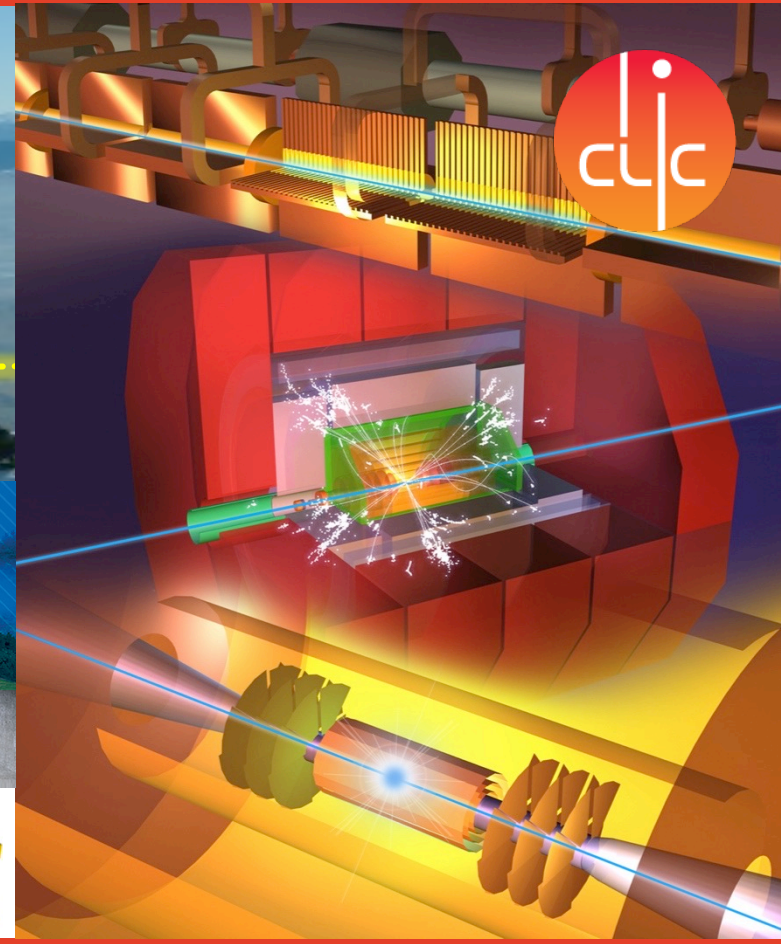


# Towards the final report



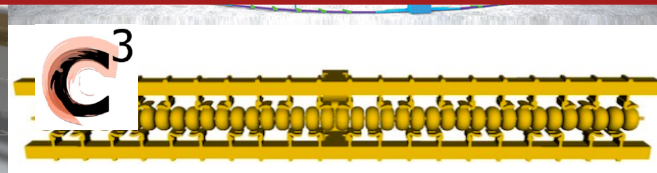
ECFA workshop, 11 October 2024  
Aidan Robson & Christos Leonidopoulos

# Towards the final report



## *Outline*

- ◆ Report structure
- ◆ Timeline
- ◆ Next steps



ECFA workshop, 11 October 2024  
Aidan Robson & Christos Leonidopoulos



# Report Planning

We've seen a huge amount of activity and many beautiful results represented in this workshop!  
The challenge now is to try to capture this in a useful report

- ◆ *Concept: a synoptic outline of the physics case and the ECFA study activities, drawing particular attention to the work that has spanned projects, concepts, and WGs, helping to strengthen and build the  $e^+e^-$  community.*  
*The report should:*
  - be self-contained and reasonably comprehensive  
(but not ab initio and not extensively repeating material from previous reports)
  - and be concise enough that it's a document that people can actually read
- ◆ Hope many activities will write individual notes/papers → we really encourage this  
→ report will largely summarise and reference them
- ◆ Physics analysis tools and detector technologies sections will be cross-referenced with physics topics, where they are closely linked

taking shape in Overleaf

# Outline Structure

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◆ Sections:

- Introduction
- Common Developments
- Developments in Higgs Physics
- Developments in Electroweak Physics & QCD
- Developments in Top Physics
- Global Interpretations
- Direct Searches for New Particles
- Flavour
- New Detector Technologies

# Outline Structure

- ◆ Report will **concentrate on recent material**, given in the context of longer-term studies
- ◆ Note: the Focus Topics are just one aspect of the study, and the scope of physics content of the report goes well beyond the Focus Topics (depending on area)

Example: Searches →

<b>7</b>	<b>Direct Searches for New Particles</b>	
7.1	Phenomenological Introduction	.....
7.1.1	General motivation for BSM	.....
7.1.2	Possible scenarios with focus on direct signatures	.....
7.1.3	Possible search strategies	.....
7.1.4	Expected search landscape after HL-LHC	.....
7.2	Focus topic: Exotic scalar searches	.....
7.3	Focus topic: Long lived particles	.....
7.4	Focus topic: Exotics top decays	.....
7.5	Further topics	.....
7.5.1	Heavy Neutral Leptons	.....
7.5.2	Dark Photons (?)	.....
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7.5.7	Two-particle angular correlations in the search for new physics	.....
7.6	Detector and running option considerations	.....
7.6.1	Role of polarization	.....
7.6.2	Key detector design issues	.....
7.6.3	Key challenges in systematics	.....

- ◆ Detailed structure of each chapter lies in the first instance with topical conveners; others have been / are being co-opted to edit subsections



# Section editing

- ◆ Editor names are already associated with many sections – thank you! WG1 topical conveners (for analysis topics) or WG2/3 coordinators request direct Overleaf editing access for others.

2 Common Developments

108 **2 Common Developments**

109 Editors: Fulvio Piccinini, Patrizia Azzi, Dirk Zerwas

110 **2.1 Software Ecosystem**

111 Editors: Andre Sailer, Frank Gaede, Gerardo Ganis

112 **2.2 Generators**

113 Editors: Carlo Carloni Calame, Juergen Reuter, Marco Zaro

114 More detailed generator-by-generator developments e.g. revived KKMC, new developments in e.g. Sherpa

115

116 Add new file/subsection per generator.

117 **2.3 Beamstrahlung & Luminosity Spectra**

118 Editors: Thorsten Ohl, Daniel Schulte

119 **2.4 FOCUS TOPIC: Luminosity**

120 Editors: Ayres Freitas, PA

121 Precision measurements of the luminosity are important for all cross-section and line-shape measurements,

122 in particular the Z peak cross section,  $\sigma_Z^0$ ; the total Z width from the line-shape of  $e^+e^- \rightarrow f\bar{f}$ ; the W boson

123 mass and width from the line-shape of the cross-section for  $e^+e^- \rightarrow W^+W^-$  near threshold; and the total

124 cross section for  $e^+e^- \rightarrow HZ$  (used for extracting the effective HZZ coupling and the total Higgs boson width).

125 At LEP, an absolute calibration of the luminosity with a relative experimental uncertainty of  $3.4 \times 10^{-4}$  has been

126 achieved [2]. using small-angle Bhabha scattering. For future  $e^+e^-$  colliders, the luminosity uncertainty will

3 Developments in Higgs Physics

278 **3 Developments in Higgs Physics**

279 Editors: Chris Hays, Karsten Koeneke

280 Introductory text...

281 **3.1 FOCUS TOPIC: ZH production and angular studies**

282 Editors: Ivanka Brozovic, Chris Hays, Markus Klute, Sandra Kortner, Cheng Li, Ken Mimasu, Gudrid Moortgat-Pick

283 **3.1.1 CP-odd coupling studies**

284 **Models of CP violation in the Higgs sector**

285 Editor: Gudrid Moortgat-Pick

286 **CP studies at the LHC**

287 Editor: Sandra Kortner

288 **HZZ CP studies at the FCC**

289 Editors: Andrei Gritsan, Nicholas Pinto, Valdis Slokenbergs

290 **CP studies at the CEPC**

291 Editor: Qiyu Sha

292 **CP tests with polarised beams**

293 Editor: Cheng Li

294 **HVV CP studies at the ILC with  $\sqrt{s} = 1$  TeV**

295 Editor: Ivanka Bozovic

296 **CP studies in  $H \rightarrow \tau\tau$**

297 Editor: Kazuki Sakurai

298 **3.1.2 CP-even coupling studies**

299 **Impact of additional Higgs bosons**

300 Editor: Sven Heinemeyer

# Timeline

- ◆ 20/10 Deadline for physics studies to submit 2-page summary
- ◆ 20/10 – 10/11 Compilation and editing by WG1 subgroup conveners / nominated editors, and WG2/3 editors (as well as coordinators & chief editors)  
*10/11 is the deadline for WG1 subgroup conveners finish their part!*
- ◆ 10/11 – 27/11 Editing by WG1 coordinators, WG2/3 editors & coordinators, and chief editors.  
*27/11 is deadline for complete draft to be handed over to chief editors.*
- ◆ 27/11 – 18/12 Editing by chief editors only
- ◆ 18/12 Circulation of version 1 to contributors and R-ECFA
- ◆ 17/1 Deadline to receive comments on version 1
- ◆ 24/1 Deadline to receive final results/plots from contributors
- ◆ February Incorporation of comments, final results, and references
- ◆ 21/2 Final version to R-ECFA
- ◆ 7–8/3 R-ECFA approval during country visit  
followed by submission to arXiv

# Timeline

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followed by submission to arXiv

Timeline is very tight; no room for slippage!

Please expect a lot of interaction / clarification among all editors and contributors at each stage – thanks in advance!



# Physics studies: 2-page summaries

- ◆ Template available: <https://www.overleaf.com/read/sqtfdqjvdsnqd#386e64>
- ◆ – it has been distributed via topical email lists
  - you must please use this – it's the same format as the final report to allow straightforward incorporation

ECFA-Higgs-Template

Download

Sorry, no preview is available.

Recompile

2 / 2

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- 1 Introduction
- 2 References

Document formatting convention requests

Please follow this guidance to help the editors incorporate your text in the final report:

**Particle symbols**

For particles, please use the `heppennames2` package (included).  
For example:

- $t\bar{t}$  is `\PQt\PAQt` (which also has the local alias `\ttbar`)
- $H \rightarrow b\bar{b}$  is `\PH\to\PB\PAQb` (which also has the local alias `\Hbb`)

Please feel free to add other useful aliases to the relevant section of `ECFAreport_definitions`

**Units**

For units, please use the `siunitx` package.  
For example:

- $3.1 \text{ ab}^{-1}$  is `\SI{3.1}{\per\atto\barn}`
- $3.45 \times 10^{-4} \mu\text{m}$  is `\SI{3.45d-4}{\micro\metre}`
- $13 \text{ GeV}$  is `\SI{13}{\giga\electronvolt}`

**References**

Please use the `cleveref` package via the commands `\cref` command which takes care of Figure in an automatic way. Capitalize the `c` at the beginning of a sentence etc `\Cref`

**Paper References**

Please use the `\cite` commands, and `\biber`. For example `\cite{deBlas:2024bmz}`

4 Introduction

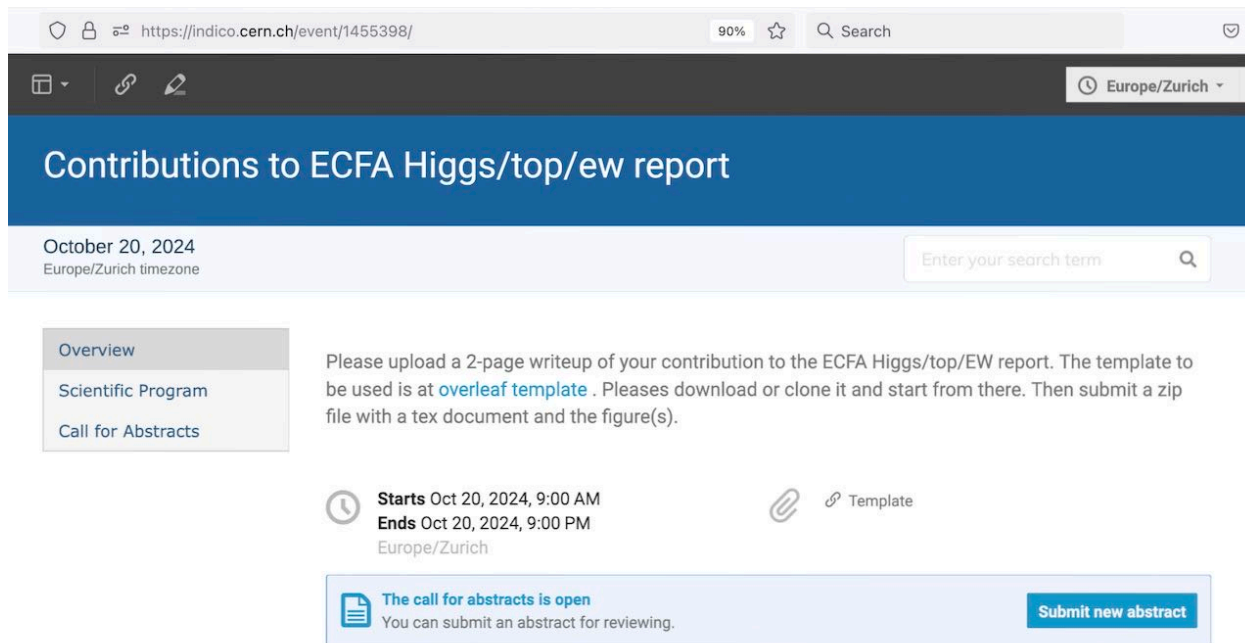
zip file of template for download

# Physics studies: 2-page summaries

## ◆ You should upload a zip file of the full source plus a pdf by 20<sup>th</sup> October!

What's expected: a brief self-contained description plus results, as a table / 1 or 2 plots.

Upload location: <https://indico.cern.ch/event/1455398/>



The screenshot shows a web browser window with the URL <https://indico.cern.ch/event/1455398/>. The page title is "Contributions to ECFA Higgs/top/ew report". The event date is "October 20, 2024" in the "Europe/Zurich timezone". A search bar is present with the placeholder "Enter your search term". On the left, there is a navigation menu with "Overview", "Scientific Program", and "Call for Abstracts". The main content area contains the following text: "Please upload a 2-page writup of your contribution to the ECFA Higgs/top/EW report. The template to be used is at [overleaf template](#). Please download or clone it and start from there. Then submit a zip file with a tex document and the figure(s).". Below this text, there are event details: "Starts Oct 20, 2024, 9:00 AM" and "Ends Oct 20, 2024, 9:00 PM" in the "Europe/Zurich" timezone. There is also a "Template" link. At the bottom, a blue banner states "The call for abstracts is open" and "You can submit an abstract for reviewing.", with a "Submit new abstract" button.

You should do this for any study / result that you would like to see included, whether it's:

- part of one of the focus topics
- or a separate recent study

We expect that by now most of these are known to the conveners

[ Uploading a 2-page summary doesn't guarantee that it is included in the report (at all or in full length); the (sub)section editors determine the content. But the spirit of the report is to include as much as possible! ]

◆ *It's fully understood that results may not be final by 20<sup>th</sup> October, but this deadline is necessary to allow the report to be prepared. There will be an opportunity to update the results (latest 24<sup>th</sup> January; see timeline).*

# WG2 Physics Analysis Tools

- ◆ WG2 report sections adopt a more top-down approach  
... but the spirit is the same: all help and additional input is very welcome.
- ◆ Editors for the broad topics span projects for maximum coverage, and will solicit input for their sections.  
But you are also welcome to contact them with offers of text and help!:

<b>Topic</b>	<b>Section editors</b>
Software Ecosystem	Andre Sailer, Frank Gaede, Gerardo Ganis
Generators	Carlo Carloni Calame, Juergen Reuter, Marco Zaro
Technical Benchmarks	Alan Price
Beamstrahlung & Luminosity Spectra	Thorsten Ohl, Daniel Schulte
Simulation	Andre Sailer, Brieuc Francois, Daniel Jeans
Reconstruction	Loukas Gouskos, Taikan Suehara, Ulrich Einhaus

Coordinated overall by WG2 coordinators, Patrizia, Dirk & Fulvio



# WG3 Detector Technologies

- ◆ WG3 acts as a bridge between DRDs and HTE factory detector concepts
- ◆ Detector technologies chapter will (very!) compactly summarize the main R&D directions, challenges, and recent results specifically towards HTE factory detectors
- ◆ As with WG2, WG3 chapter adopts a more top-down approach
- ◆ In particular, trying to avoid duplication with other reports towards ESPPU

## **Topic**

Experimental conditions

Discussion on the evolution of detector concepts from linear to circular

Mid-term R&D plans towards HTE factories, from DRD collaborations

- Vertex & Tracking
- Calorimetry & PID
- Integration, Mechanics & Cooling

Organised by WG3 coordinators, Felix, Giovanni & Mary-Cruz

# Author list

- ◆ The author list will be compiled via a self-service web interface where you can add your name, associated with your institute (and add your institute if it's not already in the database). *The link will be circulated to the ECFA Study email list in due course.*

ECFA Editorial Interface				
	Members	Publications	Editors	
University of Glasgow	United Kingdom	A. Robson	D. Protopopescu, A. Robson	-
University of Liverpool	United Kingdom		-	
University of Melbourne	Australia		-	
University of Michigan	USA		-	
University of Oxford	United Kingdom		-	
University of Siegen	Germany		-	
University of Sussex	United Kingdom		-	
University of Toronto	Canada		-	
University of Warsaw	Poland		-	
Vinca Institute of Nuclear Sciences	Serbia		-	

Found 36 institutes with 3 participating members, of which 3 listed as active.

## Add a new member institute

Use the form below to add institute info, then follow the link in the table above to edit its members.

Short Name/Abbrev.	Name	Country	LaTeX Name/Address
<input type="text" value="e.g. Argonne or ANL"/>	<input type="text" value="e.g. Argonne National Laboratory"/>	<input type="text" value="e.g. USA or United States"/>	<input type="text" value="e.g. Argonne National Laboratory, Argonne, Illinois"/>
<input type="button" value="Add institute"/>			

# The next phase

- ◆ We have seen a huge amount of activity and many beautiful results represented in this workshop
- ◆ It's a challenge to capture all this in a useful and readable report
- ◆ The next 2 months will be very intensive!
  
- ◆ If you have a study for inclusion: please submit your 2-page summary by 20<sup>th</sup> October!
- ◆ If you're a section editor: please be ready for the intensive compiling/writing/editing phase!
- ◆ If you're approached to write a section or with questions on something you've provided, please try to help!
  
- ◆ Thanks to everyone involved, in advance!!!



Backup

# Coordinator and convener contacts:

- ◆ **WG1: Physics programme** conveners Fabio Maltoni, Jenny List, Jorge de Blas, Patrick Koppenburg  
ECFA-WHF-WG1-coords@cern.ch
- ◆ **WG2: Physics analysis methods** conveners Patrizia Azzi, Fulvio Piccinini, Dirk Zerwas  
ECFA-WHF-WG2-coords@cern.ch
- ◆ **WG3: Detector technologies** conveners Felix Sefkow, Mary Cruz Fouz, Giovanni Marchiori  
ECFA-WHF-WG3-coords@cern.ch
- ◆ **study chief editors** Aidan Robson, Christos Leonidopoulos

WG1 activity area conveners: **WG1-PREC (Precision in theory & experiment):**

Ayres Freitas (Pittsburgh), Paolo Azzurri (Pisa),  
Adrian Irlles (Valencia), Andreas Meyer (DESY)  
ecfa-whf-wg1-prec-conveners@cern.ch

**WG1-GLOB (Global interpretations in (SM)EFT and UV complete models):**

Sven Heinemeyer (IFCA/IFT), Alexander Grohsjean (DESY),  
Junping Tian (Tokyo), Marcel Vos (Valencia), Jorge de Blas (Granada)  
ecfa-whf-wg1-glob-conveners@cern.ch

**WG1-HTE (TOP-HIGGS-EW and connection with LHC):**

Chris Hays (Oxford), Karsten Koeneke (Freiburg),  
Fabio Maltoni (Louvain)  
ecfa-whf-wg1-hte-conveners@cern.ch

**WG1-FLAV (Heavy Flavours):**

David Marzocca (Trieste), Stephane Monteil (Clermont Ferrand),  
Pablo Goldenzweig (KIT)  
ecfa-whf-wg1-flav-conveners@cern.ch

**WG1-SRCH (Feebly interacting particles, direct low mass searches):**

Roberto Franceschini (Rome III), Rebeca Gonzalez (Uppsala),  
Filip Zarnecki (Warsaw)  
ecfa-whf-wg1-srch-conveners@cern.ch

# Focus Topics Expert Teams

- ◆ Focus topic definitions have been developed by 'expert teams' from across projects, driven by the WG1 coordinators & conveners (next slide)
- ◆ Note: expert team members participating as 'consultants' – not necessarily active in topics at the moment!

## Expert Teams

<b>EXscalar (SRCH)</b>	<b>LLPs (SRCH)</b>	<b>EXtt (SRCH)</b>	<b>HtoSS (HTE)</b>	<b>ZHang (HTE(GLOB))</b>	<b>TwoF (HTE)</b>
Filip Zarnecki	Rebeca Gonzalez Suarez	Nuño Castro	Valentina Cairo	Ivanka Bozovic	Adrian Irles
Mikael Berggren	Juliette Alimena	Marina Cobal	Taikan Suehara	Markus Klute	Daniel Jeans
Sven Heinemeyer	Jan Hajer	Gauthier Durieux	Loukas Gouskos	Sandra Kortner	Freya Blekman
Abdollah Mohammadi	Marcin Kucharczyk	Roberto Franceschini	Matt Basso	Cheng Li	Mogens Dam
Tania Robens	Emma Torro Pastor	María Teresa Núñez Pardo de Vera	Caterina Vernieri	Gudrid Moortgat-Pick	Jorge de Blas
Nikolaos Rompotis	Sarah Louise Williams	Kirill Skovpen	Valerio Dao	Ken Mimasu	Eram Rizvi (tbc)
	Filip Zarnecki	Marcel Vos	John Alison		Emanuele Bagnaschi
			Yotam Soreq		
<b>Hself (Glob)</b>	<b>WWdiff (Glob)</b>	<b>TTthres (Glob(HTE))</b>	<b>BCFrag/Gsplit (FLAV/PREC)</b>	<b>Wmass (PREC)</b>	<b>LUMI (PREC)</b>
Junping Tian	Patrizia Azzi	Marcel Vos	Eli Ben-Haim	Paolo Azurri	Ayres Freitas
Gauthier Durieux	Timothy Barklow	Patrizia Azzi	Maria Ubiali	Josh Bendavid	Ivanka Bozovic
Jose Goncalo	Jorge de Blas	Martin Beneke	Andrzej Siodmok	Martin Beneke	Mogens Dam
Sven Heinemeyer	Ansgar Denner	Jorge de Blas	Simon Plaetzer	Stefan Dittmaier	Fulvio Piccinini
Michael Peskin	Alexander Grohsjean	Matteo Defranchis	Loukas Gouskos	Simon Plätzer	Wiesław Płaczek
Philipp Roloff	Wolfgang Kilian	Gauthier Durieux	Torbjörn Sjöstrand	Matthias Schott	André Sailer
Roberto Salerno	Frank Siegert	Roberto Franceschini		Raimund Ströhmer	Maciej Skrzypek
		Andre Hoang		Graham Wilson	Graham Wilson
<b>CKMWW (FLAV)</b>	<b>BKtautau (FLAV)</b>	Adrian Irles		Jorge de Blas	
U. Einhaus	T. Miralles	Yasuhiro Kiyoyama			
M. Selvaggi	S. Monteil	Andrej Saibel			
P. Goldenzweig	A. Wiederhold	Reinhard Schwienhorst			
M. Bordone	M. Kenzie	Frank Simon			
D. Marzocca	E. Manoni	Filip Zarnecki			
	P. Goldenzweig				
	J. Kamenik				