The DarkSide-20k Neutron Veto and its Light Detector
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**DarkSide-20k Experiment**
A global liquid argon dark matter experiment which aims to reach high WIMP mass sensitivity ($1.5 \times 10^{-47} \text{ cm}^2$) in a background free environment.

- **Signal**
  - Single nuclear recoil
  - Energy 1-100 keV

- **Background**

**Neutron veto: TPC-veto Integrated System**
Neutron capture on Gd produces a gamma cascade (8 MeV). Generates scintillation light in argon detected by veto photo detection unit (vPDU).

- 16 Tiles
- Single PCB for Tile & amplifier + 1 large PCB for control signals
- ASIC amplifier
- Sum of 4 amplified tile signals, 4 outputs

**Veto Tile**
Silicon PhotoMultiplier (SiPMs)

- 24 SiPMs total area: 5x5 cm²
- Dynamic range: 700 mV

**Veto Tile: Preliminary Results**

- Waveform example after reconstruction
- Pulse amplitude distribution
- Operation overvoltage

- @7VoV:
  - PE = 42 mV
  - SNR = 9.5
  - RMS = 4.5 mV

**Neutron Veto Performance**
Monte-Carlo simulation, including PDU performance, develop to study neutron veto efficiency.

- Neutron background reduction:
  - Single nuclear recoil selection
  - Position cuts
  - Energy in TPC > 50 keV OR energy in the veto > 200 keV

- Neutron inefficiency:
  - 1.6E-5 for neutrons coming from all detector components
  - Inefficiency is increased by 20% when including electronics response, SiPM noise effects and pile-up

- 120 vPDU in the veto -> veto light yield = 2 pe/keV
- < 0.1 event in full exposure of 200 ton x years

**UK Facilities to Produce vPDU**

- Warm/cold testing setup under construction @Manchester/ Liverpool
- First vPDU planned to test this summer

- Front end assembled @Birmingham
- Tile bonding @Liverpool / RAL

Inside a Titanium Vessel filled with 32 tons of underground liquid Argon