Particle Physics
Department of Physics and Astronomy

Visit of TRIUMF Director
Dr Alan Shotter
24 October 2001

Agenda

- introductions
- overview
- TRIUMF and Victoria
- present engineering activities
- computing
- tour of laboratories
  - MUSE computer cluster
  - TRIUMF Lab
  - ATLAS cryogenics signal feedthrough production

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Overview

- the particle physics group at the University of Victoria
  - the IPP and TRIUMF connections
- research overview
  - OPAL, ATLAS, BaBar, Computing
  - funding
  - training of highly qualified personnel
- particle physics group goals and future plans

The Particle Physics Group at UVic

Goals and accomplishments

- particle physics is a major focus of the department
- internationally recognized group
  - responsible for major components of international projects
  - the University of Victoria is a well known name in particle physics
  - diverse, talented, at or above critical mass for large impact
    - 31 researchers (faculty, fellows, associates, students, technologists) from 9 countries
    - research activities include extensive period spent at world class laboratories abroad (Geneva, Stanford)

The Particle Physics Group at UVic

Internationally recognized research group

- faculty
  - experimentalists: Keeler, Kowalewski, Lefebvre, Roney, Astbury (emeritus)
  - theorists: Picciotto, and new faculty to join in 2002
- Institute of Particle Physics fellows
  - McPherson (at CERN), Sobie
- onsite TRIUMF staff
  - Birney, Charron, A.S. Dowling, Langstaff (at CERN), Lenckowski
- research associates
  - Agarwal, Banerjee (at SLAC), Fincke, Kanaya, Poffenberger
- graduate students
  - Ph.D.: Bailey, Brown, Dobbs, Fortin, Jackson, Sanderson, Stumpf, Vachon
  - M.Sc.: Soundararajan, Yun
- computer support professional
  - van Uytven (B.Sc. Computer Science)
- technologists
  - A.W. Dowling, Holness, Vowles

The Particle Physics Group at UVic

Faculty

- R. Keeler (83) Ph.D. UBC 81
  - Electroweak physics (UA1, OPAL , ATLAS)
  - Director of IPP (Institute of Particle Physics), Chair Subatomic Physics GSC (2000-01)
- R. Kowalewski (97) Ph.D. Cornell 88
  - B physics, particle lifetimes, reconstruction software (OPAL, BaBar, ATLAS)
- M. Lefebvre (91) Ph.D. Cambridge 89
  - Electroweak physics, Calorimetry (UA2, RD3, ATLAS)
  - Founded ATLAS Canada, ATLAS Collaboration Board
- C. Picciotto (68) Ph.D. UC-Santa Barbara 68
  - Weak Decay Theory
  - Department Chair, Secretary-Treasurer of IPP
- M. Roney (96) Ph.D. Carleton 89
  - Electroweak, drift chambers and B & tau physics (OPAL, BaBar, ATLAS)
  - BaBar Executive board (1998-2001), BaBar tau Physics Coordinator (2001-)
- A. Astbury (83) (emeritus) Ph.D. Liverpool 61
  - FRS, FRSC, Pearce Chair (1983-2000)
  - Director of TRIUMF (1994-2001), Director of IPP (1989-1994)
  - Co-Spokesperson of UA1 (1978-83), Nobel Prize winning experiment

The Particle Physics Group at UVic

Institute of Particle Physics of Canada

- coordinates and promotes particle physics in Canada
  - 12 Universities, 150 scientists
- seven permanent scientists; two chose Victoria:
  - R. McPherson (97) Ph.D. Princeton 95
    - new and rare processes (BNL-E787, OPAL, ATLAS)
    - OPAL physics coordinator (2001-2002)
  - R. Sobie (92) Ph.D. Toronto 85
    - OPAL tau physics coordinator (1998-)
    - spokesman for Victoria computer storage CFI request
    - IBM SUR grant 1999 ($840,000)
    - Canadian representative on the ATLAS National Computing Board
- director (2001-2006): R. Keeler

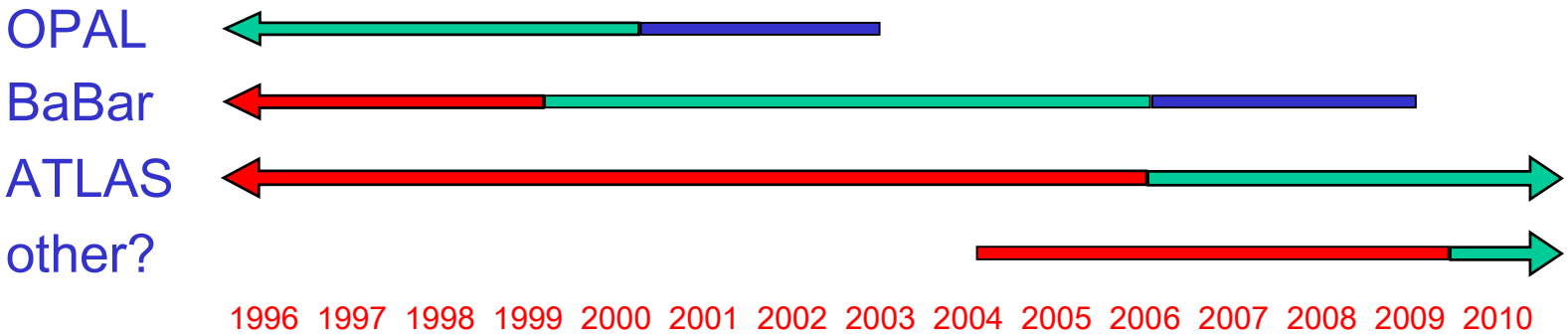
The Particle Physics Group at UVic

TRIUMF

- Victoria is one of the four founding universities
- a TRIUMF design group is located at Victoria
  - targets and beam dumps for TRIUMF
  - provides engineering & infrastructure support for particle physics
  - extremely successful mode of operation
- more in R. Keeler and A. Dowling's talks

Research Overview

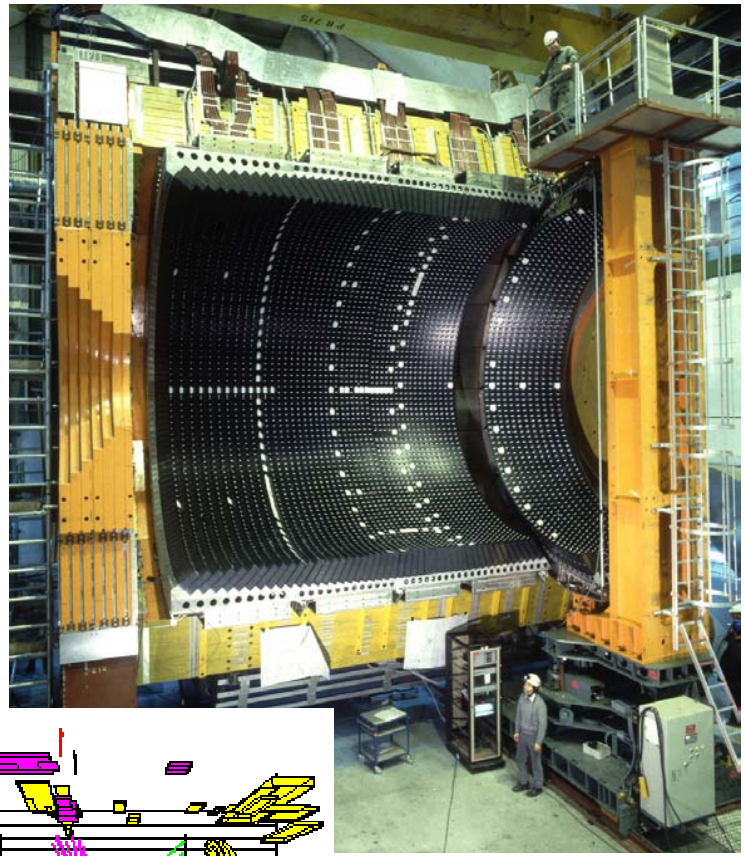
- three large projects
  - OPAL (CERN) has recently completed data taking
    - final data analysis and interpretation
  - BaBar (SLAC) started data taking in 1999
    - will continue for several years
  - ATLAS (CERN) is under construction
    - first beam for physics expected in 2006

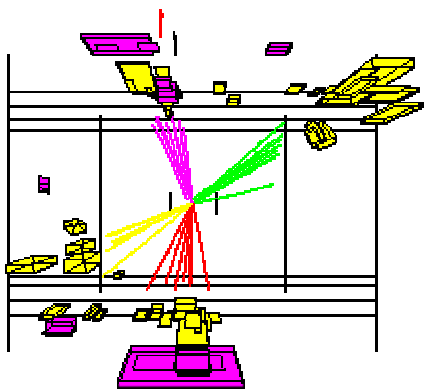


- interests beyond ATLAS
  - Next Linear Collider
  - neutrino physics (workshop with strong international content organized by Keeler, Kowalewski, Astbury; Dunsmuir Lodge, November 2001)

McPherson
Kowalewski
Keeler
Roney
Sobie

Research Overview: OPAL



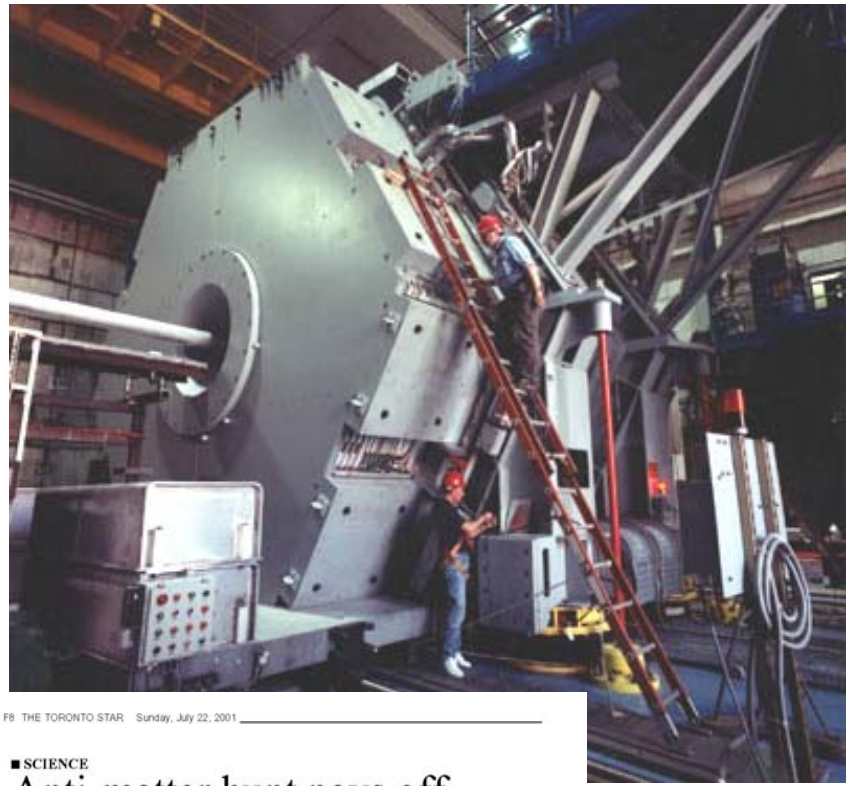


350 people
20 institutions
10 countries

- large detector at the LEP electron-positron collider at CERN, Geneva
- data collection ended Nov 2000
- UVic group concentrates on precision measurements of the electroweak force
  - analyze Z and W pair data
    - recognized tau lepton experts
  - two of the world's most precise electroweak measurements recently completed in UVic
- UVic built and operated a major computer center at CERN for the whole collaboration
- UVic hosted the international tau 2000 conference, held in Victoria

Kowalewski
Roney

Research Overview: BaBar



F8 THE TORONTO STAR Sunday, July 22, 2001

■ SCIENCE

Anti-matter hunt pays off

Canadian physicists find evidence nature really is lopsided in certain processes

By Peter Calamai
SCIENCE REPORTER

WHENEVER Star Trek needed a dramatic crisis, the show knew they could count on anti-matter.

Anti-matter fuelled the warp drive that propelled those starships. It was dangerous stuff. Just a small glitch in the containment field and, kaboom, goodbye Enterprise or Voyageur and all who sailed in her.

And that's what most people know about anti-matter: Its tricky but strictly science-fiction stuff.

An elite group of Canadian

REALLY WIRED: A scientist at TRIUMF, Canada's national laboratory for particle and nuclear physics in Vancouver, replaced 19 of the 29,000 wires in the Canadian-built detector used to probe the nature of anti-matter.

pher Hearty, a research scientist with the Institute of Particle Physics at the University of British Columbia.

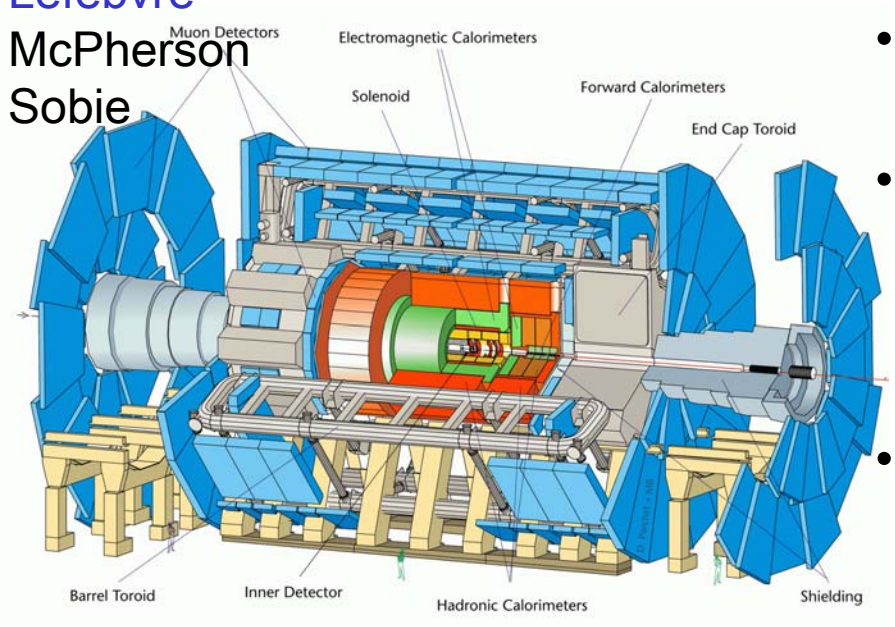
University of Montreal and McGill University. The combined price tag for the detector and what's called the B factory

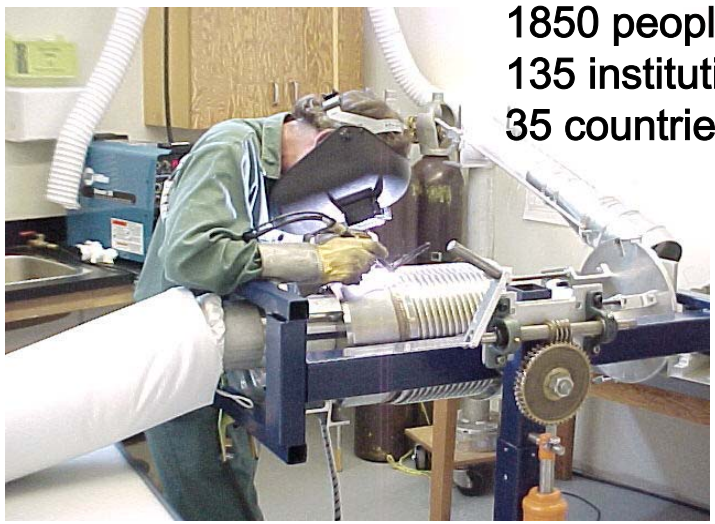
554 people
72 institutions
9 countries

- BaBar detector at the PEP II B-factory at the Stanford Linear Accelerator
- measure fundamental symmetries
- precision measurements of charge-parity violation in nature
  - b-quark charge-parity asymmetry
  - quark mixing
  - tau electroweak physics
- a large component of the detector (the drift chamber) was assembled at TRIUMF
- UVic is the only Canadian group contributing to the production of computer simulated events

Astbury
Keeler
Lefebvre
McPherson
Sobie

Research Overview: ATLAS





1850 people
135 institutions
35 countries

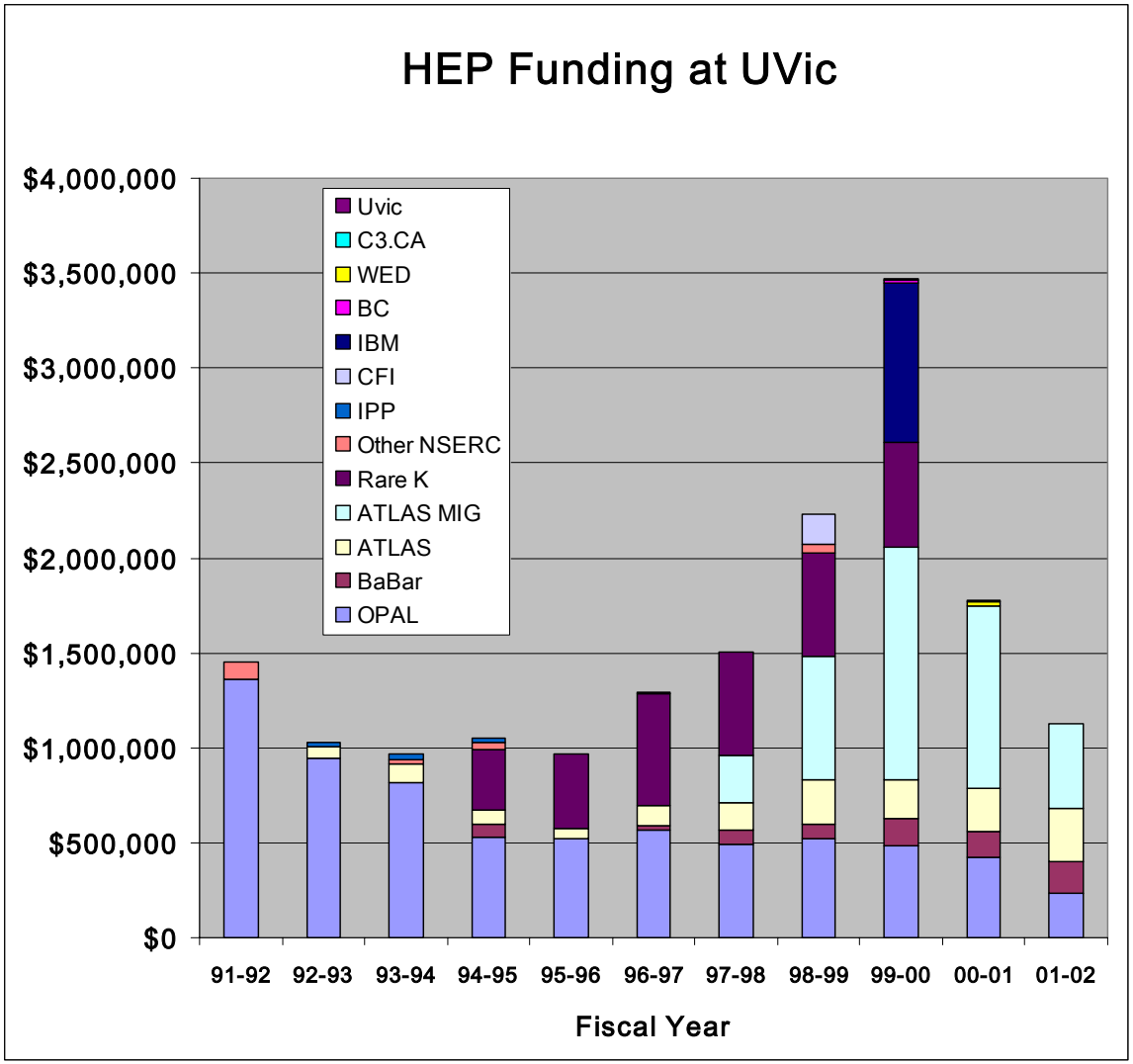
- multi-purpose detector for the Large Hadron Collider at CERN
- proton-proton collision at the energy frontier
  - study the origin of mass
  - search for new physics
- cryogenics components under construction at UVic, essential to the success of the $450M experiment
  - $4.28M of Major Installation Grant for the endcap signal feedthroughs
  - first units sent to CERN in Sep 2001
- intense software activities
  - beam test software
  - object oriented code development
  - object database

Astbury
Keeler
Kowalewski
Lefebvre
McPherson
Roney
Sobie

Research Overview: Computing

- Current and future HEP experiments face real challenges in computing
  - ATLAS data sets > 1,000,000 Gbytes/year!
- Victoria benefits from important computing infrastructure
- CFI initiatives
- GRID activities
- more in R. Sobie's talk

Research Overview: Funding



Excellent track record for attracting funding

- operating
  - about $750k per year
  - ATLAS and BaBar level increasing
- ATLAS MIG
  - $4.28M over 7 years
- IBM grant
  - February 2000
- CFI grant
  - MUSE computer cluster
- Rare K decays
  - Bryman now Warren Chair at UBC

Research Overview

training of highly qualified personnel: graduate students

- 18 M.Sc. and 14 Ph.D. degrees awarded since 1990
  - many NSERC and FCAR (Québec) scholarships
- Presently 8 Ph.D. and 2 M.Sc. students
  - 2 NSERC and 1 FCAR scholarships
- Recruitment
  - 2 M.Sc. to start in 2002
  - actively recruiting
- Quality
  - two have won the Governor General's gold medal for best Ph.D. thesis at Victoria
  - one is a faculty member at the University of Alberta
  - PDF's at SLAC, DESY, SNO, Carleton, Michigan
  - many international conference contributions and publications
  - spend at least a year in Geneva or Stanford working on experiment

Research Overview

training of highly qualified personnel

- Our group's research activities provides unique training opportunities for professional and technical staff:
  - research associates
    - critical and independent thinking
    - perform in large international collaborations, in most cases spending a year in Geneva or Stanford
    - data analysis and computing skills
  - engineers, designer, technologists
    - very challenging projects
    - mechanical and electronic design and construction
  - computer support professionals
    - leading edge computing with international scientific and industrial collaboration

Summary and Particle Physics Group Goals

- strong group in particle physics
- excellent research programme, internationally recognized
  - data analysis of world's highest energy electron-positron collisions with the OPAL detector
  - detailed study of fundamental symmetries with the BaBar detector
  - detector construction for ATLAS - a detector for physics at the high-energy frontier
  - provides unique training
- actively recruit graduate students
  - provide world class opportunities
- fill Pearce Chair
- lead the Canadian contribution to the next large particle physics projects
  - TRIUMF is essential