

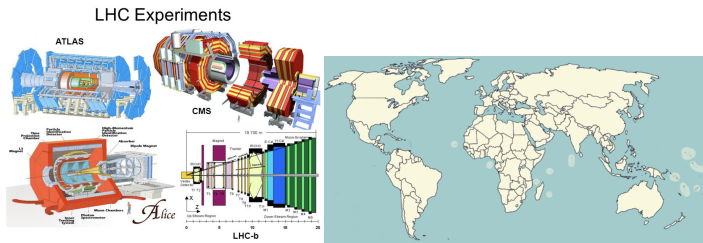
# Physics driven hackathons

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# LHC experiments



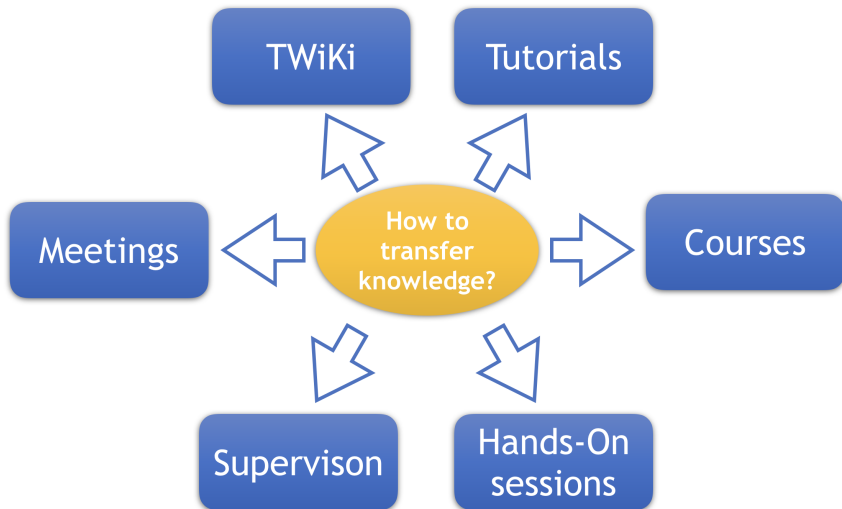
## LHC experiments:

- ~1000-3000 members,
- different background knowledge,
- every year many PhD students graduate and leave,
- every year many new students come.

How to transfer knowledge/responsibilities?

How to improve skills?

How to achieve long term goals?



## The Alice Juniors:

- a community of people in the beginning of their career,
- technical support to the newcomers,
- social networking,

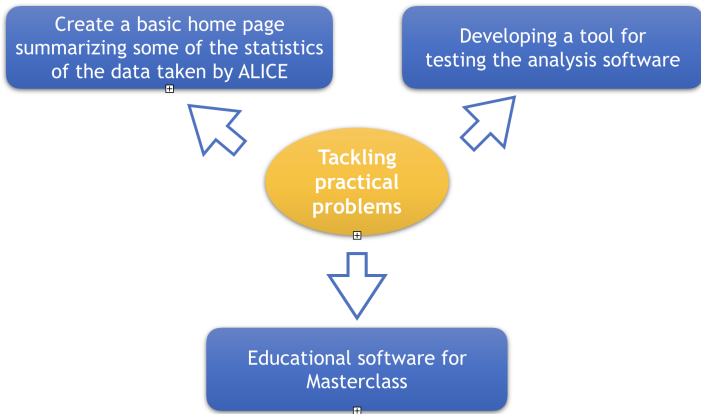


the ALICE Juniors Hackathon (link):

- started in March 2017,
- already 3 editions,
- one evening events.



# ALICE: Hackathons - topics



Work started at the hackathons and continued afterwards.  
In the hackathons we create something new! No repetition.

# Tutorials for newcomers

Almost every experiment has its own activity. Example:

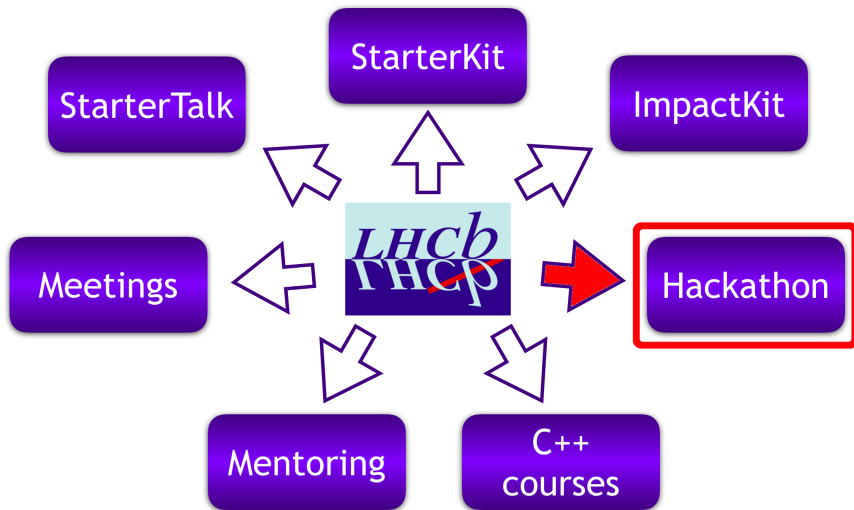
- Starter/ImpactKit was initialized in the **LHCb** collaboration in 2015.
- General part now prepared together with **The ALICE Junior**.
- Workshops held at CERN.
- Goal: **help newcomers to get involved in the software for their analyses.**
- StarterKit: 4 days long, python, bash, git, more specific tasks.
- ImpactKit: 3 days only with 1 day of hacking session with experts.

<https://lhcb.github.io/starterkit/>

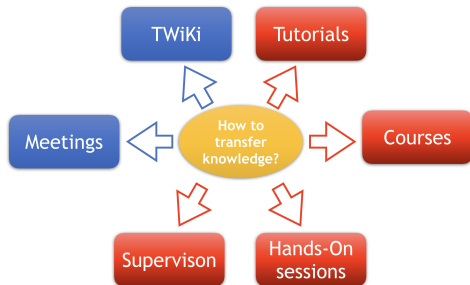


**From students to students.**

# Example: LHCb



# Hackathons: Introduction



## Hackathons

2 days of tutorials/courses:

- C++,
- git,
- functional framework,
- code optimization,
- vectorization,
- SOA,
- etc

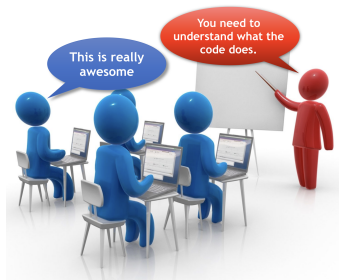
3 days of hacking:

- get involved,
- talk to experts,
- solve real problems.

The goal of hackathons is not to finish the work in 3 days,  
but set up the team and get involved in the task.

# Courses/Tutorials

- Standalone or part of hackathons.
- C++11/14 heavily used in the LHCb software.
- A very few real experts.
- How to improve situation?  
Teach, teach, teach.
- Course of modern C++:
  - 2 full days,
  - Held at CERN (so far),
  - Hands-on, hacking sessions.



Average software skills of physicists



Reality



Expectation

Getting better  
with every new  
generation!

# Hackathons: solving a real problems



Solve real problems!

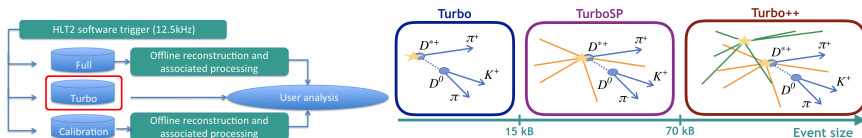
Create!

Improve communication skills!

Only team work of people with different expertise can make an efficient well performed software.

# Hackathon example: Turbothon at LHCb

- **Turbo stream**: a compact event record is written directly from the trigger and is prepared for physics analysis by the Tesla application (10.1016/j.cpc.2016.07.022).



- Turbothon: 2 days event at CERN
- Build two teams, working on two software applications.
- **Solve a real problem of data persistence.**
- Kick off event, work successfully continues afterwards.

# Hackathon example: LHCb Upgrade software

- In Run 3 (>2021) LHCb will use the full software trigger, with the input rate of 30 MHz.
- The entire software need to be optimized for
  - physics performance,
  - fitting in the time budget
  
- Already 11 hackathons in 2 years, each 1 week long,
- 20-40 participants,
- People from many fields: detector, computing, reconstruction.
- Collaborative work.





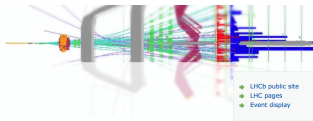
# Hackathon: Typical tasks for LHCb

- Anybody is welcome to propose a topic.
- Small tasks easy to pick up for anybody:
  - Moving algorithms to new framework.
- More advanced tasks:
  - Vectorize,
  - Optimize code,
  - Use modern code,
  - Create new functionalities.
- Try different architectures:
  - CPU, GPU, FPGA.
- Benchmarking your code.
  - Teaching good practices,
  - Useful for debugging,
  - Useful for performance monitoring.



# Hackathon example: LHCb Upgrade software

- Not only at CERN (next at the end of June in Krakow, Poland)
- Allow students from host country to participate in the courses/hacking sessions.
- Encourage new people to join effort.
- Spread knowledge as widely as possible.



#### LATEST NEWS

- Meetings of the week
- LHCb Institutes meetings

- 12th hackathon on software for the upgrade, Krakow, June 25-29, 2018

Registration is opened

- "Available" talks  
[https://lhc-sb.web.cern.ch/lhc-sb/16\\_advertised.php](https://lhc-sb.web.cern.ch/lhc-sb/16_advertised.php)

#### PHYSICS RESULTS

- Published papers
- Conference contributions

- LHCb public site
- LHC pages
- Event display

12th hackathon on software for the upgrade


An open event, everybody is welcome!


# Today at CERN

- the IML group is Inter-Experimental LHC Machine Learning Working Group.
- Hacking sessions introduced at 2nd IML Workshop in April.
- Today: a dedicated event at CERN.



## Hackathon: Machine Learning with AI Lab Linz

 Tuesday 5 Jun 2018, 09:00 → 18:00 Europe/Zurich

 3179 (CERN)

**Description** A hackathon, organized by the IML working group in collaboration with members of the AI Lab in Linz, Austria.

Everybody who is actively working on a topic related to machine learning, wishes to join an existing, or start a new ML project, is encouraged to register to this event. The hackathon will start with an introduction round where all attendants will be given the opportunity to introduce themselves, their projects, and their expertises. Everybody is then encouraged to work on their own projects, ask for help, or help others. Two "boxes" in the idea square will be available in case more privacy is needed.

A wrap-up session with the opportunity to present one's achievements of the day will conclude the hackathon. Bring your laptops.

Please register for the event ASAP, as attendance is limited to 50 people only!

We are looking forward to hearing how it went!

# Conclusion

- As big collaborations we should pay a lot of attention to
  - the collaborative work
  - student's (and not only) trainings,
  - transferring knowledge and responsibilities,
- A very important part are hackathons, which:
  - bring people together,
  - build connections among experts,
  - solve real problems,
  - improve skills,



*Thank You*

- Once a year since 2015,
- Every time around 40 participants,
- Held at CERN, with a small fee,
- Typically 4 days,
- From students for students.
- Goal:
  - Give a solid starting point to newcomers in the most used software in LHCb (both general and specific),
  - Improve software literacy in the experiment
  - Teach good practices,
  - Help newcomers socialise and integrate in the collaboration



- Once a year since 2016,
- Around 25 participants,
- Held at CERN, with a small fee,
- Typically 3 days (with one day of hackathon).
- From students for students.
- Goal:
  - follow more advanced courses,
  - One day dedicated to the hackathon where the students attack (in groups) short computing projects that can be useful to the collaboration
- Hope:
  - students get more experienced/involved in the trigger, alignment, particle identification, tracking. They stop treating them as black boxes.

