



ECFA Higgs Factories Study
**2nd topical meeting on
Reconstruction**
July 11-12 , 2023

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WG2: Physics Analysis Methods

GENERATORS

SIMULATION

RECONSTRUCTION

ALGORITHMS & TOOLS

SOFTWARE ECOSYSTEM

- Monte Carlo generators for e+e- precision EW, Flavour, Higgs, and top physics,
- Luminosity measurements
- Software framework
- Fast simulation and the limitations of such techniques
- Full Simulation
- Track and vertex reconstruction algorithms
- Jet algorithms / jet reconstruction
- Particle-flow reconstruction and global event description
- Requirements on particle identification
- Flavour tagging algorithms
- Importance of timing information
- Constrained fit

Software Ecosystem - Key4hep

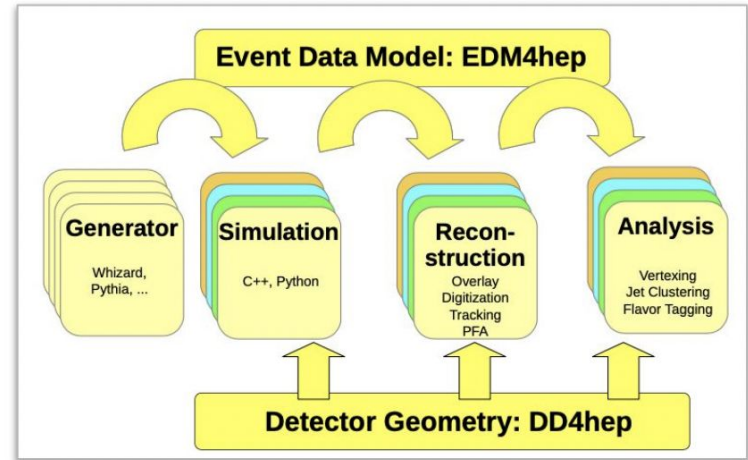
Create a software ecosystem integrating in optimal way various software components to provide a ready-to-use full-fledged solution for data processing of HEP experiments

- *Key4hep* federates FCC, ILC, CLIC , CEPC and other experiments
- In use or medium term migration plan
- Supported by R&D efforts (AIDA, CERN EP etc.)
- KEY4HEP coordinators consulted and involved in the the organisation of all WG2 meetings

Frank Gaede

Gerardo Ganis

André Sailer



LIST OF WG2 TOPICAL WORKSHOPS

1st Topical Meeting on Generators

(jointly with WG1)

<https://indico.cern.ch/event/1078675/>

(9-10 November 2021, CERN, hybrid format)

(118 participants)

as a follow up: **Focus Meeting on Beamstrahlung** (12 January 2022, online only)

<https://indico.cern.ch/event/1100734/>

(65 registrants)

1st Topical Meeting on Simulation

<https://indico.cern.ch/event/1097819/>

(1-2 February 2022) (forseen in Padua but moved online)

(141 participants)

1st Topical Meeting on Reconstruction

<https://indico.cern.ch/event/1124095/>

(4-5 May 2022, Desy, hybrid format)

(107 participants)

2nd Topical Meeting on Generators

(jointly with WG1)

<https://indico.cern.ch/event/1266492/>

(21-22 June 2023, Brussels hybrid format)

2nd Topical Meeting on Reconstruction

<https://indico.cern.ch/event/1283129/>

(11-12 July 2023, CERN, hybrid format)

1st Reconstruction Topical Workshop

Focused on taking stock of the different algorithms currently developed for lepton colliders and the latest ideas and experience from the LHC

- **Tracking I**

- MarlinTrk and Tracking in ILD (Frank Gaede)
- Conformal Tracking (SiD, CLIC, CLD) (Erica Brondolin)
- Special Tracking Gaussian Sum Filter@LHC (Ying An)

- **Tracking II**

- Tracking for CEPC (Chengdong Fu)
- ACTS (Paul Gessinger)
- Tracking for FCC IDEA (Nicola De Filippis)

- **Fundamentals**

- PFA or no PFA (Jean-Claude Brient)

- **Particle Flow I**

- Particle Flow: Pandora (John Stuart Marshall)
- Particle Flow with CMS (Kenneth Long)
- Particle Flow: Arbor (Manqi Ruan)
- Energy Flow in ATLAS (Mark Hodgkinson)

- **Particle ID**

- Flavour Tagging in ILD (Adrian Irles)
- Particle Identification with Gaseous Tracking and Fast Timing (Ulrich Einhaus)
- Flavour Tagging from CMS to FCC (Loukas Gouskos)

2nd Reconstruction Topical Workshop **NOW!**

Focused on following up on developments from last year. How to integrate and satisfy the needs of the “ECFA focus topics” physics analyses. Fostering the cross-projects work profiting of the key4hep ecosystem

FIRST DAY

- ECFA TOPICS
- KEY4HEP
- TRACKING & OBJ RECO

SECOND DAY

- PARTICLE ID
- ML BASED RECONSTRUCTION
- KINEMATIC FITS

2nd Reconstruction Topical Workshop **NOW!**

- Lots of discussion time scheduled
- This is not a conference, it is a forum to really talk to each other and first common ideas and work
- **Speakers are participants, strongly encouraged to attend the full duration of the meeting (this is why we try to keep it short)**
- **Goal 1 of this workshop** is to identify a structure for the content of the Yellow Report and with it possibly some volunteers to pick up editing roles of specific sections
- **Goal 2 of this workshop** is to connect the tools' development and their priorities with the needs of the ECFA “focus topics” and their expert teams

ECFA Focus Topics List

- 1 **HtoSS** – $e^+e^- \rightarrow Zh: h \rightarrow s\bar{s}$ ($\sqrt{s} = 240/250$ GeV) (JdB)
- 2 **ZHang** – $e^+e^- \rightarrow Zh$: reconstruction of production and decay angles ($\sqrt{s} = 240/250$ GeV) (JdB)
- 3 **Hself** – Determination of the Higgs self-coupling (JdB)
- 4 **Wmass** – W mass from WW threshold and continuum ($\sqrt{s} = 161, 240/50, 350/380, \dots$ GeV) (JdB)
- 5 **WWdiff** – Full studies of WW and $e\nu W$ ($\sqrt{s} = 240/250, 365$ GeV) (JdB)
- 6 **TTthres** – Top threshold: Detector-level simulation study of $e^+e^- \rightarrow t\bar{t}$ at a typical threshold-scan energy ($\sqrt{s} = 350, 365$ GeV) and threshold scan optimisation (JL)
- 7 **LUMI** – Precision of the luminosity measurement from low-angle Bhabha scattering (JL)
- 8 **EXscalar** – New exotic scalars (JL)
- 9 **LLPs** – Long-lived particles (JL)
- 10 **EXtt** – Exotic top decays (FM)
- 11 **CKMWW** – CKM matrix elements with on-shell and boosted W decays at $\sqrt{s} \geq m_W$ (PK)
- 12 **BKtautau** – $B^0 \rightarrow K^{0*}\tau^+\tau^-$ (PK)
- 13 **TwoF** – EW precision: 2-fermion final states ($\sqrt{s} = M_Z$ and beyond) (PK)
- 14 **BCfrag** – Measurement of b - and c -fragmentation functions and hadronisation rates ($\sqrt{s} = M_Z$ and beyond) (FM)
- 15 **Gsplit** – Measurement of gluon splitting to $b\bar{b} / c\bar{c}$, interplay with separating $h \rightarrow$ gluons from $h \rightarrow b\bar{b}/c\bar{c}$ ($\sqrt{s} = M_Z$ and beyond) (FM)

Plans for Yellow Report & ECFA Topics

- Yellow Report due by end of 2024 (in time for next European Strategy)
- Editors: *Aidan Robson and Christos Leonidopoulos* and the WG1+WG2+WG3 conveners
- Sections devoted to each WG. Detailed structure being discussed.
- Fil rouge: List of ECFA “Focus Topics” developed to exploit a set of physics processes, that would particularly profit of the development of new generator/simulation/reconstruction and analysis tools, across the different projects/machines.
 - tools to be developed in Key4hep
 - looking for sub-editors of various section/topics for WG2

ECFA Workshop in Paestum (Italy)

- October 11-13
- <https://agenda.infn.it/event/34841/>
- Registration open
 - attractive pricing to facilitate participation of ECRs
- **Abstracts deadline July 15th 2023** (soon!)
- **DEADLINE TO REGISTER FOR key4hep TUTORIAL (on the day before) July 15th 2023**
- Priority to new and/or cross-project work



SECOND • ECFA • WORKSHOP
on e^+e^- Higgs / Electroweak / Top Factories

11-13 October 2023
Paestum / Salerno / Italy

Topics:

- Physics potential of future Higgs and electroweak/top factories
- Required precision (experimental and theoretical)
- EFT (global) interpretation of Higgs factory measurements
- Reconstruction and simulation
- Software
- Detector R&D

DINNER at Luigia Academy at 19:00

- A group will walk there from CERN blg 39 (Hostel) around 18.40
- Let us know if you have not registered and you want to come