

First Year Report

Alberto Rescia

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Status of Doctoral Project

My doctoral project is a joint collaboration between the University of Genova and Deutsches Elektronen-Synchrotron (DESY) in Hamburg. My supervisor at DESY is Dr. James Ferrando and my supervisor at the University of Genova is Prof. Federico Sforza. I am based in Hamburg.

My field of research is in experimental particle physics. So far, I have focused on becoming a member of the ATLAS collaboration.

I first learned how to run an analysis in ATLAS following the available online tutorials. To cement my understanding of the analysis software, I took part in a low-mass Drell-Yan trigger study. This work was ultimately presented in a meeting of the relative analysis group.

I have also begun my ATLAS Qualification Task, required to officially enter the collaboration as an author. For this task, I have been working with the Xbb group. This group is responsible for the development of a tagger which identifies decays from any particle to a pair of b-quarks. My task involves the calibration of the tagger in Release 21. Specifically, I have been working on the calibration of the tagger on gluon events. Good progress is being made, and the next step will be to migrate the tagger to the next ATLAS software release.

Finally, I have been working on the development of a tagger sensitive to colour-flow information. These studies began while I was a Master's student and were finalised in the first months of my PhD, concluding with the publication of a paper. Lately, this project has transformed into a study focused on one variable in particular, the primary Lund Jet Plane. I have been working on some preliminary studies focused on how best to measure this observable in ATLAS and am about to begin this analysis in collaboration with Queen Mary University.

Courses Attended

- **The double trouble of the missing matter in the universe**

Prof. Enzo Branchini, University of Genova

To pass the exam, I gave two presentations based on recent papers titled *Finding the missing baryons* and *Dark matter searches at colliders*

- **Observational Astronomy**

Dr. Davide Ricci, University of Genova

Observation proposal accepted, but observation yet to take place

- **Python-based Methods and Applications in Physics**

Prof. Andrea Negri, University of Pavia

Exam not yet taken

Conferences and Workshops

- **XV Workshop ATLAS Italia**

27 - 29 June 2022, Pisa

- **14th International Workshop on Boosted Object Phenomenology, Reconstruction, Measurements and Searches in HEP**

15 - 19 August 2022, Hamburg

At this conference, I gave a talk titled *Tagging with substructure: Designing robust taggers with high-level observables*

- **ATLAS Standard Model and Luminosity Workshop 2022**

12-15 September 2022, Hamburg

- **ATLAS W Mass Workshop 2022**

15 - 16 September 2022, Hamburg

Publications

- Cavallini, L., Coccaro, A., Khosa, C.K. et al. Tagging the Higgs boson decay to bottom quarks with colour-sensitive observables and the Lund jet plane. *Eur. Phys. J. C* 82, 493 (2022). <https://doi.org/10.1140/epjc/s10052-022-10447-1>