

The electroweak sector of the SM and Run-3 operations

WG-2

Status Report

FAPESP Thematic 2020/04867-2

May 25th 2023

Marco Leite - IFUSP



1. Physics analysis

- 1.1. Precision measurements in SM
- 1.2. $HH \rightarrow bb\tau\tau$

2. Operations

- 2.1. Run-3 data taking
- 2.2. Phase-I commissioning

3. Phase-II upgrade

- 3.1. Report will go on WG-5.2

Perspectives for the next months highlighted in blue

WG-2: Physics analysis report 1: Run 2 High mTW



ATLAS Note

ANA-STD-2018-41-INT1

21st May 2022



Draft version 0.1

Details on
[kick-off meeting](#)

1

2 **Double-differential charged-current Drell-Yan cross**

3 **sections at high transverse masses in pp collisions at**

4 **$\sqrt{s} = 13$ TeV**

5 Tim Beumker^a, Christoph Dingel^a, Frank Ellinghaus^a, Alison Elliot^b, Uta

6 Klein^c, Johanna Kraus^a, Marco Leite^d, Jesal Mandalia^b, Michael O'Keefe^c,

7 Eram Rizvi^b, Frederic Schröder^a

8 ^aBergische Universität Wuppertal

9 ^bQueen Mary University of London

10 ^cUniversity of Liverpool

11 ^dUniversity of Sao Paulo

- On-going analysis, EB interaction
- ~~Wrap up still this year (?)~~ (Still needs to understand discrepancy between e and mu channels →2023)
- Unfolding tests and model systematics (Sherpa, PowhegPythia)
- **M. Leite**
 - Rivet routine for particle level kinematics
- Aiming to publication in 2023 - no more people will be involved
- Spin-off : ΓW (starting with some prospect studies in 2023). Includes Run-3
 - New MS student (P. Mascarenhas) will start to work on this next month (MC)

WG-2: Physics analysis report 2: Run 2 $Z \rightarrow \tau\tau$



ATLAS Note

ANA-STDM-2021-10-INT1

13th January 2023



Draft version 0.3.1

Measurements of high-mass di-lepton production with at least one τ -lepton and a search for leptoquarks with couplings to third-generation fermions at $\sqrt{s} = 13$ TeV with the ATLAS detector

Alderweireldt, Sara^c, Bauce, Matteo^d, Butterworth, Jonathan^b, Corradi, Massimo^d, Daumann, Caio Cesar^e, Farrington, Sinead^c, Giagu, Stefano^d, Gutschow, Christian^b, Hamity, Guillermo Nicolas^c, Hays, Chris^a, Hrynova, Tetiana^f, Juzek, Monika Katarzyna^g, Koch, Simon Florian^a, Lisboa Leite, Marco^c, Morodei, Federico^d, Mueller, Roman^h, O'Neill, Aaron Paul^h, Padovano, Giovanni^d, Pleskot, Vojtech^k, Pollard, Chris^a, Richter-Was, Elzbietaⁱ, Rieck, Patrick^j, Yue, Luzhan^b, Zhu, Yuanda^b

^aUniversity of Oxford (GB)

^bUniversity of London (GB)

^cThe University of Edinburgh (GB)

^dSapienza Università e INFN, Roma I (IT)

^eUniversidade de Sao Paulo (BR)

^fCentre National de la Recherche Scientifique (FR)

^gPolish Academy of Sciences (PL)

^hUniversitaet Bern (CH)

ⁱJagiellonian University (PL)

^jNew York University (US)

^kCharles University (CZ)

Details on

[kick-off meeting](#)

- Ongoing Run-2 analysis,
- EB request approved on Exotics (Lepton+X) Dec. 12th.
- Target is ~~Monday~~ EPS 2023
- **C. Daumann** (MS) : mass reconstruction (✓ April)
- **R. Macedo** (MS) : τ Fake factors and fake rates
- **Long range analysis (beyond Run-3)**, will also involve charged current, new interpretations etc.

Study of the Z boson mass reconstruction in the $Z \rightarrow \tau\tau$ process in proton-proton collisions at $\sqrt{s} = 13$ TeV in the ATLAS experiment

Caio Cesar Daumann

Supervisor: Prof. Dr. Marco Aurélio Lisboa Leite

Dissertation submitted to the Physics Institute of the University of São Paulo in partial fulfillment of the requirements for the degree of Master of Science.

Examining Committee:

Prof(a). Dr(a). Marco Aurélio Lisboa Leite - Orientador (IFUSP)

Prof(a). Dr(a). André Azevedo Nepomuceno (UFF)

Prof(a). Dr(a). Antonio Vilela Pereira (UERJ)

WG-2: Physics analysis report 4: Run 2 HH \rightarrow bb $\tau\tau$



ATLAS Note

ANA-HDBS-2019-27-INT1

24th May 2023



Draft version 0.4

Details on
[kick-off meeting](#)

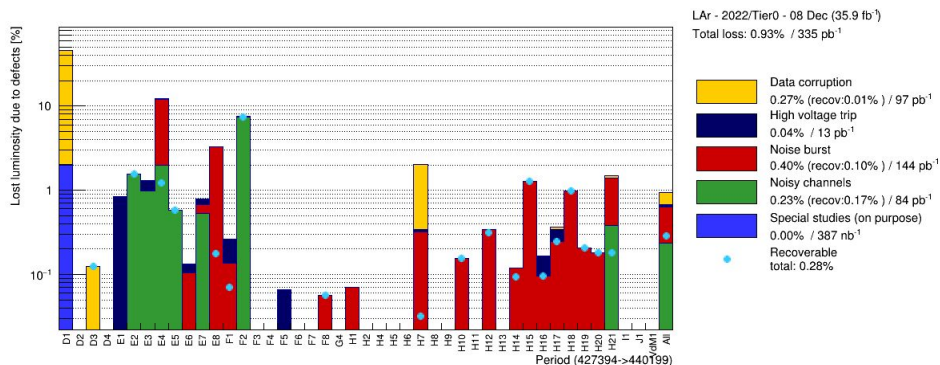
Legacy search for the non-resonant production of Higgs boson pairs via gluon fusion and vector-boson fusion in the $b\bar{b}\tau^+\tau^-$ final state in proton-proton collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector

Ali, Shahzad^a, An, Shiwen^b, Atashi, Shaghayegh^c, Bellos, Panagiotis^d, Bernardi, Gregorio^e, Betti, Alessandra^f, Buat, Quentin^g, Cairo, Valentina^h, Carquin Lopez, Edsonⁱ, Dao, Valerio^h, Deiana, Allison Mccarnⁱ, Deutsch, Christopher^j, Dimitriadi, Christina^j, Dingfelder, Jochen Christian^j, Donadelli, Marisilvia^k, Ferrari, Arnaud^l, Fuenzalida Garrido, Sebastian Julio^l, Granados, Kyle Angelo^m, Grimm, Kathryn^m, Guhit, Jem Aizen Mendiolaⁿ, Han, Liangliang^o, Haslbeck, Florian^{h, p}, Higuchi, Yu Nakahama^b, Karkout, Osama^q, Koeneke, Karsten^r, Lai, Stan^s, Leney, Katharineⁱ, Lenz, Tatjana^j, Li, Ang^e, Li, Tong^e, Liu, Yanlin^l, Longarini, Iacopo^c, Marchiori, Giovanni^e, Melo, Andres Hugo^s, Moser, Brian^h, Moss, Joshua^m, Nikolopoulos, Konstantinos^d, Ordek, Serhat^u, Pandini, Carlo Enrico^q, Paraskevopoulos, Christos^v, Reynolds, Elliot^w, Sauerburger, Frank^f, Schwarz, Thomas Andrewⁿ, Taffard, Anyes^c, Togawa, Manabu^b, Varol Mete, Tulin^a, Veatch, Jason Robert^m, Wang, Song-Ming^a, Windischhofer, Philipp^x, Wollrath, Julian^c, Xu, Zifeng^o, Zhang, Lei^o, Zhang, Sijing^l, Zhang, Yulei^{c, y}

- Full Run-2 dataset analysis with focus on κ_λ and κ_{2V} optimisation
- **M. Donadelli** :
 - contact editor, MVA analysis strategy, VBF/ggF categorisation
 - contributions in : $\tau_{\text{had}}\tau_{\text{had}}$ and $\tau_{\text{lep}}\tau_{\text{had}}$ channels
- **EB meeting in January: publication target for LHCP (May 2023)**
- **Ramping up with Run-3 commitments (see next slides)**

WG-2: Run 3 Operations

- Intense period of commitment for **9 weeks (24 hour-shift) (M. Donadelli)**
- DQ assessment to declare good runs for physics and calibration analysis for both main readout and digital trigger (Phase I Upgrade)
- Improvement of DQ infrastructure with reprocessing campaigns and training for newcomers
- LAr performing well, ~1% of data loss during all 2022 GRL (35.9 fb⁻¹)
- Annual effort during Run 3 (end of 2025)
- Y. Coutinho (UFRJ) joining effort in 2023



Express sign-off

- RUNS with STABLE BEAMS : 435229 ([jira](#)), 435333 ([jira](#)), 435678 ([jira](#)), 435816 ([jira](#)), 435831 ([jira](#)), 435854 ([jira](#)), 435931 ([jira](#))

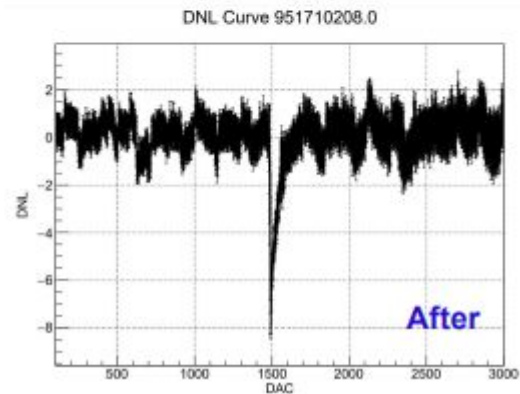
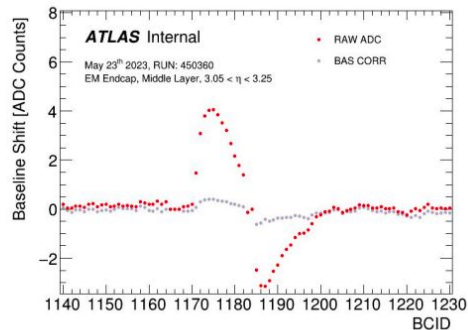
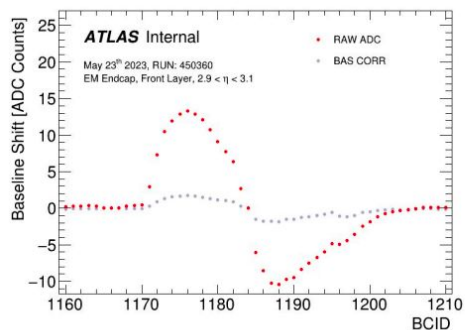
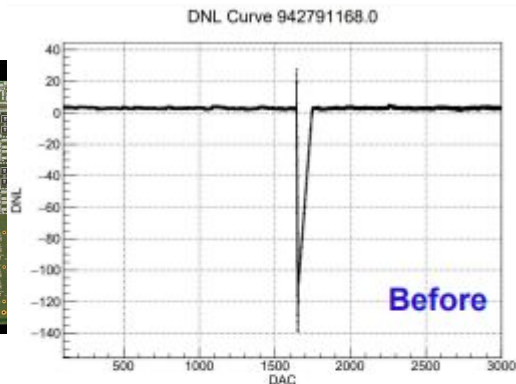
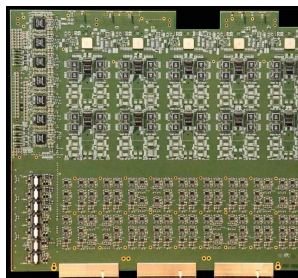
Reprocessing 427596 - 431493 (f1265_h393) to correct for LAr pileup noise (DATREP-237)

- Status of the assessment: [spreadsheet link](#)
- Covered until Monday Sep 19th, **covered afterwards, beam spot correction runs, including the ones since Friday, Sep 30**
- 427882 [jira link](#) 428071 [jira link](#) 429452 [jira link](#) 430178 [jira link](#) [430897](#) [jira link](#)
- 427883 [jira link](#) 428353 [jira link](#) 429469 [jira link](#) [430183](#) [jira link](#)
- 427884 [jira link](#) 428580 [jira link](#) 429470 [jira link](#) [430488](#) [jira link](#)
- 427885 [jira link](#) 428648 [jira link](#) 429603 [jira link](#) [430490](#) [jira link](#)
- 427892 [jira link](#) 428700 [jira link](#) 429606 [jira link](#) [430526](#) [jira link](#)
- 427911 [jira link](#) 428747 [jira link](#) 429612 [jira link](#) [430336](#) [jira link](#)
- 427914 [jira link](#) 428770 [jira link](#) 429716 [jira link](#) [430341](#) [jira link](#)
- 429606 [jira link](#) 428777 [jira link](#) 429782 [jira link](#) [430542](#) [jira link](#)
- 427927 [jira link](#) 428855 [jira link](#) 429929 [jira link](#) [430580](#) [jira link](#)
- 428759 [jira link](#) 429027 [jira link](#) 429940 [jira link](#) [430648](#) [jira link](#)
- 427929 [jira link](#) 429137 [jira link](#) 429993 [jira link](#) [430702](#) [jira link](#)
- 429018 [jira link](#) 429142 [jira link](#) 430036 [jira link](#) [430896](#) [jira link](#)

WG-2: Run 3 Operations

- Liquid Argon Calorimeter Operations
- Phase-I Upgrade Liquid Argon Trigger Digital Board (LTDB) commissioning studies
- **R. Estevam (TT-2) : 2 very important contributions**
 - ADC non-linearities and calibration across all calorimeter ($\sim 320\text{ch} \times 128$ boards)
 - Baseline correction of performance studies for LATOME firmware with offline data
 - **Very important for 2023 ($\langle u \rangle = 60 \sim 70$)**

Public plots by R.Estevam approved by ATLAS,
new ATLAS internal note in preparation :




WG-2: Deliverables

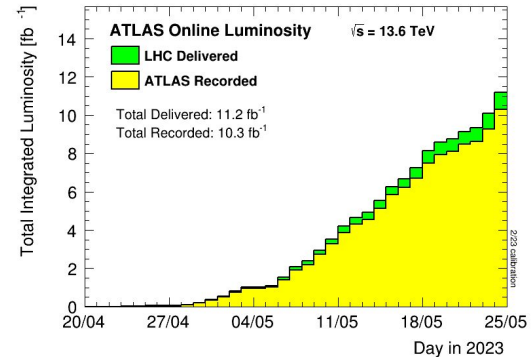
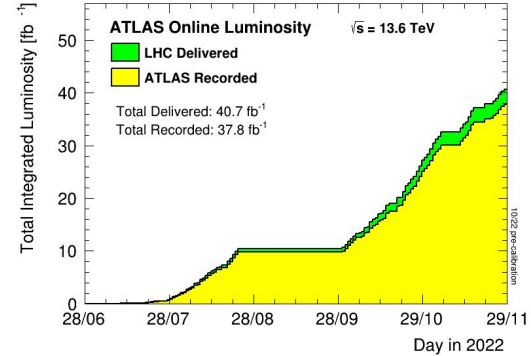
- ATLAS journal publications during the period (07/2022 -> today)
 - **ATLAS Collaboration** : 24
- ATLAS editorial Boards :
 - **ML**: "Measurement of The Lund Jet Plane in $t\bar{t}$ Events" (ANA-STDM-2020-31)
 - **MD**: "A search for decays of the Higgs boson into a pair of pseudoscalar particles in the $b\bar{b}\tau\tau$ final state using pp collisions at $s\sqrt{= 13}$ TeV with the ATLAS detector" (ANA-HDBS-2021-07)
- ATLAS appointments :
 - **ML**: ATLAS Executive Board (until Feb. 2023)
 - **ML**: ATLAS Upgrade Speakers Committee (04/2020 -> 04/2024, Chair 2023->)
 - **ML**: ATLAS Upgrade Steering Committee (Member, 04/2020 -> 04/2024)
 - **ML**: ATLAS International Computing Board (Member)
 - **ML**: ATLAS Search Committee for SCAB members (12/2022)
- ATLAS presentations in ATLAS internal meetings
 - **ALL**: 33 (SM, Higgs, LAr, HGTD)
- ATLAS Class-2 Shifts (Expert on Call)
 - **MD**: 88 days in 2022 (Calorimeter Calibration and Data Quality)
- ATLAS presentation in conferences
 - **MD**: Highlights from ATLAS (Lishep 2023)
- ATLAS Upgrade Technical support
 - **MK, RM**: 0.5 FTE 2022, 0.5 FTE 2023

WG-2: Final remarks and action items

- All analysis : on track (benefit from ATLAS pace and organization)
 - Regular reports on ATLAS analysis groups
- Commitments on Run 3 operations → LAr subsystem : on track
 - Data quality and calibration @ CERN
 - Phase-I commissioning

Action items for next months

- $Z \rightarrow \tau\tau$
 - Resonant and non-resonant leptoquark signal generation (analysis)
 - τ polarization modeling impact on phase space analysis
- $HH \rightarrow bb\tau\tau$
 - EB final interactions by early 2023
 - **Ramp-up Run-3 analysis with UERJ (MB)+ UFRJ (YC)**
 - **common HH analysis software development**
 - **MC signal samples (non-resonant and resonant): consider new calculations/treatments and coordinate with LHC-HWG-HH)**
- Presence at CERN: Class-2 & 3 Shifts
- Phase-I LTDB commissioning :
 - FAPESP TT-II for R. Estevam (2-3 months CERN presence for LAr) 



BACKUP

WG-2: Physics analysis report 3: Run 2 $HH \rightarrow bb\tau\tau$

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN)



CERN-EP-2022-109
23rd September 2022

Search for resonant and non-resonant Higgs boson pair production in the $b\bar{b}\tau^+\tau^-$ decay channel using 13 TeV pp collision data from the ATLAS detector

Details on [kick-off meeting](#)

- Paper submitted on Sep. 22nd 2022 !
 - <https://arxiv.org/abs/2209.10910>
- Sensitivity improved by factor of four on the previous ATLAS search (Phys. Rev. Lett. 121, 191801 (2018))
- **M. Donadelli**
 - contributions in : $\tau_{\text{had}}\tau_{\text{had}}$ and $\tau_{\text{lep}}\tau_{\text{had}}$ channels
- Many implications for Run 3 over the next years