

Introduction

(<http://www.bipm.org/en/measurement-units/new-si/>)

Future revision of the SI

What?

Why?

When?

Ongoing work

Communication and debate; draft documents

FAQs; More info.

The New SI based on fixed values of:

- Planck constant, h
- Avogadro constant, N_A
- elementary charge, e
- Boltzmann constant, k

Resolution 1 of the 24th meeting of the CGPM:

Invites:

- CODATA to continue to provide adjusted values of the fundamental physical constants . . .
since these CODATA values and uncertainties will be those used for the revised SI



- SI road-map  (updated 2014)

- Resolution 1 of the CGPM (2014): On the future revision of the International System of Units, the SI
- Resolution 1 of the CGPM (2011): On the possible future revision of the International System of Units, the SI



TGFC members

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*Deceased



TGFC LSA Methodology

- **Collect all data**
 - Older data from previous LSAs
 - Include new data since the last LSA
- **Preliminary review of the data**
 - Check for up-to-date input and corrections, full uncertainty analysis, and internal consistency
 - Select acceptable data by lowest uncertainties
- **Assess relation with other input data**
 - Supersedes previous results?
 - Covariance - sort by common uncertainty components



TGFC LSA Methodology (cont.d)

- Run mini LSA for each of the main constants and use “standard” statistic tools to investigate “goodness of fit”
 - Chi squared (χ^2), Probability of reduced χ^2 , Birge ratio R_B , Maximum Normalized Residuals (MNR), Maximum Normalized Difference (MND), etc.

$$\chi^2 = \sum \frac{(y_i - y_m)^2}{\sigma_{ii}^2} \quad \sqrt{\chi^2 / \nu} \quad \frac{(y_i - y_m)}{\sigma_{ii}} \quad \frac{(y_i - y_m)}{(\sigma_{ii}^2 + \sigma_m^2)^{0.5}}$$

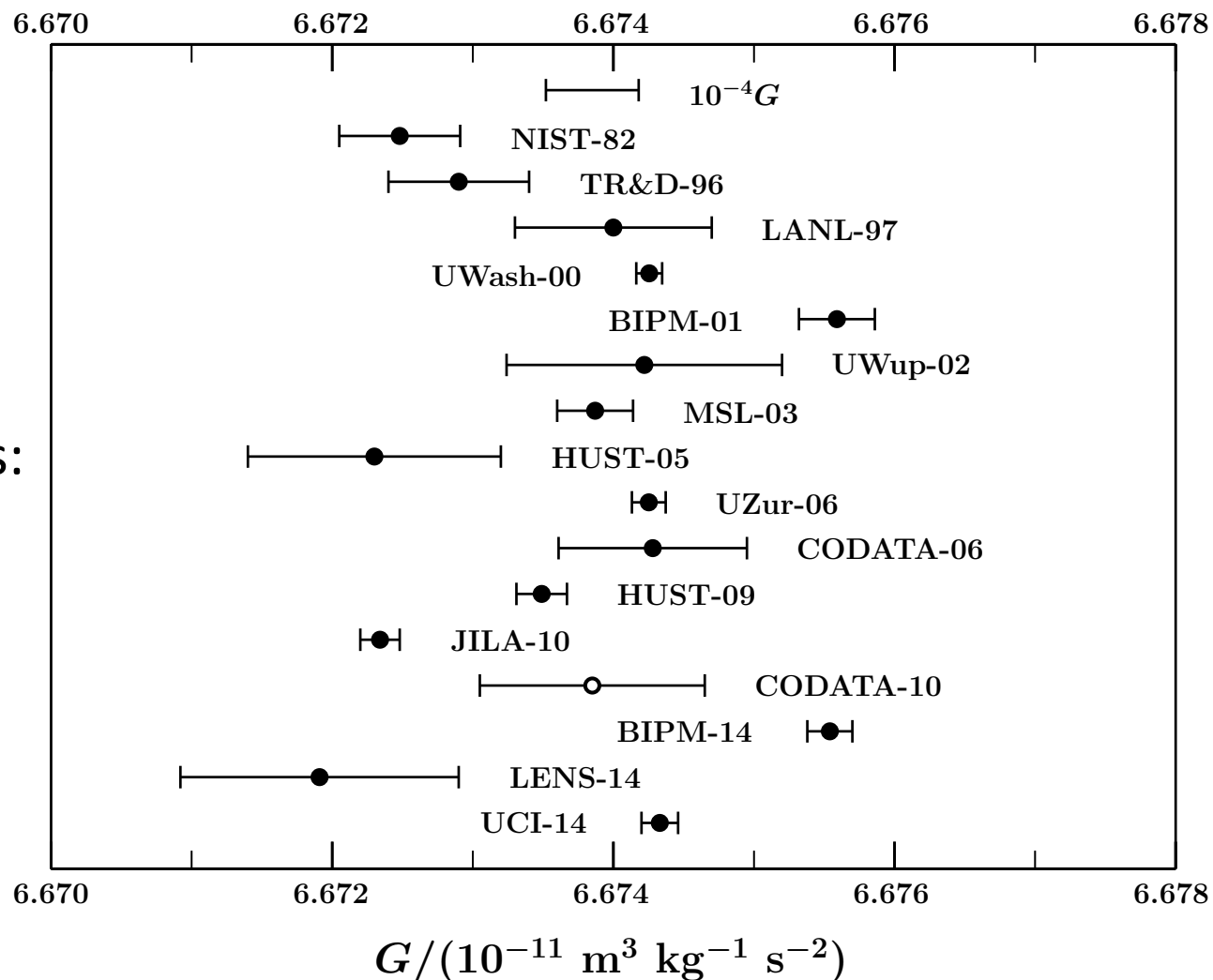
- Adjust expansion factors, include/exclude specific data
 - 1% self sensitivity test
- Run “final” multi-variant LSA, argue, re-run LSA, etc.
- *Minimize total ‘disagreement’*



2014 Input data related to the Gravitational constant

χ^2 : 318
DOF: 13
Prob. χ^2 : $6.8 \times 10^{-13} \%$
 R_B : 4.95

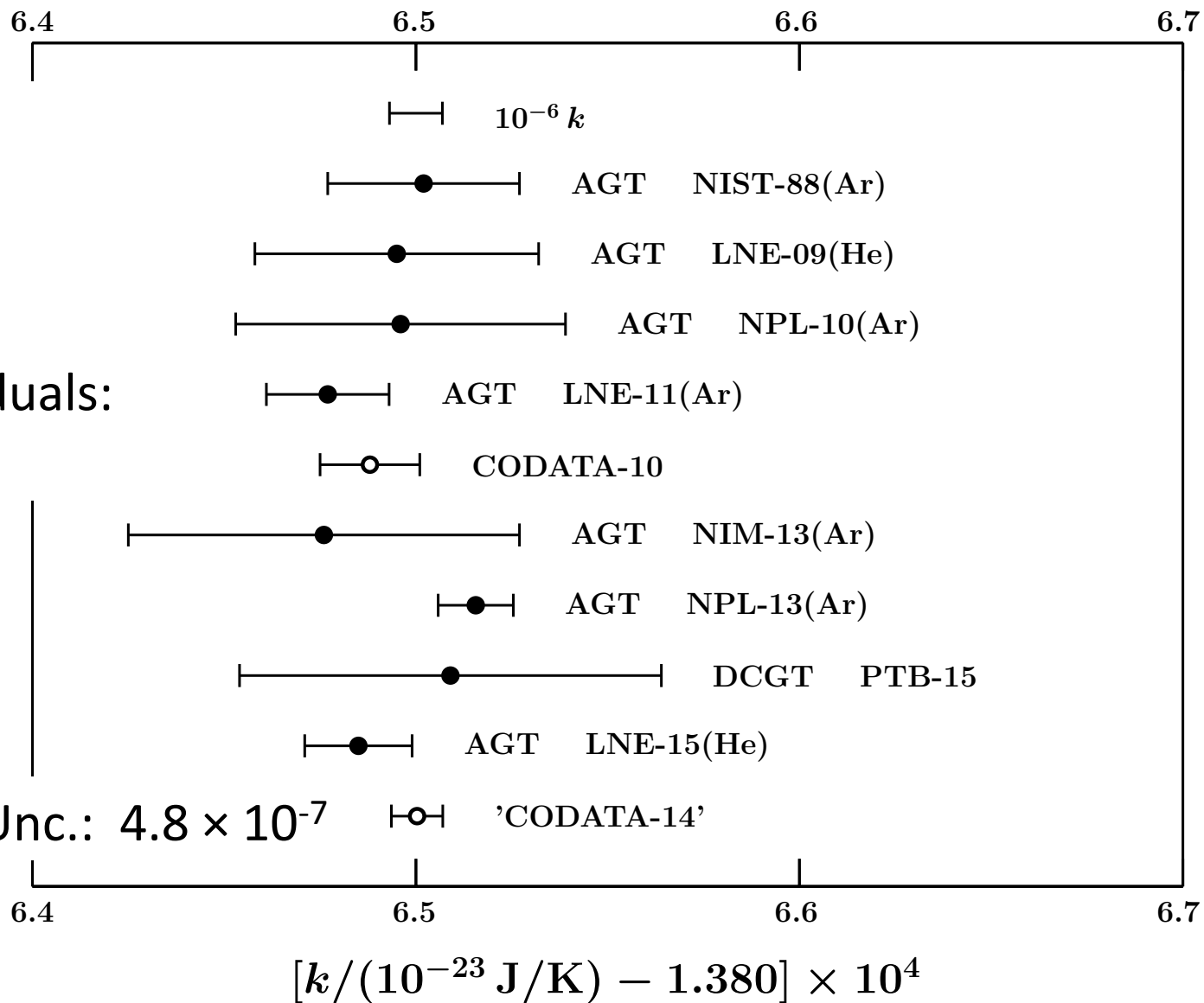
Max. reduced residuals:
-12.4, 9.14





2014 Input data related to the Boltzmann constant

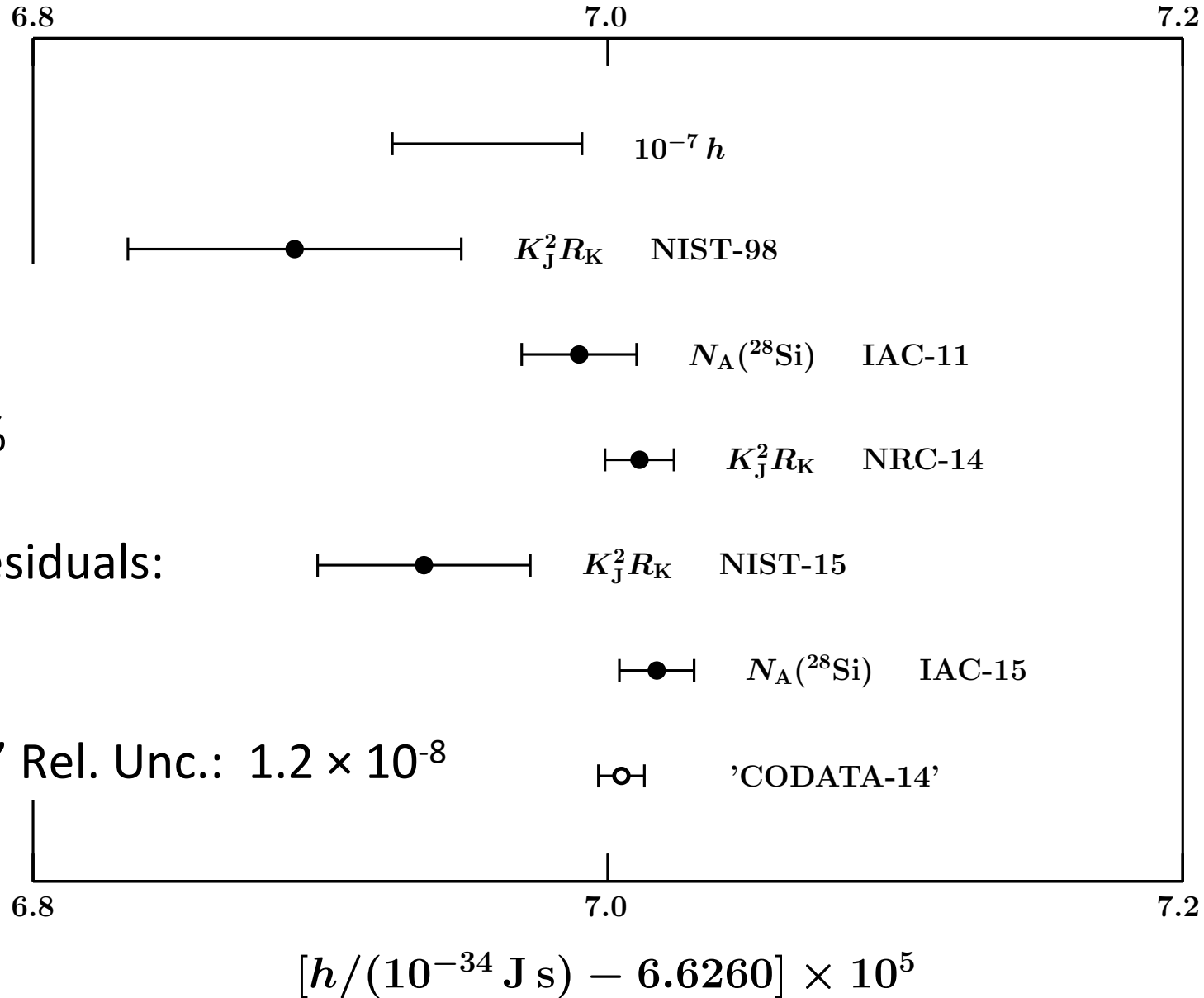
χ^2 : 5.50
 DOF: 7
 Prob. χ^2 : 60.0%
 R_B : 0.89
 Max. reduced residuals:
 -1.28, 1.55





2014 Input data related to the Planck constant

χ^2 : 8.49
DOF: 4
Prob. χ^2 : 7.52%
 R_B : 1.45
Max. reduced residuals:
1.98, 1.86

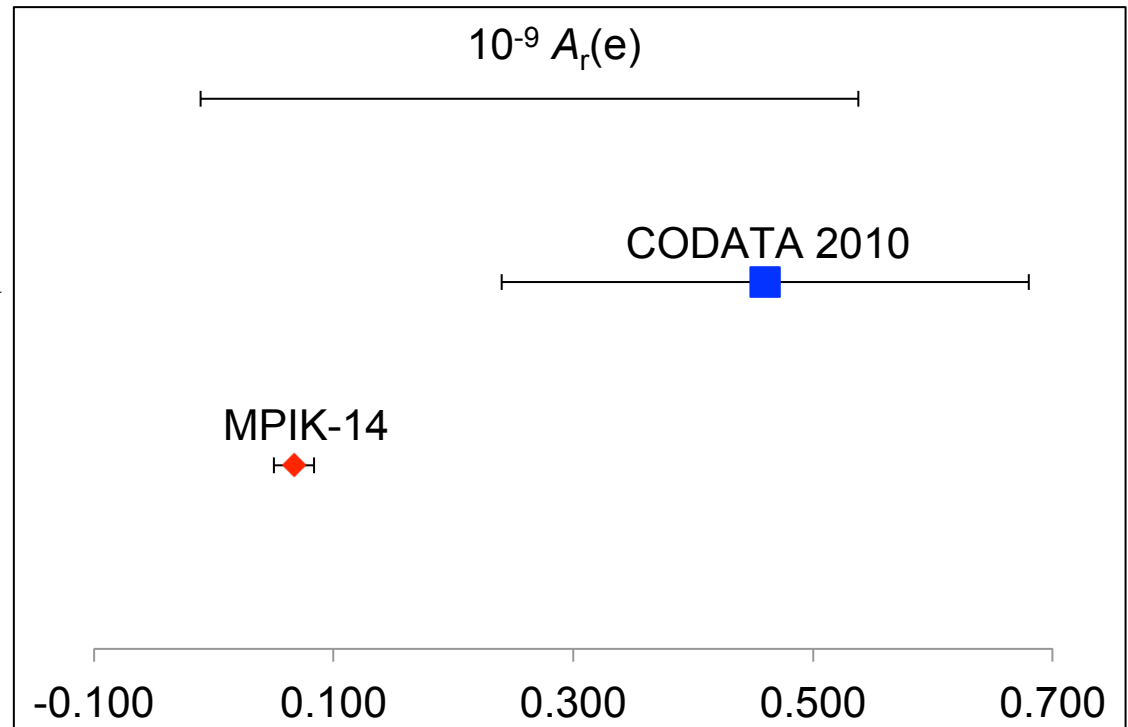


'CODATA-14' Rel. Unc.: 1.2×10^{-8}

High-precision measurement of the atomic mass of the electron

S. Sturm¹, F. Köhler^{1,2}, J. Zatorski¹, A. Wagner¹, Z. Harman^{1,3}, G. Werth⁴, W. Quint², C. H. Keitel¹ & K. Blaum¹

- Factor 13 more accurate than other data
- Silicon and carbon frequency ratio measurements correlated
- Need to review ionization energies of carbon and silicon

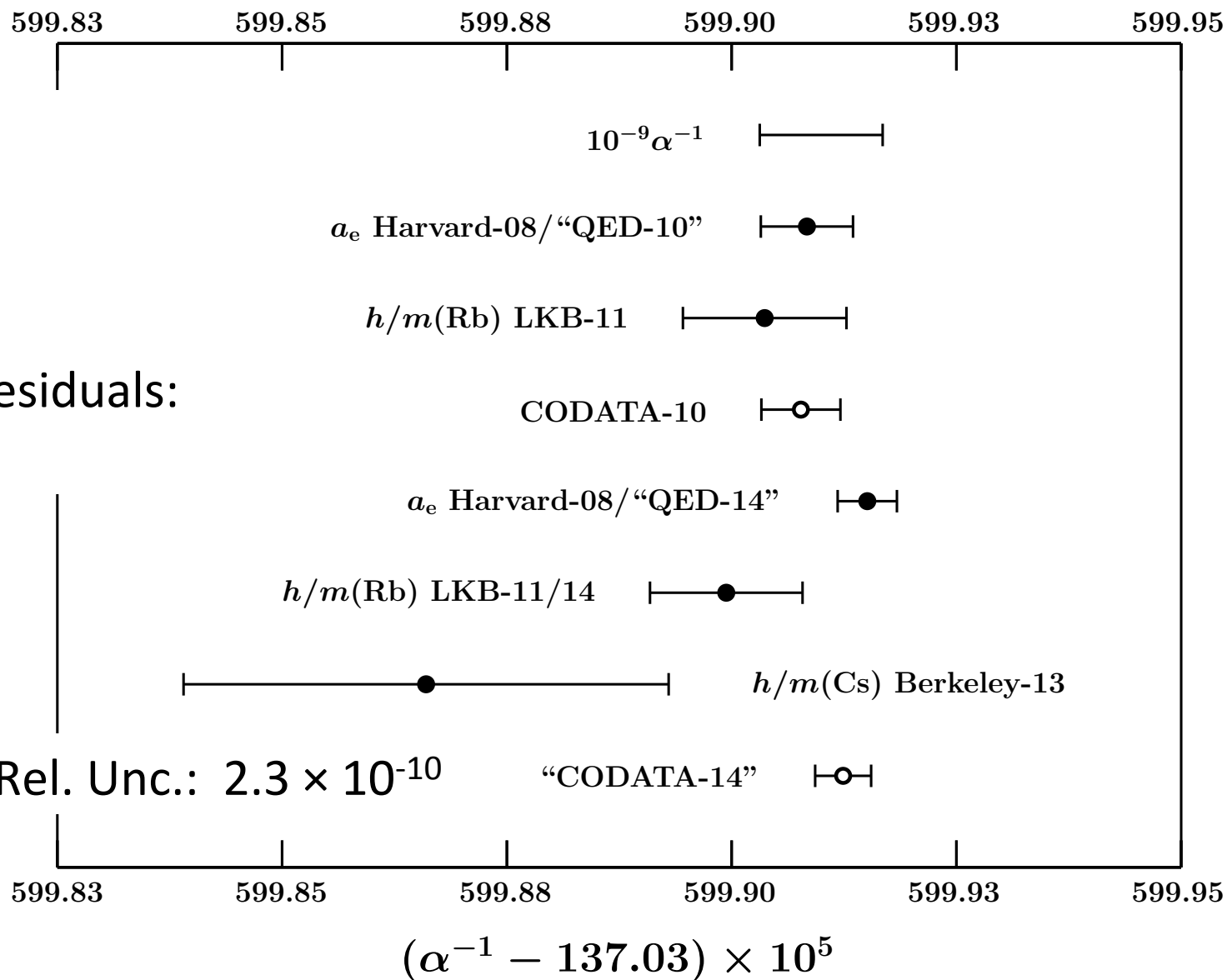


$$[A_r(e) - 0.000\,548\,579\,909\,4] \times 10^{12}$$



2014 Input data related to the Fine-structure constant

χ^2 : 5.82
 DOF: 2
 Prob. χ^2 : 5.8%
 R_B : 1.71
 Max. reduced residuals:
 1.51, 1.70

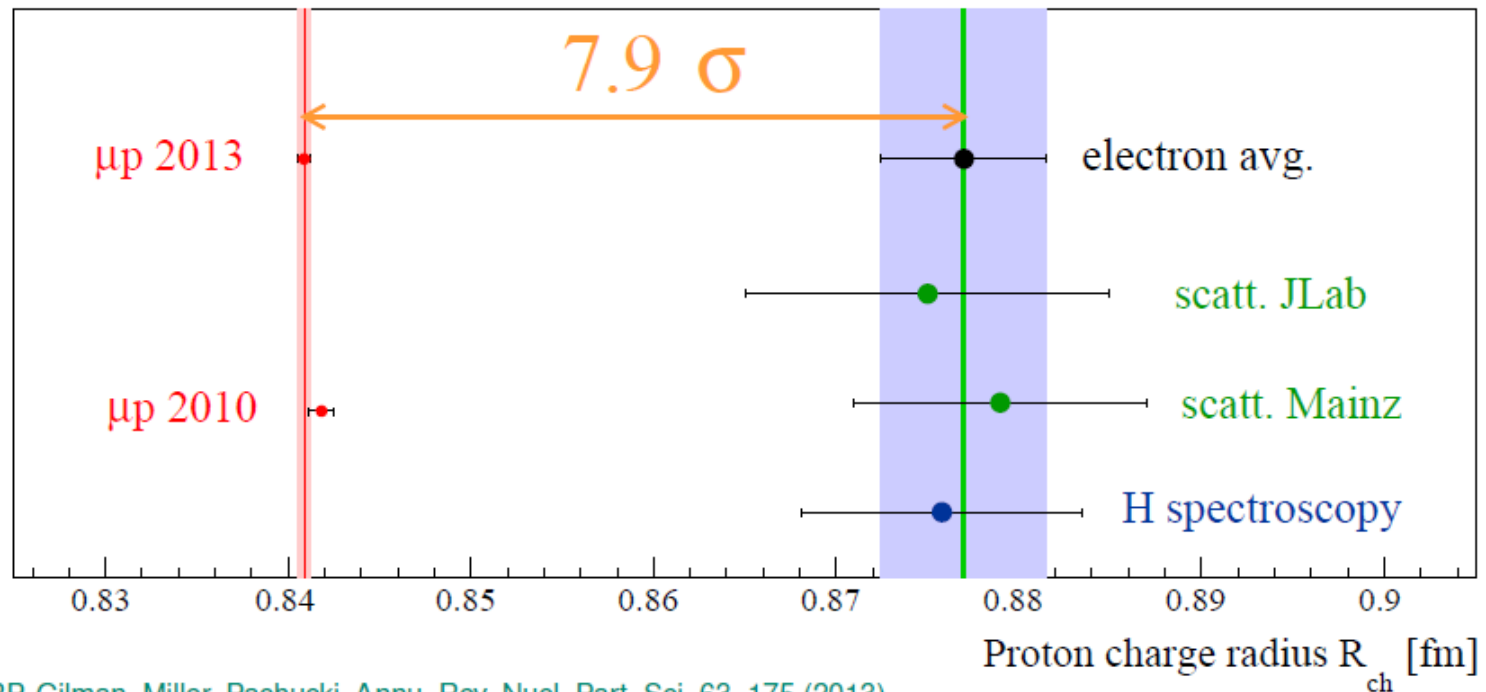


Rydberg constant, muonic hydrogen, and the proton radius

The proton rms charge radius measured with

electrons: 0.8770 ± 0.0045 fm

muons: 0.8409 ± 0.0004 fm





CODATA TGFC meeting 1 – 2 November, 2014





CODATA Task Group on Fundamental Constants

[Introduction](#)

[Membership](#)

[Recommended values of the fundamental constants](#)

[Contact info.](#)

[Minutes](#)

[Members' area](#)

➔ The purpose of the CODATA Task Group on Fundamental Constants (TGFC) is "to periodically provide the scientific and technological communities with a **self-consistent set of internationally recommended values of the basic constants and conversion factors of physics and chemistry** based on all of the relevant data available at a given point in time."

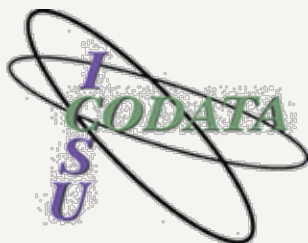
The CODATA-TGFC is not constituted under the auspices of the BIPM, but because of the close linkage between the SI units and fundamental constants, it enjoys a close relationship with the CCU and the BIPM; this portal, created as a working website for the Task Group, is an example.

The public section of this website provides information about the activities of the Task Group on Fundamental Constants including meeting dates, meeting minutes, and membership.

CODATA internationally recommended values of the Fundamental Physical Constants (2010 LSA)

➔ The next meeting of the TGFC will take place on **31 August and 1st September 2015** at the BIPM.

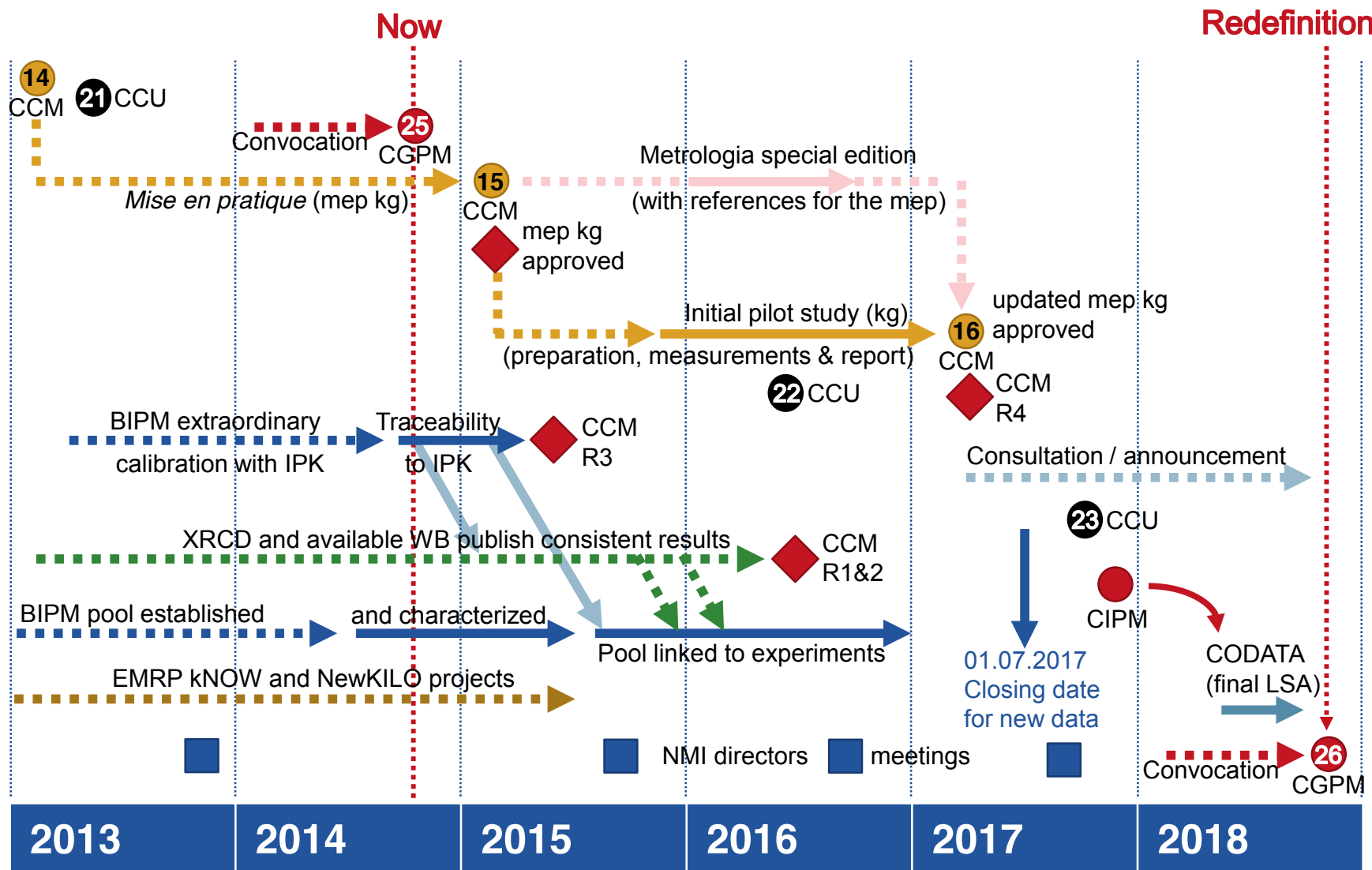
➤ [More](#)



- [Members of the CODATA Task Group on Fundamental Constants](#)
- [Group photograph \(November 2014, BIPM\)](#)
- [Meeting reports](#)
- [Paper on the 2010 LSA](#) 
- [CODATA-TGFC Working Documents](#):  (TGFC members only)
- [More information on CODATA: <http://www.codata.org/>](#)

On the road to redefinition

Joint CCM and CCU roadmap for the new SI





Critical Closing Dates for Data

1 July 2017

Closing date for data for special CODATA constants adjustment to determine exact values of h , e , k , and N_A for 2018 revised SI (International System of Units).

BY this date data must be published or available in a preprint accepted for publication.



Critical Closing Dates for Data

1 July 2018

Closing date for data for CODATA constants adjustment to determine new set of CODATA recommended values consistent with the revised SI (replaces 31 December 2018 normal closing date).

By this date data should be published or available in a preprint for publication.