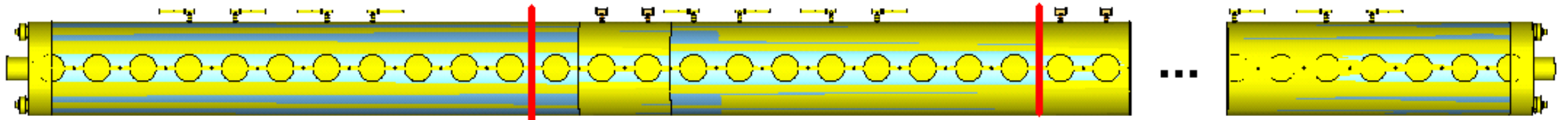


# Transverse HOM damping in the 200MHz TWC

P. Kramer, J. Repond

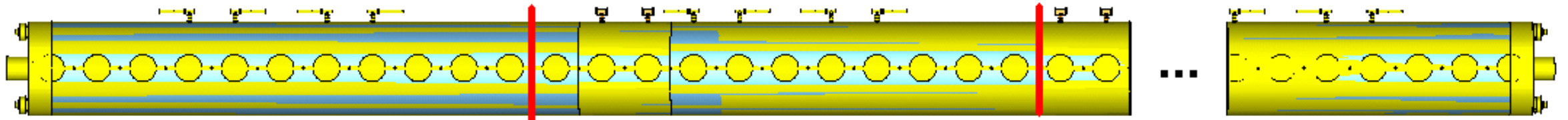
# Present configuration in the tunnel

- Two 4-section cavities
- Two 5-section cavities
- 460MHz **transverse** HOM couplers (4 per cavity)
- 628MHz **longitudinal** HOM coupler (4 per section)
- 938MHz **transverse** HOM coupler (0-3 per section)



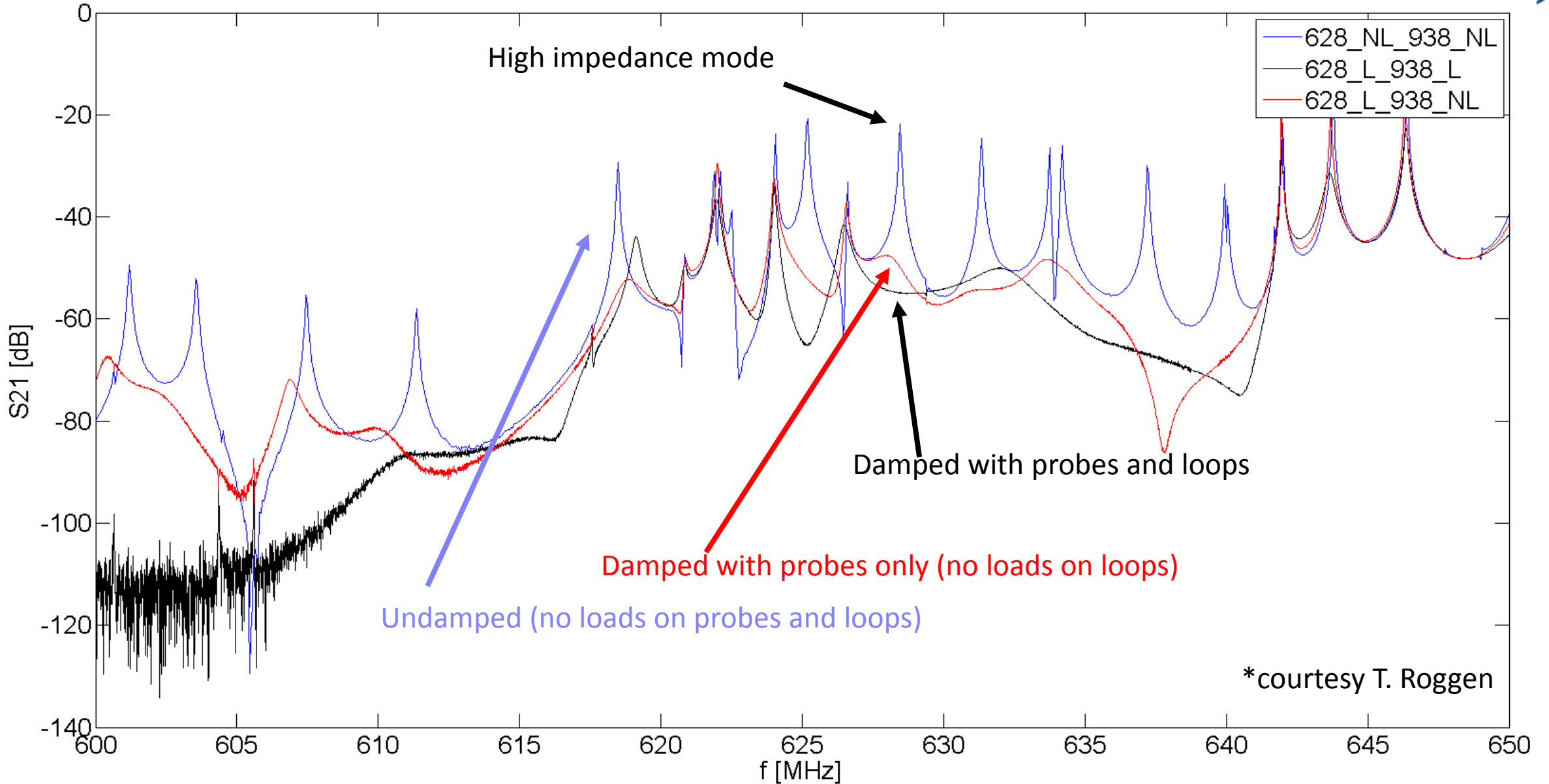
# 628MHz impedance

- Considered most deteriorating HOM regarding beam stability
  - Further significant damping required for LS2
- Existing 628MHz HOM couplers damp already very well
- Further improvements are difficult to achieve
- **Possible option:** Couple to the magnetic field in the positions of the 938MHz transverse couplers (via it's coupling loops)

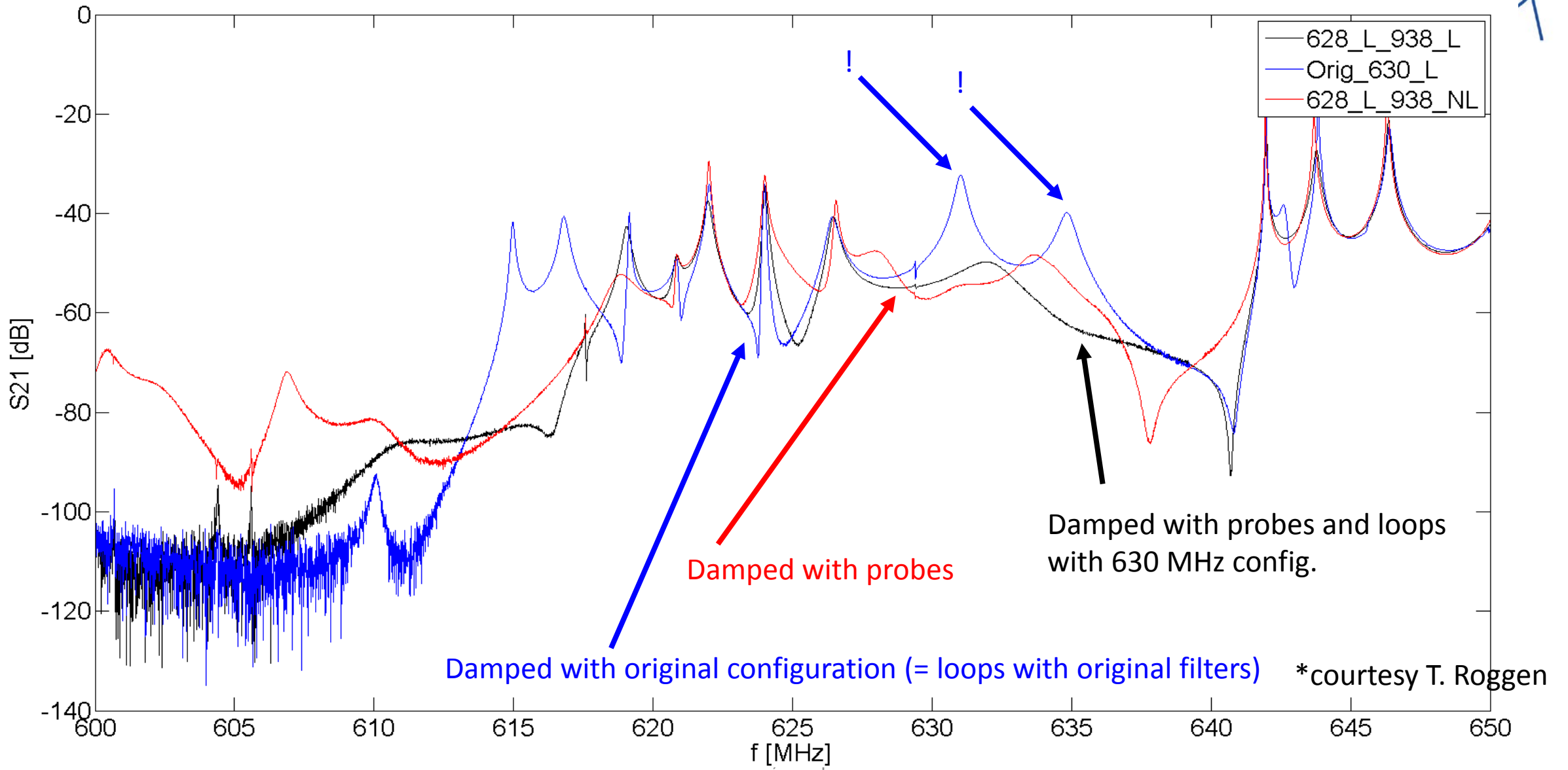


➔ Test measurements in the lab on a single-section cavity

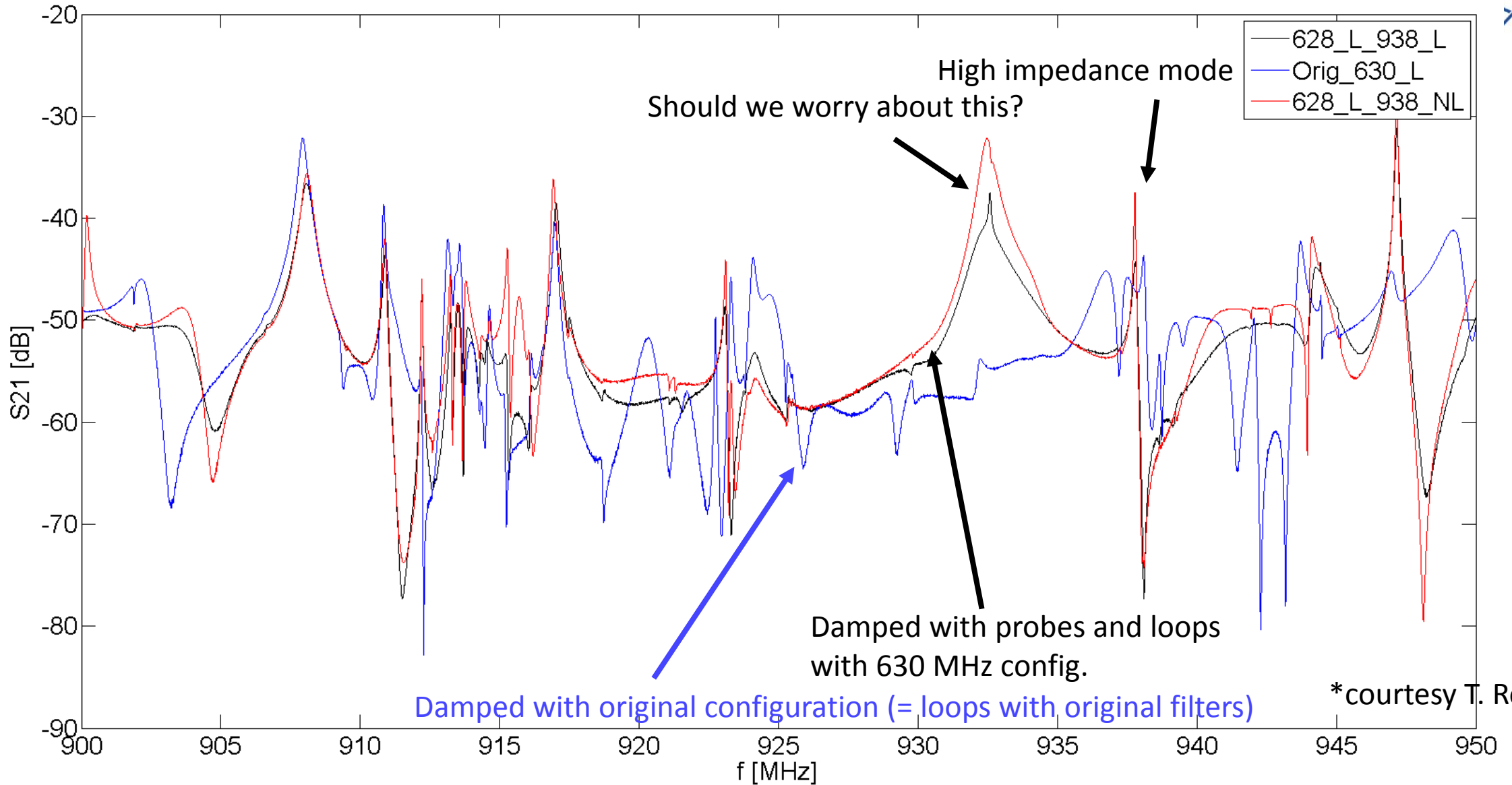
# Improvements in 600MHz range 1



# Improvements in 600MHz range 2



# Effects in the 900MHz range





# Transverse impedance

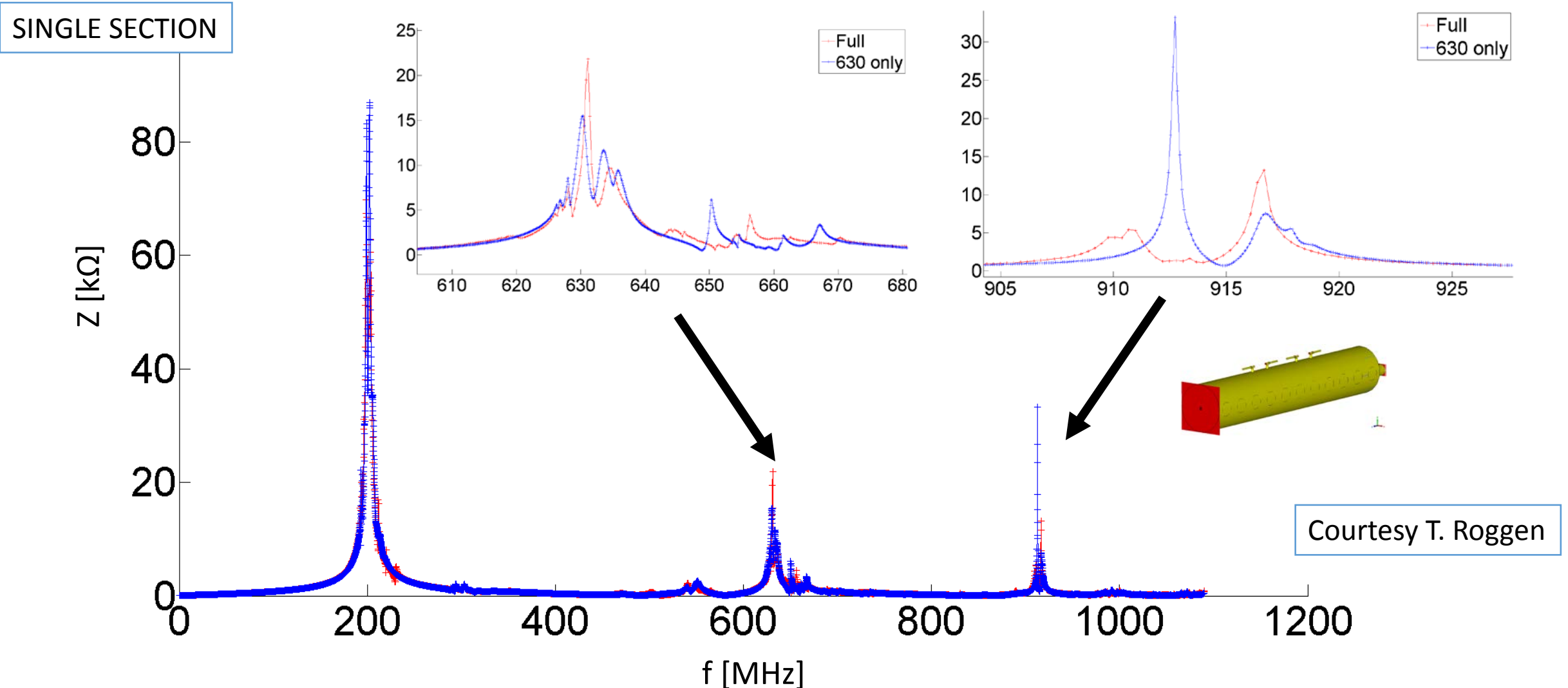
- Which values of transverse impedance are acceptable in the SPS?
- Which values of transverse impedance are acceptable in the 200MHz TWC?
  - What are the critical transverse resonances in the ranges 460 & 940MHz
- How much less damping of 938MHz mode is acceptable?
  - E.g. when replacing with a combined coupler for both 628&938MHz modes





# Transverse coupler at 938 MHz acts on longitudinal impedance:

- Damp the longitudinal HOM at 914 MHz ( $\sim \times 0.15$ )
- Enhance the longitudinal HOM at 628 MHz ( $\sim \times 1.4$ )

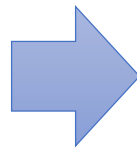
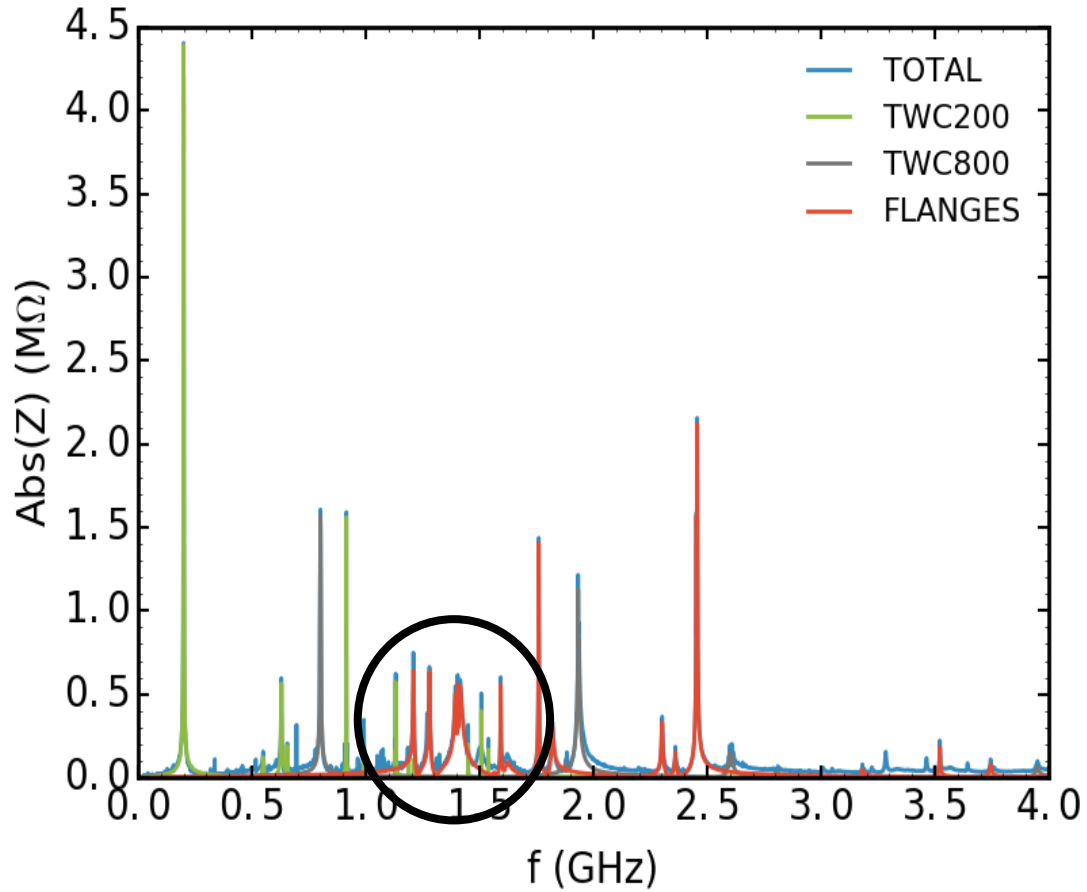


# Longitudinal stability – Transverse coupler off

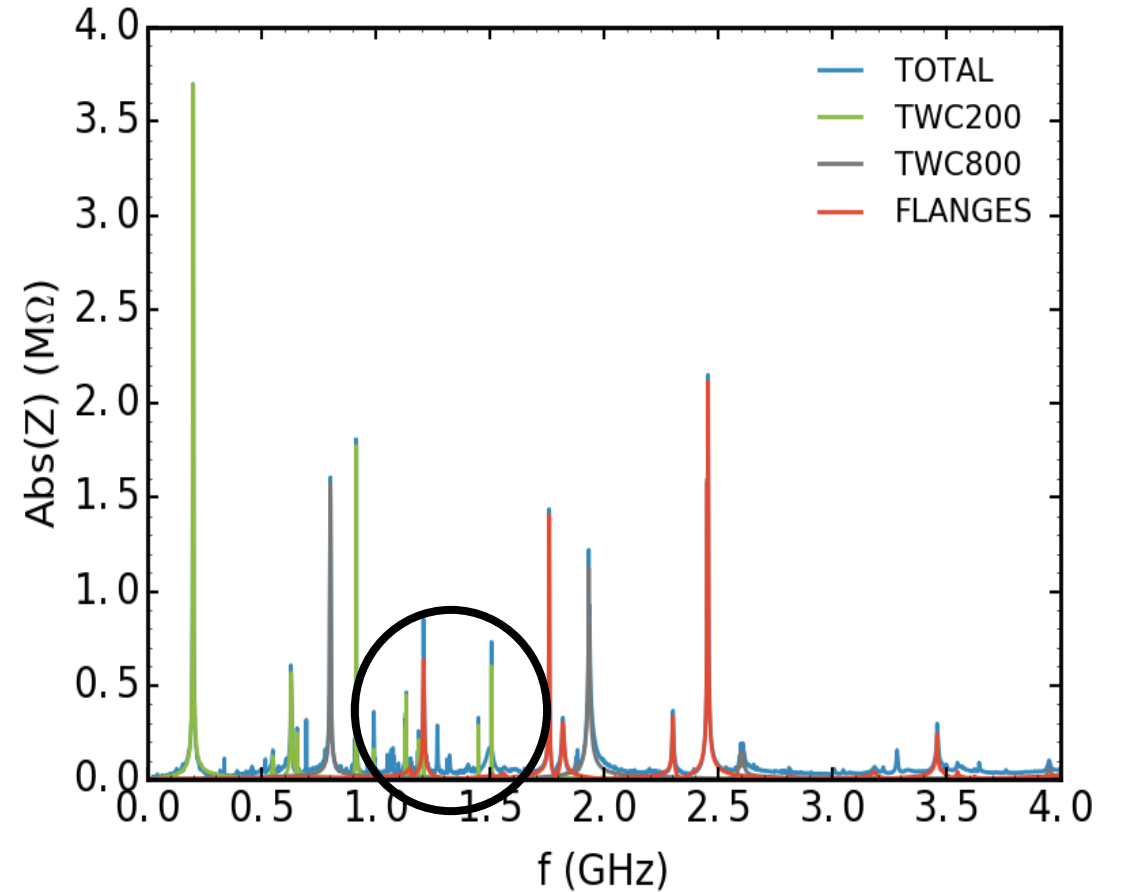
- 628 MHz HOM critical for long. stability.
- Changing the filter on transverse 938 MHz coupler:
  - 628 MHz longitudinal HOM multiplied by 0.68.
  - 914 MHz longitudinal HOM multiplied 6.6.
- Simulations on SPS FT, 72 bunches, double RF: 10 MV + 1 MV and LIU baseline longitudinal impedance model.

# Impedance model

PRESENT

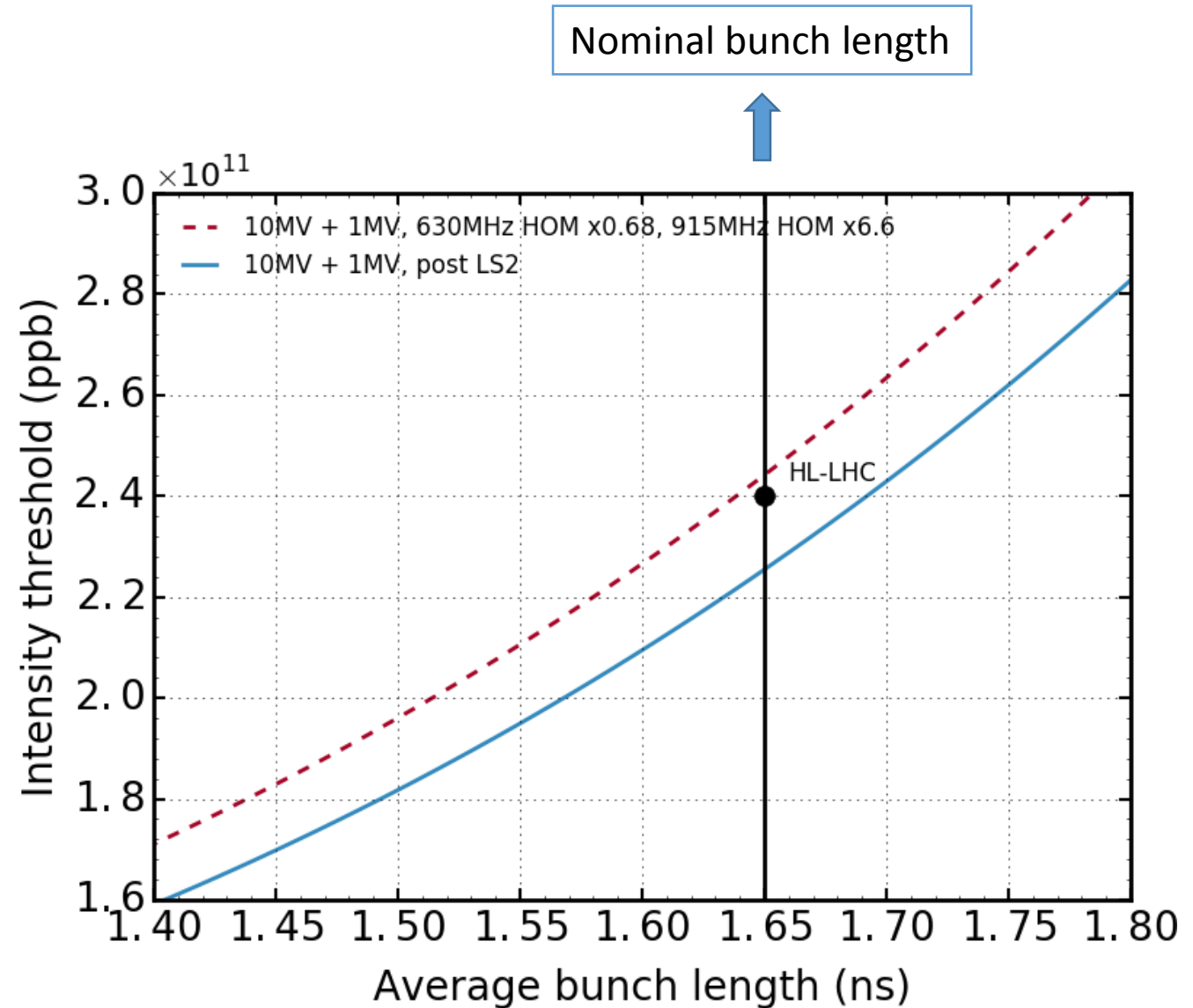


FUTURE



# Longitudinal stability – Transverse coupler off

- 628 MHz HOM critical for long. stability.
- Changing the filter on transverse 938 MHz coupler:
  - 628 MHz longitudinal HOM multiplied by 0.68.
  - 914 MHz longitudinal HOM multiplied 6.6.
- Simulations on SPS FT, 72 bunches, double RF: 10 MV + 1 MV and LIU baseline longitudinal impedance model.
- Longitudinal stability threshold increased by 10%.
- What about transverse stability?



# Thank you for your attention.

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## **Acknowledgements:**

- Thank to T. Roggen for the impedance study with CST and the countless fruitful discussions.
- Thank to R. Calaga to have suggested this study.
- Thank to E. Shaposhnikova for her help and suggestions.
- Thank to the BLonD team for the constant development and improvements of the code.

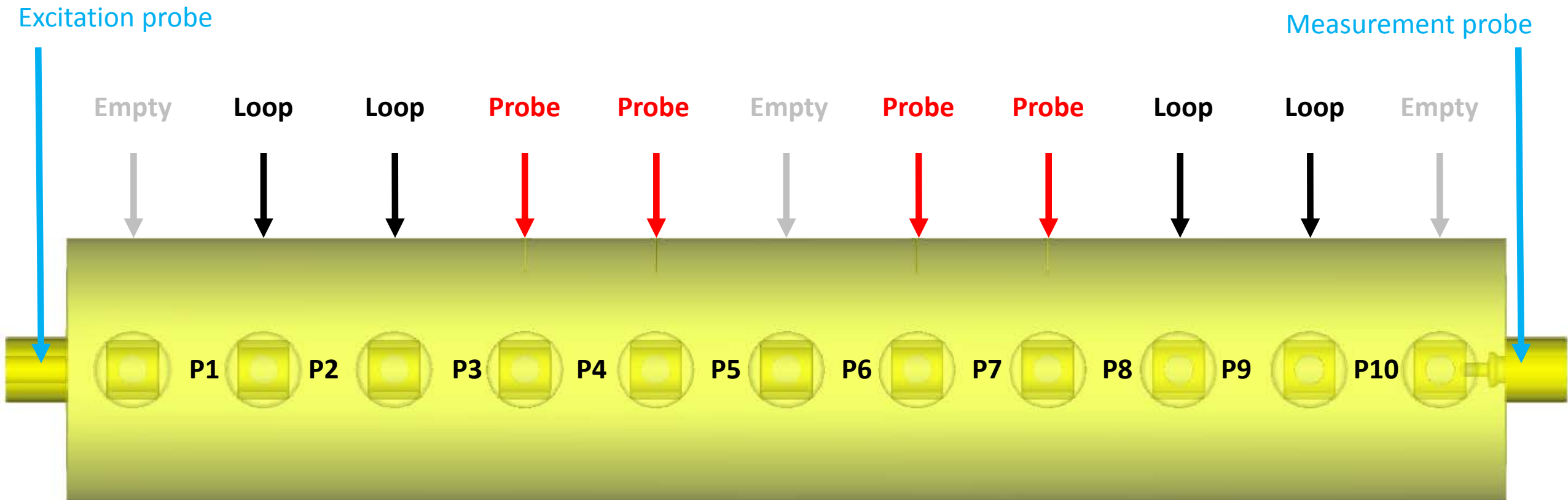


# 1section SP-measurements



- Single section in workshop
- On ALL couplers (loop & probe) a 630-filter unit was mounted (!)
- Measured:  $S_{21}$

\* slide by T. Roggen



# References



- [3] R. J. Lauckner, T. P. R. Linnecar. The Transverse Coupled Bunch Mode Instability at 940MHz in the SPS, September 1980.