



# Introduction to the new GeantV simulation, Based on new tools of MPC and HPC

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- Geant4 is the 20-year-old standard toolkit for the simulation of the passage of particles and radiation through matter
- GeantV is a 3-year old project to redesign the Geant toolkit using new tools and concepts from MPC and HPC computing, with the goal of 3x-5x faster throughput
- Some of the partner institutions: CERN, Fermilab, UNESP, BARC/India, OpenLAB at CERN, Intel,
- One of the main tricks relied on to reach this goal is the so-called SIMD Vectorization – that's the 'V' in GeantV!

# Outline of the lab session

- This lab will focus on SIMD vectorization, which is one of the CPU performance optimization dimensions
  - Definitions
  - Understand potential performance gains from [SIMD vectorization] x [multi-threading]
  - Vectorization approaches: auto-vectorization, intrinsics, vectorization libraries
  - Existing vectorization libraries in use by the GeantV project
  - Example: optimizing a very simple algorithm, a quadratic polynomial equation solver
  - VecGeom and GeantV: some tests and benchmarks within the packages

# Goals of the lab session

- The lab session was designed with some goals on mind:
  - to motivate you to learn more about how to use SIMD vectorization
  - to provide you with some suggestions of starting points for your vectorization adventure
  - to illustrate some important issues relevant to vectorization
  - to provide you with some working examples with performance comparisons
  - to help you decide what track you want to take to start using SIMD vectorization in your own code
  - to help those interested in getting started with the GeantV package, it is a good time to join and participate of its development