

MD4506: APERTURE MEASUREMENTS WITH AC DIPOLE

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On behalf of the collimation and OP team.

- ❑ A new global aperture measurement method based on using the AC dipole beam excitations plus a collimator scan was tested for the first time in **2017 in MD2396 on B1 at injection**.

↳ New method could be combined with optics measurements providing the largest AC dipole kick amplitude.

- ❑ **Compatible results were obtained between methods** in the MD2396 for B1H at injection.

Bottleneck at injection for B1H	AC dipole	ADT blow-up
Q6R2	12.9±0.8	12.7±0.8
Q4L6	12.7±0.8	12.6±0.8

- ❑ **The method was** tested at **top energy** during optics MD in 2017.

✓ For B2H methods disagree by 1σ .

Date	B1H [σ]	B1V [σ]	B2H [σ]	B2V [σ]
AC dipole Dec. 2017 30 cm 150 urad	Q3R5 10.8-11.3	Q2R5 and Q3L1 10.5-11	Q3R5 and Q3L1 11.8-12.3	Q3R1 10-10.5
ADT TS2 2017 30 cm 150 urad	Q3R5 and Q3L1 10.6-11.1	--- >10.5	Q3R5 10.9-11.4	Q3R1 10.5-11

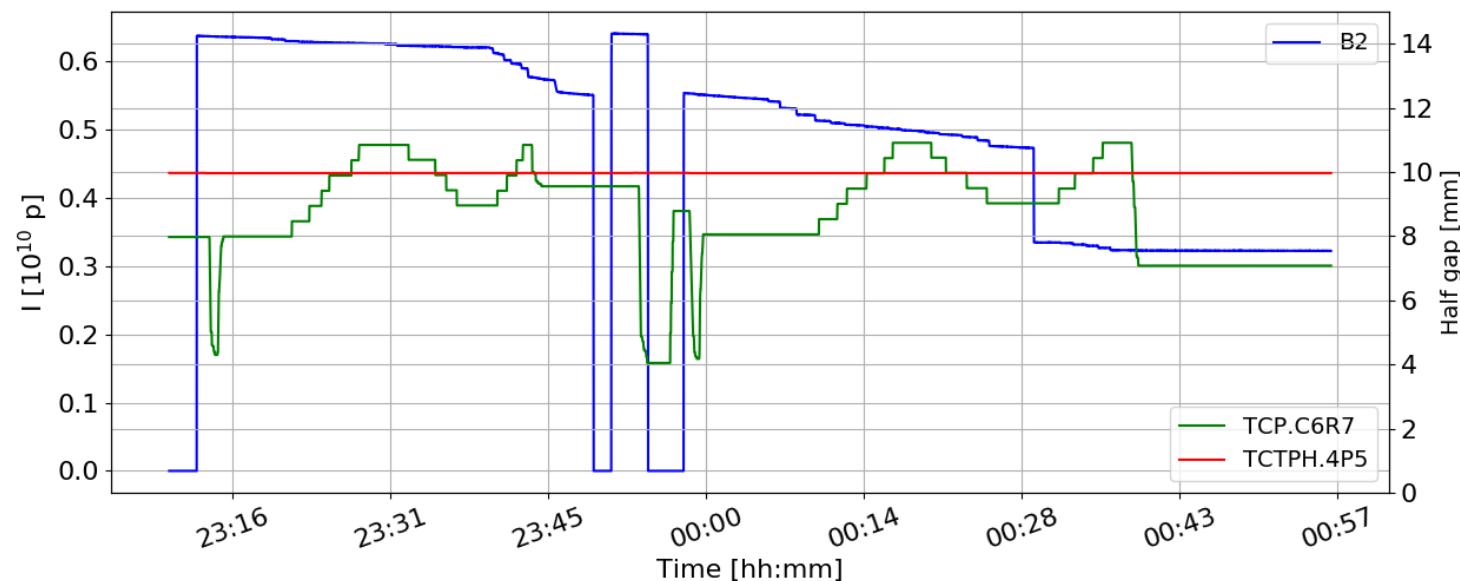
- ❑ In the **2018 commissioning** the aperture for B2H was measured with the AC dipole method.

✓ Same level of discrepancy was observed.

MD merit:

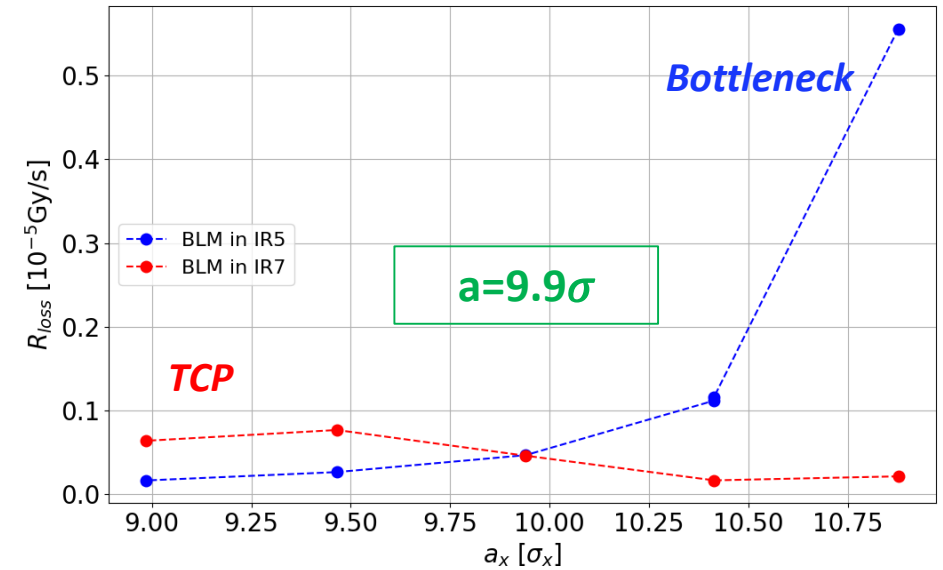
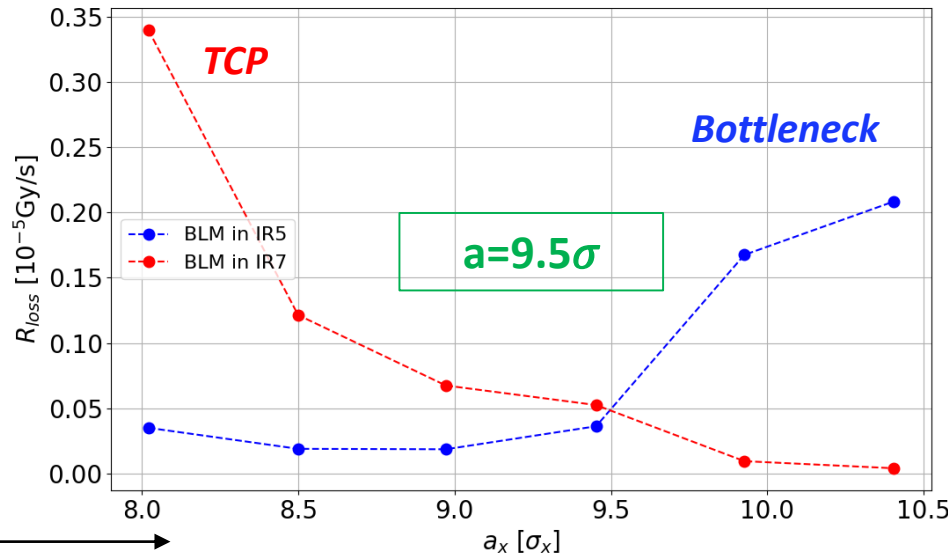
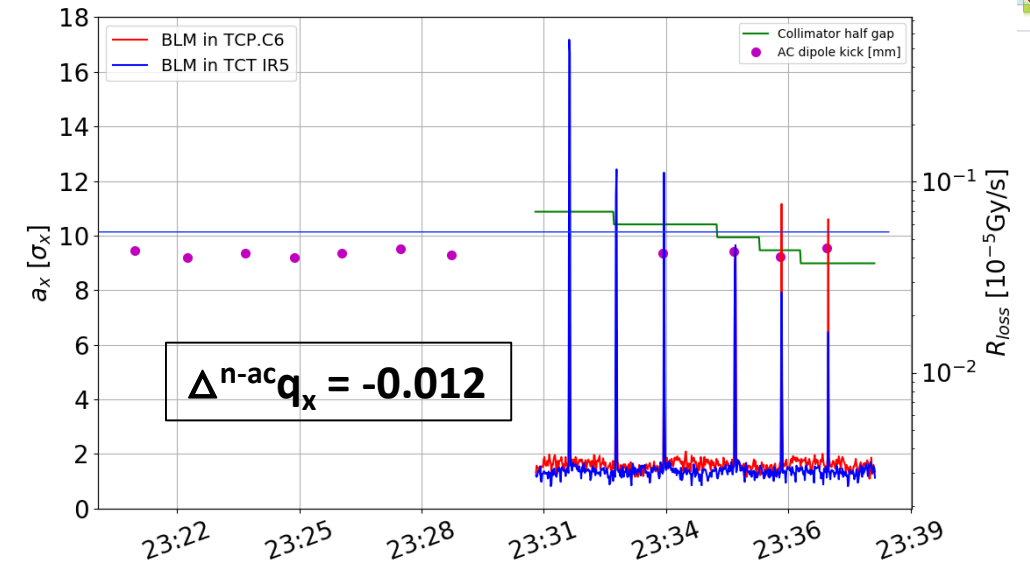
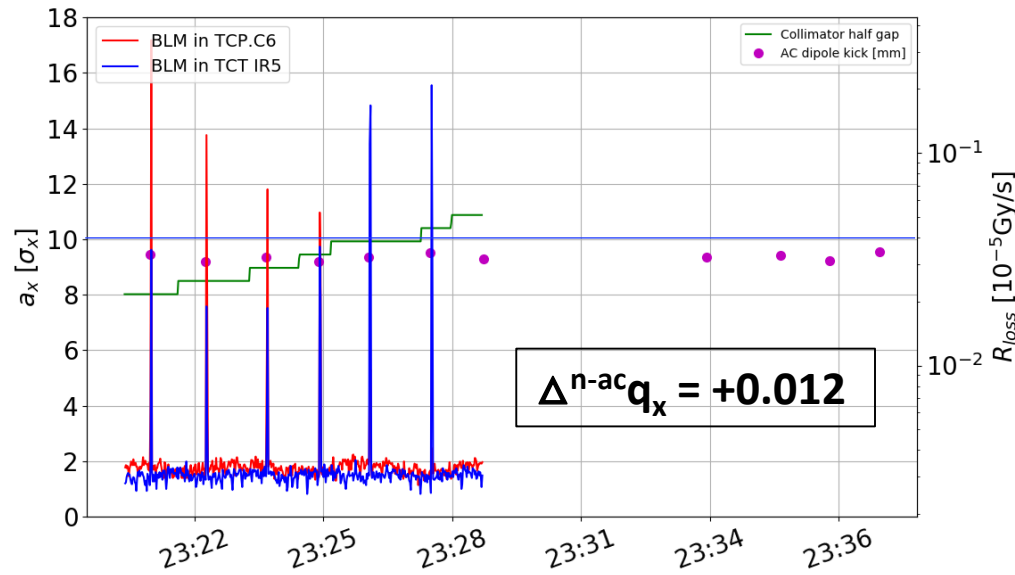
- ✓ Investigate if the observed discrepancy in physics at FT energy occurs also at injection.
- ✓ Investigate the effect of the AC dipole tune, vertical settings and chromaticity on the measurements.

- 4h MD.
- Injection optics.
- B2H.
- TCTPH.IP5 fixed to 10σ
- Aperture scanned with TCP.



Measurements performed:

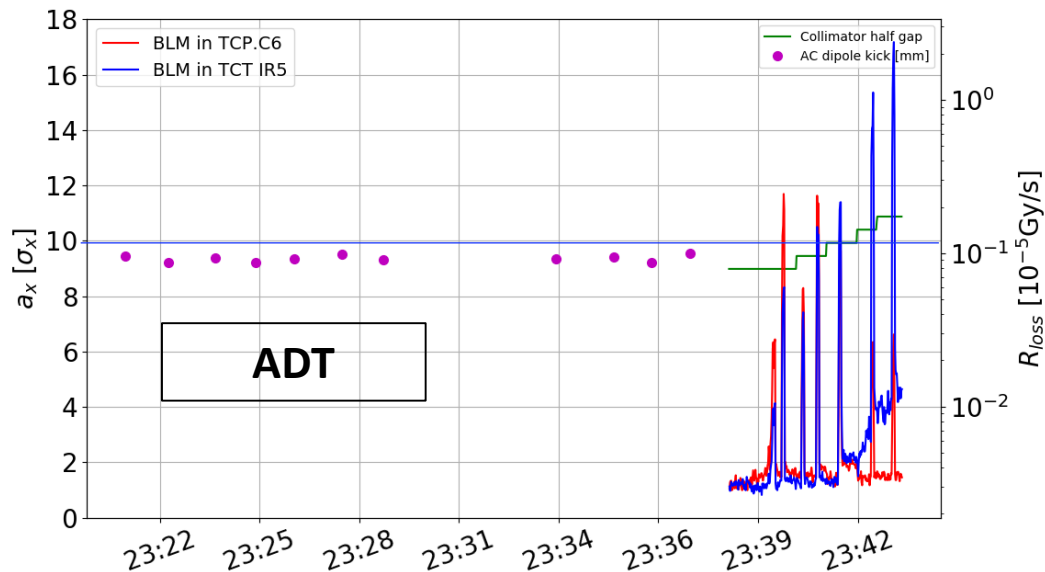
- Aperture measurements with the AC dipole method.
 - Different AC dipole delta tunes to test the β - β -beating introduced by the AC dipole oscillations.
 - Different vertical working point and AC dipole vertical kick amplitude.
 - Different chromaticity.
- Aperture measurements with the ADT method for benchmarking.
- TCP and the TCT alignment for each scan because of the orbit drift due to ALICE solenoid ramp down.



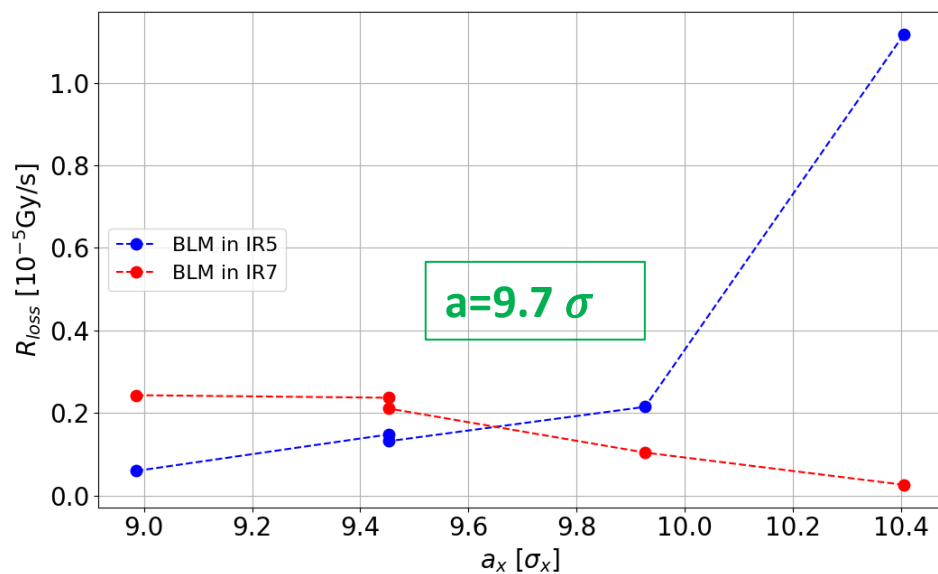
Opening of the TCP collimator



- $\Delta a \sim 0.4\sigma$ observed between positive and delta tune.
- Could be explained by the β -beating introduced by the AC dipole in agreement with MADX predictions.



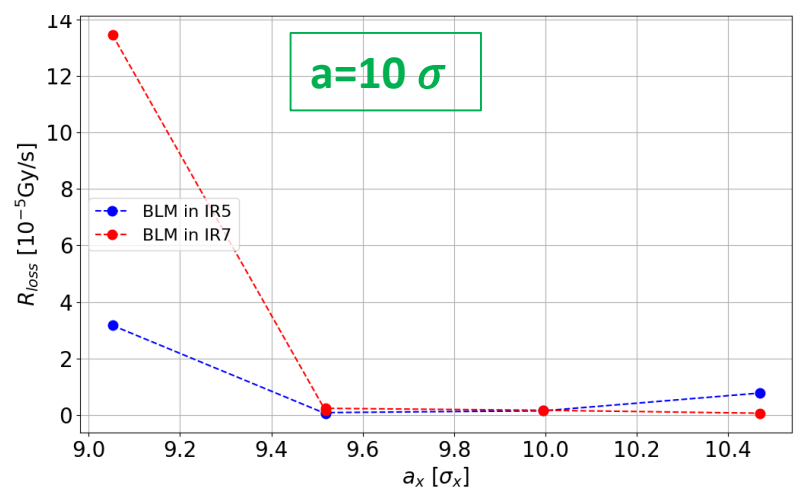
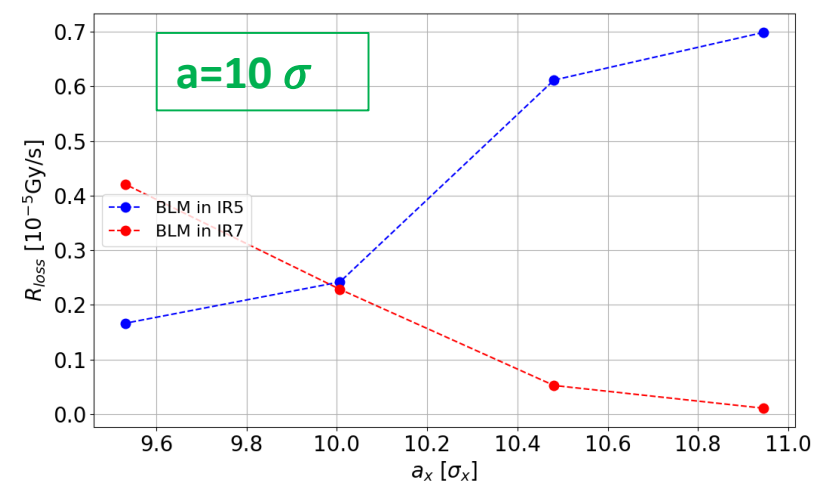
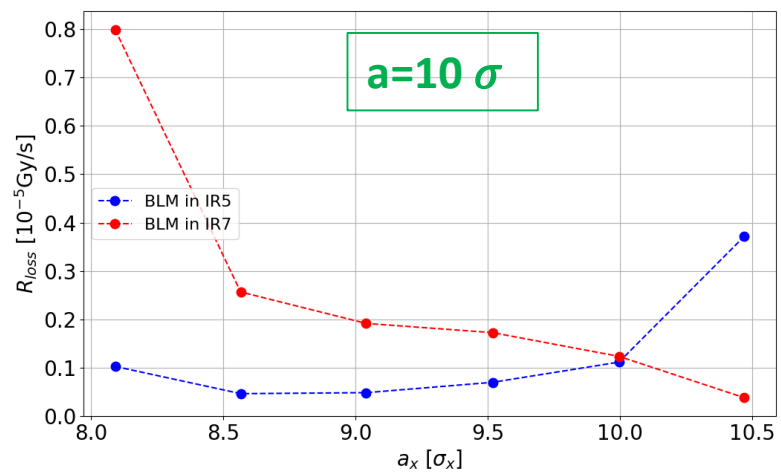
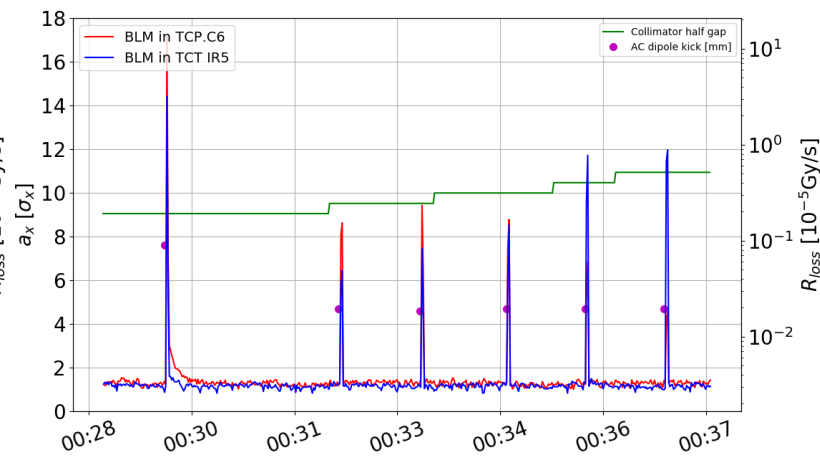
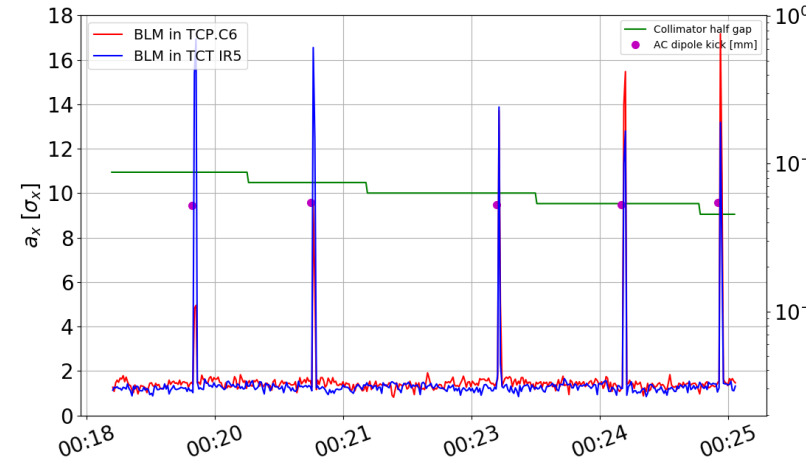
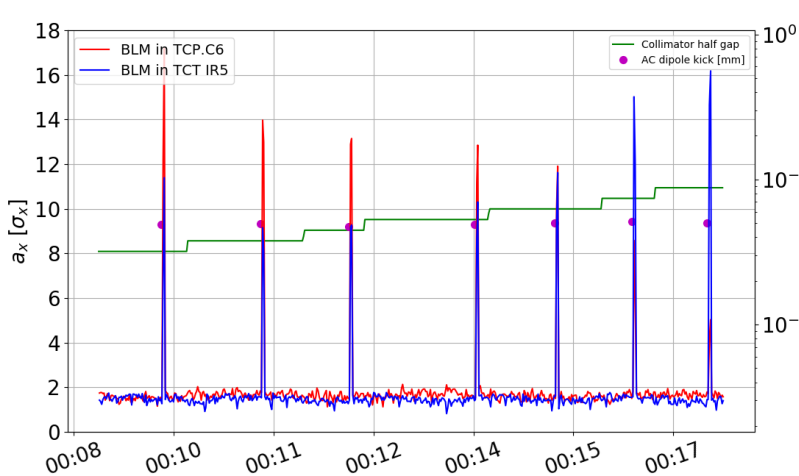
B2H	AC dipole
$\Delta^{n-ac}q_x = +0.012$	9.5
$\Delta^{n-ac}q_x = -0.012$	9.9
ADT blow-up method	9.7
TCTPH half gap	10



- ADT-blow up method aperture measurement in the same fill.
- Good agreement between the methods.
- 200 μm beam drift observed between the start and end of this fill ($\sim 0.2 \sigma$).

Possible effect from vertical plane
 $Q_y=0.3105 \rightarrow Q_y=0.295$
1% increase on the vertical kick

Higher chromaticity



No impact on the measurements.

- ❑ **Good agreement** is found between the AC dipole measurements and the ADT blow-up standard method for all the cases studied **at injection**.
 - ❑ At injection the methods are equivalent for **B1 and B2**.

- ❑ **There is not a big effect from tune and the chromaticity**.
 - ❑ Results are in agreement with the MADX predictions.
 - ❑ This does not explain the observed discrepancies at FT.
 - ❑ Observed discrepancy at FT will require further investigation.