Asian Forum for Accelerators and Detectors (AFAD) 2018
DCC, Daejeon, Korea

Computing in Korea

2018. 1. 30

Kihyeon Cho (KISTI)

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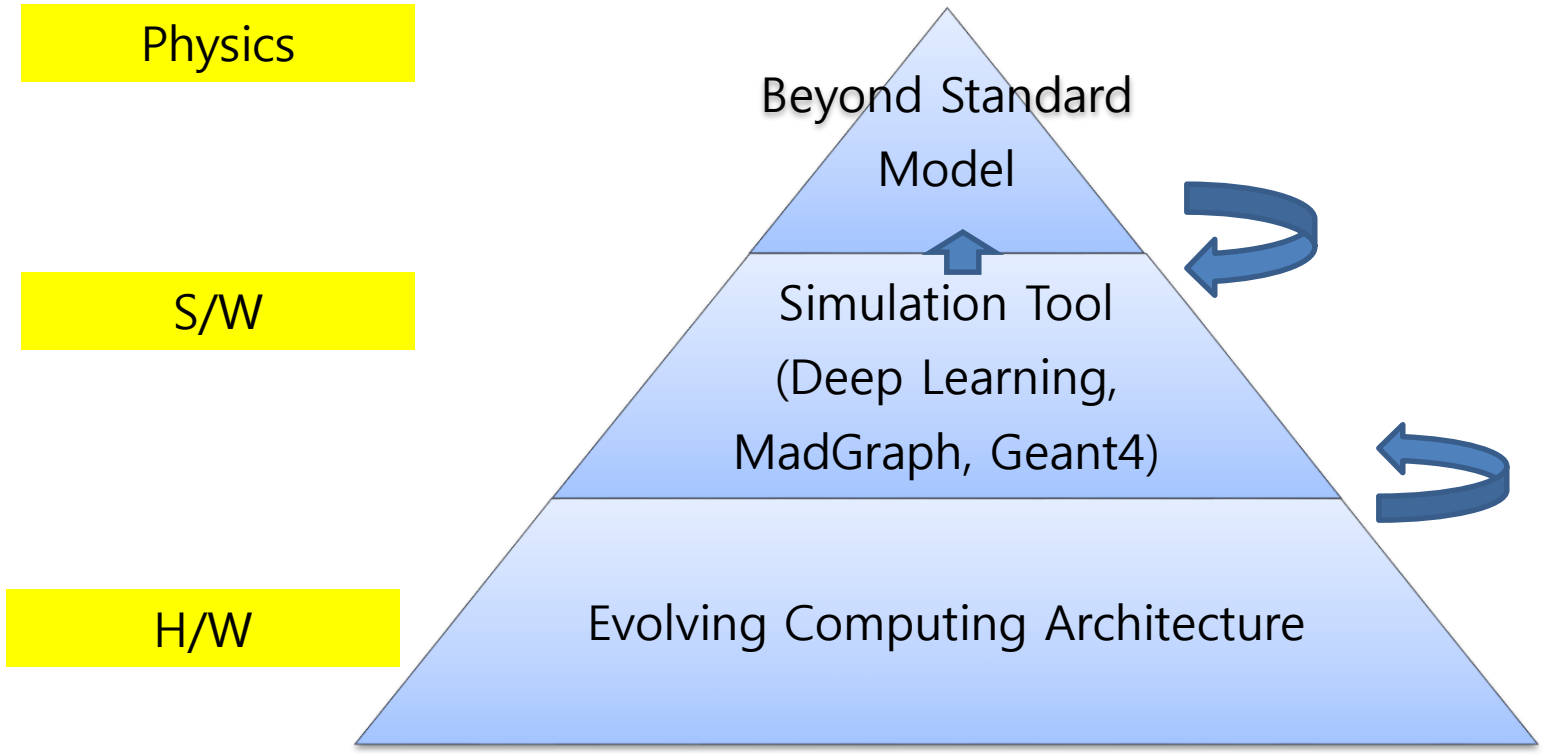
High Energy Physics in Korea

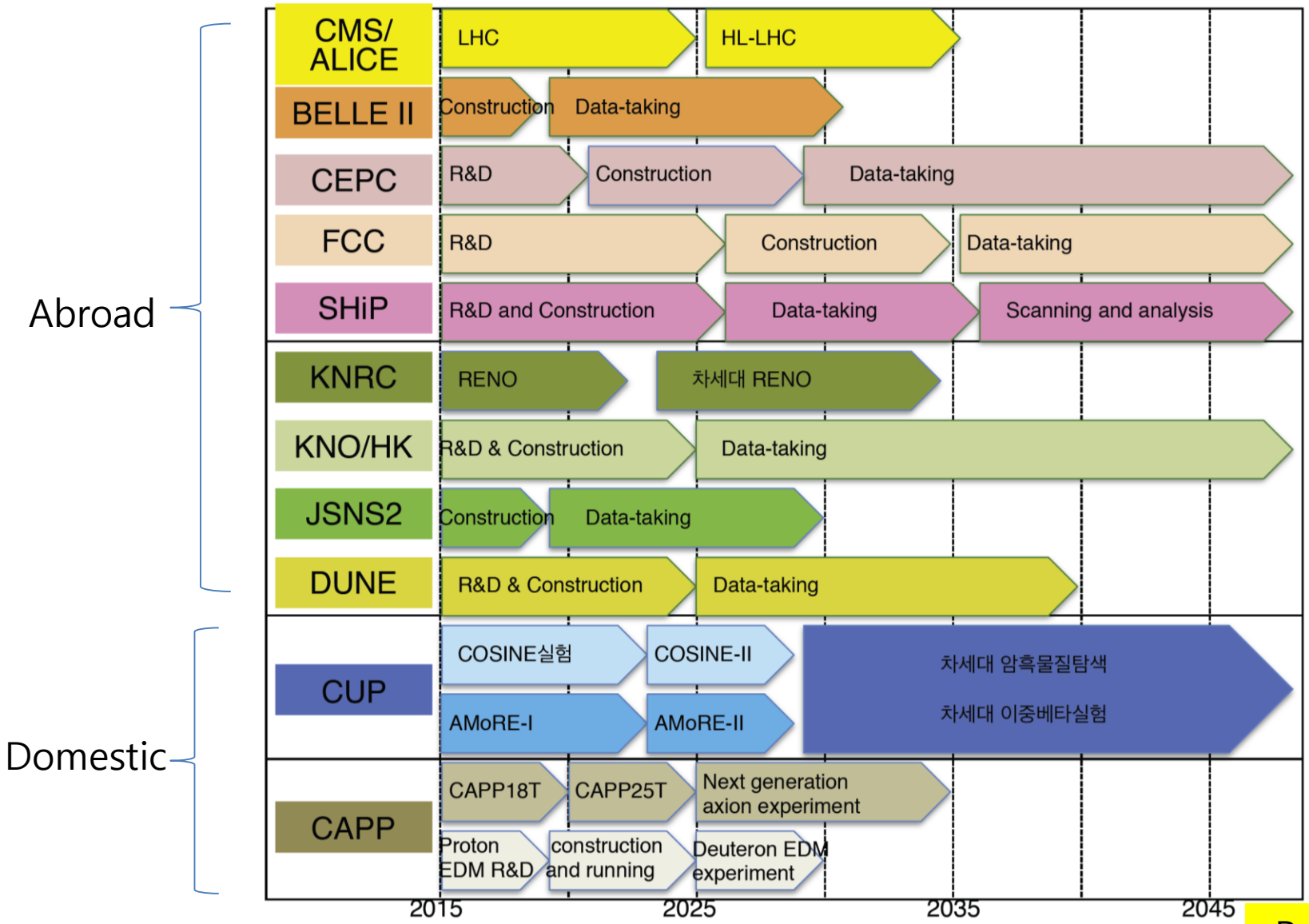
Evolving Architecture for beyond Standard Model



Scientific discovery drivers

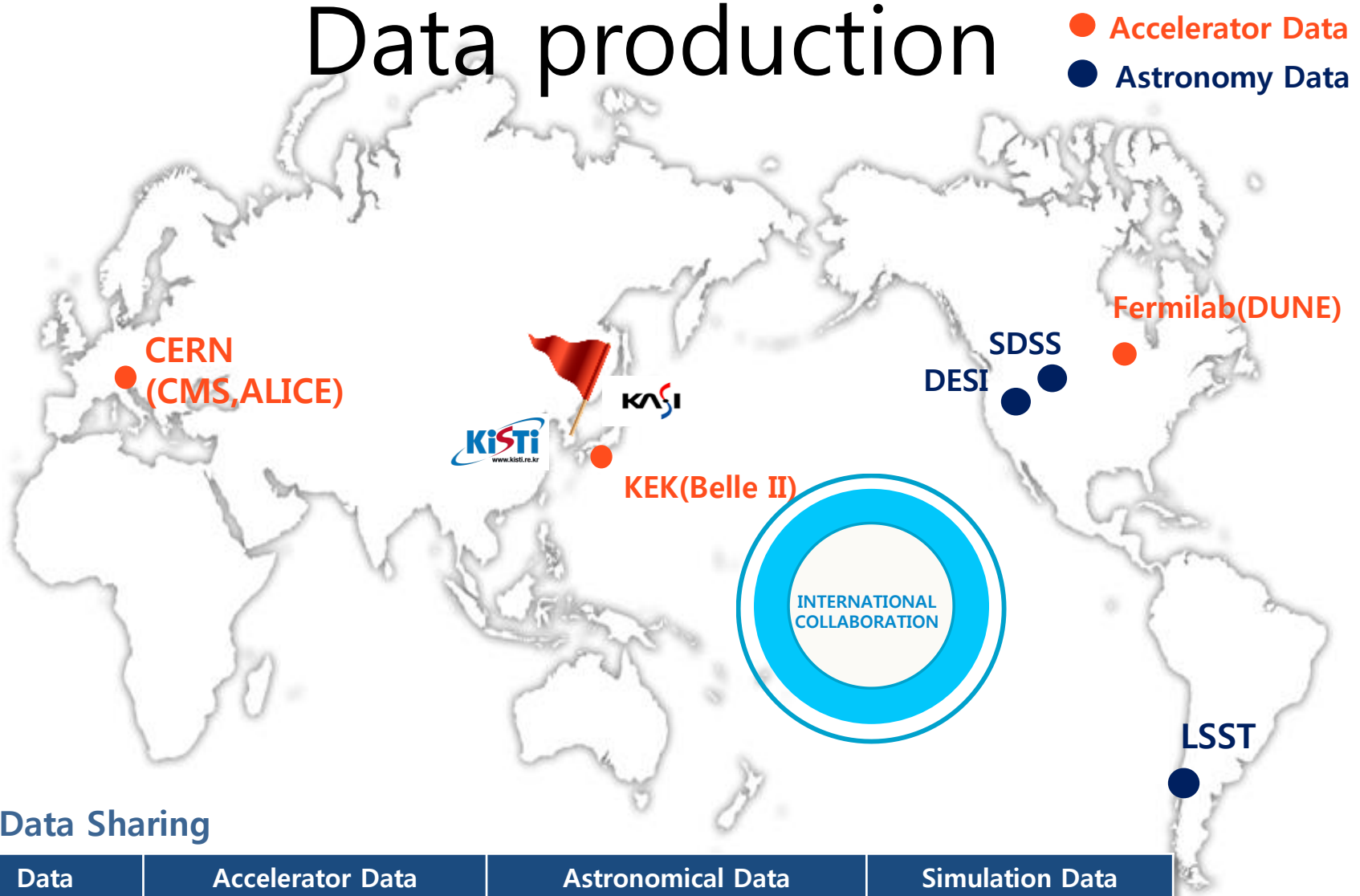
1. Data
   - Sensors, Instruments, DB, Internet, Storage
2. Computational Science
   - Theory-Experiment-Simulation
3. Machine Learning
   - AI, Statistics, Data Mining, Algorithms, Deep Learning

HEP Experiments in Korea



Prof. Y. Kwon

Data production



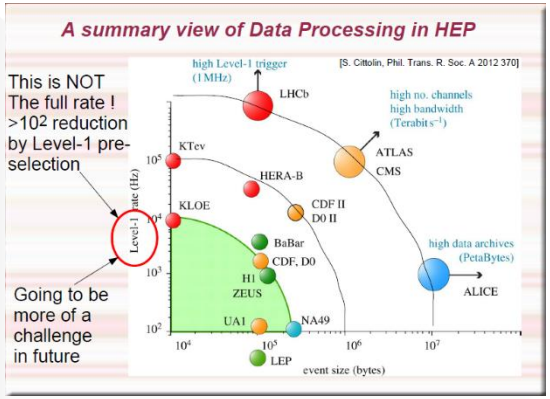
- **Data Sharing**

Data	Accelerator Data	Astronomical Data	Simulation Data
Input	Collaboration only	Collaboration only	All researcher share
Output	All researcher share	All researcher share	All researcher share

The size of data

Accelerator Data

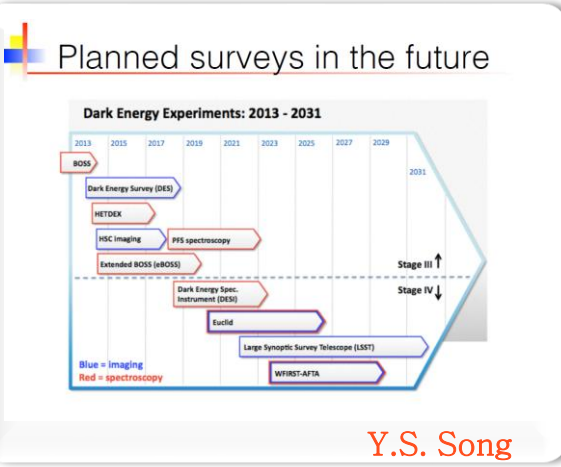
Year	Experiment	Size of data
Current	Belle	~1 PB
Current	LHC(CMS)	10~20 PB/year 100 PB/year(Simulation included)
2018~2024	Belle II	100 PB (50 times of current)
2025~	LHC(CMS)	100PB/year (5~10 times of current)



S. Cittoling

Astronomy Data

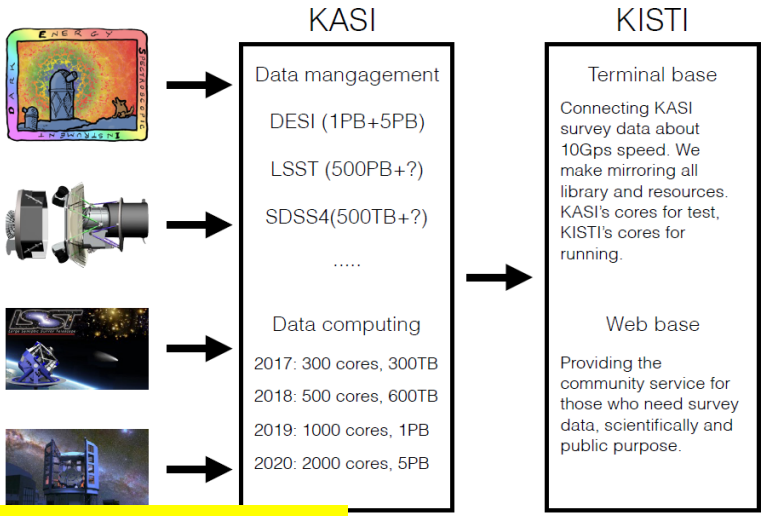
Year	Observatory	Size of Data (Total)
Current	SDSS	300TB
2018~	DESI (Starting)	1PB
2014~2020	SDSS4	500TB
2017~2022	DESI	5PB
2023~2030	LSST	500PB



Y.S. Song

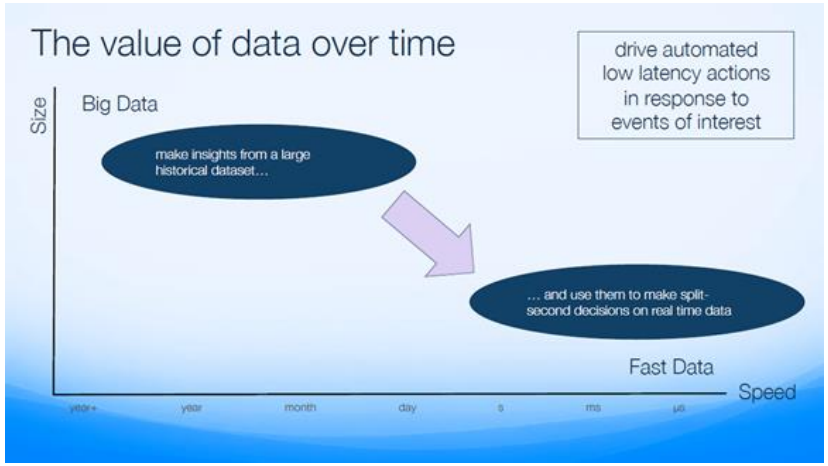
Data Management System

Survey data management



Prof. Y. S. Song

- From Big data to Fast data
- From theory-driven approach to Data-driven approach



E. Dobson

Computational Science

Technical Paper
J. Astron. Space Sci. 33(1), 63-67 (2016)
http://dx.doi.org/10.5140/JASS.2016.33.1.63

JASS Journal of Astronomy and Space Sciences

e-Science Paradigm for Astroparticle Physics at KISTI

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The Korea Institute of Science and Technology Information (KISTI) has been studying the e-Science paradigm. With its successful application to particle physics, we consider the application of the paradigm to astroparticle physics. The Standard Model of particle physics is still not considered perfect even though the Higgs boson has recently been discovered. Astrophysical evidence shows that dark matter exists in the universe, hinting at new physics beyond the Standard Model. Therefore, there are efforts to search for dark matter candidates using direct detection, indirect detection, and collider detection. There are also efforts to build theoretical models for dark matter. Current astroparticle physics involves big investments in theories and computing along with experiments. The complexity of such an area of research is explained within the framework of the e-Science paradigm. The idea of the e-Science paradigm is to unify experiment, theory, and computing. The purpose is to study astroparticle physics anytime and anywhere. In this paper, an example of the application of the paradigm to astrophysics is presented.

Keywords: e-Science, astroparticle physics, dark matter

1. INTRODUCTION

Current research can be analyzed by big data in the framework of the e-Science paradigm. The e-Science paradigm unifies experiments, theories, and computing simulations that are related to big data (Lin & Yen 2009). Hey explained that a few thousands of years ago, science was described by experiments (Hey 2006). In the last few hundred years, science was described by theories and in the last few decades, science was described by computing simulations (Hey 2006). Today, science is described by big data through the unification of experiments, theories, and computing simulations (Cho et al. 2011).

We introduce the e-Science paradigm in the search for new physics beyond the Standard Model, as shown in Fig. 1. It is not a mere set of experiments, theories, and computing, but an efficient method of unifying researches. In this paper, we show an application of the e-Science paradigm to astroparticle physics.

Dark matter is one of three major principal constituents of the universe. The precision measurements in flavor physics have confirmed the Cabibbo-Kobayashi-Maskawa (CKM) theory (Kobayashi & Maskawa 1973). However, the Standard Model leaves many unanswered questions in particle physics such as the origin of generations and masses, and the mixing and abundance of antimatter. Astrophysical evidence

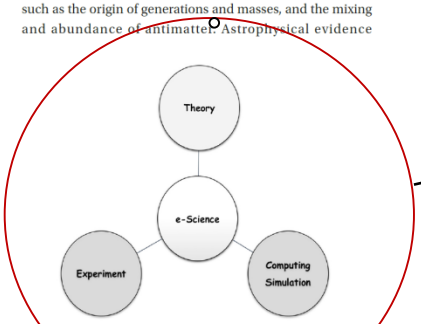

Fig. 1. Paradigm of e-Science in astroparticle physics represented as a unification of experiment, theory, and computing.

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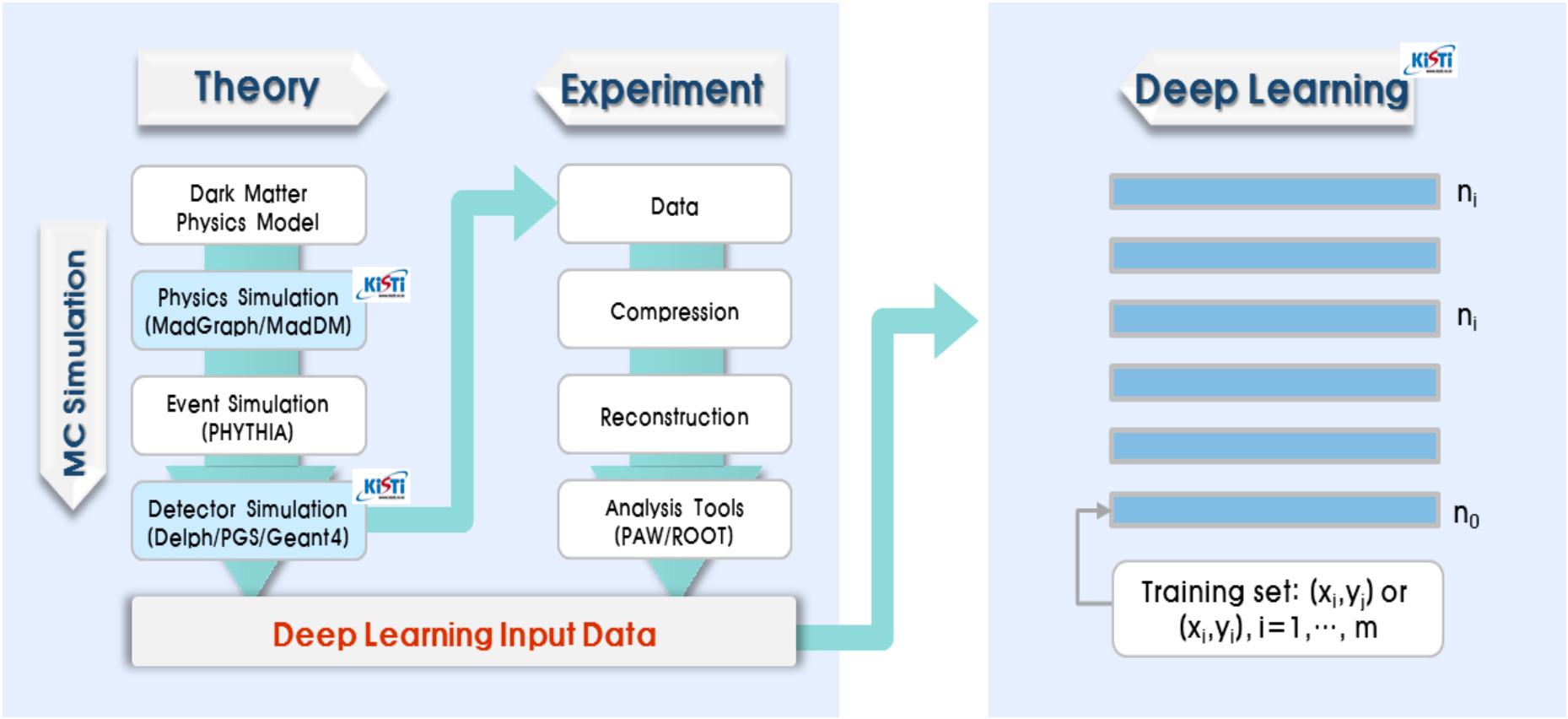
- Theory-Experiment-Simulation

⇒ computational Science

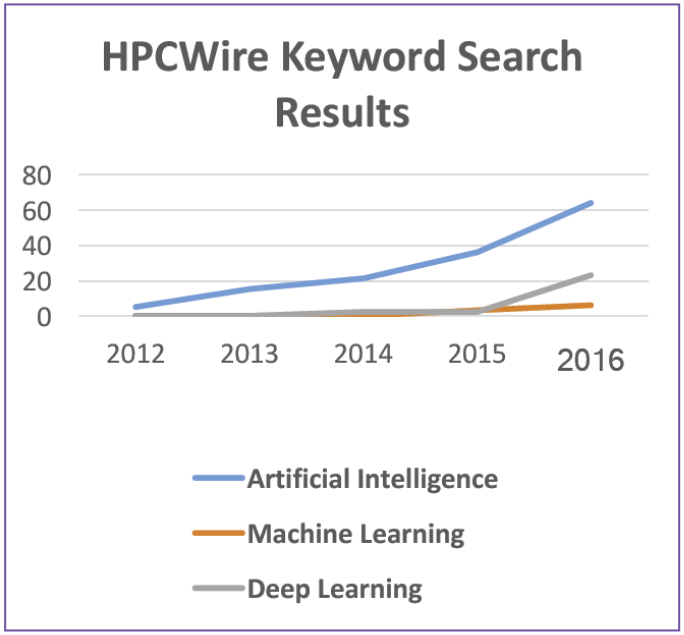
Deep Learning

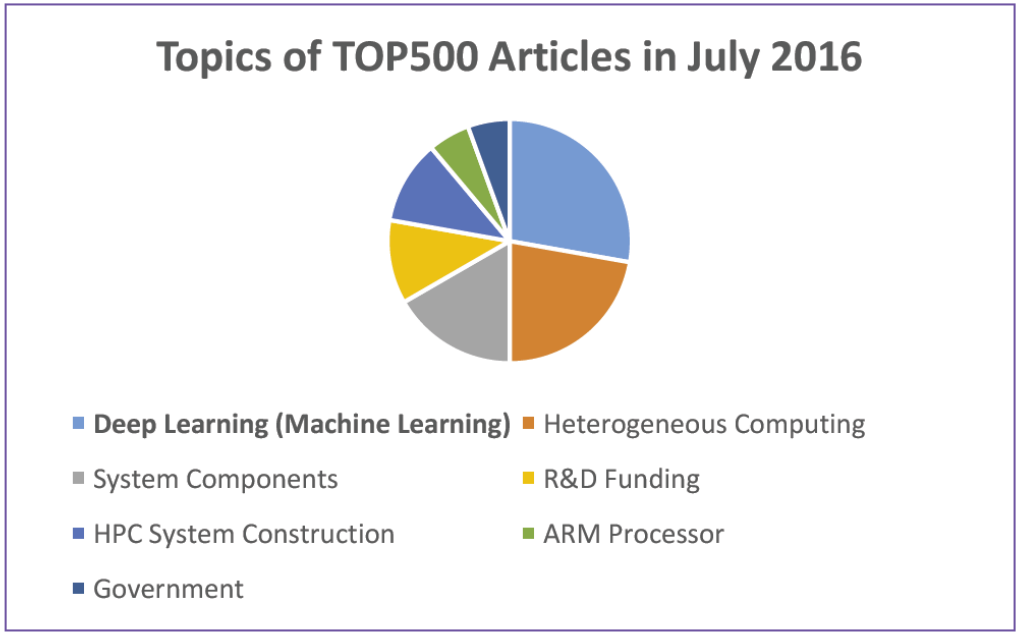


Deep Learning and Supercomputing

- Supercomputing meets deep learning.

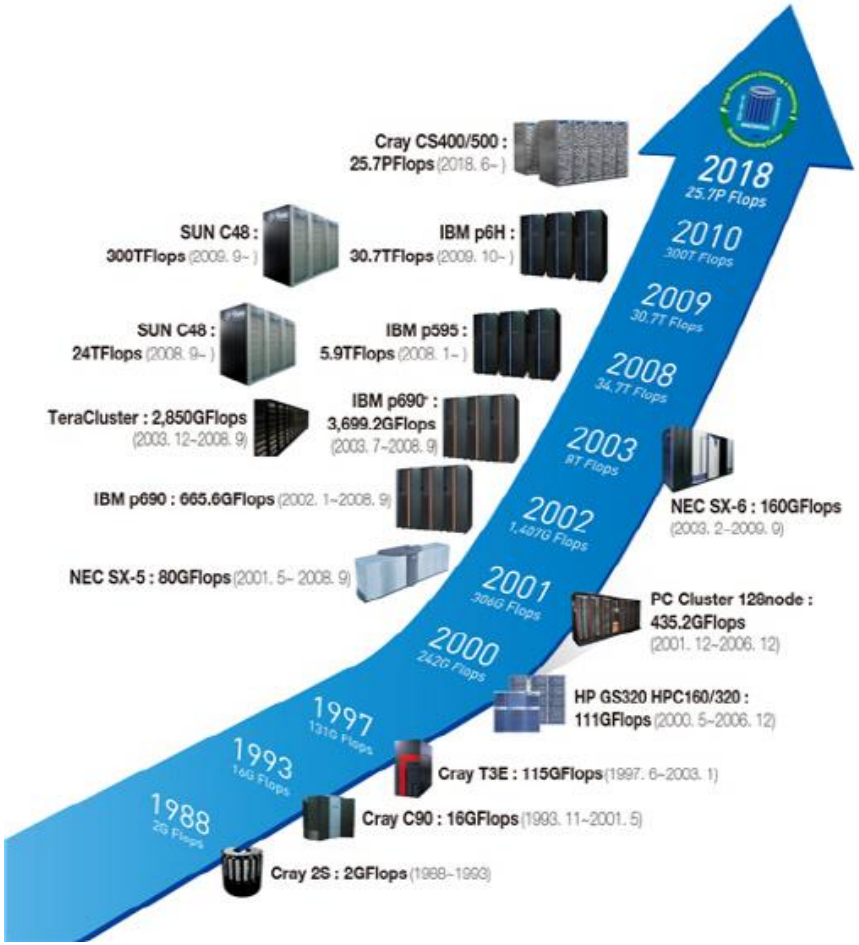
  ⇒ Heterogonous computing





Prof. J. Lee

KISTI Supercomputing center



- 5th Supercomputer
  - Processing: 25.7PF
    - Heterogonous: 25.3PF CS400 w/KNL
    - CPU: 0.4PF CS500 w/SKL
  - Storage
    - 20PB SPS
    - 10PB Archive
  - Schedule
    - Installing now
    - Service (2Q, 2018)

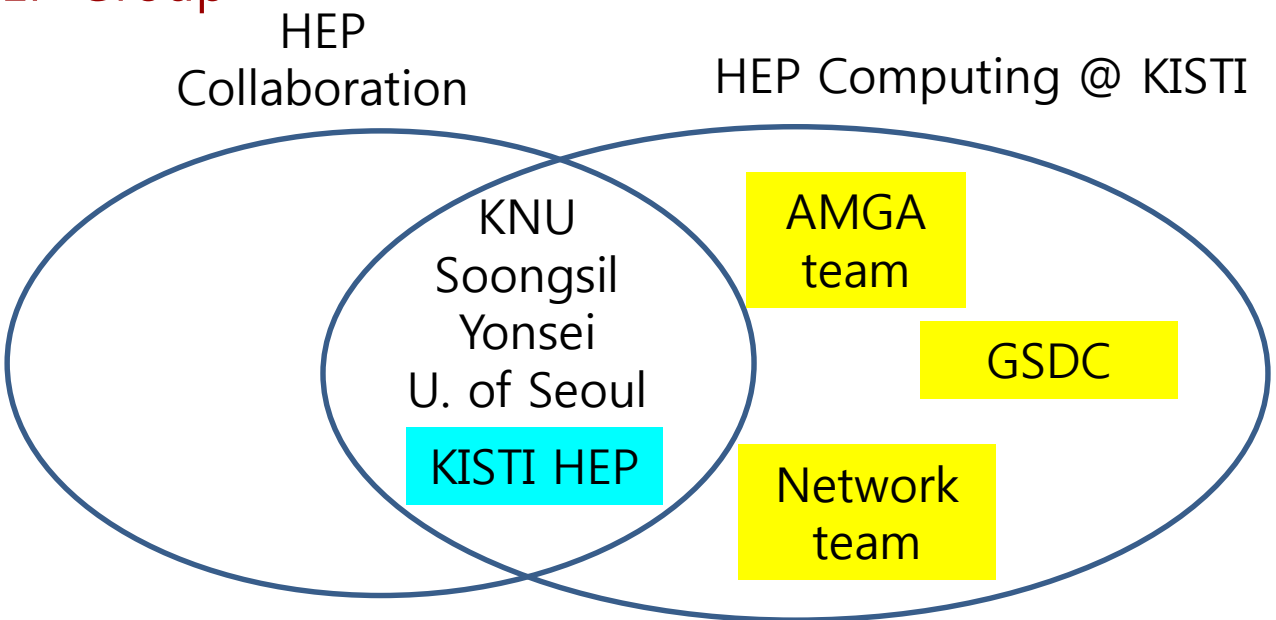

국가슈퍼컴퓨팅센터


슈퍼컴퓨터 5호기
2017
Korea Supercomputing Conference 2017

Computing in High Energy Physics

HEP & HEP computing

- HEP itself & HEP Computing
  - KNU
  - Soongsil University
  - Yonsei University
  - University of Seoul
  - KISTI HEP Group
- KISTI



Contact Persons and Mailing list

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AMGA	Soonwook Hwang
GSDC	Seo Young Noh
Network	Buseong Cho

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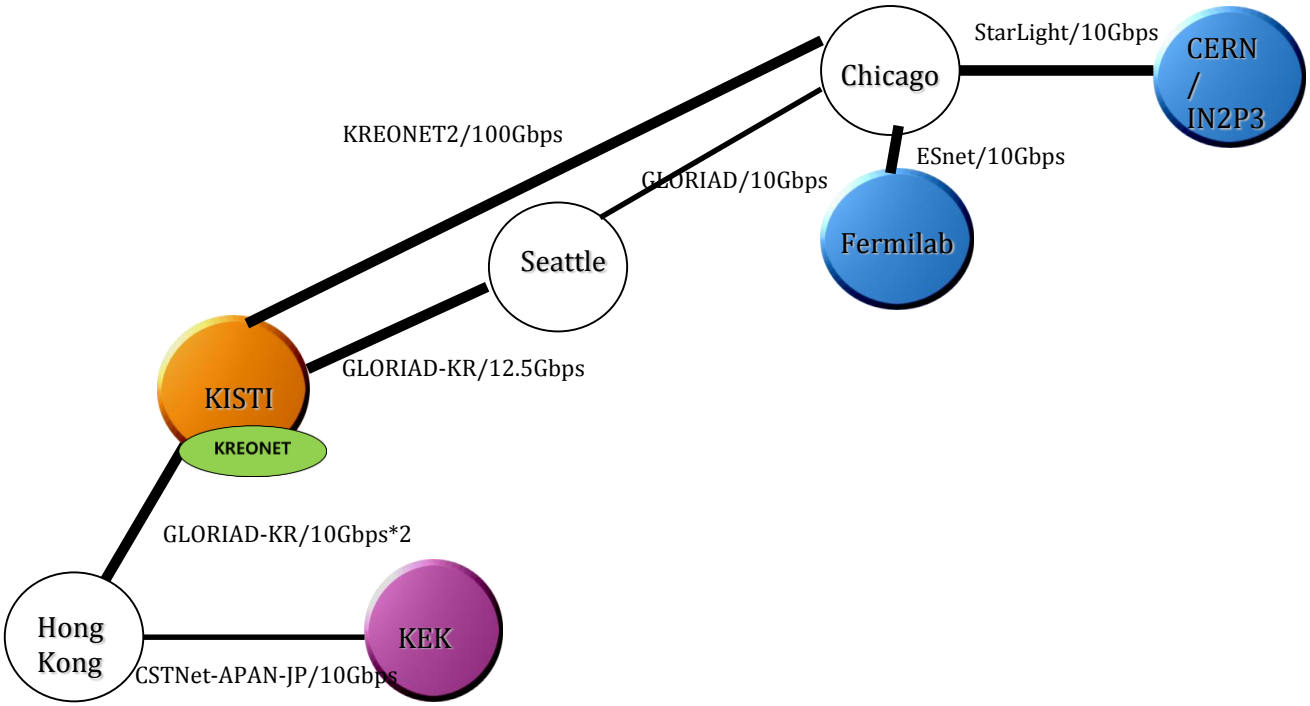
amga@edison.re.kr	AMGA Team + Kihyeon, Miyake, Hara
belle2_comuting@kisti.rekr	GSDC + Kihyeon
belle2@kisti.re.kr	All KISTI persons related with Belle II

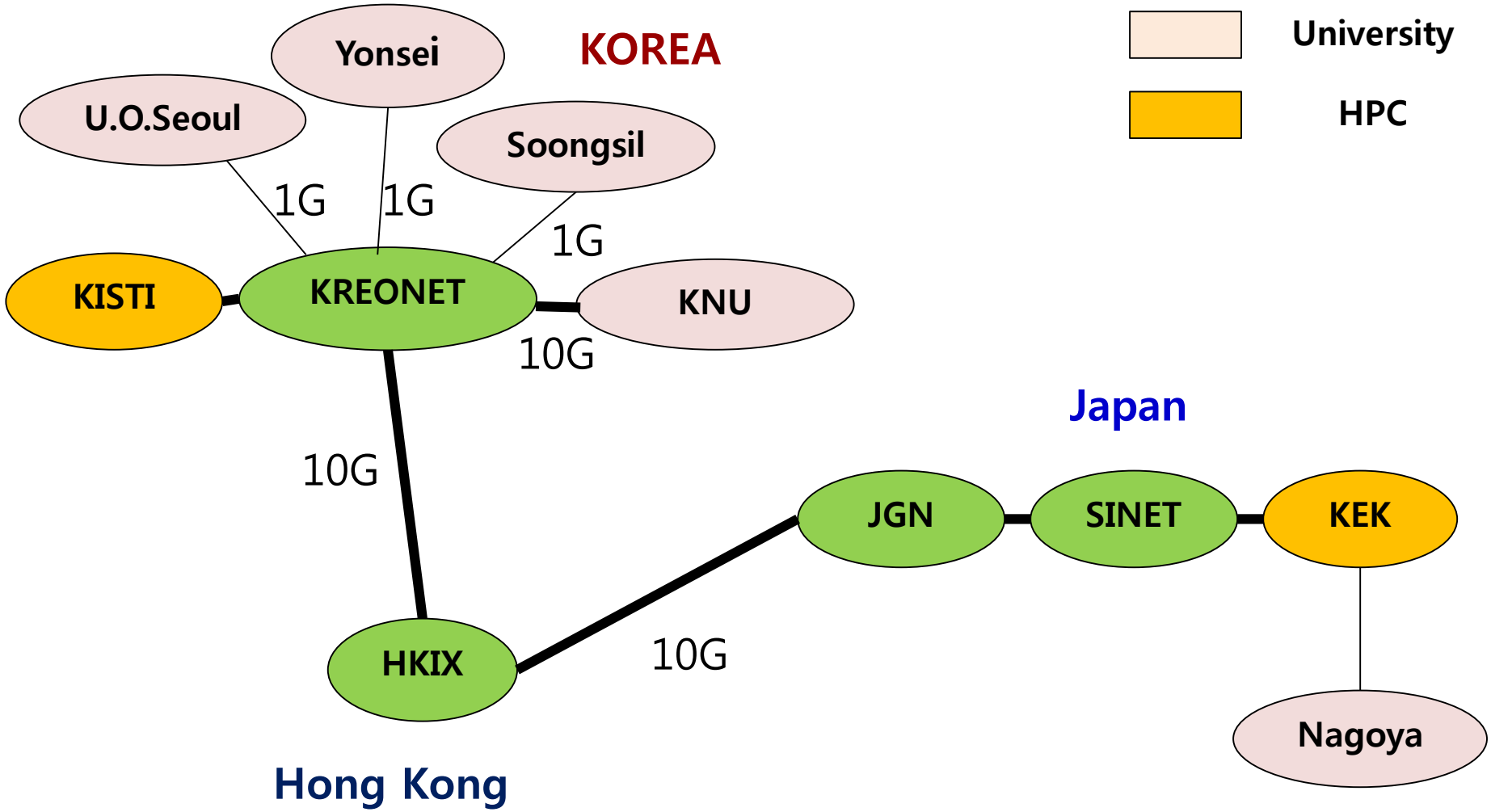
Network

Prof. B. S. Cho

HEP sites abroad



HEP Sites in Korea



Reports on HEP sites in Korea

- Soongsil U. / Yonsei U.
  - Belle II
- KNU
  - CMS
- KISTI GSDC
  - ALICE, CMS
  - LIGO
  - Belle II
  - etc.

Summary

Summary

- Physics goes beyond discovery.
- Computing needs solutions for the evolving architecture.

⇒ Efforts to fulfill the gap between physics and computing in Korea

Thank you.