

Career Development Plan - Year 1

Name of ESR: Yacine Haddad

Name of Supervisors:

Gavin Davies / Paul Dauncey (Imperial College London) & Nigel Glover (IPPP Durham)

Date: 21/01/2015

BRIEF OVERVIEW OF RESEARCH PROJECT AND MAJOR ACCOMPLISHMENTS EXPECTED

The project involves the CMS experiment at the LHC, within Durham University and Imperial College London, on measurements of the Higgs boson's properties and phenomenology. Initial focus will be on preparations for LHC Run2 data taking by developing and validating the analysis framework for the $H \rightarrow \gamma\gamma$ channel, in the VBF production mechanism. Analysis of these data, and those from associated channels with different final states will follow. In particular, effort will be devoted to studying and understanding the QCD jet production. This will be reached by taking advantage of the interface between IPPP Durham and Imperial College London. Exploiting the expertise at both, it will be possible to reduce the theoretical and experimental uncertainties on the QCD background in the case of the VBF production processes at CMS.

Secondment in one of our private sector partners such as Maplesoft, Wolfram Research and Shell is also in the program.

LONG –TERM CAREER OBJECTIVES (over 5 years):

1. *Goals:*

- ✓ Successful completion and publishing of thesis at the end of 2014 leading to award of PhD
- ✓ Integration into the CMS group at Imperial College London involved in VBF Higgs production with $H \rightarrow \gamma\gamma$
- ✓ Preparation and validation of the the $H \rightarrow \gamma\gamma$ framework for Run2 at the LHC
 - ✓ Optimisation of the jet reconstruction and Pile-Up mitigation algorithms
 - ✓ Software development, optimisation and validation
- ✓ Take a leading role in the $H \rightarrow \gamma\gamma$ analysis during Run2
- ✓ Comparison with other VBF channels analysis ($H \rightarrow$ invisible and $H \rightarrow \tau\tau$) carried out at Imperial. Target common issues and develop suitable strategies
- ✓ Interact with IPPP Durham to understand the QCD background jets and try to reduce the theoretical uncertainties on VBF production, and any associated jet vetoes.
- ✓ Presentation of the Higgs boson analysis results at conferences/workshops (ICHEP, Moriond ...) in the field to gain exposure to the community
- ✓ Write analysis notes and papers

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

- ✓ Networking and communication skills
- ✓ Training in writing applications for scientific positions/research grants
- ✓ Collaborate with IPPP Durham to benefit from research experience on QCD phenomenology
- ✓ Secondment to Private Sector Partner to learn about research in a commercial environment

SHORT-TERM OBJECTIVES (1-2 years):

1. *Research results:*

- *Anticipated publications:*
 - ✓ Achieve the qualification tasks to be a CMS Author
 - * Be involved in the detector upgrade activities for Phase 2 at the LHC
 - * Participate in CMS-shifts at CERN
 - ✓ Better understanding for the QCD jets for a better theoretical predictions and reduction of QCD related uncertainties in VBF production processes in CMS.
 - ✓ Write Higgs analysis notes and conference proceedings
- *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 for example **Moriond** in March 2015, **ICHEP** in September 2015
 - ✓ Presentation of work at HiggsTools Annual Meetings and Young Researcher Meetings. Giving Seminars within Durham and at other nodes of the network

2. *Research Skills and techniques:*

- *Training in specific new areas, or technical expertise etc.:*
 - ✓ Further training in mathematical and statistical methods
 - ✓ Further training in theoretical physics and phenomenology and the application of theory to experiment

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 Fellowship in 2017-2018

4. *Communication skills:*

see above

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

- ✓ Possibly training in teaching and assessing undergraduate, PhD students

6. *Anticipated networking opportunities*

- ✓ Networking with the other ESRs within the HiggsTools network and building up support structures,

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

- ✓ Training in how to communicate science effectively to young people and share with them my passion for science
- ✓ Participate in outreach events such as the HEP Masterclasses, co-developed at Imperial College

Date & Signature of ESR:

21/01/15 

Date Signature of Supervisor:

21/01/15 Gavin Davies

