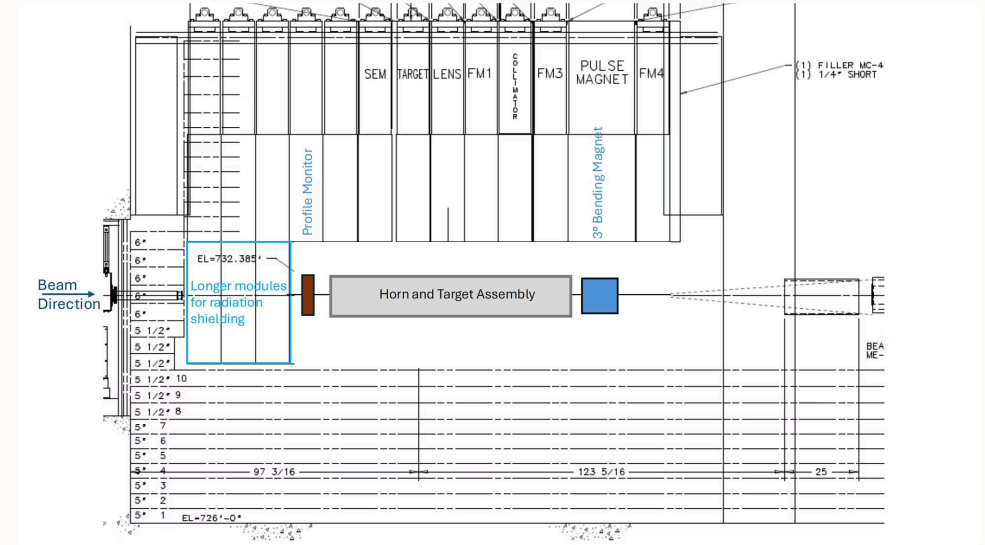
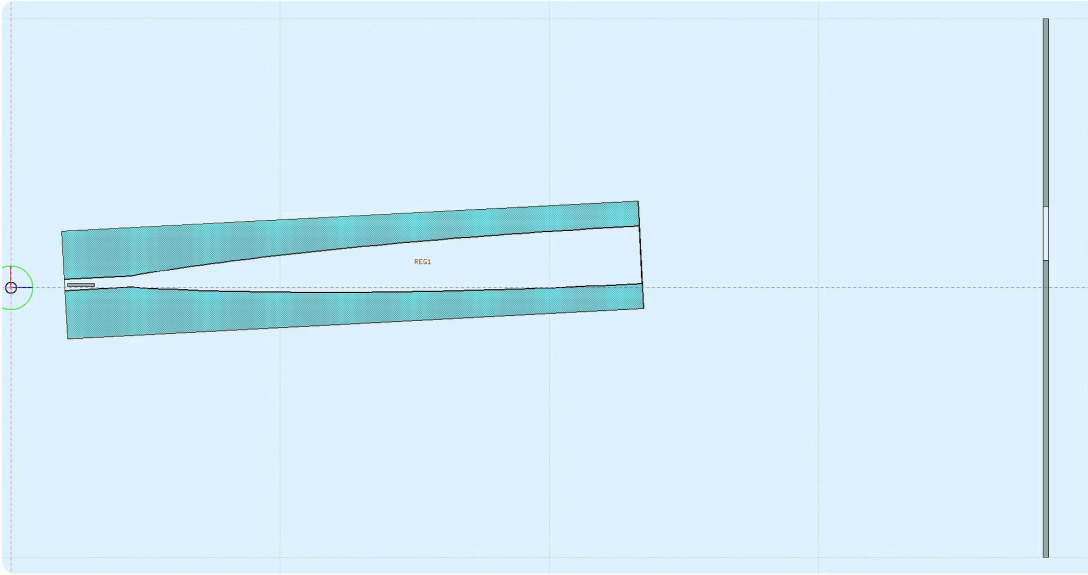


Horn Structure for the AP0 Tunnel

 by Prateek Rao

Design



1. Distance from start of the horn to window $\rightarrow$ 2.2m
2. Window width $\rightarrow$ 15cm
3. No. proton primaries $\rightarrow$ 100K @ 8GeV
4. tilt angle $\rightarrow$ 3°

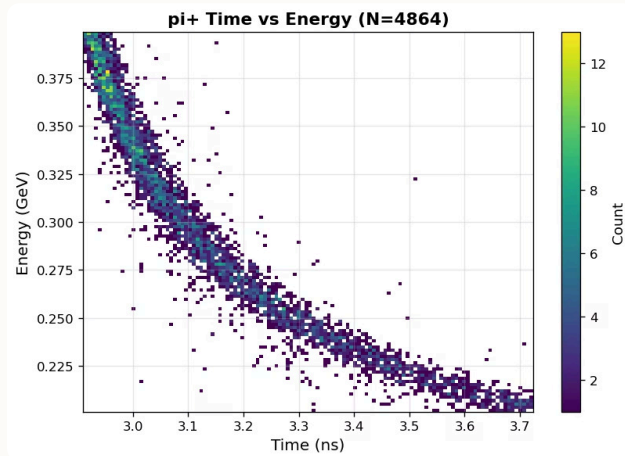
Optimization

Bayesian Optimization of the Pion-Capture Horn

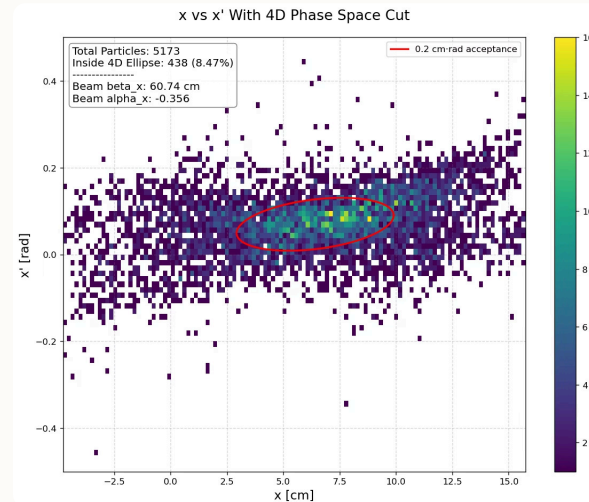
1. **What it does:** An automated optimizer tunes the horn's geometry and current to maximize low-energy pion capture into the downstream channel, replacing hand-tuned parameter scans.
2. **Evaluation budget:** Each candidate design is scored on a 10,000-primary FLUKA run, balancing statistical resolution of the transmission estimate.
3. **Elliptical design study:** An elliptical inner-conductor design was also explored. The ellipticity only introduced a **weak quadrupole** correction on top of the monopole focusing, and yielded results almost indistinguishable from the circular case.
4. **Outcome:** The circular conductor still outperforms the elliptical variant, with the best converged design reaching a ~32% transmission rate of pions in $0.2 \leq E \leq 0.4\text{GeV}$

Plots

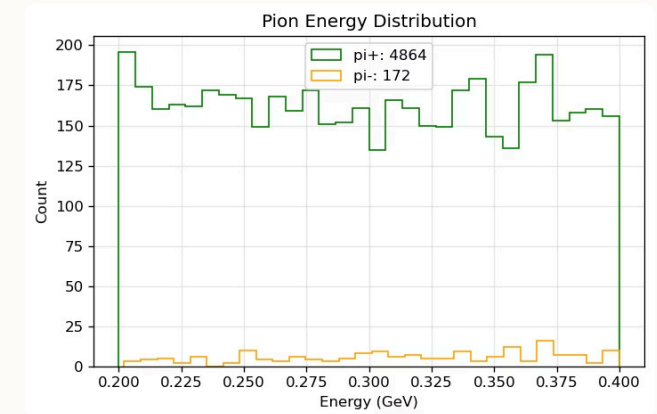
End of Horn



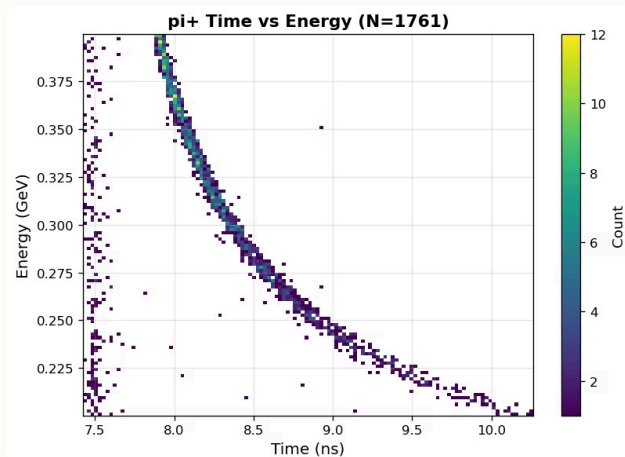
End of Horn



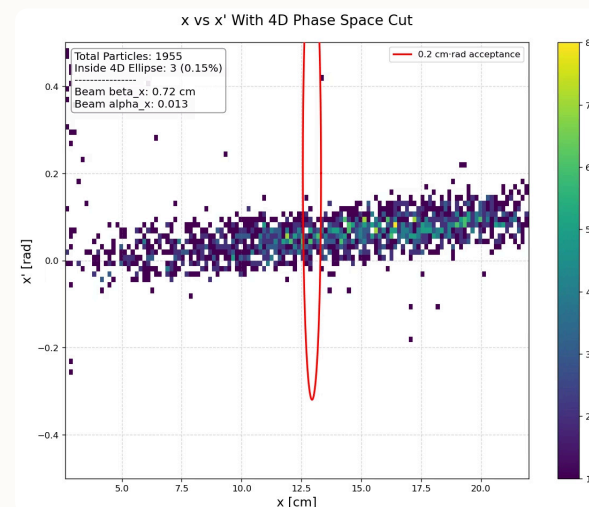
End of Horn



At the AP0 Exit Window



At the AP0 Exit Window



AP0 Exit Window

