

## DRDT 4.3 Theme

DEVELOP RICH AND IMAGING DETECTORS  
WITH LOW MASS AND HIGH TIMING RESOLUTION



DEVELOP RICH AND IMAGING DETECTORS  
FOR FUTURE EXPERIMENTS.

UPDATE

Alessandro Petrolini and Fulvio Tassarotto

INFN and University of Genova - INFN Trieste

2023-06-28

# UPDATE

- Disclaimer: we apologize in advance for the rush of this DRD4 process, which forces all of us to do in parallel processes which should happen, ideally, in series.
- We tried to draft in more detail the WP in the theme, while waiting for survey 4. We tried to define a loose framework for the DRD4.3 theme, based on what we presented on June 15th, on our understanding of the results of survey 3, and feedback we received.
- We tried to define proto-projects and deliverables, trying to go into a slightly more detailed description of the different activities.
- Identified points of friction with other DRDT which need clarification.
- We are now ready to circulate the draft among 4.3 groups, addressing specific points on a group by group basis and asking your feedback and contribution to fill in all details.

# UPDATE: WP AND TASKS ARCHITECTURE. 1

This theme is currently organized as follows.

- **4.3-WP-1. New Materials Radiators and Components for RICH detectors**
  - ▶ T-4.3.1.1 Study of radiator gases alternative to per-fluorocarbons
  - ▶ T-4.3.1.2 Aerogel optimization
  - ▶ T-4.3.1.3 Solid radiator material quality
  - ▶ T-4.3.1.4 Development of Low-Mass Mirrors Suitable for In-Acceptance Detector Design
  - ▶ T-4.3.1.5 Development of Materials and Mechanical Solutions Suitable for Detector Design
  - ▶ T-4.3.1.6 Development of Laboratory Instrumentation and Techniques for Precise Characterization
  
- **4.3-WP-2. Next RICH and other imaging detectors**
  - ▶ T-4.3.2.1 New RICH detector concepts for improved performance .
  - ▶ T-4.3.2.2 RadHard fast low-noise scalable f/e for single-photon counters and vertical integration
  - ▶ T-4.3.2.3 Prototype Solid-State Single-Photon Sensitive Module for Imaging Arrays
  - ▶ T-4.3.2.4 Prototype systems for online characterization/calibration/alignment/monitoring
  
- **4.3-WP-3. Future RICH and other imaging detectors; Blue-Sky**
  - ▶ T-4.3.3.1 New solid radiators and MetaMaterials
  - ▶ T-4.3.3.2 **New RICH detector concepts for improved performance after 2035**

# UPDATE: WP AND TASKS ARCHITECTURE. 2

- Still in a pre-project status

## 4.3-WP-4. Software and Performance.

These activities need a number of iterations to be elevated to projects.

- ▶ A-4.3.4.A study algorithms for Machine Learning applied to RICH;
- ▶ A-4.3.4.B establish a common framework for tracing of optical photons;
- ▶ A-4.3.4.C define agreed benchmarks for evaluation and comparison of RICH performance;
- ▶ A-4.3.4.D establish tools for Fast Optical Photon Tracing In RICH.
- ▶ A-4.3.4.E establish Fast Pattern Recognition For RICH In High-Multiplicity Environment.
- ▶ A-4.3.4.F Study Novel Architectures For RICH PID: Development Of A Test-bench/Framework.
- ▶ A-4.3.4.G Study Novel Reconstruction Algorithms For RICH PID: Development Of A Detector-Agnostic Software Framework.
- ▶ A-4.3.4.H map and share satellite SW for studies of specific aspects preliminary to GEANT4-like simulations;
- ▶ A-4.3.4.I investigate tools for evaluation of systematic uncertainties in simulation and analysis SW;
- ▶ A-4.3.4.J establish (possibly experiment-dependent) tools and standards for validation of simulation against real data;

## UPDATE: WP AND TASKS ARCHITECTURE. 3

- 4.3-WP-1. New Materials Radiators and Components for RICH detectors. ≈ 11 groups
- 4.3-WP-2. Next RICH and other imaging detectors. ≈ 17 groups
- 4.3-WP-3. Future RICH and other imaging detectors; Blue-Sky. ≈ 2 groups
- 4.3-WP-4. Software and Performance. ≈ 7 groups

Total of: ≈ 12 staff, ≈ 10 post-doc, ≈ 9 students, ≈ 7 engineers.

Many tiny contributions (0.1-0.2 FTE) possibly due to splitting into a few WP.

Very diverse exposed funding contributions,  
presumably due to the vaguely defined boundary conditions: work will be needed.

## WHAT NEXT?

- Fine-tune the architecture using feedback from groups.
- Propose **coverage of essential but missing topics** and try to rationalize and optimize.
- **Enlarge** and **extend** proto-collaborations out the perimeter of existing experiments, in order to build synergy, exchange information, knowledge, ideas, (and possibly instruments and infrastructure) and to contaminate groups with each other.
- Here we need a to build a three/four/(?five) years project, with **deliverables**, **milestones**, **FTE** and **money**....  
It will require iterations/negotiations with your agencies, in the next months, until the MoU.
- We need your help....

END