# Welcome to Fermilab

AI for Experiments – Research Collaboration
(JTFI Workshop, Part II)
Thursday, October 20th, 2022

- Please note this event is being recorded.
- Slide decks and recordings will be posted on the Workshop website.
- https://indico.fnal.gov/event/55607/

# Agenda

Today's in-person agenda is available at: https://indico.fnal.gov/event/55607/

| | | |
|---|---|---|
| 8:30 & 8:55am | Arrival and Welcome | Mauricio Suarez, Bonnie Fleming |
| 9:00 | How Can ML Advance Scientific Measurement? | Eric Jonas |
| 9:30 | HPI + AI-Enabled X-ray Science at the Advanced Photon Source | Mathew Cherukara |
| 10:00 | Break | |
| 10:15 | Efficient Machine Learning in HEP | Jennifer Ngadiuba |
| 10:45 | Quantifying Predictive Uncertainty with Conformal Inference | Rina Barber |
| 11:15 | Breakout Discussion | Yuxin Chen |
| 11:30 | Lunch | |
| 1:00pm | Breakout Round 1 | Eric Jonas, Nhan Tran, Yuxin Chen |
| 1:45 | Break | |
| 2:00 | Breakout Round 2 | Eric Jonas, Nhan Tran, Yuxin Chen |
| 2:45 | Break | |
| 3:00 | Questions & Panel Discussion | Eric Jonas, Nhan Tran, Paul Fenter, Yuxin Chen |
| 3:50-4:00 | Closing | James Amundson |

# Opening Remarks

Bonnie Fleming
Deputy Director, Science & Technology
Chief Research Officer

# Break

Content resumes at 10:15am CDT

# Virtual Break

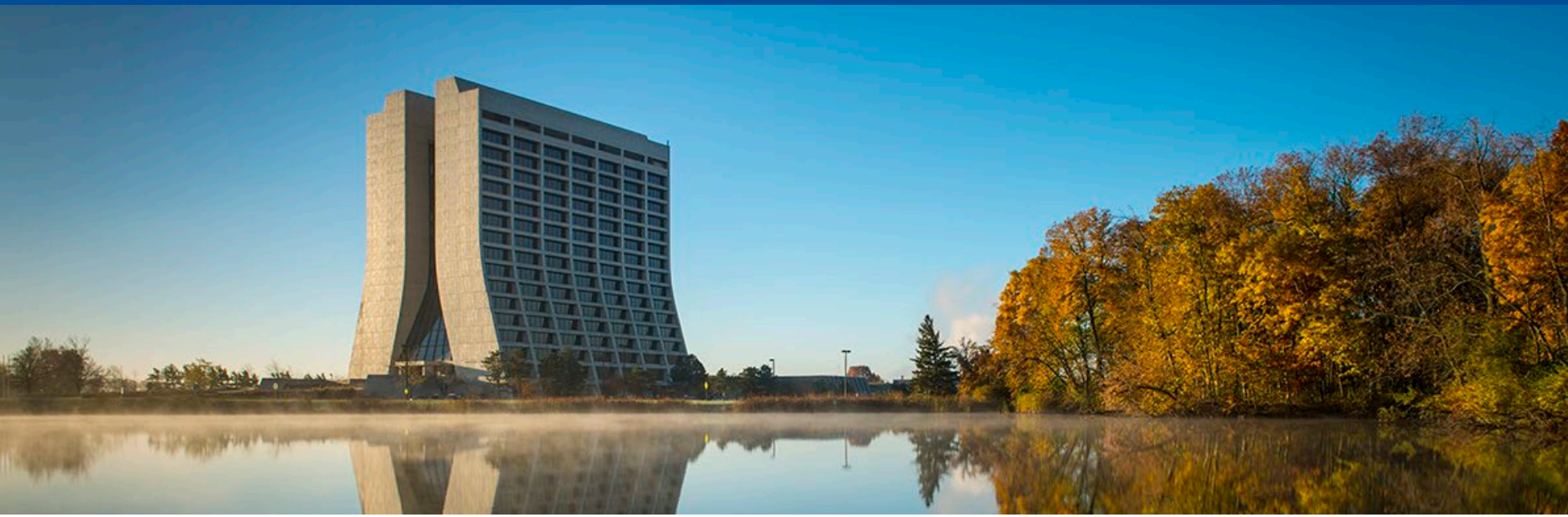
- Content resumes at 3:00pm CDT
- Please use the same Zoom link

# Breakout Room Options – complete emailed survey

| | | |
|---|---|---|
| Robust and Efficient Inverse Problems | How can AI help solve inverse problems (like in imaging) more robustly and with better incorporation of domain knowledge? How can we use data-driven methods (with either real or simulated data) to improve recovery? What types of physical knowledge can we incorporate directly into our machine learning algorithms, and where is that useful? Can methods in AI help us skip expensive iterative reconstruction techniques and solve these problems faster? Can they help us learn regularizers that, when combined with classical algorithms, enable reconstruction with far-fewer steps? Are there opportunities for novel hardware architectures and chip design to play a role? Imagine if you could perform inference 10,000 times faster than is possible today – what new applications and domains does this open up? | Nhan Tran |
| Computational Imaging, Measurement, and Experiment Design | How can we modify our measurements to make the inverse problem easier to solve, or to extract more data? Techniques such as compressive sensing were revolutionary a decade ago, and led to developments in computational imaging where taking *novel* types of measurements (say, encoded in a special way) coupled with new algorithms allow for wholly new capabilities. How can AI techniques expand the space of measurements we can make? How can we use AI to arrive at the optimal set of experiments or measurements that will get us to the answer faster? | Eric Jonas |
| Active Learning | Ultimately we can imagine having the AI technique be “in the loop”, helping decide what measurements to take next. How can we actively and adaptively collect data to most benefit your models? What techniques from active learning work today, and what might work tomorrow? What sorts of problems does this work on? How can you avoid biases in the AI system corrupting your measurements? Are there safeguards we can put in place? What is the maximum possible speed-up such techniques could provide? | Yuxin Chen |

# Lunch

- Lunch is served in the 2nd Floor lunchroom
- Breakout rooms begin at 1:00pm and 2:00pm
- Room assignments will be posted in the lunchroom



# Questions and Panel Discussion

Moderator: Nhan Tran

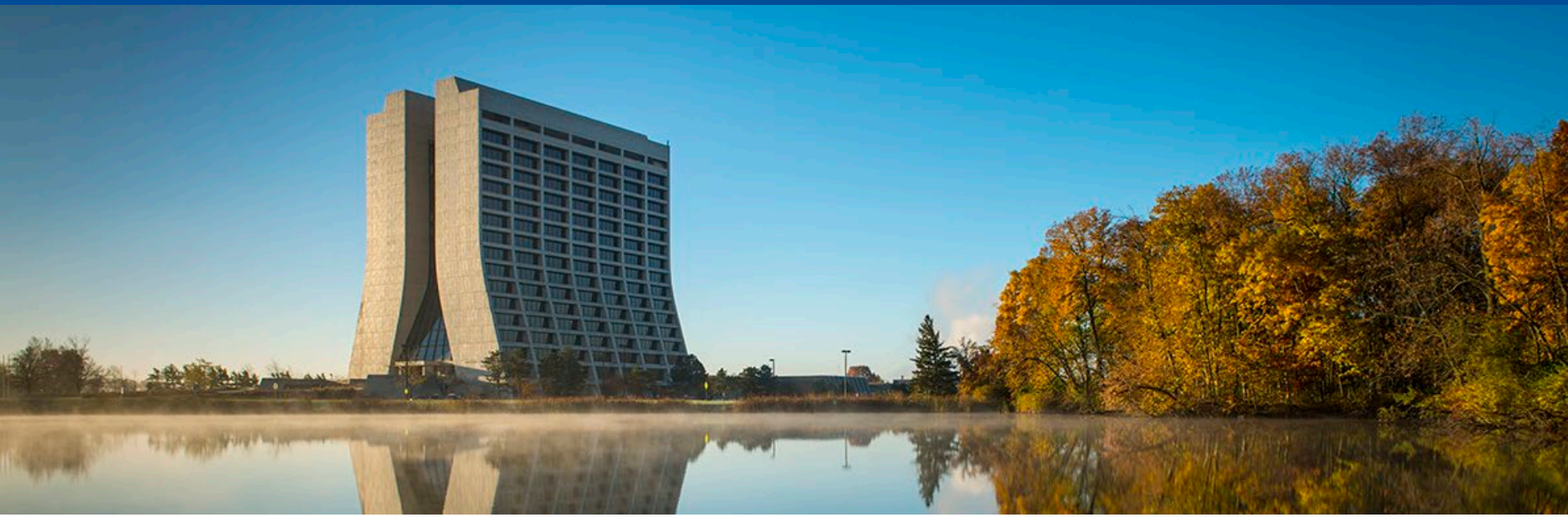
Eric Jonas

Paul Fenter

Yuxin Chen

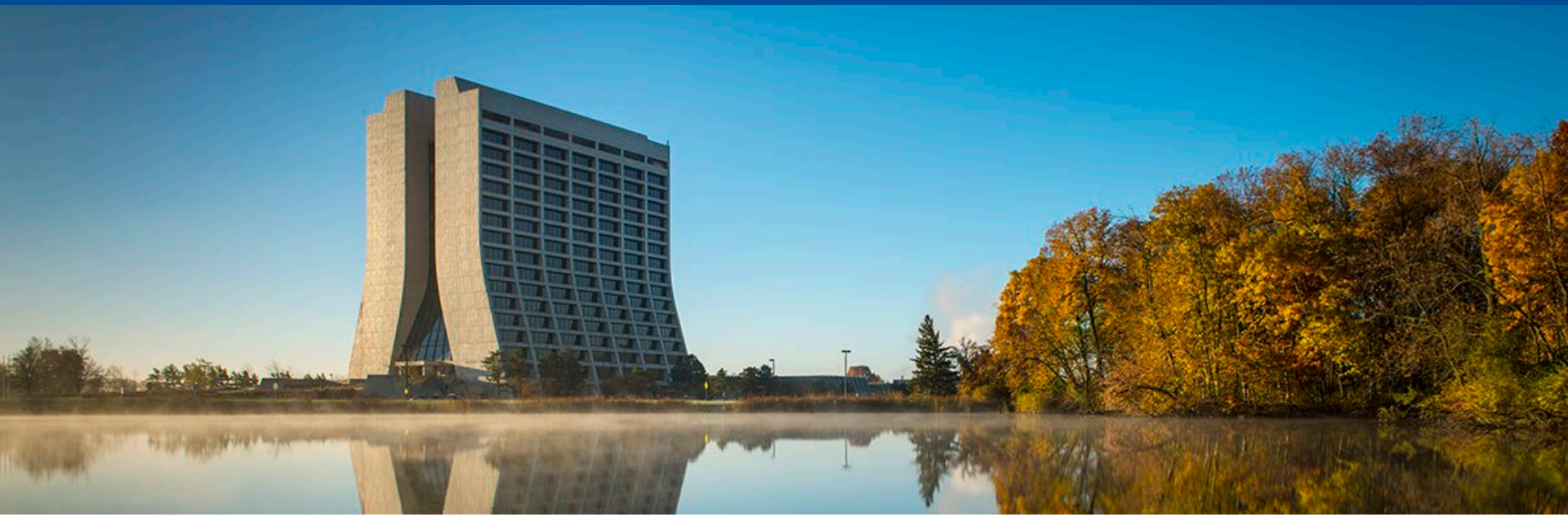
Virtual participants:

Please submit questions via chat or raise your hand to be called upon.



# Closing Remarks

Jim Amundson
Associate Laboratory Director,
Computational Science and Artificial Intelligence Directorate



# Thank You for Joining the Conversation!

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