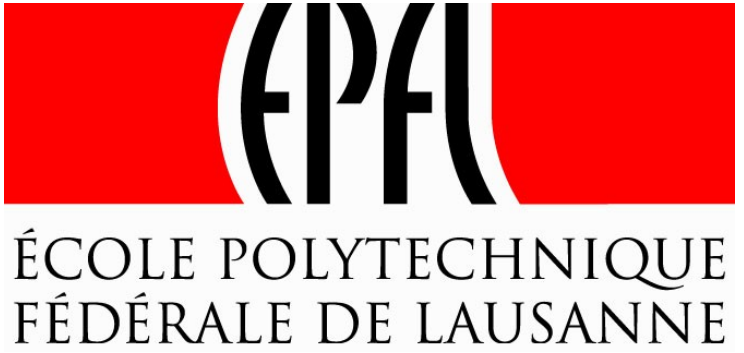


Preliminary Beam-Beam Studies for the FCC-hh

Javier Barranco (EPFL), Tatiana Pieloni, Xavier Buffat (CERN)

Acknowledgements: Roman Martin, Andy Langner, Rogelio Tomas

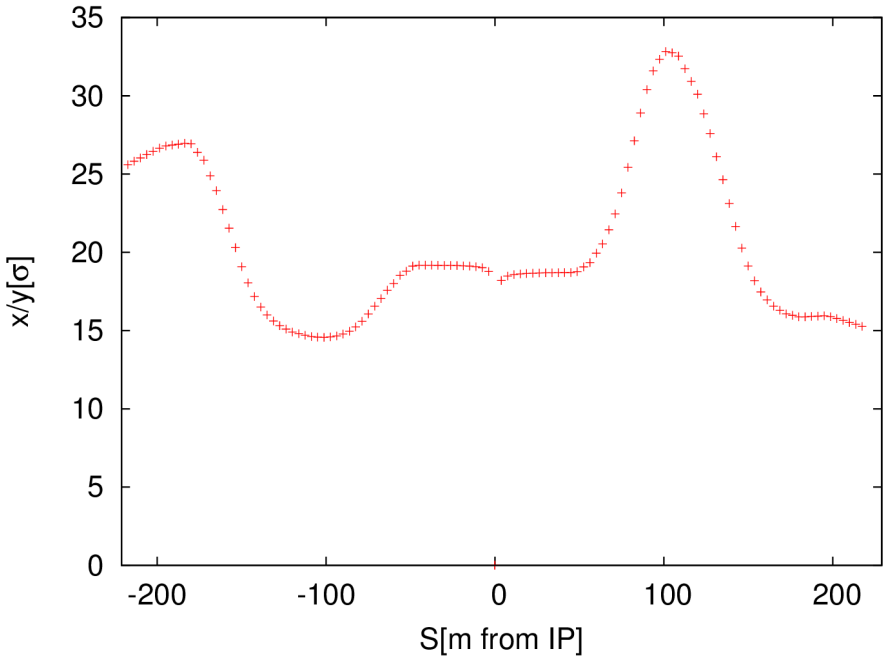
Introduction

- EPFL are responsible for beam-beam studies for FCChh (smooth transition in collaboration with Xavier).
- Beam-beam studies are key to set up the interaction region layout (crossing angles, spectrometers, crossing schemes, etc.). They have to be done at the lattice design level to not limit the future performance of the collider.
- Using same tools as for LHC and HL-LHC. Quite some work preparing inputs MADX thin lens lattices, SixTrack inputs, footprints scripts, etc. All now working and producing results.
- Baselines in our studies:
    - L^* = 45 m (36, 61 still to be considered?) | β^*=30 cm
    - I = 1 10^{11} ppb
    - $\varepsilon_{n,x,y}$ = 2.2 μmrad (round beams)
    - Crossing scheme H/V

Results shown next are preliminary as discussions for Rome as still on going.

Baseline L^*=45 m

- Extensive DA simulations campaign (each scan for a given emittance ~4 days)
- Scan of wide ranges around baseline paremeters (sixdesk environment) to understand the importance of HO and LR.
  - ε_n= 0.5, 1, 2
  - I=0.2-3 1011 ppb
  - θ/2= 20-180 μrad
  - No spectrometer
- Larger emittances imply larger crossing angles.
  - LR are closer.
  - HO not important???



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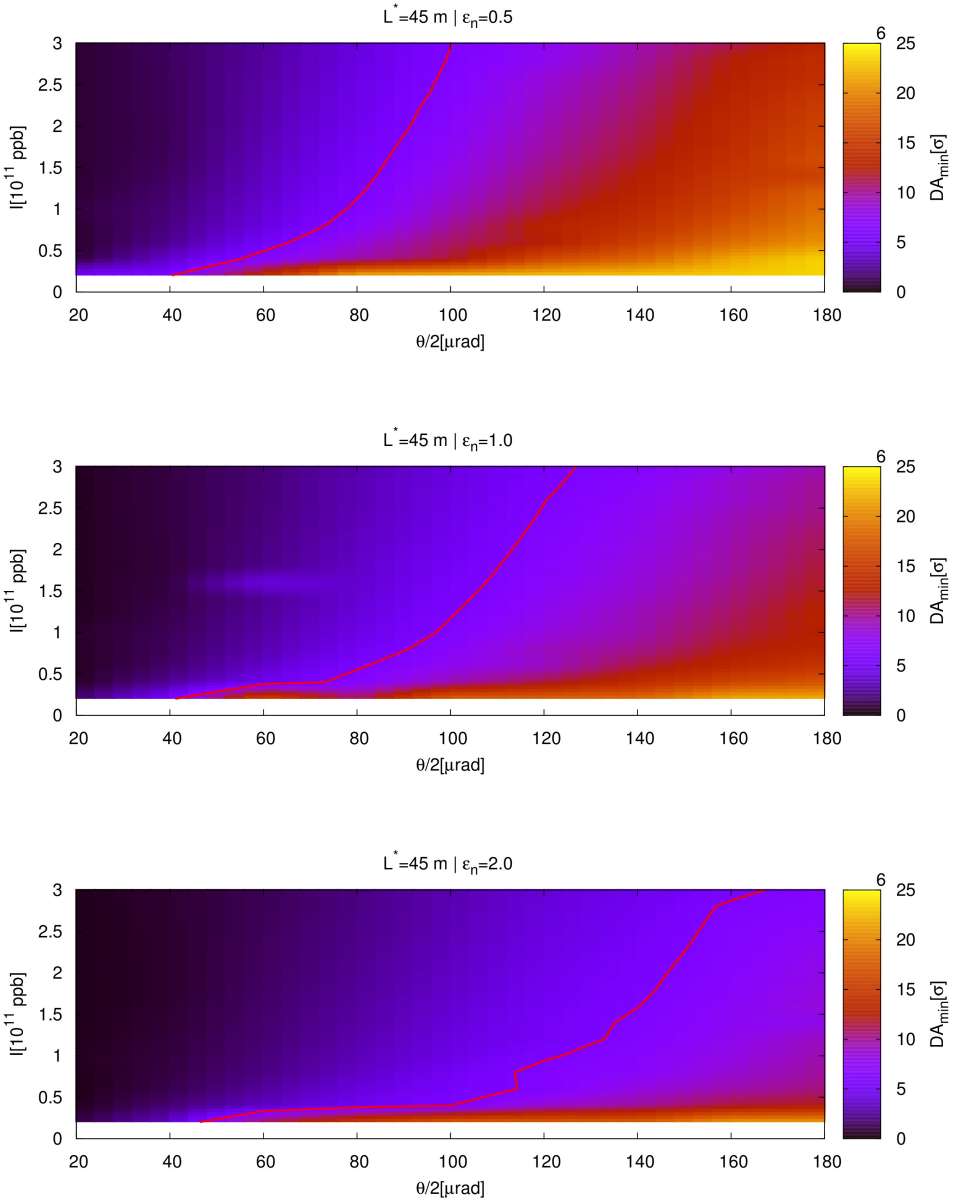

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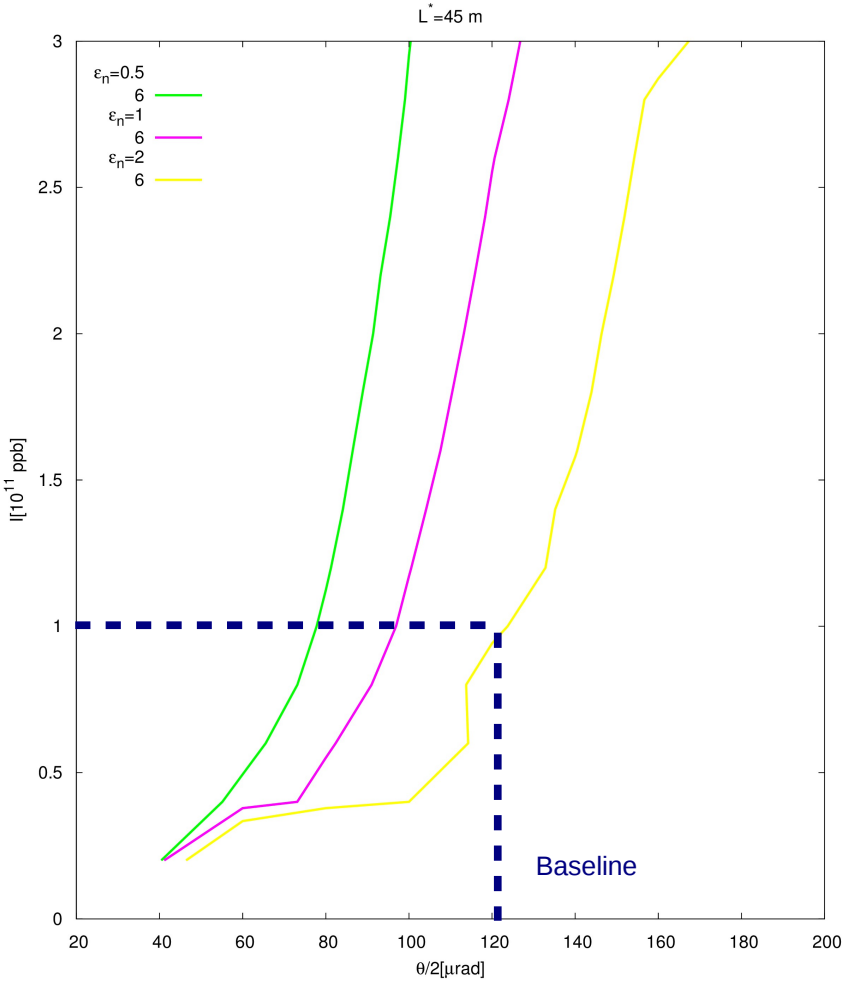
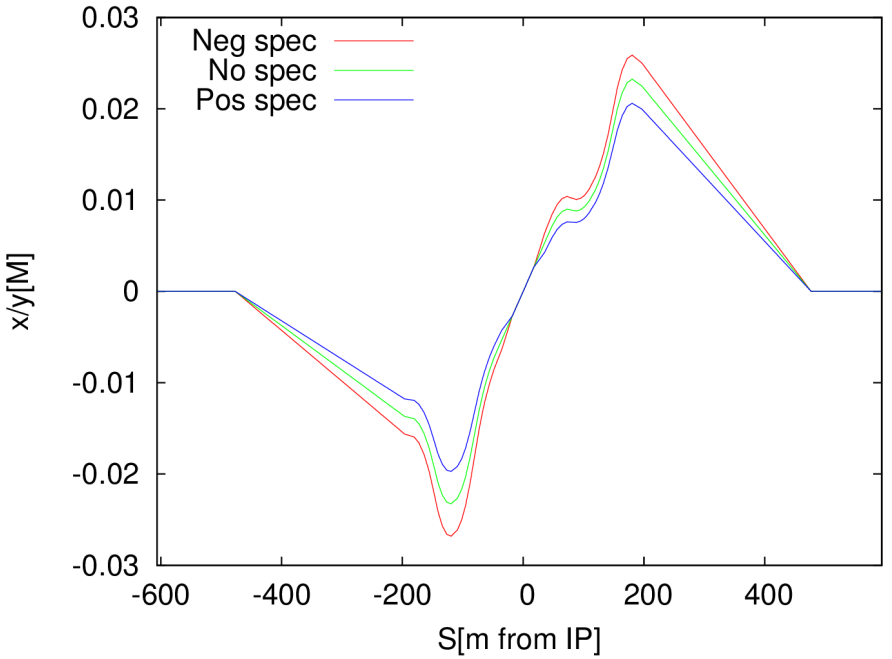
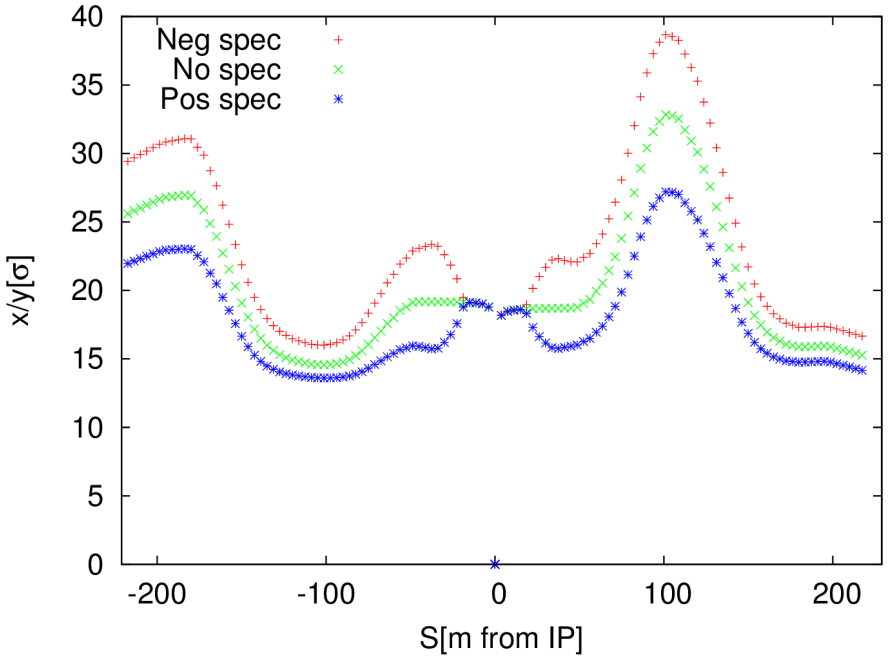


- DA limit of 6 σ is a figure of merit adopted from LHC.
- It relates with the minimum aperture of the primary collimators.

Spectrometer

- Option requested by the experiments.
- Introduces a new concept: internal and effective crossing angle.

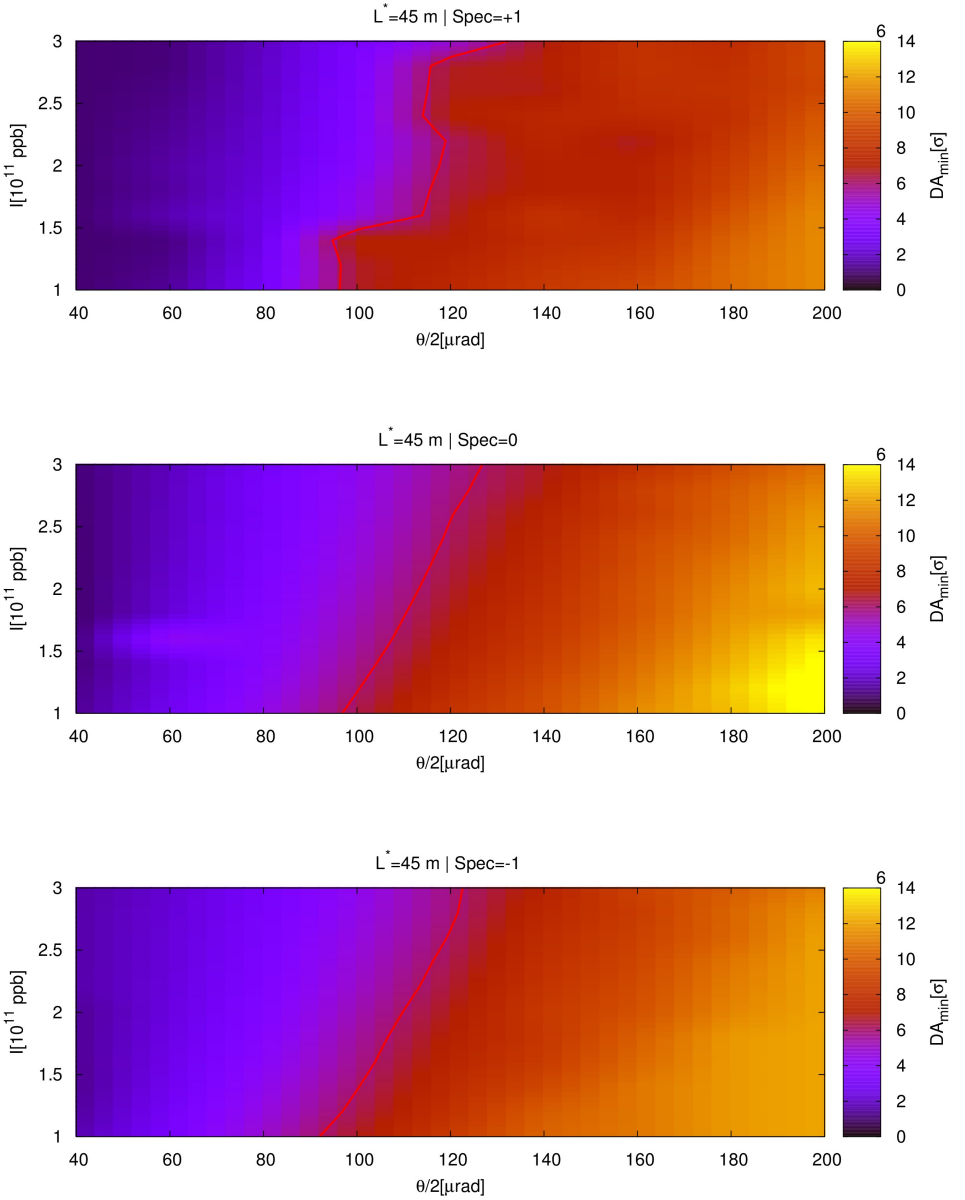




- Approaches:
  - Internal crossing angle (luminosity)
  - Effective crossing angle (aperture)
  - DA should evaluate in all cases to ensure < 6 σ.

Spectrometer

- Preliminary DA results just enabling spectrometer w/o crossing angles optimization.
- In this case HO is the same for all cases.
- A small different being spec=-1 better due to larger LR amplitudes.



Summary

- Good progress in BB studies since before Christmas.
    - All simulations tools are now working and already producing results.
- No hard conclusions so far, but getting the feeling about the different scenarios.
- Already a quite complete plan for Rome available (see Tatiana's presentation).
- Some ongoing studies for the near future:
  - L^* scans for L^*= 36 ,61 similarly to the L^*= 45 m.
  - Detailed studies with spectrometer (apertures issues, effective crossing angle, etc.).
  - Different crossing schemes impact of DA (see Tatiana's presentation).
  - Not round beams ($\varepsilon_x \neq \varepsilon_y$).