$\overline{\text{P}}$ANDA - $\overline{\text{p}}$ Annihilation at Darmstadt

N. Bianchi, A. M. Bragadireanu (Ass.), P. Gianotti (Resp. Naz.),
C. Guaraldo (Ass.), V. Lucherini, E. Pace, D. Pietreanu (Ass.)
In collaboration with LNF SPAS: D. Orecchini (Tec.).
In collaboration with LNF nuclear physics esperiments support:
L. Passamonti (Tec.), D. Piergluigi (Tec.), A. Russo (Tec.)

1 Introduction

$\overline{\text{P}}$ANDA 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 $\overline{\text{p}}$p of 5.5 GeV.

The $\overline{\text{P}}$ANDA 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 $\overline{\text{P}}$ANDA detector, and is having the chair of the Physics Board.

2 The $\overline{\text{P}}$ANDA experiment at FAIR

FAIR is a new international laboratory that will consist of a major upgrade of the presently running GSI accelerator complex of Darmstadt [1)]. In October 2010, Germany, Finland, France, India, Poland, Romania, Russia, Sweden, Slovenia, and later also the UK, signed an international agreement that has established the FAIR GmbH, to which they transferred the responsibility for the construction and operation of the FAIR particle accelerator that started in January 2013. Figure 1 shows a recent view of the FAIR construction site.

Figure 1: *Aerial view of the GSI Laboratory. The FAIR construction site is visible on the back.*

The major novelty of FAIR will be an intense, high momentum resolution, antiproton beam, with momenta between 1.5 and 15 GeV/c. This will circulate in the High Energy Storage Ring

(HESR), where the experimental activity will be carried out using the $\overline{\text{P}}$ANDA general purpose detector. This magnetic spectrometer will be build surrounding an internal target station installed at one of the two straight sections of the storage ring. Figure 2 shows a schematic drawing of the

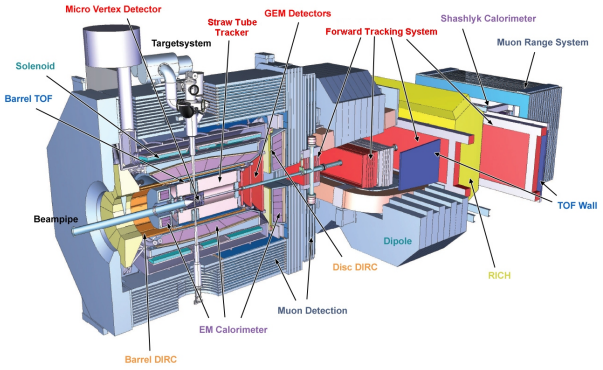

Figure 2: *A schematic view of the $\overline{P}$ANDA apparatus.*

$\overline{\text{P}}$ANDA 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 $\overline{\text{P}}$ANDA Central Tracker

For tracking charge particles in the target spectrometer, $\overline{\text{P}}$ANDA will use different detectors: a silicon Micro Vertex Detector (MVD) a Straw Tube Tracker (STT) and a set of forward GEM chambers [3].

The LNF $\overline{\text{P}}$ANDA group is deeply involved in the STT realization and has the responsibility of the mechanics of the whole tracking system. The Technical Design Report (TDR) of the STT has been approved in 2013 and the construction of the straw tubes started in 2014.

The $\overline{\text{P}}$ANDA 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. 3). Each chamber is made of aluminized mylar straw tubes, diameter 10 mm, length 1500 mm, thickness 30 μm, arranged in planar double layers.

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 $\pm 3^o$ with respect to the beam axis.

4 Activity of the LNF $\overline{\text{P}}$ANDA 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 a first prototype, realized in collaboration with the INFN Torino workshop, has been shipped to Jülich FZ in 2015. Figure 4 shows the prototype structure during the re-assembly in Jülich.

The activity of the LNF $\overline{\text{P}}$ANDA group during 2015 has been devoted to the following tasks:

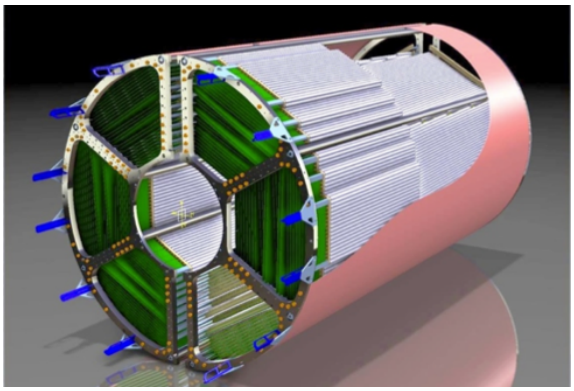

Figure 3: *CAD drawing of the $\overline{P}$ANDA Straw Tube Tracker*

- design of the service system support structure;
- participation to the test beams at Jülich to determine the performance of different electronic setups for the STT.

Figure 4: *The STT mechanical frame prototype, during the installation at the Jülich FZ.*

In parallel with this activity, the LNF $\overline{\text{P}}$ANDA group holds the chair of the Physics Board of the collaboration. At the end of 2014, P. Gianotti has been elected Physics Coordinator of the experiment for a term of two year.

5 List of Conference Talks presented by LNF group members in Year 2015

1. P. Gianotti,"Overview of $\overline{\text{P}}$ANDA physics programme", invited talk at the *$\overline{P}$ANDA Physics Perspectives at SMI*, Vienna, Austria, 19-20 Febbraio 2015.
2. P. Gianotti, "$\overline{\text{P}}$ANDA Physics Overview", invited talk at the $\overline{\text{P}}$ANDA Russia workshop, FRRC, Mosca, 25-27 Maggio 2015.
3. P. Gianotti, " The antiproton physics program of the $\overline{\text{P}}$ANDA experiment", invited talk at the *International Workshop on Antiproton Physics and Technology at FAIR*, Novosibirsk, Russia, 16-19 Novembre 2015.

6 Publications

1. P. Gianotti, "Experimental techniques in hadron spectroscopy ", EPJ Web Conf. 95 (2015) 03012.

2. $\overline{\text{P}}$ANDA Collaboration (B.P. Singh (Aligarh Muslim U.) *et al.*) Eur. Phys. J A51 (2015) 8, 107.

References

1. `http://www.fair-center.com/`.

2. `http://www-panda.gsi.de/`.

3. W. Erni *et al.*, Eur. Phys. J. A49 (2013) 25.