Our HEP group activities in Tau Physics

Centro de Investigación y estudios Avanzados del Instituto Politécnico Nacional

Universidad Autónoma de Sinaloa

Universidad Nacional Autónoma de Mexico

Benemerita Universidad Autónoma de Puebla

Pedro Luis Manuel Podesta Lerma, Tau Workshop, Cinvestav Mexico
In a Nutshell

• Large Angle Beamstrahlung Monitor (LABM)
• Computing resources, Two Grid Nodes (GRID)
• Software for Grid, Analysis (ANALYSIS)
• Physics phenomenology (PHYSICS)

FUNDING

• This is based in two main projects from CONACYT:
  - “Participación Mexicana en superb” (CB 2012/180233) 4.3 Million Pesos
  - “Asimetría materia-antimateria en el universo y la búsqueda de nuevas leyes fundamentales de la física mediante medidas de alta precision” FC 2015/296, 4 Million Pesos
**Hardware**

The Large Angle beamstrahlung Monitor (LABM)

- Beam monitor based in visible light produced by one beam due EM field of the other beam
- We work in electronics, DAQ, control, installations and operations
- Key role in accelerator commissioning
- Japan/EUA/Saudi Arabia /Mexico collaboration

Superkekb nanobeam scheme
Mirrors remotely controlled

Optical Channels

HV, LV and counters

Data

Electronic card
Computing

Sites

Two grid nodes one in Sinaloa that is the first Grid Node, and other in Mexico city.
Computing

Mexico provides approximately 3% of computing resources for Belle II
Software

Grid developing:
Data transfers, developing tools to monitor storage space, and others

Montecarlo production:
In charge of Montecarlo production for Tau group, implemented recent version of Tauola and models

Tau analysis tools development:
General software tool skimming, data formats etc.
Theoretical Physics

In close collaboration with theorists in our Group:

- Estimate of backgrounds and Form factor models in searches of Second Class Currents in tau decays at Belle II

- Study of Lepton-Number violating decays of tau leptons and B mesons

- Implementation of hadronic channels in TAUOLA

- Discussions on common topics of interest in tau lepton physics: hadronic channels, lepton-flavor violating modes, hadronic inputs for precision observables (muon g-2, $V_{us}$), Lepton Universality tests, Tests of V-A structure of charged weak current ....
Recent publications on tau physics of our HEP group (last five years):

1.- “$\tau \to \eta^{(')} \pi \nu \gamma$ decays as background in the search for second class currents”,

2.- “Five-body leptonic decays of muon and tau leptons”,

3.- “LFV in hadronic decays of the tau lepton in the simplest little Higgs model”,

4. “Predictions on the second class currents decays $\tau \to \pi \eta^{(')} \nu$”, R. Escribano,

5.- “Combined analysis of the decays $\tau \to K_{S} \pi - \nu$ and $\tau \to K - \eta \nu$”, R. Escribano,
S. Gonzalez-Solis, M. Jamin and P. Roig, JHEP 1409, (042 (2014)

6.- “Weak radiative pion vertex in $\tau \to \pi \ell + \ell - \nu_{\tau}$ decays”,
Recent publications on tau physics of our HEP group (last five years):

7.- “Resonance chiral lagranian currents and experimental data for \( \tau \rightarrow \pi \pi \pi \nu \)”,

8.- “\( \tau \rightarrow K \eta^{(*)} \nu \) decays in chiral perturbation theory with resonances”,

9.- “Dispersive representation of the pion form factor in \( \tau \rightarrow \pi \pi \nu \) decays”,

10.- “Resonance Chiral lagrangian analysis of \( \tau \rightarrow \eta \pi \pi \nu \) decays”,

11.- “Resonance chiral lagrangian currents and \( \tau \) decay Monte Carlo”,

12.- “Lepton number violating four-body tau lepton decays”,
Universidad Autonoma de Sinaloa (UAS)

Isabel Dominguez Jimenez
- Belle II Member
- Works in Analysis and computing
- LNV in Tau

Pedro Podesta Lerma
- Professor
- Works in LABM an analysis
- LNV and LFV in Taus
Universidad Autonoma de Sinaloa (UAS)

Samuel Doeg Izaguirre
- Undergraduate student
- Worked in LABM hardware
- Currently is doing a PhD in Wayne also for LABM

Daniel Ricalde Herrman
- Undergraduate student
- Working in simulation of the synchrotron background for LABM

David Rodriguez Perez
- PhD Student
- Belle II Member
- LNV in Taus
- Work in Analysis and software
Benemérita Universidad Autónoma de Puebla (BUAP)

Guillermo Tejeda Muñoz

- Works in LABM
- Interested in detector development
Universidad Autónoma de Mexico (UNAM)

Genaro Toledo Sánchez  
- Professor  
- Belle II Member  
- Works in phenomenology for analysis

Master Students

Marxil Sanchez.

- Lepton number violation in B decays

Mariana Bolaños.

- Lepton number violation in tau decays

Antonio Rojas.

- Hadronic Tau decays
Centro de investigación y estudios avanzados del politecnico nacional (CINVESTAV)

Gabriel Lopez Castro
- Phenomenology for analysis
- Tau, Bs

Eduard de la Cruz Burelo
- Data analysis
- Taus, Bs

Ivan Heredia de la Cruz
- Data analysis
- Exotic states

Pablo Roig
- Phenomenology for analysis, Tauola Models
- Taus, Bs
Centro de investigacion y estudios avanzados del politecnico nacional (CINVESTAV)

- Jorge Luis Reyes
  - Second class currents, hadronic decays in Taus

Gerardo Hernandez Tome
- Phenomology in Tau decays for Belle II data

Jorge Martinez
- Data Analysis

Estela Garces
- Second class currents

Adolfo Guevara
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Master
LFV Thesis

- Jesus Avendaño
- Jorge Pacheco
- Alejandro Yta
- Hugo Boccal

PhD

Michel Hernandez Villanueva

- Works in computing, software and analysis
- Second class currents in Tau Decays
PhD Candidates, already made a Master

• **Marcela Marin**  in LFV in Tau

• **Jesus Rendon**  in Polarization effects in Tau desintegrations
Conclusions

- 8 Researchers, 1 PosDoc, 2 PhD, 2 Master, 1 bachelor directly involved in Belle II activities. 14 Members.

- 1 Researchers, 3 Posdocs, 2 PhD, 5 Master, in Total 12 participants. Some with very strong collaborations for Belle II analysis.

- Data taking will start at end 2018, the shift of the work will be towards analysis we need more students since the amount for Belle II tasks is growing.

- We have explored some possibilities of new physics in Tau sector mainly LNV, LFV and SCC. They are already in advanced state. We are in search on novel ideas.

- The group is consolidating and we welcome collaborators

THANKS