

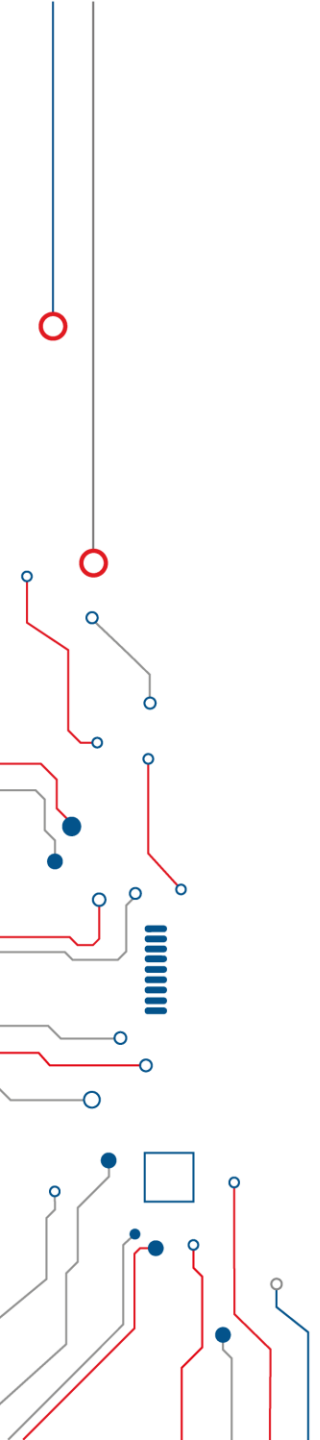


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# Open Source Workshop @ IHP 2023

## Wrap-Up

Aug 2023



# OpenPDK Workshop at IHP at a glance



- **OpenPDK, OpenTooling and Open Source Design – An Initiative to Push Development**
- 2-day workshop on 27/28 June @Frankfurt (Oder)
- Promote exchange and networking
- Designers present ideas to educate chip designers
- Tool developers present tool features / planned enhancements
- Bring together the tooling world, users and OpenSource PDK providers
- Feedback for IHP Open 130 G2 PDK Roadmap



- Talks covering the topics
  - Open-Source design activities
  - Open-Source EDA tool activities

Presentation slides can be found here

<https://github.com/IHP-GmbH/IHP-Open-PDK/wiki/Networking-Workshop-FMD-QNC>

- **Summary of the discussions is given here**





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# IHP 130 G2 Roadmap



## Disclaimer:

- IHP open 130 G2 is delicately developed for use with Open-Source EDA Tool chain
- **NO recycled proprietary PDK**



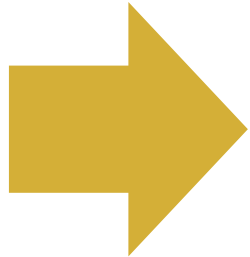
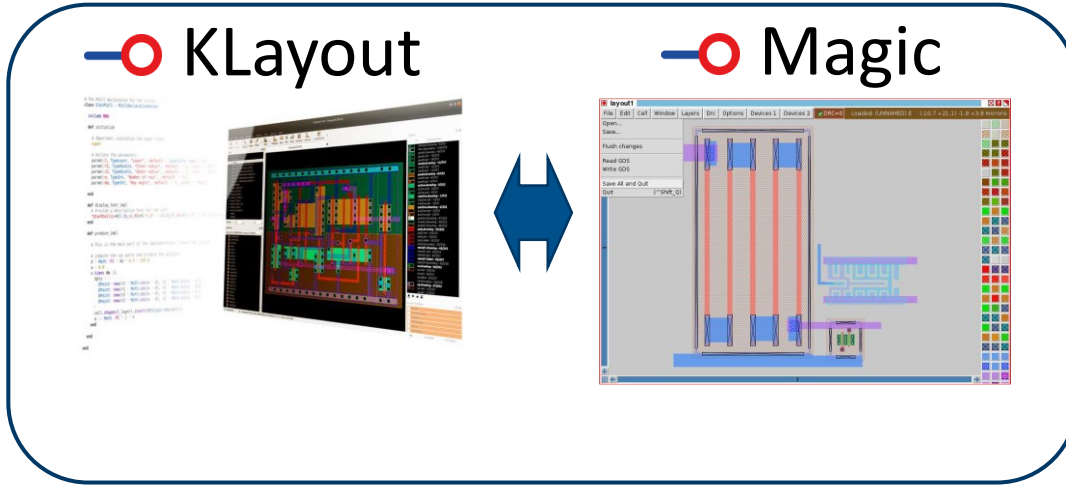
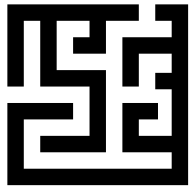
# IHP 130 G2 Roadmap



—○ What tools should the IHP 130 G2 PDK should support?

—○ KLayout

—○ Magic



Layout Design: KLayout **and** Magic

# IHP 130 G2 Roadmap



—○ What tools should the IHP 130 G2 PDK should support?

—○ ngspace

—○ Xyce

ngspace - open source spice simulator

ngspace is the open source spice simulator for electric and electronic circuits.

Such a circuit may comprise of JFETs, bipolar and MOS transistors, passive elements like R, L, or C, diodes, transmission lines and other devices, all interconnected in a netlist. Digital circuits are simulated as well, event driven and fast, from single gates to complex circuits. And you may enter the combination of both analog and digital as a mixed-signal circuit.

ngspace offers a wealth of device models for active, passive, analog, and digital elements. Model parameters are provided by our [collections](#), by the [semiconductor device manufacturers](#), or from [semiconductor foundries](#). The user adds her circuits as a netlist, and the output is one or more graphs of currents, voltages and other electrical quantities or is saved in a data file.

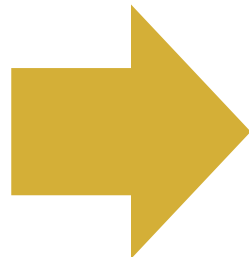
ngspace does not provide schematic entry: its input is command line or file based. There are however [third party](#) interfaces available.

Xyce

Parallel electronic simulation

About Xyce

Xyce is an open source, SPICE-compatible, high-performance analog circuit simulator, capable of solving extremely large circuit problems by supporting large-scale parallel computing platforms. It also supports serial execution on all common desktop platform small-scale parallel runs on Unix-like systems. In addition to analog electronic simulation, Xyce has also been used to investigate more general network systems, such as neural networks and power grids. [Read more about Xyce.](#)



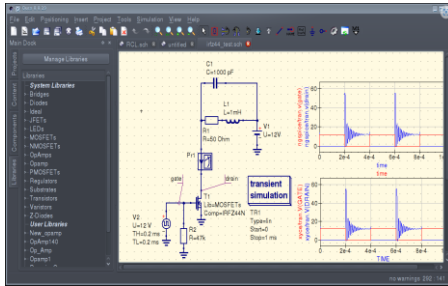
Circuit Design:  
QUCS-S **and** Xschem

# IHP 130 G2 Roadmap

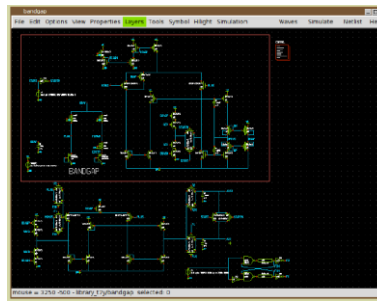


—○ What tools should the IHP 130 G2 PDK should support?

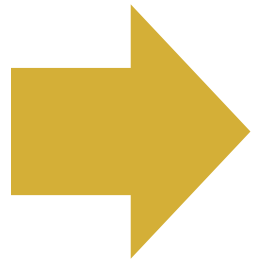
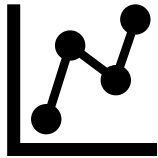
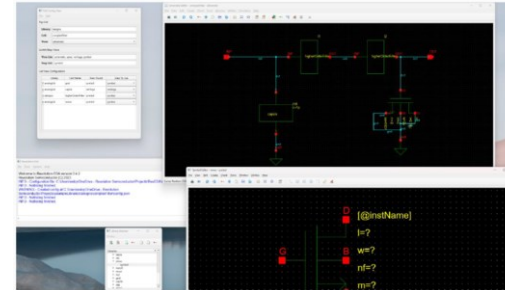
—○ QUCS-S



—○ Xschem



—○ RevolutionEDA



Simulation: ngspice **and** Xyce



# IHP 130 G2 Roadmap



## Upcoming PDK Data:

- transistor models Q4/23
- IO Cells Q4/23
  - first digital design Q4/23
  - first Alpha version of Analog OpenPDK Q3/24
- IHP OpenPDK SiGe HBT devices – ultra high speed & best in class

# IHP 130 G2 Roadmap



## Wider activities:

- IHP OpenPDK SiGe HBT devices – ultra high speed & best in class
- Adoption of IHP OpenPDK early access data – ETH Zurich (Iguana), part of IIC-OSIC tools Docker image
- Q4/24: TapeOut a fully open Risc V based hardware security module
  - <https://hep-alliance.org/>



## What's next? – open questions:

- Accept that there is no perfect start
  - Just a start with subsequent development – includes PDK dev
- Long road for Analog / RF design





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# Panel discussion





## —○ PANEL MEMBERS:

- Prof. Harald Pretl – Head of Institute for Integrated Circuits at Uni Linz
- Prof. Steffen Reith – Theoretical computer science / mathematics / cryptography; Open-Source digital design enthusiast
- Matthias Köfferlein – developer of KLayout
- Markus Müller – CEO of SemiMod; Compact Model Parameter Extraction; Device Characterization; Layout and Test Structure Design
- Dr. Korbinian Schreiber – project executing agency officer at VDI

## —○ MODERATORS:

- Matthew Venn
- Dr. Norbert Herfurth



- Status-Quo analysis
  - Success stories – necessary for growth
    - impressive docker image
    - fairly large Open-Source designs
    - Functional Open-Source based ASICS
    - Powerful tools
  - Open minded community –
    - Cooperative
    - same mindset - different opinions





## Design:

- Remember Export control regulations
- Guidelines needed before putting designs to open source
- Test cases! → Open Source PDK → Start improvement cycle
  - Simple analog design using Open-Source tools made in IHP – Open-Source Flow qualification, put IP as Open-Source
- Noteworthy design examples from universities

## Tools and PDK:

- Do not copy Cadence and ADS – think it new!
- Need to set priorities for the tool development (survey?)
- Documentation of tools must be improved!
- Lacking functionality here and there, interface missing between some tools
- Performance not an issue at this point
- Missing noise and harmonic balance in Open-Source simulators → already addressed by IHP and partners
- Short-term lifespan of many Open-Source projects → IHP should take lead and become a hub





## Tools and PDK:

- Simple GUI for attracting a broader community, BUT cmd line more important → functionality and productivity
- More focus on standard files exchange format instead of common DB
- Need for user-friendly & flexible tools
- No (serious) analog/RF design before a reliable LVS is available
- Library manager would be nice to have as a user-friendly GUI
- Docker image support needed
- Lack of CI system (important)



## Community:

- Channel the efforts – agree on a subset of options
  - Python?
  - GUI?
  - Taxonomy of targeted audience – how?
- Resources and planning for Open Source tools is a problem, joint strategy?
  - Foundation (European?) for open EDA tools – join existing opportunities?

# Acknowledgment



- The IHP Open 130 G2 development is mainly, but not exclusive, driven by: Frank Vater, Christian Wittke, Sergei Andreev, Rene Scholz, Anton Datsuk, Alexey Balashov and Norbert Herfurth
- Thanks to ETH Zurich + Open-Source community
- Separate thanks to Volker Mühlhaus for work on the EM solvers
- And final thanks to different public founded German projects:
  - VE-HEP (16KIS1339K) <https://hep-alliance.org/>
  - IHP Open130-G2 (16ME0852) <https://www.elektronikforschung.de/projekte/ihp-open130-g2>
  - FMD-QNC (16ME0831) <https://www.elektronikforschung.de/projekte/fmd-qnc>
  - Workshop funding - FMD-QNC with VDI/VDE (project management agency) approval

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# Thank you for your attention!

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