NA62: Unlocking the Zeptouniverse

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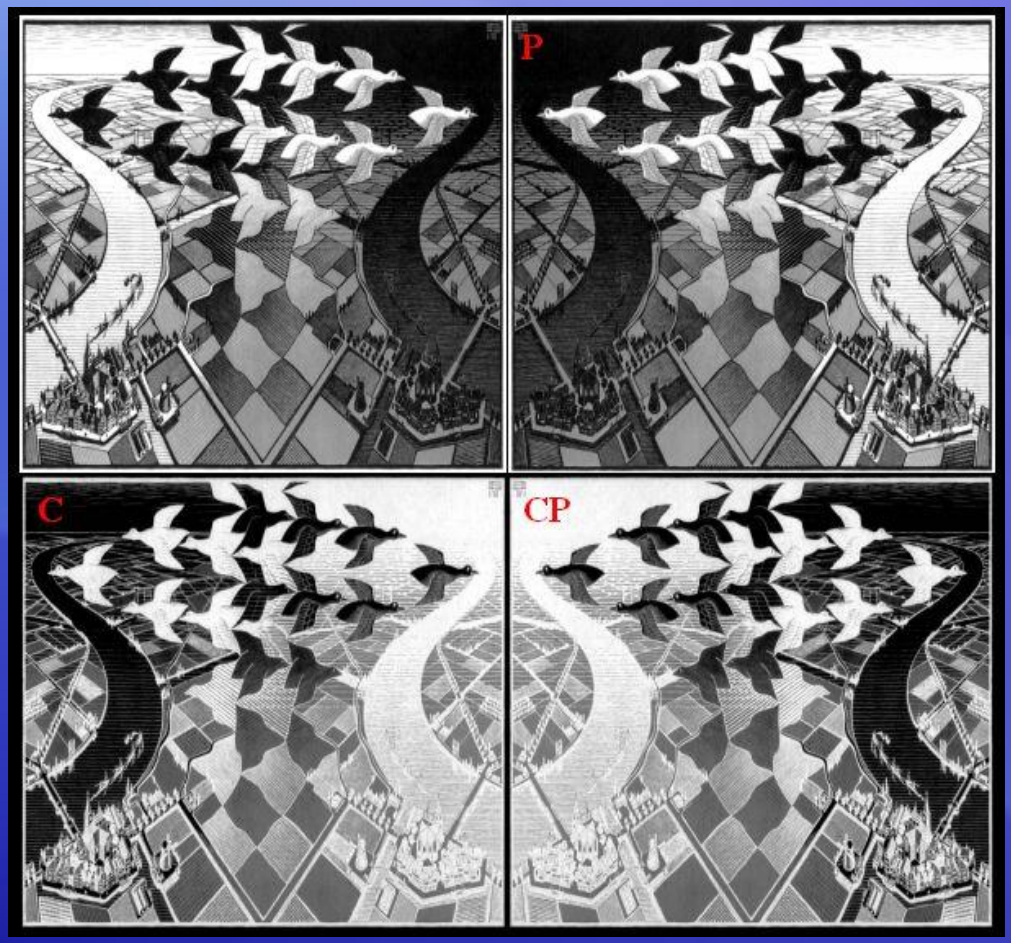
Problem:

- CP Symmetry Violation



Why don’t we know more about it?

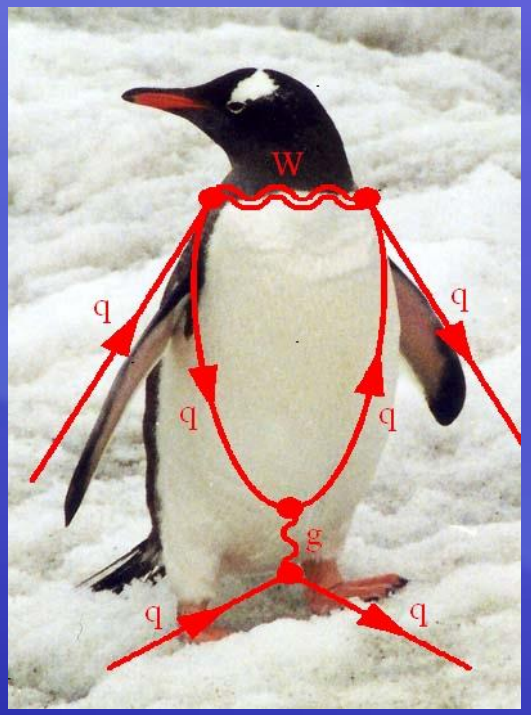
- We would need inaccessibly high energies to directly probe such a small length scale!!

Solution? Probe Indirectly

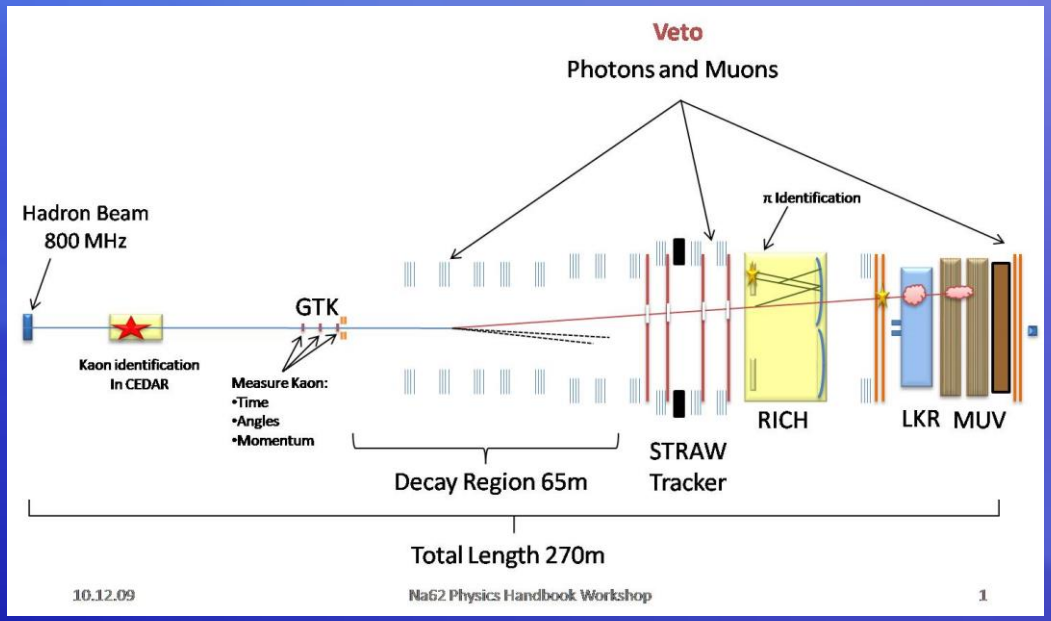
- K^+ to pi^+ + neutrino + antineutrino

- Process given by a “penguin diagram”
  - Highly suppressed (1 in 10^{10})

- Dependent on $|V_{td}|$ parameter, which is in turn linked to CP violation

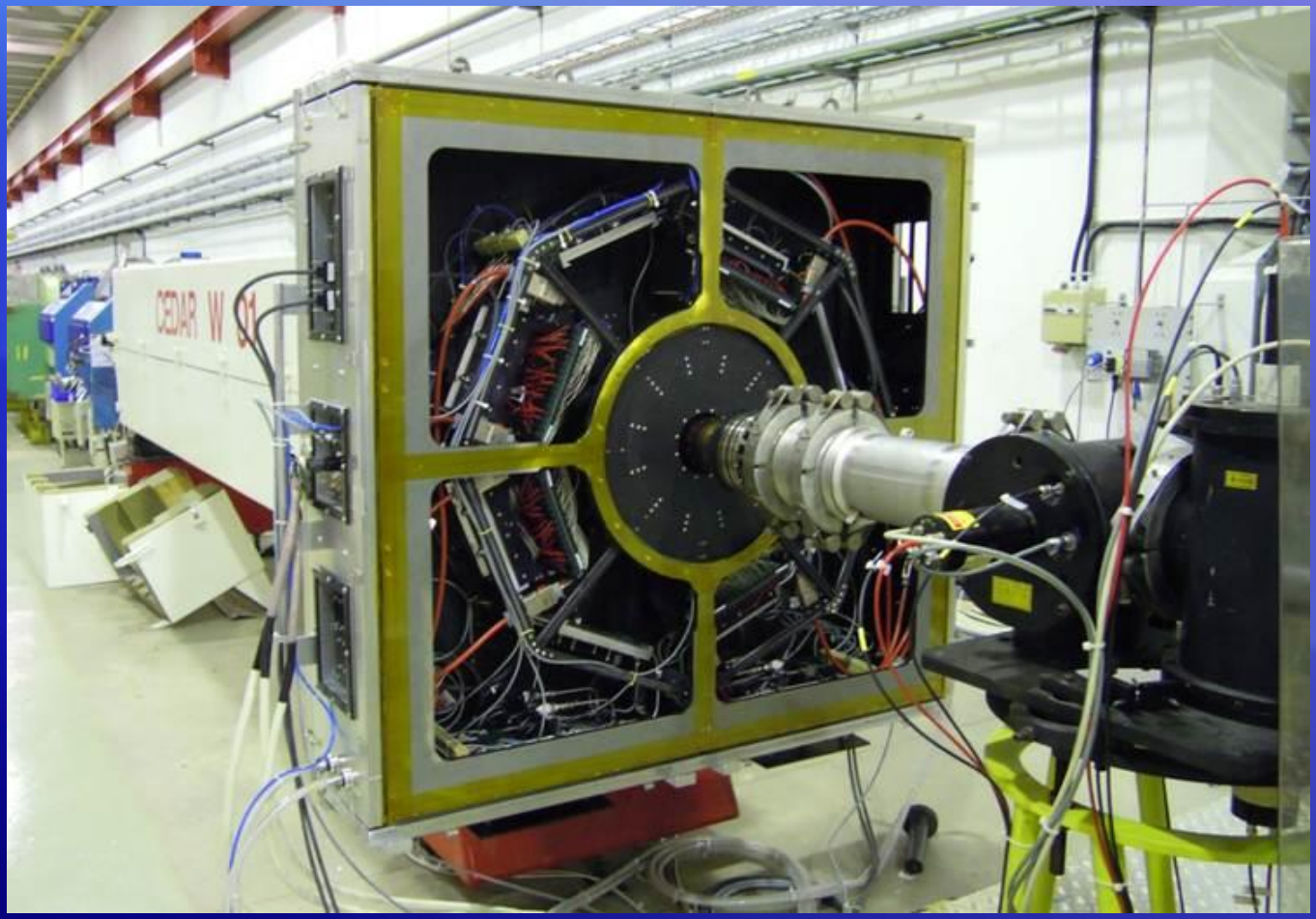


Experimental Setup:



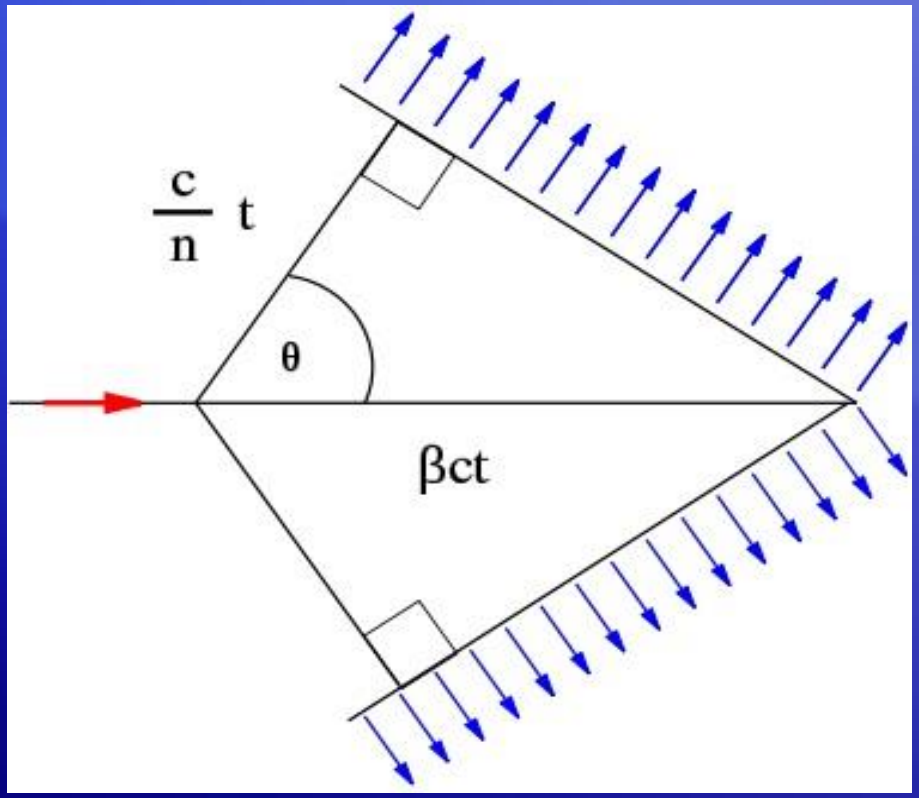
The KTAG identifies particles of a certain mass.

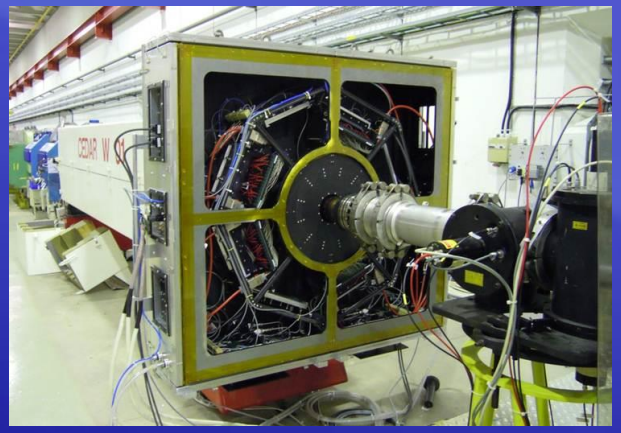
In our case, we want to identify kaons.



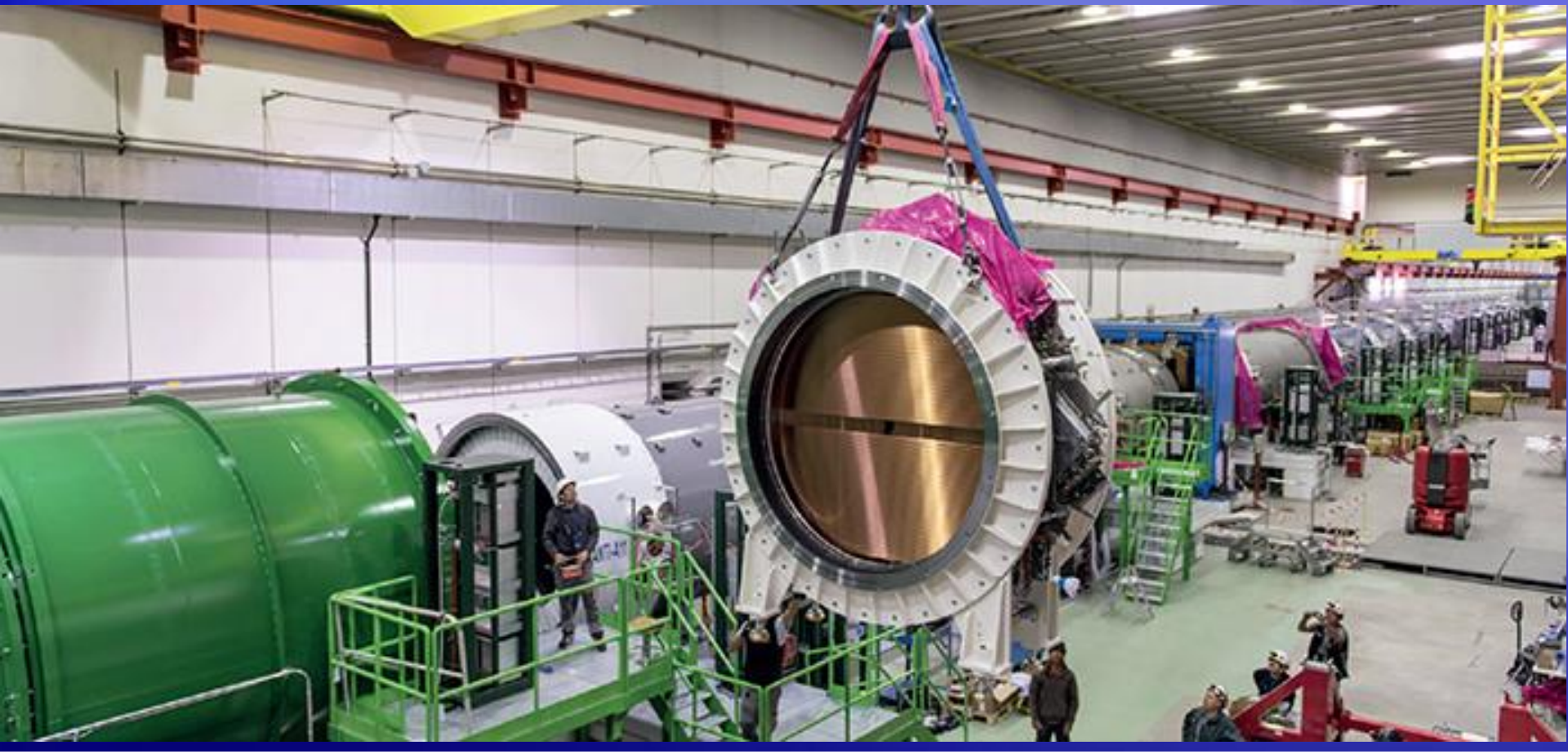
The KTAG measures Cherenkov radiation

emitted at angles specific to the particles' velocities.





The Straw Tracker is used to measure the positions of particles. This lets us know their momentum too.



The CHOD is a scintillation photon detector

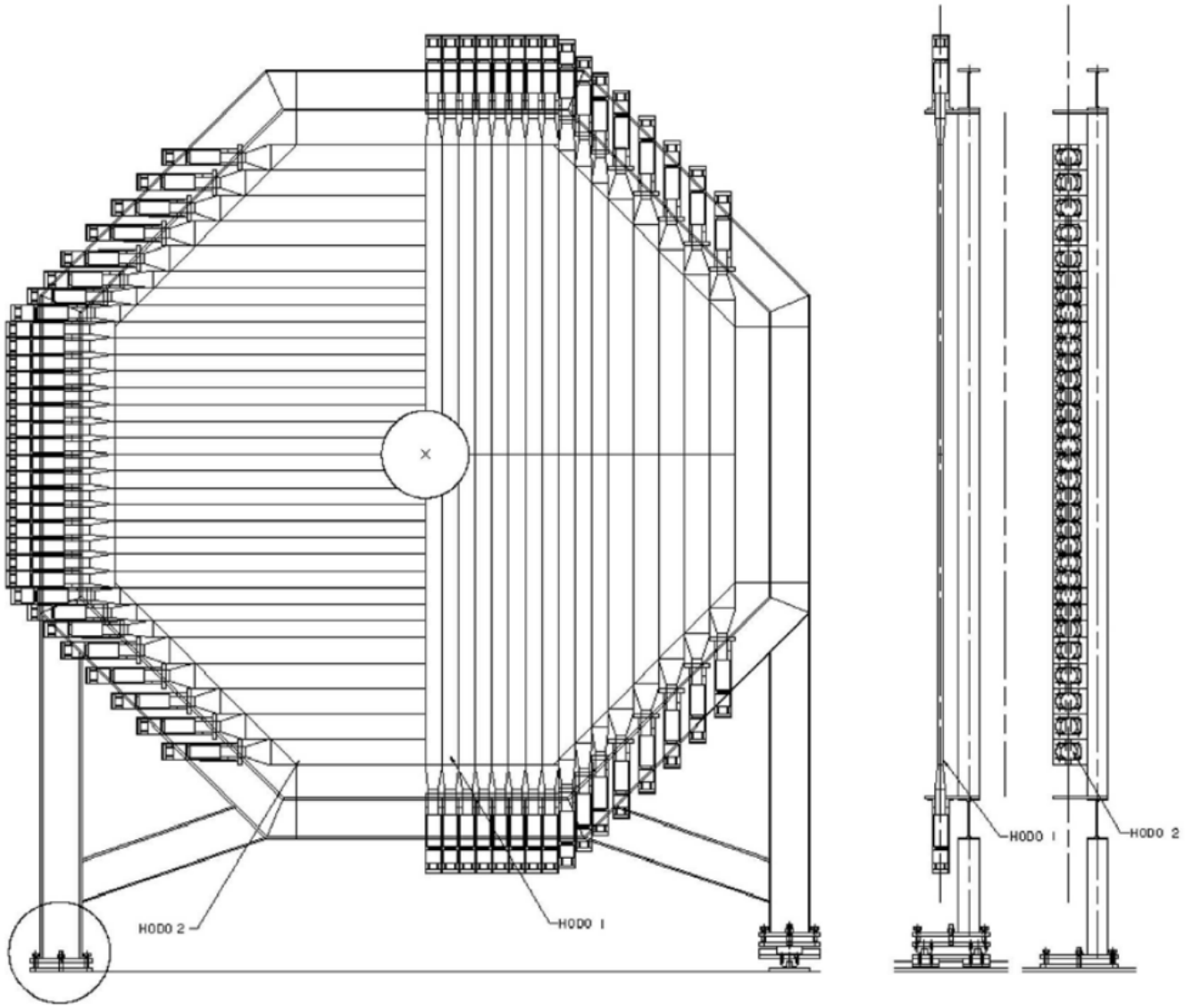
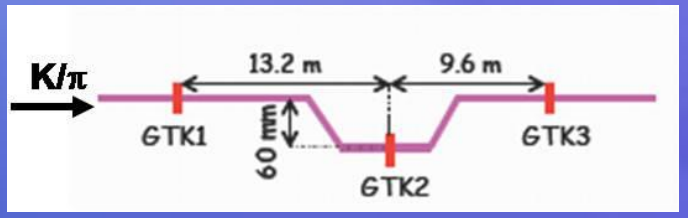
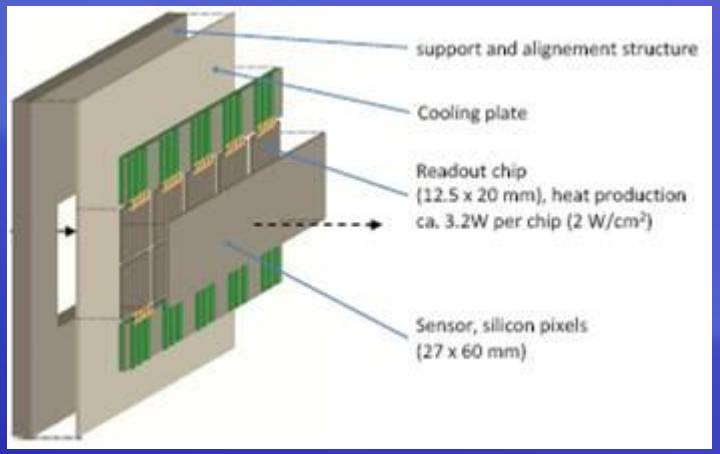


Figure 1 Schematic view of the CHOD detector

Gigatracker

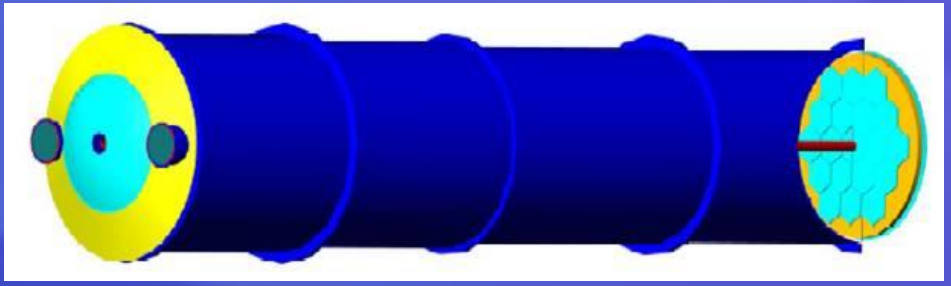
- Precisely measures the momentum, position, and time of the kaon beam before it decays





Ring Imaging Cherenkov Detector (RICH)

- Obtains mass of decay products
- Important for separating muons and pions



Photon Veto System

$K^+ \rightarrow pi^+ + nu + nubar$ *looks a lot like* $K^+ \rightarrow pi^+ + pi^0$ …

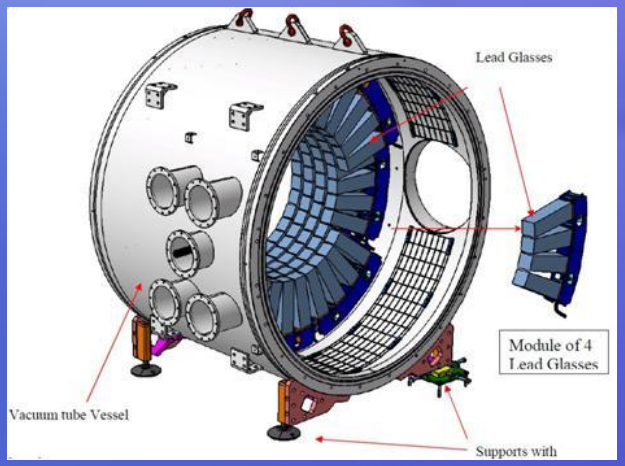
Solution? Try to get all the photons!

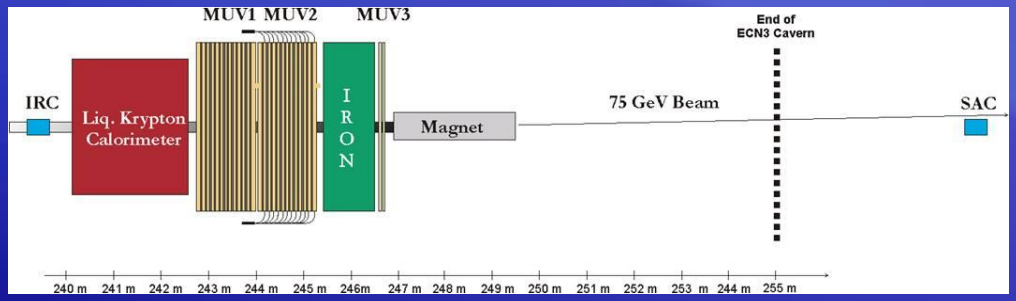
Liquid Krypton Calorimeter (LKr)

- Liquefied noble gases have scintillating properties
- Photons ionize LKr atoms
  - → detection
- For angles between 1mrad and 8.5 mrad

LAVs and SAVs

- Large Angle Vetoes:
  - For photon angles >8.5 mrad
- Small Angle Vetoes:
  - For photon angles <1 mrad
  - IRC + SAC
- Supplement the LKr to cover all relevant angles





Other important detector components

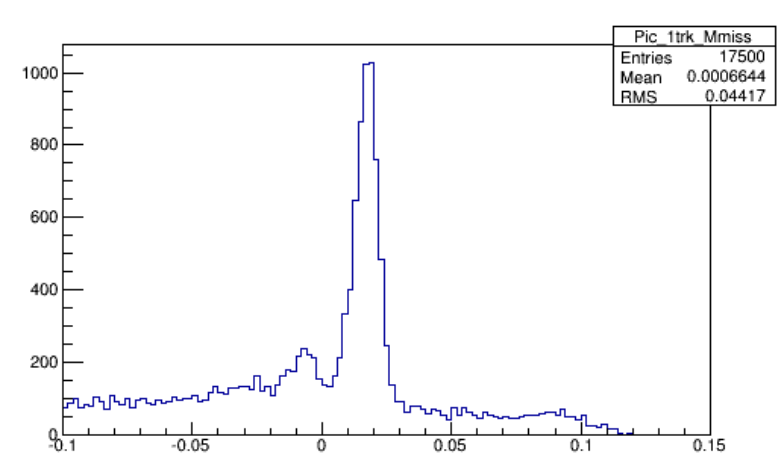
- MUV (muon veto)
- CHANTI (reduces background)

Current Status

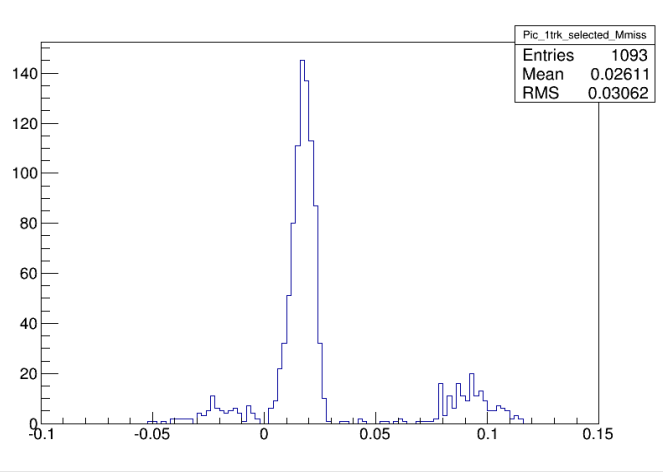
- NA62 had its first-ever run last December.
- Now it's time to analyze the data from the first run.
- The next ("real") run is July 1st !

Examples of results from the first run

With minimal conditions imposed on data



With more constraints:

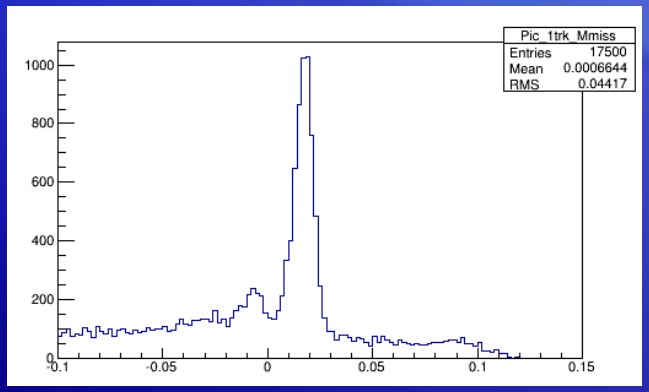


What we've been doing

- Getting familiar with the project
- Getting familiar with the data analysis code
- Creating histograms within the pre-existing code

Things that need to happen

- Adjustments from GigaTracker data
  - Current code uses a present Kaon momentum 4-vector
  - Will improve resolution of pi^+ missing mass peak



- More precise estimation of magnetic field in the straw tracker
  - Currently assuming uniform field
  - Modelling a non-uniform field will give us a more accurate momentum measurement for decay products

Questions?