

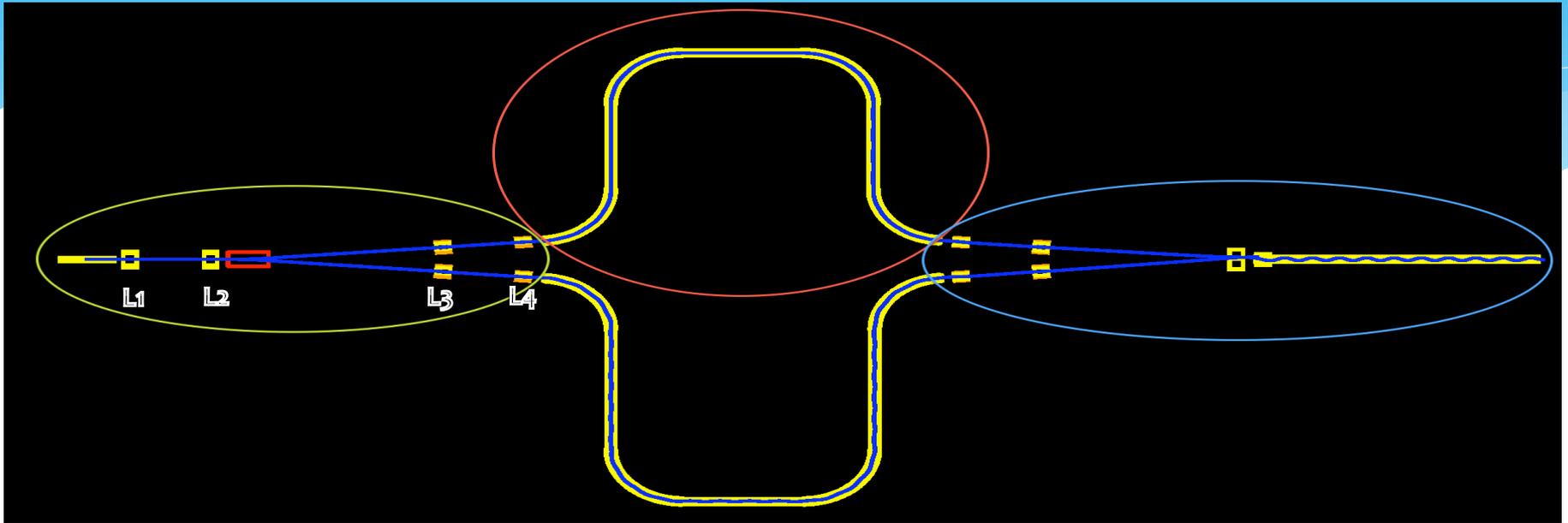
Transverse Merge Status

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UC Riverside

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Merge Scheme



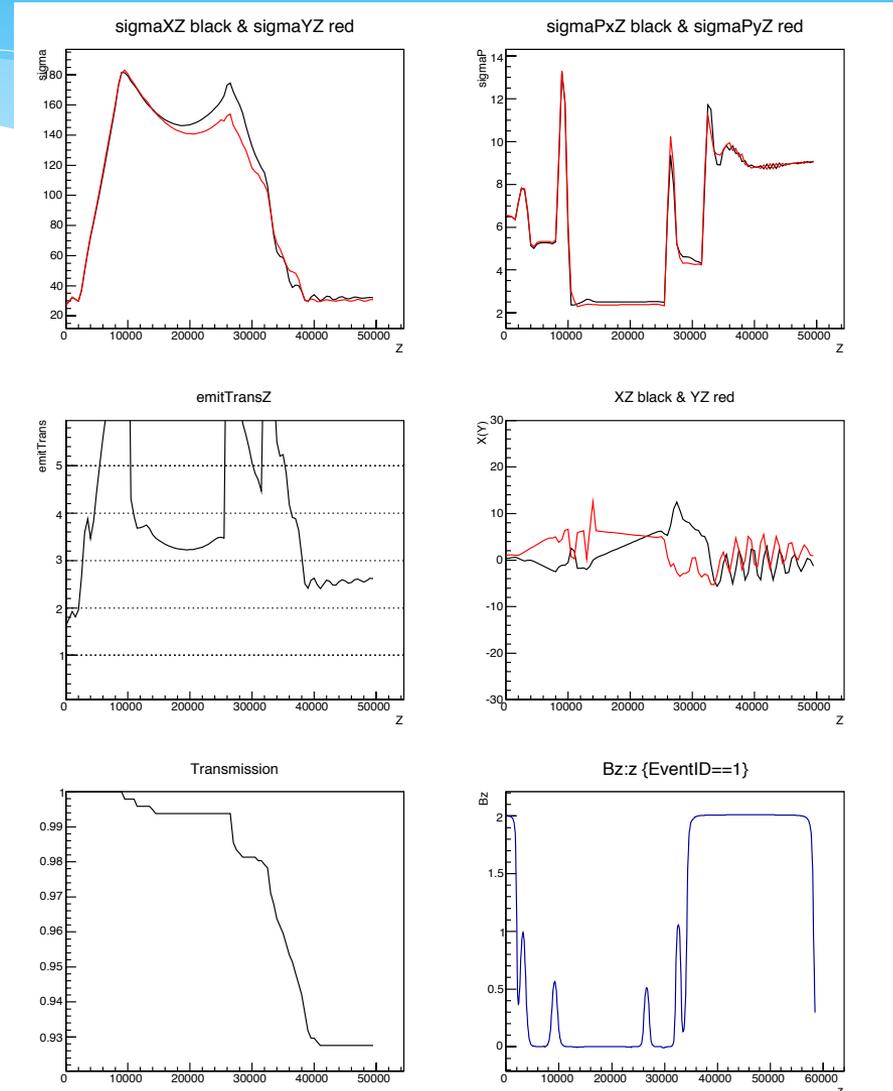
-  **Focusing Channel:** 4 solenoid lens to focus the beam to the trombones. (done)
-  **Trombone:** lead the bunches to different paths. (optimizing)
-  **Collecting:** collect the bunches to a final solenoid. (not yet)

Focusing Channel

Focusing channel is optimized to match into a straight solenoid.

Emittance reached 2.5 in the straight solenoid.

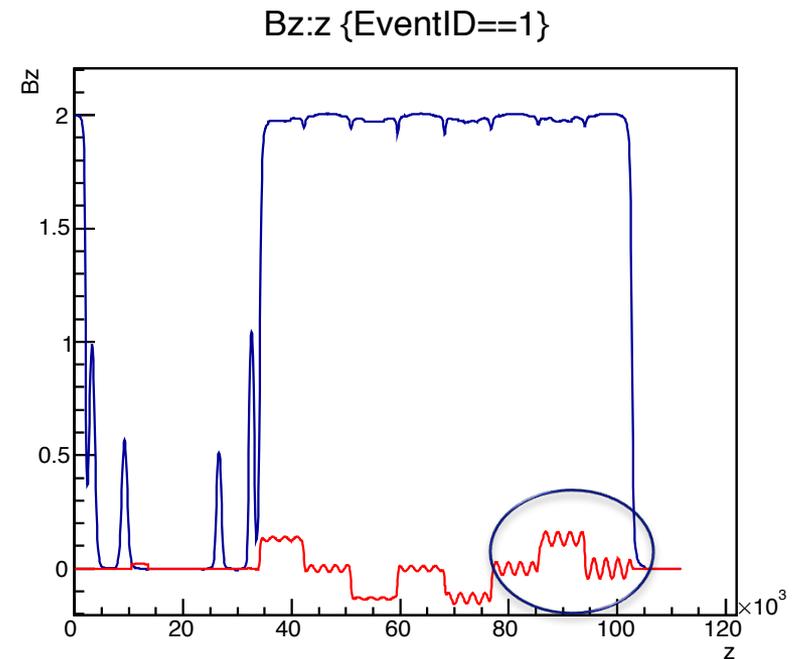
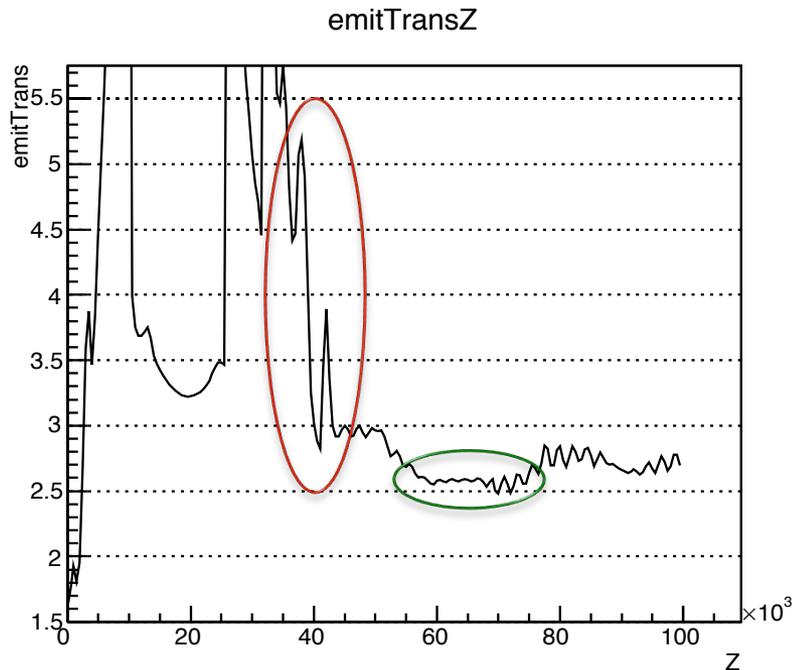
Distance between lens 2 and 3 is about 18 m. Beam size at lens 3 is <6cm. Give enough space for 6 lens 3 in parallel.



Trombone

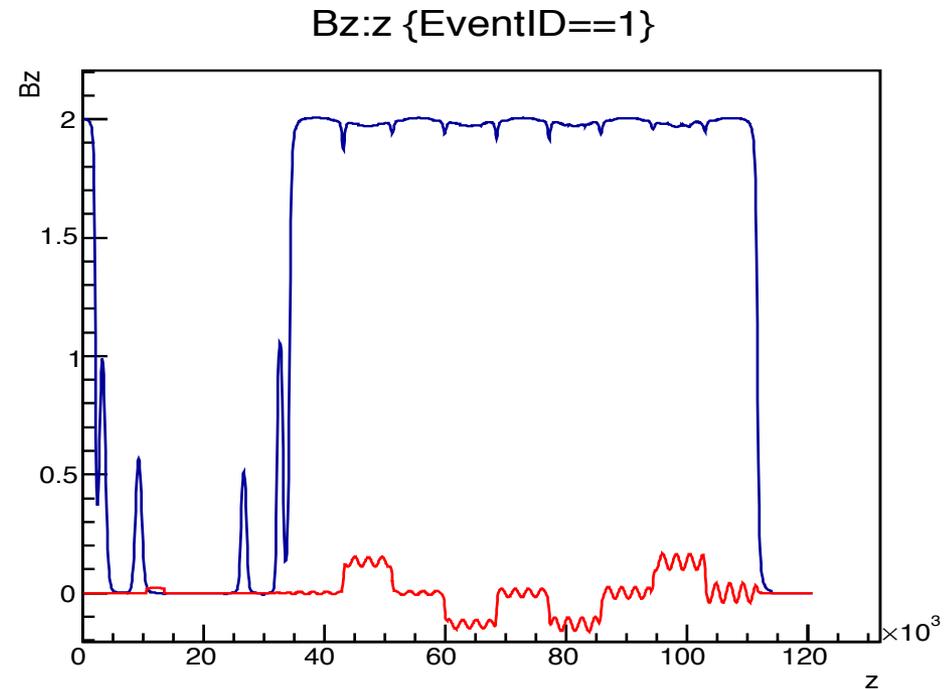
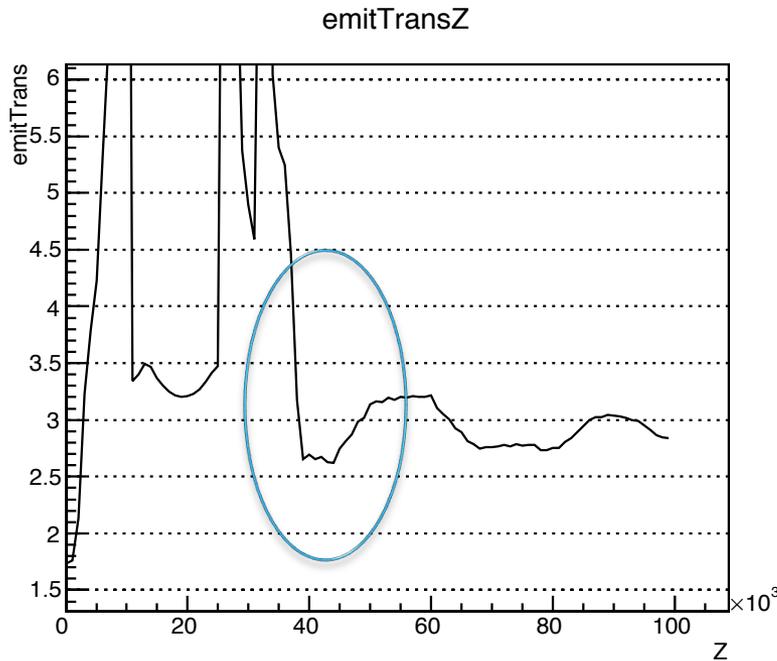
- ❏ The trombone is made by bent and straight solenoids
- ❏ The bent solenoid is made by small solenoids of 5cm long, with 2T B-field at center.
- ❏ Each small solenoid is tilted by 6.5 degree to provide a dipole bending field.
- ❏ Each solenoid (bent/straight) is $4 \cdot \lambda$ long, where $\lambda = 2 \cdot \pi \cdot p / B_c = 2.22\text{m}$
- ❏ Radius of 90 degree bent solenoid is 5.653m
- ❏ Radius of 85 degree bent (first bent after kicker) is 5.986m

Matching to the trombone



Emittance in the trombone reaches as low as 2.5, but still mis-match at the entrance and inside the trombone. Emittance = 2.8mm after the trombone. Reference particle mis-matched.

Straight to Bent



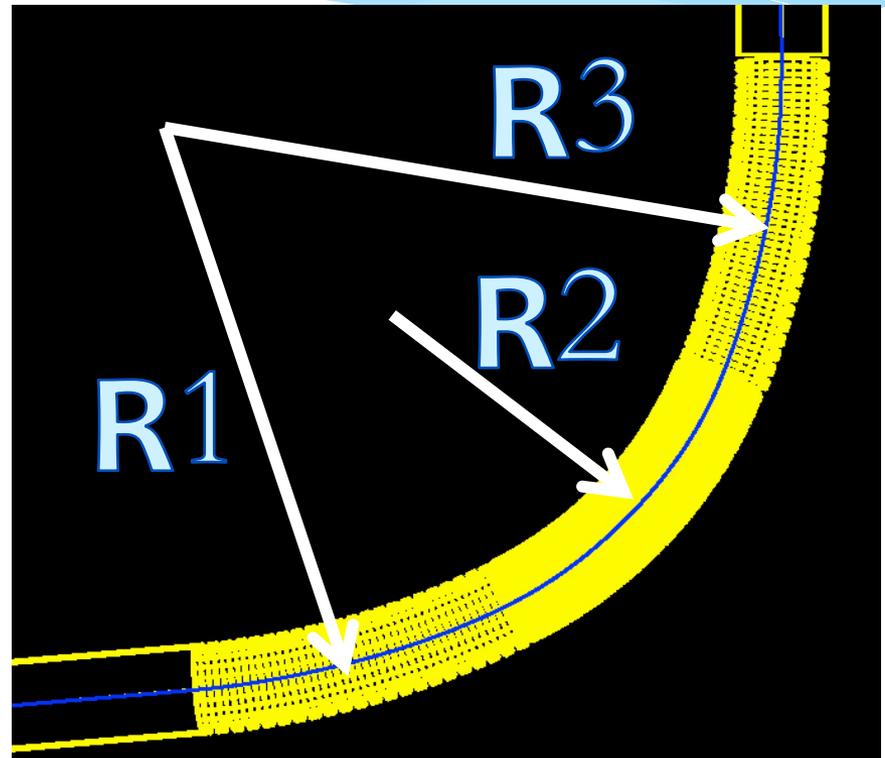
Matching to the straight is good.
Mis-match from straight to bent.

Re-design bent section

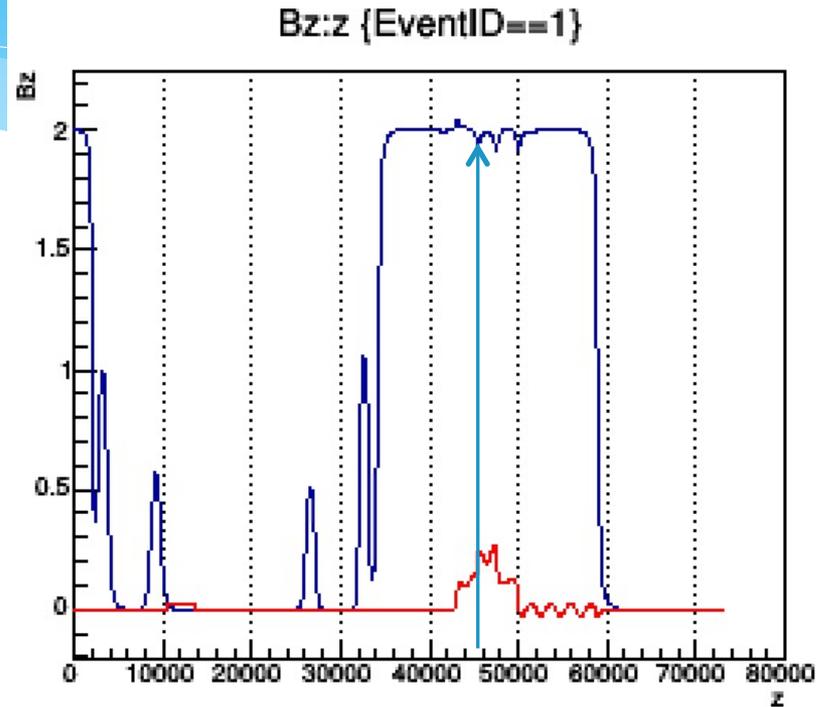
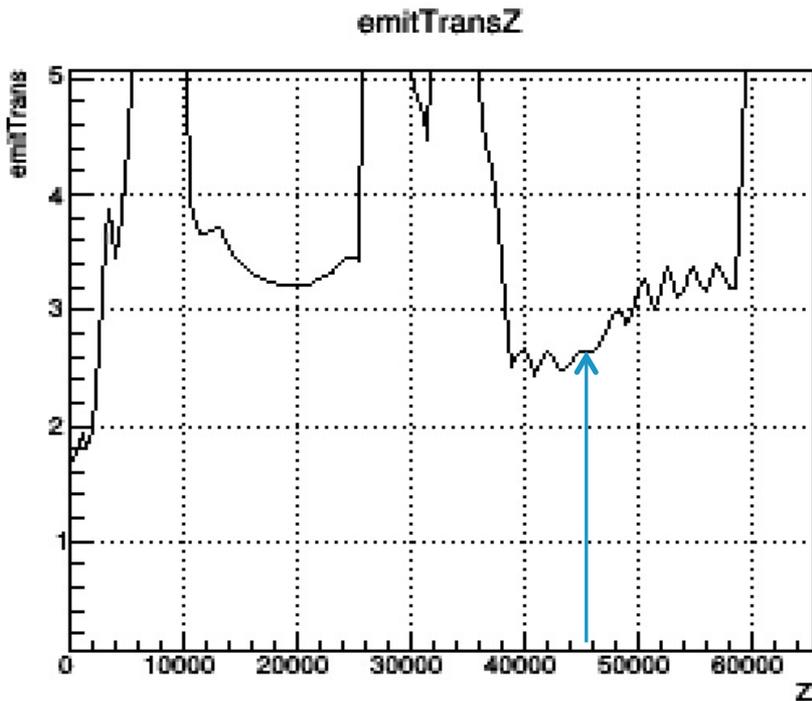
☒ Make 85 degree bent into 3 sections:
21 degree + 42 degree + 21 degree + 1 degree for the gaps

☒ $R1=2*R2=R3=\text{Lamb$
 $\text{da}*180/21/\text{Pi}$

☒ Tilting angle
 $\text{Theta}1=\text{Theta}2/2=\text{T}$
 $\text{heta}3=6.35$ degree



Result



Matching to the straight good.
Matching to the first bent section fine.
Emittance increase at the second bent.

Summary

-  Beam focused well at the entrance of the trombone
-  Matching well to a straight solenoid. Emittance kept at 2.5 mm
-  Mis-match at the entrance of the trombone. Emittance grows to 2.8mm
-  3-section bent designed. Beam only matches to the first bent section. Emittance increases at the second bent.

To do and questions

-  Try the “tune” function of G4BL to optimize more the focusing channel.
-  Align the reference particle. Reduce the oscillation at the end of the trombone.
-  How to improve the 3-section bent?
-  Funnel collection
-  Add RF cavity in the trombone and check longitudinal emittance.