

WG3@YR workshop: introduction and status so far

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YR June Plenary meeting, CERN, 18/6/2018

Workshop timeline



- ▶ June/July 2017: creation of the structure
- ▶ Oct/Nov 2017: kick-off meeting
- ▶ 21 Dec 2017: WG conveners meeting: skeleton table of contents
- ▶ March/April 2018: draft table of content, start writing
 - ▶ two WG3 meetings in April and May
- ▶ 18/20 June 2018: plenary meeting, Close-to-final table of contents
 - ▶ **This workshop!**
- ▶ September 2018: Full drafts
 - ▶ Expected: Experimental contributions + final write up theory contribution
- ▶ December 2018: executive summary and submission
- ▶ ES for PP: Open Symposium in May 2019

Status of the WG3 document: Table of content

<https://twiki.cern.ch/twiki/bin/view/LHCPhysics/HLHEWG3>

The table of content is based on the input collected so far in this online [spreadsheet](#). That does not yet included all experimental studies already done or in progress [being updat

1. Introduction and overview

1. New Physics models
2. Analysis methods and approaches
3. Treatment of systematic uncertainties

2. Supersymmetry

1. generic searches for [SUSY](#)
 - a. Prospects for realistic [SUSY](#) models at the HL-/HE-LHC (*S. Heinemeyer et al.*)
 - b. Probing [SUSY](#) at HL- and HE-LHC (*T. Han et al.*)
2. [SUSY](#) strong production
 - a. Prospects for third generation squark production at the HL-LHC and HE-LHC (*I. Vivarelli et al. ATLAS*)
 - b. same-sign dilepton [SUSY](#) (*CMS*)
3. [SUSY](#) EWK production
 - a. Prospects for [C1N2](#) via WZ and Wh in multilepton at the HL-LHC and HE-LHC (*A. de Santo et al. ATLAS*)
 - b. Prospects for chargino pair production at HL- and HE-LHC (*S. Carra' et al. ATLAS*)
 - c. Search for chargino pair production in Wh channel using 1Lbb final states (*M. D'Onofrio et al. ATLAS*)
 - d. Prospects for direct stau production at the HL-LHC (*C. Zhong et al ATLAS*)
 - e. Compressed electroweakinos at HL- and HE-LHC (*S. Amoroso et al. ATLAS*)
 - f. Prospects for radiative natural SUSy at HL- and HE-LHC (*H. Baer et al.*)
 - g. Constraining slepton and chargino through compressed top squark search (*P. Konar et al.*)
 - h. light Higgsino - ISR + 2leptons and VBS + 2leptons (*CMS*)

3. Dark Matter searches

1. DM + jets
 - a. Prospects for DM interpretations in jet+MET analysis at HL/HE-LHC (*C. Gustavino et al. ATLAS*)
 - b. Monojet searches for DM (*CMS*)
2. DM + ttbar / bbbar
 - a. Prospects for associated production of dark matter and top quark pairs at the HL-LHC (*F. Meloni et al. ATLAS*)
 - b. Prospects for associated production of dark matter and bottom quark pairs at the HL-LHC (*M. McDonald et al. ATLAS*)
 - c. HL/HE-LHC prospect for determining the CP nature of spin-0 mediators in associated production of dark matter and top pairs (*U. Haisch et al.*)
3. DM + single top
 - a. HL/HE-LHC prospect for DM and a single top-quark production in a 2HDM model with a pseudoscalar mediator (*P. Pani et al.*)
 - b. Studies of DM production in single-top events (*CMS*)
 - c. Studies of DM production in single-top events (*ATLAS*)
4. More models expected to be targeted
 - a. Prospects for pure WIMP (pure triplet) Dark Matter at HL-LHC (*L. Carminati et al. ATLAS*)

4. Long Lived particles

- a. disappearing tracks
- b. displaced vertex
- c. various interpretations? Other signatures (stable)?

5. Dark sector: dark photons

- a. Searching for dark photons via Higgs boson production at the HL-LHC and HE-LHC (*S. Biswas et al.*)

Status of the WG3 document: Table of content

- ▶ Structured in sections:
 - ▶ Section 1: Intro and review
 - ▶ Section 2: SUSY
 - ▶ Section 3: DM
 - ▶ Section 4: LLP
 - ▶ Section 5: Dark sectors
 - ▶ Sections 6 and 7: Resonances, VLQ (to be decided on possible merging)
 - ▶ Section 8: Flavor-related and Miscellanea
- ▶ HE contributions scattered around - to be seen how they fit best (dedicated section or not)
- ▶ Structure to be reviewed when all contributions are included - experimental contributions expected for September
 - ▶ i.e. could decide to have a separate section on characterisation of new signals if NP evidence is found
- ▶ Possible overlaps with other WGs also to be resolved when all contributions are included
- ▶ Incorporation of complementary experiments/facilities will depend also on the material - either separate sections or by topic

Status of WG3 document so far

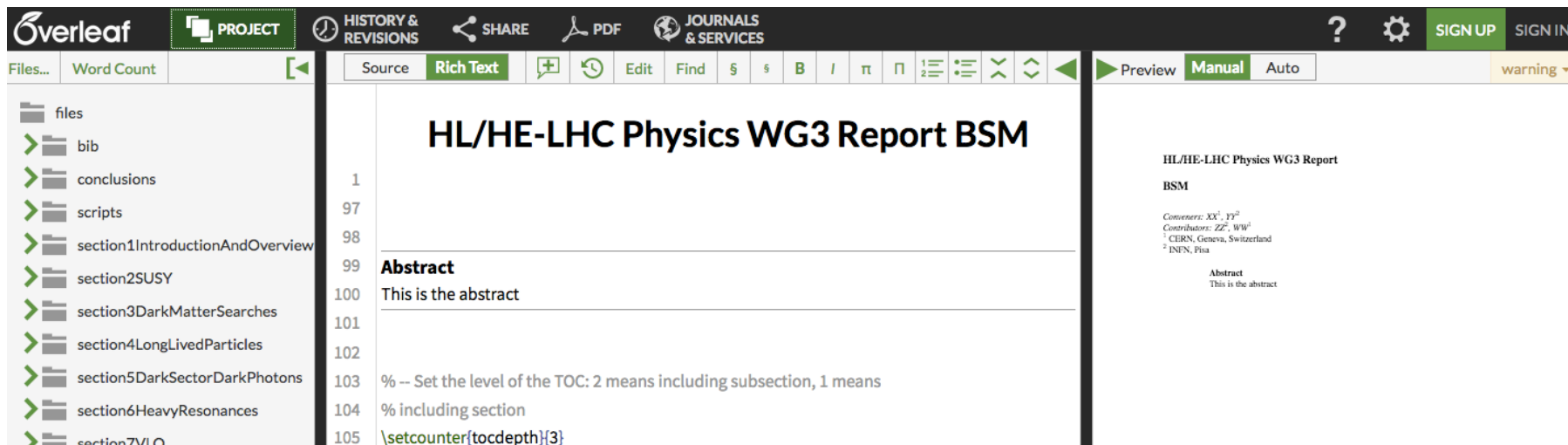
- ▶ 113 pages, theoretical contributions only, thanks to everybody who contributed so far!!

<https://www.overleaf.com/14722141bbfgfvqrrvbp#/56185127/>

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Overleaf experience

- ▶ Overleaf is the platform chosen for the YR. It allows on-line edition (similar to google-docs) and it compiles latex documents automatically.
- ▶ Working quite well and overall positive experience
 - ▶ Simple and straightforward
 - ▶ People are filling their pre-allocated sub-sections
 - ▶ Compilation mistakes are promptly fixed
 - ▶ Some babysitting needed by conveners, but less than expected



- ▶ In case you are having troubles, please let us know immediately!

Status of the analyses

- ▶ Experimental contributions:
 - ▶ Being followed within experiments
 - ▶ Readiness to be illustrated by status reports of ATLAS, CMS and LHCb at this meeting
 - ▶ SUSY, DM, Resonances, Long-Lived Particles + BSM/Higgs and BSM/Flavors talks
- ▶ Theoretical contributions:
 - ▶ Status report and a 2-page summary has been requested by 30th of May 2018 (in case you are late, please let us know)
 - ▶ Several presentations on the various topics at the meetings before this:
 - ▶ 23rd of April <https://indico.cern.ch/event/723739/>
 - ▶ 22nd of May <https://indico.cern.ch/event/727604/>
 - ▶ Results and approaches will have to be evaluated and compared where relevant

Discussion of ‘special’ section 1

- ▶ Introduction and overview should include a brief outline of the NP models considered but also
 - ▶ Analysis methods and approaches
 - ▶ Projections vs full analysis, usage and details of DELPHEs cards, assumptions made for PU (HE-LHC)
 - ▶ **Q: Include also validation plots e.g. for DELPHEs vs full CMS simulation vs ATLAS smearing?**
 - ▶ Treatment of systematic uncertainties
 - ▶ Discussion among experiments (esp. CMS and ATLAS) to ensure same assumptions are taken
 - ▶ Relevant also for theory studies
- ▶ Section to be defined once we have all material
- ▶ Also, include possible improvements and techniques
 - ▶ E.g. Proposed contribution: “ Fitting techniques using Gaussian Processes for resonance searches”

Miscellanea

- ▶ Mini-groups formed including ATLAS and CMS experimentalists to discuss common topics. E.g.:
 - ▶ SUSY: EWK higgsinos, stau pair production
 - ▶ DM + heavy flavor
 - ▶ Ttbar and other resonances (also at 27 TeV)
- ▶ Discussion on systematic uncertainties on-going
 - ▶ Talks in plenary sessions at this workshop
 - ▶ Involving SM group for theoretical uncertainties
- ▶ DELPHES code and MC samples for 27 TeV:
 - ▶ https://twiki.cern.ch/twiki/bin/view/LHCPhysics/HLHEWG_MC
 - ▶ Code in GitHub, samples in <http://fcc-physics-events.web.cern.ch/fcc-physics-events/>

In this meeting:

- ▶ we had already several reports at the previous WG3 meetings
- ▶ At this meeting we aim to review the remaining theoretical studies and some follow up on a subset of those already documented
- ▶ The agenda is a bit scattered to accommodate people, so it does not follow directly the section structure, but should be easy to follow anyway.
- ▶ Hope to have fruitful discussions!