

44th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting 2012

**Reston, Virginia, USA
26-29 November 2012**

Editors:

Nancy C. Blemly

ISBN: 978-1-62748-871-6

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2012) by the Institute of Navigation
All rights reserved.

Printed by Curran Associates, Inc. (2013)

For permission requests, please contact the Institute of Navigation
at the address below.

Institute of Navigation
8551 Rixlew Lane
Suite 360
Manassas, VA 20109

Phone: (703) 366-2723
Fax: (703) 366-2724

membership@ion.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

PTTI Executive Committee	vii
PTTI Advisory Board	viii
PTTI 2012 Meeting Officers	ix
Distinguished PTTI Service Award 2012 Selection Committee	x
Past Recipients of the Distinguished PTTI Service Award	x
Distinguished PTTI Service Award to Mr. Ronald L. Beard..... Presented by Dr. Dennis D. McCarthy	xi
PTTI 2012 Session Chairs	xiii
List of Attendees at PTTI 2012	xiv

SESSION I: VENDOR PRESENTATIONS

TRAK Microwave, Inc.; TimeTech GmbH; Synergy Systems, LLC; Symmetricom, Inc.; SpectraTime; SpectraDynamics, Inc.; Spectracom; Piktime Systems; Pascall Electronics, LTD; Masterclock, Inc.; Linear Photonics, LLC; GuideTech; Furuno Electric Company, LTD; Frequency Electronics, Inc.; ESE; Digital Instruments; Brandywine Telecommunications.

SESSION II: LABORATORY REPORTS AND ACTIVITY UPDATES

ACTIVITY REPORT FROM NICT	1
Yuko Hanado, Kuniyasu Imamura, Tsukasa Iwama, Ryuichi Ichikawa, Mamoru Sekido, Tadahiro Gotoh, and Toshio Iguchi	
TIME AND FREQUENCY ACTIVITIES AT THE U. S. NAVAL OBSERVATORY	11
Demetrios Matsakis	
TIME AND FREQUENCY ACTIVITIES AT THE JHU APPLIED PHYSICS LABORATORY	29
Mihran Miranian, Gregory L. Weaver, Jeffrey F. Garstecki, and Richard A. Dragonette	
RECENT CALIBRATIONS OF UTC(NIST) –UTC(USNO)	35
Victor Zhang, Thomas E. Parker, Russell Bumgarner, Jonathan Hirschauer, Angela McKinley, Stephen Mitchell, Ed Powers, Jim Skinner, and Demetrios Matsakis	

SESSION III: TIME AND FREQUENCY TRANSFER - SATELLITE

ACCURACY / PRECISION OF USNO PREDICTED CLOCK ESTIMATES FOR GPS SATELLITES.....	43
Christine Hackman	
USING IGS PRODUCTS FOR NEAR REAL-TIME COMPARISONS OF UTC(k)'S.....	53
Pascale Defraigne, Quentin Baire, and Eric Pottiaux	
GNSS ACTIVITIES AND PERFORMANCE AT USNO	65
Stephen Mitchell, Ed Powers, Jeff Prillaman, Valeri Makarov, and Demetrios Matsakis	
REPLICATING UTC(NIST) AT REMOTE SITES	79
Michael A. Lombardi, Andrew N. Novick, Jose Mauricio López-Romero, and Rodrigo Ramos P.	
THREE YEARS OF GLONASS USE FOR UTC	91
Z. Jiang and W. Lewandowski	

SESSION IV: NEUTRINO TIME OF FLIGHT METROLOGY

SYNCHRONIZATION BETWEEN REMOTE SITES FOR THE MINOS EXPERIMENT.....	99
S. Römisch, S. R. Jefferts, V. Zhang, T. E. Parker, N. Ashby, P. Adamson, G. Barr, A. Habig, J. Meier, C. James, R. Nicol, R. Plunkett, C. Rosenfeld, R. Bumgarner, M. Christensen, J. Hirschauer, B. Fonville, S. Mitchell, A. McKinley, E. Powers, J. Wright, and D. Matsakis	
MEASUREMENT OF THE VELOCITY OF THE NEUTRINO WITH MINOS.....	119
P. Adamson, N. Ashby, R. Bumgarner, M. Christensen, B. Fonville, J. Hirschauer, S. R. Jefferts, D. Matsakis, A. McKinley, T. E. Parker, E. Powers, S. Römisch, J. Wright, and V. Zhang	
MEASUREMENT OF CNGS MUON NEUTRINOS SPEED WITH BOREXINO: INRIM AND ROA CONTRIBUTION	133
Giancarlo Cerretto, Hector Esteban, Marco Pallavicini, Valerio Pettiti, Cedric Plantard, and Alessandro Razeto	
RELATIVE CALIBRATION OF THE TIME TRANSFER LINK BETWEEN CERN AND LNGS FOR PRECISE NEUTRINO TIME OF FLIGHT MEASUREMENTS	141
Thorsten Feldmann, A. Bauch, D. Piester, P. Alvarez, D. Autiero, J. Serrano, and G. Brunetti	

SESSION V: TIME AND FREQUENCY TRANSFER – OPTICAL FIBER

SUPPRESSION OF SBS-INDUCED RF PHASE NOISE IN AN RF-PHOTONIC LINK	151
James P. Cahill, Olukayode Okusaga, Weimin Zhou, and Gary M. Carter	
TWO-WAY TIME TRANSFER VIA A COMMON-PATH FIBER LINK	159
Wen-Hung Tseng, Shinn-Yan Lin, Yi-Jiun Huang, Fang-dar Chu, and Kai-Ming Feng	

SESSION VI: POSTER SESSION

Poster and student papers have been incorporated into the topical sessions.

SESSION VII: RECEIVER PERFORMANCE ON PTTI SYSTEMS

TIMING CALIBRATION OF A GPS/GALILEO COMBINED RECEIVER	167
Blair Fonville, Edward Powers, Rigas Ioannides, Jörg Hahn, and Alexander Mudrak	
IN SEARCH OF A NEW PRIMARY GPS RECEIVER FOR NIST	179
M. A. Weiss, J. Yao, and J. Li	
IN SITU GNSS RECEIVER BIAS CALIBRATIONS USING PICOSECOND PULSES.....	187
Johnathan York, Otto Caldwell, Aaron Kerkhoff, Jon Little, David Munton, Scot Nelsen, Brent Renfro, and Thomas Gaussiran	
ENABLING ACCURATE DIFFERENTIAL CALIBRATION OF MODERN GPS RECEIVERS	203
S. Römisch, V. Zhang, T. E. Parker, and S. R. Jefferts	

SESSION VIII: LOCAL CLOCK TIMEKEEPING USING INNOVATIVE SOURCES

CLOCK STEERING USING FREQUENCY ESTIMATES FROM STAND-ALONE GPS RECEIVER CARRIER PHASE OBSERVATIONS	211
Edward Byrne, Thao Q. Nguyen, Lars Boehnke, Frank van Graas, and Samuel Stein	
EXPERIMENTAL AND SIMULATION STUDY FOR COMMERCIAL TIME TRANSFER SERVICE OVER GEOSTATIONARY SATELLITE	221
Jacqueline Walker and Marco Genova	
PROGRESS ON TWO-WAY SATELLITE TIME TRANSFER USING DPN SIGNALS.....	239
Tadahiro Gotoh, Jun Amagai, Miho Fujieda, and Masanori Aida	
HIGH-PRECISE PORTABLE TIME INTERVAL AND FREQUENCY COUNTER	247
R. Szplet, Z. Jachna, K. Różyc, and P. Kwiatkowski	
A VOICE TIME MONITORING AND RECORDING SUB-SYSTEM FOR THE TELEPHONE SPEAKING CLOCK.....	257
C.C. Lin, P. C. Chang, J. L. Wang, T. Y. Chiu, and S. Y. Lin	

SESSION IX: TIME SCALES AND ALGORITHMS

PERFORMANCE AND APPLICATIONS OF AN ENSEMBLE OF ATOMIC FOUNTAINS	269
Steven Peil, James Hanssen, Thomas B. Swanson, Scott Crane, and Christopher R. Ekstrom	
SOLVING FOR TIME: A UNIFIED, COVARIANCE-BASED COMPARISON OF CELESTIAL AND RADIONAVIGATION ALGORITHMS FROM 1770 TO THE PRESENT	273
Daniel G. Jablonski	

DISCRETE SIMULATION OF POWER LAW NOISE	289
Neil Ashby	
TIME SCALES COMPARISONS USING SIMULTANEOUS MEASUREMENTS IN THREE FREQUENCY CHANNELS	301
Petr Pánek and Alexander Kuna	
TESTS OF THE BIPM PORTABLE CALIBRATION STATION - METODE: MEASUREMENT OF TOTAL DELAY	311
Z. Jiang, L. Tisserand, and G. Petit	
GPS CARRIER-PHASE TIME TRANSFER BOUNDARY DISCONTINUITY INVESTIGATION	317
Jian Yao and Judah Levine	
SESSION X, MINI 1: MICRO-ATOMIC CLOCKS	
A COLD-ATOM CLOCK BASED ON COHERENT POPULATION TRAPPING	327
Elizabeth A. Donley, Francois-Xavier Esnault, Eric Blanshan, and John Kitching	
SESSION X, MINI 2: SPACE-BASED CLOCKS	
LONG TERM BEHAVIOR OF QUARTZ OSCILLATORS IN SPACE	335
James C. Camparo, James O. Hagerman, and Thomas A. McClelland	
OSCILLATOR SOURCES FOR A DORIS SATELLITE SDR RECEIVER SYSTEM.....	351
Benjamin H. Barnum, Chris Haskins, Wesley Millard, David Rainwater, and Michael Kelly	
MESSENGER ONBOARD TIMEKEEPING ACCURACY DURING THE FIRST YEAR IN ORBIT AT MERCURY	361
Stanley B. Cooper, J. Robert Jensen, and Gregory L. Weaver	
SESSION XI: NETWORK SYNCHRONIZATION	
EVALUATION OF TIME TRANSFER UNITS FOR TIME AND FREQUENCY TRANSFER IN OPTICAL FIBERS UTILIZING A PASSIVE TECHNIQUE BASED ON SONET/SDH	371
James Hanssen, Christopher Ekstrom, Sven-Christian Ebenhag, and Kenneth Jaldehag	
ASYMMETRY MITIGATION THROUGH LINE SWAPPING IN IEEE 802.3 ETHERNET	377
Reinhard Exel, Thomas Bigler, and Nikolaus Kerö	
IRIG-B TIME SIGNAL DISTRIBUTION OVER GEOSTATIONARY SATELLITES	391
Senol Gulgonol, Mesut Gokte, Thomas Meinerz, Erdem Demircioglu, and Nedim Sozbí	
TOWARDS TIMELY INTELLIGENCE IN THE POWER GRID.....	399
Julien Amelot, Dhananjay Anand, Thomas Nelson, Gerard Stenbakken, Ya-Shian Li-Baboud, and James Moyne	