

DART in ArDM done and
yet to do

Walter

Importance of DART beyond DarkSide-20k

Interest in UAr from many collaborations including COHERENT, LEGEND, DUNE-like, ARGO, environmental assays + DarkSide-LowMass (paper in preparation)

Snowmass2021 White Paper

A Facility for Low-Radioactivity Underground Argon

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Phases of DART

UAr of DS50: $R_{50}=(7\pm 2)\times 10^{-4}$

For DS20k:

Phase 1: single phase DART 1kg UAr sensitivity for UAr UL 90% 6×10^{-4}
(published MC study, JINST)

For future projects it will be useful to know the ^{39}Ar radioactivity if $< R_{50}$ (some hints from hypothesis of Henning Back)

Phase2: double phase DART 10kg UAr sensitivity for UAr UL 90% 10^{-5} ? (Edgar, Pablo), TBD

Both in ArDM as active VETO

What is already done

DArT v0: non radiopure acrylic, 2 boards DarkEye (one top and one bottom) with one SiPM each from FBK

Tests in surface at CIEMAT and underground at LSC inside a LN2 test cryostat

At CIEMAT: 1PE/KeV (from average gain with both Po peaks and source calibration), observed BiPO coincidence, PSD and Po peaks

At LSC: many new things (DAQ and analysis chain) + shield: several new experimental issues experienced and many runs performed. Most of them solved by now and results of CIEMAT (almost) reproduced. Need a new long run (this week?).

Best result: observation of ^{39}Ar spectrum over some background (about 1/1)

At LSC situation now

What are we using:

- new DAQ MIDAS-based (DS20k)
- Old gas system and slow control
- Software reconstruction and analysis chain as for DS20k in place

Still open points:

Low gain 0.1Pe/KeV measured from resolution (Paris group):

- Understand if really lower than what was measured at CIEMAT
- need more DarkEye (double) or/and change SiPMs (Alessandro said QE mysteriously doubled with LFoundry ones) or reflector in front of argon (disfavored by Alessandro)
- Purity? Does this setup need a getter?

Maybe still some residual leak, TBC

Test at LSC in test cryo tbd

Optimise experimental setup with

- 4 boards
- New SIPMS

Measure ^{39}Ar rate with background subtraction run with DS50 UAr

Can we do it after radiopure acrylic is made?

Papers (some backbone exists)

ArDM

Excellent coating work at LNGS/ETHZ and fixing of HV cables

Now need define shipping, storage and integration in ArDM

Need to fix dates

Test of PMTs in situ

Test with argon gas?

Lead belt installation before LAr operation

Simulation work

Still some more work needed to understand data

Light propagation etc., comparison of resolutions, source response

Also needs a full revisiting of sensitivity inside ArDM

Need to study also double phase chamber again

Responsibilities/structure

Technical coordination: V. Pesudo (+F.Gabriele as TC of Aria), Software/analysis coordination:P.Garcia

ETHZ/LNGS/L'Aquila/Napoli PMT coating, installation and ArDM commissioning and operation

LNGS/L'Aquila electronic boards

CIEMAT DART assembly and operation, gas system, simulation, analysis, lead belt

LSC DART operation, gas system, simulation, analysis (help welcome for in-situ student)

Zaragoza DART operation, DAQ/electronics

Cagliari (INFN+Engineering Department of University): DART, gas system, Slow control, simulation

Paris APC data reconstruction/analysis/simulation

Carleton/Astrocent acrylic (TBD)

Timetable

Before meeting

After meeting