ATLAS in 2015
goodbye run 1, hello run 2

The year 2015 was one of transition for ATLAS. We were still very busy bringing in the last part of the rich physics harvest of run 2, while at the same time preparing the detector for the start of run 2 after a two-year shut-down, later on commissioning and operating the detector at a new energy frontier. It was also a good year for data-taking, with 4 fb^{-1} of collisions recording at an energy of 13 TeV.

2015 ended on a high note when the Dutch ATLAS group was awarded the Snellius Medal for its contribution to the discovery of the Higgs boson in 2012 by the Dutch Society for the Advancement of Science, Medicine and Surgery. The Snellius Medal is awarded for cutting-edge research in the field of physics, mathematics or computing science. The medal was established in 1951 and is awarded once every ten years. Nikhef director Stan Bentvelsen received the medal on behalf of the group and gave a presentation on the long road to discovery at the Lustrum Symposium of the society.

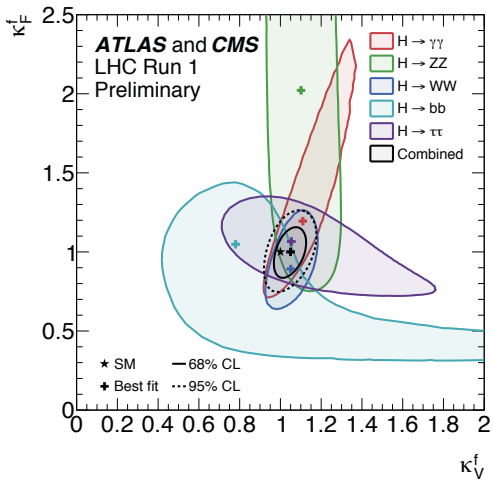
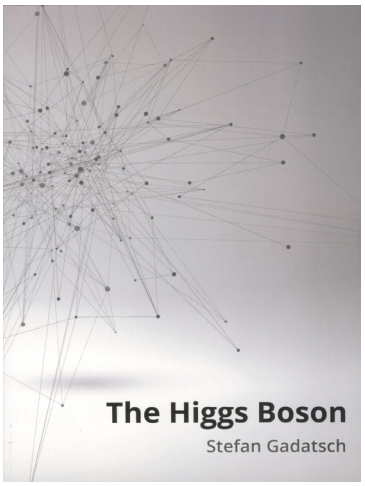


Figure 1. A highlight of 2015 : the final combination of the measurements of the couplings of the Higgs boson by the ATLAS and CMS experiments. The paper has a major Nikhef contribution, both in the RooFit software tools that were used for the combination which were developed by a.o. Wouter Verkerke as in the actual combination where also PhD student Stefan Gadatsch played an important role.



Stefan Gadatsch
26 June 2015

Management
prof.dr. N. de Groot
dr. W. Verkerke

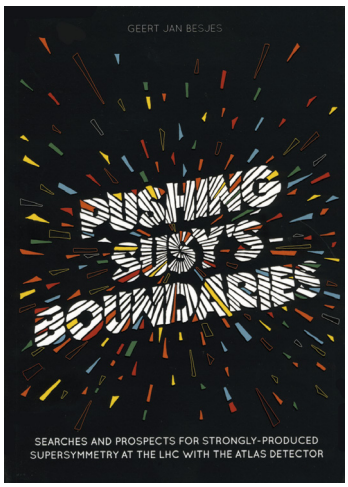
Throughout the year ATLAS has maintained an impressive production of physics analyses. In 2015 ATLAS submitted 122 new papers and passed the milestone of its 500th paper. Some of the remarkable papers on run 1 data from this year were the searches for lepton flavour violation in which Nikhef played a leading role. New, improved, limits were set on the decay of the tau lepton into three muons and of the Z boson into a muon-tau pair. In the area of Higgs property measurements four papers with major Nikhef contributions were published: the assessment of the spin/CP hypothesis of the Higgs boson, measurement of the Higgs coupling structure, the interpretation of these couplings in various extensions of the Standard Model, and the final measurement of the Higgs signal strength in the decay mode H→WW, the most precisely measured channel to date.

The ATLAS publication machine was led by Nikhef physicist Paul de Jong. Other coordinating positions in ATLAS were held by Pamela Ferrari (H→WW group), Olya Igonkina (Express stream), David Salek (luminosity group), Jochen Meyer (muon software), Pierfrancesco Butti (alignment), David Berge (astroparticle physics forum), Noam Tal Hod (lepton+X exotics) and Wouter Verkerke (Higgs combination and statistics forum).

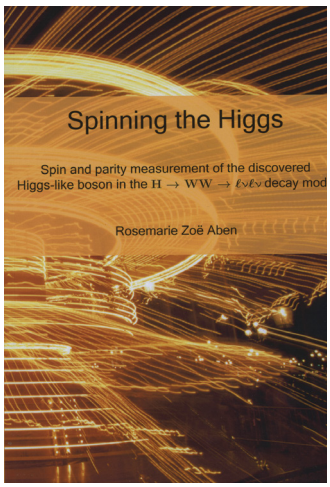
For run 2, the Insertable B-Layer (IBL), a new 4th pixel layer, close to the beam pipe has been integrated into ATLAS. Nikhef has contributed to the cooling system, the design front-end electronics and to the alignment and performance studies. The IBL has been operating smoothly in 2015 and has already shown to improve the impact parameter resolution by a factor two. Other Nikhef hardware contributions for run 2 are the firmware upgrade to the muon read-out drivers, which allows for an increased data rate in the detector and contributions to the trigger system were we built electronics to include the muon trigger information in a new topology trigger and the design of a much improved trigger for events with missing transverse energy. Run 2 started slowly, with a strong emphasis on commissioning the LHC, but in the second half the luminosity increased and the combination of the data set of over

4 fb^{-1} together with the increased energy allowed ATLAS to improve limits in a number of searches. The 2015 data taking was concluded with a short heavy-ion run.

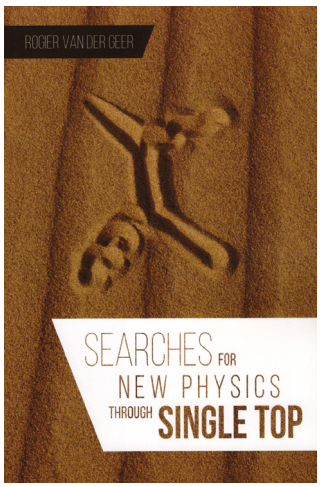
ATLAS' first 13 TeV results were presented at the EPS-HEP conference, only two months after Stable Beams were declared. On 15 December, the ATLAS collaboration presented its end-of-year results at a joint session with the CMS experiment. A total of 28 results were presented using the 2015 full data sample, with four of these results already submitted for publication. With the many ATLAS analyses, several modest deviations from the expectations of the Standard Model were observed as one would expect. These include excesses with a significance of about two sigma in the search for a hypothetical new resonance that decays into a pair of photons, and in the search for supersymmetry in the channel with jets, a Z-boson and missing energy. While tantalising, the two sigma significance is far short of that needed for a discovery, but strongly motivates ATLAS to be ready for 2016 data-taking.



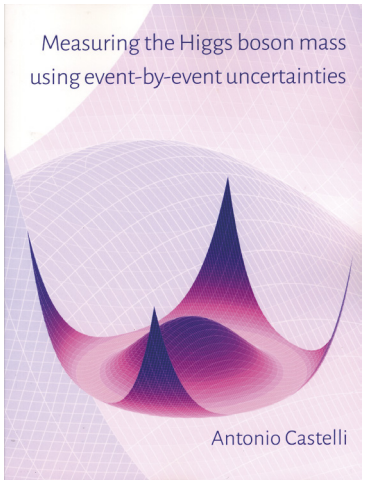
Geert Jan Besjes
19 March 2015



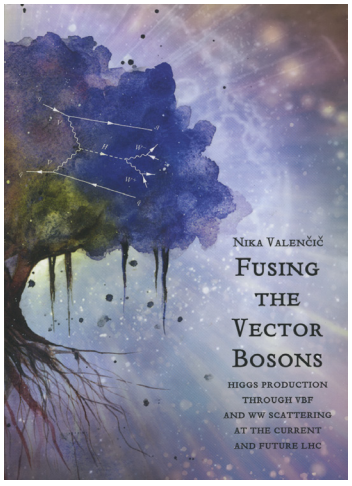
Rosemarie Zoë Aben
17 June 2015



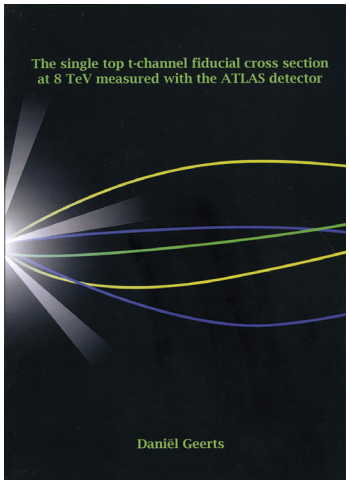
Rogier van der Geer
1 September 2015



Antonio Castelli
25 September 2015



Nika Valenčič
10 November 2015



Daniël Geerts
1 December 2015

In praise of wonder, curiosity, and an open mind: contributing to children's television

Lucie de Nooij
Nikhef alumna,
PhD 15 May 2014

By Laetis Kuipers

Of all the possible fields in which our PhD graduates may continue their careers after leaving Nikhef, children's television would seem to be a relatively unlikely candidate. But is it? It is a field where Lucie de Nooij feels completely at home working as a science and technology editor for the iconic Klokhuis series. "All things considered," she says, "my relationship with physics and Nikhef spans just over two decades, going back to when my primary school class paid an educational visit to the Institute. I vividly remember my sense of wonder and the thrill of it all, but couldn't possibly know that I would return one day."

In 2014, within the framework of CERN's ATLAS experiment, Lucie completed her dissertation on a particle that is produced during proton-proton collisions and a few other simultaneous processes. She explains: "It was the culmination of the journey I embarked on when I started my physics studies and later joined CERN's Summer School. This unique environment showed me what it means to work in a multidisciplinary and multicultural international team of people on a joint mission. My work has taught me many wise lessons that continue to stand me in good stead today: not only content-wise, but also in terms of team management, giving and receiving constructive feedback, looking at things from many different angles, and communicating scientific knowledge."

"My travels in the world of physics paired with Nikhef's unconditional support, especially when times were hard, have made me who I am today. I have always had the opportunity to raise and study fundamental questions, to explore different perspectives and to satisfy my curiosity. What more could anyone want? It gave me the courage and the confidence to apply for my current job. My move was actually inspired by my own daughter. She's very young, and I kept asking myself how she, unbiased and with the kind of open curiosity that's so typical of children, would view the world into which she was born. I wondered what kind of questions she would ask, and what conclusions she herself would draw on the basis of what she would see and hear. This has enabled me to contribute to Klokhuis' programmes for today's young viewers – and their parents, too. Working for the series requires a well-developed sense of wonder, innate curiosity, and an open mind: precisely those characteristics that typify successful scientists, whether they work at CERN or for Klokhuis."

The Jan Kluyver Prize

One of the highlights of 2015 and even of run 1 of the LHC has been the final combination of the measurements of the couplings of the Higgs boson by the ATLAS and CMS experiments. This paper had a major Nikhef contribution, both in the RooFit software tools that were used for the combination which were developed by *a.o.* Wouter Verkerke, as in the actual combination where also PhD student **Stefan Gadatsch** played an important part. His monumental thesis, appropriately named "the Higgs Boson", had led to a *"cum laude"* defence and has been awarded the Jan Kluyver prize.

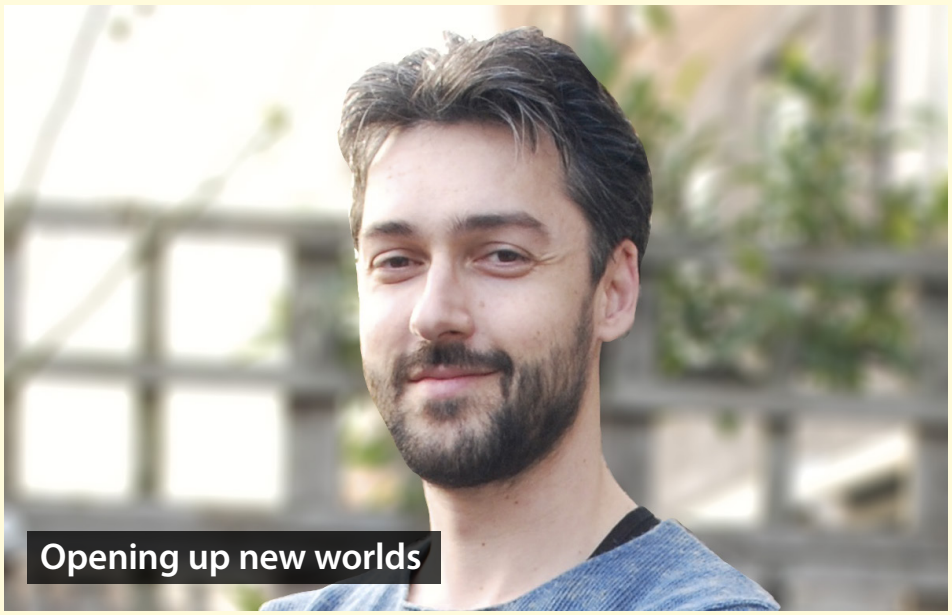
Presenting the Jan Kluyver prize. Left is Stefan Gadatsch, on the right is prof.dr. J. Gaemers.

Two Nikhef ATLAS initiatives among new NLeSC projects

Wouter Verkerke and **Sascha Caron** have both been awarded an NLeSC grant within the framework of the ASDI (Accelerating Scientific Discovery) call. They will each be supported with 500 k€ (combined cash and in kind provision of eScience research engineers). Their projects *"Automated Parallel Calculation of Collaborative Statistical Models"* and *"iDark: The intelligent Dark Matter Survey"* are scheduled to start in 2016. The purpose of the ASDI call is to enable domain scientists, working for example in application fields of Physics & Beyond, to address compute-intensive and/or data-driven problems within their research.

Olga Igonkina appointed professor

Olga Igonkina was appointed extraordinary professor at the Faculty of Science of the Radboud University in Nijmegen with effect from 1 January 2015. Her teaching assignment is *"The study of proton-proton interactions at the Large Hadron Collider at CERN"*. Igonkina is researcher in the ATLAS group at Nikhef.



Opening up new worlds

Zdenko van Kesteren
Nikhef alumnus,
PhD 12 March 2010

By Laetis Kuipers

When Zdenko van Kesteren participated in CERN's ATLAS project, he couldn't know that his ensuing career steps would lead him to the Netherlands Cancer Institute (NKI) and the Amsterdam Medical Centre (AMC), where he currently operates as a medical physicist. "When my PhD project neared its completion, I found myself at a crossroads," he says, "where I had to make a decision either to continue in my field of expertise and venture abroad or to stay in Amsterdam and move into a different discipline. Making this choice wasn't easy, as my decision would obviously affect the rest of my professional career, but then I realised that my physics background and the skills I had acquired during my Nikhef years would actually stand me in good stead in a great many areas."

"You see," Zdenko explains, "my tasks at CERN involved the commissioning of muon detectors that had been built at Nikhef, and they included the final testing of the detector systems before their installation. I also developed reconstruction software for the identification of muons in the ATLAS detector, validated with the help of modelled data and real data from cosmic muons. I imagined that my skills in detection, data modelling and data analysis, paired with a thorough knowledge of statistics, would make me suitable for positions in realms that would appear to be miles apart, such as defence and security or actuarial sciences and the share trade, for instance, or clinical physics and radiotherapy. I opted for the latter and accepted a post-doc position at the NKI, where I concentrated on the implementation of new treatment planning techniques, bridging research and application."

"In 2011, I moved to the AMC," says Zdenko, "to work as a medical physicist. Here, I continued to enjoy the best of two worlds: being involved in research as well as its application for the benefit of cancer patients. It is precisely the applied nature of my tasks and the patient care involved that makes my work so appealing, inspirational and rewarding. I am fortunate to be able to make a fundamental contribution to improvements in the treatment of cancer, and thus to make a true difference for patients. My background in physics has been instrumental to my development, and being part of CERN's multicultural and highly focused international team has proven to be an excellent preparation for working in the strongly motivated multidisciplinary group that I am part of today. There's a great deal of mutual inspiration, learning and synergy, with everyone involved pulling their weight in the design of new treatment options."