

# XXV Congresso de Iniciação Científica da Unicamp

October 18 to 20 Campinas | Brazil



2017



## Metrology, Statistics, and Computer Programming

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### Abstract

In this project, three high-school students realized a series of theoretical and practical activities to learn about Metrology and Statistics. They studied Object Oriented Programming and developed a computer software related to the theme.

### Key words:

Measurement Instruments, data series, object oriented programming

### Introduction

The objective of this project was to teach the participants the main concepts of Metrology, Statistics and Computer Programming, leading them to the development of a software for data series analysis, according to the Statistical Process Control procedures (SPC).



The project was conducted through lectures, discussions, practical activities, and bibliographic research. The concepts of metrology and instrumentation were used to produce several data series with calipers and micrometers. After a brief training period, the students developed a Java program to show the charts of SPC. The activities used the



following resources:

- Centesimal vernier calipers (0.005 mm);
- Millesimal micrometer (0.001 mm);
- A set of metallic nuts, bolts, and washers
- A set of safety match sticks;
- Ubuntu Linux and its usual tools;
- Eclipse IDE Neon.3;
- Java JDK 1.8.

The most of the activities took place in the Concrete Mathematics Laboratory (LMC) at School of Technology.

### Results and Discussion

The main results of this project were: a) the full engagement of the participants in the campus life; b) the learning of a solid base of statistical concepts; c) the practical use of high precision measurement tools; d) the first contact with computer programming and Linux operating system; e) the formation of a new and favorable vision of the involved themes.



The Figure 1 shows the charts produced by the participants using commercial spreadsheets during introductory study about SPC. They learned how to calculate the controls limits and how to analyses the behavior of the measurements.

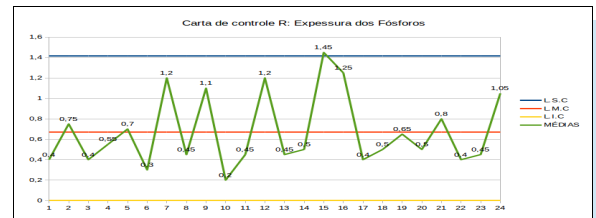
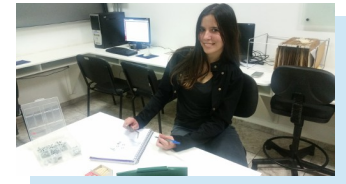


Figure 1. initial SPC charts

The Figure 2 is a screenshot of the developed software showing the charts of average and range produced by the data from the measured metallic bolts.

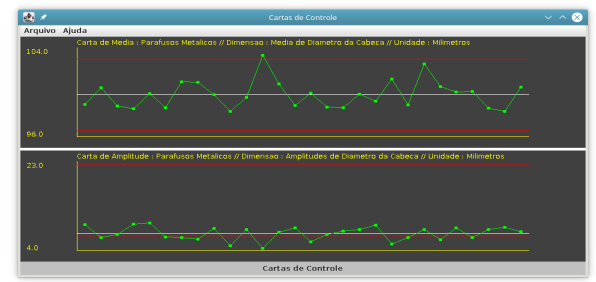
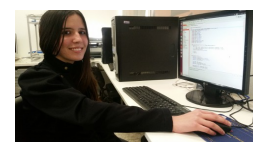


Figure 2. developed software showing SPC charts

### Conclusions



All the planned activities were executed according to the schedule and the goals of the project were reached. The students enjoyed the period they passed inside the University,

learned about the discussed subjects, and pushed their formation to the next level.

### Acknowledgement

We acknowledge CNPq and PRP for the scholarships and project resources.