SIMT TIME NETWORK AND SIM TIME SCALE

MEETING OF THE WORKING GROUP OF TIME AND FREQUENCY OF THE SIM
AND THE WORKSHOP OF METROLOGY IN TIME AND FREQUENCY

30/10/2017

CONTENT:

- The SIM Time Network (SIMTN)
- Time Scale SIMT
- Computer implementation of the SIMT Time Scale
- Next step on the SIMT Time Scale

Regional metrology organizations (RMOs) are regional associations of national metrology institutes.

CALIBRATION AND MEASUREMENT CAPABILITIES CMCS

1.- Participation of the NMI in scientific comparisons, being approved.

2.- Have an adequate and approved quality management system.

3.- Comparison by pairs (regional and international) of the capacities of calibration and measurement.

The Inter-american Metrology System (SIM) resulted from a broad agreement among national metrology organizations from 34 nations of the Americas.

SIM was created to promote and support an integrated measurement infrastructure in the Americas which enables each national measurement institute to stimulate innovation, competitiveness, trade, consumer safety and sustainable development by effectively participating in the international metrology community.

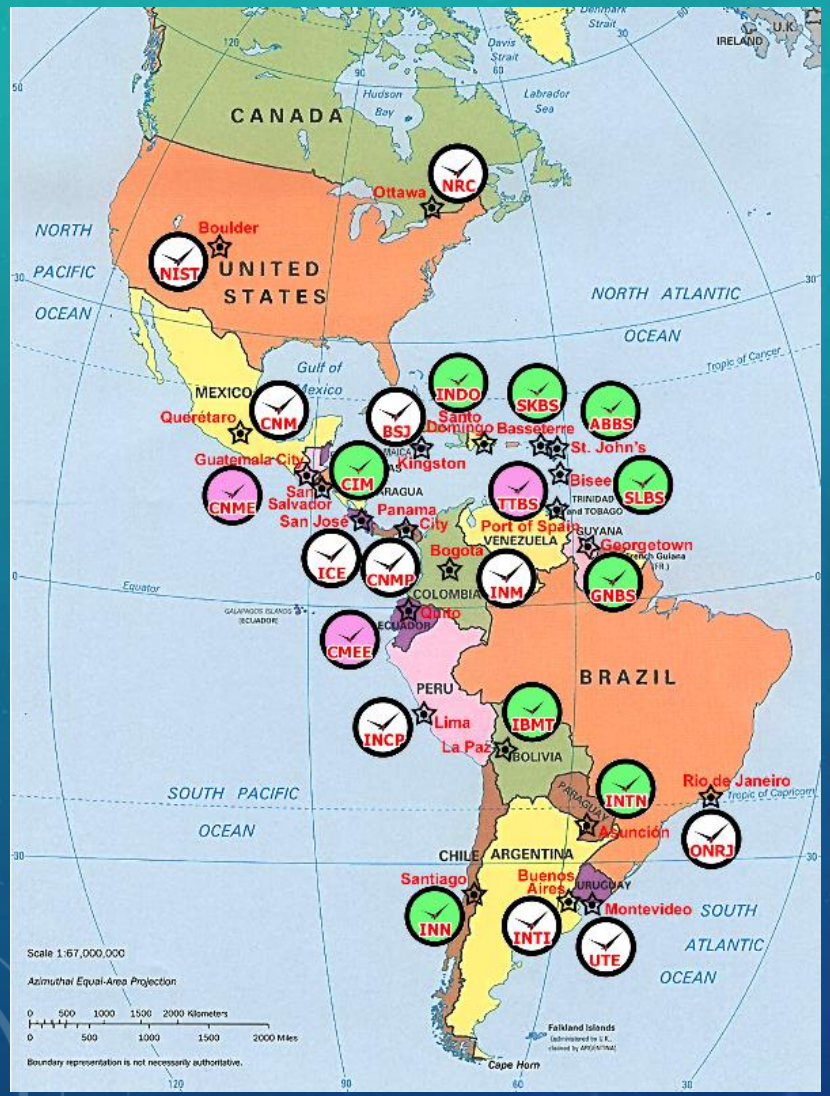
The SIMTN is a clock comparison network for the SIM region. It was developed by the SIM Time and Frequency Metrology Working Group (SIM TFWG) with support from the OAS.

When two clocks are not at the same location, the time difference between them can be measured by simultaneously comparing both clocks to a common GPS satellite signal in “common-view” of both sites.

ORGANIZATION OF AMERICAN STATES

SIM
SISTEMA INTERAMERICANO DE METROLOGIA
SIM TFWG

SIMTN EQUIPMENT
23 common-view GPS receiver
3 WEB servers



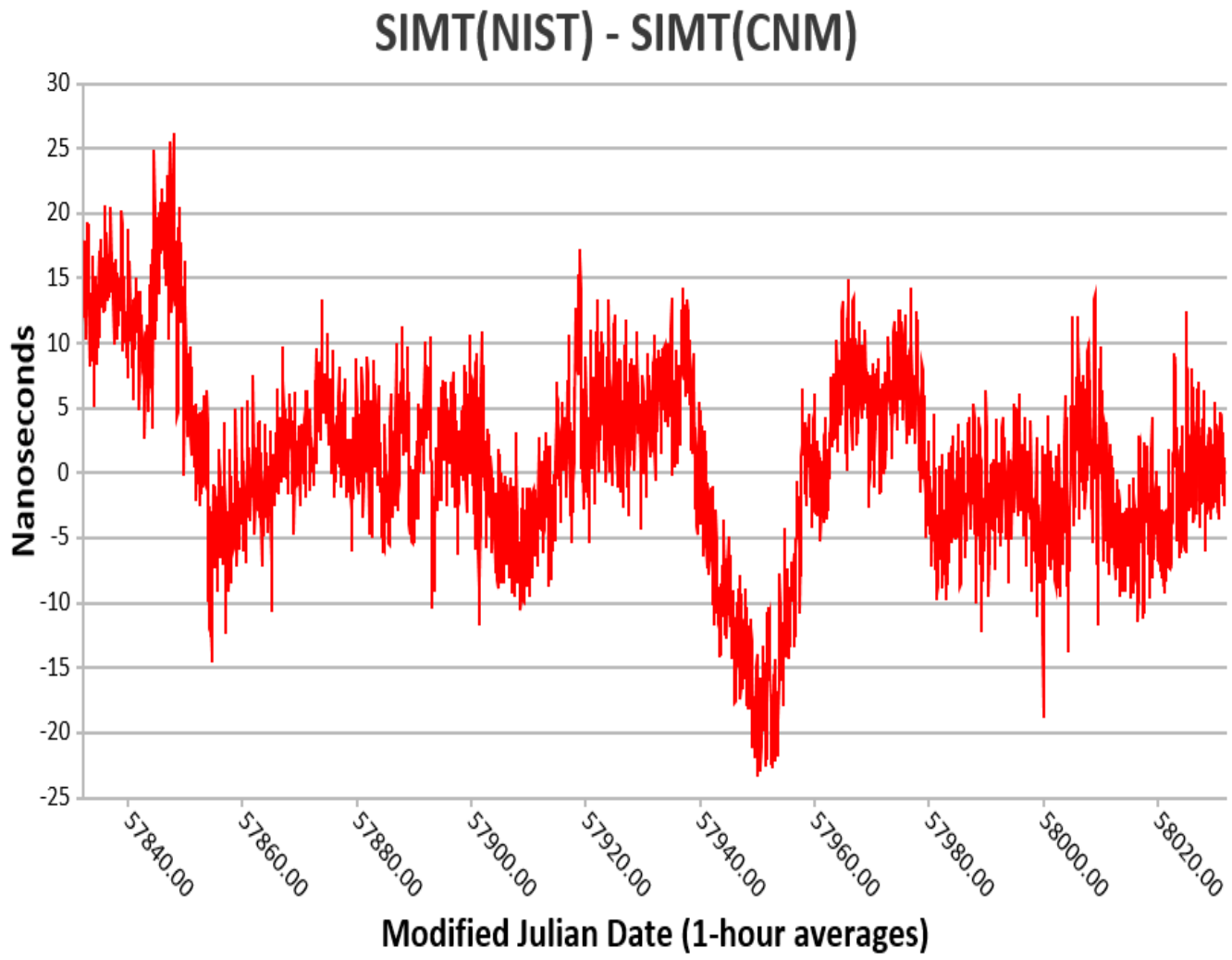
Country	NMI	Year of first participation	Time Standard
United States	NIST	2005	Ensamble Time Scale
México	CENAM	2005	Ensamble Time Scale
Canada	NRC	2005	Ensamble Time Scale
Panama	CENAMEP	2005	Cesium
Brazil	ONRJ	2006	Ensamble Time Scale
Costa Rica	ICE	2007	Cesium
Colombia	INM	2007	Cesium
Argentina	INTI	2007	Cesium
Guatemala	LNM	2007	GPS receiver
Jamaica	BSJ	2007	Cesium
Uruguay	UTE	2008	Cesium
Paraguay	INTN	2008	Rubidium
Peru	SNM	2009	Cesium
Trinidad & Tobago	TTBS	2009	GPS receiver
Saint Lucia	SLBS	2010	Rubidium
Chile	INN	2010	Rubidium
Antigua & Barbuda	ABBS	2011	Rubidium
Ecuador	CMEE	2012	GPSreceiver
Bolivia	IBMETRO	2012	Cesium
St. Kitts	SKBS	2012	Rubidium
Guyana	GNBS	2012	Rubidium
El Salvador	CIM	2015	Rubidium
Republica Dominicana	INDO	2015	Rubidium

SIM Time Network

(real-time measurement results for the 10-minute period ending on 10-05-2017 at 1530 UTC)

	United States SIMT(NIST)	Mexico SIMT(CNM)	Canada SIMT(NRC)	Panama SIMT(CNMP)	Brazil SIMT(ONRJ)	Costa Rica SIMT(ICE)	Colombia SIMT(INM)	Argentina SIMT(INTI)	Guatemala SIMT(CNME)	Jamaica SIMT(BSJ)	Uruguay SIMT(UTE)	Paraguay SIMT(INTN)	Peru SIMT(INCP)	Trinidad SIMT(TTBS)	St. Lucia SIMT(SLBS)	Chile SIMT(INN)	Antigua SIMT(ABBS)	Ecuador SIMT(CMEE)	Bolivia SIMT(IBMET)	St. Kitts SIMT(SKBS)	Guyana SIMT(GNBS)	El Salvador SIMT(CIM)	Dominican Rep. SIMT(INDO)
United States SIMT(NIST)		-0.4	-31.6	-8.7	14.6	12.1			11.6		-59.8	-15.6	-136.9		17.6	-5.5		-11.8	3179.7			-0.2	10.3
Mexico SIMT(CNM)	0.4		-28.4	-7.3	7.8	12.3			13.3		-73.1	-23.4	-141.0		20.1	-29.4		-9.8	3172.9			4.9	11.5
Canada SIMT(NRC)	31.6	28.4		23.5	48.7	43.9			42.7		-27.1	16.8	-108.5		46.7	6.1		20.3	3206.2			22.9	40.7
Panama SIMT(CNMP)	8.7	7.3	-23.5		21.7	20.6			19.9		-55.4	-8.5	-130.1		28.9	-11.7		-2.5	3186.9			12.2	18.8
Brazil SIMT(ONRJ)	-14.6	-7.8	-48.7	-21.7		10.1			-3.1		-73.1	-26.9	-149.3		5.9	-15.1		-21.9	3164.1			19.1	-5.2
Costa Rica SIMT(ICE)	-12.1	-12.3	-43.9	-20.6	-10.1				1.9		-85.5	-35.6	-156.3		0.8	-38.9		-23.1	3156.5			-8.4	-7.2
Colombia SIMT(INM)																							
Argentina SIMT(INTI)																							
Guatemala SIMT(CNME)	-11.6	-13.3	-42.7	-19.9	3.1	-1.9					-75.4	-27.1	-147.9		7.9	-21.1		-21.4	3168.2			-2.4	-0.6
Jamaica SIMT(BSJ)																							
Uruguay SIMT(UTE)	59.8	73.1	27.1	55.4	73.1	85.5			75.4			48.1	-75.7		79.1	55.4		56.0	3240.2			108.9	68.5
Paraguay SIMT(INTN)	15.6	23.4	-16.8	8.5	26.9	35.6			27.1		-48.1		-124.2		35.7	2.5		7.4	3189.6			45.9	22.6
Peru SIMT(INCP)	136.9	141.0	108.5	130.1	149.3	156.3			147.9		75.7	124.2			157.3	127.0		129.1	3315.1			156.7	148.1
Trinidad SIMT(TTBS)																							
St. Lucia SIMT(SLBS)	-17.6	-20.1	-46.7	-28.9	-5.9	-0.8			-7.9		-79.1	-35.7	-157.3			-32.5		-31.2	3158.2			-13.2	-9.5
Chile SIMT(INN)	5.5	29.4	-6.1	11.7	15.1	38.9			21.1		-55.4	-2.5	-127.0		32.5			3.5	3187.2			65.1	21.9
Antigua SIMT(ABBS)																							
Ecuador SIMT(CMEE)	11.8	9.8	-20.3	2.5	21.9	23.1			21.4		-56.0	-7.4	-129.1		31.2	-3.5			3189.7			14.8	21.3
Bolivia SIMT(IBMET)	-3179.7	-3172.9	-3206.2	-3186.9	-3164.1	-3156.5			-3168.2		-3240.2	-3189.6	-3315.1		-3158.2	-3187.2		-3189.7				-3146.0	-3168.4
St. Kitts SIMT(SKBS)																							
Guyana SIMT(GNBS)																							
El Salvador SIMT(CIM)	0.2	-4.9	-22.9	-12.2	-19.1	8.4			2.4		-108.9	-45.9	-156.7		13.2	-65.1		-14.8	3146.0				6.6
Dominican Rep. SIMT(INDO)	-10.3	-11.5	-40.7	-18.8	5.2	7.2			0.6		-68.5	-22.6	-148.1		9.5	-21.9		-21.3	3168.4			-6.6	
Last Update (HHMM)	1530	1530	1530	1530	1530	1530	0130	1520	1530		1530	1530	1530		1530	1530		1530	1530			1530	1530

Hours in Common-View	Mean Time Offset (ns)	Range (ns)	Frequency Offset	Confidence (r)
4791	1.12	49.62	-5.21×10^{-16}	-0.36

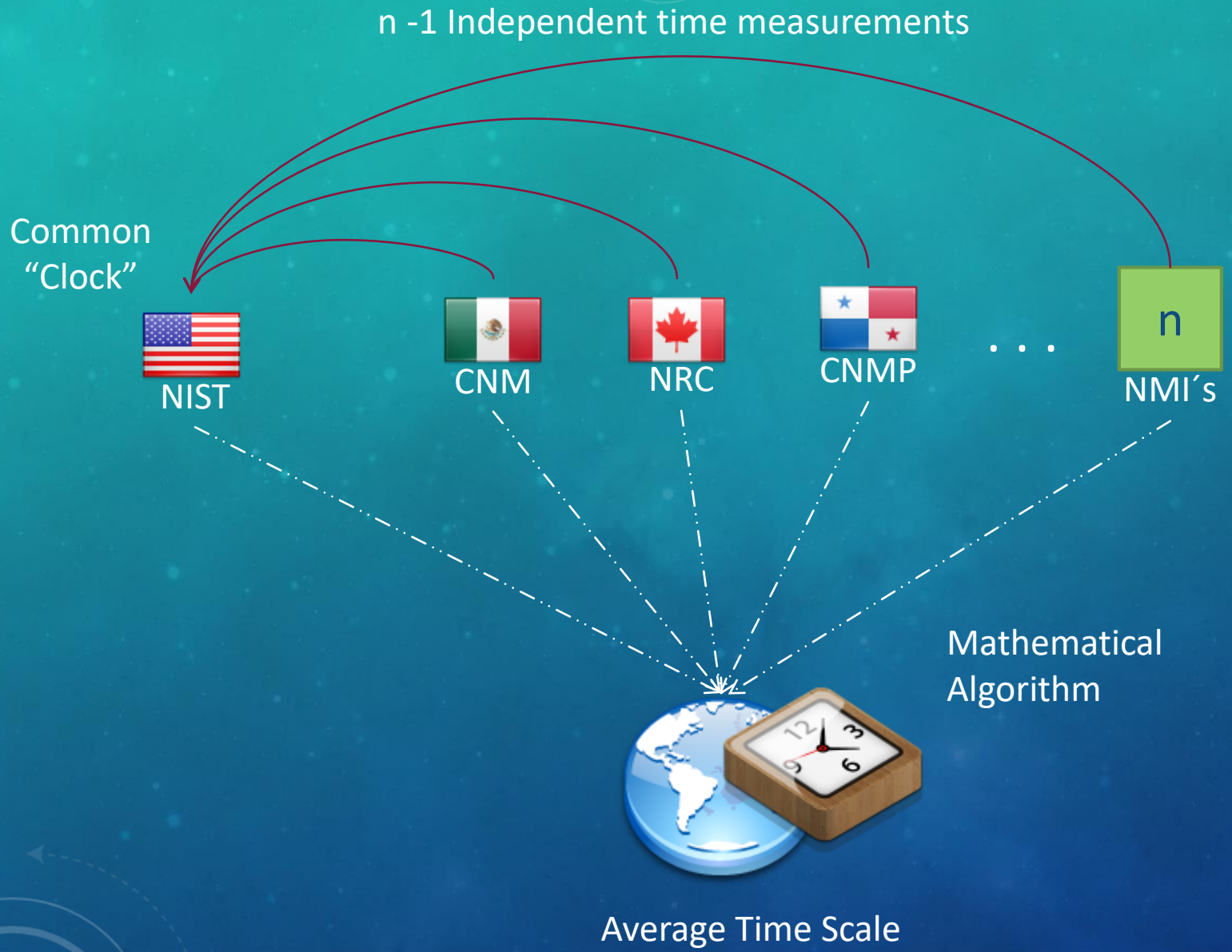


SIMTN

- Publication of results in real time (update of publication every 10 minutes).
- Immediate detection of anomalies in published results.
- Observation of results from any computer or mobile device.

CONTENT:

- The SIM Time Network (SIMTN)
- **Time Scale SIMT**
- Computer implementation of the SIMT Time Scale
- Next step on the SIMT Time Scale



$$\bar{X}_i(t+\tau) = X_i(t) + \left[Y_i(t) + \frac{D_i \tau}{2} \right] \tau$$

$$X_i(t+\tau) = \sum_{j=1}^{N} w_j \left[\bar{X}_j(t+\tau) - X_{ji}(t+\tau) \right]$$

$$\bar{Y}_i(t+\tau) = \frac{X_i(t+\tau) - X_i(t)}{\tau}$$

$$Y_i(t+\tau) = \frac{\bar{Y}_i(t+\tau) + m_i Y_i(t)}{1+m_i}$$

ADVANTAGES OF THE SIMT TIME SCALE

SIM Time Scale

(SIMT - SIMT(*k*) for the 1-hour period ending on 2017-10-06 at 13:20:00 UTC)

National Standard	National Flag	SIMT - SIMT(*k*), ns	SIMT Contribution	National Standard	National Flag	SIMT - SIMT(*k*), ns	SIMT Contribution
United States SIMT(NIST)		5.73	33.76 %	Trinidad SIMT(TTBS)		---	0.00 %
Canada SIMT(NRC)		35.47	20.76 %	Antigua SIMT(ABBS)		---	0.00 %
Mexico SIMT(CNM)		-0.81	17.58 %	St. Kitts SIMT(SKNBS)		---	0.00 %
Panama SIMT(CNMP)		12.43	7.45 %	Guyana SIMT(GNBS)		---	0.00 %
Brazil SIMT(ONRJ)		-4.26	6.86 %	Guatemala SIMT(LNM)		-7.30	0.00 %
Argentina SIMT(INTI)		6.45	5.11 %	Paraguay SIMT(INTN)		118.83	0.00 %
Colombia SIMT(INM)		3.85	4.15 %	St. Lucia SIMT(SLBS)		5.85	0.00 %
Costa Rica SIMT(ICE)		-6.56	2.68 %	Chile SIMT(INN)		0.37	0.00 %
Uruguay SIMT(UTE)		72.00	0.76 %	Ecuador SIMT(CMEE)		12.46	0.00 %
Peru SIMT(INACAL)		136.00	0.63 %	El Salvador SIMT(CIM)		2.34	0.00 %
Bolivia SIMT(IBMET)		-3217.00	0.27 %	Dominican Rep. SIMT(INDOCAL)		0.30	0.00 %
Jamaica SIMT(BSJ)		---	0.00 %	Bahamas SIMT(BBSQ)		---	0.00 %

- Be a time scale available in real time via the Internet.
- Work directly with local time scales of national metrology institutes regardless of whether it is a single atomic clock or a set of atomic clocks.
- Provide a traceability path to the IS for NMIs with limited resources.
- Improve the metrological capacities of the entire SIM region.

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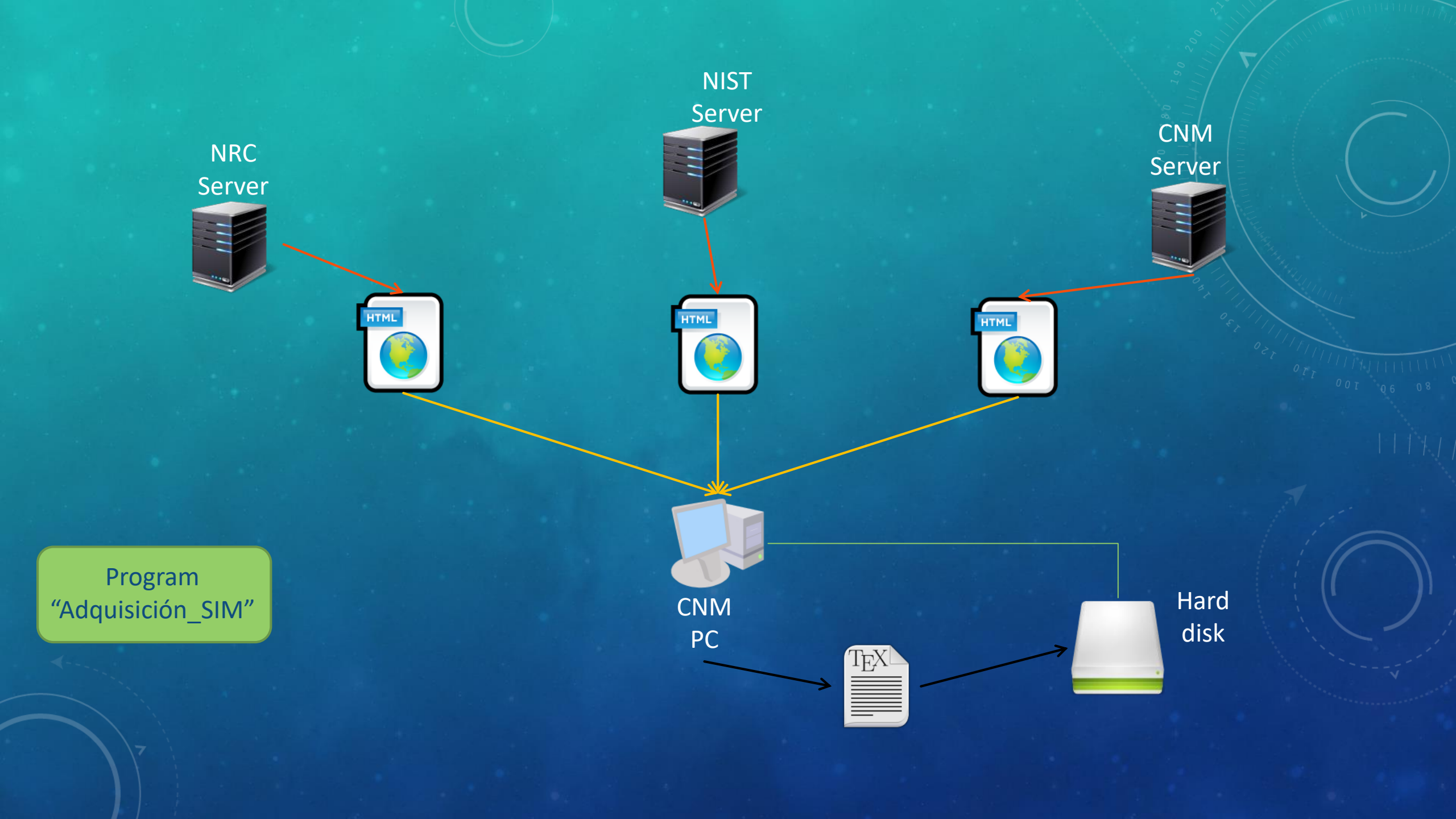
COMPUTER MODULES FOR THE GENERATION OF THE SIMT TIME SCALE

Program
“Adquisición_SIM”

Program
“ETP-1”

Program “FTP”


NIST
Server
NRC
Server
CNM
Server
HTML
HTML
HTML
CNM
PC
Hard
disk
TEX
Program
“Adquisición_SIM”

SERVER	LINK
CNM	http://172.16.131.226/scripts/avscale2.exe?20170929060144
NIST	http://132.163.4.82/scripts/avscale2.exe?20170929060144
NRC	http://132.246.11.235/scripts/avscale2.exe?20170929060144

CNM

Reference Lab = SIMT(NIST)

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58042.6875, 2017-10-16, 16:30, 0.0, 13.3, -30.3, -14.1, 15.8, -3.8, ---, -31.7, 5.4, ---, -56.3, 171884824.1, -115.8, -
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NRC

Reference Lab = SIMT(NIST)

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58042.6042, 2017-10-16, 14:30, 0.0, 12.2, -31.0, -13.4, 11.9, -8.6, ---, -34.3, 0.7, ---, -59.2, 171883957.8, -122.9,
58042.5972, 2017-10-16, 14:20, 0.0, 14.0, -31.0, -12.8, 13.6, -8.0, ---, -33.0, 3.6, ---, -58.4, 171883885.3, -121.6,

NIST

Reference Lab = SIMT(NIST)

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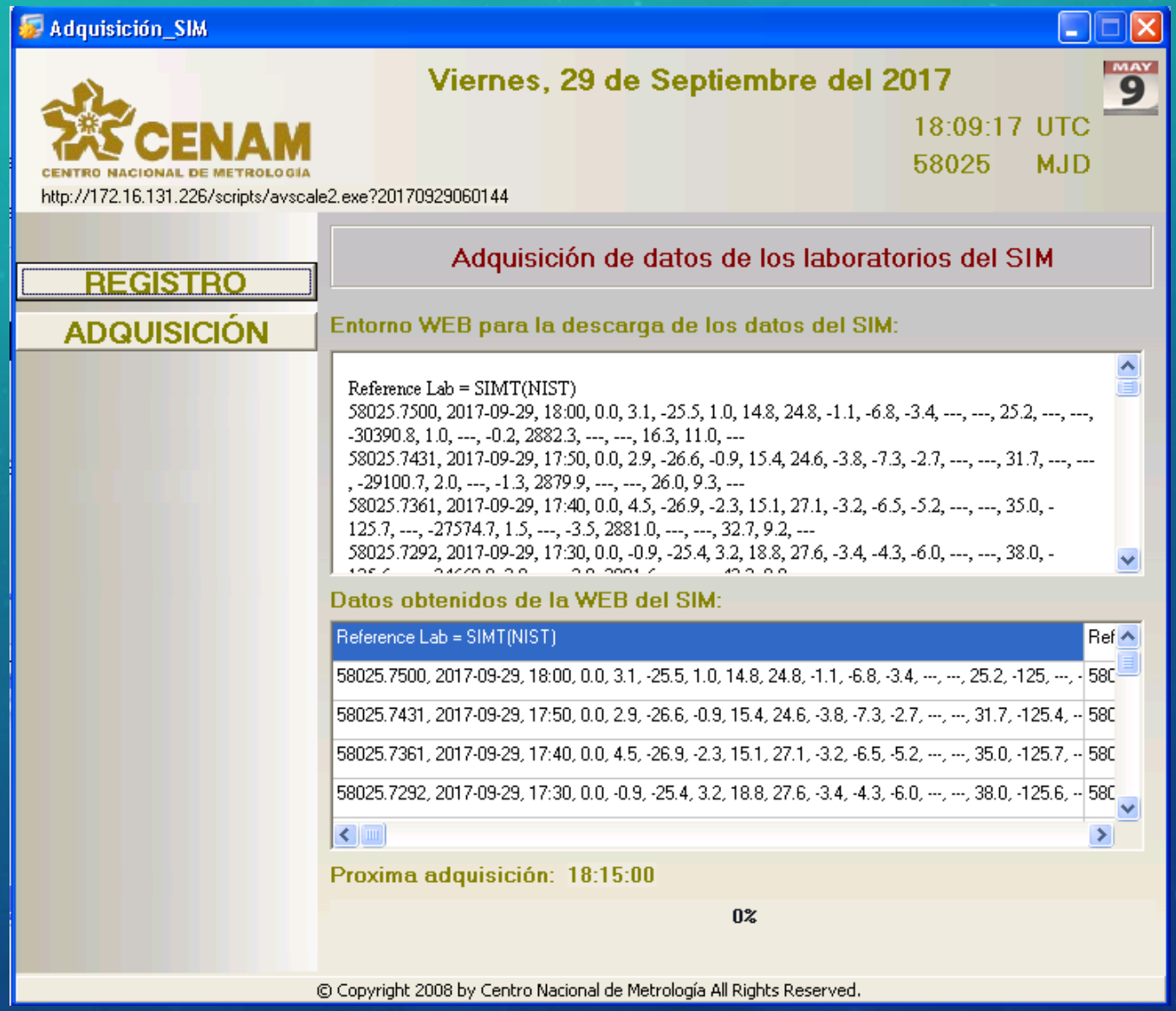
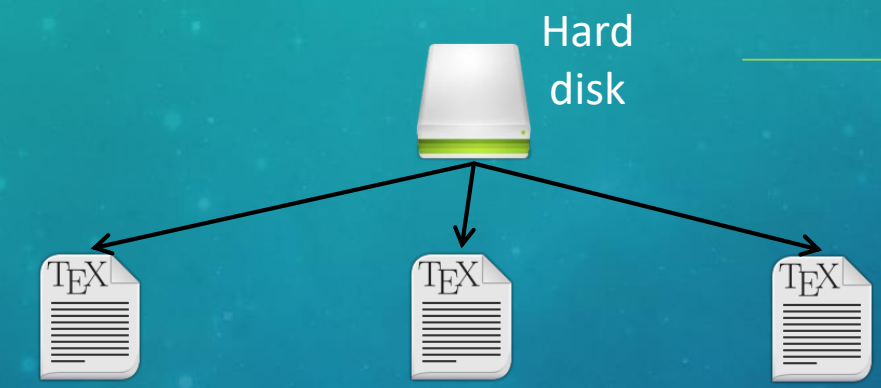
Main screen of the program



Program
ETP-1”



Time difference archives between laboratories

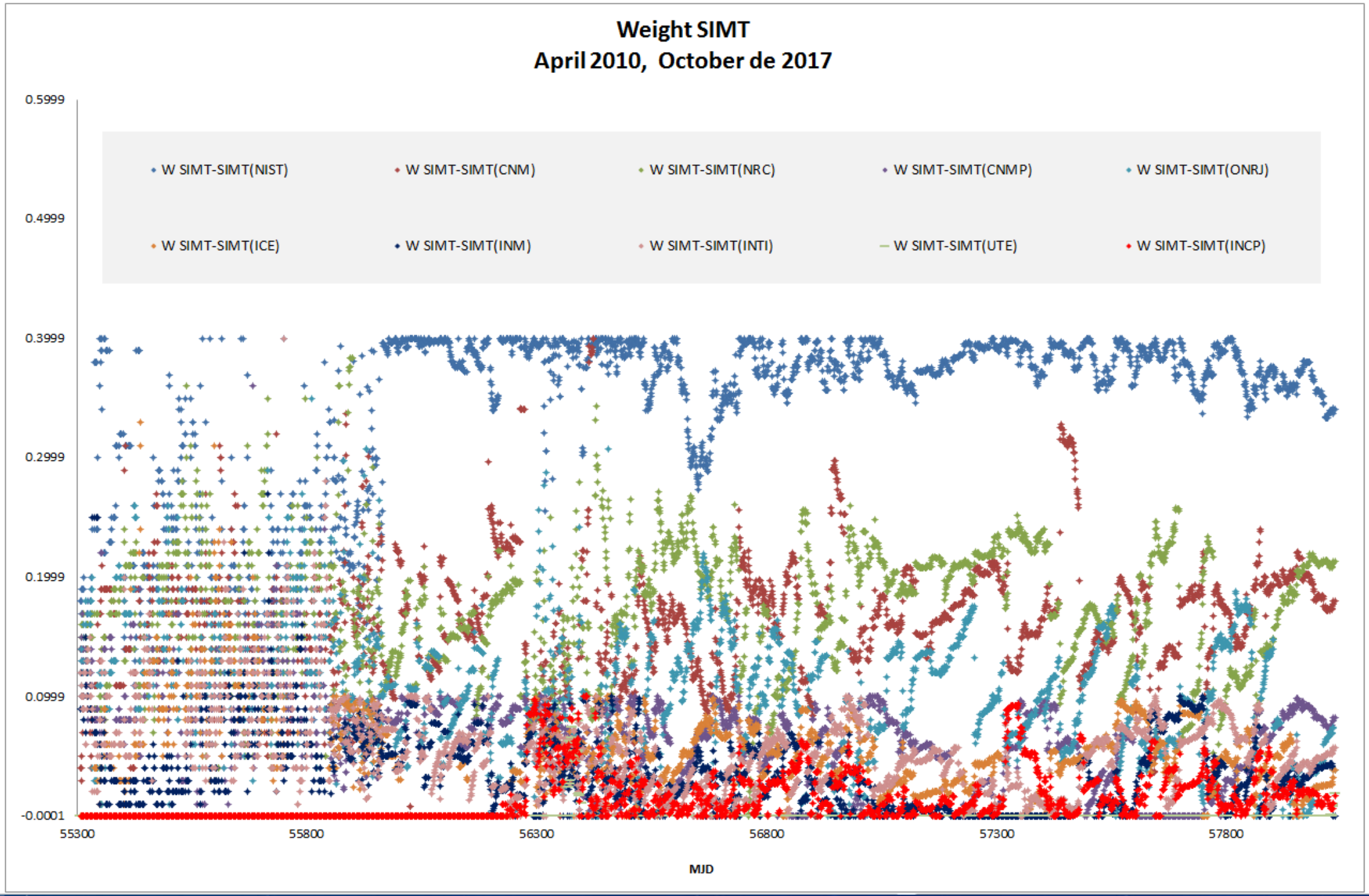
$$X_i(t+\tau) = X_i(t) + \left[Y_i(t) + \frac{D_i \tau}{2} \right] \tau$$

$$X_i(t+\tau) = \sum_{j=1}^{N} w_j \left[\hat{X}_j(t+\tau) - X_{ji}(t+\tau) \right]$$

$$\hat{Y}_i(t+\tau) = \frac{X_i(t+\tau) - X_i(t)}{\tau}$$

$$Y_i(t+\tau) = \frac{\hat{Y}_i(t+\tau) + m_i Y_i(t)}{1+m_i}$$

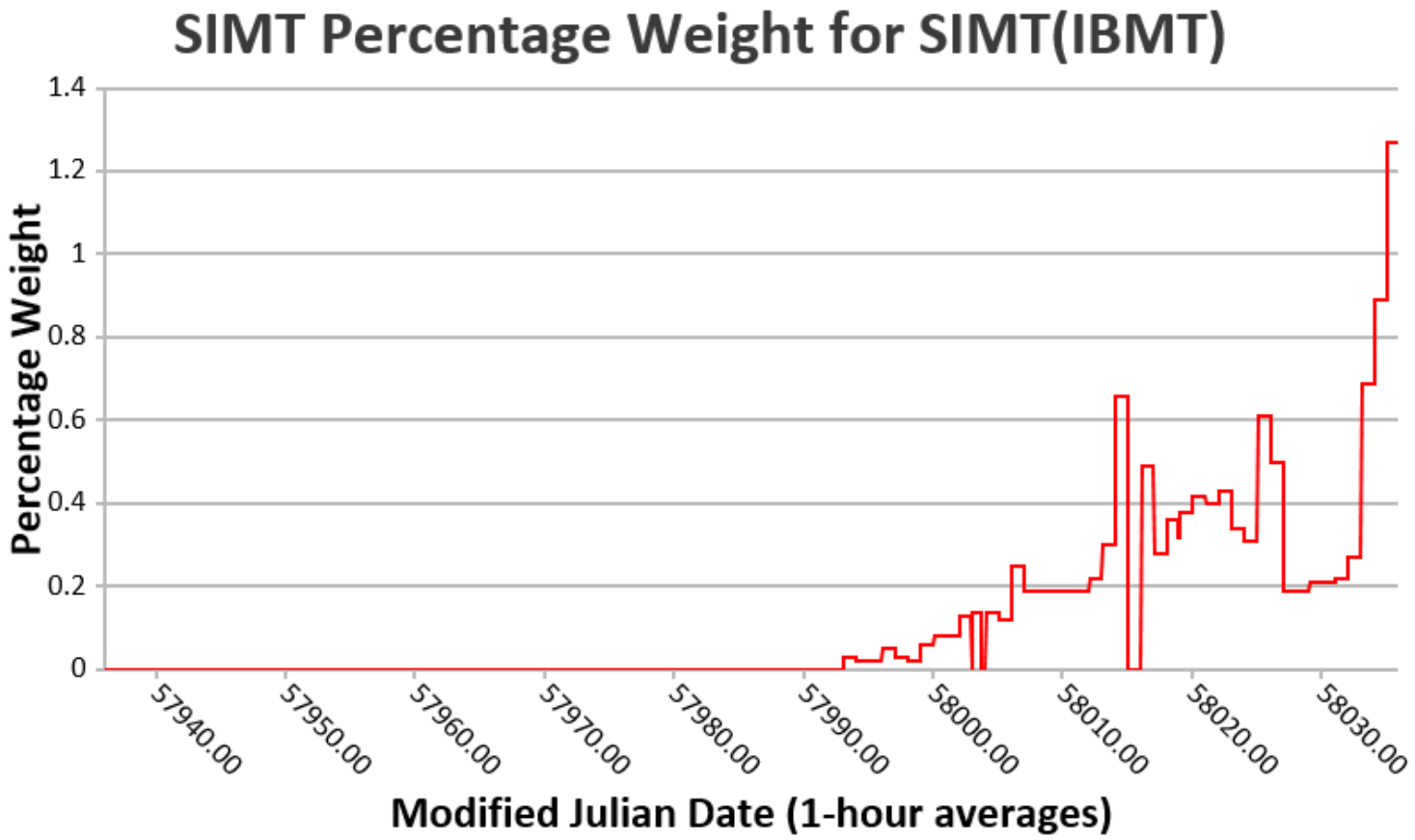
Time difference files between the SIMT scale and the participating laboratories


Weight SIMT
April 2010, October de 2017
0.5999
0.4999
0.3999
0.2999
0.1999
0.0999
-0.0001
W SIMT-SIMT(NIST)
W SIMT-SIMT(CNM)
W SIMT-SIMT(NRC)
W SIMT-SIMT(CNMP)
W SIMT-SIMT(ONRJ)
W SIMT-SIMT(ICE)
W SIMT-SIMT(INM)
W SIMT-SIMT(INTI)
W SIMT-SIMT(UTE)
W SIMT-SIMT(INCP)
55300
55800
56300
56800
57300
57800
MJD

SIMT Percentage Weight for SIMT(IBMT) for the 100 day period ending 2017-10-09

Next Time Scale Previous Time Scale Next Date

Hours	Average Weight
2395	0.12 %



Weight assignment

$$\sum_{i=1}^{N_{\mathrm{Tot}}} \omega_i = 1$$

$$\omega_i \propto \frac{1}{\sigma_i(\tau)}$$

Weight SIMT
April 2010, October de 2017

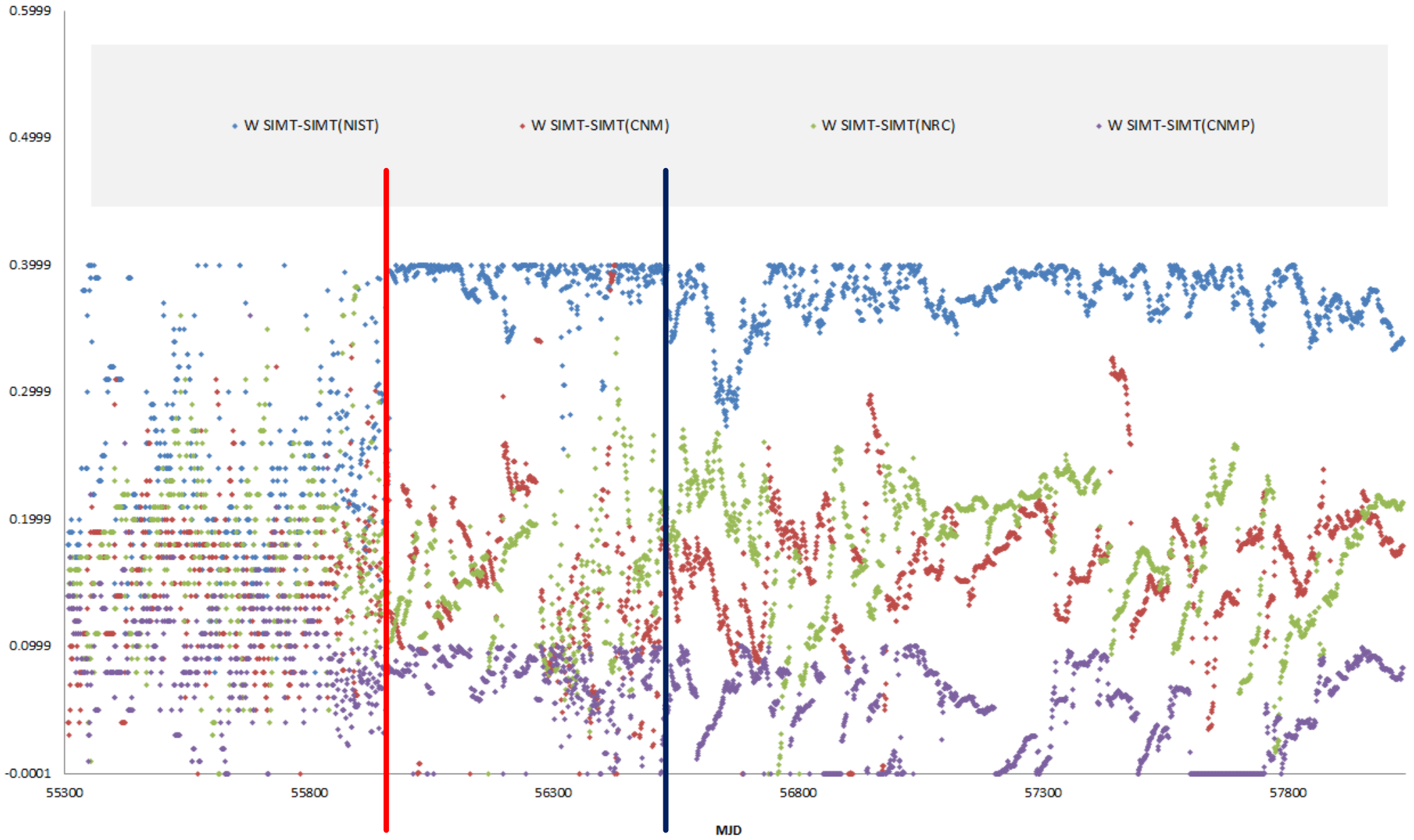
Weight assignment

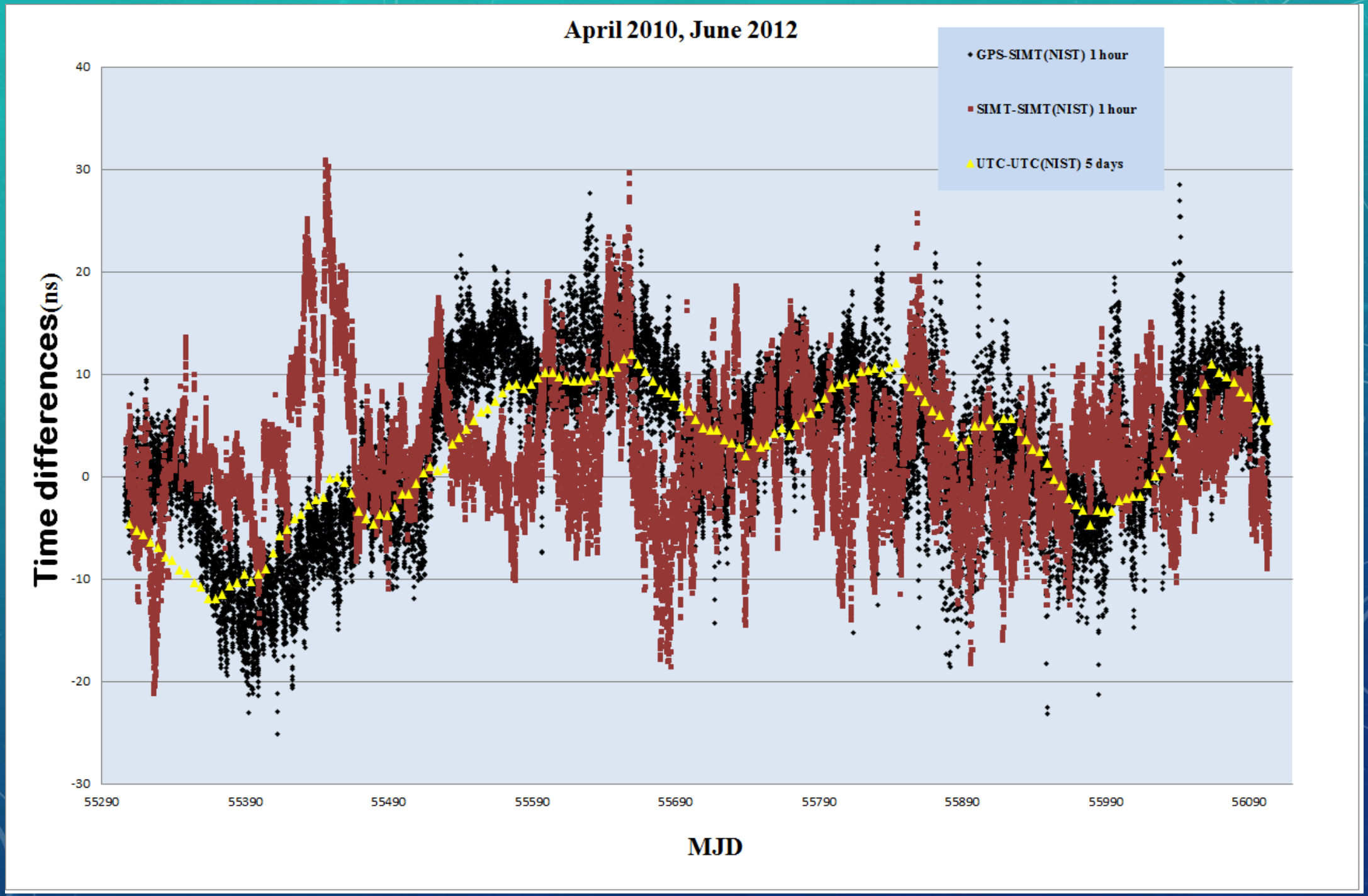
$$\sum_{i=1}^{N_{\mathrm{Tot}}} \omega_i = 1$$

$$\omega_i \propto \frac{1}{\sigma_i(\tau)}$$

Time Standard	Percentage of participation
Ensamble Time Scale	40%
Cesium	10%
Rubidium	0%
GPSDO	0%

Weight SIMT
April 2010, October de 2017




April 2010, June 2012
GPS-SIMT(NIST) 1 hour
SIMT-SIMT(NIST) 1 hour
UTC-UTC(NIST) 5 days
Time differences(ns)
40
30
20
10
0
-10
-20
-30
55290
55390
55490
55590
55690
55790
55890
55990
56090
MJD

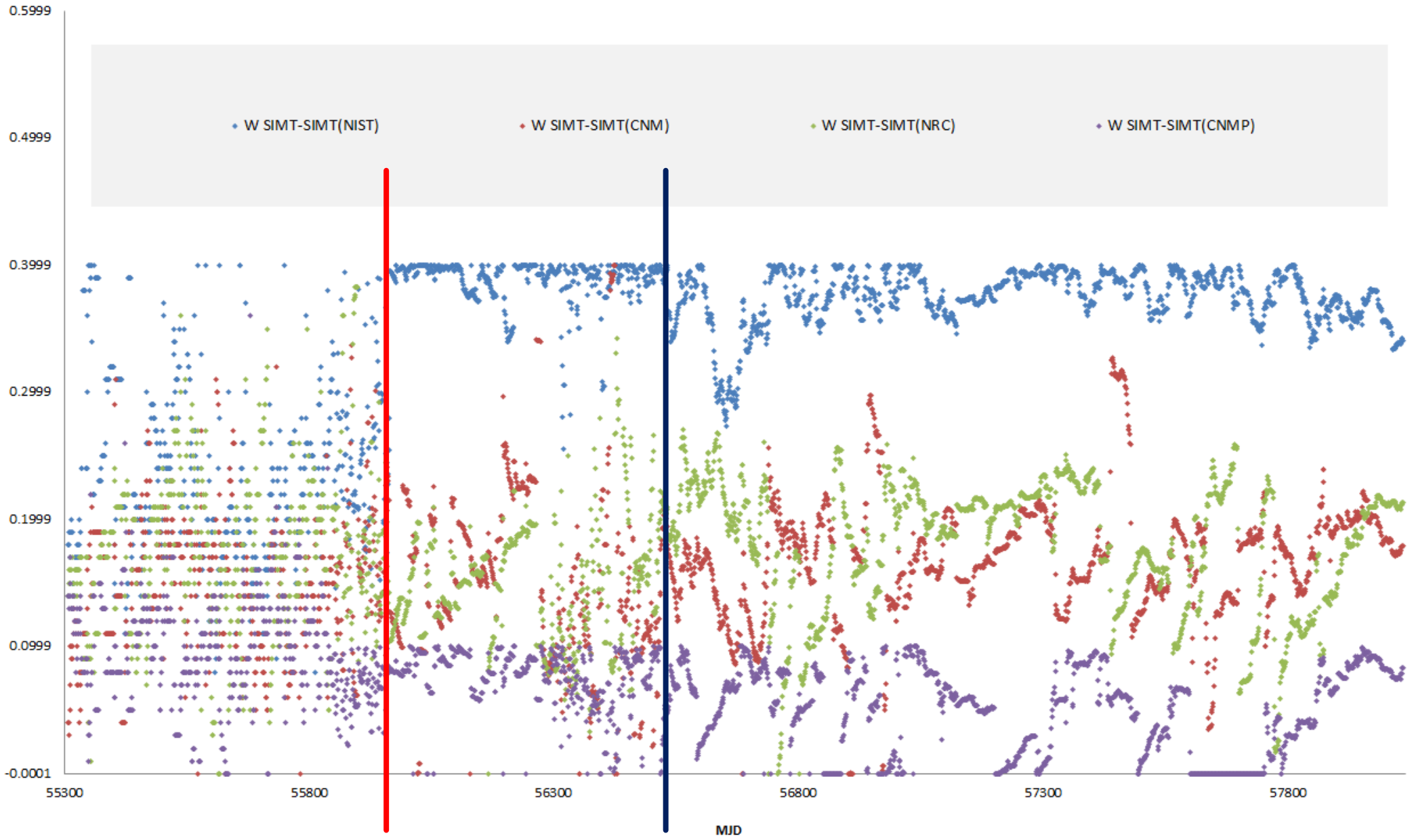
Weight assignment

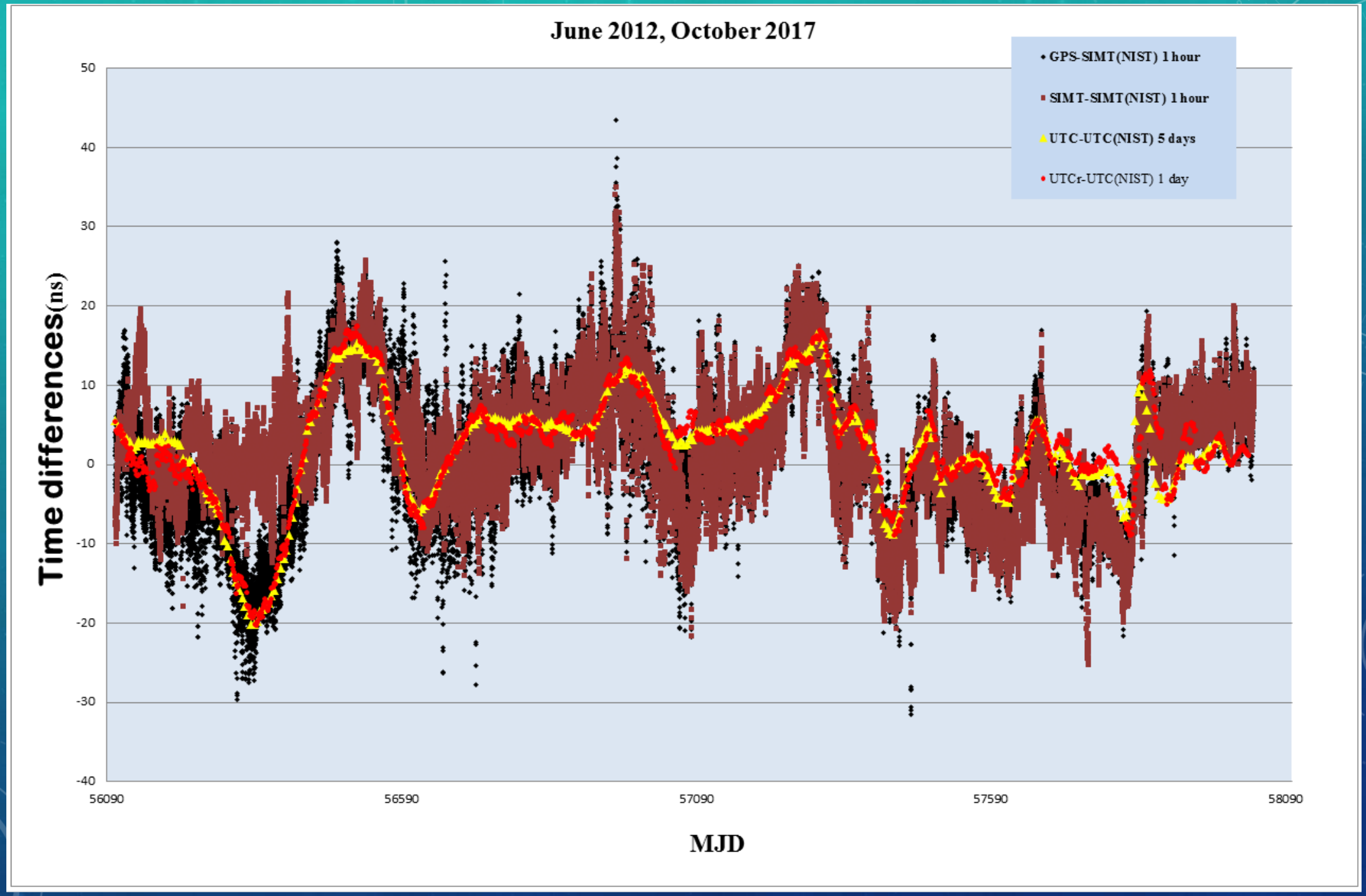
$$\sum_{i=1}^{N_{\mathrm{Tot}}} \omega_i = 1$$

$$\omega_i \propto \frac{1}{\sigma_i(\tau)} \times \frac{1}{\left|\left\langle \frac{\Delta f}{f} \right\rangle\right|}$$

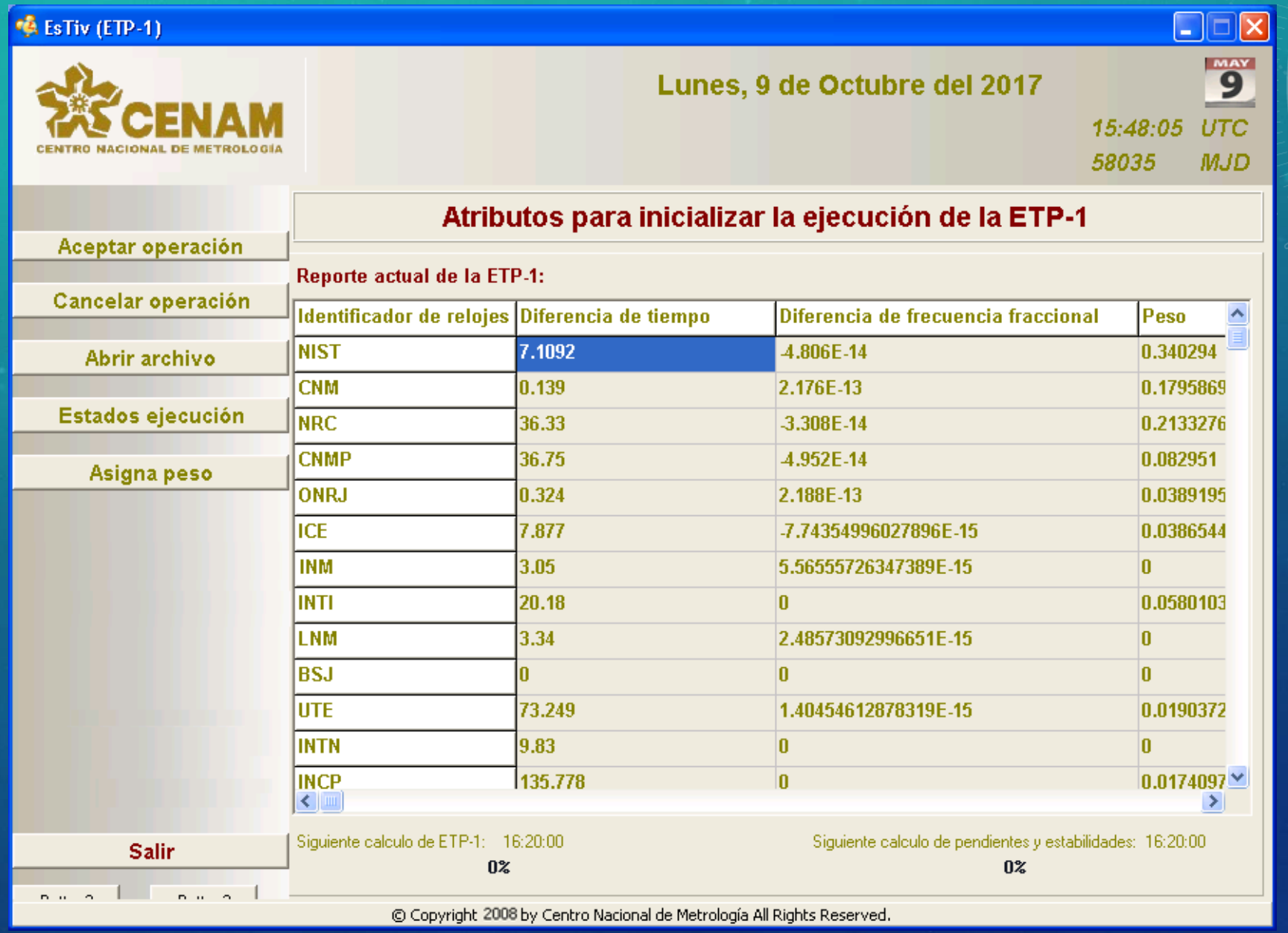
Time Standard	Percentage of participation
Ensamble Time Scale	40%
Cesium	10%
Rubidium	0%
GPSDO	0%

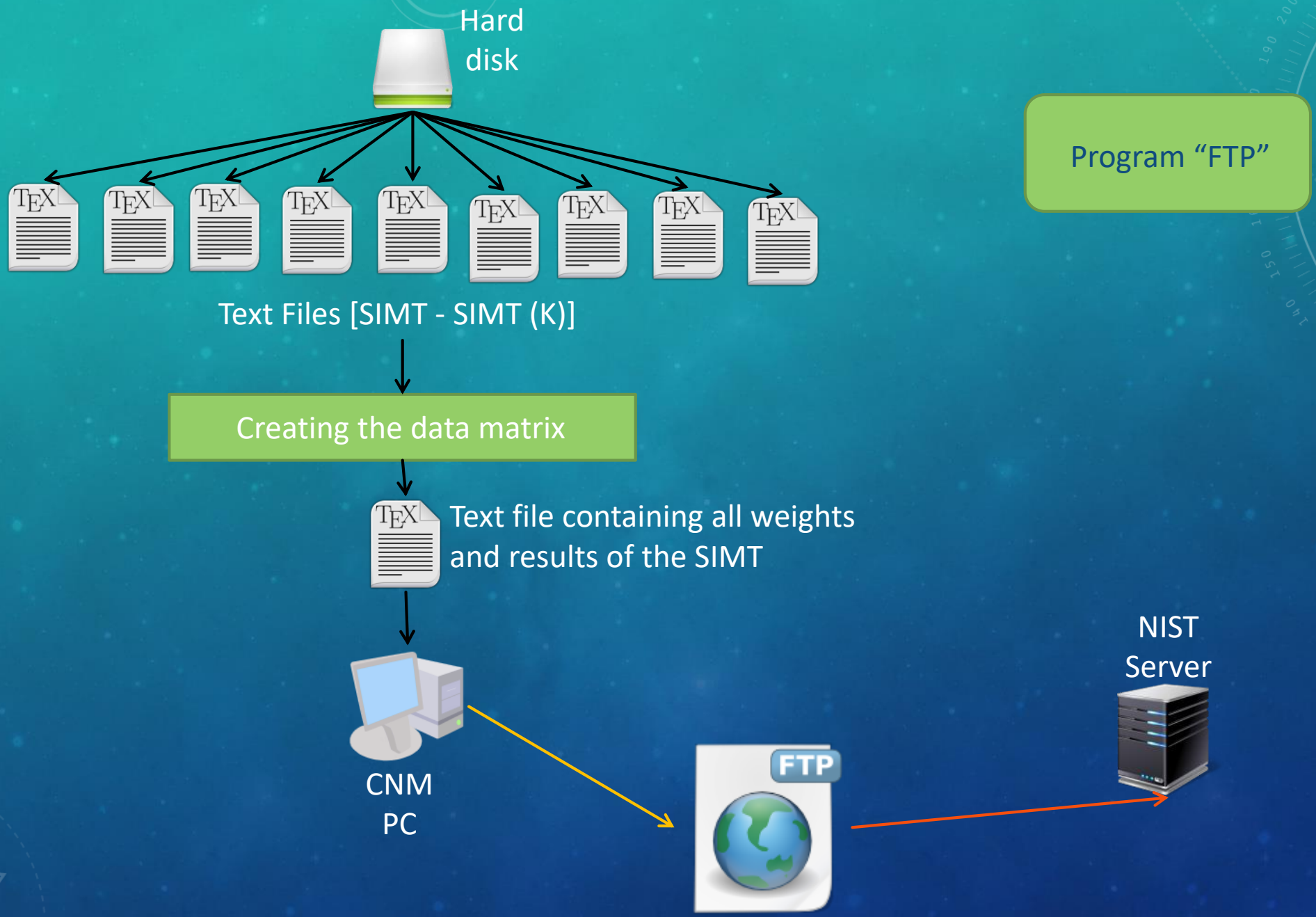
Weight SIMT
April 2010, October de 2017




June 2012, October 2017
GPS-SIMT(NIST) 1 hour
SIMT-SIMT(NIST) 1 hour
UTC-UTC(NIST) 5 days
UTCr-UTC(NIST) 1 day
Time differences(ns)
50
40
30
20
10
0
-10
-20
-30
-40
56090
56590
57090
57590
58090
MJD

Main screen of the program




Hard disk
Program “FTP”
Text Files [SIMT - SIMT (K)]
Creating the data matrix
Text file containing all weights and results of the SIMT
CNM PC
FTP
NIST Server

Text file of SIMT scale results

SIM-TIME58035: Bloc de notas

Archivo Edición Formato Ver Ayuda

```
MJD, HH:MM:SS, NIST, W, CNM, W, NRC, W, CNMP, W, ONRJ, W, ICE, W, INM, W, INTI, W, LNM, W, BSJ, W, UTE, W, INTN, W, INCP, W, TTBS, W, SLBS, W, INN, W, ABBS, W, CMEE, W, IBME, W, SKBS, W, GNBS, W, CIM, W, INDO, W
58035, 00:30:00, 10.14, 0.3402, 2.84, 0.1795, 38.82, 0.2133, 29.59, 0.0829, 0.56, 0.0389, 6.18, 0.0386, ---, 0.0000, 17.94, 0.0580, -3.06, 0.0, ---, 0.0000, 74.03, 0.0190, ---, 0.0000, 133.85, 0.0174, ---, 0.0000, -23.56, 0.0, 44.94,
58035, 01:30:00, 10.54, 0.3402, 1.91, 0.1795, 38.87, 0.2133, 31.32, 0.0829, -0.47, 0.0389, 7.68, 0.0386, ---, 0.0000, 17.30, 0.0580, 3.14, 0.0, ---, 0.0000, 71.91, 0.0190, ---, 0.0000, 133.01, 0.0174, ---, 0.0000, -9.56, 0.0, 30.74,
58035, 02:30:00, 10.49, 0.3402, 2.52, 0.1795, 38.49, 0.2133, 31.59, 0.0829, -0.71, 0.0389, 7.45, 0.0386, ---, 0.0000, 18.10, 0.0580, 4.89, 0.0, ---, 0.0000, 71.64, 0.0190, ---, 0.0000, 132.79, 0.0174, ---, 0.0000, 15.49, 0.0, -6.11,
58035, 03:30:00, 9.89, 0.3402, 3.89, 0.1795, 37.84, 0.2133, 32.32, 0.0829, -1.42, 0.0389, 7.66, 0.0386, ---, 0.0000, 19.33, 0.0580, -1.51, 0.0, ---, 0.0000, 70.94, 0.0190, ---, 0.0000, 132.37, 0.0174, ---, 0.0000, -8.91, 0.0, -29.31,
58035, 04:30:00, 9.17, 0.3402, 3.28, 0.1795, 38.04, 0.2133, 34.27, 0.0829, -0.42, 0.0389, 8.35, 0.0386, ---, 0.0000, 19.91, 0.0580, -0.13, 0.0, ---, 0.0000, 71.68, 0.0190, ---, 0.0000, 133.65, 0.0174, ---, 0.0000, -0.53, 0.0, -10.03,
58035, 05:30:00, 8.61, 0.3402, 1.99, 0.1795, 38.10, 0.2133, 36.46, 0.0829, -0.89, 0.0389, 9.65, 0.0386, ---, 0.0000, 20.32, 0.0580, 0.71, 0.0, ---, 0.0000, 70.93, 0.0190, ---, 0.0000, 134.91, 0.0174, ---, 0.0000, 8.21, 0.0, 7.71, 0.0
58035, 06:30:00, 8.20, 0.3402, 1.26, 0.1795, 38.84, 0.2133, 38.92, 0.0829, -1.38, 0.0389, 10.48, 0.0386, ---, 0.0000, 20.56, 0.0580, -0.50, 0.0, ---, 0.0000, 72.04, 0.0190, ---, 0.0000, 140.07, 0.0174, ---, 0.0000, -1.90, 0.0, 13.60,
58035, 07:30:00, 8.52, 0.3402, -0.12, 0.1795, 38.56, 0.2133, 39.77, 0.0829, 6.03, 0.0389, 10.37, 0.0386, ---, 0.0000, 21.92, 0.0580, -4.48, 0.0, ---, 0.0000, 72.49, 0.0190, ---, 0.0000, 142.09, 0.0174, ---, 0.0000, 2.12, 0.0, 1.72, 0
58035, 08:30:00, 8.90, 0.3402, -0.26, 0.1795, 38.21, 0.2133, 39.87, 0.0829, -0.68, 0.0389, 10.98, 0.0386, ---, 0.0000, 23.00, 0.0580, 0.10, 0.0, ---, 0.0000, 73.52, 0.0190, ---, 0.0000, 143.63, 0.0174, ---, 0.0000, -9.40, 0.0, -5.70,
58035, 09:30:00, 9.99, 0.3402, -1.01, 0.1795, 36.92, 0.2133, 39.27, 0.0829, 6.75, 0.0389, 11.08, 0.0386, ---, 0.0000, 23.91, 0.0580, -0.61, 0.0, ---, 0.0000, 72.89, 0.0190, ---, 0.0000, 143.01, 0.0174, ---, 0.0000, 5.99, 0.0, -0.11,
58035, 10:30:00, 10.37, 0.3402, -1.58, 0.1795, 36.72, 0.2133, 39.87, 0.0829, 4.91, 0.0389, 11.99, 0.0386, ---, 0.0000, 23.59, 0.0580, -0.43, 0.0, ---, 0.0000, 71.73, 0.0190, ---, 0.0000, 143.45, 0.0174, ---, 0.0000, 2.77, 0.0, 6.67,
58035, 11:30:00, 10.39, 0.3402, -1.37, 0.1795, 36.59, 0.2133, 40.65, 0.0829, 3.79, 0.0389, 12.09, 0.0386, ---, 0.0000, 22.25, 0.0580, 0.89, 0.0, ---, 0.0000, 70.43, 0.0190, -2115780.00, 0.0, 143.98, 0.0174, ---, 0.0000, 1.29, 0.0, -3
58035, 12:30:00, 10.37, 0.3402, -0.57, 0.1795, 36.28, 0.2133, 40.36, 0.0829, 3.43, 0.0389, 12.22, 0.0386, ---, 0.0000, 21.19, 0.0580, 0.07, 0.0, ---, 0.0000, 70.41, 0.0190, -1238344.00, 0.0, 143.18, 0.0174, ---, 0.0000, 17.67, 0.0, -
58035, 13:30:00, 11.11, 0.3402, 0.34, 0.1795, 35.61, 0.2133, 38.58, 0.0829, 3.66, 0.0389, 11.08, 0.0386, ---, 0.0000, 20.66, 0.0580, 1.11, 0.0, ---, 0.0000, 70.46, 0.0190, 2029.11, 0.0, 141.44, 0.0174, ---, 0.0000, -9.69, 0.0, 7.51,
58035, 14:30:00, 11.54, 0.3402, 0.94, 0.1795, 35.50, 0.2133, 37.02, 0.0829, 4.04, 0.0389, 9.70, 0.0386, ---, 0.0000, 21.38, 0.0580, 5.34, 0.0, ---, 0.0000, 71.09, 0.0190, 15193.55, 0.0, 138.54, 0.0174, ---, 0.0000, 2.54, 0.0, ---, 0.
58035, 15:30:00, 7.30, 0.3402, 0.57, 0.1795, 36.84, 0.2133, 36.21, 0.0829, 0.30, 0.0389, 7.07, 0.0386, ---, 0.0000, 20.53, 0.0580, 3.15, 0.0, ---, 0.0000, 73.85, 0.0190, 21198.79, 0.0, 135.80, 0.0174, ---, 0.0000, -13.55, 0.0, 5.20,
58035, 16:30:00, 8.01, 0.3402, 1.01, 0.1795, 35.66, 0.2133, 34.88, 0.0829, -0.45, 0.0383, 5.72, 0.0386, ---, 0.0000, 20.07, 0.0580, 18.81, 0.0, ---, 0.0000, 72.43, 0.0190, 21304.91, 0.0, 135.83, 0.0174, ---, 0.0000, -8.49, 0.0, -3.6
58035, 17:30:00, 8.37, 0.3402, 0.82, 0.1795, 36.48, 0.2133, 32.99, 0.0829, -1.74, 0.0383, 4.32, 0.0386, ---, 0.0000, 19.93, 0.0580, 12.87, 0.0, ---, 0.0000, 72.84, 0.0190, 20820.17, 0.0, 135.10, 0.0174, ---, 0.0000, -7.63, 0.0, -25.1
58035, 18:30:00, 9.42, 0.3402, 0.72, 0.1795, 36.94, 0.2133, 28.93, 0.0829, -1.46, 0.0383, 2.29, 0.0386, ---, 0.0000, 20.05, 0.0580, 14.92, 0.0, ---, 0.0000, 72.43, 0.0190, 20328.42, 0.0, 134.62, 0.0174, ---, 0.0000, 12.42, 0.0, -24.1
58035, 19:30:00, 9.96, 0.3402, 2.02, 0.1795, 36.87, 0.2133, 24.77, 0.0829, -1.10, 0.0383, 0.58, 0.0386, ---, 0.0000, 20.39, 0.0580, 8.06, 0.0, ---, 0.0000, 72.93, 0.0190, 19826.96, 0.0, 134.67, 0.0174, ---, 0.0000, -5.74, 0.0, -5.34,
58035, 20:30:00, 9.54, 0.3402, 3.95, 0.1795, 36.46, 0.2133, 24.10, 0.0829, -3.10, 0.0383, -0.04, 0.0386, ---, 0.0000, 21.20, 0.0580, 0.14, 0.0, ---, 0.0000, 74.67, 0.0190, 19475.74, 0.0, 134.43, 0.0174, ---, 0.0000, -11.06, 0.0, 1.64
58035, 21:30:00, 8.70, 0.3402, 5.46, 0.1795, 35.77, 0.2133, 25.76, 0.0829, -3.72, 0.0383, 1.10, 0.0386, ---, 0.0000, 22.61, 0.0580, -3.50, 0.0, ---, 0.0000, 74.77, 0.0190, 19386.40, 0.0, 132.68, 0.0174, ---, 0.0000, 14.40, 0.0, -0.5
```

SIM Time Scale

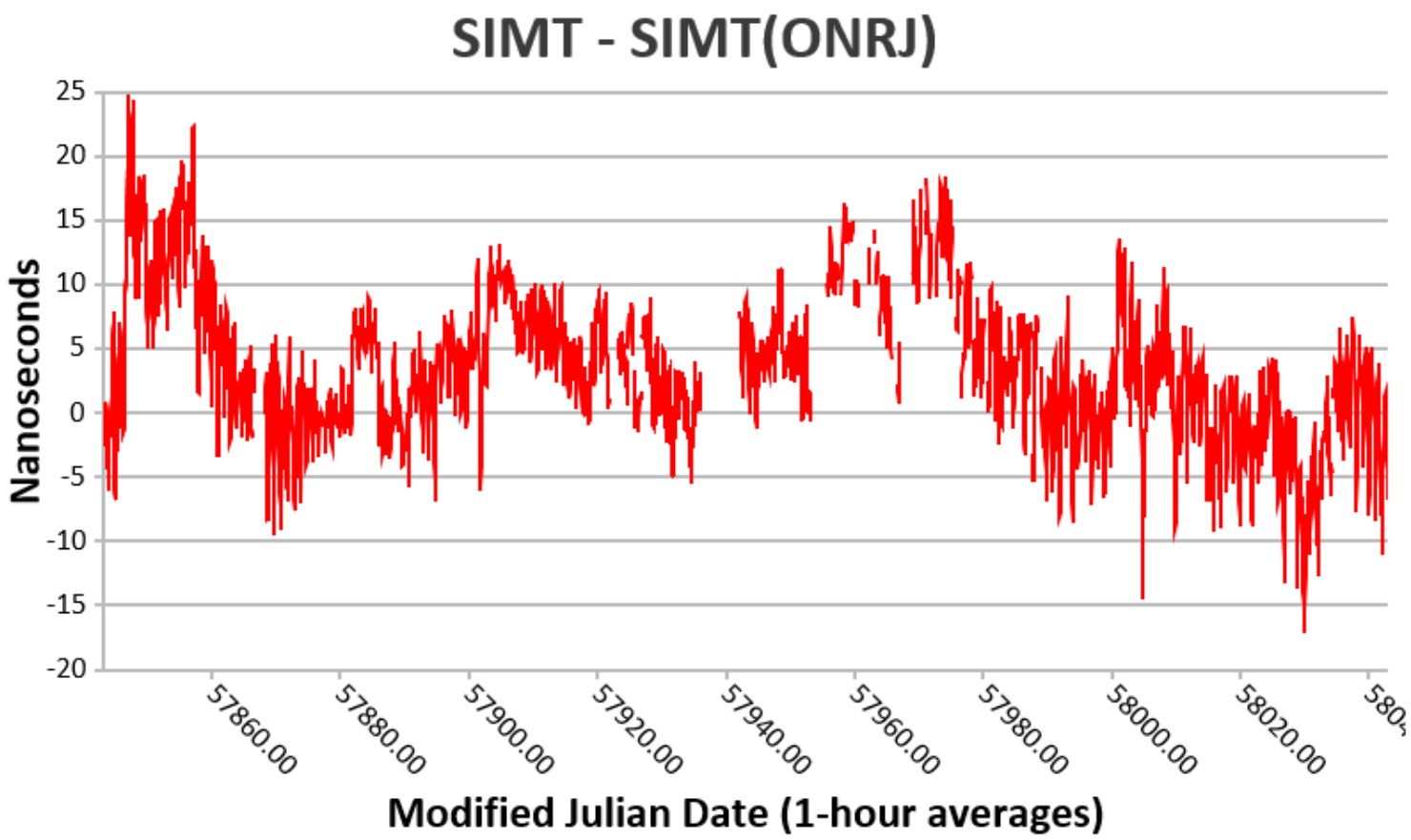
(SIMT - SIMT(*k*) for the 1-hour period ending on 2017-10-09 at 21:20:00 UTC)

National Standard	National Flag	SIMT - SIMT(*k*), ns	SIMT Contribution	National Standard	National Flag	SIMT - SIMT(*k*), ns	SIMT Contribution
United States SIMT(NIST)		8.70	34.02 %	Trinidad SIMT(TTBS)		---	0.00 %
Canada SIMT(NRC)		35.77	21.33 %	Antigua SIMT(ABBS)		---	0.00 %
Mexico SIMT(CNM)		5.46	17.95 %	St. Kitts SIMT(SKNBS)		---	0.00 %
Panama SIMT(CNMP)		25.76	8.29 %	Guyana SIMT(GNBS)		---	0.00 %
Argentina SIMT(INTI)		22.61	5.80 %	Guatemala SIMT(LNM)		-3.50	0.00 %
Costa Rica SIMT(ICE)		1.10	3.86 %	Paraguay SIMT(INTN)		19386.40	0.00 %
Brazil SIMT(ONRJ)		-3.72	3.83 %	St. Lucia SIMT(SLBS)		14.40	0.00 %
Uruguay SIMT(UTE)		74.77	1.90 %	Chile SIMT(INN)		-0.50	0.00 %
Peru SIMT(INACAL)		132.68	1.74 %	Ecuador SIMT(CMEE)		6.80	0.00 %
Bolivia SIMT(IBMET)		-3372.40	1.27 %	El Salvador SIMT(CIM)		-55.30	0.00 %
Colombia SIMT(INM)		---	0.00 %	Dominican Rep. SIMT(INDOCAL)		14.00	0.00 %
Jamaica SIMT(BSJ)		---	0.00 %	Bahamas SIMT(BBSQ)		---	0.00 %

SIMT - SIMT(ONRJ) for the 200 day period ending 2017-10-16

Return to Grid | Next Time Scale | Previous Time Scale | Next Date | Last Date

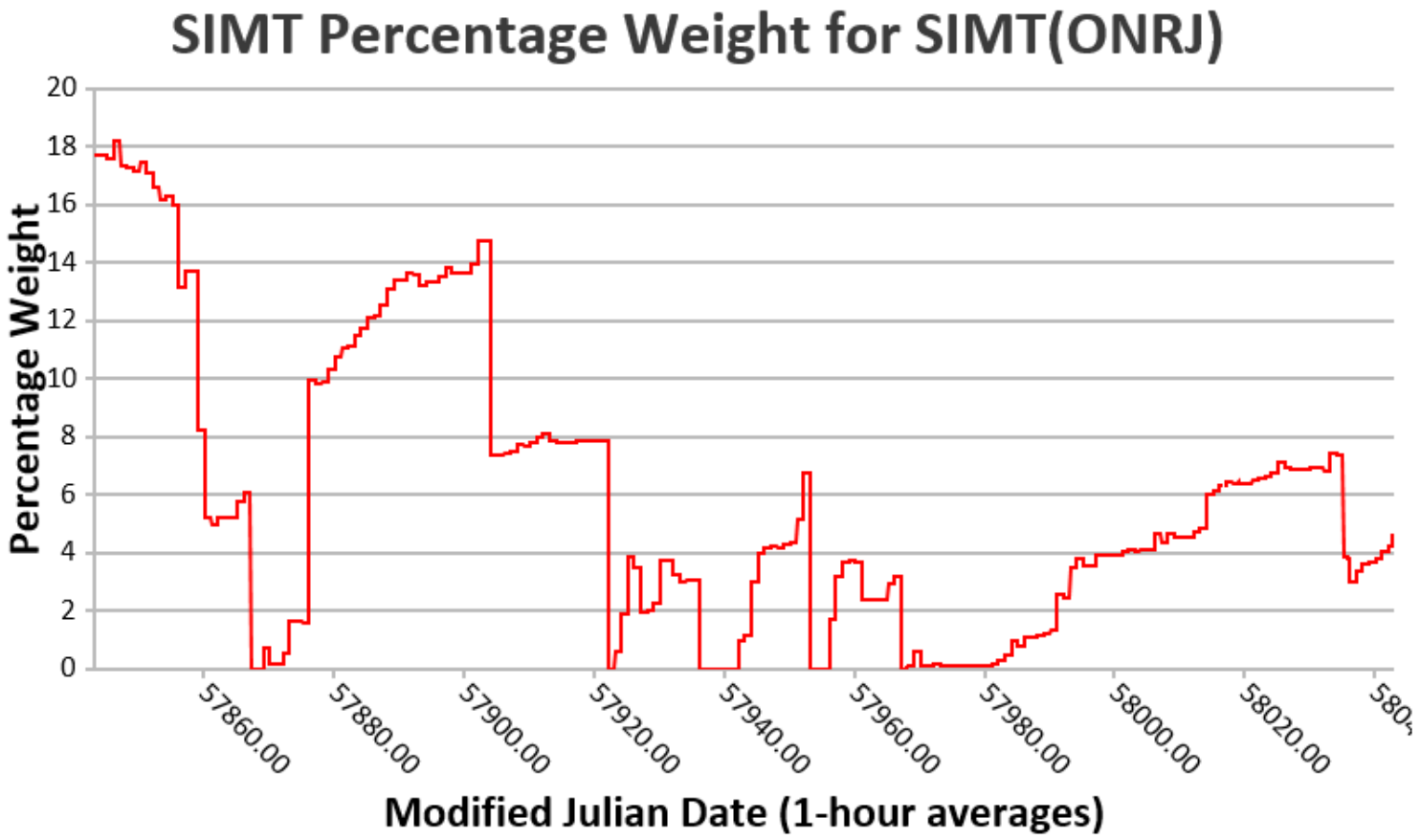
Hours	Mean Time Offset (ns)	Range (ns)	Frequency Offset	Confidence (r)
4794	3.18	41.89	$<1.0 \times 10^{-15}$	-0.32



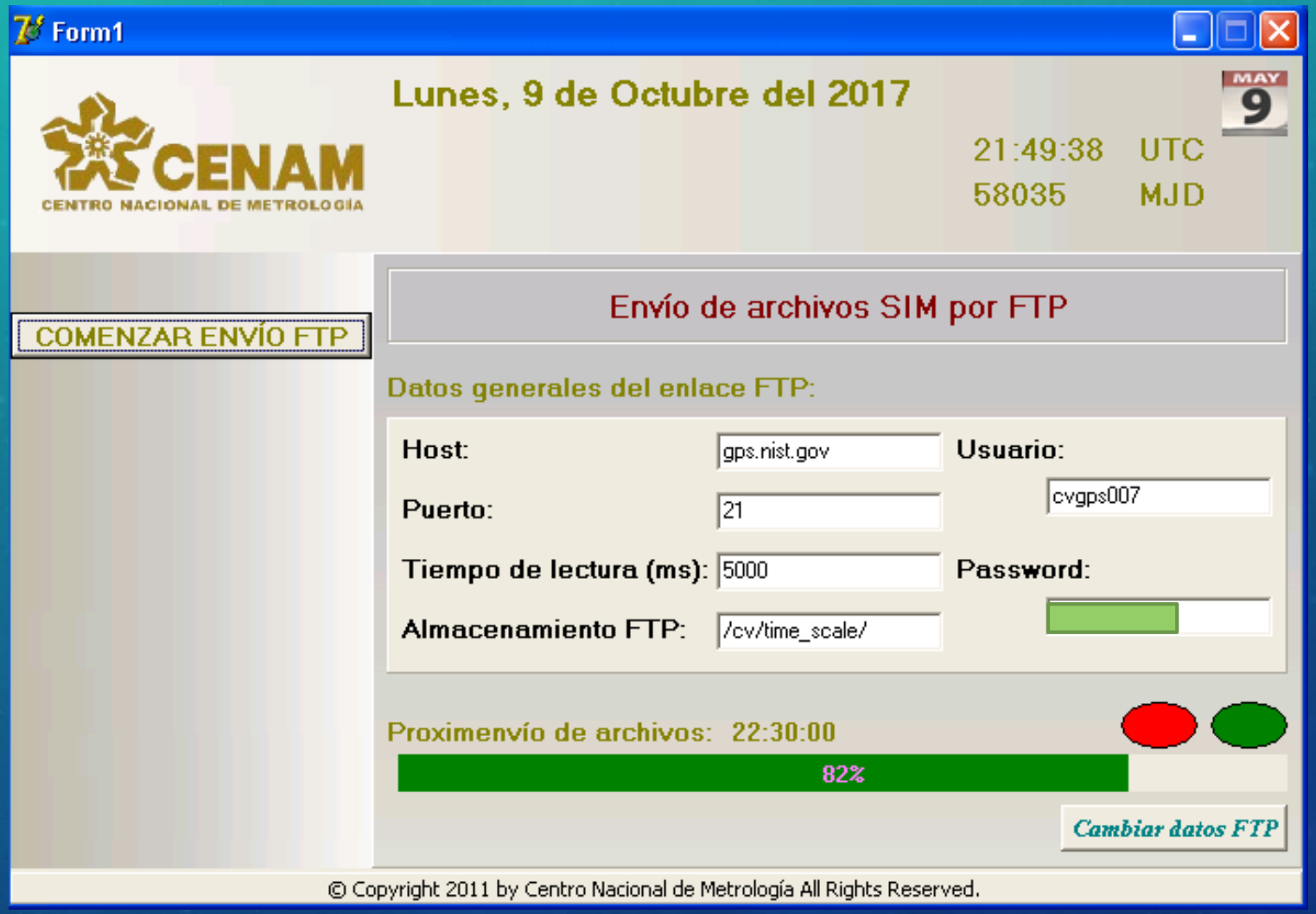
SIMT Percentage Weight for SIMT(ONRJ) for the 200 day period ending 2017-10-16

Return to Grid | Next Time Scale | Previous Time Scale | Next Date | Last Date

Hours	Average Weight
4795	5.97 %



Main screen of the program



CONTENT:

- The SIM Time Network (SIMTN)
- Time Scale SIMT
- Computer implementation of the SIMT Time Scale
- Next step on the SIMT Time Scale

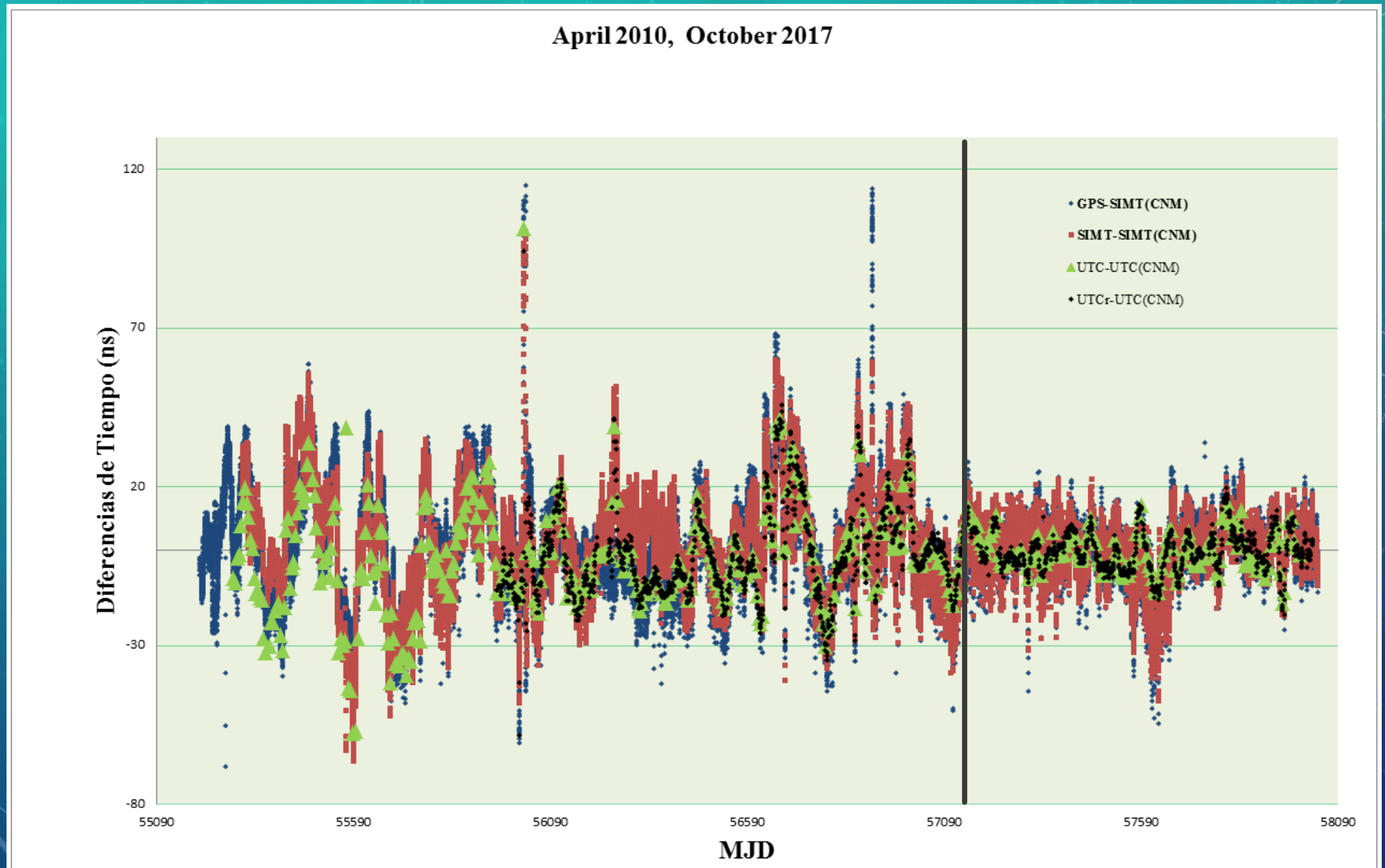
Operating system update

WIN XP

WIN 7,8, 10

Operating system update

Replacing the "PARADOX" database with text files


April 2010, October 2017
Diferencias de Tiempo (ns)
120
70
20
-30
-80
55090
55590
56090
56590
57090
57590
58090
MJD
GPS-SIMT(CNM)
SIMT-SIMT(CNM)
UTC-UTC(CNM)
UTCr-UTC(CNM)

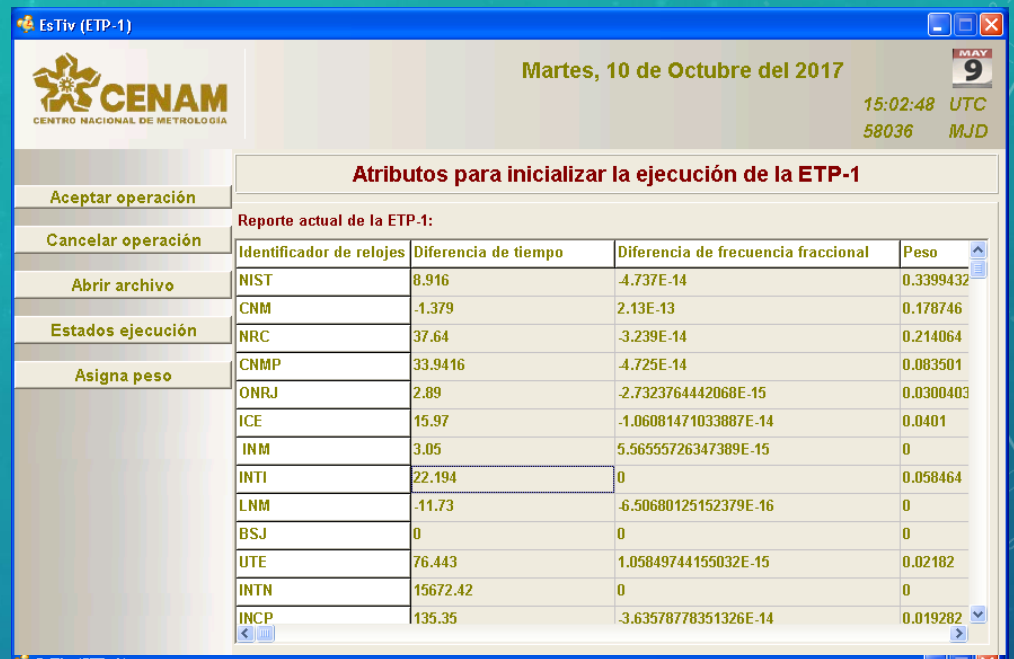
SIMULATIONS

$$\hat{X}_i(t+\tau) = X_i(t) + \left[Y_i(t) + \frac{D_i \tau}{2} \right] \tau$$

$$X_i(t+\tau) = \sum_{j=1}^{N} w_j \left[\hat{X}_j(t+\tau) - X_{ji}(t+\tau) \right]$$

$$\hat{Y}_i(t+\tau) = \frac{X_i(t+\tau) - X_i(t)}{\tau}$$

$$Y_i(t+\tau) = \frac{\hat{Y}_i(t+\tau) + m_i Y_i(t)}{1 + m_i}$$



Generation of the SIMT Time Scale in different sites.

SIMT

SIMT´ SIMT´´

NIST Server

SIM Time Scale

(SIMT - SIMT(*k*) for the 1-hour period ending on 2017-10-09 at 21:20:00 UTC)

National Standard	National Flag	SIMT - SIMT(*k*), ns	SIMT Contribution	National Standard	National Flag	SIMT - SIMT(*k*), ns	SIMT Contribution
United States SIMT(NIST)		8.70	34.02 %	Trinidad SIMT(TTBS)		---	0.00 %
Canada SIMT(NRC)		35.77	21.33 %	Antigua SIMT(ABBS)		---	0.00 %
Mexico SIMT(CNM)		5.46	17.95 %	St. Kitts SIMT(SKNBS)		---	0.00 %
Panama SIMT(CNMP)		25.76	8.29 %	Guyana SIMT(GNBS)		---	0.00 %
Argentina SIMT(INTI)		22.61	5.80 %	Guatemala SIMT(LNM)		-3.50	0.00 %
Costa Rica SIMT(ICE)		1.10	3.86 %	Paraguay SIMT(INTN)		19386.40	0.00 %
Brazil SIMT(ONRJ)		-3.72	3.83 %	St. Lucia SIMT(SLBS)		14.40	0.00 %
Uruguay SIMT(UTE)		74.77	1.90 %	Chile SIMT(INN)		-0.50	0.00 %
Peru SIMT(INACAL)		132.68	1.74 %	Ecuador SIMT(CMLE)		6.80	0.00 %
Bolivia SIMT(IBMET)		-3372.40	1.27 %	El Salvador SIMT(CIM)		-55.30	0.00 %
Colombia SIMT(INM)		---	0.00 %	Dominican Rep. SIMT(INDOCAL)		14.00	0.00 %
Jamaica SIMT(BSJ)		---	0.00 %	Bahamas SIMT(BBSQ)		---	0.00 %

THANK YOU