19th International Workshop on ACAT at Geneva

Production experience and performance study for HEP data production at HPC TianheII

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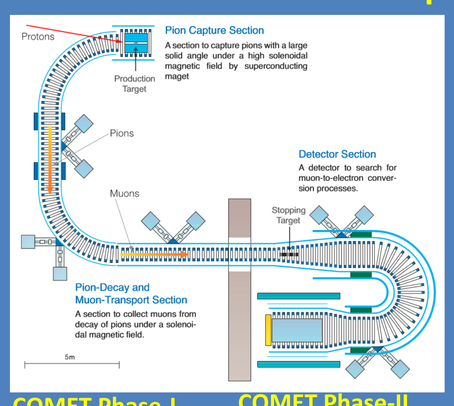
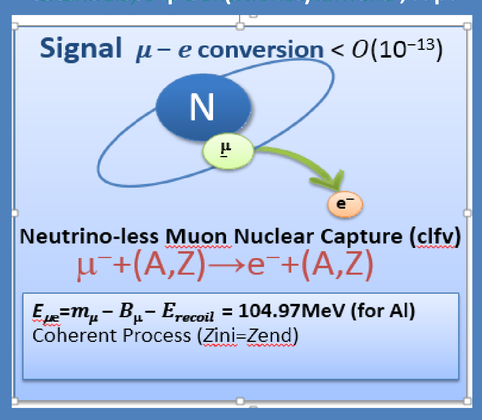
Introduction

Pursuit of 10^{-17} level single event sensitivity of charged lepton flavor violation(cLFV) require a extremely huge computing power consuming for end to end beam transportation simulation. The task is a big challenge to normal computing cluster, and we test the possibility of fulfill the requirement by employ more and more faster supercomputer power in China.

COMET experiment



Located in the Japan Proton Accelerator Research Complex (J-PARC) in Tokai, Japan.



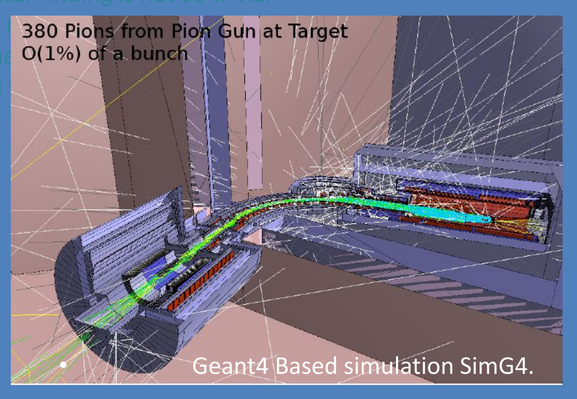
COMET Phase-I
- For BG measurements,
- R~10^{-15} muon conversion
- proton beam power 3kW

COMET Phase-II
- For R~10-15 muon conversion measurement
- proton beam power 56kW

Production challenge for COMET Phase-I

- Simulate 1 second beam on need:

1x10^6bunch/s x 8x10^6protons/bunch x 2.7CPU s/proton = **6X10^9 CPU hours**

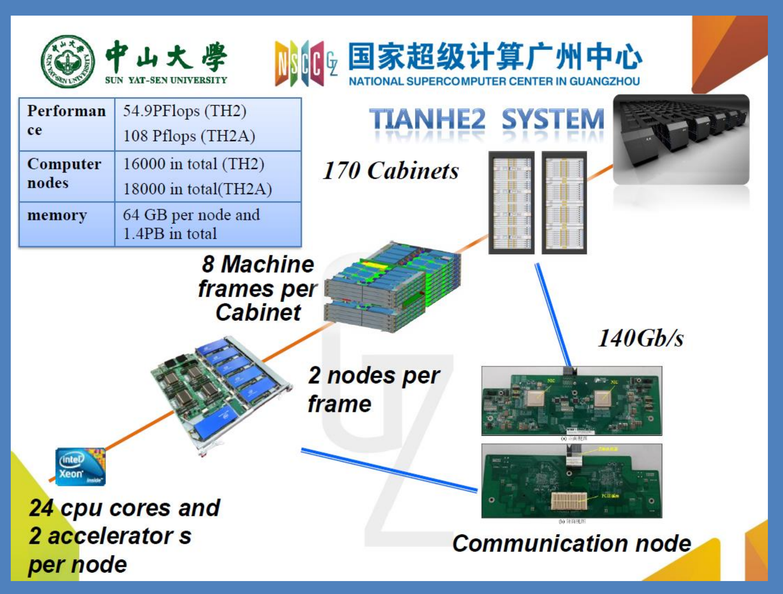


Tianhe-2(Milky Way2) Supercomputing

中山大學 SUN YAT-SEN UNIVERSITY　国家超级计算广州中心 NATIONAL SUPERCOMPUTER CENTER IN GUANGZHOU

- Located in Sun Yat-sen University, National Supercomputing center in Guangzhou, China, http://en.nscc-gz.cn/
- ~16,000 node, 24 CPUs/node, total CPU cores
- World's fastest at 2013 ~ 2015

- Resources for COMET
  - –500 nodes = 1,2000 CPUs run in parallel



Software framework ICEDUST was installed in TianheII successfully, mass production performance and data transfer were tested

ICEDUST installation

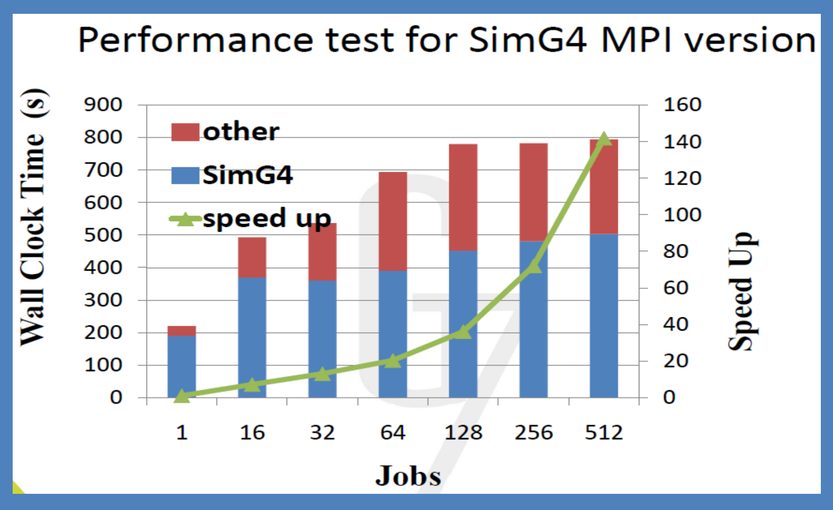
- Operation system
  - Linux version 2.6.32-431.TH.x86_64
  - gcc version 4.4.7 20120313 (Red Hat 4.4.7-4)
  - support mulit-thread compiling OpenMP and MPI
- Source code (for security no internet connection)
  - download from gitlab into IHEP
  - copy ICEDUST v3r1p3 and EXTERNAL v3r3 packages by scp
- Installation
  - could not use default ICEDUST install script
  - broadcast make at Project/cmt directory

Speed

	# file	Proton/file	CPU time/proton
Tianhe-2	230	4e4	**2.4 second**
In2p3-cc	122	8e6	2.76 second
TAURUS	122	4e4	2.7 second

The speed is sensitive to the memory bandwidth

	64GB		128GB	
Jobs in one nodes	Wall clock time(s)	SimG4(s)	Wall clock time(s)	SimG4(s)
20	859.6	565	506	296
24	1720	952	533	309



Data transfer to IHEP

Bandwidth from Tianhe-2 to IHEP is 5~6MByte/s

This is equivalent to the output of run 10,000 jobs in parallel

Summary

Tianhe-2 used for COMET production is tested

1. ICEDUST installation and job submission have been realized
2. Computing speed is ~2.43second/proton
3. Data transfer ability is 5~6MByte/second=~10,000 MC4o thread
4. We will parallel the software in some different ways and test which will be better

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