**CYGNUS-TPC White Paper**

**Abstract**

**1.0 Introduction**

* 1. Case for WIMP dark matter
  2. Case for directionality
  3. Case for TPC technology
  4. The CYGNUS collaboration

**2.0 CYGNUS-TPC Vision and Sensitivity**

2.1 CYGNUS-TPC and pathfinder concept

2.2 WIMP detection sensitivity

2.3 WIMP directionality and astrophysics capability

2.4 Directional coherent neutrino scattering sensitivity

**3.0 CYGNUS-TPC Stage I Proposal Concept**

3.1 Multi-site staging

3.2 Size and sensitivity

3.3 Integration of R&D activity

**4.0 Experiment Engineering and Infrastructure**

4.1 Vacuum vessel engineering

4.2 Field cage and high voltage

4.3 Underground site infrastructure – north and south

4.4 Passive shielding design

**5.0 High Resolution TPC Readout and Electronics**

5.1 Optical readout

5.2 Micromegas, strip and pixel charge readout

**6.0 High Volume TPC Readout and Electronics**

6.1 MWPC readout

6.2 GEM 1D readout

**7.0 Background Control**

7.1 Neutron and gamma control and mitigation

7.2 Radon and RPR control and mitigation

**8.0 Target Gas Control and Recirculation**

**9.0 Detector Calibration and Validation**

9.1 Quenching factor measurements

9.2 Target gas physics

**10.0 Supporting R&D**

10.1 CYGNUS-Kamioka

10.2 CYGNUS-Boulby

**11. Computing and Analysis**

**12. Prior R&D**