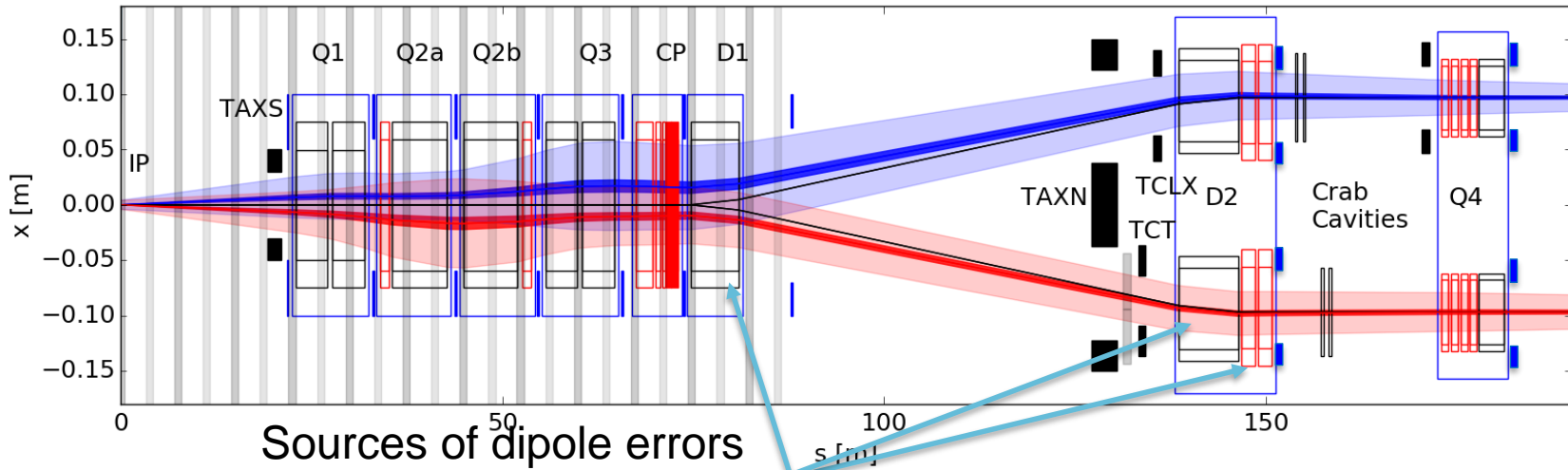




## **D1 BPM and aperture**

R. De Maria, D. Gamba, J. Andersson

# D1 BPM

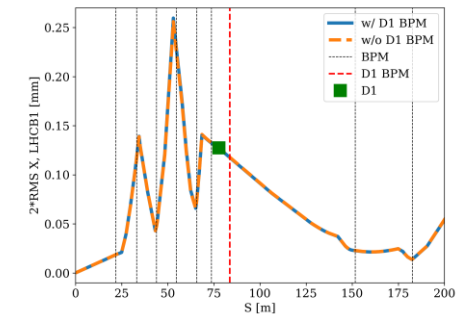
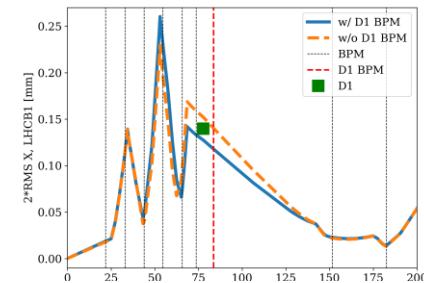


Without BPM in D1 unobservable close bump:

- Assuming 20 units transfer function error and 1 mrad tilt: orbit error 320  $\mu\text{m}$  (inj.) and 32  $\mu\text{m}$  (flat top)

For statistically distributed error at flat top, it is possible to restore the correction performance by updating the strategy (more weights on the BPMs close to D1)

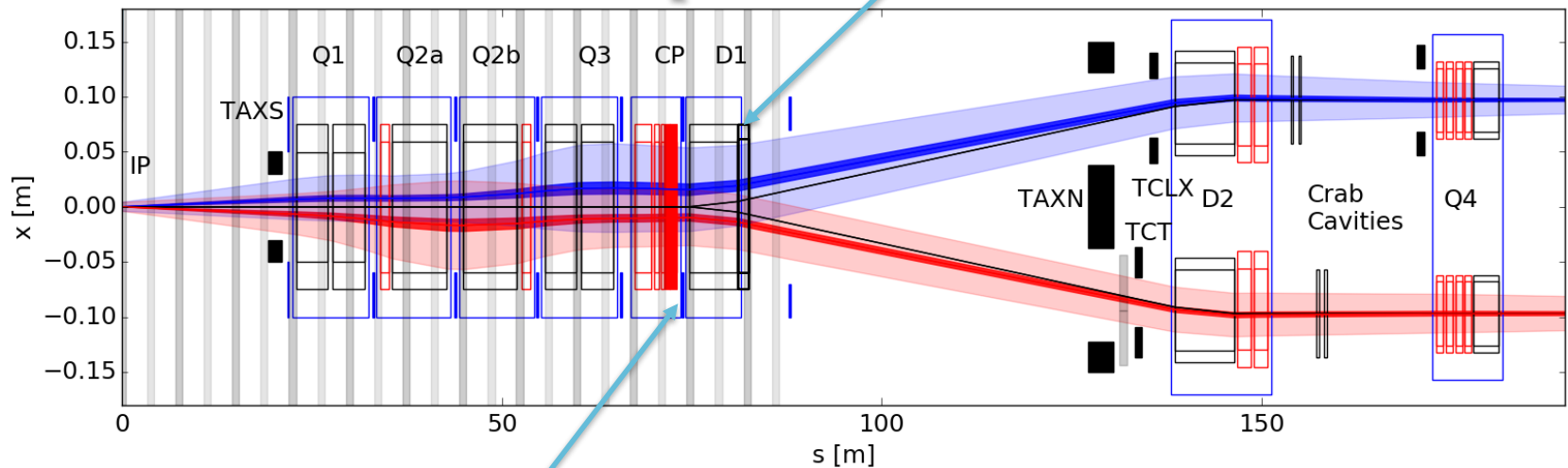
BPM useful for redundancy or large than expected errors



# Aperture general features

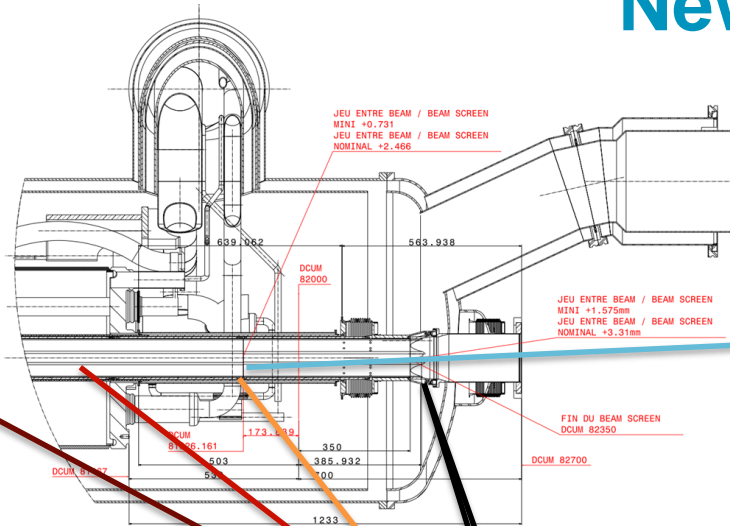
Aperture at edge of D1 cold mass already at the limit.

B.S. extension (not to scale)

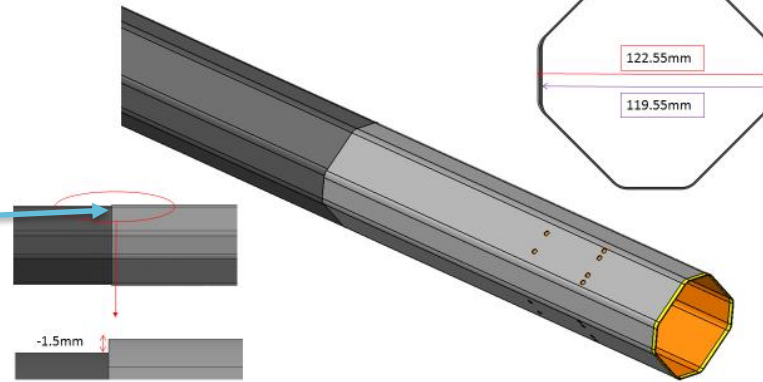


Envelope not symmetric, misalign D1 towards the outside of the machine helps

# New D1 B.S.



MODIFICATION Beam screen



C. Garion, 13/2/2019

Design criteria:  
All apertures should be in the shadow of the triplets by  $>0.5 \sigma$ , ideally.

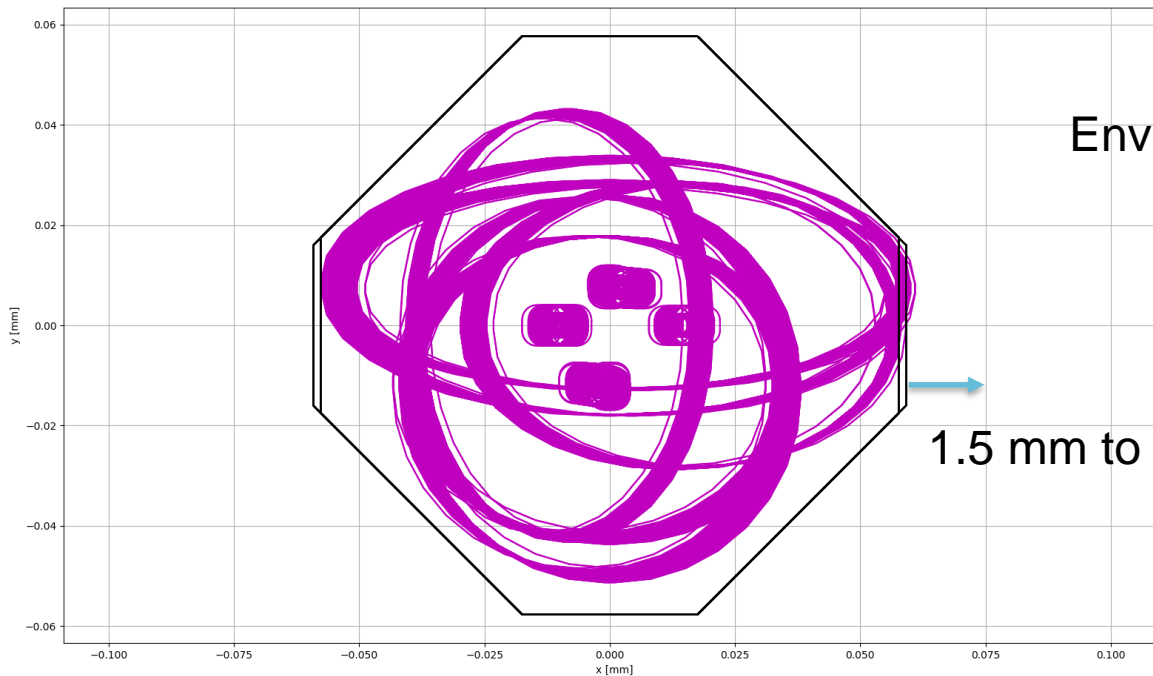
Aperture [ $\sigma$ ]	Round Optics	Flat optics
Triplet	13.1	12.7
D1 Magnet	13.9 (+0.8)	13.0 (+0.3)
D1 BS 81826	13.5 (+0.4)	12.7 (0)
D1 BS 82386	13.3 (+0.2)	12.5 (-0.2)
New BS 82386	13.8 (+0.7)	12.9 (+0.2)

Aperture calculation will be reviewed with updated tolerances when available.

Increased aperture restore aperture hierarchy by  $\sim 0.5 \sigma$

# Further improvement

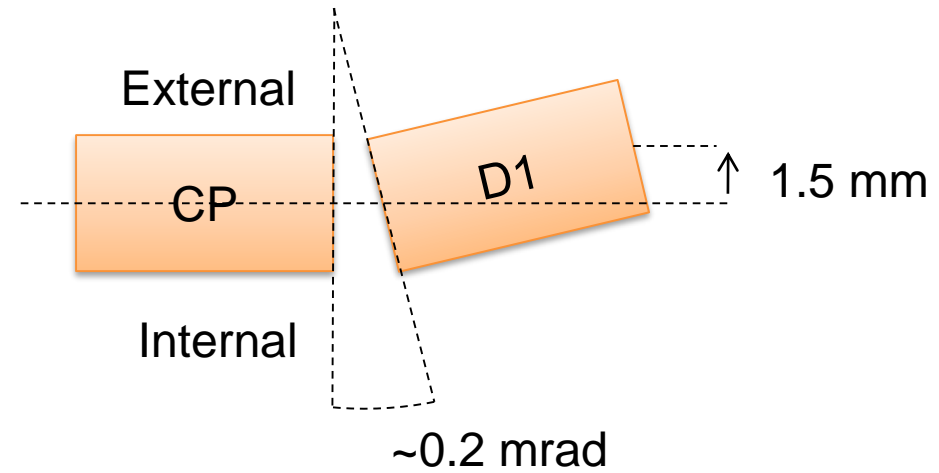
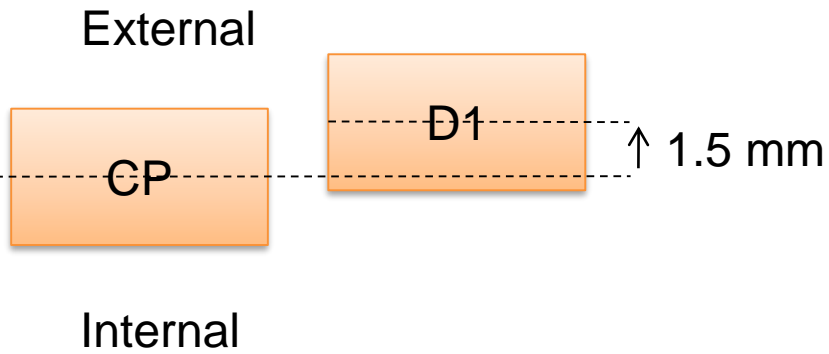
Further gain could be achieved by increase the aperture by misaligning D1 by  $\sim 1.5$  mm inside the ring. Consequences to be evaluated.



Envelopes for flat and round

1.5 mm to center the beam envelopes

# Alignment options



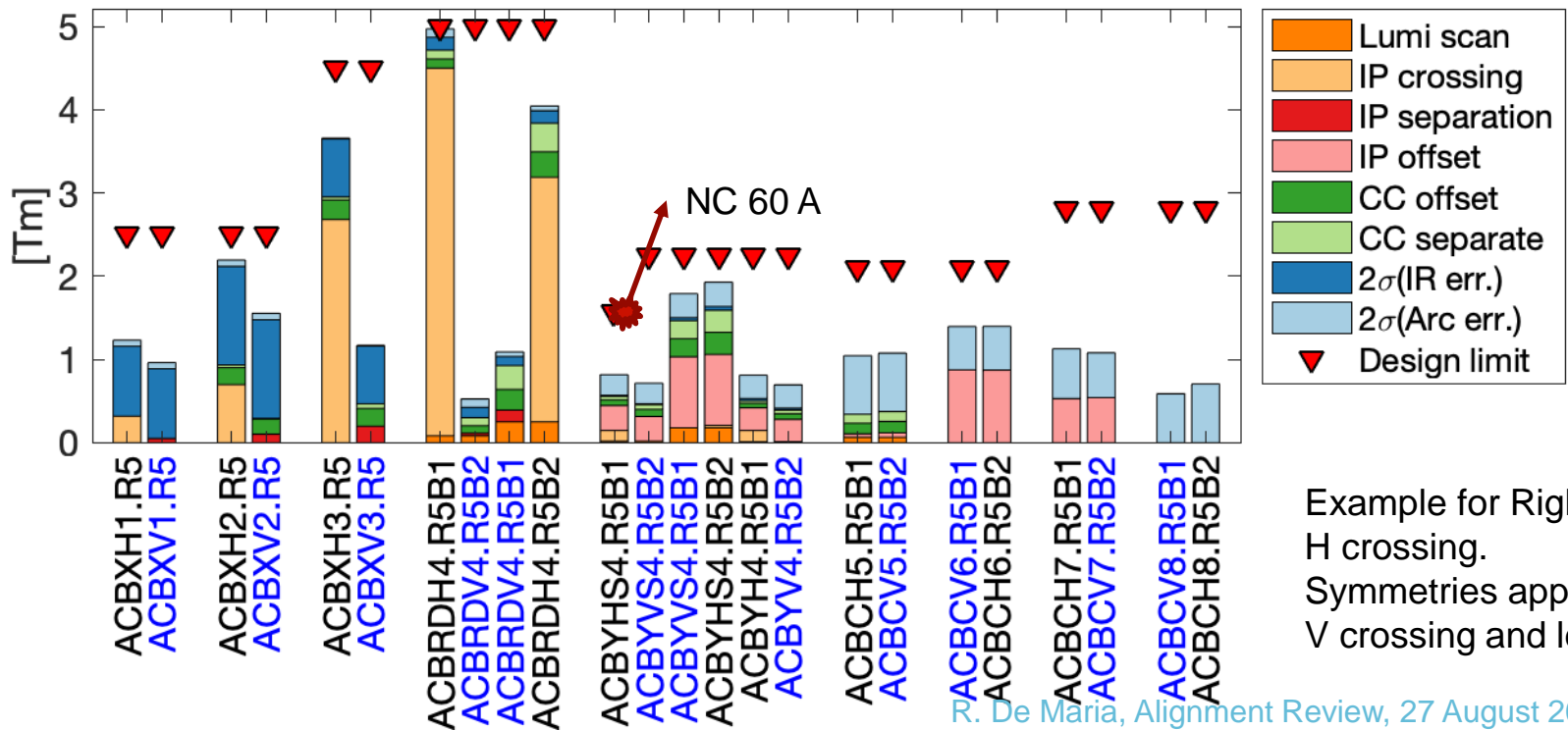
# Back-up

# Summary of strengths with remote alignment

## Knobs and correction for:

- $\pm 295 \mu\text{rad}$  crossing angle in H/V plane (H in the figure)
- $\pm 0.75 \text{ mm}$  separation in V/H plane (V in the figure)
- $\pm 2 \text{ mm}$  IP offset Q1-Q4 displaced by 2 mm + Q5 1 mm + and correctors
- $\pm 0.1 \text{ mm}$  IP movement independent for B1/B2 for luminosity scan
- $2 \sigma$  correction of  $\pm 0.5 \text{ mm}$  residual quad. misalignment and  $\pm 0.5 \text{ mrad}$  dipole tilt.
- Short range orbit adjustments ( $\pm 0.2 \text{ mm}$  CC adjustment)

Assume remote alignment for IP shift and orbit corrector minimization during beam commissioning.



Example for Right 5 with H crossing. Symmetries applies for V crossing and left side.