

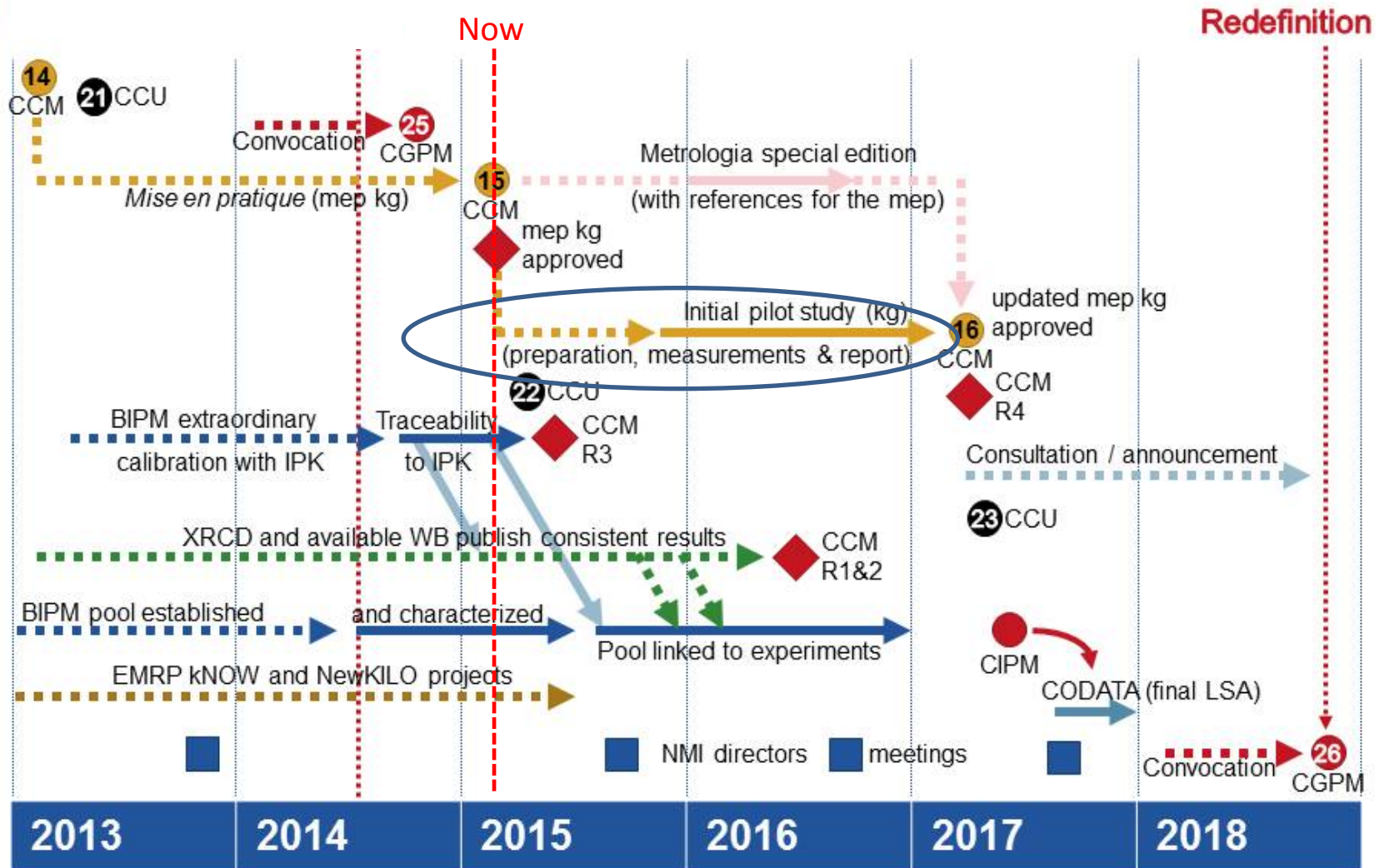
# Plan for a pilot study on the realization of the awaited kilogram definition

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**B**ureau  
International des  
Poids et  
Mesures

# The CCM roadmap towards a redefinition in 2018



# Targets of the pilot study

## Objective: Test of the procedures described in the *mise en pratique*

- comparison of independent primary **realizations** of the kilogram from watt/joule balances and Avogadro spheres, as directly as possible (**in vacuum**)
- comparison of **dissemination** from independent primary realizations (**in air**)

## In addition:

- link of the **BIPM Ensemble** of reference mass standards to primary realizations
  - ➡ starting point for
    - dissemination from BIPM
    - future comparisons with BIPM

# Status

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- Pilot laboratory: BIPM
- Support group: H. Bettin, M. Stock, C. Sutton
- Questionnaire with a proposal sent to potential participants in January 2014
- Participation limited to NMIs capable of realizing the mass unit with a primary method with appropriate uncertainty ( $u_r < 5 \times 10^{-7}$ , 500  $\mu\text{g}$ ):
  - watt balance,
  - joule balance,
  - access to  $^{28}\text{Si}$  sphere, surface characterization and volume meas.
- Positive replies received from 8 NMIs:
  - watt/joule balance: LNE, METAS, MSL, NIM, NIST, NRC
  - $^{28}\text{Si}$ : NMIJ, PTB

# Proposed comparison scheme

- Comparison of the **realization** of the kilogram:

Participants determine mass values of a transfer standard **under vacuum** using a primary realization experiment, based on a numerical value for  $h$ , stated in the protocol

- Comparison of the **dissemination** of the kilogram:

Participants determine mass values of a set of stainless steel standards **in air**, traceable to the same primary realization (unc. includes air-vacuum transfer and buoyancy correction)

Standards shipped to BIPM (in air)

BIPM will compare transfer standards as directly as possible (**under vacuum** / **in air**),  
-> ideally all standards at the BIPM during same period  
(PTB and NMIJ both need spheres AVO28-S5 and S8)

# Mass standards

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Transfer standards shall be provided by the participating institutes:

- Comparison of primary realizations (in vacuum):

1 (or 2) Pt-Ir prototype(s)

- Comparison of dissemination (in air):

2 stainless steel standards

Transfer standards need to be characterized with regard to their mass stability;

Participants shall make additional measurements to determine stability of standards during comparison.

# Comparison of Pt-Ir standards under vacuum

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1. Value assigned to transfer standard via primary realization experiment in vacuum
2. Transfer to air
3. Comparison with additional Pt-Ir standard in air (test for stability)
4. Standard transferred to BIPM, in air
5. All transfer standards compared directly, in vacuum
6. Standards returned to NMIs
7. Comparison with a Pt-Ir standard in air (test for stability)
8. Stability during transfer process assessed
9. Standard transferred to vacuum
10. Value re-assigned to transfer standard via primary realization experiment

# Comparison of stainless steel standards in air

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1. Transfer standards compared in air with NMI secondary standard, traceable to primary realization experiment
2. Standard transferred to BIPM
3. All transfer standards compared directly
4. Standards returned to NMIs
5. Transfer standards re-compared in air with NMI secondary standard

Steps 1 and 5 also serve as stability check



# Timescale

- Participants need operational primary realization experiment ( $u_r < 5 \times 10^{-7}$ , 500  $\mu\text{g}$ )  
-> Most potential participants requested start of the measurements **as late as possible**

February 2015:	presentation of plans at CCM meeting
June 2015:	protocol agreed by potential participants and WGR-kg chair (draft already exists)
Aug-Dec 2015:	transfer standards selected and characterized by participants
Jan-March 2016:	transfer standards calibrated by participants
March 2016:	transport to BIPM
April-June 2016:	comparison of transfer standards at BIPM
July 2016:	return of standards to participants
Aug-Sept 2016:	re-calibration by participants

# Timescale

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- Oct 2016: Comparison measurements completed, results sent to BIPM
- Dec 2016: Draft A report
- Feb 2017: Draft B report
- March 2017: Final report
- **May 2017: CCM meeting**
- June 2017: Publication of final report

# Publication of results

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Default method for KCRV: weighted mean, in case of statistical problems choice in consultation with participants

Results will not be published in KCDB (pilot study, no key comparison), but on CCM web site and in *Metrologia Technical Supplement*.