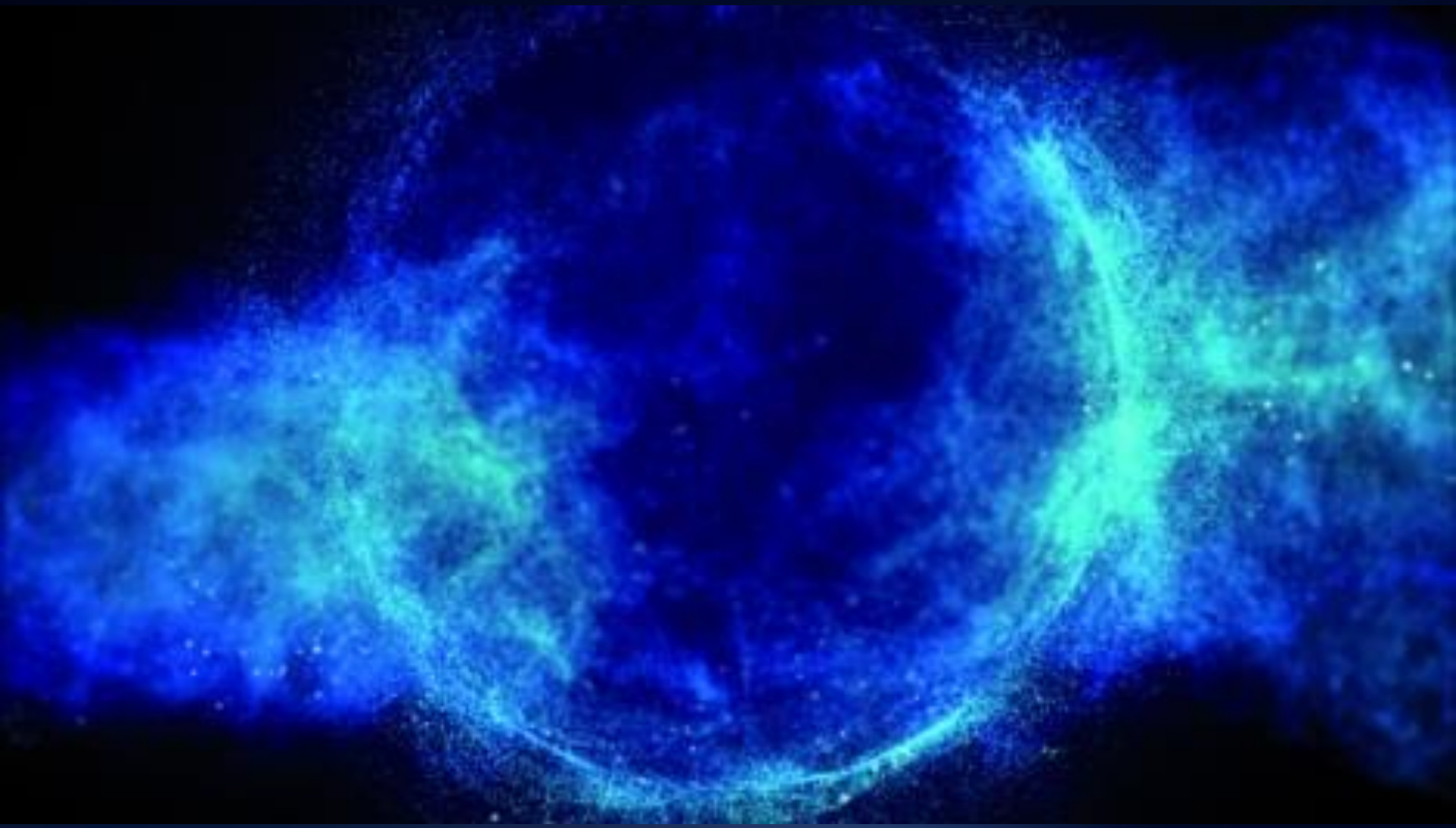
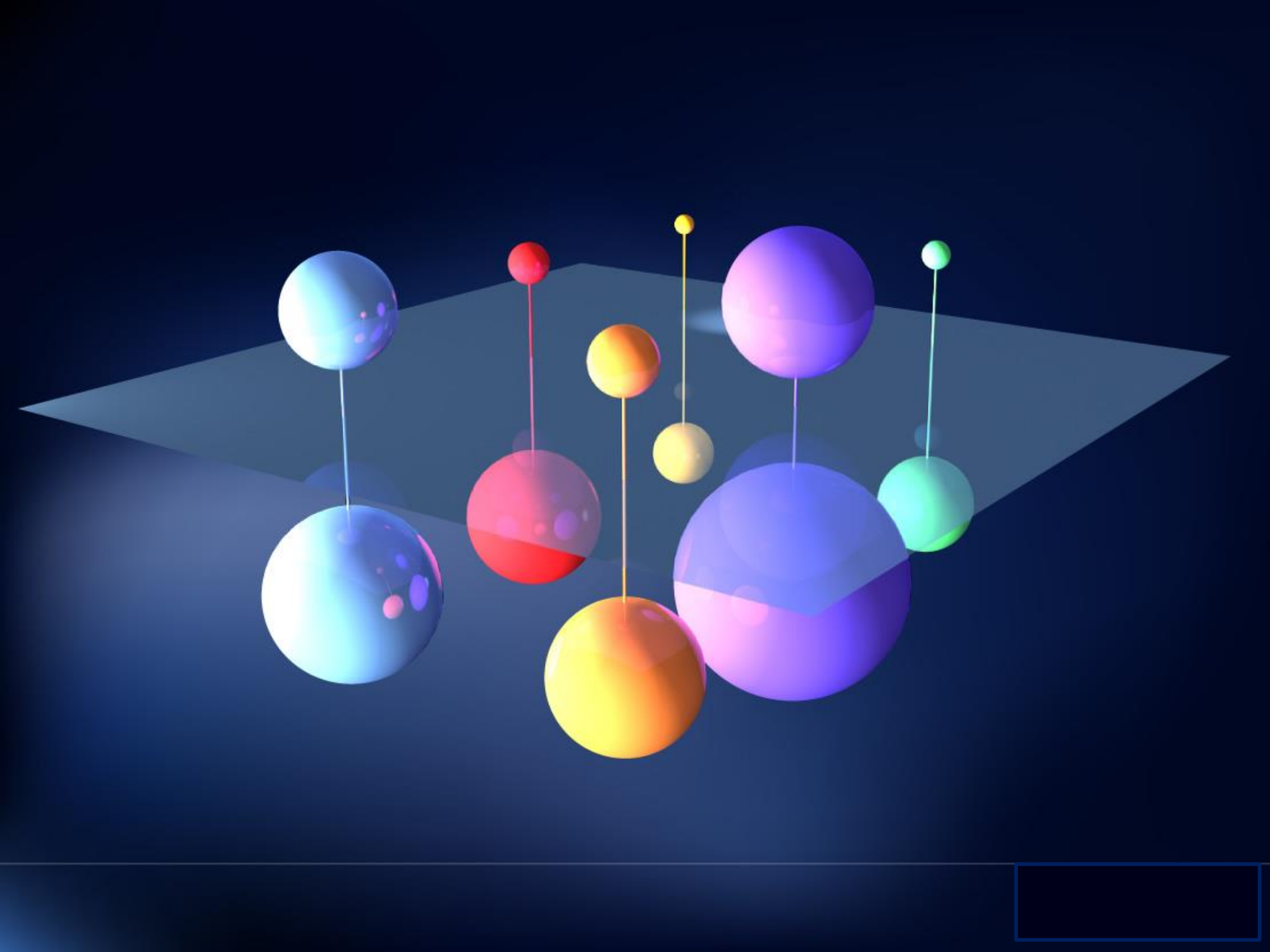
Why Are We Here?: Connecting the Micro and Macro

About CERN, Physics, and Innovation

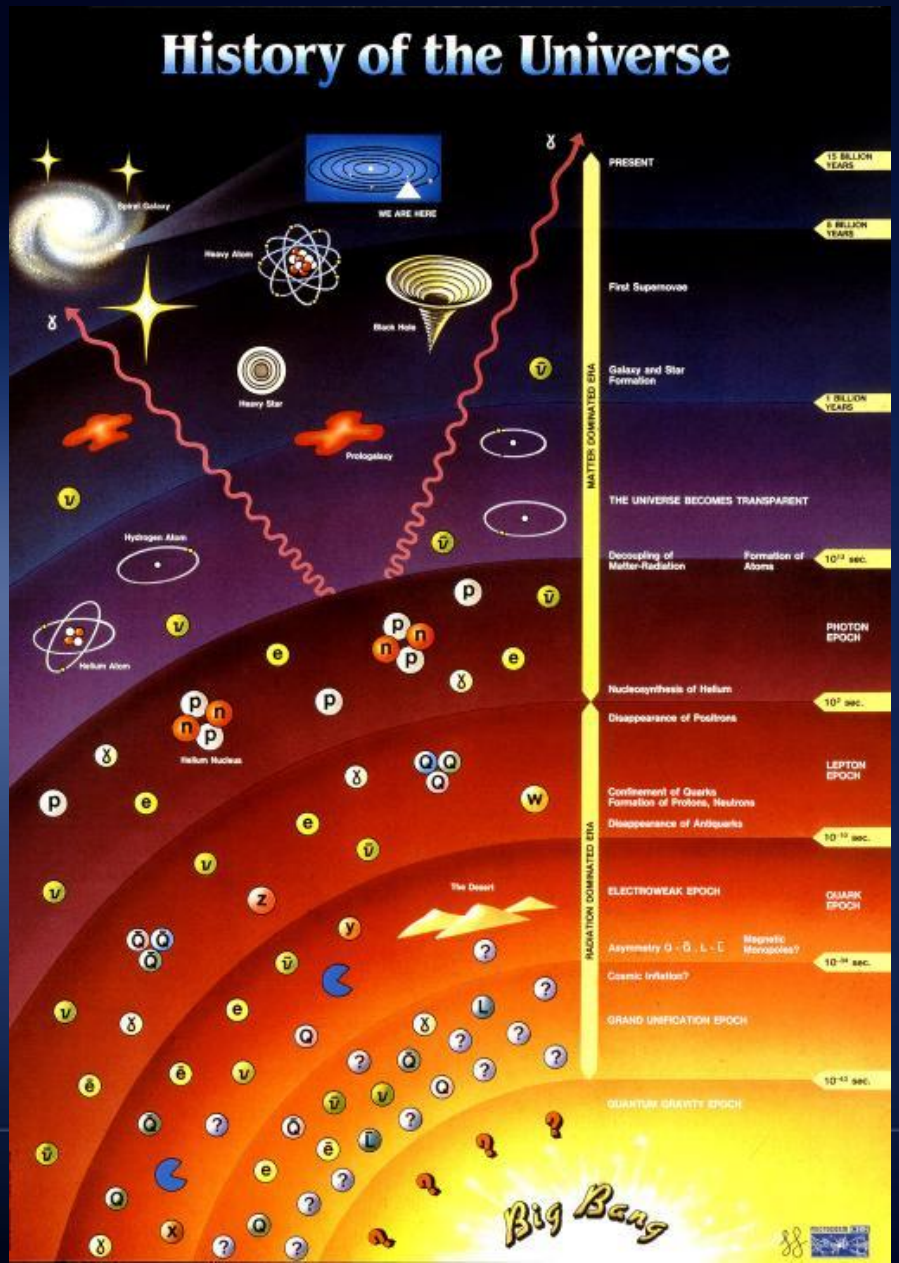
CBI-A3 November 1, 2022
Markus Nordberg (CERN)

What is Wrong with this Picture?



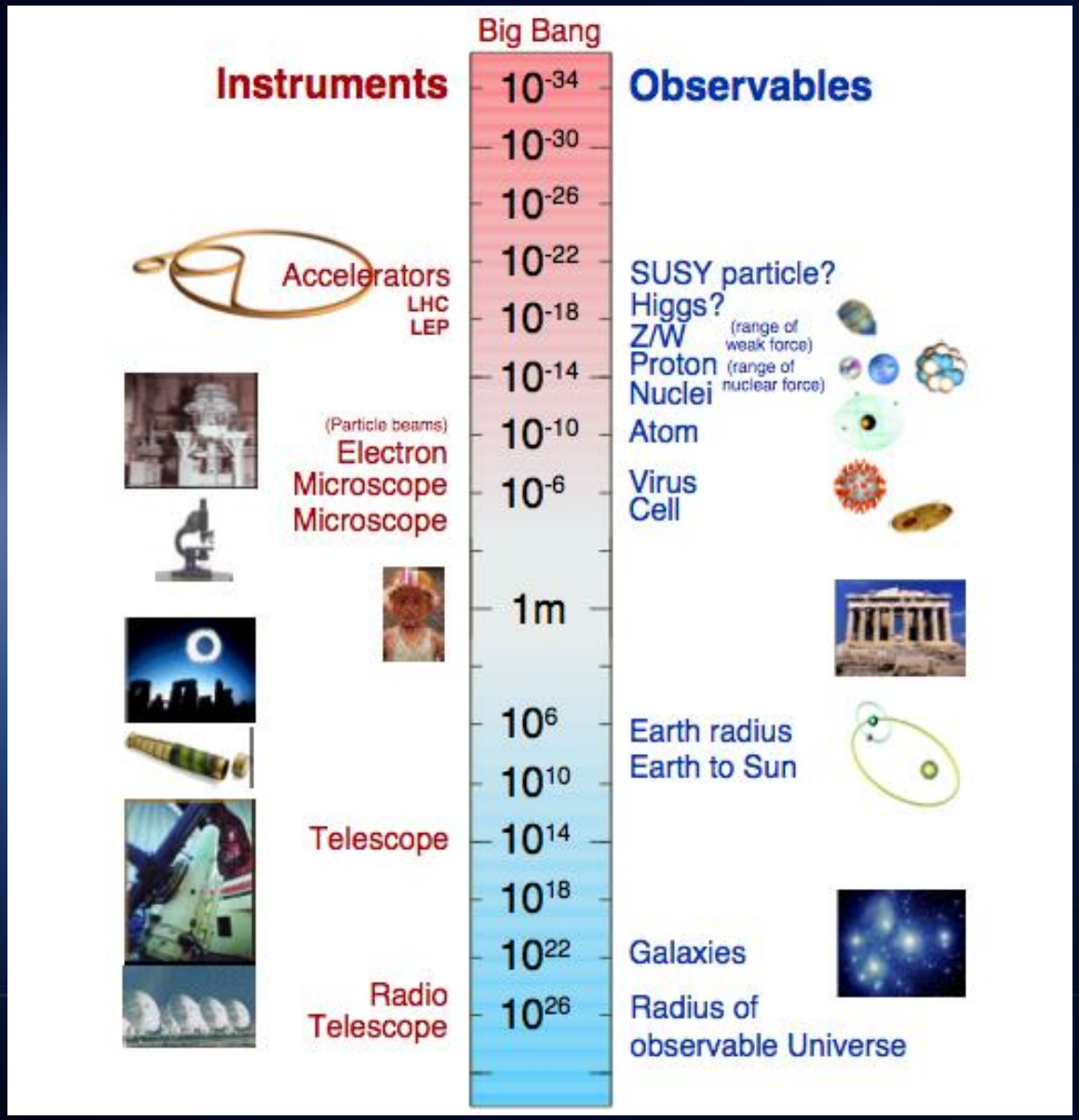


How does CERN Connect?

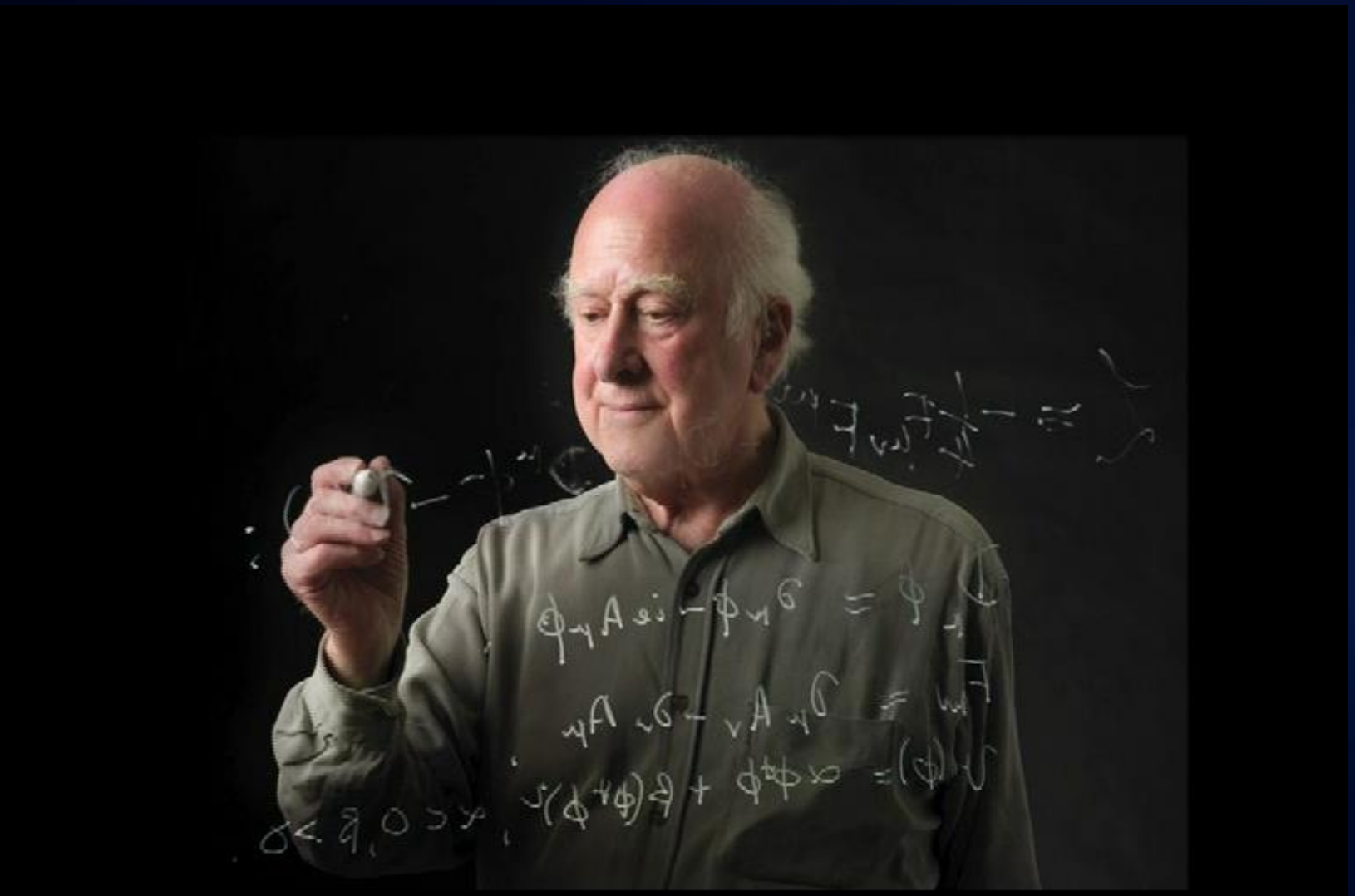


Size of things

How does CERN Measure?



Where do we start?




StorageTek
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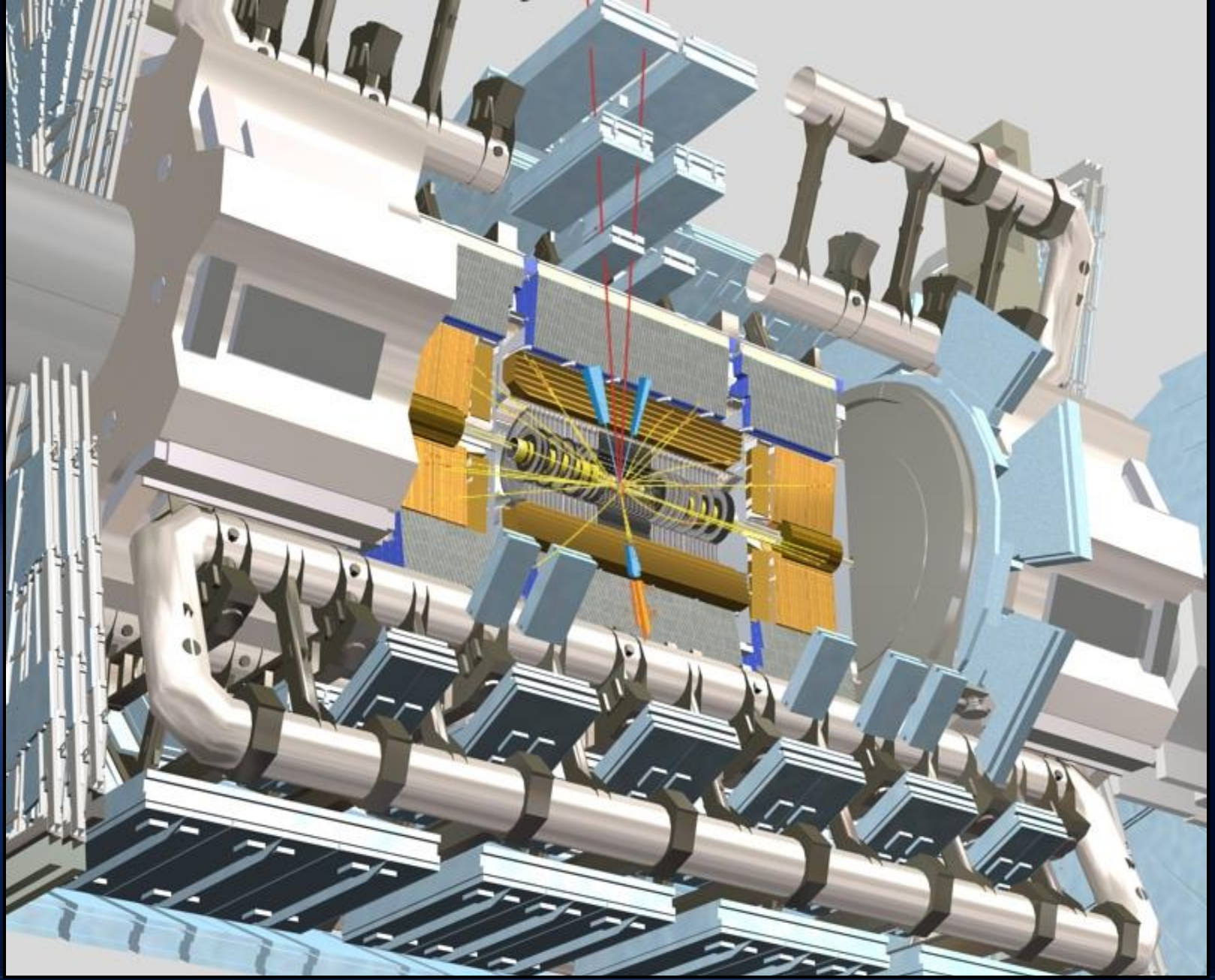
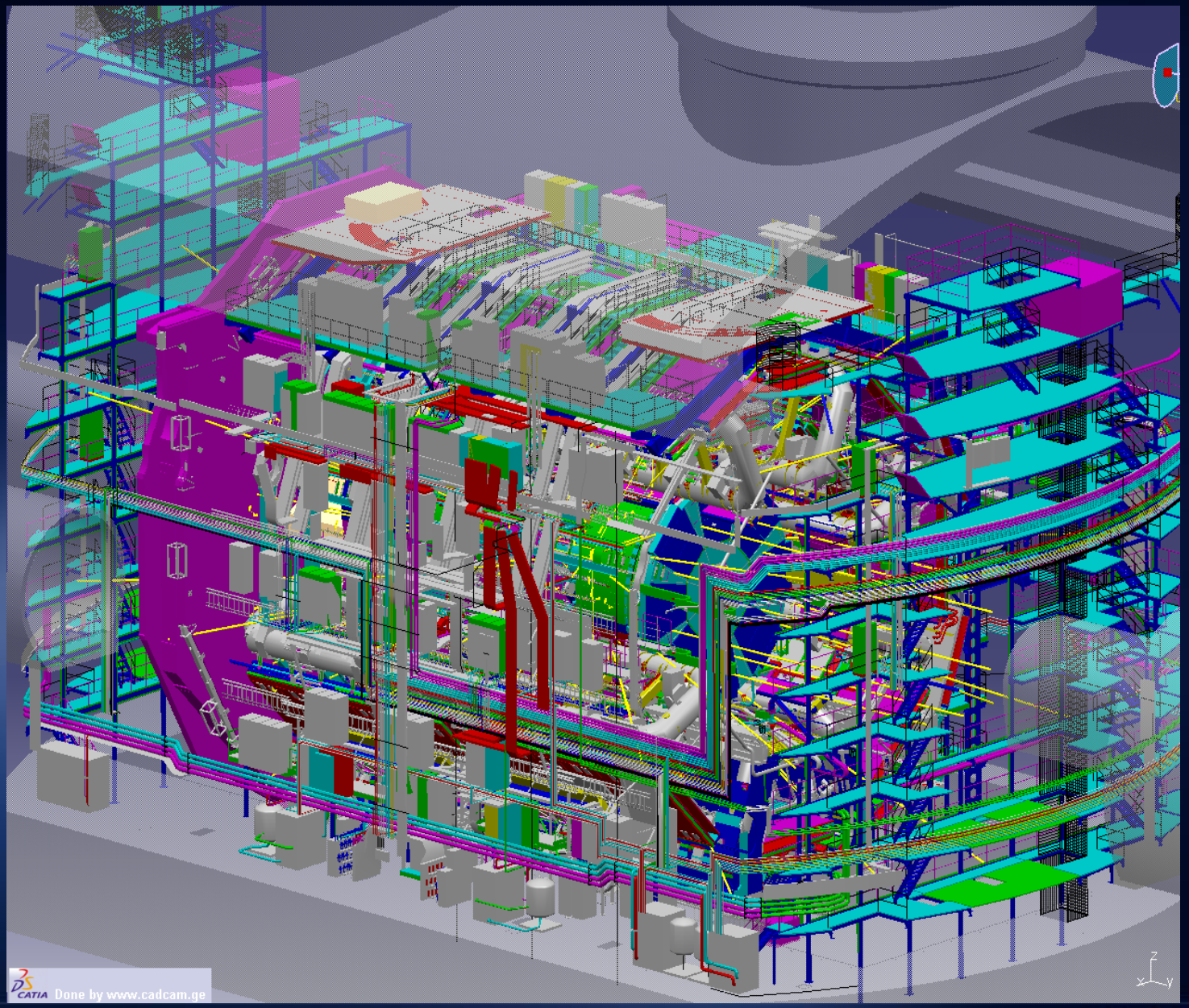
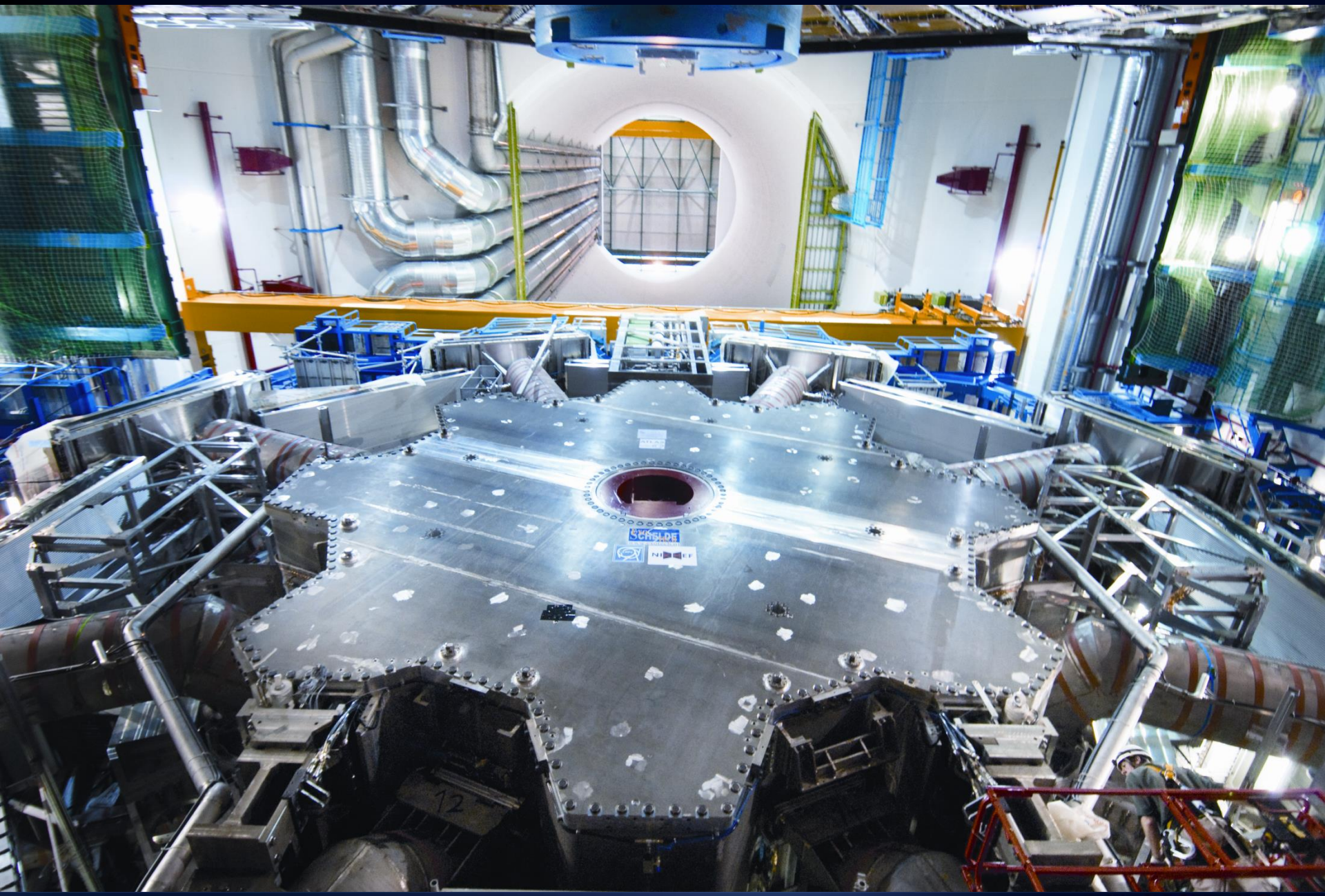


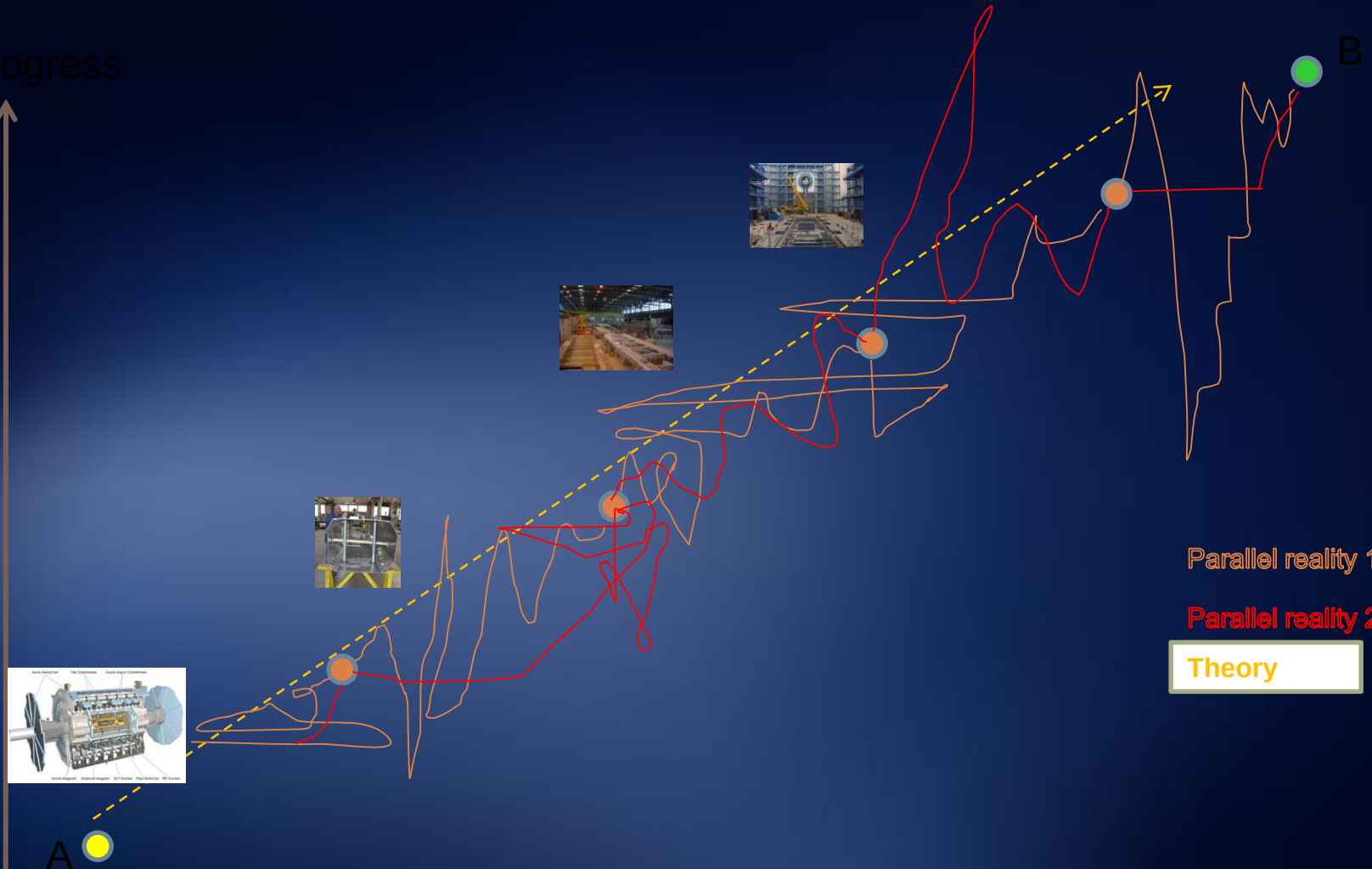
ATLAS EXPERIMENT



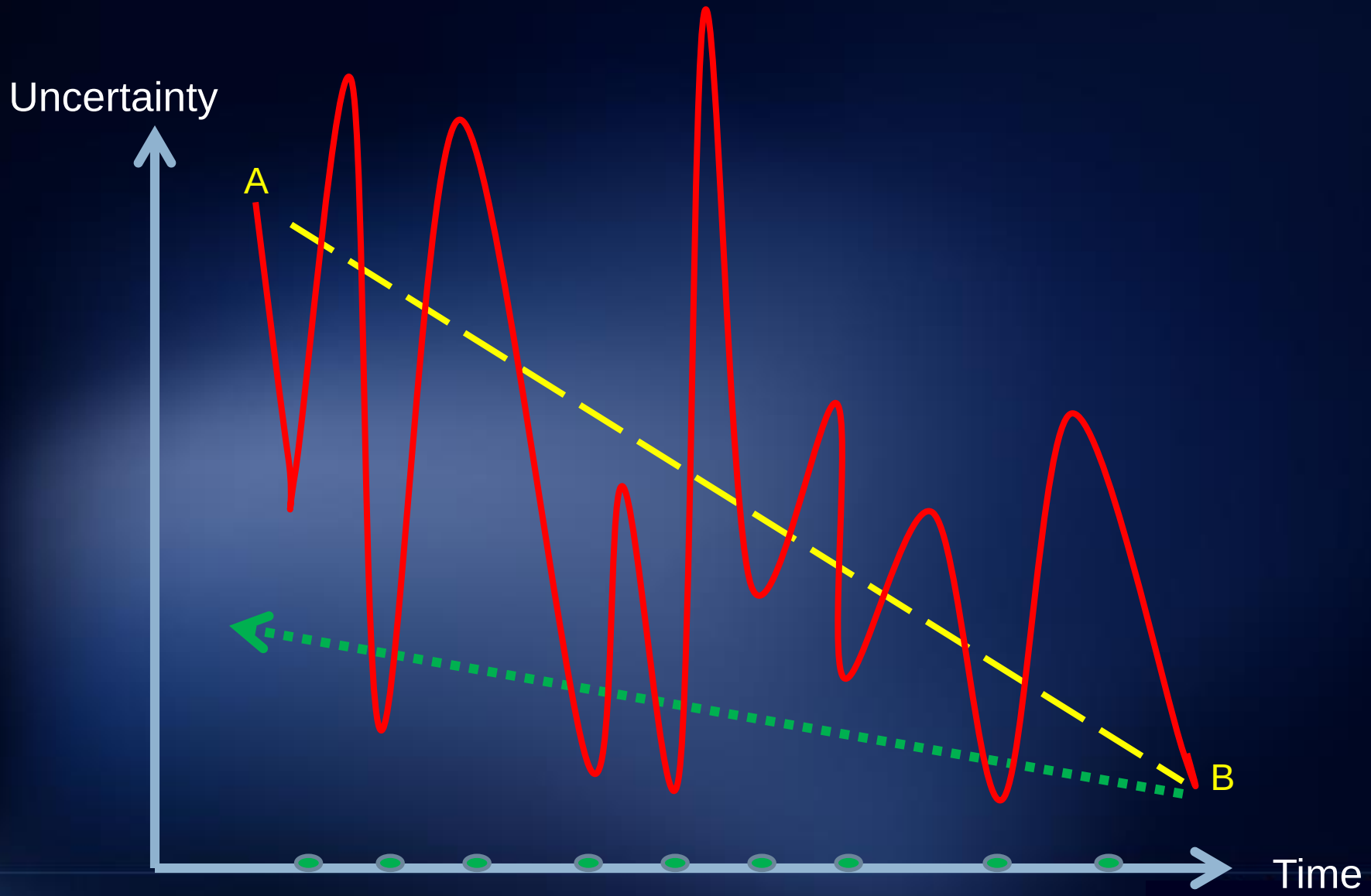
ATLAS EXPERIMENT


ATLAS
EXPERIMENT

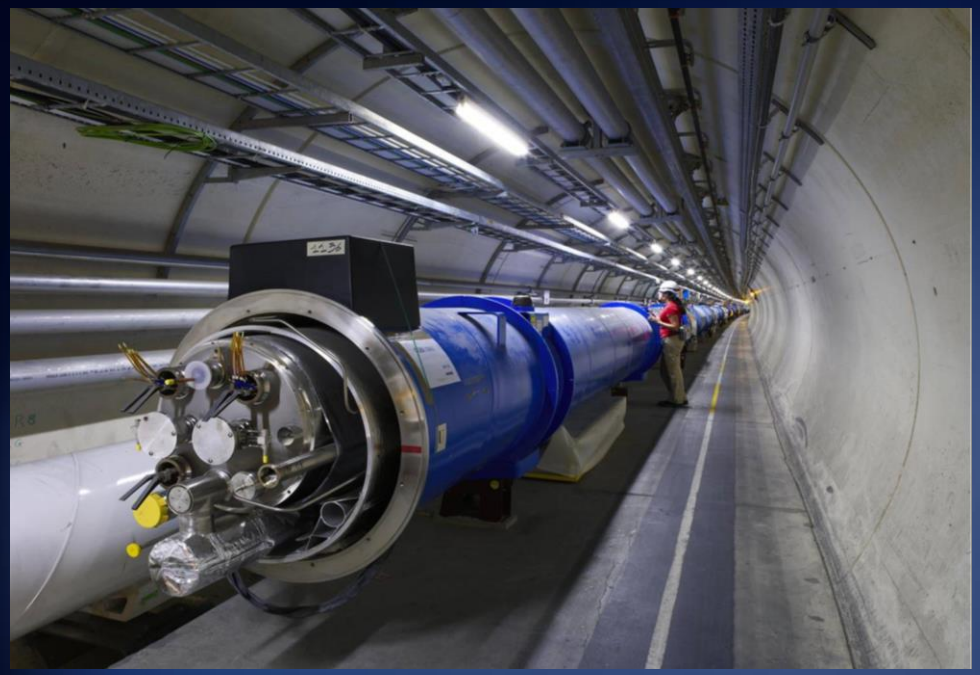
Implementing Strategy is Not Linear

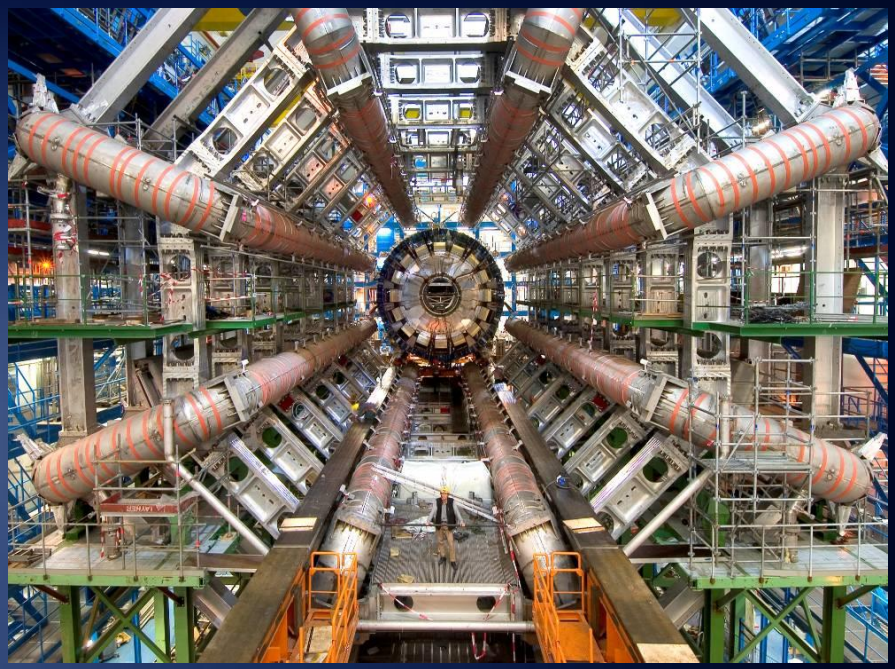


Absorbing vs. Reducing Uncertainty



Seeing the Micro needs the Macro (scopes)





CERN was founded 1954: 12 European States
Today: 23 Member States

- ~ 2676 staff, 783 Fellows
- ~ 1700 other paid personnel
- ~ 11 200 users
- Budget (2022) ~1200 MCHF

- 23 Member States: Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Israel, Italy, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.
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Charged-particle multiplicities in pp interactions at $\sqrt{s} = 900$ GeV measured with the ATLAS detector at the LHC ☆,☆☆

ATLAS Collaboration

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ABSTRACT

The first measurements from proton–proton collisions recorded with the ATLAS detector at th
are presented. Data were collected in December 2009 using a minimum-bias trigger during col
at a centre-of-mass energy of 900 GeV. The charged-particle multiplicity, its dependence on tran
momentum and pseudorapidity, and the relationship between mean transverse momentum and ch
particle multiplicity are measured for events with at least one charged particle in the kinematic
$|\eta| < 2.5$ and $p_T > 500$ MeV. The measurements are compared to Monte Carlo models of proton–
collisions and to results from other experiments at the same centre-of-mass energy. The charged-p
multiplicity per event and unit of pseudorapidity at $\eta = 0$ is measured to be 1.333 ± 0.003(s
0.040(syst.), which is 5–15% higher than the Monte Carlo models predict.

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1. Introduction

Inclusive charged-particle distributions have been measured in pp and $p\bar{p}$ collisions at a range of different centre-of-mass energi
13]. Many of these measurements have been used to constrain phenomenological models of soft-hadronic interactions and to p
properties at higher centre-of-mass energies. Most of the previous charged-particle multiplicity measurements were obtained by sel
data with a double-arm coincidence trigger, thus removing large fractions of diffractive events. The data were then further correc
remove the remaining single-diffractive component. This selection is referred to as non-single-diffractive (NSD). In some cases, desig
as inelastic non-diffractive, the residual double-diffractive component was also subtracted. The selection of NSD or inelastic non-diffr
charged-particle spectra involves model-dependent corrections for the diffractive components and for effects of the trigger selecti
events with no charged particles within the acceptance of the detector. The measurement presented in this Letter implements a dif
strategy, which uses a single-arm trigger overlapping with the acceptance of the tracking volume. Results are presented as incl
inelastic distributions, with minimal model-dependence, by requiring one charged particle within the acceptance of the measureme

This Letter reports on a measurement of primary charged particles with a momentum component transverse to the beam dire

ATLAS Collaboration

G. Aad [48], E. Abat [18a,*], B. Abbott [110], J. Abdallah [11], A.A. Abdelalim [49], A. Abdesselam [117], O. Abdinov
B. Abi [111], M. Abolins [88], H. Abramowicz [151], H. Abreu [114], E. Acerbi [89a,89b], B.S. Acharya [162a,162b],
M. Ackers [20], D.L. Adams [24], T.N. Addy [56], J. Adelman [173], M. Aderholz [99], C. Adorisio [36a,36b], P. Adrag
T. Adye [128], S. Aefsky [22], J.A. Aguilar-Saavedra [123b], M. Aharrouche [81], S.P. Ahlen [21], F. Ahles [48],
A. Ahmad [146], H. Ahmed [2], M. Ahsan [40], G. Aielli [132a,132b], T. Akdogan [18a], P.F. Åkesson [29], T.P.A. Åkes
G. Akimoto [153], A.V. Akimov [94], A. Aktas [48], M.S. Alam [1], M.A. Alam [76], J. Albert [167], S. Albrand [55],
M. Aleksa [29], I.N. Aleksandrov [65], M. Aleppo [89a,89b], F. Alessandria [89a], C. Alexa [25a], G. Alexander [151],
G. Alexandre [49], T. Alexopoulos [9], M. Alhroob [20], M. Aliev [15], G. Alimonti [89a], J. Alison [119], M. Aliyev
P.P. Allport [73], S.E. Allwood-Spiers [53], J. Almond [82], A. Aloisio [102a,102b], R. Alon [169], A. Alonso [79],
J. Alonso [14], M.G. Alviggi [102a,102b], K. Amako [66], P. Amaral [29], G. Ambrosini [16], G. Ambrosio [89a,d],
C. Amelung [22], V.V. Ammosov [127,*], A. Amorim [123a], G. Amorós [165], N. Amram [151], C. Anastopoulos
T. Andeen [29], C.F. Anders [48], K.J. Anderson [30], A. Andreazza [89a,89b], V. Andrei [58a], M.-L. Andrieux [55],
X.S. Anduaga [70], A. Angerami [34], F. Anghinolfi [29], N. Anjos [123a], A. Annovi [47], A. Antonaki [8], M. Anton
S. Antonelli [19a,19b], J. Antos [143b], B. Antunovic [41], F. Anulli [131a], S. Aoun [83], G. Arabidze [8], I. Aracena
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A. Tonazzo [133a,133b], G. Tong [32a], A. Tonoyan [13], C. Topfel [16], N.D. Topilin [65], E. Torrence [113],
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V. Tsiskaridze [51], E.G. Tskhadadze [51], I.I. Tsukerman [95], V. Tsulaia [122], J.-W. Tsung [20], S. Tsuno [66],
D. Tsybychev [146], J.M. Tuggle [30], M. Turala [38], D. Turecek [126], I. Turk Cakir [3e], E. Turlay [105], P.M. Tuts [34],
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P. Urquijo [49,x], P. Urrejola [31a], G. Usai [7], M. Uslenghi [118a,118b], L. Vacavant [83], V. Vacek [126], B. Vachon [85],
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P. Vankov [73], F. Vannucci [78], E. Varela Rodriguez [29], R. Vari [131a], E.W. Varnes [6], D. Varouchas [14],

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H. Zhu [41], Y. Zhu [170], X. Zhuang [98], V. Zhuravlov [99], B. Zilka [143a], R. Zimmermann [20], S. Zimmermann [20],
S. Zimmermann [48], M. Ziolkowski [140], R. Zitoun [4], L. Živković [34], V.V. Zmouchko [127,*], G. Zobernig [170],
A. Zoccoli [19a,19b], Y. Zolnierowski [4], A. Zsenei [29], M. zur Nedden [15], V. Zutshi [5]

[1] University at Albany, 1400 Washington Ave, Albany, NY 12222, United States
[2] University of Alberta, Department of Physics, Centre for Particle Physics, Edmonton, AB T6G 2G7, Canada
[3] Ankara University[(a)], Faculty of Sciences, Department of Physics, TR 061000 Tandogan, Ankara; Dumlupinar University[(b)], Faculty of Arts and Sciences, Department of Physics, Kutahya; Gazi University[(c)], Faculty of Arts and Sciences, Department of Physics, 06500 Teknikokullar, Ankara; TOBB University of Economics and Technology[(d)], Faculty of Arts and Sciences, Division of Physics, 06560 Sogutozu, Ankara; Turkish Atomic Energy Authority[(e)], 06530 Lodumlu, Ankara, Turkey
[4] LAPP, Université de Savoie, CNRS/IN2P3, Annecy-le-Vieux, France
[5] Argonne National Laboratory, High Energy Physics Division, 9700 S. Cass Avenue, Argonne, IL 60439, United States

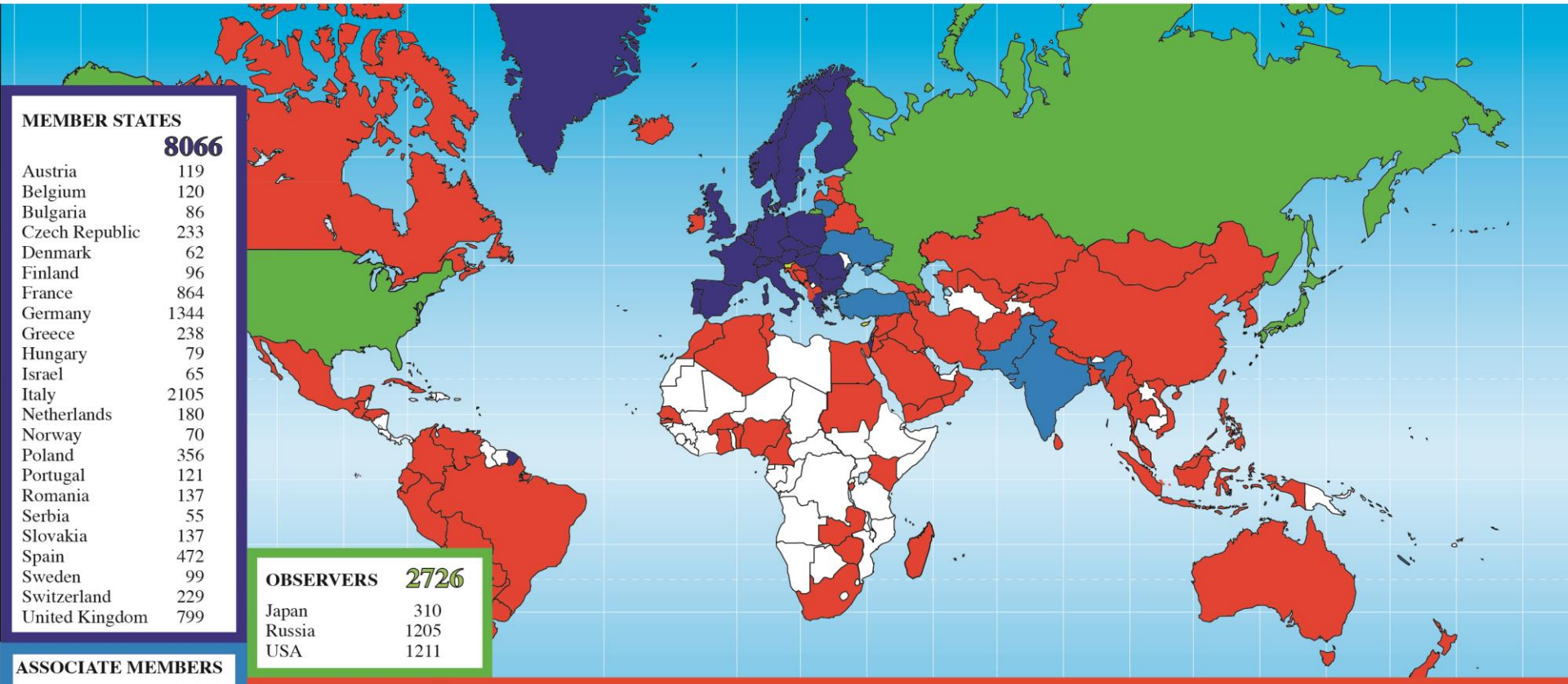
[63] University of Iowa, 203 Van Allen Hall, Iowa City, IA 52242-1479, United States
[64] Iowa State University, Department of Physics and Astronomy, Ames High Energy Physics Group, Ames, IA 50011-3160, United States
[65] Joint Institute for Nuclear Research, JINR Dubna, RU-141 980 Moscow Region, Russia
[66] KEK, High Energy Accelerator Research Organization, 1-1 Oho, Tsukuba-shi, Ibaraki-ken 305-0801, Japan
[67] Kobe University, Graduate School of Science, 1-1 Rokkodai-cho, Nada-ku, JP - Kobe 657-8501, Japan
[68] Kyoto University, Faculty of Science, Oiwake-cho, Kitashirakawa, Sakyou-ku, Kyoto-shi, JP - Kyoto 606-8502, Japan
[69] Kyoto University of Education, 1 Fukakusa, Fujimori, fushimi-ku, Kyoto-shi, JP - Kyoto 612-8522, Japan
[70] Universidad Nacional de La Plata, FCE, Departamento de Física, IFLP (CONICET-UNLP), C.C. 67, 1900 La Plata, Argentina

[138] University of Sheffield, Department of Physics & Astronomy, Hounsfield Road, Sheffield S3 7RH, United Kingdom
[139] Shinshu University, Department of Physics, Faculty of Science, 3-1-1 Asahi, Matsumoto-shi, JP - Nagano 390-8621, Japan
[140] Universität Siegen, Fachbereich Physik, D-57068 Siegen, Germany
[141] Simon Fraser University, Department of Physics, 8888 University Drive, CA - Burnaby, BC V5A 1S6, Canada
[142] SLAC National Accelerator Laboratory, Stanford, CA 94309, United States
[143] Comenius University, Faculty of Mathematics, Physics & Informatics[(a)], Mlynska dolina F2, SK-84248 Bratislava; Institute of Experimental Physics of the Slovak Academy of Sciences, Dept. of Subnuclear Physics[(b)], Watsonova 47, SK-04353 Kosice, Slovak Republic
[144] Stockholm University, Department of Physics[(a)]; The Oskar Klein Centre[(b)], AlbaNova, SE-106 91 Stockholm, Sweden
[145] Royal Institute of Technology (KTH), Physics Department, SE-106 91 Stockholm, Sweden
[146] Stony Brook University, Department of Physics and Astronomy, Nicolls Road, Stony Brook, NY 11794-3800, United States
[147] University of Sussex, Department of Physics and Astronomy, Pevensey 2 Building, Falmer, Brighton BN1 9QH, United Kingdom
[148] University of Sydney, School of Physics, AU - Sydney NSW 2006, Australia
[149] Insitute of Physics, Academia Sinica, TW - Taipei 11529, Taiwan
[150] Technion, Israel Inst. of Technology, Department of Physics, Technion City, IL - Haifa 32000, Israel
[151] Tel Aviv University, Raymond and Beverly Sackler School of Physics and Astronomy, Ramat Aviv, IL - Tel Aviv 69978, Israel
[152] Aristotle University of Thessaloniki, Faculty of Science, Department of Physics, Division of Nuclear & Particle Physics, University Campus, GR-54124 Thessaloniki, Greece
[153] The University of Tokyo, International Center for Elementary Particle Physics and Department of Physics, 7-3-1 Hongo, Bunkyo-ku, JP - Tokyo 113-0033, Japan
[154] Tokyo Metropolitan University, Graduate School of Science and Technology, 1-1 Minami-Osawa, Hachioji, Tokyo 192-0397, Japan
[155] Tokyo Institute of Technology, 2-12-1-H-34 O-Okayama, Meguro, Tokyo 152-8551, Japan
[156] University of Toronto, Department of Physics, 60 Saint George Street, Toronto M5S 1A7, Ontario, Canada
[157] TRIUMF[(a)], 4004 Wesbrook Mall, Vancouver, B.C. V6T 2A3; York University[(b)], Department of Physics and Astronomy, 4700 Keele St., Toronto, Ontario, M3J 1P3, Canada
[158] University of Tsukuba, Institute of Pure and Applied Sciences, 1-1-1 Tennoudai, Tsukuba-shi, JP - Ibaraki 305-8571, Japan
[159] Tufts University, Science & Technology Center, 4 Colby Street, Medford, MA 02155, United States
[160] Universidad Antonio Nariño, Centro de Investigaciones, Cra 3 Este No.47A-15, Bogota, Colombia
[161] University of California, Irvine, Department of Physics & Astronomy, CA 92697-4575, United States
[162] INFN Gruppo Collegato di Udine[(a)]; ICTP[(b)], Strada Costiera 11, IT-34014 Trieste; Università di Udine, Dipartimento di Fisica[(c)], via delle Scienze 208, IT-33100 Udine, Italy
[163] University of Illinois, Department of Physics, 1110 West Green Street, Urbana, IL 61801, United States
[164] University of Uppsala, Department of Physics and Astronomy, P.O. Box 516, SE-751 20 Uppsala, Sweden
[165] Instituto de Física Corpuscular (IFIC), Centro Mixto UVEG-CSIC, Apdo. 22085 ES-46071 Valencia, Dept. Física At. Mol. y Nuclear, Univ. of Valencia, and Instituto de Microelectrónica de Barcelona (IMB-CNM-CSIC), 08193 Bellaterra Barcelona, Spain
[166] University of British Columbia, Department of Physics, 6224 Agricultural Road, CA - Vancouver, B.C. V6T 1Z1, Canada
[167] University of Victoria, Department of Physics and Astronomy, P.O. Box 3055, Victoria B.C., V8W 3P6, Canada
[168] Waseda University, WISE, 3-4-1 Okubo, Shinjuku-ku, Tokyo 169-8555, Japan
[169] The Weizmann Institute of Science, Department of Particle Physics, P.O. Box 26, IL 76100, Rehovot, Israel
[170] University of Wisconsin, Department of Physics, 1150 University Avenue, Madison, WI 53706, United States
[171] Julius-Maximilians-University of Würzburg, Physikalisches Institute, Am Hubland, 97074 Würzburg, Germany
[172] Bergische Universität, Fachbereich C, Physik, Postfach 100127, Gauss-Strasse 20, D-42097 Wuppertal, Germany
[173] Yale University, Department of Physics, P.O. Box 208121, New Haven, CT 06520-8121, United States
[174] Yerevan Physics Institute, Alikhanian Brothers Street 2, AM-375036 Yerevan, Armenia
[175] ATLAS-Canada Tier-1 Data Centre 4004 Wesbrook Mall, Vancouver, BC, V6T 2A3, Canada
[176] GridKA Tier-1 FZK, Forschungszentrum Karlsruhe GmbH, Steinbuch Centre for Computing (SCC), Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany
[177] Port d'Informacio Cientifica (PIC), Universitat Autonoma de Barcelona (UAB), Edifici D, E-08193 Bellaterra, Spain
[178] Centre de Calcul CNRS/IN2P3, Domaine scientifique de la Doua, 27 bd du 11 Novembre 1918, 69622 Villeurbanne Cedex, France
[179] INFN-CNAF, Viale Berti Pichat 6/2, 40127 Bologna, Italy
[180] Nordic Data Grid Facility, NORDUnet A/S, Kastruplundgade 22, 1, DK-2770 Kastrup, Denmark
[181] SARA Reken- en Netwerkdiensten, Science Park 121, 1098 XG Amsterdam, Netherlands
[182] Academia Sinica Grid Computing, Institute of Physics, Academia Sinica, No.128, Sec. 2, Academia Rd., Nankang, Taipei, Taiwan 11529, Taiwan
[183] UK-T1-RAL Tier-1, Rutherford Appleton Laboratory, Science and Technology Facilities Council, Harwell Science and Innovation Campus, Didcot OX11 0QX, United Kingdom
[184] RHIC and ATLAS Computing Facility, Physics Department, Building 510, Brookhaven National Laboratory, Upton, NY 11973, United States

[*] Present address FermiLab, United States.

A Global Reach

Distribution of All CERN Users by Nationality as of mid-April 2019



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Hungary	79
Israel	65
Italy	2105
Netherlands	180
Norway	70
Poland	356
Portugal	121
Romania	137
Serbia	55
Slovakia	137
Spain	472
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Pakistan	71
Turkey	165
Ukraine	116

ASSOCIATE MEMBERS IN THE PRE-STAGE TO MEMBERSHIP 59

Cyprus	26
Slovenia	33

OTHERS 1999

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Algeria	14	Bosnia & Herzegovina	3	Egypt	27	Ireland	13	Mexico	85	Paraguay	1	Syria	1
Argentina	26	Brazil	127	El Salvador	1	Jordan	2	Mongolia	2	Peru	6	Taiwan	56
Armenia	22	Burkina Faso	1	Estonia	15	Kazakhstan	10	Montenegro	11	Philippines	3	Thailand	26
Australia	36	Burundi	1	Georgia	51	Kenya	1	Morocco	24	Saint Kitts and Nevis	1	Tunisia	4
Azerbaijan	10	Cameroon	1	Ghana	1	Korea	183	Myanmar	2	San Marino	1	Uruguay	1
Bahrain	1	Canada	170	Guatemala	1	Kyrgyzstan	1	Nepal	7	Saudi Arabia	4	Uzbekistan	3
Bangladesh	8	Chile	21	Hong Kong	1	Latvia	4	New Zealand	5	Senegal	1	Venezuela	9
Belarus	45	China	576	Honduras	1	Lebanon	27	Nigeria	4	Singapore	5	Viet Nam	11
Benin	1	Colombia	44	Iceland	4	Luxembourg	4	North Korea	4	South Africa	56	Zambia	1
		Croatia	50	Indonesia	11	Madagascar	1	North Macedonia	3	Sri Lanka	10	Zimbabwe	2
		Cuba	16	Iran	58	Malaysia	22	Oman	3				

(How) Do We Manage This?

What do you see differently?