Measurement of the TMCI threshold at flat-top in the LHC

D.Amorim, N.Biancacci, B.Salvant
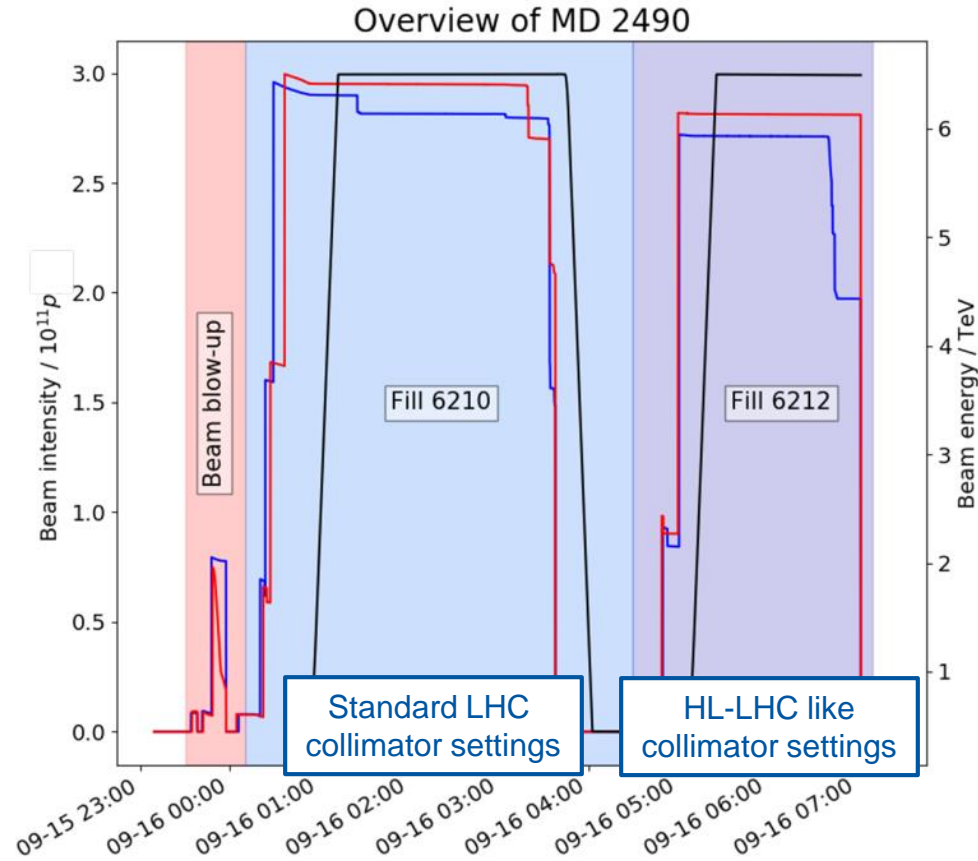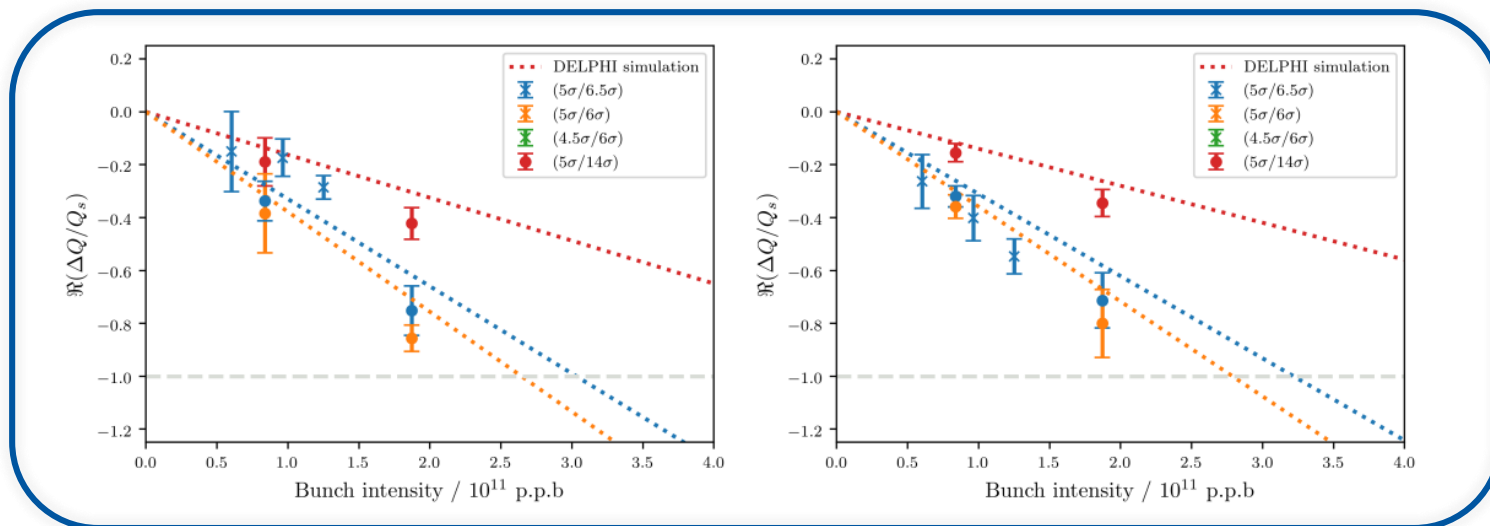
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Short summary of the "TMCI" MD

Objective: Measure the LHC extrapolated TMCI threshold from tune shift of bunches as a function of intensity at low chromaticity and computing crossing with the mode -1
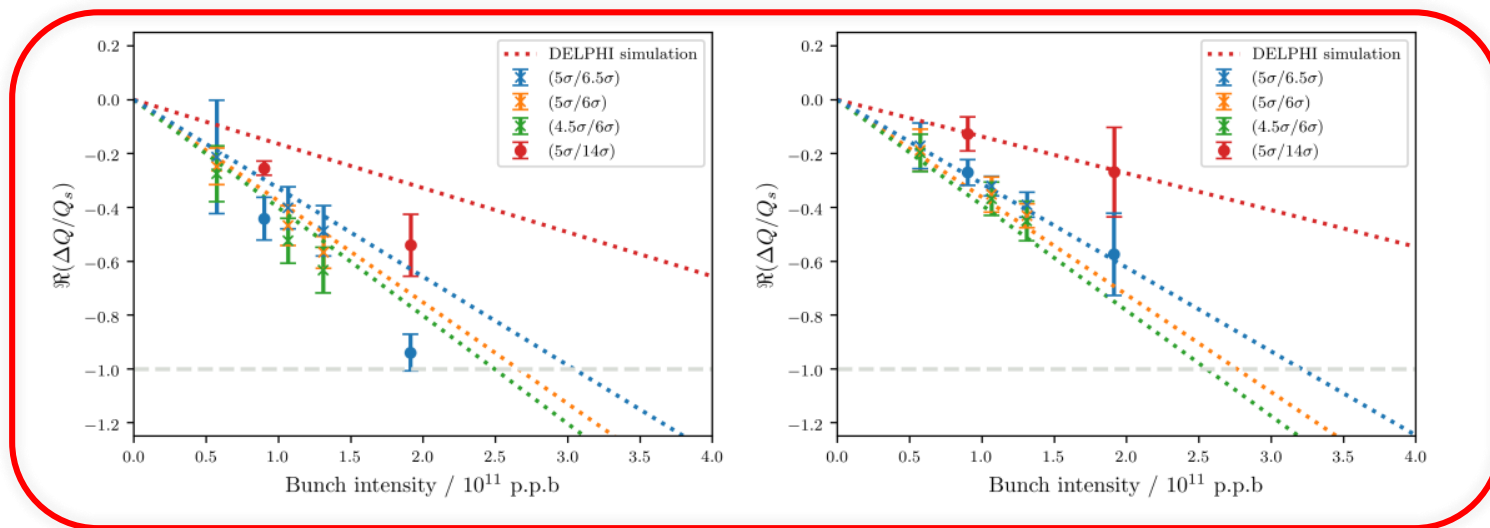

Overview of MD 2490

Measured tune shifts

B1

B2

Table in MD2490 note

Fill	Plane	Scenario	Tune shift / 10^{-12} p.p.b $\times Q_s$				
			Sim.	Corr. factor	Sim. w/ quad.	Measured	Ratio
6210	B1H	2 (5/6.5)	-4.1	0.81	-3.3	-2.2 ± 0.3	1.50
	B1V	2 (5/6.5)	-3.4	0.92	-3.1	-4.3 ± 0.4	0.72
	B2H	2 (5/6.5)	-4.0	0.82	-3.3	-3.8 ± 0.5	0.86
		3 (5/6.0)	-4.7	0.81	-3.9	-4.4 ± 0.4	0.89
		4 (4.5/6.0)	-5.0	0.81	-4.0	-4.9 ± 0.5	0.81
	B2V	2 (5/6.5)	-3.4	0.92	-3.1	-3.0 ± 0.2	1.03
		3 (5/6.0)	-3.9	0.93	-3.6	-3.3 ± 0.3	1.09
		4 (4.5/6.0)	-4.2	0.93	-3.9	-3.5 ± 0.4	1.11
6212	B1H	1 (5/14)	-1.9	0.86	-1.6	-2.3 ± 0.3	0.70
		2 (5/6.5)	-4.1	0.81	-3.3	-4.0 ± 0.4	0.82
		3 (5/6.0)	-4.7	0.81	-3.8	-4.6 ± 0.3	0.83
	B1V	1 (5/14)	-1.6	0.85	-1.4	-1.8 ± 0.2	0.77
		2 (5/6.5)	-3.4	0.92	-3.1	-3.8 ± 0.4	0.82
		3 (5/6.0)	-3.9	0.92	-3.6	-4.3 ± 0.4	0.83
	B2H	1 (5/14)	-1.9	0.86	-1.6	-2.8 ± 0.3	0.57
		2 (5/6.5)	-4.0	0.82	-3.3	-4.9 ± 0.3	0.67
	B2V	1 (5/14)	-1.6	0.85	-1.4	-1.4 ± 0.5	1.0
		2 (5/6.5)	-3.4	0.92	-3.1	-3.0 ± 0.4	1.03

Question from Gianluigi: what is the reason for the asymmetry between B1 and B2?

Detailed analysis
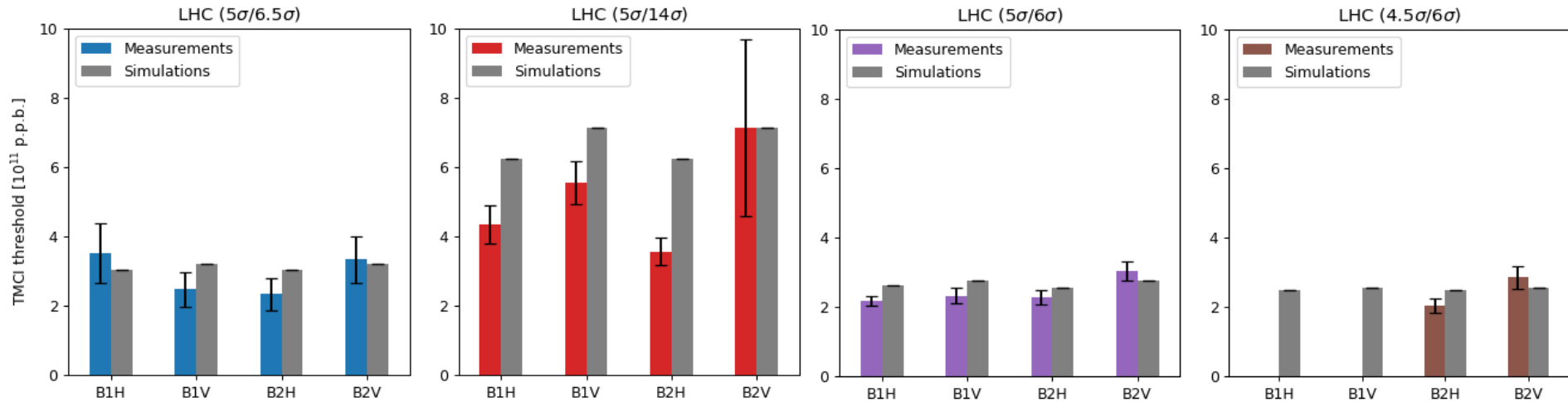
- **B2V**: close or slightly higher threshold w.r.t model
- **B1H, B1V**, **B2H**: lower threshold than model

	TMCI threshold (ratio to model)	
B1H	0.80 ± 0.06	
B1V	0.82 ± 0.03	**20-25% lower**
B2H	0.77 ± 0.14	
B2V	1.08 ± 0.03	**5-10% higher**

Summary and conclusions

Measurements of estimated TMCI threshold performed in the LHC.
- B1H/V and B2H show 20-25% lower threshold than model.
- B2V shows 5-10% higher threshold to model.

B2V difference consistent for all collimator settings to be further investigated.

Very little dataset as usual (4 points at max)
- additional tune shift and impedance localization measurements would help.