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2nd European Frequency and Time Seminar
EFTS 2014

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Dates & place :
From Monday, June 30 to Friday, July 4 juillet 2014 (5 days)
Organised by : Département Temps-Fréquence (DTF) - FEMTO-ST Institute
CNRS UMR 6174 http://www.femto-st.fr
The EFTS is hosted by :
École Nationale Supérieure d'Ingénieurs de Mécanique et des Microtechniques
ENSMM http://www.ens2m.fr
26, Rue de l'Épitaphe
CS 51813
25030 BESANÇON CEDEX

EFTS2014 DETAILED PROGRAM

1 Lectures & Seminars

Total duration of lectures & seminars : 23 hours.

1.1 Introduction to Time & Frequency

Monday June 30 from 9h50 to 10h40 - Noël Dimarcq - CNRS-LNE-SYRTE (F)

1.2 Oscillator Primer

Monday June 30 from 11h10 to 12h00 - Jean-Pierre Aubry - consultant (F)
Introduction - T&F generalities - Oscillator Applications, performances / domain - Noise in Oscillators -Environmental sensitivities - Oscillators hierarchy - Trends and evolution - Conclusions

1.3 Phase noise Measurements S_ϕ

Monday June 30 from 12h00 to 12h50 - Enrico Rubiola - FEMTO-ST (F)

Basic concepts - Phase noise measurement methods - The measurement of Oscillators - The Cross-Spectrum method - Noise in amplifiers and components - Amplitude noise

1.4 Oscillator Measurements - time domain σ_y

from 14h20 to 15h10 - David A. Howe - NIST - Boulder, CO, USA

Variance and variance measurements

1.5 Quartz Oscillators

Monday June 30 from 15h10 to 16h00 - Jean-Pierre Aubry - consultant (F)

Why do we need quartz oscillators - Basic quartz oscillators : TCXO, VCXO, OCXO, BVA, MCXO - Waves and materials : BAW, SAW - Quartz resonators - Non-Quartz devices - Oscillators and Frequency synthesis for Atomic Clocks - Comparison and future

1.6 Introduction to Atomic Clocks

mardi July 1 from 9h to 9h50 - Gaetano Mileti - Uni Neuchâtel (CH)

Basic principles and building blocks - Categories and examples of atomic clocks.

1.7 Space Projects

Tuesday July 1 from 9h50 to 10h40 - Noël Dimarcq - CNRS-LNE-Syrte (F)

1.8 Timing in Networks

Tuesday July 1 from 11h10 to 12h00 - Jean-Pierre Aubry - consultant (F)

Various networks T&F requirements - Basics on Frequency & Time - Telecom : fix line infrastructure and wireless - Power Networks / Smart Grid requirements - GNSS vulnerabilities - Solutions for time transfer over networks - Secure Power Network Timing - Path toward future technologies

1.9 White Rabbit Techniques

Tuesday July 1 from 12h00 to 12h50 - Javier Serrano - CERN (CH)

1.10 Physics of Atomic Clocks

Tuesday July 1 from 16h30 to 17h20 - Gaetano Mileti - Uni Neuchâtel (CH)

Magnetic resonance and generalised Bloch equations - Tunable lasers and basics of atom-light interaction - Main fields of applications and specific examples

1.11 Relativity

Wednesday July 2 from 9h to 10h40 - Gérard Petit - BIPM

Introduction to the theory of relativity - Current definitions and realisations of space-time reference systems for the Solar system and for the Earth - Applications in the geocentric system

1.12 Time Scales

Wednesday July 2 from 9h to 10h40 - Gérard Petit - BIPM

Definitions and interrelations of TT, TT(BIPM), TAI, UTC, UTC(k), UTCr - Main features of TAI / UTC - Primary and secondary frequency standards - UTCr, a rapid realisation of UTC

1.13 Satellite Synchronisation

Wednesday July 2 from 11h10 to 12h00 - Andreas Bauch - PTB Braunschweig (D)

1.14 Very Long Base Interferometry

Wednesday July 2 from 12h00 to 12h50 - Ulrich Schreiber - TÜ München (D)

1.15 Navigation - GNSS

Wednesday July 2 from 14h20 to 15h10 - Andreas Bauch - PTB Braunschweig (D)

Clock requirements - Reference Time Scale - GNSS signal structure and modelling - ionosphere and observation equations - Satellite position and clock - Satellite clock correction - Troposphere delays - GPS codes and phases - Satellite synchronisation systems - GNSS Time Transfer

1.16 Optical fiber link for ultra-stable frequency dissemination

Wednesday July 2 from 15h10 to 16h00 - Anne Amy Klein - LPL Villetaneuse (F)

Ultrastable optical fiber links - Current developments and applications

1.17 Stabiliser lasers

Thursday July 3 from 9h00 to 9h50 - Clément Lacroûte - FEMTO-ST (F)

Fabry-Perot interferometer basics - Ultra-stable Fabry-Perot cavities - FP cavities geometries : a review - FP cavities : state of the art

1.18 Small Clocks

Thursday July 3 from 9h50 to 10h40 - Christophe Affolderbach - Uni Neuchâtel (CH)

1.19 Cold Atoms

Thursday July 3 from 14h20 to 15h10 - Clément Lacroûte - FEMTO-ST (F)

Optical forces on neutral atoms - Magneto-Optical traps - Cold Atom Clocks : a few examples

1.20 Femtosecond Optical Combs

Thursday July 3 from 15h10 to 16h00 - Anne Amy Klein - LPL Villetaneuse (F)

Introduction, how to measure and optical frequency - The femtosecond laser as a frequency ruler - Frequency metrology with an optical frequency comb

1.21 Optical Clocks

Friday July 4 from 9h45 to 10h35 - Jérôme Lodewyck - (F)

Motivations - Frequency references with an atom ? - Why go optical ? - Prospective systems - Lattice clocks - Absolute frequency measurements - Progress toward ultimate performances

1.22 Leeson Effect

Friday July 4 from 10h35 to 11h25 - Enrico Rubiola - FEMTO-ST (F)

The Leeson effect in a nutshell - Phase noise and friends - Heuristic explanation of the Leeson effect - Phase noise in amplifiers - Oscillator hacking - Resonator theory - Formal proof for the Leeson effect - The Leeson effect in delay-line oscillators - AM-PM noise coupling - Acknowledgements and conclusion

1.23 Servo Loops

Friday July 4 from 11h25 to 12h30 - Gonzalo Cabodevilla - FEMTO-ST (F)

2 Hands-on lab sessions

Total number of hours, hands-on lab sessions : 10 hours.

Lab 1	Oscillator Measurements S_ϕ / σ_y
Lab 2	Surface Acoustic Wave piezo devices and related wireless sensors
Lab 3	GPS receivers, pseudo-random codes, practical implementation
Lab 4	Microwave Photonics - Optical Fiber Time & Frequency systems
Lab 5	Transportable and miniature Cold Atoms Atomic Clocks
Lab 6	Computer simulation and processing of T&F measurements

3 Visits & social programme

Monday	June 30	Visit of the Besançon Observatory
Tuesday	July 1	Visit of the Besançon Museum of Time (horological collections)
Wednesday	July 2	Night sessions with the observatory's telescopes (according to weather conditions)
Thursday	July 3	Banquet
Friday	July 4	Lab tour, FEMTO-ST institute

Contacts :

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