

## Research Activities – Prof. Wesley H. Smith

In 2014-16, Prof. Smith supervised 3 students (in addition to 5 students in 2011-13 and 4 present students) who have graduated with CMS theses. They are Isobel Ojalvo on the  $W+bb$  cross section and a MSSM  $H \rightarrow \tau\tau + bb$  search, Austin Belknap on the spin and parity of the Higgs Boson in the  $H \rightarrow ZZ \rightarrow 4l$  channel and a search for a doubly charged Higgs and Tom Perry on  $W+bb$  production and a search for mono-photon signals of dark matter. Over his career, Prof. Smith has had 30 of his own students receive a Ph. D. in particle physics. Some of those continuing in particle physics have become tenured faculty, including Prof. Anna Goussiou at U. Washington and Prof. Sabine Lammers at U. Indiana.

Prof. Smith's physics studies for the next 3 years concentrate on understanding the characteristics of the Higgs boson, particularly decays to  $\tau$ 's, searches for MSSM Higgs and exotic Higgs and searches for DM. Jointly with Prof. Dasu he is supervising Senior Scientist Savin and postdocs Caillol and Gomber on these studies. Prof. Smith is presently supervising 4 students in their CMS physics analysis, including Laura Dodd on Higgs decays to  $\tau$ 's, searches for MSSM Higgs and exotic Higgs, Nate Woods on  $ZZ$  cross sections and high mass  $ZZ$  resonances decaying to 4 leptons, Nick Smith on dilepton plus missing transverse energy signals measuring  $Z\nu\nu$  and invisible Higgs production and searching for Dark Matter and Usama Hussain on mono-pencil jets searches for a light  $Z'$  and Dark Matter. Prof. Smith also helped with supervision of graduated student Aaron Levine advised by Prof. Dasu on a search for lepton flavor violating Higgs decays and  $W$  production. Prof. Smith is presently assisting Prof. Dasu in the supervision of students Davin Taylor on a doubly charged Higgs search and  $WZ$  production measurement, Tyler Ruggles on Higgs  $\tau$ 's, searches for MSSM Higgs and exotic Higgs and James Buchanan on a mono-photon DM search.

Prof. Smith served as Trigger Coordinator from 2007 to July 2012 with responsibility for the CMS event selection from detector to disk through the Level-1 and Higher Level Triggers, including the selection of all the data used for the Higgs boson discovery. He was the CMS Trigger Project Manager from 1994 until the operations phase began in 2007, with responsibility for design, construction, installation and commissioning of the L1 trigger. He served on the CMS Executive and Management Boards for 18 years.

From 2012-15, Prof. Smith co-convoked of the CMS Trigger Performance and Strategy Working Group that developed the trigger architecture for the CMS HL-LHC upgrade and he co-edited the trigger chapter of the CMS Phase 2 (HL-LHC) Upgrade Technical Proposal and presented this proposal for approval by the collaboration and the LHCC. From 2013-16, Prof. Smith was the US CMS Phase 1 Trigger Upgrade Project Manager, which included upgrades of the Calorimeter Layer 1 and Endcap Muon Trigger systems, which were both successfully delivered in 2015-16 and are now triggering CMS with capabilities to handle the higher luminosity. Prof. Smith continues serving as US CMS Trigger Project Manager since 1997, with responsibility for the US CMS trigger operations for the calorimeter, muon and higher level triggers with a record of high trigger performance and negligible system downtime. From 2016 onward, Prof. Smith has been the US CMS HL-LHC Calorimeter Trigger Upgrade Project Manager. Along with Prof.

Dasu, Prof. Smith supervises Scientist Pamela Klabbers, the postdocs and students and the UW US-CMS project-supported team of Electrical Engineer Tom Gorski, Firmware Engineers Ales Svetek and Marcelo Vicente, Software Engineer Jes Tikalsky and Technician Bob Fobes on the UW trigger projects, including the Phase-1 Upgrade Calorimeter Trigger operations and the HL-LHC Calorimeter and Correlator L1 Trigger R&D.

Prof. Smith singly authored a review article in 2016 on Triggering at the LHC<sup>i</sup> and gave Trigger and Data Acquisition summer school lectures at both the CERN-Fermilab Hadron Collider Summer School and SLAC Summer Institute in 2016. He is a member of the DPF Coordinating Panel for Advanced Detectors (CPAD) and was co-Chair of the ECFA HL-LHC Preparatory Group on Trigger, Offline, Online and Computing in 2013 and 2014. He is a founding member of the organizing committee of the yearly Topical Workshop on Electronics for Particle Physics (TWEPP) that started as the Conference on Electronics for LHC Experiments in 1995. In the past year he has served on the DOE National Laboratory Energy Frontier Program Review and the DOE Comparative Review of HEP-supported National Laboratory Detector Research and Development.

Prof. Smith's has chaired, served as spokesperson, or otherwise strongly influenced a large number of important high-level advisory panels, including the DOE High Energy Physics Advisory Panel (HEPAP). In 2007 He served as the vice-chair of the DOE/NSF HEPAP University Grants Program Subpanel.

Prof. Smith led the US group on the ZEUS experiment at the HERA ep collider located at the DESY laboratory in Hamburg Germany. Prof. Smith led the international team that built the ZEUS trigger system that became the basis for all subsequent particle physics collider detectors and developed at UW the revolutionary Calorimeter First Level Trigger. This system uses more than a thousand high-speed electronics boards analyzing 14 kbits of data at an input rate of 10 MHz beam crossings to select a few hundred Hz of events for further analysis. ZEUS has been one of the most productive and important of the major particle physics experiments, publishing more than 170 articles in refereed journals including 31 physics publications that have more than 100 citations each. These results on the strong force of Quantum ChromoDynamics that binds the quarks and gluons in the proton have dramatically changed the understanding of QCD and the gluons that are the production mechanisms for new physics expected in the next generation of particle physics experiments.

Prof. Smith designed and developed the tracking detectors and readout electronics that transformed the famous CCFR neutrino experiment in order to use the Fermilab new high-energy neutrino beam in extremely short but intense bursts and record all the information on every interaction. As spokesman over a decade he led groundbreaking physics analyses that measured such fundamental quantities as the charges of the quarks in the proton, the number of strange and charmed quarks in the proton and the fraction of the proton composed of gluons. These results are now part of standard particle physics textbooks.

In outreach, Prof. Smith has given a number of public lectures and made appearances on various television and radio programs. He started a new course, Physics Today, for UW undergraduate physics majors to bring them latest results from the research frontiers. This highly appreciated course has become a staple of the Physics Department curriculum and is taught by Prof. Smith in addition to his regular teaching load. Prof. Smith has also pioneered new teaching methods in the Physics Department introductory undergraduate courses.

Prof. Smith has been a National Science foundation Presidential Young Investigator and a Department of Energy Outstanding Junior Investigator. He is a Fellow of the American Physical Society and in 2006 was named the University of Wisconsin Bjorn Wiik Professor of Physics.

Note: Further information is available on the vita found at:

<http://www.hep.wisc.edu/wsmith/vita.pdf>

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- <sup>i</sup> *Published single author paper*: “Triggering at the LHC”, W.H. Smith, Annual Review of Nuclear and Particle Science, Vol. 66, November 2016, [doi: 10.1146/annurev-nucl-102115-044713](https://doi.org/10.1146/annurev-nucl-102115-044713).