First studies on impedance and beam stability limits for run II

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Outline

1. Impedance in runII
2. Unstable modes
3. Stability diagrams from octupoles
4. Conclusions and next steps
Estimated the impedance for run II at $\beta^*$ 40cm. Increase of 30-50% with respect to run I due to tighter collimator settings.
Estimated the impedance for run II at $\beta^* = 40\text{cm}$. Increase of 30-50% with respect to run I due to tighter collimator settings.
From the impedance we calculate the most unstable modes with damper of 50 turns, varying $Q'$. 

$\blacktriangleright$ We can study the cases of $Q' \simeq 3$ (minimum) and $Q' \simeq 15$ (value of 2012 operation).
From the impedance we calculate the most unstable modes with damper of 50 turns, varying $Q'$.

→ For $Q' = 3$ modes 2 and -3 get unstable.
→ For $Q' = 15$ modes 0 and 1 get unstable.
Mode shifts referred to the correspondent azimuthal mode number $m$.

$\rightarrow$ For $Q' = 3$ the modes are shifted up to $10^{-4}$.
$\rightarrow$ For $Q' = 15$ the modes are shifted up to $4 \cdot 10^{-4}$.
From the impedance we calculate the most unstable modes with damper of 50 turns, \( Q' = 15 \). 

The octupole stability region is studied for gaussian and parabolic distribution (cut at 3.2 \( \sigma \)) for \( I = \pm 550 \) A.
• From the impedance we calculate the most unstable modes with damper of 50 turns, $Q'=15$.

• The octupole stability region is studied for gaussian and quasi-parabolic distribution for $I=\pm 550$ A.

• From the crossings we can infer the stability limit as intensity Vs emittance.

→ Factor 3-4 discrepancy from the 2012 observation scaling.
- From the impedance we calculate the most unstable modes with damper of 50 turns, $Q' = 3$.
- The octupole stability region is studied for gaussian and parabolic distribution (cut at 3.2 $\sigma$) for I=±550 A.
- From the impedance we calculate the most unstable modes with damper of 50 turns, $Q' = 3$.
- The octupole stability region is studied for gaussian and quasi-parabolic distribution for $I = \pm 550$ A.
- From the crossings we can infer the stability limit as intensity Vs emittance.

$\rightarrow$ Larger stability region with respect to the previous case of $Q' = 15$. 
Conclusions:

- Estimated the impedance for 2015 run II at $\beta^* = 40$ cm.
- Compared the most unstable mode obtained from DELPHI with the SD from LHC octupoles.
- Instability limits for $Q' = 15$: Factor 3-4 discrepancy w.r.t. the 2012 scaling.
- Instability limits for $Q' = 3$: Factor $\approx 2$ relative increase in stability w.r.t. $Q' = 15$ case.

Next steps:

- Evaluate the impedance model and stability limits at 80 cm and 65 cm.
- How are we sensitive to $Q'$? Study stability Vs $Q' \pm 1$ unit.
- ...
From the impedance we calculate the most unstable modes with damper of 50 turns, varying $Q'$.

$\rightarrow$ We can study the cases of $Q' \approx 3$ and $Q' \approx 15$