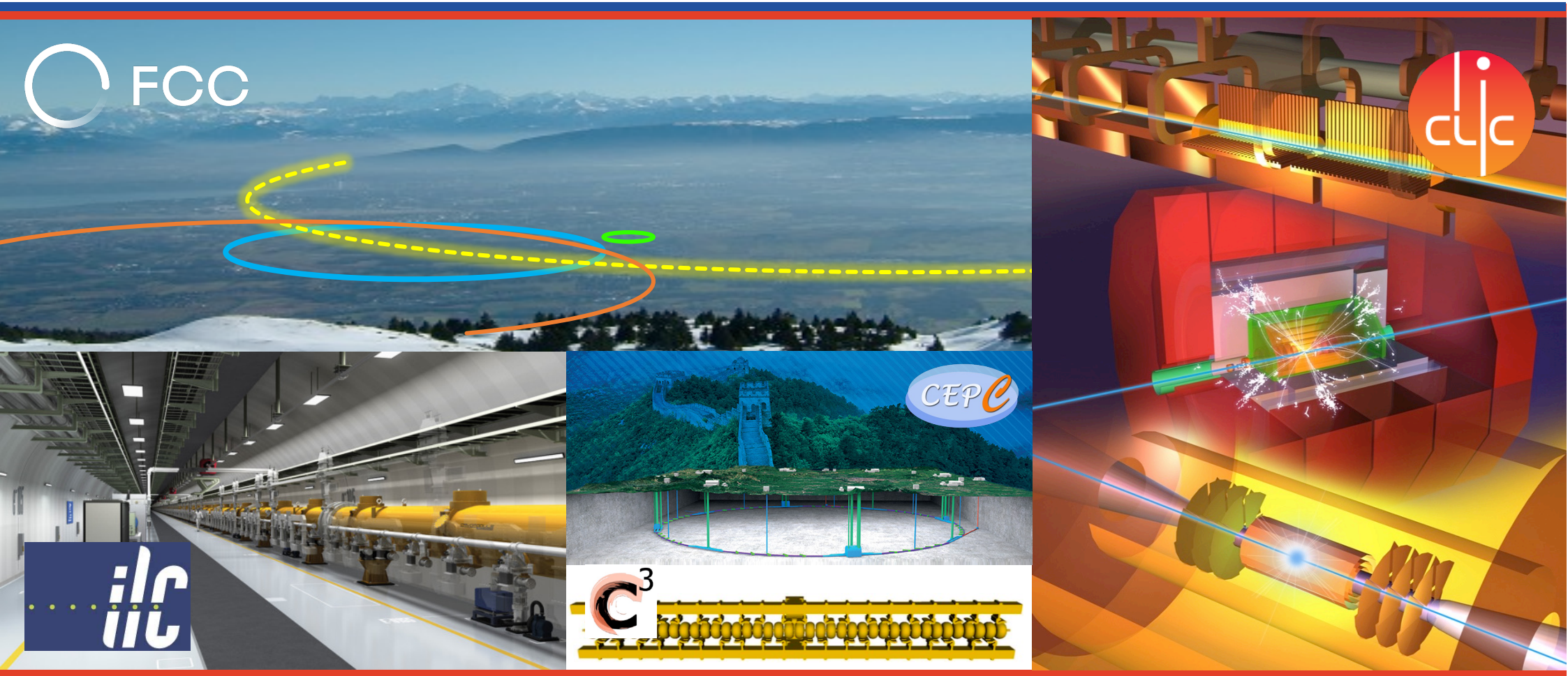
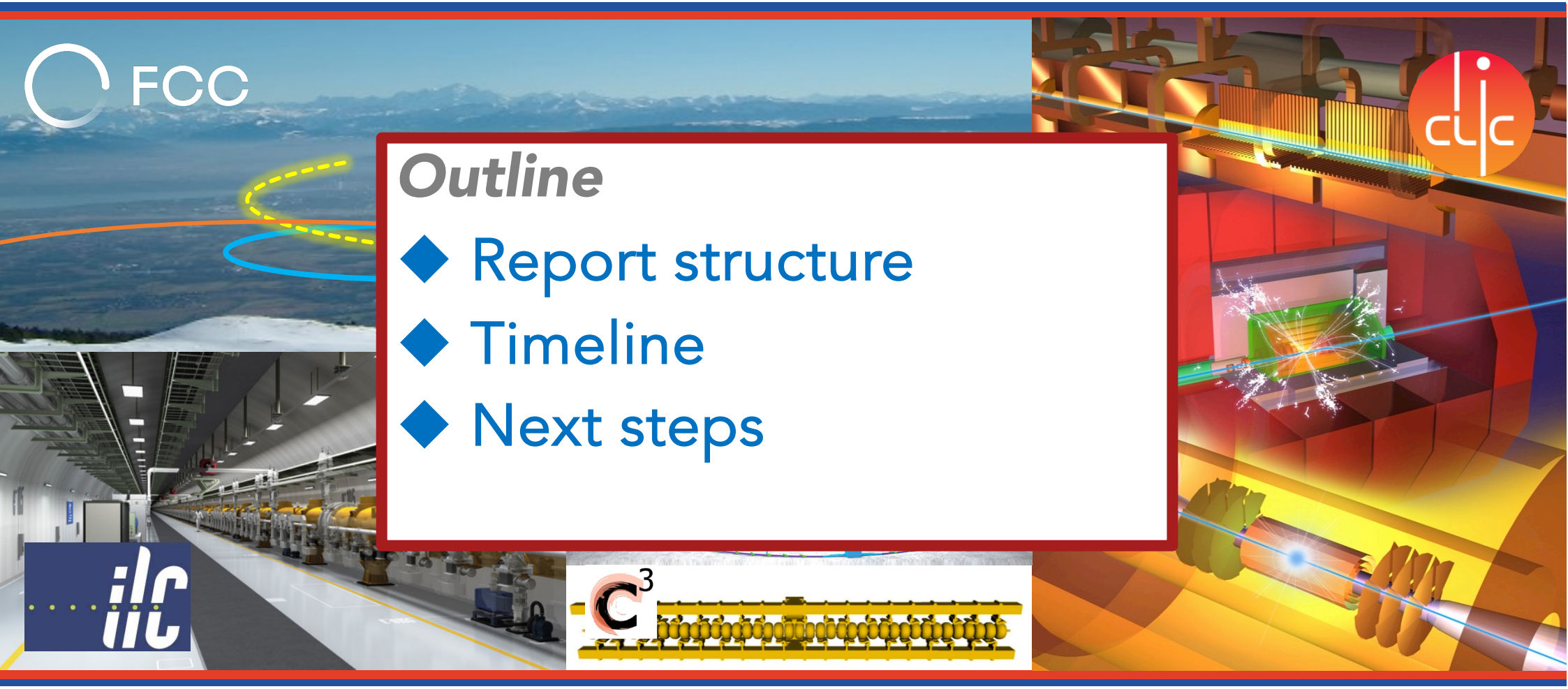
Towards the final report



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

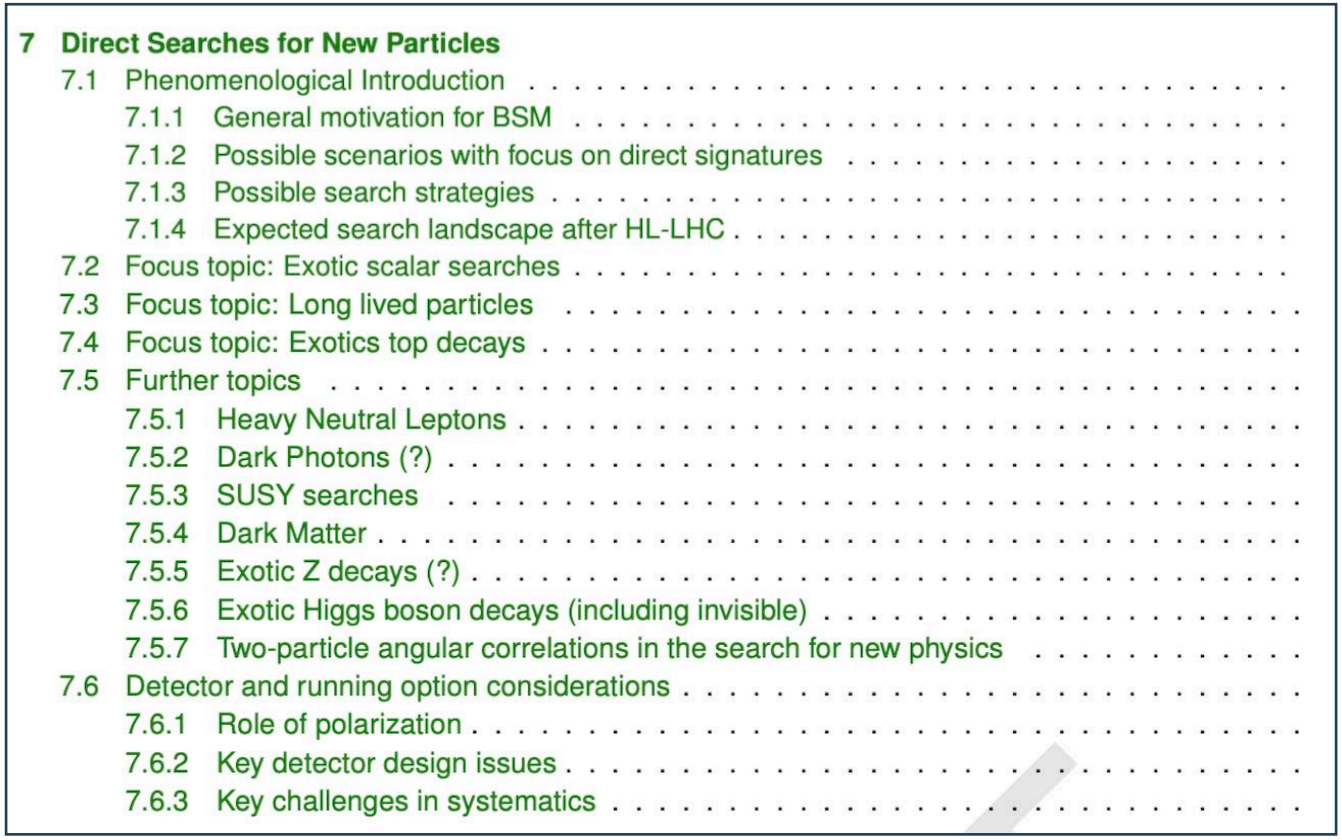
Contents

- **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



7 Direct Searches for New Particles

- 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 (?)
  - 7.5.3 SUSY searches
  - 7.5.4 Dark Matter
  - 7.5.5 Exotic Z decays (?)
  - 7.5.6 Exotic Higgs boson decays (including invisible)
  - 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

Editors: Fulvio Piccinini, Patrizia Azzi, Dirk Zerwas

2.1 Software Ecosystem

Editors: Andre Sailer, Frank Gaede, Gerardo Ganis

2.2 Generators

Editors: Carlo Carloni Calame, Juergen Reuter, Marco Zaro

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

Add new file/subsection per generator.

2.3 Beamstrahlung & Luminosity Spectra

Editors: Thorsten Ohl, Daniel Schulte

2.4 Focus Topic: Luminosity

Editors: Ayres Freitas, PA

Precision measurements of the luminosity are important for all cross-section and line-shape measurements, in particular the Z peak cross section, σ_Z^0; the total Z width from the line-shape of $e^+e^- \to f\bar{f}$; the W boson mass and width from the line-shape of the cross-section for $e^+e^- \to W^+W^-$ near threshold; and the total cross section for $e^+e^- \to HZ$ (used for extracting the effective HZZ coupling and the total Higgs boson width). At LEP, an absolute calibration of the luminosity with a relative experimental uncertainty of 3.4×10^{-4} has been achieved [2], using small-angle Bhabha scattering. For future e^+e^- colliders, the luminosity uncertainty will

3 Developments in Higgs Physics

Editors: Chris Hays, Karsten Koeneke

Introductory text...

3.1 Focus Topic: ZH production and angular studies

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

3.1.1 CP-odd coupling studies

Models of CP violation in the Higgs sector

Editor: Gudrid Moortgat-Pick

CP studies at the LHC

Editor: Sandra Kortner

HZZ **CP studies at the FCC**

Editors: Andrei Gritsan, Nicholas Pinto, Valdis Slokenbergs

CP studies at the CEPC

Editor: Qiyu Sha

CP tests with polarised beams

Editor: Cheng Li

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

Editor: Ivanka Bozovic

CP studies in $H \to \tau\tau$

Editor: Kazuki Sakurai

3.1.2 CP-even coupling studies

Impact of additional Higgs bosons

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

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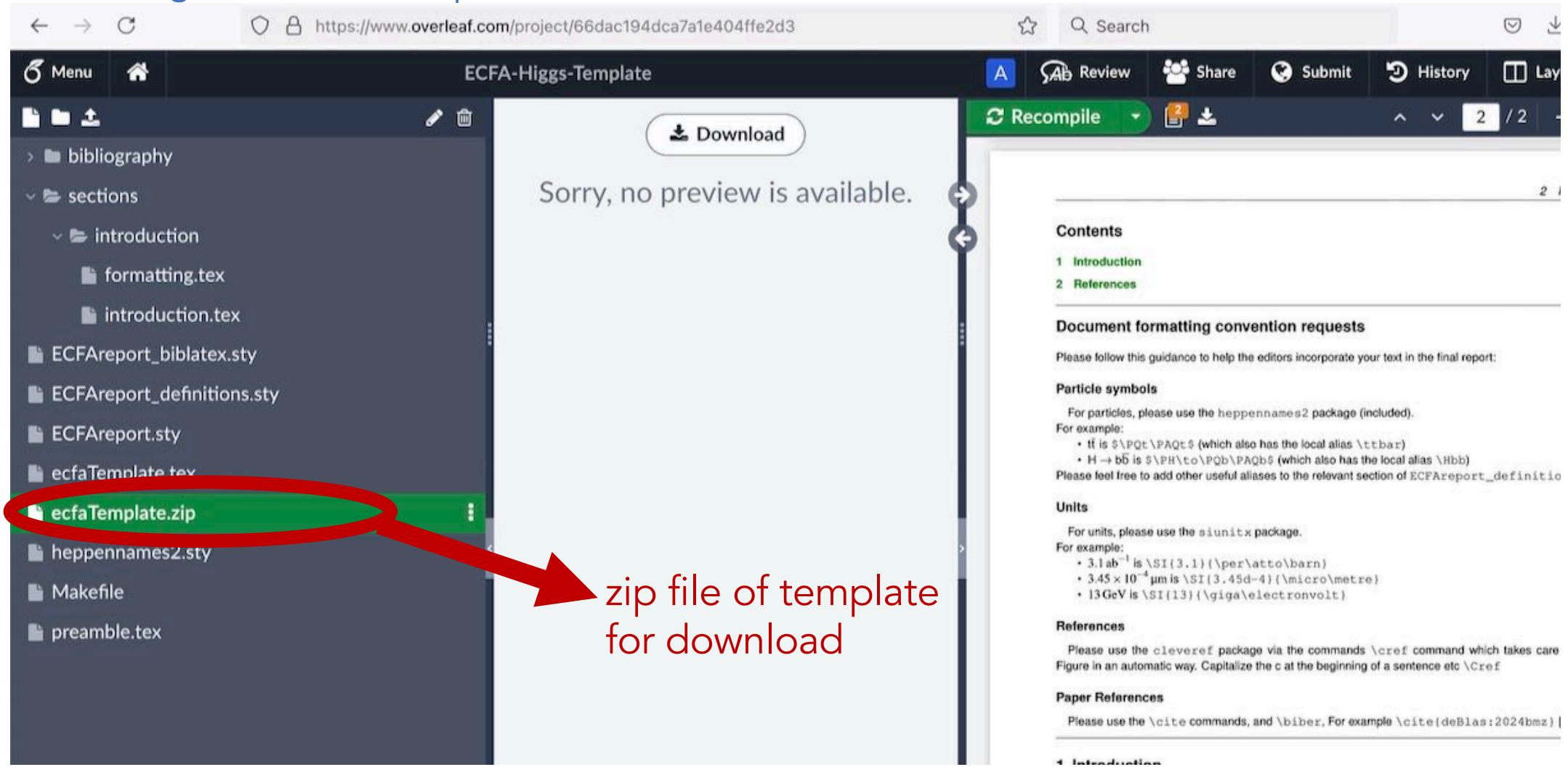
Timeline is very tight; no room for slippage!

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

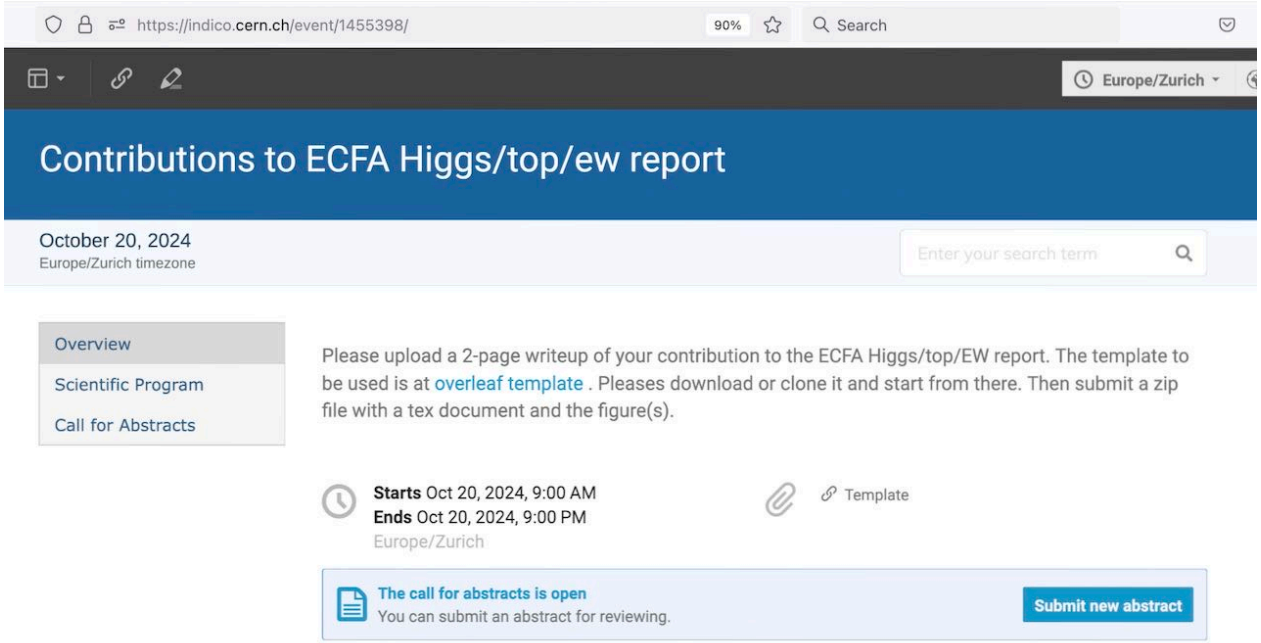
Physics studies: 2-page summaries

- Template available: https://www.overleaf.com/read/sqtfdqjvdnqd#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



Physics studies: 2-page summaries

- ***You should upload a zip file of the full source plus a pdf by 20th 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/



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

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!]

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!:

Topic	***Section editors***
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

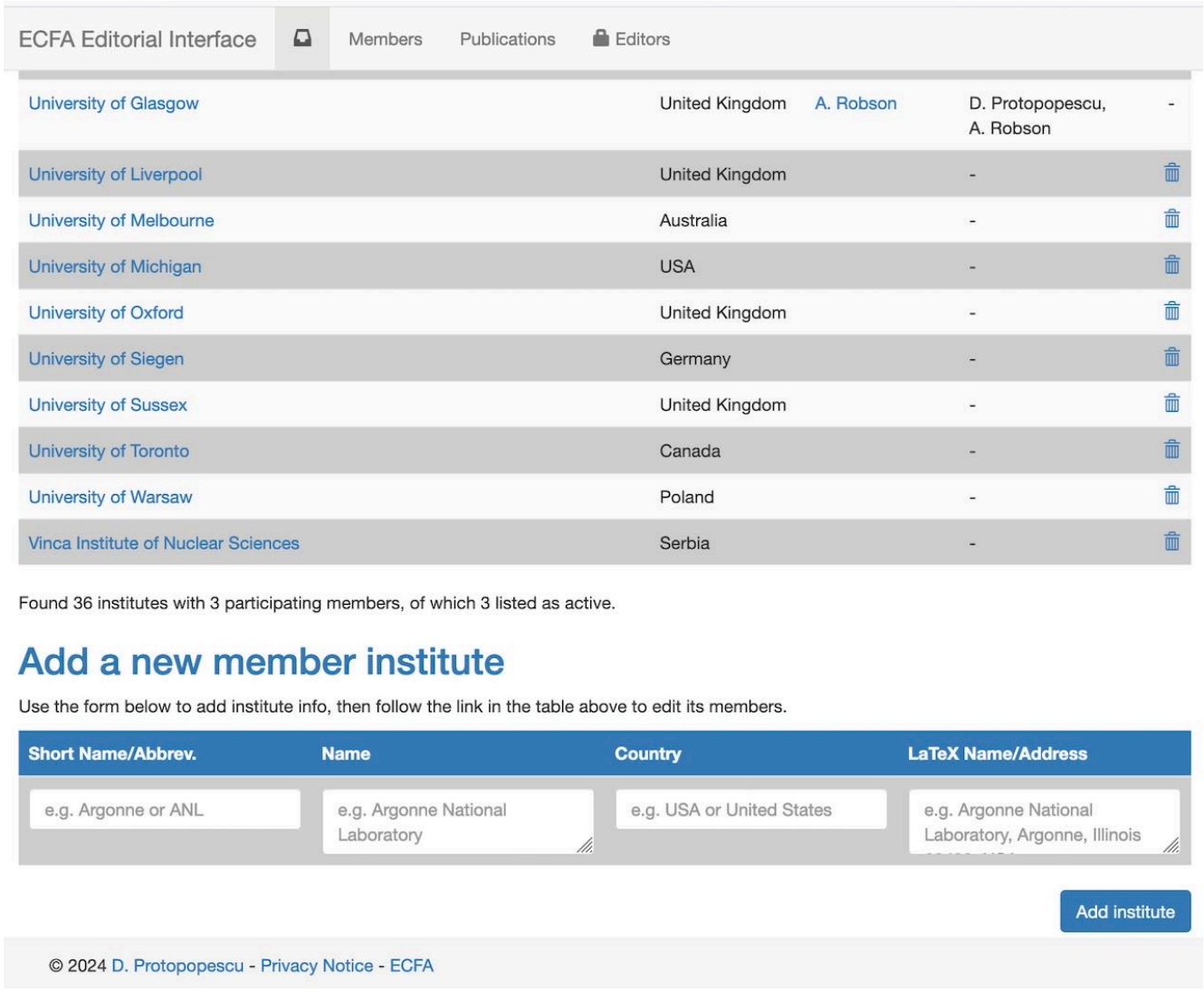
Topic

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.*



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 20th 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 Irles (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

EXscalar (SRCH)	**LLPs (SRCH)**	**EXtt (SRCH)**	**HtoSS (HTE)**	**ZHang (HTE(GLOB))**	**TwoF (HTE)**
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		
Hself (Glob)	**WWdiff (Glob)**	**TTthres (Glob(HTE))**			
Junping Tian	Patrizia Azzi	Marcel Vos	**BCFrag/Gsplit (FLAV/PREC)**	**Wmass (PREC)**	**LUMI (PREC)**
Gauthier Durieux	Timothy Barklow	Patrizia Azzi	Eli Ben-Haim	Paolo Azurri	Ayres Freitas
Jose Goncalo	Jorge de Blas	Martin Beneke	Maria Ubiali	Josh Bendavid	Ivanka Bozovic
Sven Heinemeyer	Ansgar Denner	Jorge de Blas	Andrzej Siodmok	Martin Beneke	Mogens Dam
Michael Peskin	Alexander Grohsjean	Matteo Defranchis	Simon Plaetzer	Stefan Dittmaier	Fulvio Piccinini
Philipp Roloff	Wolfgang Kilian	Gauthier Durieux	Loukas Gouskos	Simon Plätzer	Wiesław Płaczek
Roberto Salerno	Frank Siegert	Roberto Franceschini	Torbjörn Sjöstrand	Matthias Schott	André Sailer
		Andre Hoang		Raimund Ströhmer	Maciej Skrzypek
CKMWW (FLAV)	**BKtautau (FLAV)**	Adrian Irles		Graham Wilson	Graham Wilson
U. Einhaus	T. Miralles	Yasuhiro Kiyo		Jorge de Blas	
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				