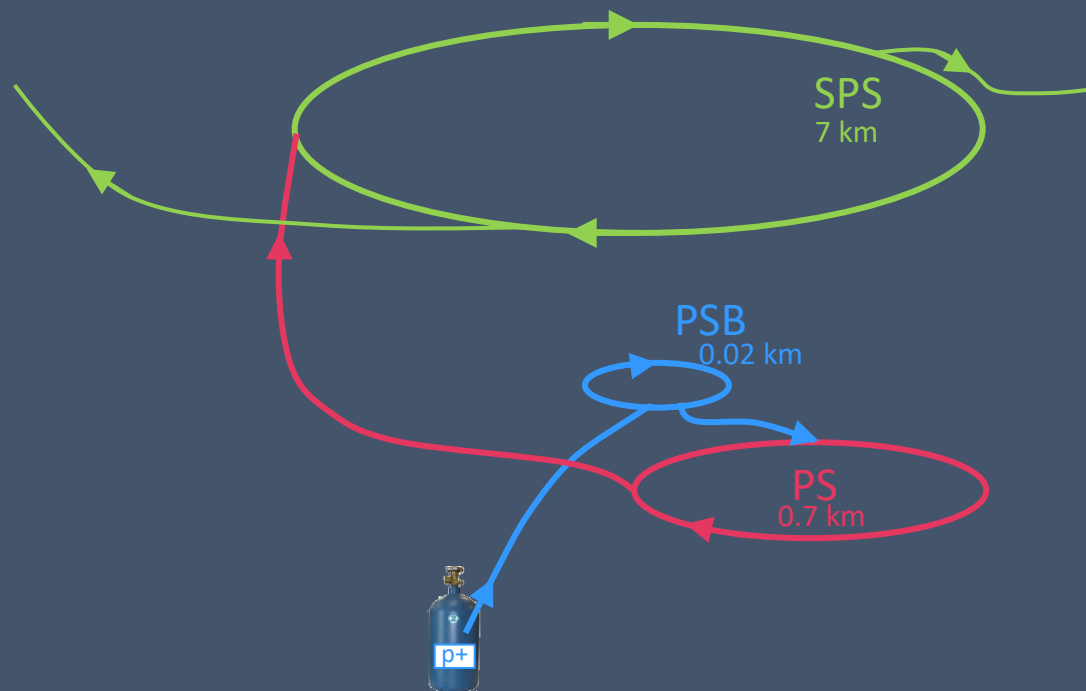# OPEN SOURCE HARDWARE
AT CERN

EVA GOUSIOU | 22 NOV 2023
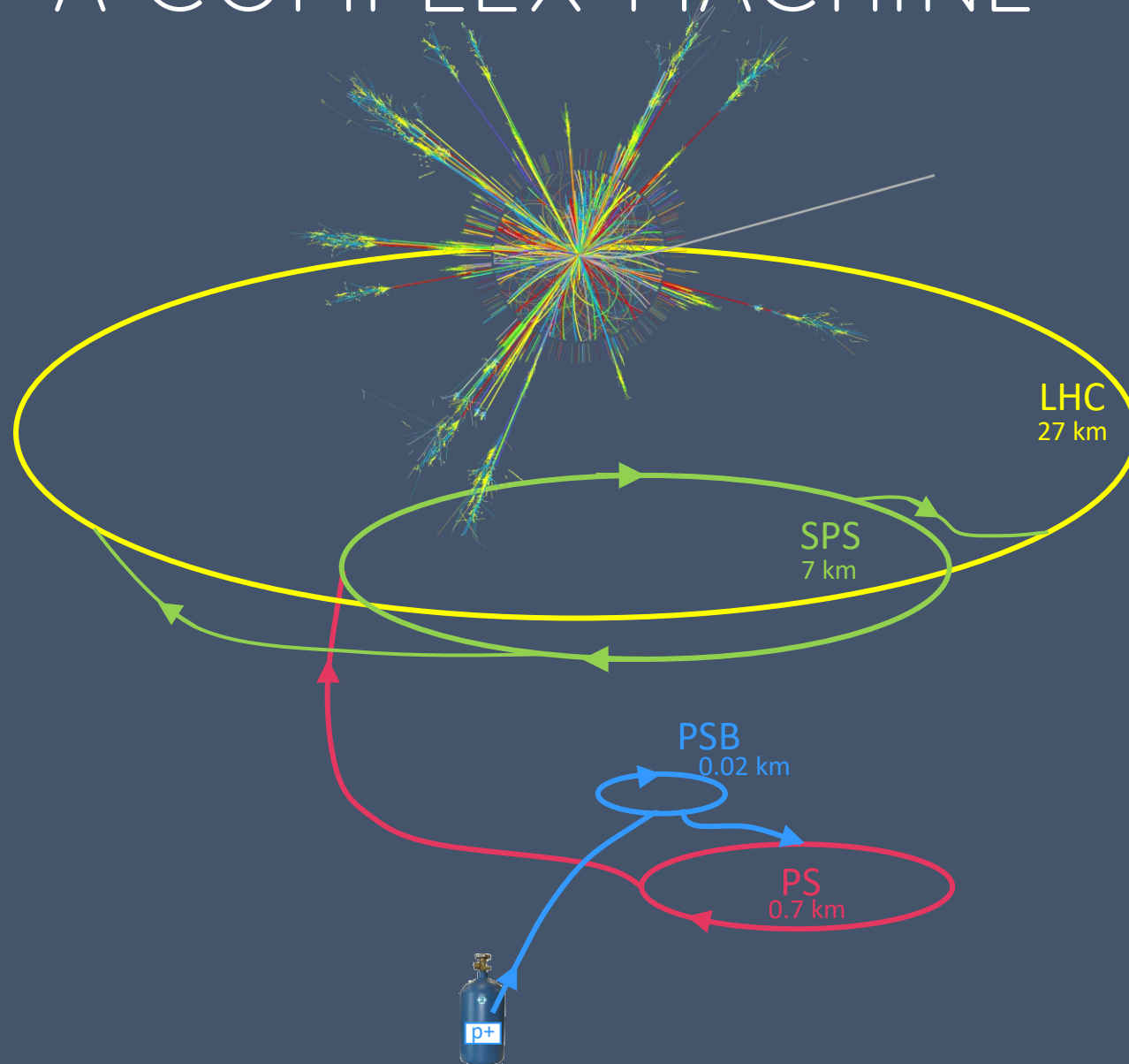
OPEN SOURCE HARDWARE
AT CERN

EVA GOUSIOU | 22 NOV 2023

A COMPLEX MACHINE

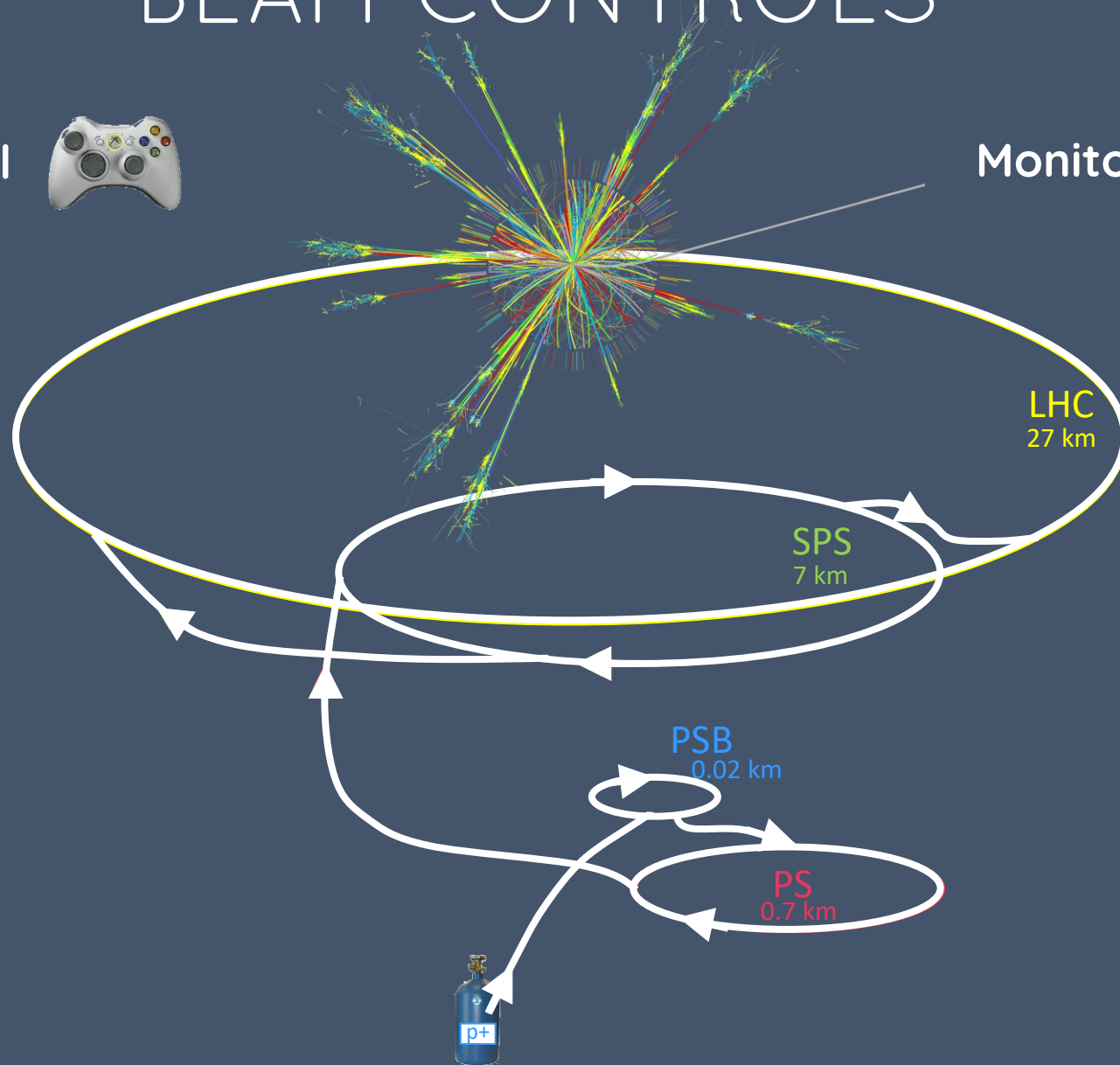# A COMPLEX MACHINE

LHC
27 km

SPS
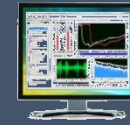7 km

PSB
0.02 km

PS
0.7 km

p+

BEAM CONTROLS

Control

Monitor

LHC
27 km

SPS
7 km

PSB
0.02 km

PS
0.7 km

p+
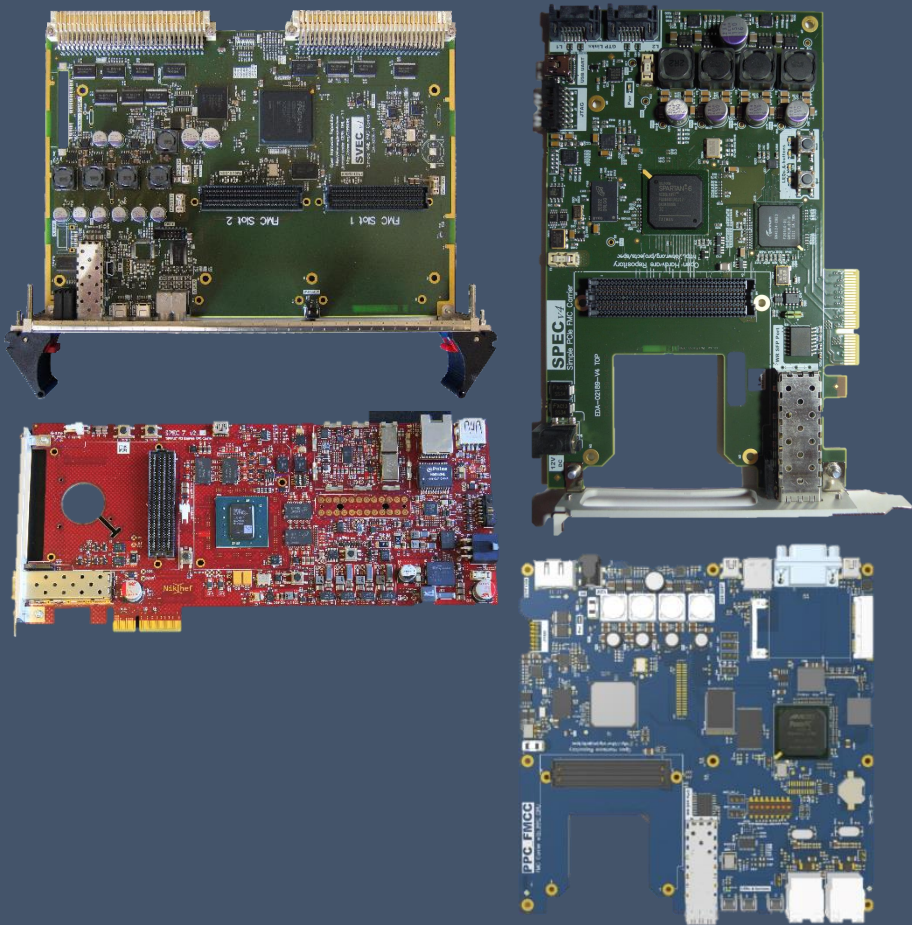
OUR MISSION

Carriers

Mezzanines

White Rabbit
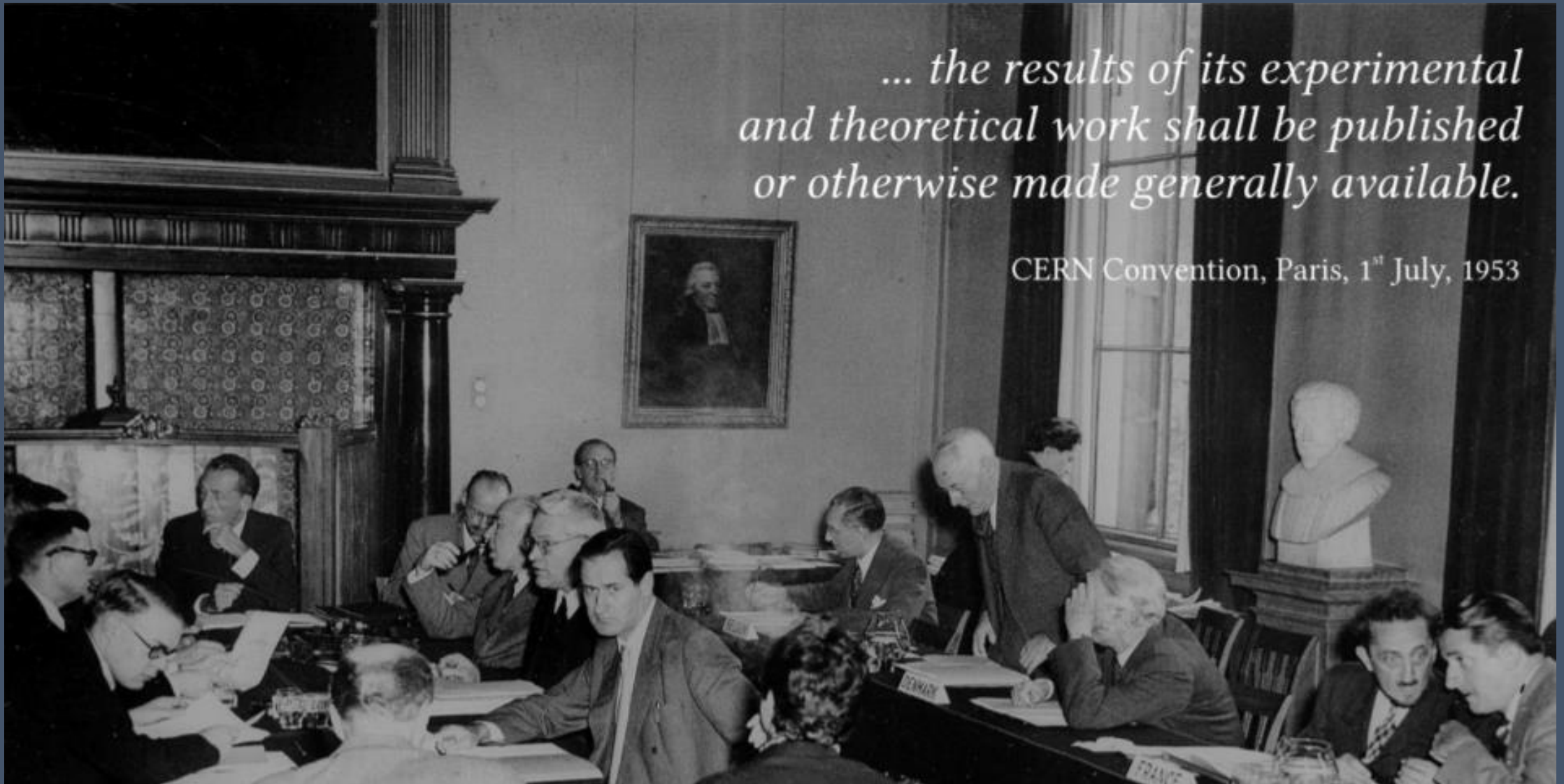
★ Dozens of designs

★ Modular & Generic

★ Use of standards

★ Industry Collabs

★ 10y operation

... the results of its experimental and theoretical work shall be published or otherwise made generally available.
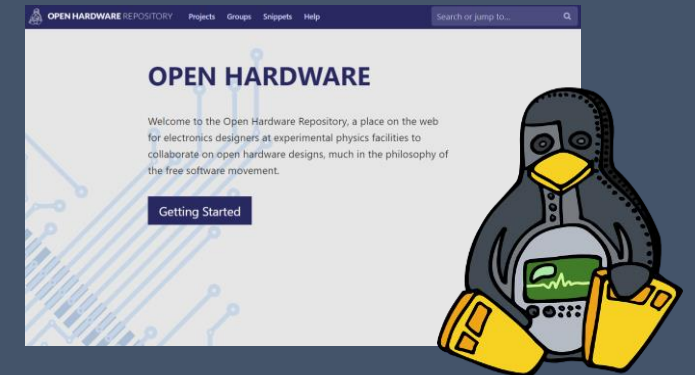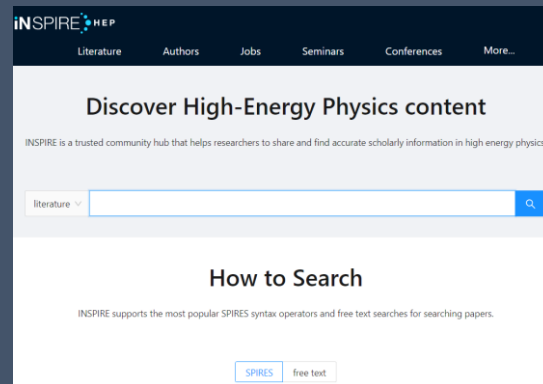
CERN Convention, Paris, 1st July, 1953
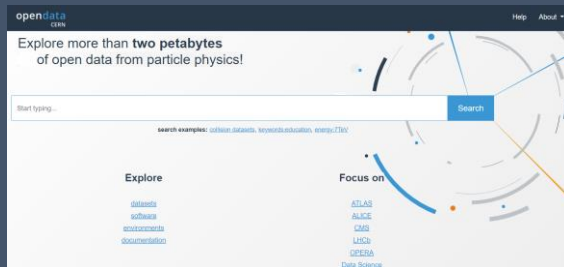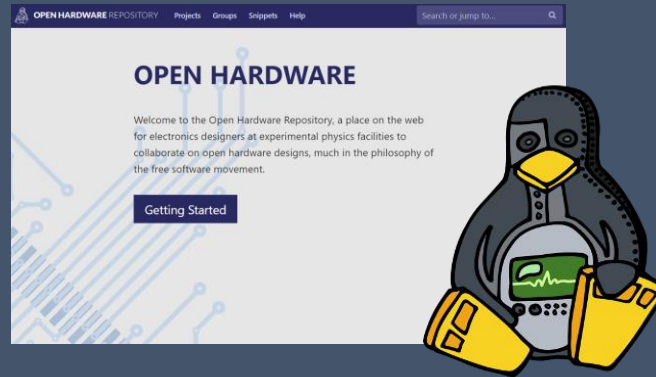
OUR MISSION

Open Data

Open Access

Free Open Source Software

Open Hardware

WHAT – WHY - HOW

👍 Study

👍 Modify

👍 Distribute

👍 Make & Sell

♥ No Vendor Lock-in

♥ More Contributors

♥ Higher Quality

♥ Our Mission

Inspired by SW

BRIEF HISTORY OF THE SW MILESTONES

1950
Fortran, COBOL
Punchcards

1970
vi, emacs

1980
C, C++

2000
Eclipse, SVN

2016
GITHUB
> 35M repos

1960
OOP, Classes, Libraries
Compilers

1990
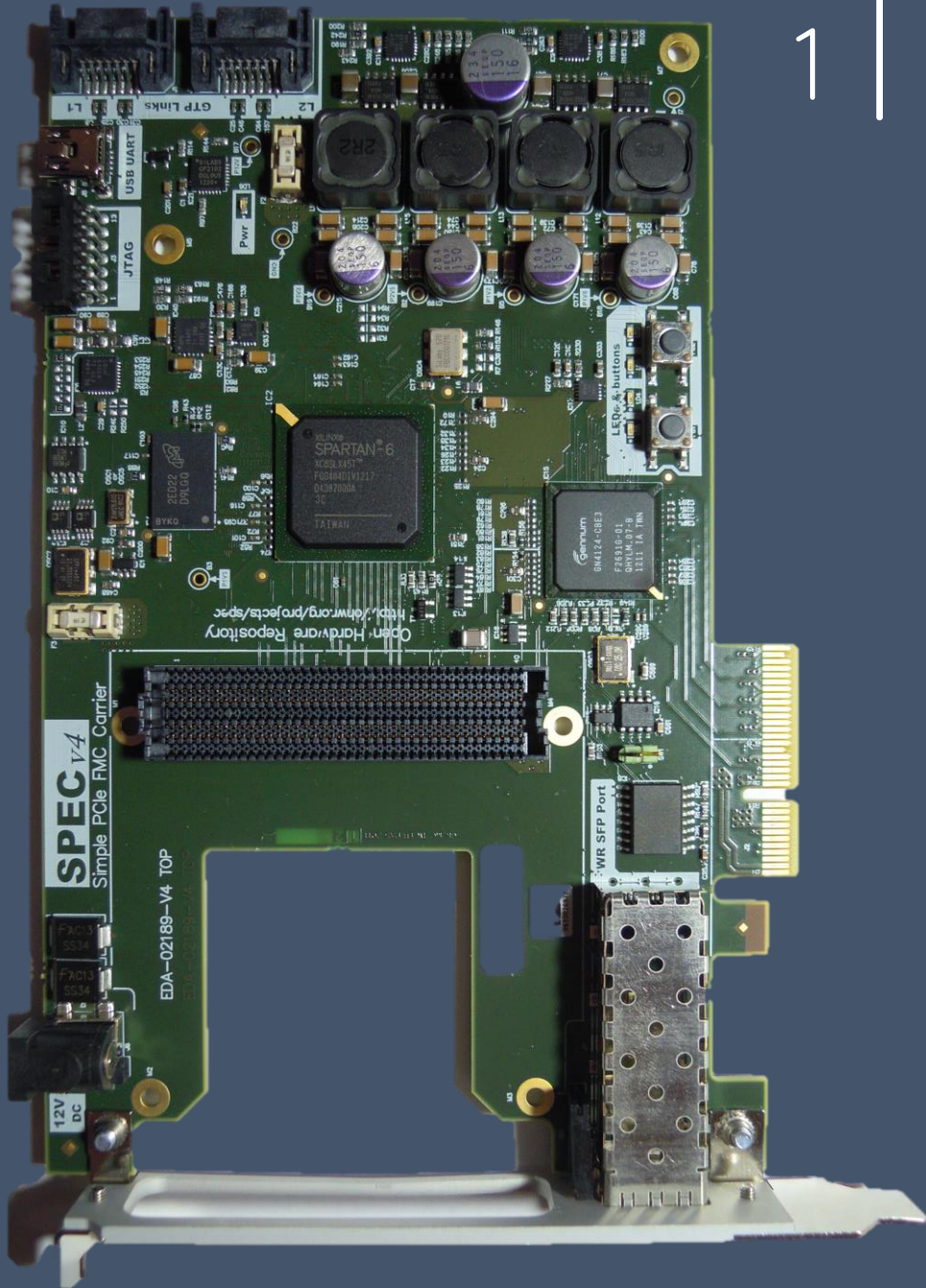MIT, GPL license

2005
GIT
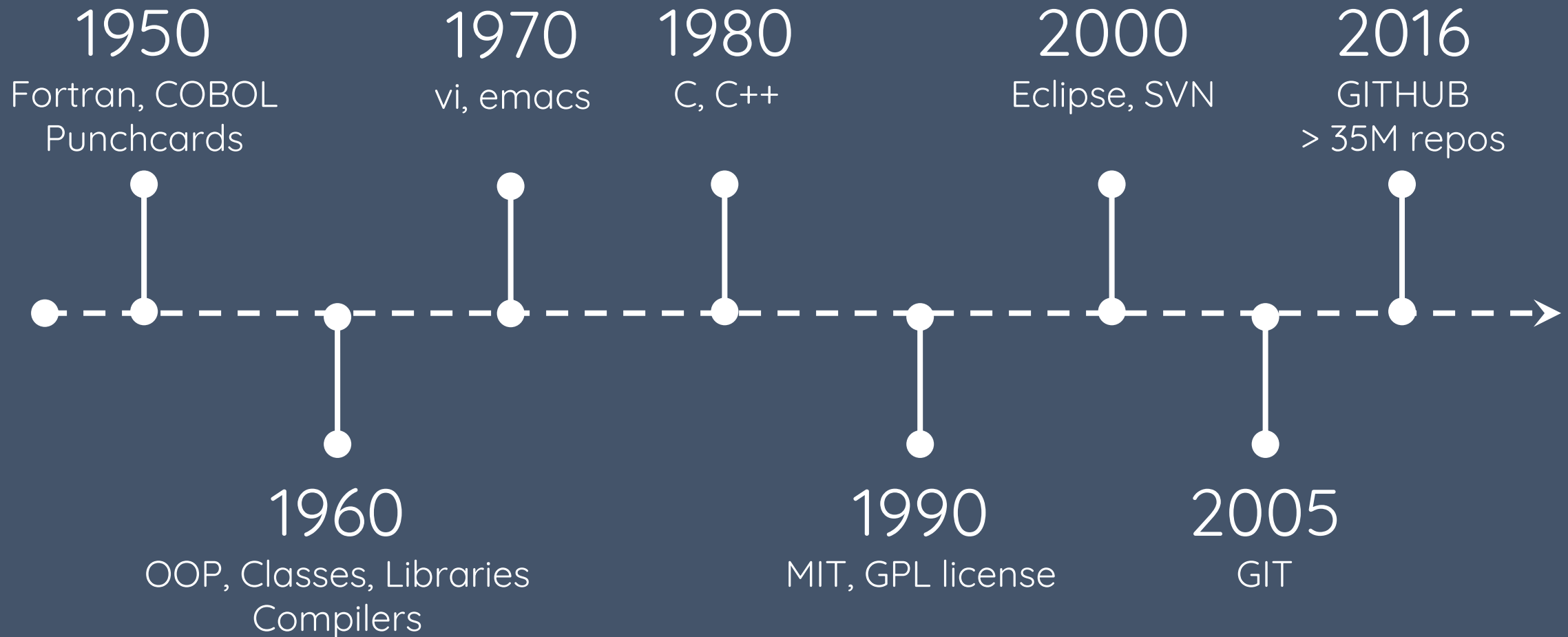
FOLLOWING THE FOSS PRINCIPLES

1 | Host

2 | License

3 | Tools

FOLLOWING THE FOSS PRINCIPLES
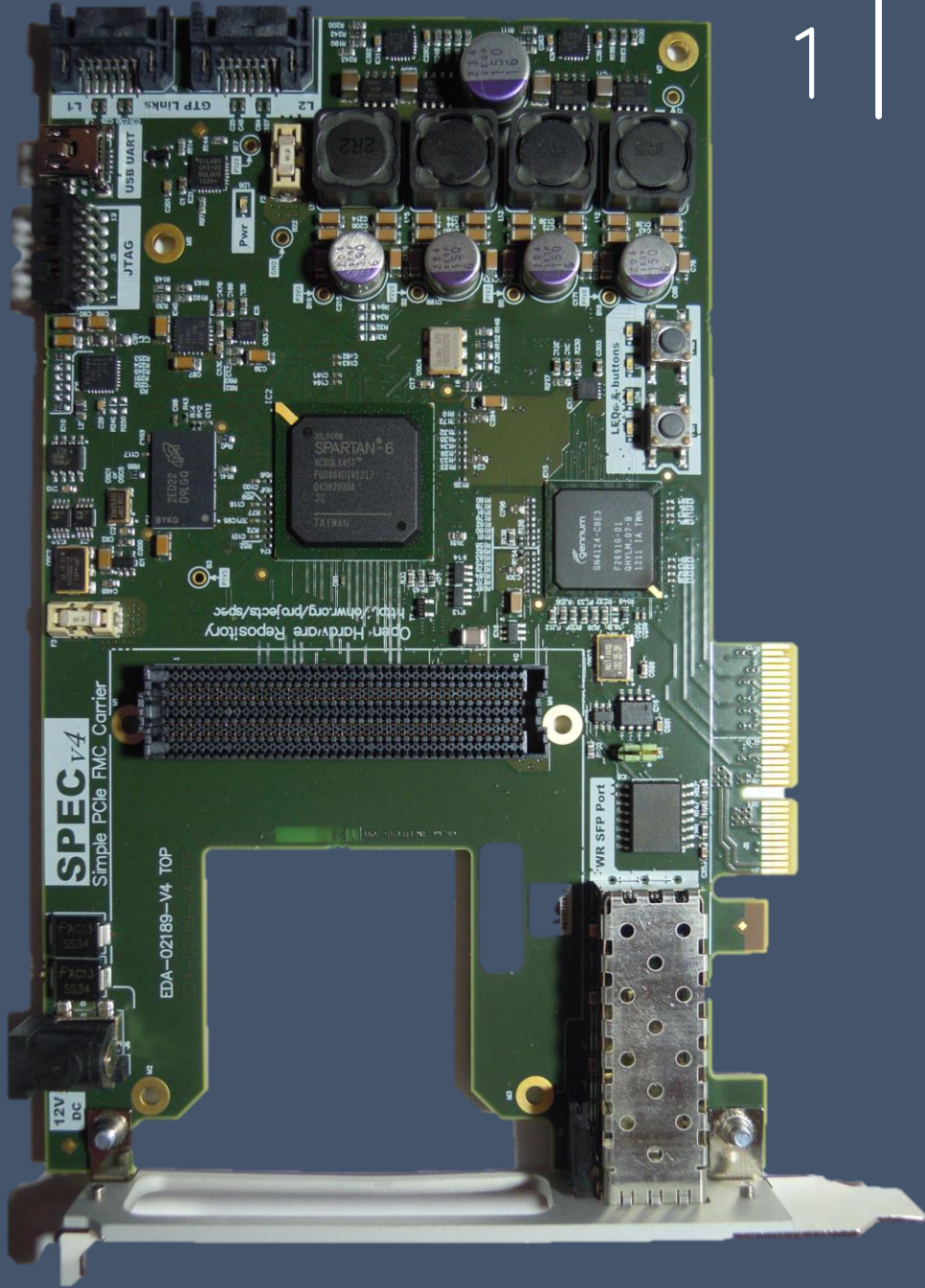
1 | Host

2 | License

3 | Tools

1 | OHWR.ORG

★ Hardware, Firmware Software

★ Design choices

★ Document everything

★ Issues tracking and detected bugs

★ Mailing list discussions

1 | OHWR.ORG

★ Produced Units > 1000

★ Users outside CERN > 100

★ Spinoffs > 9

COMMERCIAL VS OPEN

	Commercial	Non-commercial
Open	**Winning combination Best of both worlds**	Whole support burden falls on developers. Not scalable.
Proprietary	Vendor lock-in.	Dedicated, non-reusable projects

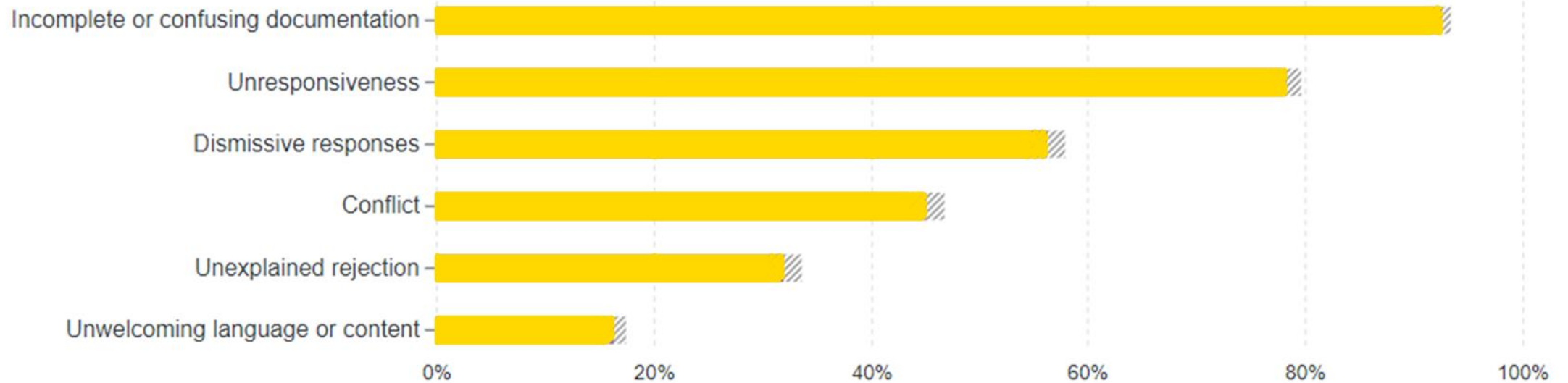|	Commercial	Non-commercial
Open	**Winning combination Best of both worlds**	Whole support burden falls on developers. Not scalable.
Proprietary	Vendor lock-in.	Dedicated, non-reusable projects

COMMERCIAL VS OPEN
NON-COMMERCIAL OPEN-SOURCE

Fig1. - Problems encountered in open source

Source: opensourcesurvey.org

16

	Commercial	Non-commercial
Open	**Winning combination Best of both worlds**	Whole support burden falls on developers. Not scalable.
Proprietary	Vendor lock-in.	Dedicated, non-reusable projects

Fig5. - What open source users value in software

Source: opensourcesurvey.org

Stability

Security

User experience

Compatibility

Transparency

Customizability

‹ V. important not to have

V. important to have ›

FOLLOWING THE FOSS PRINCIPLES

1 | Host

2 | License

3 | Tools

2 | CERN OPEN HARDWARE LICENCE V2

https://ohwr.org/cernohl

★ CERN-OHL-S: Strongly-reciprocal
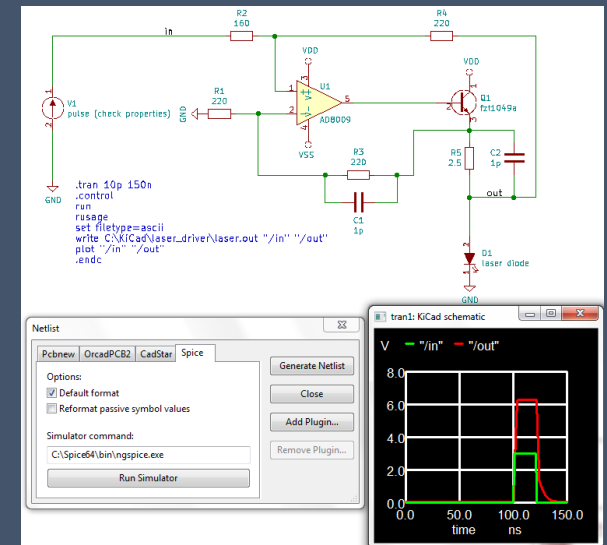
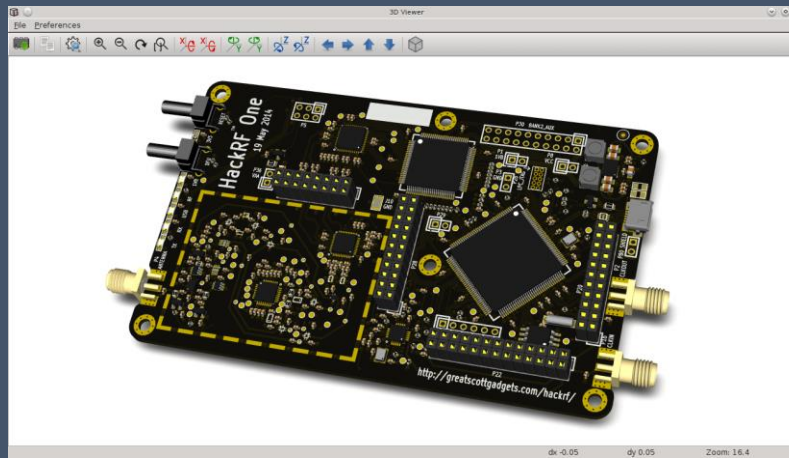★ CERN-OHL-W: Weakly-reciprocal
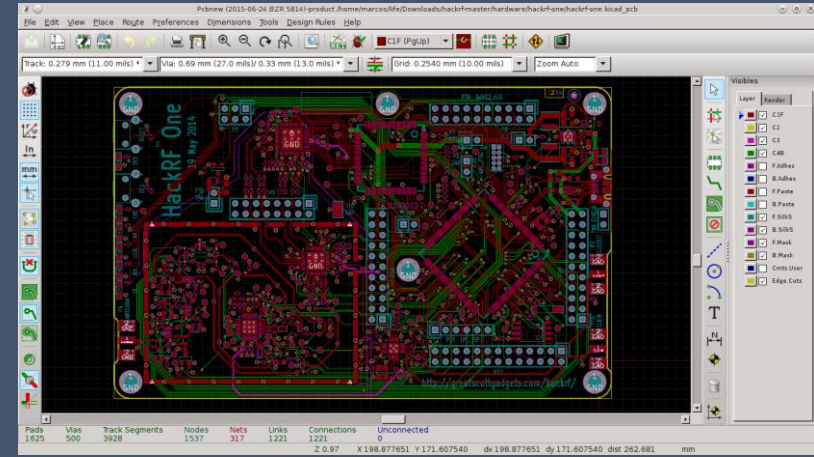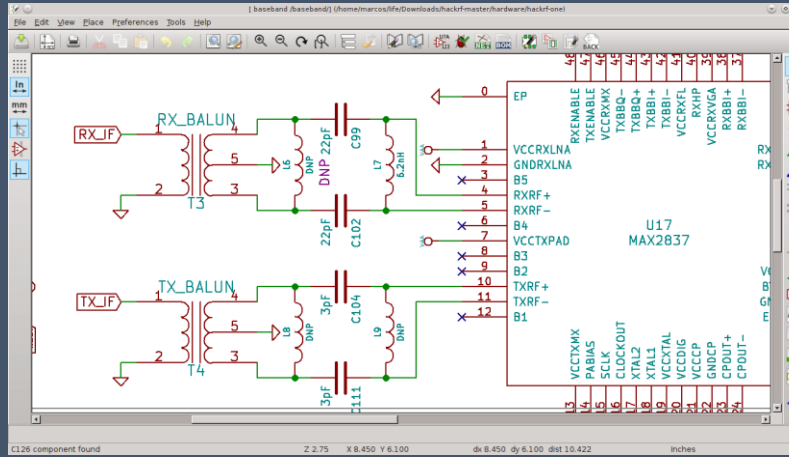
★ CERN-OHL-P: Permissive

FOLLOWING THE FOSS PRINCIPLES

1 | Host

2 | License

3 | Tools

3 │ TOOLS

I. Hardware

3 | TOOLS

II. Gateware, Firmware
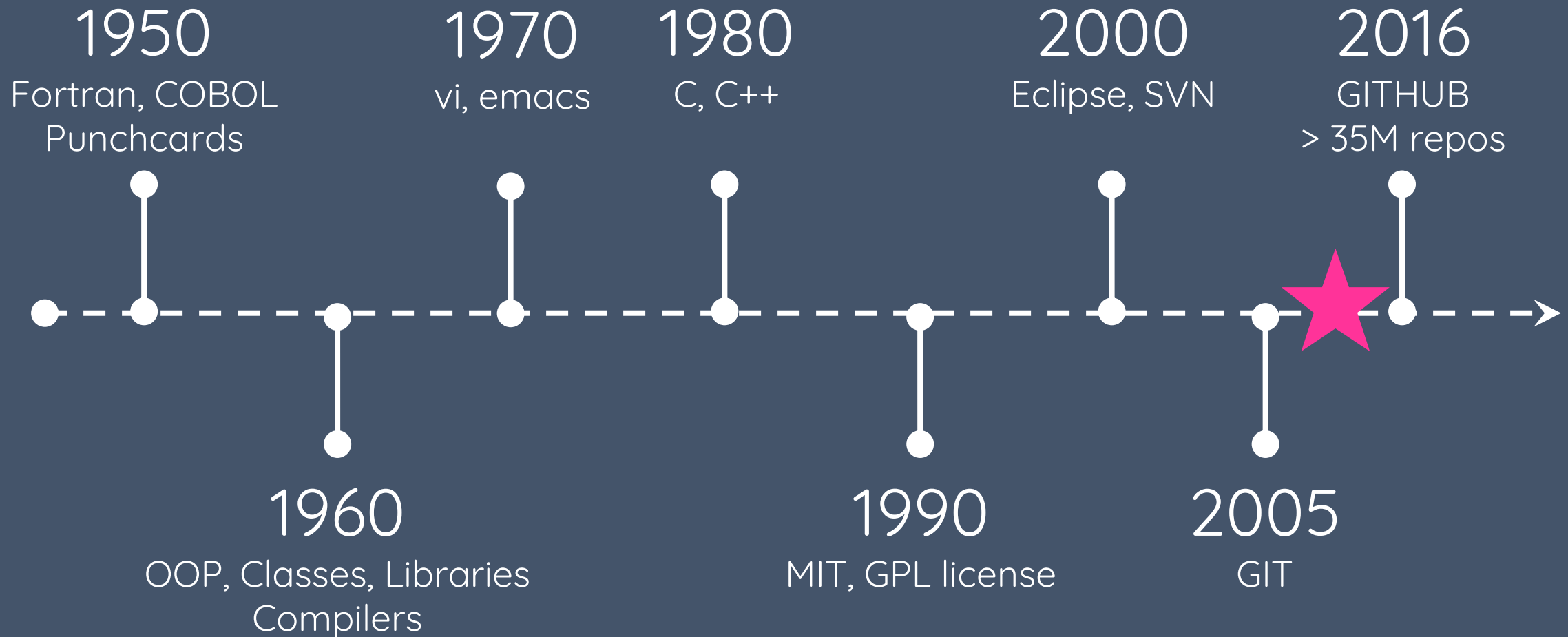
★ Simulators: GHDL

★ Dev Flow: HDLmake | Cheby

3 | TOOLS

The Future

★ Libraries (circuits, sub-assemblies) for HW

★ Version Control for HW

★ Debug at the module level

★ Integrated environment with all tools in one place

★ Mixed Language Simulator

# BRIEF HISTORY OF THE SW MILESTONES

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1970
vi, emacs

1980
C, C++

2000
Eclipse, SVN

2016
GITHUB
> 35M repos

1960
OOP, Classes, Libraries
Compilers

1990
MIT, GPL license

2005
GIT

OHWR.ORG: A SUCCESS STORY

When every ns counts

- ★ CERN needs
- ★ Based on Open standards
- ★ Institutes & Companies
- ★ High Quality product
- ★ Open & Available in industry
- ★ IEEE standard-extension
- ★ WR collaboration

LHC
27 km

SPS
7 km

PSB
0.02 km

PS
0.7 km

p+
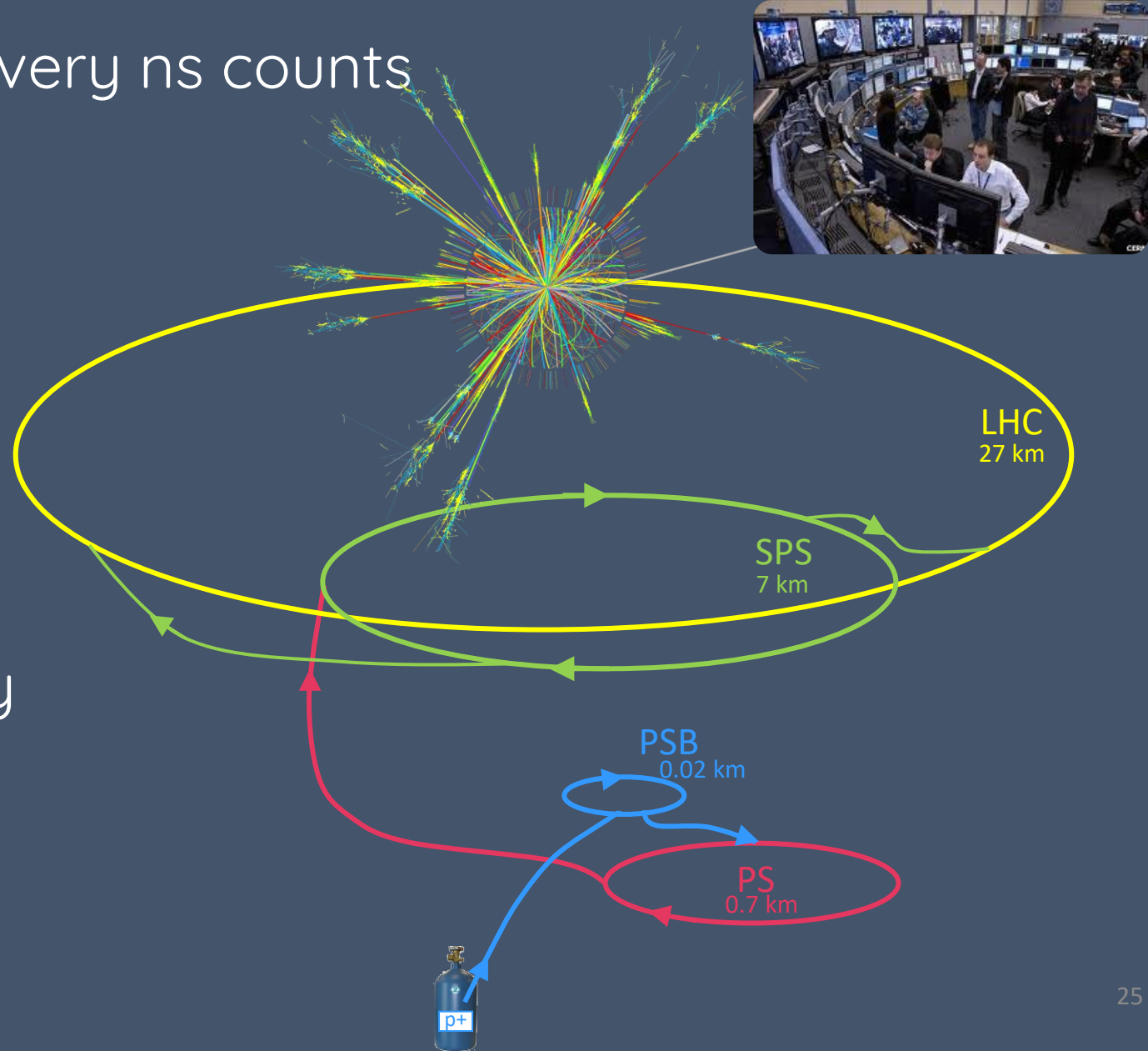
YOUR CONTRIBUTION

★ ohwr.org

★ kicad.org

★ zenodo.org