

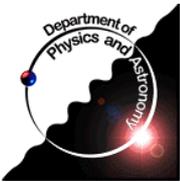
Introduction

to

Particle Physics

at the

University of Victoria



M. Lefebvre
NSERC Site Visit
October 16th 2000

- Faculty and Researchers
- Research Overview
 - OPAL, BaBar, ATLAS
- Computing and Infrastructure
- Future Plans and Goals

Personnel

- Young active group
- Internationally recognized research program
- Faculty:
 - Experimentalists: Keeler, Kowalewski, Lefebvre, Roney, Astbury (Emeritus)
 - Theorists: Picciotto
- Institute of Particle Physics Fellows
 - McPherson, Sobie
- Onsite TRIUMF Staff
 - Birney, Hodges, Langstaff, Lenckowski, Walsh
- Research Associates
 - Onsite: Fincke, Poffenberger
 - CERN: Long, Sbarra
- Computing
 - Van Uytven
- Technicians
 - Dowling, Vowles

Faculty

- **R. Keeler (83) PhD UBC 81**
 - Electroweak physics (UA1, OPAL , ATLAS)
 - IPP Director (elect 2001) (Institute of Particle Physics)
 - Chair Subatomic Physics GSC (2000-2001)
- **R. Kowalewski (97) PhD Cornell 88**
 - B physics, particle lifetimes, reconstruction software (OPAL, BaBar)
- **M. Lefebvre (91) PhD Cambridge 89**
 - Electroweak physics, Calorimetry (UA2, RD3, ATLAS)
 - Founded ATLAS Canada
- **C. Picciotto (68) PhD UC-Santa Barbara 68**
 - Weak Decay Theory
- **M. Roney (96) Carleton 89**
 - Electroweak, drift chambers and B and tau physics (OPAL, BaBar)
- **A. Astbury (83) PhD Liverpool 61**
 - FRS, FRCS
 - Director of TRIUMF (1994-2001)
 - Emeritus Professor

Adjunct Faculty

IPP

- **R. McPherson (97) PhD Princeton 95**
 - Nonstandard Model (OPAL, *ATLAS*)
 - OPAL Non-SM Searches coordinator
 - OPAL Physics coordinator (2001-2002)
 - Rare Kaon Decays (BNL-E787)
- **Sobie (92) PhD Toronto 84**
 - OPAL, ATLAS
 - OPAL Tau physics coordinator (1998-)
 - Spokesman for Victoria HPSS CFI request \$12M
 - Holds IBM SUR Grant (\$840,000)

TRIUMF

- **Bryman** (Jan 2000 Warren Chair UBC)
- **Honma** (March 1998, CERN Permanent Staff)

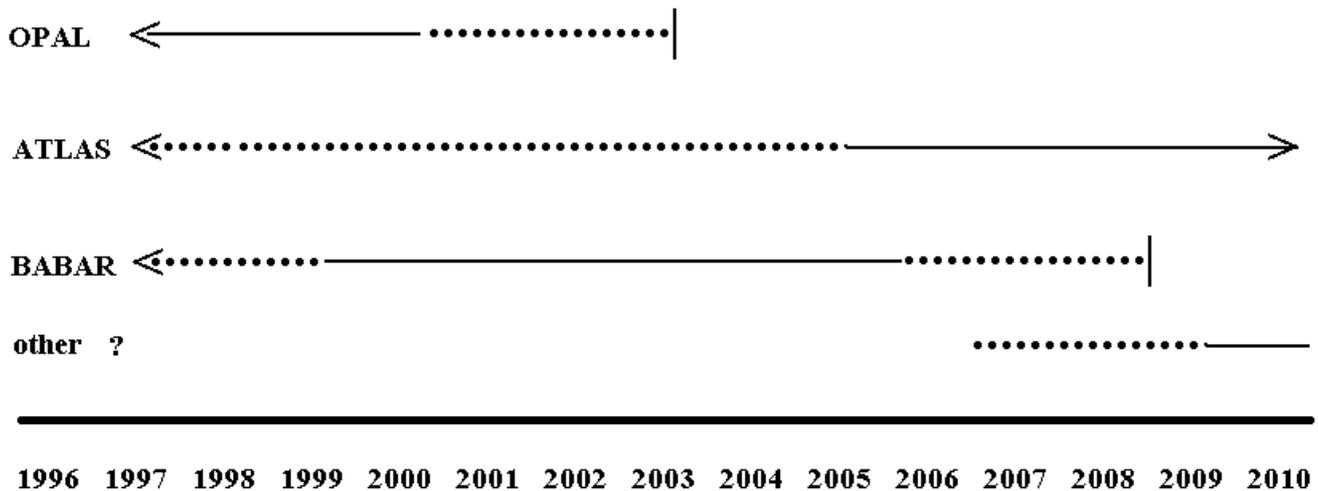
New Positions

- Theorist
 - Assistant Professor tenured track position currently advertised
 - Particle Physics or Particle Astrophysics
- Pearce Chair soon to be advertised
 - Previously held by A. Astbury
- We expect to replace Bryman and Honma over the next two years.
 - Both worked closely with UVic
- CRC Junior Chair request sent to Dean

Research Overview

Experimental Program

Time Line



- OPAL data taking is extended until end Oct 2000
 - Analysis will continue for a few years
- Babar has just started data taking
 - will continue for several years
- ATLAS is under construction
 - First beam in ~2005
- New physics
 - Next Linear Collider
 - Neutrino physics

Research Overview

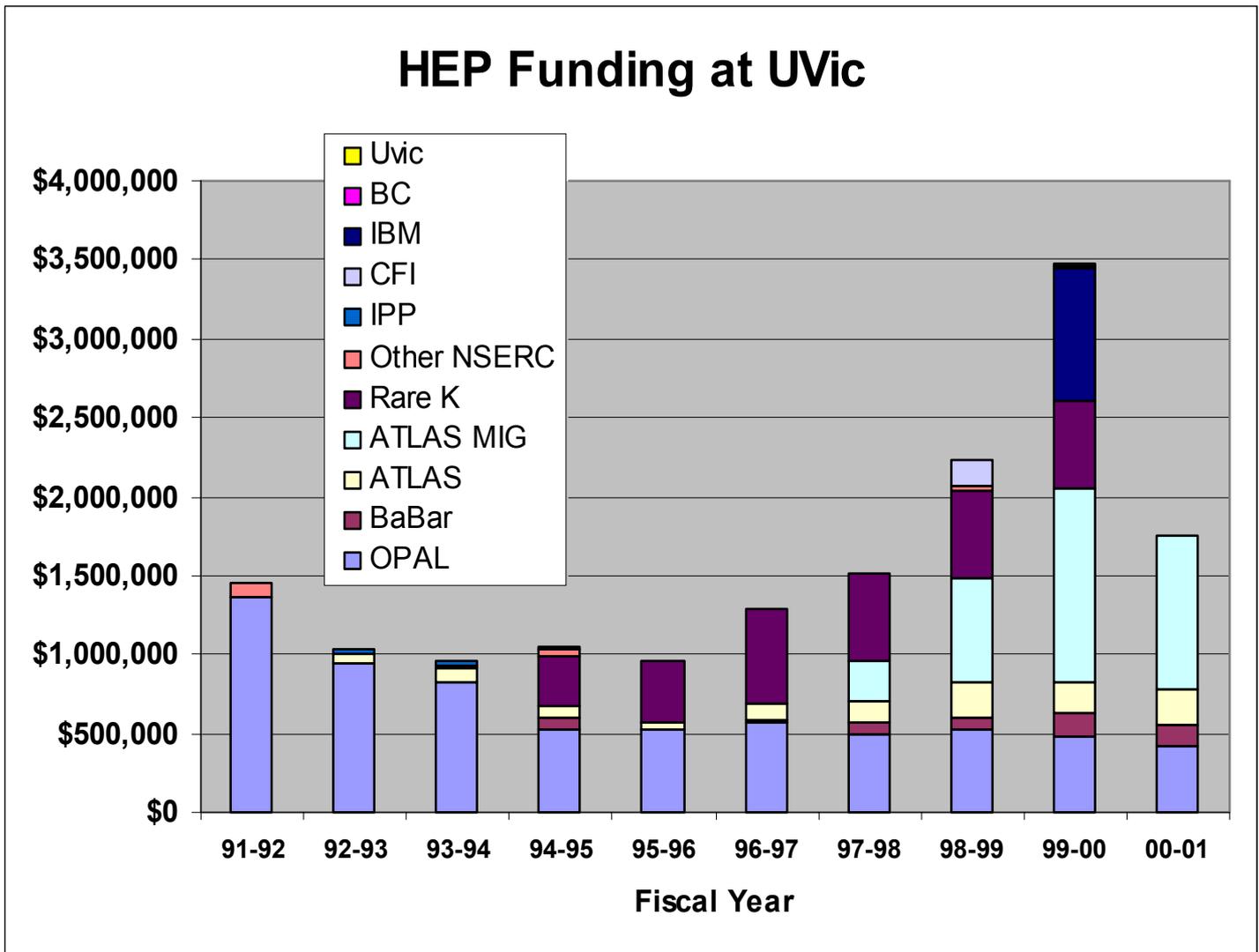
- Graduate Students
 - 12 M.Sc. and 9 Ph.D. degrees awarded since 1990
 - 7 NSERC scholarships
 - Presently 5 Ph.D. and 3 M.Sc. students
 - 2 NSERC scholarships, 1 FCAR
 - Recruitment
 - 3 M.Sc. → 3 Ph.D. starting in Jan 2001 (1 FCAR)
 - 1 M.Sc. coming in 2001
 - actively recruiting
 - Quality
 - Two have won the Governor General's gold medal for best thesis at Victoria
 - One is a faculty member at U. of Alberta
 - PDF's at SLAC, DESY, SNO, Carleton, Michigan

Research Funding

- Research Funding
 - NSERC 2000-2001
 - Operating \$786,000
 - OPAL, BaBar and ATLAS experiments
 - Equipment \$960,000
 - \$4.3M over 7 years (ATLAS Feedthroughs)
 - Industrial
 - \$840,000 (in kind computers from IBM)
 - CFI & BCKDF (Federal & Provincial)
 - Beowulf cluster award \$155,000
 - Physics and Astronomy
 - HPC award \$2.5M
 - University wide

Research Funding

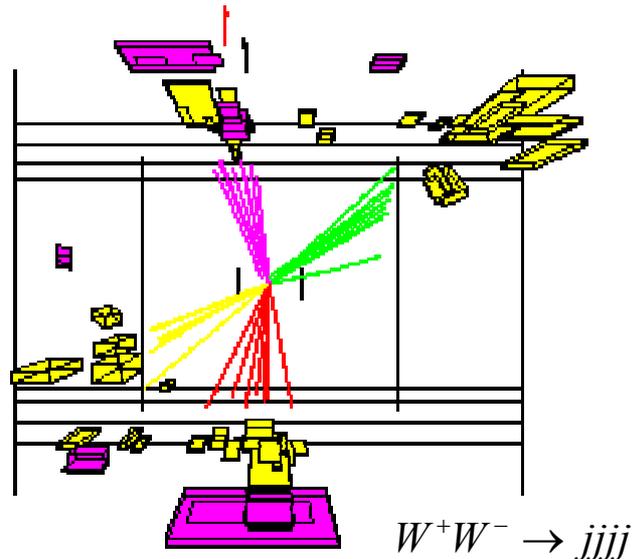
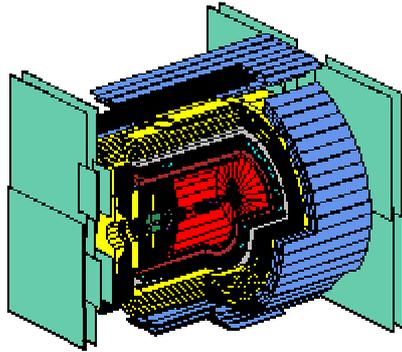
Excellent track record for attracting funding



- Operating ~ \$700k - \$800k per year
- ATLAS MIG is \$4.3M over 7 years
- Rare K has left (Bryman)
- IBM \$840k grant is for one year only

OPAL

McPherson
Kowalewski
Keeler
Roney
Sobie



Large Detector at the LEP electron-positron Collider at CERN

- Searching for the Higgs and physics beyond the Standard Model
- Collect and analyze W pair data from LEP2
 - Triple Gauge Couplings (substructure)
 - W -tau coupling
- Analyze precision data from LEP1 (5M events)
 - tau polarization, tau decay branching ratios
 - UVic hosted the 6th Tau Lepton Physics Conference (18-21 Sep 2000)

BaBar

Kowalewski
Roney

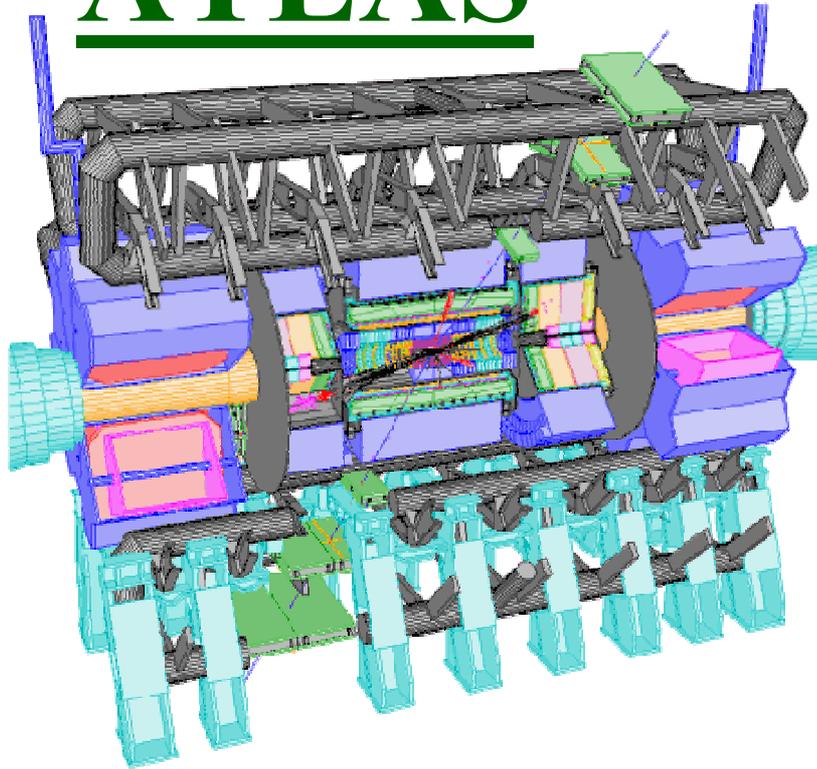


Detector for the PEP-II B Factory at SLAC

- CP Violation in the B system and Precision Measurement
 - CP asymmetry in B meson decays
 - quark mixing (CKM)
 - tau electroweak physics

ATLAS

Lefebvre
Keeler
Sobie
Birney
Hodges
Langstaff



MultiPurpose Detector for the Large Hadron Collider at CERN

- Proton-proton collisions at the energy frontier
 - Understand Electroweak Symmetry Breaking and searches for the Higgs Boson
 - Search for physics beyond the Standard Model (Supersymmetry, compositeness, leptoquarks, technicolour, extra dimensions, new vector bosons, ...)
- Onsite ATLAS Lab

Computing

- Current and future HEP experiments face real challenges in computing
 - large data sets (ATLAS > 1 Pbyte/year !)
 - OO technology
 - large international collaborations
- which require
 - large data store
 - distributed data and processing
 - fast links
 - coordination!

Computing

- Computing Infrastructure and Initiatives
 - Local HEP computers migrating to linux
 - All groups share the computing support costs
 - MUSE (CFI funded 40 node linux PC cluster with 750 Gbytes of disk for HEP)
 - Only Canadian site importing BaBar data
 - We hire a computer science professional to run
 - MUSE
 - 9 HPUNIX stations
 - 6 linux stations
 - 16 NT stations, 2 Windows 95/98 stations
 - IBM Grant \$840k
 - Strong involvement in ATLAS-Canada computing design and planning HPC award
- University wide
 - HPC Award \$2.5M
 - CFI Data Storage Facility request

Infrastructure

- TRIUMF, National Laboratory supporting accelerator based research
 - Victoria is one of the founding universities
 - Target Design Group located at Victoria
 - Provides Engineering Support for particle physics
 - SLD Calorimeter
 - ATLAS Endcap Hadronic Calorimeter and Feedthroughs Engineering Support
 - Hodges (TRIUMF Engineer)
 - Replacement position advertised
 - Langstaff (TRIUMF Senior Designer)
 - Lenckowski (TRIUMF Junior Designer)
 - Birney (TRIUMF Senior Technologist)
 - Walsh (TRIUMF Admin Assistant)
- Department
 - Machine shop
 - Electronics shop
 - Lab space
- Science Faculty
 - Glass shop & stores

Particle Physics Group

Future Plans and Goals

- Pursue the most exciting questions in particle physics
- Maintain a strong and balanced research program
 - data analysis (OPAL, BaBar)
 - data taking (*OPAL*, BaBar)
 - detector construction (BaBar, ATLAS)
 - phenomenological studies (ATLAS)
 - software development and maintenance
 - computing for HEP, and in particular ATLAS
- Attract and train graduate students and Research Associates
- Strengthen our group
 - Theorist faculty position search in progress
 - Fill the Pearce Chair (held previously by A. Astbury)
 - Replace Bryman and Honma
 - CRC Junior Chair request sent to Dean

OPAL

Leadership

- Physics Co-ordinator Elect (2001)
 - (2001) McPherson
- Searches Working Group Convenor
 - (1997-) McPherson
- Tau Physics Coordinator
 - (1998-) Sobie
 - (1991 - 95) Roney
- OPAL B Physics Coordinator
 - (1991-1995) Kowalewski

Responsibilities

- Online Data Reconstruction
 - The Victoria group designed and built a large computer cluster that has reconstructed every OPAL event within an hour of it being collected
 - It runs year round doing reprocessing
 - It will stop by mid 2001
- Run Coordination (McPherson)
- Zed Chamber Detector Coordination (McPherson)
- Zed Chamber DAQ maintenance (McPherson)

OPAL

Training

- Research Associates located at CERN
 - Long, Sbarra, (Smith, Deatrich)
- Graduate Students
 - Degrees Awarded (1991-): 5 M.Sc and 6 Ph.D.
 - In progress: 4 Ph.D.
- Undergraduate Students

BaBar

Leadership

- Member of BaBar Executive Board
 - (1998-) Roney
- Chair of BaBar Computing Coordination Board
 - (2000) Kowalewski

Responsibilities

- Hardware
 - Drift chamber QA/QC, maintenance, controls
- Software
 - Track reconstruction, Beowulf cluster
- Analysis
 - Lepton ID tools, lepton universality from tau
 - V_{ub} measurement, charmless B decays

Training

- Research Associates
 - (Desilva, Kaufmann)
- Graduate Students
 - Degrees in progress: 2 M.Sc., → 3 to start Ph.D. in 2000
- Undergraduate Students

Leadership

ATLAS

- LAr DataBase Coordinator
 - (2000-) Sobie
- Member of the ATLAS National Computing Board
 - (1999-) Sobie
- Advisory Committee to the Collaboration Board
 - (1998-99) Lefebvre
- ATLAS-Canada Co-Spokesperson
 - (1998-99) Keeler
- HEC Chief Engineer
 - (1996-2000) Hodges
- Endcap Signal Feedthrough Project Leader
- LAr Cryostat and Cryogenics Steering Committee
- LAr Hadronic Endcap Beam Test Software Coordinator
 - (1997-) Lefebvre

Responsibilities and Activities

- Hardware
 - Endcap Signal Feedthroughs (Uvic/TRIUMF)
 - HEC mechanical design (Uvic/TRIUMF)
- Software
 - Computing for ATLAS-Canada
 - Prototype OO LAr reconstruction code
 - HEC beam test software
- Analysis
 - Single top (O'Neil)
 - Triple Gauge Boson and NLO Generators (Dobbs)
 - HEC beam tests (O'Neil, Fortin)

ATLAS

Training

- **Research Associates**

- Fincke, Poffenberger, Sbarra (with OPAL and TRIUMF)
- One new RA in 2001

- **Graduate Students**

- Degrees Awarded: 3 M.Sc. and 1 Ph.D.
- In progress: 1 M.Sc. and 1 Ph.D.

- **Technologists (supervisor: Birney)**

- Dowling, Vowles

- **Undergraduate Students**

Particle Physics

Ph.D. Theses since 1990

- I. Lawson, “Neutral Kaon Production from One-Prong Tau Decays”, 2000. (Sobie, Keeler)
- D. O’Neil, “Performance of the ATLAS Hadronic Endcap Calorimeter and The Physics of Electroweak Top Quark Production at ATLAS”, 1999. (Lefebvre)
- S. Robertson, “A Measurement of the Tau Electronic Branching Ratio”, 1998. (Sobie, Keeler)
- S. Richardson, “A Study of Some Rare Radiative Meson Decays”, 1997. (Picciotto)
- M. Rosvick, “Measurement of the Neutral Current in the Standard Model Using the Tau Polarization Asymmetries Determined from the Decay $\tau^- \rightarrow \rho^- \nu_\tau$ ”, 1995. (Keeler)
- P. Schenk, “A Measurement of the Partial Width of the Z^0 Boson into b Quarks and the Forward-Backward Asymmetry in the Reaction $e^+e^- \rightarrow Z^0 \rightarrow b\bar{b}$, Using Inclusive Electrons”, 1992. (Astbury)
- J. Steuerer, “Measurement of the Product Branching Ratio $f(b \rightarrow \Lambda_b) \cdot BR(\Lambda_b \rightarrow \Lambda l \bar{\nu} X)$ ”, 1995. (Astbury)
- M. Vinciter, “A Precision Measurement of the Ratio of the Effective Vector to Axial-Vector Couplings of the Weak Neutral Current at the Z^0 Pole”, 1996. (Keeler)
- J. White, “Testing Lepton Universality using One-Prong Hadronic Tau Decays”, 1998. (Sobie, Lefebvre)