Adam Morris

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I am a finishing PhD student and short-term postdoc at the University of Edinburgh LHCb group. I will be able to start a new job in January 2018. My research experience is in studies of four-body charmless hadronic decays of B mesons. My thesis work comprises a measurement of the $B_s^0 \to \phi\phi$ branching fraction, with a search for $B^0 \to \phi\phi$, and an amplitude analysis of $B_s^0 \to \phi K^+ K^-$ decays. I have also worked on RICH detector operations, monitoring and studies for the upgrade. My research interests lie in experimental flavour physics, particularly precision measurements of rare processes and exotic hadron spectroscopy.

Employment

Postdoctoral research associate Aug 2017 — Dec 2017
University of Edinburgh

Description Four month contract to work on an amplitude analysis of $\Lambda_b \to \chi_{c\{1,2\}} p K^-$ decays.

Education

PhD in experimental particle physics Sep 2013 — Sep 2017
University of Edinburgh

Thesis title *Measurements of charmless B_s meson decays at LHCb*
Supervisors Matthew Needham and Franz Muheim
Status Thesis submitted; awaiting Viva

MSci in physics Oct 2009 — Jul 2013
University of Birmingham

Thesis title *A possible lepton flavour violation search at NA62*
Supervisors Cristina Lazzeroni and Evgueni Goudzovski
Classification Upper second class honours

Physics analysis

Amplitude analysis of $\Lambda_b \to \chi_{c\{1,2\}} p K^-$ decays 2017 —
Amplitude fits to $\Lambda_b \to \chi_{c1} p K^-$ and $\Lambda_b \to \chi_{c2} p K^-$ decays using Run 1 and 2 data, with a focus on searching for pentaquarks decaying to $\chi_{c\{1,2\}} p$. My role is to develop the eight-dimensional fitter, within a framework based on TensorFlow, to run on a GPU cluster at Edinburgh.

Amplitude analysis of $B_s^0 \to \phi K^+ K^-$ decays 2015 — 2017
An amplitude fit to $B_s^0 \to \phi K^+ K^-$ events with $m(K^+K^-) < 1.8$ GeV. The decay $B_s^0 \to \phi f_2'(1525)$ is observed for the first time, and measurements are made of its branching fraction and longitudinal polarisation fraction. This is my primary thesis work, and I was responsible for performing the analysis, from selection, modelling the acceptance, signal and background, fitting the data and calculating results and systematic uncertainties.

Measurement of the $B_s^0 \to \phi\phi$ branching fraction and search for $B^0 \to \phi\phi$ [1] 2014 — 2015
The $B_s^0 \to \phi\phi$ branching fraction was measured using $B^0 \to \phi K^{*0}$ for normalisation, resulting in a factor of five reduction in the statistical uncertainty compared to the previous best result. In addition, a search was performed for the suppressed $B^0 \to \phi\phi$ decay, and an upper limit placed on its branching fraction, which is a factor of seven improvement compared to the previous best result. This analysis forms part of my thesis work, and I was responsible for the mass fits and most of the calculations of efficiencies and systematics, as well as setting the limit on the B^0 mode using the CL_s method.

Measurement of CP violation in $B_s^0 \to \phi\phi$ decays [2] 2013 — 2014
A time-dependent angular fit performed to $B_s^0 \to \phi\phi$ events to extract the weak phase ϕ_s, which is expected to be close to zero due to cancellation between the leading-order mixing and decay diagrams. I was responsible for parametrising the peaking backgrounds and performing fits to the $\phi\phi$ invariant mass to obtain event yields.

Hardware and operations

LHCb control room shifts (4× shift leader & 11× data manager) 2015 — 2016
RICH piquet shifts (3 weeks) 2015 — 2016
Ion feedback monitoring of the RICH HPDs 2015 — 2016
RICH upgrade testbeam 2014 — 2016
I participated in 4 testbeam periods, during which I took data-taking shifts and improved the automation of the data acquisition and processing. I performed the dark count analysis (see Ref. [3]) and developed an online alignment tool.
Performance of MaPMTs in magnetic fields for the RICH upgrade [4] 2013 — 2014
I measured the drop in efficiency of the multi-anode photomultipliers, selected for the RICH upgrade, as a function of magnetic field strength applied along different axes for different operating voltages. This study led to the conclusion that, under the operating conditions at LHCb, magnetic shielding is required to achieve 90% efficiency for all anodes.

Schools, workshops and conferences

Exotic hadron spectroscopy workshop University of Edinburgh, September 2016
Heavy Quarks and Leptons (HQL) conference Virginia Tech, May 2016
Talk: *Charmless b-meson and b-baryon decays at LHCb* [5]
LHCC Poster Session CERN, March 2016
Poster: *Measurement of the $B_s \to \phi\phi$ branching fraction and angular analysis of $B_s \to \phi\pi^+\pi^-$ at LHCb*
UK HEP forum: "Anomalies and Deviations" workshop STFC, Abingdon, November 2015
Poster: *Measurement of the $B_s \to \phi\phi$ branching fraction and search for $B^0 \to \phi\phi$ at LHCb*
European School of High-Energy Physics Bansko, Bulgaria, September 2015
Young Experimentalists and Theorists Institute (YETI) workshop Durham University, January 2015
STFC HEP summer school University of Warwick, September 2014
B-physics at frontier machines (Beauty) conference University of Edinburgh, July 2014
Poster: *Measurement of CP violation in $B_s^0 \to \phi\phi$ decays [6]*

Public outreach

Participant in an 'Ask Me Anything' session organised by CERN on *reddit.com* May 2015
Participant in a *Speed Science* event at the *Glasgow Science Festival* June 2014
Demonstrator at the *Discovering the Higgs Boson* exhibit at the *Big Bang Fair*, Birmingham NEC March 2014

Skills

- HEP data analysis techniques: multivariate selection, maximum-likelihood fits, amplitude analysis and limit-setting
- Proficiency with C++, Python and shell scripting.
- Familiarity with ROOT (incl. TMVA, RooFit and RooStats), GSL, Boost and the LHCb software
- Experience using parallel computing resources, such as the Edinburgh and CERN batch services and the LHC Grid
- Frequent user of version control systems (Git and SVN) and experience with collaborative software development

Publications

Papers

[1] *Measurement of the $B_s^0 \to \phi\phi$ branching fraction and search for the decay $B^0 \to \phi\phi$*,
LHCb collaboration, JHEP **10** (2015) 053

[2] *Measurement of CP violation in $B_s^0 \to \phi\phi$ decays*,
LHCb collaboration, Phys. Rev. **D90**, (2014) 052011

[3] *Test of the photon detection system for the LHCb RICH Upgrade in a charged particle beam*,
M. K. Baszscyk *et al*, LHCb-PUB-2016-019, to be submitted to JINST

Proceedings

[4] *Characterisation and magnetic field properties of multianode photomultiplier tubes*,
S. Eisenhart *et al*, on behalf of the LHCb RICH collaboration, Nucl. Instrum. Meth. **A766** (2014) 167-170

[5] *Charmless b-meson and b-baryon decays at LHCb*,
A. Morris, on behalf of the LHCb collaboration, PoS (HQL 2016) 059

[6] *Measurement of CP violation in $B_s^0 \to \phi\phi$ decays*,
A. Morris, on behalf of the LHCb collaboration, PoS (Beauty 2014) 064