Group 1-2 calibrations for UTC

Update on guidelines, results and implementation plans

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GNSS WG Meeting

5 April 2016

Bureau International des Poids et Mesures

Outline

- Calibration Guidelines: Updates
- Status of GPS Group 1 and Group 2 calibrations
- Implementation in BIPM Circular T

BIPM Guidelines for GNSS calibrations

- « BIPM Guidelines for GNSS calibrations » Update v3.2 in February 2016
- Covers evolution of a calibrated system between two calibration exercises
  - Change in set-up (affecting only REFDLY)
  - or change in some elements (antenna cable?)
  - or replacement of a full system
  - or …
- What should be done?
  - If change affects only REFDLY AND if calibration results are expressed as INTDLY or SYSDLY, just measure and report the new REFDLY value. No change in Calibration Identifier (Cal_Id) nor in u_{CAL} .
  - In all other cases, the laboratory should perform and report a “transfer of calibration”

Transfer of calibration

- Transfer of calibration (TC)
  - Typically done by simultaneous operation of two systems in common-clock;
    - Either the new receiver in parallel to the old one
    - Or using a backup receiver to bridge between the new system/set-up and the old one
  - Short report to be transmitted to the BIPM;
  - Cal_Id (znnn-YYYY) will be expanded to reflect the TC
    - Same system as was initially calibrated: New Cal_Id = znnn-YYYY-TC1
    - New system: New Cal_Id = znnn-YYYY-SSSS-TC1 where SSSS is the originally calibrated system
    - TC counter can be incremented (TC2, TC3 …), each time with a report
    - BIPM will expand u_{CAL} by 1 ns in quadrature.

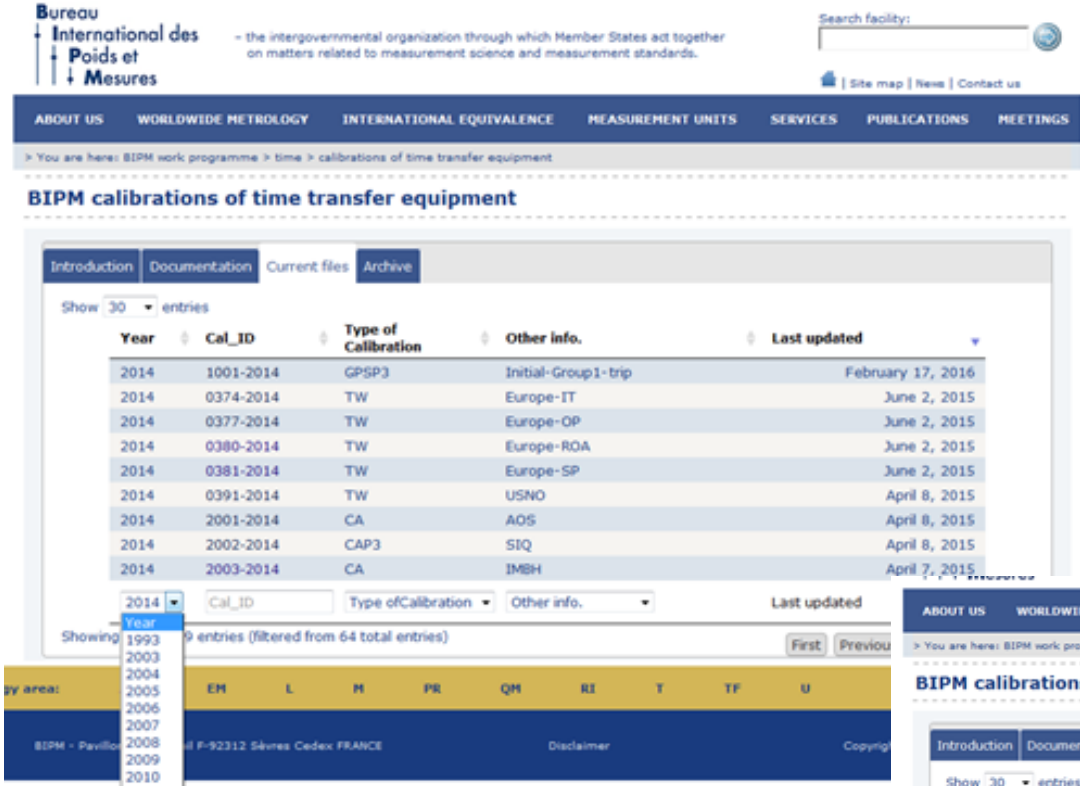
Calibrations web page

http://www.bipm.org/jsp/en/TimeCalibrations.jsp

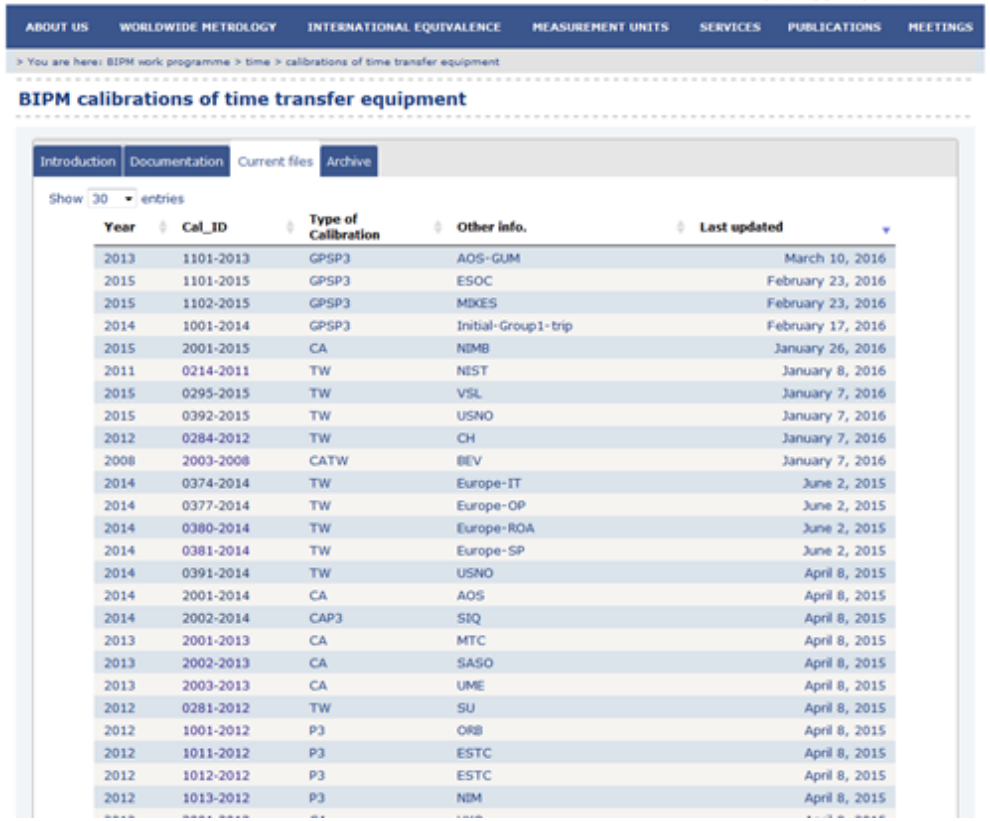
On line 09/04/2015

Intended to host all reports of UTC calibrations

WARNING: ftp contents have been moved from ftp://tai.bipm.org/TFG/.. to ftp://ftp2.bipm.org/pub/tai/.. on 24/03/2016.



- **Display completed by « Last updated ».**
- **Eventually will be accessed through the future database.**



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Status of G1-2 calibrations

Status of planned and requested GPS calibration exercices

Information in these tables is provided on a best-effort basis and do not imply a commitment of the mentioned institutions or individuals. The tables will be updated as required, please send all updates to tai@bipm.org or gpetit@bipm.org.

The first table provides a summary of the planned calibration exercises and the attributed calibration identifiers.

Cal_Id	Umbrella	Responsible	Planned period	Visits	Type	Links to documents	Comments	Notes
1001-2016	BIPM	BIPM/G. Petit	**02/2016 onwards**	**NIM, NICT, TL To be continued in EURAMET G1 labs**	GPS P1/P2 C1	N/A	Group 1 trip	(1)
1011-2016	Eurametc	ROA/H. Esteban	**Start 02/2016**	**ROA(G1), BIM, UME, BoM (FYROM), DMDM, IMBiH, INRIM**		N/A		(2)
1012-2016	Eurametc	PTB/A. Bauch	**Start 04/2016**	**PTB(G1), DLR, BEV, METAS, VSL**		N/A		(3)
1013-2016	OP	OP	**2016**	**OP(G1), PTB(G1), ROA(G1), INRIM, SP**		N/A	Under Galileo TVF	(4)
1014-2016	NIM	NIM/K. Liang	**04/2016**	**NIM(G1), NTSC**				(5)
1015-2016	NIM	NIM/K. Liang	**06/2016**	**NIM(G1), BIRM**				(5)

- Group 1 (2016) started (9 visits total)
- Group 2: 13 visits planned so far

Implementation for Circular T

- January 2016: New form of Circular T
- $u_{CAL}(t) = (u_{CAL0}^2 + u_{AG}^2 [+ u_{AL}^2])^{1/2}$
  - Typically u_{CAL0} is 1.7 ns for G1, 2.5 ns (default) for G2 trips (closure), 4 ns (default) for "golden system" (no closure).

5 - Time links used for the computation of TAI, calibrations information and corresponding uncertainties.

Link	Type	Equipment	Cal_ID1	/ Cal_ID2	u_{Stb}/ns	u_{Cal}/ns	u_{Ag}/ns	Al/ns	YYMM
AOS /PTB	GPSPPP	AO_4 /PT02	1101-2013	/ 1001-2014	0.3	2.7	1		
APL /PTB	GPSPPP	AP__ /PT02	NA_Al	/ 1001-2014	0.3	11.2	10	24.3	1511
AUS /PTB	GPSPPP	AU01 /PT02	1002-2010	/ 1001-2014	0.3	5.4	2		
BIM /PTB	GPS MC	BM37 /PT05	2004-2008	/ 1005-2008	1.5	8.6	5		
BIRM/PTB	GPS MC	BI01 /PT05	NC_Al	/ 1005-2008	1.5	20.0		-30.0	0709
BY /PTB	GPS MC	BY__ /PT05	NA_Al	/ 1005-2008	1.5	8.6	5	53.0	0804
CAO /PTB	GPS MC	CA__ /PT05	NC	/ 1005-2008	8.0	20.0			
CNM /PTB	GPS MC	CN00 /PT05	NA_Al	/ 1005-2008	3.0	11.2	10	-27.3	0804
CNMP/PTB	GPS MC	MP__ /PT05	1002-2004	/ 1005-2008	3.5	11.2	10		
DFNT/PTB	GPS P3	DN__ /PT02	NC_Al	/ 1001-2014	0.7	20.0		10.3	1507
DMDM/PTB	GPSPPP	ZM68 /PT02	NA	/ 1001-2014	0.3	7.3	2		
DTAG/PTB	GPSPPP	DT01 /PT02	NA	/ 1001-2014	0.3	7.6	3		
EIM /PTB	GPS MC	EI__ /PT05	1011-2007	/ 1005-2008	7.5	7.8	6		
ESTC/PTB	GPSPPP	ES03 /PT02	1012-2012	/ 1001-2014	0.3	5.4	2		
HKO /PTB	GPSPPP	HKO2 /PT02	NA_Al	/ 1001-2014	0.3	7.3	2	11.6	1509
IFAG/PTB	GPSPPP	IF13 /PT02	1011-2011	/ 1001-2014	0.3	5.4	2		
IGNA/PTB	NL								
IMBH/PTB	GPSPPP	BH01 /PT02	NA_Al	/ 1001-2014	0.3	7.0	0	31.6	1505
INPL/PTB	GPS P3	IL02 /PT02	NA_Al	/ 1001-2014	0.7	7.7	3	-46.8	1212
INTI/PTB	GPS MC	IN__ /PT05	NC	/ 1005-2008	2.5	20.0			
INXE/PTB	GPSPPP	NXRA /PT02	NC	/ 1001-2014	0.3	20.0			
JV /PTB	GPSPPP	JV__ /PT02	NC_Al	/ 1001-2014	0.3	20.0		130.0	1509
KEBS/PTB	GPS MC	KE__ /PT05	NC	/ 1005-2008	1.5	20.0			
KIM /PTB	GPS MC	KI02 /PT05	NC_Al	/ 1005-2008	2.0	20.0		-30.6	0901
KRIS/PTB	GPSPPP	KRZ1 /PT02	1003-2005	/ 1001-2014	0.3	11.2	10		
KZ /PTB	GPSGLN	KZ01 /PT05	2002-2008	/ 1005-2008	1.5	8.6	5		
LT /PTB	GPS MC	LT01 /PT05	1007-2006	/ 1005-2008	2.0	7.8	6		

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Future training course

- The BIPM plans to organize (within 1 year) a training course on calibrations
- Practical issues linked to calibration measurements, laboratory set-up etc…
- More details later

THANK YOU

Thanks to all Group 1 and other participating laboratories