

A decorative graphic on the left side of the slide consists of a network of white lines and small circles, resembling a circuit board or a neural network, set against a blue gradient background.

WHAT HURDLES DO YOU NEED TO JUMP TO USE AN FPGA IN HEP

ANDY ROSE, IMPERIAL COLLEGE LONDON

IN THE BEGINNING...

- ... the FPGA was empty and without form

BUT TO USE AN FPGA FOR SCIENTIFIC APPLICATIONS, YOU NEED:

- Access from the outside world for
 - Configuration
 - Monitoring
 - DAQ

BUT TO USE AN FPGA FOR SCIENTIFIC APPLICATIONS, YOU NEED:

- Access to elements within the chip for
 - Configuration
 - Monitoring

BUT TO USE AN FPGA FOR SCIENTIFIC APPLICATIONS, YOU NEED:

- Synchronization to your experiment
 - Clocking
 - Triggering

BUT TO USE AN FPGA FOR SCIENTIFIC APPLICATIONS, YOU NEED:

- The ability to test your algorithm
 - On the PC
 - In the chip

BUT TO USE AN FPGA FOR SCIENTIFIC APPLICATIONS, YOU NEED:

- The ability to test your communications between chips
 - Standalone
 - Error-checking in-situ
 - That means external link protocols

BUT TO USE AN FPGA FOR SCIENTIFIC APPLICATIONS, YOU NEED:

- Validation of what firmware is running in your system
 - Chain-of-custody over your data

BUT TO USE AN FPGA FOR SCIENTIFIC APPLICATIONS, YOU NEED:

- The ability to develop firmware within a collaboration
 - Needs tools for collaborative development

BUT TO USE AN FPGA FOR SCIENTIFIC APPLICATIONS, YOU NEED:

- A whole bunch of components around the FPGA
 - Some of which will need configuring
 - Some of which will need monitoring

BUT TO USE AN FPGA FOR SCIENTIFIC APPLICATIONS, YOU NEED:

- Flexibility to port between devices for future upgrades and improvements to your experiment

The background is a blue gradient with decorative white circuit-like lines in the corners. The text is centered in a large, white, sans-serif font.

NONE OF THIS COMES
INCLUDED WITH YOUR DEVICE

OBSERVATION

- It is easy to “bodge” a solution to any one of these problems
- It is a lot of work to validate and maintain such a solution

OBSERVATION

- It is easy to “bodge” a solution to any one of these problems
- It is a lot of work to validate and maintain such a solution
- It is exponentially harder to validate and maintain such a solution to each problem

The background is a blue gradient with decorative white circuit-like lines in the corners. These lines consist of straight segments and small circles, resembling a stylized electronic circuit or data flow diagram.

DO WE DESPAIR NOW?

- No!

DO WE DESPAIR NOW?

- No!
- UK-CMS has tried to come up with coherent, rigorous, generic solutions to all the above challenges
 - UK-CMS was first at CMS to create generic FPGA-hardware
 - UK-CMS was first at CMS to promote common approaches across all FPGAs
 - UK-CMS was first at CMS to push for porting software-like best-practices to firmware

The background is a blue gradient with decorative white circuit-like lines in the corners. A central white rectangle with a red border contains a list of items.

External access

Internal access

Synchronization

Algorithm testing capability

System testing capability

Firmware validation

Collaborative development tools

External component management

Cross-device portability