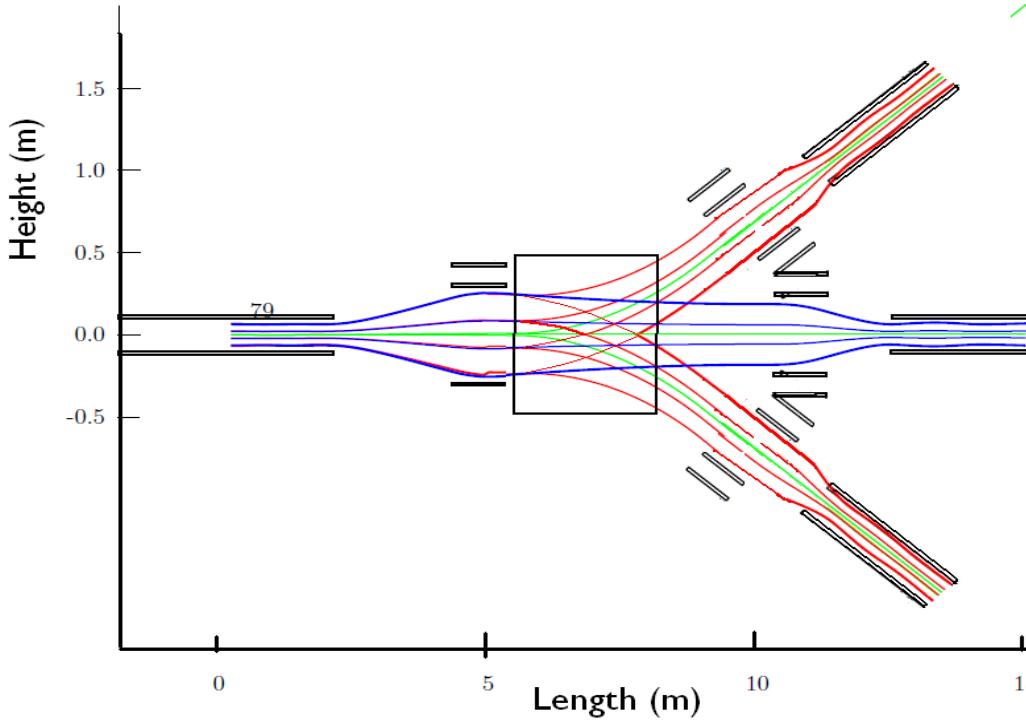
6D Merge Progress

Yu Bao
UC Riverside
Dec. 10 2013

Bob's scheme

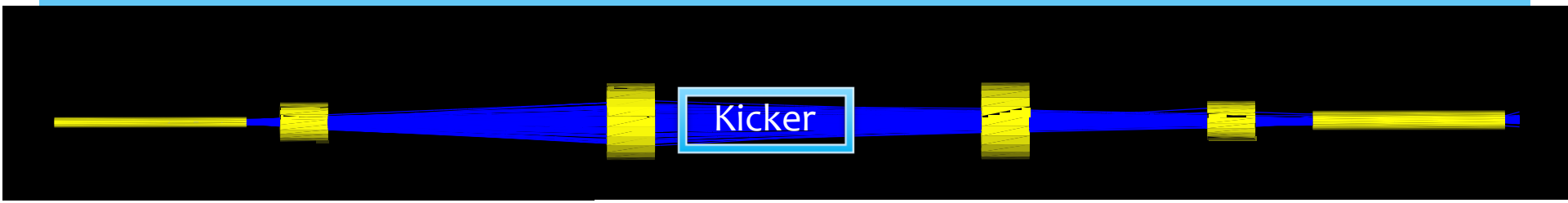
1. Kick 6 bunches into 6 channels
2. Use solenoid lens to Keep the emittance low
3. Use trombones to lead the bunches to different channels



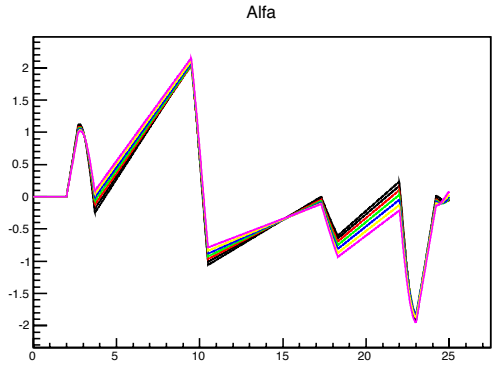
Steps

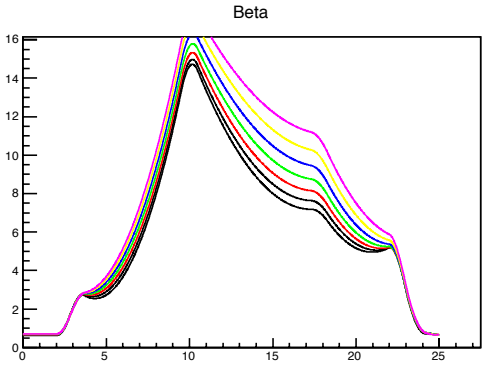
1. Optimize a straight channel, using solenoid lenses to reach a low emittance at the last collecting solenoid.
2. Put the trombone at the end, replacing the collecting solenoid.
3. Put the kicker on, modify and align the trombone.
4. Put 6 channel on, check field interactions.

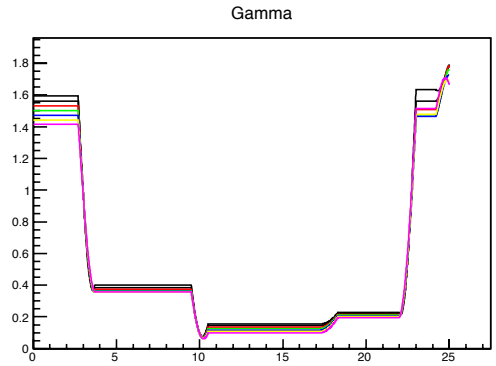
Step 1. Straight Channel

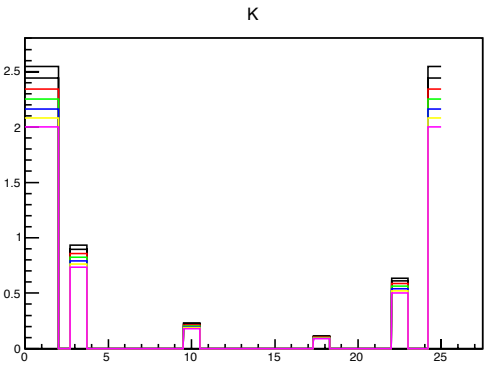


- Propagate the Courant-Snyder parameters
- Optimize the 4 focusing solenoid to get the best match to the end
- Keep beta at B2 higher than B3, so that the beam is focusing at the kicker

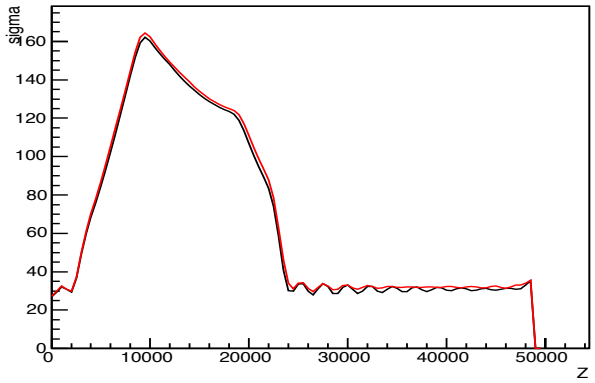




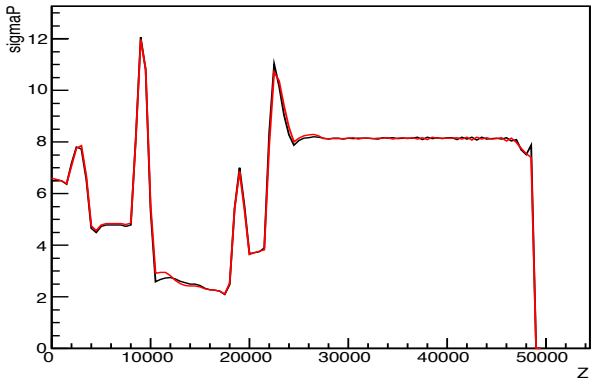




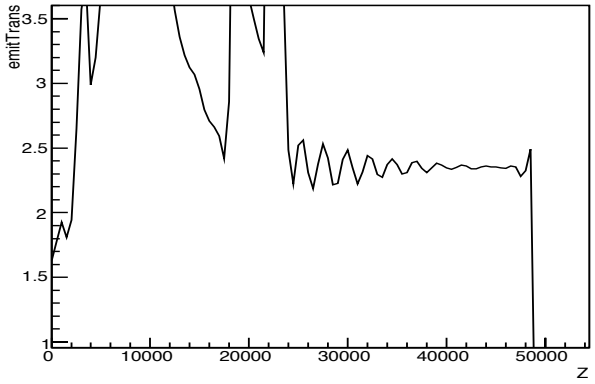
sigmaXZ black & sigmaYZ red



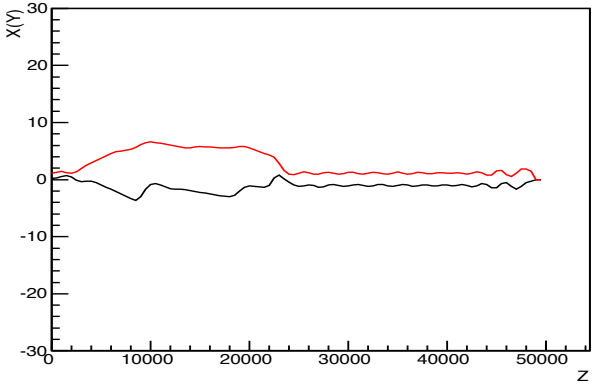
sigmaPxZ black & sigmaPyZ red



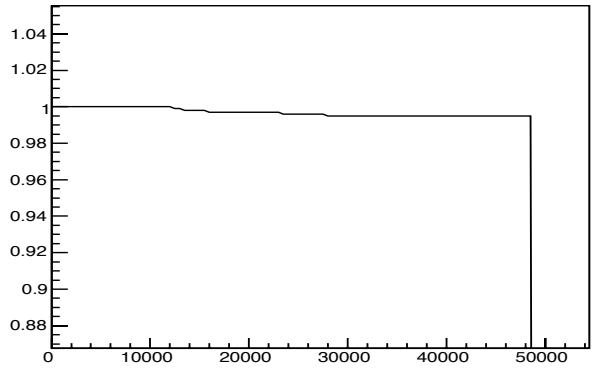
emitTransZ



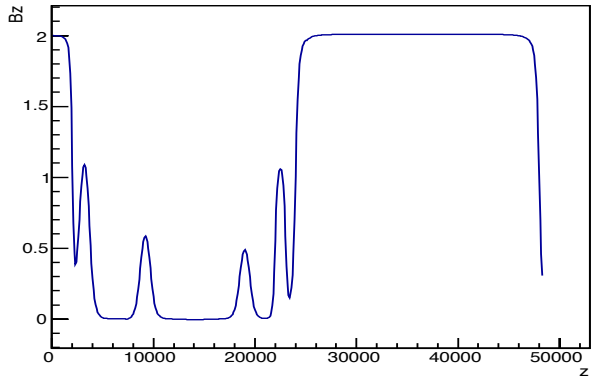
XZ black & YZ red



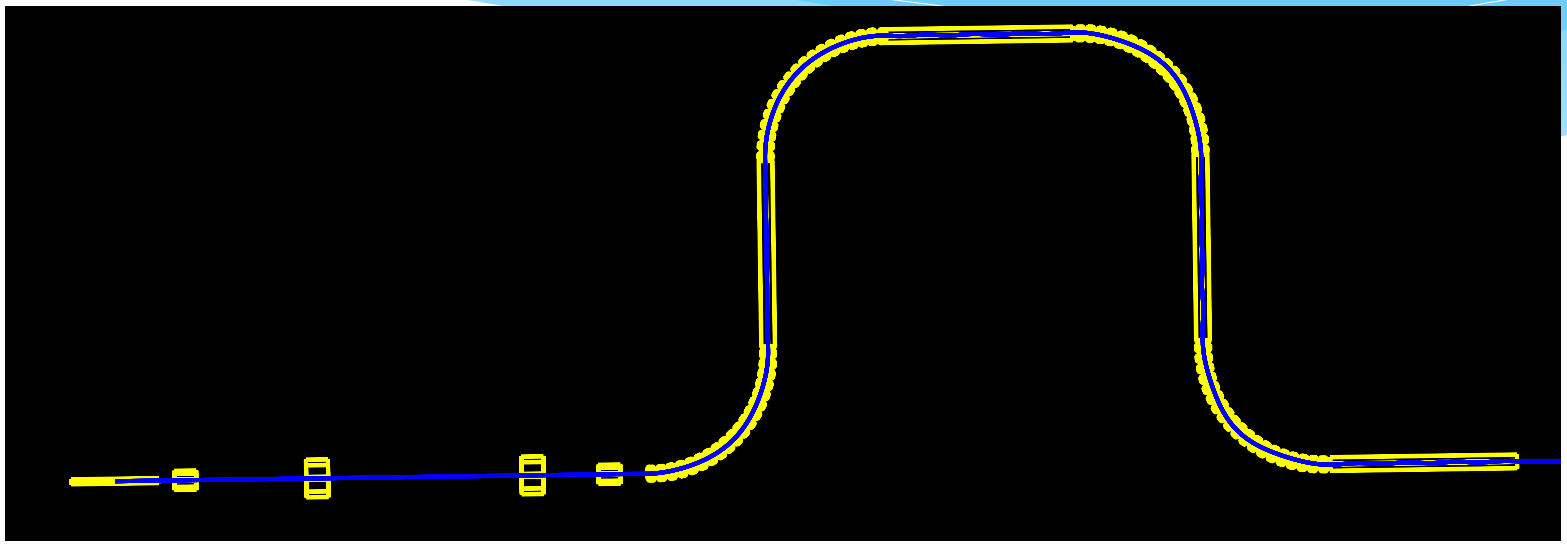
Transmission



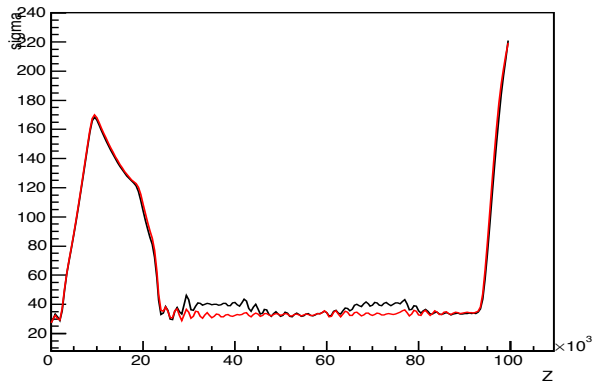
Bz:z {EventID==1}

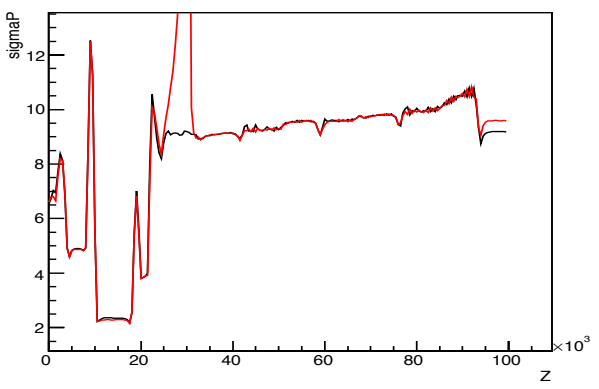


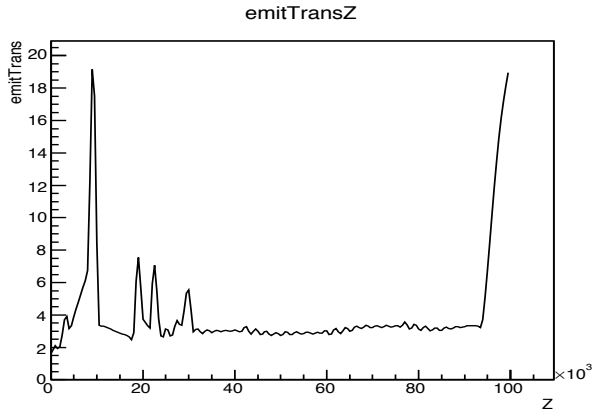
Step 2. Trombone

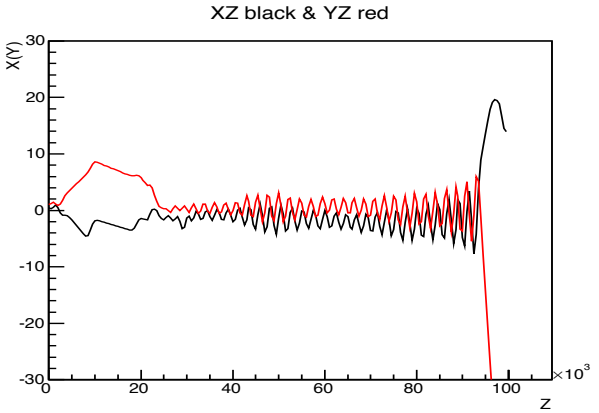


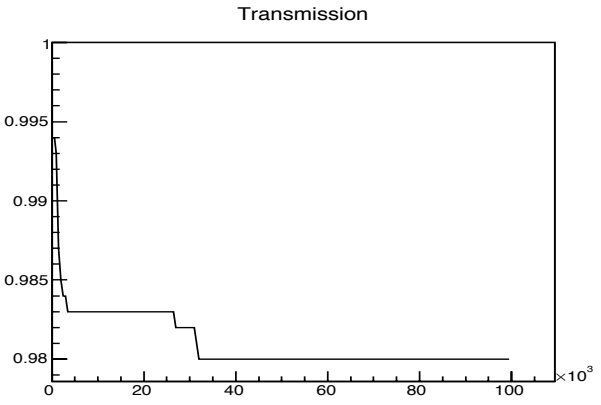
- Each bent solenoid is made of 90 small solenoids, tilted by a small angle
- Lengths of the bent and straight solenoids are defined by the betatron oscillation period.

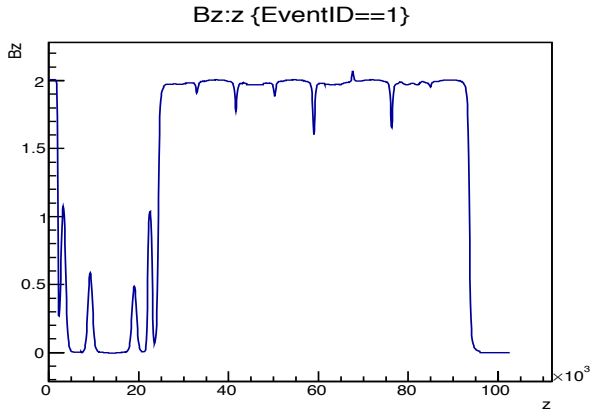

sigmaXZ black & sigmaYZ red
sigma
Z
×10³


sigmaPxZ black & sigmaPyZ red
sigmaP
Z
×10³


emitTransZ
emitTrans
Z
×10³

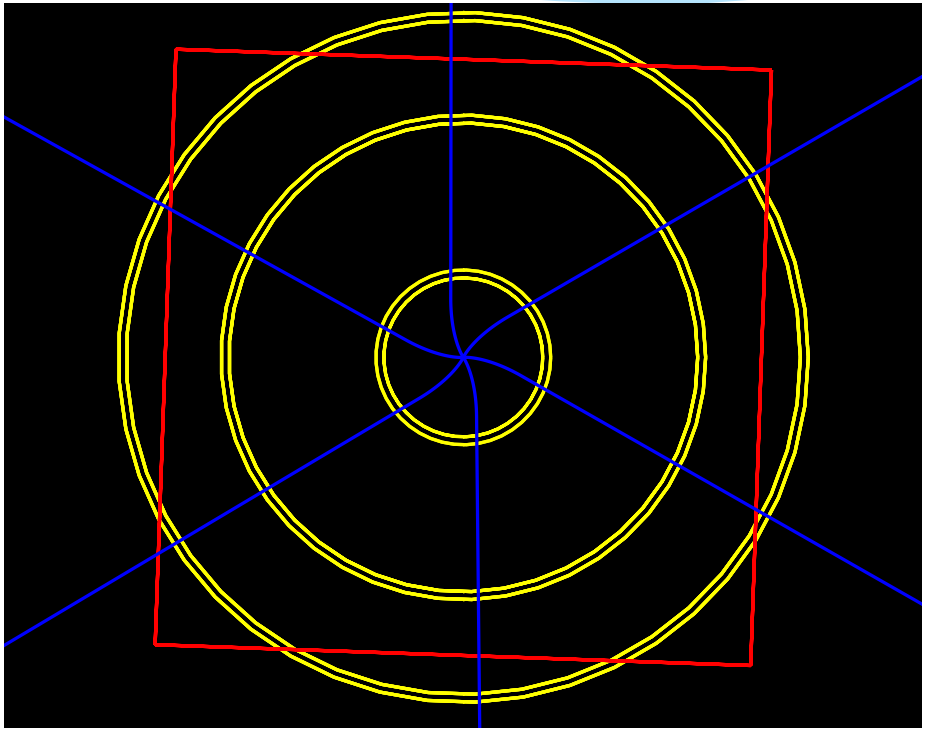

XZ black & YZ red
X(Y)
Z
×10³


Transmission
×10³

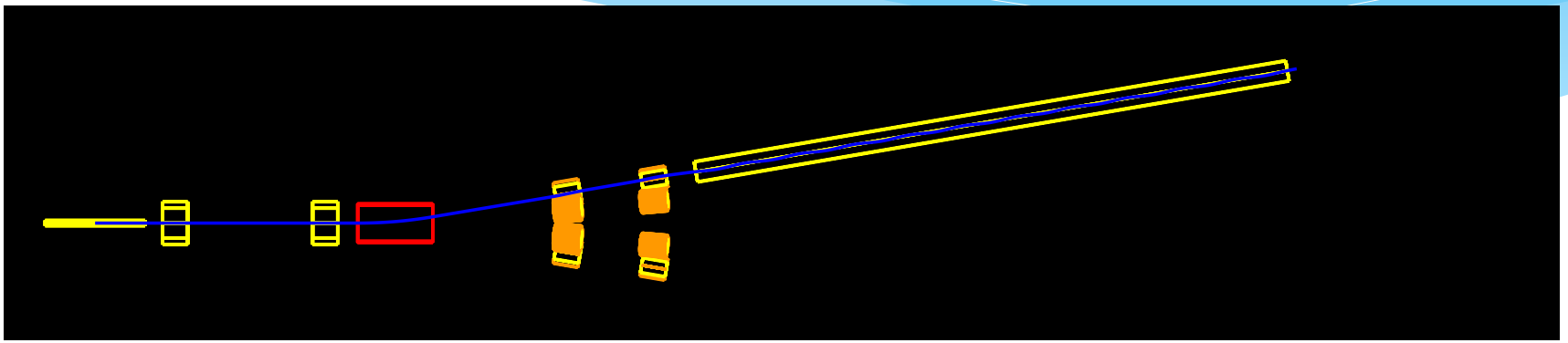

Bz:z {EventID==1}
Bz
z
×10³

Kicker

- The kicker is 3m long and 1m in x and y
- Kicker field is defined as
  - Bx=B0*cos(2Pi*f-Phi)
  - By=B0*sin(2Pi*f-Phi)
  - Where B0=0.042T, f=18MHz
  - Phi is the arriving time of the reference

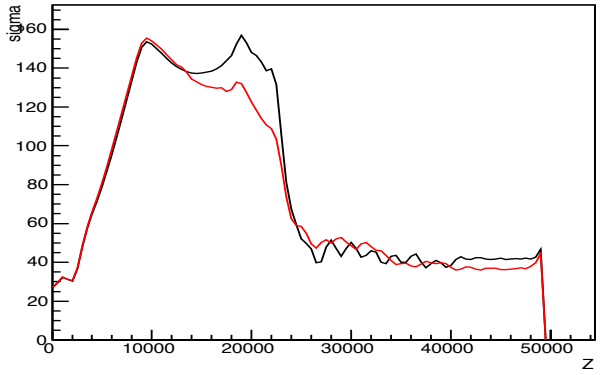


Step 3. Kicker on

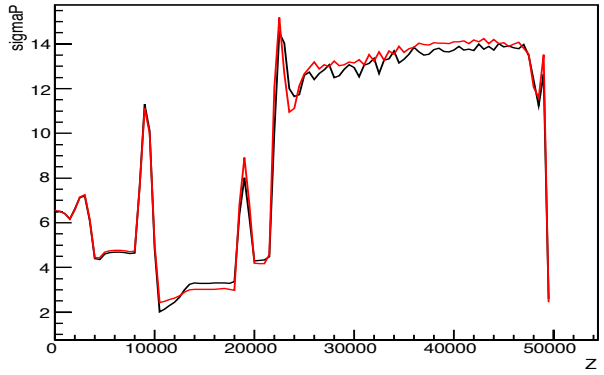


- Solenoid lens 3 and 4 are separated to 6 channels
- Aperture of lens 3 is 70 cm. Bulking coil used to reduce the field interaction.
- Kicker kicks the beam by 9.7 degree in Y direction
- Kicker also has a little effect on X direction.
- Downstream needs to be aligned

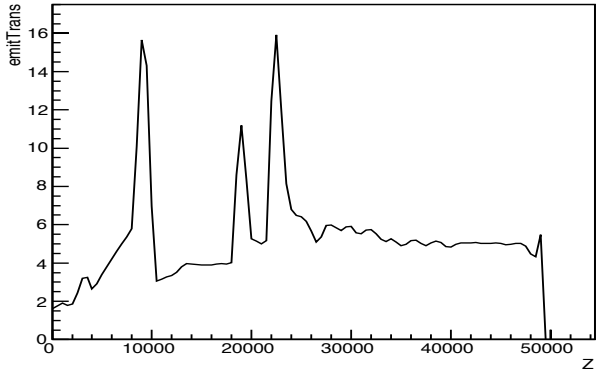
sigmaXZ black & sigmaYZ red



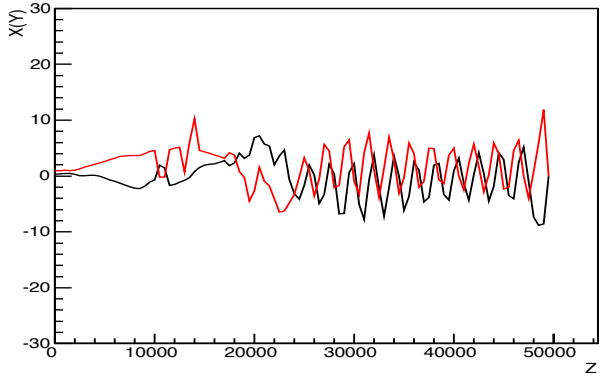
sigmaPxZ black & sigmaPyZ red



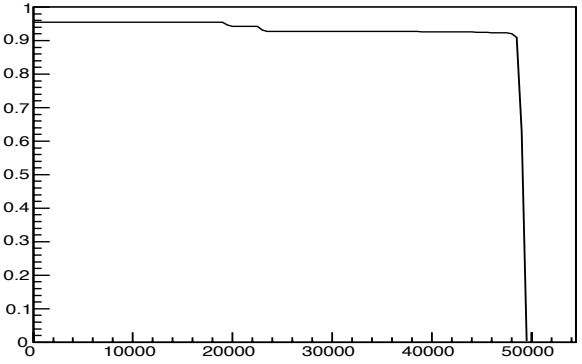
emitTransZ



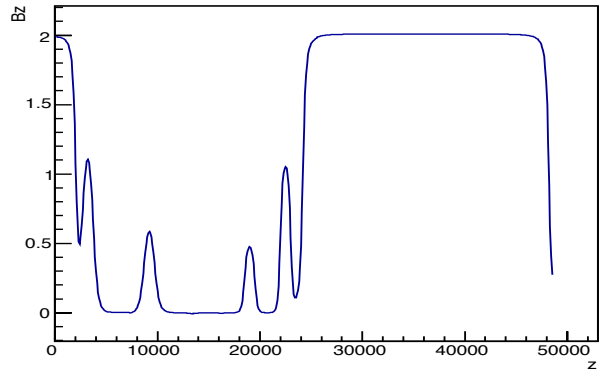
XZ black & YZ red



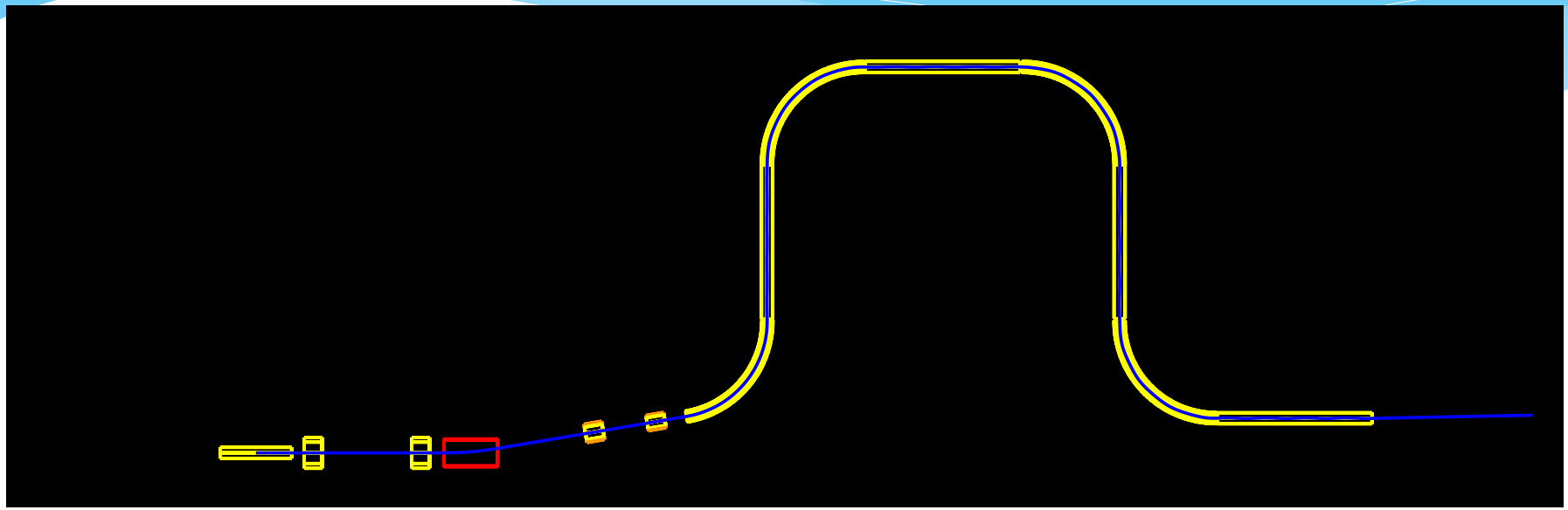
Transmission



Bz:z {EventID==1}

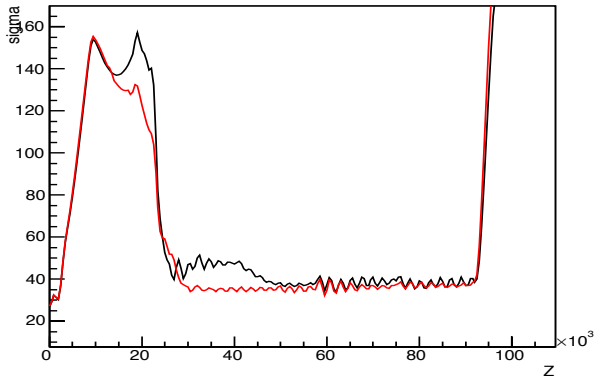


Step 3. Kicker on with a trombone

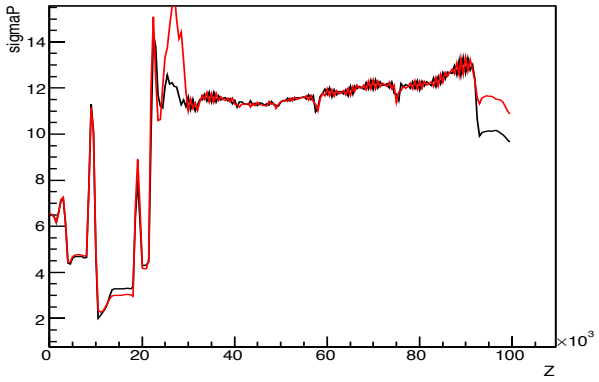


- First bent solenoid is 80 degree.
- Maybe last bent should also 80 degree to merge to the “funnel”
- Needs to be aligned better and optimized

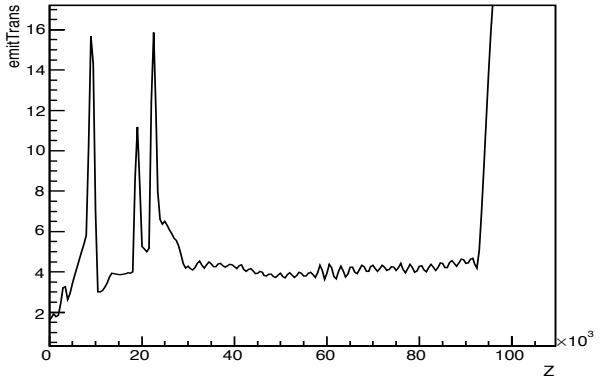
sigmaXZ black & sigmaYZ red



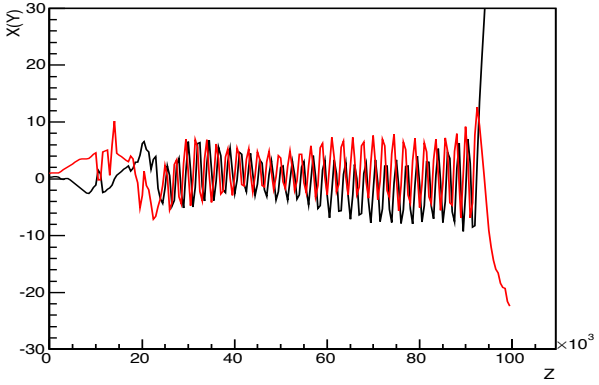
sigmaPxZ black & sigmaPyZ red



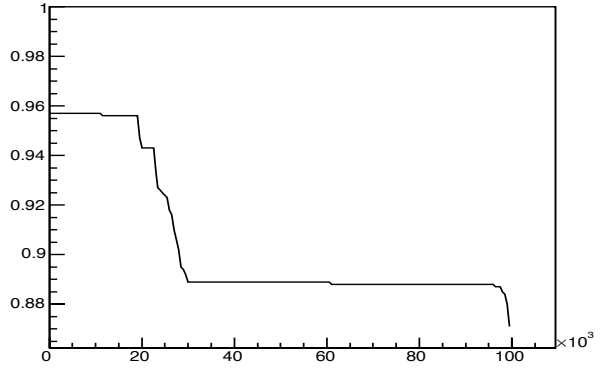
emitTransZ



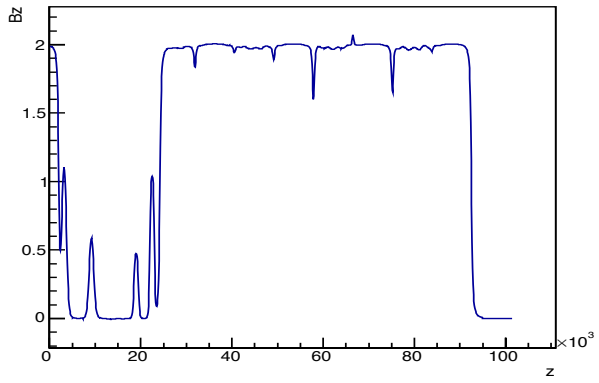
XZ black & YZ red



Transmission



Bz:z {EventID==1}



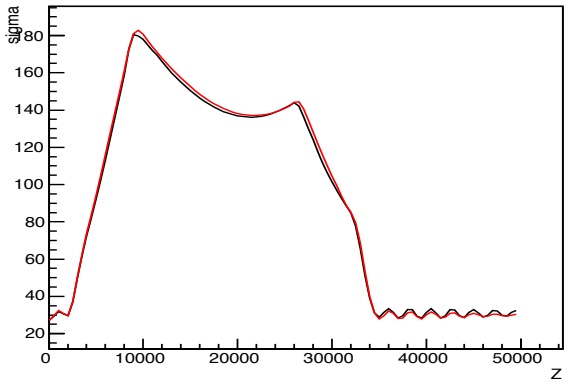
Step 5. Merge two bunches

- Since align 6 channels takes time, I will first put 2 channels on.
- To merge the bunches, the lengths of the channels have to be matched correctly.
- The collecting funnel needs to be considered

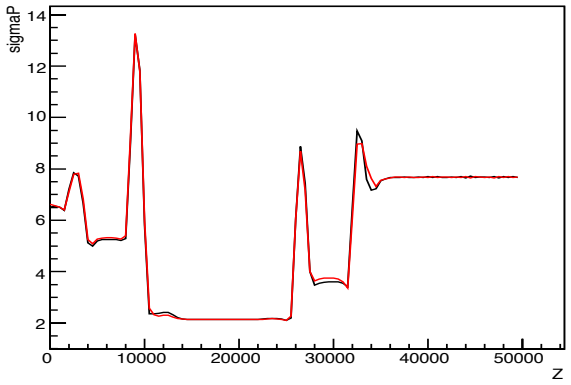
Possible improve

- Increase the distance between lens 2 and 3, to give more space for the kicker, so that:
  - The kicker strength can be lower
  - Bending angle can be smaller
  - Aperture of lens 3 can be larger, or more space for putting the 6 solenoids in parallel

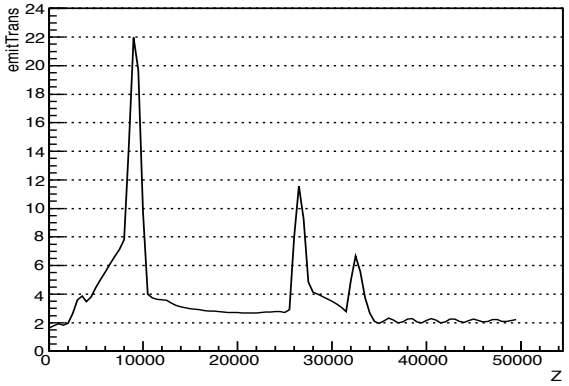
sigmaXZ black & sigmaYZ red



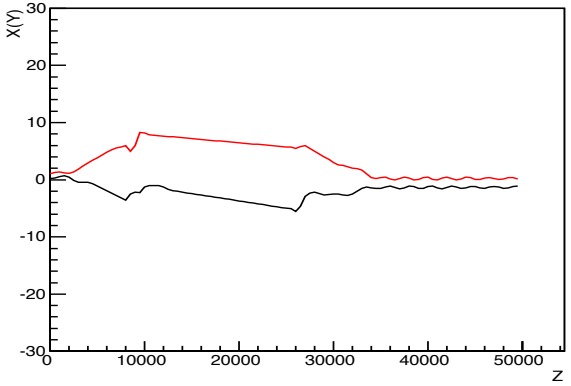
sigmaPxZ black & sigmaPyZ red



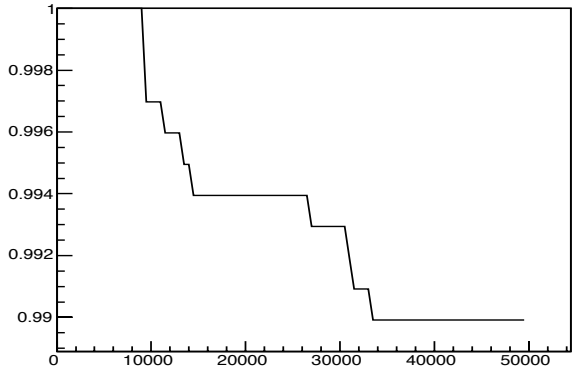
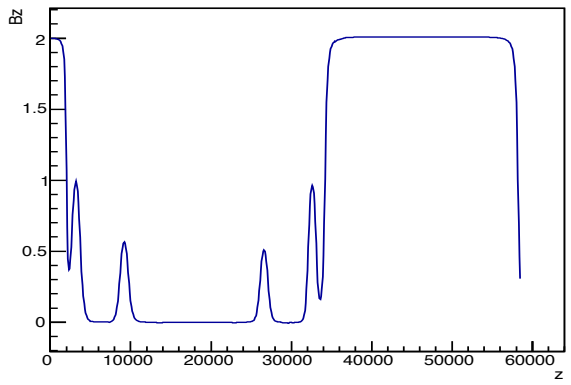
emitTransZ



XZ black & YZ red



Transmission



Bz:z {EventID==1}