

## Annual Report

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| <b>Funding Programme:</b>        | Helmholtz Young Investigators Groups   |
| <b>Project ID No.:</b>           | VH-NG-503  |
| <b>Project Title:</b>            | Probing Electroweak Symmetry Breaking at LHC : Higgs Physics with the CMS Detector |
| <b>Group Leader:</b>             | Dr. Alexei Raspereza   |
| <b>Helmholtz Centre:</b>         | DESY   |
| <b>Participating University:</b> | Karlsruhe Institute of Technology  |
| <b>Report Period:</b>            | 01/04/2013 – 31/03/2014  |

### 1) Group Structure

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

Group Leader : Dr. Alexei Raspereza.

YIG Members : Dr. Roberval Walsh (post-doc), Agni Bethani (post-doc), Armin Burgmeier (Ph.D. Student), Jakob Salfeld-Nebgen (Ph.D. Student).

Associate members : Prof. Wolfgang Lohmann (staff), Dr. Rainer Mankel (staff), Dr. Matthias Schroeder (post-doc), Luigi Calligaris (Ph.D. Student), Gregor Hellwig (Ph.D. Student), Igor Marfin (Ph.D. student)

### 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 activities of the group are well embedded in the physics programme of the LHC groups at DESY. Furthermore, the leader of the group is principle collaborator in the Sonderforschungsbereich (SFB) Project B9 „Probing the physics of electroweak symmetry breaking with results from LHC“.

### 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'm satisfied with the working conditions provided by the Helmholtz Centre and partner university.

### 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?*

The Young Investigators Group has made significant contribution to the landmark paper by CMS Collaboration, presenting evidence for the Higgs boson coupling to tau leptons. The paper has been accepted for publication in the Journal of High Energy Physics. Another essential scientific contribution of the group was the paper, reporting results of the searches for Supersymmetric Higgs bosons in decays to b quarks at the LHC. The paper has been published in the journal Physics Letters B. The group has contributed to the operations of the CMS beam condition monitor, a device which ensured reliable and safe performance of the CMS detector in the harsh radiation conditions, and to the upgrade of this device for the LHC Run-II. Furthermore, the group has taken an active part in the activities on the upgrade of the CMS pixel detector. One member of the group, Ms. Agni Bethani, has successfully defended her Ph.D. thesis „Neutral Higgs Boson Searches in the  $H \rightarrow \tau\tau \rightarrow \mu\mu$  Decay Channel“ at the Karlsruhe Institute of Technology in July 2013.

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| <b>5) Financial Plan / Time Schedule</b><br><i>Can you comply with the financial plan and time schedule or do you see a need for adjustment?</i>  |
| Yes   |
| <b>6) Status</b><br><i>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>  |
| No  |
| <b>7) Teaching Activities of the Group Leader</b><br>Together with Prof. Guenter Quast the group leader gave a lecture course "Higgs Physics" at the Karlsruhe Institute of Technology during spring semester of 2013.  |
| <b>8) Publications of the Group</b><br>1) "Evidence for the 125 GeV Higgs boson decaying to a pair of tau leptons", accepted by JHEP [arXiv:1401.5041]<br>2) "Observation of a new boson with mass near 125 GeV in pp collisions at 7 and 8 TeV", CMS Collaboration, JHEP 1306 (2013) 081 [arXiv:1303.4571]<br>3) "Search for a Higgs boson decaying into a b-quark pair and produced in association with b quarks in proton-proton collisions at 7 TeV", CMS Collaboration, Phys. Lett. B722 (2013) 207-232 [arXiv:1302.2892]<br>4) "Search for MSSM Neutral Higgs Bosons Decaying to Tau Pairs in pp Collisions", CMS Collaboration, CMS Physics Analysis Summary HIG-13-021. |
| <b>9) External Funding</b><br>No  |
| <b>10) Patent Applications</b><br><i>No. of pending/granted patents</i>   |
| No  |
| <b>11) Awards received by Group Members / Professorship Appointments offered to Group Leader</b><br>No  |