

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):



The image shows a screenshot of a web browser displaying an Indico event page. The browser's address bar shows the URL <https://indico.cern.ch/event/387296/>. The page features a large blue banner with the FCC-ee logo, which consists of the letters 'FCC' in a stylized font above 'hh ee he' in a smaller font, all enclosed within a blue oval shape. Below the banner, the event title 'First FCC-ee mini-workshop on Precision Observables and Radiative Corrections' is displayed in white text. At the bottom left, the dates '13-14 July 2015' and the location 'CERN' are listed, along with the time zone 'Europe/Zurich timezone'. A search bar with a 'Search' button is located at the bottom right of the page.

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

Search

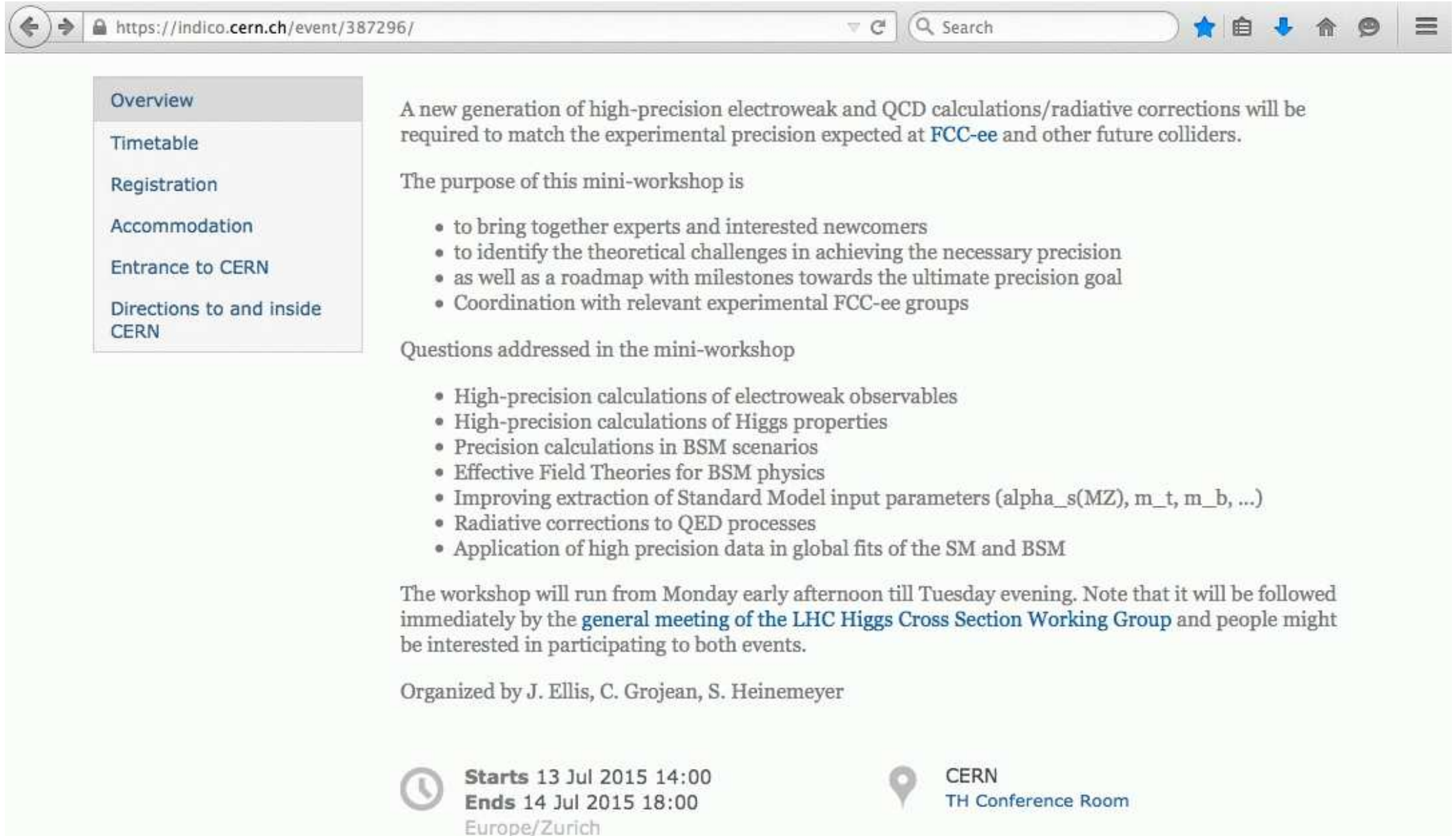


First FCC-ee mini-workshop on Precision Observables and Radiative Corrections

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CERN
Europe/Zurich timezone

Search

Workshop on PO and RC (II):



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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 ($\alpha_s(M_Z)$, 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 total 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 LHCHSWG, 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

⇒ defines the experimental/parametric uncertainties!

Monday afternoon:

| Mon 13/07 | | Tue 14/07 | All days |
|--|--|-----------|---------------------------|
| Print PDF Full screen Detailed view Filter | | | |
| 14:00 | Introduction | | <i>Sven HEINEMEYER</i> |
| | <i>TH Conference Room, CERN</i> | | 14:00 - 14:15 |
| | EWPO in the SM | | <i>Giuseppe DEGRASSI</i> |
| | <i>TH Conference Room, CERN</i> | | 14:15 - 14:45 |
| | Anticipated Precision of EWPO in the SM (via Vidyo) | | <i>Ayres FREITAS</i> |
| 15:00 | <i>TH Conference Room, CERN</i> | | 14:45 - 15:15 |
| | Precision SM boson masses using the pure MSbar scheme (via Vidyo) | | <i>Stephen MARTIN</i> |
| | <i>TH Conference Room, CERN</i> | | 15:15 - 15:45 |
| | coffee break | | |
| 16:00 | <i>TH Conference Room, CERN</i> | | 15:45 - 16:15 |
| | MW in the MSSM and the NMSSM | | <i>Lisa ZEUNE</i> |
| | <i>TH Conference Room, CERN</i> | | 16:15 - 16:45 |
| | EWPO in BSM | | <i>Giovanni VILLADORO</i> |
| 17:00 | <i>TH Conference Room, CERN</i> | | 16:45 - 17:15 |
| | EWPO fits in the SM with ILC/FCC-ee precision | | <i>Roman KOGLER</i> |
| | <i>TH Conference Room, CERN</i> | | 17:15 - 17:45 |

Tuesday morning:

| | | | | |
|-------|---|------------------|----------------------|--|
| | Mon 13/07 | Tue 14/07 | All days | |
| | Print PDF Full screen Detailed view Filter | | | |
| 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 α_{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 m_t | | Stefan WEINZIERL | |
| | TH Conference Room, CERN | | 11:30 - 12:00 | |
| 12:00 | Precision determination of m_t | | Andre HOANG | |
| | TH Conference Room, CERN | | 12:00 - 12:30 | |
| | Precision determination of m_b from lattice | | Nicolas GARRON | |
| | TH Conference Room, CERN | | 12:30 - 13:00 | |
| 13:00 | lunch break | | | |

Tuesday afternoon:

| | | |
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| 14:00 | <i>TH Conference Room, CERN</i> | 13:00 - 14:15 |
| | Higgs/EWPO in EFT | <i>Adam FALKOWSKI</i> |
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| 16:00 | <i>TH Conference Room, CERN</i> | 15:45 - 16:15 |
| | Higgs/EWPO in EFT at NLO (via Vidyo) | <i>Giampiero PASSARINO</i> |
| | <i>TH Conference Room, CERN</i> | 16:15 - 16:45 |
| | How to get to the required Theory precision? | <i>ALL</i> |
| 17:00 | <i>TH Conference Room, CERN</i> | 16:45 - 17:30 |

⇒ final discussion!?

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LET'S START! :-)