



Preliminary Agenda for the Tutorial on Optical Synchronization

This tutorial is held in course of the IRUVX-PP project

Monday, October 13th

14:00 – 14:10	Welcome & Tutorial Organization	Dr. Axel Winter (DESY)
14:10 – 16:10	Sources of Timing jitter for SASE FEL's	Dr. Josef Frisch (SLAC)
16:10 – 16:30	Coffee Break	
16:30 – 17:30	Balanced optical and optical-microwave phase detectors Part 1	Prof. Franz X. Kärtner (MIT)
17:30 – 18:30	Discussion	

Tuesday, October 14th

08:30 – 10:00	Balanced optical and optical-microwave phase detectors Part 2	Prof. Franz X. Kärtner (MIT)
10:00 – 10:50	Coffee Break	
10:50 – 12:50	Dynamics of fiber lasers	Prof. Omer Ilday (Bilkent University)
12:50 – 13:30	Lunch Break	
13:30 – 15:30	Introduction into phase noise and timing jitter	Mr. Jesse Searls (Poseidon Scientific Instruments)
15:30 – 16:00	Coffee Break	
16:00 – 18:00	Cutting edge technology for phase and amplitude noise measurements	Mr. Jesse Searls (Poseidon Scientific Instruments)
18:00 – 18:30	Discussion	
19:00	Workshop Dinner	

Wednesday, October 15th

08:30 – 10:30	Feedback Control & Theory	Dr. Gerwald Lichtenberg (TU Harburg)
10:30 – 10:50	Coffee break	
10:50 – 11:50	Optical clocks	Prof. Franz X. Kärtner (MIT)
11:50 – 12:50	RF Frequency standards and oscillators Part 1	Mr. Jesse Searls (Poseidon Scientific Instruments)
12:50 – 13:30	Lunch break	
13:30 – 14:30	RF Frequency standards and oscillators Part 2	Mr. Jesse Searls (Poseidon Scientific Instruments)
14:30 – 15:00	Discussion with all Experts	Searls, Kärtner, Ilday, Frisch, Lichtenberg
15:00 – 15:15	Closing remarks	Dr. A. Winter

List of covered topics:

- Dynamics of fiber lasers (mode-locked and cw) (Speaker: Prof. Ilday, Bilkent Uni)
 - some laser fundamentals, nonlinear effects etc.
 - quantum limitation of phase noise
 - cw-lasers vs mode-locked lasers
 - achievable parameter space (repetition rate, output power)
- Balanced optical microwave phase detector (Speaker: Prof. Kärtner, MIT)
 - Cross-correlation techniques (crystal basics, overview of existing crystals, phase matching, balanced detection, fast vs. slow CC, efficiency estimations)
 - Noise estimation
 - Tolerances on design
- RF phase noise and phase noise basics (Speaker: J. Searls, Poseidon Scientific Instruments)
 - Principle of phase noise (definition)
 - Allen variance
 - Phase noise measurement techniques (delay line, SSA-type, heterodyne beating)
- Cutting edge technology for phase and amplitude noise measurements (Speaker: J. Searl, Poseidon Scientific Instruments)
 - Mixer technology
 - Typical performance of mixer
 - RF interferometers
 - Measurements below the thermal noise limits
- Feedback controls and theory (Speaker: Dr. G. Lichtenberg TU Harburg)
 - PLL
 - Typical transfer functions
 - Controller design considerations
 - Gain and phase margin
 - Stability analysis
 - Complex controllers
 - Implementation in Digital Systems
- Frequency standards and oscillators (Speaker: J. Searls, Poseidon Scientific Instruments)
 - VXCO
 - DRO
 - Frequency synthesizer
 - Sapphire loaded oscillator
 - Allen variance and phase noise
 - RF aspects of optical clocks
- Optical clocks (Speaker: Prof. F. X. Kaertner, MIT)
- Timing jitter budgets of seeded and SASE FELs (Speaker: Dr. Joe Frisch SLAC)
 - Jitter due to bunch compression & LLRF regulation
 - Warm & cold machines
 - Jitter due to electron beam fluctuations
 - Transition into super radiance regime
 - Dependence on charge, orbit, peak current
 - Measurement techniques