Beam-beam status
HL-LHC WP2 Task 2.5

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April 25, 2013
List of Studies and Priorities

1. Evaluate selected options of HL-LHC (SLHCV3.1b with various $\beta^*$ and crossing angle) using existing tools (weak-strong) in order to provide other Tasks with immediate input. These simulations will only include beam-beam interactions and simplistic machine model.

1. SixTrack (S.White, D.Banfi) and Lifetrac (A.Valishev, D.Shatilov)
   
   – DA scans (vs. x-angle, bunch intensity) for “old” scenario ($\xi=0.02, A=12.5\sigma$) with both codes agree well. DA>6$\sigma$

   – Problem: not perfect agreement between Simon’s and Danilo’s results
List of Studies and Priorities

1. 

1. Lifetrac (Valishev)
   – “New” scenario (**full crab**, level with $\beta^*$) evaluated.
   – DA good at
     • Beginning of fill ($\xi=0.034$, $A=26\sigma$)
     • End of fill ($\xi=0.015$, $A=12.5\sigma$)
     • There may be a 15\% margin on crab voltage (assuming no imperfections and emittance growth).
   – Multiparticle simulation suggests there may be beam-beam induced emittance growth ($\tau=20$ h). Currently looking at effect of working point.
   – SixTrack to follow (crab implemented earlier).
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2. Establish team and process for w-s simulations. Develop weak-strong tools and cross-check with MD data.

1. 6D lens in SixTrack (B.Muratori)
   - Decided course of action: cross-check Lifetrac and SixTrack on a simple machine model for agreement with large x-angle, crabbed collisions.
     * Sasha created the lattice
     * Bruno set-up SixTrack environment. He needs assistance with I/O and general usage
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2.

2. Element-by-element tracking in Lifetrac (Valishev, Shatilov)
   - Done, all recent results with the full thin-lens machine model (sextupoles only)

3. Include multipole errors (interface with Task 2.3)
   - SixTrack has the capability to do this immediately. However, the origin of disagreement between previous results and Danilo’s simulations must be understood first.

   - Lifetrac – problem with implementation of orbit correctors (no closed orbit). Shatilov working on solution.
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2. 

4. Simulate the latest MD (interface with LHC b-b group)
   – Not started yet
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1. Single-bunch effects
   – No detrimental strong-strong effect found (provided that chromaticity and damper are on).

2. Crab cavity and feedback
   – Established emittance growth due to phase noise.
     Agreement between two codes.
   – Interfacing with WP4, Task 2.4 to include imperfections
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3. Multi-bunch effects
   – Pacman effects – orbit, tune, chromaticity (T. Pieloni). There is a problem with the code.
   – Multibunch stability studies are in progress (S. White, X. Buffat)
     • Need to include crab cavity
Collaboration and Task Assignments

• W. Fischer, BNL (0.1) – RHIC studies, compensation
• B. Muratori, Cockcroft (0.5) – SixTrack 6D beam-beam
• K. Ohmi, KEK (0.1-0.2) – strong-strong, crab cavity
• T. Pieloni, CERN (0.5) – coordination, interface with LHC b-b
  – D. Banfi (0.5-1.0). weak-strong
  – EPFL Fellow 2 (0.5-1.0). strong-strong
• J. Qiang (0.2), S. Paret (0.5), LBNL – strong-strong, crab cavity, feedback
• D. Shatilov, BINP (0.3) – weak-strong
• A. Valishev, FNAL (0.5) – coordination, weak-strong
• S. White, BNL/CERN (1.0) – strong-strong
• F. Zimmermann, CERN (0.2) - compensation
• M. Zobov, INFN/LNF (0.1) – weak-strong, crab
Collaboration

1. Monthly collaboration meetings in EVO or WebEx (had 2 so far).

2. Bi-weekly (or as needed) phone meetings between Tatiana and Sasha

3. E-mail list