Requirements for a warm skew quadrupole
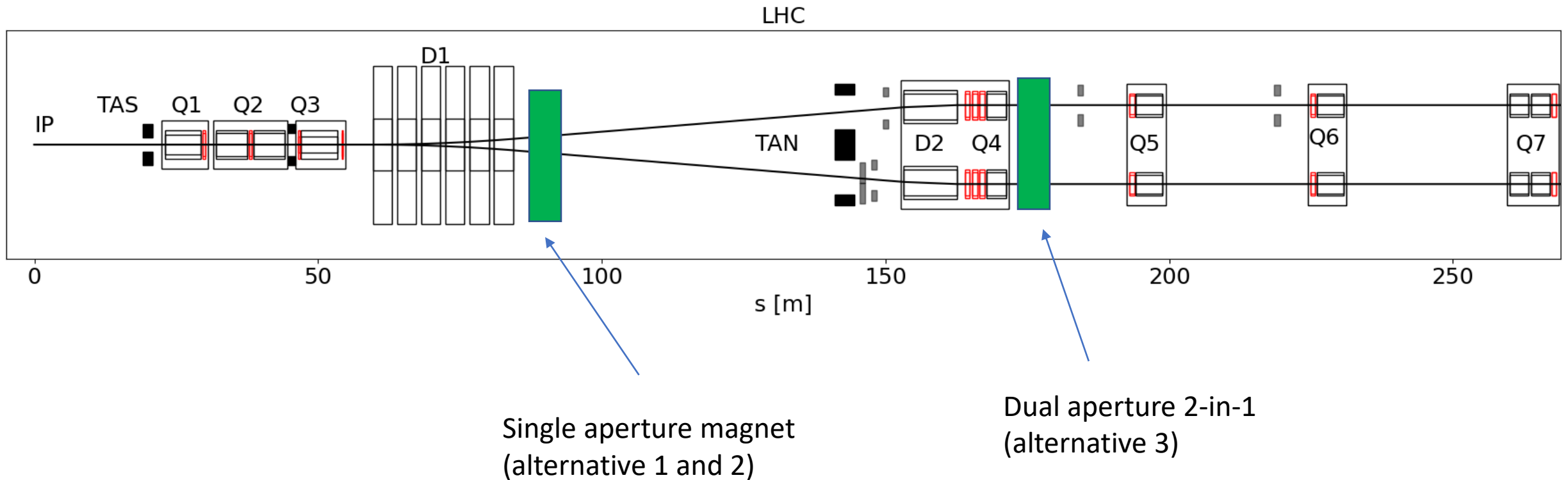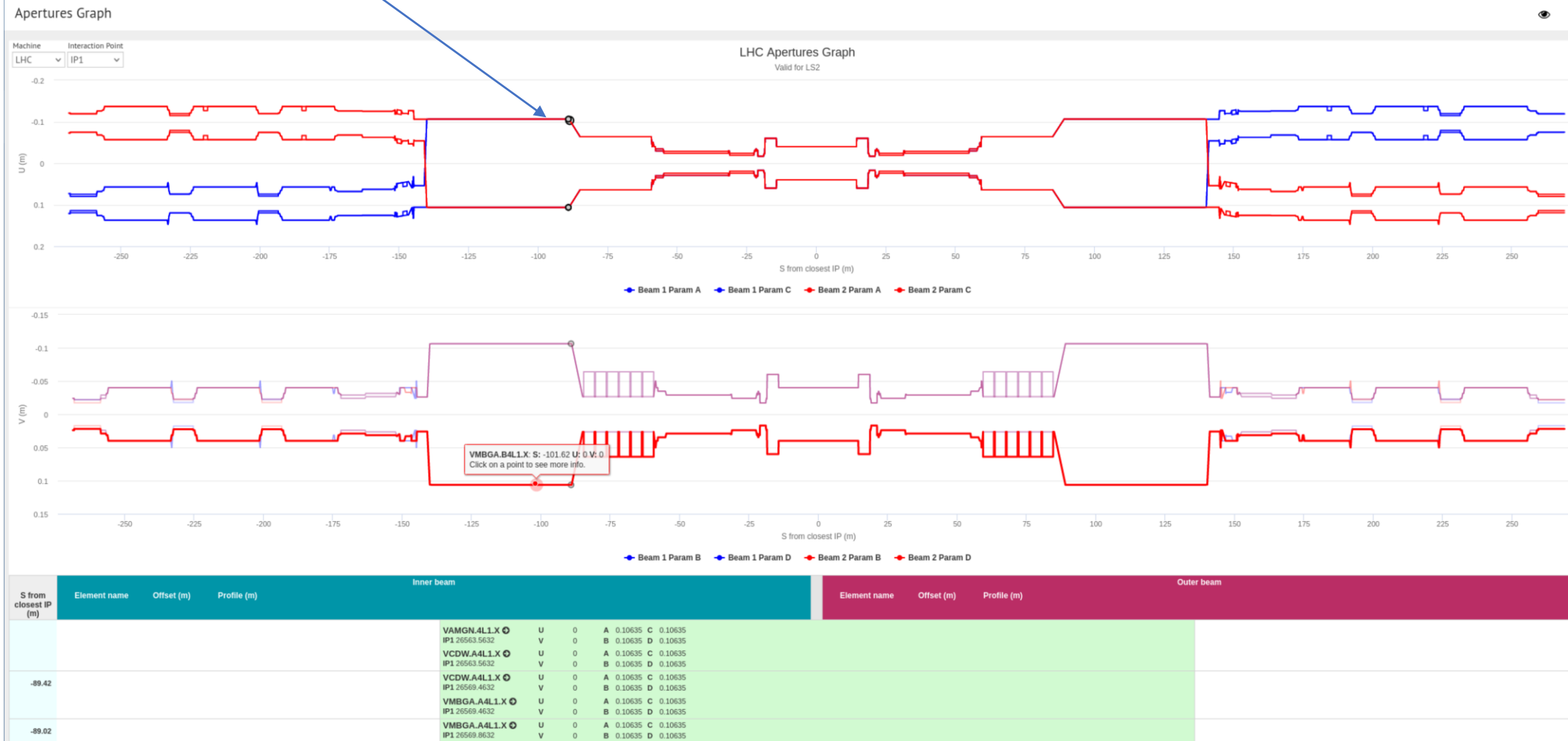
Two options for a warm skew quadrupole to replace the MQSX
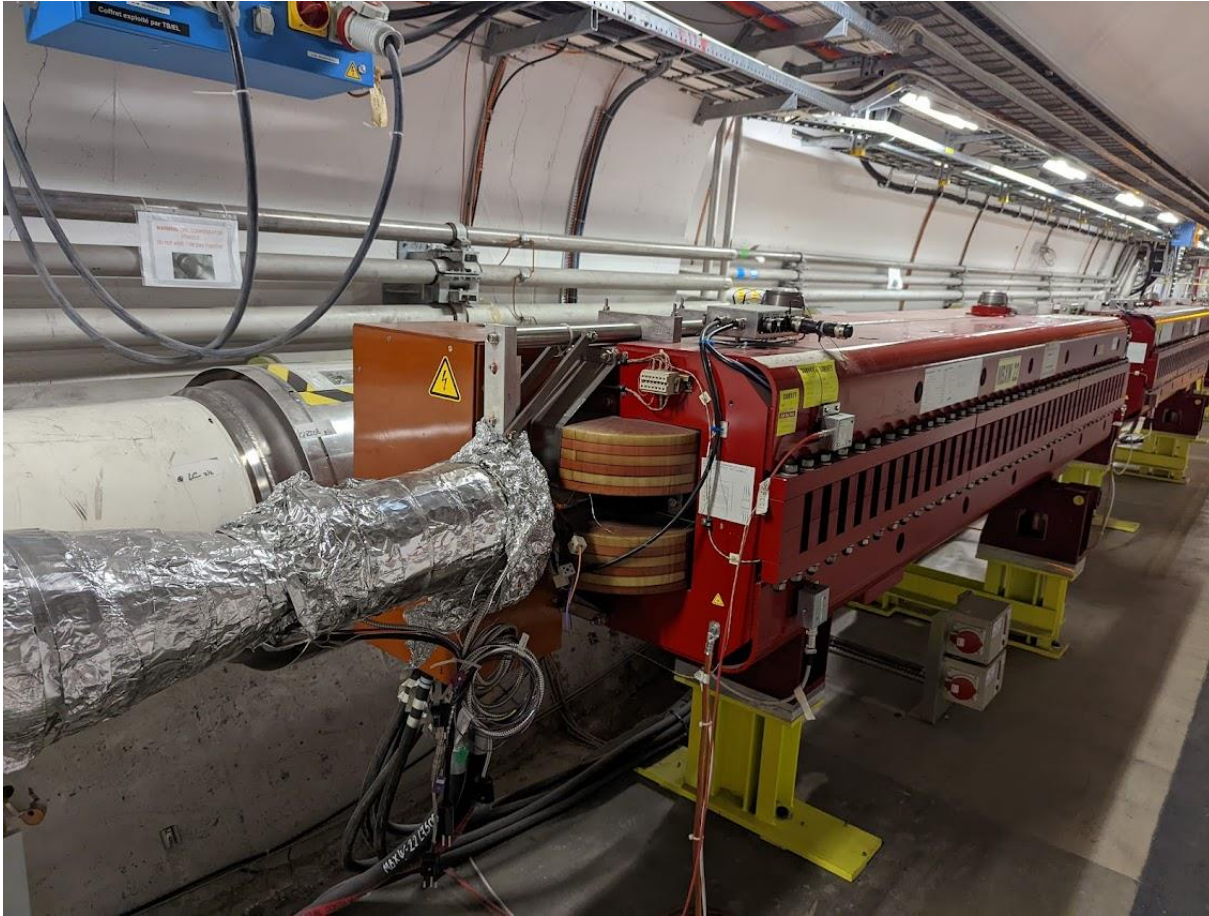

Single aperture magnet (alternative 1 and 2)

Dual aperture 2-in-1 (alternative 3)

Single aperture magnet
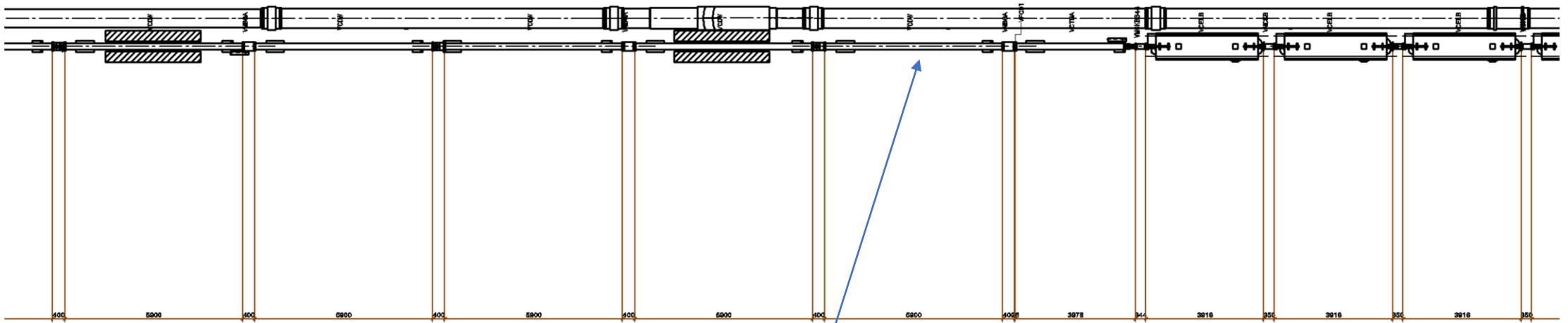
Magnet close to the D1

How it looks like in the tunnel

Direction of the triplet

Direction away from the triplet
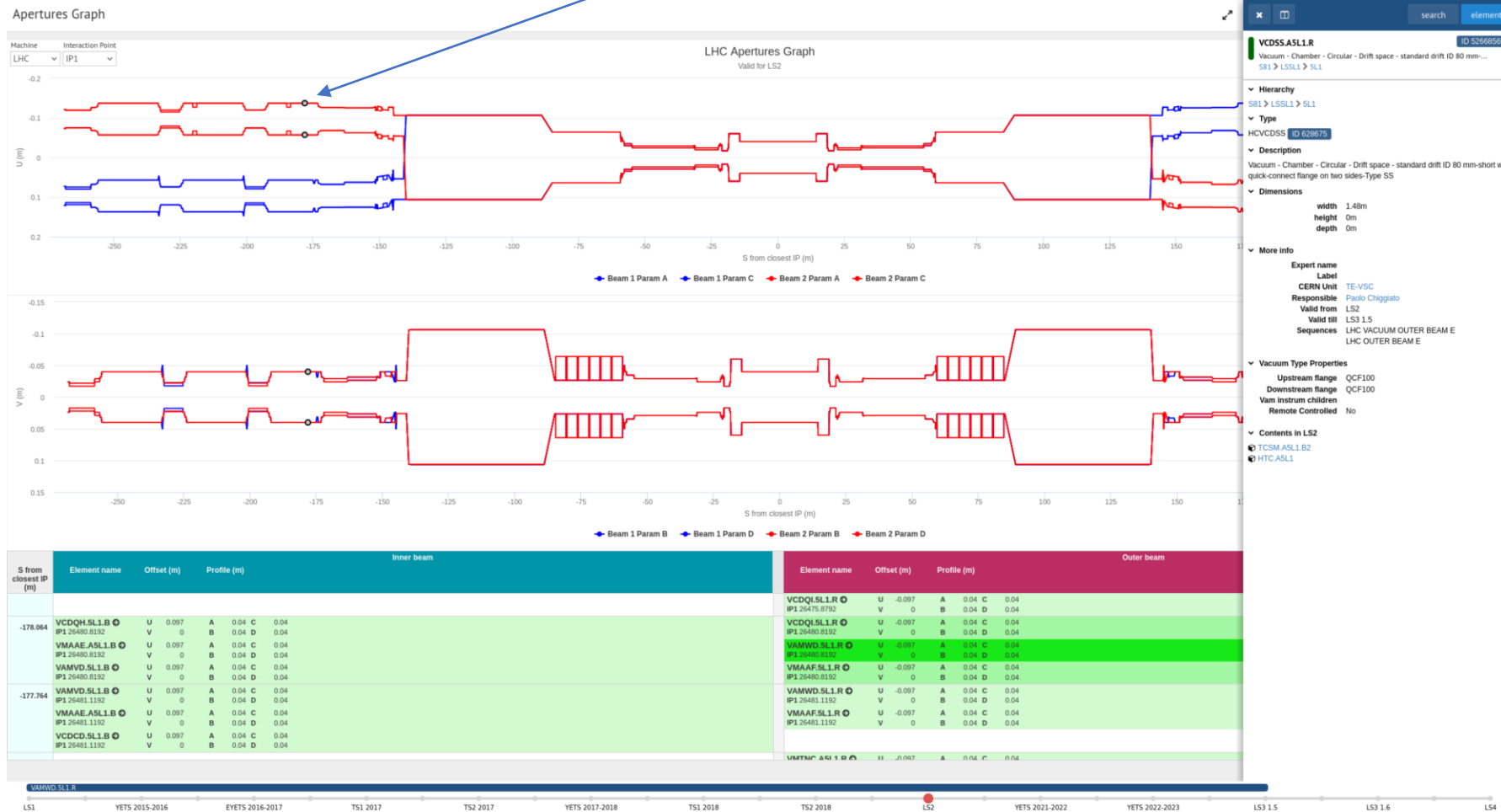The magnet could be placed close to here

Install the magnet here

1. Install the warm skew quadrupole without breaking the vacuum.
   - The external chamber is 219.1 mm.
   - We would need a magnet with 2.3m long and strength 3.3 T/m -> 0.73T peak
2. Replace the vacuum pipe to something smaller. Exact values to be studied but assume 150 mm would be ok
   - External chamber is 150 mm
   - 2.3 m long magnet and strength 3.3T/m -> 0.5 T peak

*Note that the 2.3 m is not fixed it could easily be up to 3 m or down to 1 m if that would make it easier/cheaper to construct as long as the integrated strength is the same.

What about the location close to outside Q4 (away from the IR) ?

Magnet could be located here
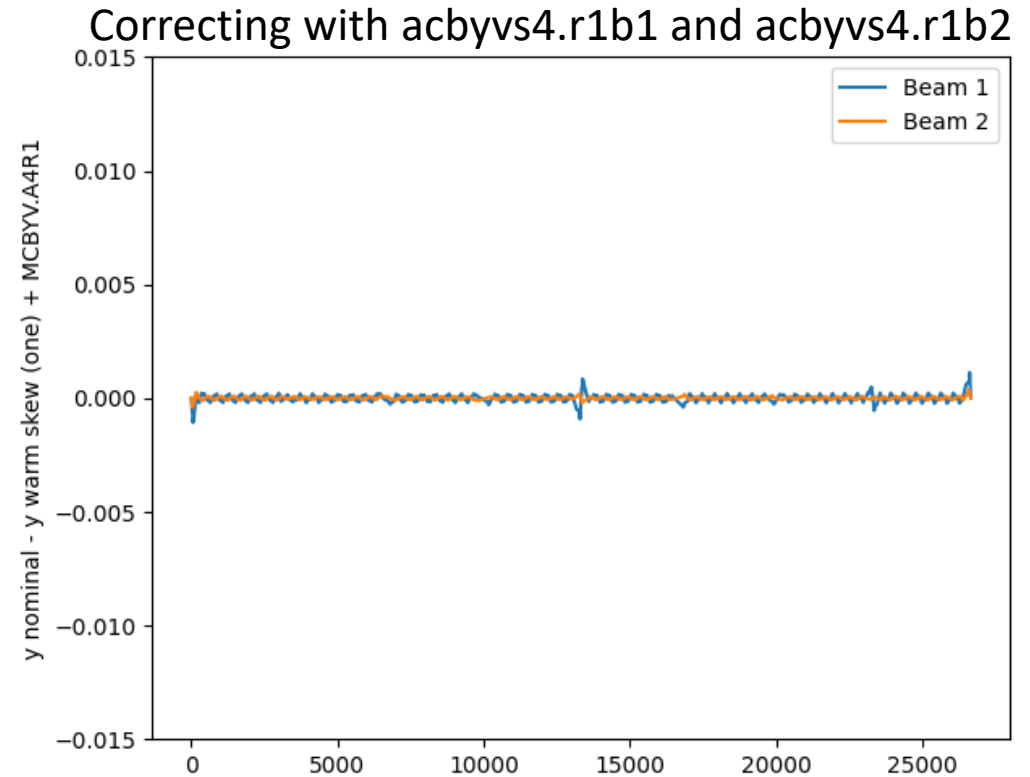
At the q4 looking away from the IR

194 mm from centre to centre

84 mm   84 mm

Install magnet here

3. External beam pipe 84 mm and separated with 194 mm (see previous slide)

- Need separate powering for each beam
- Need 9.5 T/m for a 2.3 m long (we need stronger at this location because of the optics)
- Maybe something like the MQW could work in terms of design

What about the feed-down for the magnet close to the D1?

Correcting with acbyvs4.r1b1 and acbyvs4.r1b2
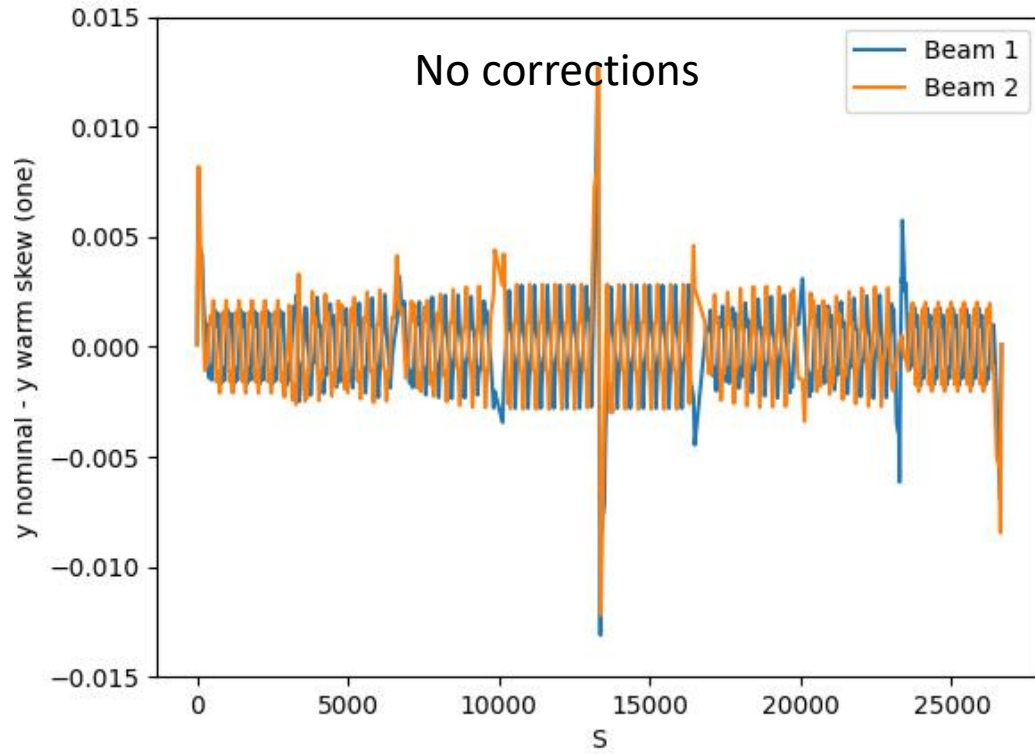
- Offset calculated from survey
- I only used acbyvs4.r1b1 and acbyvs4.r1b2
- They can be powered to 72 Amps and the max used in Run 2 was 12 Amp (checked left and right of IP1 and IP5)
- Correcting with only acbyvs4 I found that I needed around 20 Amp maximum for 6.8TeV
- -> Correction could be optimized but it is not a show stoper

Conclusion

- Installing a magnet either close to Q3 or Q4 seems reasonable and is rather a decision what is easiest/cheapest for the magnet design

- The feed-down from the offset in the skew-quadrupole is manageable

- The easiest seems to be keep the vacuum pipe but one could possibly reduce the aperture and the possibly save on the magnet
  - A full study would have to be done to see how much we can reduce the aperture at this location
    - Only interesting if there is a significant cost saved on the magnet.