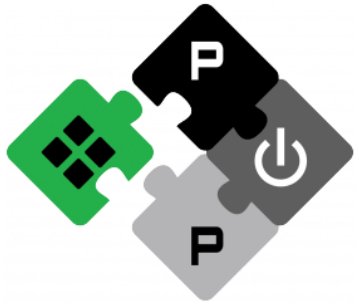


PULP PLATFORM

Open Source Hardware, the way it should be!

PULP Platform, what's next?

Six years of working on open source hardware

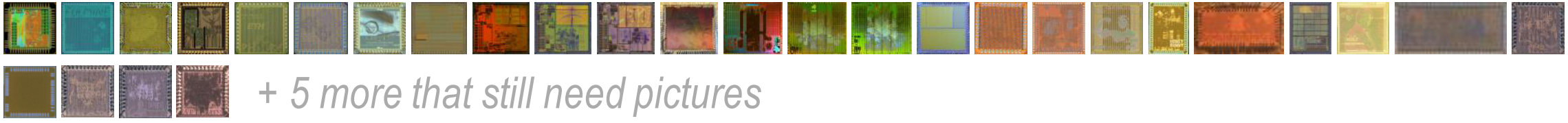
Frank K. Gürkaynak, ETH Zürich

http://pulp-platform.org @pulp_platform

ETH zürich

PULP started in 2013

- **Luca wanted to work on NEW energy efficient architectures**
  - Keywords were: parallel processing, near threshold operation, energy efficiency
  - **P**arallel **U**ltra **L**ow-**P**ower platform was born
- **Large group of 60 people in ETH Zurich and University of Bologna**
  - Working on technology, IC design, architecture, programming, and applications.
- **By the end of this month, we will have 34 ASICs taped out**
  - **4x** 22nm, **4x** 28nm, **1x** 40nm, **15x** 65nm, **5x** 130nm, **5x**180nm



+ 5 more that still need pictures

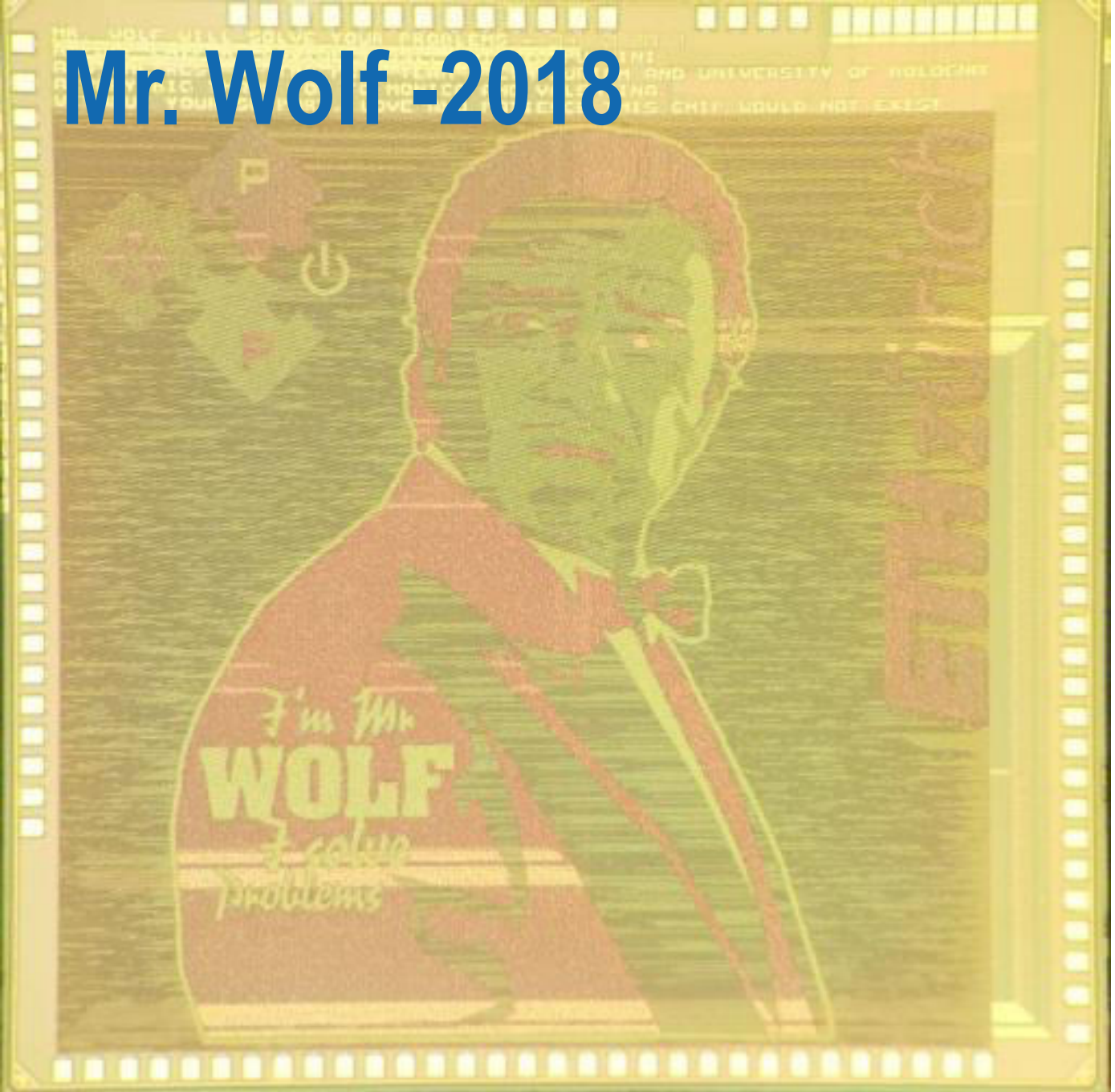
Committed to open source from day one

- **Our goal was to release everything (we could) as open source**
  - There are still discussions on what can be released (HDL source, scripts, netlist, GDS)
  - PULP has been using a permissive Solderpad license since the beginning
- **Our first open source release was in February 2016 (PULPino)**
  - Very simple microcontroller using a single 32-bit RISC-V core (RI5CY)
- **As of now (2019) we have released:**
  - Single core platforms: PULPino, PULPissimo
  - Cluster-based multi-core platforms: OpenPULP, HERO, Open Piton + Ariane
  - And a range of RISC-V cores, peripherals, accelerators and interconnect solutions

Open source hardware is a necessity for us

- **Allows us to collaborate more easily with partners**
  - Both with academia and industry. Agreements are simpler (Back/Foreground is open source)
  - Can work with more people, can start faster, we can reuse what we develop in one project
- **Leverage the community**
  - Even a large academic group can not manage to support everything.
- **Fair benchmarking**
  - Everyone can verify our performance claims. Ultimately this will improve quality of results
- **Open source solutions may help issues with Security and Safety**
  - There is a lot of research interest in these domains.

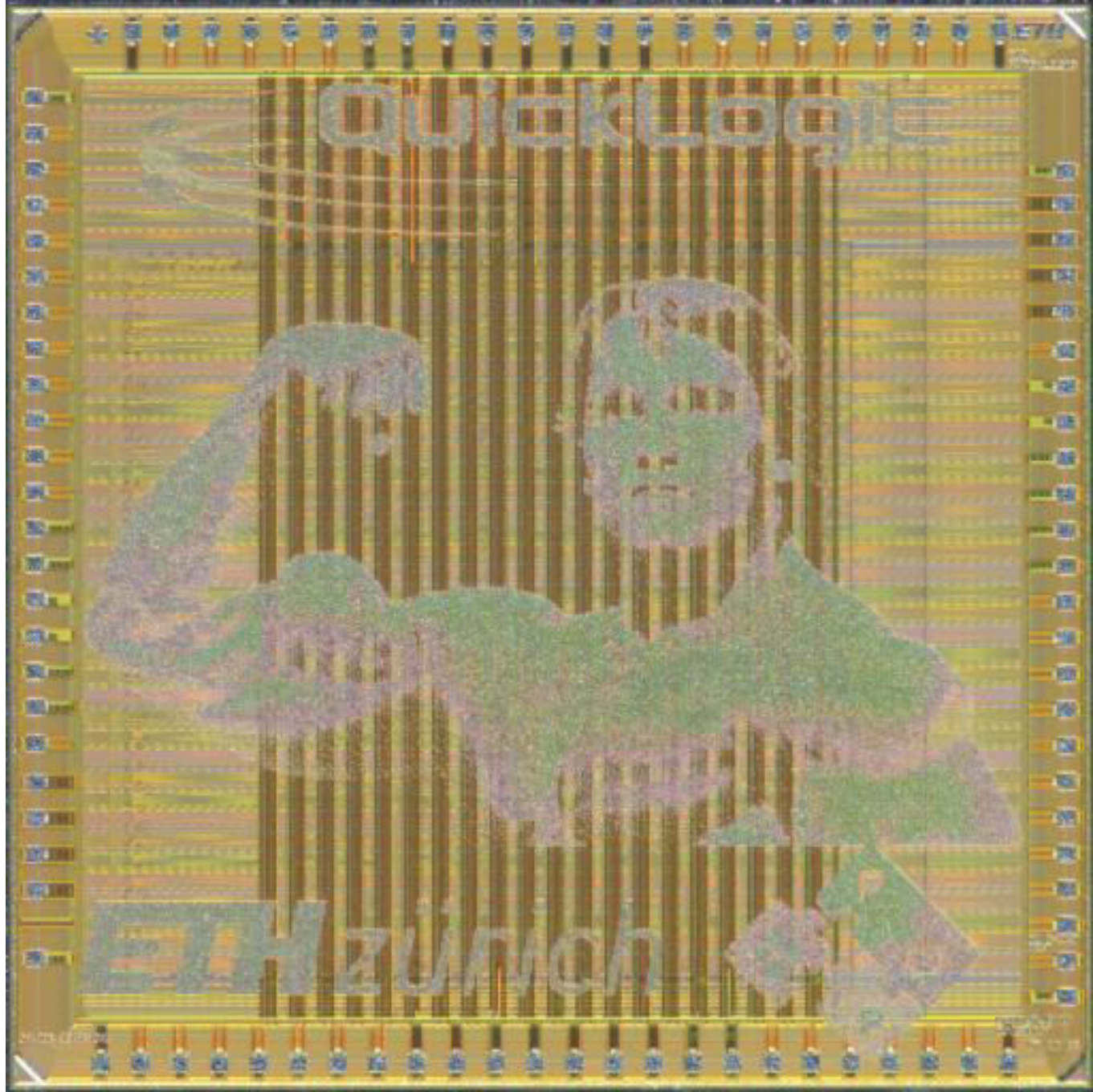
Mr. Wolf -2018



- **TSMC 40LP**
  - Multi-cluster IoT processor
  - Similar to GAP8 of Greenwaves
- **w/ Dolphin Integration**
  - Power management IP
- **Win-win for both**
  - We get to use State of Art IP
  - Dolphin can show their IP working in a complete system.

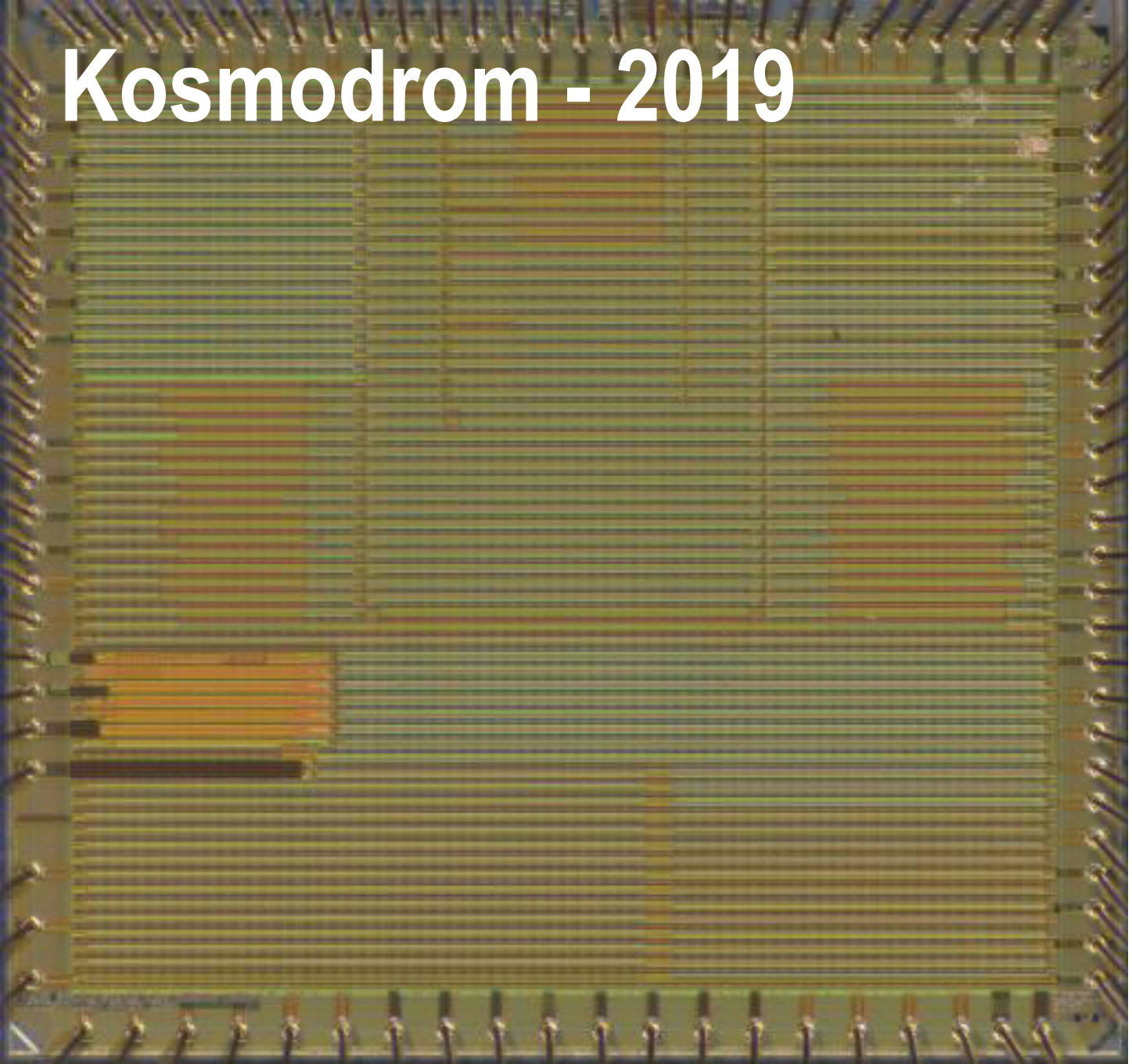
Arnold - 2019

- **GF 22 FDX**
  - Demonstrator (not a product)
- **Cooperation w/Quicklogic**
  - PULPissimo system paired with
  - Aurora eFPGA
- **In 1 year from idea to chip**
  - Fast collaboration
  - Wouldn't have been possible without open source hardware



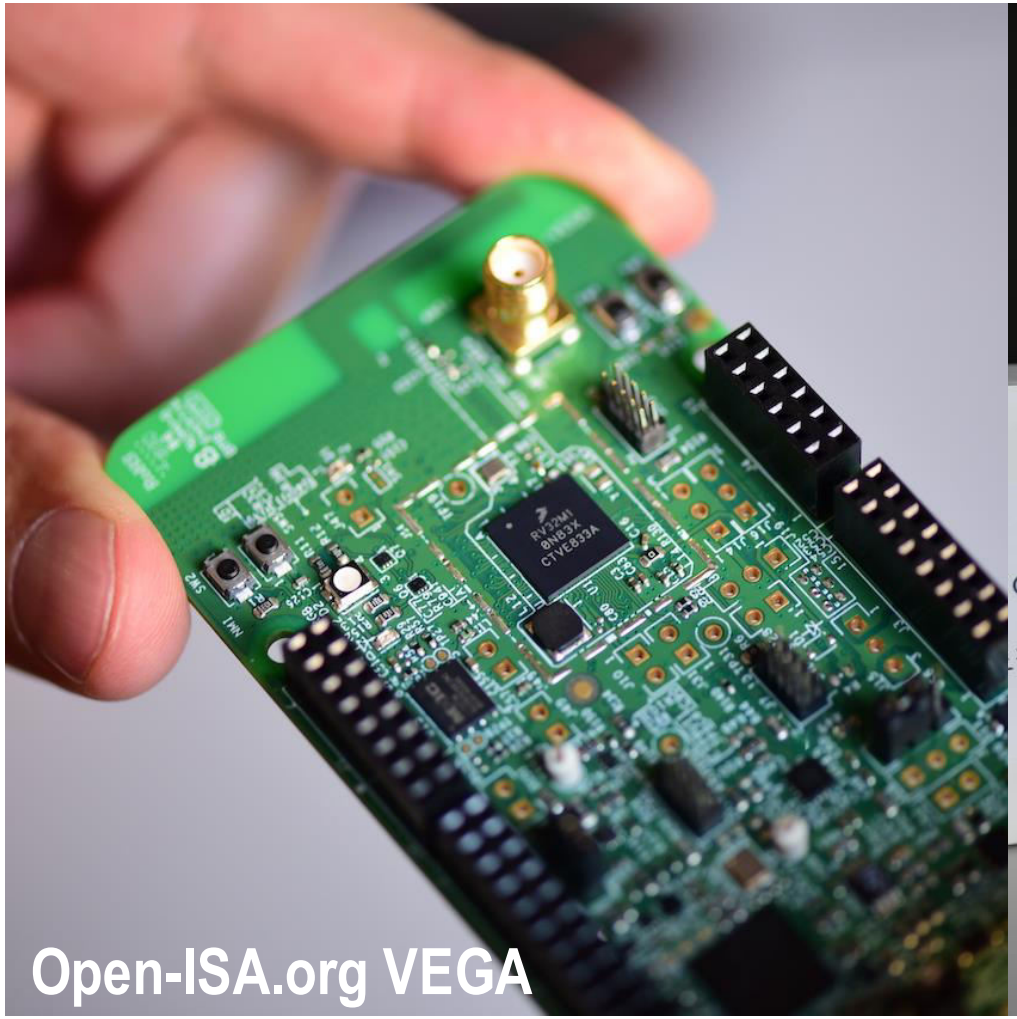
PULP

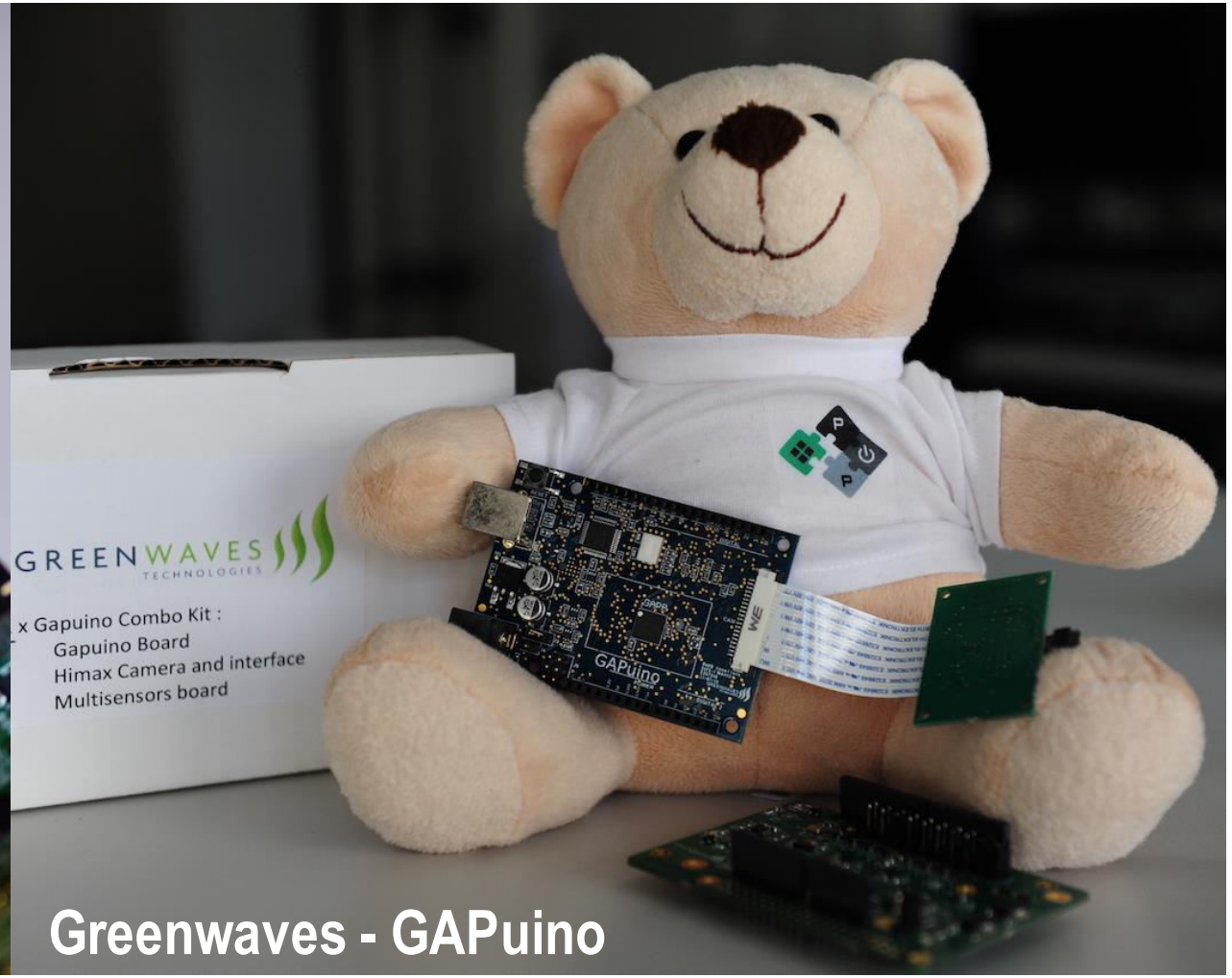
Kosmodrom - 2019



- **GF22 FDX**
  - Test chip with 2x Ariane (RV64)
- **With Globalfoundries**
  - Design methodology for energy efficient design
  - Body basing solutions (together with Invecas)
- **Demo vehicle**
  - We get access to new technology
  - GF gets a portable benchmark

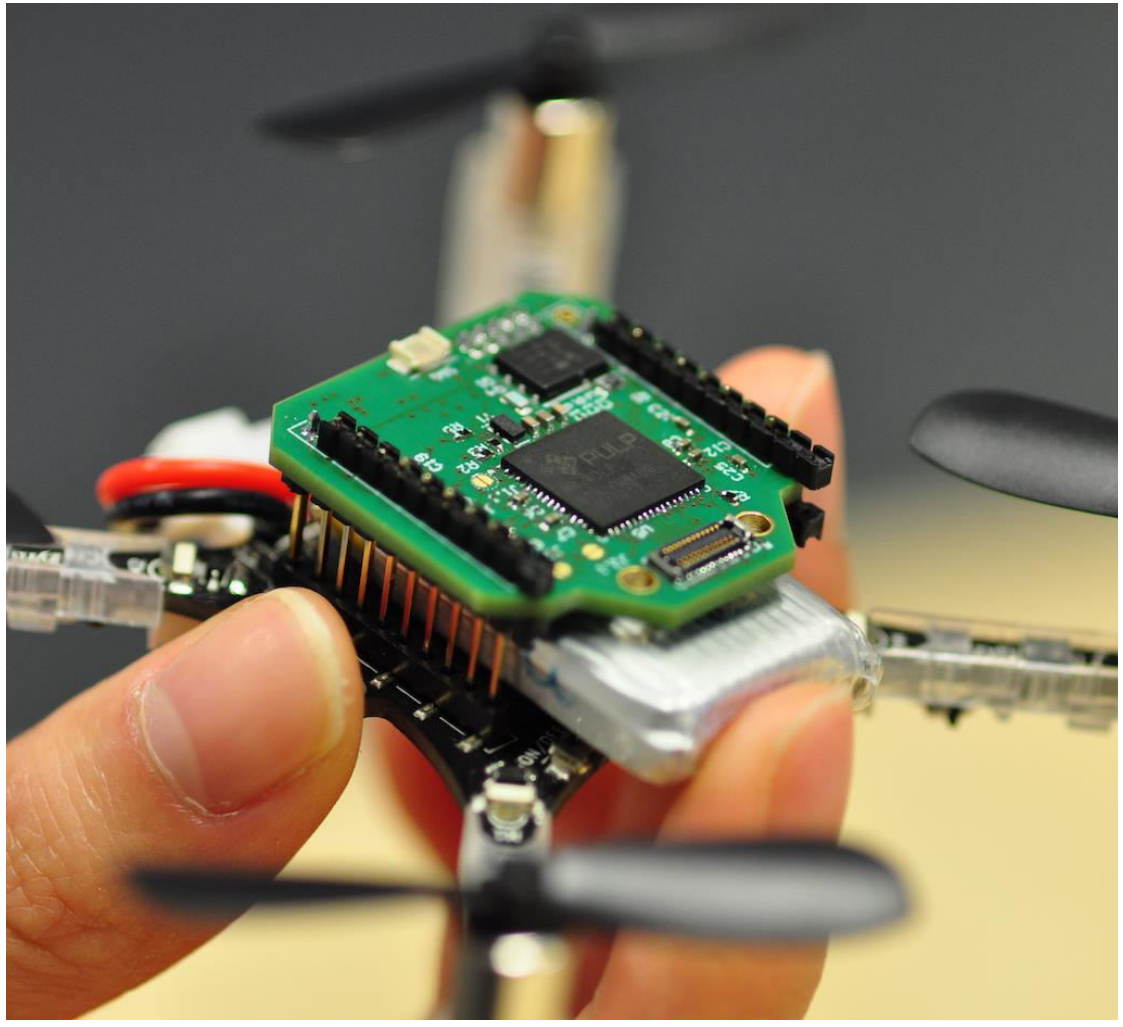
You can buy development boards with PULP





As a university our goal is research

- **We develop new architectures**
  - We rely on open source cores
  - But core development is not our business
- **Technical support needed**
  - Documentation
  - User support
  - Design-for-Test solutions for production
  - Production level verification
- **Not easy in an academic env.**



Micro/Zero riscy is now Ibex

- **LowRISC has agreed to maintain micro/zero riscy**
  - Interested in using the core in their projects
  - They have a team that can provide support
  - ETH Zürich and University of Bologna will continue to contribute to Ibex
- **Our core has grown and left the house**
  - Alpine Ibex (*Capra Ibex*) is a mountain goat that is typical in the mountains of Switzerland

OpenHW Group launches CORE-V

- **OpenHW group was founded by Rick O'Connor to:**

  "boost the adoption of open-source processors by providing a platform for collaboration, creating a focal point for ecosystem development, and offering open-source IP for processor cores."

- **ETH Zürich is a founding member of OpenHW Group**
  - The **RI5CY** and **Ariane** cores will continue to be maintained as part of Core-V
  - ETH Zürich and University of Bologna will continue to contribute to these cores
  - But now we will also have additional technical support from experts as well.

We are excited about the future of PULP

- **Our cores have found homes that will take excellent care of them**
  - Micro/Zero-riscy is being maintained by **LowRISC** as Ibex
  - RI5CY and Ariane will be maintained as part of **Core-V project** of OpenHW Group
- **This support will result in better cores**
- **And it will allow us to concentrate on what we do best:**
  - **Developing new and efficient architectures** using the building blocks we have
  - We already have several ideas that we are working on,
  - Stay tuned..


Any
Questions
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