

Analysis and study of the problems on the wires used in the MEG CDCH and the construction of the new drift chamber

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Abstract

In the MEG II detector, the measurement of the momentum of the charged particle is performed by a high transparency single volume, full stereo cylindrical Drift Chamber (CDCH). It is composed of 9 concentric layers, each consisting of 192 drift cells. The single drift cell is approximately square, with a $20\text{ }\mu\text{m}$ gold plated W sense wire surrounded $40\text{ }\mu\text{m}/50\text{ }\mu\text{m}$ silver plated Al field wires in a ratio of 5:1. During the construction of the first CDCH, we had the breaking of a hundred cathode wires: of these, 97 are $40\text{ }\mu\text{m}$ aluminum wires while 10 are $50\text{ }\mu\text{m}$ wires. Since the number of broken cathodes is less than 1% of the total, one can expect the influence on the track reconstruction efficiency to be not so dramatic.. Finally we will show the study carried out on new wires to overcome the weaknesses found and the process that will be used for the construction of the new drift chamber (CDCH2). It will be built with the same modular technique, as for the first, the wiring robot will be used by improving some weak points and using new wires with a diameter of 25% thicker diameter, which has very little effects on the resolution and efficiency of the detector. Furthermore these wires are made with a manufacturing process different from their used previously.

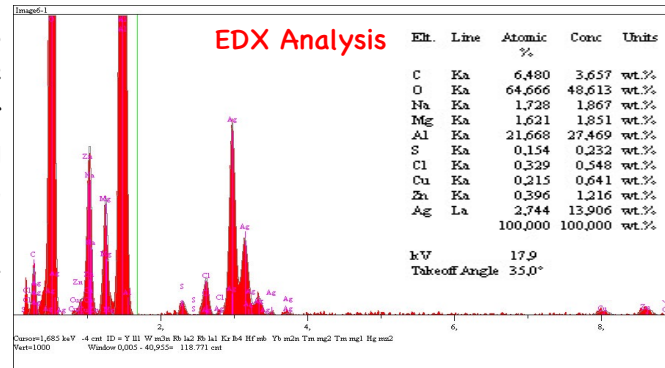
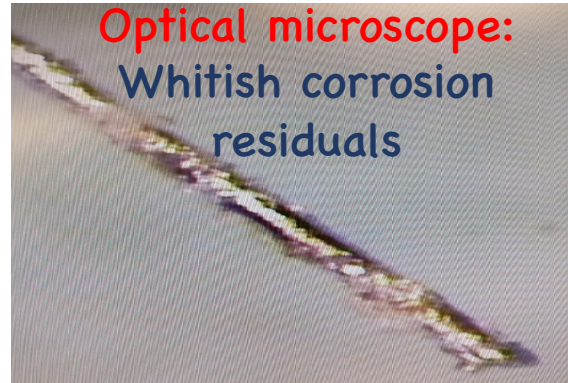
- Breakings due to corrosion of the aluminum wire core
 - Imply water as catalyst (Air moisture condensation inside cracks in the Ag coating)
- Found a good linear correlation between number of broken wires and exposure time to humidity
- The only way to stop the corrosion is to keep the wires in an inert atmosphere

After several analyses carried out and considered different wires, we decided to use new wires with pros and cons for the CDCH2 (the choice is in progress):

- $50\text{ }\mu\text{m}$ Ag-coated Al wires in which the ultra-finishing step is avoided
- $50\text{ }\mu\text{m}$ pure Al wires (soldering plus glue)

We are doing tests to understand the best wire to avoid problems

The wiring robot has been transferred from Lecce to Pisa and is ready.



For more information "Detailed analysis of chemical corrosion of ultra-thin wires used in drift chamber detectors", JINST 16 (2021) T12003.

