Welcome and Introduction

Adam Lyon

LArSoft Multi-threading and Acceleration Workshop
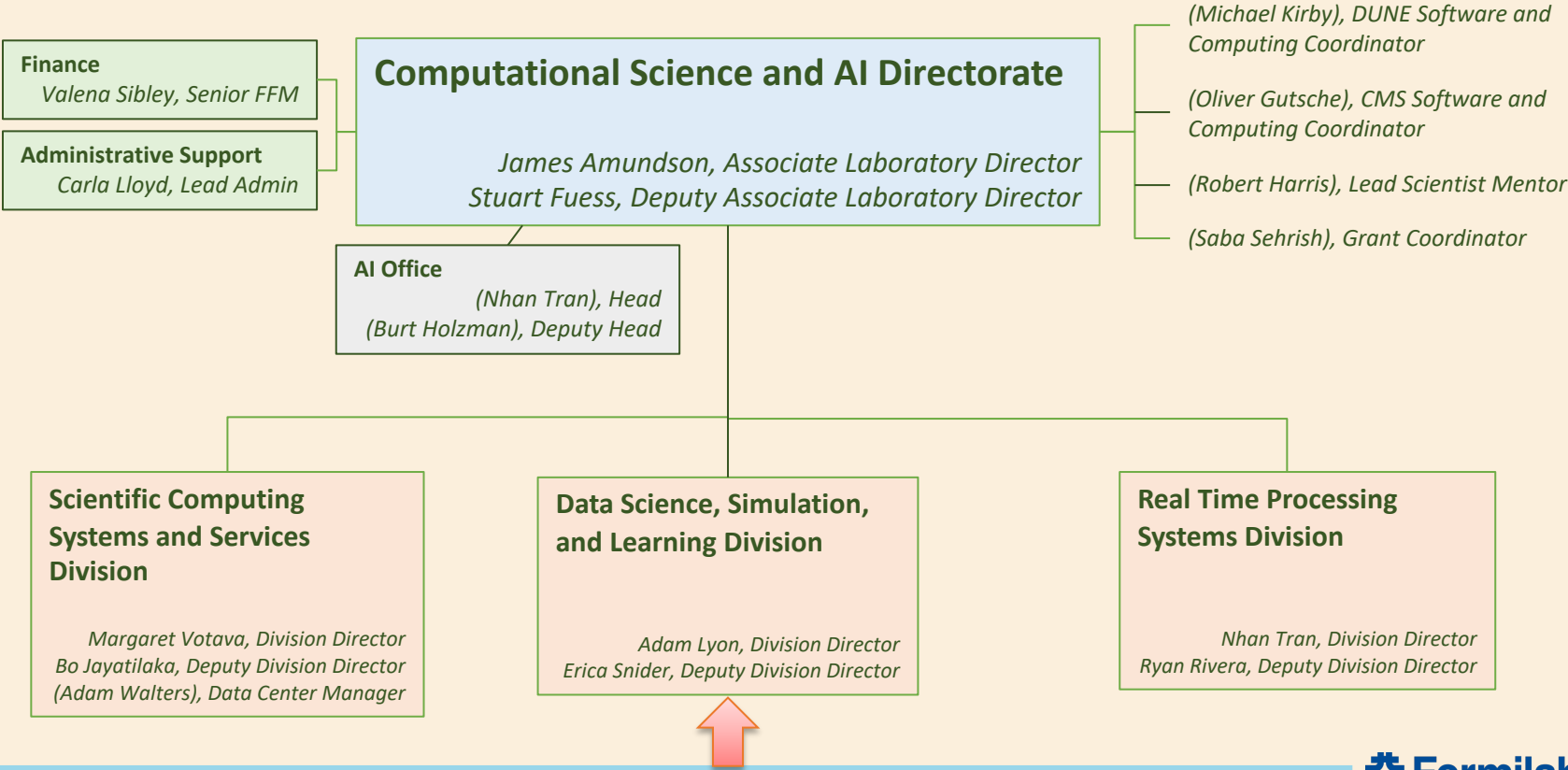
March 2-3, 2023

Reorganization

The lab has reorganized starting with SCD -> CSAID

We've strived to set up a structure that is more understandable to experiments and to serve them better…

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Data Science, Simulation and Learning

Finance
Valena Sibley, Senior FFM

Administrative Support
Carla Lloyd, Lead Admin

Computational Science and AI Directorate

James Amundson, Associate Laboratory Director
Stuart Fuess, Deputy Associate Laboratory Director

(Michael Kirby), DUNE Software and Computing Coordinator

(Oliver Gutsche), CMS Software and Computing Coordinator

(Robert Harris), Lead Scientist Mentor

(Saba Sehrish), Grant Coordinator

AI Office
(Nhan Tran), Head
(Burt Holzman), Deputy Head

Scientific Computing Systems and Services Division

Margaret Votava, Division Director
Bo Jayatilaka, Deputy Division Director
(Adam Walters), Data Center Manager

Data Science, Simulation, and Learning Division

Adam Lyon, Division Director
Erica Snider, Deputy Division Director

Real Time Processing Systems Division

Nhan Tran, Division Director
Ryan Rivera, Deputy Division Director

We are here!

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Data Science, Simulation, and Learning

Adam Lyon, Division Director
Erica Snider, Deputy

Computational Science

Saba Sehrish, Department Head
Marc Paterno, Deputy

- Energy Frontier (Matti Kortelainen)
- Intensity Frontier (Kyle Knoepfel)

Data Science and AI

Giuseppe Cerati, Dept. Head
Liz Buckley-Geer, Deputy

- Cosmic AI (Alex Ciprijanovic)
- Cosmic Surveys (Liz Buckley-Geer)
- CMS & Muon Experiments (Robert Harris)
- Neutrino Experiments (Andrew Norman)

Physics Simulation

Krzysztof Genser, Dept. Head
Jim Simone, Deputy
P. Canal, S. Mrenna, Asst. Dept. Heads

- Accelerator Simulation (Eric Stern)
- Event Generators
  S. Gardiner
- LQCD Software (Jim Simone)
- Physics & Detector Simulation
  (Soon Yung Jun)

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DSSL Mission

The mission of the Data Science, Simulation, and Learning Division is to maximize the **discovery potential** of experiments with **leadership** in scientific software **infrastructure** and physics **simulation** codes and advanced expertise in **software engineering** best practices, **reconstruction**, physics **analysis**, and **machine learning** tools and techniques. We collaborate with the experiments, including having division scientists as experiment collaboration members, other national laboratories including Argonne National Laboratory, and DOE offices including OHEP and ASCR. We contribute to HEP science and technical research and publish.

We are here to help you on the experiments

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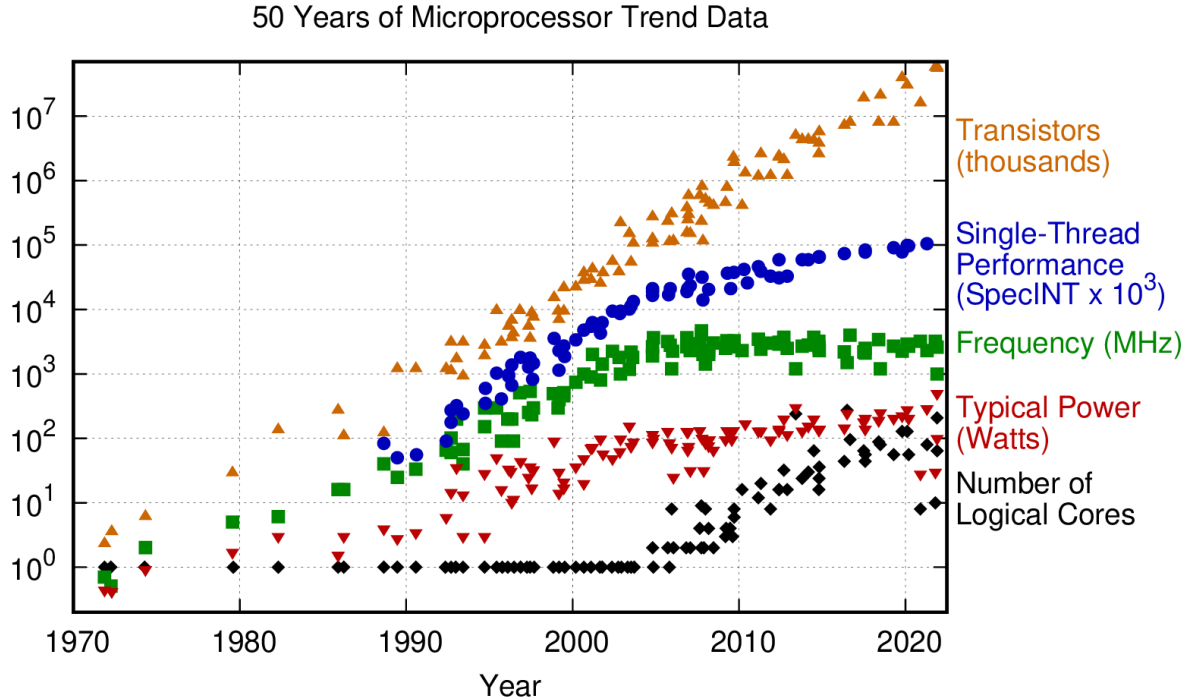# Cramming more components onto integrated circuits

With unit cost falling as the number of components per circuit rises, by 1975 economics may dictate squeezing as many as 65,000 components on a single silicon chip

By Gordon E. Moore

Director, Research and Development Laboratories, Fairchild Semiconductor division of Fairchild Camera and Instrument Corp.

Electronics, Volume 38, Number 8, April 19, 1965

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Why are multithreading and accelerators important?

50 Years of Microprocessor Trend Data

- Transistors (thousands)
- Single-Thread Performance (SpecINT x 10^3)
- Frequency (MHz)
- Typical Power (Watts)
- Number of Logical Cores

Original data up to the year 2010 collected and plotted by M. Horowitz, F. Labonte, O. Shacham, K. Olukotun, L. Hammond, and C. Batten
New plot and data collected for 2010-2021 by K. Rupp

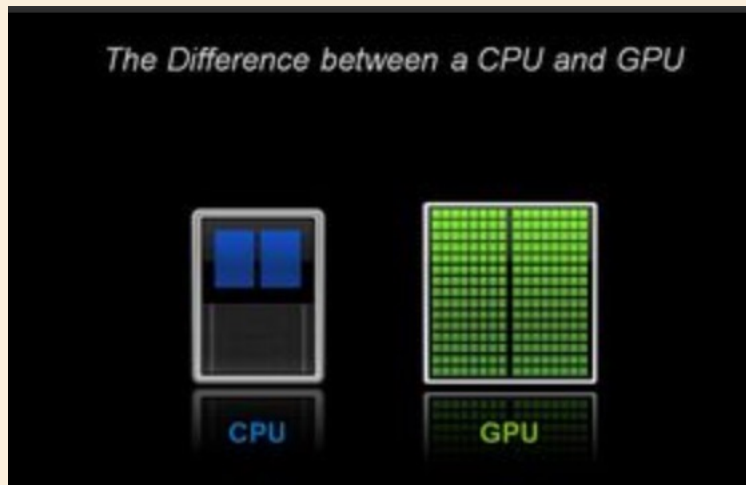Instead of making cores faster, give you more of them

Difficult to take advantage of these multicores

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Technology

- GPUs are winning over many-thread CPUs

NVIDIA Blog

- Like multithreading, GPUs are difficult to program
  - Portability libraries help? (Kokkos, Alpaka)

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This workshop

- Multithreading and GPU stories from across the division
- Experiment adoption of multithreading and GPUs

Enjoy the workshop and learn something new!

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