IRIS-HEP Analysis Grand Challenge Tools Workshop

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https://indico.cern.ch/e/agc-tools-2

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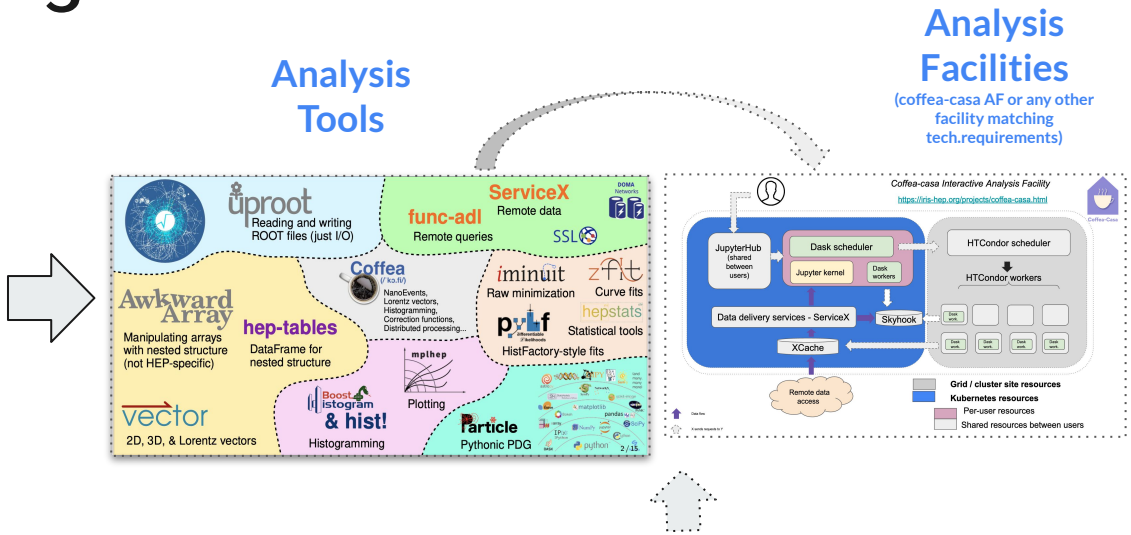
Analysis Grand Challenge

Motivation:

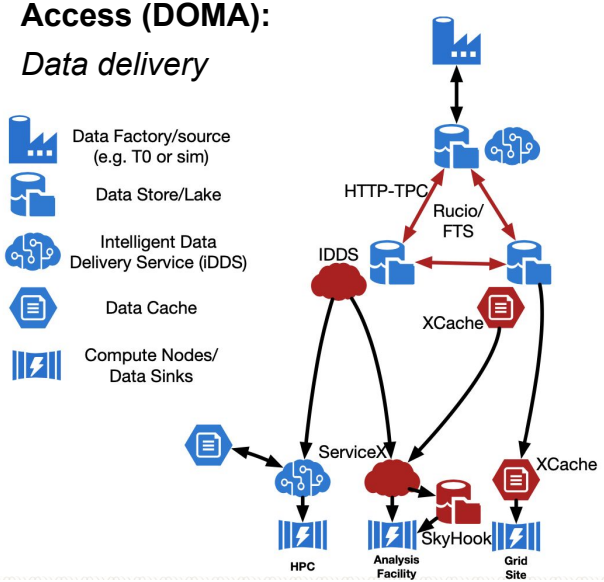
- Allow coping with HL-LHC data sizes by rethinking data pipeline
  - Evaluating the new Python analysis ecosystem and integrating a differentiable analysis pipeline
- Provide flexible, easy-to-use, low latency analysis facilities



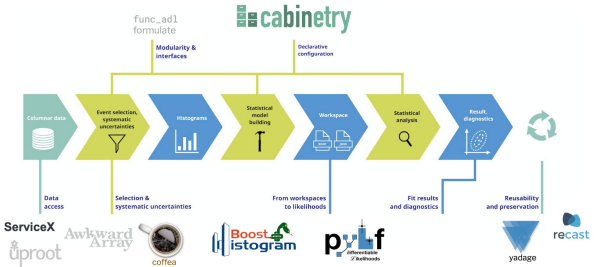
Analysis Grand Challenge will be conducted during **2021–2023**, leaving enough time for tuning software tools and services developed as a part of the IRIS-HEP ecosystem before the start-up of the HL-LHC and *organized together with the US LHC Operations programs, the LHC experiments and other partners.*

The AGC is connecting different working groups and IRIS-HEP partners

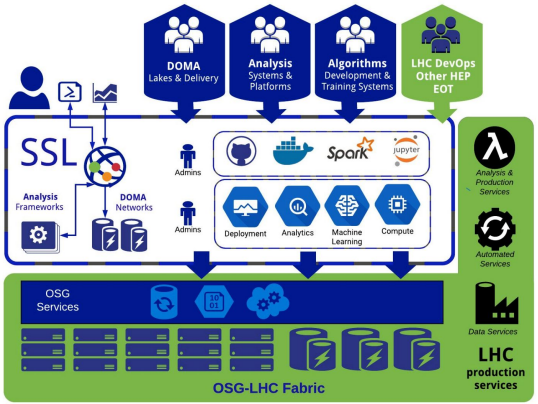
Data Organization, Management and Access (DOMA):
Data delivery



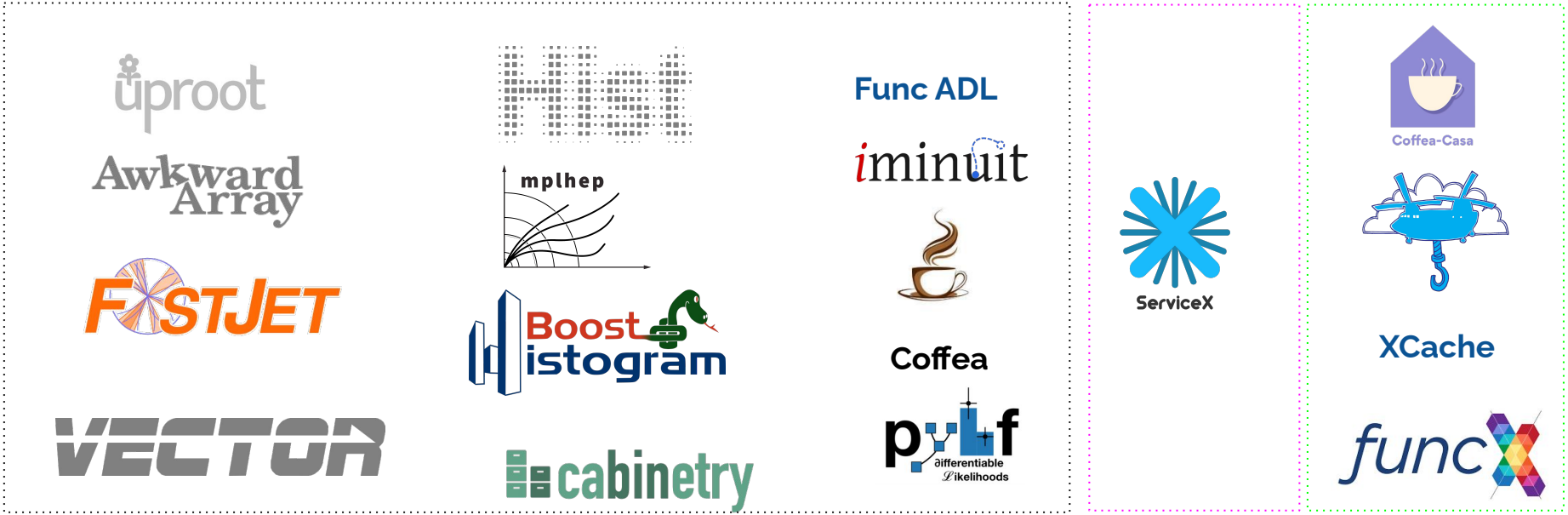
Analysis Systems (AS):
tools



Scalable Systems Laboratory (SSL): *deployment techniques and resources*



Software and services requirements



Analysis specific frameworks and packages (available in Docker container)

Data delivery service (k8s)

Optional services (k8s)

Towards a benchmark analysis

- Main AGC analysis example is based on **Run-2 CMS Open Data**
  - Open Data is crucial: allows everyone to participate!
  - Currently using PhysObjectExtractorTool to convert existing miniAOD datasets into ntuple format
  - In close contact with CMS to make conversion to nanoAOD format possible in the medium term
    - Will switch to nanoAODs when available to more closely mirror PHYSLITE / nanoAOD workflows
  - Intention of demonstrator is to show functionality, **not** to discover new physics in the released Open Data!
  - **Many thanks** to the **CMS DPOA team** for all the help with the CMS Open Data!
- **Categorized datasets** in terms of role in AGC demonstrator (AGC repository)
- **Everything is openly developed** (**AGC repository**)
  - We encourage you to re-implement (parts of) the pipeline with other tools!
  - We hope this exercise can be useful broadly to the field for benchmarking purposes as well

AGC: The timeline

- **Nov 2021:** first demonstration of toolchain at AGC workshop (agenda)
- **April 2022:** second iteration of AGC workshop happening now (agenda)
- **May 2022:** related event: Analysis Ecosystem workshop (agenda), consider joining us in Paris!
- **Summer 2022:** benchmarking of system components in the AGC context
- **Spring 2023:** execution of AGC at full scale

Stay in touch via analysis-grand-challenge@iris-hep.org (sign up: google group link)

Day 1:

a tour through the ecosystem and pipeline demonstrations

Timetable

Mon 25/04 | Tue 26/04 | All days

Print | PDF | Full screen | Detailed view | Filter

15:00

- **Introduction** — *Alexander Held et al.* — 15:30 - 15:40
- **Foundation libraries (uproot, awkward, hist, mplhep)** — *Mason Proffitt* — 15:40 - 16:25

16:00

- **Queries with func_adl and data delivery with ServiceX** — *Gordon Watts* — 16:25 - 17:10

17:00

- **Break** — 17:10 - 17:30
- **Columnar analysis with coffea** — *Lindsey Gray et al.* — 17:30 - 18:15

18:00

- **Statistical inference: pyhf and cabinetry** — *Matthew Feickert* — 18:15 - 19:00

19:00

- **From data delivery to statistical inference with CMS Open Data** — *Alexander Held* — 19:00 - 19:30

Day 2:

Skyhook, scale-out on coffea-casa, user experience & experiment-specific sessions

Timetable

Mon 25/04 | Tue 26/04 | All days

Print | PDF | Full screen | Detailed view | Filter

15:00

- **Data management with Skyhook** — *Carlos Maltzahn et al.* — 15:30 - 16:00

16:00

- **Scale-out with coffea: coffea-casa analysis facility** — *Carl Lundstedt et al.* — 16:00 - 16:30
- **Break** — 16:30 - 16:50

17:00

- **Analysis user experience with Python HEP data science tools in CMS** — *Lindsey Gray* — 16:50 - 17:10
- **Analysis user experience with Python HEP data science tools in ATLAS** — *Matthew Feickert* — 17:10 - 17:30
- **Analysis user experience with Python HEP data science tools in LHCb** — *Nathan Allen Grieser* — 17:30 - 17:50
- **Discussion** — 17:50 - 18:10

18:00

- **Break** — 18:10 - 18:30

19:00

- **CMS session** — *Lindsey Gray et al.* — 18:30 - 19:30
- **ATLAS session** — *Lukas Alexander Heinrich* — 18:30 - 19:30

For the last **Tuesday block**, we are hosting experiment-specific sessions: **<u>if you are affiliated with CMS or ATLAS, please join!</u>**

Communication channels

- **Zoom link is attached to the agenda:**
  - https://indico.cern.ch/event/1126109/videoconference/

- **This meeting is being recorded, recordings will be made available afterwards**

- **We are encouraging you to use Slido for questions:**
  - Join at slido.com with #152901 or with this direct link
  - Ask Questions, vote questions you'd like to see answered to the top
  - Feel free to also use Zoom chat for follow-up discussion

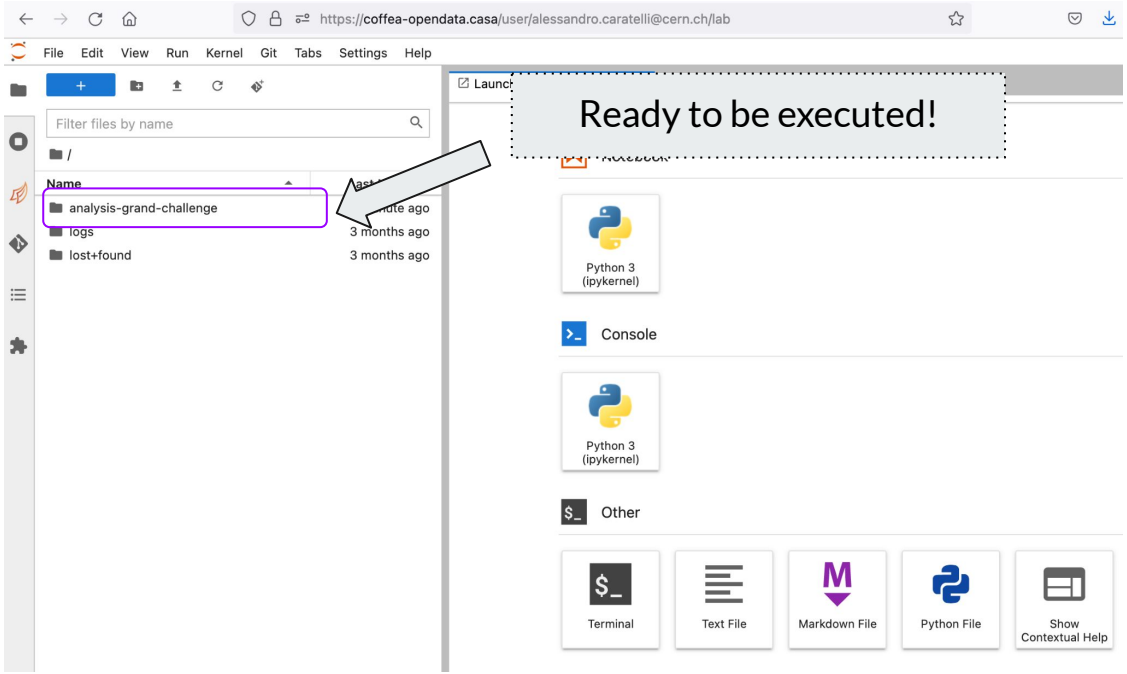
As a participant in this workshop, you are expected to follow our code of conduct:
https://indico.cern.ch/event/1126109/page/24856-edi-statement

Generic AGC Tools sessions:

Opendata Coffea-casa AF @ UNL

Opendata Coffea-casa AF @ UNL

- **For all generic sessions**, you can follow tutorials on *the prototype of the Open Data Coffea Analysis Facility @ UNL*: https://coffea-opendata.casa
- Instance has all AGC tools & packages including Open Data instance of ServiceX
- To access it, you will need to register (it is only two minutes, we promise!)
- More documentation how to register is available here
- Any questions & suggestions: https://github.com/CoffeaTeam/coffea-casa/discussions



If you already have this repository from previous workshop,
don't forget to pull updates from terminal (or JH plugin):
git pull origin master

ATLAS AGC Tools sessions:

ATLAS coffea-casa AF @ UChicago

ATLAS Coffea-casa @ UChicago

- As a member of the ATLAS experiment, you can use *a prototype ATLAS Coffea Analysis Facility @ UChicago*: https://coffea.af.uchicago.edu
- Instance has all AGC tools & packages and we tested the ATLAS instance of ServiceX: https://uproot-atlas.servicex.af.uchicago.edu/

  (documentation how to get ServiceX access is here)
- *To access it, you just need to be a member of the ATLAS experiment*, access there will be granted based on your credentials.
- More documentation how to register is available here
- Any questions & suggestions: https://github.com/CoffeaTeam/coffea-casa/discussions

Generic & CMS AGC Tools sessions:

EAF @ Fermilab

EAF @ FNAL

- For the generic and CMS experiment session, we would like to promote Elastic Analysis Facility @ FNAL: https://analytics-hub.fnal.gov
- Instance has all AGC tools & packages
- *To access it, you just need to have **FNAL account (FERMI SERVICES domain credentials)***, access there will be granted based on your credentials.
- In the analysis notebook, please select in global configuration section: *AF = "EAF"*

CMS AGC Tools sessions:

CMS coffea-casa AF @ UNL

CMS Coffea-casa @ UNL

- For the CMS experiment session, we would like to promote ***(it is not required for session)*** *a prototype of the CMS Coffea Analysis Facility @ UNL*: https://coffea.casa
- Instance has all AGC tools & packages
- *To access it, you just need to be a member of CMS experiment*, access there will be granted based on your credentials.
- More documentation how to register is available here
- Any questions & suggestions: https://github.com/CoffeaTeam/coffea-casa/discussions

We hope you will enjoy the workshop!

We expect to have more such events in the future.

Big thanks to all speakers!

- *Coffea* team
- *FuncADL* & *ServiceX* teams
- *pyhf* & *cabinetry* teams
- many more people in the surrounding ecosystem who have helped us!

Many thanks to the team providing resources & support to make this workshop happen:
- UNL “coffea-casa” team: Ken Bloom, Garhan Attebury, Carl Lundstedt, John Thiltges
- SSL: Lincoln Bryant, Fengping Hu, Rob Gartner, Ilia Vukotic, Suchandra Thapa