

CMS Experimental Activity @ IoP

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Group Status & Activity

The CMS experimental activity @IOP started from beginning of 2016: **~1.5 years old**

- One faculty member

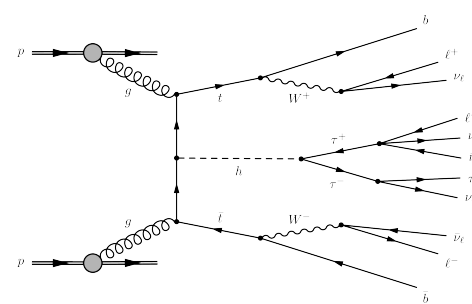
Current Activities:

- Physics analysis, development of object identification methods, development of high level trigger, participation in the R&D of CMS detector upgrade

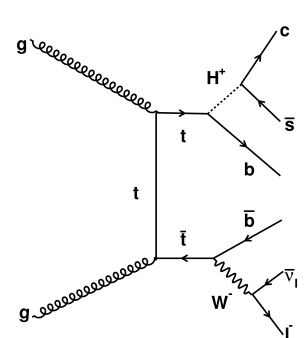
Physics analyses:

- Measurement of Higgs boson to top quark coupling in $t\bar{t}H$, $H \rightarrow \tau\tau$ channel.
- Search for a charged Higgs boson in top quark decay using the search channel $t \rightarrow bH^+$, $H^+ \rightarrow c\bar{s}$

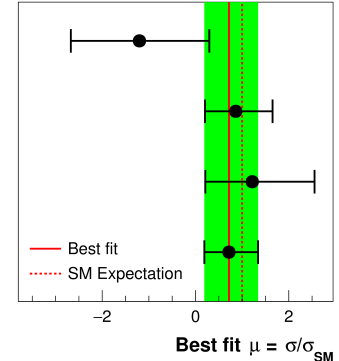
CMS-PAS-HIG-17-003



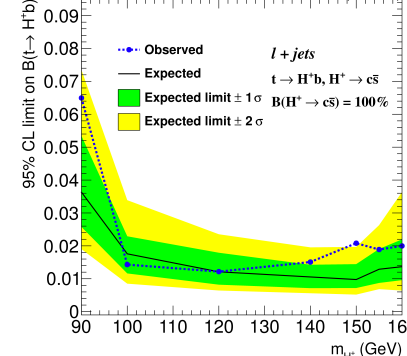
JHEP 12 (2015) 1



CMS Preliminary 35.9 fb⁻¹ (13 TeV)



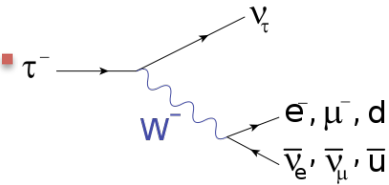
CMS 19.7 fb⁻¹ (8 TeV)



Group Status & Activity

Development of object reconstruction techniques

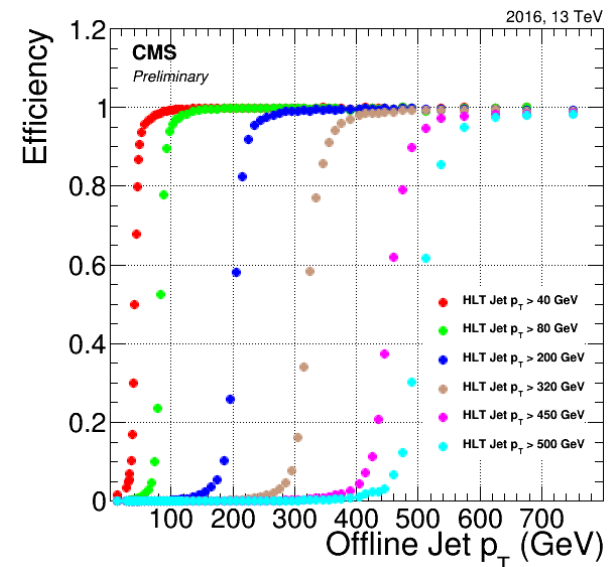
- Development and performance study of tau lepton identification in their hadronic decays
 - Served as co-convener of the group for last 2 years.
 - Now leading the effort on performance measurement in 2016 data



Decay mode	Meson resonance	\mathcal{B} [%]
$\tau^- \rightarrow e^- \bar{\nu}_e \nu_\tau$		17.8
$\tau^- \rightarrow \mu^- \bar{\nu}_\mu \nu_\tau$		17.4
$\tau^- \rightarrow h^- \nu_\tau$		11.5
$\tau^- \rightarrow h^- \pi^0 \nu_\tau$	$\rho(770)$	26.0
$\tau^- \rightarrow h^- \pi^0 \pi^0 \nu_\tau$	$a_1(1260)$	9.5
$\tau^- \rightarrow h^- h^+ h^- \nu_\tau$	$a_1(1260)$	9.8
$\tau^- \rightarrow h^- h^+ h^- \pi^0 \nu_\tau$		4.8
Other modes with hadrons		3.2
All modes containing hadrons		64.8

Development of High Level Trigger

- Leading the Jets and Missing Transverse Energy Trigger development in CMS High Level Trigger (HLT)
 - Co-convener of Jet & Missing E_T trigger group
- The CMS HLT is a computing farm where a offline like object reconstruction algorithms, but faster for timing requirement, are developed/used to select events

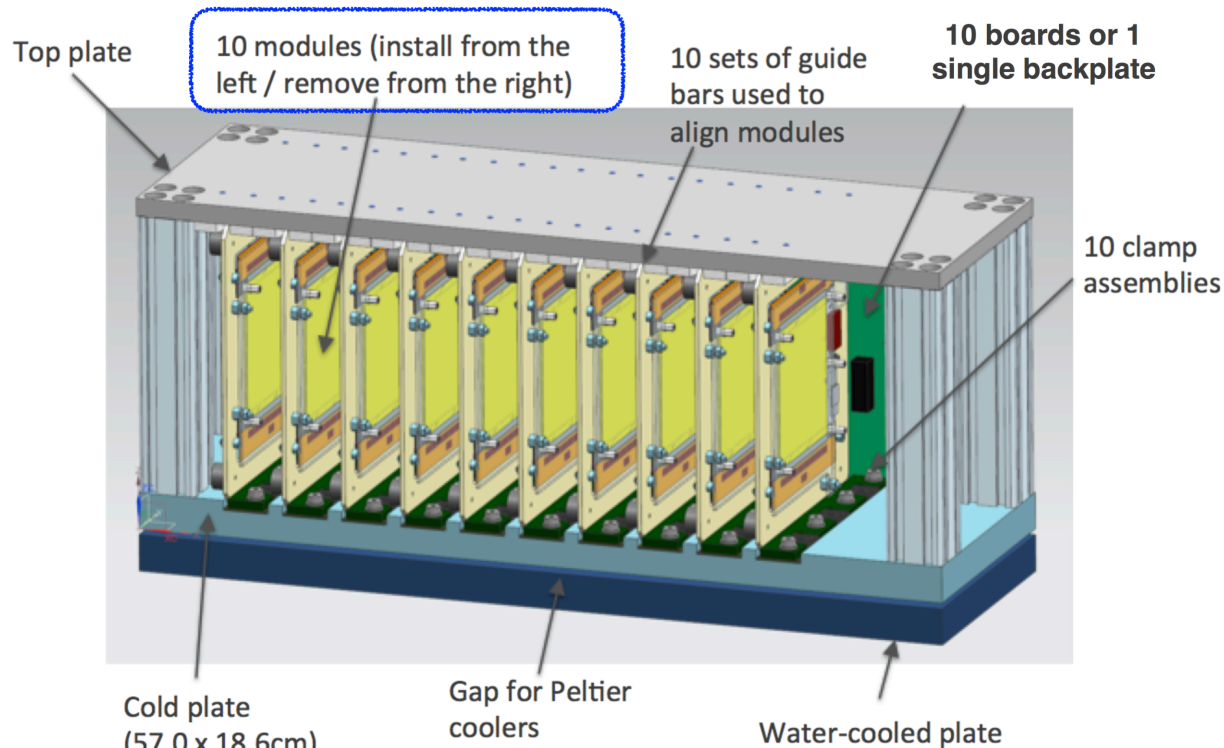


(Jet trigger performance in 2016)

Group Status & Activity

Detector R&D for CMS upgrade:

- Starting R&D activities for CMS silicon-strip tracker upgrade for high luminosity LHC (HL-LHC)
- Plan to contribute to the si-strip tracker module testing
 - Tests at temperature cycle of 20C, -30C, 20C (between room and operating temperature)
 - In contact with Fermilab group to build a cold burn-in system for this purpose



(Design from Fermilab)

Previous Experience

Participating in the CMS experiment for more than 10 years (both during PhD & Post-docs)

- PhD: Tata Institute of Fundamental Research, Mumbai
- Post-Docs: (1) **LIP**, Lisbon, Portugal, (2) IRFU, CEA, **Saclay**, France, (3) **DESY**, Hamburg, Germany

Physics Analyses

- Higgs Physics: Searches for SM & MSSM $H \rightarrow \tau\tau$, Charged Higgs searches in $\tau\nu$ & $cs(\bar{c})$ channels, SM Higgs CP measurement
- Top Quark Physics: Cross section measurements of top pair production
- SM measurements: Z+b-jet cross section measurement
- Cosmics: Measurement of cosmic muon charged asymmetry

Object Reconstruction & Calibration

- Development of hadronic tau decay identification algorithms (Led the group for two years)
- Data driven quark/gluon Jet energy calibration
- Calibration with pion test beam data

Previous Experience

Trigger Development & Performance study

- High Level Trigger paths development and performance measurement with taus (Led the group for two years)
- High Level Trigger development and performance measurements for jets and Missing E_T (Leading the group currently)
- Level-1 Trigger performance measurement for e/γ , jet and missing E_T triggers

Detector R&D:

- Participated in the R&D of silicon-strip tracker mechanics for phase-II CMS detector upgrade (during post-doc at DESY)
- Studied plastic scintillator characteristics for Outer Hadron calorimeter (during PhD).

Detector Operation

- Online and offline shift for trigger and DQM monitoring

Future Plans of the Group

Continue participation in the CMS experiment at LHC

- Plan to strengthen the group with, possibly one, more faculty member(s). And broaden our contribution to the CMS programme.
- Continue contribution to the physics analyses during next years (LHC run-2 & run-3)
- Planning R&D for contribution to phase-II CMS detector upgrade (as part of the contribution from Indian Institutes)

Explore possibilities to participate in other experiment(s)

- Depending on the strength of our group, we may be interested to participate in another experiment.
- Interest in contributing to both physics and, if possible, hardware activities
- Options are open, but depends on available manpower