1 Introduction

PANDA is one of the biggest experiments of hadron and nuclear physics that will be carried out at the new Facility for Antiproton and Ion Research (FAIR) at Darmstadt, Germany. It is dedicated to the study of the annihilations of antiprotons on nucleons and nuclei up to a maximum center-of-mass energy in \( \bar{p}p \) of 5.5 GeV.

The PANDA collaboration consists of more than 500 physicists from 19 countries spread all over the world. The Italian groups involved are: Torino, University, Politecnico and INFN, Trieste, University and INFN, Genova INFN, Pavia, University and INFN, Ferrara, University and INFN, Legnaro INFN laboratory and Frascati INFN laboratory. The LNF group is involved in the design and construction of the central straw tube tracker of the PANDA detector.

2 PANDA experiment

The construction in Germany of the new FAIR accelerator complex started in January 2013. It consists of a major upgrade of the presently running GSI accelerator complex of Darmstadt. Figure ?? shows a view of the construction site. The actual schedule of the project foresees the first beams in year 2020.

An intense, high momentum resolution antiproton beam, with momenta between 1.5 and 15 GeV/c, will be available at the High Energy Storage Ring (HESR), and the experimental activity will be carried out using a general purpose detector PANDA that will be build surrounding an internal target station installed in one of the two straight sections of the storage ring. Figure ?? shows a schematic drawing of the PANDA apparatus. It is designed as a large acceptance...
multi-purpose detector consisting of two distinct parts: a solenoidal spectrometer, surrounding the interaction target region, and a forward spectrometer to cover the solid angle between 5 and 22 degrees. It will allow the detection and the identification of either the neutral and the charge particles emitted following $\bar{p}$ annihilation.

3 The PANDA Central Tracker

For tracking charge particles in the target spectrometer, PANDA will use different detectors: a silicon Micro Vertex Detector (MVD) a Straw Tube Tracker (STT) and a set of forward GEM chambers. Figure ?? shows the layout of the Target Spectrometer tracking system.

Figure 2: A schematic view of the PANDA apparatus.

Figure 3: The PANDA tracking system of the Target Spectrometer. It consists of three detectors: Micro Vertex Detector, Straw Tube Tracker, Forward GEM.

The requirements for this system are:

• almost full solid angle coverage;
• momentum resolution $\delta p/p \sim 1.5\%$;
• low material budget $X/X_0 \sim$ few $\%$;
• good spatial resolution $\sigma_{r,\phi} = 150, \mu m$, $\sigma_z =$ few mm.

The Technical Design Report (TDR) of the STT has been approved in 2013 and the construction of the straw tubes started in 2014.

The LNF PANDA group is deeply involved in the STT realization and has the responsibility of the mechanics of the whole tracking system.

### 3.1 Layout of the straw tube detector

The PANDA STT will consist of two identical chambers separated by the beam-target cross-pipe that is cutting the $x,y$ plane in two halves (see fig. ??). Each chamber is made of aluminized mylar straw tubes, diameter 10 mm, length 1500 mm, thickness 30 $\mu m$, arranged in planar double layers.

![Figure 4: CAD drawing of the PANDA Straw Tube Tracker](image)

Inside a double layer the tubes are glued together and operated with an Ar+CO$_2$ (90+10) gas mixture with an over-pressure of 1 bar. This solution has been chosen to avoid strong support structures and to keep the detector design modular and simple. To measure also particle $z$ coordinate, some layers will be mounted with a skew angle $\pm 3^\circ$ with respect to the beam axis.

### 4 Activity of the LNF PANDA group

The STT mechanical structure has to support also the beam-target cross-pipe and the MVD. This frame, has to be extremely light and has to allow the movements of the whole block of detectors during the installation or the maintenance operations. It has been designed by LNF SPAS and it realization is foreseen for 2015, provided that INFN approve the Italian participation to the project. In fact up to now only R&D fund have been given to the Italian collaboration.

The activity of the LNF PANDA group during 2014 has been devoted to the following tasks:

• design of the service system support structure;
• participation to the test beams at Juelich to determine the performance of different electronic setups for the STT.
List of Conference Talks presented by LNF group members in Year 2013


Publications


References