Software Life Cycle

ALICE

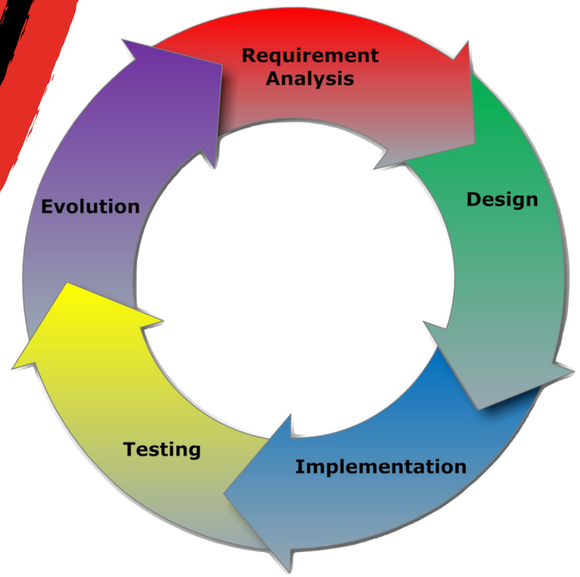
SDLC

ISO12207

Oscar Vázquez

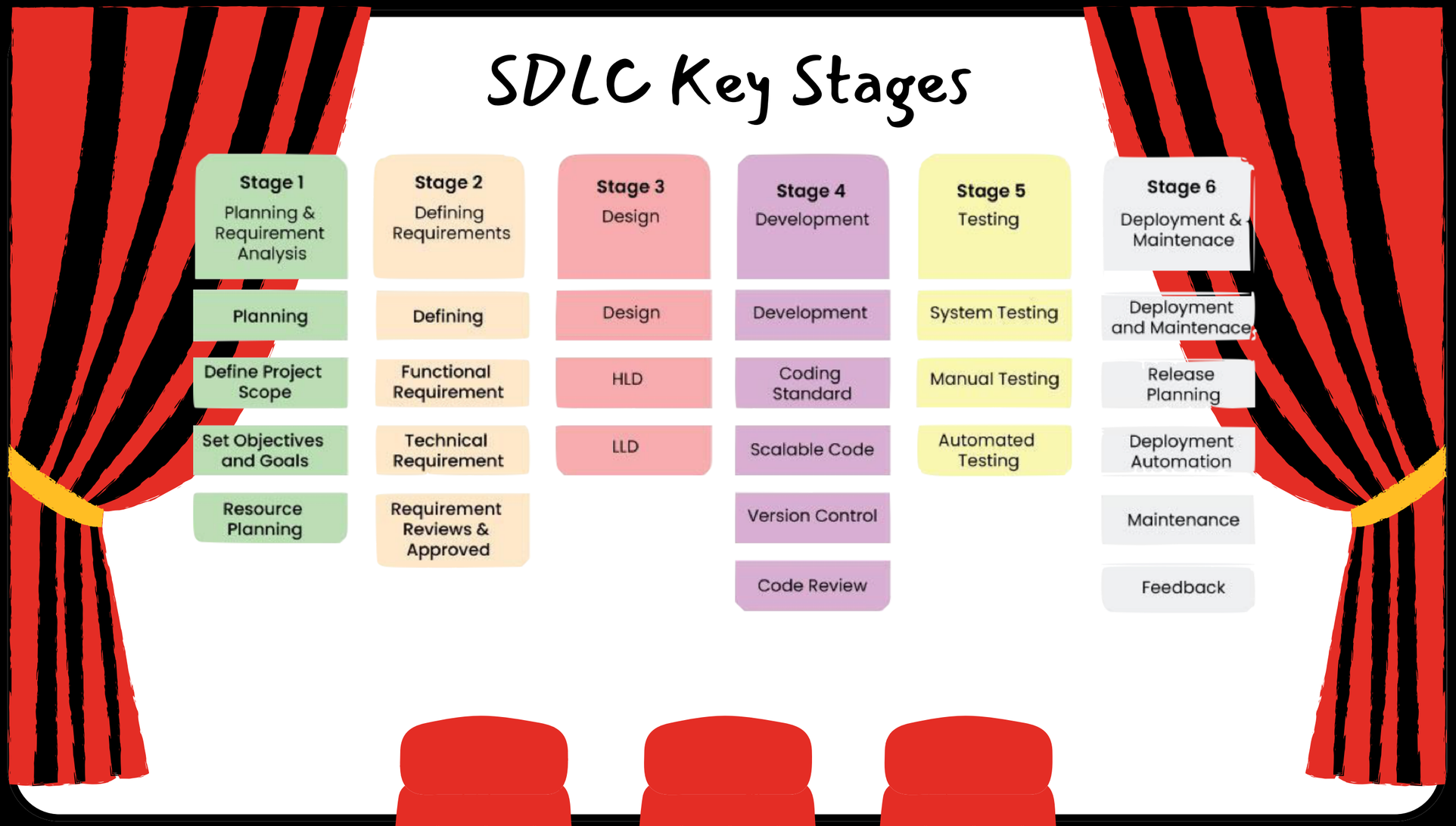

SOFTWARE

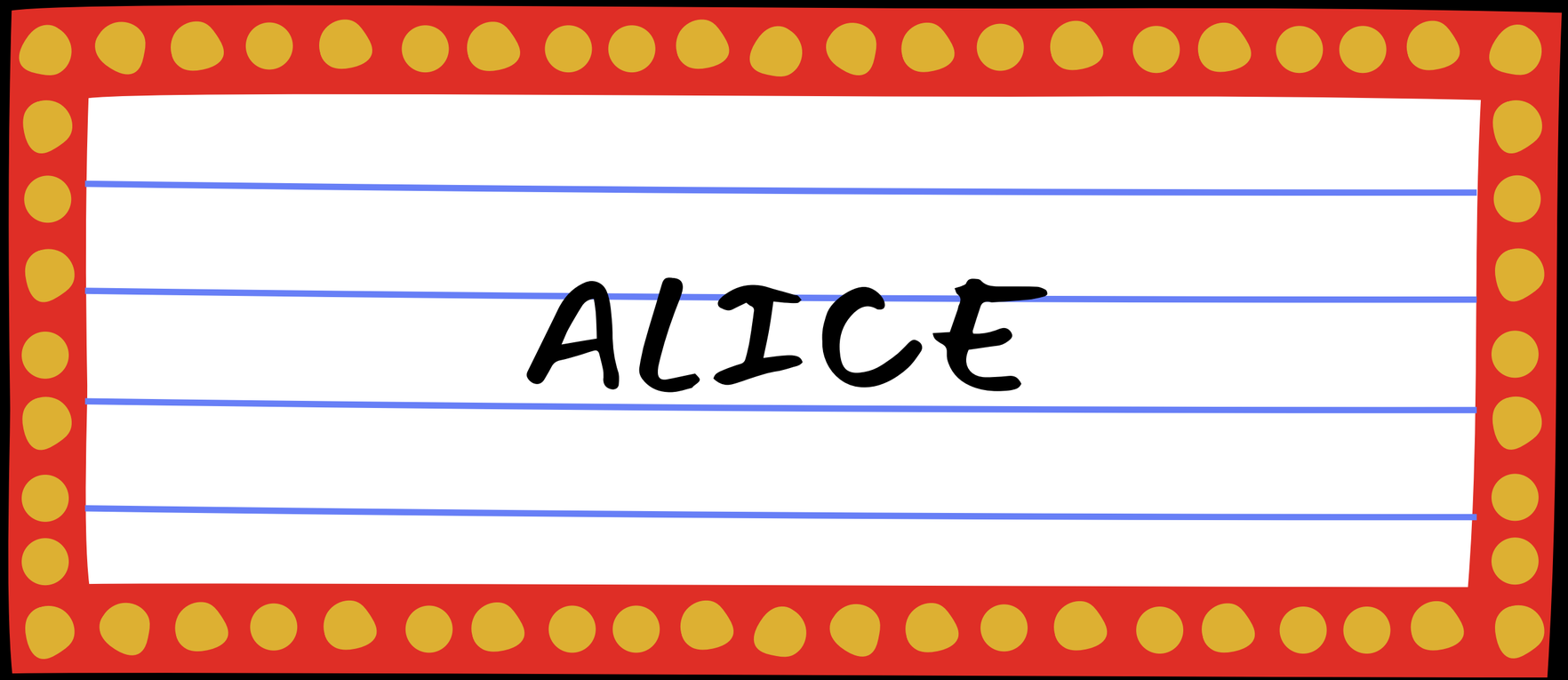
Software Development



SDLC, or software development life cycle, is a methodology that defines the entire procedure of software development step-by-step.

SDLC Key Stages




ALICE

ALICE

ALICE has designed a data acquisition system (DAQ) that operates satisfactorily during LHC collisions (protons and heavy ions). Additionally, ALICE's DAQ balances its recording ability central collision events and events with effective sections of rare events.

1

All Software (simulation environment) used in ALICE is known as AliRoot, which has the root environment as its platform.

2

AliRoot is built based on classes, which are responsible for carrying out specific tasks Simulations and Reconstructions of events.

3

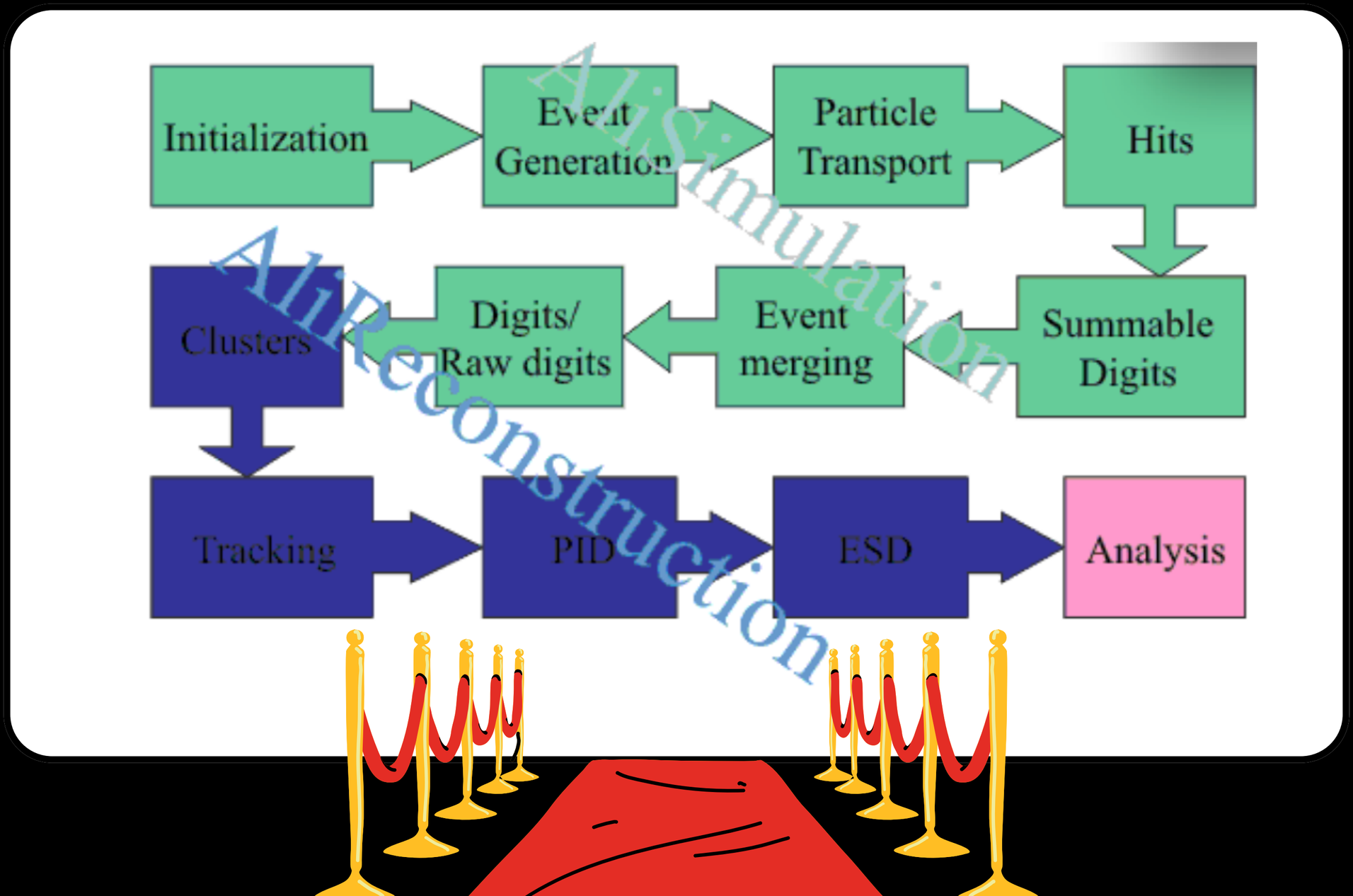
AliRoot's Life Cycle

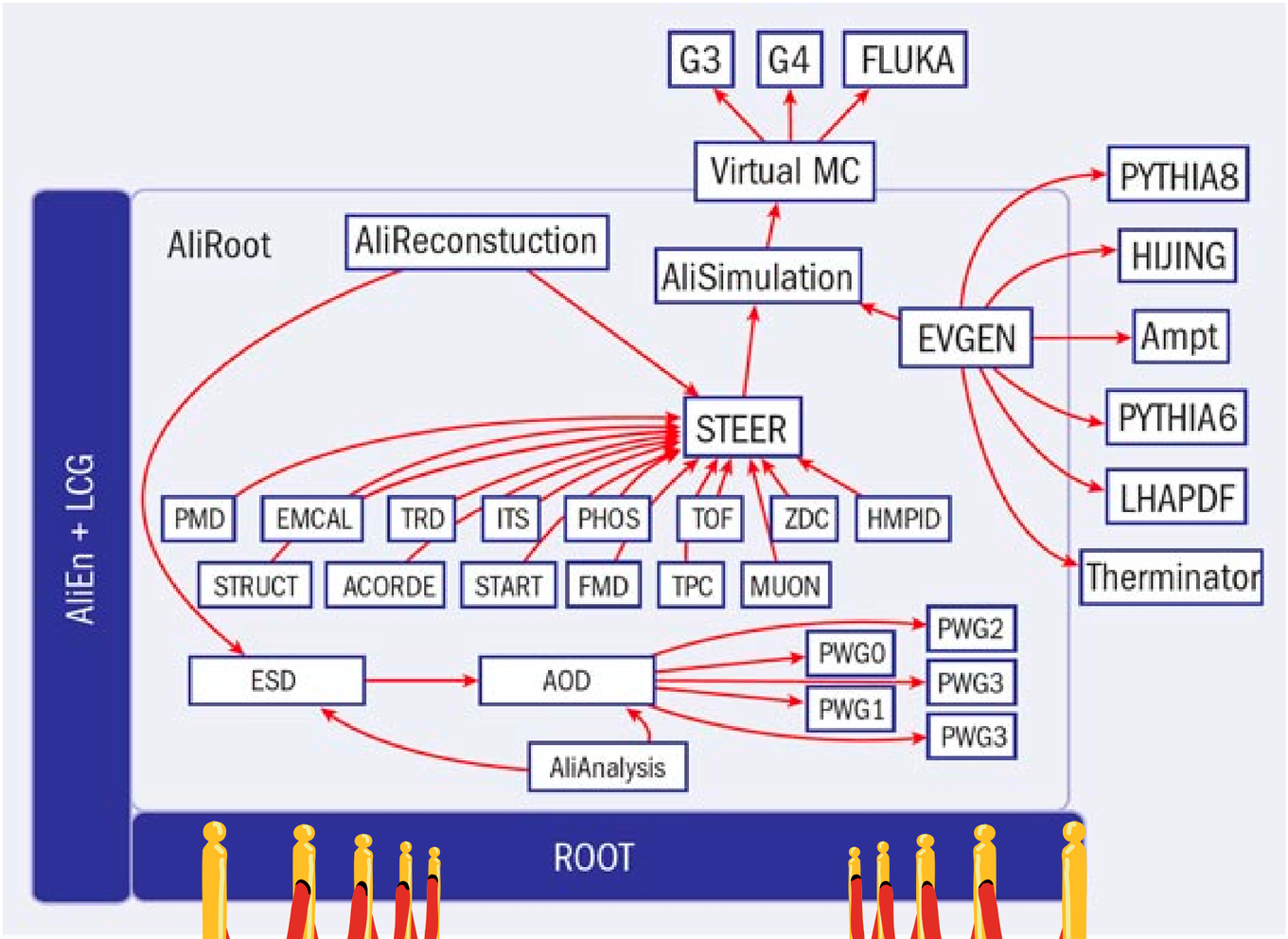
AliRoot

1. Simulations. The different types of simulation carried out in ALICE are: primary collisions (protons and heavy ions), generation of particles, transport of these through the detector, simulation of the energy deposited in each of them, the response of the detectors and the digital signal generation.

2. Reconstruction of events

After finishing the simulation of events in ALICE, we proceed to the reconstruction of them using files that contain digits or RAW data types.


Initialization
Event Generation
Particle Transport
Hits
Summable Digits
Event merging
Digits/ Raw digits
Clusters
Tracking
PID
ESD
Analysis
AliSimulation
AliReconstruction


G3
G4
FLUKA
Virtual MC
PYTHIA8
HIJING
Ampt
PYTHIA6
LHAPDF
Therminator
AliRoot
AliReconstuction
AliSimulation
EVGEN
STEER
AliEn + LCG
PMD
EMCAL
TRD
ITS
PHOS
TOF
ZDC
HMPID
STRUCT
ACORDE
START
FMD
TPC
MUON
ESD
AOD
PWG2
PWG0
PWG3
PWG1
PWG3
AliAnalysis
ROOT

International Standards

ISO 12207

1

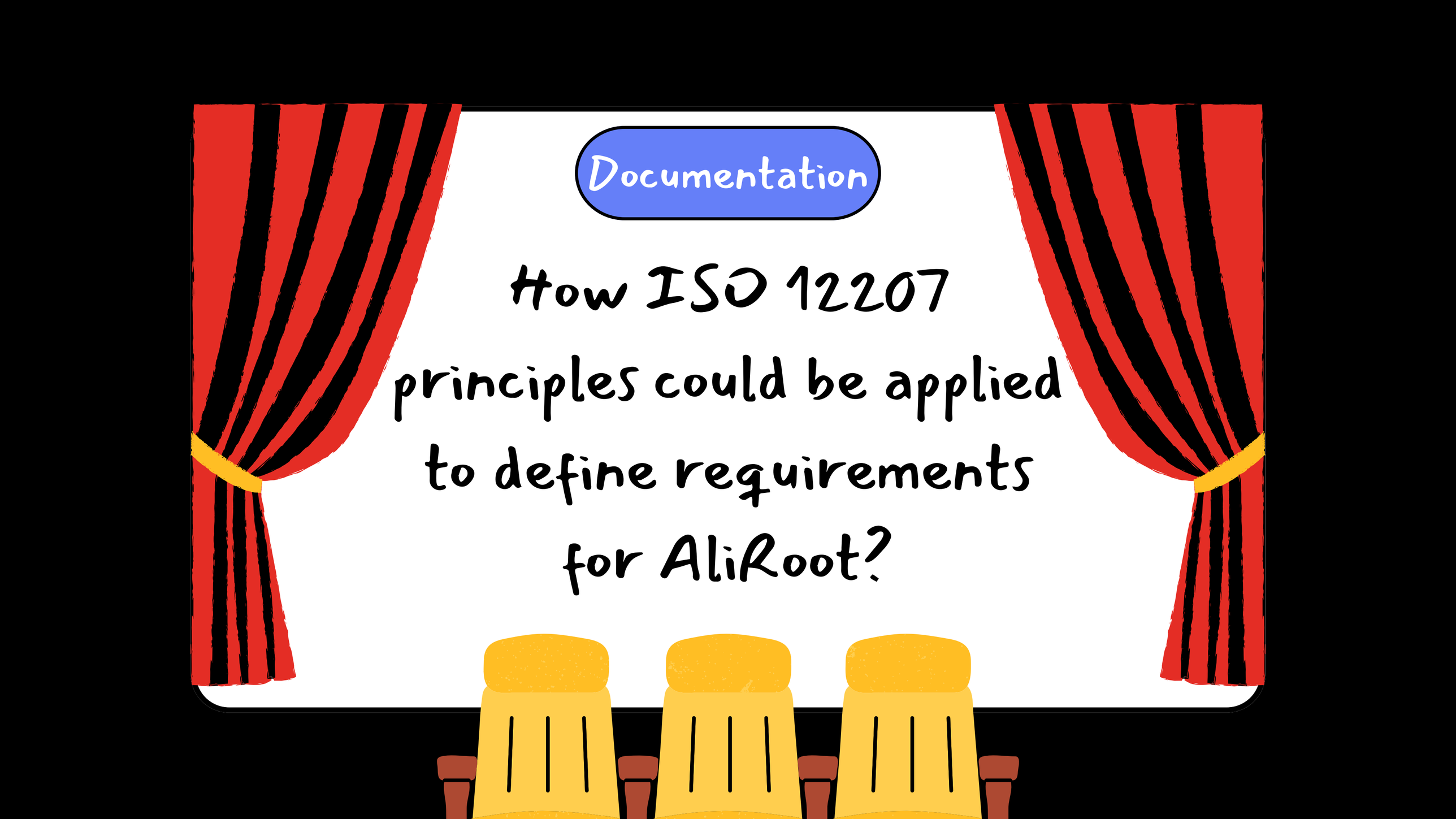
Intarnational Standard ISO 12207, establishes a framework for software's life cycle

2

Specifies processes, activities and tasks related to the development, acquisition and maintenance of software.

3

This standard does not specify any model life cycle or software management.


Documentation
How ISO 12207 principles could be applied to define requirements for AliRoot?

Documentation ISO 12207 example for AliRoot

Step	Name	Requirement	Justification
1	Acquisition Process:	AliRoot shall provide documentation specifying its functionality, interfaces, and system requirements for potential users.	This requirement ensures that users can understand the capabilities and limitations of AliRoot before acquiring and using it for their experiments.
2	Supply Process:	AliRoot shall be delivered with installation instructions, user guides, and release notes.	Providing comprehensive documentation and support materials facilitates the installation, configuration, and use of AliRoot by end-users.
3	Development Process:	AliRoot developers shall follow a documented software development process, including requirements analysis, design, implementation, testing, and maintenance.	Adhering to a structured development process ensures the reliability, maintainability, and extensibility of AliRoot throughout its life cycle.
4	Operation Process:	AliRoot shall support compatibility with various computing platforms commonly used in high-energy physics research.	Supporting multiple computing platforms ensures that AliRoot can be deployed and used effectively in different research environments.

Step	Name	Requirement	Justification
5	Maintenance Process:	AliRoot shall provide mechanisms for bug reporting, issue tracking, and software updates.	Continuous maintenance and support are essential for addressing software defects, improving performance, and adding new features over time.
6	Configuration Management Process:	AliRoot shall implement version control and configuration management practices to track changes to source code, documentation, and other project artifacts.	Effective configuration management ensures the integrity and traceability of software artifacts throughout their life cycle.
7	Quality Assurance Process:	AliRoot shall undergo regular quality assurance activities, including code reviews, testing, and validation against experimental data.	Quality assurance activities help ensure that AliRoot meets specified requirements, performs reliably, and produces accurate results for data analysis.
8	Documentation Management Process:	AliRoot shall maintain up-to-date documentation describing its architecture, algorithms, APIs, and usage guidelines.	Comprehensive documentation facilitates understanding, collaboration, and knowledge transfer among AliRoot developers and users.
9	Improvement Process:	AliRoot shall periodically assess its performance, usability, and user feedback to identify opportunities for enhancement and optimization.	Continuous improvement ensures that AliRoot remains relevant, efficient, and user-friendly in supporting high-energy physics research.

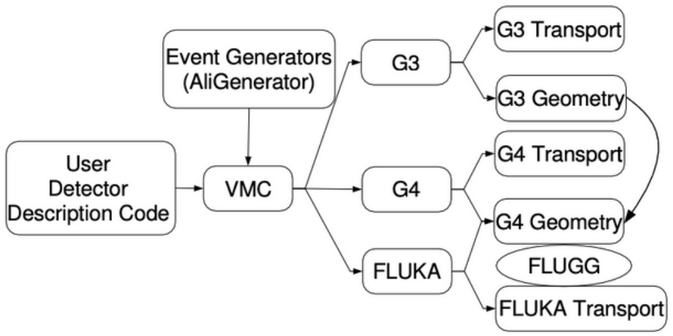


Figure 3: Virtual Monte Carlo

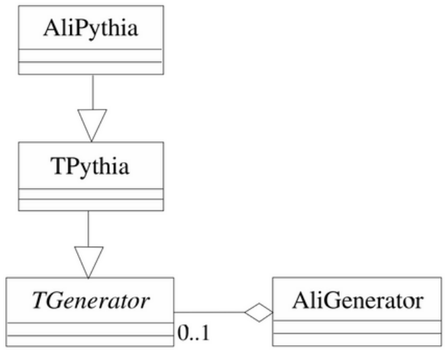
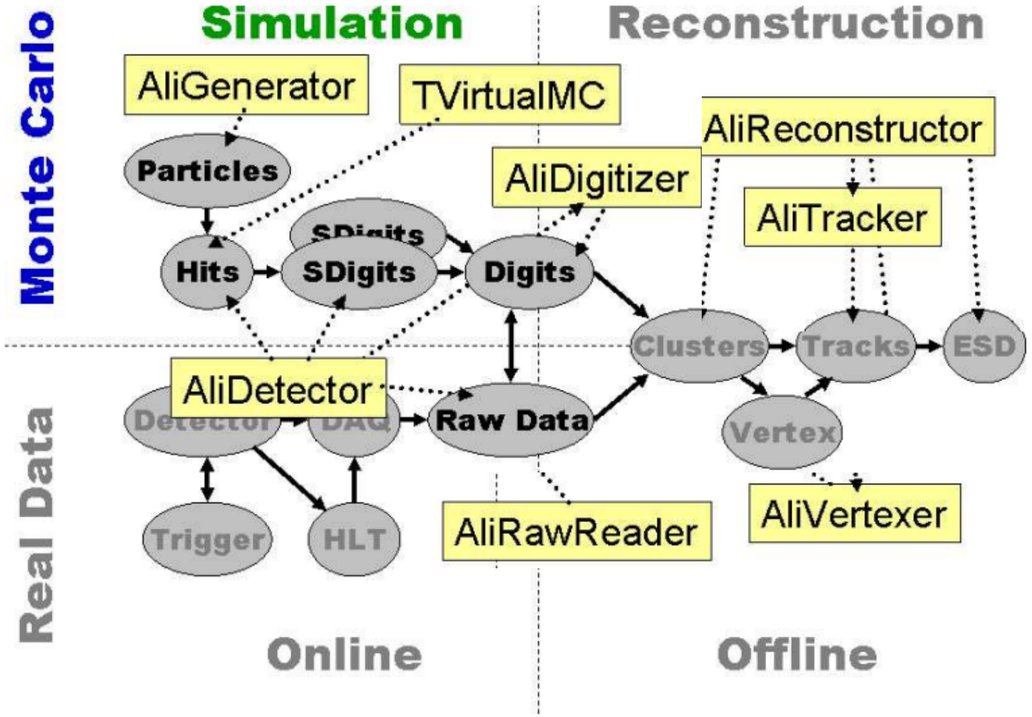


Figure 4: `AliGenerator` is the base class, which has the responsibility to generate the primary particles of an event. Some realizations of this class do not generate the particles themselves but delegate the task to an external generator like PYTHIA through the `TGenerator` interface.



SWOT Analysis

1

You will guess a movie based on the characteristics or something that is related to the movie

2

You will guess a movie shown in the question and choose the right one in multiple choices

3

You will guess a movie from a picture related to the movie

3

You will guess a movie from a picture related to the movie

SWOT Analysis

Strengths

AliRoot provides a comprehensive framework for simulating, reconstructing, and analyzing data

AliRoot's architecture allows for easy customization, providing flexibility to researchers.

v AliRoot is built on top of the ROOT framework, enabling seamless integration with powerful tools for data storage, analysis, and visualization, which enhances its capabilities for handling large datasets.

Weakness

The complexity of AliRoot's architecture and functionality may pose a challenge for novice users to understand and utilize effectively, requiring a steep learning curve.

Despite efforts to provide comprehensive documentation and user support resources, there may be areas where the documentation is lacking or outdated, leading to difficulties for users in navigating the software.

Opportunities

AliRoot can capitalize on opportunities to integrate with new experiments beyond ALICE, expanding its user base and applicability to a broader range of high-energy physics research projects.

Expanding the user community through outreach efforts, training programs, and collaborative initiatives can foster knowledge exchange, innovation, and the sharing of best practices among AliRoot users worldwide.

Threats

Heightened concerns about data privacy and security in the context of high-energy physics experiments could present challenges for AliRoot in ensuring compliance with regulatory requirements and addressing potential vulnerabilities in data handling and processing.

The emergence of competing software frameworks for high-energy physics data analysis could pose a threat to AliRoot's market share and adoption if they offer superior features, performance, or user experience.


Thank you
for your
attention!