beam-beam compensation and crab cavities

“time is now, people are here!”

long-range beam-beam is getting tougher but no show-stopper

wire compensator important for phase 1 and even before; ~2 sigma gain in aperture

how many low-distance LR encounters can be accepted?

- **beam energy, lattice, chromaticity, tunes,…**
- **experience/experiments at Tevatron, RHIC, SPS**
- **reliable simulation tool**
- **head-on important**

Natalia Abreu, Beam-Beam with a Few Long-Range Collisions at Short Distance, CARE-HHH BEAM'07, October 2007

Conclusions

- LHC with early separation scheme has between 1 and 3 LR encounters at 4-5σ;
  - Tevatron: 70 LR encounters at a mean separation of 9-10σ. Losses start for minimum separation smaller than 5-6σ;
  - SPS:
    - Wire experiments indicates that 2 LR interactions at 5σ can create losses that can not be tolerated at LHC; → **'07 results more optimistic**
    - Experiments with wire also show that for all 120 LR (I_{wire}=276 A) losses start at 8-9σ;
  - RHIC:
    - experiments with 1 LR (100 GeV/n) show onset of losses at 4σ;
    - BBLR experiment with 1-10 LR (I_{wire}=5-50 A) show onset of losses at 5-9σ (very sensitive to working point);

no universal rule, several important parameters - some not identified?!

Conclusions

- Simulations for RHIC show that a 1 long range encounter at 5σ imposes a diffusive aperture at 10σ (for the nominal working point);
- Simulations with the wire at RHIC can reproduce the onset of losses around 9σ for Experiment II;
- Simulations for the LHC shows that the wire compensator can increase the diffusive aperture by almost 2σ and also that a few LR encounters at 5.5σ (while the mean separation is kept constant at 9.5σ) does not affect the diffusive aperture;

can we open collimators to 9 sigma if dynamic aperture is at 5-7 sigma?

wire successful at DAFNE (higher average luminosity); good understanding; can compensate with octupole

SPS experiments at 37 and 55 GeV indicate threshold

dc wire does well, RF BBLR does even better

impact of crab cavities on collimation?

funding: - BBLR for LHC
- RF BBLR prototype
- crab cavity prototype – SBIR