This paper describes objective technical results and analysis. Any subjective views or opinions that might be expressed in the paper do not necessarily represent the views of the U.S. Department of Energy or the United States Government.

SAND2019-7961C

THE ELECTRONICS RESURGENCE INITIATIVE

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XYCE OPEN-SOURCE CIRCUIT SIMULATOR

ERIC KEITER

SANDIA NATIONAL LABORATORIES
ALBUQUERQUE, NM

THE Xyce™ ANALOG CIRCUIT SIMULATOR

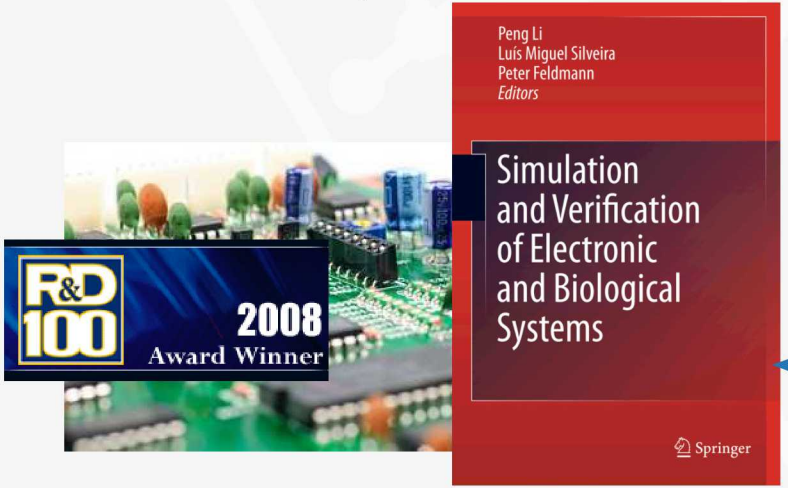
- SPICE-Compatible syntax
  - Berkeley 3f5, Hspice
- **Distributed Memory Parallel** (MPI-based)
- Unique solver algorithms
- Industry standard models

Open Source, GPLv3

- Since September of 2013 (Xyce 6.0)

Xyce Release v6.11

- June, 2019
- 24th major release



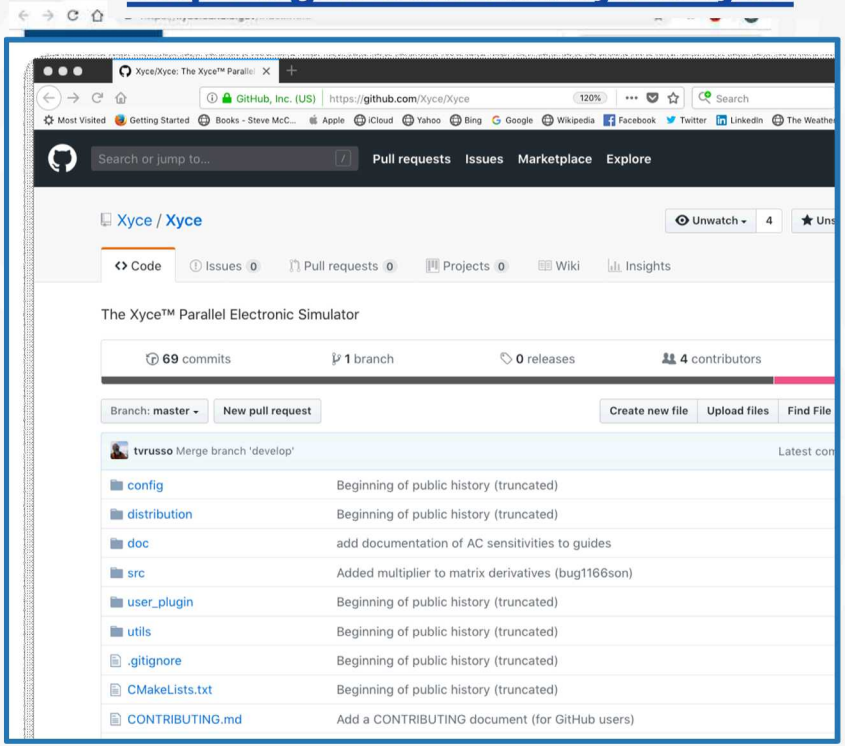
Keiter, et al., "Parallel Transistor-Level Circuit Simulation"

OBTAINING XYCE

- Two Options:
  - Go to our website and download
  - Go to github.com/Xyce/Xyce and clone

- At original website, many resources are available.
  - **Binary executables** for Windows, OSX and Red Hat Enterprise Linux
  - **Xyce Source code** and **build instructions**
  - **Regression test suite** (several thousand tests)
  - **Documentation**

https://xyce.sandia.gov
https://github.com/Xyce/Xyce



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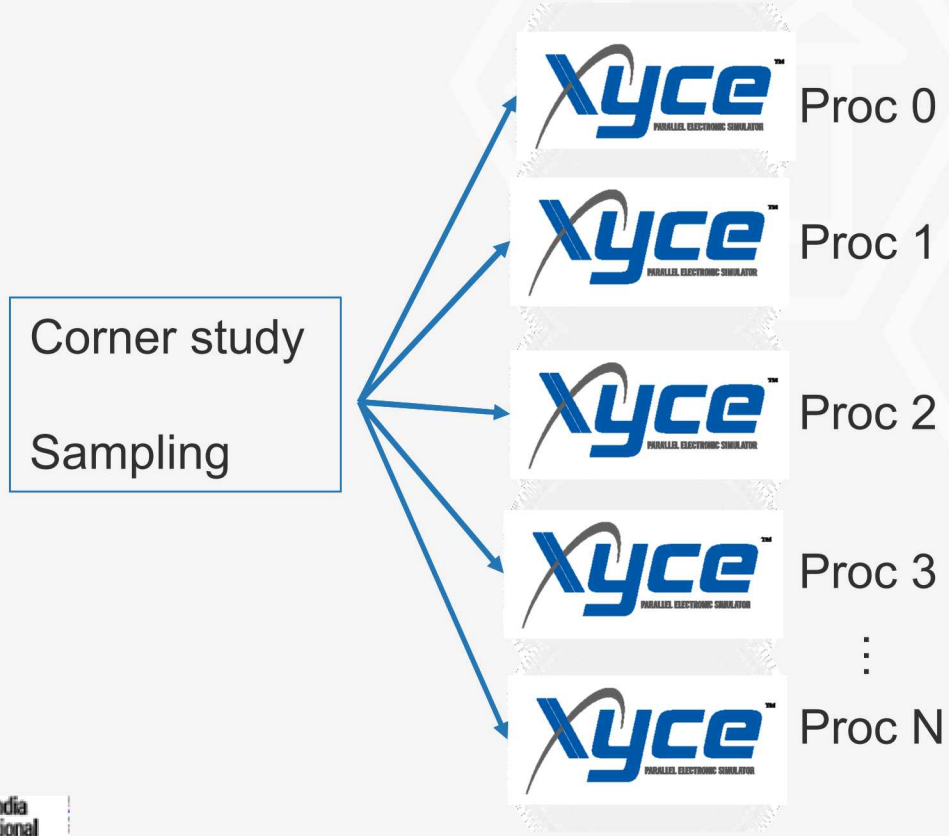
OPEN SOURCE ADVANTAGE: UNLIMITED LICENSES



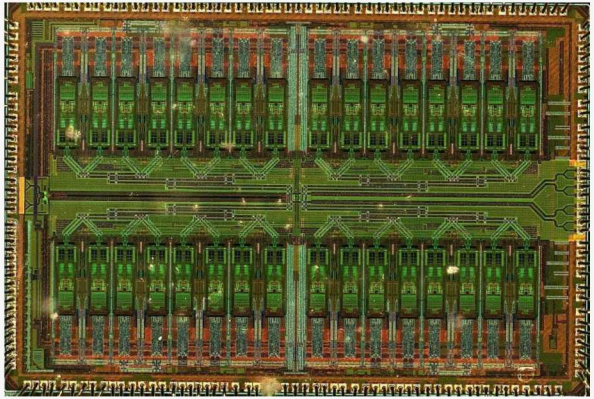
Unlimited licenses allow *unlimited simultaneous simulations*

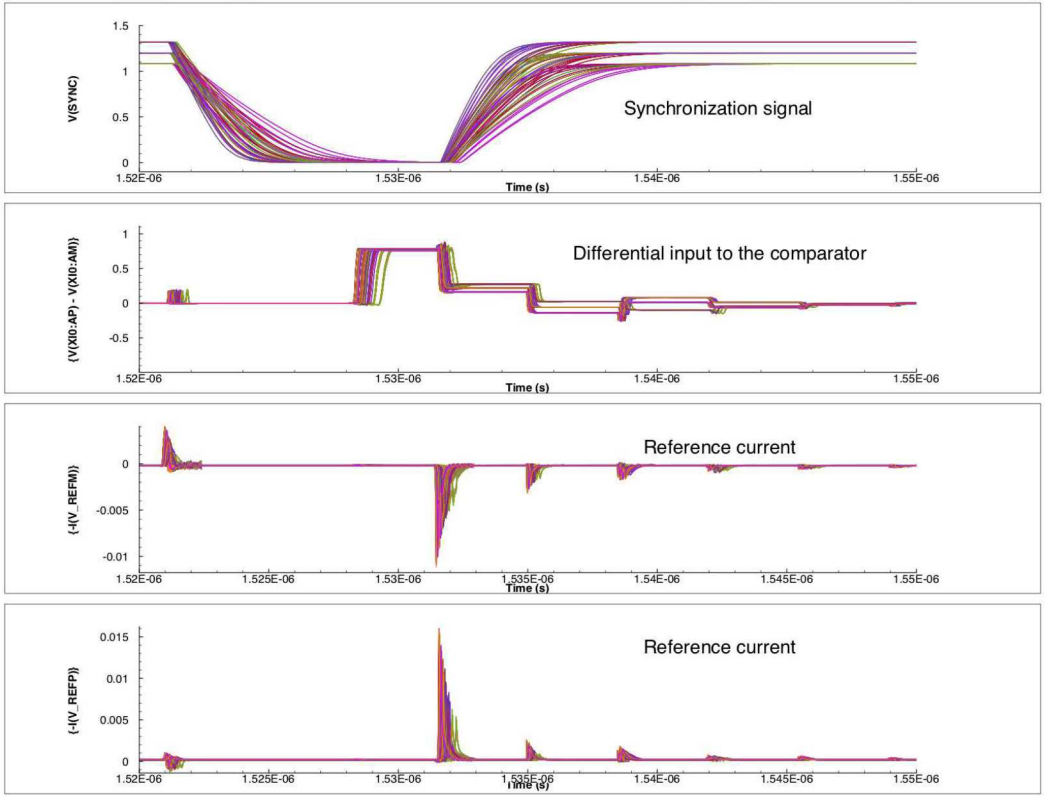
- Embarrassingly parallel
- a.k.a. ”Massively Serial”

Common for smaller companies to have a single commercial simulator license

XYCE DEMO: SAR ADC CIRCUIT CORNER STUDY

- **SAR ADC** = successive approximation register analog-to-digital converter
- Open source circuit, developed under the POSH program by Mike Chen's group at USC.
- See video





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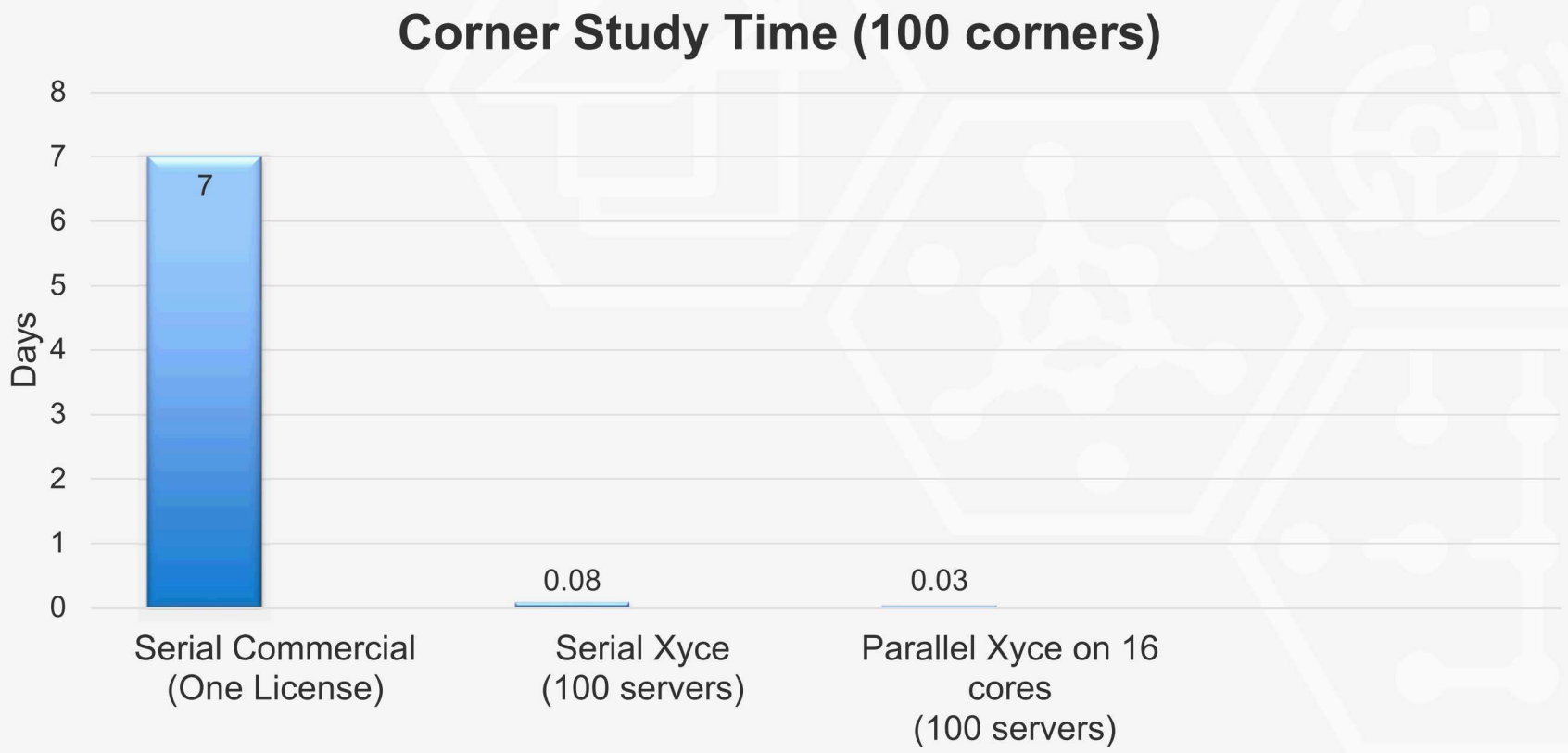
CORNER STUDY RUNTIME COMPARISON



Microsystems Technology Office

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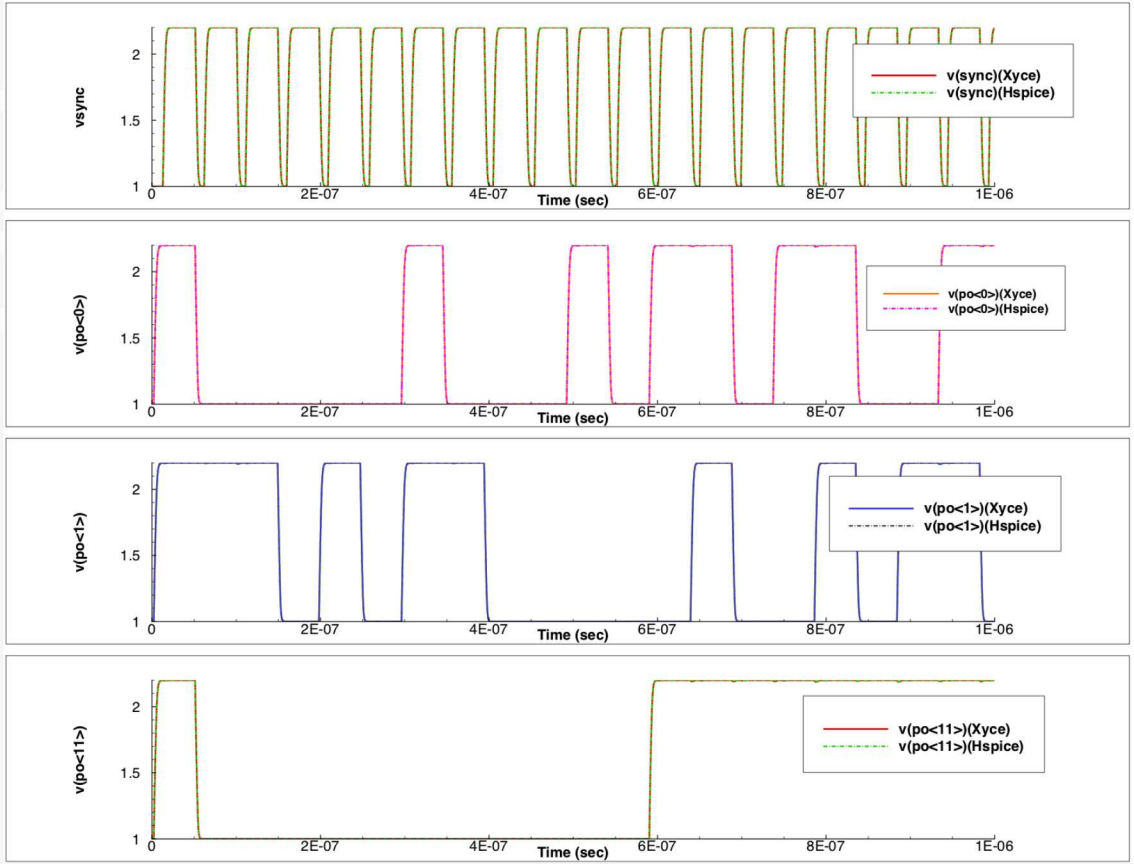
SIMULATOR OUTPUT COMPARISON

Results match well
RMS Errors small

RMS relative error v(sync) is 0.0434905680015374%
RMS relative error v(po<0>) is 0.0232474456164593%
RMS relative error v(po<1>) is 0.023581461963474%
RMS relative error v(po<2>) is 0.02583082511786%
RMS relative error v(po<3>) is 0.0240096727254828%
RMS relative error v(po<4>) is 0.0166525520072121%
RMS relative error v(po<5>) is 0.00929693070847055%
RMS relative error v(po<6>) is 0.0309201017241085%
RMS relative error v(po<7>) is 0.0230237794341722%
RMS relative error v(po<8>) is 0.0259005260949305%
RMS relative error v(po<9>) is 0.0175662606806119%
RMS relative error v(po<10>) is 0.00940986678122403%
RMS relative error v(po<11>) is 0.00976999004888706%



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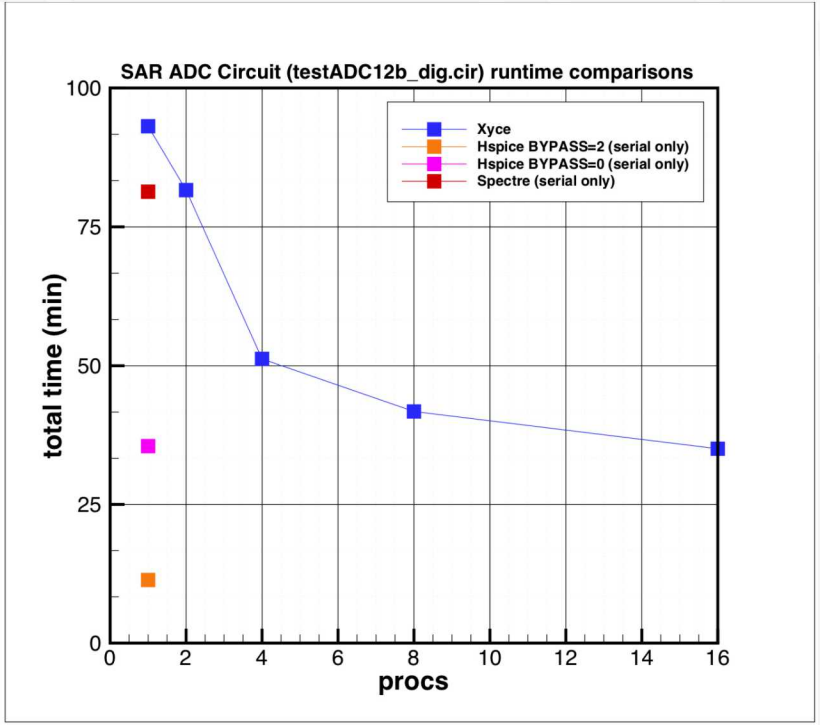
SIMULATOR RUNTIME COMPARISON

- Xyce competitive with Spectre in serial.
- Still work to do to catch Hspice.
- Xyce parallel speedup
  - device evaluation in parallel
  - linear solve in serial
  - 8333 devices
  - 15750 unknowns