PROTON - ANTIPROTON COLLISIONS @ SPPBARS

1981 - 1990

UA2 & UA6 EXPERIMENTS

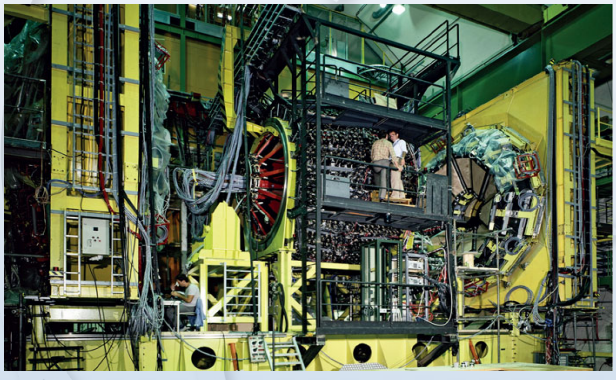
ANS / JAHRE / ANNI CERN

60 YEARS OF SWISS SCIENCE AT CERN

SPPBARS – THE SPS CONVERTED IN A PROTON-ANTIPROTON COLLIDER

In order to study **STRONG** and **ELECTROWEAK** interactions for the first time in the energy domain around 100 GeV, the SPS was converted in a tricky way into a **proton-antiproton collider** in the 1980s. The injection of stochastically cooled antiprotons into the SPS and their acceleration to 270 GeV opened up the possibility to study proton-antiproton collisions at the centre-of-mass energy of 540 GeV. The primary experimental goal was to search for the massive **Intermediate Vector Bosons W** and **Z** postulated 1967 in the unified electroweak theory.

UA2 - Underground Area 2



UA2 was a custom built setup around the beam pipe. UA2 had electromagnetic and hadronic calorimeters to detect electrons and hadrons, but could not measure particle charges except for limited regions where the W decay asymmetry was maximal. There was no muon detector.

Highlights:

★ 1982: First net *evidence* for high transverse momentum **hadron JETs**, confirming the 2-jet configuration dominance (Fig. 1)

★ 1983: *Discovery* of W^+, W^- (Fig. 2) & Z^0 (Fig. 3)

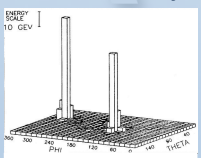


Fig. 1. Lego plot
2-JET production

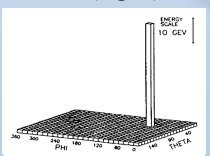


Fig. 2. Lego plot
Decay W → e+ν

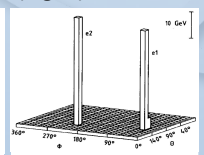


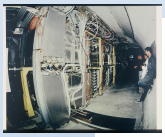
Fig. 3. Lego plot
Decay Z → e+e

UA2 Collaboration
Data taking 1981–1990

Bern – CERN – Copenhagen – Orsay – Pavia – Saclay

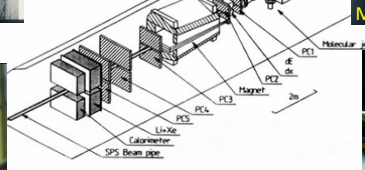
The UA6 experiment

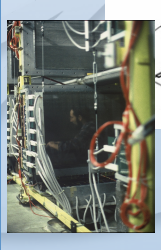
UA6 was a fixed target experiment installed at the SppBarS. A jet of H_2 hydrogen molecules was injected in the SppBarS beam-line causing collisions of H_2 molecules with protons and antiprotons in opposite directions at a centre of mass energy of 24.3 GeV and an instantaneous luminosity of ~10^{31} $cm^{-2}s^{-1}$. The experiment was instrumented with a two-arm magnetic spectrometer equipped with multiwire proportional chambers, an electromagnetic calorimeter, and a transition radiation detector. The Lausanne University group built several MWPCs, contributed to the design and construction of the molecular jet target, and also tested the "transputer" technology to implement the trigger logic.



Calorimeter

Molecular jet





Multiwire
Proportional
Chambers

Front chamber
and beam pipe

Aims:

★ Determination of the cross-section of prompt photon and J/ψ production in pp and pp̄ collisions

★ Determination of the strong coupling constant α_s

UA2 Collaboration
Data taking 1984–1990.

CERN – Lausanne – Michigan – Rockefeller

Swiss Institute of Particle Physics

SPS/CHIPP ANNUAL MEETING 2014

Fribourg, 30 June – 2 July 2014

swiss physical society