

# **Design and Burn-in of TOF Preamplifier**

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**April 27<sup>th</sup>, 2006**

# Outline

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- **Endcap TOF Preamplifier:**
  - Design**
  - Test**
  
- **Barrel TOF Preamplifier Burn-in**

# Design of Endcap TOF Preamplifier

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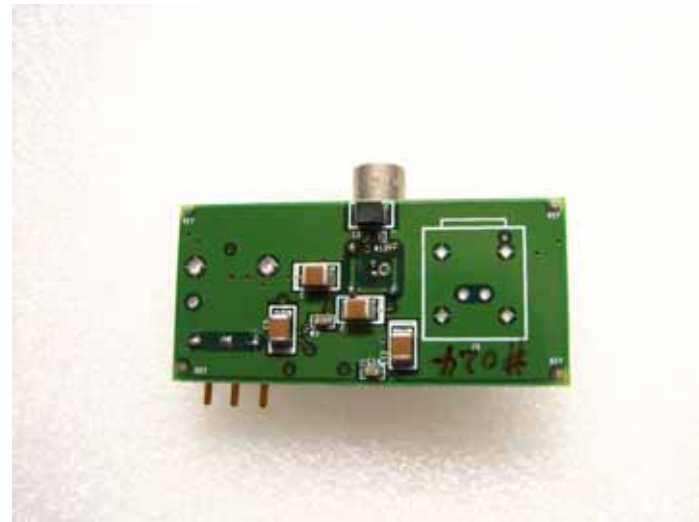
## Reminder : barrel TOF preamplifier

**Gain:**  $\sim 10\text{V/V}$

**INL:**  $\sim 0.5\%$

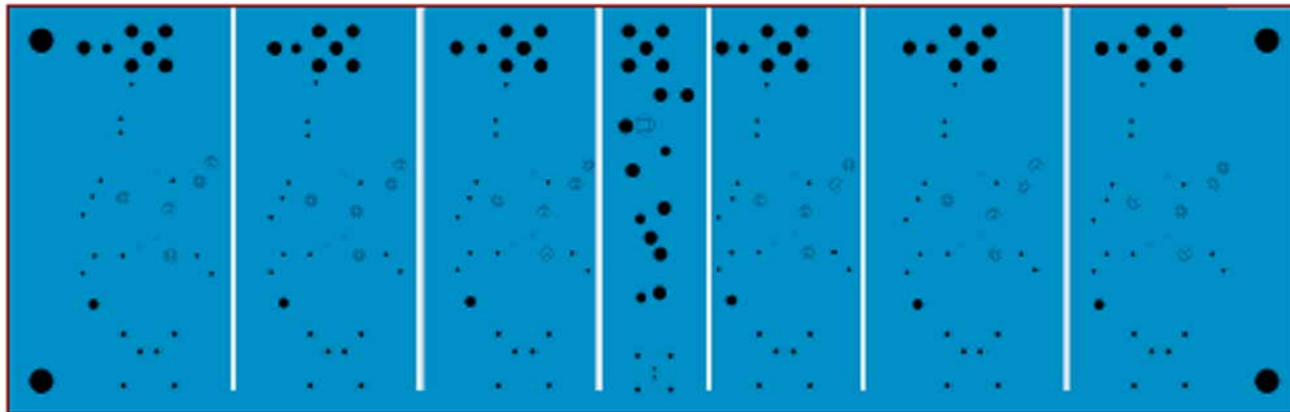
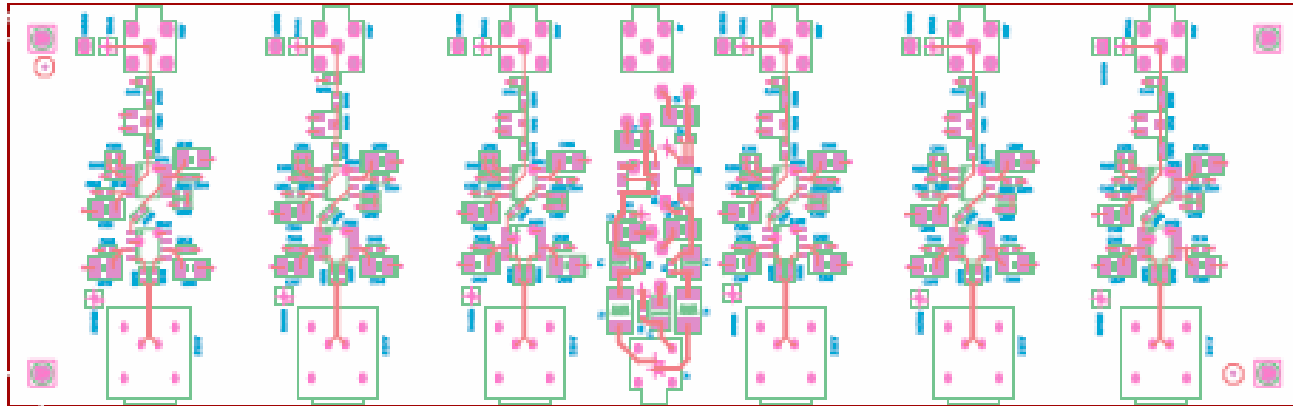
**$T_{\text{rise}}$ :**  $< 2\text{ns}$

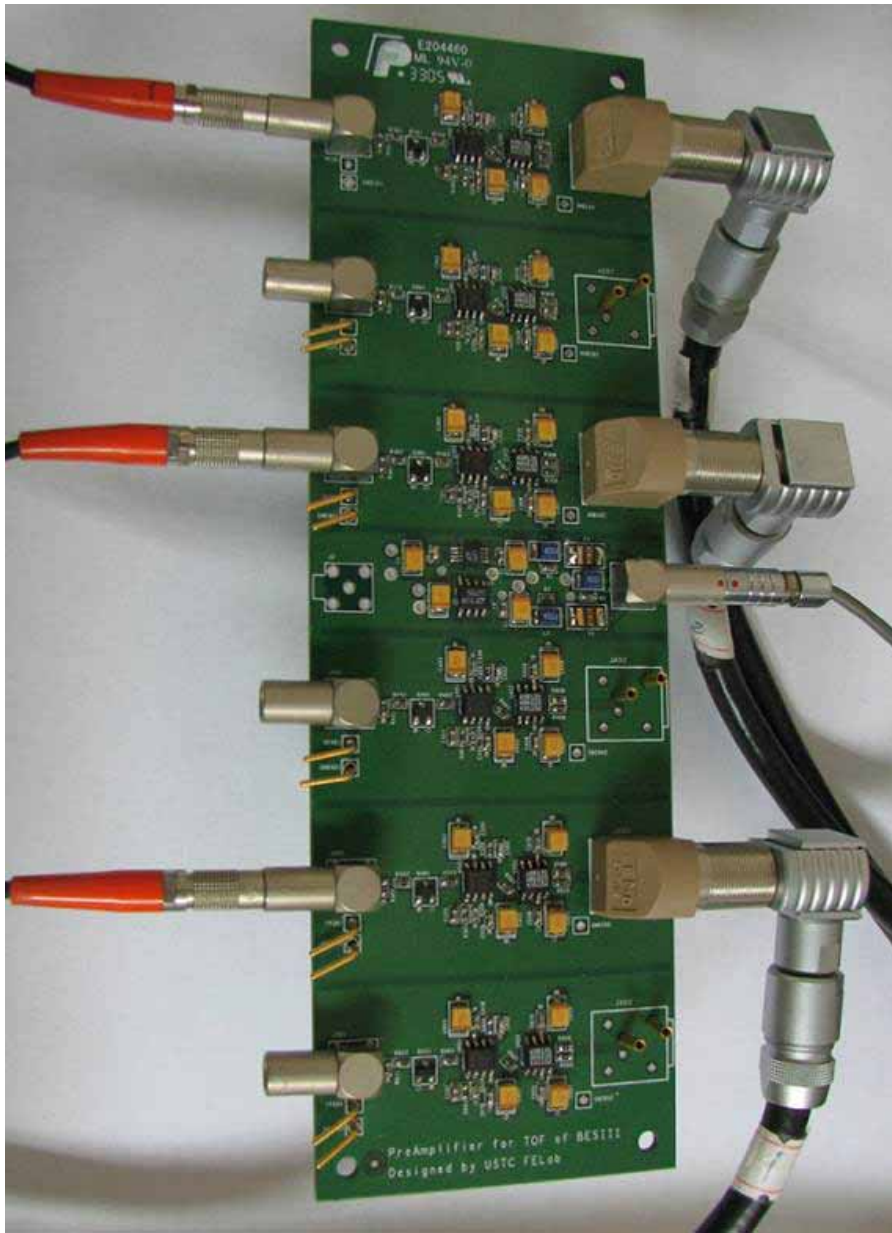
**DR:**  $\sim 4\text{V}$



# PCB Layout of the Endcap TOF Preamplifier

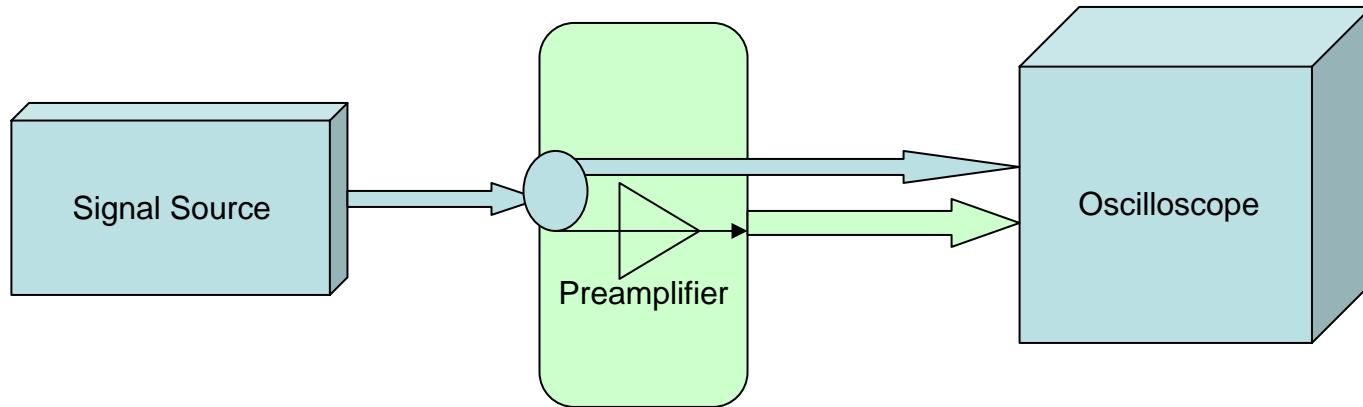
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# The Test System

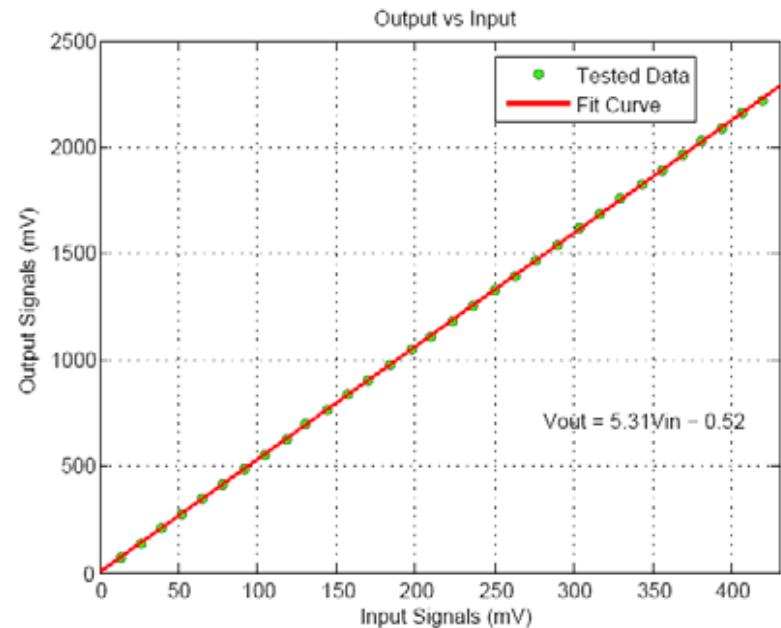
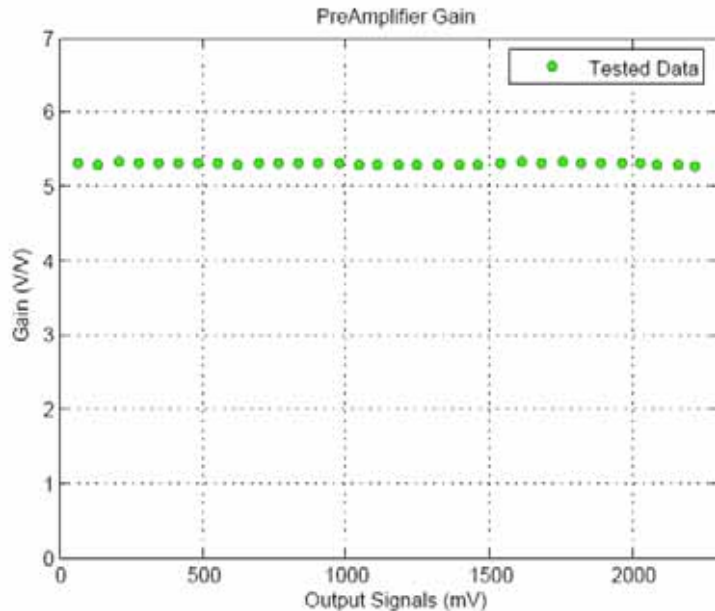
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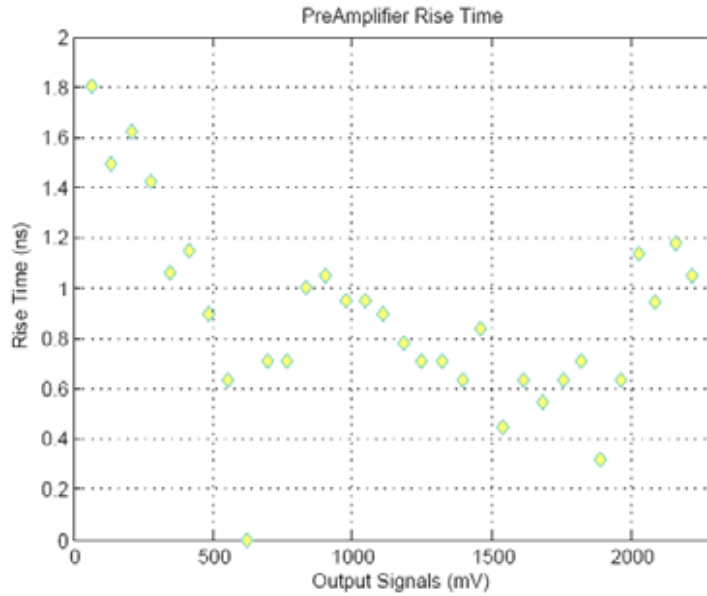
- **Oscilloscope: Tektronics TDS7104 , BW 1G , 10GSPS**
- **Probe: P6243, BW 1G, 1M Ohm, 1PF**
- **Source: Agilent33250A , rise time 5ns , pulse width 10ns**
- **Both input and output signals are sent into the scope.**

# Test of Endcap TOF Preamplifier

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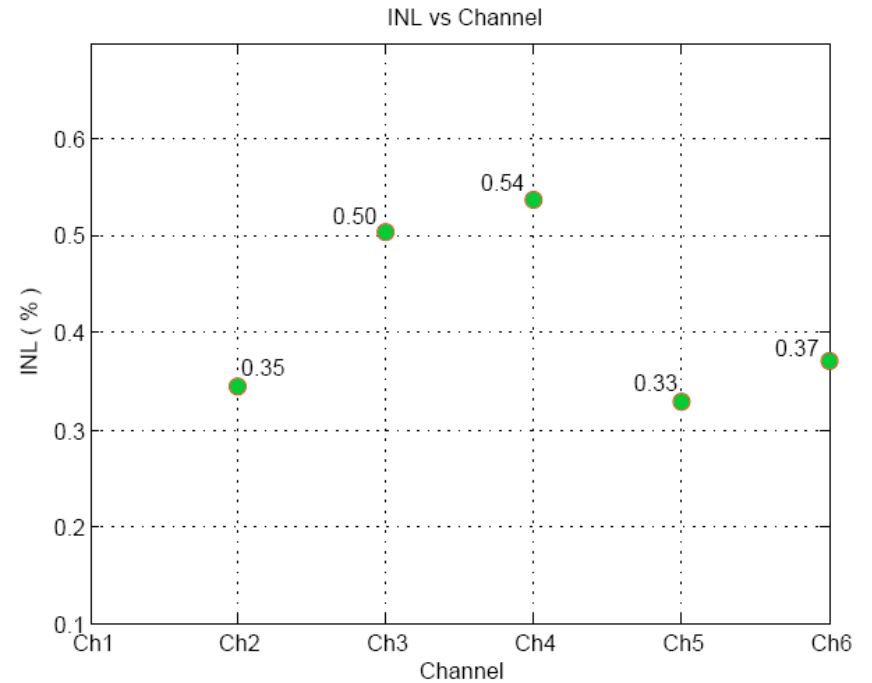
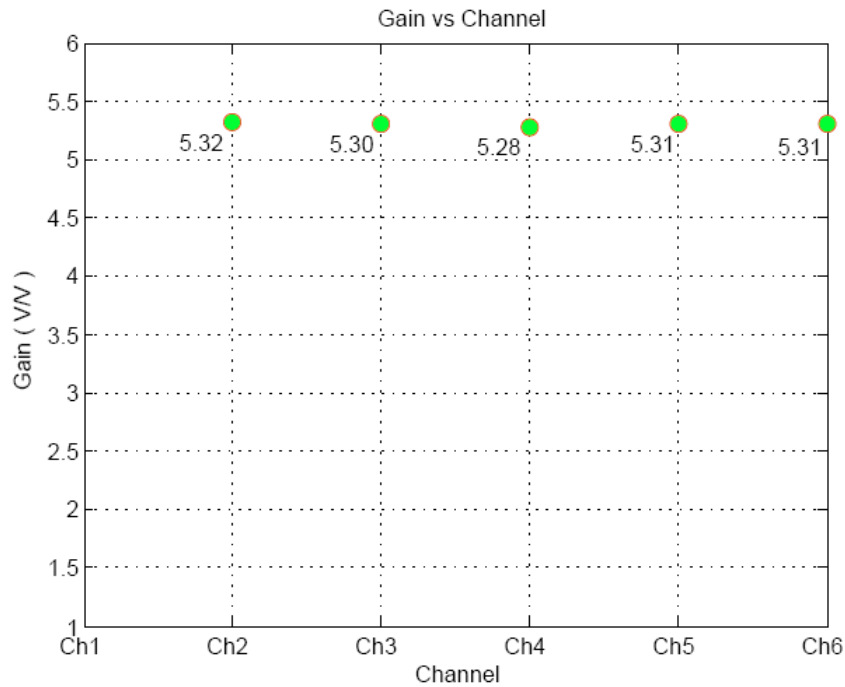


- The differential gain is about 10.6 V/V
- The dynamic range is larger than 4V



**Gain difference among channels is less than 0.8% .**

**Detector-test is running.**





# **Burn-in of Barrel TOF Preamplifier**

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- **Produce the Preamplifier**
- **Burn-in Procedure**
  - Three test steps**
    - ✓ **Pre test**
    - ✓ **Continual power on under 50    for 7 days**
    - ✓ **Re test**

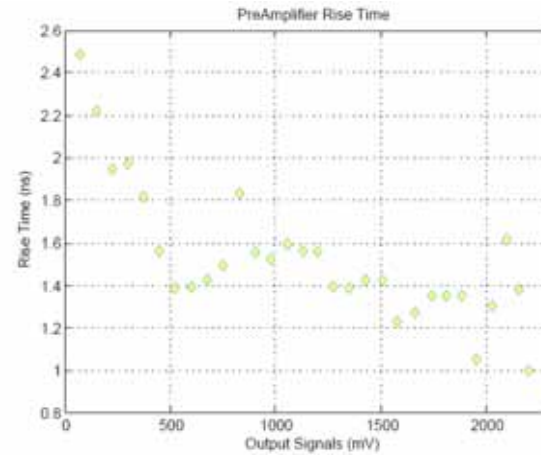
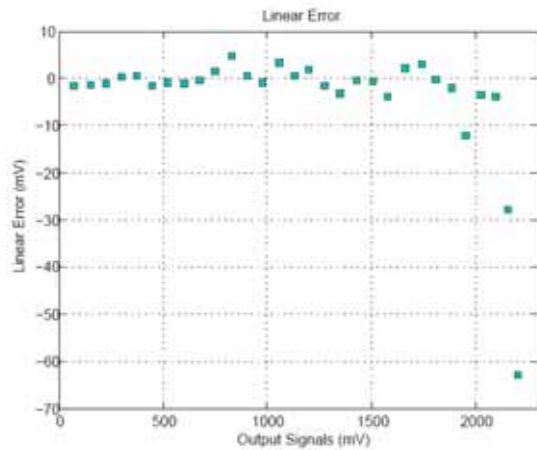
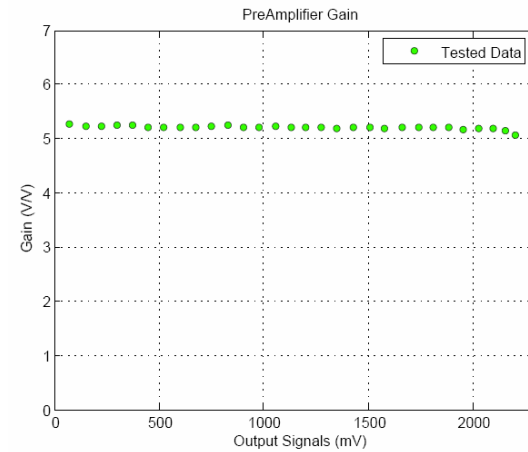
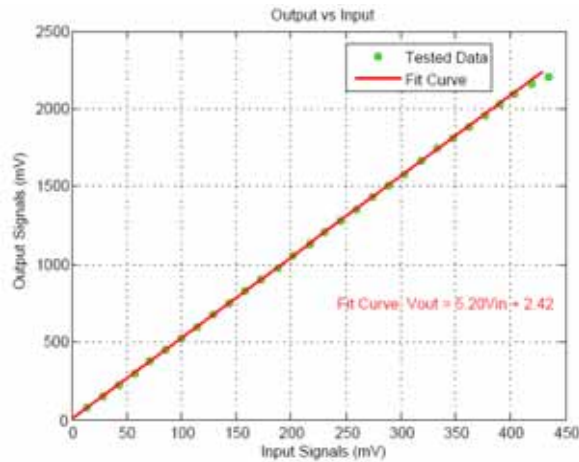
# The Barrel Preamplifier

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# Detailed Test of the Preamplifier

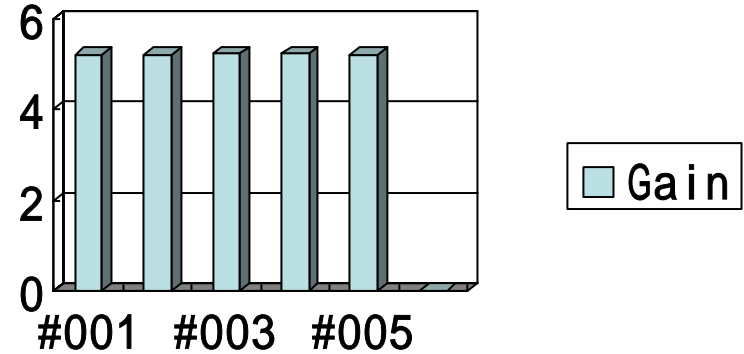
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# Uniformity of the Performance

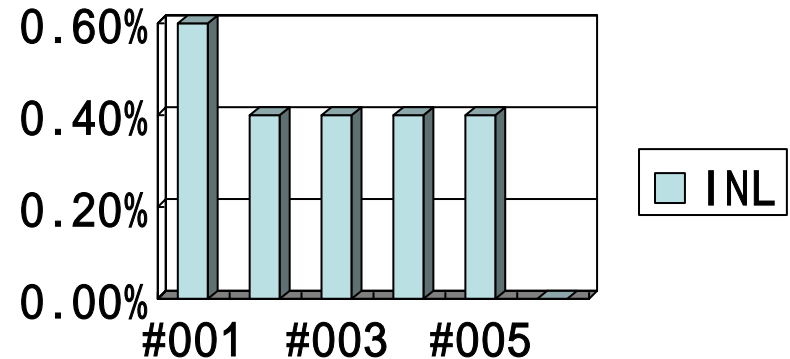
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No.	001	002	003	004	005
Gain (V/V)	5.20	5.21	5.23	5.23	5.21



the differences of the gain are less than 0.6%

No.	001	002	003	004	005
INL	0.6%	0.4%	0.4%	0.4%	0.4%

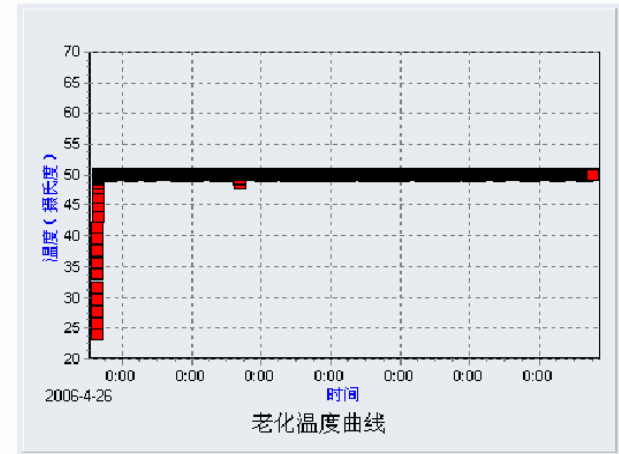
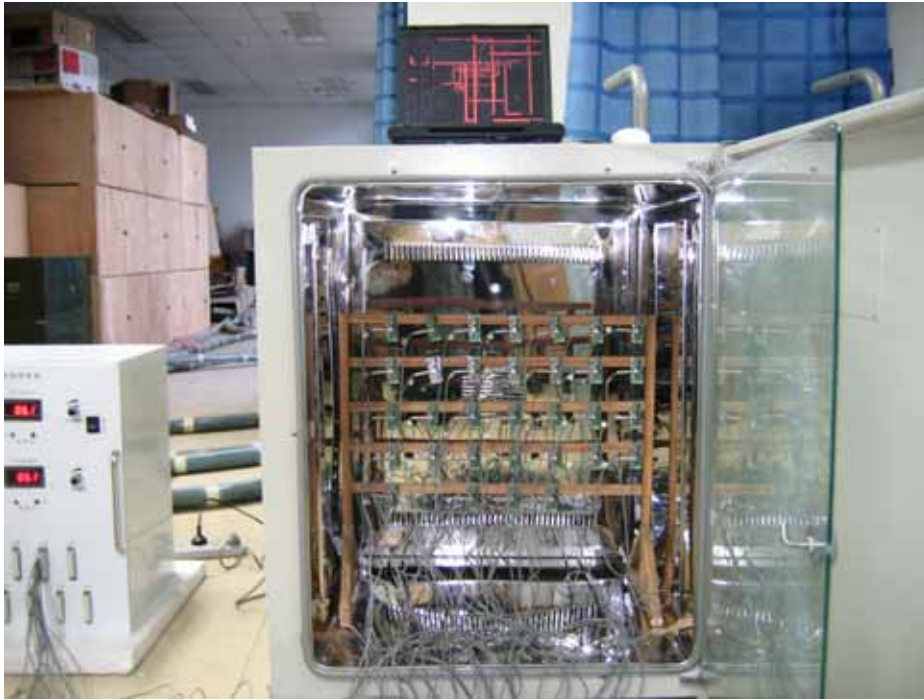


# Assembly of Burn-in System

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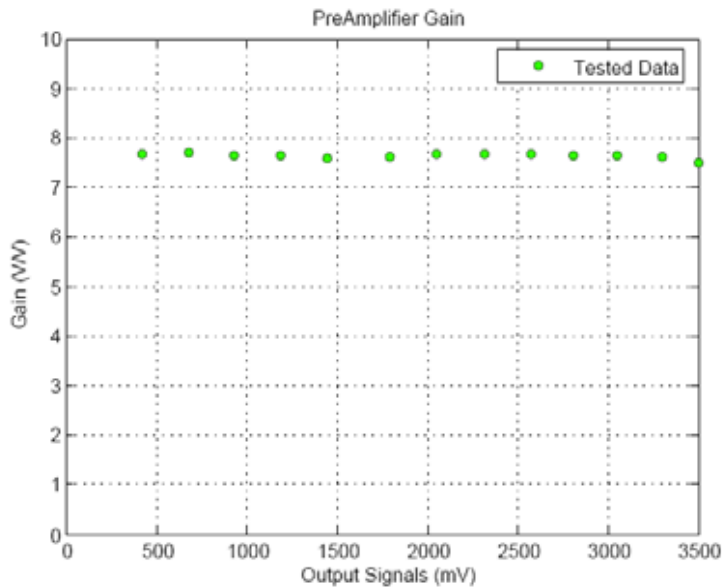
- **$\pm 5\text{V}$  DC power supply:**  
**192(16  $\times$  12) channels for barrel amplifier**  
**adjustable:  $\pm 5.1\text{V} \sim \pm 6.1$**
- **$\pm 6\text{V}$  DC power supply:**  
**16(16  $\times$  1) channels for endcap amplifier**  
**adjustable:  $\pm 6.1\text{V} \sim \pm 7.1$**



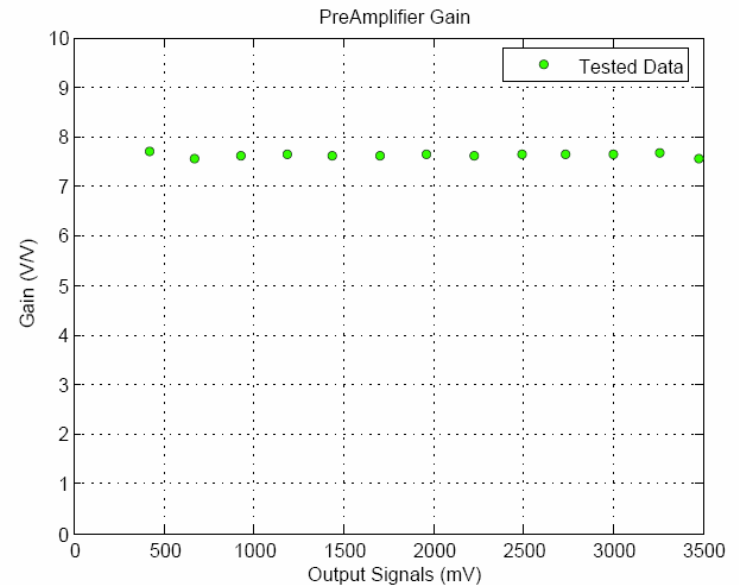
- A burn-in period of 1 week is proposed, at an elevated ambient temperature of  $50^{\circ}\text{C}$ , this means  $\sim 100$  times faster than at the normal operating temperature of  $25^{\circ}\text{C}$ .
- It is estimated that this process should yield about 32 tested, burned-in amplifier each week. The full production volume could be completed in  $\sim 15$  weeks.

# Amplifier Gain before and after Burn-in

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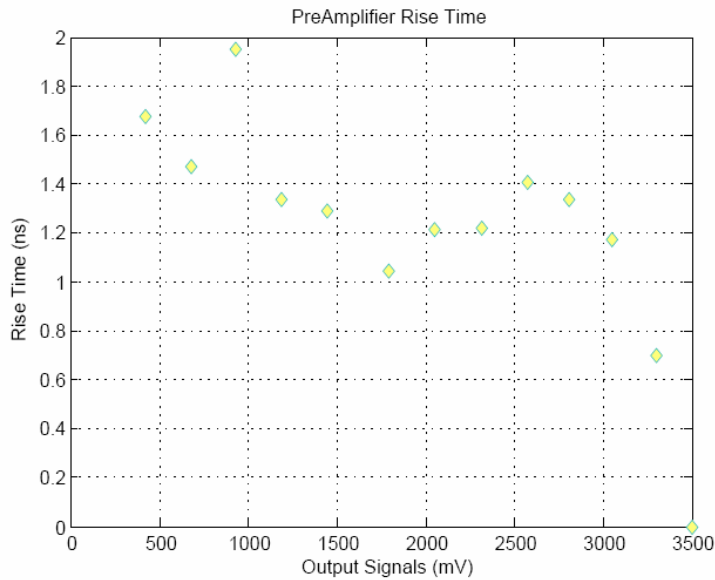
Amplifier Gain before Burn-in



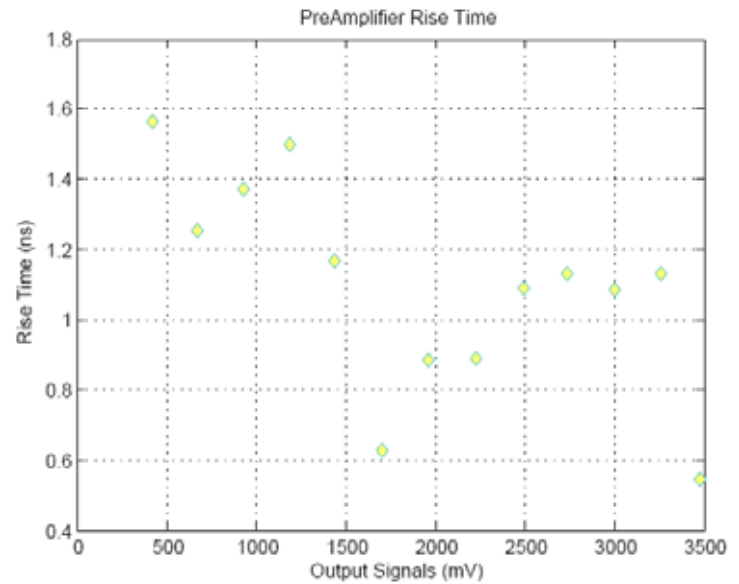
Amplifier Gain after Burn-in

- The fit value of gain ( #004) before and after burn-in is 7.664 V/V and 7.660V/V respectively, the difference is negligible when considering the test system noise.

# Amplifier $T_{\text{rise}}$ before and after Burn-in



Amplifier  $T_{\text{rise}}$  before Burn-in



Amplifier  $T_{\text{rise}}$  after Burn-in

- The rise time of the preamplifier ( #004) is less than 2 ns in both case.



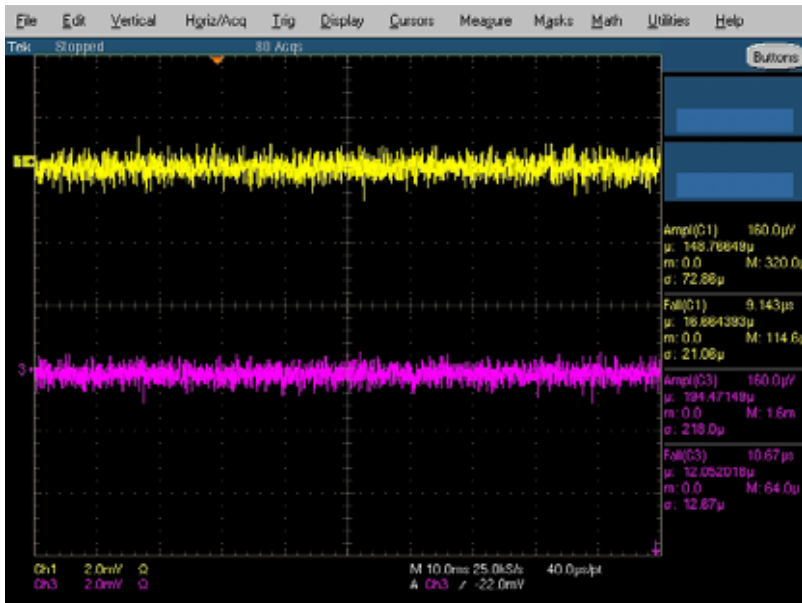
# Gain Compare

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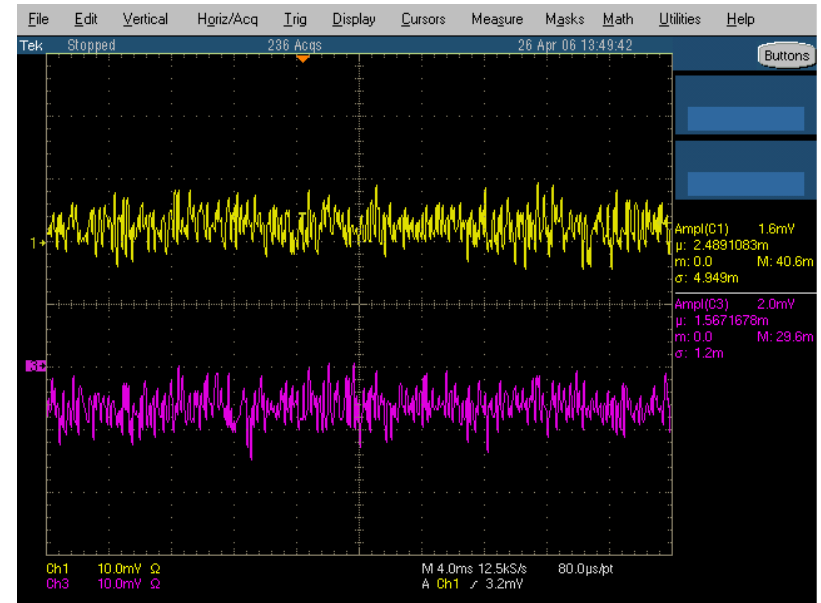
No.	#001	#005	#011	#014	#019	#023	#029	#030
B Gain (V/V)	7.62	7.68	7.69	7.69	7.68	7.66	7.74	7.69
A Gain (V/V)	7.63	7.61	7.68	7.66	7.62	7.67	7.71	7.65

- **The largest difference : 0.07 V/V (0.9%)**
- **Considering the noise interference, the burn-in procedure influence the preamplifier gain very little.**

# Noise Introduced by Test Means



Noise with cable input



Noise with probe input

- The P-P noise with cable input is less than 2mV
- The P-P noise with probe input is about 15mV, which will introduce 0.75% error for a signal with amplitude 2V.

# Conclusion

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- **The performance specifications, as gain, rise time, INL, dynamic range and so on, are all influenced little by the burn-in procedure.**
- **More detailed test will be done.**

**Thank You!**