DUNE ColdADC ASIC Preliminary Testing Results

Authors go here

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DUNE Electronics Consortium

Abstract

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1 Introduction [Grace/Lin]

Note to authors: executive summary of the testing plan and status. Include specs table.

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]

Note to author: 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

Note to authors: discuss in this section the high level performance results. The main message here is to convey to the readers that the ASIC functions well overall. The details of the known issues will be discussed in the next section.

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, SNDR)

4.4 Channel Crosstalk [Gao]

4.5 Power Consumption [Gao]

5 Issues Identified and Mitigations

Note to authors: describe studies that have been done to identify the issues and possible mitigations.

5.1 Auto Calibration [Grace]
5.2 Level Shifter [Grace]
5.3 ADC Core Linearity [Prakash]
5.4 SHA/MUX Linearity [Prakash]
5.5 SDC Linearity [Dabrowski]
5.6 IR Drop [Christian/Miryala/Lin]
5.7 SHA/MUX Crosstalk [Grace/Prakash/Lin]
5.8 BGR Op-amp [Dabrowski]
5.9 Overflow Wraparound [Grace]
6 Production Testing [Furic/Gao]
6.1 Test Setup
6.2 Results
7 Summary

References

[1] "LBNF/DUNE Conceptual Design Report", https://web.fnal.gov/project/LBNF/ReviewsAndAssessments/LBNF-DUNE%20CD-1-Refresh%20Directors%20Review/SitePages/Conceptual%20Design%20Report.aspx

[2] First scientific application of the membrane cryostat technology, D.Montanari et al, *AIP Proceedings 1573, 1664 (2014)* http://scitation.aip.org/content/aip/proceeding/aipcp/10.1063/1.4860907

[3] "The GENIE Neutrino Monte Carlo Generator", C. Andreopoulos, et al., Nucl. Instrum. Meth. A614, 87 (2010).

Appendix

Example for citing references. References [1–3] should be entered in bibliography.tex file under your section.

```
Example for citing references. References~\cite{dunecdr,montanari_35ton,genie}.
```

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

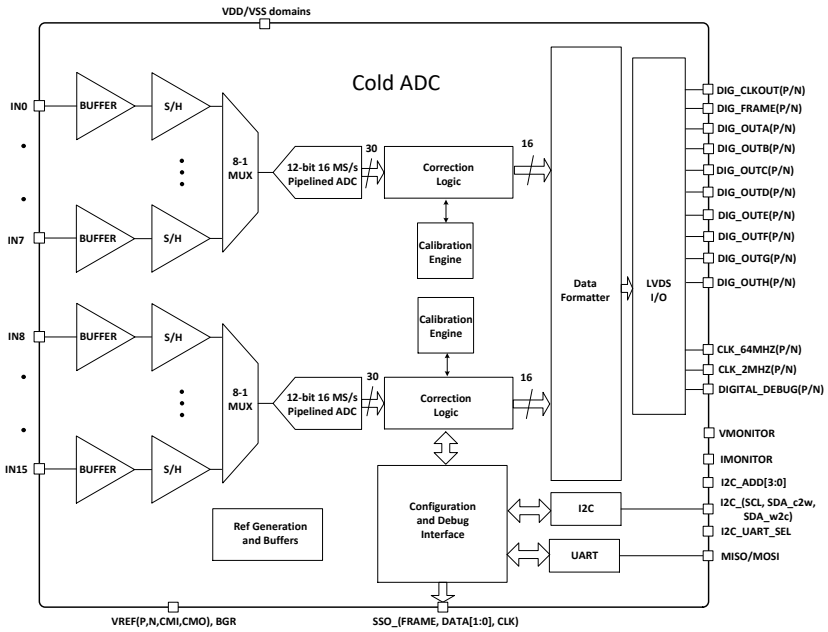

Figure 1: ColdADC Block Diagram.

```
\begin{figure}[htb]
\centering
\begin{center}
\includegraphics[width=0.7\textwidth]{figures/coldadc_blockdiagram.pdf}
\end{center}
\caption{ColdADC Block Diagram.}
\label{fig:adc_blockdiagram}
\end{figure}
```

Here is an example of how to create Table 1.

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

Table 1: Dimensions of DUNE-PT.

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