First complete DA tracking with PTC

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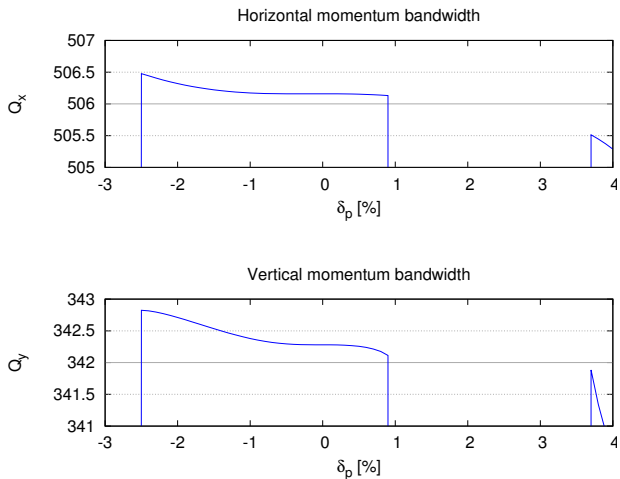[2]CERN, BE/ABP

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1. **Introduction**

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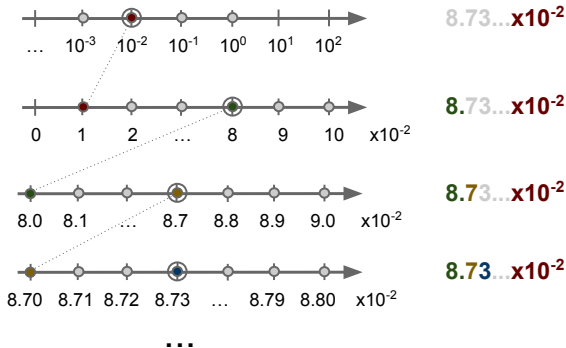# Starting point: TLEP_V14_IR_6-13-2

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Initial Parameters

- Routine developend in Python (and Bash).
    - Split in several modules.
    - PTC is used for tracking.
- Use of the CERN Batch System.
    - Computations made in parallel.
    - Significant reduction of computing time.

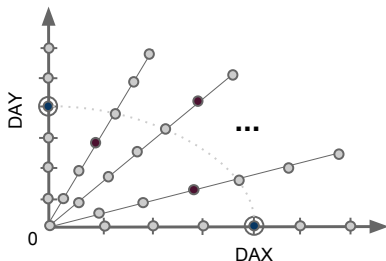| Parameters	Values
Input file	`FCCee.madx`
External files	`macro.madx`
β_x	`0.5`
β_y	`0.001`
ϵ_x	`2.17e-9`
ϵ_y	`4.25e-12`
No. of turns	`2000`
No. of lines	`46` ($\times$2)
Highest order	`0`
No. of test	`16`
Fringe	`N`

Table 1 : Some of the initial parameters required for the use of the automatic dynamic aperture calculation routine.
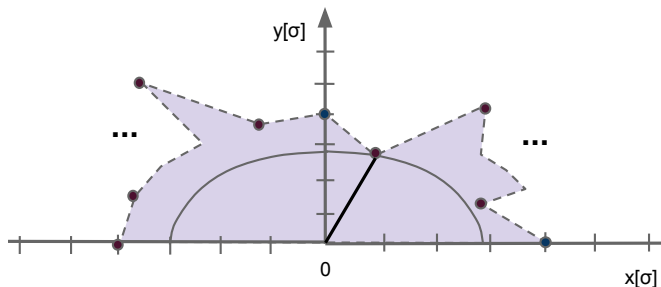
First module: `FindHighest`

- For each of the two axis, *x* and *y*:
    - Determines the position of the particle with the longest deviation with respect to the ideal orbit that generates a stable orbit.

Second module: `Grid`

- It makes an array of particles (initial values) for tracking.
- Particles along a line with a given angle w.r.t. the horizontal.

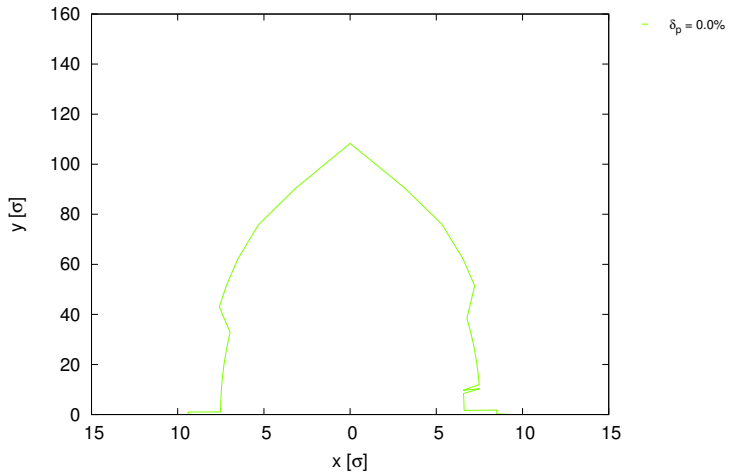# Third and last module: `TrackLines` and `End`

- Tracking computations for each line.
- Determines minimum dynamic aperture and generates graphical output.
- Repeat for different δ_p in the momentum bandwidth.

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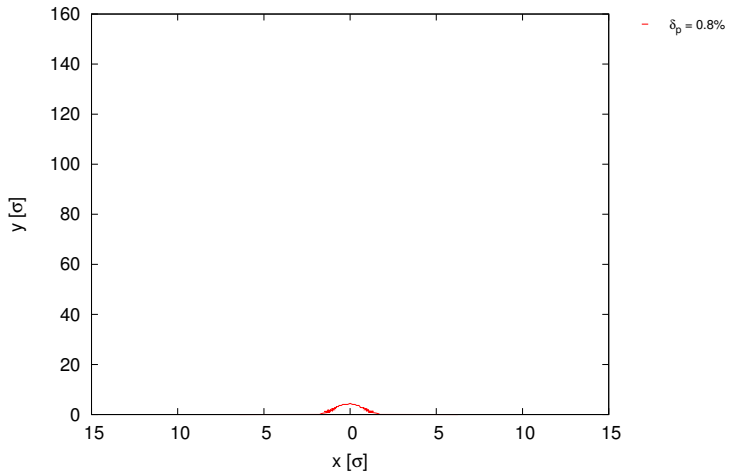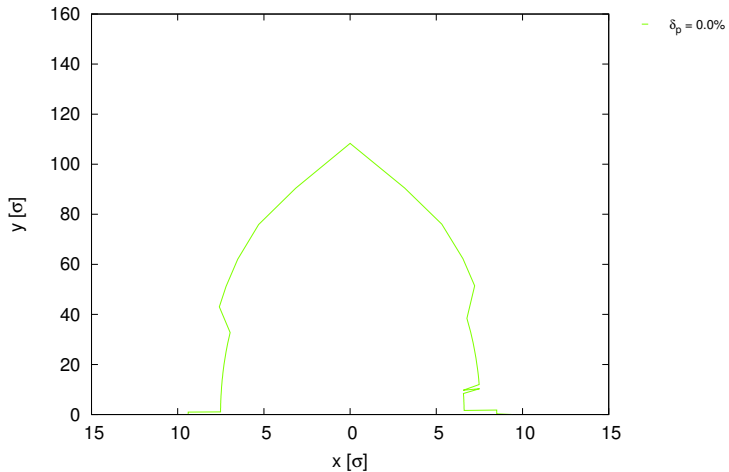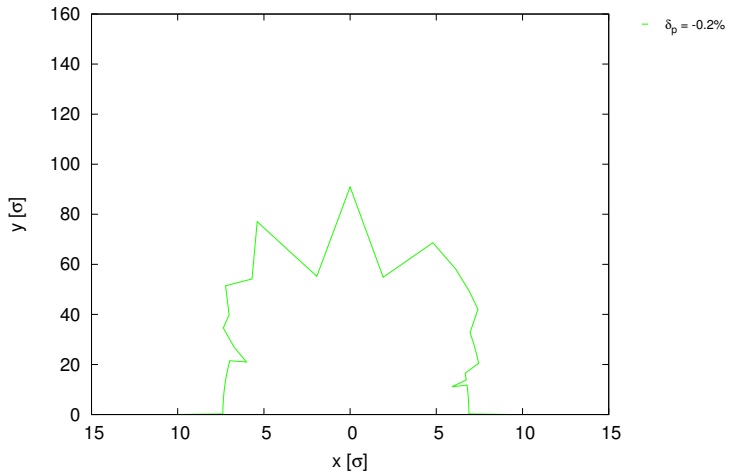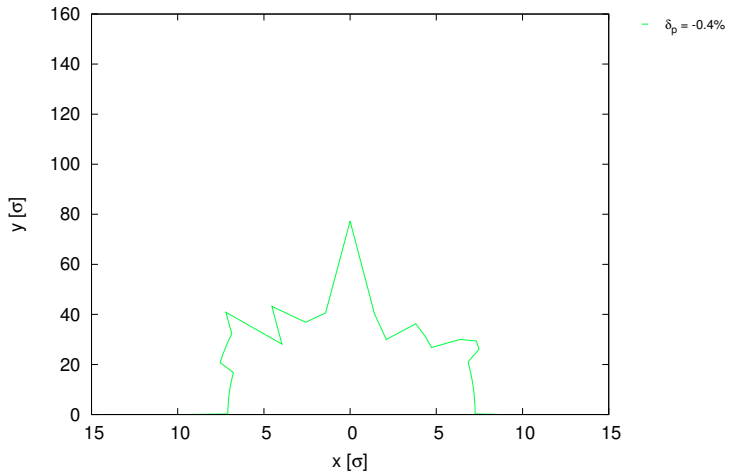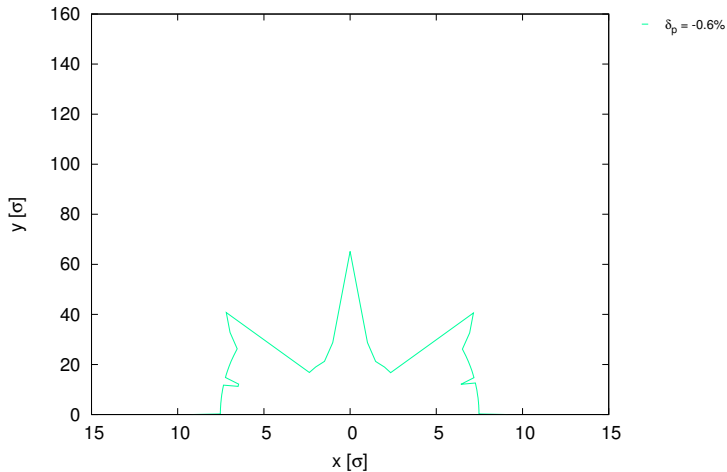
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Dynamic aperture at different momentum deviations

Dynamic aperture at different momentum deviations

Dynamic aperture at different momentum deviations

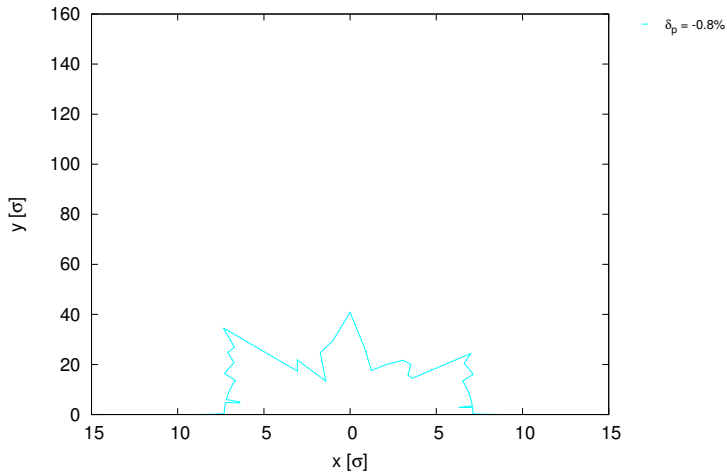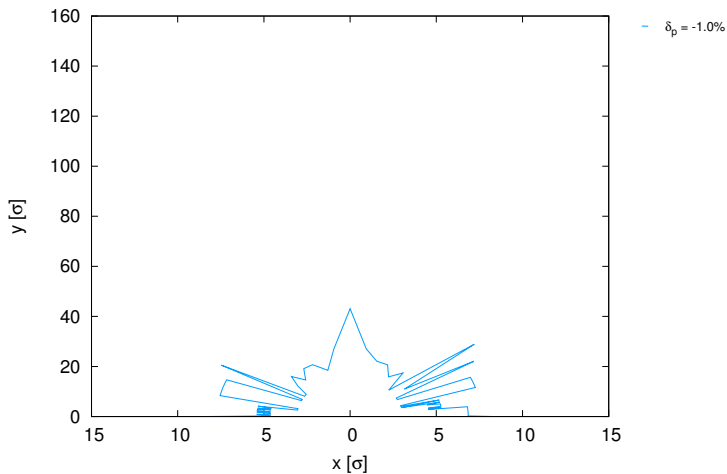Dynamic aperture at different momentum deviations

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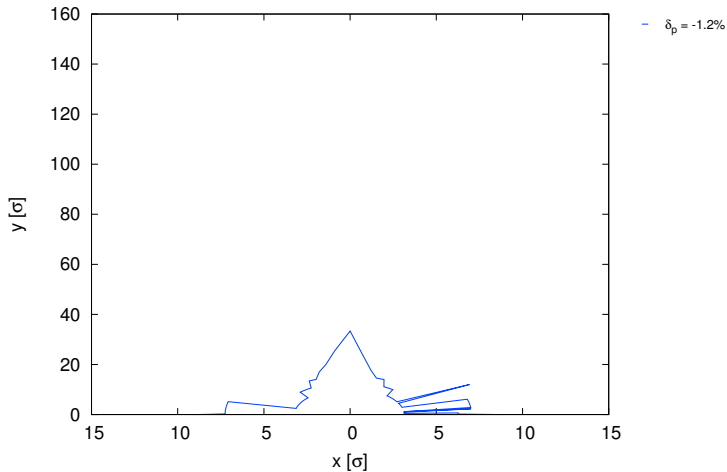
Dynamic aperture at different momentum deviations

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Dynamic aperture at different momentum deviations
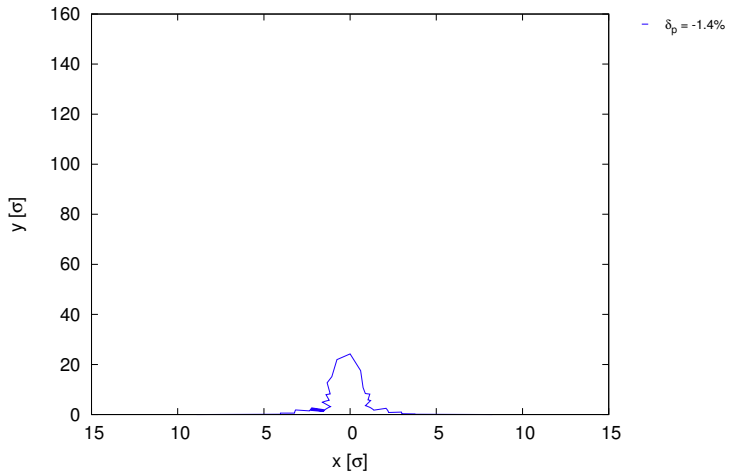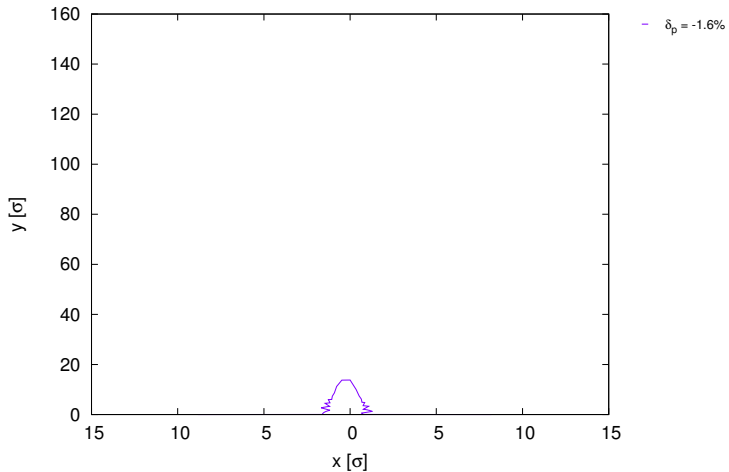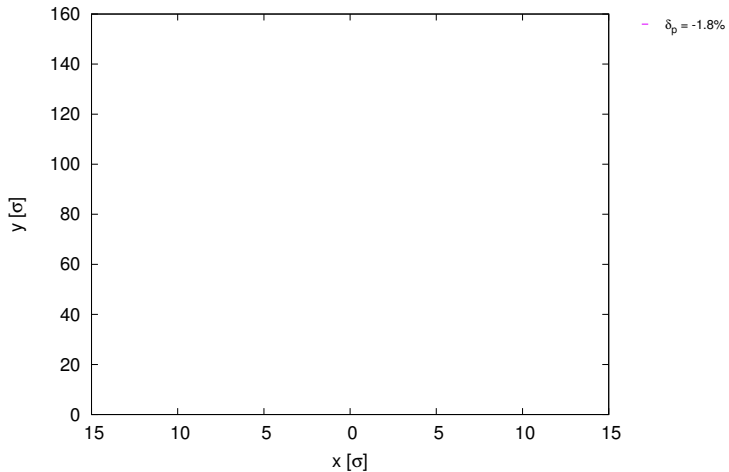
δ_p = -1.0%

Dynamic aperture at different momentum deviations

Dynamic aperture at different momentum deviations

Dynamic aperture at different momentum deviations

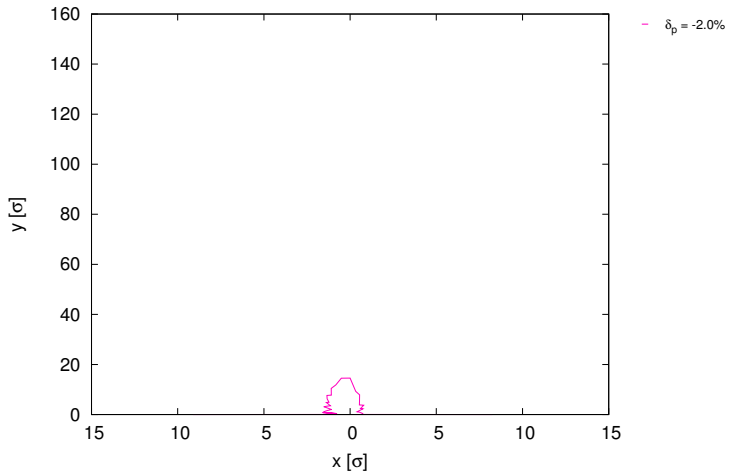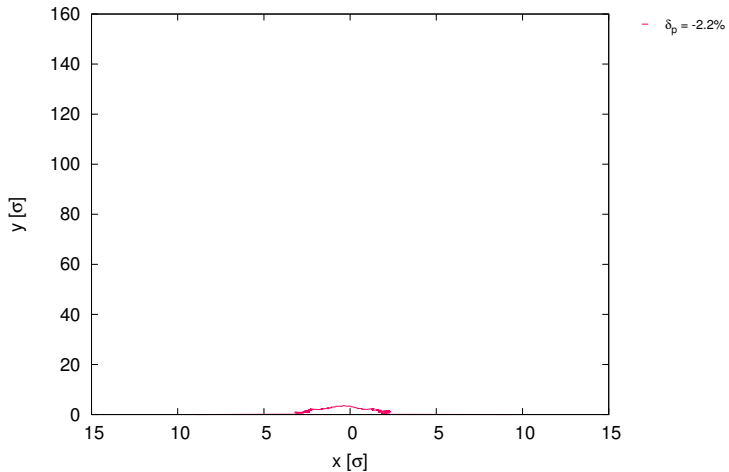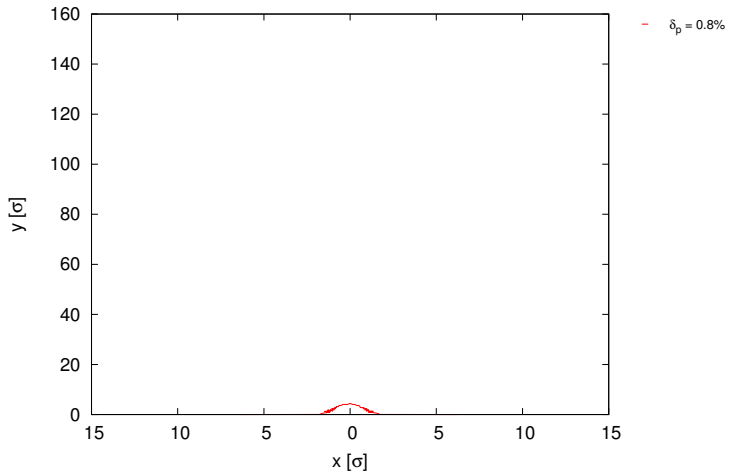Dynamic aperture at different momentum deviations

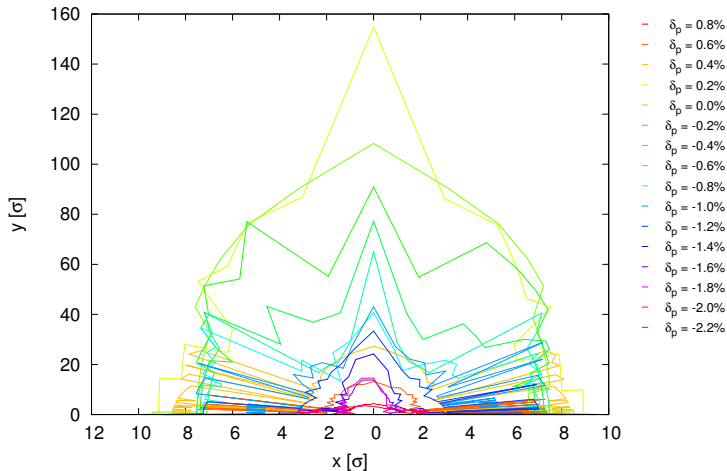Dynamic aperture at different momentum deviations

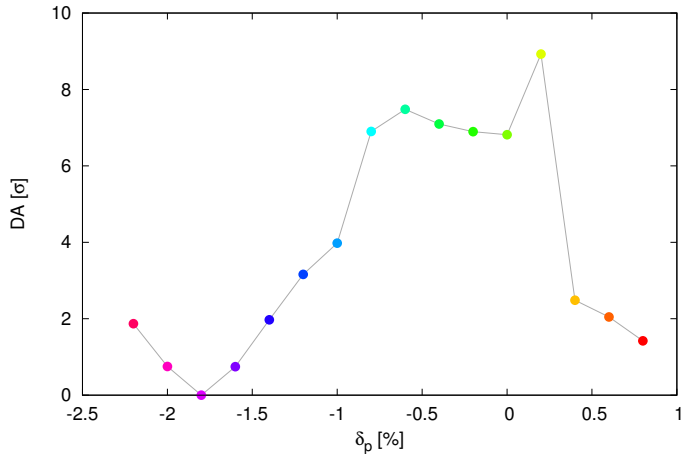Dynamic aperture at different momentum deviations

Dynamic aperture at different momentum deviations

Dynamic aperture at different momentum deviations

Minimum dynamic aperture at different momentum deviations

Conclusions

- Development of flexible routine for dynamic aperture studies.
- Significant reduction of the required computing time.
  - For the present study: $\lesssim$ 2 days (Rate: $\sim 1 \times 10^6$ per hour).
- Results show:
  - Low overall DA for the different values of δ_p in the momentum bandwidth.
  - A minimum DA of $\sim 7\sigma$ for on-momentum particles.
- Design must be improved.