# International Collaboration and Division of Scope

Karsten Heeger Yale University

CUPID LBNL Project Review December 16-17, 2024





## **CUPID Collaboration**



#### A strong, international collaboration builds on Italian-US partnership









## **US CUPID Groups**









# **International CUPID Collaboration**



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#### Italy and France are the major partners besides the US

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4

#### 1.0 CUPID Project

Technical Coordinator: M. Biassoni (INFN MiB) IT Project Director/Chief Scientist: F. Bellini (Sapienza Roma) US Project Director/Chief Scientist: Y. Kolomensky (UCB)





#### Color coding shows countries' responsibilities

#### Some WBS elements have Co-L3s

France responsibility

L3 first name: primary responsibility L3 second name: secondary responsibility

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US L3: C. Grant (BU)

1.06.04 Screening Labs FR

FR L3: D. Poda (IJCLab)

1.06.05 Crystal Validation Runs

IT L3: L. Marini (INFN LNGS)

US L3: K. Alfonso (VT)

FR L3: E. Olivieri (JCLab)

- enrichment
- crystal production
- heaters
- electronics
- Neutron shield
- detector structure
- cryogenics
- assembly
- on-site logistics
- Background screening

US responsibility Italy responsibility France responsibility

L3 first name: primary responsibility L3 second name: secondary responsibility

1.05 Data Readout

US L2: B. Welliver (UCB)

JS CAM: T. Stezelberger (LBNL)

IT L2: P. Carniti (UniMiB)

1.05.01 Management

1.05.02 Electronics: FEE

IT L3: G. Pessina (INFN MiB)

1.05.03 Electronics: Power

Supplies & Pulsers

FR L3: D. Baudin (CEA)

1.05.04 Electronics: Filters &

Digitizers

US L3: H. Huang (UCLA)

1.05.05 SW DAQ & Trigger

US L3: B. Welliver (UCB)

1.05.06 Slow Control &

Monitoring

US L3: P.T. Surukuchi (Pitt)

1.05.07 Comp.& Data Storage

US L3: B. Welliver (UCB)

1.05.08 Data Readout

Integration

IT L3: P. Carniti (UniMiB)

JS L3: T. Stezelberger (LBNL)







IT L3: M. Biassoni (INFN MiB)

System IT L3: S. Copello (INFN Pavia)



#### US

- Project mamagement
- Light detectors
- NTDs
- Muon veto
- calibration
- Sensors
- Slow control
- electronics
- data readout and DAQ
- Background screening

#### US responsibility Italy responsibility France responsibility

L3 first name: primary responsibility L3 second name: secondary responsibility



7



IT L3: S. Copello (INFN Pavia)



#### Italy responsibility France responsibility

L3 first name: primary responsibility L3 second name: secondary responsibility

#### US

- Project mamagement
- Light detectors
- NTDs
- Muon veto
- calibration
- Sensors
- Slow control
- electronics
- data readout and DAQ
- Background screening

As part of scope swap, US contributes to: 1.02.08, 1.03.07, 1.03.08, 1.03.09 in Phase II: 1.03.10 1.04.09, 1.05.02







IT L3: M. Biassoni (INFN MiB)

System IT L3: S. Copello (INFN Pavia)

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#### France

- light detectors
- heaters
- gluing
- Assembly line
- Background screening and projections

US responsibility Italy responsibility France responsibility

L3 first name: primary responsibility L3 second name: secondary responsibility





# **Principles of Scope Division**

- Project is coordinated between three major countries: Italy, US and France
- Scope and deliverables matched to the unique capabilities of the collaborating partners.
- **Italy:** host country; provides site, infrastructure, cryogenics and logistics; takes the lead in isotope and crystal procurement
- **US:** NTDs, electronics, muon veto, and half of light detectors, calibration, data readout and • project management
- **France:** light detectors, gluing, and assembly
- Current scope split between Italy and the US is  $\sim 60/40$ , similar to the existing arrangement in CUORE. Will be defined in MOU.
- Scope swap between US and Italy to offset costs for major procurements like crystals (over  $\bullet$ course of full experiment inluding Stages I and II).
- Decouple dependencies between countries to the extent possible.







# **Coordination and Deliverables**

- Technical requirements are documented in one technical reference document (conceptual design report for the US) prepared by the <u>entire</u> collaboration
- Scope and **deliverables are well-defined** and matched to expertise. •
- While collaboration and project are highly coordinated, scope split allows for asynchronous project reviews in each country and some limited flexibility in funding timeline.
- Project scope and timeline designed for staged approach to experiment. • Contributions from all countries critical to realize Stage I of experiment. •



# Management of Scope, Scientific, Technical Decisions



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# **CUPID** builds on existing infrastructure at LNGS



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# Staged Deployment of CUPID



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#### Detector configuration inside cryostat





# **Reviews, Meetings, and Next Steps**

- LBNL project review, December 16-17, 2024
- INFN President's review, spring 2025

  - waiting for next steps in the US and for first delivery/test of enriched crystals - important milestone for procurement of full set of enriched crystals
- International Double Beta Decay Summit
  - May 2025 (tentative)
  - Follows summits at LNGS and SNOLAB (2023)
- CUORE/CUPID collaboration meeting, LNGS, May 12-16, 2025





## Summary

- CUPID has an active and engaged collaboration with decades of experience from CUORE and bolometer program at LNGS.
- Scope and responsibilities well-defined and matched to experience of countries and institutions.
- Collaboration and project have mechanisms to collaborate and coordinate technical scope and deliverables.
- INFN set to take the lead as host country and in critical crystal procurement.
- US will make key contributions, critical to Stage I and the full experiment.



