



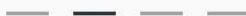
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3K Closed-Cycle Optical Cryostats

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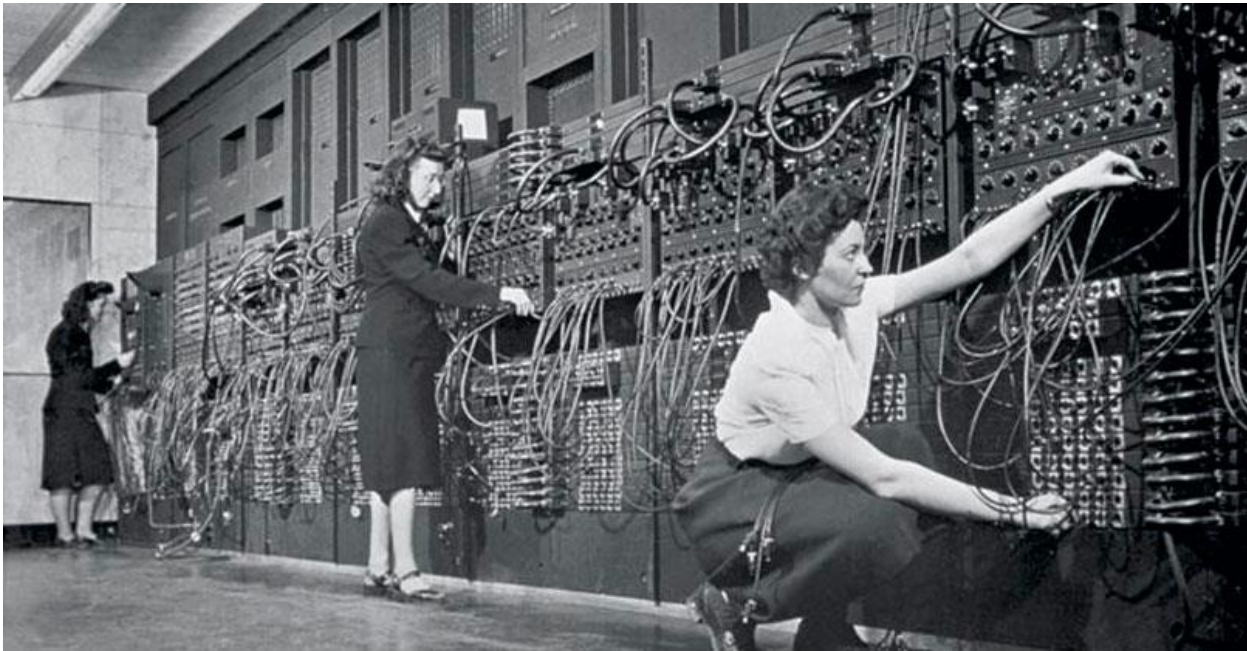


# Challenges Future

- We are in the early stages as an industry
- Need is not only cryogenic systems; cryogenic hardware like components, I/O too.
- Must address now or problem will get worse

*Left: First commercial digital computer.*

*Right: Early commercial quantum computer*





# How to Make Progress?



- Strengthen quantum supply chain.
- If scarcity is the issue, how do we create abundance?
- Simplify cryogenics
- Think long-term and short-term

## Long-term:

- 6<sup>th</sup>-12<sup>th</sup> grade exposure/involvement (Q12)
- What is a Quantum Engineer

## Short-term:

- Apprenticeship model as a starting place
- One-year and two-year programs

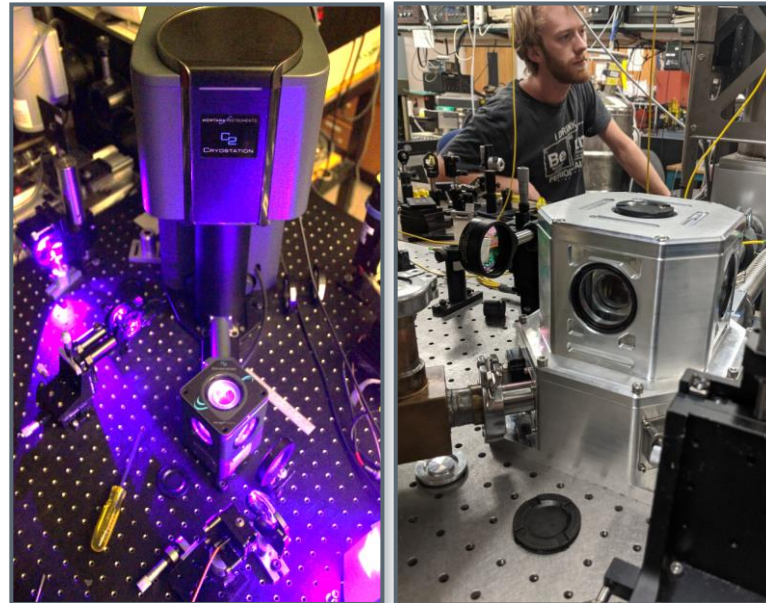
- High-tech apprenticeships
  - Highly mentored, highly advanced, not offered in education experience
  - Giving back to community
  - “Farming” and growing talent locally





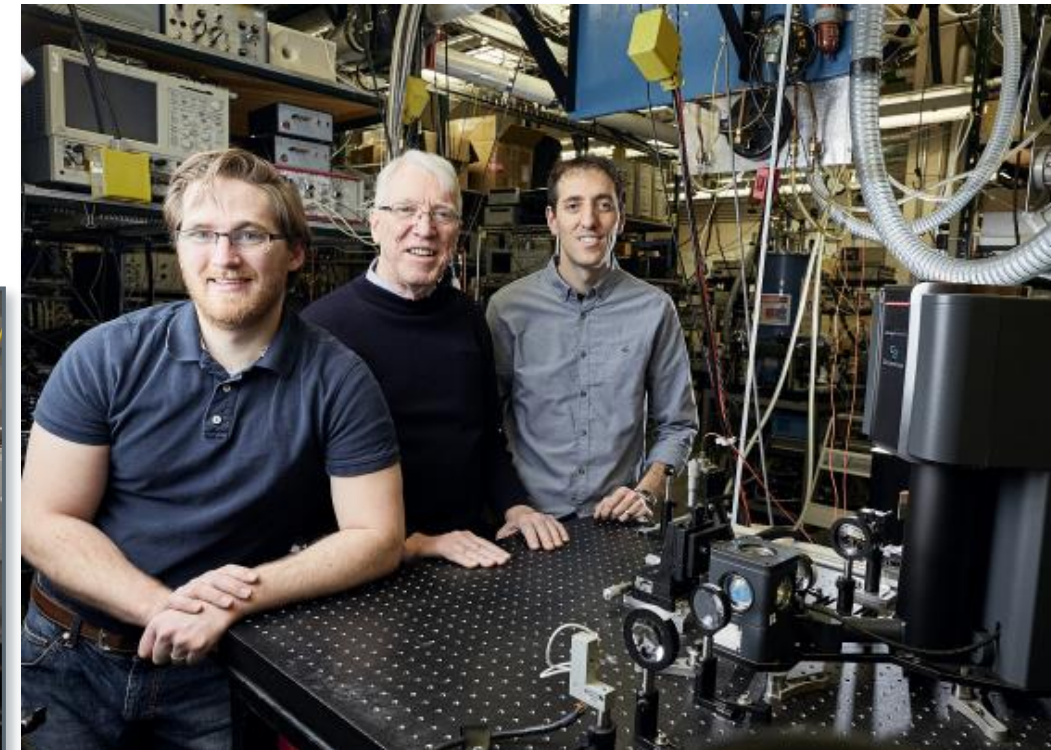
- Partnership with QIST-NET
  - Purpose to foster industry and national lab interaction with academia
- Montana State University - Triplet

1. Alpha test: new 1.7K low vibration optical product.
2. How to measure and optimize performance of cryocoolers for our research? How to apply this information to other fields?



## QISE-NET

QUANTUM INFORMATION SCIENCE  
AND ENGINEERING NETWORK



Montana State University doctoral student, Aaron Marsh (left), Professor Rufus Cone (center), and Montana Instruments Director of R&D, Josh Doherty (right), pictured with a Montana Instruments CRYOSTATION® s50. Read article here: <https://www.montana.edu/news/18382/msu-grad-student-receives-nsf-award-to-further-refine-super-cold-refrigerator>