CERN openlab

Physics Data Analytics and Data Reduction with Apache Spark

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Contents

Goal

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“to perform Physics Analysis and Data Reduction
with Big Data Technologies
over data acquired from the CMS Experiment”

Motivation and Vision

Why Data Analytics and Reduction with Spark?

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Why Data Analytics and Reduction with Spark?

- Investigate new ways to analyse physics data and improve resource utilization and time-to-physics

- Adopt new technologies widely used in the industry
  - Open the HEP field to a larger community of data scientists
  - Improve chance of researchers on the job market outside academia

Collaboration Members

Who is participating?

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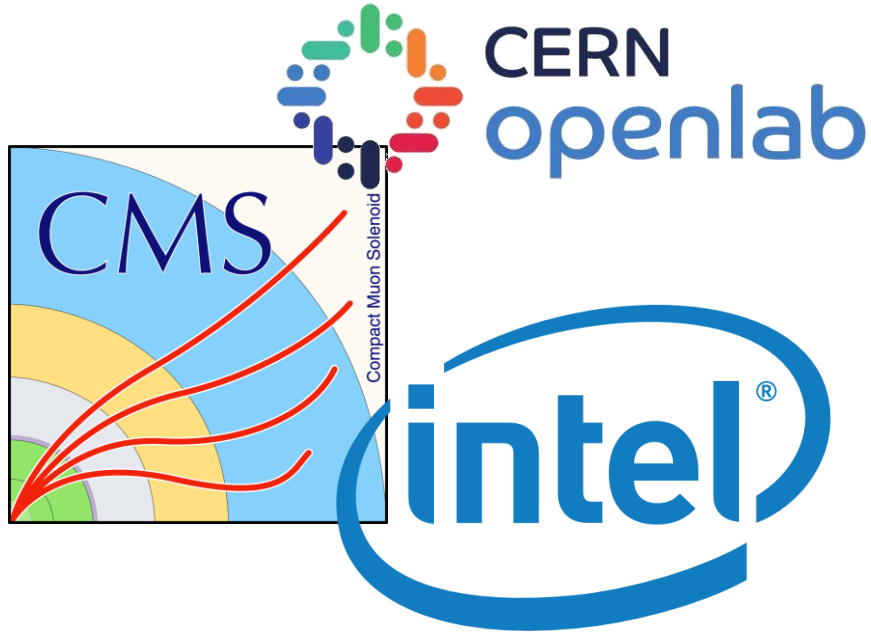
- CERN IT Department (openlab and IT-DB)
- The CMS Experiment
- Intel



Standard HEP Analysis Procedures

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A modular scientific software framework which provides all the functionalities needed to deal with big data processing, statistical analysis, visualization and file storage. It is mainly written in C++ but also integrated with Python and R.

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EOS Service

A disk-based, low-latency storage service with a highly-scalable hierarchical namespace, which enables data access through the XROOT protocol. It provides storage for both physics and user use cases via different service instances such as EOSPUBLIC, EOSATLAS, EOSCMS.

Progress

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We now have fully functioning Analysis & Reduction examples tested over CMS Open Data (1 TB)

1. Read Files in ROOT Format directly from Spark

DIANA-HEP developed “spark-root”

A Scala library which implements DataSource for Apache Spark

Spark can read ROOT TTrees and infer their schema

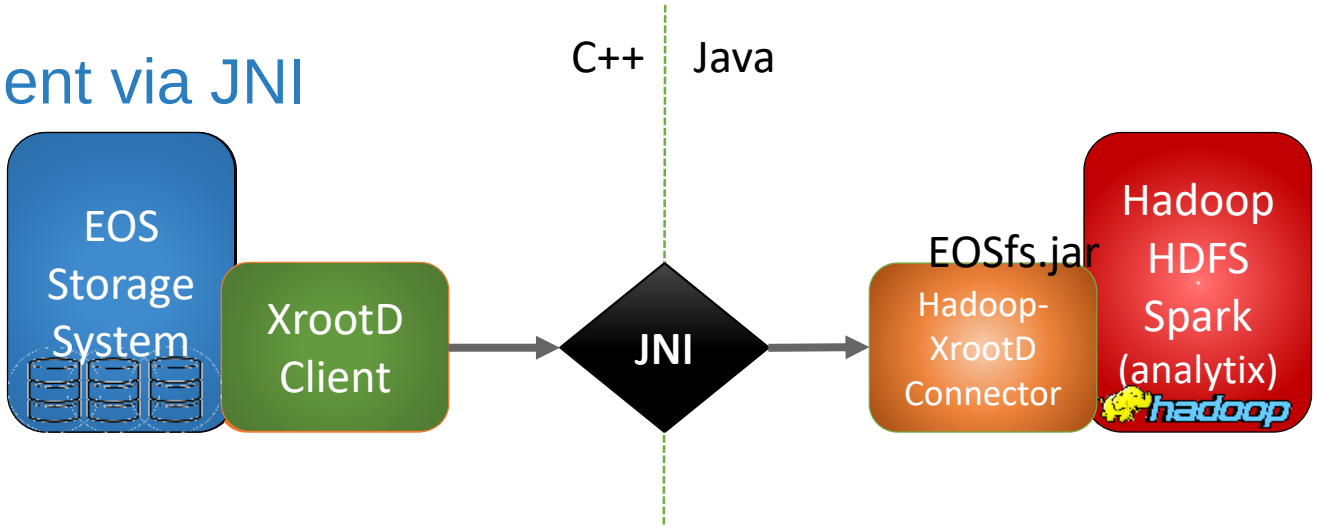
Root files are imported to Spark Dataframes/Datasets/RDDs

2. Access files stored in EOS directly from Spark/Hadoop

We developed “Hadoop-XrootD Connector”

A library that connects to the XrootD client via JNI

It reads files on EOS directly
(no need for import/export)



Currently working with 30% the speed of direct HDFS access for a READ operation

Planned Architecture Overview

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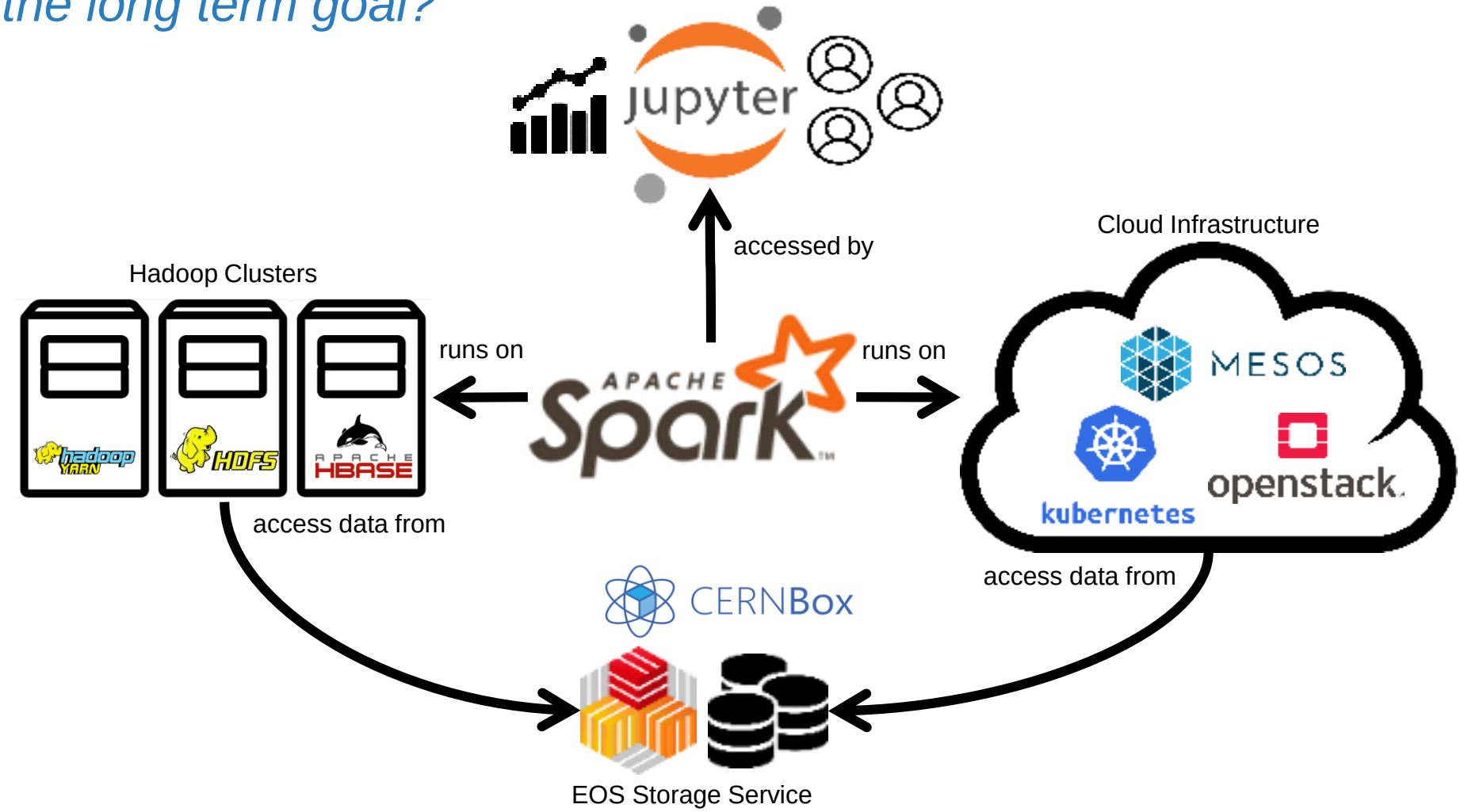
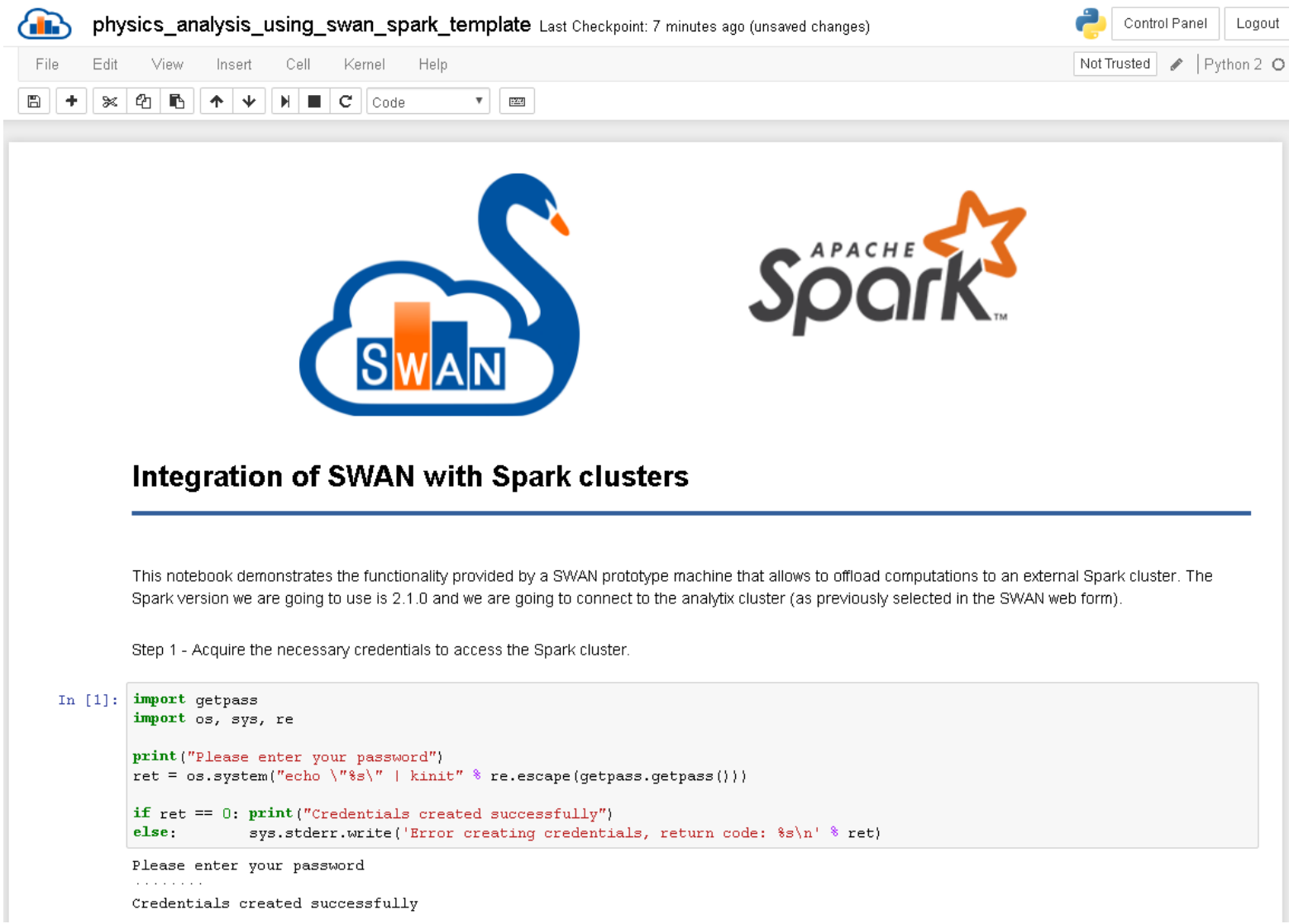


Lightning Demo



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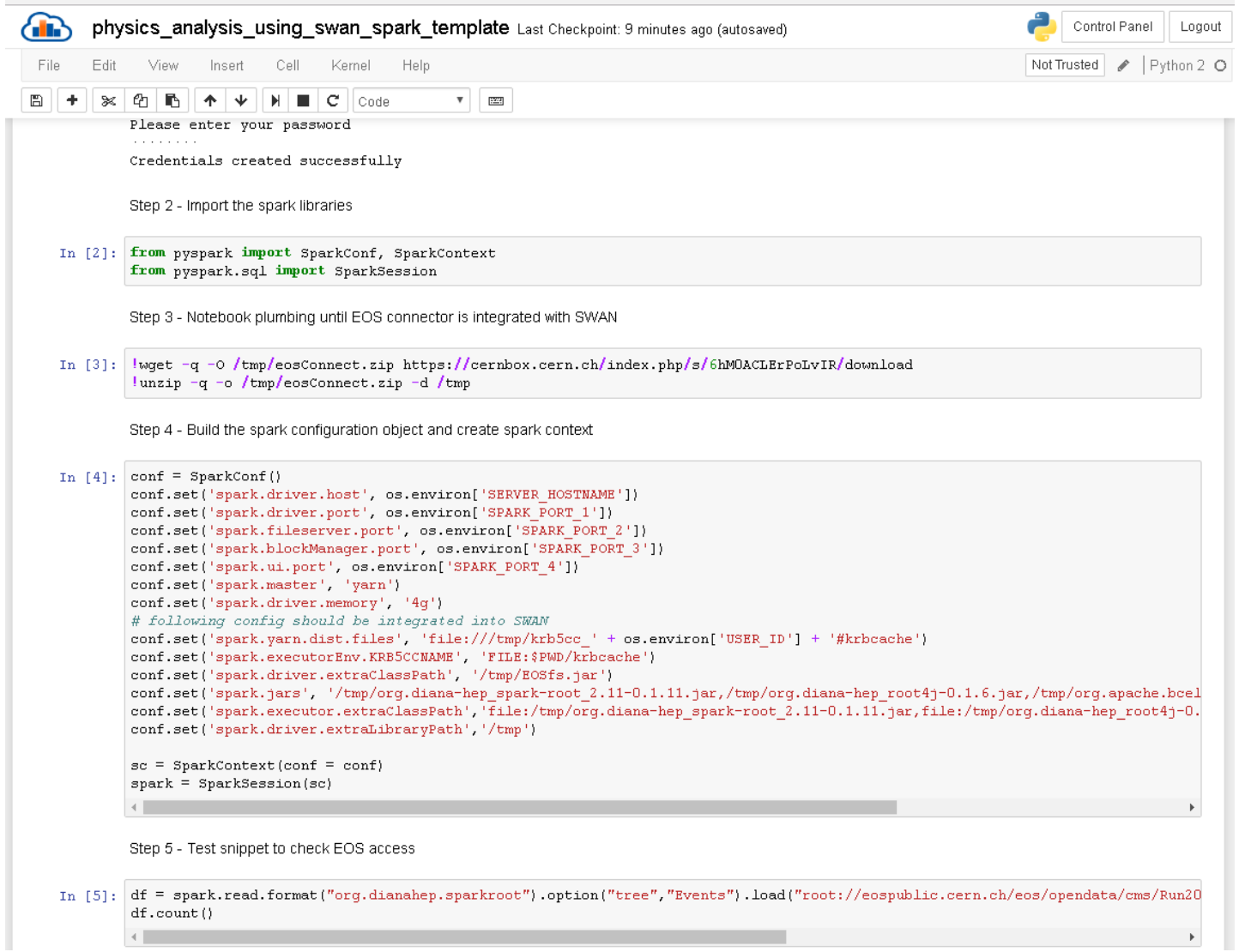

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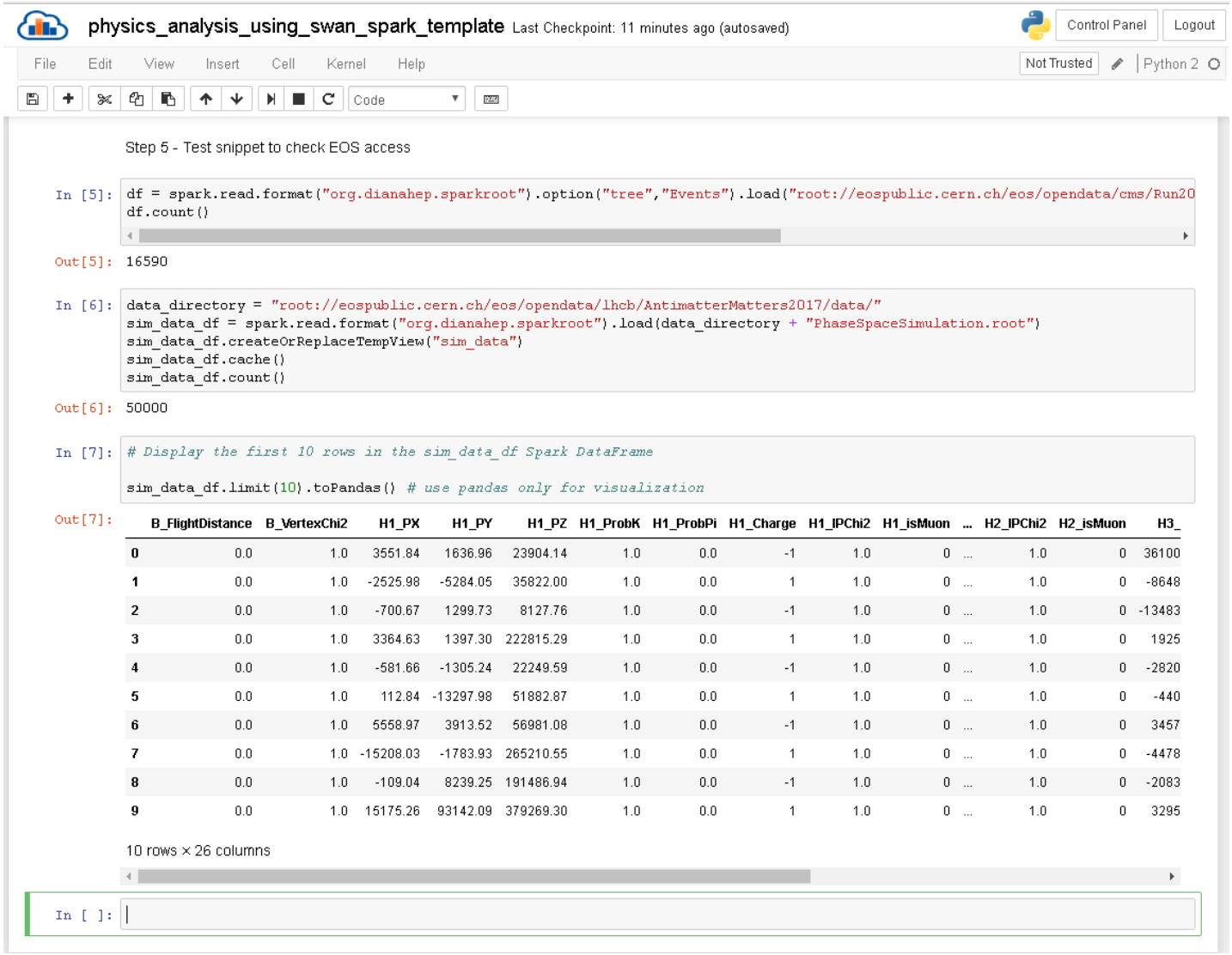

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Investigate the possibility to use Spark over Openstack

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Our long term goal is to provide a unified Spark service:

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This will simplify the existing physics data analysis procedures by:

- improving resource utilization
- providing user-friendly environments
- reducing the overall “time-to-physics”

Questions?

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