ATLAS Experiment – Physics and Operations

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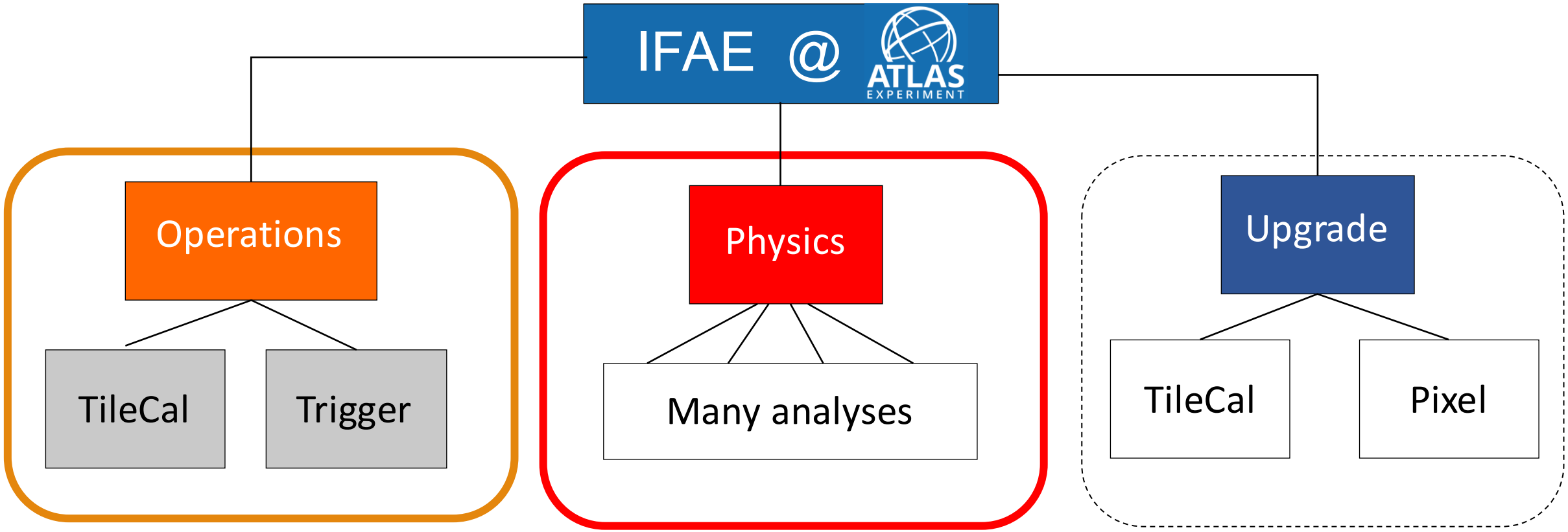
on behalf of the IFAE-ATLAS group

18th May 2026

Meeting with Tsung-Dao Lee Institute

Overview of IFAE activities in ATLAS



See talk by S. Grinstein

Operations: Tile Calorimeter and Trigger

Major contributions to TileCal

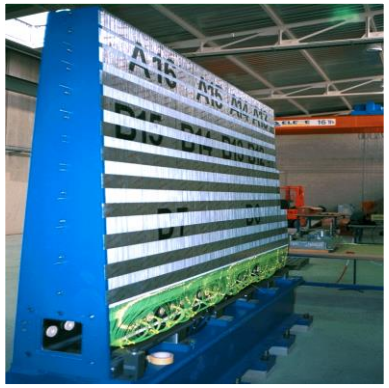
- Construction of one "**Extended Barrel**"
  - All 64 modules assembled and instrumented at IFAE

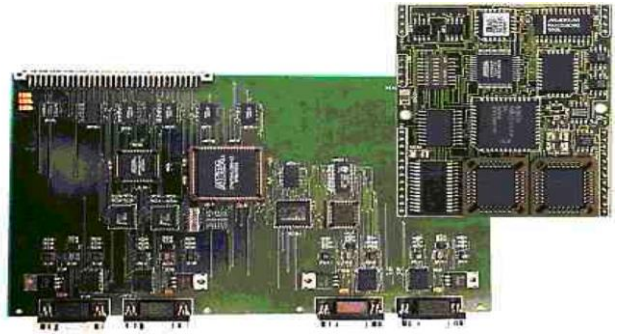
Current activities

- Contributing with shifts and Tilecal run coordination
- Studies of TileCal performance and detector aging
- Luminosity measurement with TileCal integrator

HL-LHC upgrade activity

- Design and production of 40% of 1024 mini-drawers
- Plan to participate in the assembly and installation



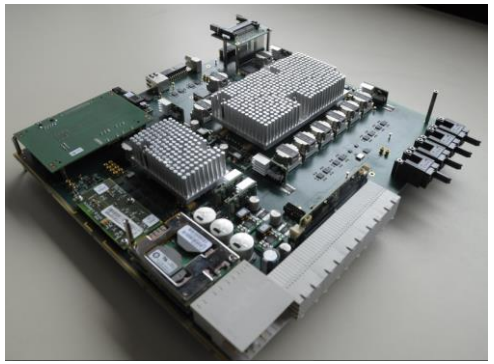


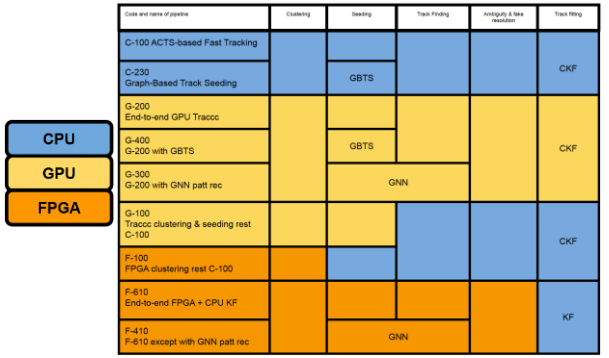
Major contributions to Trigger

- Commissioning and operation of the trigger since Run 1
- Held various coordination roles through the years
- Contributions to HLT infrastructure, tau trigger, jet trigger
- Responsibility of the simulation and commissioning of the L1 Topological trigger in Run 2 and currently in Run 3

HL-LHC upgrade activity

- Participation in the Event Filter Tracking activity
  - Performance evaluation and GPU code optimization
- Coordinating the Phase-II physics and performance group and participating in the trigger algorithms review panel





Current physics analyses in IFAE

Top physics

Top-quark measurements
- 4-top production
- ttH/tH

BSM physics

Extended Higgs sector
- Heavy Higgs bosons
- Light scalars

SUSY
- Electroweakinos

Other new particles
- Vector-like leptons
- Leptoquarks

Model-agnostic searches

Multi-Higgs physics

HH/HHH searches
- HH → 4b / 2b2τ
- HHH → 6b / 4b2τ

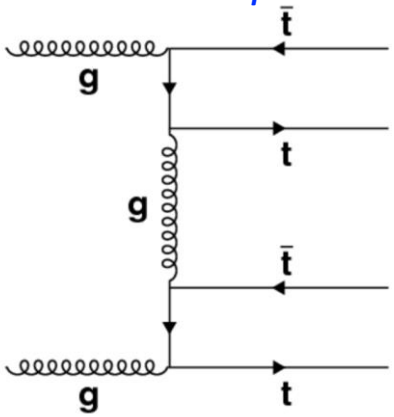
Generally motivated by excesses observed in previous analyses

Top and top/Higgs analyses

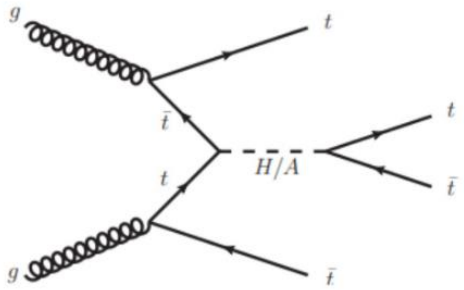
Analyses of four top quark events

- Both **SM production measurement** and **search for heavy Higgs decays to a pair of top-quarks**
- Involved in the 2lSS/≥3l final states
- Using full Run 2 and partial/full Run 3 data

SM 4-tops

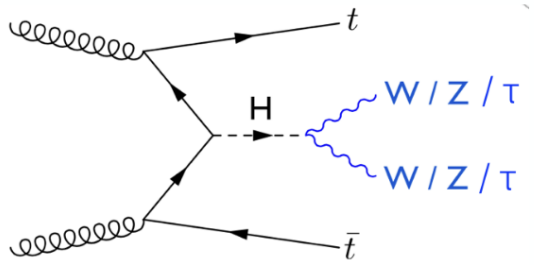


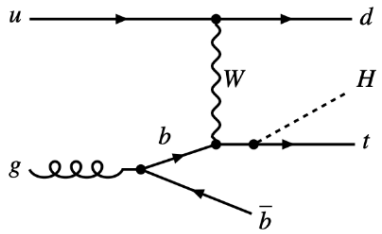
BSM 4-tops

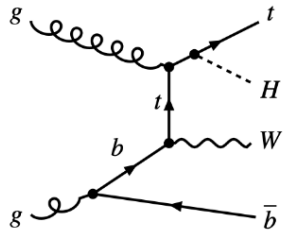


Simultaneous search for ttH/tH production

- Focus on the 2lSS/≥3l channels, most sensitive
- Plan to measure inclusive and differential STXS cross-section
- Using full Run 2 and full Run 3 data

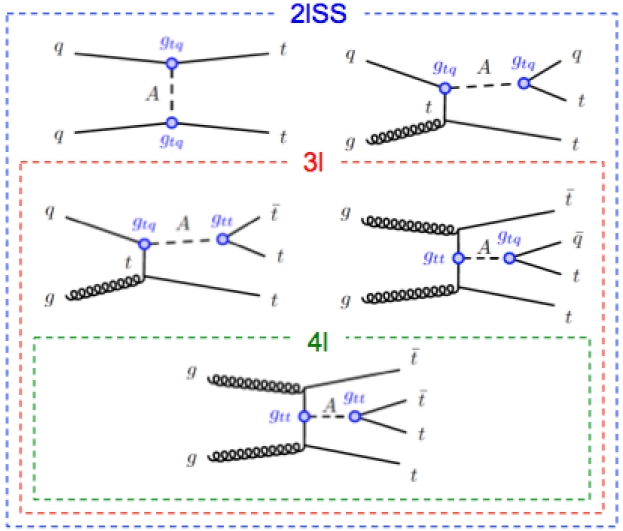






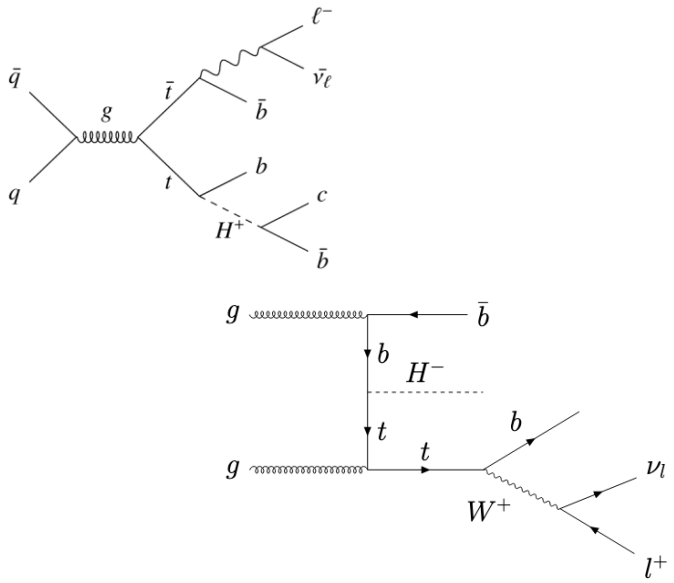
BSM – new scalars and anomaly detection

- **Search for flavour-violating neutral scalars as predicted by a General 2HDM** with a sophisticated search of multiple channels including taus



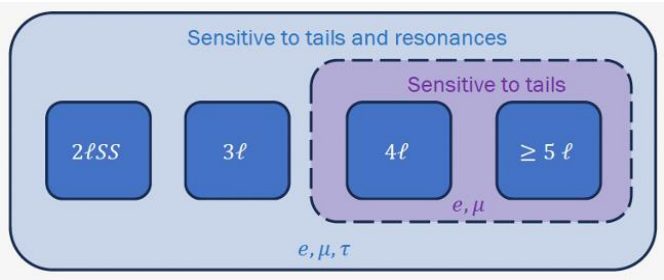
- Previous analysis found a local excess of 2.8σ at m_A=900 GeV and large flavour-violating g_{tu} coupling

- **Search for charged Higgs $H^+ \rightarrow cb$** with full Run 2 and partial Run 3 in a wide mass range and using c-tagging



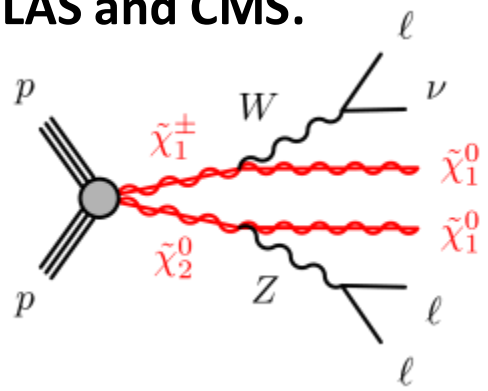
- Previous analysis found a local excess of 3σ at m_{H+}~130 GeV, consistent with mass resolution

- **Anomaly detection search with multi-lepton events**
- Novel **model-agnostic search** using an anomaly score to detect non-SM-like events
- Extends the previous analysis with more multi-lepton channels

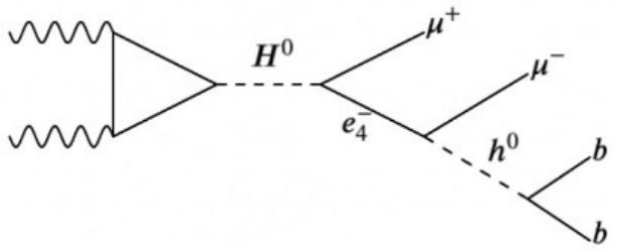


BSM – SUSY/VLL/LQ

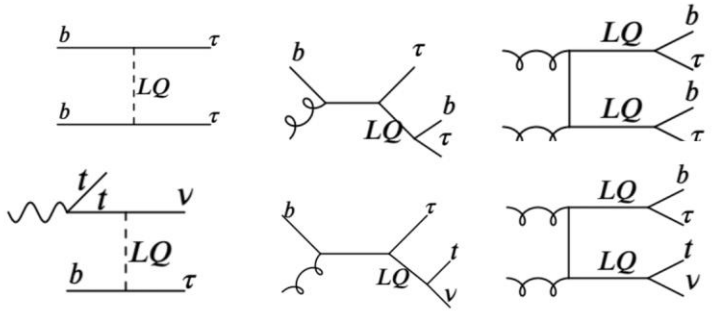
- **Search for chargino/neutralino** in 2l/3l+Etmiss
- New analysis targeting a previously unexplored signature using Run 2 + Run 3 data.
- **Following previous excess by ATLAS and CMS.**



- **Search for Vector-like Leptons** in 2l+bjets in a VLL+2HDM model
- New analysis targeting yet an unexcluded region
- Decay to VLL singlet for VLL mass > 320-400 GeV and heavy Higgs mass > 350-400 GeV



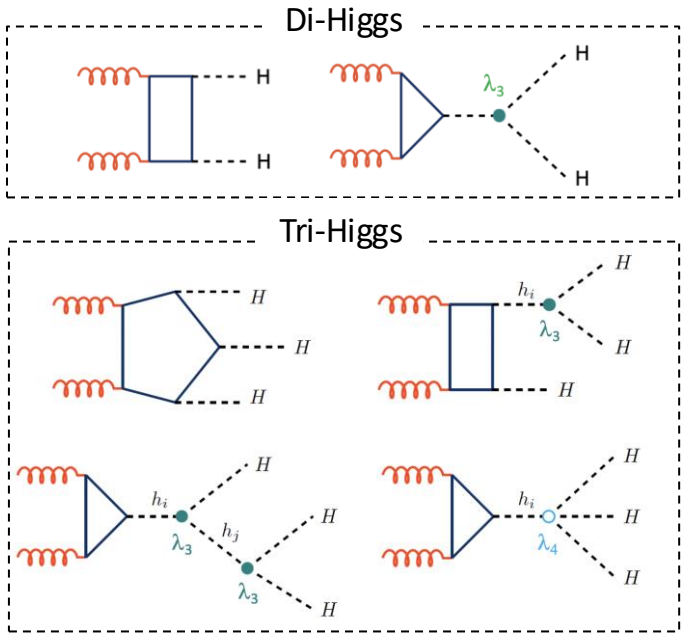
- **Search for 3rd generation Leptoquarks in tau final states**
- Probing in a **single search all relevant production and decay modes**
- Covering non-resonant and single/double resonant
- To interpret in the coupling-mass plane. Sensitive to space consistent with R(D), R(D*) anomalies



Multi-Higgs searches

- **Important analyses to probe the shape of the Higgs potential by measuring the Higgs self coupling** (trilinear and quartic)
- Involved in some of the highest profile **di-Higgs** and **tri-Higgs** physics analyses channels:

- **Di-Higgs:**
  - HH ⟶ bbττ
  - HH ⟶ 4b
- **Tri-Higgs:**
  - HHH ⟶ 4bττ
  - HHH ⟶ 6b



ATLAS Run 2