

Annual Report

<b>Funding Programme:</b>	Helmholtz Young Investigators Groups
<b>Project ID No.:</b>	VH-NG-803
<b>Project Title:</b>	Approaching the Fundamentals of Physics using Top Quarks at the LHC
<b>Group Leader:</b>	Yvonne Peters
<b>Helmholtz Centre:</b>	DESY/Hamburg
<b>Participating University:</b>	Georg-August Universität Göttingen
<b>Report Period:</b>	01.07.2012-31.12.2012

**1) Group Structure**

*Please report briefly on the structure and personnel development of your group.*

My group currently consists of  
 - one postdoc (Cecile Deterre; started 01.09.2012)  
 - one PhD student (Ralph Schäfer; started 01.10.2012)  
 Additionally, we were able to attract a Desy fellow (Sara Borroni) to work with our group.

The main work of the group consists of two areas: data analysis at ATLAS and tracking related activities. During 2012, Cecile Deterre concentrated more on the latter, and the rest of the group members more on data analysis in the top quark sector.

**2) Network**

*Please describe how you / your research group are integrated within the Helmholtz Centre and the partner university (e.g. as member of committees).*

The group is fully integrated into the ATLAS group at Desy, especially working closely together with the colleagues working on simulation for the Atlas upgrade. My team participates in the common meetings and discussions.

Within the University, so far the connection is mostly limited to myself. I work as part of the group in Göttingen on teaching at the University, and discuss with the students of the group.

The group is also well situated within the Atlas collaboration, having two of the members (Y. Peters and S. Borroni) being editors of two of the analyses. Cecile Deterre is fully integrated within the ATLAS team working on the sonar DCS system as well as the ongoing ttbar charge asymmetry analysis. In addition, we form a strong collaboration with colleagues from Saclay, with whom we share a common framework.

**3) Satisfaction**

*How satisfied are you with the general working conditions provided by the Helmholtz Centre / partner university? Is there anything that meets your criticism?*

I am very satisfied with the working conditions at the Helmholtz Centre. My team is fully integrated into the ATLAS group at DESY, while allowing very autonomous working conditions at the same time.

Since this report will be made public, I prefer to not put points of criticism concerning the conditions at the partner University into this document.

#### 4) Scientific Progress / Milestones

*How has your work plan progressed? Which important milestones could be achieved during the report period? Is the progress of your work in accordance with original planning or has the work plan been changed?*

My work plan progressed very well, despite a small shift in the topics. Instead of concentrating on spin correlations in lepton plus jets events, we now consider several top properties, in particular the top quark polarization,  $t\bar{t}$  charge asymmetry and spin correlations, in the dilepton final state. I was able to already participate in the setup and performance of the top quark polarization measurement using lepton plus jets events, that was shown at the Top2012 workshop – on which I worked in close collaboration with colleagues from Canada and the US. Furthermore, we currently work on publications of the top quark polarization in the dilepton final state, combined with lepton plus jets. Sara is editor for this paper. The other publication, that I am leading as editor together with a colleague from the University of Göttingen, is on the measurement of  $t\bar{t}$  spin correlations. Cecile is involved in the publication of the  $t\bar{t}$  charge asymmetry. All these publications use the full 7TeV ATLAS data sample and are expected to get public in 2013.

In addition, Cecile works on a project of a sonar detector control system, for which she is already primary author on a publication.

Despite the small shift in work plan, my team is fully within the planned time. Due to the joining Desy fellow we already could get involved in a publication using 7TeV, for which we would otherwise have first analysed 8TeV also and only would have aimed towards a publication in 2014. In that sense, we are ahead of the proposed schedule.

Cecile also works on a sonar detector control system effort as part of her ATLAS qualification task, while Ralph got involved into the study of the service routing for the tracking system for the 2022 detector upgrade. Myself, I finished with the involvement on the development and implementation of a  $Z \rightarrow ee$  track trigger monitoring tool and fulfilled my qualification to become ATLAS author in November 2012.

In addition to these activities, the group leader is member of the D0 collaboration, serving as D0 representative of the „Tevatron+LHC Top Properties Combination Group“. Until end of July 2012, the group leader was convener of the top quark physics group at D0.

#### 5) Financial Plan / Time Schedule

*Can you comply with the financial plan and time schedule or do you see a need for adjustment?*

Due to waiting for her thesis defense, I got my postdoc slightly later than planned (september instead of july). Also, it took me a bit longer than planned to find a first student (october instead of july). Furthermore, in the first year of the YIG, no long-term stays at Cern were necessary. Therefore the planned amount of money was not fully spent. This does not require an adjustment though.

We fully comply with the time schedule so far.

#### 6) Status

*Do you hold a joint Junior Professorship or a W2/W3 Professorship? Do you aim for such a position? What is the status of your negotiations in this respect?*

I am Juniorprofessor at the University of Göttingen.

## 7) Teaching Activities of the Group Leader

- August 2012: Co-docent (with A. Quadt) of a workshop on "Physics at the LHC" at the international summer academy of the Studienstiftung des Deutschen Volkes, Rot an der Rot, Germany.
- September 2012: Lecture on "Experimental top quark physics" at the DPG school on "Heavy Particles at the LHC", Bad Honnef, Germany.
- Winter term 2012/2013: Lecture plus tutorials (2V+2Ü) on "Statistical Methods of Data Analysis" at the University of Göttingen.

In addition, I participate in a one-year certificate program for academic teaching at the University of Göttingen.

Furthermore, I participated at the "Nacht des Wissens" at the University of Göttingen with a talk on top quark physics for the general public (November 2012).

## 8) Publications of the Group

### Publications:

- 1) R. Bates et al., "A combined ultrasonic flow meter and binary vapour mixture analyzer for the ATLAS silicon tracker", 2013\_JINST\_8\_P02006 (submitted in December 2012, published in February 2013).
- 2) V. M. Abazov et al. [D0 Collaboration], "Measurement of Leptonic Asymmetries and Top Quark Polarization in  $t\bar{t}$  Production", Phys. Rev. D 87, 011103 (2013) (submitted in 2012, published in 2013).
- 3) Y. Peters, Proceedings on "Top anti-top Asymmetries at the Tevatron and the LHC", PIC2012, Strbske Pleso, Slovakia, September 2012 [arXiv:1211.6028[hep-ex]].
- 4) Y. Peters, Proceedings on " $t\bar{t}$  Spin Correlations at D0", ICHEP2012, Melbourne, Australia, July 2012 [arXiv:1210.7189[hep-ex]].
- 5) Y. Peters, Proceedings on "Single Top Quark Production at the Tevatron", ICHEP2012, Melbourne, Australia, July 2012 [arXiv:1210.7188[hep-ex]].
- 6) The ATLAS Collaboration, "Measurement of top quark polarisation in  $t\bar{t}$  events with the ATLAS detector in proton-proton collisions at  $\sqrt{s} = 7$  TeV", ATLAS-CONF-2012-133, September 2012.
- 7) The CDF and D0 Collaborations, "Combination of the  $t\bar{t}$  production cross section measurements from the Tevatron Collider", D0note 6363-CONF, September 2012.

Besides these, Cecile and myself are authors of all D0 publications from 2012, and Sara on all ATLAS publications in 2012. Since November 2012, I am officially ATLAS author.

### Public talks at Conferences and seminar talks:

- 1) Y. Peters, on " $t\bar{t}$  Spin Correlations at D0", ICHEP2012, Melbourne, Australia, July 2012.
- 2) Y. Peters, on "Single Top Quark Production at the Tevatron", ICHEP2012, Melbourne, Australia, July 2012.
- 3) Y. Peters on "Top anti-top Asymmetries at the Tevatron and the LHC", PIC2012, Strbske Pleso, Slovakia, September 2012.
- 4) Y. Peters, on " $t\bar{t}$  Asymmetries and Top Quark Polarization", LHC Physics Discussion, DESY, Hamburg, October 2012.
- 5) C. Deterre, on " $t\bar{t}$  asymmetries and top quark polarization at Atlas", seminar at the University of Göttingen, November 2012.

**9) External Funding**

No external funding was acquired during 2012.

**10) Patent Applications**

*No. of pending/granted patents*

No patents were applied for during 2012.

**11) Awards received by Group Members / Professorship Appointments offered to Group Leader**

No awards or appointments have been received by the group members.