Particle Physics Group

Introduction

- Faculty and Researchers
- Research directions
  - Overview
  - OPAL, ATLAS, BaBar
- Infrastructure
- Future plans and Goals

Personnel

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

Faculty

- R. Keeler (83) PhD UBC 81
  - Electroweak physics (UA1, OPAL , ATLAS)
  - Director (elect 2001) IPP (Institute of Particle Physics)
  - Chair Subatomic Physics GSC (2000-2001)
- R. Kowalewski (97) PhD Cornell 88
  - B physics, particle lifetimes, reconstruction software (OPAL, BaBar, *ATLAS*)
- 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 physics (OPAL, BaBar, *ATLAS*)
- A. Astbury (83) PhD Liverpool 61
  - FRS, FRCS
  - Director of TRIUMF (1994-2001)

Particle Physics Group

Adjunct Faculty

- IPP
  - R. McPherson (97) PhD Princeton 95
    - Nonstandard Model (BNL-E787, OPAL, *ATLAS*)
    - OPAL NonSM Searches coordinator
    - OPAL Physics coordinator (2001-2002)
  - Sobie (92) PhD Toronto
    - OPAL Tau physics coordinator (1998-)
    - Spokesman for Victoria HPSS CFI request $12M
    - Holds IBM SUR Grant ($820,000)
- TRIUMF
  - Bryman (Jan 2000 Warren Chair UBC)
  - Honma (March 1998, CERN Faculty)
  - We expect to replace Bryman and Honma over the next two years.

IPP

- Institute of Particle Physics of Canada
  - Coordinates and promotes particle physics in Canada
  - 12 Universities, 150 individuals
  - Seven Scientists supported through national funding agency
  - Maximum of two per university
    - Scientists choose their location
    - McPherson - being reviewed for IPP tenure
    - Sobie - Senior IPP Scientist
  - Previous IPP scientists at Victoria
    - J. McKenna (Faculty UBC)
    - M. Roney
  - Director Elect (2001-2006) Keeler

Citations

Renowned Papers

SPIRES: Cited 733 times Astbury, Keeler
G. Arnison et al., EXPERIMENTAL OBSERVATION OF LEPTON PAIRS OF INVARIANT MASS AROUND 95-GEV/C**2 AT THE CERN SPS COLLIDER. Phys.Lett.B126:398-410,1983.

SPIRES: Cited 750 times Astbury, Keeler
G. Arnison et al., EXPERIMENTAL OBSERVATION OF ISOLATED LARGE TRANSVERSE ENERGY ELECTRONS WITH ASSOCIATED MISSING ENERGY AT S**(1/2) = 540-GEV. Phys.Lett.B122:103-116, 1983. Moriond: Hadronic 1983:611 (QCD161:R34:1983,V.1)

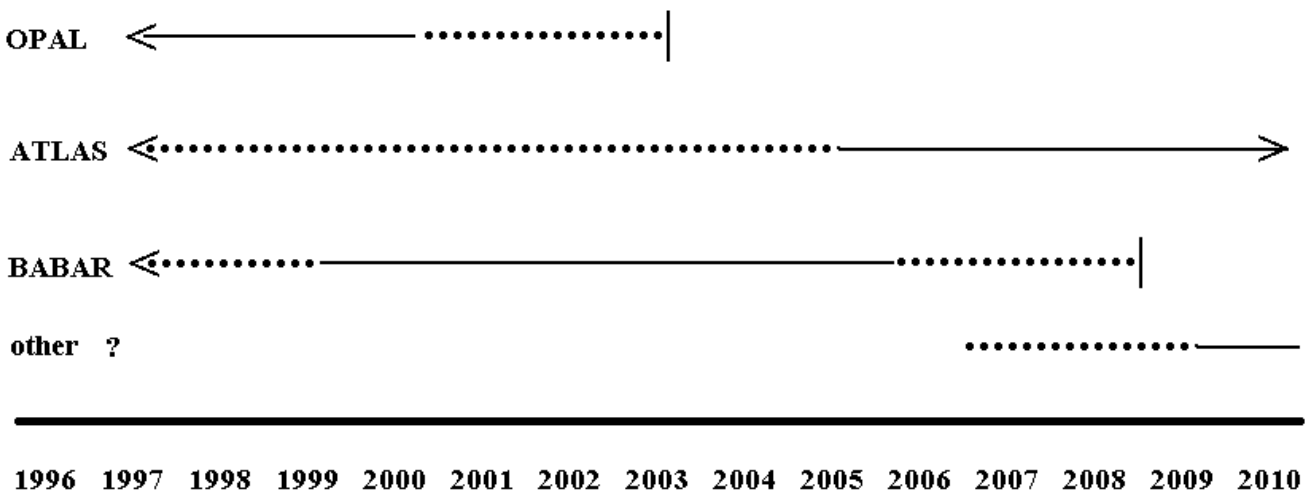
SPIRES: Cited 107 times Kowalewski, Roney
M.Z. Akrawy et al., SEARCH FOR THE MINIMAL STANDARD MODEL HIGGS BOSON IN E+ E- COLLISIONS AT LEP. Phys.Lett.B253:511-523,1991.

SPIRES: Cited 228 times Kowalewski, Roney
G. Alexander et al., MEASUREMENT OF THE Z0 LINE SHAPE PARAMETERS AND THE ELECTROWEAK COUPLINGS OF CHARGED LEPTONS. Z.Phys.C52:175-208,1991.

Research Overview

Experimental Program

Time Line



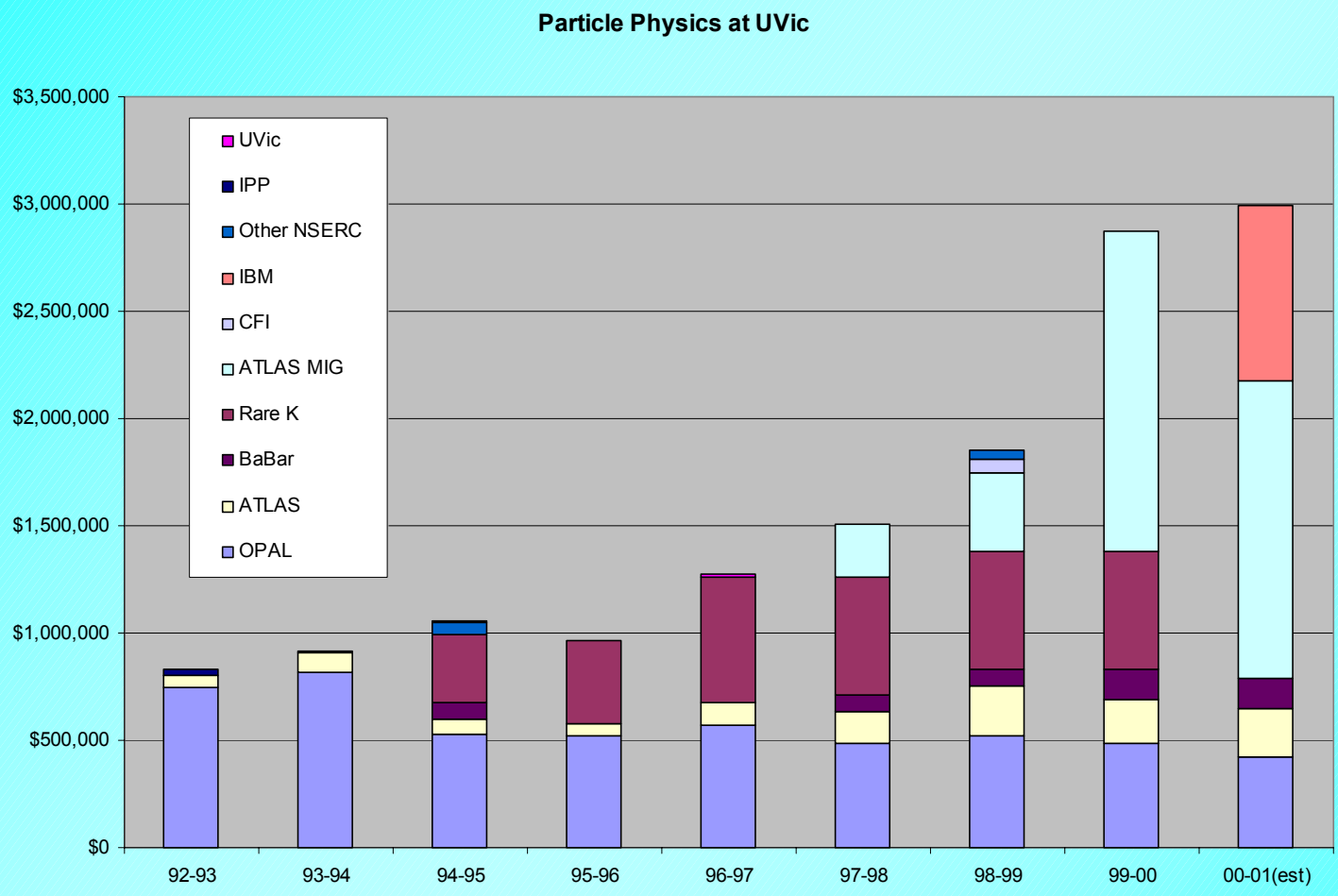
- OPAL is completing data taking this year
  - Analysis will continue
- Babar has just started data taking and will continue for several years
- ATLAS is under construction
  - First beam in ~2005
- New physics - Next Linear Collider, Neutrino physics

Research Overview

- Research Funding
  - NSERC 1999/2000
    - Operating $728,970
      - OPAL, BaBar and ATLAS experiments
    - Equipment $1.4M
      - 4.3M$ over 7 years (ATLAS Feedthroughs)
  - Industrial $820,000 (in kind computers from IBM)
  - CFI & BCKDF (Federal & Provincial)
    - Beowulf cluster award $155,000
      - Physics and Astronomy
    - HPC award $2.5M
      - University wide
    - HPSS Request 12M$

Research Funding

Excellent track record for attracting funding



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

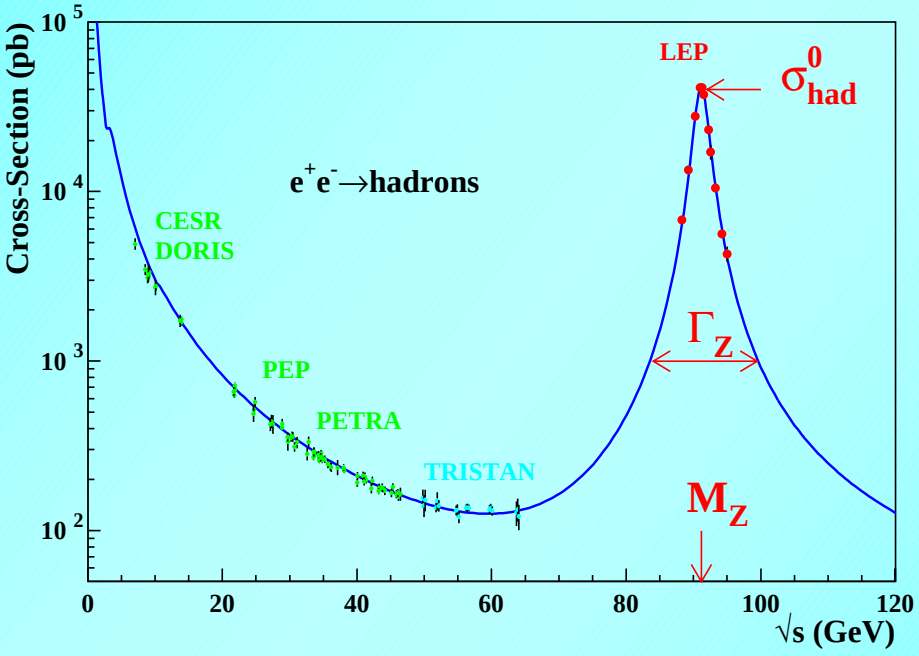
Research Overview

- Graduate students
  - 10 MSc and 7 PhD degrees awarded over last 10 years
    - NSERC scholarships 7
  - Presently 6 PhD and 3 MSc students (one PhD graduated 2 weeks ago)
    - NSERC scholarships 2, FCAR 1
  - Recruitment
    - 1 MSc coming
    - 2 MSc in negotiation
  - Quality
    - Two have won the Governor General's gold medal for best thesis at Victoria
    - One is a faculty member at U. Alberta
    - PDF's at SLAC, DESY, SNO, Carleton, Michigan

Research Program

OPAL

McPherson
Kowalewski
Keeler
Roney
Sobie



Large Detector at the LEP electron-positron Collider at CERN

- 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

OPAL Research

Leadership

Physics Co-ordinator Elect (2001) - McPherson

Tau Physics Coordinator -

(1998-) Sobie

(1991 - 95) Roney

OPAL B Physics Coordinator

(1991-1995) Kowalewski

Responsibilities

- Online Data Reconstruction
- 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

Research Associates (located at CERN)

Gordon Long (Photons + E-missing)

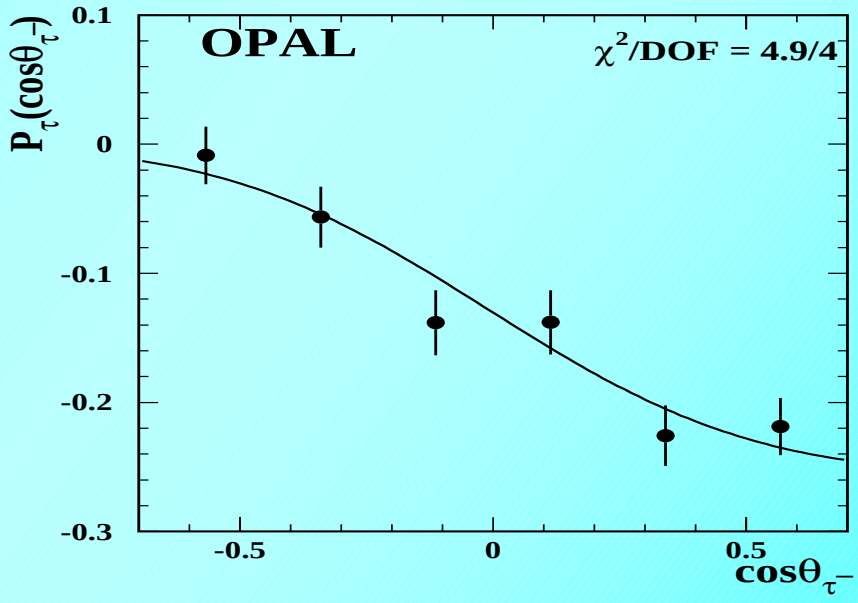
Carla Sbarra (Triple Gauge Couplings)

T. Smith (now CERN staff)

D. Deatrich (EPFL Lausanne)

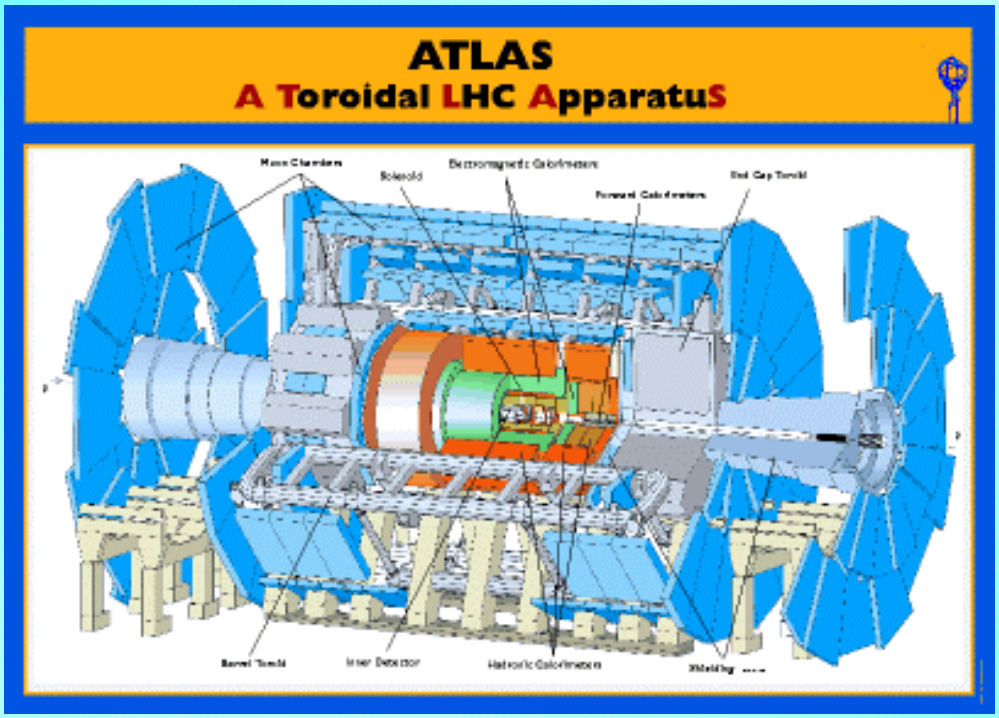
OPAL Research

- Graduate Students (1991-)
  - Degrees Awarded : 5 MSc 6 PhD
  - Bailey PhD - Triple gauge couplings
  - Graham PhD - $\sin^2(\theta_W)$ (tau polarization)
  - Stumpf PhD - Tau lepton universality
    - At CERN running shifts (1month)
  - Vachon PhD - Excited Leptons
    - At CERN - ONLINE Reconstruction (18 months)
- Undergraduate students ~1-2 per year



ATLAS

ATLAS
Lefebvre
Keeler
Sobie
Birney
Hodges
Langstaff



- Proton-proton collisions at the energy frontier
  - Understand Electroweak Symmetry Breaking
  - Search for Supersymmetry
  - General Purpose Detector

ATLAS Research

Responsibilities & Activities

- Endcap Cryogenic Feedthrough
  - Onsite - will visit.
  - 4.3M$ project
  - Mechanical design & finite element analysis - EC & Barrel (T. Hodges, R. Langstaff)
  - Established electrical requirements and tests (Fincke,Poffenberger)
  - Prototype completed - Production to start in May
- Endcap Hadronic Calorimeter
  - TRIUMF project -mechanical design (Hodges, Langstaff)
  - Test beam software - Lefebvre
- Computing for ATLAS Canada
  - National Computing Board - Sobie
  - Prototype OO reconstruction code

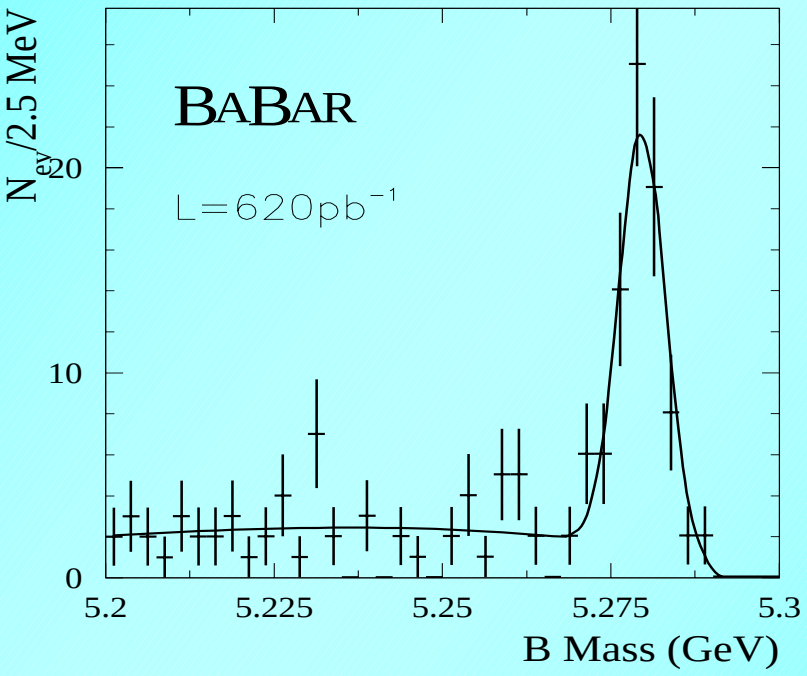
Assembly of a feedthrough model

ATLAS RESEARCH

- Research Associates
  - M. Fincke (FT stripline design)
  - P. Poffenberger (Production manager)
- Technologists (Birney - Supervisor)
  - A. Dowling, G, Vowles
- Graduate Students
  - Degrees awarded 3 MSc 1 PhD
  - M. Dobbs - PhD Triple Gauge Couplings at ATLAS
  - D. Fortin - MSc Endcap hadron calorimeter beam tests (finish summer)
  - V. Singh - MSc (start in Sept.)
- Undergraduates
  - 5 so far and 2 starting in May

BaBar

BaBar
Kowalewski
Roney



CP Violation at SLAC

- Precision Measurements
  - b-quark CP asymmetry
  - quark mixing (CKM)
  - tau electroweak physics

Leadership

- Member BaBar executive board - Roney 1998-
- Chair BaBar computing coordination board Kowalewski (2000)

BaBar Research

Responsibilities & Activities

- Detector
  - Provided QC/QA during drift chamber construction - continuing responsibility for maintenance and slow controls
- Software
  - Track reconstruction: bunch t0, decay-in-flight, kink-finding
  - Beowulf - designed & built cluster for BaBar Canada data analysis - Rensing
- Analysis
  - Lepton ID tools
  - Lepton universality from tau decays
  - Vub measurement
  - Charmless B-decays

BaBar Research

- Research Associates
  - Boudinov (starting May 1)
  - Desilva (now BaBar software professional)
  - Kaufmann (now in industry)
- Graduate Students
  - C. Brown - MSc Lepton Universality (will do a PhD)
  - P. Jackson - MSc Track kink reconstruction (will do a PhD)
  - D. Fortin - will start a PhD in Sept.
- Undergraduates
  - 4 to date, 1 starting in May

Infrastructure

- TRIUMF
- Department
  - Machine shop
  - Electronics shop
- Science Faculty
  - Glass shop & stores (detector R&D)

TRIUMF

- National Laboratory supporting accelerator based research
  - Victoria was one of the founding universities
- "Target design group" is located at Victoria
  - Provides Engineering Support for particle physics
    - SLD Calorimeter
    - ATLAS Endcap Hadronic Calorimeter and Feedthroughs Engineering Support
  - Hodges (TRIUMF Engineer)
    - Langstaff (TRIUMF Senior Designer)
    - Lenckowski (TRIUMF Junior Designer)
    - Birney (TRIUMF Senior Technologist)
    - Walsh (TRIUMF Admin Assistant

Particle Physics Group Goals

- Replace Pearce Chair
- Hire Particle Theorist or Phenomenologist
- Strengthen group
  - Junior faculty
  - Group size ~6 experimentalists & 2 theorists for critical mass
- Maintain and Improve infrastructure
  - Replace TRIUMF Scientists & Engineers
  - Maintain Machine Shop
  - Maintain Electronics Shop