# SR4: Hosted by Imperial

Imperial College London

#### ESR4 senior position

- Three year position (two on Higgs Tools budget) starting in 2014
- Supervisor: Jim Virdee
- Co-supervisors: Gavin Davies, Paul Dauncey

#### Workpackage 2

• Task 2.1: SM Higgs production/couplings predictions and measurements

#### Target at weak boson fusion (WBF) Higgs production

- Allows experimental tagging of Higgs production without a specific decay mode
- Sensitive to different mix of couplings compared with gluon fusion production

#### **Connections** with

- Other CMS collaborators (ETH Zurich, Torino, ESR10,11,12,14)
- Other collaborators with WBF interest (Freiburg, ERS5,6,7)
- Durham (ESR3)





### ESR4: Why Imperial?

Imperial College London

Extensive programme on the Higgs over a long period of time

• From conception of CMS through to discovery and characterisation

Five permanent staff members currently involved

- David Colling, Paul Dauncey, Gavin Davies, Chris Seez, Jim Virdee
- Also currently four RAs and five PhD students

Many Higgs studies with Imperial contributions

- Standard Model:  $H \rightarrow \gamma\gamma$ ,  $H \rightarrow \tau\tau$ , H JP, combined fit of all Higgs couplings
- BSM:  $\phi \rightarrow \tau \tau$  (high tan $\beta$ ), H  $\rightarrow$  hh  $\rightarrow \tau \tau$  bb (low tan $\beta$ ), H  $\rightarrow$  invisible (Higgs and DM)



WBF is obvious first step in separating Higgs production modes

- Already attempting to select WBF modes in many of above analyses; essential for invisible modes
- Imperial initiated CMS effort for WBF-specific trigger ("parked data") in last run





### ESR4: To do what?

"Easy" measurements have been done

• Need to work harder to get at the next layer; "experimental NLO"

ESR4 position would work directly on

- Analysis of WBF production in next LHC run as a CMS member
- Understanding of theoretical uncertainties

### Role as "trainee"

- Theory uncertainties and mitigation: critical to understand WBF qq → H+2jets vs gluon fusion higher order gg → H+2jets and control errors
- MC implementation

Role as "trainer"

- Feasibility/reality of applying proposed new theory ideas within CMS
- Understanding/interpretation of experimental measurements and limits



## R4: Supervisor – Jim Virdee

Imperial College London



Tejinder (Jim) Virdee is Professor of Physics at Imperial College. He is primarily distinguished for the design, construction and exploitation of the huge CMS experiment at the CERN Large Hadron Collider. He originated the concept of CMS with four colleagues around 1990 and there are now over 3000 participants from 38 countries. A prime motivation was the search for the mass generating mechanism for matter, now revealed by the discovery of a Higgs boson, and the nature of what lies beyond the Standard Model.

Jim devised a new technology for the large CMS electromagnetic calorimeter and one of his earlier innovations was employed for the hadron calorimeter. He was leader of the collaboration during final commissioning and first data taking between 2006 and 2009. The superb performance of CMS since high energy collisions began at the LHC is testimony to his foresight, expertise and appreciation of the complex interplay of techniques which are needed for such success. Jim had a key involvement in the discovery of a Higgs boson in CMS, announced on 4th July 2012, which was seen especially strongly in the electromagnetic calorimeter.

Jim was elected Fellow of the Royal Society in 2012. In 2013 he was awarded the European Physical Society's High Energy Particle Physics Prize, and in 2012 he was awarded the Special Fundamental Physics Prize, and in 2009 the Institute of Physics awarded him the Chadwick Medal and Prize.

