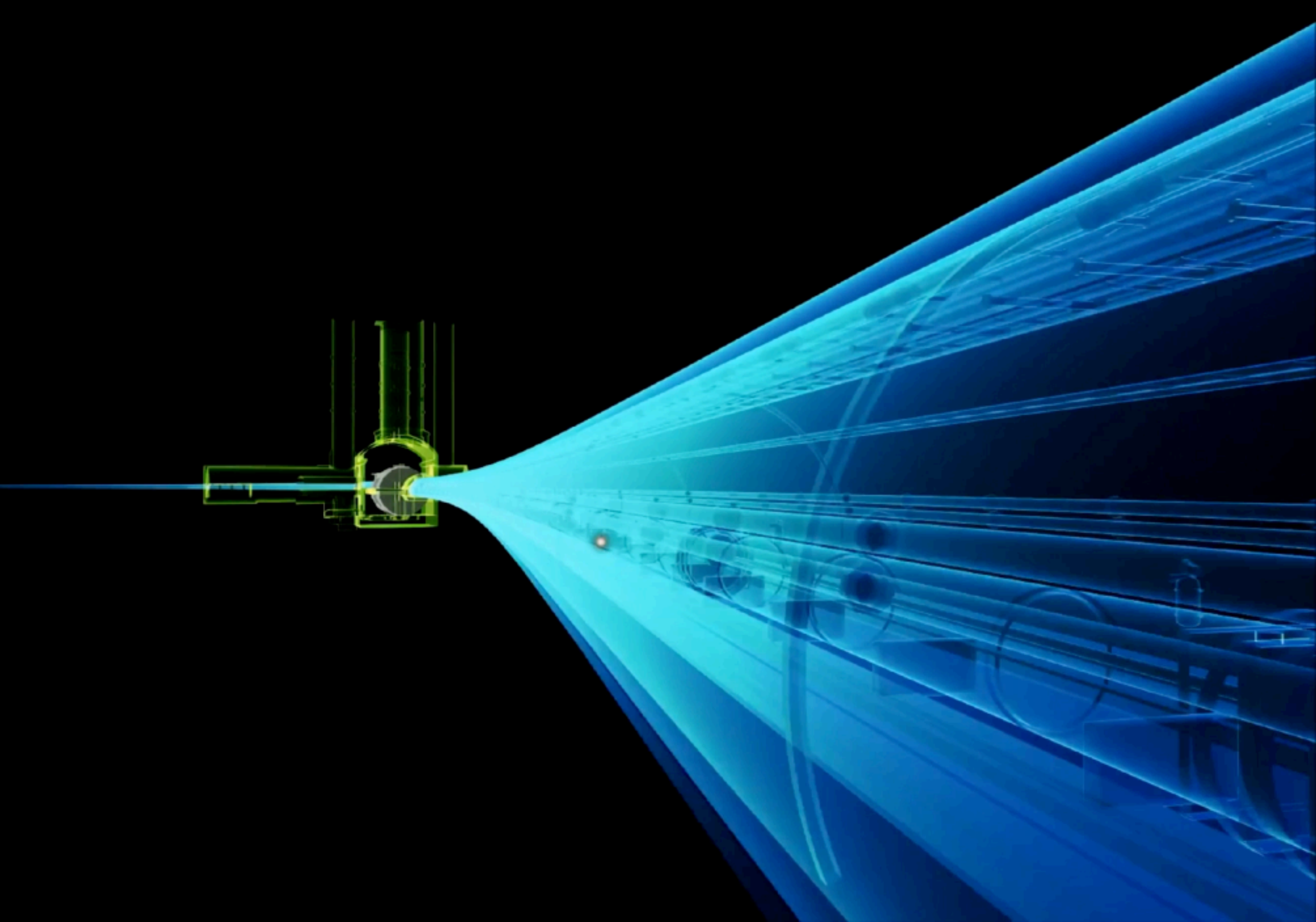
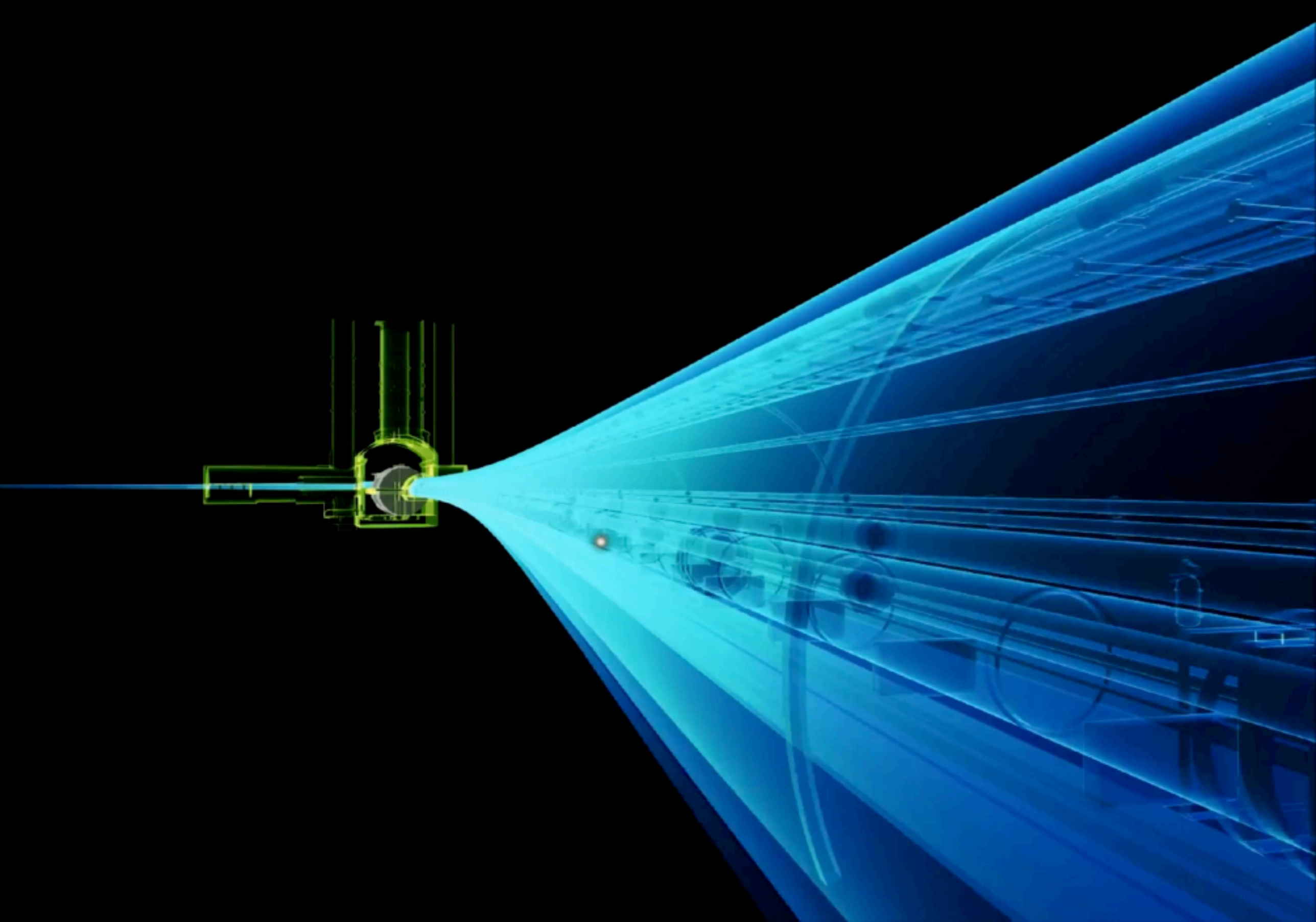
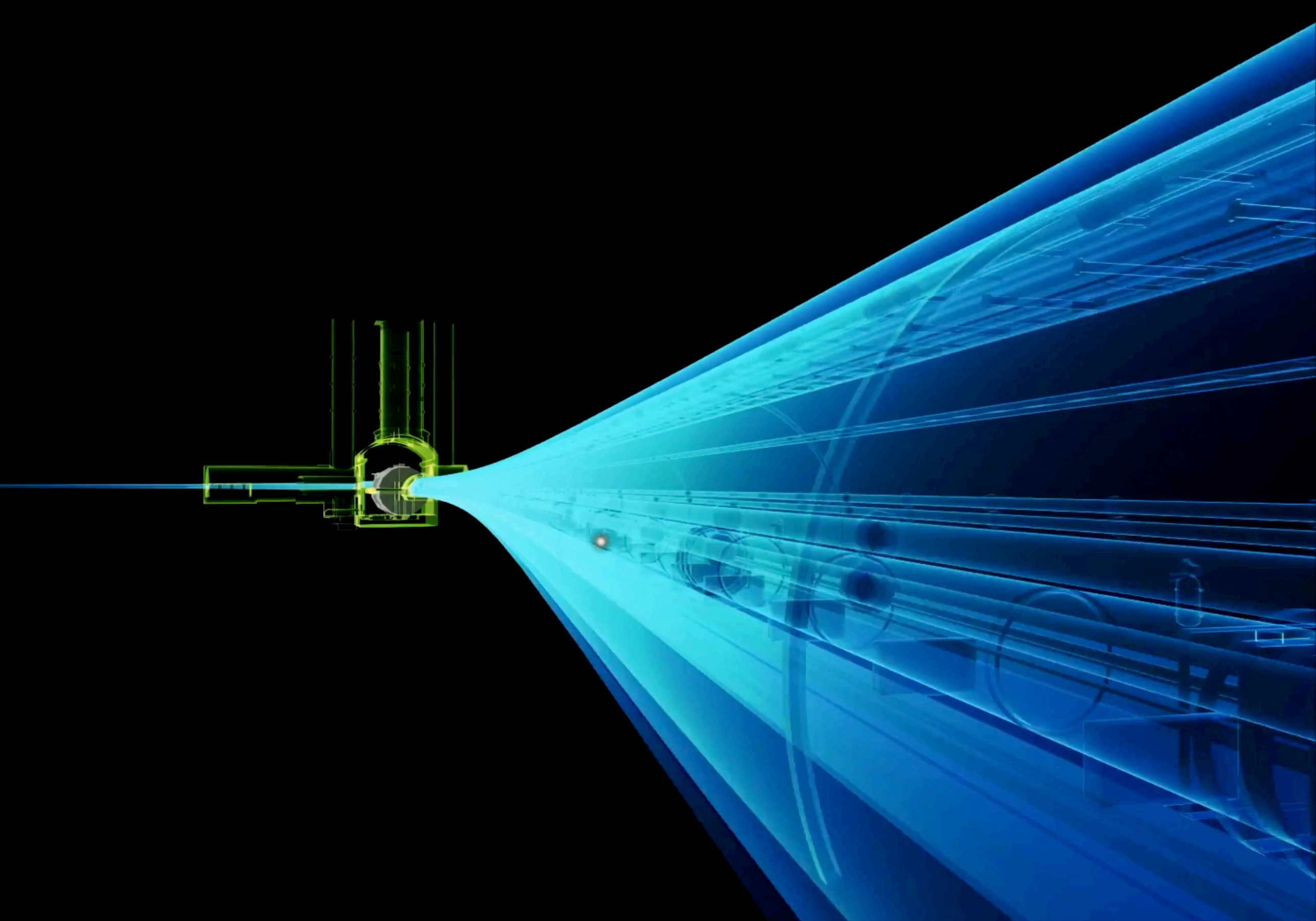
A High-Energy Neutrino Factory



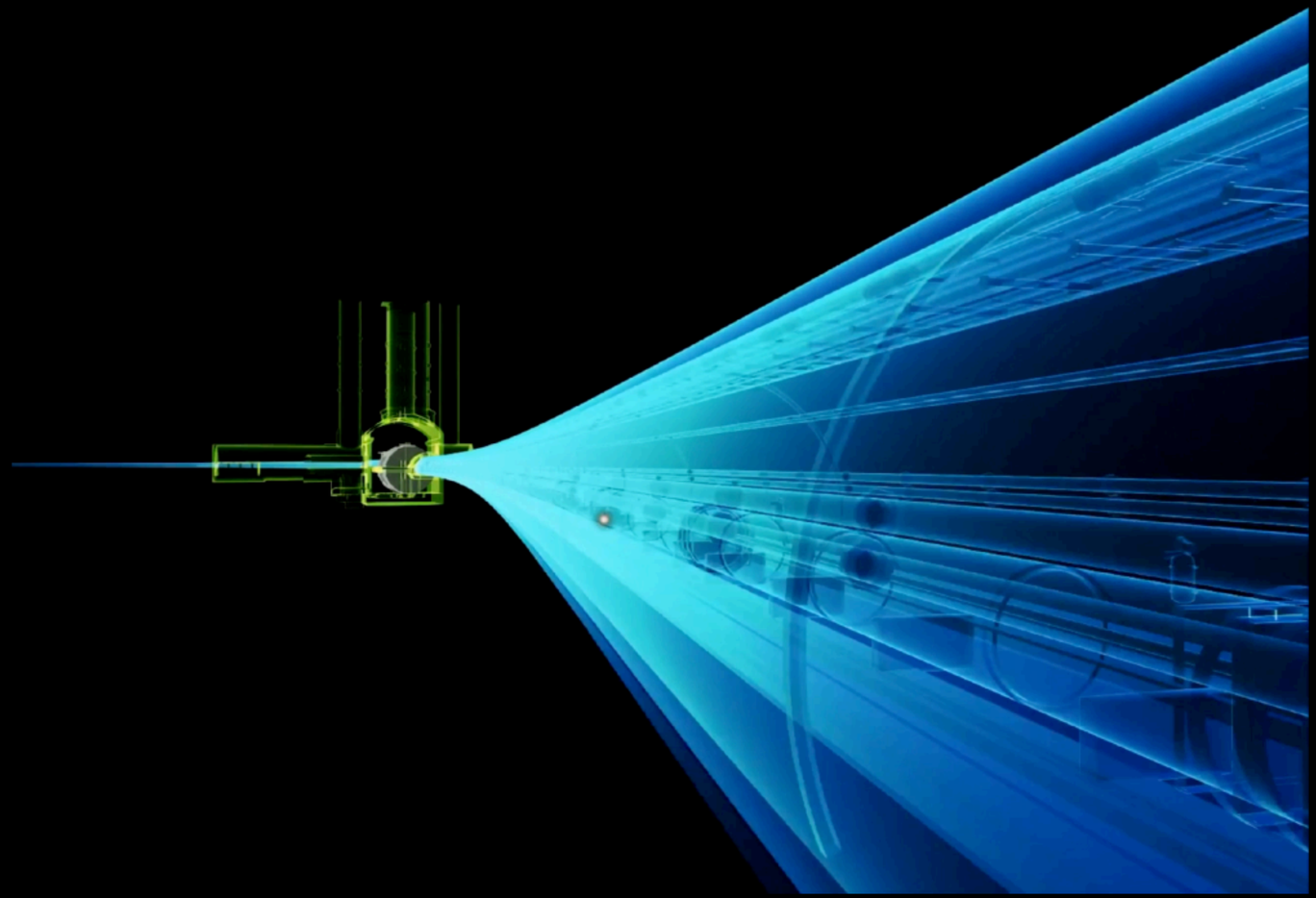




Large Hadron Collider

A High-Energy Neutrino Factory

- **An Unexplored Source:** The LHC provides the highest-energy neutrinos ever produced in a laboratory, opening a new window into particle physics.
- **The Ring:** Protons travel around a **27-Km ring (LHC)**, circling it over **11,000 times every second** before they are guided into collision
- **Detection:** p-p collisions at $\sqrt{s} = 13\ TeV$ (13.000x higher then AGS) inside detectors like ATLAS
- **Forward secondary particles:** These collisions create a massive spray of secondary **hadrons** (π , K)

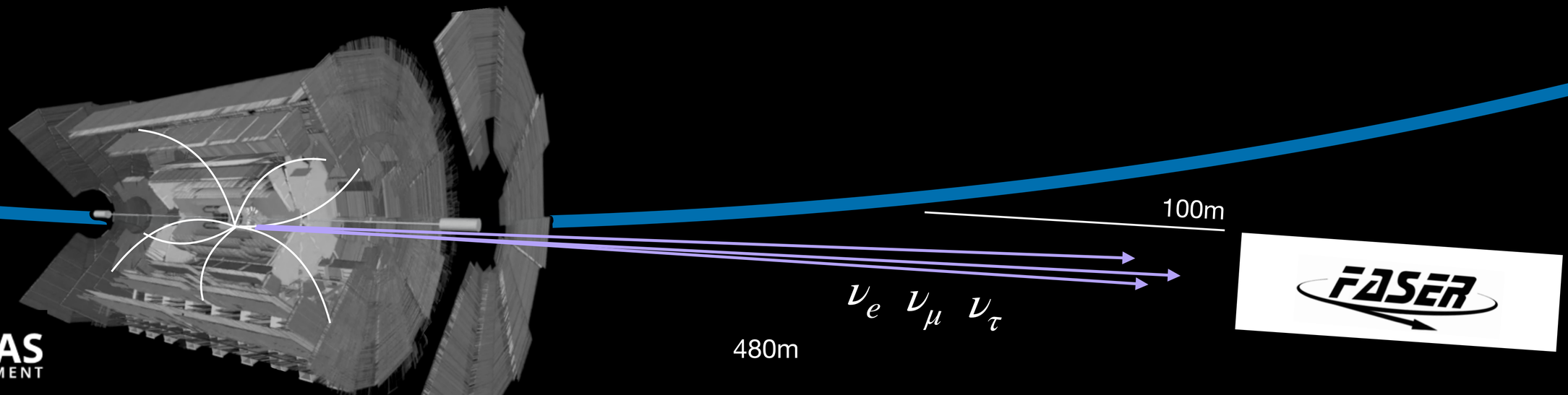


Large Hadron Collider

Neutrino production at LHC

- Unstable hadrons travel forward and **decay** almost instantly, producing **collimated beam** of neutrinos → ***FASER*** detector

- **FASER detector 480 meters downstream** from the collision point, perfectly aligned with the beam (TI12 service tunnel).
- **Shielding:** 100 meters of rock and concrete filter out all particles except neutrinos and very high-energy muon.
- Expecting ~1700 ν_e , ~8500 ν_μ and ~30 ν_τ charged current (CC) neutrino interactions in FASERν in LHC Run-3 (250/fb)



ATLAS EXPERIMENT