Simulation tools

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Simulation tools

CERN Accelerating science

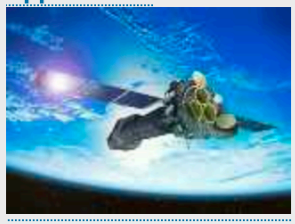
GEANT4
A SIMULATION TOOLKIT

Geant4

Overview

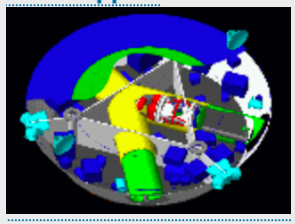
Geant4 is a toolkit for the simulation of the passage of particles through matter. Its areas of application include high energy, nuclear and accelerator physics, as well as studies in medical and space science. The three main reference papers for Geant4 are published in Nuclear Instruments and Methods in Physics Research A 506 (2003) 250-303, IEEE Transactions on Nuclear Science 53 No. 1 (2006) 270-278 and Nuclear Instruments and Methods in Physics Research A 835 (2016) 186-225.

Applications



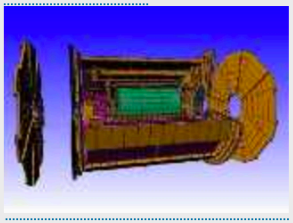
A sampling of applications, technology transfer and other uses of Geant4

User Support



Getting started, guides and information for users and developers

Publications



Validation of Geant4, results from experiments and publications

Collaboration

Who we are: collaborating institutions, members, organization and legal information

Geant4 is monte-carlo simulation toolkit – http://geant4.web.cern.ch

• Simulates radiation interactions with matter

• GEometry ANd Tracking

• HEP background

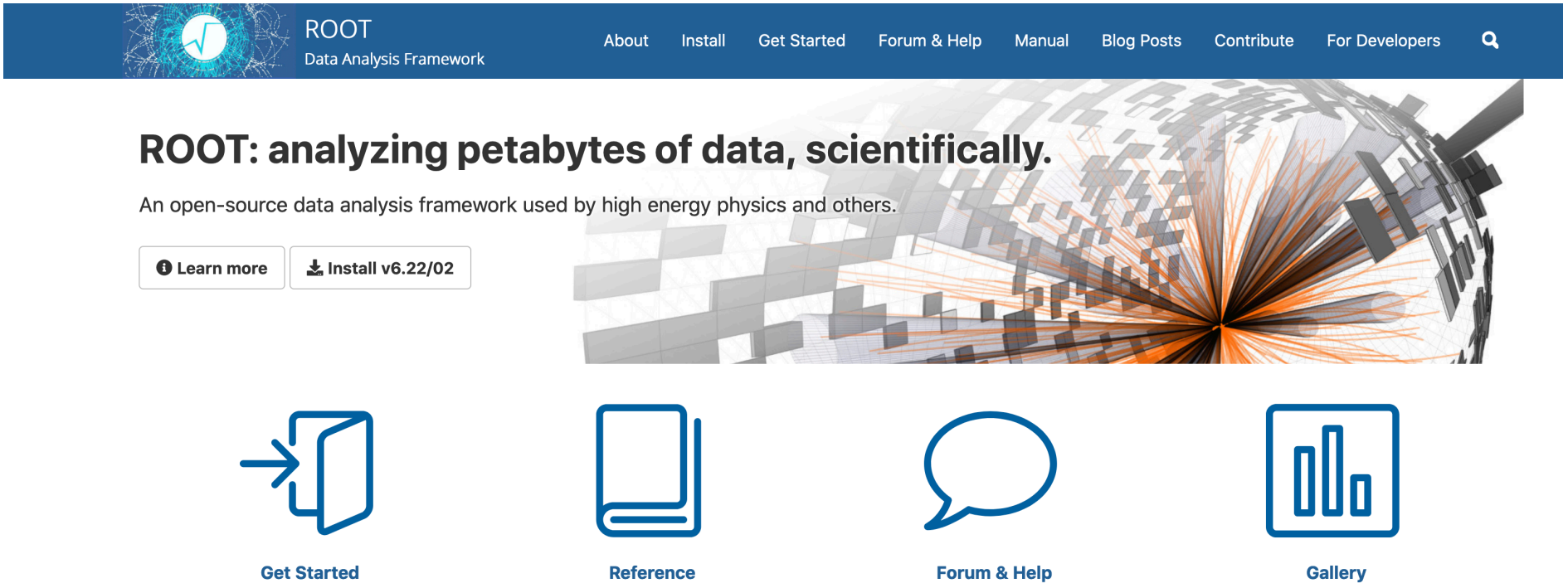
Simulation tools

All the physics about the interaction of muons with matter is included in a simulation package developed at CERN and called GEANT4. Indeed GEANT4 is a toolkit for simulating the passage of particles through matter. It includes a complete range of functionality including **tracking, geometry, physics models and hits**.

The toolkit is the result of a worldwide collaboration of physicists and software engineers. It has been created exploiting software engineering and object-oriented technology and implemented in the C++ programming language. It is being used in applications in particle physics, nuclear physics, accelerator design, space engineering and medical physics.

It is the most complete, reliable and basically the *de facto* statutory software toolkit for this kind of simulations.

Simulation tools



CERN software to analyse physics data

**Mathematics, statistics, visualisation, histograms, graphs, ….
everything you need**

Simulation tools

+

VMC
Simulation Framework

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vmc-project on Github
Copyright
Credits

Built from Grav and Hugo

VMC PROJECT

Virtual Monte Carlo (VMC) defines an abstract layer between a detector simulation user code (MC application) and the Monte Carlo transport code (MC). In this way the user code is independent of any specific MC and can be used with different transport codes within the same simulation application.

The implementation of the interface is provided for two Monte Carlo transport codes, GEANT3 and Geant4. The implementation for the third Monte Carlo transport code, FLUKA, has been discontinued by the FLUKA team in 2010.

VMC was developed by the ALICE Software Project and, after the complete removal of all dependencies from the experiment specific framework, it was included in ROOT and then gradually separated from ROOT into a stand-alone vmc-projet.

These are new documentation pages, migrated from root.cern.ch/vmc. If you have suggestions about how to improve this documentation, you can let us know. See Support.

Info

Reference paper
Hřivnáčová I et al: The Virtual MonteCarlo,
ECONF C0303241:THJT006,2003; e-Print: cs.SE/0306005

Contact: root-vmc@cern.ch

Last update: 09/09/2020

Simulation tools - What's inside the MC

Cosmic ray muons generator

Each "muon" is generated according
to the natural flux (energy and direction)
[GENERATING OVER A CYLINDER]

Geant4

Geant4

Blast furnace Geometry

The elements of the Blast (geometry, size and composition)
are reproduced [based on muBlast project]

Detectors

The elements of the detectors
(geometry, size and composition) are reproduced.

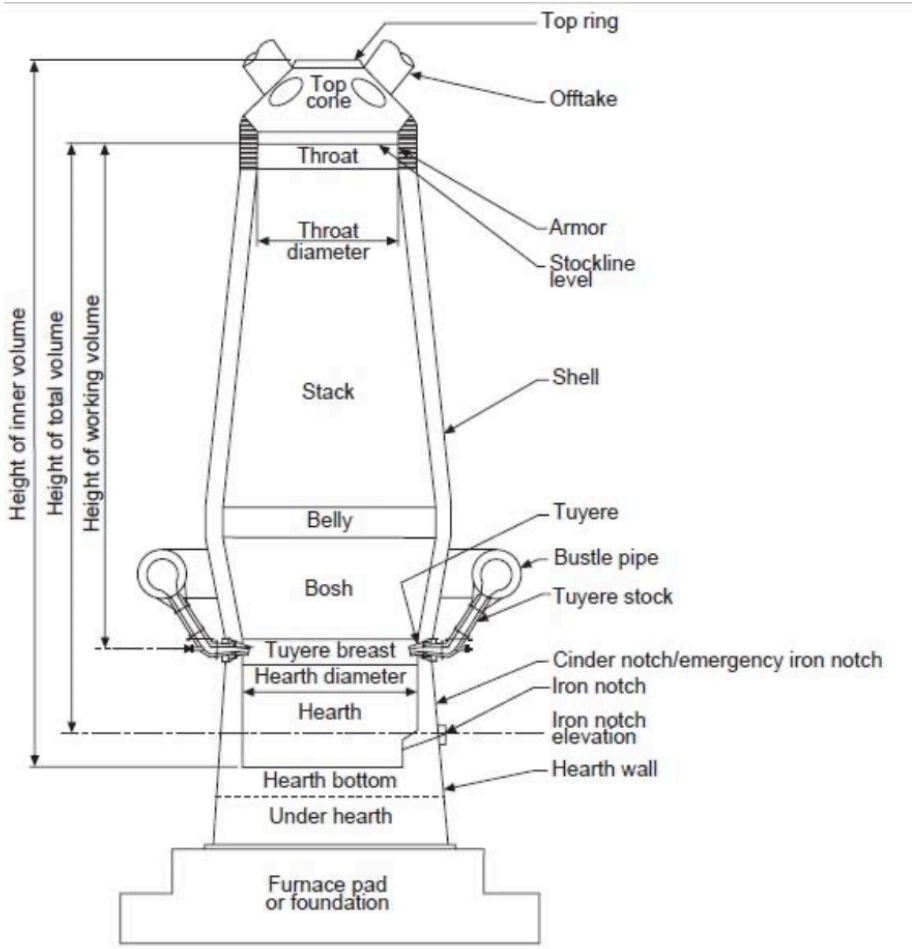
Simulation tools - Geometry

MATERIAL COMPOSITION OF THE DIFFERENT ZONES

The material composition of the different zones has to be defined. The following table reports simply a guess.

material	Zone	composition	Density (g/cm^3)
1	Zone 1, ore layer	70%Fe + 30%O	2.30
2	Zone 1, coke layer	100% C	0.5
3	Zone 2, mixed ore and coke	50% ore layer(1) + 50% coke layer(2)	In consequence
4	Zone 3, softened ore	50% ore layer(1) + 50% pig iron(10)	In consequence
5	Zone 3, coke layer	100% C	0.5
6	Zone 4, deadman with percolating iron	90% coke(2) + 5% pig iron(10)	In consequence
7	Zone 5, gas from tuyeres	100% air	10^(-3)
8	Zone 6, slag	41% O + 27.9% Ca + 16.8% Si + 9.0% Mg + 5.3% Al	2.80
9	Zone 7, coke + slag	75% Coke(2) + 20% Slag(8) + 5% pig iron(10)	In consequence
10	Zone 8, pig iron	95% Fe + 4.0% C + 1.0% Si	6.64
11	Zone 9, coke + pig iron	75% Coke(2) + 25% Pig iron(10)	In consequence

Simulation tools - Geometry



Simulation tools - Geometry check