



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 México

Benemerita Universidad Autónoma de Puebla



Pedro Luis Manuel Podesta Lerma, Tau Workshop, Cinvestav Mexico

In a Nutshell

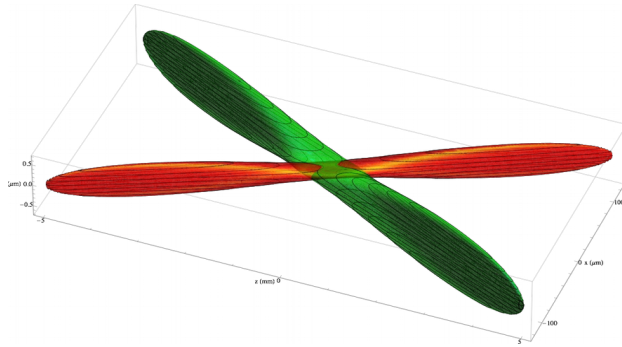
- *Large Angle Beamstrahlung Monitor (LABM)*
- *Computing resources, Two Grid Nodes (GRID)*
- *Software for Grid, Analysis (ANALYSIS)*
- *Physics phenomenology (PHYSICS)*

FUNDING

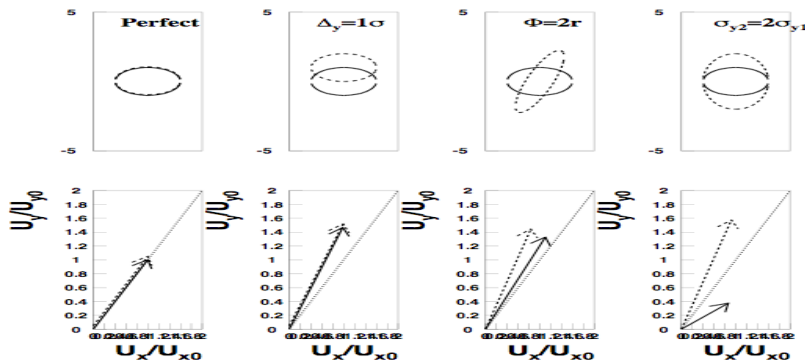
- This is based in two main projects from CONACYT :
 - **“Participación Mexicana en superb” (CB 2012/180233) 4.3 Million Pesos**
 - **“Asimetría materia-antimateria en el universo y la búsqueda de nuevas leyes fundamentales de la física mediante medidas de alta precisión” FC 2015/296, 4 Million Pesos**

Hardware

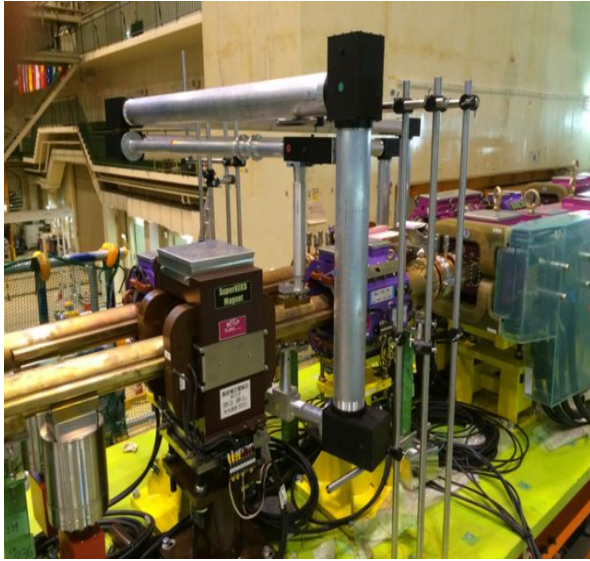
The Large Angle beamstrahlung Monitor (LABM)



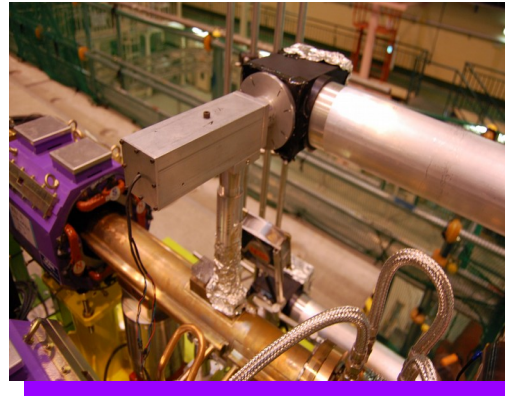
Superkekb nanobeam scheme



- 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
- Installed in 2015 take data in 2016, upgrade in 2017.
- Key role in accelerator commissioning
- Japan/EUA/Saudi Arabia /Mexico collaboration



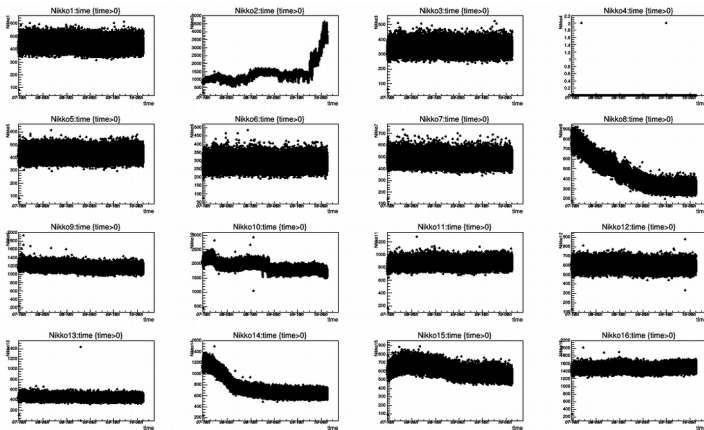
Optical Channels



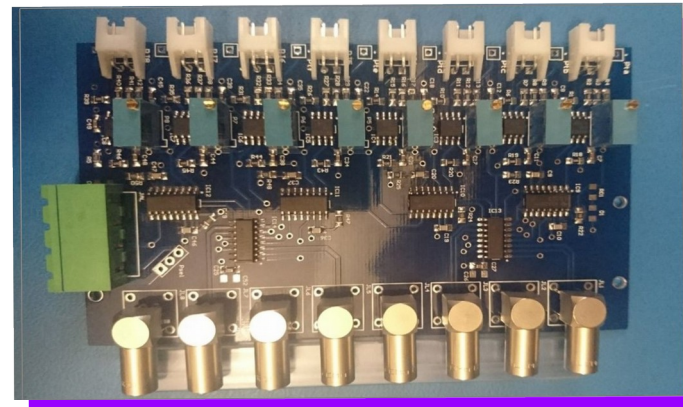
Mirrors remotely controlled



HV, LV and counters

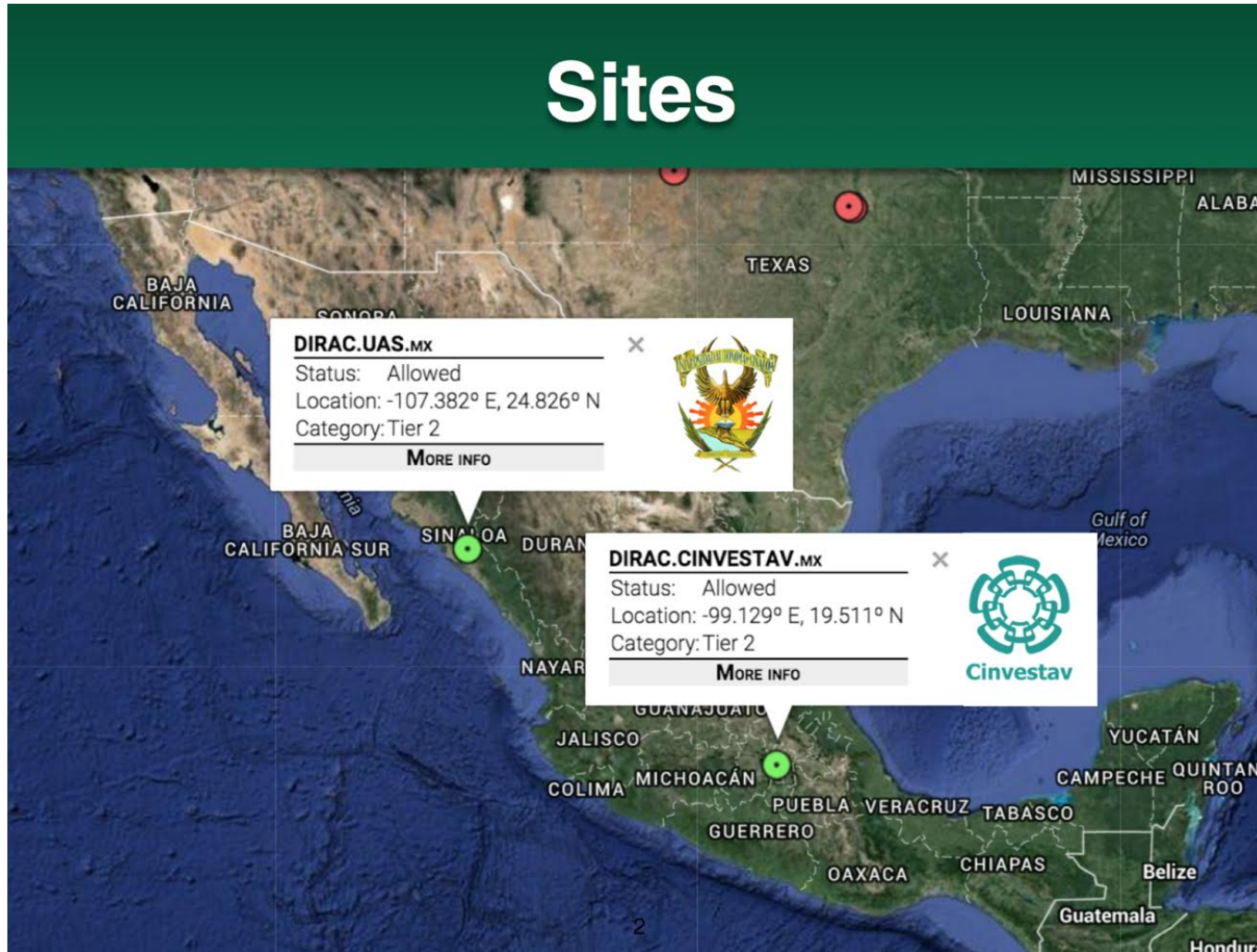


Data



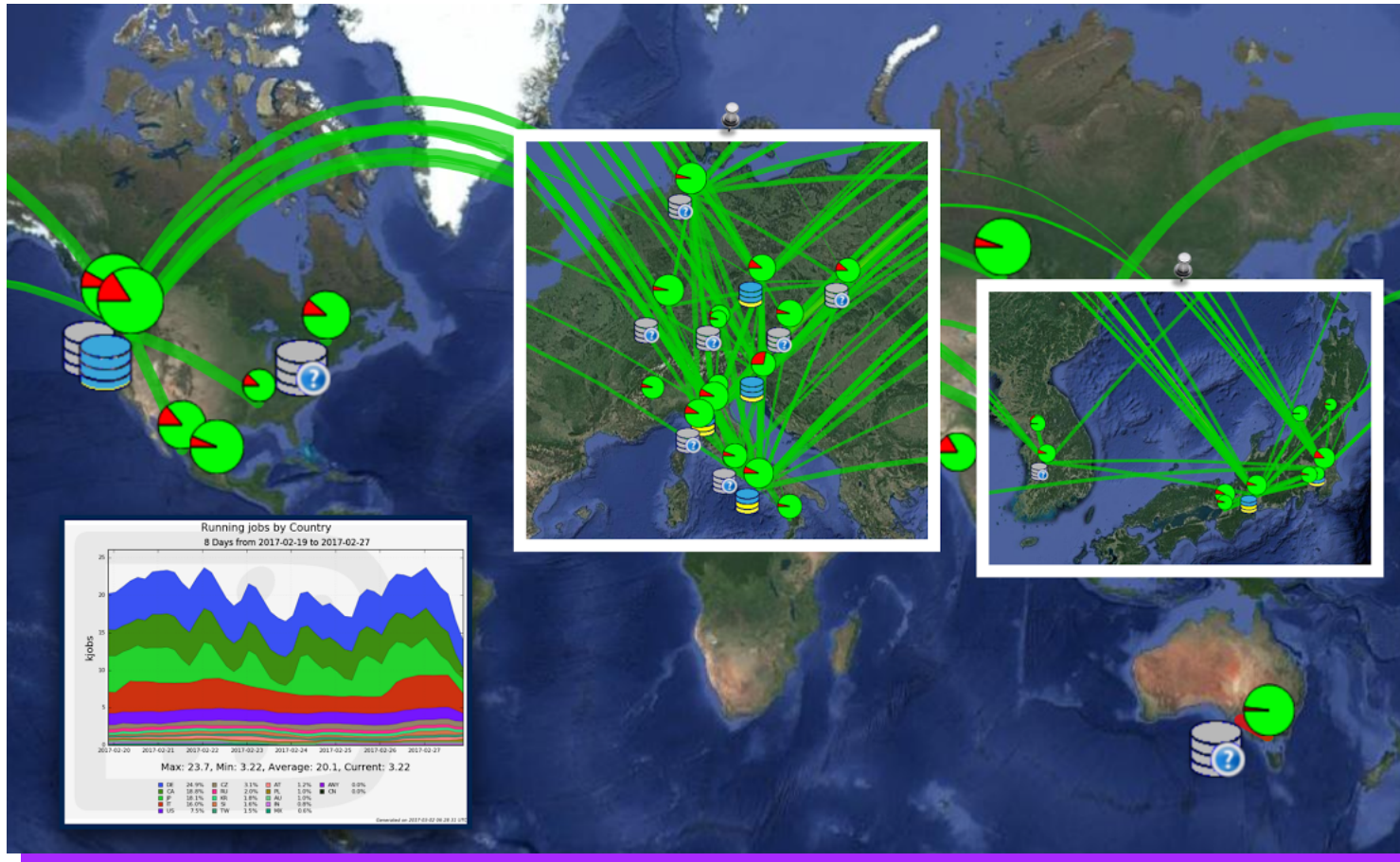
Electronic card

Computing



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.- “ $\tau \rightarrow \eta^{(\prime)} \pi \nu \gamma$ decays as background in the search for second class currents”,
A. Guevara, G. Lopez Castro and P. Roig, Phys. Rev. D95, 054015 (2017).
- 2.- “Five-body leptonic decays of muon and tau leptons”,
A. Flores-Tlalpa, G. Lopez Castro and P. Roig, JHEP 1604, 185 (2016)
- 3.- “LFV in hadronic decays of the tau lepton in the simplest little Higgs model”,
Lami, J. Portoles and P. Roig, Phys. Rev. D93, 076008 (2016)
4. “Predictions on the second class currents decays $\tau \rightarrow \pi \eta^{(\prime)} \nu$ ”, R. Escribano,
S. González Solís and P. Roig, Phys. Rev. D94, 034008 (2016).
- 5.- “Combined analysis of the decays $\tau \rightarrow K_S \pi \nu$ and $\tau \rightarrow K \eta \nu$ ”, R. Escribano,
S. Gonzalez-Solis, M. Jamin and P. Roig, JHEP 1409, (042 (2014)
- 6.- “Weak radiative pion vertex in $\tau \rightarrow \pi \ell^+ \ell^- \nu_\tau$ decays”,
A. Guevara, G. Lopez Castro and P. Roig, Phys. Rev D88, 033007 (2013)

Recent publications on tau physics of our HEP group (last five years):

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

I. M. Nugent, T. Przedzinski, P. Roig, O. Shekhotsova And A. Was, Phys. Rev. D88, 093012 (2013)

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

R. Escribano, S. Gonzalez Solin and P. Roig, JHEP 1310, 039 (2013)

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

D. Gomez-Dumm and P. Roig, Eur. Phys. J. C63, 2528 (2013).

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

D. Gomez-Dumm And P. Roig, Phys Rev. D86, 076009 (2012)

11.- “Resonance chiral lagrangian currents and τ decay Monte Carlo”,

O. Shekhotsova, T. Przedzinski, P. Roig and Z. Was, Phys. Rev. D86, 113008 (2012).

12.- “Lepton number violating four-body tau lepton decays”,

G. Lopez Castro and N. Quintero, Phys. Rev. D85, 076006 (2012)

Universidad Autonoma de Sinaloa (UAS)



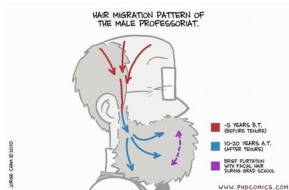
Isabel Dominguez Jimenez

- 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

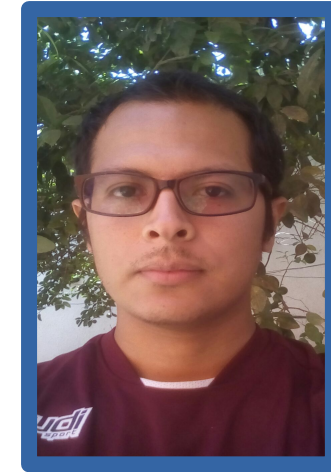
- Worked in LABM hardware
- Currently is doing a PhD in Wayne also for LABM



Daniel Ricalde Herrman

Undergraduate student

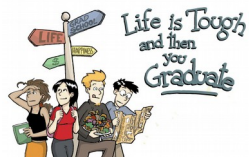
- Working in simulation of the synchrotron background for LABM



David Rodriguez Perez

• PhD Student

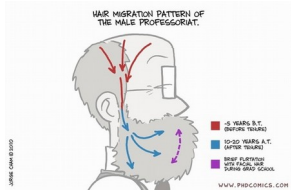
- Belle II Member
- LNV in Taus
- Work in Analysis and software



Benemerita Universidad Autonoma 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.

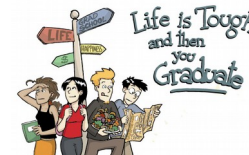
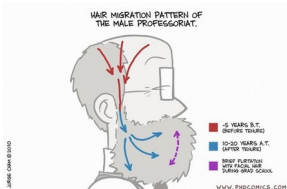
- Lepton number violation in B decays

Mariana Bolaños.

- Lepton number violation in tau decays

Antonio Rojas.

- Hadronic Tau decays





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Gabriel Lopez Castro

- Phenomenology for analysis
- Tau, Bs



Eduard de la Cruz Burelo

- Data analysis
- Taus, Bs,



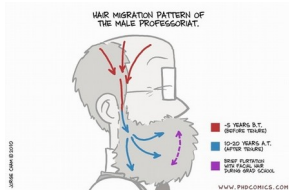
Ivan Heredia de La Cruz

- Data analysis
- Exotic states



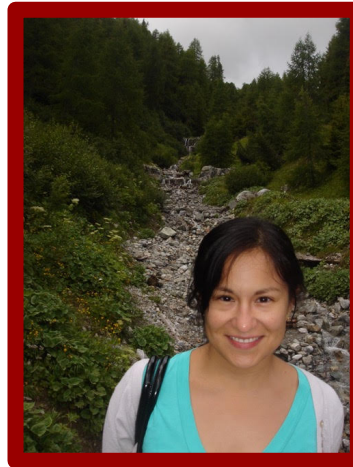
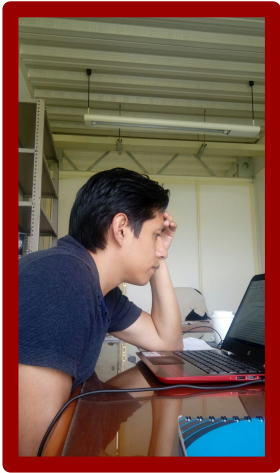
Pablo Roig

- Phenomenology for analysis, Tauola Models
- Taus, Bs





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- *Jorge Luis Reyes*

Gerardo Hernandez Tome

- Phenomenology in Tau decays for Belle II data

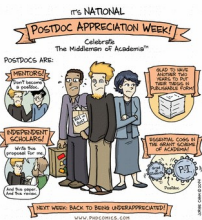
Jorge Martinez

- Data Analysis

Estela Garces

- Second class currents

- *Adolfo Guevara*
- Second class currents, hadronic decays in Taus





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Master

LFV Thesis

- *Jesus Avendaño*
- *Jorge Pacheco*

New

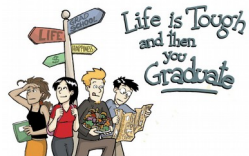
- *Alejandro Yta*
- *Hugo becerril*

PhD



Michel Hernandez Villanueva

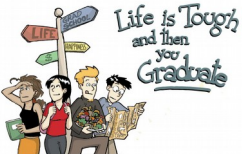
- Works in computing, software and analysis
- Second class currents in Tau Decays



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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