



ELSEVIER

Nuclear Instruments and Methods in Physics Research A 478 (2002) xiii–xx

**NUCLEAR  
INSTRUMENTS  
& METHODS  
IN PHYSICS  
RESEARCH**  
Section A

[www.elsevier.com/locate/nima](http://www.elsevier.com/locate/nima)

## Contents

Vienna Conference on Instrumentation 2001

Proceedings of the Ninth International Conference on Instrumentation  
Vienna, Austria, February 19–23, 2001

Editors: M. Jeitler, M. Krammer, G. Neuhofer, M. Regler, R. Wedenig

Editorial . . . . .	vii
Committees . . . . .	viii
List of Participants . . . . .	ix

### Section 1. Invited talks

Particle detectors for biomedical applications—demands and trends N.A. Pavel . . . . .	1
Progress with micro-pattern gas detectors R. Bellazzini, G. Spandre and N. Lumb . . . . .	13
Micromegas, a multipurpose gaseous detector G. Charpak, J. Derré, Y. Giomataris and Ph. Rebourgeard . . . . .	26
Overview of silicon detectors H. Dijkstra . . . . .	37
The LHC project M.J. Price . . . . .	46
Triggering at LHC experiments W.H. Smith . . . . .	62
Heavy ion experiments at the relativistic heavy ion collider H. Pernegger . . . . .	68
B-factory detectors D.R. Marlow . . . . .	80

### Section 2. Applications in medicine, biology

Digital detectors for electron microscopy A.R. Faruqi and D.M. Cattermole . . . . .	88
Experimental test of a new technique of background suppression in digital mammography M.G. Bisogni, S. Bottari, M.A. Ciocci, M.E. Fantacci, P. Maestro, N. Malakhov, P.S. Marrocchesi, M. Novelli, M. Quattrocchi, F. Pilo, V. Rosso, N. Turini and S. Zucca . . . . .	95
A scintillating GEM for 2D-dosimetry in radiation therapy J.H. Timmer, T.L. van Vuure, V. Bom, C.W. van Eijk, J. de Haas and J.M. Schippers . . . . .	98

High rate X-ray imaging using multi-GEM detectors with a novel readout design S. Bachmann, S. Kappler, B. Ketzer, Th. Müller, L. Ropelewski, F. Sauli and E. Schulte . . . . .	104
BETAview: a digital $\beta$ -imaging system for dynamic studies of biological phenomena E. Bertolucci, M. Conti, G. Mettievier, M.C. Montesi and P. Russo . . . . .	109
<b>Section 3. Applications in space and cosmic-ray</b>	
The PAMELA experiment on satellite and its capability in cosmic rays measurements	
O. Adriani, M. Ambriola, G. Barbarino, L.M. Barbier, S. Bartalucci, G. Bazilevskaia, R. Bellotti, S. Bertazzoni, V. Bidoli, M. Boezio, E. Bogomolov, L. Bonechi, V. Bonvicini, M. Boscherini, U. Bravar, F. Cafagna, D. Campana, P. Carlson, M. Casolino, M. Castellano, G. Castellini, E.R. Christian, F. Ciacio, M. Circella, R. D'Alessandro, C.N. De Marzo, M.P. De Pascale, N. Finetti, G. Furano, A. Gabbanini, A.M. Galper, N. Giglietto, M. Grandi, A. Grigorjeva, F. Guarino, M. Hof, S.V. Koldashov, M.G. Korotkov, J.F. Krizmanic, S. Krutkov, J. Lund, B. Marangelli, L. Marino, W. Menn, V.V. Mikhailov, N. Mirizzi, J.W. Mitchell, E. Mocchiutti, A.A. Moiseev, A. Morselli, R. Mukhametshin, J.F. Ormes, G. Osteria, J.V. Ozerov, P. Papini, M. Pearce, A. Perego, S. Piccardi, P. Picozza, M. Ricci, A. Salsano, P. Schiavon, G. Scian, M. Simon, R. Sparvoli, B. Spataro, P. Spillantini, P. Spinelli, S.A. Stephens, S.J. Stochaj, Y. Stozhkov, S. Straulino, R.E. Streitmatter, F. Taccetti, M. Tesi, A. Vacchi, E. Vannuccini, G. Vasiljev, V. Vignoli, S.A. Voronov, Y. Yurkin, G. Zampa and N. Zampa . . . . .	114
The Alpha Magnetic Spectrometer (AMS)	
J. Alcaraz, B. Alpat, G. Ambrosi, H. Anderhub, L. Ao, A. Arefiev, P. Azzarello, E. Babucci, L. Baldini, M. Basile, D. Barancourt, F. Barao, G. Barbier, G. Barreira, R. Battiston, R. Becker, U. Becker, L. Bellagamba, P. Bene, J. Berdugo, P. Berges, B. Bertucci, A. Biland, S. Bizzaglia, S. Blasko, G. Boella, M. Boschini, M. Bourquin, L. Brocco, G. Bruni, M. Buenerd, J.D. Burger, W.J. Burger, X.D. Cai, C. Camps, P. Cannarsa, M. Capell, D. Casadei, J. Casaus, G. Castellini, C. Cecchi, Y.H. Chang, H.F. Chen, H.S. Chen, Z.G. Chen, N.A. Chernoplekov, T.H. Chiueh, Y.L. Chuang, F. Cindolo, V. Commichau, A. Contin, P. Crespo, M. Cristinziani, J.P. da Cunha, T.S. Dai, J.D. Deus, N. Dinu, L. Djambazov, I. D'Antone, Z.R. Dong, P. Emonet, J. Engelberg, F.J. Eppling, T. Eronen, G. Esposito, P. Extermann, J. Favier, E. Fiandrini, P.H. Fisher, G. Fluegge, N. Fouque, Yu. Galaktionov, M. Gervasi, P. Giusti, D. Grandi, O. Grimm, W.Q. Gu, K. Hangarter, A. Hasan, V. Hermel, H. Hofer, M.A. Huang, W. Hungerford, M. Ionica, R. Ionica, M. Jongmanns, K. Karlamaa, W. Karpinski, G. Kenney, J. Kenny, W. Kim, A. Klimentov, R. Kossakowski, V. Koutsenko, M. Kraeber, G. Laborie, T. Laitinen, G. Lamanna, G. Laurenti, A. Lebedev, S.C. Lee, G. Levi, P. Levchenko, C.L. Liu, H.T. Liu, I. Lopes, G. Lu, Y.S. Lu, K. Lübelmeyer, D. Luckey, W. Lustermann, C. Maña, A. Margotti, F. Mayet, R.R. McNeil, B. Meillon, M. Menichelli, A. Mihul, A. Mourao, A. Mujunen, F. Palmonari, A. Papi, I.H. Park, M. Pauluzzi, F. Pauss, E. Perrin, A. Pesci, A. Pevsner, M. Pimenta, V. Plyaskin, V. Pojidaev, V. Postolache, N. Produit, P.G. Rancoita, D. Rapin, F. Raupach, D. Ren, Z. Ren, M. Ribordy, J.P. Richeux, E. Riihonen, J. Ritakari, U. Roeser, C. Roissin, R. Sagdeev, G. Sartorelli, A. Schultz von Dratzig, G. Schwering, G. Scolieri, E.S. Seo, V. Shoutko, E. Shoumilov, R. Siedling, D. Son, T. Song, M. Steuer, G.S. Sun, H. Suter, X.W. Tang, S.C.C. Ting, S.M. Ting, M. Tornikoski, J. Torsti, J. Trümper, J. Ulbricht, S. Urpo, I. Usoskin, E. Valtonen, J. Vandenhiert, F. Velcea, E. Velikhov, B. Verlaet, I. Vetlitsky, F. Vezzu, J.P. Vialle, G. Viertel, D. Vite, H. Von Gunten, S.W. Wicki, W. Wallraff, B.C. Wang, J.Z. Wang, Y.H. Wang, K. Wiik, C. Williams, S.X. Wu, P.C. Xia, J.L. Yan, L.G. Yan, C.G. Yang, M. Yang, S.W. Ye, P. Yeh, Z.Z. Xu, H.Y. Zhang, Z.P. Zhang, D.X. Zhao, G.Y. Zhu, W.Z. Zhu, H.L. Zhuang, A. Zichichi and B. Zimmermann . . . . .	119
The Prototype Synchrotron Radiation Detector (PSRD)	
H. Anderhub, D. Baetzner, S. Baumgartner, A. Biland, C. Camps, M. Capell, V. Commichau, L. Djambazov, Y.-J. Fanchiang, G. Fluegge, O. Grimm, K. Hangarter, H. Hofer, R. Kan, G. Kenney, V. Koutsenko, M. Kraeber, J. Kuipers, A. Lebedev, S.-C. Lee, D. Ren, Z.L. Ren, U. Roeser, S.C.C. Ting, A. Tiwari, G.M. Viertel, H.P. von Gunten, S. Waldmeier Wicki, T.-S. Wang and B. Zimmermann . . . . .	123
The camera of the Pierre Auger Observatory Fluorescence Detector	
M. Ambrosio, C. Aramo, F. Bracci, P. Facal, R. Fonte, G. Gallo, E. Kemp, G. Matthiae, D. Nicotra, P. Privitera, G. Raia, E. Tusi and G. Vitali . . . . .	125
Large-area imaging micro-well detectors for high-energy astrophysics	
P. Deines-Jones, J.K. Black, S.D. Hunter, K. Jahoda and S.M. Owens . . . . .	130

**Section 4. Drift chambers, drift tubes, MWPC and time projection chambers**

## Limits to drift chamber performance at LHC luminosities

M. Aleksa, C.W. Fabjan and W. Riegler . . . . .	135
---	-----

## The KLOE drift chamber VCI 2001

M. Adinolfi, A. Aloisio, F. Ambrosino, A. Andryakov, A. Antonelli, M. Antonelli, F. Anulli, C. Bacci, A. Bankamp, G. Barbiellini, F. Bellini, G. Bencivenni, S. Bertolucci, C. Bini, C. Bloise, V. Bocci, F. Bossi, P. Branchini, S.A. Bulychjov, G. Cabibbo, A. Calcaterra, R. Caloi, P. Campana, G. Capon, G. Carboni, A. Cardini, M. Casarsa, G. Cataldi, F. Ceradini, F. Cervell, F. Cevenini, G. Chiefari, P. Ciambone, S. Conetti, S. Conticelli, E. De Lucia, G. De Robertis, R. De Sangro, P. De Simone, G. De Zorzi, S. Dell'Agnello, A. Denig, A. Di Domenico, C. Di Donato, S. Di Falco, A. Doria, E. Drago, V. Elia, O. Erriquez, A. Farilla, G. Felici, A. Ferrari, M.L. Ferrer, G. Finocchiaro, C. Forti, A. Franceschi, P. Franzini, M.L. Gao, C. Gatti, P. Gauzzi, S. Giovannella, V. Golovatyuk, E. Gorini, F. Grancagnolo, W. Grandegger, E. Graziani, P. Guarnaccia, U.v. Hagel, H.G. Han, S.W. Han, X. Huang, M. Incagli, L. Ingrosso, Y.Y. Jang, W. Kim, W. Kluge, V. Kulikov, F. Lacava, G. Lanfranchi, J. Lee-Franzini, F. Lomtadze, C. Luisi, C.S. Mao, M. Martemianov, M. Matsyuk, W. Mei, L. Merola, R. Messi, S. Miscetti, A. Moalem, S. Moccia, M. Moulson, S. Mueller, F. Murtas, M. Napolitano, A. Nedosekin, M. Panareo, L. Pacciani, P. Pages, M. Palutan, L. Paoluzi, E. Pasqualucci, L. Passalacqua, M. Passaseo, A. Passeri, V. Patera, E. Petrolo, G. Petrucci, D. Picca, G. Pirozzi, C. Pistillo, M. Pollack, L. Pontecorvo, M. Primavera, F. Ruggieri, P. Santangelo, E. Santovetti, G. Saracino, R.D. Schamberger, C. Schwick, B. Sciascia, A. Sciubba, F. Scuri, I. Sfiligoi, J. Shan, P. Silano, T. Spadaro, S. Spagnolo, E. Spiriti, C. Stanesco, G.L. Tong, L. Tortora, E. Valente, P. Valente, B. Valeriani, G. Venanzoni, S. Veneziano, Y. Wu, Y.G. Xie, P.P. Zhao and Y. Zhou . . . . .	138
---	-----

## The CLEO III drift chamber

D. Peterson, K. Berkelman, R. Briere, G. Chen, D. Cronin-Hennessy, S. Csorna, M. Dickson, S. von Dombrowski, K.M. Ecklund, A. Lyon, Sz. Marka, T.O. Meyer, J.R. Patterson, A. Sadoff, P. Thies, E.H. Thorndike and D. Urner . . . . .	142
---	-----

## The CMS muon detector

P. Giacomelli . . . . .	147
-------------------------	-----

## The first precision drift tube chambers for the ATLAS muon spectrometer

F. Bauer, W. Blum, H. Dietl, S. Kotov, H. Kroha, A. Manz, A. Ostapchuk, R. Richter, S. Schael, S. Chouridou, D. Schaile, A. Staude, R. Ströhmer, T. Trefzger, K. Bouzakis, A. Krepouri, P. Paschalias, Ch. Petridou, D. Sampsonidis, I. Tsiafis, Ch. Valderanis, J. Wotschack, R.M. Avramidou, M. Dris, E.N. Gazis, E.C. Katsofous, S. Maltezos, G. Stavropoulos, D. Fassoulitis, P. Ioannou, C. Kourkoumelis, V. Birioukov, G.A. Chelkov, D.V. Dedovitch, P.G. Evtoukhovitch, A.L. Gongadze, M.I. Gostkin, D.V. Khartchenko, I.N. Potrap, E.V. Rogalev, E.G. Tskhadadze, V.V. Zhuravlov, E. Diehl, D. Levin, S. McKee, H. Neal, G. Tarle, R. Thun and B. Zhou . . . . .	153
--	-----

Study of high-pressure hydrogen-operated wire chambers designed for a precision measurement of the singlet  $\mu p$  capture rate

E.M. Maev, V.A. Andreev, T.A. Case, K.M. Crowe, P.U. Dick, A. Diksmann, J. Egger, A.A. Fetisov, V.A. Ganzha, W.D. Herold, F.J. Hartmann, P. Kammel, A.G. Krivchitch, O.E. Maev, C. Petitjean, G.E. Petrov, R. Prieels, S.M. Sadetsky, G.N. Schapkin, R. Schmidt, G.G. Semenchuk, M. Soroka, A.A. Vorobyov and N.I. Voropaev . . . . .	158
---	-----

## A laser calibration system for the STAR TPC

A. Lebedev . . . . .	163
----------------------	-----

## A TPC for measuring high multiplicity events at RHIC

J.H. Thomas . . . . .	166
-----------------------	-----

**Section 5. Resistive plate chambers**

## Development of large area and of position-sensitive timing RPCs

A. Blanco, R. Ferreira Marques, Ch. Finck, P. Fonte, A. Gobbi, S.K. Mendiratta, J. Monteiro, A. Policarpo and M. Rozas . . . . .	170
--	-----

A multigap resistive plate chamber prototype for time-of-flight for the STAR experiment at RHIC B. Bonner, G. Eppley, J. Lamas-Valverde, W.J. Llope, T. Nussbaum, E. Platner, J. Roberts, E.C. Zeballos, D. Hatzifotiadou, N.-Y. Kim, A. Semak and M.C.S. Williams . . . . .	176
Trigger detectors for the LHCb muon system VCI 2001 W. Riegler . . . . .	180
The multigap RPC: the time-of-flight detector for the ALICE experiment M.C.S. Williams . . . . .	183
<b>Section 6. Microstructure devices</b>	
Performance test of a micro-pattern stereo detector with two gas electron multipliers T. Barvich, P. Blüm, M. Erdmann, M. Fahrner, K. Kärcher, F. Kühn, D. Mörmann, Th. Müller, D. Neuberger, F. Röderer, H.J. Simonis, A. Skiba, W.H. Thümmel, Th. Weiler and S. Weseler . . . . .	187
The sand-glass gas detector (SGG) P. Majewski, J.-M. Brom, M. Ćwiok, W. Dominik, J. Królikowski, J.-C. Labbé, A. Lounis and R. Veenhof . . . . .	190
Development of micro pixel chamber A. Ochi, T. Nagayoshi, S. Koishi, T. Tanimori, T. Nagae and M. Nakamura . . . . .	196
Recent progress with the MicroCAT gaseous imaging detector A. Orthen, H. Wagner, H.J. Besch, R.H. Menk, A. Sarvestani, A.H. Walenta and H. Walliser . . . . .	200
Performance of MICROMEGAS with preamplification at high intensity hadron beams A. Delbart, J. Derré, Y. Giomataris, F. Jeanneau and I. Papadopoulos . . . . .	205
Tracking with $40 \times 40 \text{ cm}^2$ MICROMEGAS detectors in the high energy, high luminosity COMPASS experiment A. Magnon, J. Ball, Y. Bedfer, E. Delagnes, F. Kunne, J.-M. Le Goff, F. Lehar, C. Marchand, A. Miéville, D. Neyret, H. Pereira, S. Platchkov, Ph. Rebourgeard, G. Tarte and D. Thers . . . . .	210
Electron drift velocity measurements at high electric fields P. Colas, A. Delbart, J. Derré, I. Giomataris, F. Jeanneau, V. Lepeltier, I. Papadopoulos and Ph. Rebourgeard . . . . .	215
Results of in-beam tests of an MCP-based vacuum sector prototype of the T0/centrality detector for ALICE M. Bondila, L. Efimov, D. Hatzifotiadou, G. Feofilov, V. Kondratiev, V. Lyapin, J. Nysten, P. Otiougova, T.A. Tulina, W.H. Trzaska, F. Tsimbal, L. Vinogradov and C. Williams . . . . .	220
<b>Section 7. GEM devices</b>	
Sealed GEM photomultiplier with a CsI photocathode: ion feedback and ageing A. Breskin, A. Buzulutskov, R. Chechik, B.K. Singh, A. Bondar and L. Shekhtman . . . . .	225
A gas avalanche photomultiplier with a CsI-coated GEM D. Mörmann, A. Breskin, R. Chechik, P. Cwetanski and B.K. Singh . . . . .	230
Single electron detection in quadruple-GEM detector with pad readout J. Va'vra and A. Sharma . . . . .	235
A fast triple-GEM detector for high-rate charged-particle triggering G. Bencivenni, W. Bonivento, C. Bosio, A. Cardini, G. Felici, A. Lai, F. Murtas, D. Pinci, B. Saitta, L. Satta and P. Valente . . . . .	245
Operation of MSGC+GEM detectors in a high rate environment A. Nowack and A. Zander . . . . .	250
<b>Section 8. Ageing of detectors</b>	
The effect of oxygen on anode wire swelling under high accumulated radiation dose T. Ferguson, G. Gavrilov, A. Krivchitch, E. Kuznetsova, V. Lebedev and L. Schipunov . . . . .	254

Aging investigation of straw drift tubes using nuclear reaction analysis G. Gavrilov, A. Krivchitch, E. Kuznetsova, V. Lebedev, L. Schipunov and E. Lobachev . . . . .	259
An aging study of triple GEMs in Ar-CO <sub>2</sub> L. Guirl, S. Kane, J. May, J. Miyamoto and I. Shipsey . . . . .	263
Behaviour of small Gap + GEM chambers in close LHC condition D. Bouvet, V. Chorowicz, D. Contardo, R. Haroutunian, L. Mirabito, S. Perriès and G. Smadja . . . . .	267
RPC ageing studies G. Aielli, P. Camarri, R. Cardarelli, R. de Asmundis, A. Di Ciaccio, L. Di Stante, B. Liberti, A. Paoloni, E. Pastori and R. Santonico . . . . .	271
<b>Section 9. Silicon detectors</b>	
The ATLAS silicon microstrip tracker L. Feld . . . . .	277
Studies on performances of wedge Silicon Microstrip Detectors A. Buffini . . . . .	280
The CMS all-silicon tracker — strategies to ensure a high quality and radiation hard silicon detector F. Hartmann . . . . .	285
Assembly studies for silicon detector modules R. Wedenig . . . . .	288
Performance of an irradiated LHCb prototype p-on-n silicon microstrip detector T. Bowcock, J. Buytaert, G. Casse, M. Charles, H. Dijkstra, P. Collins, O. Dormond, M. Ferro-Luzzi, F. Fiedler, R. Frei, G. Gagliardi, P. Jalocha, J. Libby, T. Ketel, C. Parkes, U. Parzefall, T. Ruf, M. Tareb, F. Teubert, V. Wright and M. Witek . . . . .	291
Status of the Belle SVD detector R. Abe, H. Aihara, G. Alimonti, Y. Asano, A. Bakich, E. Banas, A. Bozek, T. Browder, J. Dragic, C. Everton, C. Fukunaga, A. Gordon, H. Guler, J. Haba, K. Hara, T. Hara, N. Hastings, M. Hazumi, E. Heenan, T. Higuchi, T. Hojo, H. Ishino, G. Iwai, P. Jalocha, J. Kaneko, P. Kapusta, T. Kawasaki, K. Korotuschenko, J. Lange, Y. Li, D. Marlow, T. Matsubara, H. Miyake, L. Moffitt, G. Moloney, S. Mori, Y. Nagashima, T. Nakadaira, T. Nakamura, Z. Natkaniec, S. Okuno, S. Olsen, W. Ostrowicz, H. Palka, L. Peak, M. Rozanka, J. Ryuko, M. Sevier, K. Shimada, S. Stanič, K. Sumisawa, R. Stock, S. Swain, H. Tajima, S. Takahashi, H. Tagomori, F. Takasaki, N. Tamura, J. Tanaka, M. Tanaka, G.N. Taylor, T. Tomura, K. Trabelsi, T. Tsuboyama, Y. Tsujita, G. Varner, K. Varvell, Y. Watanabe, Y. Yamada, H. Yamamoto, M. Yokoyama, H. Zhao and D. Žontar . . . . .	296
Performance of the PHOBOS silicon sensors M.P. Decowski, B.B. Back, M.D. Baker, D.S. Barton, R.R. Betts, R. Bindel, A. Budzanowski, W. Busza, A. Carroll, E. Garcia, N. George, K. Gulbrandsen, S. Gushue, C. Halliwell, J. Hamblen, G.A. Heintzelman, C. Henderson, R. Hołyński, D.J. Hofman, B. Holzman, E. Johnson, J.L. Kane, J. Katzy, N. Khan, W. Kucewicz, P. Kulinich, W.T. Lin, S. Manly, D. McLeod, J. Michałowski, A.C. Mignerey, J. Mülmenstädt, R. Nouicer, A. Olszewski, R. Pak, I.C. Park, H. Pernegger, C. Reed, L.P. Remsberg, M. Reuter, C. Roland, G. Roland, L. Rosenberg, P. Sarin, P. Sawicki, W. Skulski, S.G. Steadman, G.S.F. Stephans, P. Steinberg, M. Stodulski, A. Sukhanov, J.-L. Tang, R. Teng, A. Trzupek, C. Vale, G.J. van Nieuwenhuizen, R. Verdier, B. Wadsworth, F.L.H. Wolfs, B. Wosiek, K. Woźniak, A.H. Wuosmaa and B. Wystouch . . . . .	299
Novel prototype Si detector development and processing at BNL Z. Li, R. Beuttenmuller, W. Chen, D. Elliott, V. Radeka, J. Takahashi and W.C. Zhang . . . . .	303
Test results of monolithic active pixel sensors for charged particle tracking Yu. Gornushkin, G. Claus, W. de Boer, J. Bol, G. Deptuch, A. Dierlamm, W. Dulinski, D. Husson, M. Koppenhöfer, J.L. Riester and M. Winter . . . . .	311
Performance of ultra-thin silicon detectors in a 5 MeV antiproton beam P. Riedler, J. Rochet, A. Rudge, M. Doser and R. Landua . . . . .	316

Recent results from beam tests of large area silicon drift detectors E. Crescio, M. Bondila, V. Bonvicini, P. Cerello, P. Giubellino, A. Kolojvari, M.I. Martinez, G. Mazza, L.M. Montaño, D. Nouais, S. Piano, C. Piemonte, A. Rashevsky, A. Rivetti, F. Tosello, A. Vacchi and R. Wheadon . . . . .	321
A new ultra radiation hard cryogenic silicon tracker for heavy ion beams L. Casagrande, M.C. Abreu, K. Borer, A. De Falco, B. Dezillie, V. Granata, E. Heijne, M. Hess, Z. Li, C. Lourenco, A. Neves, T.O. Niinikoski, V.G. Palmieri, B. Pes, P. Ramalhete, P. Rato Mendes, P. Rosinsky, G. Ruggiero, J. Seixas, P. Sonderegger, P. Sousa, G. Usai and G. Vandoni . . . . .	325
Lorentz angle measurements in silicon detectors V. Bartsch, W. de Boer, J. Bol, A. Dierlamm, E. Grigoriev, F. Hauler, S. Heising, O. Herz, L. Jungermann, R. Keränen, M. Koppenhöfer, F. Röderer and T. Schneider. . . . .	330
<b>Section 10. Calorimetry</b>	
The CMS electromagnetic calorimeter G. Organtini . . . . .	333
Results of the R&D program on a magnetized SCIFI calorimeter I. De Mitri. . . . .	336
<b>Section 11. Particle identification</b>	
COMPASS RICH-1 E. Albrecht, G. Baum, R. Birsas, M. Bosteels, F. Bradamante, A. Braem, A. Bressan, A. Cicutin, P. Ciliberti, A. Colavita, S. Costa, M. Crespo, P. Cristaudo, S. Dalla Torre, V. Diaz, P. Fauland, M. Finger, F. Fratnik, M. Giorgi, B. Gobbo, A. Grasso, R. Ijaduola, V. Kalinnikov, M. Lamanna, M. Laub, A. Martin, G. Menon, P. Pagano, D. Panzner, D. Piedigrossi, P. Schiavon, A. Chapiro, F. Tassarotto, R. Valbuena and A.M. Zanetti . . . . .	340
Precision optical systems for the new generation of Ring Imaging Cherenkov detectors in high energy physics experiments C. D'Ambrosio, L. Fernandez, M. Laub and D. Piedigrossi. . . . .	344
Testbeam results on particle identification with aerogel used as RICH radiator M. Alemi, T. Bellunato, A. Braem, M. Calvi, E. Chesi, A. Duane, C. Joram, D. Liko, C. Matteuzzi, P. Negri, N. Neufeld, M. Paganoni, J. Seguinot, D. Voillat, S. Wotton and T. Ypsilantis . . . . .	348
Test of aerogel counters for the KEDR detector A.Yu. Barnyakov, M.Yu. Barnyakov, V.S. Bobrovnikov, A.R. Buzykaev, A.F. Danilyuk, F.F. Guber, G.M. Kolachev, S.A. Kononov, V.A. Krasnov, E.A. Kravchenko, A.B. Kurepin, G.D. Minakov, A.P. Onuchin, G.A. Savinov and V.A. Tayursky . . . . .	353
<b>Section 12. Associated electronics</b>	
CCD readout of GEM-based neutron detectors F.A.F. Fraga, L.M.S. Margato, S.T.G. Fetal, M.M.F.R. Fraga, R. Ferreira Marques, A.J.P.L Policarpo, B. Guerard, A. Oed, G. Manzini and T. van Vuure. . . . .	357
Low-noise design criteria for detector readout systems in deep submicron CMOS technology M. Manghisoni, L. Ratti, V. Re and V. Speziali . . . . .	362
PHAROS: a spectrometer-on-a-chip for digital radiology systems with spectral detection S. Cadeddu, D. Caredda, M. Caria, A. Lai and P. Randaccio . . . . .	367
Feasibility studies of microelectrode silicon detectors with integrated electronics G.-F. Dalla Betta, G. Batignani, S. Bettarini, M. Boscardin, L. Bosio, M. Carpinelli, S. Dittongo, F. Forti, M. Giorgi, P. Gregori, A. Lusiani, M. Manghisoni, G.U. Pignatelli, M. Rama, L. Ratti, V. Re, F. Sandrelli, V. Speziali, F. Svelto and N. Zorzi. . . . .	372

**Section 13. Photomultipliers and photodiodes**

Detection of the primary scintillation light from dense Ar, Kr and Xe with novel photosensitive gaseous detectors L. Periale, V. Peskov, P. Carlson, T. Francke, P. Pavlopoulos, P. Picchi and F. Pietropaolo . . . . .	377
Hybrid gaseous photomultipliers I. Rodionov, T. Francke, V. Peskov and T. Sokolova . . . . .	384
Surface sensitivity of multianode photomultiplier tubes S. Korpar, I. Bizjak, A. Gorišek, P. Križan, R. Pestotnik, M. Starič and A. Stanovnik. . . . .	391
Non-linear behaviour of large-area avalanche photodiodes L.M.P. Fernandes, J.A.M. Lopes, C.M.B. Monteiro, J.M.F. dos Santos and R.E. Morgado . . . . .	395
Development, fabrication and test of a highly segmented hybrid photodiode A. Braem, E. Chesi, C. Joram, J. Séguinot, P. Weilhammer and T. Ypsilantis . . . . .	400

**Section 14. Special devices**

The performance of the NA48 detector M. Jeitlert . . . . .	404
Automatic microscope systems in the CHORUS experiment C. Bozza . . . . .	411
A large, high performance, curved 2D position-sensitive neutron detector J. Fried, J.A. Harder, G.J. Mahler, D.S. Makowiecki, J.A. Mead, V. Radeka, N.A. Schaknowski, G.C. Smith and B. Yu . . . . .	415
Status of the KEDR detector V.V. Anashin, V.M. Aulchenko, B.O. Baibusinov, V. Balashov, E.M. Baldin, L.M. Barkov, A.K. Barladyan, M.Yu. Barnyakov, S.E. Baru, I.V. Bedny, D.M. Beilin, A.E. Blinov, V.E. Blinov, D.V. Bondarev, A.E. Bondar, A.R. Buzykaev, P. Cantoni, A.G. Chilingarov, L.V. Dneprovsky, S.I. Eidelman, D.A. Epifanov, P.L. Frabetti, P.B. Gaidarev, V.R. Groshev, S.V. Karpov, V.A. Kiselev, S.G. Klimenko, G.M. Kolachev, S.A. Kononov, V.N. Kozlov, E.A. Kravchenko, V.F. Kulikov, L.M. Kurdadze, A.S. Kuzmin, S.A. Kuznecov, F. Lanni, M.Yu. Lelchuk, L.A. Leontiev, E.B. Levichev, V.M. Malyshev, P.F. Manfredi, A.L. Maslennikov, G.D. Minakov, V.P. Nagaslaev, A. Naumenkov, S.A. Nikitin, A. Nomerotsky, A.P. Onuchin, S.B. Oreshkin, R. Ovechkin, F. Palombo, S.V. Peleganchuk, S.S. Petrosyan, S.V. Pivovarov, A.O. Poluektov, G.E. Pospelov, I.Ya. Protopopov, V. Re, L.V. Romanov, N.I. Root, A.A. Ruban, G.A. Savinov, A.G. Shamov, D. Shatilov, M.A. Shubin, A.I. Shusharo, B.A. Shwartz, V.A. Sidorov, Yu.I. Skovpen, V.P. Smakhtin, R.G. Snopkov, A.V. Sokolov, A.M. Soukharev, A.A. Talyshev, V.A. Tayursky, V.I. Telnov, Yu.A. Tikhonov, K.Yu. Todyshev, Yu.V. Usov, A.I. Vorobyev, A.N. Yushkov, A.V. Zatcepin and V.N. Zhilich . . . . .	420
Comprehensive measurements of GaAs pixel detectors capacitance M. Caria, L. Barberini, S. D'Auria, A. Lai, P. Randaccio and S. Cadeddu . . . . .	426
Design of a hybrid gas proportional counter with CdTe guard counters for $^{14}\text{C}$ dating system L. Zhang, H. Takahashi, N. Hinamoto, M. Nakazawa and K. Yoshida . . . . .	431
Liquid-xenon $\gamma$ -camera with ionisation readout V. Solovov, V. Chepel, M.I. Lopes, F. Neves, R. Ferreira Marques and A.J.P.L. Policarpo . . . . .	435
Timing characteristics of scintillator bars S. Denisov, A. Dzierba, R. Heinz, A. Klimenko, V. Samoylenko, E. Scott, A. Shchukin, P. Smith, C. Steffen and S. Teige . . . . .	440

**Section 15. Software simulations and development**

The quasi-static electromagnetic approximation for weakly conducting media Th. Heubrandtner and B. Schnizer . . . . .	444
--	-----

Simulation study of silicon and gaseous tracking detectors W. Beaumont, T. Beckers, G. De Lentdecker, O. Devroede, F. Udo, C.V. Velde, W. Van Doninck, C. Van Dyck, P. Vanlaer, F. Verbeure and V. Zhukov . . . . .	448
GEM simulation methods development V. Tikhonov and R. Veenhof . . . . .	452
Tracking in CMS: software framework and tracker performance A. Khanov, M. Lenzi, T. Todorov, T. Speer, P. Vanlaer and M. Winkler . . . . .	460
Author index . . . . .	465