

Career Development Plan – Year 1

Name of ESR: Théo Megy

Name of Supervisor: Prof. Karl Jakobs

Date: 19.10.2015

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

The overall goal of this project is the measurement of the coupling parameters of the Higgs boson to tau leptons. This measurement will be based on data collected at the ATLAS experiment during the Run 2 of the Large Hadron Collider (LHC) using proton-proton collisions at a centre-of-mass energy of 13-14 TeV. The coupling of the Higgs boson to tau leptons will be the only coupling in the lepton sector that can be measured with good precision with this foreseen dataset.

The measurement will be performed using decays of the Higgs boson into two tau leptons where one tau lepton decays into an electron or muon (and neutrinos), while the other tau lepton decays into hadrons and a neutrino. Thus, an excellent understanding and precise determination of the efficiency to identify a hadronically decaying tau lepton is essential to achieve the outlined goal. Therefore, the efficiency to detect these tau leptons is being measured, both in simulation and with data, using Z boson decays to tau leptons as a standard candle. This work is carried out in collaboration with the so-called tau combined performance working group of the ATLAS collaboration.

The analysis of Higgs boson decays to tau leptons will be newly optimized, given the new running conditions of the LHC and the resulting new signal-to-background ratios. The usage of advanced multi-variate algorithms is envisioned in order to maximize the separation of the signal from background processes. The final signal extraction will be performed with a maximum likelihood fit, taking into account several background control regions in data that are disjoint from the signal region, as well as theoretical uncertainties. These theoretical uncertainties are planned to be evaluated using various Monte Carlo event generators. SHERPA plays a key role amongst these generators, also due to the close collaboration with Prof. Frank Krauss (Durham). Visits at IPPP Durham are planned in order to intensify the collaboration and maximise the physics output. Short term stays at CERN are also foreseen.

Depending on the progress of the project, the combination of the results achieved with Higgs boson decays into tau leptons may be combined with other decay and production channels of the Higgs boson in order to gain maximum insight into the physics of the Higgs boson.

LONG –TERM CAREER OBJECTIVES (over 5 years):

1. Goals:
 - Successful completion of thesis and defence in early 2019 leading to award of a PhD
 - Original research leading to publications in high impact peer reviewed journals
 - Presentation of research at conferences and workshops in the field to gain exposure within the community
 - First post-doctoral position

2. What further research activity or other training is needed to attain these goals?
 - Presentation skills
 - Networking and communication skills
 - Training in writing research papers
 - Training in writing applications for scientific positions and research grants
 - Secondment to Durham to benefit from research experience of co-workers based there
 - Secondment to private sector partner to learn about research in a commercial environment
 - Learn effective communication skills with international collaborators

SHORT-TERM OBJECTIVES (1-2 years):

1. Research results
 - Anticipated publications:
 - Presentation of preliminary results at Summer conferences 2016
 - Publication of tau lepton performance results in 2016
 - Publication with the 2015-2016 dataset in the Spring of 2017
 - Final journal publication of the measurement of the coupling structure of the Higgs boson to tau leptons in 2018/2019
 - Anticipated conference, workshop attendance, courses, and/or seminar presentations:
 - Attending all HiggsTools meetings, young researcher meetings, annual meetings, annual schools, etc.
 - Attending major conferences in related areas, e.g., “LHC Physics 2017”, “Higgs Couplings 2018”
 - Presentation of work at HiggsTools annual meetings and young researcher meetings. Giving seminars in Freiburg, Durham, and other nodes of the network
 - Attendance and presentation of results at the yearly German Physics Society conference DPG.
2. Research Skills and techniques:
 - Training in specific new areas, or technical expertise etc.:
 - Further training in statistical analysis methods
 - Further training in Monte Carlo generators and on the application of theory to experiment
 - Further training in multivariate analysis
 - Further training in C++ and Python
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 to apply for a CERN research fellowship or EU Marie Skłodowska Curie Fellowship in 2019
4. Communication skills:

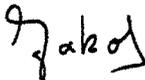
See above

5. Other professional training (course work, teaching activity)
 - Possibly training in teaching and assessing undergraduate students. Useful for a longer-term career in academia, and also for improving presentation skills.
6. Anticipated networking opportunities
 - Networking with other ESRs within the network and building up support structures that will help the research activity.
7. Other activities (community, etc.) with professional relevance:
 - Training in how to communicate science effectively to your people in order to share the excitement of particle physics and inspire them to study science.

Date & Signature of ESR:

26.10.2015 

Date Signature of Supervisor:

K. Jakob 

Freiburg, 19. October 2015

Career Development Plan

Guidance on Some of the Competencies Expected

The following points are a non-exhaustive series of aspects that could be covered by the career development plan, and it is relevant to the short-term objectives that will be set by the researcher and the reviewer at the beginning of the fellowship period. The objectives should be set with respect to the skills and experience that each researcher should acquire at a given time of his/her career. A postgraduate researcher at PhD level will have very different needs compared to a post-doctoral researcher at an advanced stage of his/her professional development. These objectives should be revised at the end of the fellowship and should be used as a pro-active monitoring of progress in the researcher's career.

1. Research results

These should give an overview of the main direct results obtained as a consequence of the research carried out during the training period. It may include publications, conference, workshop attendance, courses, and /or seminar presentations, patents etc. This will vary according to the area of research and the type of results most common to each field. The information at this level should be relatively general since the career development plan does not strictly constitute a report on the scientific results achieved.

2. Research skills and techniques acquired

Competence in experimental design, quantitative and qualitative methods, relevant research methodologies, data capture, statistics, analytical skills;
Original, independent and critical thinking;
Critical analysis and evaluation of one's findings and those of others;
Acquisition of new expertise in areas and techniques related to the researcher's field and adequate understanding their appropriate application;
Foresight and technology transfer, grasp of ethics and appreciation of IPPR.

3. Research management

Ability to successfully identify and secure possible sources of funding for personal and team research as appropriate;

Project management skills relating to proposals and tenders work programming, supervision, deadlines and delivery, negotiation with funders, financial planning, and resource management;

Skills appropriate to working with other and in teams and in teambuilding.

4. Communication skills

Personal presentation skills, poster presentations, skills in report writing and preparing academic papers and books;

To be able to defend research outcomes at seminars, conferences, etc.;

Contribute to promote public understanding of one's own field.

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

Involvement in teaching, supervision or mentoring

6. Anticipated networking opportunities

Develop/maintain co-operative networks and working relationships as appropriate with supervisor/peers/colleagues within the institution and the wider research community.

7. Other activities (community etc.) with professional relevance

Issues related with career management, including transferable skills, management of own career progression, ways to develop employability, awareness of what potential employers are looking for when considering CV applications etc.