ND Computing

Mathew Muether and Palash Roy

December 2021 – Essential Computing Workshop

About us

- Associate Professor, Wichita State University
- Member of NOvA, DUNE, and Emphatic
  - Formerly Neutrino Interaction WG Convener for NOvA
  - DUNE ND Reco/Sim Physics Coordinator
  - TMS L3 Manager
  - ND Computing Manager

Dr. Mathew Muether
Mathew.Muether@wichita.edu

- PhD Student, Passed Qual this Semester
- Work on ongoing ND Production effort
- Designed TMS GDML (geometry)

Palash Kumer Roy

New ND Reconstruction and Simulation Working Group

Physics Coordination Inés Gil-Botella Chris Marshall	**Long-baseline** Callum Wilkinson Luke Pickering Mayly Sanchez	**High energy** Lisa Koerner Vitaly Kudryavstev Yun-Tse Tsai	**FD sim/reco** Chris Backhouse Dom Brailsford
DUNE Physics Working Groups	**Neutrino Interactions** Cheryl Patrick Mateus Carneiro	**BSM** Justo Martin-Albo Alex Sousa Jae Yu	**ND sim/reco** Linda Cremonesi Mat Muether
Liaisons Dan Cherdack (ND) Tom Junk (computing)	**Low Energy** Clara Cuesta Alex Friedland Kate Scholberg	**Calibration** David Caratelli Mike Mooney	**protoDUNE analysis** Leigh Whitehead Tingjun Yang Jaime Dawson Slavic Galymov

ND Reco/Sim Conveners and Meeting Time

Dr. Linda Cremonesi

Queen Mary
University of London

l.cremonesi@qmul.ac.uk

Dr. Mathew Muether

WSU WICHITA STATE UNIVERSITY

Mathew.Muether@wichita.edu

[Bi-weekly meetings - Wednesday at 10 am Central](#)

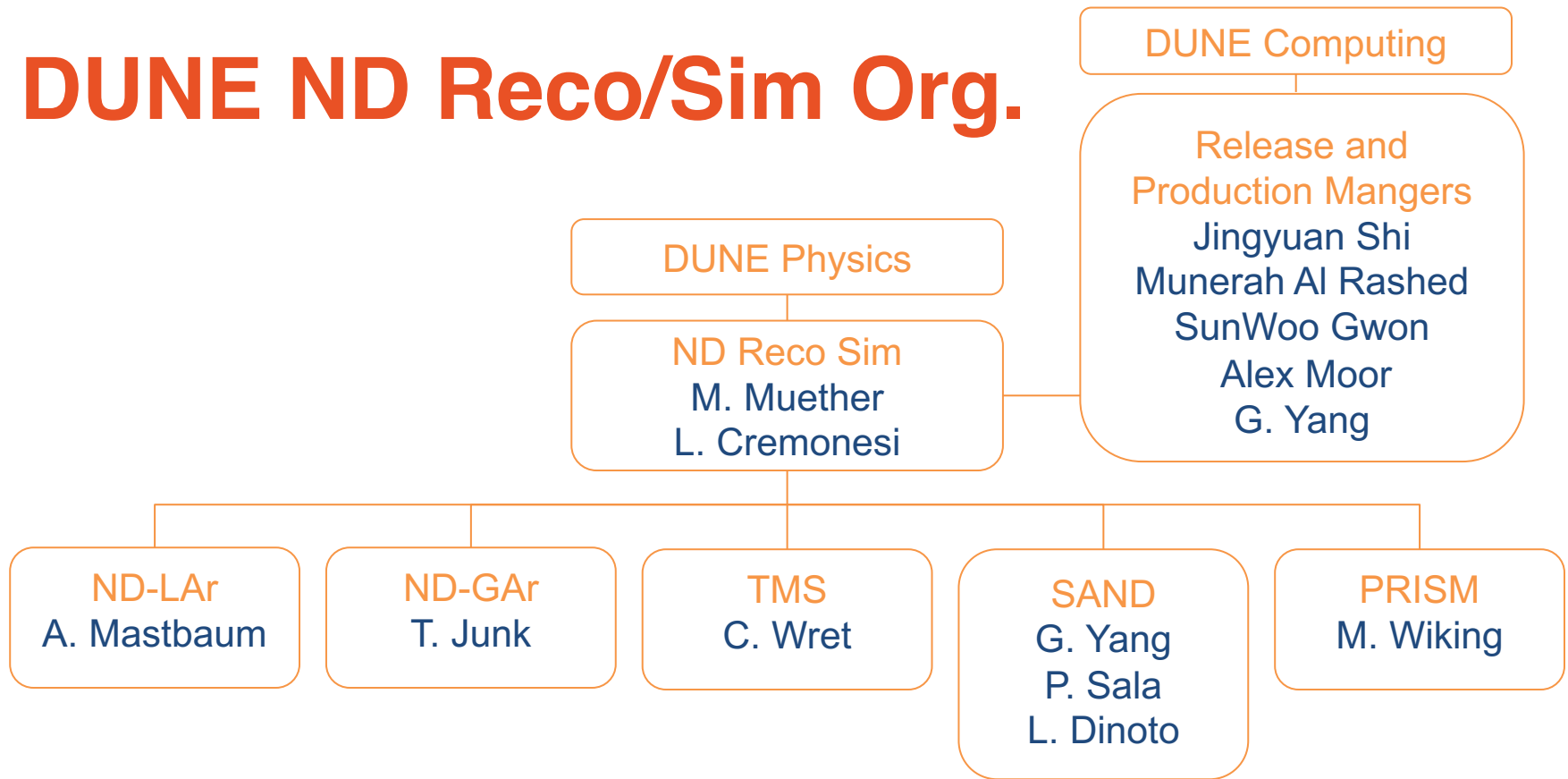[DUNE-ND-SW-INTEGRATION @LISTSERV.FNAL.GOV](#)

#nd-reco-sim

The software for the individual DUNE ND sub-detectors (Lar, GAr, TMS, SAND) is developed in group Sim/Reco efforts in coordination with the global effort. The group also coordinates with FD Sim/Reco WG, Physics working groups, PANDORA, and DUNE computing.

Dune Computing Consortium

DUNE ND Reco/Sim Update – M. Muether/L. Cremonesi

DUNE ND Reco/Sim Org.

DUNE Computing

Release and Production Mangers
Jingyuan Shi
Munerah Al Rashed
SunWoo Gwon
Alex Moor
G. Yang

DUNE Physics

ND Reco Sim
M. Muether
L. Cremonesi

ND-LAr
A. Mastbaum
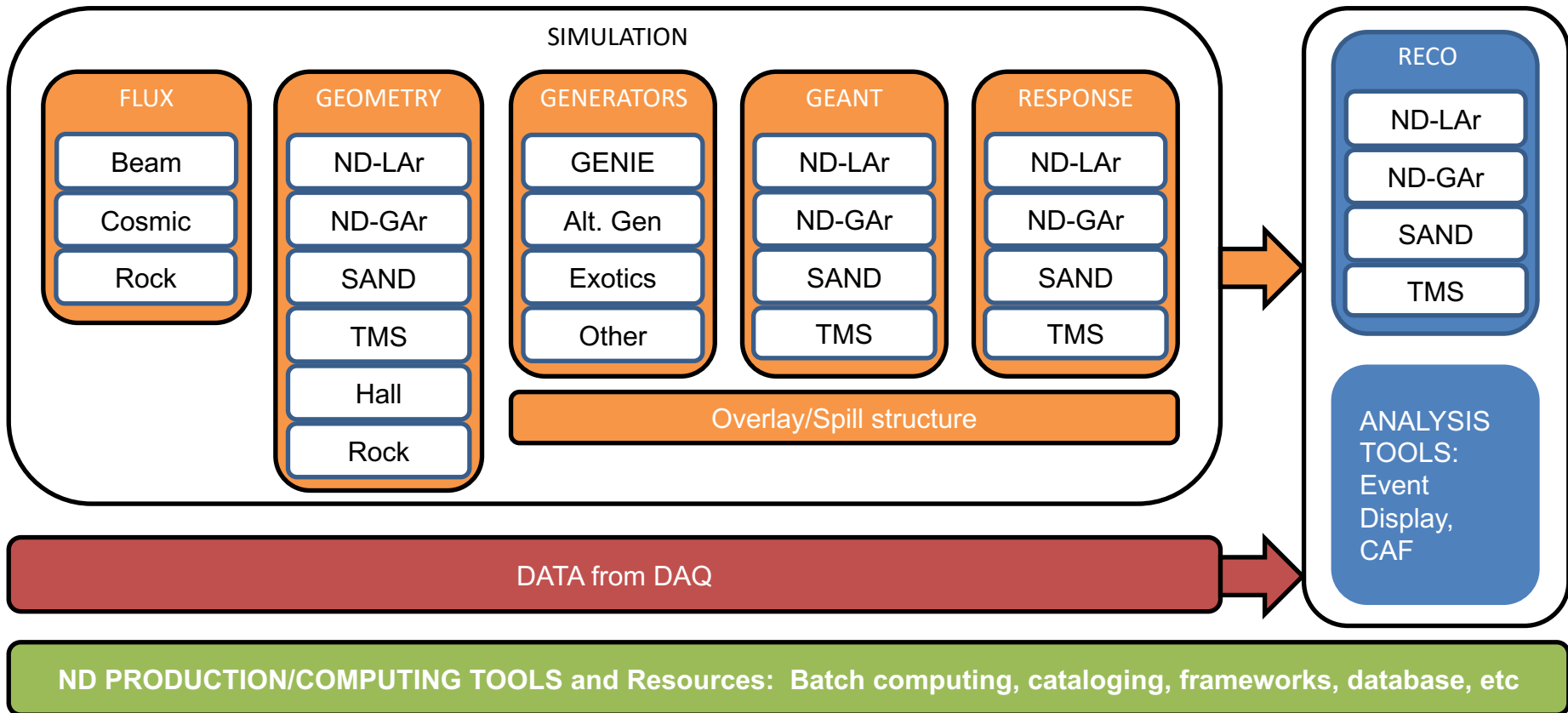
ND-GAr
T. Junk

TMS
C. Wret

SAND
G. Yang
P. Sala
L. Dinoto
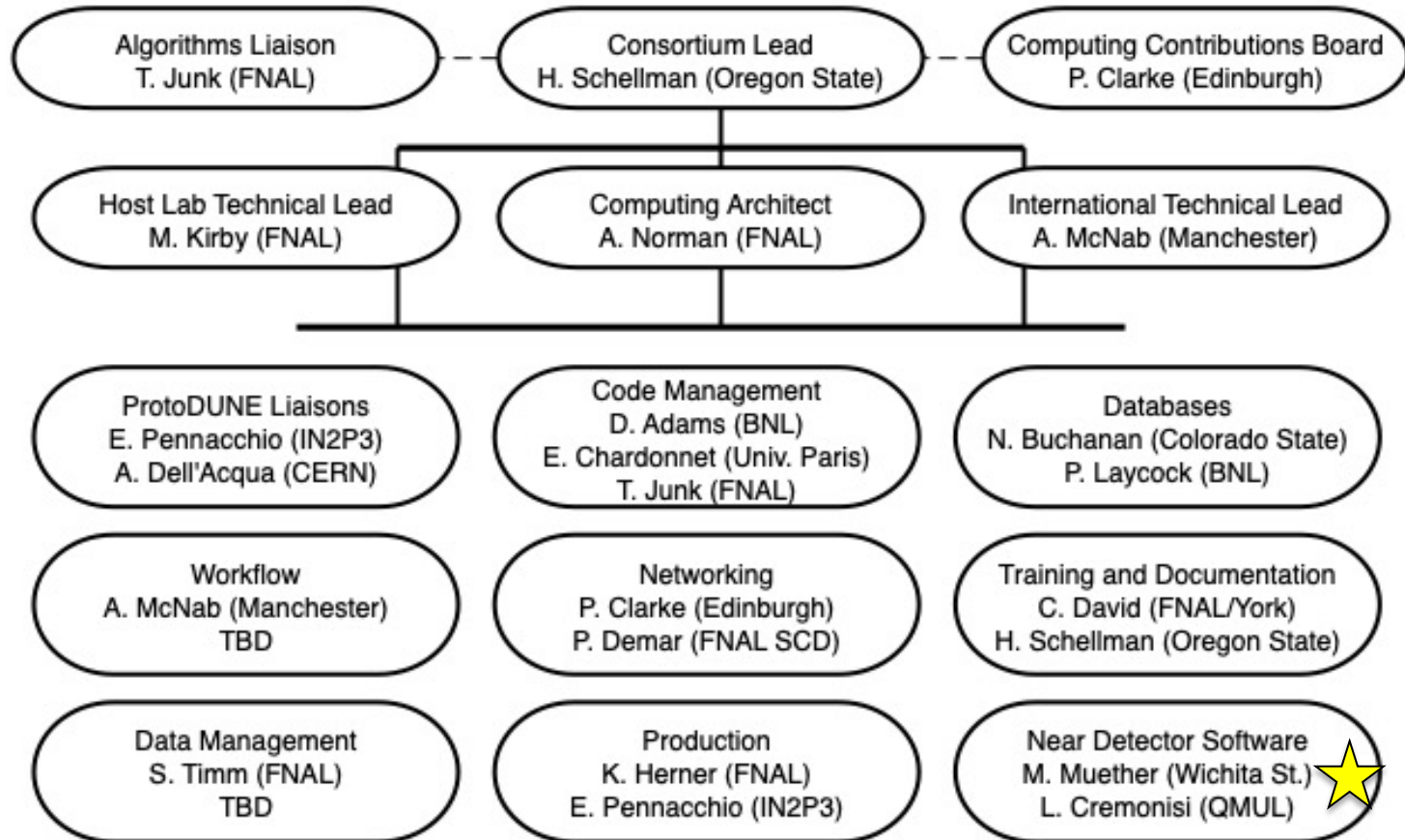
PRISM
M. Wiking

- The ND Sim/Reco Working Group is tasked with overseeing the the software for and production of ND files for physics and design analysis.
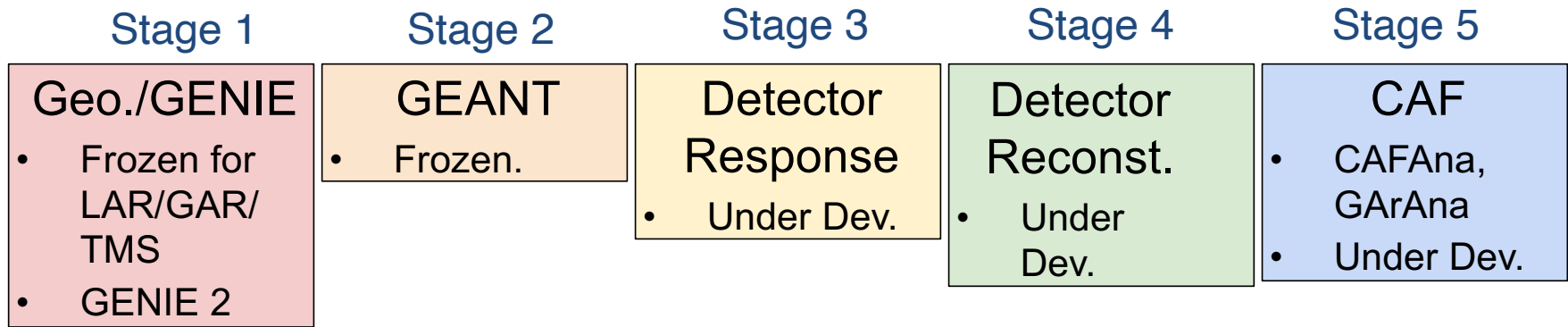
Overview of the Software

SIMULATION

FLUX
- Beam
- Cosmic
- Rock

GEOMETRY
- ND-LAr
- ND-GAr
- SAND
- TMS
- Hall
- Rock

GENERATORS
- GENIE
- Alt. Gen
- Exotics
- Other

GEANT
- ND-LAr
- ND-GAr
- SAND
- TMS

RESPONSE
- ND-LAr
- ND-GAr
- SAND
- TMS

Overlay/Spill structure

RECO
- ND-LAr
- ND-GAr
- SAND
- TMS

ANALYSIS TOOLS: Event Display, CAF

DATA from DAQ

ND PRODUCTION/COMPUTING TOOLS and Resources: Batch computing, cataloging, frameworks, database, etc

DUNE ND Reco/Sim Update – M. Muether/L. Cremonesi

Staged Production Process/Status

Stage Steps

Freezes → Mini-Production → Validation → Full Production

Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Geo./GENIE • Frozen for LAR/GAR/TMS • GENIE 2	**GEANT** • Frozen.	**Detector Response** • Under Dev.	**Detector Reconst.** • Under Dev.	**CAF** • CAFAna, GArAna • Under Dev.

YOU ARE HERE

Stage 1/2 Mini Production 1

• Priority samples Completed: Interactions ND-LAr volume (1e19 POT), Hall + ND-LAr + TMS (1e19 POT), Hall + ND-LAr + ND-Gar (1e19 POT),

• Upcoming: Rock (1e18 POT, In Progress)

ND TDR Production Status

Stage 1 and 2 Mini Production Complete (Nov. 2021)

- Interactions on Lar Active Volume produced at NERSC

Top volume	Active (1e19 POT for each geometry)					
Horn current	FHC			RHC		
Geometry	TMS	GAr	GAr-Lite	TMS	GAr	GAr-Lite
File size	1.50 TB	1.50 TB	1.40 TB	0.90 TB	0.95 TB	0.90 TB
Top volume	Non-Active (1e18 POT for each geometry)					
Horn current	FHC			RHC		
Geometry	TMS	GAr	GAr-Lite	TMS	GAr	GAr-Lite
File size	0.19 TB	0.21 TB	0.19 TB	0.12 TB	0.13 TB	0.12 TB

Next Steps

- Analysis Groups are validating files.
- ND Software will be made compatible with SAM dataset input.
- Incorporating reconstruction/detector response software into ND production framework.

Goals and Milestones

- Deliver end-to-end simulation through CAF with robust file handling in 2022.

- Define DUNE ND Computing Model.

- Document and define the reco/sim requirements and demonstrate capabilities (with physics use cases).

- Generate ND Production to support upcoming reviews and analyses .

Additional Planning

- The ND Reco/Sim WG has produced a Data Model Document detailing metadata, external data raw data, simulated data calibrated data, reconstructed data, and analysis tree information.

- DUNE Software Management and Workflow/load Management groups have been established and ND is communicating with them.

- Regular meetings with FD Reco/sim to assure compatibility for LBL analyses.

BACKUP