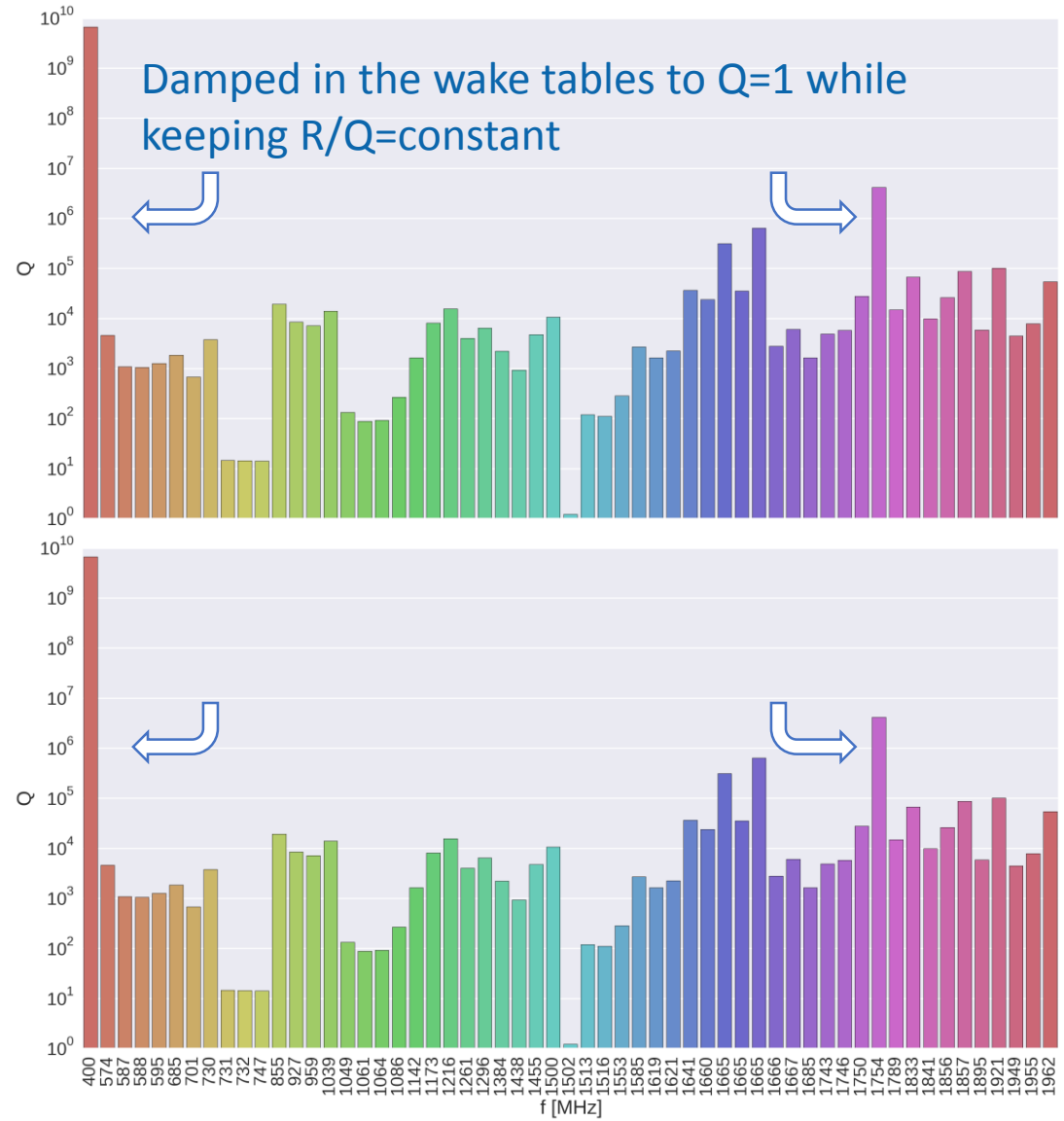


# HOMs for BNL and SLAC crab cavities

BNL

Q

BNL updated



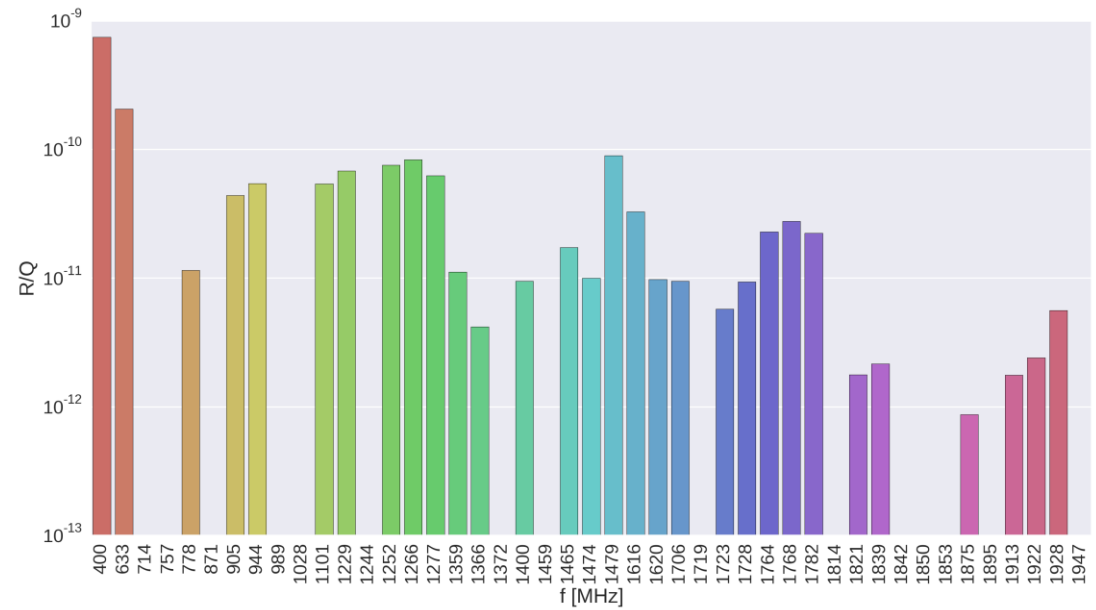


# HOMs for BNL and SLAC crab cavities

SLAC

R/Q

BNL updated

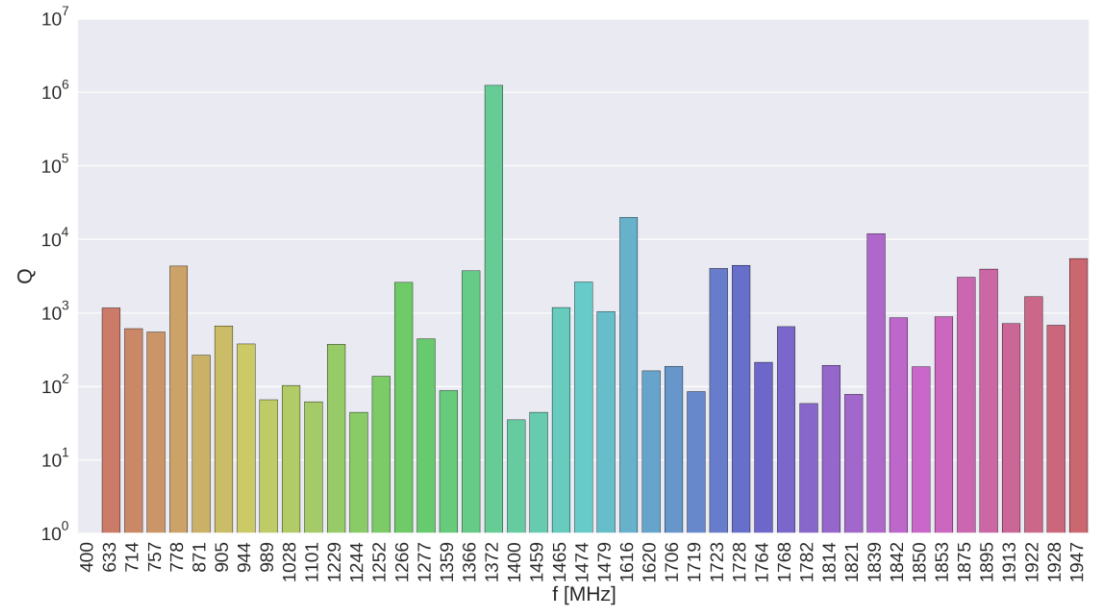


# HOMs for BNL and SLAC crab cavities

SLAC

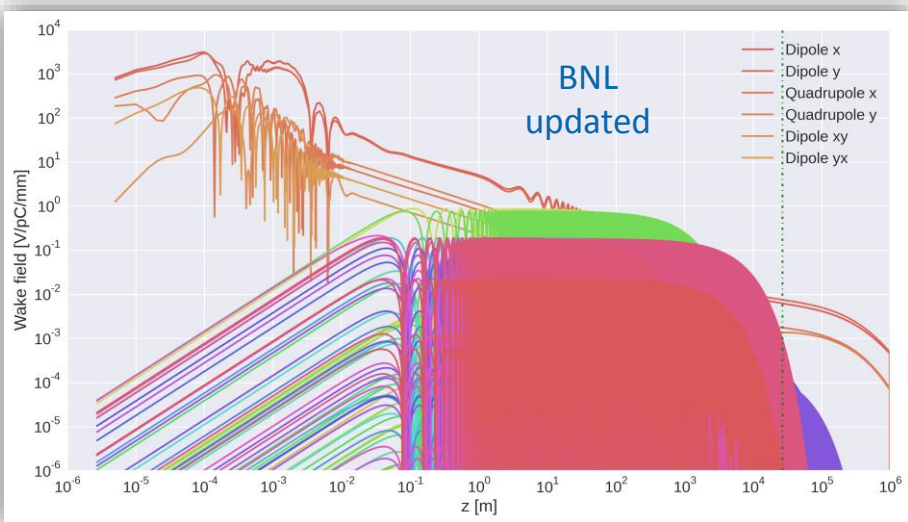
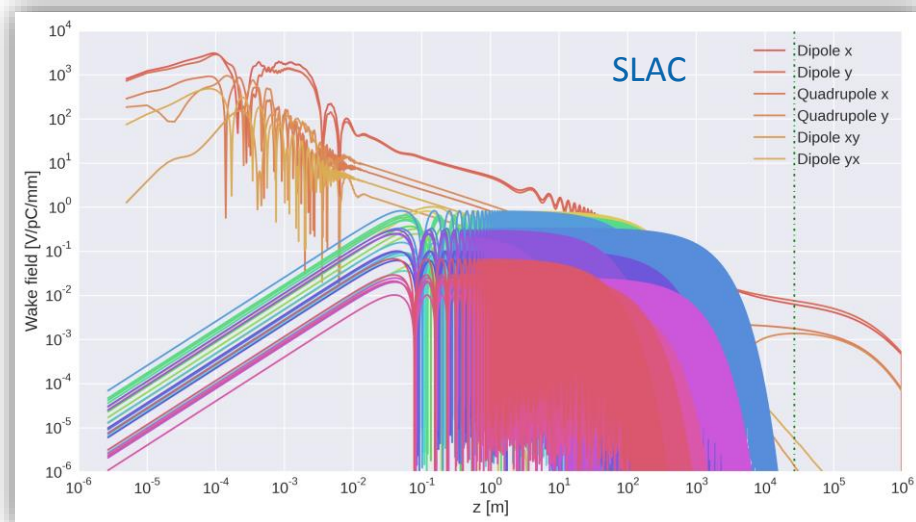
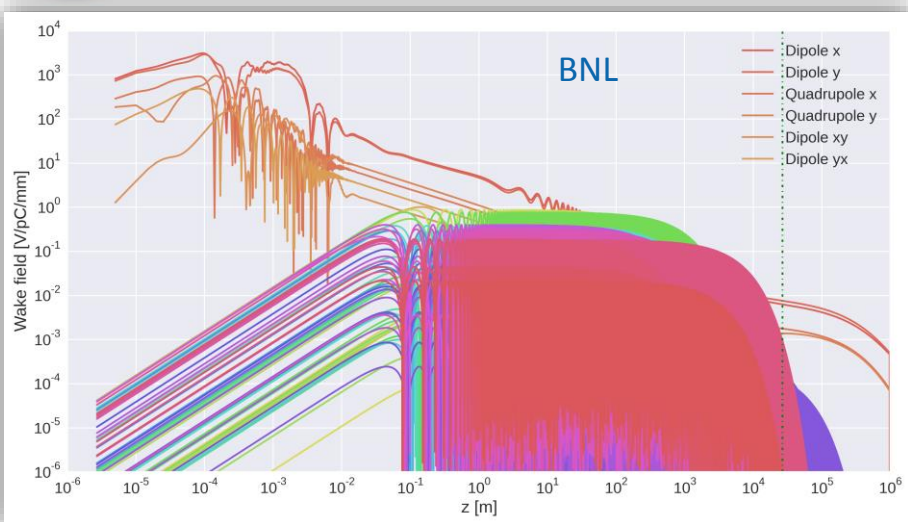
Q

BNL updated

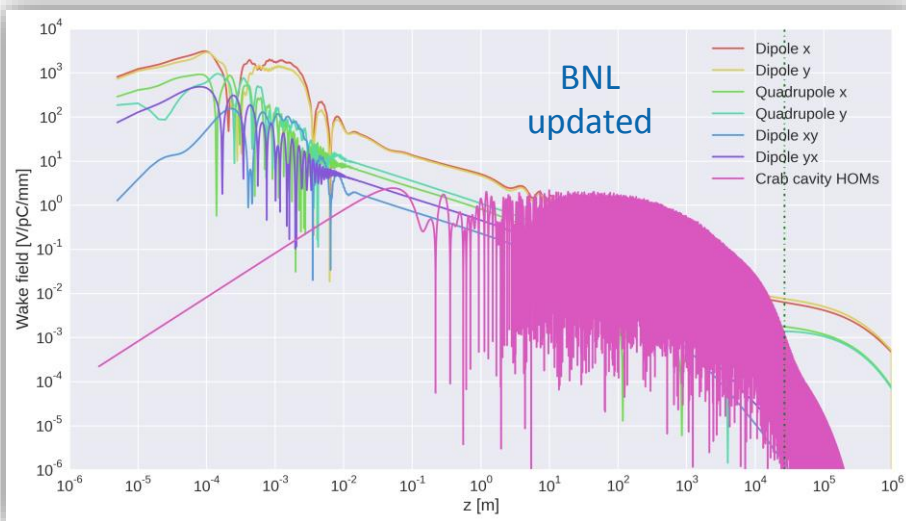
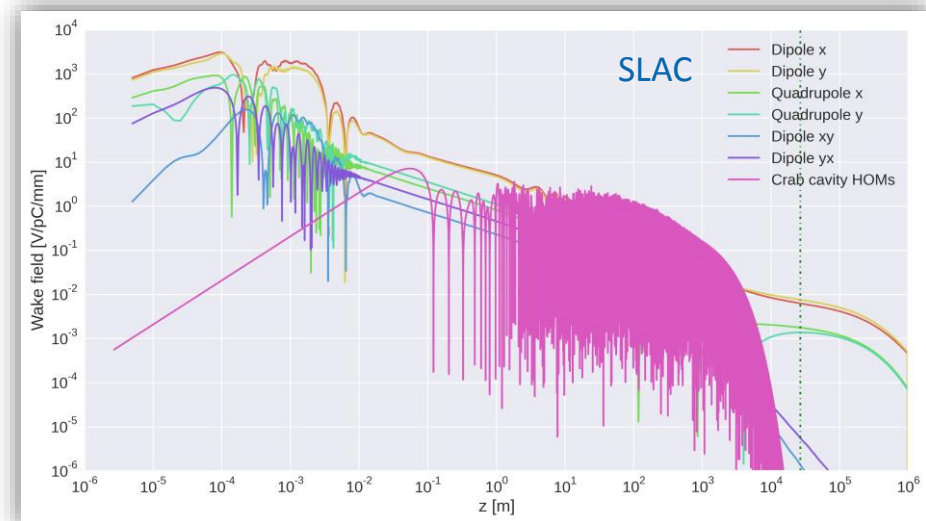
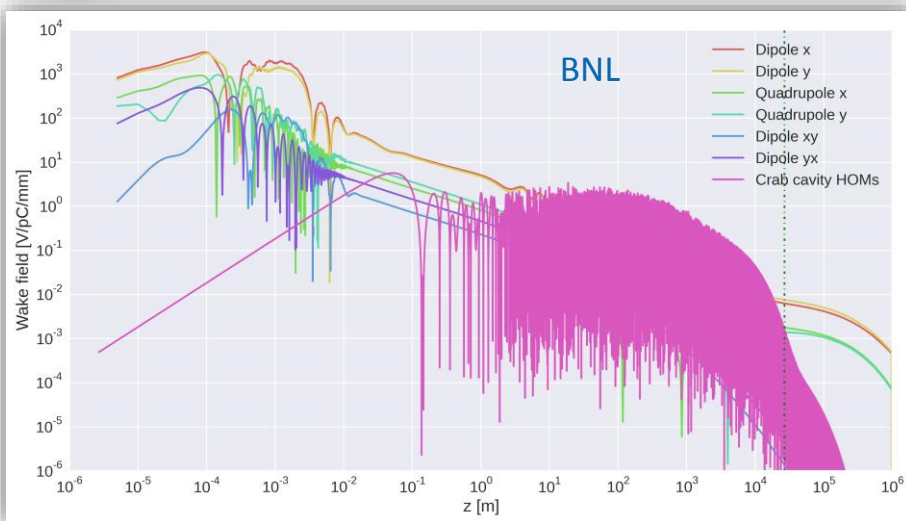




# Wakes for BNL and SLAC crab cavities



# Wakes for BNL and SLAC crab cavities



Macroparticles	1 000 000
Slices	500
Turns	300 000
Damping time	50 turns
Energy	7 TeV
$\alpha$	3.225e-4
$Q_x$	62.31
$Q_y$	60.32
$\beta_x$	70 m
$\beta_y$	70 m
$Q'_x$	0
$Q'_y$	0
$\varepsilon_x$	2.5 $\mu\text{m}$
$\varepsilon_y$	2.5 $\mu\text{m}$
$\sigma_z$	8.1 cm

- Use these 4 wake tables together with the current HL-LHC impedance model (HL-LHC\_15cm\_7TeV\_5umMo+MoC\_IP7\_TCT5)
- Scan
  - Intensity [2.3e11, 3e11, 4e11, 5e11]
  - Chroma [-20...20]
  - Damper gain [25, 50, 250, 5000]
- Study & compare instability rise times

- We prepared a set of wake tables taking into account the most recent full HOM model for the crab cavities.
- These wake tables will be used in conjunction with the HL=LHC impedance model for beam dynamics simulations.



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