

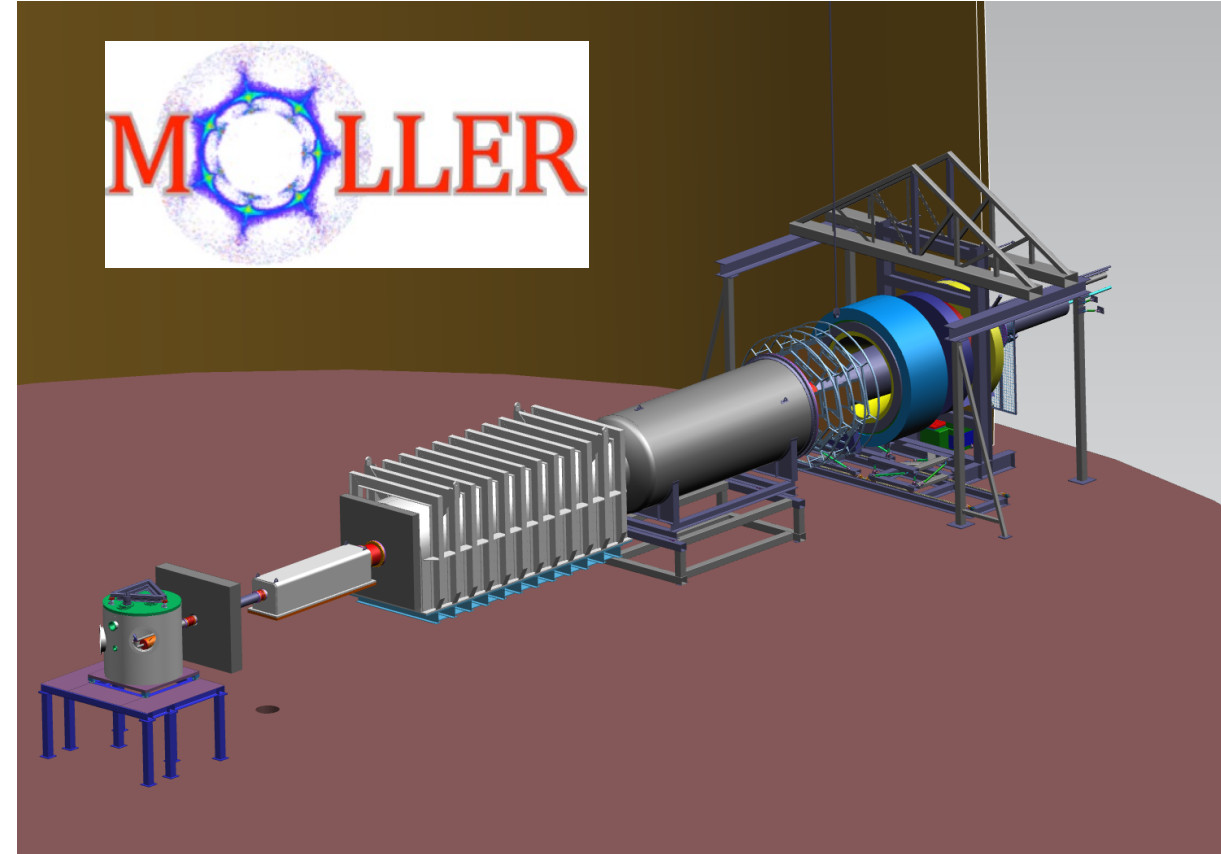
# MOLLER-NSF Midscale Project Update

MOLLER Collaboration Meeting

June 2022

Mark Pitt  
Virginia Tech

Jefferson Lab



# MOLLER-NSF in the Overall MOLLER Experiment

## MOLLER-NSF “Apparatus for Normalization and Systematic Control of the MOLLER Experiment”

Distinct roles for funding agencies supporting the experiment:

- **DOE MIE:** Prepare quantum state to be measured: scattered Møller electrons – beam-related issues, construction of target, spectrometer, required hall infrastructure
- **CFI (Canada Foundation for Innovation)/RM (Research Manitoba):** Measure raw asymmetry and achieve the needed statistical error – construction of main thin quartz integrating detector and integrating electronics chain
- **NSF Physics Division Midscale:** Make measurements needed to provide the [Normalization and Systematic Control](#) to achieve the systematic error goals – construction of the tracking system, background detectors, main detector mechanics, auxiliary asymmetry detectors, and certain aspects of beam monitoring and polarimetry

# MOLLER-NSF Team

Subsystem	Institution	Major Team Member
Science contact - MIE portion	University of Manitoba	Juliette Mammei
Science contact - NSERC/CFI portion	University of Manitoba	Michael Gericke
Science contact - Jefferson Lab/DOE	Jefferson Lab	Robert Michaels
Shower-max detector	Idaho State Univesity	Dustin McNulty
Pion detector	William & Mary	David Armstrong
Tracking system: GEM Detectors	University of Virginia	Nilanga Liyanage Kondo Gnanvo
Tracking system: Trigger Scintillators	Louisiana Tech	Rakitha Beminiwattha
Tracking system: Electronics	William & Mary	David Armstrong
Tracking system: Rotation system and support	William & Mary Muskingum University	David Armstrong Chandika Annasiwatta
Scanner	Virginia Tech	Mark Pitt
Integrating detector mounting/support	University of Massachusetts Amherst Syracuse University	Krishna Kumar Paul Souder
Scattered beam monitors	Virginia Tech	Mark Pitt
Data acquisition and monitoring system	Ohio University	Paul King
Polarized beam: Pockels cell and polarimetry detector	University of Virginia	Kent Paschke

- 9 collaborating universities
- Three “science contacts” (unfunded senior personnel) to Jefferson Lab and the other potentially funded pieces

## Recent MOLLER-NSF Midscale Administrative Events

- **March 2021:** Funding received from NSF; start of 4 year \$5.7M project; March 2021 – March 2025
- **Preliminary Design Reviews completed:**
  - DAQ/Trigger (March 2021), GEMs (August 2021), Detectors (January 2022)
- **February 2022:** First annual report submitted to NSF; funding increments allocated
- **June 2022 status:** Written monthly reports provided to NSF and updates to DOE at joint DOE/NSF monthly meetings; Overall status at end of May 2022:

	<b>Budgeted Cost</b>	<b>Cumulative Actual cost</b>	<b>Work % Complete</b>
<b>Project Total</b>	\$5,706,183	\$562,675	8%

Current work for all subsystems is focused on prototypes and developing >90% designs towards final design reviews in November 2022.

After Final Design Reviews, the MOLLER-NSF PPEP allows for procurements for construction to proceed.

# Technical Progress Highlights – High Level View since December 2021

- **WBS 2.04.02: Main Detector Mechanics/Supports:** Umass/Syracuse: Integrated main detector/shower-max support structure, with full azimuthal rotation for installation from above developed (**PDR rec.**); ring 6 module pre-production prototype validated in Mainz test beam
- **WBS 2.04.03: Shower-max detector:** ISU: Shower-max prototypes nearly ready to be constructed and tested; extensive report on quartz irradiation studies completed; irradiation studies for 3D printed parts beginning
- **WBS 2.04.04 Scanners and WBS 2.07.06 Scattered Beam Monitors:** VT: Completing light transport, background, and ferrous materials studies prior to prototyping; working to interface SAM/DS scanners and LAMs with beampipe and barite wall
- **WBS 2.05.01 GEM Detectors and WBS 2.05.05 Møller Polarimeter GEM detectors:** UVa: nearly ready to begin construction of prototype coordinate GEMs; design of polarimeter GEMs is done
- **WBS 2.05.02 Pion Detectors and Tracking Electronics:** W&M: New pion detector design to improve S/B ratio completed; decided purchase of x10 amps and NIM bins will not be needed due to built-in preamps planned in PMT bases
- **WBS 2.05.02 Tracking system: Trigger scintillator:** LaTech: Based on PDR suggestions, developed a new readout scheme with WLS fibers; prototype parts ordered and preparations in progress
- **WBS 2.05.03 Ferris Wheel:** Muskingum: Ferris wheel design has evolved based on PDR feedback and is now based on a three wheel design
- **WBS 2.07.02/.03/.04: Data acquisition, trigger, online computing:** Ohio U.: Test stand set up at Jefferson Lab; FADC tested and integration module will be tested when available