Merge Status Log

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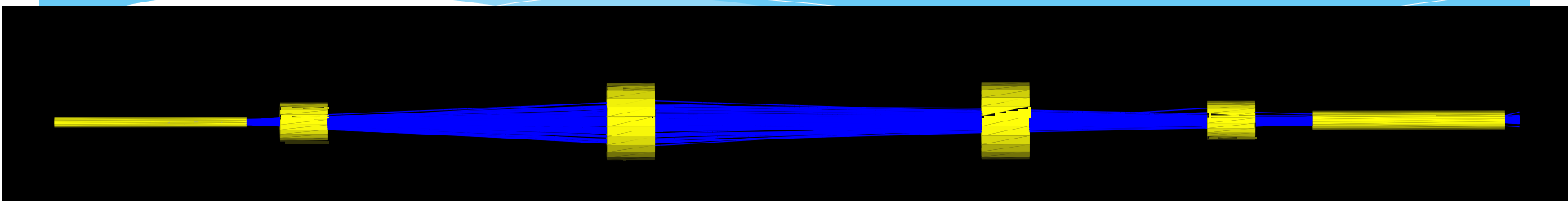
Progress

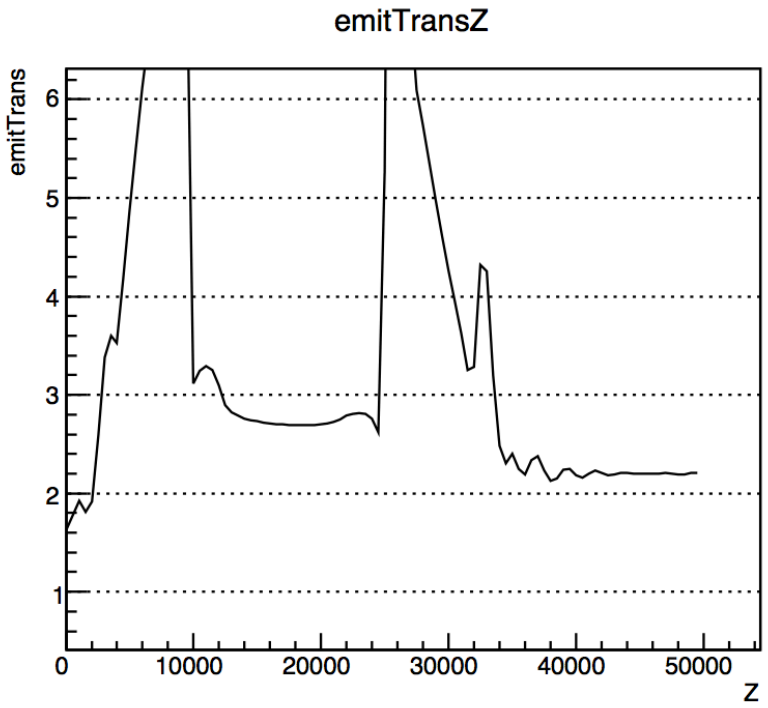
- Optimized by hand the focusing channel
- Implemented Ecalc9 and compared with my calculation
- Transformed simulations to centerline coordinates
- Use thinner solenoids units (1 cm instead of 5 cm)
- Checked the effect of the B-field “spikes” in the gap between straight and bent solenoid

Optimize the straight focusing channel



- Previously the focusing channel was based on optimizing the Courant-Snyder parameters, where the B fields of 4 lenses were ideal step functions.
- Now the strengths of the 4 lenses were adjusted by hand to reach lowest Emit at trombone.
- No position change for the solenoids

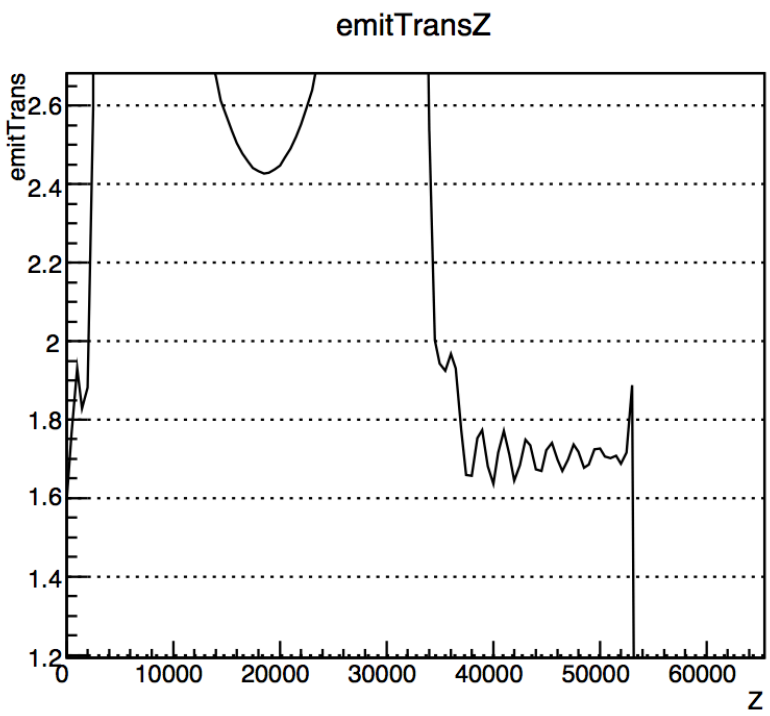
emitT before



Transverse emittance was 2.2 at trombone

Transmission 98.5%

emitT now

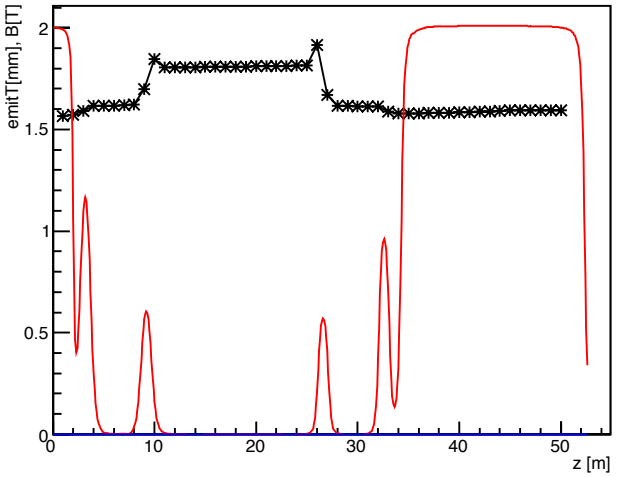


Transverse emittance reached 1.7 after optimization, which is roughly the same as input 1.6

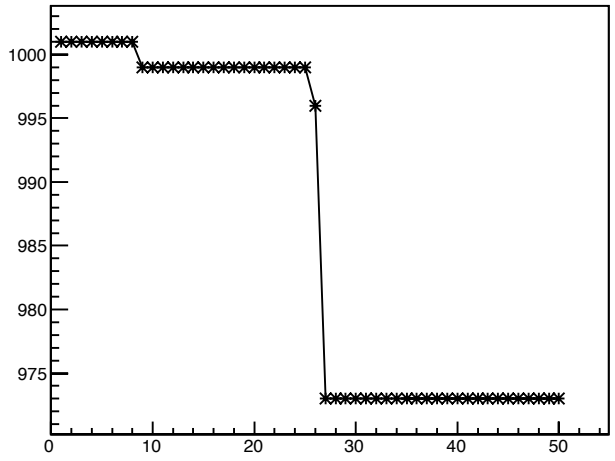
Transmission 97%

Ecalc9 results (explain in next slide)

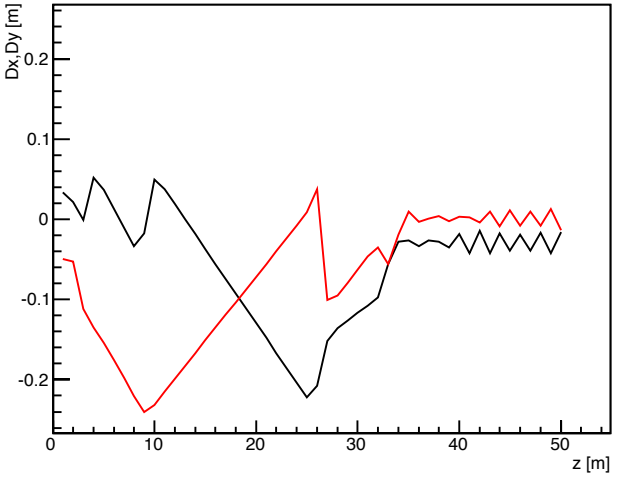
Eperp black, Bz red, Bx blue



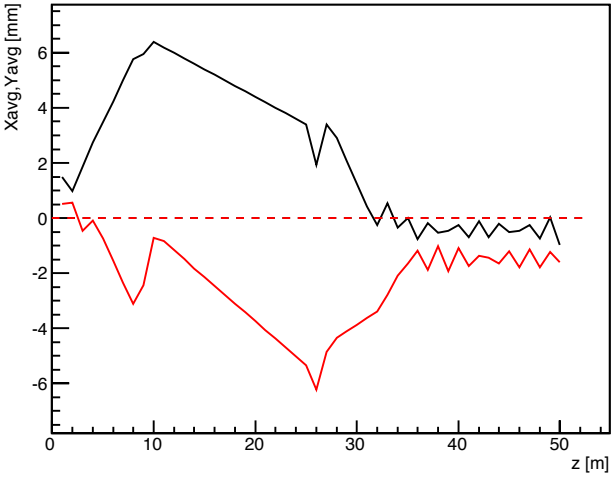
Transmission



Dxy, X red, Y black



XY avg(solid) reference(dash), X red, Y black



Ecalc9 results of the focusing channel

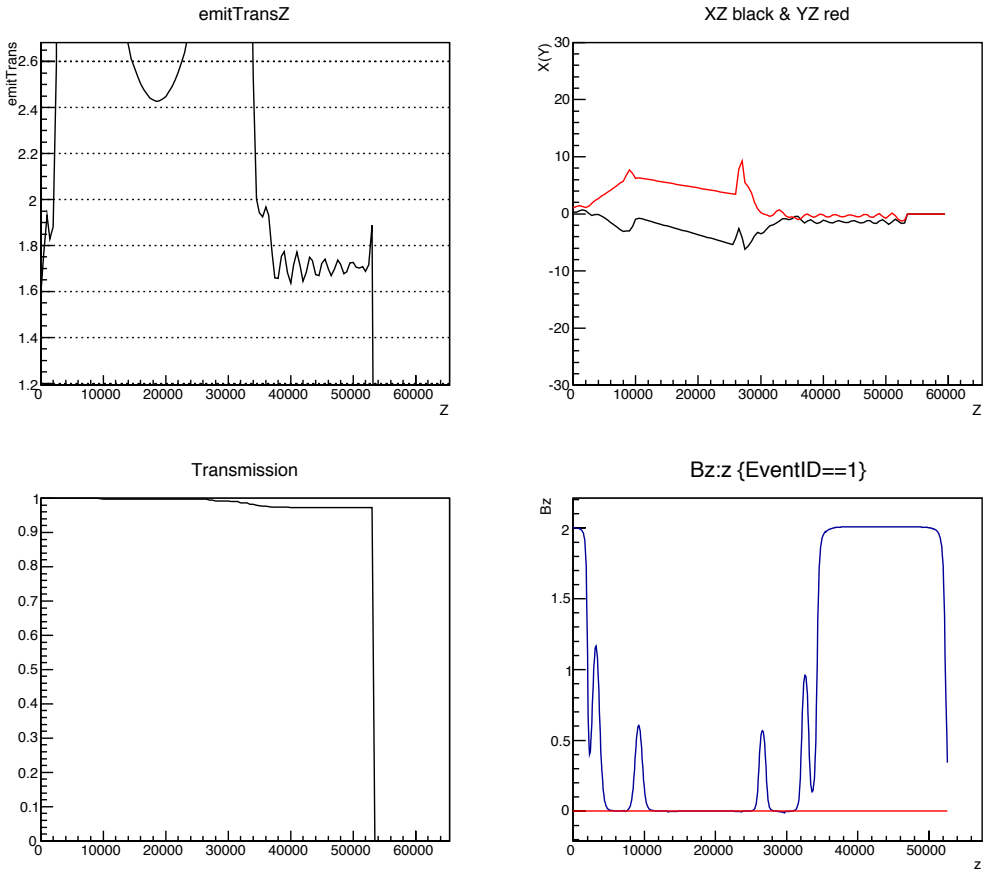
- Upper left: transverse emittance [mm] along z [m] (black curve), and Bz field [T] along z (red curve)
- Upper right: Transmission with 1001 particles
- Lower left: Dx (red) and Dy (black) in [m]
- Lower right: Average x (red solid) and y (black solid) in [mm], and the x y of the reference particle (dash line)

My calculation

Similar emittance in the trombone, but ecalc9 has much smaller or No rise-up in the focusing solenoids. (upper left)

Same average x, y divergence, probably because of the large beam size. (Upper right)

Same transmission.(lower left)



Coordinates

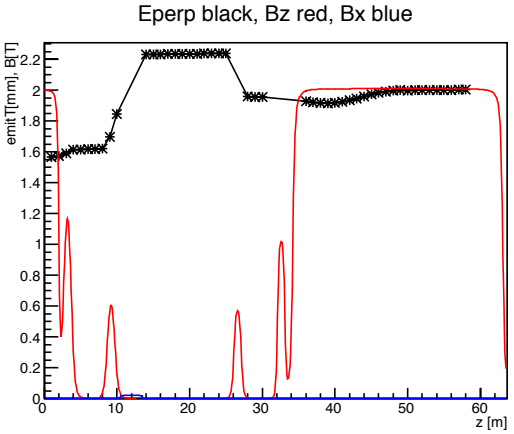
- Reference coordinates were used in previous simulations. Not accurate in the bent solenoids.
- Centerline coordinates is accurate for bending, easier for alignment, no later transform needed for Ecalc9 analysis. But G4bl is using 3 points to define a bent: one at entrance, one at exit and one in middle. This makes big errors in the large angle bending solenoids.
- Solution: make one large angle into small sections. Each one bent a small angle to reduce errors.

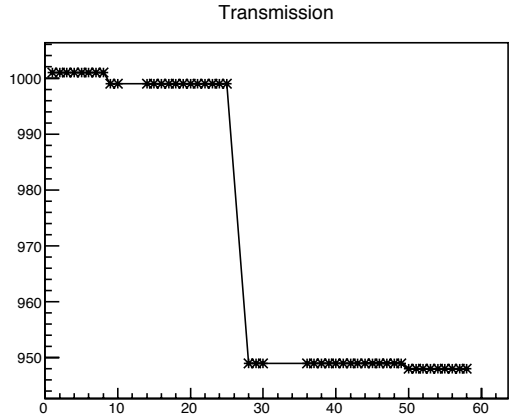
Then, turn the Kicker on, match to a straight solenoid

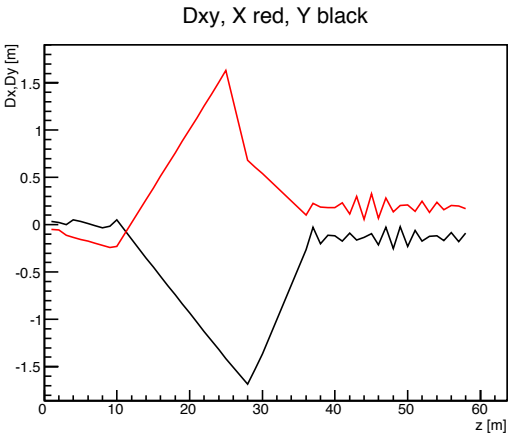
Emittance slightly increased in the straight solenoid, but kept lower than 2mm

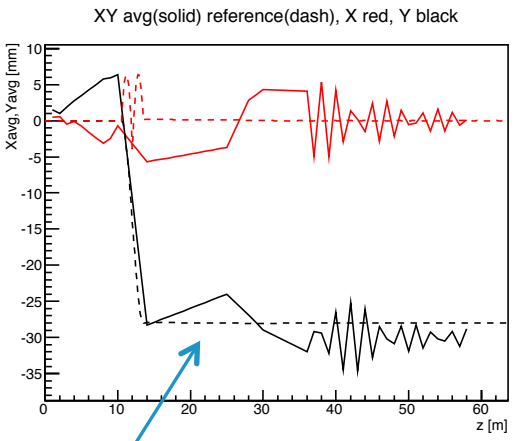
Transmission 95%

Average and reference particle kept on the centerline. Kicker kicks in X direction (so the centerline is along the bent in X) and has small effect in Y. The offset of Y after the kicker is this effect.









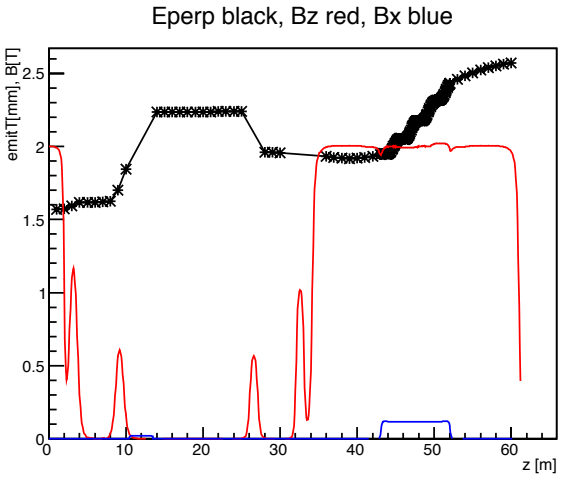
Offset in Y by kicker

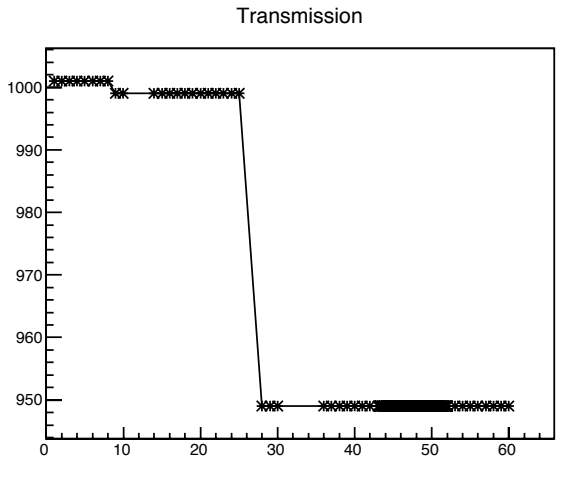
Trombone (one bent)

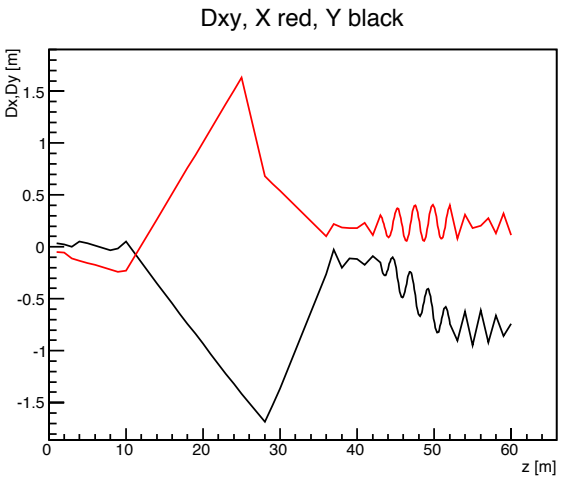
The first part (straight-bent-straight) of the trombone is simulated.

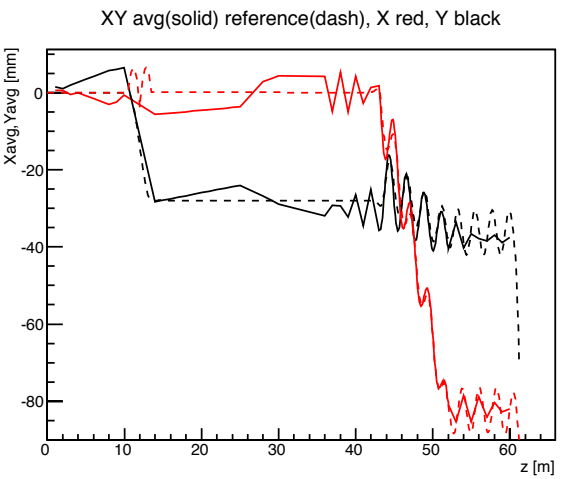
Emittance rises up in the trombone to 2.4mm in the bent. Still increasing in the second straight. (blue line is the Bx field)

Reference particle kept on Y axis but diverged large in X.







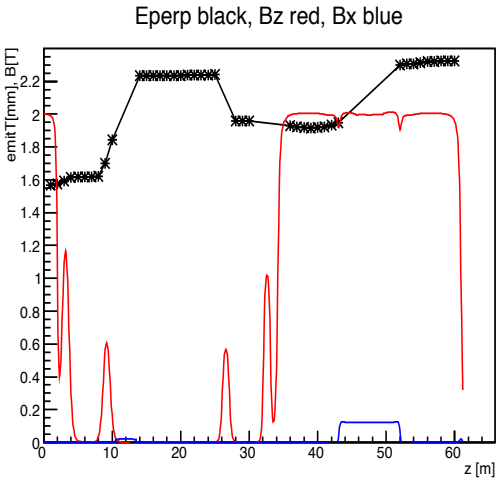


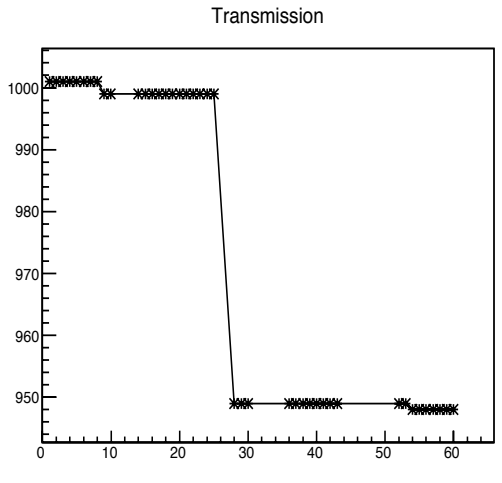
Use 1 cm solenoid sections

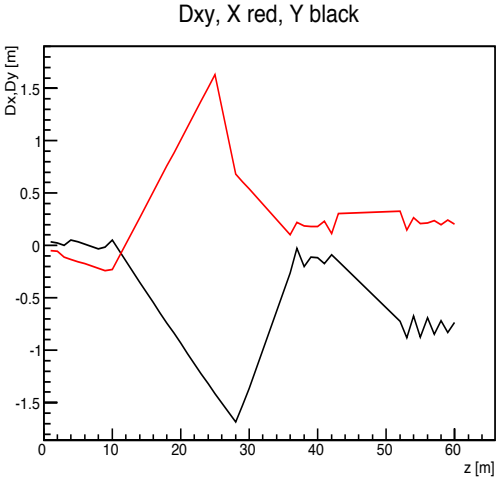
Replace the 5 cm long solenoids by 1 cm long units for the bent solenoids. Each small solenoid bends 0.2 degree.

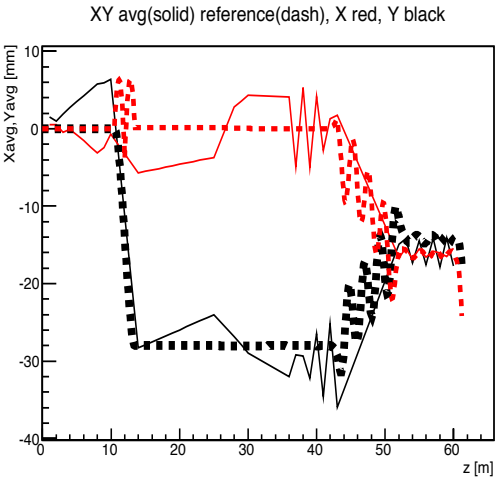
Emittance still increase in the bent solenoid. 2.3mm in the second straight.

X and Y of reference particle both diverge by 15 mm after the trombone







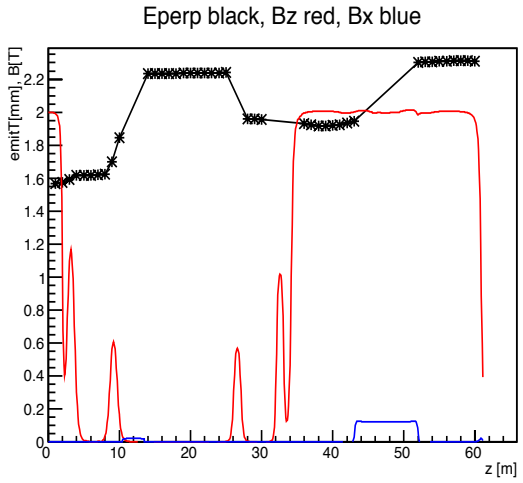


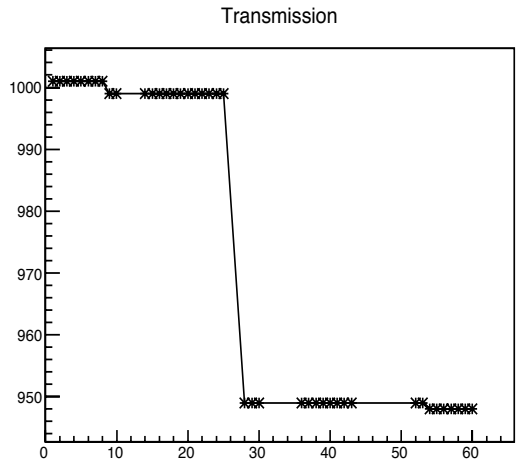
Reduce the spikes of B-field

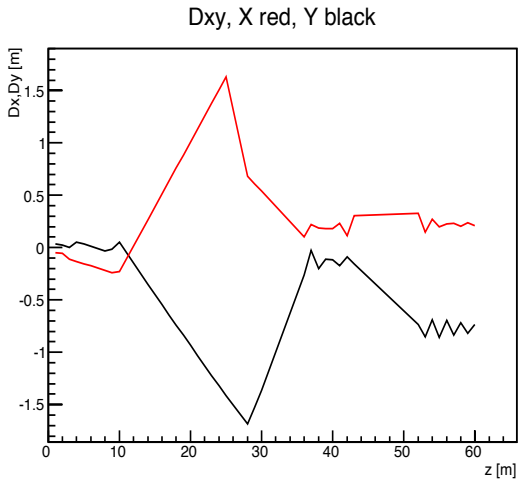
Here I simply reduced the spikes of B-field by reducing the gaps between straight and bent solenoids.

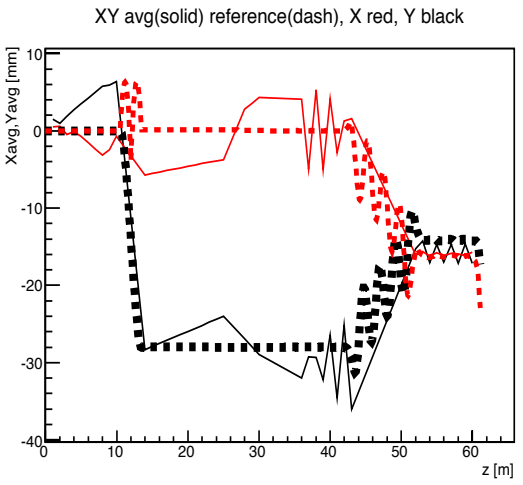
There are overlaps in Geometry.

Emittance does not change.







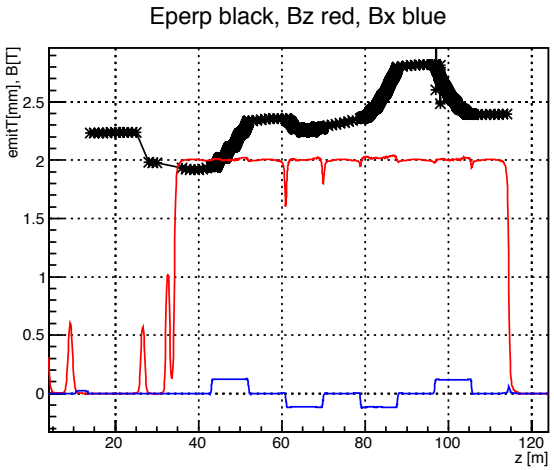


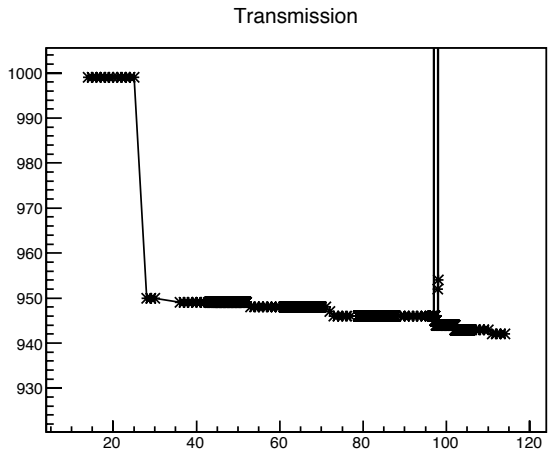
Whole Trombone

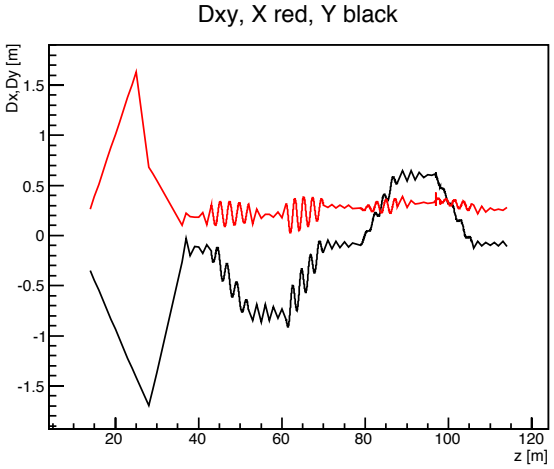
Emittance lower than 2.5 mm after a whole trombone.

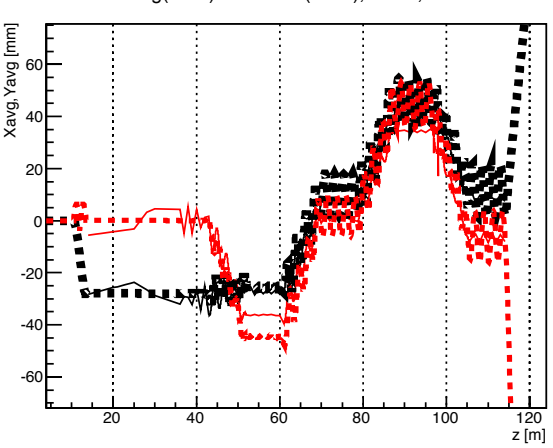
Trombone should be and can be improved.

Tilting angles are adjusted to have Y on centerline in the straight section after the first bent.









Next step

- Optimize the second bent section of the trombone.
- Align the straight sections to the center of the beam, instead of centerline of the geometry.
- Make a thin weak solenoid with large aperture at the gap to reduce the spikes of field.
- Check the field map at the gap.

- Funnel?