Wire tests at injection energy

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with helpful discussions at the BB WG and with M. Fitterer, D. Gamba, A. Levichev, S. Redaelli, A. Rossi ,M. Poyer,

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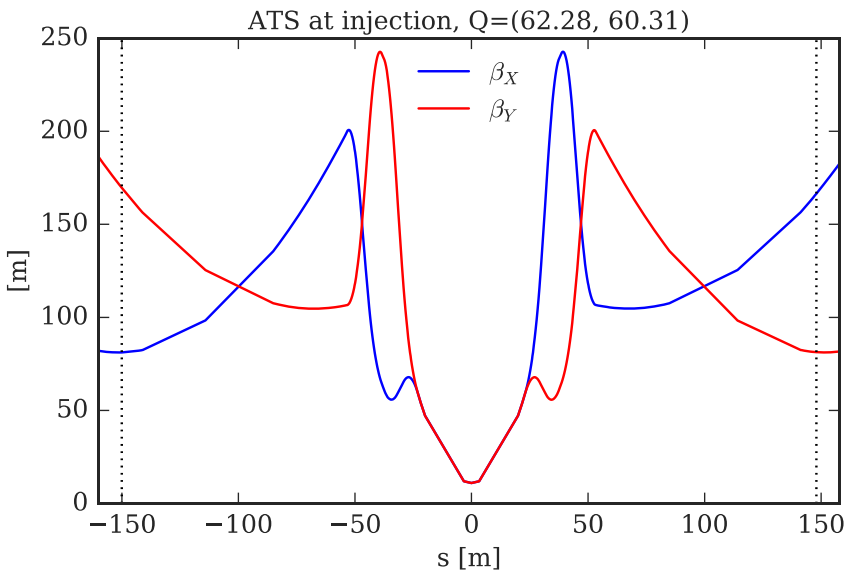
Outline

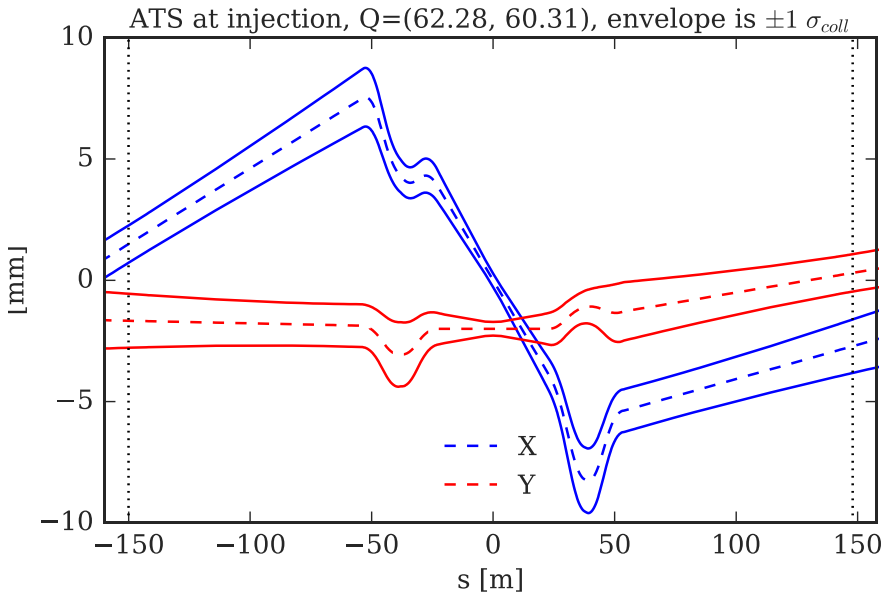
What we can learn using the wire at **injection energy**?

1. Calibrating the wires → 1 beam and 1 wire
2. Compensation btw wires → 1 beam and 2 wires
3. Mimic the LR → 1 beam and 1 wire
4. LR compensation → 2 beams and 1 wire

Most of these tests (1,2,3) can be done with 1 PILOT at 450 GeV if compatible with the required BI precision.

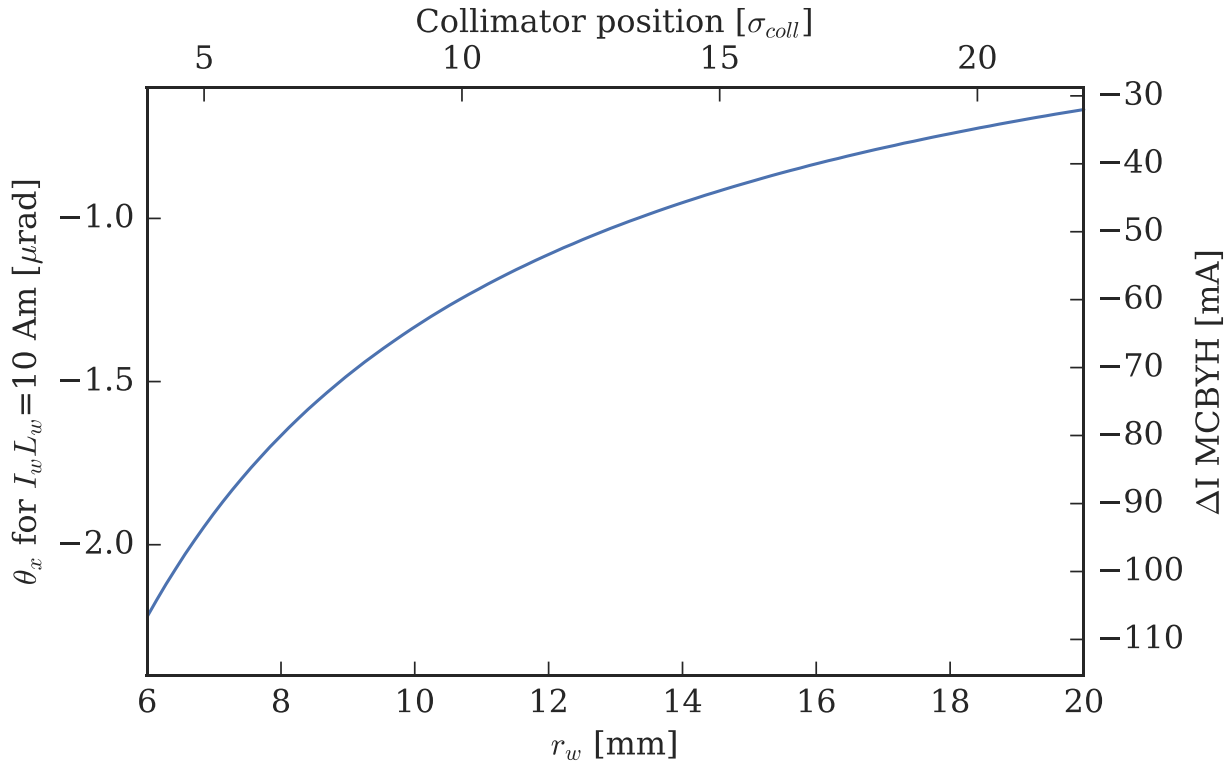
Calibration tests: dipolar kick I





- For both wires we need to position the wire at the beam V position by adjusting the collimator jaws (starting from 4R5).
- PURPOSE:
  - Noise level at I=0 and closest approach.
  - Verify control on the wire position with the beam (no effect on V orbit)
  - Verify linearity vs current and independence on the jaw position that does not carry the current.
  - Measure magnetic dipolar length of the wire

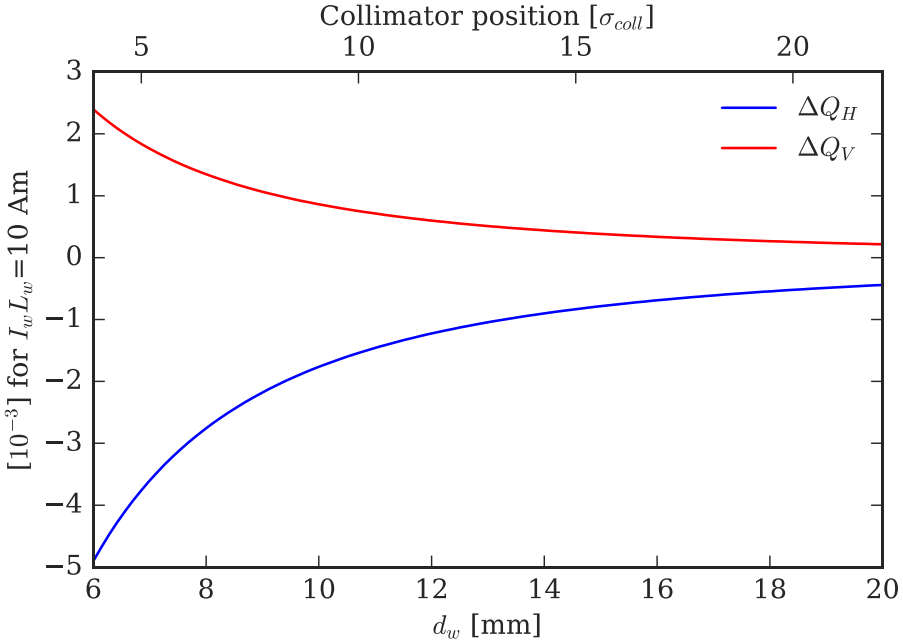
Calibration tests: dipolar kick

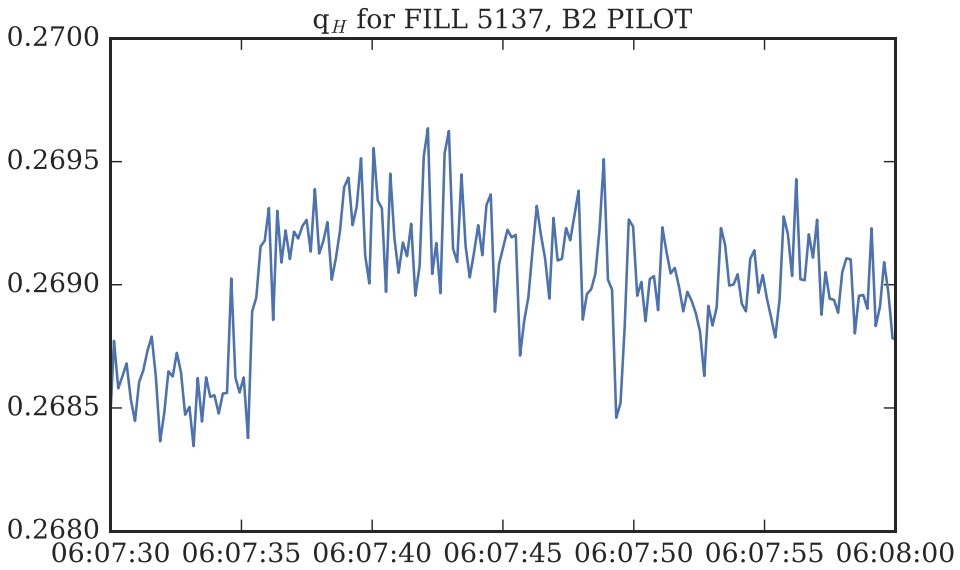


We would like to

- use the MCBYH corrector ($\Delta\mu$=5 deg) to compensate the induced dipolar kick.
- to implement a simple feed forward to trim this corrector as f(x_w, I_w)

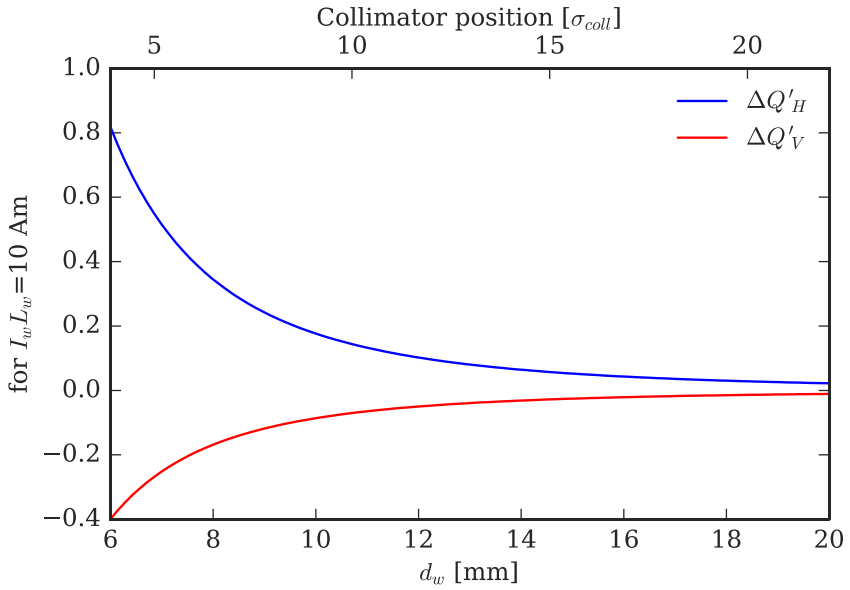
Calibration tests: quadrupolar effect

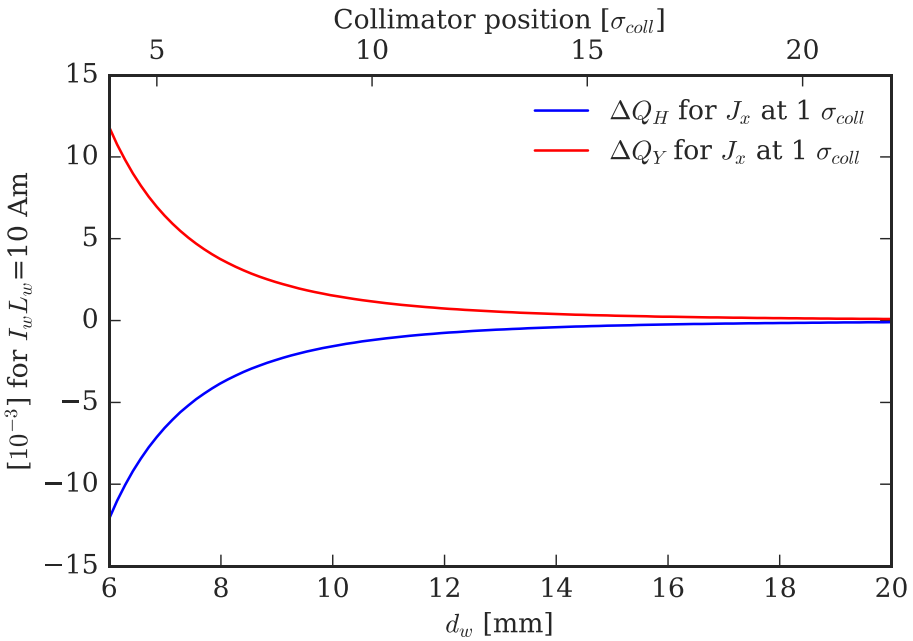




- Make a feed-forward for the quadrupolar effect using the standard tune trimming quads
- Verify the quadrupolar magnetic length of the wire
- A pilot should be fine for appreciate the tune shift.

Calibration tests: sextupoles and octupoles



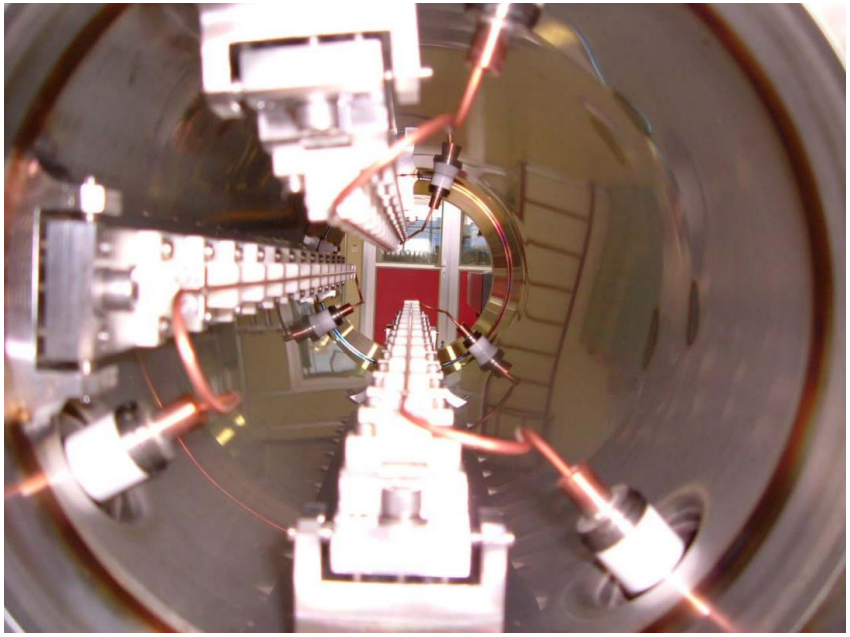


- Once having correct the linear effect of the wire we can explore the non linear ones:
- Effect on linear chromaticity
- Effect of detuning with amplitude

Mimic the effect of the BBLR with a wire

Using the scaling laws in [1] one could excite a BBLR-like effect as done in the SPS. One has to scale the Iw for the beam normalized emittance (not with beam energy).

- What is the minimum I_w with a detectable effect on lifetime?
- What is the effect of ramping the current (increasing the number of BBLRs)? What is is effect with the tune? Benchmarking with simulations.

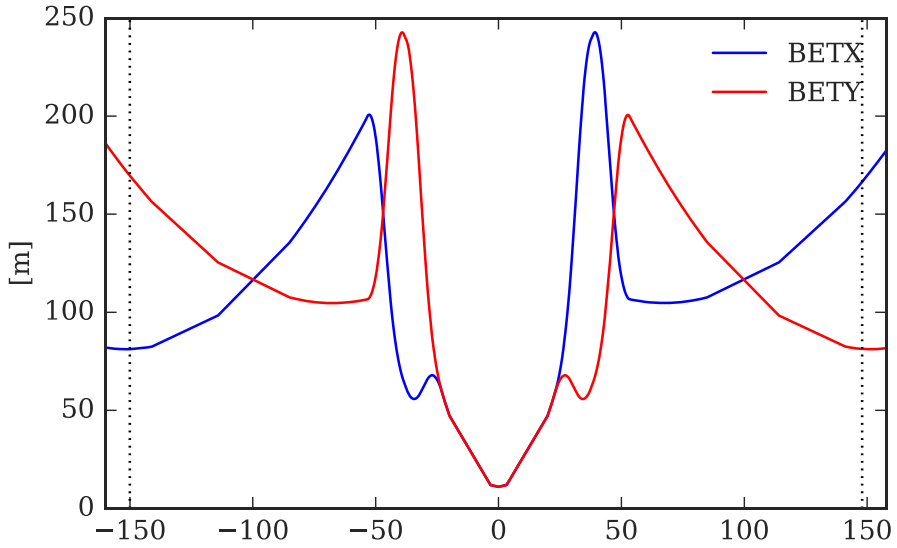


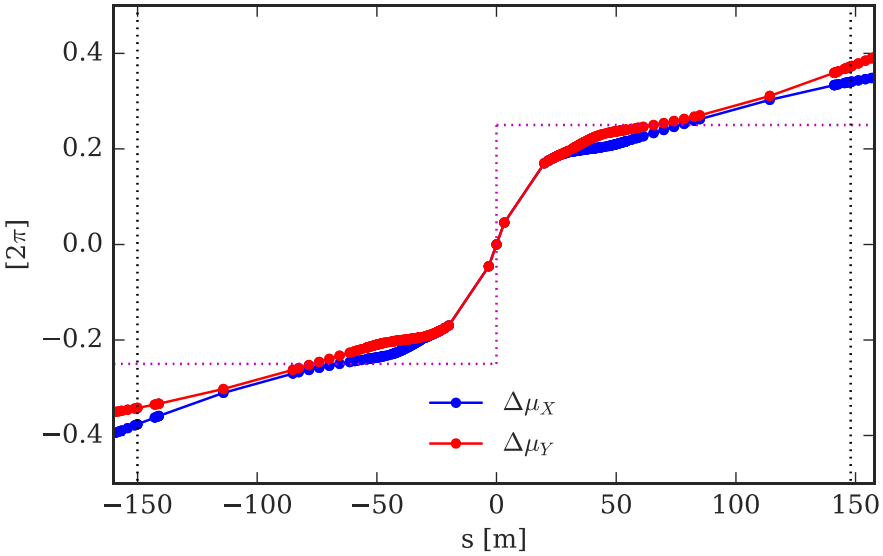
Wires in SPS to simulate a “B2”

Use 1 wire to excite and the other to compensate

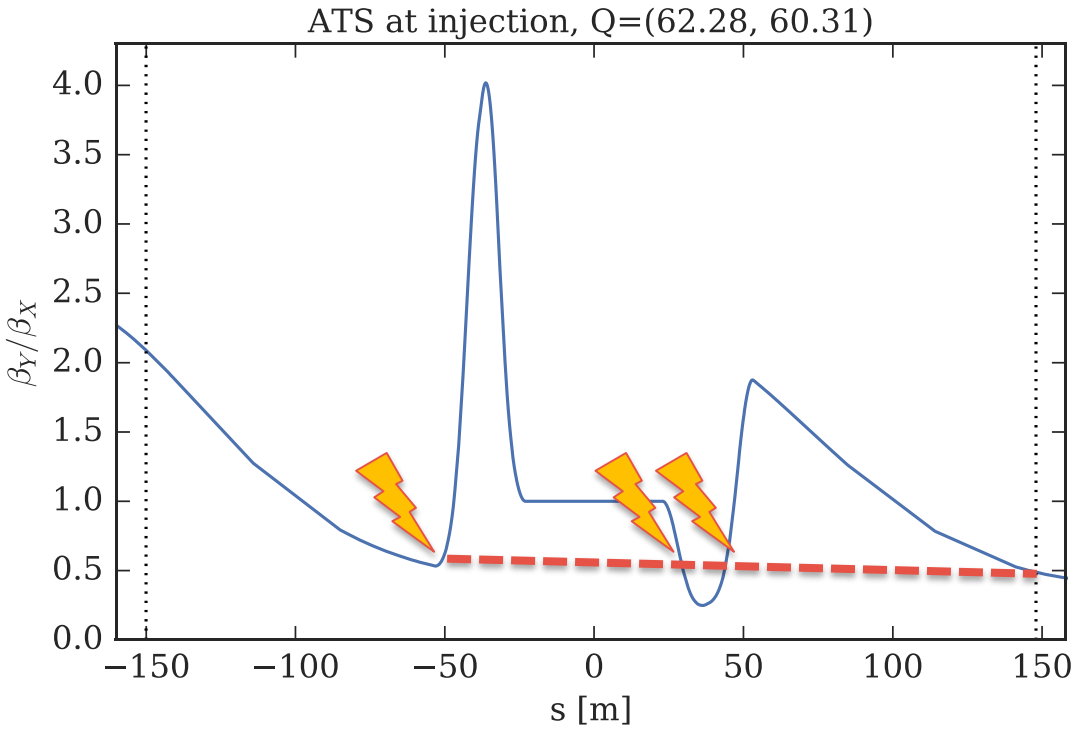
In the ATS nominal configuration is possible to compensate the wire effect in only one plane.
One could compensate the octupolar detuning in the H plane.

- To compensate one wire with the other we need a special anti-symmetric optics to have same βx
- What is the effect of ramping the current (increasing the number of BBLRs)? Benchmarking simulations.





BB LR compensation and 1 wire



Summary

We presented a series of possible tests and measurements at LHC injection energy using the wire.

We can operate using the ATS injection optics for

- Calibrating the wires → 1 beam and 1 wire
- Mimic the LR effects → 1 beam and 1 wire
- Compensation btw wires on one plane

Another injection optics has to be prepared for

- Compensation btw wires → 1 beam and 2 wires
- LR compensation → 2 beams and 1 wire

Sinergies with other experiments will be explored

- Halo experiments in the collimation team
- RDT measurements
- …

Thank you for the attention.

References:

[] SF

[] FZ

[] YP