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13 July 2010

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“Life is never as you've foreseen. This is also true for natural laws, and that's why I like to be a physicist so much,” says Pascal Pralavorio

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Detector detectives

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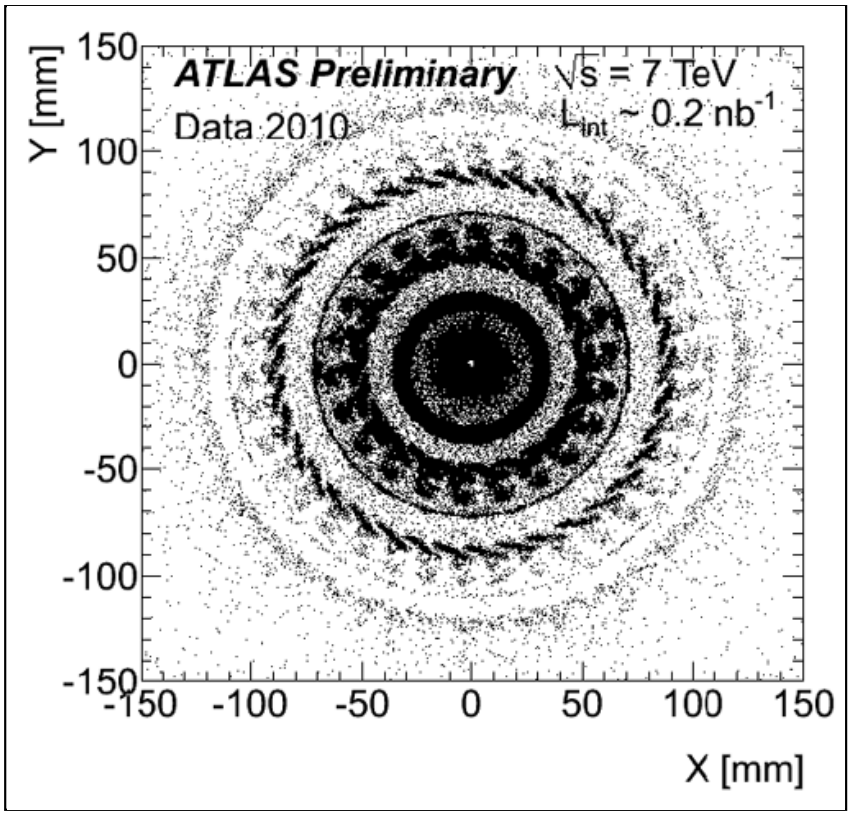


The Pixel detector, looking down the line of the beam. The thick band of the beam pipe, the 22 modules of the first Pixel layer, and the 38 modules of the second Pixel layer can be clearly seen. The third Pixel layer can just be discerned outside of these.

Hot on the heels of the material-mapping study reported in last week's e-News, a new study uses secondary hadronic interactions to map the material in the Pixel detector in great detail.

Building an accurate picture of the amount and distribution of ‚stuff'in the Inner Detector is crucial if ATLAS is to be able to reconstruct particle tracks with great precision. While the **previously reported study** focussed on photon conversions in material to assess where that material was, the **new study** looks at primary collision products – pions, protons, kaons and so on – as they undergo nuclear interactions with material in their paths.

“I mentioned something about starting this project in one of the Inner Detector Tracking Performance meetings,” remembers co-author Vivek Jain, “and Vadim [Kostyukhin] said that he had developed a software package that would be useful. We started collaborating on it.”

Vadim's software package looks for all vertices in an event. By applying cuts, tracks originating from the primary vertex – where protons collided in the centre of ATLAS – can be removed, leaving only those tracks resulting from secondary conversions.

“So you have these guys going out and they hit the material there and cause an interaction,” Vivek explains. “Depending on how much material there is, you'll have less or more interactions. It's like X-ray [imaging] – the more material you have, the denser [the image] looks.“

The two methods – the first based on electromagnetic conversions, and this one

based on hadronic interactions – are complementary, according to Vivek. “But one of the major advantages of our method is that it has very good precision.” Precision that reveals fine details like the position of each tiny screw, in fact.

“In the third Pixel layer, we can locate the vertex with a precision of about 1 millimetre,” says Vadim. “But at the beam pipe, or in the first Pixel layer, we can locate it with a precision of about 200 microns.”

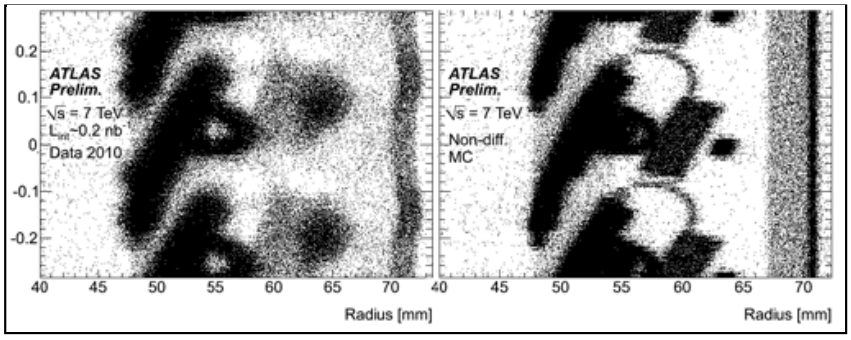
This is because the innermost vertices are estimated using three layers of fine resolution Pixel hits whereas the outer vertices are inherently less precise, as they must be estimated using hits outside the Pixel, in the lower resolution SCT and TRT.

Incorporating less than 1 per cent of the total cumulative dataset – about 0.2 nb^{-1} at 7 TeV centre of mass energy – Vivek and Vadim's work is really a feasibility study to show the potential of what could be done with this method. Already though, they have revealed discrepancies between the real-life detector geometry and that which is accounted for in the simulation.

The images at the end of this article show overlaid information describing each of the 22 modules of the first Pixel layer, for real data and Monte Carlo respectively. The more diffuse nature of the real data image indicates that each module is in a slightly different position than predicted. The beam pipe, too, is off-centre by around two millimetres. Although a shift of this magnitude was completely expected, the details of its exact size and direction weren't known until now.

The next step will be for this improved knowledge of the detector to be fed back into the simulation software to improve tracking accuracy. “The question is how exactly to do this, but all these things do need to be put back,” says Vivek.

As well as improving knowledge of the material in the detector, the hadronic material mapping technique will also be critical in some new physics searches. For instance, some Supersymmetric models propose particles that decay at large distances from the primary vertex, meaning that accurate knowledge of the material in the Inner Detector will be essential for distinguishing between real decays and the simple material interactions which could mimic these and skew results.



The current discrepancy between data (left) and Monte Carlo (right), seen by comparing overlaid images of the 22 modules of the first Pixel layer.

Ceri Perkins
ATLAS e-News

ATLAS e-News
28 June 2010

Stranger in our midst

13 July 2010

Colliding Particles - Episode 1: Codename Eurostar from **Mike Paterson**.

A three-year documentary film project, which follows two ATLAS physicists and features many more, is nearing completion, and filmmaker Mike Paterson was in Copenhagen to see the Collaboration in action and capture the excitement of the ICHEP approval talks.

Mike's project, **Colliding Particles**, comprises seven 10-minute Internet shorts, which explore the long-term nature of research – a mundane truth that is often poorly conveyed in the media. Funded by the UK Science and Technology Facilities Council, the shorts have a 'throughline' following UCL ATLAS physicist Jonathan Butterworth, his PhD student Adam Davison, and Paris-based theorist Gavin Salam.

In the first episode we learn that the team have come up with a novel analysis – 'Project Eurostar' – for discovering the Higgs, which subsequently becomes accepted among the official ATLAS search channels.

“It's a smarter way of finding the Higgs when it is travelling very fast,” explains Jonathan. “It will decay to a spray of hadrons, and we came up with a good way of picking that spray, or jet, apart and finding the traces of the Higgs decay. ”

The paper itself is an artificial line weaving in and out of the films; a vehicle for exploring how fundamental research works, how ideas are shared, what motivates physicists, the day-to-day realities of experimental and theoretical physics, and what the LHC project is all about.

Ironically, Mike ended up learning more about the long timescales involved in experimental particle physics than he'd bargained for: “We started filming in summer 2008, before Big Bang Day,” he explains. “We planned to film for the following 18 months, but obviously it's got quite a bit longer, what with the…'hiccup' in the middle.”

Mike was in Copenhagen to gather footage for the build-up to the finale. The last film, number seven, will finish with the public presentation of some of the first LHC data at ICHEP in Paris this summer. “That will give us a kind of punctuation mark,” Mike smiles. “Not a full stop, but a kind of comma.”

“I was at the beginning of my second year when we started and I must have been filmed five or six times since," Adam recalls. "It's very interesting to look back now and watch those earlier videos. They cover some of the most exciting parts of my PhD, the LHC startup being the obvious one."

Although he says he was apprehensive about being filmed at first, he soon relaxed into the project when the films emerged, and he received positive comments from colleagues at CERN (not to mention a national newspaper pointing out his resemblance to a popular British actor).

“I think there's a general perception that research is this mysterious, esoteric place.

These films show the human side, that we're real people doing this interesting work," he says, adding: "I think that's really important for teenagers thinking about a science degree, to see that it's an environment they might enjoy working in."

Jonathan too is impressed by how well Mike has managed to portray the particle physicist's reality, and hopes the films will have an influence on a broader scale:

"The LHC's impact in the media is a real opportunity to give people an insight into the ongoing story of research behind the big headlines … I like Mike's approach, which is to give a genuine flavour of what it feels like to do research; he's good at picking out humour and at telling a real story."

Once the films are complete, Mike hopes that they might be re-edited and sewn together as a single full-length TV documentary. And the possibility of returning in three or four years to film an extra episode, if Project Eurostar proves its worth, is not completely off the cards.

"Maybe, who knows," he laughs. "It's gone on for a lot longer than I thought it would, and I'm quite looking forward to doing something else. But maybe in four years time…"

"What they do is not very interesting to watch on a day-to-day basis – sitting in front of computers and talking to each other in some alien language," he muses. "But what they actually do [long-term] is fascinating."

Ceri Perkins
ATLAS e-News

ATLAS e-News
28 June 2010

Conference social events: learning more about Copenhagen

13 July 2010

Enjoying the lesson about Copenhagens University's history

Receptions at the Copenhagen meeting offered a nice way of combining the get-together in a conference with more information about the city of Copenhagen itself, as well as the University and the City Hall where receptions were hosted.

The ATLAS week was officially opened by Prof. Thomas Bjoernholm, the University Vice-Rector, who stressed his firm belief in the importance of basic scientific research. Reminiscing about his recent visit to CERN, Prof. Bjoernholm said that contrary to his daughter who was disappointed not to find Dan Brown's version of it, he himself thought pure science is often more surprising than science fiction. He concluded by thanking everyone for coming to Copenhagen. This opening was followed by a fascinating talk by Prof Andrew Jackson from NBI about the thermodynamics of general anesthesia with the intriguing title 'The Nerve of it!'.

For the first reception everyone was invited in the ceremony hall of the university. After a light buffet of smørebrød and frokost combined with local beverages - due to the nice warm weather the Carlsberg beer was very much appreciated – a bell invited everybody to listen to John Renner Hansen, head of Niels Bohr Institute.

John first introduced us to the university building: the Ceremonial Hall, which was not as old as we might have thought since in 1801, the British fleet bombarded Copenhagen during the Battle of Copenhagen, destroying most of the university buildings. When by 1836, the new main building was finished and the Ceremonial Hall was inaugurated. John led us through the university history using the 19th century's paintings decorating the walls as ”slides”. The first historical picture painted by Wilhelm Marstrand showed the inauguration of the University of Copenhagen in 1479. With more than 530 years, the University of Copenhagen is one of the oldest universities in Northern Europe. In 1537, the Natural Sciences were only represented by a single chair in physics and one in combined mathematics and astronomy. It is therefore surprising that Denmark was the home of the world's first natural sciences research centre - the astronomer Tycho Brahe's observatory.

Tycho Brahe was born in 1546 and began his studies at the University of Copenhagen at the age of 12. There he studied law, but also a variety of other subjects and became interested in astronomy. The solar eclipse of 21 August 1560, especially the fact that it had been predicted so impressed him that he began to make his own studies of astronomy, helped by some of the professors. The most significant event in Brahe's

career took place on 11 November 1572: he observed a new «star» - which we know was a supernova some 200 light years from Earth - in the Cassiopeia constellation. He published the results of his observation and was invited to lecture at the University. In 1576 the King offered him a post as Royal Scientist and the entire island of Hven was put to his disposal. The third painting, done by Carl Bloch showed Tycho Brahe, who was a European celebrity at this time, receiving the King of Scotland, James VI in 1590. Unfortunately this golden era in the history of Danish science took an end when Brahe's relationship with king Christian IV, whose reign commenced in 1596, soured and Brahe fell out of favour with the Court. In April 1597 Brahe went to the Imperial Court of Prague, where he worked with Johannes Kepler. The University of Copenhagen attained prominence during the 19th Century by names like H. C. Oerstedt (1777-1851), who is renown for his discovery of electromagnetism.

During its first four centuries, the University of Copenhagen was strictly reserved to male students. Today, women make up the majority of students. The shift started in 1873, when Nielslinde Mathilde Nielsen applied to the University of Copenhagen to study medicine. The University Senate first refused but finally they gave in and Nielsine graduated in 1885. In 1887 Nanna Berg became the first female law graduate in Denmark.

”And in 2010, ATLAS has a female spokesperson,” John remarked as he passed the microphone to Fabiola Gianotti. She took the opportunity to thank him and the organisers for the warm welcome in Copenhagen.

To make this reception an everlasting souvenir Associate professor Troels Petersen asked everybody to stand between the letters ATLAS marked on the floor with tape. He then ventured to the gallery and took a photo with everybody happily waving.

The ATLAS conference picture

The second reception was held in the town hall where, after a warm welcome we had the opportunity not only to see the nice townhall and wander around, but also to taste the famous ”rådhus pandekagers”, the ”townhalls pancakes”. Finally the conference dinner was held in one of Copenhagen nicest spots, a location offering panoramic views of the entire waterfront: the Langelinie Pavillonen restaurant, where in the summer one can enjoy parties on the outdoor terrace, normally close to the Little Mermaid. But not this summer since it was the Little Mermaid's turn to take a trip abroad. For the very first time she left her home to participate not in a conference, but take part in the World Expo 2010 in Shanghai, China.

More photos in this week's **gallery**.

Birgit Ewert
ATLAS e-News

ATLAS e-News
28 June 2010

ATLAS Week: What's the point?!

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Informal discussions about work and the World Cup

The brilliant sunshine and sparkling waters of Copenhagen were the setting for the 2010 summer ATLAS Overview week, and spirits were high: According to locals, ATLAS managed to stumble upon the best week of sun the city had seen all year, the World Cup was heating up along with the weather (Copenhagen can seemingly rival Geneva for international supporter flavour too)… and then there was the small matter of ICHEP results approval.

With around 15 hours of talks dedicated to this alone, many cited it as a major draw for attending the conference this year. In particular, those who had been busy working on their own analyses were looking forward to getting their heads above water and catching up with everything else that had been going on around them lately.

“This one feels special somehow,” was the view of Deputy Spokesperson Andy Lankford, by virtue of it being the first time that real LHC collision data had been under consideration at an external ATLAS Week. “We're beginning to get more data and more interesting results.”

Manuel Kayl, a fourth year PhD student based at NIKHEF, Amsterdam, was at the conference to present a note. “What's different about ATLAS Weeks abroad is the composition of people,” he considered. “In Geneva you can more or less just go to your office and work, so you only go to selected talks, but abroad the whole audience is tied together all of the time.”

For ATLAS regulars, the sight of that kind of audience has probably long since lost its impact, but third year PhD student Kevin Mercurio – attending his first ATLAS Week, and on his way to CERN for the first time from Harvard – saw the scene with fresh eyes: “For some reason I hadn't foreseen walking into a room with literally hundreds of physicists all on laptops at the same time,” he said. “The scale [of the Collaboration] is a bit intimidating but I think I'm finally finding my place.”

ATLAS Weeks in general are a chance for collaborators to get together and go over all the different aspects of the experiment; operations, physics results, the upgrade, and everything in between. But according to CERN fellow Kirill Prokofiev, in Copenhagen on his first external ATLAS Week, the week away from CERN is “somehow a bigger event”.

“ATLAS Weeks at CERN are relatively regular, but smaller in scale,” he explained, “but this is more like a yearly milestone: A big count of all the things – like what we have

achieved since last year. That's very important."

For University of Granada postdoc Nuno Castro, the brainstorming sessions on organisational topics such as shift and service work coverage and the results approval process are an especially valuable feature of the external meetings. But, like others based away from Geneva, the overview weeks at CERN offer him the added efficiency of tagging shift work onto the start or end of a trip.

But whether at CERN or away, he said, "For those of us who are not based at CERN these weeks are excellent occasions to be closer to data and to talk personally with our colleagues."

In the absence of everyday commitments, informal discussions are more prevalent at external ATLAS Weeks, he reckoned, pointing out: "With so many interesting results popping out during the talks, [these informal discussions are] quite focused on LHC physics these days. But the World Cup has been an off-side hot topic too!"

The 'captive audience' effect – getting people together away from CERN and the distractions of their normal day-to-day routines – spills over into social time too, which is no bad thing, according to Andy: "There's a certain degree of bonding goes on … people spend more time together outside the meetings."

"People are more open in a 'meeting people' kind of way," agreed Columbia postdoc Kathy Copic, based 50/50 between CERN and New York City. "To somehow be stuck together – in hotels and on the bus – somehow people are a little more friendly."

This rings true both for those who are based together at CERN, but rarely mix outside of Restaurant 1 or meetings, and those who have collaborated at a distance. For Manuel, this meant spending downtime with the CERN-based co-authors of his note after weeks of communicating over Skype and Evo, and for others it meant putting faces they had never seen to names and voices with which were already very familiar.

In the end, employing some expressive hand gestures and a big grin, Kathy summed up neatly what many picked out as one of the nicest things about ATLAS Week, whether held at CERN or abroad:

"ATLAS Week is great because it's the kind of place where someone can come up to you, tell you their name and then say, 'You know me from…" she explained, illustrating her point by making a frantic typing motion with her hands. "Because you do know them! You've probably exchanged a lot of emails with them, but you've never met them in person before."

Ceri Perkins
ATLAS e-News

ATLAS e-News
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Pascal Pralavorio

Nationality - French

Pascal in the Building 40 cafeteria, in front of the ATLAS model

“In a sense, life is never as you've foreseen it to be. This is also true for natural laws, and that's why I like to be a physicist so much,” Pascal Pralavorio says as he explains what makes discovery so interesting for him.

Pascal seems to have a trend flowing through his life: to strategise and plan, to accept the consequences of discovery, and to enjoy the ride. For him, to explore is everything. With such varied interests as physics, singing, and playing guitar, piano, and games of strategy, it is apparent that he has a love for the thinking process. Pascal enjoys what he encounters unexpectedly, and especially what stems from the toughest parts of problematic situations.

“For me, the real pleasure is when you solve a problem, or solve a difficulty, even in your life, and you see that it's difficult. If you feel the difficulty, and you overcome this difficulty, then you are really feeling a part of you, and have a lot of pleasure because of it.”

Coming from the Centre de Physique des Particules de Marseille (IN2P3), Pascal took part in the construction, testing, and commissioning of the ATLAS Electromagnetic Calorimeter. He worked for many years preparing it to perform as expected. It was

very difficult for him when, in September 2008, the LHC suddenly failed. He could have gone away from ATLAS at that point, realising that he had already learned a great deal, but decided to wait for a second chance to get this extraordinary machine running. He is very glad he did. Experience has taught him not to anticipate success, but to expect, with proper preparation, to encounter the unforeseeable with joy. To him, this makes the whole journey worthwhile.

Along these lines, his insights are clearly valuable. “If you have something you really want, and you do all the things in this direction, you always get some prize. Not always the one you will expect, or the one you have searched for, but you always get something.” He added, “In a sense, life is never as you've foreseen it to be. This is also true for natural laws, and that's why I like to be a physicist so much.”

At present, Pascal is engaged in helping rediscover the Z and W bosons. “It is a major milestone for the ATLAS detector since these particles were discovered at CERN almost 30 years ago. This is the first step before any new discovery can be claimed!”

He is part of the team which ensures that the calorimeter is working as expected. More precisely, thanks to the work he has pursued with his colleague, Fabrice Hubaut, they managed to detect subtle changes in the material located in front of the calorimeter, as reported in a recent issue of **ATLAS e-News**. Pascal is deeply involved in understanding how to best detect particles that deposit no energy in the calorimeter. He does this through inferring their presence by means of tracking missing energy. This work means a great deal to him, and this research and data analysis are absolutely central in his life.

Pascal also has a love of games. Igisoro and Go are two of his favorites, both of which satisfy his penchant for strategy. Igisoro is a two-player game, part of the mancala family, and a variant played primarily in central Africa. Go is from China and is an abstract strategy game involving the capture of your opponents stones, as well as the creation of territories.

Pascal is the father of two girls, Lisa and Noemie, and he is married to Corinne Pralavorio, who works at CERN in the communication group. Of all of his family's activities, walking in nature and singing together are his favorites. All four of them sing, and it seems that his heart likely soars a bit when he gets to sing with his girls.

Though he clearly loves to sing, Pascal also plays the guitar and piano, and has a group of musical friends near his home in Farges, France, with whom he sometimes plays. Together they try to emulate music by artists such as Bob Dylan. To Pascal, Dylan represents something special in music, mainly because of Dylan's ability to animate language with music. “It's a melting between the words and the music and how you phrase it, and how you enhance it somehow. It's like when you put spice on your food; it completely changes your feeling. So, even if I'm not a native English [speaker] I can really feel what [Dylan's] expressing, and this is really amazing.“

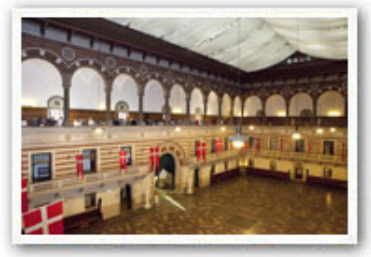
Sarah McGovern
ATLAS e-News

ATLAS e-News

Impressions of the Copenhagen Conference






More photos are available **here**