

# ANDERS RYD

## Work Address:

Cornell University  
Physical Sciences Building 393  
Ithaca, NY 14853  
Phone: (607) 255-2529  
Fax: (607) 254-4552  
e-mail: Anders.Ryd@cornell.edu

## Education History:

Sept. 1991 - May 1996: Ph.D. Physics, University of California Santa Barbara.  
Sept. 1987 - Sept.1991: B.S. Physics, University of Lund, Sweden.  
June 1989 - June 1990: Military service in Sweden.

## Fellowships and awards:

- 2009 NSF CAREER Award.
- 2005 Alfred P. Sloan Research Fellowship.
- 1996 Sherman Fairchild Postdoctoral Scholar Fellowship.

## Professional Employment:

Professor, Cornell University, July 2015 - Present.  
Associate Professor, Cornell University, July 2009 - July 2015.  
Assistant Professor, Cornell University, Aug. 2003 - July 2009.

- Selected interim PI for the CMS phase 2 upgrade proposal for the NSF component of the upgrade. This proposal will be an MREFC (Major Research Equipment and Facility Construction) which is to be submitted in parallel with the ATLAS collaboration.
- Starting September 2012 I was asked to co-chair, together with Emmanuelle Perez from CERN, the Track Trigger Integration (TTI) group in CMS. This group is charged with organizing the studies needed to evaluate different strategies for an upgraded trigger with tracking capabilities in the L1 trigger. This upgrade is targeted for deployment around 2024 when the LHC has a major upgrade to increase the luminosity. The TTI group has made key contributions to the CMS technical proposal for the phase 2 upgrades where we demonstrate how the proposed track trigger will allow an efficient operation of the trigger at the High Luminosity LHC. This work is documented in our Technical Proposal that will be released in May 2015.

- Cornell has been the institution leading the development of a new approach to implementing the L1 track trigger. We have proposed the use of a FPGA based system to reconstruct tracks. The challenge is that we have to process about 10,000 hits (called stubs) in every bunch crossing of the LHC at a rate of 40 MHz and reconstruct in each bunch crossing about 125 tracks. At Cornell we have developed the firmware and are now close to demonstrating the functionality of the L1 tracking.
- Together with graduate student Benjamin Kreis and post doc Joshua Thompson we have worked on searches for super symmetry in final states with  $b$ -quark jets. Final results on the LHC run 1 data was the topic of B. Kreis' thesis.
- I served as CMS run coordinator in 2011 and deputy run coordinator in 2010. I was based at CERN these two years and my primary responsibility was to coordinate the operation and data taking of the CMS experiment and interface to the LHC. As run coordinator on CMS I was a member of the management board and executive board where I regularly updated the management on the progress with the data taking. During 2011 CMS recorded  $5.2 \text{ fb}^{-1}$  of proton-proton collisions at a center-of-mass energy of 7 TeV. These data has been used to re-establish the standard model measurements, search for new physics beyond the standard model, and most significantly the data contained strong evidence for a Higgs at around 125 GeV. With another about  $5 \text{ fb}^{-1}$  of data recorded in 2012 the observation of a new boson with a mass around 125 GeV was announced on July 4, 2012.
- Organizer of the International Workshop on Charm Physics in Ithaca, August 5-8, 2007. This workshop brought together about 100 experts on charm physics.
- Joined CMS collaboration in 2005. Together with several students (Souvik Das, Ben Kreis, Heng Li, and James Hunt) and postdocs (Joshua Thompson, Freya Blekman, and Karl Ecklund) we have provided most of the online software and calibration tools needed to operate the CMS pixel detector. Souvik Das and
- Using CLEO-c data, studied the absolute hadronic  $D$  branching fractions using a technique in which the  $D$  mesons are tagged by exclusive reconstruction. Precise measurements of the hadronic  $D$  branching fractions are important for precise measurements of the CKM matrix element  $|V_{cb}|$ . This technique has also been applied to study the hadronic decays of  $D_s$  branching fractions. This work was done together with students Peter Onyisi and Steve Stroiney. Improved and developed tools for simulation of the  $D$  decays based on the EvtGen package for use at CLEO-c.

Staff Scientist, California Institute of Technology, Pasadena, CA, Sept. 2002 - Aug. 2003. Supervisor: Professor David Hitlin.

Senior Postdoctoral Scholar, California Institute of Technology, Pasadena, CA, Sept. 1999 - Sept. 2002. Supervisor: Professor David Hitlin.

Sherman Fairchild Postdoctoral Scholar, California Institute of Technology, Pasadena, CA, Sept. 1996 - Sept. 1999. Supervisor: Professor David Hitlin.

- Discovered the rare flavor-changing neutral current decays  $B \rightarrow K^{(*)} \ell^+ \ell^-$  in the BABAR data in parallel with Belle. These decays only take place via loop diagrams in the standard model, and are hence an interesting place to look for new physics.

- Served as co-convener for the 'Radiative Penguin' analysis working group in BABAR. This working group covers analysis topics such as inclusive and exclusive  $b \rightarrow (s, d)\gamma$  and  $b \rightarrow s\ell\ell$ . These analyses are important both as a means to search for new physics as well as for the determination of fundamental properties of the standard model, such as  $|V_{td}|$  and  $|V_{ub}|$ .
- Served as reconstruction manager for BABAR. In this role I was responsible for maintaining the reconstruction software and producing production executables for the reconstruction of BABAR data. The main challenge was to make sure that we were able to reconstruct the data we took in a timely fashion as the luminosity increased.
- Development and commissioning of algorithms and tools for the BABAR L3 trigger. In particular, a fast track finding and fitting algorithm were developed to find the three-dimensional trajectories of particles using the drift chamber. The L3 trigger has proved successful and meet all major design goals during the first year of running.
- Developed the EvtGen package for simulation of particle decays. This package provides many powerful tools for simulation of the physics of  $B$  meson decays. This package was used by BABAR as the main package for simulation of  $B$ -physics. The software is now maintained by the University of Warwick group for use by the LHCb experiment.

Graduate Student Researcher, University of California Santa Barbara, CA, May 1993 - Sept. 1996.  
Supervisor: Professor Jeffrey Richman.

- Measurement of the form factors in the decay  $\bar{B}^0 \rightarrow D^{*+}\ell^-\bar{\nu}$  using data collected with the CLEO II experiment. A fit is performed in a four dimensional space of the kinematic variables to extract two form factor ratios and the  $q^2$  dependence of the form factors. The extracted form factor ratios test predictions of heavy quark effective theory, while the measurement of the  $q^2$  dependence tests non-perturbative methods.
- Implementation of a Kalman filter as the track fitter for the CLEO II experiment. The Kalman filter was an important improvement to the track fitting at CLEO since it correctly incorporates the effects of energy loss and multiple coulomb scattering, which is important for the low energy environment at the  $\Upsilon(4S)$ . The estimator is optimal in the limit of Gaussian multiple scattering and straggling in the energy loss.

### Grants:

- Funding from USCMS for upgrade R&D in FY 2015 \$110,000 for track trigger work jointly with Prof. Peter Wittich and \$50,000 for PS module development jointly with Prof. Julia Thom.
- Funding from USCMS for upgrade R&D in FY 2014 \$70,000.
- Particle Physics at the Energy Frontier  
NSF 09/01/2013 – 08/31/2016, \$4,100,000  
[co-PI with J. Alexander (PI), J. Thom, P. Wittich, R. Patterson]
- Funding from USCMS to pay my salary during my stay at CERN while I was run coordinator in 2010 and 2011.
- Funding from USCMS for improving computing performance \$140,000.

- CAREER  
NSF 06/10/2009 – 06/10/2014, \$800,000
- Particle Physics at the Energy and Intensity Frontiers  
NSF 09/01/2010 – 08/31/2013, \$4,025,500  
[co-PI with J. Alexander (PI), D. Cassel]
- Particle Physics at the Energy Frontier with CMS  
NSF 04/15/2008 – 03/31/2011, \$2,067,000  
[co-PI with J. Alexander (PI), L. Gibbons, J. Thom, and P. Wittich]
- Particle Physics at the Energy Frontier  
NSF 06/01/2007 – 05/31/2008, \$600,000  
[co-PI with J. Alexander (PI) and D. Cassel]
- Proposal to Initiate Cornell Research in CMS  
NSF 09/01/2006 – 08/31/2007, \$300,000  
[co-PI with J. Alexander (PI) and D. Cassel]

### **Professional Activities:**

- Co-organizer of CMS Tracker+Trigger workshop at Fermilab, Sept. 11-12, 2014.
- Organizer of CMS run coordination workshop in Madrid, Nov. 2-4, 2011.
- Organizer of CMS run coordination workshop in Zurich, Nov. 2-3, 2010.
- Organizer of the International Workshop on Charm Physics in Ithaca, August 5-8, 2007. This workshop brought together about 100 experts on charm physics.
- Served as reviewer for IEEE Transactions on Nuclear Science, Physics Review Letters and Physical Review D.
- Served on NSF review panel and reviewer of proposals.
- Served on graduate admission committee 2005-2007.
- Member of the American Physical Society.
- Outreach to local community colleges.

## Seminars and Invited Talk

A. Ryd, "The CMS Detector Upgrade for the High Luminosity LHC", General Physics Colloquium Cornell University, Oct. 27, 2014.

A. Ryd, "The Discovery of the Higgs Boson", Public Lecture at the Elmira-Corning Astronomy Society, Oct. 3, 2014.

A. Ryd, "Track Trigger at L1 for HL-LHC", INFIERI Summer School, Oxford, UK, July 12, 2013.

A. Ryd, "CMS and ATLAS Tracking", Workshop on future needs of ASICs in HEP, Berkeley, CA, May 30, 2013.

A. Ryd, "How the Higgs was Found", NYS APS meeting, Aurora, NY, April 19, 2013.

A. Ryd, "CMS Status Report", LHCC Open Session, Dec. 7, 2011.

A. Ryd, "Experiments desiderata", LHC mini-Chamonix Workshop, July 15, 2011.

A. Ryd, "First Year of CMS Operation: Operational Experience and First Physics Results", General Physics Colloquium University of New Hampshire, May 2, 2011.

A. Ryd, "First Year of CMS Operation: Operational Experience and First Physics Results", General Physics Colloquium Cornell University, April 4, 2011.

A. Ryd, "Performance of the CMS Detector and Electronics During First LHC Beam Operation", TWEPP 2010, Aachen, Germany, Sept. 20-24, 2010. Published in JINST 6 C01097, 2011.

A. Ryd, "Operational Experience at 7 TeV", 14th Annual RDMS Collaboration Conference, Varna, Bulgaria, Sept. 6-13, 2010.

A. Ryd, "Status of CMS", 12th Topical Seminar on Innovative Particle and Radiation Detectors (IPRD10), Siena, Italy, June 7-10, 2010. Published in Nucl. Phys. Proc. Suppl. **215**, 8 (2011).

A. Ryd, "CMS Track Trigger for SLHC", Vertex 2009, Puten, The Netherlands, Sept. 13-18, 2009. Published in PoS VERTEX **2009**, 040 (2009).

A. Ryd, "CMS: Meeting the LHC Challenge", General Physics Colloquium Cornell University, Nov. 3, 2008.

A. Ryd, "Experience with CMS Pixel Detector Commissioning", Vertex 2008, Utö, Sweden, July 27 - Aug. 1, 2008. Published in the proceedings of Vertex 2008, PoS **VERTEX2008**, 014 (2008).

A. Ryd, "Determination of Hadronic Branching Fractions", International Workshop on Charm Physics (Charm 2007), Ithaca NY, Aug. 5-8, 2007. Published in the proceedings of International Workshop on Charm Physics (Charm 2007), eConf C070805,(2007).

- A. Ryd, "Determination of Charm Hadronic Branching Ratios and New Modes", 5th Flavor Physics and CP Violation Conference (FPCP 2007), Bled, Slovenia, 12-16 May 2007. Published in the proceedings of 5th Flavor Physics and CP Violation Conference (FPCP 2007), Bled, Slovenia, 12-16 May 2007, pp 023.
- A. Ryd, "The CMS Pixel Detector", Princeton University, April 23, 2007.
- A. Ryd, "Recent CLEO-c Results on  $D$  and  $D_s$  Mesons", LBNL, November 3, 2006.
- A. Ryd, "Recent CLEO-c Results on  $D$  and  $D_s$  Mesons", SLAC, October 28, 2006.
- A. Ryd, "Leptonic  $D^+$  and  $D_s^+$  decays at CLEO-c", International Workshop on Tau-Charm Physics (Charm 2006), June 5-7, 2006, Beijing, China. Published in the proceedings of the International Workshop on Tau-Charm Physics, International Journal of Modern Physics A21, 5445-5448, (2006).
- A. Ryd, "Initial CLEO-c Results", California Institute of Technology, November 29, 2005.
- A. Ryd, "Weak Decays, CKM, CP Violation", International Conference on Weak Interactions and Neutrinos, Delphi, Greece, June 6-11, 2005.
- A. Ryd, "First CLEO-c Results", International Conference on Weak Interactions and Neutrinos, Delphi, Greece, June 6-11, 2005.
- A. Ryd, "Leptonic decays", CKM2005: Workshop on the Unitarity Triangle, San Diego, March 15-18, 2005.
- A. Ryd, "Hadronic  $D$  Decays and the  $D$  Meson Decay Constant with CLEO-c", 32<sup>nd</sup> International Conference on High Energy Physics, August 16th-22nd 2004, Beijing, China. Published in the proceedings of the 32<sup>nd</sup> International Conference on High Energy Physics vol. 2, 1188-1191 (2005).
- A. Ryd, "Evidence for  $B \rightarrow K^* \ell^+ \ell^-$  and Measurement of  $B \rightarrow K \ell^+ \ell^-$ ", European Physical Society International Europhysics Conference on High Energy Physics, July 17th-23rd 2003, Aachen, Germany. Published in Eur. Phys. J. C **33**, S285 (2004).
- A. Ryd, "Radiative Penguin Decays at BABAR," 9th International Symposium on Heavy Flavor Physics, Pasadena, California, September 10-13, 2001. Published in the Proceedings of the 9th International Symposium on Heavy Flavor Physics, ed. A. Ryd and F.C. Porter, AIP Conference Proceedings Volume 618, 143-152 (2002).
- A. Ryd, "CP Violation Measurements at BABAR," Beauty 2000, Maagan, Sea of Galilee, Israel, September 13 - 18, 2000. Published in Nucl. Instrum. and Meth. A **462**, 57-65 (2001).
- A. Ryd, "CP Violation at Asymmetric  $e^+e^-$  B-Factories," Presented at the first of two B-physics workshops at Fermilab, September 24, 1999.
- A. Ryd and D. Lange, "The EvtGen Event Generator Package," Computing in High Energy Physics 1998, Chicago, Illinois, August 31 - September 4, 1998.

A. Ryd, "Form Factors in  $B$  and  $D$  Decays," 7th International Symposium on Heavy Flavor Physics, Santa Barbara, California, July 7-11, 1997. Published in the Proceedings of the Seventh International Symposium on Heavy Flavor Physics, ed. C. Campagnari, World Scientific, 19-28 (1997).

A. Ryd, "Form Factor Measurements in  $B$  and  $D$  Decays," 2nd International Conference on  $B$  Physics and  $CP$  Violation, Honolulu, Hawaii, March 24-27, 1997. Published in the proceedings of the 2nd International Conference on  $B$  Physics and  $CP$  Violation, ed. T.E. Browder, F.A. Harris, and S. Pakvasa, World Scientific, Singapore, 295-302 (1998).

A. Ryd, "Measurement of the Form Factors in the Decay  $\bar{B}^0 \rightarrow D^{*+}\ell^{-}\bar{\nu}$ ," 2nd Rencontres du Vietnam, Saigon, Vietnam, October 22-28 1995. Published in the Proceedings of the 2nd Rencontres du Vietnam, ed. Nguyễn van Hiêu and Jean Trân Thanh Vân, Editions Frontieres, 590-592 (1996).

A. Ryd, "Measurement of the Form Factors in the Decay  $\bar{B}^0 \rightarrow D^{*+}\ell^{-}\bar{\nu}$ ," 8th Meeting of the Division of Particles and Fields of the American Physical Society, Albuquerque, New Mexico, August 2-6, 1994. Published in the proceedings of the 8th Meeting of the Division of Particles and Fields of the American Physical Society, ed. S. Seidel, World Scientific, 847-850 (1995).

## Publications directly related to my work

Publications that appear in refereed journals are indicated by<sup>†</sup>.

G. Bonvicini *et al.* [CLEO Collaboration], “Updated Measurements of Absolute  $D^+$  and  $D^0$  Hadronic Branching Fractions and  $\sigma(e^+e^- \rightarrow D\bar{D})$  at  $E_{\text{cm}} = 3774$  MeV,” Phys. Rev. D **89**, 072002 (2014)<sup>†</sup>.

V. Khachatryan *et al.* [CMS Collaboration], “Search for long-lived particles that decay into final states containing two electrons or two muons in proton-proton collisions at  $\sqrt{s} = 8$  TeV,” arXiv:1411.6977 [hep-ex].

A. J. Bevan *et al.* [BaBar and Belle Collaborations], “The Physics of the  $B$  Factories,” Eur. Phys. J. C **74**, no. 11, 3026 (2014)<sup>†</sup>.

S. Chatrchyan *et al.* [CMS Collaboration], “Description and performance of track and primary-vertex reconstruction with the CMS tracker,” JINST **9**, no. 10, P10009 (2014)<sup>†</sup>.

S. Chatrchyan *et al.* [CMS Collaboration], “Evidence for the direct decay of the 125 GeV Higgs boson to fermions,” Nature Phys. **10**, 557 (2014)<sup>†</sup>.

P. U. E. Onyisi *et al.* [CLEO Collaboration], “Improved Measurement of Absolute Hadronic Branching Fractions of the  $D_s^+$  Meson,” Phys. Rev. D **88**, 032009 (2013)<sup>†</sup>.

M. Demarteau *et al.*, “Planning the Future of U.S. Particle Physics (Snowmass 2013): Chapter 8: Instrumentation Frontier”, arXiv:1401.6116 (2013).

CMS Collaboration, “Projected performance of an upgraded CMS detector at the LHC and HL-LHC: Contribution to the Snowmass process”, arXiv:1307.7135 (2013).

CMS Collaboration, “Search for gluino mediated bottom- and top-squark production in multijet final states in pp collisions at 8 TeV”, Phys. Lett. B **725**, 243 (2013)<sup>†</sup>.

J. Hoff *et al.* [CMS Collaboration], “Design for a L1 Tracking Trigger for CMS,” JINST **8**, C02004 (2013).

S. Chatrchyan *et al.* [CMS Collaboration], “Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC,” Phys. Lett. B **716**, 30 (2012)<sup>†</sup>.

CMS Collaboration, “Search for supersymmetry in events with b-quark jets and missing transverse energy in pp collisions at 7 TeV”, Phys. Rev. D **86**, 072010 (2012)<sup>†</sup>.

D. Cronin-Hennessy *et al.* [CLEO Collaboration], “Observation of the Dalitz decay  $D_s^{*+} \rightarrow D_s^+ e^+ e^-$ ”, Phys. Rev. D **86**, 072005 (2012)<sup>†</sup>.

A. Ryd and A. A. Petrov, “Hadronic  $D$  and  $D_s$  Meson Decays,” Rev. Mod. Phys. **84**, 65 (2012)<sup>†</sup>.



- A. Ryd [CMS Collaboration], “Status of CMS” Nucl. Phys. Proc. Suppl. **215**, 8 (2011).
- A. Ryd [CMS Collaboration], “Experience with CMS electronics in 7-TeV operation,” JINST **6**, C01097 (2011).
- CMS Collaboration, “Commissioning and Performance of the CMS Pixel Tracker with Cosmic Ray Muons,” JINST **5**, T03007 (2010)<sup>†</sup>.
- A. Ryd [CMS Track Trigger Task Force Collaboration], “The CMS track trigger upgrade for SLHC,” PoS VERTEX **2009**, 040 (2009).
- A. Ryd [CMS Pixel Collaboration], “Experience with commissioning the CMS pixel detector,” PoS VERTEX2008, 014 (2008)<sup>†</sup>.
- G. Bonvicini *et al.* [CLEO Collaboration], “Absolute Branching Fractions of Cabibbo-Suppressed  $D \rightarrow K\bar{K}$  Decays,” Phys. Rev. D **77**, 091106 (2008)<sup>†</sup>.
- J. P. Alexander *et al.* [CLEO Collaboration], “Absolute Measurement of Hadronic Branching Fractions of the  $D_s^+$  Meson,” Phys. Rev. Lett. **100**, 161804 (2008)<sup>†</sup>.
- Q. He *et al.* [CLEO Collaboration], “Comparison of  $D \rightarrow K_S^0\pi$  and  $D \rightarrow K_L^0\pi$  Decay Rates,” Phys. Rev. Lett. **100**, 091801 (2008)<sup>†</sup>.
- S. Dobbs *et al.* [CLEO Collaboration], “Measurement of Absolute Hadronic Branching Fractions of  $D$  Mesons and  $e^+e^- \rightarrow D\bar{D}$  Cross Sections at the  $\psi(3770)$ ,” Phys. Rev. D **76**, 112001 (2007)<sup>†</sup>.
- M. Artuso *et al.* [CLEO Collaboration], “Measurement of the decay constant  $f(D_s^+)$  using  $D_s^+ \rightarrow \ell^+\nu$ ,” Phys. Rev. Lett. **99**, 071802 (2007)<sup>†</sup>.
- A. Ryd [CLEO Collaboration], “Leptonic  $D^+$  and  $D_s^+$  Decays at CLEO-c,” Int. J. Mod. Phys. A **21** (2006) 5445.
- Q. He *et al.* [CLEO Collaboration], “Measurement of Absolute Hadronic Branching Fractions of  $D$  Mesons and  $e^+e^- \rightarrow D\bar{D}$  Cross Sections at  $E_{\text{cm}} = 3773$  MeV,” Phys. Rev. Lett. **95**, 121801 (2005) [Erratum-ibid. **96**, 199903 (2006)]<sup>†</sup>.
- J. Hewett *et al.*, “The discovery potential of a Super B Factory. Proceedings, SLAC Workshops, Stanford, USA, 2003,” arXiv:hep-ph/0503261.
- B. Aubert *et al.* [BABAR Collaboration], “Evidence for the Rare Decay  $B \rightarrow K^*\ell^+\ell^-$  and Measurement of the  $B \rightarrow K\ell^+\ell^-$  Branching Fraction,” Phys. Rev. Lett. **91**, 221802 (2003)<sup>†</sup>.
- A. Ryd *et al.* [BABAR Computing Group Collaboration], “Distributed offline data reconstruction in BABAR,” eConf **C0303241**, MODT012 (2003).
- B. Aubert *et al.* [BABAR Collaboration], “Search for the Rare Decays  $B \rightarrow K\ell^+\ell^-$  and  $B \rightarrow K^*\ell^+\ell^-$ ,” Phys. Rev. Lett. **88**, 241801 (2002)<sup>†</sup>.

“*Proceedings of the 9th International Symposium on Heavy Flavor Physics,*” ed. A. Ryd and F.C. Porter, AIP Conference Proceedings Volume 618 (2002).

M. Gronau, Y. Grossman, D. Pirjol, and A. Ryd, “Measuring the Photon Helicity in Radiative  $B$  Decays,” *Phys. Rev. Lett.* **88**, 051802 (2002)<sup>†</sup>.

B. Aubert *et al.* [BABAR Collaboration], “Observation of  $CP$  Violation in the  $B^0$  Meson System,” *Phys. Rev. Lett.* **87**, 091801 (2001)<sup>†</sup>.

B. Aubert *et al.* [BABAR Collaboration], “Measurement of  $CP$  Violating Asymmetries in  $B^0$  Decays to  $CP$  Eigenstates,” *Phys. Rev. Lett.* **86**, 2515-2522 (2001)<sup>†</sup>.

D. Boutigny *et al.* [BABAR Collaboration], “*The BABAR Physics Book,*” Report of the BABAR Physics Workshop, October, 1998, ed. P.F. Harrison and H.R. Quinn, SLAC-R-504.

J.E. Duboscq *et al.* [CLEO Collaboration], “Measurement of the Form Factors for  $\bar{B}^0 \rightarrow D^{*+} \ell^- \bar{\nu}$ ,” *Phys. Rev. Lett.* **76**, 3898-3902 (1996)<sup>†</sup>.

A. Ryd, “*Measurement of B Meson Semileptonic Decay Form Factors,*” Thesis, unpublished. UMI-97-04221.

A full list of publications can be obtained from:

<http://inspirehep.net/search?ln=en&ln=en&p=find+a+ryd>