

# LHC Aperture Measurements

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# LHC Aperture Measurements

- LHC aperture measurements performed inducing orbit oscillations for different phases.
- Increased + and – amplitude until losses are observed in the BLM's.
- Systematic emittance measurements performed for each phase.
- Verify loss location with madx-online.
  - Localized BLM's noise case:  
Beam 2 – VER, Phase 120, amplitude +11.2:  
Losses at MQ.31L1. Local bump performed and oscillation bump measurement repeated  
→ no losses at this location in both cases.

# Aperture Measurements: Beam1

computed from measured optics and emittances

aperture – ( tolerances + max profile)

BEAM 1 – HOR	polarity	bump ampl (nom sig)	Meas Orbit (m)	3sig env (m)	meas aper (m)	aper model (m)	Diff (%)
MQM.6R2.B1	1	8.0	-0.013	0.003	0.016	0.021	-24
MQ.11L7.B1	-1	8.0	0.003	0.001	0.004	0.020	-80
MQML.10R1.B1	-1	-8.5	0.004	0.001	0.005	0.020	-76
MQM.6R8.B1	1	8.0	0.013	0.003	0.016	0.021	-24
MQY.4R6.B1	1	8.5	-0.014	0.005	0.019	0.028	-32
MQM.6R2.B1	1	-8.0	-0.013	0.003	0.016	0.021	-24

BEAM 1 – VER	polarity	bump ampl (nom sig)	Meas Orbit (m)	3sig env (m)	meas aper (m)	aper model (m)	Diff (%)
MQ.13R8.B1	-1	11.0	0.011	0.002	0.013	0.017	-22
MQ.8R7.B1	-1	-12.0	0.012	0.002	0.014	0.017	-16
MQ.14L8.B1	-1	12.0	0.012	0.002	0.014	0.016	-15
MQ.25R8.B1	-1	-12.0	0.013	0.002	0.015	0.017	-9
MQY.4L6.B1	-1	10.0	0.016	0.003	0.019	0.028	-33
MQ.11L5.B1	-1	11.0	0.013	0.002	0.015	0.017	-11
MQY.6L4.B1	-1	-10.0	0.018	0.003	0.021	0.028	-26
MQY.5R6.B1	-1	-12.0	0.020	0.003	0.023	0.028	-19

# Aperture Measurements: Beam2

computed from measured optics and emittances

aperture – ( tolerances + max profile)

BEAM 2 – HOR	polarity	bump ampl (nom sig)	Meas Orbit (m)	3sig env (m)	meas aper (m)	aper model (m)	Diff (%)
MQXA.3R1.B2	1	10.1	0.010	0.002	0.012	0.023	-50
MQML.10R1.B2	1	-10.4	0.010	0.002	0.012	0.021	-44
MQY.4L6.B2	1	10.0	-0.018	0.003	0.021	0.027	-23
MQY.5R6.B2	1	-9.5	-0.016	0.004	0.020	0.027	-27

BEAM 2 – VER	polarity	bump ampl (nom sig)	Meas Orbit (m)	3sig env (m)	meas aper (m)	aper model (m)	Diff (%)
MQY.4R6.B2	-1	9.0	-0.017	0.005	0.022	0.028	-21
MQ.21L8.B2	-1	-12.5	0.015	0.003	0.018	0.016	11
MQ.9R7.B2	-1	12.0	0.013	0.003	0.016	0.016	1
MQML.10L1.B2	-1	-12.4	0.014	0.004	0.018	0.016	13
MQ.29L2.B2	-1	10.5	0.012	0.003	0.015	0.016	-6
MQ.33L2.B2	-1	-11.5	0.013	0.004	0.017	0.016	5
MQ.27R1.B2	-1	-11.5	0.014	0.004	0.018	0.016	12
MQ.21L2.B2	-1	10.7	0.012	0.003	0.015	0.016	-7
MQ.13L2.B2	-1	10.7	0.012	0.003	0.015	0.016	-7
MQML.6R8.B2	-1	-11.2	0.017	0.005	0.022	0.021	3

# Conclusions

- LHC aperture measurements performed for both beams, for the on-momentum case.
- From the preliminary analysis, there are no indications of critical bottlenecks.
- The agreement between measurements and model is rather good for the V plane. It is worse for the H plane.
- Aperture is above 9 (H) / 11 (V) nominal sigmas.
- Detailed n1 estimates under preparation.
- Few cases to be repeated (possible BLM noise). Possibly local bump scans.
- Beam time requested for the local bumps and for off-momentum measurements.