PAUL SCHERRER INSTITUT

K. Kirch :: NUM :: Paul Scherrer Institut

BVR 2016 – Open Meeting

BVR 2016, PSI, February 9, 2016

Mike Pendlebury
December 1, 1936 – September 1, 2015

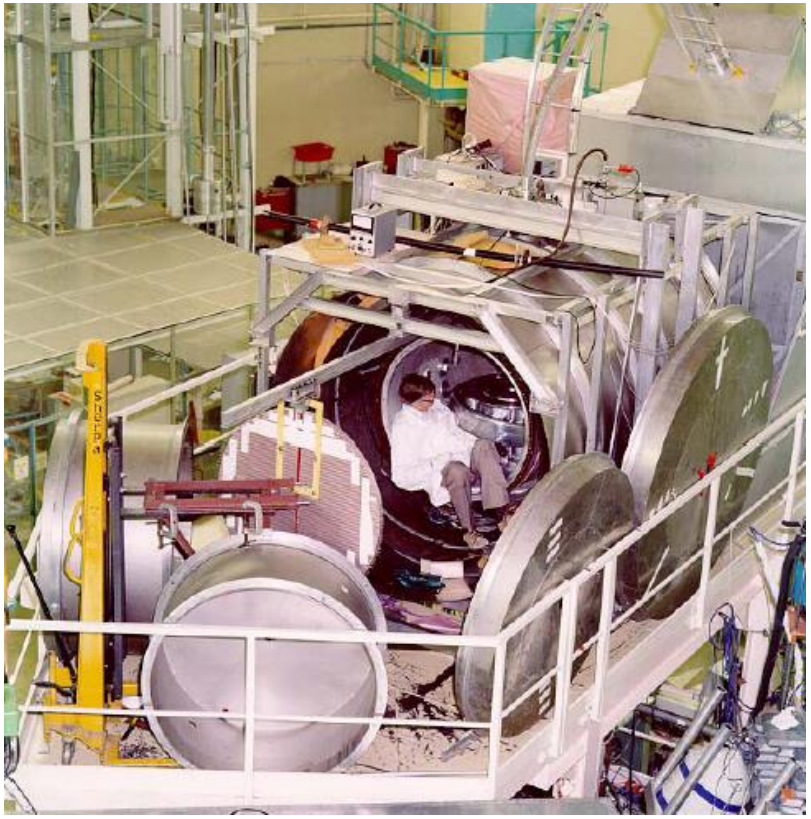
He was an admired scientist, a great teacher, and a wonderful person

A very warm welcome to you at PSI

- Commemorations
- Forthcoming shutdowns
- Progress with high intensity muon beam studies
- Upcoming events
- Invited talk: Riccardo Barbieri

Mike Pendlebury
December 1, 1936 – September 1, 2015

Joined the BVR committee when PSI decided to go for UCN source and nEDM experiment and he served for 13 years.
In 2014 Sussex University joined our nEDM.



The neutron EDM limits are amongst the most cited results of low energy particle physics . Mike has in his career improved the limit by more than 3 orders of magnitude!

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Mike Pendlebury

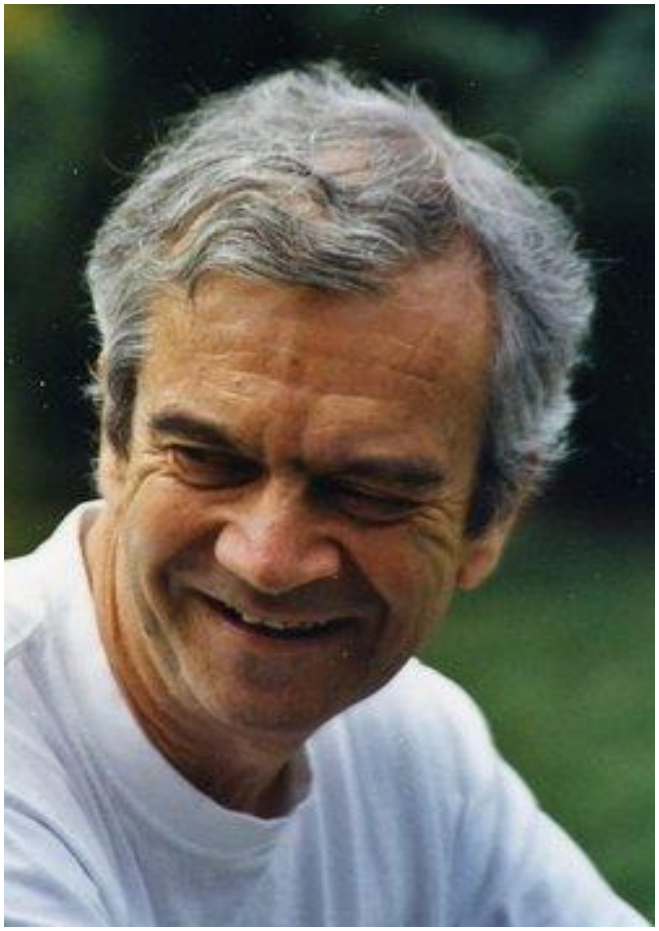
December 1, 1936 – September 1, 2015

Revised experimental upper limit on the electric dipole moment of the neutron

J. M. Pendlebury,[1,*] S. Afach,[2,3,4] N. J. Ayres,[1] C. A. Baker,[5] G. Ban,[6] G. Bison,[2] K. Bodek,[7] M. Burghoff,[8] P. Geltenbort,[9] K. Green,[5] W. C. Griffith,[1] M. van der Grinten,[5] Z. D. Grujić,[10] P. G. Harris,[1,†] V. Hélaine,[6,‡] P. Iaydjiev,[5,§] S. N. Ivanov,[5,¶] M. Kasprzak,[10,11] Y. Kermaidic,[12] K. Kirch,[2,3] H.-C. Koch,[10,13] S. Komposch,[2,3] A. Kozela,[14] J. Krempel,[3,2] B. Lauss,[2] T. Lefort,[6] Y. Lemière,[6] D. J. R. May,[1] M. Musgrave,[1] O. Naviliat-Cuncic,[6,**] F. M. Piegsa,[3] G. Pignol,[12] P. N. Prashanth,[11] G. Quéméner,[6] M. Rawlik,[3] D. Rebreyend,[12] J. D. Richardson,[1] D. Ries,[2,3] S. Roccia,[15] D. Rozpedzik,[7] A. Schnabel,[8] P. Schmidt-Wellenburg,[2] N. Severijns,[11] D. Shiers,[1] J. A. Thorne,[1] A. Weis,[10] O. J. Winston,[1] E. Wursten,[11] J. Zejma,[7] and G. Zsigmond[2]

(Received 11 September 2015; published 4 November 2015)

Reinhart Frosch
June 4,1935 – July 11, 2015



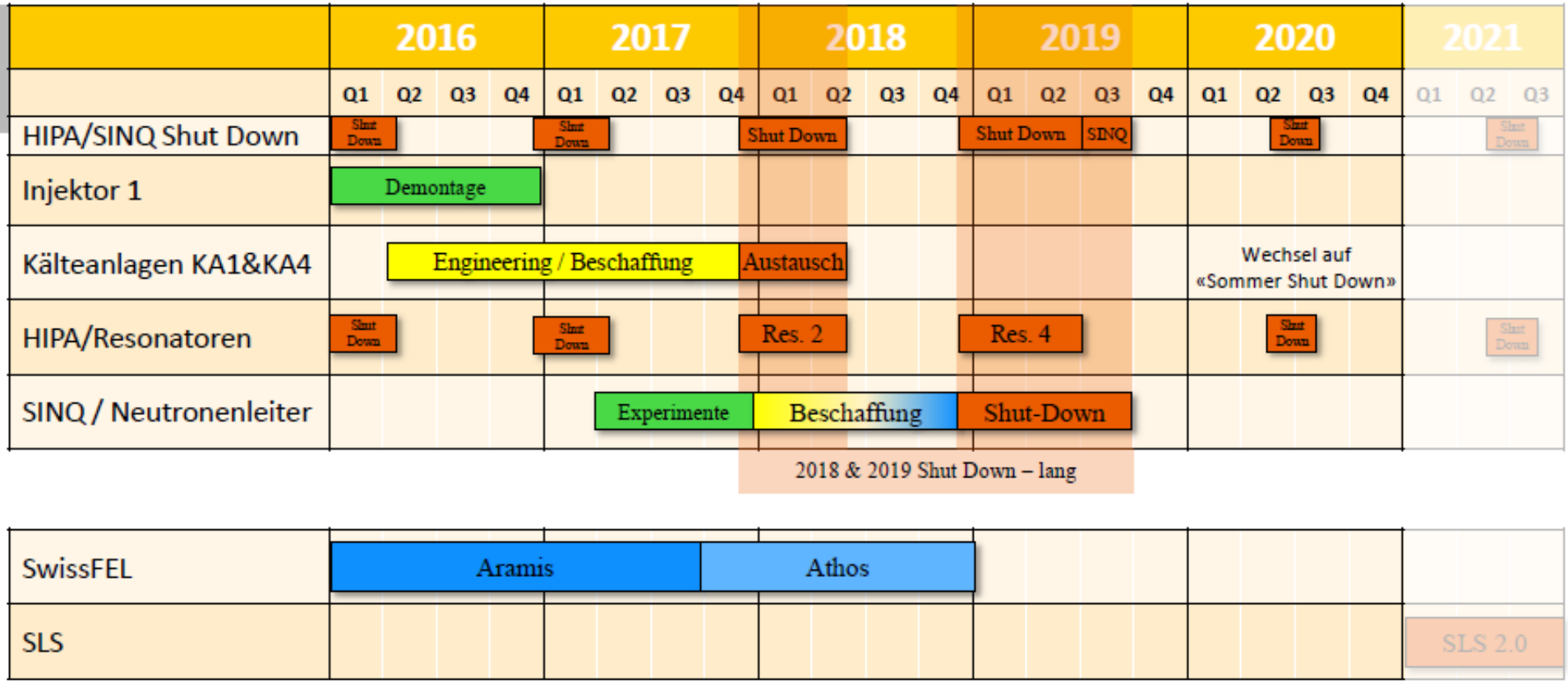
- Conceived, designed and built pion beam lines at SIN/PSI
- Measured the first pions 24.2.1974
- Lead various pion and muon experiments at PSI, most notably the
  - measurement of the muon neutrino mass
  - discovery of Coulomb de-excitation in pionic hydrogen

These two have found their way into text books.

He also measured important pion production cross sections and contributed to the technical design of the Piotron tumor treatment facility.

He was very broadly interested and a teacher and very dear colleague!

Shut Down Planung GFA 2016–2020
DIRK 1512



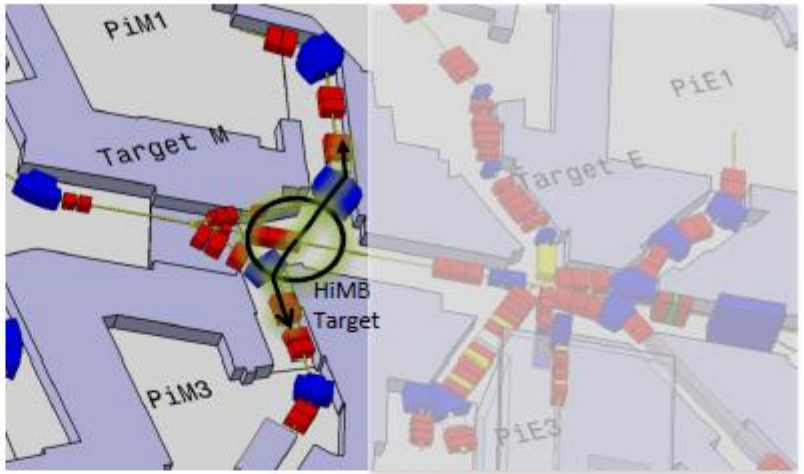
Status: SD 2016 and 2017 fixed, SD 2018 and 2019 used as guidelines for detailed planning, SD 2020 open, beyond 2020 winter SD preferered option. KC Jan 16

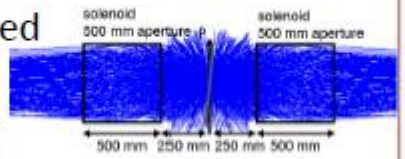
Shut-Down | Beschaffung | Demontage | Montage/IBN

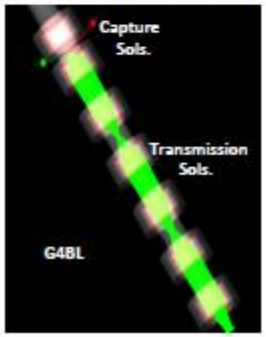
Nur Terminplanung, keine Berücksichtigung von Ressourcen, Finanzen, Lieferanten etc.

HiMB@EH

- New Target M Station
  - 20 mm thick graphite rotated (5°) slab target
  - as efficient as 40 mm Target E
- Target E remains 40 mm thick
- Split capture solenoid channel
  - one side Particle Physics (high-intensity)
  - one side Materials Science (high polarization)
- Equivalent to old Target E 60 mm length
- SINQ beam characteristics preserved
- Normal conducting solenoids
  - only front elements radiation hard

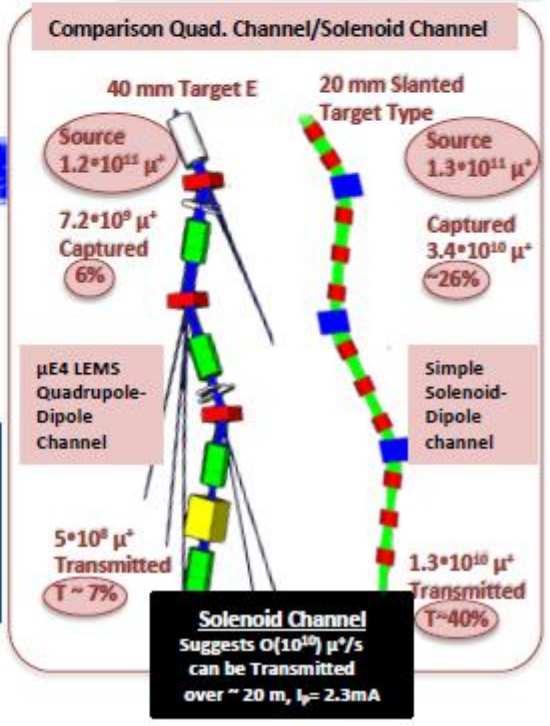






Comparison to Quadrupole channel

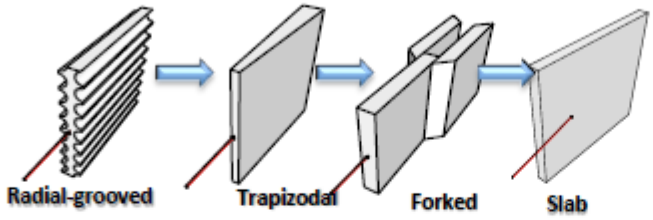
- Source intensity (20 mm slanted Target = 40 mm Target E) when viewed at 90°
- (Capture • Transport) Efficiency -> 25 x higher
- Expect $\mathcal{O}(10^{10})$ μ^+/s at 2.3 mA transmitted



Courtesy: P.-R. Kettle, A. Knecht

HiMB@EH

Target E Enhancements also studied:



Results about to published Physical Review Acc. & Beams

PHYSICAL REVIEW ACCELERATORS AND BEAMS 19, 000000 (XXXX)

Target studies for surface muon production

F. Berg,[1,2] L. Desorgher,[1,*] A. Fuchs,[1] W. Hajdas,[1] Z. Hodge,[1,2] P.-R. Kettle,[1,†] A. Knecht,[1,‡] R. Lüscher,[1] A. Papa,[1] G. Rutar,[1,2] and M. Wohlmuther[1]
[1]Paul Scherrer Institut (PSI), CH5232 Villigen PSI, Switzerland
[2]Institute for Particle Physics, ETH Zurich, 8093 Zurich, Switzerland

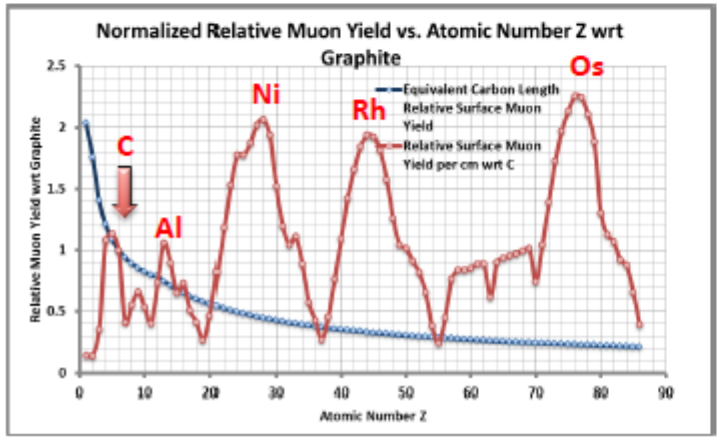
(Received 4 November 2015)

Enhancement factors vs. Geometry

Geometry/View	Sideways	Backwards	Forwards
Grooved (2mm)	1.02	1.00	0.97
Trapezoidal (2mm)	1.15	0.98	0.79
Forked (2mm)	1.45	1.14	0.79
Rotated Slab (10°)	1.28	1.40	1.63

Various Target Geometries Study

Enhancements of 30% -> 60% possible for all beam lines -> Slab Target



Material Studies: compared to C

If proton beam characteristics must be preserved (SINQ) (blue-curve) gain only for Z < 6 ➡ B_4C or Be_2C

Gives an extra 10%-14% enhancement in total Equivalent to Raising Beam Power to ~ 2 MW

Courtesy: P.-R. Kettle, A. Knecht

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PSI

Swiss Institute of Particle Physics

sc|nat

Swiss Academy of Sciences
Akademie der Naturwissenschaften
Accademia di scienze naturali
Académie des sciences naturelles

PSI Summer School

Exothiggs

Lyceum Alpinum, Zuoz, August 14–20, 2016

higgstools

MARIE CURIE ACTIONS

SEVENTH FRAMEWORK PROGRAMME

The 22nd PSI Summer School on Particle Physics: „More than Higgs – Effective Theories for Particle Physics“ 17 – 23 August – Zuoz

73 Participants (36 CH, 32 Rest-Europe, 5 Overseas), incl. 9 Lecturers

www.psi.ch/particle-zuoz-school/

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CHIPP Swiss Institute of Particle Physics

PSI 2016

4th Workshop on the Physics of fundamental Symmetries and Interactions at low energies and the precision frontier

Oct. 17-20, 2016

Paul Scherrer Institute
Switzerland

Topics:

- Low energy precision tests of the Standard Model
- Fundamental physics and precision experiments with muons, pions, neutrons, antiprotons, and other particles
- Searches for permanent electric dipole moments
- Searches for symmetry violations and new forces
- Precision measurements of fundamental constants
- Exotic atoms and molecules
- Precision magnetometry
- Advanced muon and ultracold neutron sources
- Advanced detector technologies

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www.psi.ch/psi2016

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PSI

PSI 2013

Swiss Institute of Particle Physics

173 Participants

(51 CH, 23 D, 28 USA, 18 JP, 14 FR, 9 AU, 8 RU, 5 UK, 4 PL, 4 CA, 3 BE, 3 NL, 2 IT, 1 SE)

75 oral presentations, 50 posters

5% theoretical, 95% experimental,
15% related to experimental activities at PSI,

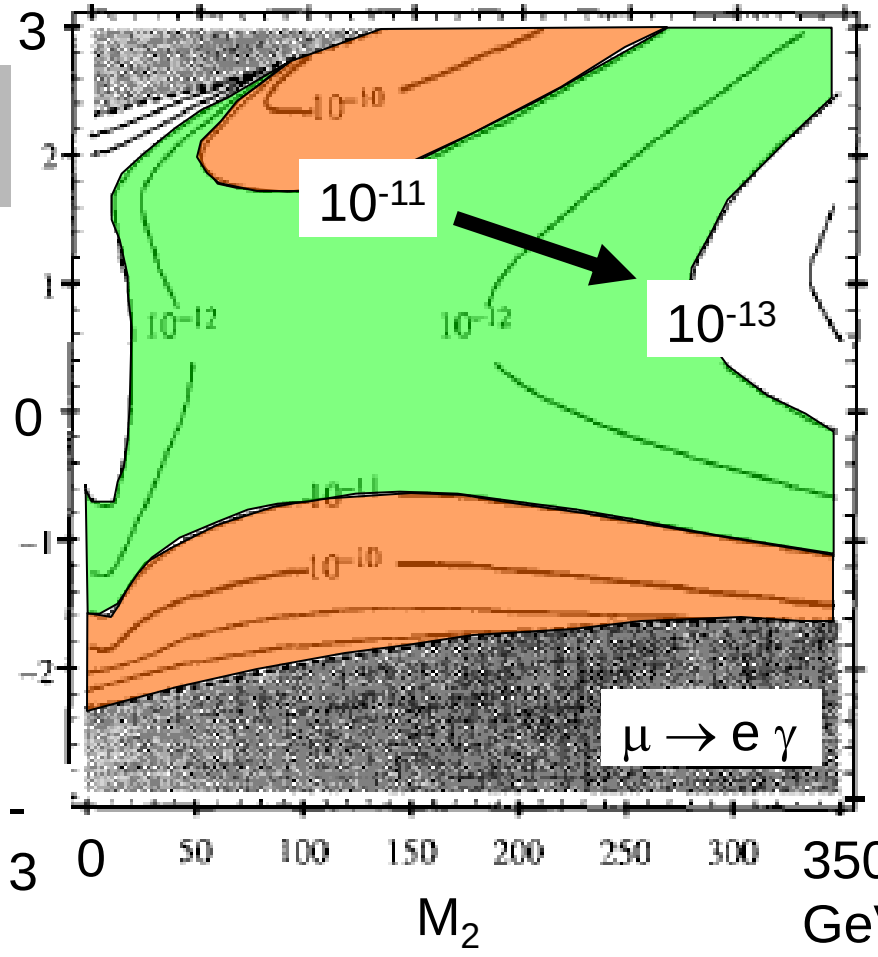
40% related to neutrons, 22% to pions and muons, 38% others

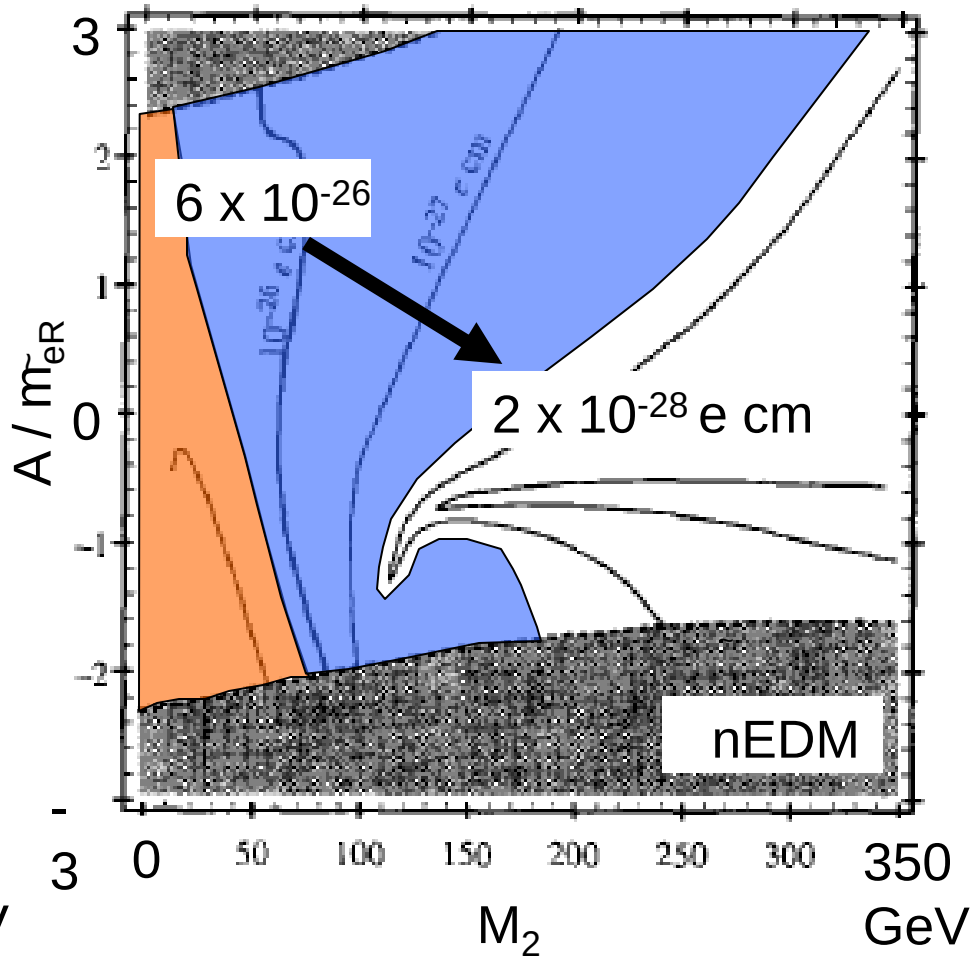
Upcoming events

- Zuoz 2016: **August 14-20**
- PSI2016: **October 16-20**
- During a talk later today, announcement: **October 21**
- BVR 2017:
  - **Monday – Wednesday, February 6-8, 2017**

MEG and nEDM

Back in the late 1990s Riccardo Barbieri gave a talk at PSI ….





R. Barbieri, L. Hall, A. Strumia, NPB449(1995)437
SO(10) ($\tan\beta$=2,$m_{\tilde{e}R}$=300GeV,λ_{tG}=1.25, RGE M=2x10^{17}GeV)

… which had quite some impact on our physics program!

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PSI

Prof. Riccardo Barbieri

Pisa, ETH-ITS

Invited talk:
Particle Physics after the discovery of the Higgs boson