Mini-Workshop on

Precision Observables and Radiative Corrections

Sven Heinemeyer, IFCA (CSIC, Santander)

CERN, 06/2015

- Why are we here?
- What will we be doing here?

Experimental situation:

LHC/ILC/FCC-ee/... will provide (high!) accuracy measurements!

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Workshop on Precision Calculations
relevant to reach first ILC, then FCC-ee precision

Workshop on PO and RC (I):

Workshop on PO and RC (II):

https://indico.cern.ch/event/387296/ Search

- Overview
- Timetable
- Registration
- Accommodation
- Entrance to CERN
- Directions to and inside CERN

A new generation of high-precision electroweak and QCD calculations/radiative corrections will be required to match the experimental precision expected at FCC-ee and other future colliders.

The purpose of this mini-workshop is

- to bring together experts and interested newcomers
- to identify the theoretical challenges in achieving the necessary precision
- as well as a roadmap with milestones towards the ultimate precision goal
- Coordination with relevant experimental FCC-ee groups

Questions addressed in the mini-workshop

- High-precision calculations of electroweak observables
- High-precision calculations of Higgs properties
- Precision calculations in BSM scenarios
- Effective Field Theories for BSM physics
- Improving extraction of Standard Model input parameters (alpha_s(MZ), m_t, m_b, ...)
- Radiative corrections to QED processes
- Application of high precision data in global fits of the SM and BSM

The workshop will run from Monday early afternoon till Tuesday evening. Note that it will be followed immediately by the general meeting of the LHC Higgs Cross Section Working Group and people might be interested in participating to both events.

Organized by J. Ellis, C. Grojean, S. Heinemeyer

Starts 13 Jul 2015 14:00
Ends 14 Jul 2015 18:00
Europe/Zurich

CERN
TH Conference Room

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Topics:

1) Electroweak precision observables

- W boson mass, M_W
- effective weak leptonic mixing angle, $\sin^2\theta_{\text{eff}}$
- partial and todal Z boson widths
- ... $\Rightarrow$ experimental precision at the level of $10^{-5} - 10^{-6}$?
  $\Rightarrow$ to be matched with intrinsic/parametric precision

2) SM input parameters

- α, α_s, $\Delta\alpha_{\text{had}}$, ...
- m_t, m_b, ...
- ... $\Rightarrow$ crucial for parametric uncertainties

3) Higgs observables $\Leftarrow$ rely also on LHCHXSWG, KUTS

- Higgs boson mass, M_h (in BSM models)
- Production cross sections, BRs, ...
- ... $\Rightarrow$ experimental precision at the percent/permille level?
  $\Rightarrow$ to be matched with intrinsic/parametric precision

4) What physics can be gained from improved precision?

Models:

1. SM
   Sets the scale for achievable theory precision

2. MSSM
   - showcase for BSM calculations
   - best worked out BSM model so far

3. More general EFT approach

4. ???

⇒ Not the plan: talks about whatever calculation in whatever model

Relevant also for experimental groups:

From the Experimental study group:

WG1: Z pole

WG2: di-bosons

WG3: Higgs

WG4: top-quark

WG5: QCD

$\Rightarrow$ defines the experimental/parametric uncertainties!

Monday afternoon:

Mon 13/07 | Tue 14/07 | All days

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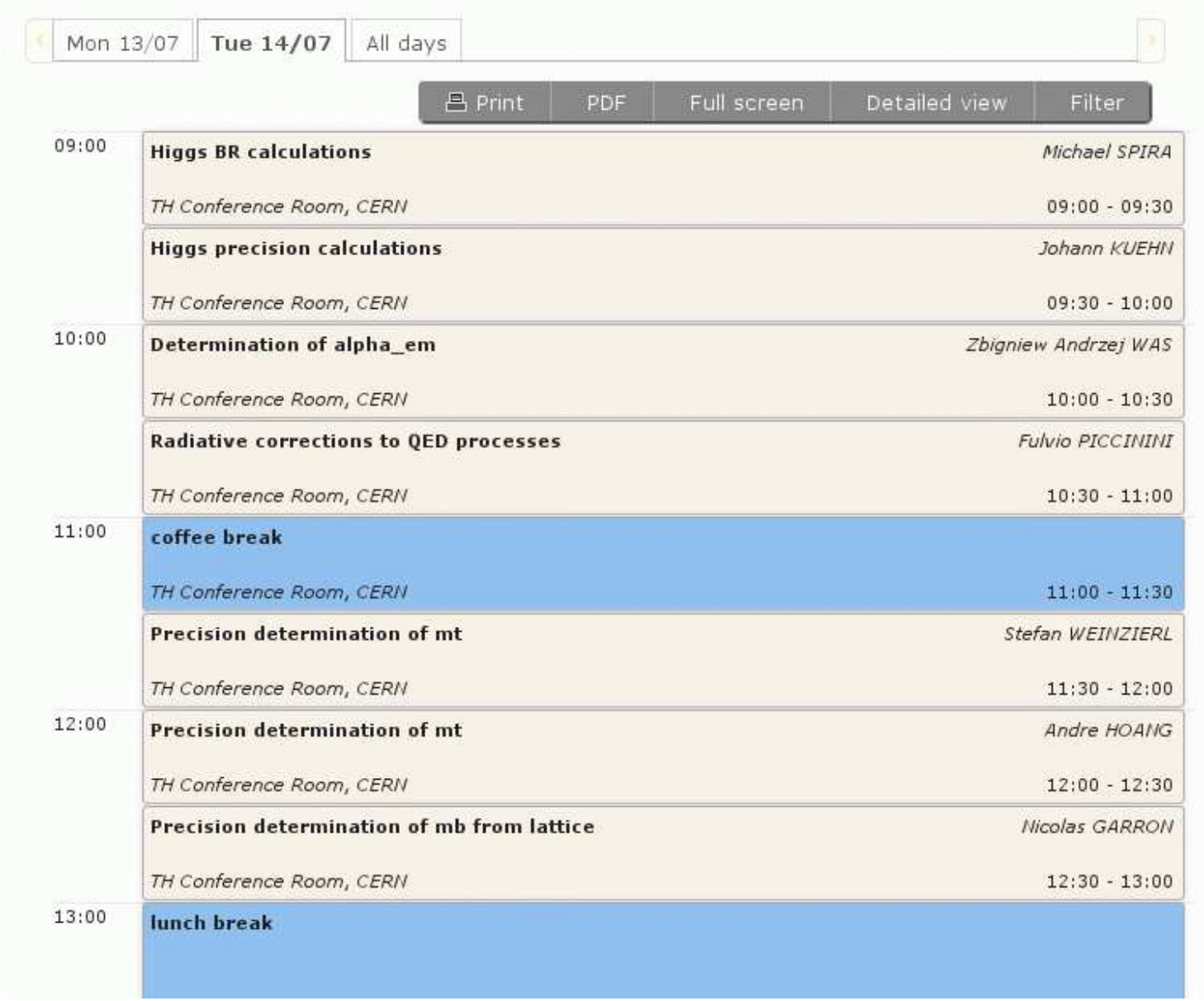
14:00	**Introduction**	*Sven HEINEMEYER*	
	TH Conference Room, CERN	14:00 - 14:15	
	EWPO in the SM	*Giuseppe DEGRASSI*	
	TH Conference Room, CERN	14:15 - 14:45	
	Anticipated Precision of EWPO in the SM (via Vidyo)	*Ayres FREITAS*	
15:00	*TH Conference Room, CERN*	14:45 - 15:15	
	Precision SM boson masses using the pure MSbar scheme (via Vidyo)	*Stephen MARTIN*	
	TH Conference Room, CERN	15:15 - 15:45	
	coffee break		
16:00	*TH Conference Room, CERN*	15:45 - 16:15	
	MW in the MSSM and the NMSSM	*Lisa ZEUNE*	
	TH Conference Room, CERN	16:15 - 16:45	
	EWPO in BSM	*Giovanni VILLADORO*	
17:00	*TH Conference Room, CERN*	16:45 - 17:15	
	EWPO fits in the SM with ILC/FCC-ee precision	*Roman KOGLER*	
	TH Conference Room, CERN	17:15 - 17:45	

Tuesday morning:



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09:00	**Higgs BR calculations**	*Michael SPIRA*	
	TH Conference Room, CERN	09:00 - 09:30	
	Higgs precision calculations	*Johann KUEHN*	
	TH Conference Room, CERN	09:30 - 10:00	
10:00	**Determination of alpha_em**	*Zbigniew Andrzej WAS*	
	TH Conference Room, CERN	10:00 - 10:30	
	Radiative corrections to QED processes	*Fulvio PICCININI*	
	TH Conference Room, CERN	10:30 - 11:00	
11:00	**coffee break**		
	TH Conference Room, CERN	11:00 - 11:30	
	Precision determination of mt	*Stefan WEINZIERL*	
	TH Conference Room, CERN	11:30 - 12:00	
12:00	**Precision determination of mt**	*Andre HOANG*	
	TH Conference Room, CERN	12:00 - 12:30	
	Precision determination of mb from lattice	*Nicolas GARRON*	
	TH Conference Room, CERN	12:30 - 13:00	
13:00	**lunch break**		

Tuesday afternoon:

$\Rightarrow$ final discussion!?

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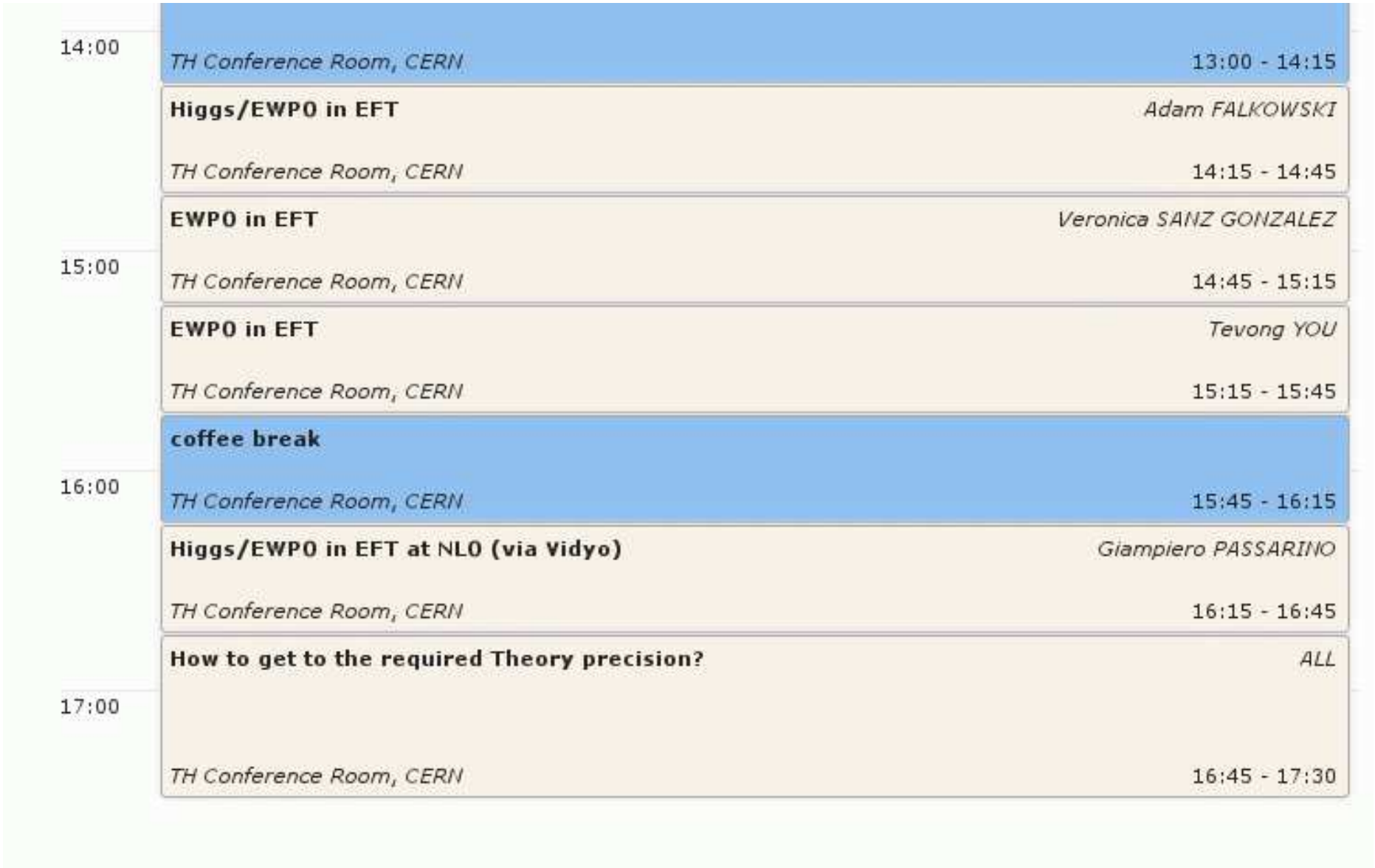

⇒ final discussion!?

LET's START! :-)