Załącznik nr 6

Summary of Professional Accomplishments

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Krakow 2014

1 Personal details:

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Home Institute:	AGH – University of Science and Technology in Krakow, Poland Department of Physics and Applied Computer Science Particle Interactions and Detection Techniques Group
Position:	assistant professor

2 Diplomas and academic degrees:

MSc: 2001 – University of Mining and Metallurgy, Krakow, Poland
Department of Physics and Nuclear Techniques

PhD: 2004 – University of Mining and Metallurgy, Krakow, Poland
Department of Physics and Nuclear Techniques
thesis *Measurement of Deeply Virtual Compton Scattering Using the ZEUS Detector at HERA* (completed with distinction)
supervisor: prof. Leszek Turczynowicz-Suszycki

3 Employment record:

2004–2005	University of Mining and Metallurgy Department of Physics and Nuclear Techniques Elementary Particles and Detectors Group assistant
2005–2007	CERN, Geneva, Switzerland PH–ATLAS research fellow
2008	AGH – University of Science and Technology Department of Physics and Applied Computer Science Particle Interactions and Detection Techniques Group assistant professor
2008–2011	University of California, Irvine Department of Physics and Astronomy assistant project scientist
2011–present	AGH – University of Science and Technology Department of Physics and Applied Computer Science Particle Interactions and Detection Techniques Group assistant professor

4 Scientific achievement as grounds for the habilitation procedure (Dz. U. nr 65, poz. 595 ze zm.):

4.1 Title

Iwona Grabowska-Bołd, **Measurements of electroweak bosons in lead-lead collisions at $\sqrt{s_{\rm NN}}$=2.76 TeV using the ATLAS detector at the LHC**

Published by Expol ISBN 978-83-63041-07-6

Description of the achievement as grounds for the habilitation procedure

4.2 Scientific objectives

The theory of strong interactions called *Quantum Chromodynamics* (QCD) predicts that at very high temperatures and very high densities, quarks and gluons should no longer be confined inside composite particles. Instead they should exist freely in a new state of matter known as *quark–gluon plasma* (QGP). Such a transition between ordinary matter and the QGP should occur when the temperature exceeds a critical value estimated to be around 2 000 billion degrees, which is 10^5 times hotter than the core of the Sun. Only for a few millionths of a second after the Big Bang the temperature was indeed above the critical value, and the entire Universe was in a QGP state.

In laboratory, such temperatures could be attained by colliding heavy ions (HI) at relativistic energies. Furthermore, in HI collisions occurring at very high energy the lifetime of the deconfined phase may be long enough to allow for the detailed study of the fundamental constituents (quarks and gluons) of the visible matter.

The Relativistic Heavy Ion Collider (RHIC) has established the formation of a deconfined system of quarks and gluons in Au+Au collisions at $\sqrt{s_{\rm NN}} = 200$ GeV. The system, which has been produced, exhibits copious production of strange hadrons, shows substantial collectivity developed in the partonic phase, exhibits suppression in high transverse momentum ($p_{\rm T}$) hadron production relative to proton-proton (pp) collisions and small fluidity as reflected by a small value of viscosity to entropy density ratio. A factor of 14 increase in the center-of-mass energy of lead-lead (Pb+Pb) collisions at the Large Hadron Collider (LHC) has been expected to unravel the temperature dependence of various observables, as well as to extend the kinematic reach in rapidity and $p_{\rm T}$ of previous measurements at RHIC. In addition, some processes, which have never been measured at RHIC due to their low production cross sections, give non-negligible rates at the LHC for the first time.

In addition to features mentioned earlier, extensive studies of HI collisions carried out by the experiments at RHIC and the LHC have established that the QGP produced in HI collisions causes a significant energy loss of the energetic color-charged carriers propagating through such a medium. A deep understanding of this phenomenon requires measuring unmodified production rates of particles before they lose energy. The best candidates to perform such measurements are particles that do not interact via the strong force. Electroweak (EW) bosons have been proposed to act as standard candles in events, in which they are produced in association with jets. In such final states, EW bosons offer the possibility of calibrating the initial energy of the jet.

The PHENIX experiment at RHIC measured the properties of photons. At the LHC, the CMS experiment reported results on photons, and $W^{\pm}$ and Z boson production. The weak bosons were investigated via muon decay modes solely. Production yields of EW bosons were found to scale linearly with the number of binary nucleon-nucleon collisions, although the statistical precision of those measurements was limited.

Also the EW boson production is recognized as an important benchmark process at hadron colliders. Cross sections of $W^{\pm}, Z$ and γ production have been an important testing ground for QCD. Theoretical calculations of these processes extend to next-to-leading order (NLO) and next-to-next-to leading order (NNLO) perturbation theory. Crucial ingredients of the resulting QCD cross-section calculations are the parameterizations of the momentum distribution functions of partons in the nucleon (PDFs). These have been determined recently in a variety of phenomenological analyses to NLO QCD by the CTEQ group and to NNLO by the MSTW and other groups. In HI collisions, EW boson production rates provide access to the initial state PDFs, which are expected to be modified by nuclear effects.

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The LHC commenced the HI program in two Pb+Pb runs, which took place in 2010 and 2011 at the center-of-mass energy of $\sqrt{s_{\rm NN}} = 2.76$ TeV per colliding nucleon pair. Three, out of four, major experiments at the LHC actively participated in data taking: ALICE, ATLAS and CMS. In 2010 the instantaneous luminosity was low enough to allow the ATLAS experiment to collect a minimum-bias (MB) sample solely. The high-$p_{\rm T}$ particles were hardly produced. In 2011 the instantaneous luminosity increased by a factor of 20, which allowed to record an enriched data sample of high-$p_{\rm T}$ photons, electrons, muons and jets, in addition to the MB data. These event statistics could improve considerably the precision of the existing EW boson results.

In this monograph, measurements of inclusive γ, Z and $W^{\pm}$ boson production based on the 2011 data sample from the ATLAS experiment are reviewed. The weak bosons via their decays to electrons are employed for the first time in an HI environment. In addition to inclusive results, also events in which a pair of γ or Z boson with a jet has been produced, are discussed. These processes turn out to introduce another avenue for benchmarking in-medium modifications to colored probes.

4.3 Results

The ATLAS experiment has performed a measurement of Z boson production decaying to di–muon and di–electron final states. The invariant mass of selected electron and muon opposite signed pairs was required to be in the region $66 < m_{ll} < 102$ GeV ($l = e, \mu$). The combinatorial background contamination was found to be less than 3% which makes this measurement very clean in particular in the context of Z+jet correlation studies. The per-event yields of Z bosons have been extracted from the mass peak and shown in Fig. 1. These yields where scaled by the number of binary collisions, $N_{\rm coll}$, and are shown as a function of centrality represented by $N_{\rm part}$ for several Z boson transverse momentum intervals. Within the statistical significance of the data sample, the Z boson per-event yield obeys the binary collision scaling with centrality.

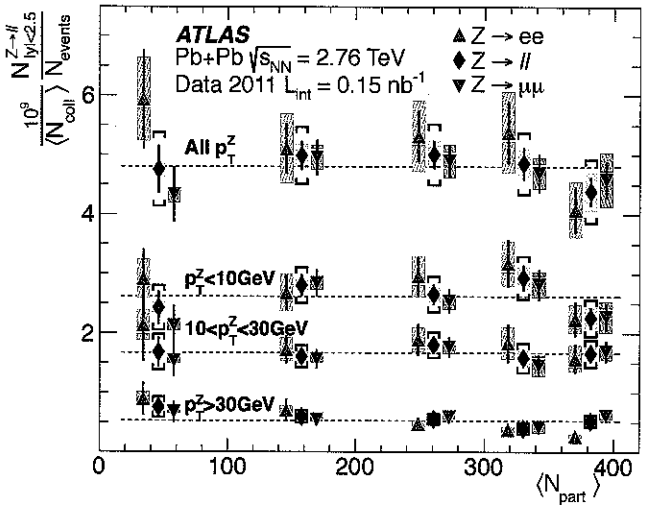

Figure 1: Centrality dependence of Z boson yields divided by $\langle N_{\rm coll}\rangle$. Results for $Z \to e^+e^-$ (upward pointing triangles) and $Z \to \mu^+\mu^-$ (downward pointing triangles) channels are shifted left and right, respectively, from their weighted average (diamonds). Bars and boxes represent statistical and systematic uncertainties, respectively. For the combined result, the brackets show the combined uncertainty including the uncertainty on $\langle N_{\rm coll}\rangle$, and the dashed lines show the results of fits, using a constant.

A measurement of $W^{\pm}$ boson production in Pb+Pb collisions at $\sqrt{s_{\rm NN}} = 2.76$ TeV has been carried out by the ATLAS experiment at the LHC. A data sample, which corresponds to an integrated luminosity of 0.14 and 0.15 nb^{-1} for the muon and electron decay channels, respectively, has been analysed. This is approximately 20 times larger than the dataset employed in the CMS result based on data taken in 2010. In addition, the electron decay mode of $W^{\pm}$ bosons is explored in the HI environment for the first time. The $W^{\pm}$ boson candidates are selected using muons or electrons with $p_{\rm T}^{\ell} > 25$ GeV and $|\eta^{\ell}| < 2.5$ in the final state in events with large missing transverse momentum, $p_{\rm T}^{\rm miss} > 25$ GeV, and large transverse mass of the charged lepton and $p_{\rm T}^{\rm miss}$

system, $m_{\mathrm{T}} > 40$ GeV. This set of requirements defines a fiducial region, for which $W^{\pm}$ boson production yields have been extracted after background subtraction and correction. Since the muon and electron channels agree, they have been combined using an averaging method with weights proportional to the inverse square of the individual uncertainties. Figure 2 shows W^{+} or W^{-} boson production yields per minimum-bias collision and normalized to a number of binary nucleon-nucleon collisions, $\langle N_{\mathrm{coll}} \rangle$, as a function of absolute pseudorapidity. The measurement is compared to LO* and NLO QCD calculations involving MRST, CT10 and EPS09 PDFs. The EPS09 set incorporates corrections to the PDFs that account for contributions from shadowing, anti–shadowing, the EMC–effect, and Fermi–motion.

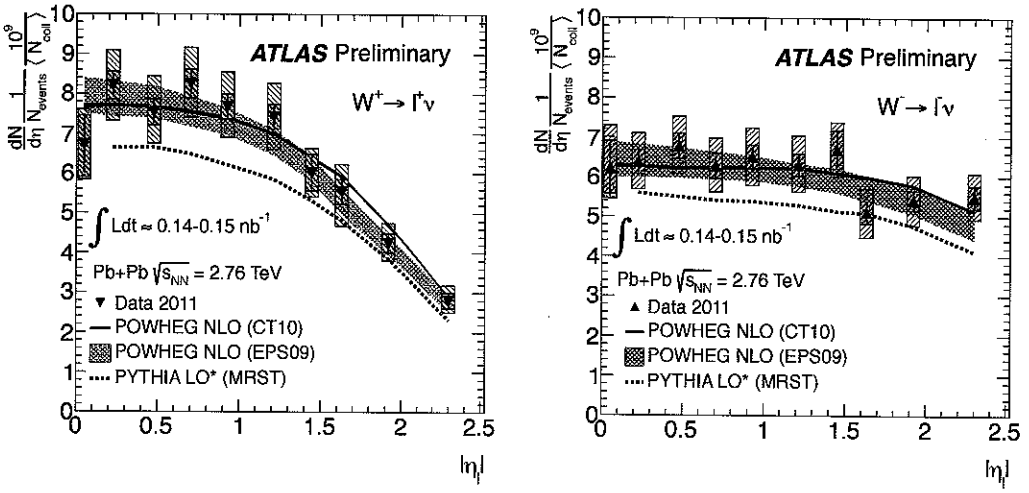

Figure 2: Differential production yields per binary collision for W^{+} (left) and W^{-} (right) production compared to LO* and NLO theoretical predictions. The kinematic requirements are $p_{\mathrm{T}}^{\ell} > 25$ GeV, $p_{\mathrm{T}}^{\mathrm{miss}} > 25$ GeV, and $m_{\mathrm{T}} > 40$ GeV. Statistical errors are shown as black bars, whereas uncorrelated systematic and statistical uncertainties added in quadrature are shown as the filled error box. Correlated scaling uncertainties are shown as the hatched boxes.

The ATLAS experiment measures prompt photons with its hermetic, longitudinally segmented calorimeter, which gives excellent spatial and energy resolution, and detailed information about the shower shape of each measured photon. This gives significant rejection against the expected background from neutral pions in jets. Rejection against jet fragmentation products is further enhanced by isolation criteria, which can be based on calorimeter energy or the presence of high–p_{T} tracks. Photon yields, scaled by the mean nuclear thickness function, $\langle T_{\mathrm{AA}} \rangle$, are measured in Pb+Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 2.76$ TeV as a function of collision centrality, transverse momentum ($22 < p_{\mathrm{T}} < 280$ GeV) and in two pseudorapidity intervals (central: $|\eta| < 1.37$, and forward: $1.52 < |\eta| < 2.37$). Figure 3 shows the ratios of photon yields between the forward and central pseudorapidity bins. These ratios partially cancel out some of the systematic effects on the efficiencies and unfolding correction factors, mitigate the effect of the theoretical uncertainties, and fully remove the uncertainties in $\langle T_{\mathrm{AA}} \rangle$. The results are compared to JETPHOX calculations for pp, Pb+Pb and EPS09 PDFs. It is clear that there is some sensitivity to the nuclear modifications to PDFs, primarily through the expected depletion of photon yields in the forward direction expected when including the neutron PDFs to match the isospin composition of the Pb nuclei. While the data are consistent with all three curves within the statistical and systematic uncertainties, a slight preference for the calculations incorporating isospin effects is observed.

In this monograph, a measurement of the correlation of back-to-back isolated prompt photons with jets as a function of transverse momentum and centrality has been discussed. Figure 4 shows the energy fraction $x_{\mathrm{J}\gamma} = p_T^{\mathrm{jet}}/p_T^{\gamma}$ for data and PYTHIA+Data[1] MC as a function of centrality represented by a number of participants, N_{part}. In the peripheral centrality interval, $\langle x_{\mathrm{J}\gamma} \rangle$ is just below what is obtained using the truth jet and true photon energies in the MC. As the centrality increases, the $\langle x_{\mathrm{J}\gamma} \rangle$ systematically decreases, although quite slowly. However, the most central

[1] A hard process is generated by PYTHIA and embedded into a minimum-bias event from real data. The in-medium energy loss is not modelled.

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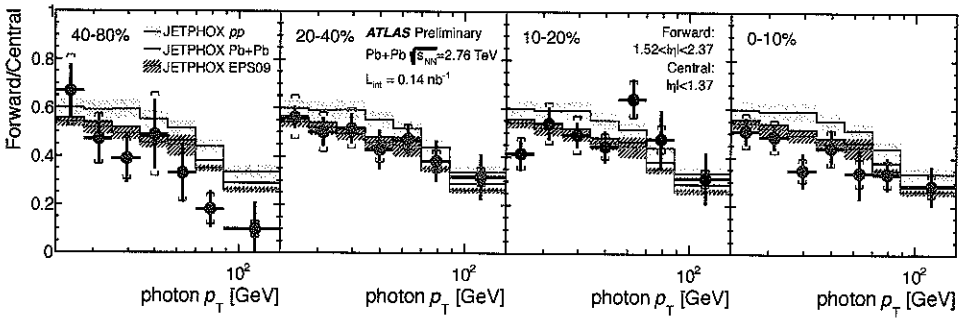

Figure 3: Fully-corrected yields of prompt photons as a function of p_{T} in $1.52 < |\eta| < 2.37$ divided by that measured in $|\eta| < 1.37$ using the tight photon selection, isolation cone radius R_{iso}= 0.3 and isolation energy of 6 GeV. The yield ratio is compared to JETPHOX predictions which implement the same isolation selection, for three different configurations: for pp collisions (yellow area), Pb+Pb collisions with no nuclear modification (black line), and Pb+Pb collisions with EPS09 nuclear modifications (blue area). Statistical uncertainties are shown by the bars. Systematic uncertainties on the photon yields are combined and shown by the braces.

value is significantly different than the PYTHIA+Data prediction.

4.4 Summary and outlook

This monograph gives an overview of results on electroweak boson production in lead-lead collisions at the center-of-mass energy of $\sqrt{s_{\mathrm{NN}}} = 2.76$ TeV per nucleon pair collected by the ATLAS detector. The results are based on a data sample recorded in 2011 with the integrated luminosity of 0.13-0.15 nm^{-1}, which constitutes a majority of event statistics from HI collisions collected in Run 1.

The LHC and its four main experiments: ATLAS, CMS, ALICE and LHCb had been designed to dopp physics. Nevertheless, one month per year is dedicated to operations with lead beams. The machine and the experiments have been in operation since fall 2009. The larger collision energies at the LHC push measurements to much higher energies than are accessible at its precursor RHIC, allowing new and more detailed characterization of the QGP.

The ATLAS experiment is one of three[2] experiments, along with ALICE and CMS, which participate in the HI program at the LHC. The ATLAS detector uses its large acceptance, high granularity calorimeters, silicon tracking detectors, and muon spectrometers to study hard scattering processes occurring in collisions of ultra-relativistic nuclei. It provides substantially larger continuous coverage, for both energy and charged particle momenta, than any of the existing RHIC detectors. The detector proved to be capable of performing systematic and comprehensive measurements of various processes of primary importance for HI physics with $W^{\pm}$, Z and γ production among them, which are benchmark processes to improve our understanding of the jet-quenching phenomenon in Pb+Pb collisions.

Due to much higher energies and larger instantaneous luminosity delivered by the LHC, the weak bosons are accessed experimentally in the HI collisions for the first time. A dedicated trigger was designed and set up to collect an enhanced data sample of high transverse momentum electrons, photons, muons and jets produced in the high occupancy environment of HI data. Isolated prompt photons, Z and $W^{\pm}$ bosons have been measured. Weak bosons were reconstructed and identified via electron and muon decay modes. Dedicated algorithms have been applied to suppress an underlying-event background, which distorts calorimeter-based variables in jet, photon and electron measurements.

The prompt photon, $W^{\pm}$ and Z production rates have been found to scale linearly with a number of binary nucleon-nucleon collisions in each centrality bin. This observation proves that neither the electroweak bosons nor their decay products (where applicable) interact with the QGP. Also the electroweak boson production rates are in agreement with the theory predictions. Transverse momentum and rapidity distributions have been extracted for γ, Z and $W^{\pm}$ bosons. The elliptic anisotropy of the Z boson measured as a function of rapidity, transverse momentum and centrality

[2] ALICE, ATLAS and CMS participate in the entire HI data taking, while the LHCb experiment was only involved in the p+Pb program.

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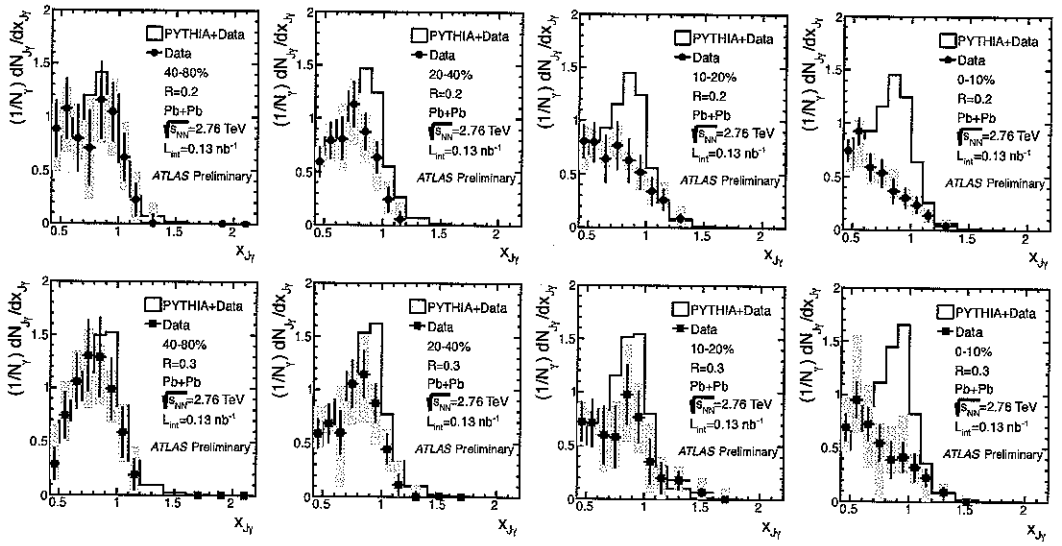

Figure 4: Fully unfolded and corrected $x_{\mathrm{J}\gamma}$ distributions from Pb+Pb data (closed symbols) compared with PYTHIA truth jet/true photon distributions (yellow histogram), for simulated events (with data overlay) with a reconstructed photon passing analysis selections. The rows represent different reconstructed jet radii (respectively $R = 0.2$ and $R = 0.3$). The columns represent different centralities, left to right: 40-80%, 20-40%, 10-20% and 0-10%. The kinematic requirements are $60 < p_{\mathrm{T}}^{\gamma} < 90$ GeV, $|\eta_\gamma| < 1.3$, $p_{\mathrm{T}}^{\mathrm{jet}} > 25$ GeV, $|\eta^{\mathrm{jet}}| < 2.1$ and $|\Delta\phi_{\mathrm{J}\gamma}| > 7\pi/8$. The error bars represent statistical errors, while the grey bands indicate the systematic uncertainties.

is consistent with zero within the uncertainties of the measurement. This observation is an independent measurement consistent with $Z \to \ell^+\ell^-$ yields being unaffected by the medium produced in the heavy-ion collisions. The lepton charge asymmetry has been measured for electrons emerging from the $W^{\pm}$ system. The shape of the distribution was dissimilar to the results from pp collisions, which is expected due to the additional neutron component in the Pb+Pb system that serves to enhance the overall W^- boson production yield. The asymmetry was found to agree well with the theory prediction both at modified leading- and next-to-leading order PDFs, making it ambiguous at the moment whether nuclear effects are non-existent or the precision of the measurement needs to be improved in order to disentangle effects due to the multi-nucleon system and nuclear modifications.

Also first results from the ATLAS experiments on the correlations of jets with photons or Z bosons have been discussed. The latter is limited by event statistics of the data sample collected in Run 1. A ratio of jet transverse momentum to the transverse momentum of the electroweak boson shows the suppression which grows with centrality in comparison to the PYTHIA prediction, which does not simulate any jet-quenching effects. Conversely, there is essentially no change in the distribution of the difference in the azimuthal angle between the jet and electroweak boson with increasing centrality, similar to what was observed for di-jets in HI collisions at the LHC.

Results on electroweak boson production provide a starting point for more complete and more detailed studies of the jet energy loss in the hot and dense medium formed in HI collisions at the LHC. In particular, the ATLAS experiment looks forward to future LHC operations with lead beams at yet higher instantaneous luminosities and higher center-of-mass energy. These new running conditions are supposed to increase event statistics by a factor of eight. With improved statistical and systematic uncertainties, along with additional data from different colliding systems such as p+Pb, it should be possible to decisively evaluate the extent of nuclear effects to PDFs and further test theoretical predictions.

5 Summary of research work

5.1 Period before receiving the PhD title

In year 2000, after my MSc thesis defense, I started a PhD study at the Department of Physics and Nuclear Techniques, AGH–UST in the group led by prof. Danuta Kisielewska. In the academic

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year 2001–2002 I did an internship in the high–energy physics laboratory DESY in Hamburg in Germany. I was working on the deeply virtual Compton scattering in electron–proton collisions in the ZEUS experiment at HERA. In parallel I was developing software to store a data structure created after the offline reconstruction and particle identification in the ZEUS experiment. This software was used by all members of the ZEUS collaboration actively working on offline analyses. My PhD thesis entitled *"Measurement of Deeply Virtual Compton Scattering Using the ZEUS Detector at HERA"* under prof. Leszek Turczynowicz–Suszycki's supervision was defended with distinction in June 2004. Then it was submitted for numerous awards and as such awarded in many competitions. Also it was published in Eur. Phys. Jour. C as an independent article. Moreover, a publication, which reported this measurement on behalf of the entire collaboration, has been one of the most cited publications of the ZEUS experiment so far.

5.2 Period after receiving the PhD title

In the academic year 2004–2005 I started an assistant position in the Elementary Particles and Detectors Group of the Department of Physics and Nuclear Techniques at the AGH–UST. At that time I started working on the ATLAS experiment at the LHC. I was involved in the inclusive Z boson production measurement in pp data. In parallel I was teaching students from our department.

In the meantime I applied for two research fellowship positions: one at DESY (Hamburg) and another at CERN (Geneva). I got both of them. In August 2005 I started a research fellowship contract at CERN. I joined the ATLAS experiment and its Trigger Project. In years 2005–2007, I was working on the Event Filter (EF) tracking reconstruction and electron trigger design and optimization. I was creating, developing, maintaining and validating algorithms in a set of `InDetTrigRecAlgs` packages. I was a primary author of the so-called *inside-out* and *outside-in* tracking sequences in the tracking triggers. I was also an author of the so-called *full scan* tracking sequences, which were of particular interest in the very early data taking period in 2009–2010. The inside-out software was used in electron, muon, tau and minimum-bias oriented triggers, which were selecting events online in Run 1 at the LHC, which took place in years 2009–2013. I was involved in performance studies of the tracking triggers prior to data taking, which were summarized in various papers and conference notes.

In years 2008–2011, I was a member of the Trigger Menu Group of the ATLAS experiment. I was working on the trigger configuration for pp data taking in Run 1. This work was a baseline for event selections of a majority of events collected by the ATLAS detector. Performance of the ATLAS trigger in the first year of online running was summarized in the dedicated publication. I was in the editorial team of this publication.

In years 2008–2009 when the ATLAS detector, already commissioned in its underground cavern, collected several hundred million cosmic ray events I was participating in trigger tests of the reconstruction and identification of trigger objects in those data. During Run 1 I was taking part in online shifts at the trigger desk in the ATLAS Control Room, as well as I was acting as a trigger menu expert and tracking expert on call. I was also doing offline trigger monitoring shifts. They led to successful trigger operations in Run 1.

In addition to my involvement to detector operations, I have been a member of the ATLAS Heavy Ion Working Group since 2010. In preparation to Pb+Pb runs in 2010 and 2011, as well as to p+Pb runs in 2012 and 2013 I coordinated work related to the trigger design, configuration and performance studies, which was done within the Heavy Ion Trigger Menu Forum (HITMF). In paralel I was a member of the Minimum Bias and Forward Detector (MBFD) Trigger Group. After successful operations with HI data, the HITMF and MBFD groups worked on performance of the triggers in HI collisions, which was summarized in two conference notes. I was an editor of them. I was appointed a co-coordinator of the MBFD trigger group for years 2014–2015.

Physics of electroweak bosons as well as reconstruction and identification of their decay products in the HI environment have been my major interest since 2011. I was involved in the Z boson measurements in Pb+Pb data at $\sqrt{s_{\rm NN}} = 2.76$ TeV. The outcome of these studies were two conference notes and a publication. In 2012 I started an analysis of $W \to e\nu$ boson production in Pb+Pb data, which complements the $W \to \mu\nu$ boson measurement reported in the conference note dedicated to the muon channel and released for the Hard Probes 2013 conference. The common publication on W boson production in Pb+Pb collisions in two decay modes was submitted to Eur. Phys. Jour. C in August 2014. Nevertheless, a preliminary combined measurement has already been released in the conference note for Quark Matter 2014. I reported on electroweak-boson measurements in

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HI collisions at various national and international conferences.

I was not directly involved in the photon studies but I contributed to them by discussions, help in reviewing the conference notes. In 2014 I became a member of the Editorial Board team, which is working towards publication of a next set of photon measurements from the ATLAS experiment. Nevertheless, it should be stressed that those studies would not be possible without triggers developed by myself in preparation to all HI operations in Run 1.

I am also involved in long–range correlations measurements in minimum-bias data from Pb+Pb and pp collisions at $\sqrt{s_{\rm NN}} = 2.76$ TeV. This subject was covered in a few diploma theses prepared under my supervision.

Moreover, I was a member of two editorial boards working on results on b quark efficiency and mis-tag rate studies. This work was concluded in two conference notes.

In years 2013–2015 I am a member of the Speakers Committee Advisory Board, which defines and implements criteria of equal distribution of conference talks in the ATLAS Collaboration. In years 20014–2015 I am a member of the Collaboration Board Chair Advisory Group. Since 2014 I have been acting as a reviewer in *Advances in High Energy Physics, impact factor 2.624* (details at http://www.hindawi.com/journals/ahep/reviewers/4/).

5.3 Future plans

I will continue my commitment in the MBFD and HITMF groups, where I coordinate work in preparation to data taking after a technical break in years 2015–2018 in the ATLAS experiment. This concerns all beam species at the LHC i.e. pp, Pb+Pb and p+Pb collisions. In particular I will continue to coordinate work related to trigger configuration and optimisation for high-$p_{\rm T}$ particles produced in Pb+Pb collisions, which will become crucial at high luminosity running.

Currently I coordinate three qualification tasks[3] within the ATLAS Collaboration:

- Trigger optimization for high-multiplicity track events in Run 2.
- Development of the trigger strategy for low-$p_{\rm T}$ electrons and muons produced in Pb+Pb collisions in Run 2.
- Updates of MBTS simulation to the new geometry of Run 2.

In addition I am a supervisor of a diploma project which aims for the development of a framework for monitoring of minimum-bias trigger performance in Run 2. All these tasks and projects need to be finalized before the ATLAS experiment resumes data taking in 2015.

In the near future I intend to start a measurement of W boson production with a decay in the electron channel in p+Pb collisions. This analysis is a natural enhancement of the W boson analysis in the Pb+Pb system, which has just been finalized. Also I hope to be able to terminate the correlation measurement. Ideally if a publication, which summarizes results of that analysis, could be published in a one–year time.

Since October 2014 I will take a new responsibility and will act as a *release coordinator* for software developed under the trigger project.

6 Detailed overview of the other scientific and research achievements

6.1 Publications

Detailed list of publications is listed in appendix 6.

Total number of publications:	434
Number of citations:	10273
Number of citations without the auto-citations:	9046
Hirsch index:	45
Total Impact Factor:	1453

The numbers come from the ISI Web of Science dated as of 04/09/2014.

[3] Each new member of the ATLAS Collaboration gets a qualification task, which he or she needs to accomplish within one year.

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Publications, which are directly related to measurements discussed in the monograph – in journals from the JCR data base, public notes of the ATLAS collaboration, which underwent the internal approval process, and conference proceedings:

1. *Measurement of Z boson Production in Pb+Pb Collisions at $\sqrt{s_{NN}}$=2.76 TeV with the ATLAS Detector*, ATLAS Collaboration (I. Grabowska-Bołd), Phys. Rev. Lett 110, 022301 (2013)
   (I contributed to trigger efficiency studies and event calibration for the entire min-bias sample. Also I was working on text of the publication. In addition, I am an author of triggers, which were used to collect data for this analysis. I estimate my contribution at the 50% level.)

2. *Measurement of the production and lepton charge asymmetry of W bosons in Pb+Pb collisions at $\sqrt{s_{NN}}$=2.76 TeV with the ATLAS detector*, ATLAS Collaboration (I. Grabowska-Bołd), arXiv:1408.4674 [hep-ex], submitted to Eur. Phys. J. C
   (I performed a complete analysis of the W boson production with a decay to $e\nu$. I am an editor of this publication. In addition I was involved in the combined measurement for muon and electron data. My contribution to the $W \to e\nu$ measurement is at the 100% level.)

3. *Measurement of the Z boson Production in Lead-Lead Collisions at $\sqrt{s_{NN}}$=2.76 TeV with the ATLAS Detector*, ATLAS Collaboration (I. Grabowska-Bołd), ATLAS-CONF-2012-052
   (I contributed to trigger efficiency studies and event calibration for the entire min-bias sample. I was working on text of the publication. In addition, I am an author of triggers, which were used to collect data for this analysis. Also I was involved in an editorial process of this publication. I estimate my contribution at the 50% level.

4. *Measurement of momentum imbalance in $Z \to ll$ + jet events in Lead-Lead collisions at $\sqrt{s_{NN}}$=2.76 TeV with the ATLAS detector*, ATLAS Collaboration (I. Grabowska-Bołd), ATLAS-CONF-2012-119
   (I contributed to trigger efficiency studies and event calibration for the entire min-bias sample. In addition, I am an author of triggers, which were used to collect data for this analysis. I was involved in an editorial process of this publication. I estimate my contribution at the 10% level.)

5. *Measurement of W boson production and the lepton charge asymmetry in Pb+Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV with the ATLAS detector*, ATLAS Collaboration (I. Grabowska-Bołd), ATLAS-CONF-2014-023
   (I performed a complete analysis of the W boson production with a decay to $e\nu$. Also I was involved in a combination of the measurements for electrons and muons. I am an author of triggers, which were used to collect data for this analysis. I am an editor of this note. My contribution to the $W \to e\nu$ measurement is at the 100% level.)

6. *Measurement of high-p_T isolated prompt photons in lead-lead collisions at $\sqrt{s_{NN}}$ = 2.76 TeV with the ATLAS detector at the LHC*, ATLAS Collaboration (I. Grabowska-Bołd), ATLAS-CONF-2012-051
   (I contributed to trigger efficiency studies and event calibration for the entire min-bias sample. In addition, I am an author of triggers, which were used to collect data for this analysis. I was involved in a review process of this analysis. I estimate my contribution to be at the 30% level.)

7. *Measurement of isolated direct photons in lead-lead collisions at 2.76 TeV with the ATLAS detector*, I. Grabowska-Bołd, Nucl. Phys. A904 (2013) 577–580
   (I am an author of triggers, which were used to collect data for the analyses discussed in this publication. I was involved in a review process of these analyses. I am the only author of this publication. I estimate my contribution at the 50% level.)

8. *Measurement of the correlation of jets with high p_T isolated prompt photons in lead-lead collisions at $\sqrt{s_{NN}}$ = 2.76 TeV with the ATLAS detector at the LHC*, ATLAS Collaboration (I. Grabowska-Bołd), ATLAS-CONF-2012-121
   (I am an author of triggers, which were used to collect data for the analysis. I was involved in a review process of this measurement. I estimate my contribution at the 10% level.)

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9. *Hard Probes in Pb-Pb Collisions at ATLAS*, I. Grabowska-Bołd, conference proceedings from Moriond 2012, Italy
(I am an author of triggers, which were used to collect data for the analyses discussed in this publication. I was involved in the analyses and in a review process of them. I am the only author of this manuscript. I estimate my contribution to be at the 50% level.)

10. *Hard Probes at ATLAS*, I. Grabowska-Bołd, conference proceedings from Moriond 2013, Italy
(I am an author of triggers, which were used to collect data for the analyses discussed in this publication. I was involved in the analyses and in a review process of them. I am the only author of this manuscript. I estimate my contribution at the 50% level.)

11. *Measurements of Vector Boson Production in lead–lead and proton–lead Collisions with the ATLAS Detector*, I. Grabowska-Bołd, conference proceedings from Quark Matter 2014, Darmstadt, Germany, ATL-PHYS-PROC-2014-081. Accepted for Nucl. Phys. A.
(I am an author of triggers, which were used to collect data for the analyses discussed in this publication. I was involved in the $W \to e\nu_e$ analysis and in its review process. I am the only author of this manuscript. I estimate my contribution to be at the 70% level.)

12. *Expected Performance of the ATLAS Experiment - Detector, Trigger and Physics*, ATLAS Collaboration (I. Grabowska-Bołd), arXiv:0901.0512 [hep-ex]
(I contributed to tracking performance studies based on information from the Inner Detector at the Event Filter trigger. Also I am an author of software which reconstructs tracks in the trigger. In addition, I coordinated editorial work of this section in the collaboration. I estimate my contribution to be at the 70% level.)

13. *The ATLAS Experiment at the CERN Large Hadron Collider*, ATLAS Collaboration (I. Grabowska-Bołd), JINST 3 (2008) S08003
(I contributed to development of the Event Filter tracking software which reconstructs tracks at the trigger level. In addition, I was working on trigger optimization and menu development for years 2009–2013. I estimate my contribution to be at the 70% level.)

14. *Performance of the ATLAS Trigger System in 2010*, ATLAS Collaboration (I. Grabowska-Bołd), Eur.Phys.J.C 72 (2012) 1849
(I contributed to this paper working on the trigger software, trigger configuration, optimisation and performance in years 2008–2011 for pp and Pb+Pb collisions. Moreover, I am an author of a section on menu evolution in years 2009-2010. I estimate my contribution to be at the 70% level.)

15. *Heavy ion physics with the ATLAS Detector*, I. Grabowska-Bołd, Acta Phys. Polon. B42 (2011) 1393-1400
(I am an author of triggers, which were used to collect data for the analyses discussed in this publication. I am the only editor of this manuscript. I estimate my contribution to be at the 70% level.)

16. *Performance of the ATLAS Minimum Bias and Forward Detector Triggers in 2011 Heavy Ion Run*, ATLAS Collaboration (I. Grabowska-Bołd), ATLAS-CONF-2012-122
(I contributed to performance studies for min-bias triggers used in the Pb+Pb collisions in 2011. Earlier I had coordinated preparatory work on the trigger menu configuration and optimisation for triggers described in this conference note. Moreover, I was part of the editorial team for this manuscript. I was also involved in its approval process in the collaboration. I estimate my contribution to be at the 70% level.)

Other publications, which are indirectly connected to measurements covered in the monograph, or internal notes of the ATLAS collaboration (which undergo the internal review and approval process) or conference proceedings:

1. *W boson production in the electron channel and lepton charge asymmetry in Pb+Pb collisions in ATLAS - Supporting Note*, I. Grabowska-Bołd, ATL-COM-PHYS-2013-1381
(I am an author of the complete W boson production measurement for the electron channel and also its combination with the muon mode. I am the only editor of this internal note. I estimate my contribution to be at the 100% level.)

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2. *Supporting note for $Z \to e^+e^-$ and $Z \to \mu^+\mu^-$ analyses using 2011 Pb+Pb data at $\sqrt{s_{NN}}$=2.76 TeV*, I. Grabowska-Bołd et al., ATL-COM-PHYS-2012-366
(I contributed to the Z boson production measurement for the electron channel. In particular I was working on the trigger efficiency measurement and the absolute calibration of min-bias event sample. I wa part of the editorial team. Moreover, I was involved in the approval process of this measurement. I estimate my contribution to be at the 70% level.)

3. *Performance of the ATLAS Minimum Bias and Forward Detector Triggers in pPb collisions*, ATLAS Collaboration (I. Grabowska-Bołd), ATLAS-CONF-2013-104
(I was working on min-bias trigger performance studies for the entire data sample with p+Pb collisions collected in 2013. Moreover, I was part of the editorial team. I was also involved in the approval process of this conference note. I estimate my contribution to be at the 50% level.)

4. *Commissioning of the ATLAS Trigger with Proton Collisions at the LHC*, I. Grabowska-Bołd, conference proceedings from PLHC 2010, Hamburg, Germany
(I contributed to software development and trigger configuration and optimisation in years 2008–2011. This includes also trigger performance studies for data collected with pp and Pb+Pb collisions. I estimate my contribution to be at the 70% level.)

5. *Charged particle correlations in pseudorapidity bins in Pb+Pb collisions at $\sqrt{s_{NN}}$= 2.76 TeV: Supporting Note*, M. Dyndal, I. Grabowska-Bold, M. Przybycien, ATL-COM-PHYS-2012-1779, publication in preparation
(I was an author of trigger configuration and optimalisation for the data set used in this internal note. This note summarizes a measurement done within a MSc project, which I was supervising. Moreover, I was part of the editorial team of this internal note. I estimate my contribution to be at the 40% level.)

6. *Performance of the ATLAS Minimum Bias and Forward Detector Triggers in 2011 Heavy Ion Runs – Supporting Note*, I. Grabowska-Bold, T. Martin, E. Sarkisyan-Grinbaum, A. Sidoti, P. Steinberg, K. Wozniak, ATL-COM-DAQ-2012-153
(I contributed to performance studies for min-bias triggers used in the Pb+Pb collisions in 2011. Earlier I had coordinated preparatory work on the trigger menu configuration and optimisation for triggers described in this conference note. Moreover, I was part of the editorial team for this manuscript. I was also involved in its approval process in the collaboration. I estimate my contribution to be at the 70% level.)

7. *Measurement of the heavy-ion collision event characteristics with the ATLAS experiment at the LHC*, K. Burka, T. Bold, I. Grabowska-Bold, ATL-COM-PHYS-2014-305, submitted to Computer Science Journal
(I was an author of the configuration and optimisation for the trigger, which was used in this measurement. Moreover, I was part of a team, which discussed steps of this measurement. Also I am a co-author of this manuscript. I estimate my contribution to be at the 20% level.)

8. *Measuring the b-tag efficiency in a sample of jets containing muons with 5 fb^{-1} of data from the ATLAS detector*, ATLAS Collaboration (I. Grabowska-Bold), ATLAS-CONF-2012-043
(I was part of the editorial board, which was in charge of reviewing all steps of this measurement. We were also responsible for reviewing the text of the conference note. I estimate my contribution to be at the 20% level.)

9. *Measuring the mistag rate with 5 fb^{-1} of data from the ATLAS detector*, ATLAS Collaboration (I. Grabowska-Bold), ATLAS-CONF-2012-040
(I was part of the editorial board, which was in charge of reviewing all steps of this measurement. We were also responsible for reviewing the text of the conference note. I estimate my contribution to be at the 20% level.)

In the ATLAS collaboration, before each new measurement has been approved, an analysis team needs to provide an internal documentation – so called internal note – with a detailed description of all steps, which were taken throughout the measurement. Then the internal note needs to pass through an approval process, which reviews the correctness of the analysis procedure but also the text of the documentation. This is done in an iterative process. A draft of the paper can only be circulated to the entire collaboration if the editorial board approves the internal note and the analysis procedure.

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6.2 Training

2008-2011	ATLAS experiment, CERN, Geneva, Switzerland (3 years)
2005-2007	ATLAS experiment, CERN, Geneva, Switzerland (2 years)
2001-2002	ZEUS experiment, DESY, Hamburg, Germany (1 year)
1999	Diploma training at DESY, Hamburg, Germany (4 weeks)
1998	Summer Student Programme at DESY, Hamburg, Germany (8 weeks)

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6.3 Conferences and larger scientific meetings

List of talks at national and international conferences or at important meetings

05.2014 *Measurements of vector boson production in lead-lead and proton-lead collisions with the ATLAS detector*, Quark Matter 2014, Darmstadt, Germany
03.2013 *Hard Probes at ATLAS*, Moriond QCD 2013, La Thuile, Italy
11.2012 *High p_T Phenomena in Pb-Pb Collisions with the ATLAS Detector*, IX Polish Workshop on Relativistic Heavy Ion Collisions, Krakow, Poland
08.2012 *Measurement of Isolated Direct Photons in Lead-Lead Collisions at 2.76TeV with the ATLAS Detector*, Quark Matter 2012, Washington DC, USA
03.2012 *Hard Probes in Pb-Pb Collisions at ATLAS*, Moriond QCD 2012, La Thuile, Italy
12.2011 *Measurement of Quarkonia and Vector Bosons in Pb-Pb Collisions in ATLAS*, VIII Polish Workshop on Relativistic Heavy Ion Collisions, Hucisko, Poland
10.2011 *Heavy Quarkonium Production in Pb-Pb Collisions at ATLAS*, HQ2011, GSI, Darmstadt, Germany
01.2011 *Heavy Ion Physics with the ATLAS Detector*, Epiphany Conference, Krakow, Poland
06.2010 *Commissioning of the ATLAS Trigger with Proton Collisions at the LHC*, Physics at the LHC, Hamburg, Germany
05.2009 *The ATLAS experiment at the Large Hadron Collider*, Frontiers in Modern Physics and its Applications, Krakow, Poland
05.2007 *Full scan mode in the EF ID*, TDAQ Week, CERN, Geneva, Switzerland
04.2007 *EF tracking DQM*, ATLAS Data Quality Workshop, CERN, Geneva, Switzerland
03.2007 *Performance of updated electron optimization*, ATLAS Trigger and Physics Week, CERN, Geneva, Switzerland
01.2007 *Status of LVL2 and EF InDet monitoring*, ATLAS Inner Detector Trigger and Offline Software Workshop, CERN, Geneva, Switzerland
06.2005 *Measurement of Deeply Virtual Compton Scattering Using the ZEUS Detector at HERA*, Talk given at the Award ceremony; *Ph.D. Award of the Association of the Friends and Sponsors of DESY*, Hamburg, Germany
10.2004 *Measurement of the t slope in Deeply Virtual Compton Scattering*, ZEUS Collaboration Meeting, Padova, Italy
09.2004 *Measurement of Deeply Virtual Compton Scattering Using the ZEUS Detector at HERA*, International School of Subnuclear Physics, Erice, Italy
10.2002 *Deeply Virtual Compton Scattering*, ZEUS Collaboration Meeting, Hamburg, Germany
06.2002 *Deeply Virtual Compton Scattering*, ZEUS Collaboration Meeting, London, UK
03.2002 XXXVIIth Rencontres de Moriond, QCD and High Energy Interactions, on behalf of ZEUS and H1 Collaborations *Progress in single-photon final states: prompt photons and DVCS*
02.2002 *Deeply Virtual Compton Scattering*, ZEUS Collaboration Meeting, Hamburg, Germany
10.2001 *Deeply Virtual Compton Scattering*, ZEUS Collaboration Meeting, Hamburg, Germany

Moreover, in this period I gave about **300** talks reporting on results of my work or summarizing results of the group I coordinate at various ZEUS or ATLAS collaboration meetings (ATLAS workshops, ZEUS/ATLAS Weeks, ATLAS weekly meetings, Physics and Performance Weeks, Heavy Ion Working Group meetings, MBFD trigger meetings, HITMF meetings, etc). It has to be stressed that a number of participants in those meetings usually exceeds a number of participants of smaller international conferences. In addition, as a coordinator of the HITMF and MBFD trigger groups I chair meetings with about 10-20 participants.

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6.4 Participation in scientific projects

1. 2 P03B 122 25 (2003-2005), PhD grant, **main participant**, *Measurement of the deeply-virtual Compton scattering in the ZEUS experiment*, Institution: AGH-UST Krakow
2. 112/E-356/SPB/DESY/P-03/DZ 116/2003-05 (2003-2005), ZEUS experiment, **participant**, *Measurement of electron-proton interactions at the ZEUS experiment at HERA*, Institution: AGH-UST Krakow
3. SPB/CERN/P-03/DZ 108/2003-05 (2003-2005), ATLAS experiment, **participant**, *Detector construction and preparation of the physics programme for the ATLAS experiment at the LHC*, Institution: AGH-UST Krakow
4. SPB nr DESY/252/2006 (2006-2008), ZEUS experiment, **participant**, *Measurement of electron-proton interactions at the ZEUS experiment at HERA*, Institution: AGH-UST Krakow
5. SPB nr CERN/85/2006 (2006-2008), ATLAS experiment, **participant**, *Detector construction and preparation of the physics programme for the ATLAS experiment at the LHC* Institution: AGH-UST Krakow
6. 665/N-CERN-ATLAS/2010/0 (2010-2013), ATLAS experiment, **participant**, *ATLAS experiment: data recording and analysis and detector maintenance and development*, Institution: AGH-UST Krakow
7. DEC-2011/03/B/ST/02631 (2012-2015), ATLAS experiment, **participant**, *Measurements of heavy-ion collisions at the highest energies*, Institution: INP PAN Krakow
8. DEC-2013/08/M/ST2/00320 (2013-2015), ATLAS experiment, **participant**, *ATLAS experiment – experimental evidences of the Standard Model and search for signals of New Physics at the LHC energies*, Institution: AGH-UST Krakow

6.5 Membership in international collaborations

1998-2006	*member of the ZEUS Collaboration*, DESY, Germany
2005-2006	qualification project within the ATLAS experiment, CERN, Geneva, Switzerland
2006-present	*member of the ATLAS Collaboration*, CERN, Geneva, Switzerland
2005-2007	*member of the electron/photon trigger group* of the ATLAS experiment
2005-2007	*member of the Inner Detector trigger group* of the ATLAS experiment
2008-2010	*member of the trigger menu group* of the ATLAS experiment
2010-present	*member of the Heavy Ion working group* of the ATLAS experiment
2012-present	*member of editorial boards for conference notes and publications* of the ATLAS experiment
2012-present	*coordinator of the Heavy Ion Trigger Menu Forum* of the ATLAS experiment
2013-2015	*member of the Speakers Committee Advisory Board* of the ATLAS experiment
2014-2015	*member of the Collaboration Board Chair Advisory Group* of the ATLAS experiment
2014-2015	*coordinator of the Minimum Bias and Forward Detector Trigger Group* of the ATLAS experiment
2014-2015	*member of the Trigger Signature Coordination group* of the ATLAS experiment
2014-2015	*member of the Trigger Menu Coordination Group* of the ATLAS experiment

6.6 Teaching activities

I already started my teaching activities when I was a fifth–year student. I was undergoing an assistant internship at the AGH–UST. I was teaching laboratory classes (laboratory I) in physics at that time. During my PhD studies in years 2000–2004 I taught physics exercises (Physics I and II) and laboratory classes (laboratory I and II) for external departments at the AGH–UST. In years 2004–2005 I taught mathematical methods of physics, statistics and data analyses for students from our department. In years 2008 and 2011–present I taught exercises in physics (Physics I and II) either for our department or for external departments.

During my stay at CERN in years 2005–2007 and 2008–2011 I did not teach students as CERN is a science lab. Nevertheless, in years 2006, 2009 and 2010 I participated in the CERN Summer

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Student Programme as a supervisor of summer students. Students were working on the following projects under my supervision:

- *Efficiency measurement of tracking reconstruction at the Event Filter trigger of the ATLAS experiment* (2006)
- *Optimization of the electron trigger for photon conversions in the ATLAS experiment* (2009)
- *Tracking and vertexing reconstruction for Pb+Pb collisions in the ATLAS experiment* (2010)

After my return to Krakow in 2011, as an assistant professor within my duties I have to teach at least 240 hours per year. In addition, in years 2013–2014 I organized seminar classes for students who were involved in BSc or MSc projects on the ATLAS experiment. Likely these activities will continue in the future.

In 2014 I was a member of the BSc Thesis Defense Committee for all students terminating their first–level study in Technical Physics at the AGH–UST.

In summer of 2014 I was a supervisor of a summer student who was doing a training at CERN within the project *Physics – Your Choice, Your Future.* His project was dedicated to development of the monitoring system for minimum–bias triggers for *pp* and HI collisions in 2015–2018 in the ATLAS experiment.

Since 2011, I have been a supervisor of the following diploma theses:

- *Optimization of the tracking reconstruction in the heavy–ion collisions in the ATLAS experiment*, BSc thesis, defended (2011)
- *Measurement of long–range correlations in proton–proton collisions in the ATLAS experiment*, BSc thesis, defended (2014)
- *Measurement of correlations in heavy-ion collisions in the ATLAS experiment*, MSc thesis, defended (2012)
- *Measurement of the W boson production in the electron channel in lead–lead collisions in the ATLAS experiment* , MSc thesis, defended (2014)
- *Measurement of forward-backward correlations in proton–proton collisions at 2.76TeV in the ATLAS experiment*, MSc thesis, ongoing

In addition, in this period I reviewed five diploma theses.

6.7 Awards and distinctions

2013	*Team Award of the AGH–UST Rector (first degree)*; for scientific achievements
2012	*Team Award of the AGH–UST Rector (first degree)*; for scientific achievements
2006	*Distinction by the Grzegorz Białkowski Award Committee* for the PhD thesis
2005	*Award of Professor Zbigniew Engel* for the best publication in the filed of basic research
2005	*Ph.D.Award of the Association of the Friends and Sponsors of DESY*; for the best PhD thesis of 2004 based on data collected at HERA
2004	"New Talents" diploma of Hofstadter at the Ettore Majorana International School of Subnuclear Physics in Erice, Sicily. Organizers: Prof. G. 't Hooft and Prof. A. Zichichi
2004	PhD degree with distinction
2000	MSc degree with distinction
1999-2000	Scholarship of the Minister of National Education of Poland
2000	Gold St. Staszic Medal for excellency for the fourth–year student at the AGH–UST
1999	Silver St. Staszic Medal for excellency for the third–year student at the AGH–UST
1998	Bronze St. Staszic Medal for excellency for the second–year student at the AGH–UST
1997	Diploma of the Rector of the AGH–UST for the excellent first–year student

6.8 Additional organizational activities

- Organization of meetings to promote physics for pupils from primary schools and pre-schools (2012-present)
- Participation in a documental movie which promotes achievements of the Particle Interactions and Detection Techniques Group at CERN (2012)
- Organization of a real-time webcast of the seminar on the discovery of the Higgs boson at CERN at the Department of Physics and Applied Computer Science (2012)
- Organization of a real-time webcast of the TEDEx@CERN event at the Department of Physics and Applied Computer Science (2013)
- Maintenance of the publications data base of the ATLAS experiment for the Particle Interactions and Detection Techniques Group (2012–present)

Iwona Grabowska-Bold