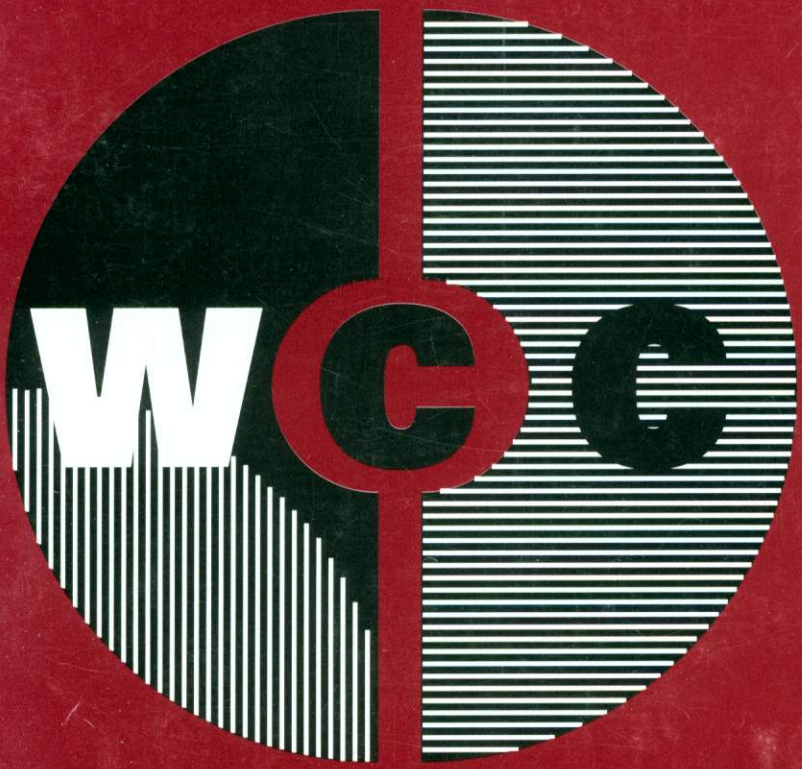
VIENNA WIRECHAMBER CONFERENCE '95



Institute for High Energy Physics of the Austrian Academy of Sciences
February 13-17,1995

Mo 14h40
IT

APPLICATIONS OF GASEOUS DETECTORS IN MEDICAL IMAGING

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A large variety of gaseous detectors has been developed in the recent years which have increasingly good granularity and high rate capability. These devices, in particular the multiwire proportional chambers, the drift chambers and the microstrip gas chambers, are being now one of the main instruments in high energy physics experiments.

So wide use of gaseous detectors in physics gave rise to the interest to their applications in different areas, in particular in medicine. Possible approaches for the application of modern detecting techniques in medicine and namely in medical imaging will be discussed. The analysis of some problems appearing when the counting detector is applyed to imaging will be done, namely necessary rate capability and spatial resolution, the different language in medical physics (from that of high energy physics) and the evaluation and comparison with analogue detectors.

I will make also a review of existing devices and analyze their advantages when compared with traditional techniques.

Th 10h15

OPTIMIZATION OF DESIGN AND BEAM TESTS OF MICRO-STRIP GAS CHAMBERS

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L. Ropelewski, F. Sauli, L.I. Shekhtman and T. Temmel
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We bave analyzed, both experimentally and theoretically, the operating performances of micro-strip gas chambers in order to optimize their performance and reliability. A model describing the onset of discharge, based on a process of spontaneous field emission from cathodes, has been developed and compared with experiment; the results suggest ways of increasing the maximum safe gain of the detector. We have also studied in detail the mechanism of signal propagation in the structure with a simulation program, analyzing the effects on signal shape and size of design parameters such as resistivity of strips, grouping of biased strips and presence of back-plane.
Several medium-size MSGC manufactured according to the results of the study and equipped with fast RD-20 amplifiers (50 ns shaping) have been operated in a test beam to study their general operating characteristics, efficiency and localization accuracy; high rate operation has been simulated by simultaneous exposure to a high rate radioactive source, and the results obtained with detectors manufactured on supports in a range of resistivity are discussed.

Th 12h45

Beam test results of the CMS Central Detector prototype

G. Bagliesi[1)], N. Bacchetta[2)], R. Bellazzini[1)], D. Bisello[2)], M. Bozzo[3)], A. Brez[1)], J.-M. Brom[4)], A. Caner[5)], R. Castaldi[1)], J.-F. Clergeau[6)], D. Contordo[6)], R. Dell'Orso[1)], E. Focardi[7)], A. Giraldo[2)], G. Hall[8)], R. Hammarström[5)], R. Haroutunian[6)], T. Kachelhoffer[4)], D. Kryn[6)], M. Loreti[2)], T. Ladzinski[5)], B. MacEvoy[8)], A. Markou[9)], M. Massai[1)], M. Meschini[7)], T. Meyer[5)], M. Millmore[8)], A. Morelli[3)], V. Nagaslaev[5,a)], A. Paccagnella[2)], A. Pallares[4)], F. Parodi[3)], G. Parrini[7)], A. Peisert[5)], S. Qian[4)], M. Raymond[8)], R. Ribeiros[5)], J.L. Riester[4)], O. Runolfsson[5)], R. Sachdeva[8)], L. Shekhtman[5,a)], G. Smadja[6)], G. Spandre[1)], G. Tonelli[1)], C. Vander Velde[10)], P. Vanlaer[10)], P.G. Verdini[1)], D. Vite[8)]

The CMS Central Detector Group Presented by Alessandra Caner

A prototype of the Central Detector of the Compact Muon Solenoid (CMS) detector proposed for the LHC was built and tested in a beam and in the magnetic field of 3 T. It contained 6 micro-strip gas chambers, 25 cm long, and 3 double sided silicon micro-strip detectors, 12.5 cm long. They were read out by PreShape32 chip with 32 channels of preamplifiers and shapers with a peaking time of 45 ns. The performance of the tracker in the magnetic field will be discussed.

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4) CRN, Strasbourg, France
5) CERN, Switzerland
6) IPN, Lyon, France
7) INFN, Florence, Italy
8) Imperial College, Unitod Krngdom
9) NCSR Democritos, Attiki/Athenes, Greece
10) ULB, Bruxelles, Belgium
a) On leave of absence from BINP, Novosibirsk, Russia

Fr 11h55

Field-dependent photoelectron extraction from CsI in different gases

A. Breskin[1], A. Buzulutskov[1], R. Chechik[1], A. DiMauro[2], E. Nappi[2], G. Paic[3], F. Piuz[4]

1) The Weizmann Institute, Rehovot
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We present the results of our latest investigations, made in laboratory and in a RICH detector, of the electric field effects on the quantum efficiency (QE) of CsI photo cathodes in various gas media, over a broad pressure range. We confirm that in a charge collection mode, the QE in a gas is generally lower than that in vacuum in a charge multiplication mode, the QE increases with the field and reaches the vacuum value at high gas gains. The largest variation of the QE with the electric field was observed in He-based gas mixtures. On the other hand, in some CH_4/i-C_4H_{10} gas mixtures the QE is practically independent of the field and is close to that in vacuum. This is due to the dependence of the photoelectron elastic back scattering probability on both gas nature and field. At high gas gain the elastic back scattering is taken over by inelastic collisions, resulting in a QE value equal to that in vacuum, independently of the gas nature. The consequences of this study on the design of CsI-based wire chambers, used for UV-photon imaging in RICH and other fields, are discussed.

A 5

A Fast One-Dimensional X-Ray Detector OD-3

V. Aulchenko, S. Baru, M. Dubrovin

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A fast X-ray detector of new design aimed for angle measurements in diffraction experiments was developed in I.N.P. The detector is based on a multiwire proportional chamber with X-ray absorption drift volume. A coordinate of the photon absorption is measured using induced charge distribution over the cathode strips. The cathode has a special shape to obtain a parallax-free images. A specially designed embedded processor allows to make continuously fast event trigger, a photon absorption coordinate reconstruction and image storage with a clock rate of 33 MHz.

The detector allows to accept photons in the energy range from 6 to 20 KeV with the angles up to ± 15 degrees and maximum rate of 10 MHz. The space resolution is about 100 micrometers (r.m.s.) in linear scale.

The first test of the chamber together with front-end electronics shows a good performance. The specific of realization, status of the experimental tests suggested with numerical simulation and future plans of this project will be discussed in the report.

A 15

The influence of materials on the wire chamber aging with DME, Argon/Carbon dioxide and Argon/isobutane gases

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A laboratory study of aging effects under intense radiation in dimethylether (DME), Argon/Carbon dioxide and Argon/isobutane filled drift chambers was carried out. The influence of the different construction materials outgassing, gas flow rate and gain on the aging rate with DME gas was investigated. In the test with drift tube the relative gain drop R is equel to 1.7% /(C*cm) was measured. For the KEDR detector drift chamber cell R is 45% /(C*cm). This would correspond to 2% pulse height decrease per year at a gas gain of 10^5 and the charge particles flux of 1kHz/cm^2. We conclude that with carefull choice of the construction materials the DME filled drift chamber can operate without considerable aging effects.

B 10

Microanalysis surface studies and photo emission properties of CsI photocathodes

J. Almeida[1], A. Braem[2], A. Breskin[3], A. Buzulutskov[3], R. Chechik[3], C. Coluzza[1], E. Conforto[1], G. Margaritondo[1], E. Nappi[4], G. Paic[5], F. Piuz[2], T. dell'Orto[1], T. Scognetti[4], S. Sgobba[2], and B.P. Tonner[6]

CsI-based gaseous chambers are widely proposed for UV-photon imaging in fast scintillators and RICH devices. We discuss here the recent results of systematic studies, correlating the quantum efficiency (QE) of CsI photo cathodes with different parameters related to the surface properties of their substrates. The data originates from various microanalysis surface studies (SEM, AFM, ESCA, XSEM, X-ray diffraction) of thin CsI films, deposited on various substrate materials and subjected to heat treatment and exposure to air following their vacuum deposition. The QE was measured at the laboratory, with a monochromator, and with particle-induced Cherenkov photons in a RICH system. It was proven that CsI films deposited on large area epoxy resin-coated Ni electrodes, have a QE close to the best one reached on polished stainless-steel substrate. Methods of preparation are discussed.

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