Beam:
Approved: 31/JAN/1996
Status: Preparation

CMS The Compact Muon Solenoid

ARMENIA, CIS

Yerevan, Yerevan Physics Institute

G. Baiatian, N. Grigorian, V. Khachatrian, A. Margarian, A. Sirunyan, S. Stepanian

AUSTRIA

Wien, Österreichische Akademie der Wissenschaften/ Institut für Hochenergiephysik (HEPHY)

W. Adam, M. Brugger, J. Ero, M. Fierro, M. Friedl, R. Fruhwirth, J. Hrubec, A. Jeitler, M. Krammer, M. Pernicka, P. Porth, H. Rohringer, L. Rurua, A. Taurok, G. Walzel, R. Wedenig, C. Wulz

BELARUS, CIS

Minsk, Byelorussian State University

V. Petrov, V. Prosolovich

Minsk, Inst. of Appl. Phys.

F. Ermalitski, P. Kuchinski, V. Lomako

Minsk, Institute of Nuclear Problems

V. Barychevski, A. Fedorov, N. Gorodichenine, M. Korjik, A. Lapatsik, O. Missevitch, V. Panov, R. Zuyeuski

Minsk, National Science & Education Centre of Particle & High Energy Physics

I. Akushevich, N. Chekhlova, N. Chomeiko, O. Dvornikov, I. Emeliantchik, I. Iourenia, A. Khomitch, V. Kolpaschikov, M. Kryvamaz, V. Kuvshinov, A. Litomine, V. Mossolov, A. Panfilenko, S. Reutovich, A. Solin, R. Stefanovitch, V. Strazhev, V. Tchekhovski, S. Vyatokhin, V. Zalessky

BELGIUM

Antwerpen, Universitaire Instelling Antwerpen (UIA)

W. Beaumont, T. Beckers, E. De Langhe, V. Joukov, F.W. Moortgat, F. Verbeure

Bruxelles, Université Libre de Bruxelles (ULB)

D. Bertrand, G. De Lentdecker, J. Stefanescu, C. Vander Velde, P. Vanlaer

Bruxelles, Vrije Universiteit Brussel (VUB)

O. Devroede, R. Goorens, J. Lemonne, S. Tavernier, F. Udo, W. Van Doninck, L. Van Lancker

Louvain-la-Neuve, Université Catholique de Louvain

D. Favart, J. Govaerts, G. Gregoire, V. Lemaitre, A.H.L. Ninane, K. Piotrzkowski, O. Van Der Aa

Mons, Université de Mons-Hainaut

I. Boulogne, E. Daubie, P. Herquet

References
LHCC-94-38/P1, LHCC/98-8, LHCC/98-9

BULGARIA

Sofia, Bulgarian Academy of Sciences/ Institute for Nuclear Research and Nuclear Energy (INRNE)

K. Abadjiev, T. Anguelov, I.H. Atanassov, J. Damgov, L. Dimitrov, V.I. Gentchev, G.D. Gueorguiev, P. Iaydjiev, B.B. Kounov, L. Penchev, P. Raykov, G. Soultanov, I. Vankov, P. Vankov

Sofia, University of Sofia ”St. Kliment Ohridski”

M. Chizhov, A. Gritskov, A. Jordanov, L. Litov, M. Mateev, P.A. Petev, V. Spassov, G. Velev

CHINA, PR

Beijing, Academia Sinica/ Institute of High Energy Physics (IHEP)

Jianguo. Bian, Guoming. Chen, He Sheng. Chen, Yanan. Guo, Jingtang. He, Guangshun. Huang, Zun-Jian. Ke, Jin. Li, Weiguo. Li, Xiaonan. Li, Jinfa. Qiu, Ben Wei. Shen, Xiao Yan. Shen, Huayi. Sheng, Yunyong. Wang, Rong Sheng. Xu, Bing-Yun. Zhang, Jiawen. Zhang, Shaoqiang. Zhang, Wei-Ren. Zhao, Zhengguo. Zhao, Jian-Ping. Zheng, Guoyi. Zhu, Yongsheng. Zhu

Beijing, Peking University

Yong. Ban, Jianxin. Cai, Jia-Erh. Chen, Hongtao. Liu, Song-Qiu. Liu, Bin-Qiao. Lou, Sijin. Qian, Yanlin. Ye

Hefei (Anhui), University of Science and Technology of China

Qi. An, Zuhe. Bian, Hongfang. Chen, Zhufang. Gong, Chaoshu. Shi, Lazhen. Sun, Xiaolian. Wang, Zhaomin. Wang, Jian. Wu, Shuwei. Ye, Ziping. Zhang

CROATIA

Split, Technical Univ. of Split,FESB

N. Godinovic, M. Milin, I. Puljak, I. Soric, J. Tudoric-Ghemo

Split, University of Split

Z. Antunovic, M. Dzelalija, K. Marasovic

Zagreb, Ruder Boskovic Institute

M. Stipcevic

CYPRUS

Nicosia, University of Cyprus

A. Hasan, P. Razis, A. Vorvolakos

ESTONIA

Tallinn, Inst.of Chem.Phys.and Biophys.(KBFI)Tallinn

A. Hall, E. Lippmaa, J. Lippmaa, M. Raidal, J. Subbi

FINLAND

Espoo, Helsinki University of Technology/ Laboratory of Advanced Energy Systems

P.A. Aarnio

Helsinki, Univ.of Helsinki Fac.of Science

K.K.M. Banzuzi, A.M. Heikkinen, J.V. Heinonen, A.J. Honkanen, T.J. Karevaara, V.J. Karimaki, H.M. Katajisto, R.L.A. Kinnunen, K. Lassila-Perini, V. Lefebure, S.T. Lehti, T. Linden, P.R. Luukka, E.U. Pietarinen, E.M. Tuominen, J. Tuominiemi, D. Ungaro, T.P. Vanhala, J. Wikner, C.J. Williams

Jyväskylä, University of Jyväskylä/ Department of Physics

J. Aysto, R. Julin, V. Ruuskanen

Oulu, University of Oulu

S. Kallijarvi, A. Keranen, L. Palmu, K. Remes, E. Suhonen, T. Tuuva

Tampere, Tampere University of Technology

J. Niittylahti, O. Vainio

FRANCE

Annecy-le-Vieux, Institut National de Physique Nucléaire et de Physique des Particules (IN2P3)/ Laboratoire d'Annecy-le-Vieux de Physique des Particules (LAPP)

Y.W. Baek, D.F. Boget, J.E.A. Ditta, J-P. Guillaud, M. Maire, J-P. Mendiburu, P. Nedelec, J-P. Peigneux, M. Schneegans, D. Sillou

Gif-sur-Yvette, Centre d'Etudes de Saclay (CEA-Saclay)/ DAPNIA

M.G. Anfreville, P.G. Bonamy, C. Bouchand, R. Chipaux, M.M. Dejardin, D. Denegri, F-X. Gentit, A. Givernaud, F. Kircher, Y. Lemoigne, E. Locci, J-P. Lottin, J-P. Pansart, A. Payn, J. Rander, J-M. Reymond, F. Rondeaux, A. Rosowsky, P. Roth, P. Verrecchia

Palaiseau, Ecole Polytechnique/ Laboratoire de Physique Nucléaire des Hautes Energies

J. Badier, M.J. Bercher, J.M. Bourotte, P. Busson, D. Chamont, C.P. Charlot, L. Dobrzynski, J.L.H. Gilly, M. Haguenauer, M.A. Karar, Geun Beom. Kim, L. Kluberg, D. Lecouturier, P. Matricon, G.R. Milleret, P.M.G. Mine, R. Morano, P. Paganini, P. Poilleux, T. Romanteau

Strasbourg, Université Louis Pasteur/ Institut de Recherches Subatomiques IReS (IReS)

A. Albert, J-D. Berst, R. Blaes, J-M. Brom, F.F. Charles, J. Coffin, F. Didierjean, F. Drouhin, J-P. Ernenwein, J-C. Fontaine, W. Geist, U. Goerlach, J-M. Helleboid, D. Huss, P. Juillot, A. Lounis, C. Maazouzi, S. Moreau, Y. Riahi, I. Ripp, T. Todorov, D. Vintache, A. Zghiche

Villeurbanne, Université Claude Bernard Lyon-I/ Institut de Physique Nucléaire de Lyon (IPNL)

M. Ageron, M. Bedjidian, E. Chabanat, C. Combaret, D. Contardo, P. Depasse, O. Drapier, M.L. Dupanloup, H. El Mamouni, J. Fay, S. Gascon, N.A. Giraud, C. Girerd, M. Goyot, R. Haroutunian, B. Ille, P. Lebrun, M.M. Lethuillier, J-P. Martin, L. Mirabito, G.S. Muanza, P. Pangaud, S.O. Perries, P. Sahuc, G. Smadja, S.P. Tissot, J-P. Walder, F. Zach

GEORGIA

Tbilisi, Georgian Academy of Sciences/ Institute of Physics

N. Djaoshvili, I. Iashvili, A. Kharchilava, N. Roinichvili, V. Roinichvili

Tbilisi, Tbilisi State University

N. Amaglobeli, I. Bagaturia, R. Chanidze, V. Kartvelishvili, R. Kvatadze, D. Mjavia, Z. Tsamalaidze

GERMANY

Aachen, Rheinisch-Westfälische Technische Hochschule (RWTH)/ I. Physikalisches Institut

M. Axer, K. Banicz, S. Bechstein, F. Beissel, C. Berger, A.G. Bohm, K. Bosseler, W. Braunschweig, J. Breibach, V. Commichau, H. Faissner, H. Fesefeldt, G. Flugge, Weihua. Gu, K. Hangarter, A. Heister, S. Hermann, W. Karpinski, T. Kirn, S.J.M. Koenig, C. Kukulies, D. Lanske, D. Macke, J. Mnich, A.S. Nowack, A. Ostaptchouk, D. Pandoulas, M. Petertill, G. Pierschel, F. Raupach, D. Rein, H.K.V. Reithler, S. Schael, D. Schmitz, P. Schmitz, R. Schulte, A. Schultz Von Dratzig, R. Siedling, L. Sonnenschein, H. Szczesny, M. Tonutti, W. Wallraff, M. Wegner, B. Wittmer, A.I. Zander

Berlin, Humboldt-Universität zu Berlin

M. Grunewald, T. Hebbeker, K. Hoepfner

Karlsruhe, Universität Karlsruhe/ Institut für Experimentelle Kernphysik

V.C. Bartsch, P. Blum, W. De Boer, A. Dierlamm, G.H. Dirkes, V. Drollinger, M. Erdmann, M. Feindt, E. Grigoriev, F. Hartmann, F. Hauler, A.W. Heiss, T. Muller, F.D. Roederer, H.J. Simonis, A. Skiba, A. Theel, H.W. Thummel, T. Weiler, S. Weseler

GREECE

Athens, National Research Center for Physical Sciences ”Demokritos” (NRCPS)/ Institute of Nuclear Physics

P. Adzic, M. Barone, I. Bozovic-Jelisavcic, T. Geralis, S. Harissopulos, P. Kokkinias, A. Kyriakis, D. Loukas, A. Markou, C. Markou, N. Mastroyiannopoulos, J. Mousa, I. Siotis, M. Spyropoulou-Stassinaki, A. Staveris Polykalas, A. Tsirigotis, S. Tzamarias, A. Vayaki, K. Zachariadou, M. Zupan

Athens, University of Athens

L. Resvanis

Ioánnina, University of Ioánnina

A. Asimidis, I. Evangelou, P. Kokkas, N. Manthos, O. Mitropoulos, K. Prouskas, F. Triantis, N. Tzoulis

HUNGARY

Budapest, Hungarian Academy of Sciences/ KFKI Research Institute for Particle and Nuclear Physics

Z.I. Bagoly, G. Bencze, A. Csilling, C. Hajdu, P. Hidas, D. Horvath, G. Odor, A. Ster, L. Urban, G. Vesztergombi, P. Zalan, M. Zsenei

Debrecen, Institute of Nuclear Research of the Hungarian Acad. of Sci.(ATOMKI)

G. Dajko, A.C. Fenyvesi, J. Molnar, J. Palinkas, D. Sohler, Z.L. Trocsanyi, J. Vamosi, J. Vegh

Debrecen, University of Debrecen Kossuth Lajos University (KLTE)/ Institute of Physics

L. Baksay, T. Bondar, S. Juhasz, L.G. Marian, S. Nagy, P.P. Raics, J. Szabo, Z. Szabo, S. Szegedi, Z. Szillasi, T. Sztaricskai, P. Tarjan, G. Zilizi

INDIA

Bombay, Bhabha Atomic Research Centre BARC (BARC)/ Nuclear Physics Division

S. Borkar, V.B. Chandratre, R.K. Chaudhury, M. Dixit, M. Ghodgaonkar, B. John, S.K. Kataria, A.K. Mohanty, A. Topkar

Bombay, Tata Institute of Fundamental Research (TIFR)

B.S. Acharya, T. Aziz, S. Banerjee, S. Banerjee, S. Bheesette, S.R. Chendvankar, P.V. Deshpande, S. Dugad, S.N. Ganguli, A. Gurtu, S.D. Kalmani, S. Katta, M.R. Krishnaswamy, V.R. Lakkireddi, M. Maity, K. Mazumdar, N.K. Mondal, N. Panyam, S.C. Tonwar, N.S. Vemuri, P. Verma

Chandigarh (Mandir), Panjab University/ Department of Physics

S. Bala, V. Bhatnagar, M. Kaur, J.M. Kohli, J. Singh

New Delhi, University of Delhi South Campus (UDSC)/ Centre for Detector and Related Software Technology

A. Bhardwaj, R.K. Shivpuri, V.K. Verma

ITALY

Bari, Univ. + INFN

M. Abbrescia, A. Colaleo, D.M. Creanza, N. De Filippis, A.M. De Martinis, M. De Palma, L. Fiore, G. Iaselli, F. Loddo, G. Maggi, B. Marangelli, M. Menegotto, S. My, S. Natali, S. Nuzzo, G.M. Pugliese, V. Radicci, A. Ranieri, F. Romano, F. Ruggieri, G. Selvaggi-Maggi, L. Silvestris, P. Tempesta, G. Zito

Bologna, Univ. + INFN

A. Benvenuti, P. Capiluppi, F. Cavallo, M. Cuffiani, I. D'Antone, G-M. Dallavalle, F. Fabbri, P. Frabetti, G. Giacomelli, P. Giacomelli, C. Grandi, M. Guerzoni, S. Marcellini, P. Mazzanti, A. Montanari, C. Montanari, F. Navarria, F. Odorici, A. Perrotta, A. Rossi, T. Rovelli, G.P. Siroli, R. Travaglini

Catania, Università di Catania

S. Albergo, V. Bellini, D. Boemi, P. Castorina, S. Cavalieri, M. Chiorboli, S. Costa, L. Lo Monaco, R. Potenza, V. Russo, A. Tricomi, C.N. Tuve

Firenze, Università di Firenze

L. Bellucci, U. Biggeri, E. Borchi, M. Bruzzi, A. Buffini, S. Busoni, G. Castellini, C. Civinini, R. D'Alessandro, E. Focardi, G. Landi, A. Macchiolo, M. Meschini, C. Minelli, G. Parrini, M. Pieri, S. Pirollo, R. Ranieri, S. Sciortino

Genoa, Istituto Nazionale di Fisica Nucleare (INFN)/ Sezione di Genova

M. Bozzo, P. Fabbricatore, S. Farinon, R. Musenich, C. Priano

Padova, Università degli Studi di Padova

P. Azzi, N. Bacchetta, M.A. Bellato, M. Benettoni, D. Bisello, A. Candelori, A. Castro, P. Checchia, E. Conti, M. De Giorgi, A. De Min, U. Dosselli, C. Fanin, F. Gasparini, U. Gasparini, F. Gonella, A. Kaminski, S. Lacaprara, I. Lippi, M. Loreti, A.T. Meneguzzo, M. Michelotto, F. Montecassiano, A. Neviani, A. Paccagnella, S. Paoletti, M. Passaseo, M. Pegoraro, P. Ronchese, I. Stavitski, E. Torassa, M. Vassanelli, L. Ventura, S. Ventura, M. Verlato, P. Zotto, G. Zumerle

Pavia, Università degli Studi di Pavia

S. Altieri, G. Belli, G.L. Bruno, R. Guida, M.M. Merlo, S.P. Ratti, C. Riccardi, P. Torre, P. Vitulo

Perugia, Università degli Studi di Perugia/ Istituto Nazionale de Fisica Nucleare (INFN)

M. Angarano, E. Babucci, M. Biasini, G.M. Bilei, M.T. Brunetti, F. Ceccotti, B. Checcucci, M. Giorgi, P. Lariccia, G. Mantovani, D. Passeri, P. Placidi, V. Postolache, R. Santinelli, A. Santocchia, A. Scorzoni, L. Servoli, G. Tommasi

Pisa, Università degli Studi di Pisa

F. Angelini, G. Bagliesi, A. Bardi, A. Basti, R. Bellazzini, J. Bernardini, T. Boccali, L. Borrello, F. Bosi, P.L. Braccini, A. Brez, R. Carosi, R. Castaldi, G. Chiarelli, V. Ciulli, M. Dell'Orso, R. Dell'Orso, S. Donati, S. Dutta, L. Foa, S. Galeotti, P. Giannetti, A. Giassi, S. Giusti, G. Iannaccone, L. Latronico, F. Ligabue, N. Lumb, G. Magazzu, M. Mariani, M. Massai, A. Messineo, O. Militaru, A. Moggi, F. Morsani, F. Palla, G. Punzi, F. Raffaelli, L.F. Ristori, G. Sanguinetti, A. Sciaba, G. Segneri, G. Sguazzoni, G. Spandre, M.A. Spezziga, F. Spinella, A. Starodumov, R. Tenchini, L. Teodorescu, G. Tonelli, A. Venturi, P.G. Verdini, Jinchuan. Wang, Zhen. Xie

Roma, Università di Roma I ”La Sapienza”/ Dipartim.di Fisica G.Marcone RomeI

S. Baccaro, L. Barone, A. Bartoloni, M. Castellani, A. Cecilia, I. Dafinei, F. De Notaristefani, M. Diemoz, A. Festinesi, E. Longo, M. Montecchi, G. Organtini, M. Puccini, F. Rapuano, E. Valente, A. Zullo

Torino, Politecnico di Torino/ Dipartimento di Fisica

S. Fratianni

Torino, Università degli Studi di Torino

N. Amapane, M. Arneodo, F. Bertolino, C. Biino-Palestini, R. Cirio, M. Costa, D. Dattola, F. Daudo, V. Del Duca, N. Demaria, G. Favro, M.I. Ferrero, S. Maselli, V. Monaco, C. Peroni, A. Romero, R. Sacchi, A.M. Solano, A. Staiano, A. Vitelli

KOREA

Cheju, Cheju National Univ.

Yong Joo. Kim

Chonju (Chollabuk-Do), Chonbuk Nat. Univ.

Yong Uhn. Kim

Chuncheon (Gangweon-Do), Kangweon National Univ.

Soon-Kwon. Nam

Iksan (Chollabuk-Do), Wonkwang Univ.

Sang Yull. Bahk

Kwangju, Chonnam National University/ Department of Physics

Hanil. Jang, Jae Yool. Kim, Tae Ick. Kim, In-Taek. Lim

Naju (Chollanam-Do), Dongshin Univ.

Myoung-Youl. Pac

Namwon (Chollabuk-Do), Seo Nam Univ.

Seok Jae. Lee

Seoul (Cheongryangri), Kon-Kuk University/ Department of Physics

June-Tak. Rhee

Seoul (Cheongryangri), Korea University/ Physics Department

S. Ahn, Byungsik. Hong, Seong Jong. Hong, Young-Jin. Kim, Kyong Sei. Lee, Heung Keun. Park, Sung Keun. Park, Kwang Souk. Sim

Seoul (Cheongryangri), Seoul National University

Bock-Joo. Kim, Soo-Bong. Kim, Il Hung. Park

Seoul (Cheongryangri), Seoul National University of Education

Duk-Gil. Koo

Suwon City (Kyonggi-Do), Department of Physics Sungkyunkwan University

B.G. Cheon, Y-I. Choi

Taegu, Kyungpook National University/ Laboratory of High Energy Physics

Woo Hyun. Chung, S.W. Ham, Hun Moo. Jeon, Dong Hee. Kim, Guinyun. Kim, Woo-Young. Kim, Sun Kun. Oh, S. Ro, Dongchul. Son

NETHERLANDS

Eindhoven, Technische Universiteit Eindhoven

P. Van Der Stok

PAKISTAN

Islamabad, Quaid-i-Azam University/ National Centre for Physics

Z. Aftab, M.M. Ahmad, J. Alam Jan, N. Bhatti, K.S. Hasanain, H. Hoorani, M.K. Khan, S.M. Khan, A. Niaz, R. Riazuddin

Swabi, Ghulam Ishaq Khan Inst. of Eng. Sciences and Technology

J. Ahmad, I.U. Awan, N. Iftikhar, M.A. Khan, M.U. Mirza, A. Muhammad, J. Zeb

POLAND

Warszawa, Soltan Institute for Nuclear Studies

R.J. Gokieli, M. Gorski, L. Goscilo, G. Wrochna, P. Zalewski

Warszawa, University of Warsaw/ Institute of Experimental Physics

M. Cwiok, H. Czyrkowski, R. Dabrowski, W. Dominik, M. Kazana, J. Krolikowski, I. Kudla, P. Majewski, M.A. Pietrusinski, K.T. Pozniak, P.P. Zych

PORTUGAL

Lisboa, Laboratório de Instrumentação e Física Experimental de Partículas

C.B. Almeida, T. Barata Monteiro, P. Bordalo, S.L. Da Mota Silva, J. Da Silva, O.P. Dias, N.M. Girao De Almeida, J. Gomes, F. Goncalves, S.E. Ramos, M. Santos, J. Semiao, S. Sequeira Lopes Tavares, S. Silva, C.M. Simoes Azevedo, J.A. Soares Augusto, I. Teixeira, J.P. Teixeira, J. Varela, N.M. Vaz Cardoso

RUSSIAN FEDERATION, CIS

Dubna, Moscow Region, Joint Institute for Nuclear Research (JINR)

S. Afanassiev, I.S. Anissimov, D. Bandourine, A. Belkov, S. Chatrchyan, C. Cheshkov, S. Chmatov, A. Dmitriev, V. Elsha, I. Erchov, M. Finger, M. Finger, L. Glonti, I. Goloutvine, N. Gorbounov, I. Gramenitski, A. Ioukaev, I. Ivantchenko, A. Janata, V. Kalaguine, V. Karjavine, S. Khabarov, V. Khabarov, I. Kiriouchine, V. Kolesnikov, V. Konoplianikov, V. Korencov, I. Kossarev, A. Koutov, T. Kracikova, V. Krasnov, A. Litvinenko, V. Lysiakov, A. Malakhov, G. Mechtcheriakov, I. Melnitchenko, V. Mitsyn, P. Moissenz, S. Movtchan, V. Paltchik, V. Perelygine, I. Petoukhov, M. Popov, D. Pose, R. Pose, A. Samochkine, M. Savina, S. Sergueev, S. Shulha, N. Skatchkov, A. Skatchkova, V. Smirnov, D. Smoline, A. Tcheremoukhine, A. Tchvyrov, E. Tikhonenko, V. Uzhinskii, N. Vlassov, A. Volodko, N. Zamiatine, A. Zaroubin, P. Zaroubine, E. Zoubarev

Gatchina (St.Petersburg), Petersburg Nuclear Physics Institute (PNPI)/ High Energy Physics Division (HEPD)

A. Atamantchouk, V. Barashko, N. Bondar, L. Chtchipounov, A. Denissov, G. Gavrilov, V. Golovtsov, I. Goussev, I. Ivanov, O. Kisselev, E. Kouznetsova, V. Kozlov, E. Lobatchev, G. Makarenkov, E. Orichtchine, A. Petrunin, O. Prokofiev, B. Razmyslovich, V. Razmyslovitch, V. Sedov, V. Sknar, I. Smirnov, S. Sobolev, V. Soulimov, V. Souvorov, N. Terentiev, A. Vassiliev, G. Velitchko, S. Volkov, A.A. Vorobiev

Moskva, Institute for Theoretical and Experimental Physics (ITEP)

E. Dorochkevitch, V. Gavrilov, A. Ioumachev, V. Kaftanov, A. Khanov, I. Kisselevitch, V.V. Kolosov, M. Kosov, A. Krokhotine, S. Kuleshov, A. Oulianov, N. Stepanov, V. Stoline, S. Uzunyan

Moskva, Moscow State University

A. Belski, V. Bodyagin, E.E. Boos, A. Cherstnev, A. Demianov, M. Doubinine, L. Doudko, A. Erchov, R. Gloukhov, A. Gribouchine, V. Ilin, O. Kodolova, V. Korotkikh, A. Krioukov, N. Krouglov, I. Lokhtine, V. Mikhailine, A. Poukhov, L. Sarycheva, V. Slad, A. Sniguirev, I. Vardanian, A. Vassiliev

Moskva, Res.&Devel.Inst.of Power Eng.RDIPE Moscow

V. Sakharov

Moskva, Russian Academy of Sciences/ Institute for Nuclear Research (INR)

G. Atoian, V. Bolotov, E. Devitsine, A. Fomenko, S. Gninenko, N. Goloubev, E. Gouchtchine, M. Kirsanov, N. Konovalova, A. Kovzelev, V. Kozlov, N. Krasnikov, A. Lebedev, N. Loktionova, N. Lvova, V. Matveev, A. Pachenkov, A. Poliarouch, V. Postoev, S. Potashov, A. Proskouriakov, S. Rusakov, A. Sadovski, I. Semeniouk, V. Shmatkov, A. Skassyrskaia, A. Terkoulov, A. Toropine

Protvino, Moscow Region, Ministry of the Russian Federation for Atomic Energy/ Inst.for High Energy Physics IHEP (IHEP)

A. Abramov, V. Abramov, I. Ajguirei, S. Bitioukov, P. Chaguine, K. Datsko, A. Dolgopolov, V. Evdokimov, V. Falaleev, P. Gontcharov, A. Inyakin, V. Katchanov, I. Kharlov, V. Klioukhine, E. Kolatcheva, A. Korablev, I. Korneev, A. Kostritski, A. Krinitsyn, V. Krychkine, O. Lapyguina, A. Levine, A. Markov, V. Medvedev, M. Oukhanov, A. Ouzounian, V. Pak, D.I. Patalakha, V. Petrov, V. Pikalov, V. Potapov, A. Sannikov, Z. Simonova, E. Skvortsova, S. Slabospitski, A. Sobol, V. Solovianov, V. Sougoniaev, A. Sourkov, S. Stepouchkine, A. Sytine, B.V. Tchouiko, S. Terechtchenko, N. Tiourine, L. Tourtchanovitch, S. Trochine, A. Volkov, A. Zaitchenko, S. Zelepoukine

Snezhinsk, Tchelyabinsk Region, Russian Federal Nuclear Center VNIITF

S. Kochelev, S. Kotegov, V. Pravilnikov

SLOVAKIA

Bratislava, Slovak Academy of Sciences/ Institute of Electrical Engineering

P. Ballo, J. Lipka, V. Necas, M. Seberini, K. Vitazek

SPAIN

Madrid, Consejo Superior de Investigaciones Científicas (CSIC)/ Centro de Investigaciones Energeticas Medioambientales y Tecnologicas (CIEMAT)

M. Aguilar-Benitez, J. Alberdi, J. Barcala, M. Cerrada, N. Colino, M. Daniel, M. Fernandez Garcia, A. Ferrando, M. Fouz Iglesias, M.I. Josa Mutuberria, P. Ladron De Guevara, J. Marin, A. Molinero, J.C. Oller, J.L. Pablos, J. Puerta Pelayo, L. Romero, J. Salicio, C. Willmott

Madrid, Universidad Autónoma de Madrid

C. Albajar

Oviedo (Asturias), Universidad de Oviedo

F. Cuevas Maestro

Santander (Cantabria), Universidad de Cantabria/ Instituto de Física de Cantabria, Grupo de Altas Energías

P. Arce, E. Calvo Alamillo, C.A. Fernandez Figueroa, G. Gomez Ceballos, I. Gonzalez Caballero, M.A. Lopez Virto, J.M. Lopez, J. Marco, F. Matorras, T. Rodrigo, A. Ruiz Jimeno, I. Vila Alvarez

SWITZERLAND

Basel, Universität Basel/ Institut für Physik

P. Garcia-Abia, L. Tauscher, S. Vlachos, M. Wadhwa

Genève, European Organization for Nuclear Research (CERN)

D. Abbaneo, R. Alemany Fernandez, A. Annenkov, P. Aspell, E. Auffray Hillemanns, P. Azzurri, P. Baillon, A. Ball, R. Barillere, D. Barney, D. Blechschmidt, P. Bloch, M. Bosteels, S. Braibant-Giacomelli, H. Breuker, P. Brooks, D. Campi, A. Caner, E. Cano, F. Carena, A. Cattai, F. Cavallari, G. Cervelli, R. Chierici, P. Chin Kee Figueiredo, J. Christiansen, S. Cittolin, B.R. Cure, C. D'Ambrosio, A. De Roeck, T. De Visser, D. Delikaris, M. Della Negra, A. Elliott-Peisert, B. Faure, A. Favara, H. Foeth, R. Folch, A. Frey, W. Funk, A. Furtjes, A. Gaddi, J-C. Gayde, H. Gerwig, K.A. Gill, F. Glege, W. Glessing, R. Goudard, P. Gras, J-P. Grillet, J. Gutleber, F. Hahn, S. Hameed Khan, R. Hammarstrom, M. Hansen, H. Heijne, A. Herve, A. Honma, M. Huhtinen, V. Innocente, W. Jank, P. Janot, P. Jarron, M.M. Kado, K. Kloukinas, C. Koch, M. Konecki, Z. Kovacs, V.R. Lara, C. Lasseur, J-M. Le Goff, M. Lebeau, P. Lecoq, M. Lenzi, M. Letheren, M. Liendl, C. Ljuslin, B. Lofstedt, R. Loos, R. Mackenzie, R. Malina, M. Mannelli, E. Manola-Poggioli, A. Marchioro, J-C. Marin, C. Mariotti, C. Martinez Rivero, J.M. Matheson, J-M. Maugain, F. Meijers, M. Mermoud, E. Meschi, E. Migliore, F. Mossiere, A. Moutoussi, N. Neumeister, A. Nikitenko, Alexander. Oh, A.T.O. Onnela, M. Oriunno, L. Orsini, C. Palomares Espiga, L. Pape, G. Passardi, G. Pasztor, P. Petagna, A. Pfeiffer, M. Pimia, P.A. Pinto Dos Reis, R. Pintus, E. Piotto, B. Pirollet, A. Placci, J-P. Porte, W.J. Postema, J. Pothier, A. Quadt, A. Racz, P. Rebecchi, S. Reynaud, H. Rezvani Naraghi, R. Ribeiro, J. Roche, P. Rodrigues Simoes Moreira, T.V. Rohe, L. Rolandi, H. Sakulin, D. Samyn, J-C. Santiard, C. Schaefer, W. Schleifer, R. Schmidt, M. Schroeder, C. Schwick, P. Sempere Roldan, P. Sharp, P. Siegrist, A. Simma, P. Spagnolo, P. Sphicas, H. Stockinger, F. Szoncso, B. Taylor, D. Tchougounov, T. Toifl, N.Z. Toth, D. Treille, J. Troska, E. Tsesmelis, A. Tsirou, F. Van Lingen, F. Vasey, T. Virdee, H.H. Voss, W. Weingarten, J-P. Wellisch, P. Wertelaers, M. Wilhelmsson, I.M. Willers, M. Winkler, S. Wynhoff

Villigen, Paul Scherrer Institut (PSI)

R. Baur, W. Bertl, K. Deiters, P. Dick, A. Dijksman, K. Gabathuler, J. Gobrecht, G. Heidenreich, R. Horisberger, Q. Ingram, B. Kotlinski, R. Morf, D. Renker, R. Schnyder

Zürich, Eidgenössische Technische Hochschule Zürich (ETH)

H.B. Anderhub, G. Antchev, A. Badertscher, A.J. Barczyk, B. Betev, A. Biland, B. Blau, D. Bourilkov, A. Bueno, M. Campanelli, P. Cannarsa, C. Carpanese, N.S. Chivarov, M. Dittmar, L. Djambazov, R. Eichler, W. Erdmann, G. Faber, J-L. Faure, M. Felcini, K. Freudenreich, I. Gil Botella, C. Grab, M. Hilgers, H. Hofer, A.G. Holzner, I. Horvath, C. Humbertclaude, B.I. Iliev, P. Ingenito, J. Kuipers, P. Le Coultre, P. Lecomte, B. List, W. Lustermann, I.D. Nanov, F. Nessi-Tedaldi, R.A. Ofierzynski, A. Patino Revuelta, F. Pauss, G. Rahal, J.F. Rico, C.H. Rivetta, U. Roser, A. Rubbia, H. Rykaczewski, A. Schoning, N. Sinanis, H. Suter, S. Udriot, J. Ulbricht, I. Veltchev, G. Viertel, H. Von Gunten, S. Waldmeier, A. Zanet

Zürich, Universität Zürich

C. Amsler, R. Kaufmann, H. Pruys, C. Regenfus, P. Riedler, P. Robmann, T. Speer, S. Steiner

TAIWAN, ROC

Chung-Li (Taoyuan Hsien), National Central University/ Department of Physics

Yuan-Hann. Chang, Ei Fong Augustine. Chen, Apollo. Go, Willis. Lin

T'Ai-Pei, National Taiwan University (NTU)

Paoti. Chang, George Wei-Shu. Hou, K. Ueno

TURKEY

Adana, Cukurova University/ Physics Department

I. Dumanoglu, E. Eskut, A. Kayis Topaksu, G. Onengut, N. Ozdes Koca, A. Polatoz

Ankara, Middle East Technical University (METU)/ Physics Department

M.A. Guler, R. Sever, P. Tolun, H. Yildiz, Mehmet. Zeyrek, Meltem. Zeyrek

Istanbul, Bogazici Univ./ Department of Physics

E. Gulmez, R. Unalan

UKRAINE, CIS

Kharkiv, Institute for Single Crystals of National Academy of Science (ISC)

A. Borisenko, B. Grynyov, V. Lebedev, V. Lyubynskiy, V. Senchyshyn, V. Vasilchuk

Kharkiv, Kharkov State University (KSU)

S. Duplij, N. Kluban, I. Zalyubovskyy

Kharkiv, Ukrainian Academy of Sciences/ Kharkov Institute of Physics and Technology (KIPT) (KFTI)

L. Levchuk, A. Nemashkalo, V. Popov, P. Sorokin

UNITED KINGDOM

Bristol, University of Bristol/ H.H. Wills Physics Laboratory

D.S. Bailey, J.J. Brooke, D.G. Cussans, R. Head, G.P. Heath, H.F. Heath, C.K. Mackay, D. Newbold, A.D. Presland, M.G. Probert, V. Smith, R. Tapper

Bristol, University of the West of England

G. Chevenier, F. Estrella Cainglet, G. Mathers

Chilton, Didcot, Rutherford Appleton Laboratory/ Particle Physics

R.A. Barlow, E. Bateman, K. Bell, R. Brown, D. Cockerill, J.A. Coughlan, L. Denton, P. Flower, V.B. Francis, M.J. French, J. Greenhalgh, R.N.J. Halsall, W. Haynes, F. Jacob, P.W. Jeffreys, B. Kennedy, A.L. Lintern, A.B. Lodge, A.J. Maddox, B. Smith, S. Spagnolo, M. Sproston, R. Stephenson, I. Tomalin, M.J. Torbet, J. Williams

London, University of London/ Imperial College

M.L.G. Apollonio, G. Barber, R. Beuselinck, D. Britton, W. Cameron, E.P. Corrin, G.J. Davies, K. Fountas, J.R. Fulcher, G. Hall, J.M. Hays, G.M. Iles, B. Macevoy, N. Marinelli, E.M. McLeod, E.A. Noah Messomo, D.M. Raymond, P.J. Savage, C. Seez, L. Toudup, P.G. Walsham

Uxbridge, Middx., Brunel University/ Detector Development Group

B. Camanzi, P. Hobson, D. Imrie, A. McKemey, O. Sharif, S.J. Watts

UNITED STATES OF AMERICA

Ames, Iowa State University

E.W. Anderson, H. Chakir, J.M. Hauptman, J. Krane

Baltimore, Johns Hopkins University (JHU)

B.A. Barnett, C-Y. Chien, H-S. Cho, G. Liang, M. Swartz, Xiaobo. Xie

Batavia, Fermi National Accelerator Laboratory (FNAL)

G. Apollinari, M. Atac, S. Aziz, L. Bauerdick, A.E. Baumbaugh, U. Baur, A. Beretvas, M. Binkley, M. Bowden, J. Butler, N.S. Chester, I. Churin, S. Cihangir, M. Crisler, L. De Barbaro, D. Denisov, M. Diesburg, D.P. Eartly, J. Elias, S. Feher, J. Freeman, I. Gaines, H. Glass, D.A. Glenzinski, J. Goldstein, D. Green, J.E. Hanlon, S. Hansen, R. Harris, V. Iarba, J.R. Incandela, U. Joshi, S. Kwan, M. Lamm, S. Lammel, G. Lanfranco, D. Lazic, R.H. Lee Jr, M. Litmaath, S. Los, K. Maeshima, J.M. Marraffino, S. Mishra, N. Mokhov, C. Moore, S. Muzaffar, V.R. O'Dell, J. Patrick, R. Pordes, R. Raja, M.A. Reichanadter, A. Ronjine, V. Rykaline, T. Shaw, M. Shea, E. Skup, R. Smith, L.G. Spiegel, D. Stuart, I. Suzuki, S. Tkaczyk, R.S. Tschirhart, R. Vidal, R. Wands, H-J. Wenzel, J. Whitmore, J.W. Womersley, Wei Min. Wu, A. Yagil

Blacksburg, Virginia Polytechnic Institute and State University (VPI & SU)

H. Meyer, L.W. Mo, T.A. Nunamaker

Boston, Boston University

R. Carey, E. Hazen, E. Kearns, E. Machado, J. Miller, D. Osborne, L.B. Roberts, J. Rohlf, L. Sulak, J.D. Sullivan, Shouxiang. Wu

Boston, Northeastern University

G. Alverson, A. Dorokhov, H. Fenker, I. Gaponenko, J. Moromisato, I. Moussienko, S. Nicol, T. Paul, S. Reucroft, J.D. Swain, L. Taylor, E. Von Goeler, T. Yasuda

Cambridge, Massachusetts Institute of Technology (MIT)

G. Bauer, J. Friedman, C. Paus, S.J. Pavlon, L. Rosenson, K. Sumorok, S. Tether, J. Tseng

Chicago, University of Illinois at Chicago/ Physics Department

M.R. Adams, C.E. Gerber, K. Papageorgiou, J. Solomon

College Park, University of Maryland

S. Abdoulline, S. Arcelli, A.R. Baden, R. Bard, S.C. Eno, D. Fong, T. Grassi, N.J. Hadley, R. Kellogg, S. Kunori, A. Sharma, A. Skuja

Columbus, Ohio State University

B. Bylsma, S. Durkin, J. Gilmore, Jianghui. Gu, D.C. Herman, Chang. Kim, D. Larsen, Ta-Yung. Ling, C.J. Rush, V. Sehgal

Davis, University of California at Davis

R. Breedon, M.E. Case, P.T. Cox, J. Gunion, S.G. Hershman, B. Holbrook, W. Ko, R. Lander, P. Murray, D. Pellett, J. Smith, M.S. Tripathi, R. Vogt

Evanston, Northwestern University

B. Gobbi, S. Malik, R. Tilden

Fairfield, Fairfield University

C. Beetz, G.T. Cirino, V. Podrasky, C. Sanzeni, D. Winn

Gainesville, University of Florida

D.E. Acosta, P. Avery, S. Dolinski, R.D. Field, L. Gorn, S. Klimenko, J. Konigsberg, A. Korytov, A. Madorsky, G. Mitselmakher, A. Nomerotski, P. Ramond, B. Scurlock, H. Stoeck, Song Ming. Wang, J. Yelton

Houston, Rice University

N. Adams, M. Corcoran, G.W. Eppley, J. Lamas Valverde, M. Matveev, H. Miettinen, T. Nussbaum, P.B. Padley, E. Platner, J. Roberts, P. Yepes Stork

Iowa City, University of Iowa

U. Akgun, A.S. Ayan, A. Cooper, M. Fountain, E.R. McCliment, J-P. Merlo, M.J. Miller, Y. Onel, I. Schmidt

Lawrence, University of Kansas

A.L. Bean

La Jolla, University of California at San Diego

S. Bhattacharya, J. Branson, I. Fisk, J.P. Fryckman, D. Macfarlane, M. Mojaver, H.P. Paar, G.H. Raven, V. Sharma, A. White

Lincoln, University of Nebraska in Lincoln

W.B. Campbell, D. Claes, C. Lundstedt, G.R. Snow

Los Angeles, Univ.of California Los Angeles UCLA (UCLA)

K. Arisaka, A.J. Attal, D. Cline, R. Cousins, S. Erhan, J. Hauser, M. Lindgren, C. Matthey, J. Mumford, S. Otwinowski, I. Pichtchalnikov, P. Schlein, Y.. Shi, B.H. Tannenbaum, M. Von Der Mey, Hanguo. Wang

Lubbock, Texas Tech University

N. Akcurin, J. Cranshaw, O.B. Lobban, V. Nagaslaev, V. Papadimitriou, A. Sill, M. Wigmans

Madison, University of Wisconsin

D. Carlsmith, P.R. Chumney, S.R. Dasu, F. Feyzi, C. Foudas, L.S. Greenler, M. Jaworski, J. Lackey, R. Loveless, S. Lusin, D. Reeder, W. Smith

Manhattan Ks, Kansas State University Graduate School

W.E. Kahl, S. Korjenevski

Melbourne Fl, Florida Institute of Technology

M. Mohammadi

Minneapolis, University of Minnesota

P. Cushman, A.H. Heering, I.J. Kronkvist, R. Rusack, A. Singovski, P. Vikas

Notre Dame, University of Notre Dame

B. Baumbaugh, J. Bishop, N.M. Cason, M.D. Hildreth, D.J. Karmgard, R. Ruchti, J. Warchol, M. Wayne

Pasadena, California Institute of Technology CALTECH (CALTECH)

J. Bunn, S. Chevtchenko, G. Denis, P.D. Galvez, M. Gataoulline, M. Hafeez, T. Hickey, K. Holtman, I. Legrand, V. Litvine, H. Newman, A. Samar, R. Wilkinson, Lei. Xia, Ren-Yuan. Zhu

Piscataway, Rutgers, the State University of New Jersey/ Dept.of Physics and Astronomy

E.H. Bartz, J.S. Conway, T. Devlin, J. Doroshenko, P. Jacques, M.S. Kalelkar, T.W. Koeth, A. Lath, L. Perera, S.R. Schnetzer, S. Somalwar, R. Stone, G. Thomson, T.L. Watts

Pittsburgh, Carnegie Mellon University

T. Ferguson, J. Russ, H. Vogel, I. Vorobiev

Princeton, Princeton University

J-M. Bussat, W.C. Fisher, V.K. Gupta, J.M. Mans, D. Marlow, P. Piroue, D. Stickland, C. Tully, A. Wildish

Richardson, University of Texas at Dallas

R.C. Chaney, E.J. Fenyves, H. Hammack, M.R. O'Malley, D. Suson, A.V. Vassiliev

Riverside, University of California

R. Clare, I. Crotty, J.W. Gary, J.G. Layter, H. Rick, Benjamin. Shen, V. Sytnik, D. Zer-Zion

Rochester, University of Rochester

S.R. Blusk, A. Bodek, H. Budd, A. Dychkant, G. Ginther, M.C. Kruse, D. Ruggiero, W. Sakumoto, P. Slattery, P. Tipton

Tallahassee, Florida State University

H. Baer, M. Bertoldi, H.J. Goldman, S.L. Hagopian, V. Hagopian, K. Johnson, H. Prosper, J. Thomaston, H. Wahl

University, University of Mississippi

K. Bhatt, M. Booke, L.M. Cremaldi, R. Kroeger, J.J. Reidy, D. Sanders, D. Summers

West Lafayette, Purdue University

V.E. Barnes, G. Bolla, D. Bortoletto, A. Bujak, A. Garfinkel, L. Gutay, M. Kopal, A. Laasanen, S. Medved, I. Pal, C. Rott, A. Roy, A. Sedov

UZBEKISTAN, CIS

Ulugbek (Tachkent), Uzbek Academy of Sciences/ Inst.of Nucl.Phys. U.G.Gulyamov Lab.of Relativistic Nucl.Phys.

A. Avezov, M. Belov, N. Bisenov, A. Gafarov, E. Gasanov, E. Ibragimova, Genchan. Kim, Y. Koblik, N. Rakhmatov, I. Rustamov, I. Shukrullo, A. Urkinbaev, B. Yuldashev

Spokesperson: M. Della Negra
Glimos: R. Schmidt FGSO: C. Schaefer/ A. Tsirou

CMS is a general purpose proton-proton detector designed to run at the highest luminosity at the LHC. It is also well adapted for studies at the initially lower luminosities. The CMS Collaboration consists of 1700 scientists and engineers from 152 institutes in 32 countries. The main design goals of CMS are:

i) a highly performant muon system;

ii) the best possible electromagnetic calorimeter consistent with (i);

iii) high quality central tracking to achieve (i) and (ii);

iv) a detector costing less than 475 MCHF.

The Technical Design Reports of the Magnet, Inner Tracking, the Muon System, the Electromagnetic and Hadronic Calorimeters have been submitted and approved.

- Magnet

  The detector (Figure CMS-1,2) will be built around a long (13 m) and large bore (ϕ=5.9 m) high-field superconducting solenoid (4 T) leading to a compact design for the muon spectrometer. The magnetic flux is returned through 1.5 m of saturated iron yoke (1.8 T) instrumented with muon chambers. The Technical Design Report for the magnet was submitted and approved in 1997. The construction of the magnet has started and is proceeding according to schedule and will be tested on the surface in 2003.

- Inner Tracking

  All high p_t muons, isolated electrons and charged hadrons, produced in the central rapidity region, are reconstructed with a momentum precision of $\Delta p_t/p_t = 0.005 + 0.15 p_t$ (p_t in TeV). The high momentum precision is a direct consequence of the high magnetic field. The tracking volume is given by a cylinder of length 6 m and a diameter of 2.6 m. In order to deal with high track multiplicities tracking detectors with small cell sizes are used. Solid-state and gas microstrip detectors provide the required granularity and precision. Stereo information is provided by double-sided microstrip detectors. Pixel detectors placed close to the interaction region improve the measurement of the track impact parameter and secondary vertices. High track finding efficiencies are achieved for isolated high p_t tracks and for high p_t tracks in jets. The short bunch crossing time at the LHC (25ns) and high levels of radiation place challenging requirements on readout electronics. The construction of the tracker is scheduled to start in 2000.

- Muon System

  Centrally produced muons are measured three times, in the inner tracker, after the coil and in the return flux. They are then identified and measured in four identical muon stations (MB) inserted in the return yoke. Special care has been taken to avoid pointing cracks and to maximize the geometric acceptance. Each muon station consists of twelve planes of aluminium drift tubes designed to give a muon vector in space, with 100 μm precision in position and better than 1 mrad in direction. The four muon stations include RPC triggering planes that also identify the bunch crossing and enable a cut on the muon transverse momentum at the first trigger level. The endcap muon system also consists of four muon stations (ME). Each station consists of six planes of Cathode Strip Chambers. The chambers are arranged such that all muon tracks traverse four stations at all rapidities, including the transition region between the barrel and the endcaps. The last muon stations are after a total of $\geq 20\lambda$ of absorber so that only muons can reach them. The four muon stations lead to a redundant and robust muon system. The large bending power is the key to very good momentum resolution even in the so called ″stand alone″ mode especially at high transverse momenta.

  The combined (using the inner tracker as well as the muon chambers) muon momentum resolution is better than 5% at 0.3 TeV in the central rapidity region $|\eta|$<2 and $\approx$ 10% for p_t=2 TeV. Low-momentum (p_t< 100 GeV) muons are measured before the absorber with a precision of about 1.5% up to a rapidity of 2. Production prototypes are being made and mass production will commence in 2000.

- Calorimetry

  The coil radius is large enough to install essentially all the calorimetry inside and hence avoid the coil-electromagnetic calorimeter interference. A high precision electromagnetic calorimeter (ECAL) using lead tungstate ($PbWO_4$) crystals has been chosen. Lead tungstate is a dense and relatively easy crystal to grow from readily available raw materials and substantial production capacity already exists. Scintillating crystals such as lead tungstate offer the best energy resolution for electrons and photons. The scintillation light is detected by silicon avalanche photodiodes in the barrel region (EB, $|\eta|$ <1.48) and vacuum photodiodes in the endcap region (EE, 1.48<$|\eta|$ <3.0). The expected energy resolution is better than 0.6% for electrons and photons with energies greater than 75 GeV. For example an energy resolution of 0.45% is measured in a test beam for 280 GeV electrons. A preshower system is installed in front of the ECAL (EB, EF) at high luminosities to measure the photon direction in the region $|\eta| \leq 1.1$, and π^0 rejection at all luminosities in the endcap ($1.6 \leq |\eta| \leq 2.6$). The ECAL is followed by a copper/scintillator sampling hadronic calorimeter (HB, HF). The light is channelled by clear fibres fused to wave-length shifting fibres embedded in scintillator plates. The light is detected by photodetectors that can provide gain and operate in high axial magnetic fields (proximity-focussed hybrid photodiodes). Coverage up to rapidities of 5.0 is provided by a Cu/quartz fibre calorimeter. The Cerenkov light emitted in the quartz fibres is detected by photomultipliers. Several thousand crystals have been delivered and a production prototype supermodule will be assembled and tested in 2000. Beam tests of production prototype HCAL modules have been carried out and mass production has started.

- Trigger and Data Acquisition

  The trigger and data acquisition consists of four parts: the front-end detector electronics, the calorimeter and muon first level trigger processors, the readout network and an on-line event filter system. The first two parts are synchronous and pipelined with a pipeline depth corresponding to ≈3 μs. The latter two are asynchronous and based on industry standard data communication components and commercial RISC processors. The resources that would have been required for a hardware second level trigger processors are invested in a high bandwidth (≈ 500 Gbit/s) readout network and in the event filter processing power (10^6-10^7 MIPs), both of which are more suitable for upgrading as commercially available technology develops.

- Software and Computing

  CMS has moved from Fortran to C++ and "Object Oriented" approach for software. This and OO database system are being used in the test beams and for studies of higher-level triggers. The data-storage, networking and processing power needed to analyse CMS data are well in excess of those of today's facilities. The optimum mixture of storage, networking and processing evolves and is the subject of study in the context of the CMS Computing Model.

- Physics Performance

  Although high luminosity is essential to cover the entire range of mechanisms of electroweak symmetry-breaking, the LHC machine will start at significantly lower luminosities (L $\leq 10^{33}$ cm$^{-2}s^{-1}$). The pixel detectors and the $PbWO_4$ crystal electromagnetic calorimeter considerably enhance the discovery potential of CMS at low luminosities.

  A Standard Model (SM) Higgs boson with mass between 95 and 150 GeV would be discovered via its two photon decay after an integrated luminosity of about 3.10^4 pb^{-1}. The same integrated luminosity gives a discovery range covering masses from 135 to 525 GeV in the four lepton (e or μ) channel, with only a small gap in the coverage around 2 m_w. An integrated luminosity of 10^5 pb^{-1} (taken at 10^{34} $cm^{-2}s^{-1}$) would allow discovery via these channels over the full range between 85 and 700 GeV. Tagging the events produced by WW- and ZZ-fusion by detecting characteristic forward jets, and using decay modes with larger branching ratios ($H \rightarrow WW \rightarrow l\nu jj$, and $H \rightarrow ZZ \rightarrow lljj$), should allow the discovery range for a SM Higgs boson to be extended up to 1 TeV for the same integrated luminosity.

The two photon and four lepton channels are also crucial for the discovery of a Higgs boson in the Minimal Supersymmetric Standard Model (MSSM). Various channels involving the tau lepton (h^0, H^0, $A^0 \rightarrow \tau\tau$, $H^\pm \rightarrow \tau\nu$) help to cover much of the remaining allowed (m_A, $\tan\beta$) parameter space. Precise impact parameter measurements using the pixel detector play an important role here. Many physics studies have been carried out in the context of supergravity models (SUGRA). A many-point scan of the gaugino / scalar mass parameter space has been conducted. Squarks and gluinos weighing up to 2 TeV can be detected using, as signature, events with one or more charged leptons, missing transverse energy and two or more jets. Sleptons weighing as much as 400 GeV can be found by looking for events without hadronic jets, but with lepton pairs and missing transverse energy with distinctive kinematic characteristics. Three-lepton states are particularly promising for the detection of charinos and neutralinos. In many cascade decays a heavier neutralino is produced that subsequently decays into the lightest one with the emission of a pair of charged leptons. The spectrum of the di-lepton invariant masses shows a strikingly sharp end-point determined by the difference in neutralino masses. This feature can be used to select and almost fully reconstruct some events yielding e.g. the mass of the bottom squark. The above studies of specific SUSY models indicate that it is possible to detect and measure a large fraction of the expected SUSY spectrum in CMS. Within the SUGRA models it should be possible to determine the fundamental parameters at the GUT scale.

The copious production of B mesons at LHC opens the way for significant measurements of CP violation effects in the B system. Using the $B_d^0 \rightarrow J/\psi$ K_s^0 and $B_d^0 \rightarrow \pi\pi$ channels two of the angles in the unitarity triangle can be measured. Furthermore, by observing the time development of $B_s^0 - \bar{B}_s^0$ oscillations, the mixing parameter x_s can be measured for values up to 20 - 25.

In addition to running as a proton-proton collider, LHC will be used to collide heavy ions at a centre of mass energy of 5.5 TeV per nucleon pair. A new form of deconfined hadronic matter, the quark-gluon plasma (QGP), should be formed at the resulting high energy densities (4-8 GeV/fm^3). Work has been carried out to obtain detailed understanding of the capabilities of CMS for heavy-ion physics especially for signatures involving dimuon production, jet quenching and Z production. The formation of quark-gluon plasma in the heavy ion collisions is predicted to be signalled by a strong suppression of Υ' and Υ'' production relative to Υ production when compared to pp collisions. The CMS detector is well suited to detect low momentum muons and reconstruct the Υ, Υ' and Υ'' mesons produced. The good mass resolution (σ=37 MeV at Υ mass), afforded by the 4T field, enables the measurement of the suppression.