Update on PSB – PS optics studies

J.L. Abelleira, W. Bartmann
• New model of the lines:
  – New magnetic length for the septa
  – New magnetic length for the quads
  – New magnetic length for BT.BHZ10
  – Moved quads
1. Moving quads

- In principle, the position of BT.QNO40 and BT.QNO50 was kept for the upgrade
- However, the new length of the quads presents small integration issues

J.M. Lacroix: « Il apparaît que BT.QNO40 et BT.BPM40 doivent être déplacés de 70mm vers l’aval au minimum (100mm serait plus confortable). Dans mon étude j’ai également déplacé BT.QNO50 de la même valeur». 
1. Moving quads

- **BTM optics**
  - Dump
  - Vertical measurement
  - Horizontal measurement (small $D_x$)
  - Horizontal measurement (large $D_x$)

- **BTP optics:**
  - HI
  - LHC matched
  - LHC mismatched

For each case we have 4 optics (dif. rings)

We have analysed the 28 different optics in terms of $\beta_x$, $\beta_y$, $D_x$, $D_y$ (a total of 112x2 different functions)
BT-BTP: HI optics

Present position of BT.QNO40
BT.QNO50

Present position of BT.QNO40
BT.QNO50
+ displacement of 0.1 m

24-Sep-2015
Review of LIU-PSB ejection lines
BT-BTP: LHC matched optics

Review of LIU-PSB ejection lines
BT BTP: LHC present optics
BT BTM: Dump optics

Review of LIU-PSB ejection lines
BT BTM: hor. meas. (Large dispersion) optics

[Graphs showing variation in \( \beta \) and \( D \) with respect to \( s \).]

24-Sep-2015
Review of LIU-PSB ejection lines
BT BTM: Hor. meas. (Small dispersion) optics

Review of LIU-PSB ejection lines
BT BTM: Vertical meas. optics
2. New BTM.BHZ10

- THE NEW BTM.BH.Z10 DIPOLE MAGNET. EDMS: 1552147
(Half) beam sizes computed as

\[ A_{x,y} = n_{sig} \cdot \sqrt{k_\beta \cdot \beta_{x,y} \cdot \frac{\epsilon_{N;x,y}}{\gamma_r \beta_r}} + 2 |D_{x,y} \frac{\Delta p}{p}| + CO \cdot \sqrt{\beta_{x,y}} \]

With (NORMGPS beam)

\[ n_{sig} = 3 \]
\[ k_\beta = 1.2 \]
\[ \epsilon_{N;x} = 15 \, \pi \, \text{mm mrad} \]
\[ \epsilon_{N;y} = 9 \, \pi \, \text{mm mrad} \]

\[ \frac{\Delta p}{p} = 1.35 \times 10^{-3} \]
\[ CO = 3 \text{mm} \]
\[ E_k = 1.4 \, \text{GeV} \]

Beam envelopes define the GFR.
Beam envelopes for BT-BTM

BTM.BHZ10

GFR(H)=35 mm
GFR(V)=40 mm
Conclusions

- Ok for moving [0-100 mm] downstream quadrupoles BT.QNO40 and BT.QNO50 (optics change negligible compared to spread from the different rings).
- Ready to provide beam envelopes for the BT-BTM lines
- Provide beam envelopes for BT-BTP when rematching is finished.