Tracking dynamic aperture with beam-beam

■ **At present we work on two separate studies:**

➤ **Tune scan (now first priority):**

- different collision schemes
- nominal and PACMAN bunches
- with and without triplet errors (corrected)
- preparation for tracking almost complete

  ➤ Dobrin

➤ **Linear imperfections:**

- correct for imperfections
- orbit, collision adjustment, coupling, β-beating
- preparation for tracking almost complete, other studies foreseen but presently suspended

Tunescan for different configurations

■ **Estimated computing requirements:**

➡ **Scan parameters: (considered as minimum):**

- Nominal and PACMAN bunches (2)
- HH and HV crossing schemes (2)
- Tunes (80)
- Angles (x/y) (9)
- Seeds (60)
- Amplitude intervalls,2 σ steps (5)

➡ means about 900000 runs, i.e. 9 million CPU hours

➡ cannot be done on LSF, must use CPSS and BOINC

➡ requires running on different computers and environments

Complications and required preparations

■ **Data processing (Eric and Dobrin):**

- New procedures for tune scan and submission

- Monitor execution on distributed systems and execute re-submission if necessary

- Data collection and analysis

■ **Consistency of results on distributed systems (Eric):**

- Results must be deterministic and reproducible

- Requires identical floating point arithmetic on all computers

- Minimum impact on speed

- Ensure compliance to IEEE-754 standard, extended to elementary functions

Linear imperfections

Basic idea (steps):

◼ Assign field and alignment errors on both beams

◼ Correct errors, simulate operation, i.e. use only information available in control room (NO matching !) :

➡ Ideal model (e.g. for orbit correction)

➡ Knobs (e.g. for β-adjustment (adapted from W. Wittmer), tune, chromaticity, adjust collision etc.)

◼ Derive beam-beam elements from the two corrected beams and install them (all with MADX)

◼ Track one or both beams with beam-beam elements (with sixtrack) to get dynamic aperture

Problem:

☠ Installation of beam-beam elements must be followed by a **USE** command

➡ Wipes out all errors !

➡ Wipes out all corrections !

➡ Must retain this feature, many users rely on that !

■ Additional "features":

➡ Special treatment of correctors (a booby-trap even for well established MAD users...)

➡ Two beams (all operational, but should be used with care)

■ Result: large re-write of several modules in MADX necessary, invest in the future at the same time

The solution:

- **Generalize treatment of MAD** tables**:**
  - → **Generic READ/WRITE of internal tables**
  - → **Possibility to have multiple tables of the same type (but different names)**
  - → **New commands to attach data from tables to sequence:**
  - → *SETERR*: **attach errors directly to sequence, i.e. from ESAVE(d) tables (speed gain up to $\approx 10^4$)**
  - → *SETCORR*: **attach corrector strength directly to orbit correctors in sequence, e.g. from external or internal tables, (was not possible before)**
- **En passant: several "features" fixed**

Status of linear imperfections:

- MAD program is set up, most knobs are available

- New features now in official version of MAD

- Use optics version V6.4 for backward comparison (V6.5 has additional complications)

- Errors as specified by optics team, further by A. Lombardi and L. Bottura

- Tracking for dynamic aperture will start when resources are available

- For tracking use results from tune scan