RAL DESIGN & DISCOVERY
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RUTHERFORD APPLETON LABORATORY
SCIENCE AND ENGINEERING RESEARCH COUNCIL

INNOVATIVE TECHNOLOGY

The exhibits shown on this display are examples of just a few of the special components made from selected materials needed to satisfy the exacting requirements of Particle Physics Experiments.

The complexity of shapes, also show the various manufacturing techniques which have to be employed to obtain the required accuracy.

A **ELECTROPLATED, VACUUM FORMED PLASTIC**

Electroplated with copper and nickel, 180 of these electronic COVERS were required for the H1 Forward Tracking Detector. The requirement was to provide protection from, physical damage, dust and radio frequency interference whilst being transparent to Nuclear Particles. The material had to be flame retardent and easily formable. NYLON XY7 was chosen.

B **PLASTIC EXTRUSIONS**

A rigid, strong and good impact resistant material with low mould shrinkage, excellent thermal dimensional stability and flame retardency was required for the OPAL experiment. NORYAL (a modified Polyphenylene Oxide) was chosen. A section (of the 15 kilometres needed) of the gas jacket and detector profile are shown.

C **DIAMOND LAPPED CERAMIC**

The requirement was for high precision components of very low coefficient of friction, low thermal expansion, and excellent dimensional stability at low temperature, lead to the use of FUSED ALUMINA components for the Stanford Linear Detector (SLD).

D **BERYLLIUM COPPER**

60 of these springs were required for the SLD experiment as part of the signal readout connector. A material capable of being pressed, formed and heat treated to high strength, possessing good electrical properties, uniformity of mechanical properties at room and low temperature, Beryllium Copper fulfilled this requirement.

E **ALUMINIUM ALLOY**

This material was chosen for the prototype support structure for the same SLD experiment. With correct stress relieving this alloy gives a very stable finished component after being spark eroded to produce complex patterns, with good dimensional accuracy.

F **BERYLLIUM**

BERYLLIUM possesses low radiation length and therefore is virtually transparent to nuclear particles. Although a relatively expensive and toxic material, its use is growing as manufacturing techniques improve. Its other advantages are high flexual modulus, high strength, excellent dimensional recovery after thermal cycling and good thermal conductivity. This sample is the main support for the SLD vertex detector.

G **PLASTIC MOULDINGS**

Noryl plastic feedthroughs. Prototypes were machined at RAL by CAD/CAM and production items were injection moulded which maintained a hole positional accuracy of 25 micron. 1500 pairs of left and right hand were used to accurately position the sense wire in the H1 Planar detector.

H **ALUMINIUM EXTRUSION**

The ability to extrude this high strength alloy to precise dimensional tolerances and maintain these, over long production runs, made this the ideal material for the ALPHA experiment - 30 kilometres were used in this detector.

I **STAINLESS STEEL MESH**

Made from polished, non magnetic 25 micron diameter stainless steel wire. This mesh was woven to 100 wires per centimetre and used to produce cathode planes in multiwire proportional counters.

J **TUNGSTEN WIRES**

160 wires, 10 micron in dia and gold plated have been used to produce this anode plane of a counter. Each wire is positioned to a tolerance of 5 micron and tensioned to 10 grams.

The outer guard wires increase in size from 20, 50, 70 to 100 micron in diameter.

K **OTHER WIRES**

The special requirements of some counters need different materials. Shown here are:

10 & 20 micron diameter gold plated Tungsten
50 & 100 micron diameter gold plated Tungsten
100 micron dia silver plated Beryllium copper
100 micron dia plain Beryllium copper
200 & 300 micron dia plain Beryllium & Rodium alloy

These can be positioned with great accuracy and tensioned to suite the application.

L **COMBINED METAL CRIMP PINS & INSULATORS**

The requirement to position and hold 24192 wires with an overall accuracy of 41 micron rms when located in the detector end plates led to the development of these composite copper and brass crimp pins. Drawn together, the brass and copper tubes with a 15 micron concentric dia hole after final machining. The wires are secured in the pins by crimping the ends of the crimp pins.

The material requirements for the insulator, likewise produced to high orders of accuracy and are good high voltage electrical properties, mechanical rigidity and long term stability. ULTEM was the plastic chosen for the insulators.

M **NYLATRON**

Guide feet for the DELPHI outer detector:- The material selected was NYLATRON-GSM a modified NYLON-6 with Molybdenum disulphide additive, to act as lubricant. These unique detectors of which 17 kilometres of aluminium tube was used, as seen on the display, were slid into the main experiment a distance of 6 metres.

For Further Information Contact

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