Collimator study

Fabian Metzger (BE-EA-LE)
27.01.2022
Current situation

• In a previous meeting we showed already the advantage when having vacuum along M2 instead of long air sections

• For AMBER Drell-Yan we need highest possible kaon intensity meaning:
  • Lose as little kaons as possible
  • Increase the tagging efficiency of the CEDARs by improving the beam parallelism at their location

• Lau studied an alternative M2 optics design in 2009 with a larger beam at the CEDARs

• We studied the influence of further collimation on the beam divergence

• Shown transmissions relative to number of particles that were simulated
  • Currently, we do these with a realistic beam composition to see how the kaon intensity would be influenced by the proposed collimation
$x$-plane
Transmission horizontal collimator

![Graph showing transmission vs half opening in mm]
Dispersion horizontal collimator

- Clear reduction of divergence in collimated plane
  - We would gain a factor 2 when closing the collimator from 30mm to 15mm
    → Further decrease would not make a difference as $\sqrt{\sigma_x'^2 + \sigma_y'^2}$ is the determining factor
  - We would lose a factor 2 of intensity
- No influence as expected in the other plane
$y$-plane
Transmission vertical collimator
• No real improvement when considering the loss of intensity
  • However, when minimizing the divergence in $\chi'$ the divergence in $\gamma'$ is the limiting factor
• Again, no influence in the plane in that the beam is not collimated
Conclusion

- This is a first proposal for an optimization of the collimation scheme

- The positions of the collimators are not final; there might be still room for improvement

- Background in the experiment should not be enhanced as we collimate in the $x$-plane far upstream from the target; and in the $y$-plane even upstream of COLL5

- The simulations have been performed in vacuum
  - The clear advantage of vacuum over air along M2 have been showed in a separate meeting already

- Currently, simulations with a realistic beam composition are performed to see the influence on the kaon intensity when collimating the beam

- We will study if we could achieve the same performance with the existing collimators to save costs and implementation time