Multi-PMT Collaboration in Mexico

Saul Cuen-Rochin

WCTE Workshop, 2020/11/25

Outline

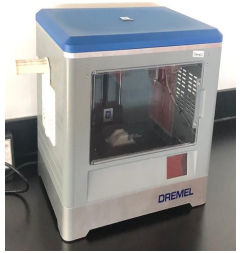
- Hyper-K Mexico is interested in mPMT collaboration with WCTE, and Hyper-K's IWCD, and far detector.

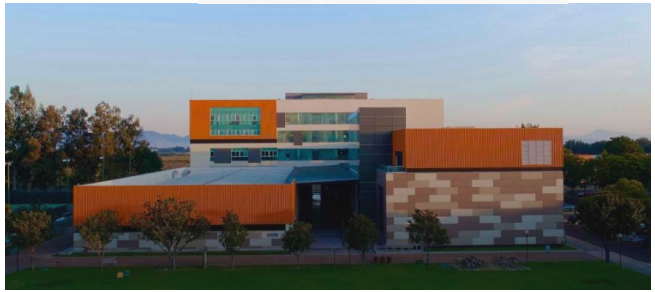
- Current member institutions:
  - Tec de Monterrey, Guadalajara (ITESM-GDL) with 2 faculty, 1 staff, 1 undergrad, +10 special group of students
  - Tec de Monterrey, Sinaloa (ITESM-SIN) with 1 faculty transitioning from Sinaloa University.
  - Universidad de Guadalajara (UdeG) with 1 faculty, 2 staff, 1 grad, 2 undergrad.
- Other interested:
  - Universidad Panamericana, Guadalajara, (UP) 1 faculty with Ph.D from Queen Mary U. London.

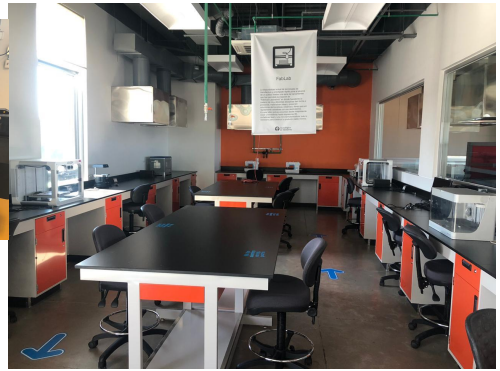
- Current funds, facilities, and resources secured so far from each institution.
- Collaboration proposal
  - International mPMT assembly/prototyping laboratory
  - Catching up with analysis and simulation
  - Share computing resources for MC production, analysis, and storage

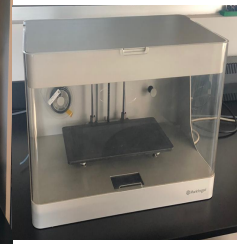
Mechanical development laboratory (EIAD) from Tecnológico de Monterrey

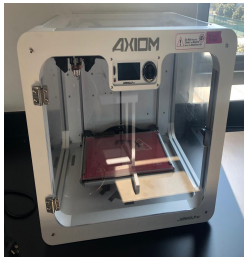
- Lab space for mPMT assembly and prototyping.
- The engineering dean sent official letter offering facilities for mPMT development.
- Industrial-standard tools available
  - CNC laser
  - CNC plasma
  - Durometers
  - 3D printers
- Could do/be
  - An international assembly/prototyping point
  - Stress tests on plastic parts (support matrix, cup, pillar, cylinder)
  - Aging tests on mechanical parts (support matrix, cup, pillar, cylinder). Any ideas?
  - Mass production schemes and private company quotes for support matrix, cup and pillars
  - Metrology testing
  - Production of steel back plates











Letter from the dean:

Tecnológico de Monterrey

24 November 2020

Professor Akira Konaka
University of Victoria,
Research Scientist at TRIUMF,
Canada's Particle Accelerator Center

Dear Professor Akira Konaka

I want to bring to your kind consideration that we desire to become an assembly point for building the mPMTs. Our institution has the infrastructure and the precise facilities to correctly contribute in this project, (*i.e.* space to store and assemble, laboratories for plasma cutting, 3d printers, and durometer).

As School of Engineering and Sciences of the Tecnologico de Monterrey, we are committed to collaborating in the development of the HyperKamiokande project. It is a great opportunity to involve our students and faculty in this research-academic project contributing to their academic development during their participation. Later, according to the needs of the project, we can make changes to this letter of intent.

Without further ado, I thank you for your kind attention.

Personal regards,

Dr. Ricardo Swain Oropeza

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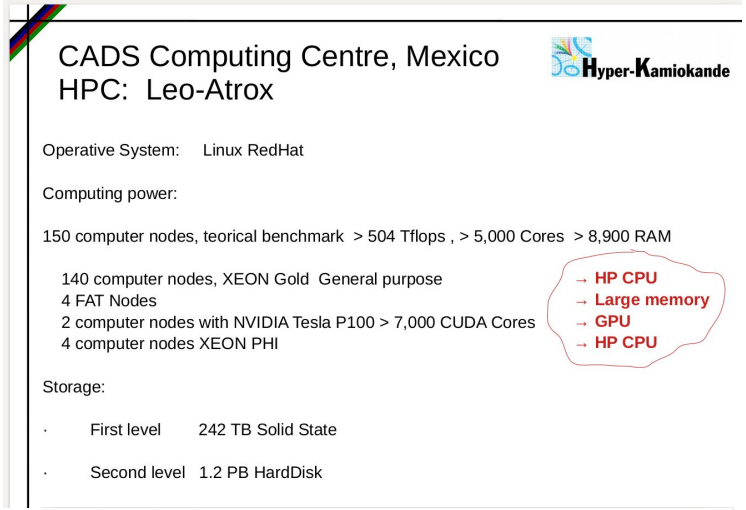
ITESM-GDL cluster

- GPUs available for Hyper-K related projects.


	Tesla V100 PCIe	Tesla V100 SXM2
GPU Architecture	NVIDIA Volta	
NVIDIA Tensor Cores	640	
NVIDIA CUDA® Cores	5,120	
Double-Precision Performance	7 TFLOPS	7.8 TFLOPS
Single-Precision Performance	14 TFLOPS	15.7 TFLOPS
Tensor Performance	112 TFLOPS	125 TFLOPS
GPU Memory	32GB /16GB HBM2	
Memory Bandwidth	900GB/sec	
ECC	Yes	
Interconnect Bandwidth	32GB/sec	300GB/sec
System Interface	PCIe Gen3	NVIDIA NVLink
Form Factor	PCIe Full Height/Length	SXM2
Max Power Comsumption	250 W	300 W
Thermal Solution	Passive	
Compute APIs	CUDA, DirectCompute, OpenCL™, OpenACC	

UdeG

- Funds for 1 mPMT, secured.
- Leo-Atrox cluster available
  - University officials (provost) already green flagged Leo-Atrox cluster to be used from international Hyper-K collaborators, MOU underway,
  - also interested in becoming tier 2 level cluster as described in “Technical note 0013: HK Computing Model”.
  - Available at the moment: 5 computer nodes (180 cores) + 5 TB for primary storage + 5 TB for secondary storage
  - We could contribute to: MC production, GPU for ML, storage.



Catching up with analysis...

- Reproduced results from ML PID analysis from workshop in U. Victoria 2019.
- Currently implementing frameworks to clusters in Mexican institutions.
- Plan to do ML PID for different mPMT and WCD geometries and compare with traditional likelihood analysis.
- Plan to investigate new ML ideas from WatChMaL group and the “Neutrino Physics and Machine Learning” workshop at Stanford 2020.

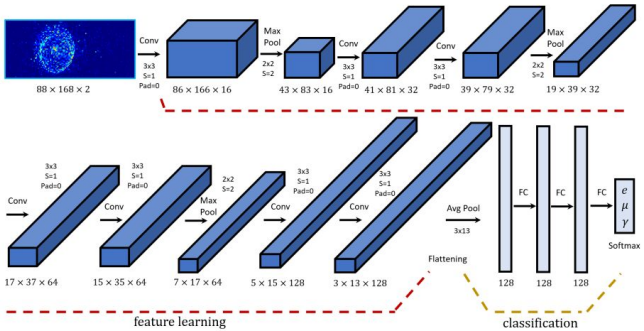


FIGURE 13. The architecture of the CNN used with the two datasets. Conv: convolutional layer with kernel nxn, stride S, Padding Pad; MaxPool: max pooling layer with kernel nxn, stride S; Avg Pool: average pooling; FC: Fully connected layer and softmax function.

Book chapter accepted with comments, to be publish spring 2021, still time for modifications...

(Draft for MAML2020, 19-Nov-)

Machine learning application for particle physics: Mexico’s involvement in the Hyper-Kamiokande observatory

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In memoriam of Dr. Luis Alberto Gutiérrez Díaz de León† (1975-2020)

Abstract. The Hyper-Kamiokande (Hyper-K) observatory, the successor to the Super-Kamiokande (Super-K) experiment, will be the largest underground water Cherenkov neutrino observatory in the world. Hyper-K will be utilized to observe high energy neutrinos coming from the Sun, supernovas, and a neutrino beam from the Japan Proton Accelerator Research Complex (J-PARC). Hyper-K’s ultimate goal is to measure neutrino properties accurately, leading to quantifying the associated Charge-Parity violation in the leptonic sector, and thus to enhance the current understanding of the matter-antimatter asymmetry in the universe. Due to Hyper-K’s construction beginning in 2020, nowadays it’s a suitable time to perform Monte-Carlo simulations and test different Machine Learning (ML) analysis techniques such as Conv[illegible] Networks (CNN) for prototype development, besides ex[illegible] detector configurations. The present chapter describes [illegible] of Mexico in the Hyper-K observatory, focusing on hov[illegible]

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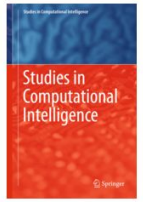

COVID 19 UPDATE: DEADLINE EXTENDED

http://diegoliva.com/cfp/cbc-maml/

Thanks. Questions or comments?