# Patrick Dunne: Research Plan

I work on the Compact Muon Solenoid (CMS) collaboration at the Large Hadron Collider (LHC) in Geneva, Switzerland. I am currently part of the Higgs group attempting to characterise the new particle discovered in July 2012, and search for additional similar new particles.

As presented in my 9 month report my work is currently focussed on setting limits on the branching fraction of the Higgs boson to invisible final states ("Higgs to invisible"), which are expected in some beyond the Standard Model theories, and the combination of the results from all of the Higgs boson decay channels ("Higgs combinations").

Over the next few months I will complete the work required for to produce a preliminary public result for the Higgs to invisible analysis. It is envisaged that this will be finished towards the end of August 2013 in time for the SUSY 2013 conference.

After this has been completed I will move on to assist with the analysis of the additional 'parked' data that is available for the Higgs to invisible analysis. This parked data is expected to significantly increase the sensitivity of the analysis. A public result is expected to be produced from the parked data in the first half of 2014.

In parallel with the analysis of the parked data I will continue to work on the Higgs combinations, with a particular emphasis on producing a public result for the combination of the search channels at high Higgs masses, this is expected to be completed in late 2013 or early 2014.

Depending on my time commitments I will also assist in the production of a cross-check of the main Higgs combinations legacy paper using Feldman-Cousins statistics, as I did for the result released after the Moriond conference this year. The legacy paper is currently scheduled to be completed in Autumn 2013.

After the above has been completed and depending on the time remaining there are several projects that I may take part in. The first is the inclusion of the Higgs to invisible result in the Higgs combinations, this will be complementary to the indirect limit on the branching fraction of the Higgs boson to invisible final states currently produced by the combinations group.

Another possible task will be assisting in preparations for the resumption of data taking at 14 TeV centre of mass energy at the LHC in early 2015 and taking part in the analysis of the new 2015 data.

Service work is required to gain authorship in the CMS collaboration. To fulfill this requirement I will measure the efficiency of virtual machines and remote data access when running high energy physics analysis code. Virtual machines are widely used in the 'grid' computing model that CMS uses for large computing tasks. This work will take place during the second half of 2013 and may lead to further service work with the computing group in the future.

PDunne

October 2010

Imperial College London

# EARLY STAGE ASSESSMENT FORM

**9 months for full-time students/18 months for part-time students**

Please read the guidance notes before completing this form.

Section B of this form is to be completed by the independent assessor(s); Section C by the Supervisor(s) and Section D by the Head of Department * or nominee.

Please tick one box where requested.

## SECTION A – To be completed by Departmental Nominee

| | | | |
|---|---|---|---|
| Student's Name: | | | |
| Department: | | | |
| Name(s) of Supervisor(s): | | | |
| Title of research project (if known: | | | |
| Research Group: | | | |
| Is this the first early stage assessment for this student? | **YES** ☐ **NO** ☐ | Date of Initial PhD/MD(Res) Registration: | |
| If NO, please give date of previous early stage assessment: | / / | | |

## SECTION B: To be completed by the independent assessor(s)

**Date of Examination:** 23 / 7 / 13

1. **Do you recommend the registration for the PhD/ MD(Res) can continue?** **YES** ☑ **NO** ☐

If NO, what course of action do you recommend? (tick one)

1) Re-submit [by 11 months of initial registration] YES ☐ NO ☐

2) Downgrade to MPhil registration (not applicable for MD(Res)) YES ☐ NO ☐

3) Fail/withdraw YES ☐ NO ☐

SEEN BY STUDENT: PDunne

*Any reference to "department" or "departmental" includes schools, institutions, centres or divisions, as appropriate.

**2. Please provide answers for the following:**

a) Does the student understand the research problem adequately at this stage? YES ☑ NO ☐

b) Has the student a critical awareness of the relevant literature on the subject? YES ☑ NO ☐

c) Has the student the capacity to pursue research? YES ☑ NO ☐

**3. Comments on the written report:**

Room for improvement in clarity.

| Overall Assessment (mark one): | ☐ Poor | ☐ Satisfactory | ☑ Good | ☐ Very Good |
|---|---|---|---|---|

**4. Comments on the oral examination:**

Excellent clear explanations.

| Overall Assessment (mark one): | ☐ Poor | ☐ Satisfactory | ☐ Good | ☑ Very Good |
|---|---|---|---|---|

**5. Comments on the plan of future work:**

| Overall Assessment (mark one): | ☐ Poor | ☐ Satisfactory | ☑ Good | ☐ Very Good |
|---|---|---|---|---|

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|---|---|
| **6. Does the student need additional English language support?** | **YES** ☐ **NO** ☑ |
| **7. Has the student completed RAFT** | **YES** ☐ **NO** ☐ |

**Signatures of Assessors**

| | | | |
|---|---|---|---|
| Assessor's Signature: | Alex Tapper | Date: | 23/7/13 |
| Name (Block Capital): | A. TAPPER | Department: | HEP |
| Assessor's Signature: | C Seez | Date: | 23/7/2013 |
| Name (Block Capital): | C. SEEZ | Department: | HEP |
| Assessor's Signature: | | Date: | |
| Name (Block Capital): | | Department: | |

**The completed form should be returned to the Supervisor(s) together with a copy of the student's report.**

## SECTION C – To be completed by the Supervisor(s)

Comments by the Supervisor(s):

| | | |
|---|---|---|
| Supervisor's Signature | | Date: |
| Name (Block Capital) | | Department: |
| Co-supervisor's Signature | | Date: |
| Name (Block Capital) | | Department |
| Co-supervisor's Signature | | Date: |
| Name (Block Capital) | | Department: |

## SECTION D – To be completed by the Head of Department or nominee

**Recommendation of Head of Department or nominee**

**Registration for the PhD/MD(Res) should continue: YES ☐ NO ☐**

If NO, what course of action do you recommend? (tick one):

1) Re-submit [by 11 months of initial registration ] YES ☐ NO ☐
2) Downgrade to MPhil registration (not applicable to MD(Res)) YES ☐ NO ☐
3) Fail/withdraw YES ☐ NO ☐

| | | |
|---|---|---|
| **Signature of Head of Department or nominee:** | | Date: |
| Print name (block capital): | | |