

A short term strategy

2023 12월 9일 (토) 고려대 원은일

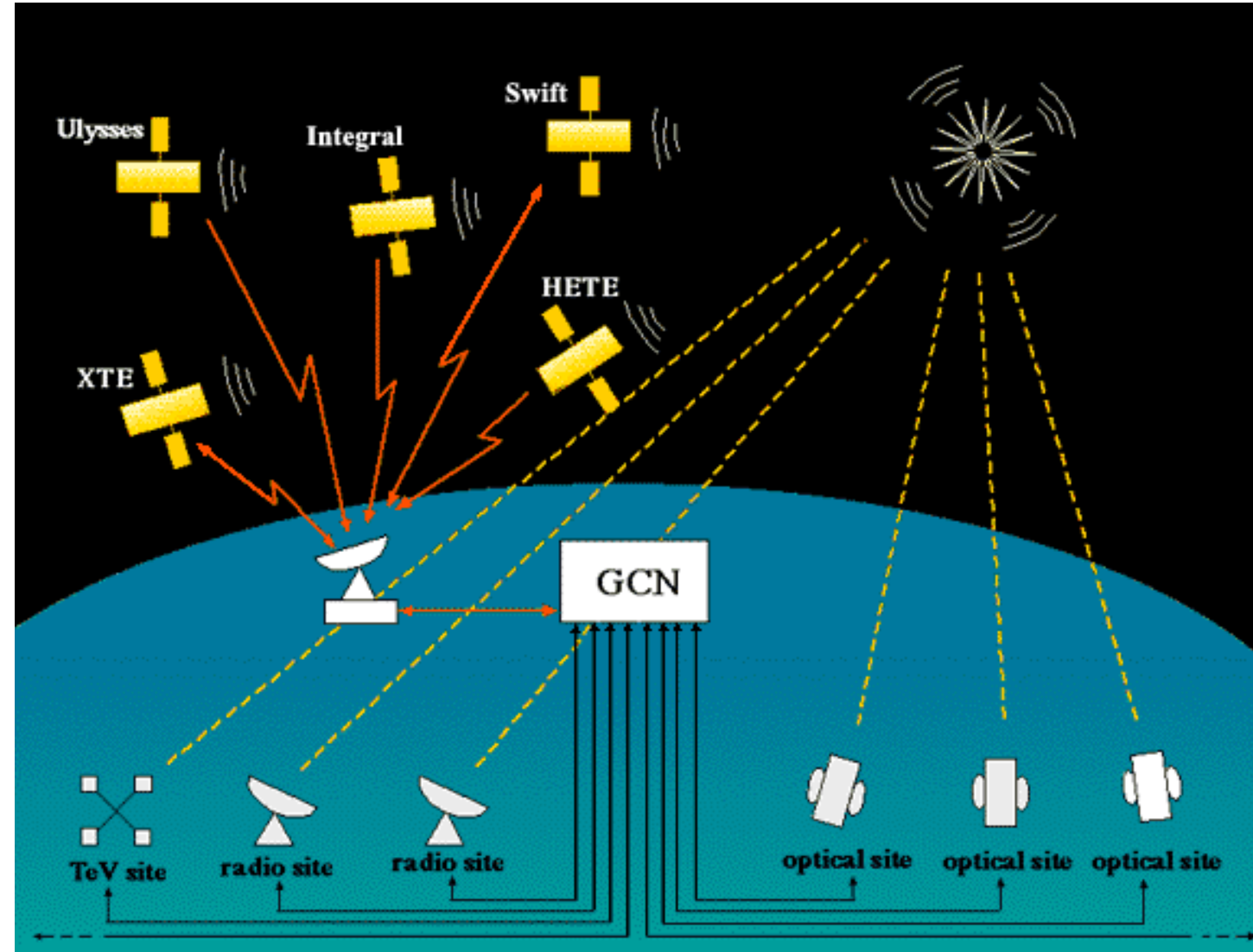
- 고려대학교 인력: 원은일 (교수), 홍기한 (포닥), 김민서, 송준혁, 왕민우, 곽형창, 김규민, 김유승 (학부)

바로 인공위성 platform 기반 UBAT, SMT 제작에는 다소 무리가 있음.

한가지 아이디어는 지상 기반 실험을 먼저 진행하여 기술력을 습득하는 것.

• BOOTES Project

- bootesnetwork.com: the Burst Observer and Optical Transient Exploring system (BOOTES)

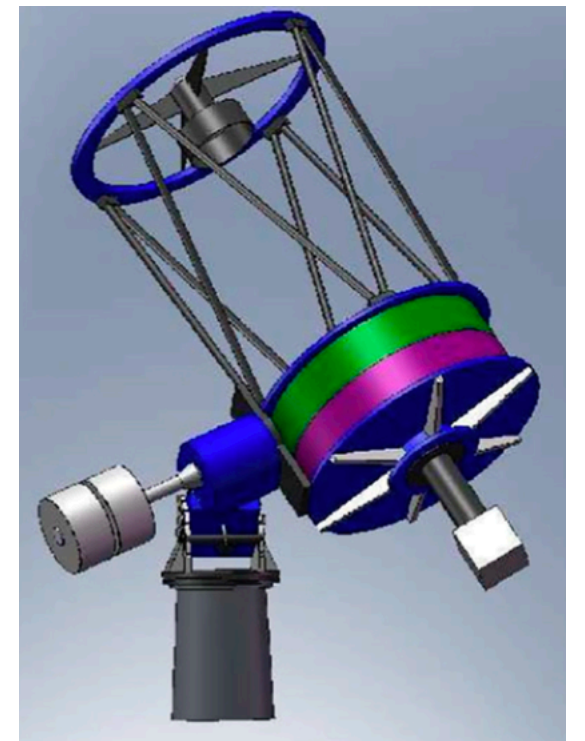


- BOOTES telescope consists of two components.

- Wide field 4096x4096 CCD, a 180° FOV (gxccd.com)
16 mm f/2.8 lens, angular resolution: 2.2'
Limiting magnitude: 8 - 10



- Ritchey-Chretien mirror 60 cm
Focus: Cassegrain, f/8, 1024x1024 EMCCD
This is the main robotic system.
3-8 seconds to rotate.



● Ground-UFFO

- Replace UBAT to wide field CCD: we start with a cheap one.
- Recycle SMT (FOV limited)

Light collection is worse by $\left(\frac{D_{\text{SMT}}}{D_{\text{BOOTES}}}\right)^2 = \left(\frac{10}{60}\right)^2 = \frac{1}{36}$

- 설치 장소 + Dome 필요.
- Electric power, maybe temperature controlled.
- Remote operation.
- Weather station.



● Ground UFFO vs. Sky UFFO (or BOOTES)

● Pros

MAPMT 신호 읽어서 digitize, 트리거 신호 생성하는 매우 복잡한 절차 필요 없음.

Space qualification 필요 없음.

지상에서 하므로 compact 할 필요 없음. Electric power 걱정 필요 없음.

● Cons

Light collection is worse by $\left(\frac{D_{\text{SMT}}}{D_{\text{BOOTES}}}\right)^2 = \left(\frac{10}{60}\right)^2 = \frac{1}{36}$

Wide-field camera 비쌘.

● GUFFO

- Since it is located in the ground, readout can be relaxed.

- Let us consider the modern high-tech.

- We had a meeting on "Versal-FPGA Task Force"
<https://kds.kek.jp/event/49042/> (You have to login, but the password is displayed).

第2回 Versal-FPGA Task Force

📅 Thursday 7 Dec 2023, 10:25 → 12:30 Asia/Tokyo

Description <https://us02web.zoom.us/j/84929774383?pwd=WWZjSHJwRnQ1Ly82M3Z5UjdWcDJvdz09>

10:30 → 10:35 Associated documents for VPK120 test bench at KEK (released at Oct. 2023)

Our first test bench with the Versal kit VPK120 has been released to CEF members in Oct. 2023. This session includes the associated documents of using the test bench, open tasks, introduction, and firmware making status with VPK120, and PCIe.

Speakers: Yun-Tsung LAI (KEK IPNS), Mathis Maurice

 20230801_Versal_o...  20230801_VPK120_...  20230801_VPK120_...  QDMA driver manua...  User Description VP...

10:35 → 10:40 Manual for hls4ml

A study by a summer internship student at KEK E-sys group.

Speaker: Yiyang Ding

 hls4ml_manual.pdf

10:40 → 11:00 Machine learning based trigger development with FPGA acceleration

Speaker: Qidong ZHOU (KEK IPNS)

 CEFVersal_QidongZ...

11:00 → 11:20 High-speed data processing in the RIBF DAQ system using the Alveo data-center accelerator card

Speaker: Yuto Ichinohe

11:20 → 11:40 Status of VPK120 firmware study: Firmware, GTM, PAM4, etc., and general plan for Versal project

Speaker: Yun-Tsung LAI (KEK IPNS)

 20231207_VPK120_...

11:40 → 12:00 Latency measurements in NOC and bringing Ethernet to PL from MIO

Speaker: Dmytro LEVIT (Technical University of Munich)

 20231207_noc_late...

12:00 → 12:20 AMD Tech Day 2023 at Tokyo

● Ground-UFFO

- 어디에 쓰려고? ✓ ?

- Trigger signal issue 할때 (?)
With AI (machine learning)

✓ ?

✓ ??

- **Versal:**
 - ACAP SoC with strong FPGA and peripheral tools for firmware-based design.
- **Kria SOM:**
 - Easier development for small system.
 - Security monitor with AI/ML.
- **Alveo: 펌웨어 작성 필요 없음.**
 - Adaptable accelerator cards for software-based design.
 - Real-time high resolution video processing.
- **RFSoc:**
 - Processing analog signal with high resolution.
 - Digital Pre-Distortion.
 - Wireless communication.

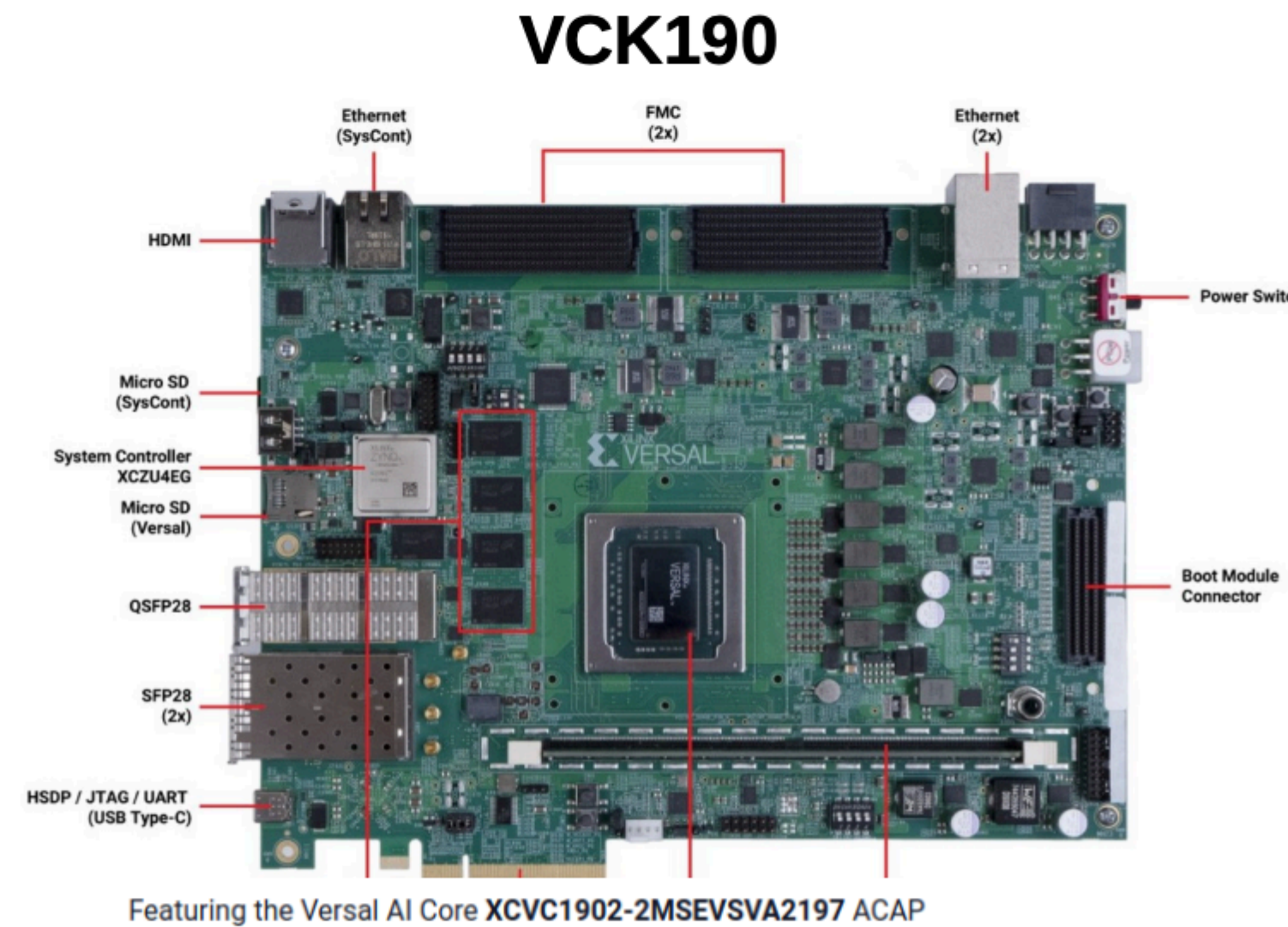
● Ground-UFFO

Versal: VEK280

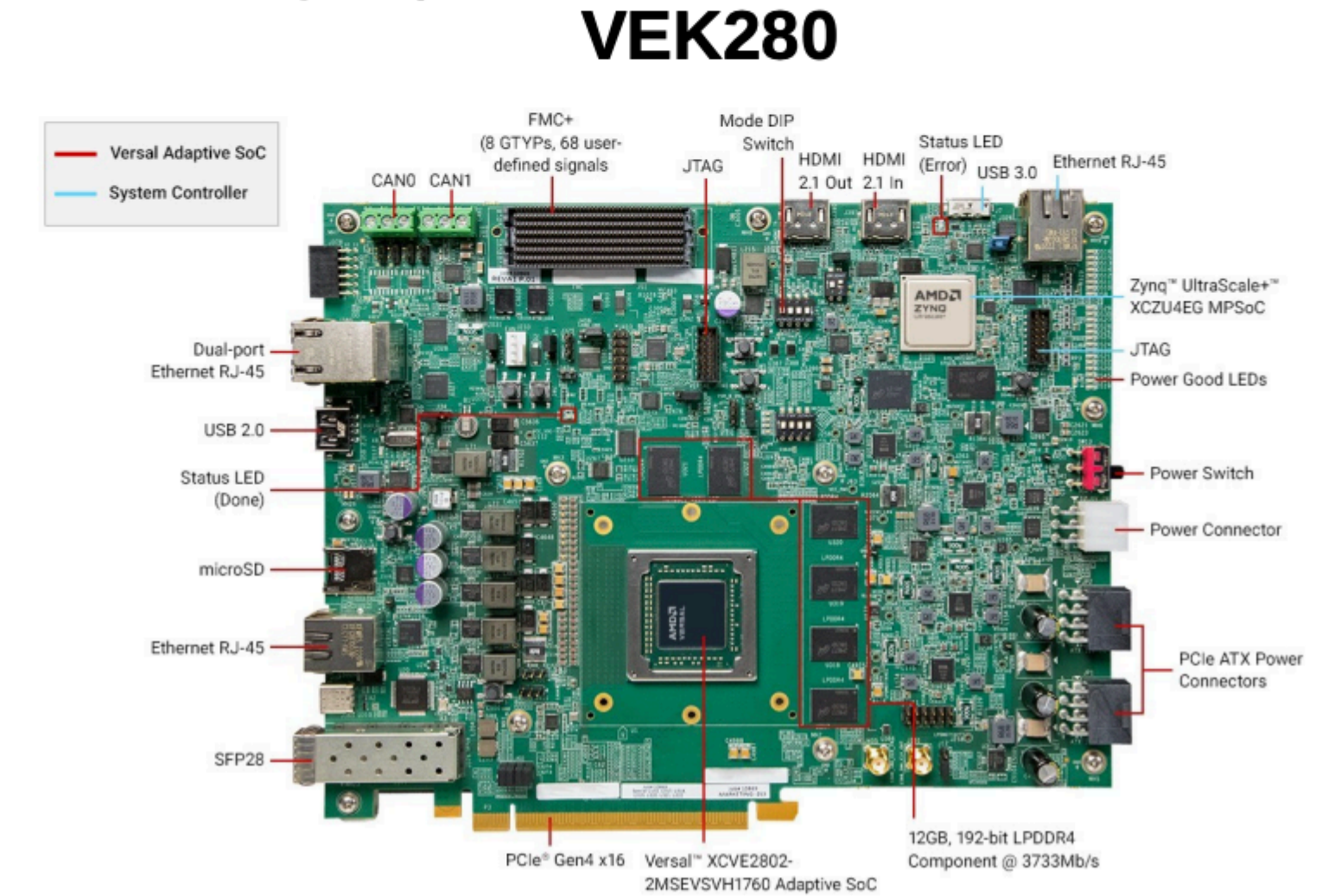
- Versal (AMD or dead Xilinx)

● 약 천만원 오더의 가격
(VCK190 은 이천만원)

- VEK280: a kind of simpler version of VCK190 (with AI engine).
 - It is scheduled to come out in 2024.



AI Engines	400
DSP Engines	1,968
System Logic Cells (K)	1,968
LUTs	899,840
Application Processing Unit	Dual-Core Arm® Cortex®-A72
Real-Time Processing Unit	Dual-Core Arm Cortex-R5F
Maximum I/O Pins	770
Programmable NoC Ports	28
Integrated Memory Controllers	4



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• I have been playing with PyTorch

Subect: PHYSxxx, Machine Learning

Lecturer: Professor Eunil Won

References

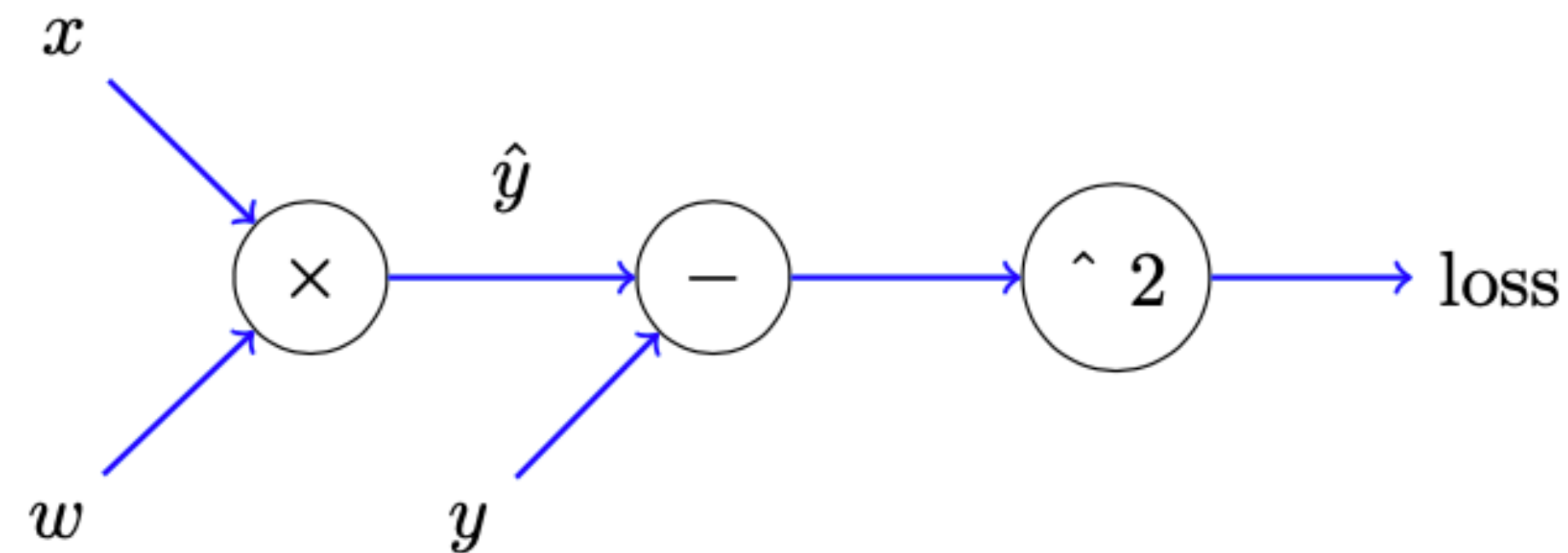
ML/DL for everyone by Sung Kim @ HKUST

python: Language

pytorch : a python tool for the machine learning

Example codes are in the github: <https://github.com/hunkim/PyTorchZeroToAll>

Diagrams are drawn using tikz package most of time. See below one.



Some of algorithms discussed in the text are source codes are in Appendix. Others can be found from the github above.

- I have been playing with PyTorch

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• You can also play with it!

PHYSxxx: Machine Learning

Chapter 1

Fall Semester, 202?

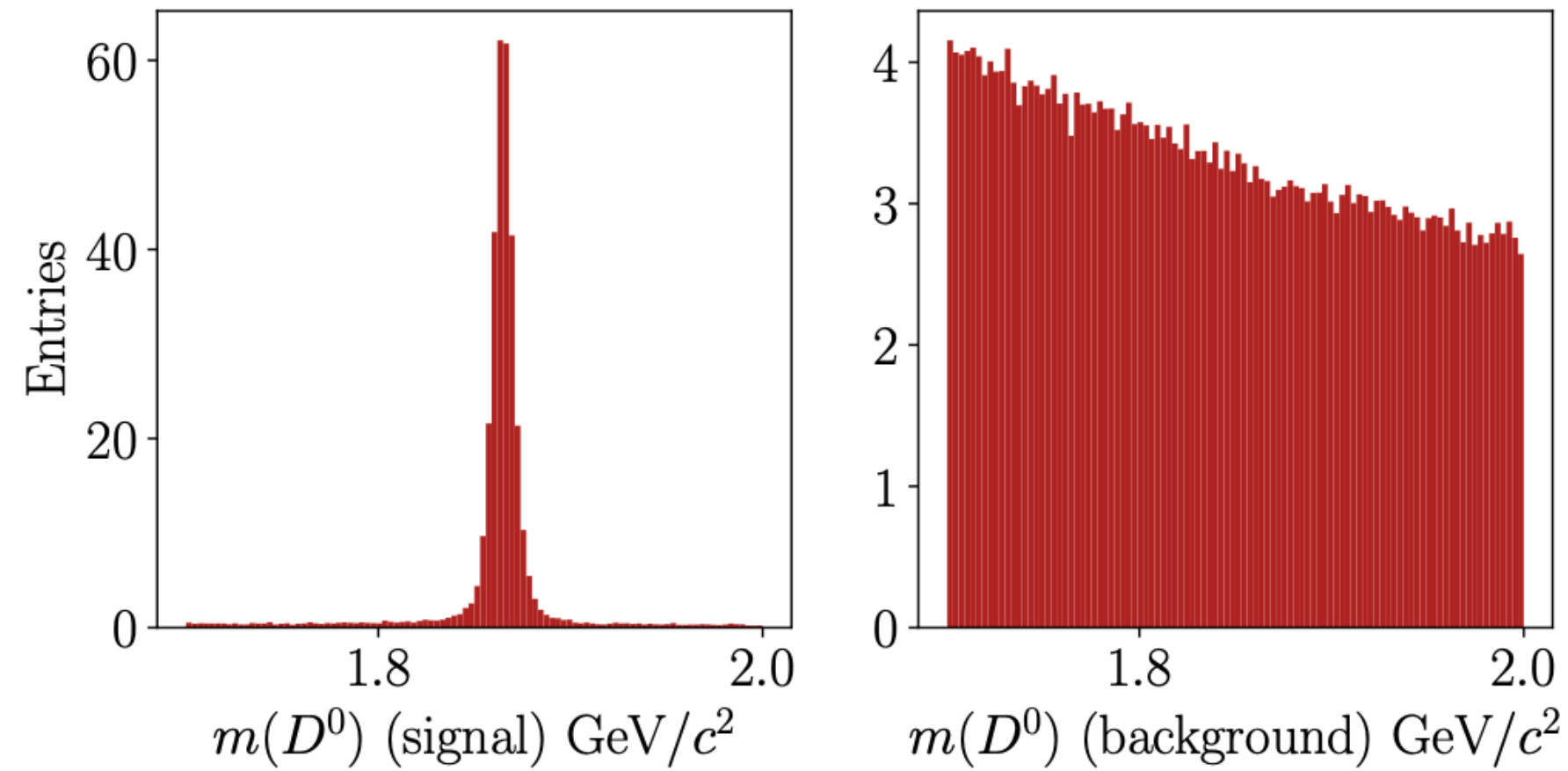


Figure 1.8: The invariant mass distribution of $K^\mp\pi^\pm$ pairs for signal (left) and for background (right). (02_histo.pdf)

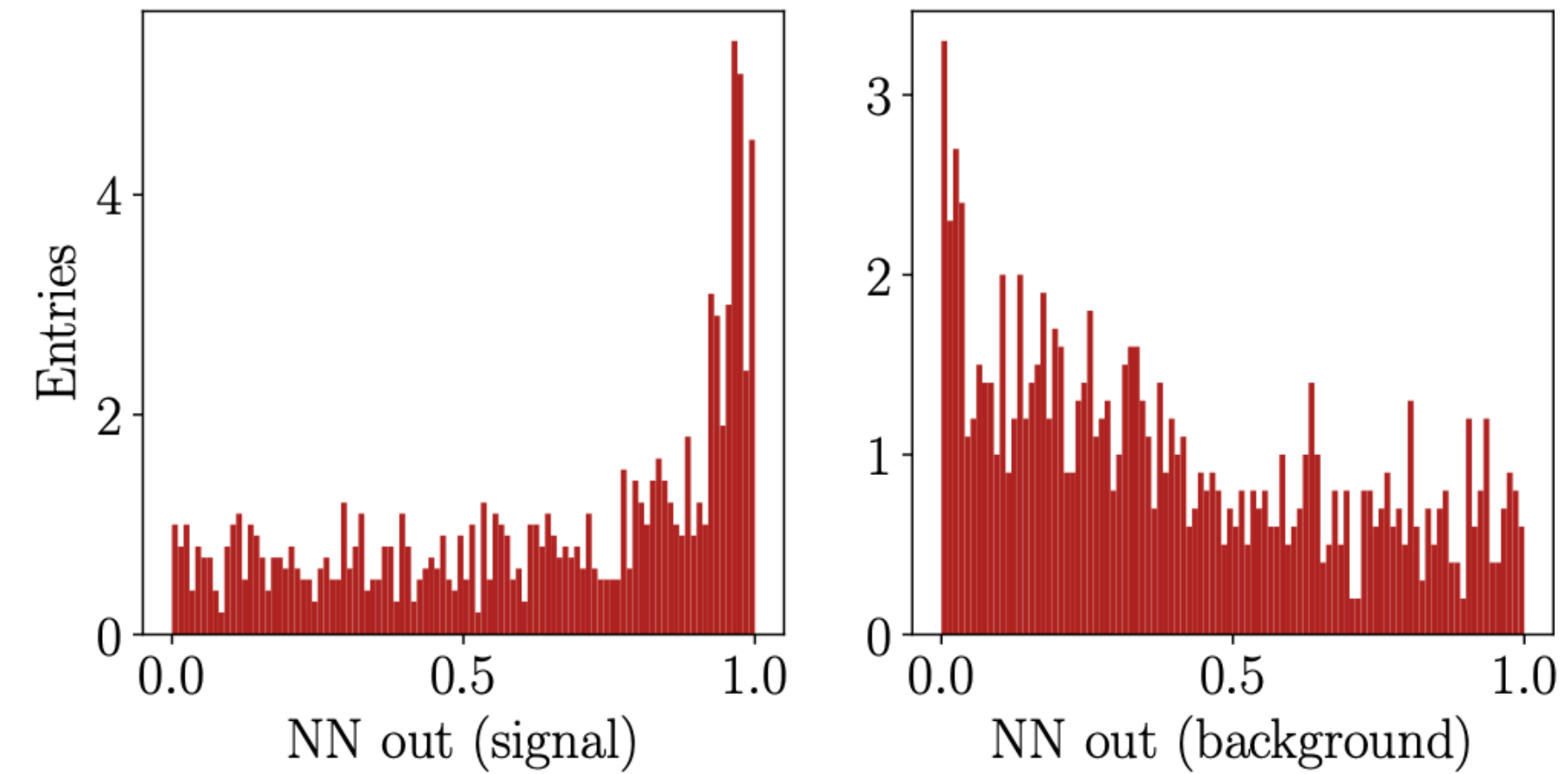


Figure 1.9: The outputs of our machine of 6-10-8-1 network, with `Sigmoid()`, `MSELoss`, `SGD`, `epoch = 30000` and the learning rate of 0.001 are shown. The left (right) is the output for the signal (background). (02_particle.pdf)

The input to the network is prepared as

$$p_x^{K^\mp} \quad p_y^{K^\mp} \quad p_z^{K^\mp} \quad p_x^{\pi^\pm} \quad p_y^{\pi^\pm} \quad p_z^{\pi^\pm} \quad \{0, 1\} \quad (1.20)$$

- 한가지 더: 다음의 망원경을 주문했음.



	CPC800
방식	슈미츠-카세그레인식
구경	203.2 mm(8 in)
초점거리	2032 mm (80 in)
F	F/10
배율	51배
한계등급	14
시야각	0.8
추적방식	경위대식/적도의식

- 잘 사용합시다 (추운 겨울이지만...)



https://sunphoto.co.kr/shop/goods/goods_view.php?goodsno=5260&category=045006