



# Containers + JLEIC

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Oct. 20, 2017



# Detector simulations

**ideal for detector concepts**

## GEMC (M. Ungaro)

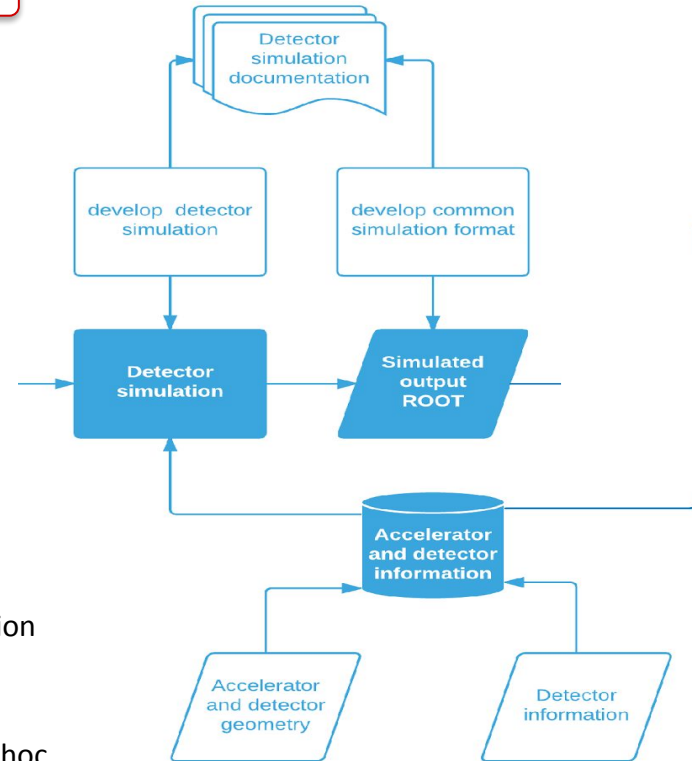
- application for detector simulations based on Geant4
- reducing the learning curve to use Geant4
  - macro language for detector design
  - various geometry definitions (GEMC, gdml, CAD)
  - data card (XML) to steer application, all Geant4 macro commands supported by design
  - GUI for interactive sessions
  - excellent documentation
- full Geant4 support: adding Geant4 features relatively simple
- transparent in-house development

## GEMC for JLEIC (Z. Zhao)

### Simulations level

same application for fast and full detector simulations fully adjustable simulation levels, e.g.,

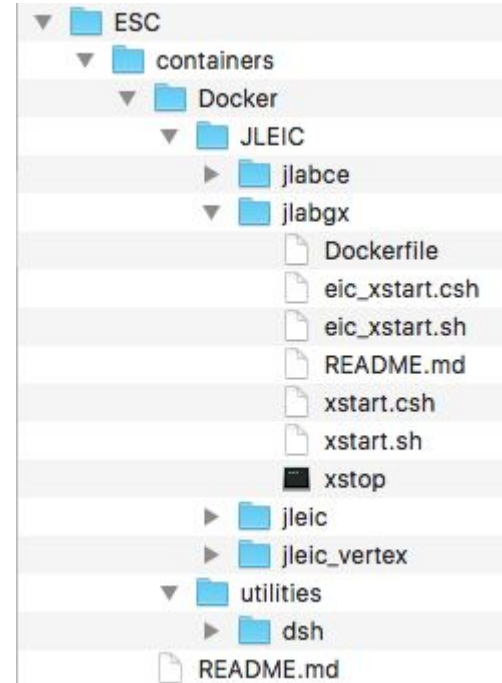
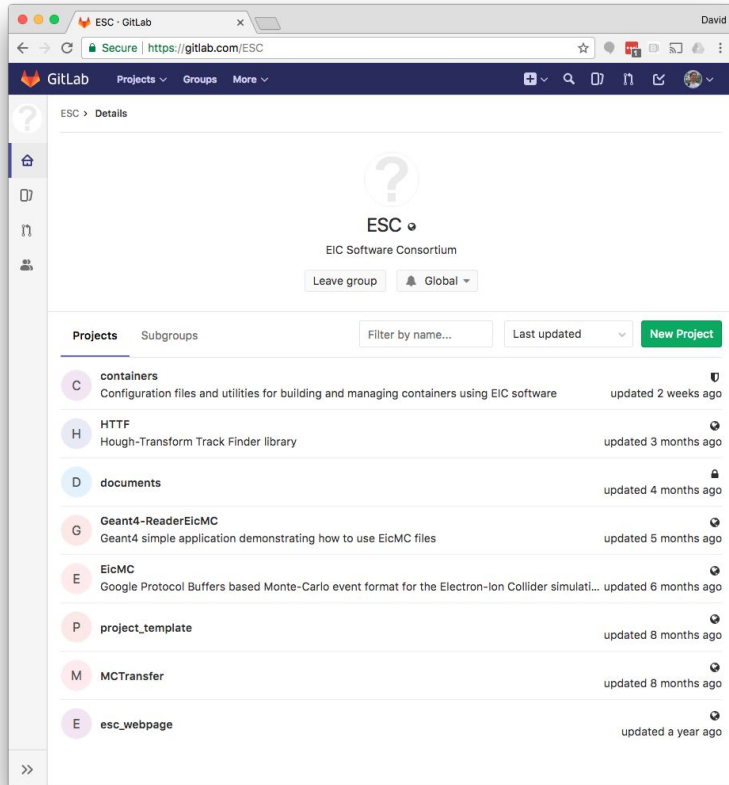
- only material transport
- using Geant4 for geometry and physics only in some critical areas and ad-hoc non-Geant4 models in other regions



# Executive Summary

- Container = very lightweight Virtual Machine
  - Not running full OS with all its daemons and services
  - Does not reserve large amounts of system resources (RAM, CPU)
- Main players
  - Docker - Industry standard, requires admin privilege on host
  - Singularity - Standard for OSG, can run entirely in unprivileged account
  - Shifter (NERSC only)
- Primary use: Provides complete software stack with all dependencies
  - Running on laptop/desktop
  - Running on batch farm

# Containers project in ESC group on GitLab



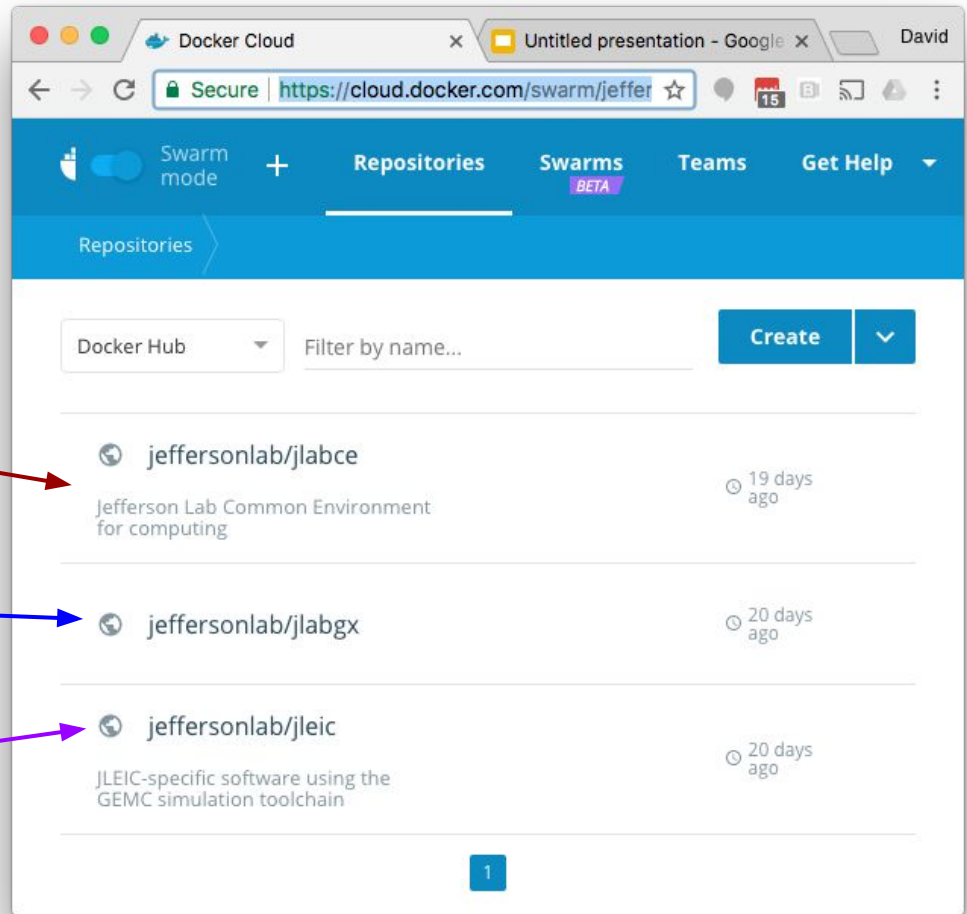
# Images on docker cloud

## JLab Common Environment

- Version 2.0 and 2.1
- Inherits from jlabgx

Low level layer based on centos:7 with minimal needed for OpenGL graphics

Latest\* jleic version from svn



The screenshot shows the Docker Cloud interface for a user named 'jeffersonlab'. The page title is 'Repositories' and the URL is 'https://cloud.docker.com/swarm/jeffer'. The interface includes a navigation bar with 'Swarm mode', 'Repositories', 'Swarms BETA', 'Teams', and 'Get Help'. Below the navigation bar, there is a search bar with 'Filter by name...' and a 'Create' button. The main content area displays a list of repositories:

Repository Name	Description	Updated
jeffersonlab/jlabce	jefferson Lab Common Environment for computing	19 days ago
jeffersonlab/jlabgx		20 days ago
jeffersonlab/jleic	JLEIC-specific software using the GEMC simulation toolchain	20 days ago

<https://cloud.docker.com/swarm/jeffersonlab/repository/list>

# How to run

1. Install Docker
2. Run container

```
> docker run -it --rm -p 6080:6080 jeffersonlab/jleic  
# xstart
```

3. Point browser on host to *http://localhost:6080*
4. Setup environment and run

```
# source /jleic/set_eic.sh  
# eic_gemc det1_dual_full.gcard
```

# OpenGL based graphics via VNC + HTML5 leverages host browser

The image shows a VNC session window titled "8f843d207371:0 () - noVNC" with the address bar displaying "localhost:6080". The main content is a GEANT4 simulation interface. On the left, a sidebar contains icons for Generator, Camera, Detector, Infos, G4Dialog, Signals, Trigger, and Physics. The main panel is titled "g4mc 2.0" and includes a "N. Events" field set to "100" with "Run", "Cycle", and "Stop" buttons. Below this, there are tabs for "Generator", "Beam 1", and "Beam 2". The "Generator" tab is active, showing "Momentum" settings: "Particle Type" set to "proton", "p:" set to "100" GeV, ":" set to "2.88479" deg, and ":" set to "180" deg. The "Vertex" section shows "vX:" set to "50.0417", "vY:" set to "0", and "vZ:" set to "-1000" cm. The right side of the window displays a 3D visualization of a particle detector, showing a central cylindrical component with various colored layers and a beam pipe extending through it. The visualization is titled "e1c\_g4mc".

# Dockerfile and image locations

<https://gitlab.com/ESC/containers/tree/master/Docker/JLEIC/jlabgx>

- <https://cloud.docker.com/swarm/jeffersonlab/repository/docker/jeffersonlab/jlabgx/general>

<https://gitlab.com/ESC/containers/tree/master/Docker/JLEIC/jlabce>

- <https://cloud.docker.com/swarm/jeffersonlab/repository/docker/jeffersonlab/jlabce/general>

<https://gitlab.com/ESC/containers/tree/master/Docker/JLEIC/jleic>

- <https://gitlab.com/ESC/containers/tree/master/Docker/JLEIC/jleic>



# dsh

- Users will want persistency on local machine outside of container
- Convenient if output files have same uid/gid as user on host
- Exec multiple shells in same container

