

DarkSide-20k Veto SiPM Detectors:

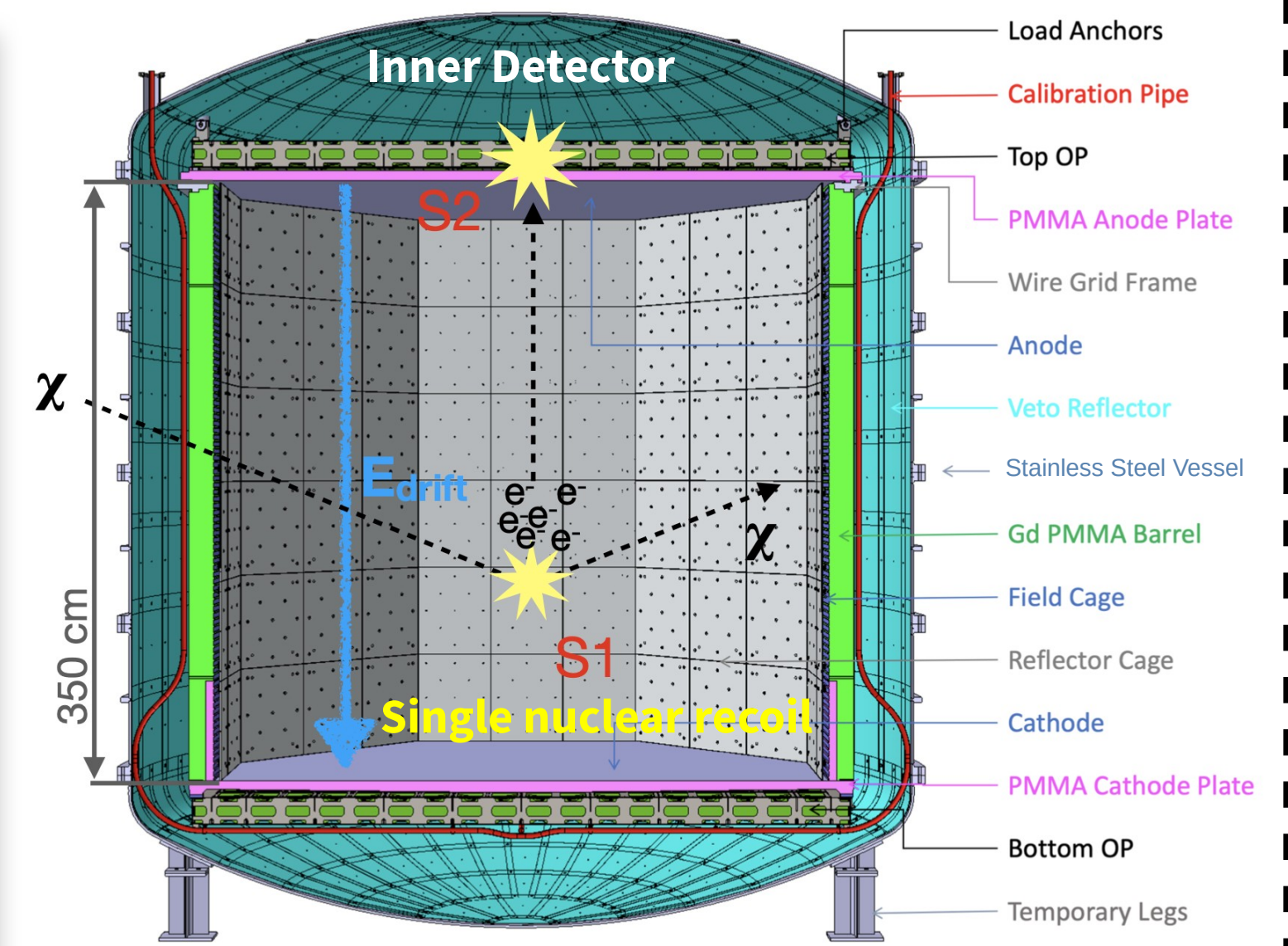
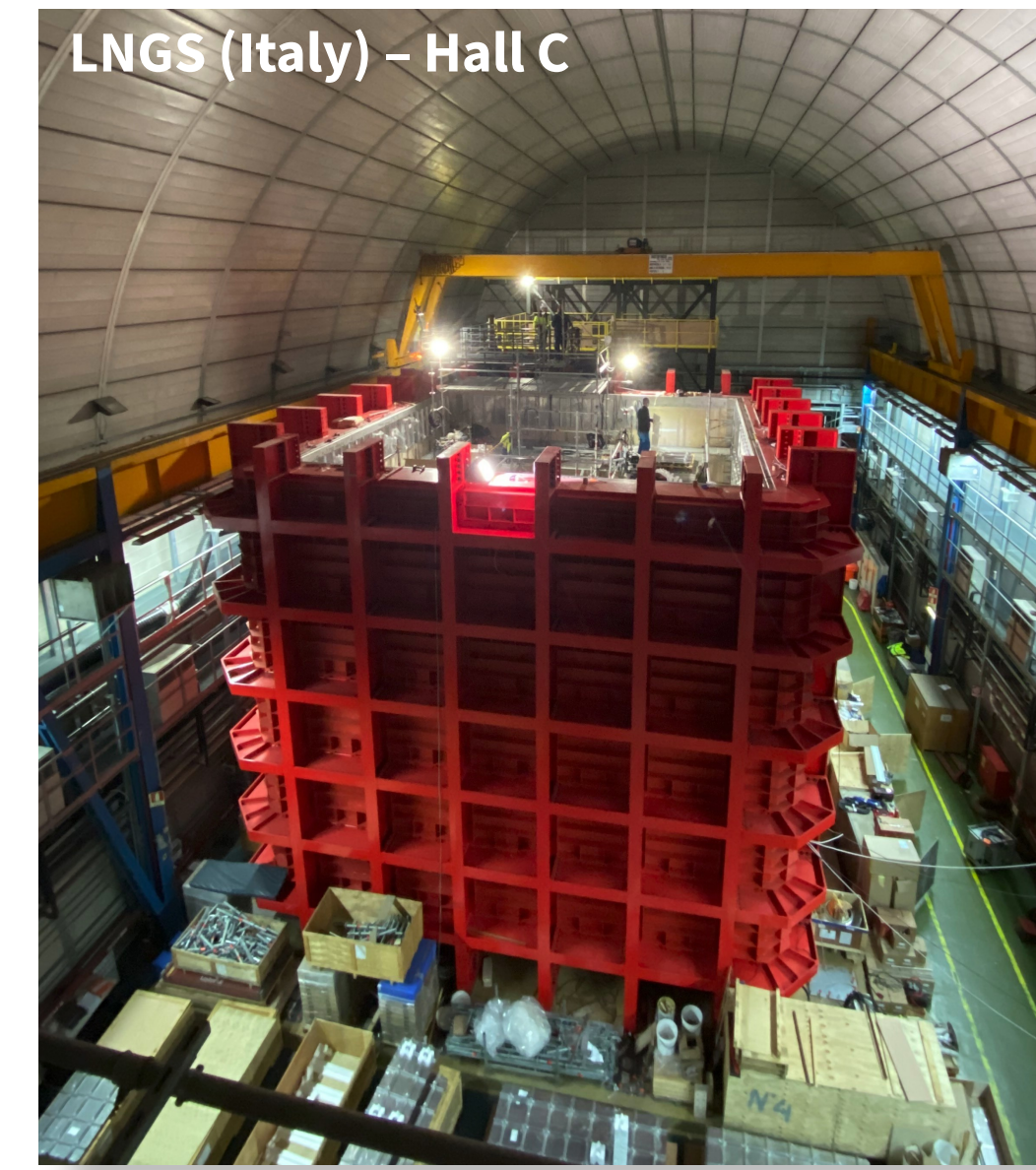
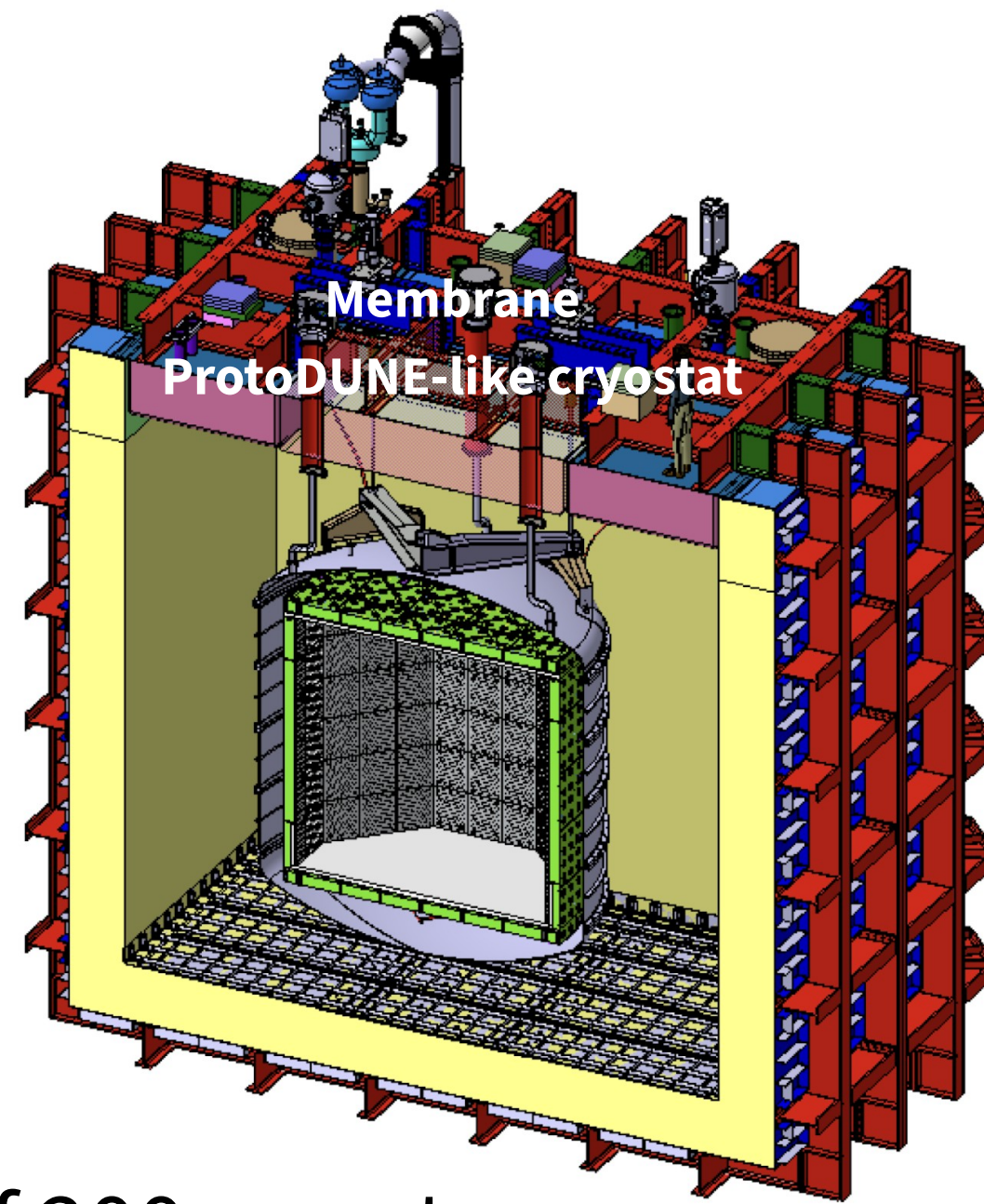
Construction and Characterisation



Paolo Franchini on behalf of the DarkSide-20k collaboration - p.franchini@lancaster.ac.uk

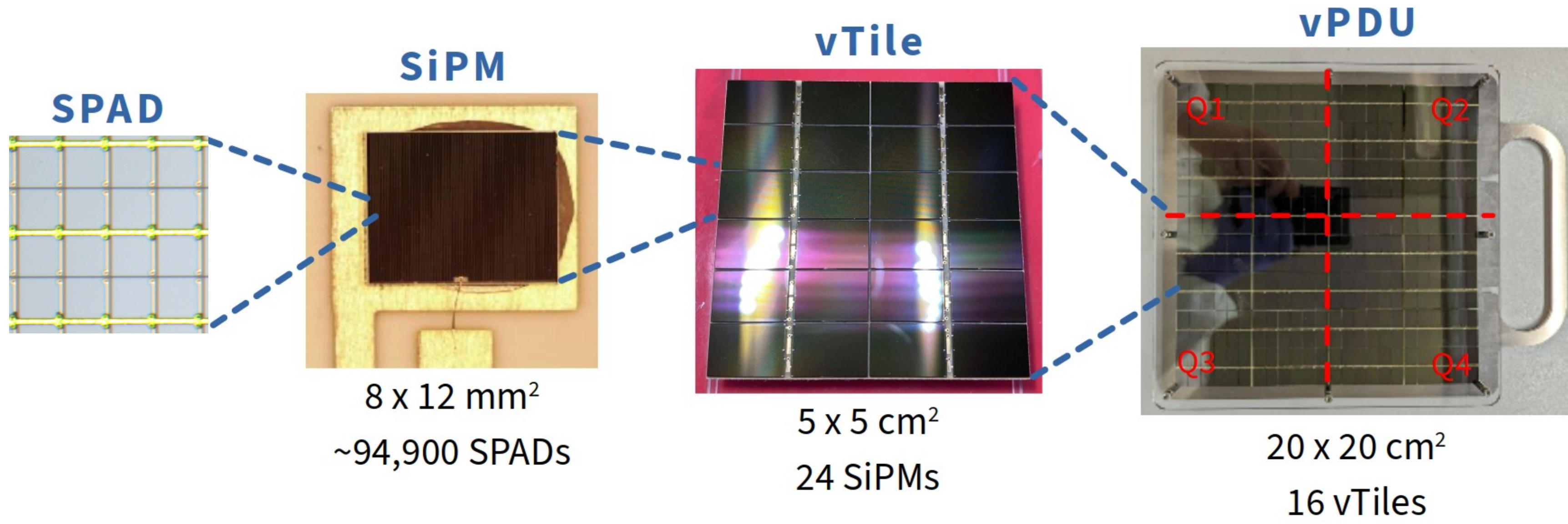
DARKSIDE-20K

- Search for **WIMP** dark matter candidates
- Underground in **LNGS** (Italy): 3400 m.w.e
- Dual phase **TCP** with 50t of underground argon
- **3D reconstruction** from scintillation and ionisation
- **Veto** system: Internal (Gd-PMMA, ~35t UAr) and External (700t atmospheric Ar) veto
- **Zero instrumental background** over the exposure of 200-year·tonne
- Sensitivity: $7.4 \times 10^{-48} \text{ cm}^2$ at a 90% c.l.



85% of dark matter in the universe

85 tonne of underground Argon



VETO PHOTO-DETECTOR UNITS

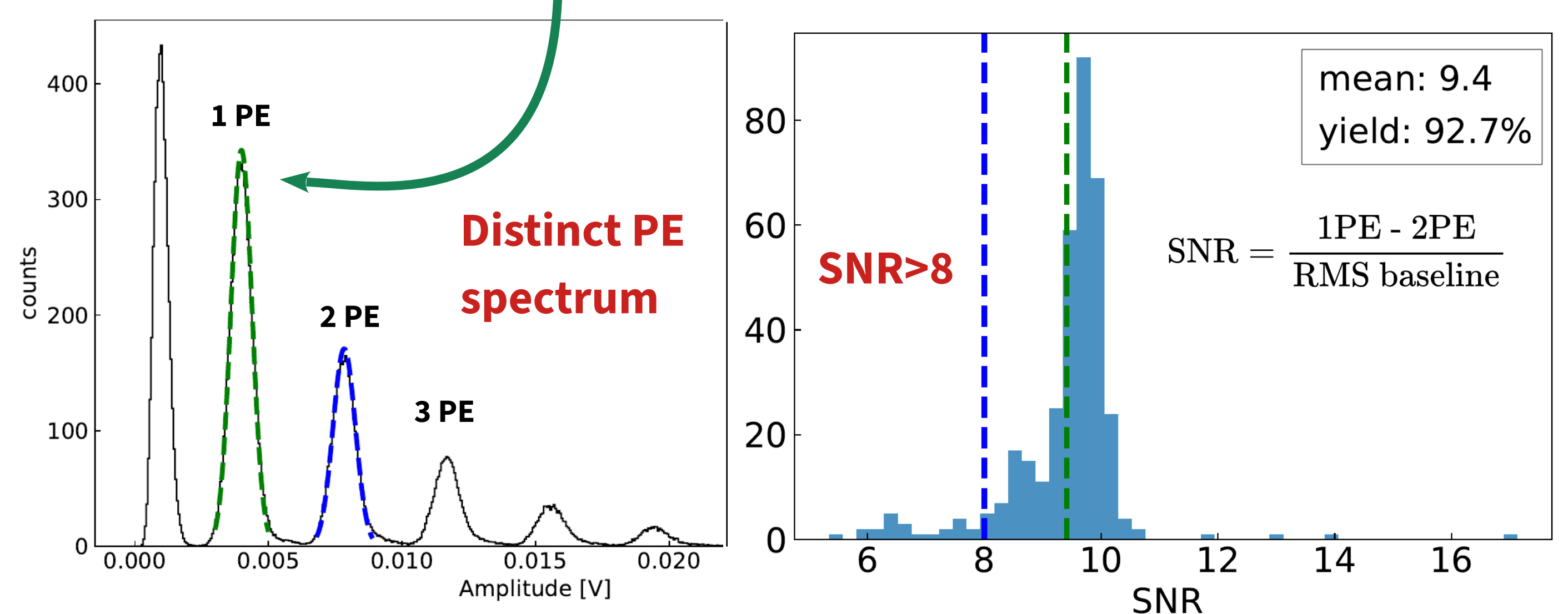
- Cryogenic **SiPM** technology developed by FBK (Italy)
- Cryogenic readout ASIC developed by INFN
- vTiles electronics on the Arlon 55N substrate backside
- vTiles mounted on a Arlon 55N motherboard
- **4 channels** (largest single readout SiPM array 10x10 cm²)
- 518 PDUs forming the two TPC optical planes
- 120 vPDUs for Inner Veto, 30 vPDUs for Outer Veto
- Strict radiopurity requirements

27m² array of SiPMs detectors

Single photoelectron resolution

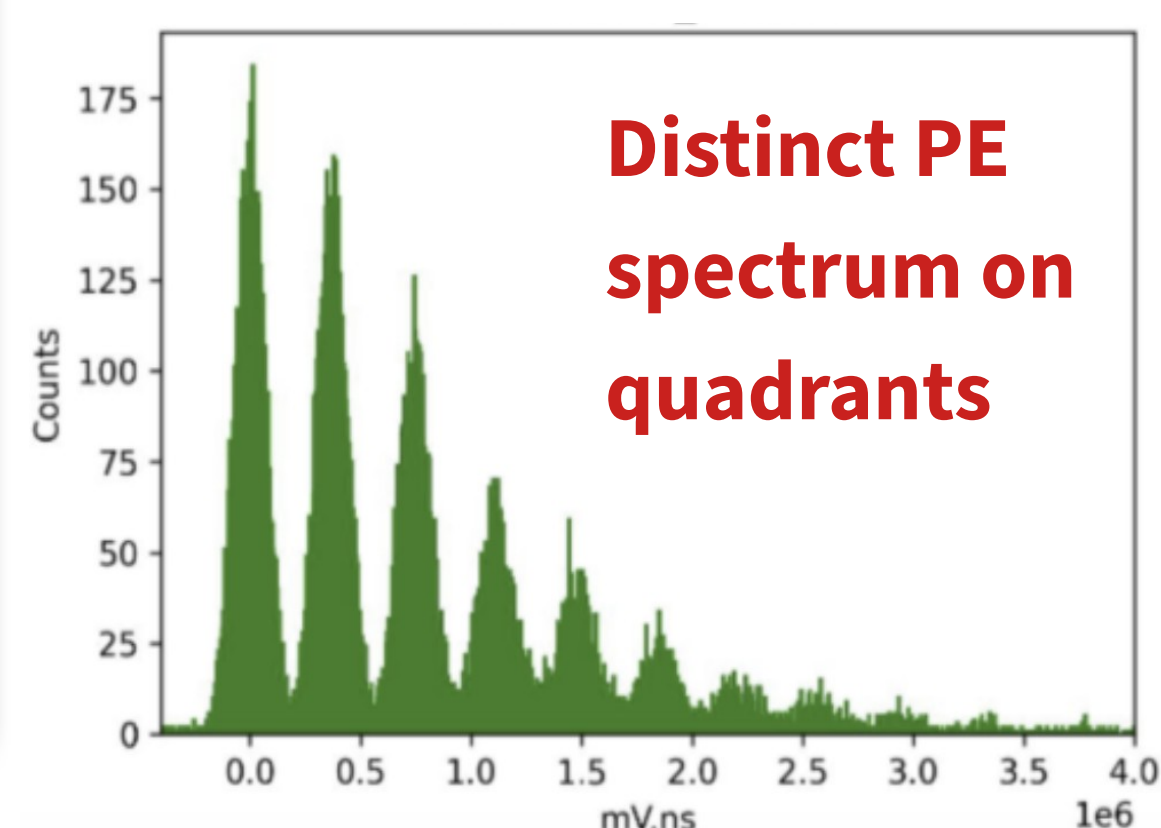
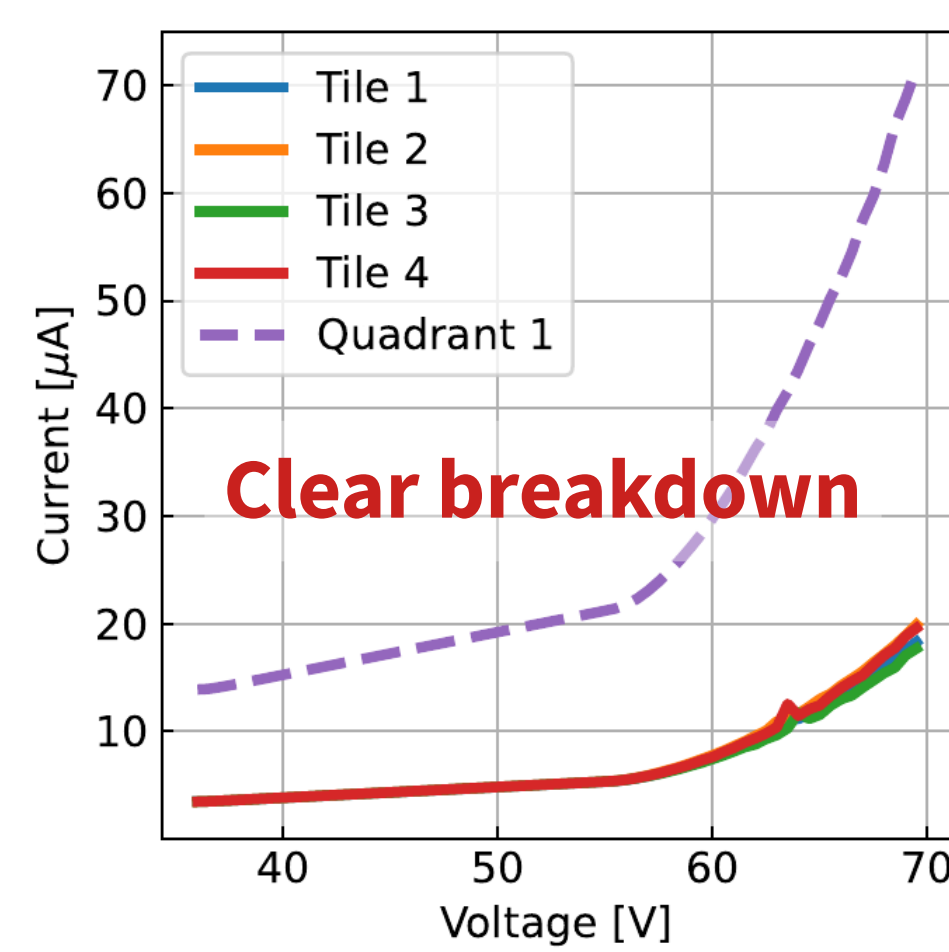
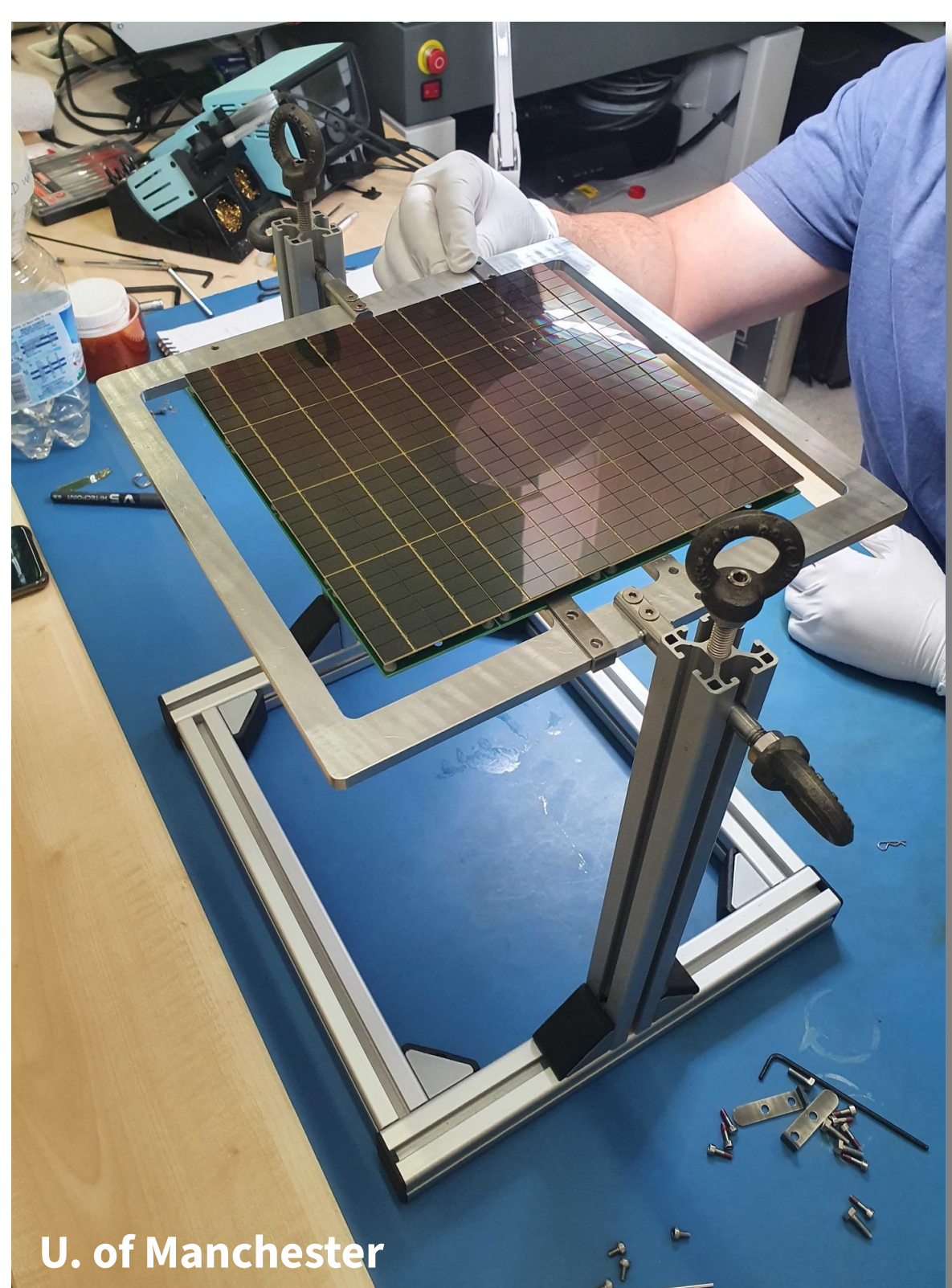
VTILE ASSEMBLY AND TESTING

- 1400 **SiPM wafers cryoprobed** in NOA (LNGS, Italy) with 94% yield
- **PCB population** in University of Birmingham (inject pulse response test)
- **SiPM die attach** in U. of Liverpool and STFC Interconnect
- **Liquid nitrogen characterisation:** laser calibration in Oxford and STFC
- **Production DB** for tracking the whole production
- **QA/QC:** dust counting, SNR, finger plots, breakdown voltage, noise figures



9 institutes for construction and testing

Min ISO 7 cleanrooms



VPDU ASSEMBLY AND TESTING

- **vPDU assembly** in U. of Manchester and Warwick, electrical characterisation and dust counting
- **Cold tests** with laser calibration at U. of Edinburgh, U. of Lancaster, U. of Liverpool and AstroCeNT (Poland)
- Characterisation of each single quadrant
- **QA/QC:** dust counting, SNR, finger plots, breakdown voltage, noise figures
- **Production well on track**

GOAL:

WIMPs world leading sensitivity!