PANDA EMC FEE Development

APFEL-(Ernte) 2007

EE - Meeting – GSI
December 2007
Peter Wieczorek GSI
Overview

- **Measurement: 1st Iteration APFEL02**
- **Overview: 2nd Iteration APFEL03**
- **Results from Simulation vs. Measurement**
  - Noise
  - Dynamic Range
  - Power Consumption
- **Summary**
ASIC Overview (1st Iteration)
Setup

Preamplifier

\[ Q = C \Delta U \]

Semi-Gaussian shaper

\[ C_{\text{reset}} \]

n-integrators

Output stage

ASIC

\[ C = 22 \text{ pF} \]

\[ C_{\text{det}} = 2.2 \text{ pF} \]
Test Setup

- APD readout board
- 50 Ohm output driver
- 2 outputs
- Test pulse input
APD Readout Pulse

![Graph of APD Readout Pulse with channel and time axes labeled.](image-url)
$^{22}\text{Na}$ Spectrum
ASIC Overview (2nd Iteration)

- 2 equivalent channels
- CQFP package
- 2 programmable DACs
ASIC on PCB
Schematic

Charge sensitive Preamplifier

Differentiator Pole-Zero cancellation

Integrators

Differential Output drivers

Ref_{16}

x16

Ref_{1}

Out

Ref_{1_16}

Ref_{1_1}

Out

In

Bias
Measurement Setup

DPO

Q=CU

AWG

CLK

DATA

Power Supply

DTG

Q=CU

Power Supply

3.3V
10 Bit DAC Test

First functional test in used range from $V_{\text{ref}} = 1.8 \text{ V} \text{ to } 2.5 \text{ V}$
Differential Outputs

- CM-voltage: \( \approx 1.2 \text{ V} \)
- Output range: \( \pm 1.5 \text{ V} \)
# Differential Outputs

![Graph of Differential Outputs]

<table>
<thead>
<tr>
<th>Value</th>
<th>Mean</th>
<th>Min</th>
<th>Max</th>
<th>St Dev</th>
<th>Count</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>171.1mV</td>
<td>171.385V</td>
<td>171.5mV</td>
<td>392.9μ</td>
<td>306.0</td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>174.5mV</td>
<td>174.394V</td>
<td>180.9mV</td>
<td>2.61m</td>
<td>305.0</td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>167.4mV</td>
<td>160.391V</td>
<td>155.0mV</td>
<td>1.86m</td>
<td>305.0</td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>866.3mV</td>
<td>866.223V</td>
<td>866.7mV</td>
<td>152.9μ</td>
<td>305.0</td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>1.557V</td>
<td>1.55745V</td>
<td>1.558</td>
<td>105.7μ</td>
<td>305.0</td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>7.931mV</td>
<td>4.43621V</td>
<td>12.28m</td>
<td>2.33m</td>
<td>305.0</td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>11.78mV</td>
<td>11.78599m</td>
<td>11.63m</td>
<td>365.3μ</td>
<td>306.0</td>
<td></td>
</tr>
</tbody>
</table>

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Peter Wieczorek
Corresponding Output Signal
Noise Measurement
LabView

- Data readout and storage with LabView:
  - Amplitude
  - Rise time
  - Noise
  - DAC settings
  - Adjustments of the DPO

- Thanks to Sven Loechner, GSI
LabView User Interface
## Summary

<table>
<thead>
<tr>
<th></th>
<th>APFEL01</th>
<th>APFEL03</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1\textsuperscript{st} Iteration)</td>
<td>(2\textsuperscript{nd} Iteration)</td>
</tr>
<tr>
<td>ENC / fC</td>
<td>0.99 (-25°C, $C_{\text{Det}}=300\text{pF}$)</td>
<td>0.69 (-20°C, $C_{\text{Det}}=326\text{pF}$)</td>
</tr>
<tr>
<td>Max. input charge / fC</td>
<td>3000 (-25°C)</td>
<td>~7000 (-20°C)</td>
</tr>
<tr>
<td>Dynamic range</td>
<td>~3000 (-25°C)</td>
<td>~12000 (-20°C)</td>
</tr>
<tr>
<td>Output</td>
<td>Single ended</td>
<td>Differential</td>
</tr>
<tr>
<td>Max. event rate</td>
<td>350 kHz</td>
<td>350 kHz</td>
</tr>
<tr>
<td>Power consumption /mW</td>
<td>28 (-25°C)</td>
<td>44 (-20°C)</td>
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