Update on instabilities at injection

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Instabilities at injection 2011

B1 Fill. 1803 started on Mon, 23 May 2011 05:33:39

Beam 1 intensity normalized

Beam 2 intensity normalized

Beam 1 time after batch injection [h]

Beam 2 time after batch injection [h]

Beam 1 intensity at injection [ppb]

Beam 2 intensity at injection [ppb]

B1 B1BQ horizontal
B1 B1BQ vertical
B2 B2BQ horizontal
B2 B2BQ vertical

912 912
Cure for 2011

Octupole knob at injection to 0.5 → octupole current: 6.5 A

All subsequent fills stable
Instabilities at injection 2012

- New in 2012: the “dromedary instability”
How was it cured?

Octupoles down to 0 A
→ instability returned!

2 x 72 bunches well separated

B1 $Qx' = 7$  B2 $Qx' = 7$
B1 $Qy' = 7$  B2 $Qy' = 7$
How was it cured?

Octupoles down to 0 A
→ instability returned!

2 x 72 bunches well separated

B1 Qx' = 7  B2 Qx' = 7
B1 Qy' = 7  B2 Qy' = 7
Summary of observations

The dromedary instability:

- Coherent
- Not cured by transverse damper
- Bunch-to-bunch & bunch spacing correlated (→ electron cloud?)
- Octupole strength & octupole polarity correlated (→ loss of Landau damping?)
- Relatively insensitive to chromaticity
- Observed first time beginning of October 2012 – after change of octupole polarity
Possible explanations

- New in 2012: the dromedary instability
  - 2 possible explanations
    - Electron cloud density overshoot

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Figure 10: Example for an electron cloud build-up simulation assuming a Gaussian distribution of the primary electrons on top of a 10% uniform background all across the vacuum chamber: central density along the bunch train (left), horizontal distribution for bunch 33 (middle) and for the last bunch (right).
Possible explanations

- New in 2012: the dromedary instability
  - 2 possible explanations
    - Electron cloud density overshoot
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    • Electron cloud density overshoot
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• Cure for the dromedary instability
  • Octupole current close to 25 A at the right polarity
  • Dynamic aperture?
Recommendations & outlook

- **Recommendations**
  - Inject 25 ns at a minimum octupole current of 13 A
  - Ensure octupole polarity?

- **Simulations**
  - Perform simulation study of the full 72 bunch injection

- **MD suggestions**
  - Study change with octupole current and polarity!