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of Physics**

WARSAW UNIVERSITY OF TECHNOLOGY



**Faculty of Electronics
and Information
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ALICE



New version of ALICE MasterClasses

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IPPOG Meeting
CERN, Geneva, Switzerland
November 29, 2019





ALICE MasterClasses

ALICE MasterClass is a part of MatPhysChemWUT project which is partially funded by the European Union through the European Social Fund



**European
Funds**

Knowledge Education Development



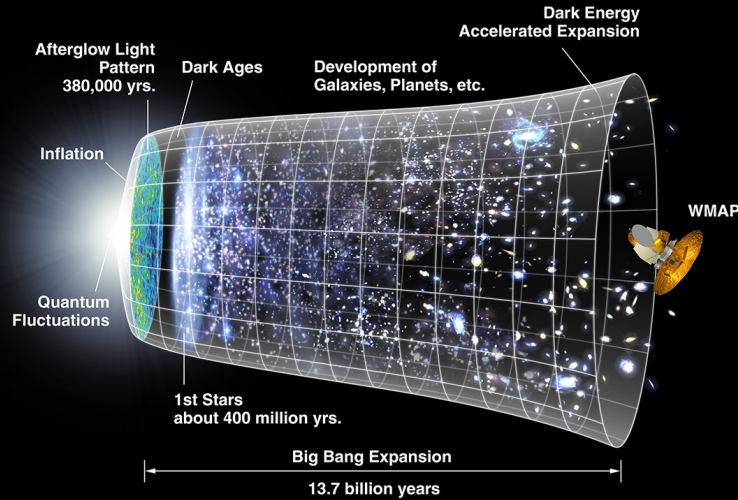
**Republic
of Poland**

European Union
European Social Fund



Big and Little Bang

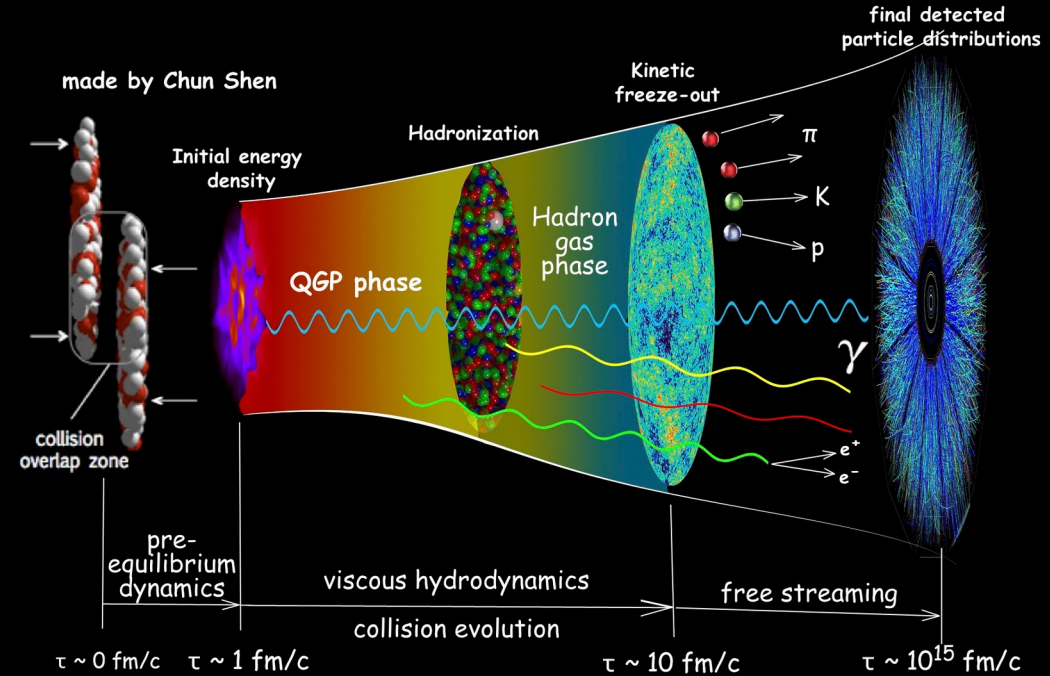
Similar to the QGP in the early universe



Credit: NASA

our Universe

NASA/WMAP Science Team

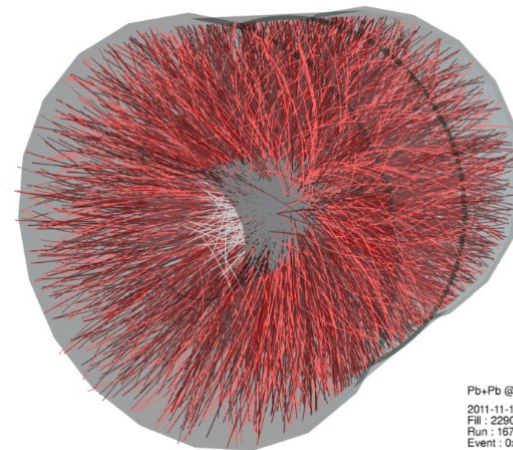


Credits: Paul Sorensen, Chen Shen

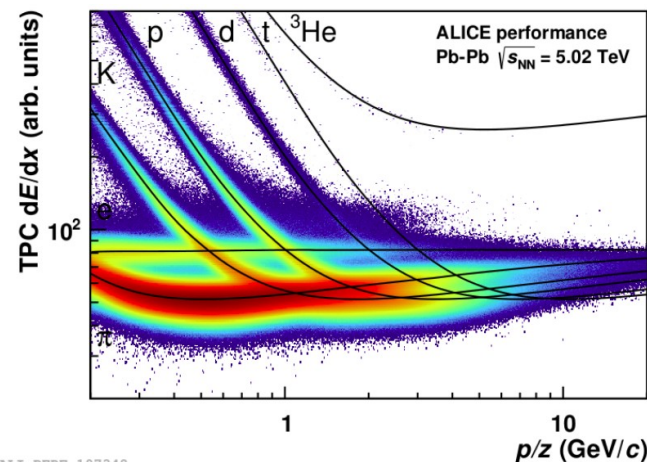
a heavy-ion collision

ALICE & Heavy-ion collisions

- **ALICE – the heavy-ion dedicated experiment at LHC**
 - study matter at extreme conditions using multiple observables
- **Main technical aspects:**
 - challenging tracking (high multiplicities, low momenta)
 - **particle identification (PID) using practically all known techniques**
 - TPC – heart of ALICE tracking and dE/dx



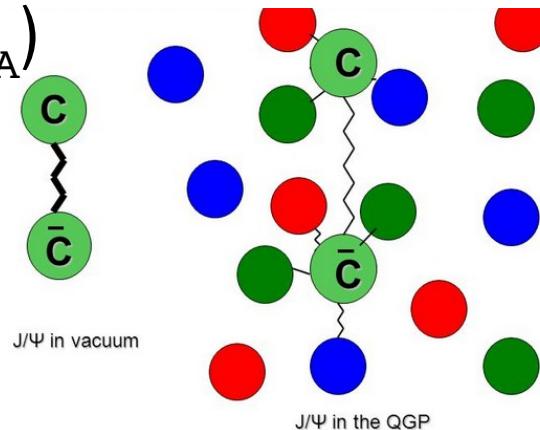
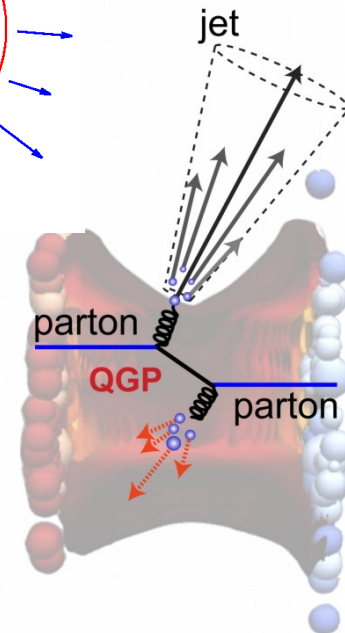
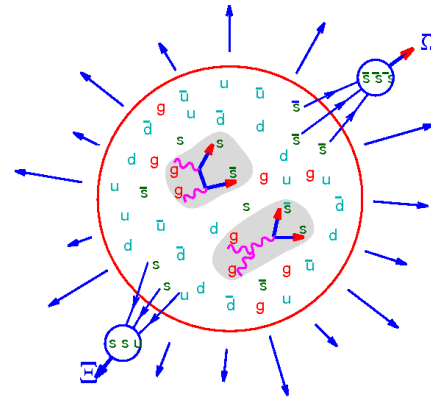
Pb+Pb @ \sqrt{s} = 2.76 ATeV
2011-11-12 06:51:12
File : 2290
Run : 167893
Event : 0x3d94315a



ALICE MasterClass – measurements

- **Three measurements**
signatures of QGP

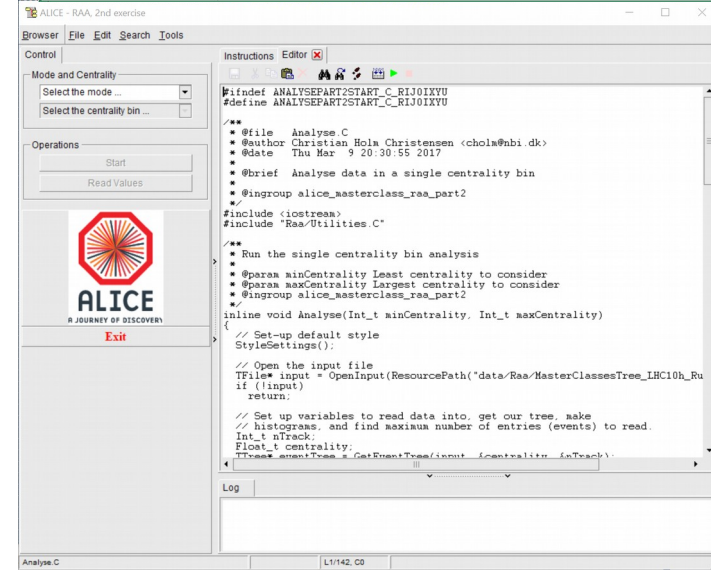
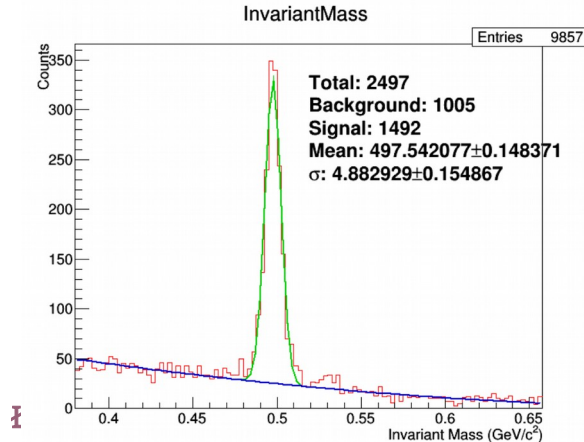
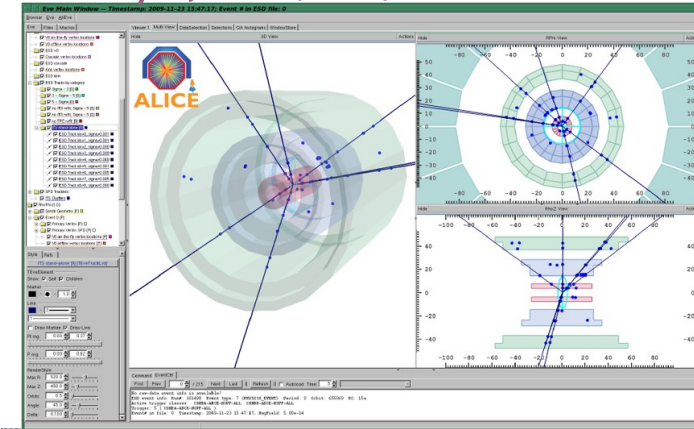
- 1) *Strangeness enhancement* → decays of strange hadrons
- 2) *Jet quenching* → nuclear modification factor (R_{AA})
- 3) *J/Ψ suppression*
(work in progress)



ALICE MasterClass

first pp event seen by ALICE
Eur. Phys. J. C65 (2010) 111-125

- Based on ROOT (EVE):
 - simplified **event display**, close to the one used in the control room
 - visual analysis of small sample of events (~50)
 - statistical analysis of larger samples (fitting, background parameterization)
 - “writing code”



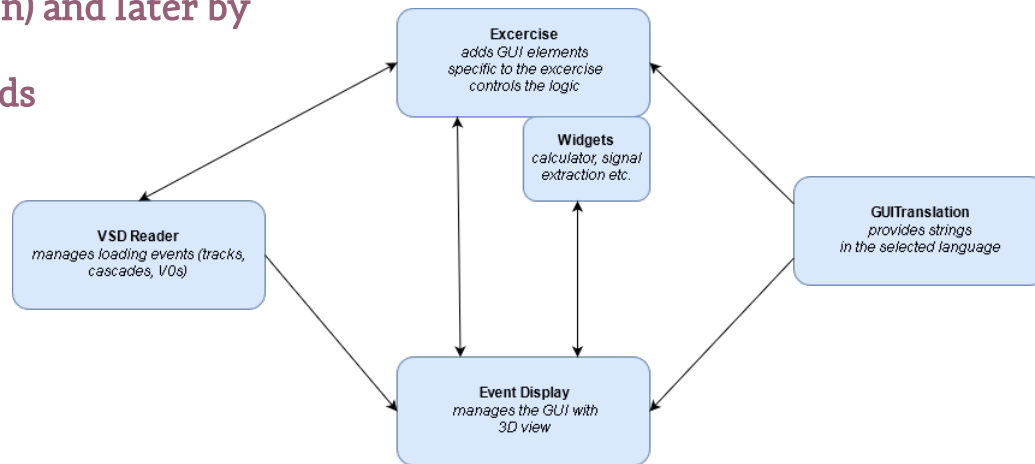
New developments

Initial work by Christian Christensen (Copenhagen) and later by CERN Summer Student (Jonas Toth) in 2018

Taken over by Piotr Nowakowski (WUT) afterwards

- **Macros → standalone app**
- **Common framework**
 - all exercises share core classes
- **Source code on CERN GitLab:**
<https://gitlab.cern.ch/pinowako/masterclass-continued>
- **CMake build system**
- **Available versions:**

- **Linux** (AppImage binary, clickable, **ROOT embedded!**)
- **Windows** (Visual Studio compiled, installer, clickable, **ROOT embedded!**) – first time provided!
- **Virtual Box** machine (pre-configured Ubuntu)



Piotr Nowakowski > masterclass-continued > Details



masterclass-continued

Project ID: 71281

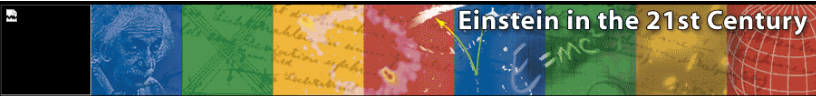
GNU GPLv3 752 Commits 2 Branches 4 Tags 759.1 MB Files

Continuation of the ROOT-based MasterClass refactor.



Webpage

OLD page



Einstein in the 21st Century

Main Menu

- Installation
- Support Material
- Students section
- Evaluation
- Instructions for the Institutes
- 4 short videos explaining the measurements and the use of the software
- Description of Exercises
 - English
 - .doc
 - .pdf
 - Deutsch
 - .doc
 - .pdf
 - Français
 - .doc
 - .pdf
 - Italiano
 - .doc
 - .pdf
 - Czech
 - .doc
 - .pdf
 - Portuguese
 - .doc
 - .pdf
 - Greek
 - .doc
 - .pdf

Looking for strange particles in ALICE

1. Overview

The exercise proposed here consists of a search for strange particles, produced in heavy ion collisions, through the recognition of their V0-decays, such as $K_S^0 \rightarrow \pi^+ \pi^-$, $\Lambda \rightarrow p + \pi^-$ and cascades, $\Xi \rightarrow \Lambda + \pi^0$, on the topology of their decay combined with the identification of the decay products. The identification of the decaying particle, as an additional confirmation of the particle species.

In what follows the ALICE experiment and its physics goals are first presented. Then the identification of strange particles as well as the tools are described in detail; then the results; then all the steps of the exercise are explained followed by the presentation of the large scale analysis is presented.

2. Introduction.

ALICE (A Large Ion Collider Experiment), one of the four large experiments at the LHC, also studies proton-proton collisions, which primarily provide reference data for genuine proton-proton physics studies. The ALICE detector has been designed to operate at the extreme energies of the LHC.

3. The ALICE Physics

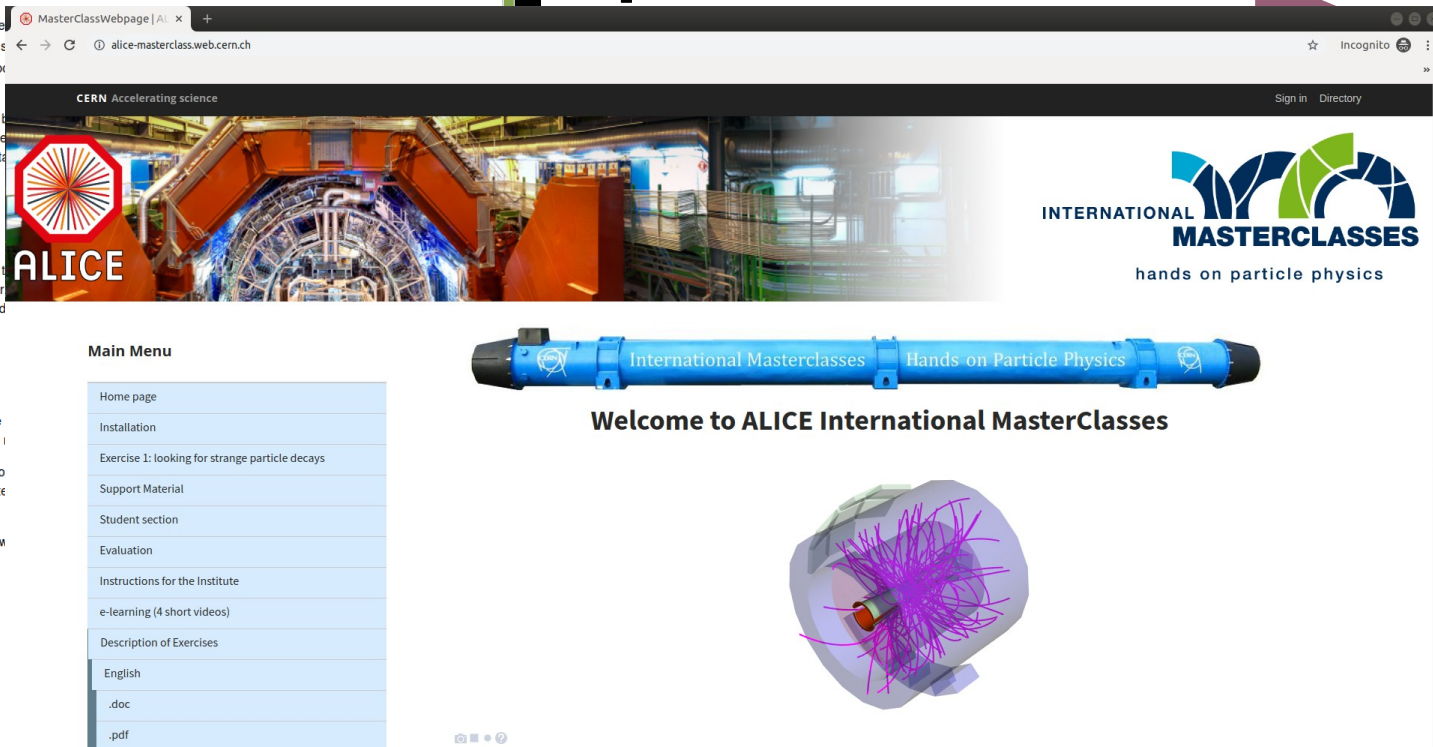
Quarks are bound together into protons and neutrons by a force known as the strong interaction. The strong interaction is also responsible for binding together the protons and neutrons into nuclei.

Even though we know that quarks are elementary particles that build up all known matter, seem to be bound permanently together and confined inside composite particles, the mechanism that causes it remains unknown.

Although much of the physics of strong interaction is, today, well understood, the

NEW page (Drupal)
...work in progress...

<https://alice-masterclass.web.cern.ch/>



Plan to use the new Drupal template
from the new IMC page, when ready

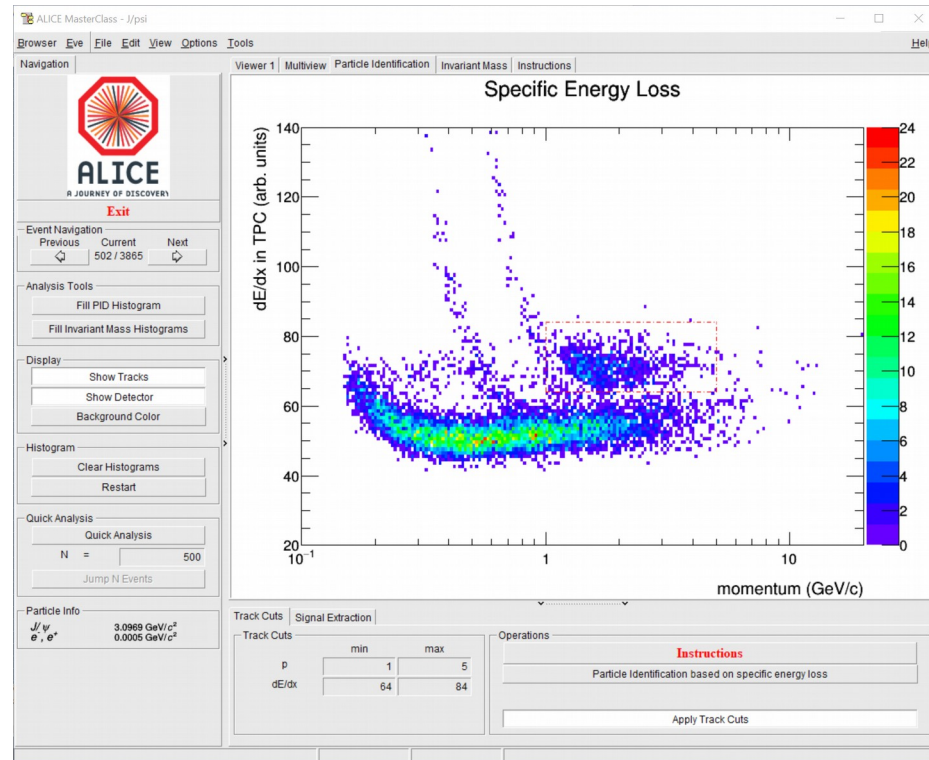
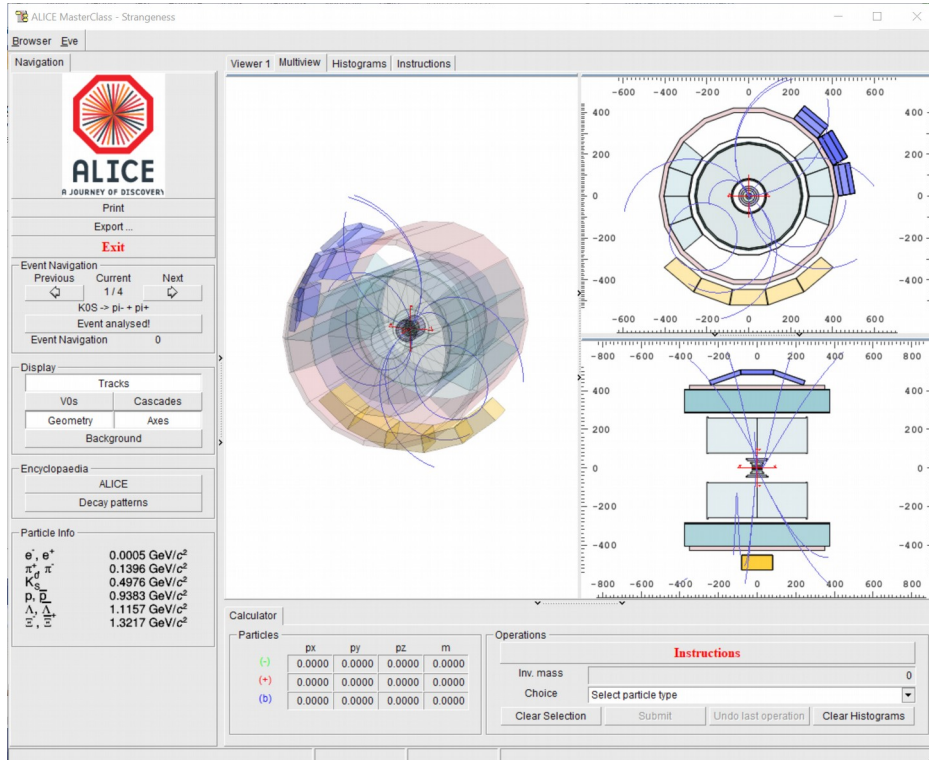
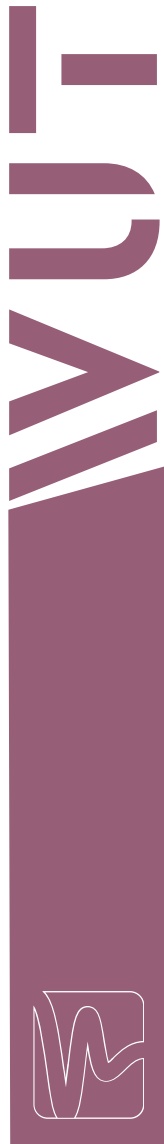


Windows 10

How does it look like?

Looking for strange particles
visual analysis

J/Ψ suppression
electron PID



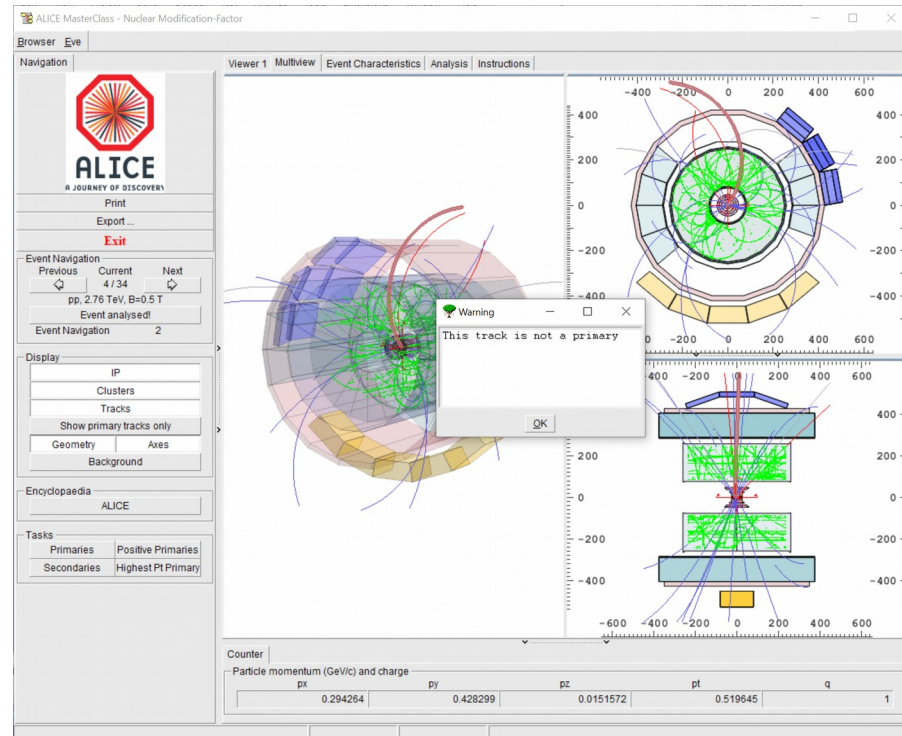
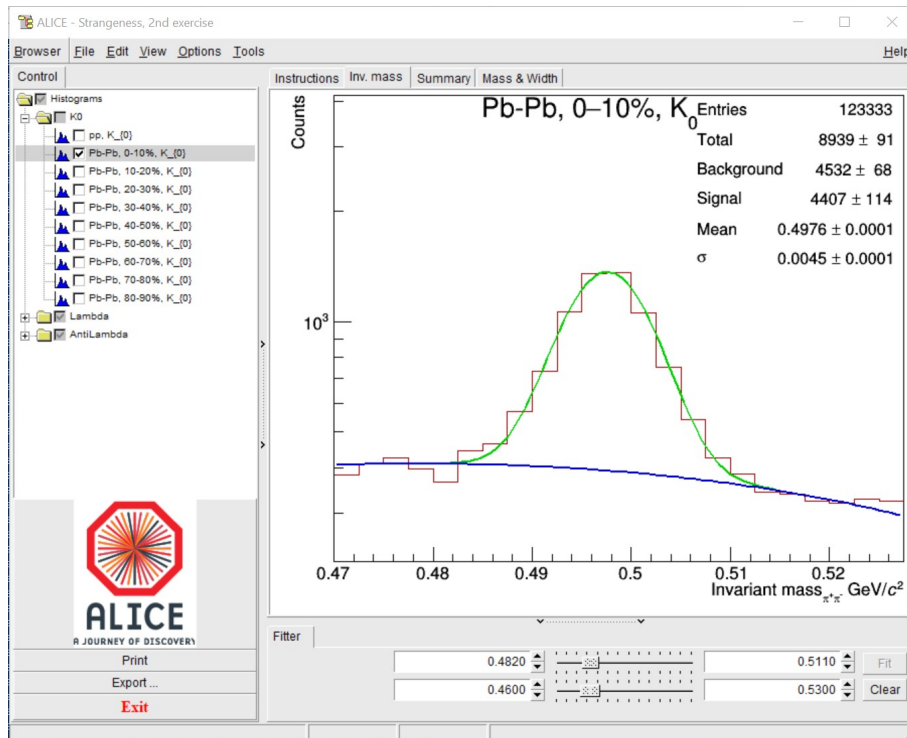
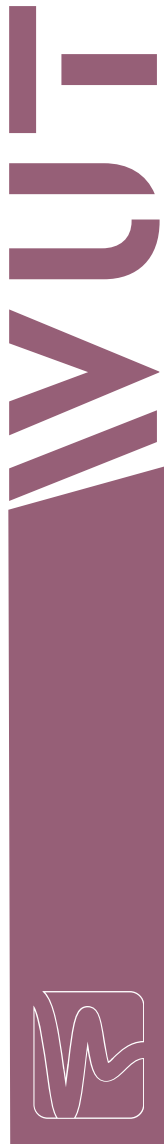


Windows 10

How does it look like?

Looking for strange particles
invariant mass fits

Nuclear modification factor (R_{AA})
selecting primary tracks

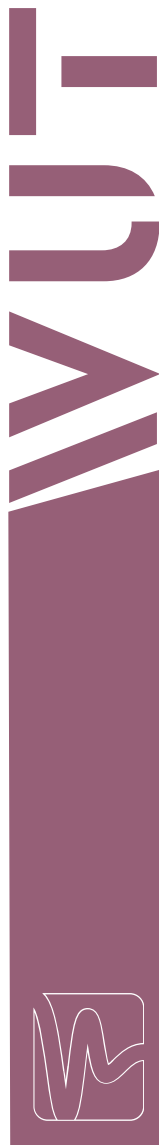


Limitations & further plans

- **Limitations of ROOT 6:**
 - EVE and GUI in ROOT to become deprecated in ROOT 7
 - no support for modern high-res. Screens (i.e. Retina)
- **Solution → towards a fully web based application**
- **Our (own) requirements:**
 - keep the app as close to the current one as possible
 - read directly ROOT data files and ROOT geometry (no data/geometry conversion)
 - most of calculations done on the client side/in the browser (avoid server overloads)
- **Technology choice (28 Nov. meeting ROOT Team):**
 - do not use ROOT on the server side → will quickly overload
 - use JSROOT to display geometry and histograms
 - use OpenUI5 for GUI (OUI5 to be used in ROOT 7)
 - use JavaScript instead of ROOT for simple fits and “code writing”

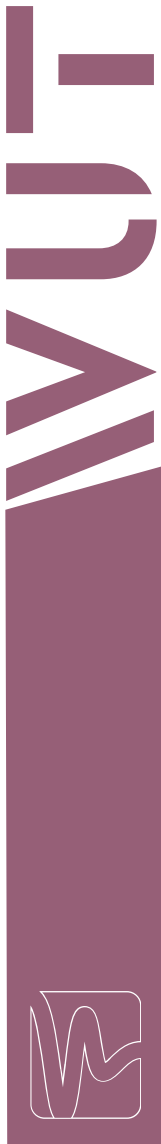
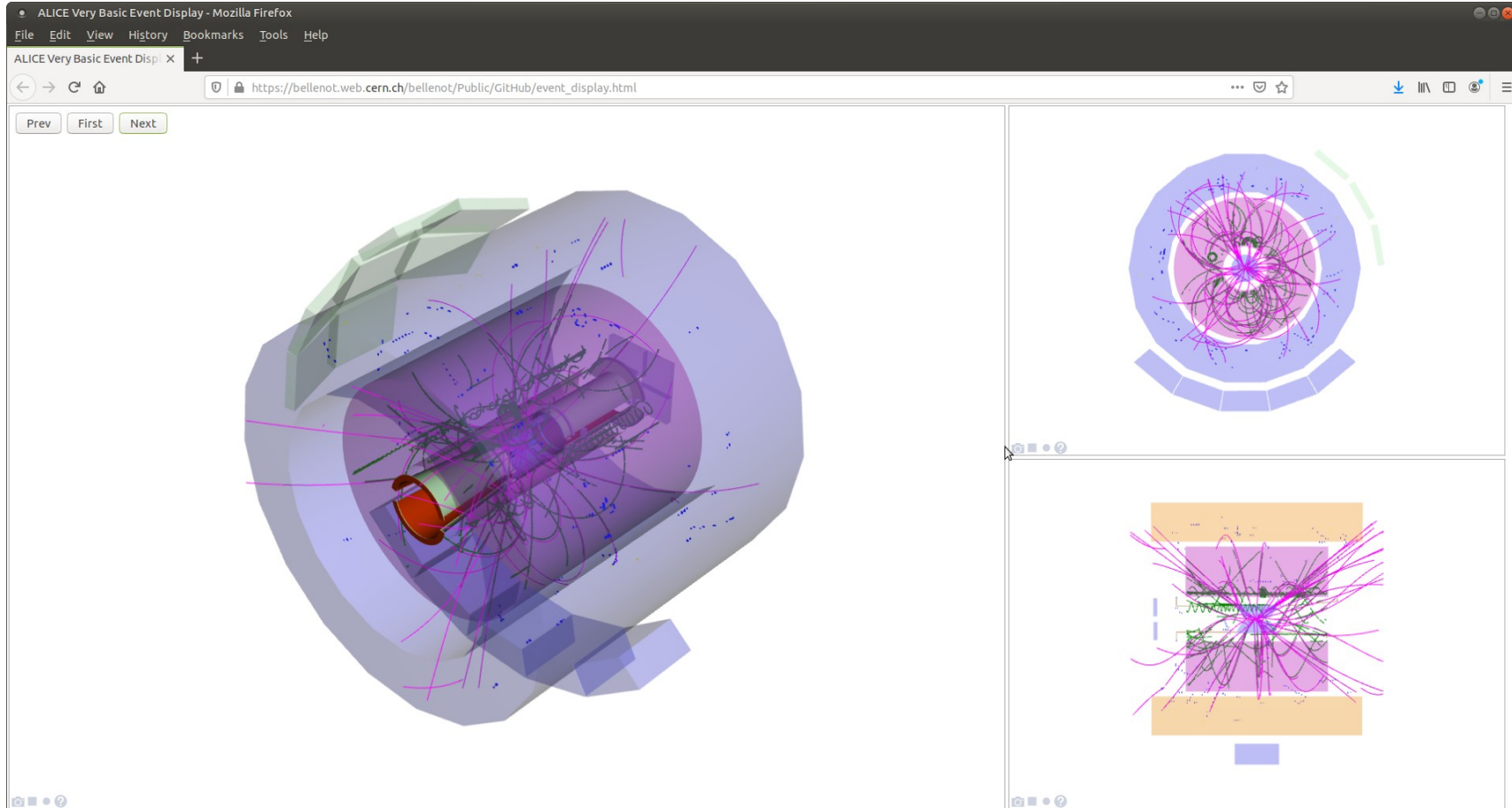


JSROOT



Web version – proof of concept

- JSROOT visualization of ALICE as implemented by ROOT Team



Instead of a Summary

LIVE DEMO

Comments, suggestions, bug reports, etc.:

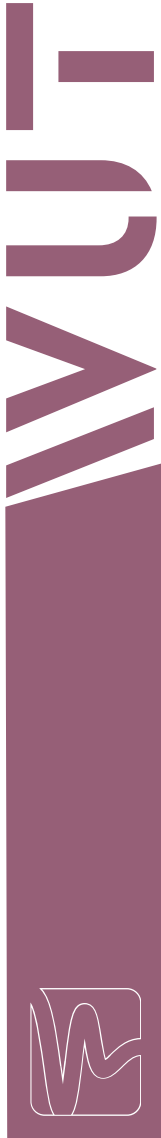
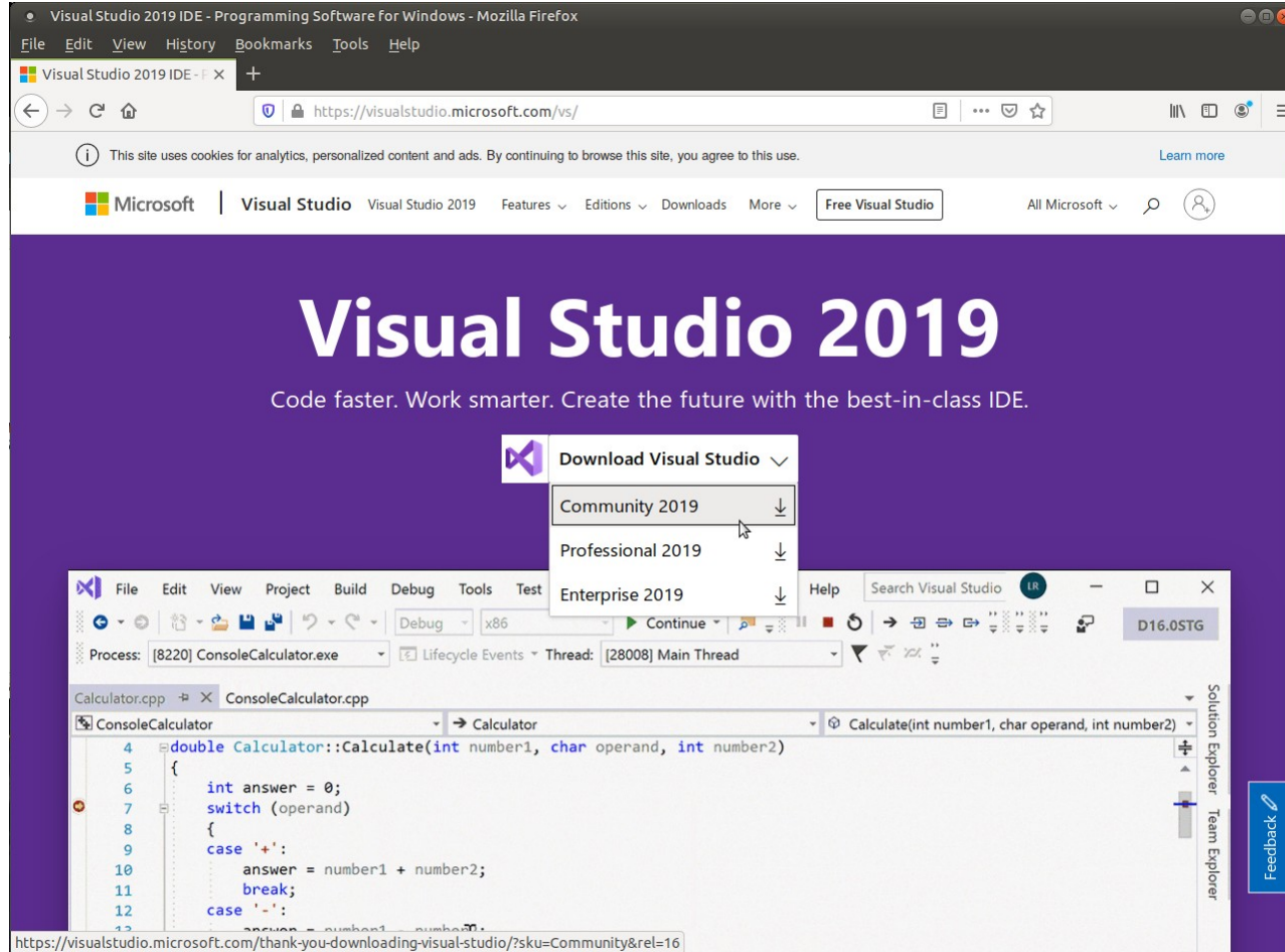
`alice-masterclass-dev@cern.ch`





Windows 10

Installation – step 1 → Visual Studio





Windows 10

Installation – step 2 → VS C++ IDE

Installing — Visual Studio Community 2019

Workloads Individual components Language packs Installation locations

Web & Cloud (4)

- ☒ **ASP.NET and web development**
Build web applications using ASP.NET, ASP.NET Core, HTML/JavaScript, and Containers including Docker support.
- ☐ **Python development**
Editing, debugging, interactive development and source control for Python.
- ☐ **Azure development**
Azure SDKs, tools, and projects for developing cloud apps, creating resources, and building Containers including...
- ☐ **Node.js development**
Build scalable network applications using Node.js, an asynchronous event-driven JavaScript runtime.

Windows (3)

- ☐ **.NET desktop development**
Build WPF, Windows Forms, and console applications using C#, Visual Basic, and F#.
- ☒ **Desktop development with C++**
Build Windows desktop applications using the Microsoft C++ toolset, ATL, or MFC.
- ☐ **Universal Windows Platform development**
Create applications for the Universal Windows Platform with C#, VB, or optionally C++.

Installation details

> Visual Studio core editor
> .NET Core cross-platform development
✓ ASP.NET and web development

Included

- ✓ .NET Core 2.1 development tools
- ✓ .NET Framework 4.7.2 development tools
- ✓ ASP.NET and web development tools

Optional

- ☒ .NET Framework 4 – 4.6 development tools
- ☒ Cloud tools for web development
- ☒ .NET profiling tools
- ☒ Entity Framework 6 tools
- ☒ Advanced ASP.NET features
- ☒ Developer Analytics tools
- ☒ Web Deploy
- ☒ Live Share - Preview
- ☐ Windows Communication Foundation
- ☐ .NET Core 2.2 development tools
- ☐ .NET Framework 4.6.1 development tools
- ☐ .NET Framework 4.6.2 development tools
- ☐ .NET Framework 4.7 development tools
- ☐ .NET Framework 4.7.1 development tools

Location
C:\Program Files (x86)\Microsoft Visual Studio\2019\Community [Change...](#)

By continuing, you agree to the [license](#) for the Visual Studio edition you selected. We also offer the ability to download other software with Visual Studio. This software is licensed separately, as set out in the [3rd Party Notices](#) or in its accompanying license. By continuing, you also agree to those licenses.

System drive (C) 3.32 GB
Other drives 971 MB
Total space required 4.27 GB

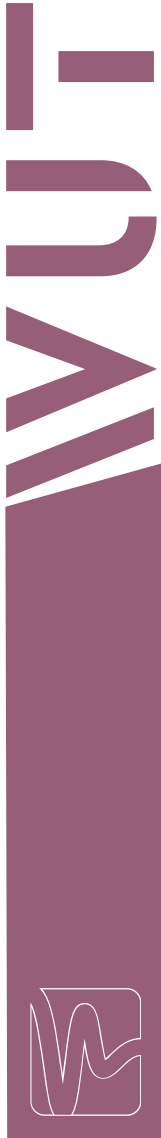
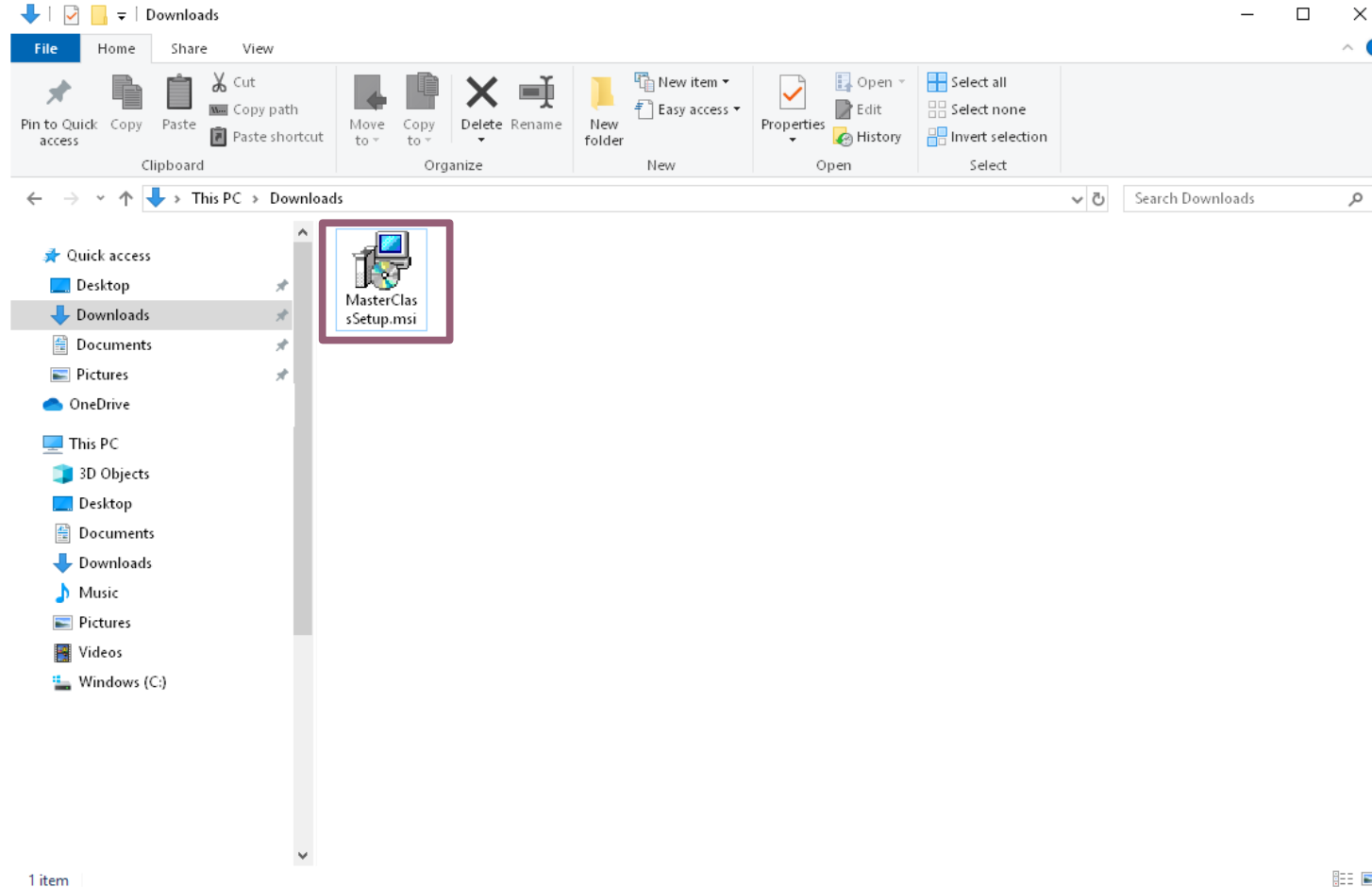
[Install while downloading](#) [Install](#)





Windows 10

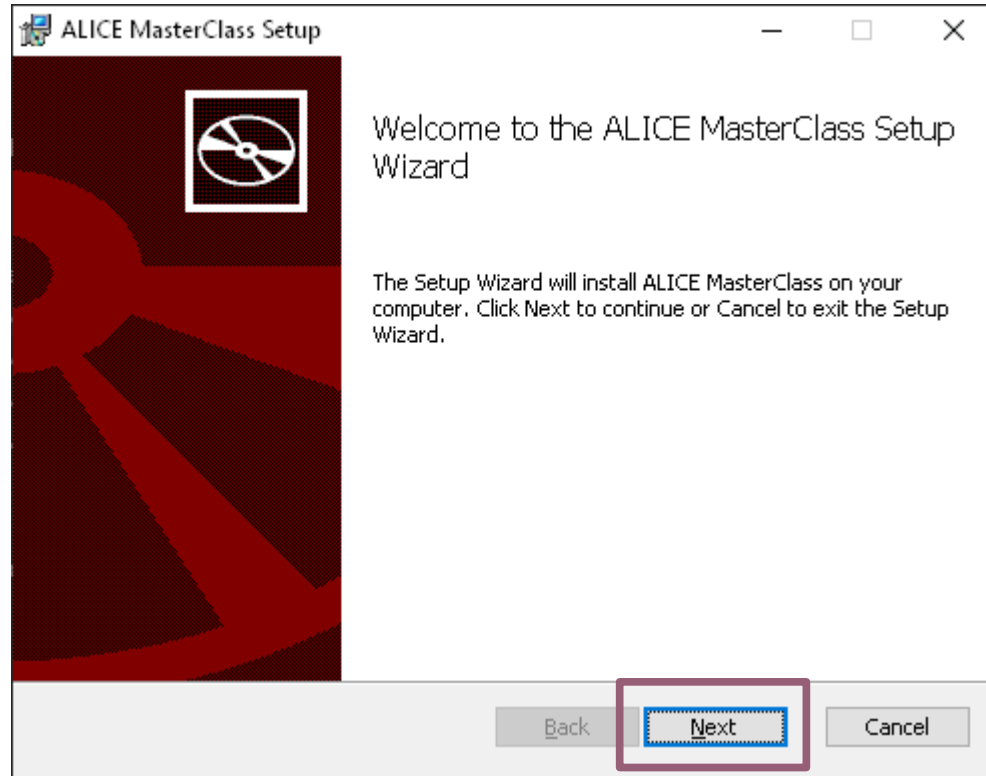
Installation – step 3 → MasterClass





Windows 10

Installation – step 4 → MasterClass





Windows 10

Launch MasterClass

