Ruggero Turra

Curriculum Vitæ

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Date of birth: May 31, 1984
Place of birth: Treviglio (BG), Italy

Education

2009 **Master's degree "Laurea Specialistica"**, *Università degli Studi di Milano-Bicocca*, Italy.
Thesis title: Study of the decay $B_s^0 \to D_s^+ D_s^-$
Supervisor: Dr. Marta Calvi
110/110 cum laude

2006 **Bachelor's degree "Laurea Triennale"**, *Università degli Studi di Milano-Bicocca*, Italy.
Thesis title: Simulazioni Monte Carlo per l'esperimento CUORE
Supervisor: Dr. Chiara Brofferio and Dr. Maura Pavan
110/110 cum laude

2003 **Diploma**, *Liceo Scientifico Tecnologico*, Crema (CR), Italy.
Maturità scientifica: 100/100

Schools

2012 **Proof and PoD tutorial**, *Laboratori Nazionali di Frascati*, Frascati.

2011 **19th European Schools of High-Energy Physics (ESHEP)**, Romania.

Present position

2012 **Simil-fellow**.
I have won an Italian "simil-fellow" position to work at CERN during 2012 as associate.

2010–Dec 2012 **PhD in Physics XXV ciclo**, *Università degli Studi di Milano*, Italy.
Main courses: Physics at LHC (F. Ragusa), calorimeters (L. Carminati), MC and optimization methods (D. Galli), jet reconstruction (M. Cacciari).

Past research activities

2006 **Simulazioni Monte Carlo per l'esperimento CUORE (Bachelor's Degree Thesis)**.
CUORE is an array made with $\mathrm{TeO_2}$ bolometers designed for the search of neutrinoless double beta decay (DBD0ν) of $^{130}\mathrm{Te}$. A periodic calibration is obtained by inserting some Th wires into the cryostat. The purpose of my thesis had been the optimization of the calibration configuration using simulations. I have analyzed how the calibration time, the pile-up and the linearity change when modifying the disposition and the number of calibration wires.

2009 **Study of the decay $B_s^0 \to D_s^+ D_s^-$ (Master's degree Thesis)**.
The goal of my thesis was the study of the $B_s^0 \to D_s^+ D_s^-$ in which the $D_s^\pm$ mesons are detected by their $KK\pi$ decay [1]. The products of the B_s^0 decays of this channel build up an even CP eigenstate, so it will be possible to study the proper time of this component separately. I have optimized different signal selections. Using these selections I extracted the decay proper time, and made an estimation of the expected statistical error assuming one year of data taking with LHCb. From this information I extracted the parameter $\Delta\Gamma_s/\Gamma_s$ and its error by comparing the proper time of the studied decay and the proper time of the semileptonic decay.

2009 **LHCb Cherenkov detectors**.
The LHCb detector has two RICH subdetectors to identify particles. I studied trackless pattern recognition algorithms. In addition I have studied the online measurement of the refraction index of the areogel using high momentum particles.

Present research activities

I currently work in the ATLAS Collaboration since January 1st, 2010, and I am an ATLAS qualified author since February 1st, 2011. My activity is focused on the performance of the electromagnetic calorimeter and on the photon physics, both within the Standard Model analyses and the search for the Higgs Boson.

2010 **Shower shape variables with early data**.
My first work in ATLAS was the study of the shower shape variables comparing data with $\sqrt{s} = 900\,\text{GeV}$ and Monte Carlo simulations [13].

2010–today **Electromagnetic calibration using Calibration Hits method**.
The Calibration Hits method [14] is based on Monte Carlo simulations that describe the energy deposition in the active but also in the passive parts of the detector. Using these simulations it is possible to parametrize the non-reconstructed energy versus measurable quantities. For the 2011 and 2012 data taking I have optimized and tested such a calibration, which is used in the ATLAS event reconstruction.

2010 **Dead material effect on the ATLAS electromagnetic calorimeter**.
Using Monte Carlo simulations with distorted geometry I have studied the effect of additional dead materials on the energy calibration and on the reconstruction and identification performance of electrons and photons.

2010 **Inclusive prompt photon at the ATLAS detector**.
The first physics result on photon published by ATLAS is the measurement of the inclusive isolated prompt photon cross section using $850\,\text{nb}^{-1}$ [15][2] followed by an update with $35\,\text{pb}^{-1}$[23][16][8, 9]. One of the main ingredients of this measurement is the estimation of the photon purity [17]. I worked in this topic using the two dimensional sideband data driven method [18].

2010–2011 **Isolated diphoton at the ATLAS detector**.
The measurement of the diphoton production cross section [19] is of great interest as a probe to the QCD, in addition diphoton events are the irreducible background for the Higgs decay into two photons. I have followed the full analysis [24], in particular I focused on the purity, the jet background decomposition using the 4×4 matrix method, the background removal from electron misidentified as photons and the unfolding of the cross section spectra.

2010–today **Proof optimization**.
Proof is a tool to easily parallelize ROOT analyses. I was involved in the installation, the configuration and the testing of a medium proof farm.

2011–today **Vertexing for the $H \to \gamma\gamma$ at the ATLAS detector**.
To improve the measurement of the direction of the two photon from the Higgs decay one can constrain the direction of the photons to pass through the primary vertex. The goal of this work is to select the most probable vertex from which the photon pair originates combining information from the calorimeter and the inner detector.

2011–today **Background estimation for the $H \to \gamma\gamma$ at the ATLAS detector**.
As in the di-photon study I have implemented the 4×4 matrix to decompose the background [20]. Thanks to the new statistics it is possible to take into account additional information, for example the dependency of the isolation on the number of primary vertexes. This method agrees with the other methods already used.

2011 **Improvement of the converted photon energy resolution**.
Being already involved in the photon and electron calibration since 2010, I have improved the energy resolution for converted photons using as additional information the reconstructed radius of conversion. For example it is possible to reduce the RMS of the $H \to \gamma\gamma$ mass by a factor or 7% considering only pair of converted photons. From this study I have produced a tool to be applied on data to correct the calibrated energy. Today this correction is approved by the e/gamma group and used by the $H \to \gamma\gamma$ analysis.

2012 **Development of an online monitor of the space token usage**.
I have developped a tool to monitor the space used by each user. A working example can be found here: `http://precision-turra.mi.infn.it/LOCALGROUPDISK_usage/`

2012–today **MVA energy calibration**.

Looking carefully to the energy calibration for electromagnetic particles it is clear that there are some dependencies that are not taken into account. To take into account a lot of variables at the same time MVA optimizations are needed. For this study I have created a small group of people working together including a summer student. Some new variables have been created, the most powerful one is the measurement of the amount of material traversed by each track. The work is in a good shape and for example there are improvement on the $H \to \gamma\gamma$ invariant mass of the order of $5 - 10\%$. During this study we've developped a generic tool to check the performance which can be useful also for other performance studies.

2012–today $H \to \gamma\gamma$ **+ MET**.

Presently I am involved into some cross checks about the missing transverse energy for the $H \to \gamma\gamma$ analysis. In particular we're checking the consintency of the object definitions entering in the MET computation and the $H \to \gamma\gamma$ analysis.

Operational activities

2011–today **Hardware on-call expert**, *CERN*.

I am a hardware on-call expert for the liquid argon subsystem of the ATLAS detector. In particular the activity is focused on the operation of the high voltage modules.

Teaching activities

2010/11 **Assistant**, *Università degli Studi di Milano*.

I was assistant of prof. Fernando Palombo during the course "Laboratorio di Trattamento Numerico dei Dati Sperimentali" (Laboratory of Numerical Treatment of Experimental Data).

2011/12 **Assistant**, *Università degli Studi di Milano*.

I was assistant of dott. Leonardo Carminati during the course "Laboratorio di Trattamento Numerico dei Dati Sperimentali" (Laboratory of Numerical Treatment of Experimental Data).

2012 **Summer student supervisor**, *CERN*.

I've been the supervisor of a CERN summer student working in the MVA energy calibration.