

Geant4 Workshop, Hebden Bridge, 19 September 2007

System benchmarks

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Introduction

Currently we have two types of "system benchmarks", i.e. Geant4 applications which stress the main components of the kernel (Geometry, Transportation, and Physics):

- **Electromagnetic calorimeters**: aimed to study the electromagnetic physics;
- **Hadronic calorimeters**: aimed to study the hadronic physics.
(Of course, electromagnetic physics is also involved, because hadronic showers have always an electromagnetic component due to $\pi^0 \rightarrow \gamma \gamma$)

EM benchmarks

- EM benchmark is established for two main calorimeter types
 - Sampling calorimeter - TestEm3
 - Crystal calorimeter - TestEm9
- Scripts are provided
- ASCII output
 - Can be used by stt
 - Parser for automatic result analysis can be added

EM CPU benchmark SLC3

Electromagnetic physics

EM-1 : 10 GeV e- in matrix 5x5 of PbWO₄ crystals (CMS-type);
cut = 0.7 mm, 1000 events.

EM-2 : 10 GeV e- in ATLAS barrel type sampling calorimeter;
cut = 0.7 mm, 1000 events.

EM-3 : 10 GeV e- in ATLAS barrel type sampling calorimeter;
cut = 0.02 mm, 100 events.

All numbers
with CERN
afs installation
for SLC3 and
shared libraries

Release	QGSP			QGSP_EMV		
	EM-1	EM-2	EM-3	EM-1	EM-2	EM-3
5.2.p02	1.03	0.99	1.59			
6.2.p02	0.89	0.98	0.97			
7.1.p01	1.00	1.00	1.00			
8.0.p01	1.33	2.24	2.26			
8.1.p01	1.37	2.43	2.01	1.06	1.08	1.07
8.2.p01	1.27	2.03	1.73	1.03	1.09	1.06
8.2.ref02	1.29	2.14	1.79	1.03	1.08	1.06
8.2.ref03	1.28	2.08	1.78	1.04	1.04	1.05

Hadronic calorimeters

Currently, for CPU performance studies, we use the following sampling hadronic calorimeter:

- Copper-Scintillator
 - 25 layers, Cu (6cm) - Sci (4mm)
- (a simplified version of CMS HCAL)

In 3 configurations:

- 1) π^- 50 GeV , B=0
- 2) e^- 50 GeV , B=0
- 3) π^- 50 GeV , B=4T

We use default 0.7 mm production cut.

We generate 4000 events.

We run on pcg4speed2 (SLC4), with local CLHEP and Geant4 installations, built statically.

CPU time results

Release	Physics List	sec/evt		Ratios	
		B=0	B=4T		
5.2.p02	QGSP_GN	1.96	2.22	1.01	1.03
6.2.p02	QGSP_GN	1.86	2.06	0.96	0.96
7.1.p01a	QGSP_GN	1.95	2.15	1.00	1.00
8.0.p01	QGSP_EMV	2.12	2.39	1.09	1.11
8.1.p02	QGSP_EMV	2.27	2.48	1.17	1.16
8.2.p01	QGSP_EMV	2.36	2.68	1.21	1.25
8.3.p01	QGSP_EMV	2.31	2.62	1.18	1.22
9.0.p01	QGSP_EMV	2.19	2.50	1.12	1.16
8.0.p01	QGSP	2.31	2.67	1.19	1.24
8.1.p02	QGSP	2.54	2.85	1.30	1.33
8.2.p01	QGSP	2.56	2.96	1.31	1.38
8.3.p01	QGSP	2.47	2.88	1.27	1.34
9.0.p01	QGSP	2.33	2.72	1.19	1.27