

Career Development Plan - Year 1

Name of ESR: Tim Michael Heinz Wolf

Name of Supervisor: Stan Bentvelsen

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BRIEF OVERVIEW OF RESEARCH PROJECT AND MAJOR ACCOMPLISHMENTS EXPECTED (half page should be sufficient)

The research focuses now on the study of the process $pp \rightarrow t\bar{t}b\bar{b}$ which is the main background to study of $t\bar{t}H(b\bar{b})$. Since the study of this background relies heavily on Monte Carlo techniques the aim is to use the MC@NLO method inside the Madgraph framework and then shower the obtained matrix elements with Pythia.

In the first stage of the research it is important to understand properly the MC@NLO method and its usage inside Madgraph. Once the complexity of the interplay between Madgraph and Pythia within MC@NLO is understood the impact of $g \rightarrow b\bar{b}$ splitting for massive b -quarks in the parton shower should be studied. This involves close collaboration with the theory group at Nikhef in order to benefit from their expertise in this field. It will hopefully improve the understanding of the background and put experimentalists into the position of measuring $t\bar{t}H(b\bar{b})$ which would be the first direct measurement of the top-Yukawa coupling. Further studies should then focus on b -tagging tools in order to improve their performance which is beneficial for the studies of $t\bar{t}H(b\bar{b})$ due to the complex final state involving four b -jets. These studies aim towards an in depth analysis of the experimental capabilities of the ATLAS detector which might provide an outlook at the high luminosity upgrade of the LHC. If everything goes according to plan, the background study of $t\bar{t}b\bar{b}$ should lead to a first publication.

LONG –TERM CAREER OBJECTIVES (over 5 years):

1. *Goals:*

- ✓ Successful defence of the PhD-thesis and award of the degree in 2018
- ✓ Original research leading to publications in high impact peer reviewed journals
- ✓ Qualification as an ATLAS author by the end of 2015
- ✓ Presentation of research at conferences/workshops in the field to gain exposure to the community
- ✓ First Post-Doctoral research position

2. *What further research activity or other training is needed to attain these goals?*

- ✓ Presentation skills
- ✓ Improvement of Programming skills
- ✓ Networking and communication skills - especially improving the ability to communicate with physicists using the different methods for the same kind of physics
- ✓ Training in writing research papers

- ✓ Secondment to CERN to benefit from research experience of co-workers based there

SHORT-TERM OBJECTIVES (1-2 years):

1. *Research results:*

- *Anticipated publications:*
 - ✓ Completion of studies on $t\bar{t}b\bar{b}$
 - ✓ Further research to improve performance of b-tagging
 - ✓ Further research based on Monte Carlo techniques in the context of $t\bar{t}H(b\bar{b})$ and backgrounds in order to improve the ability to extract signal from data
 - ✓ Research towards experimental capabilities of the ATLAS detector also in the regard of the high luminosity upgrade of the LHC
- *Anticipated conference, workshop attendance, courses, and/or seminar presentations:*
 - ✓ Attending all HiggsTools meetings – Young Researcher meetings, Annual Meetings, Annual Schools, etc.
 - ✓ Presentation of work at HiggsTools Annual Meetings and Young Researcher Meetings.

2. *Research Skills and techniques:*

- *Training in specific new areas, or technical expertise etc.:*
 - ✓ Further training in mathematical and computational methods
 - ✓ Further training in experimental physics and thereby understanding the needs of experimentalists

3. *Research management:*

- *Fellowship or other funding applications planned (indicate name of award if known; include fellowships with entire funding periods, grants written/applied for/received, professional society presentation awards or travel awards, etc.)*
 - ✓ Aim is to make an application for the CERN Fellowship in 2018.

4. *Communication skills:*

see above

5. *Other professional training (course work, teaching activity)*

- ✓ Teaching Assistant at the University of Amsterdam for Physics courses
- ✓ Taking the obligation of teaching at the University as an opportunity to improve the communication to undergraduate students

6. *Anticipated networking opportunities*

- ✓ Being able to meet other scientists with the same interests and benefit from the discussions with them
- ✓ Looking forward to listen to talks of other ESRs
- ✓ Working closely together with the theory department at Nikhef

7. *Other activities (community, etc.) with professional relevance:*

- ✓ Training in how to communicate science effectively to young people so I can share my passion of particle physics
- ✓ Trying to make a link between the theory department and the ATLAS group in Nikhef and benefit from their expertise in MC@NLO calculations

Date & Signature of ESR:

Date Signature of Supervisor: