

# DUNE ColdADC ASIC Preliminary Testing Results

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## **Abstract**

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# Contents

<b>1</b>	<b>Introduction [Grace/Lin]</b>	<b>3</b>
<b>2</b>	<b>Test Setup</b>	<b>3</b>
2.1	Cryogenic Test System (CTS) [Lin] . . . . .	3
2.2	BNL Test System [Gao] . . . . .	3
2.3	Fermilab Cryo Cooler Test System [Christian] . . . . .	3
2.4	LBNL Test Board [Lin] . . . . .	3
<b>3</b>	<b>Functional Testing [Christian]</b>	<b>3</b>
<b>4</b>	<b>Performance Results</b>	<b>4</b>
4.1	Noise . . . . .	4
4.2	Static Linearity (INL,DNL) . . . . .	4
4.3	Dynamic Linearity (ENOB) . . . . .	4
4.4	Channel Crosstalk . . . . .	4
<b>5</b>	<b>Issues Identified and Mitigations</b>	<b>4</b>
5.1	Autocal . . . . .	4
5.2	IR Drop . . . . .	4
5.3	Level Shifter . . . . .	4
5.4	ADC Core Linearity . . . . .	4
5.5	SHA/MUX Linearity . . . . .	4
5.6	SDC Linearity . . . . .	4
5.7	SHA/MUX Crosstalk . . . . .	4
5.8	BGR Op-amp . . . . .	4
5.9	Reset Out-of-Sync Between Two ADC Pipelines . . . . .	4
5.10	Overflow Wraparound . . . . .	4
<b>6</b>	<b>Production Testing [Furic]</b>	<b>4</b>
6.1	Test Setup . . . . .	4
6.2	Results . . . . .	4
<b>7</b>	<b>Summary</b>	<b>5</b>

## 1 Introduction [Grace/Lin]

## 2 Test Setup

### 2.1 Cryogenic Test System (CTS) [Lin]

### 2.2 BNL Test System [Gao]

Describe BNL test setup including the test boards.

### 2.3 Fermilab Cryo Cooler Test System [Christian]

Describe Fermilab test setup including the test boards.

### 2.4 LBNL Test Board [Lin]

## 3 Functional Testing [Christian]

Discuss functional testing including reading/writing registers with I2C and UART, verifying the data I/O, including LVDS current control, and verifying clock generation.

## 4 Performance Results

### 4.1 Noise

#### 4.1.1 ColdADC Only

#### 4.1.2 LArASIC + ColdADC [**Gao**]

### 4.2 Static Linearity (INL,DNL)

### 4.3 Dynamic Linearity (ENOB)

### 4.4 Channel Crosstalk

## 5 Issues Identified and Mitigations

### 5.1 Autocal

### 5.2 IR Drop

### 5.3 Level Shifter

### 5.4 ADC Core Linearity

### 5.5 SHA/MUX Linearity

### 5.6 SDC Linearity

### 5.7 SHA/MUX Crosstalk

### 5.8 BGR Op-amp

### 5.9 Reset Out-of-Sync Between Two ADC Pipelines

### 5.10 Overflow Wraparound

## 6 Production Testing [**Furic**]

### 6.1 Test Setup

### 6.2 Results

## 7 Summary

# Appendix

Here is an example of how to insert Fig. 1. Figures should be saved in ./figures directory.

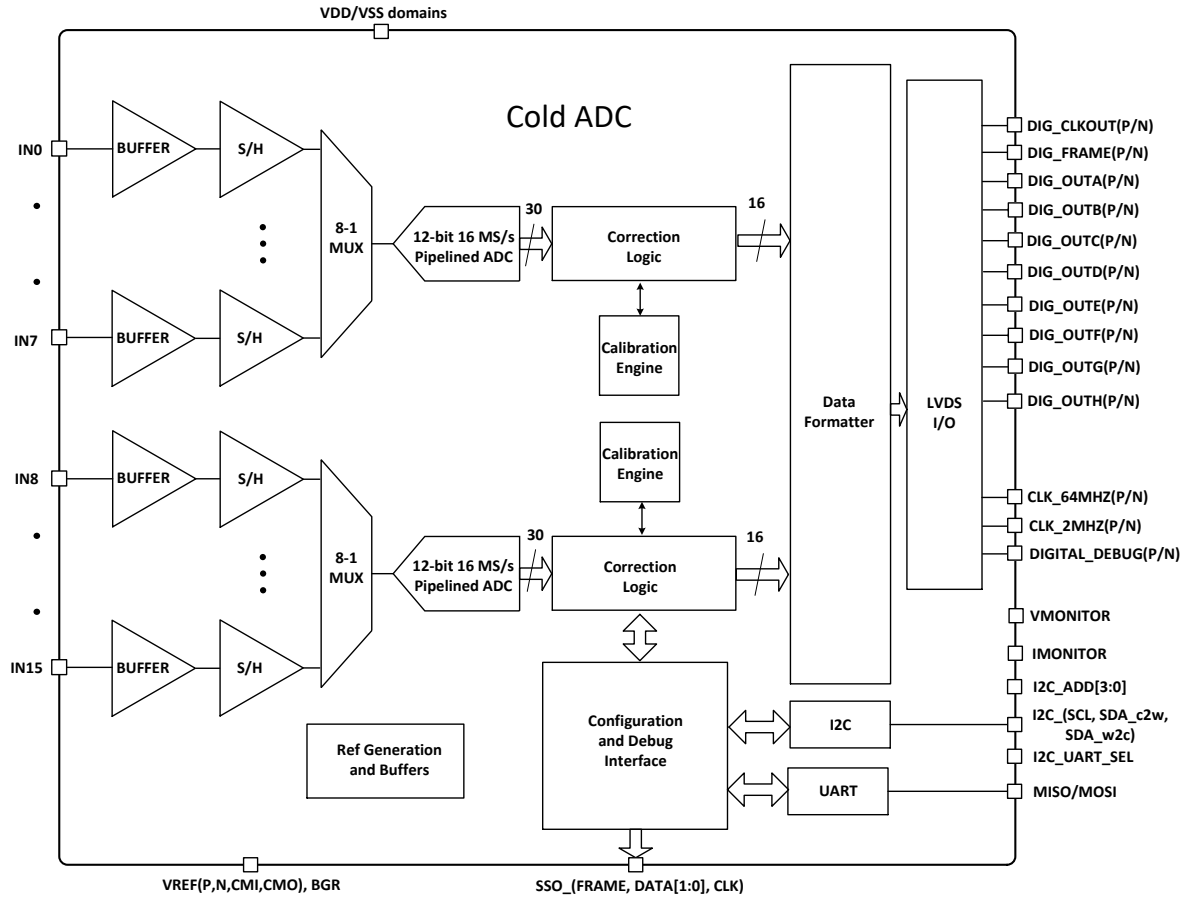


Figure 1: ColdADC Block Diagram.

```
\begin{figure}[htb]
\centering
\begin{minipage}[b]{1.0\textwidth}
\begin{center}
\includegraphics[width=1.0\textwidth]{figures/coldadc_blockdiagram.pdf}
\end{center}
\end{minipage}
\caption{ColdADC Block Diagram.}
\label{fig:adc_blockdiagram}
\end{figure}
```

Here is an example of how to create Table 1. The minimum internal size of the cryostat is also indicated in Table ?? and was determined by adding the necessary mechanical and electrical clearances to the computed size of the TPC.

Component	dimensions [m]
APA (active)	$2.29(\textit{wide}) \times 5.9(\textit{high})$
APA (external)	$2.32(\textit{wide}) \times 6.2(\textit{high})$
TPC (active)	$7.0(\textit{long}) \times 7.2(\textit{wide}) \times 5.9(\textit{high})$
TPC (external)	$7.3(\textit{long}) \times 7.4(\textit{wide}) \times 6.2(\textit{high})$
cryostat (internal)	$8.9(\textit{long}) \times 7.8(\textit{wide}) \times 8.1(\textit{high})$

Table 1: Dimensions of DUNE-PT.

```

\begin{table}[h]
\centering
\begin{tabular}{|c|c|}
\hline
\textbf{Component} & dimensions [m] \\ \hline
APA (active) &  $2.29(\textit{wide}) \times 5.9(\textit{high})$  \\ \hline
APA (external) &  $2.32(\textit{wide}) \times 6.2(\textit{high})$  \\ \hline
TPC (active) &  $7.0(\textit{long}) \times 7.2(\textit{wide}) \times 5.9(\textit{high})$  \\ \hline
TPC (external) &  $7.3(\textit{long}) \times 7.4(\textit{wide}) \times 6.2(\textit{high})$  \\ \hline
cryostat (internal) &  $8.9(\textit{long}) \times 7.8(\textit{wide}) \times 8.1(\textit{high})$  \\ \hline
\end{tabular}
\caption{Dimensions of DUNE-PT.}
\label{tab:TPC-dim}
\end{table}

```