# BeamMonitor原理样机读出电子学测试报告

2021.10.14

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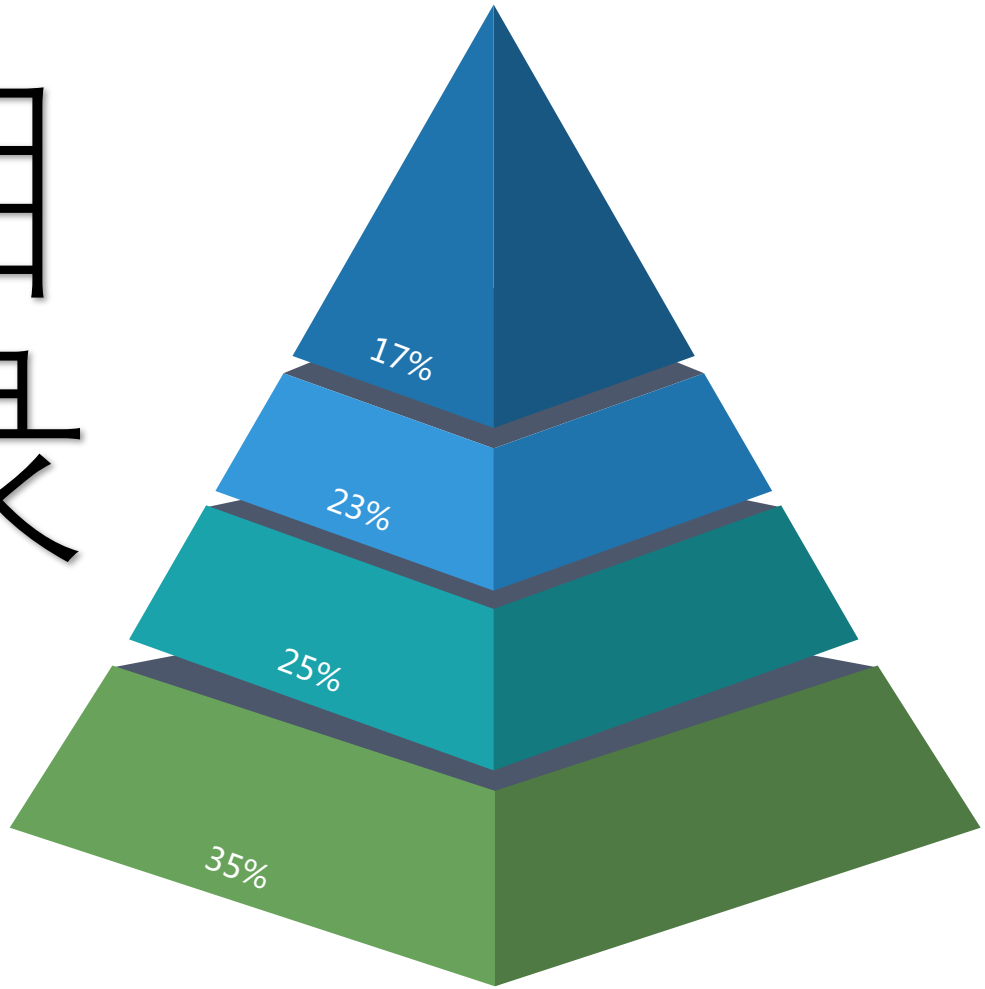



电子学噪声测试

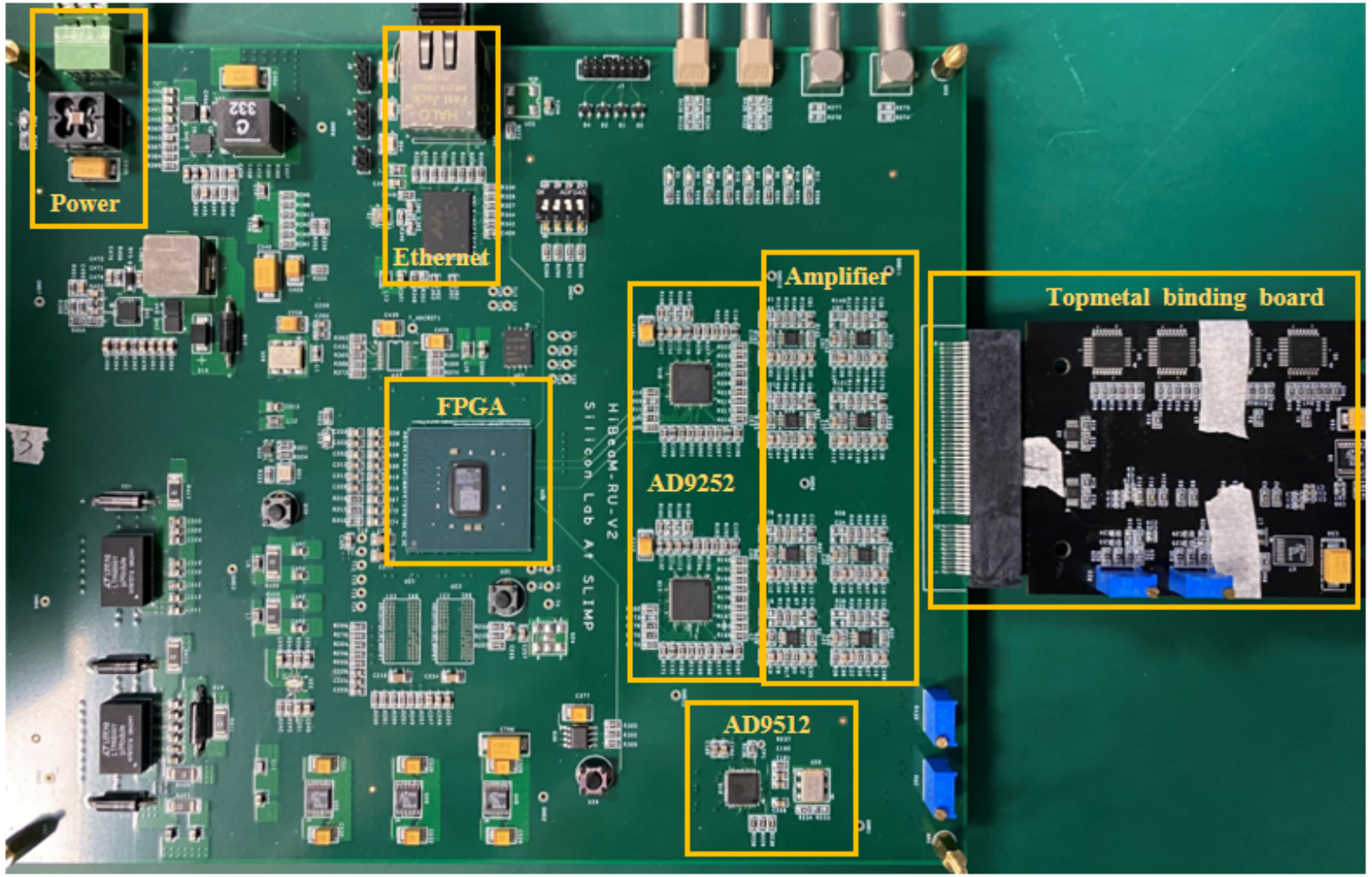
col_ib电流大小比较

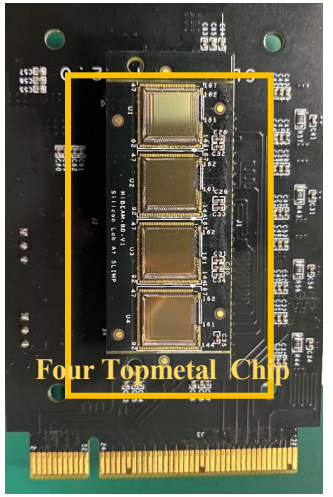
扫描时钟相位测试

改上升衰减时间

# 01 电子学噪声测试

# 读出电子学实物图




高速ADC芯片AD9252

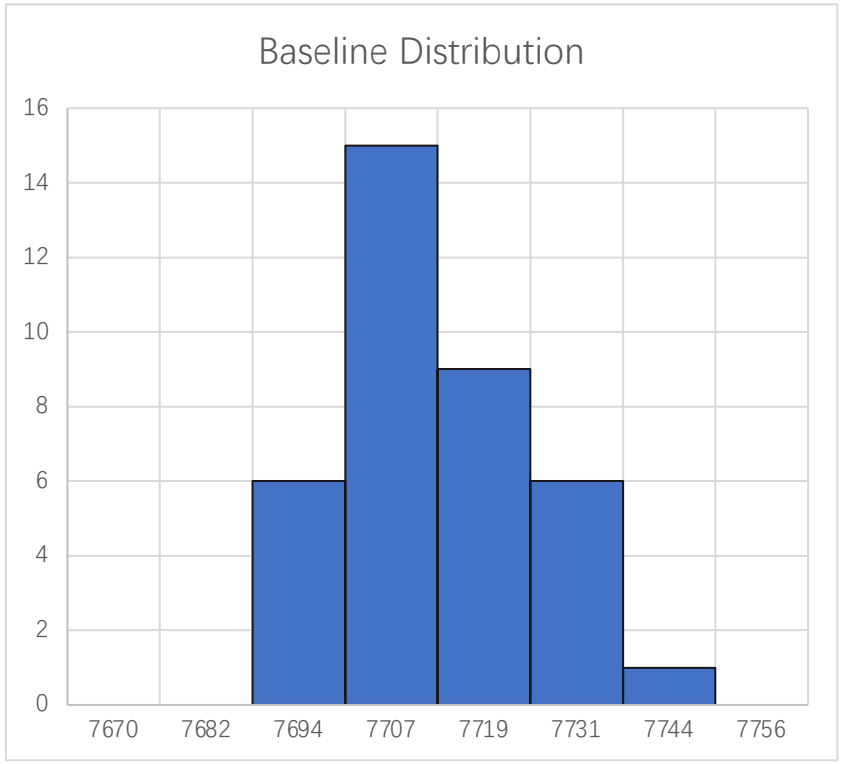
- 8通道ADC
- 单通道14bit
- 工作频率最高可达50MSPS

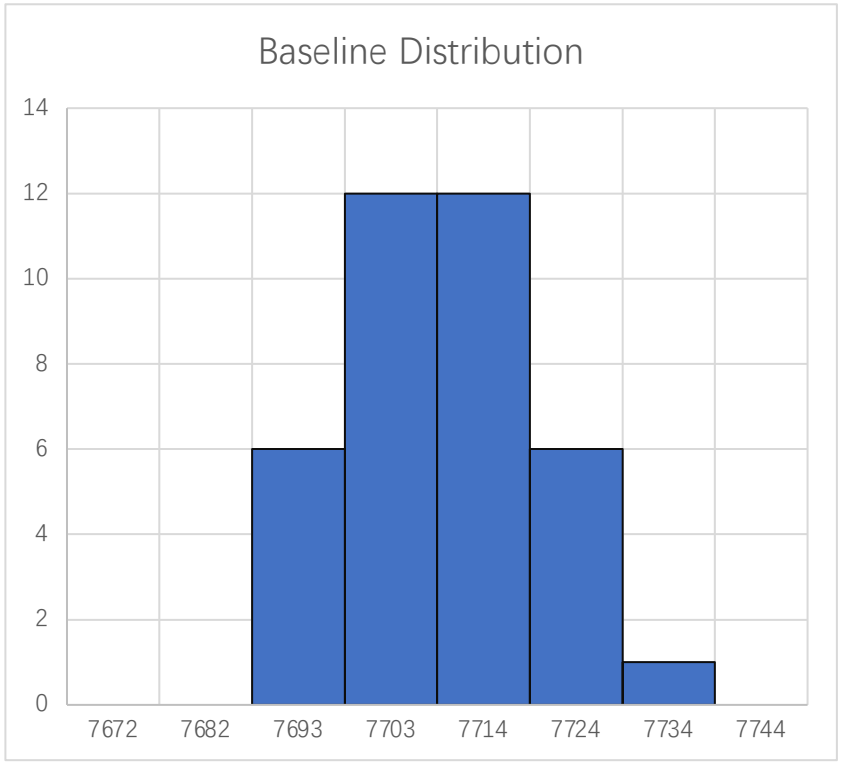
# 芯片噪声测试

**使用的ADC芯片为AD9252：14bit，Vref=1V,1bit=1/$2^{14}$=0.061mV，1mV=33e-**

使用新绑定的芯片，1.25MHz下连续读出，每次选择第四个像素，测量两次，每次37个点。

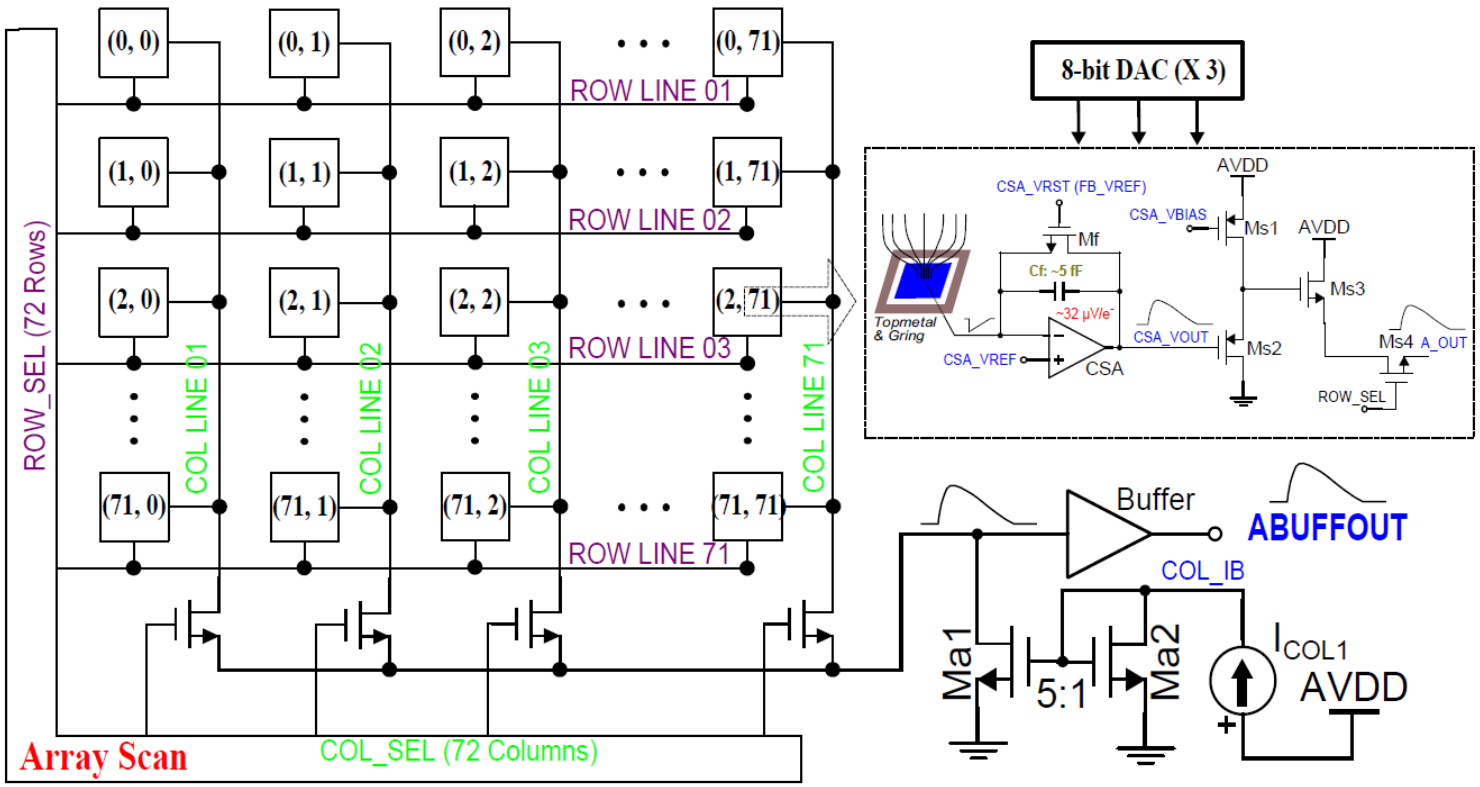
| | 信号基线(ch) | 方差（ch） | 噪声水平(mV) | 噪声水平(e-) |
|---|---|---|---|---|
| 1 | 7708 | 10.43325706 | 0.636 | 20.99e- |
| 2 | 7712 | 12.31255859 | 0.751 | 24.78e- |



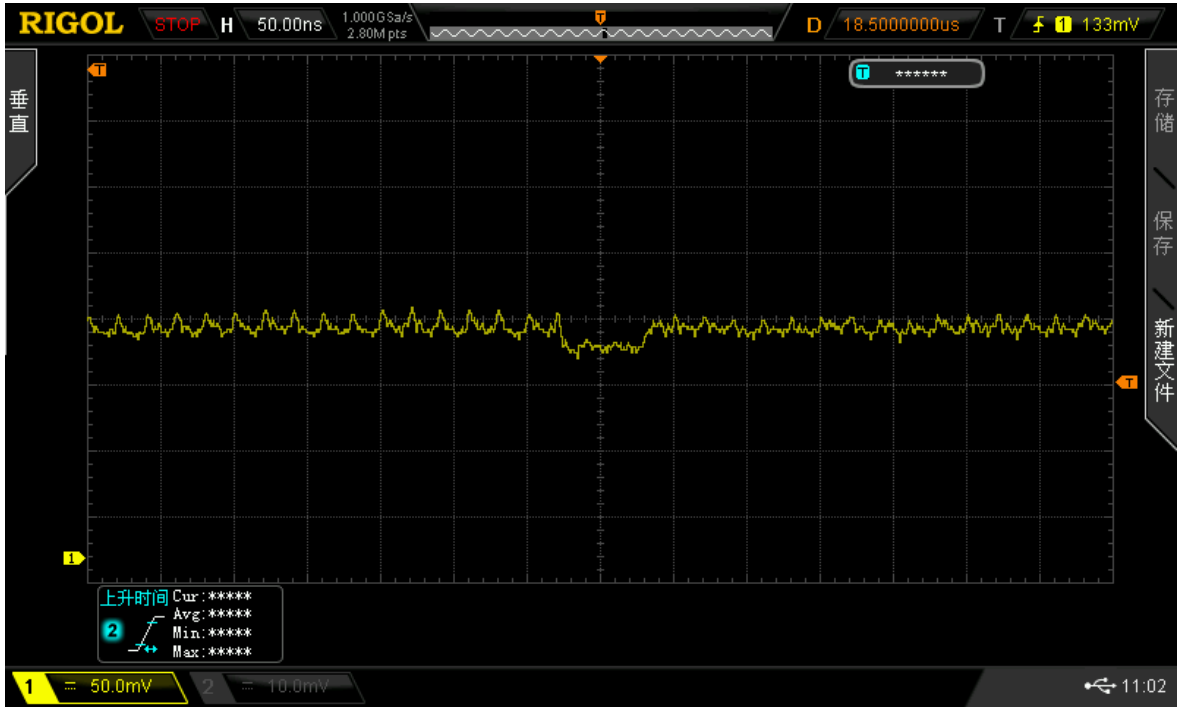
# 02 col_ib的影响

# col_ib影响信号基线，驱动能力

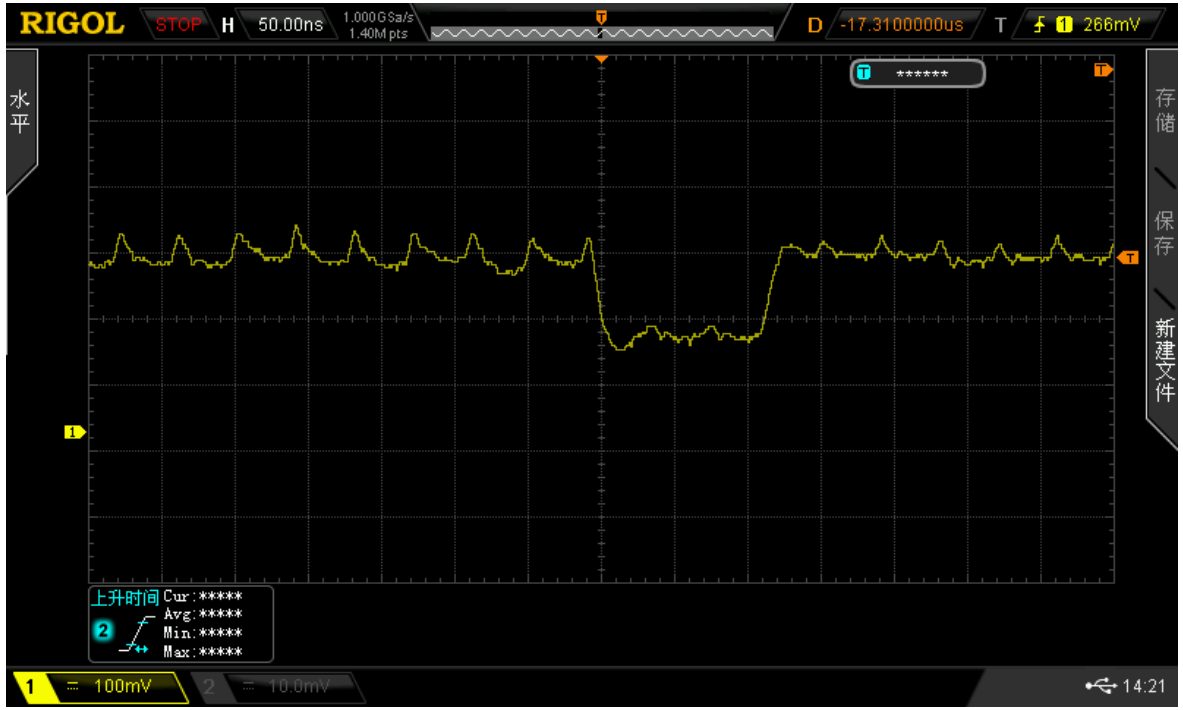



- 调整两级源跟随工作电流，进而调整扫描频率，增强驱动能力

# 示波器观察信号




接5.1k电阻

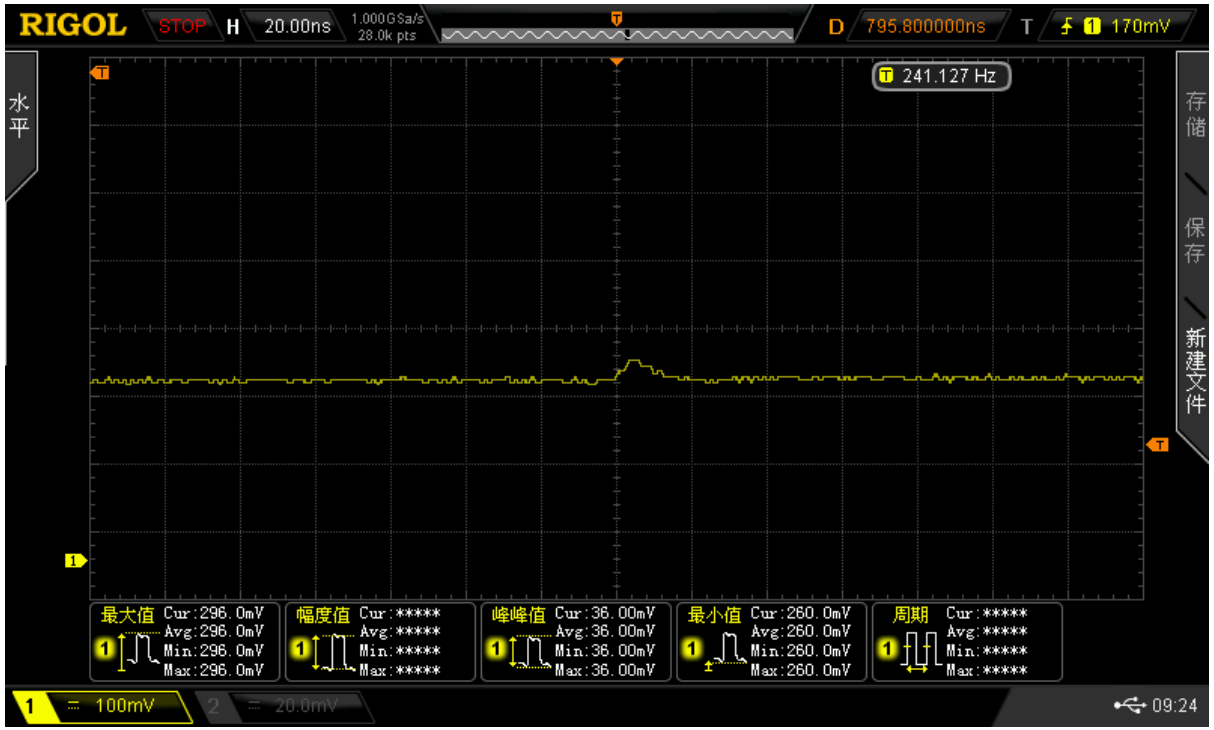



接10k电阻

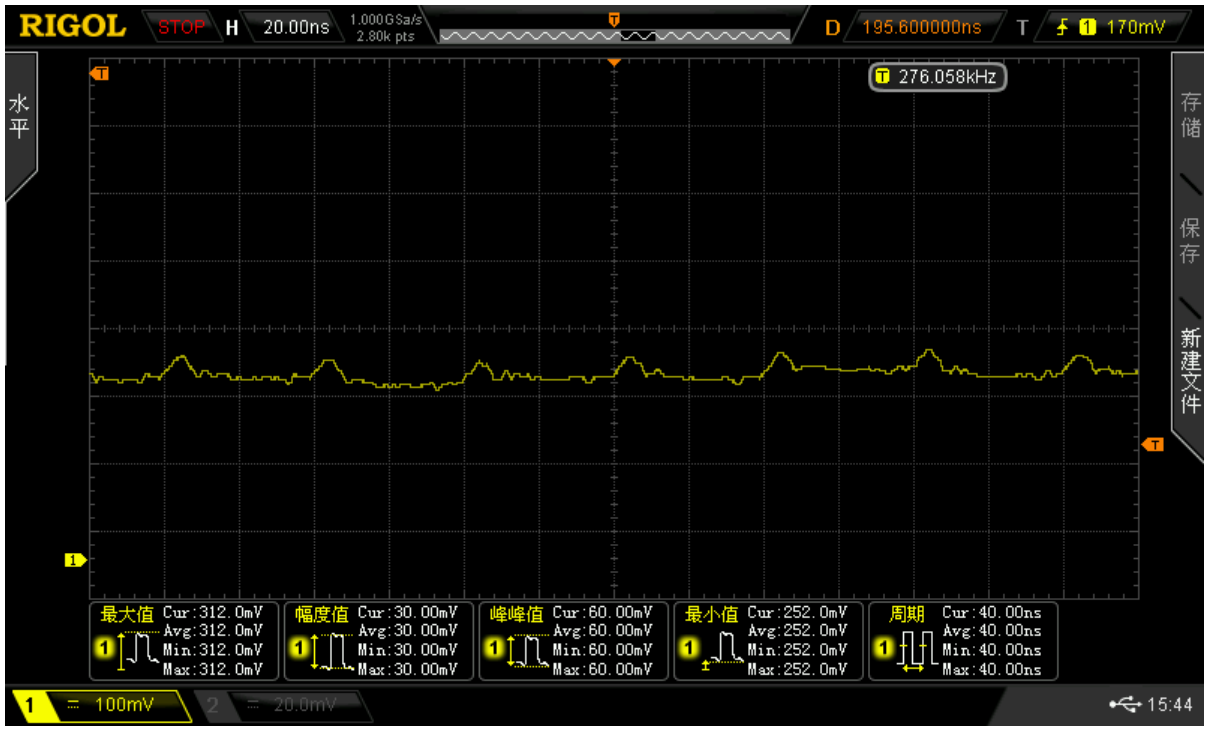
- 5.1k电阻与10k电阻驱动能力相当，10k电阻的稳定区更明显；
- 5.1k电阻信号的基线更低，前三个像素与正常像素区别很小；10k电阻信号基线较高，前三个像素与正常像素区别明显。

# 03 扫描时钟相位测试

# 像素切换时间




扫描频率1.25M



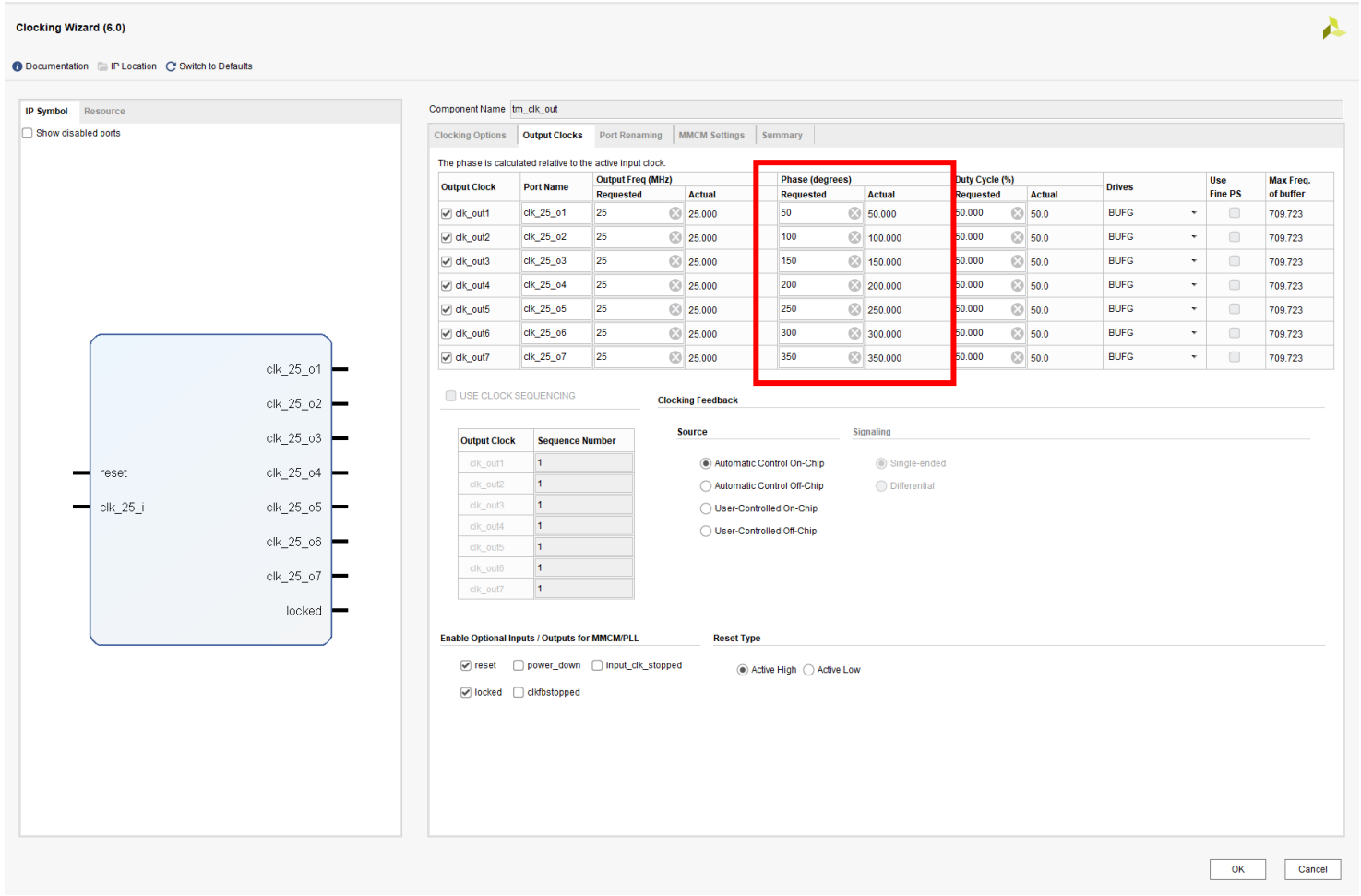

扫描频率25MHz

- 像素切换时间在扫描频率为1.25MHz与25MHz时差别不大，大约为20ns；
- 25MHz下减去像素切换时间后，真正像素值的时间只有20ns。

# 改变扫描时钟相位

- **扫描时钟：25M**
- **ADC采样时钟：25M**

通过vivado自带的时钟核，改变扫描时钟相位，每个时钟间隔50°，基本能覆盖整个信号周期，通过一个mux选择输出。

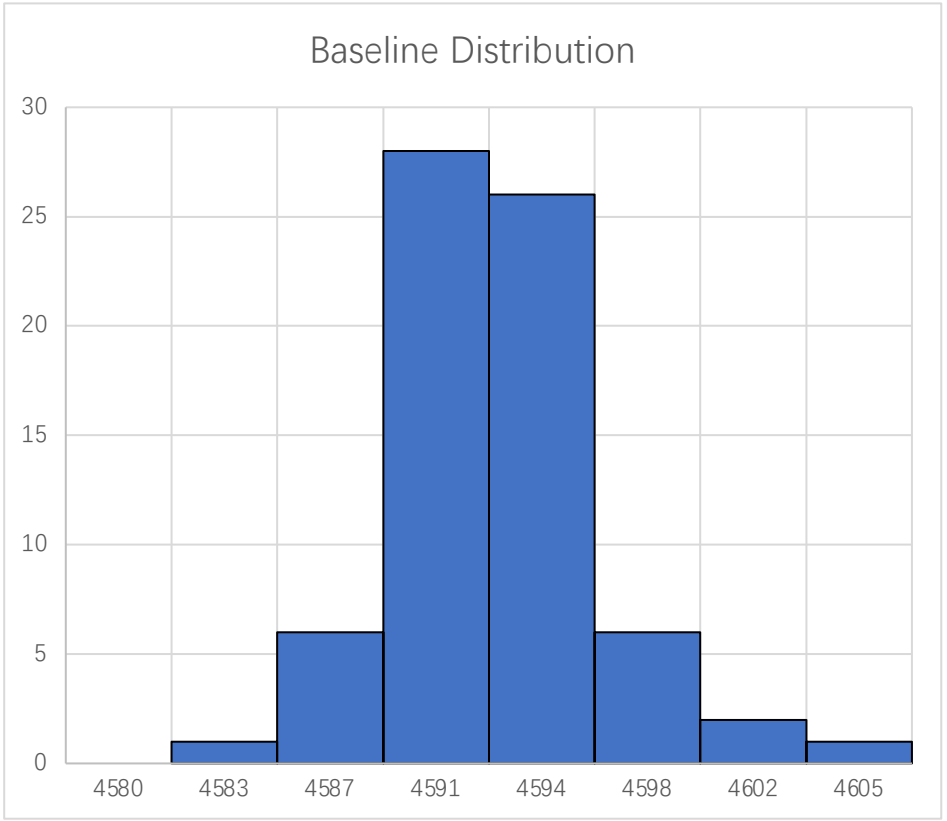



```
always @(posedge clk_200m or negedge reset)begin
    if(reset) begin
        clk_out <= 0;
    end
    else begin
    case (mux[2:0])
     8'd0: clk_out <= clk1;
     8'd1: clk_out <= clk2;
     8'd2: clk_out <= clk3;
     8'd3: clk_out <= clk4;
     8'd4: clk_out <= clk5;
     8'd5: clk_out <= clk6;
     8'd6: clk_out <= clk7;
     8'd7: clk_out <= clk_25m;
    default: clk_out <= clk_25m;
    endcase
    end
end
```

# 信号基线测试

增大col_ib后，芯片扫描时钟工作在25MHz，扫描时钟与ADC采样时钟相同，ADC一个像素只能采一个点，为了避免采到像素切换时的点，需要改变时钟相位，使ADC能恰好采到像素正常工作时的平台区。首先在1.25MHz下进行测试，得到信号的标准基线水平。

- **扫描时钟：1.25M**
- **ADC采样时钟：25M**

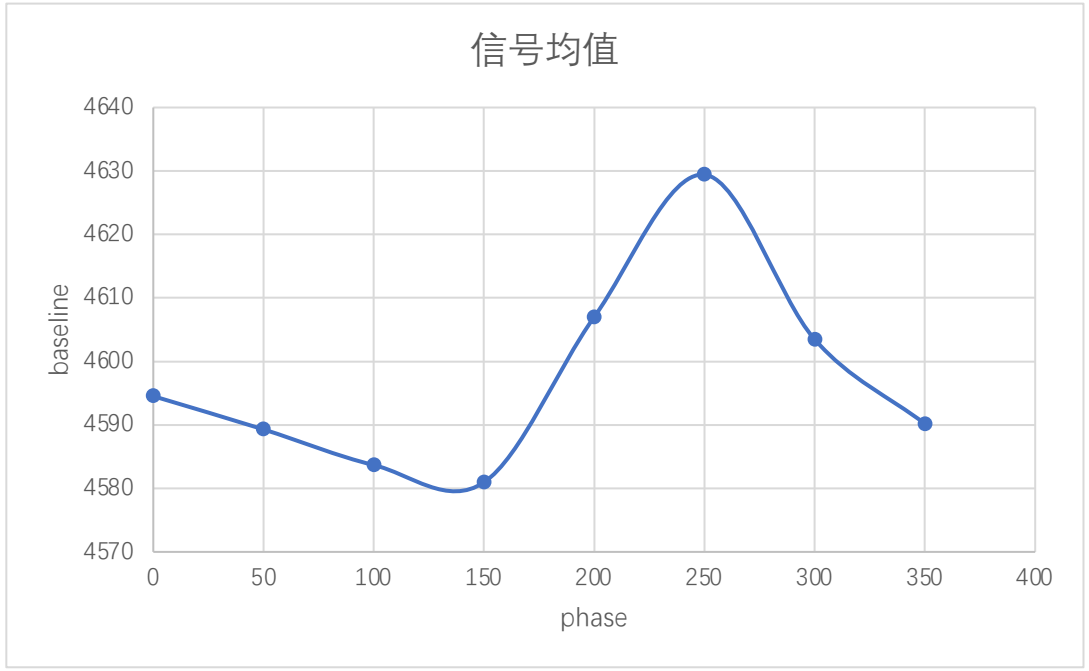


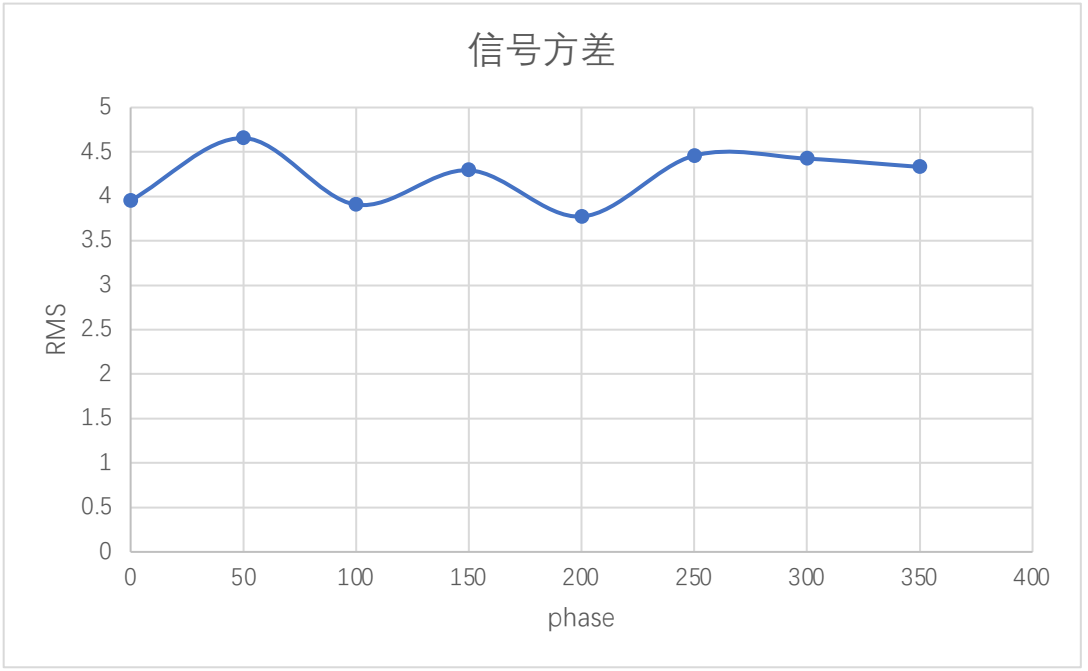

选择芯片第六个像素
基线：4590
方差：3.89

# 改变扫描时钟相位

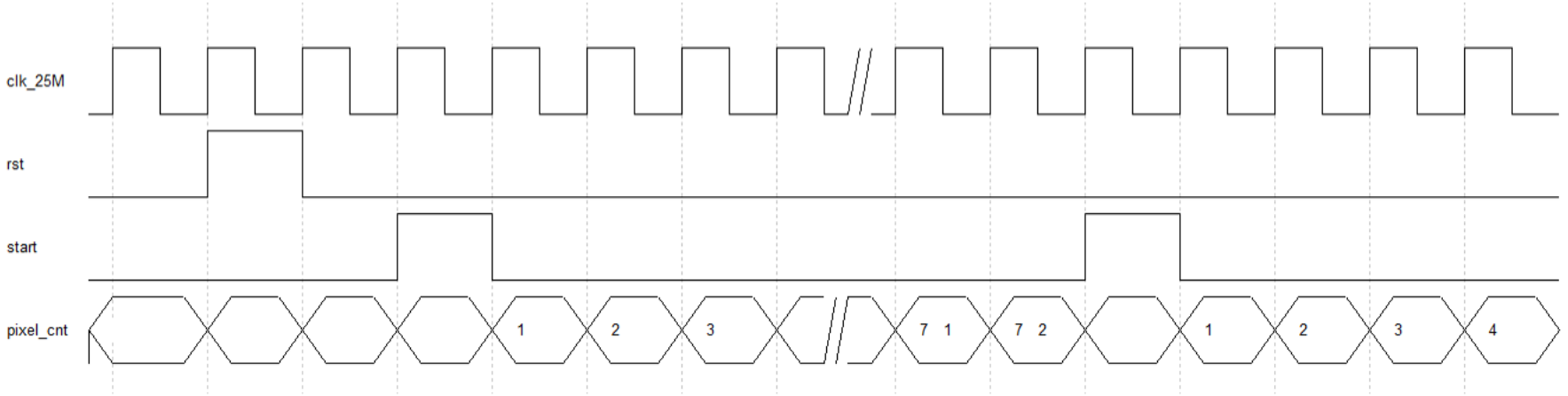
- **扫描时钟：25M**
- **ADC采样时钟：25M**

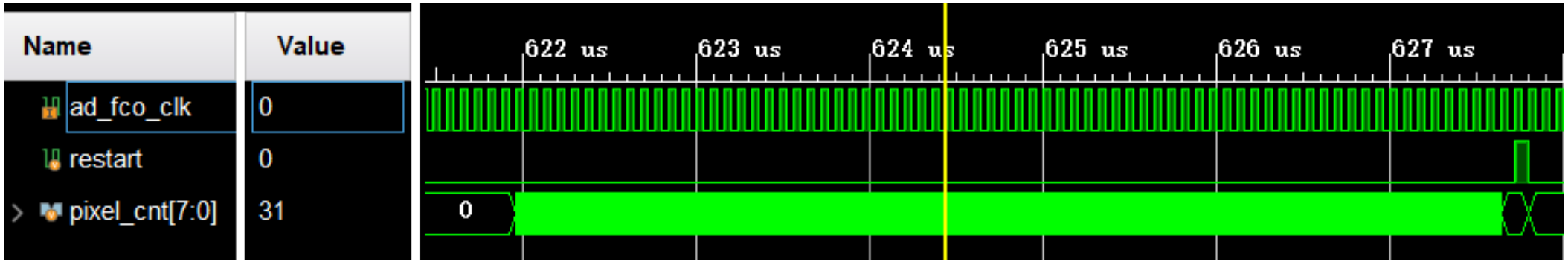
分别改变扫描时钟的相位，读出数据，画出芯片的第六个像素点的基线与方差分布图



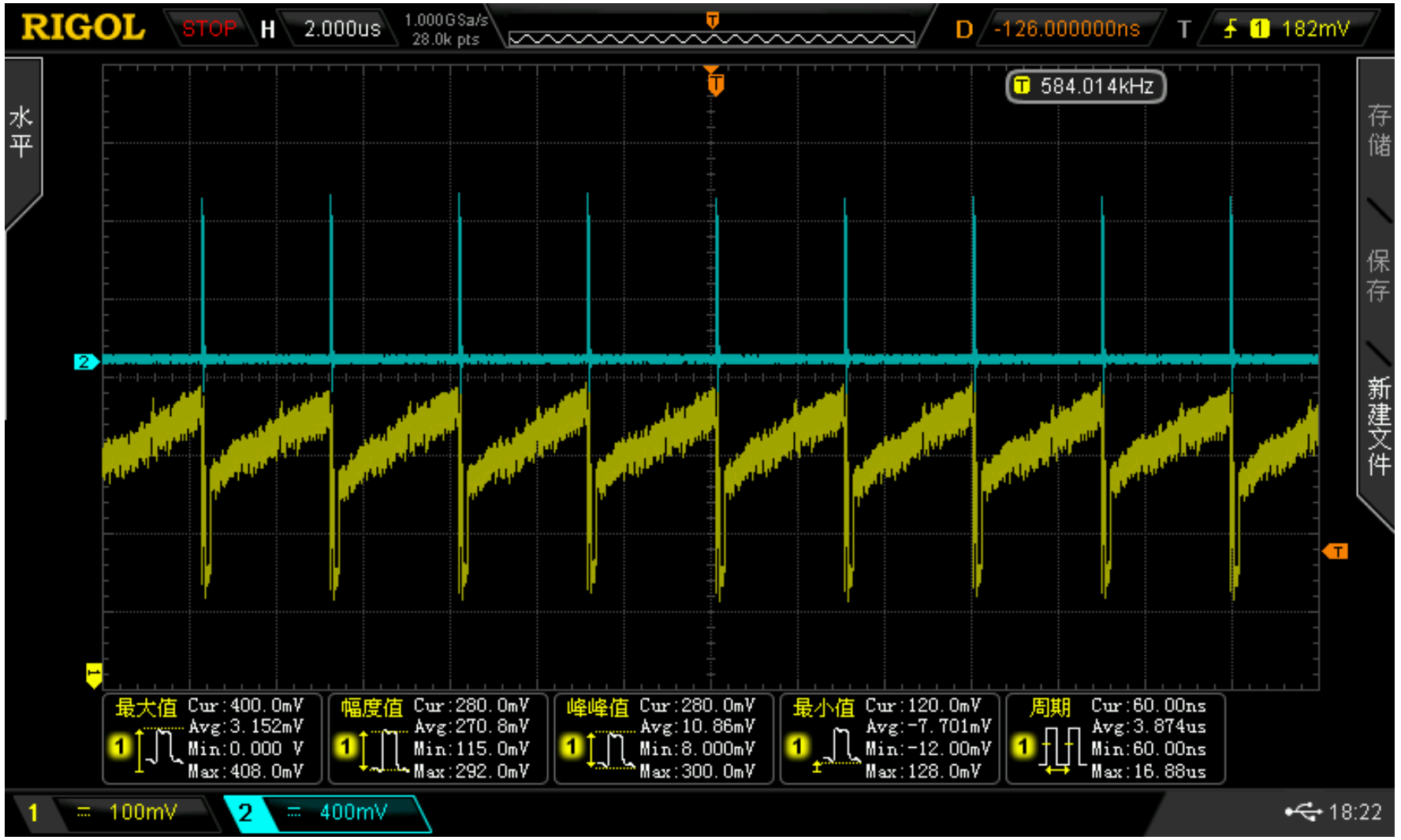
# 只读一行测时间分辨



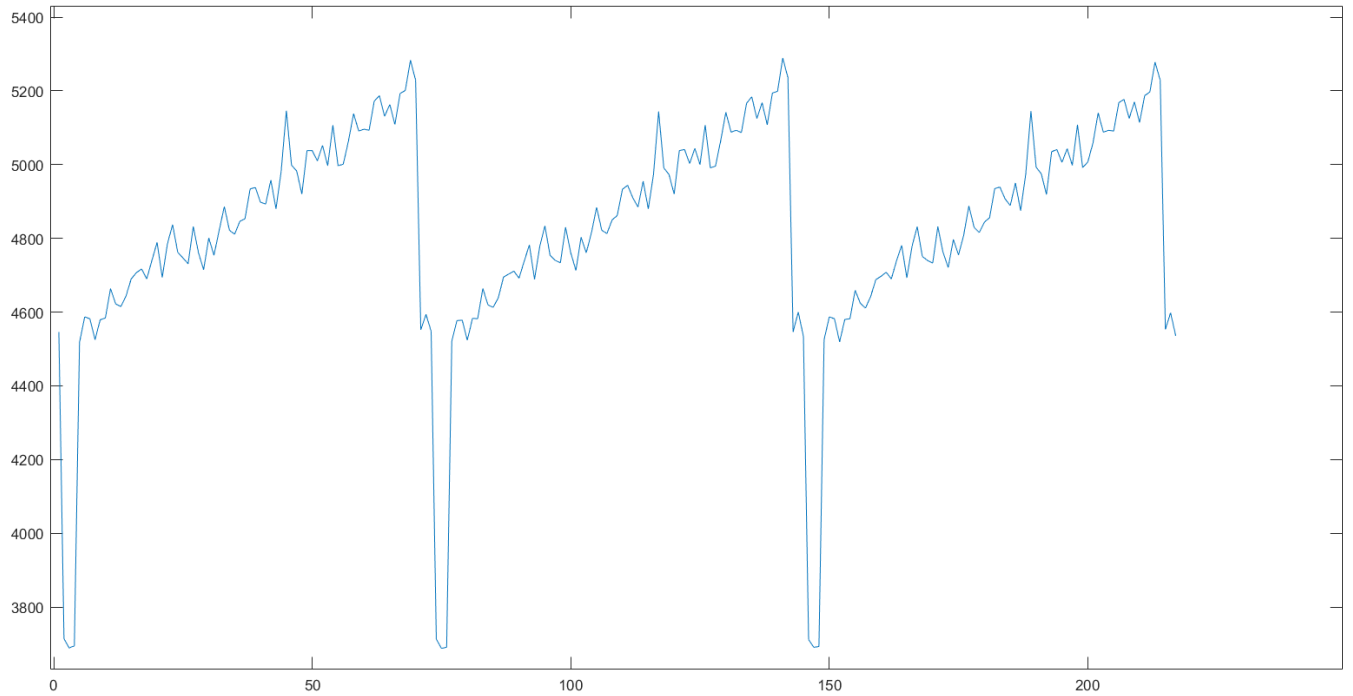

只读一行工作时序图

# 只读一行测时间分辨




实测波形图

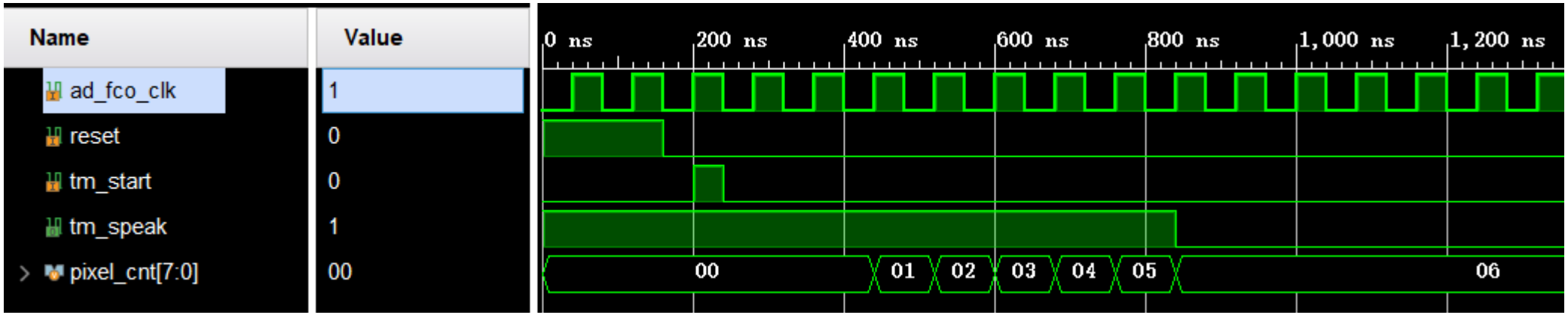
# 只读一行测时间分辨




实测波形图

# 04 上升衰减时间测试

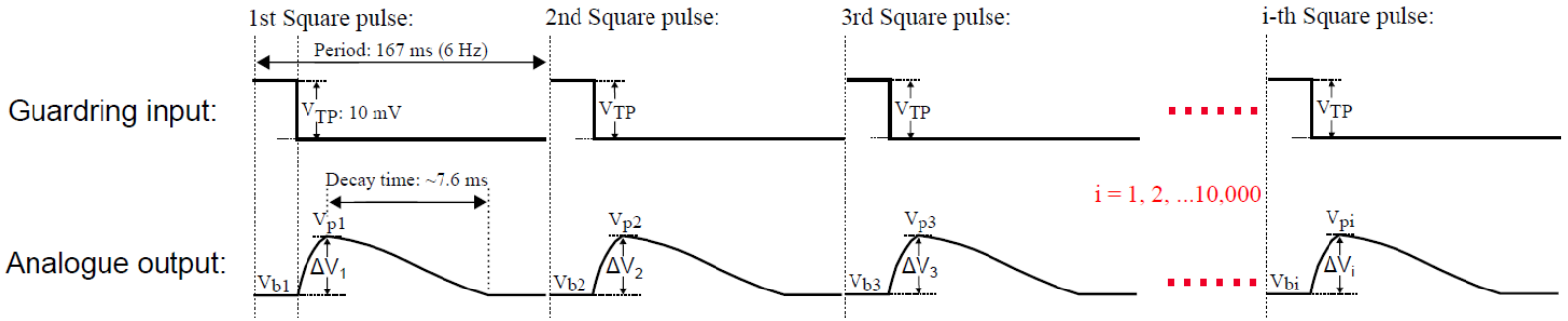
# Topmetal-II- ArrayScan选择像素




ArrayScan停在某个像素

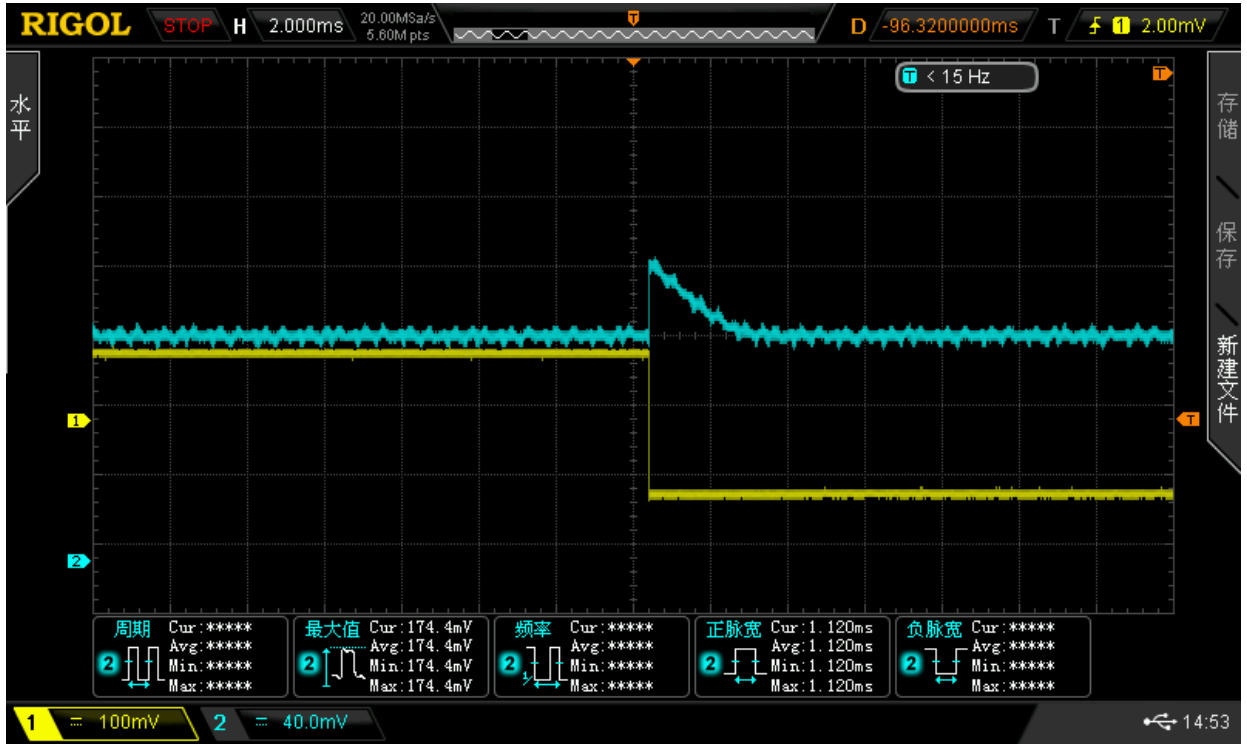
# Topmetal-II- 单个像素模拟读出

测试方案




Guardring激励方波，注入电荷

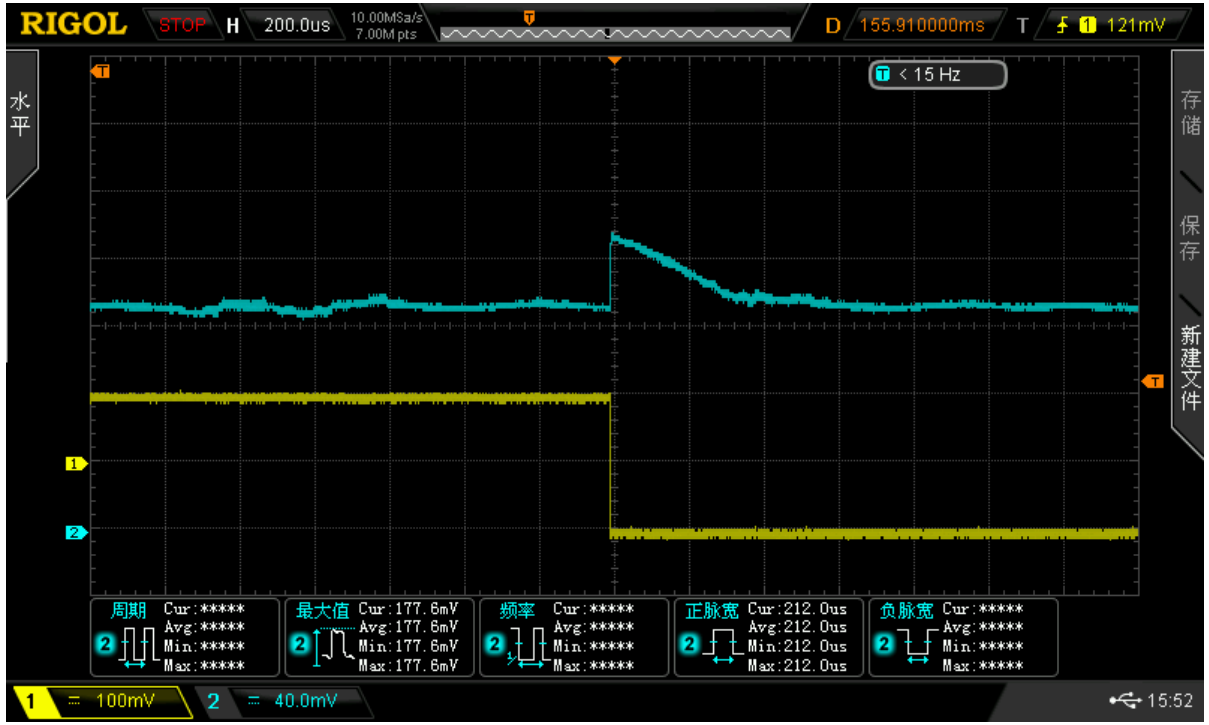
$$V_o = V_p e^{-\frac{t}{\tau}} \qquad \tau \propto {}^{1}/_{\Delta V} \qquad \Delta V = (V_{ARST\_VREF} - V_{CSA\_VREF})$$



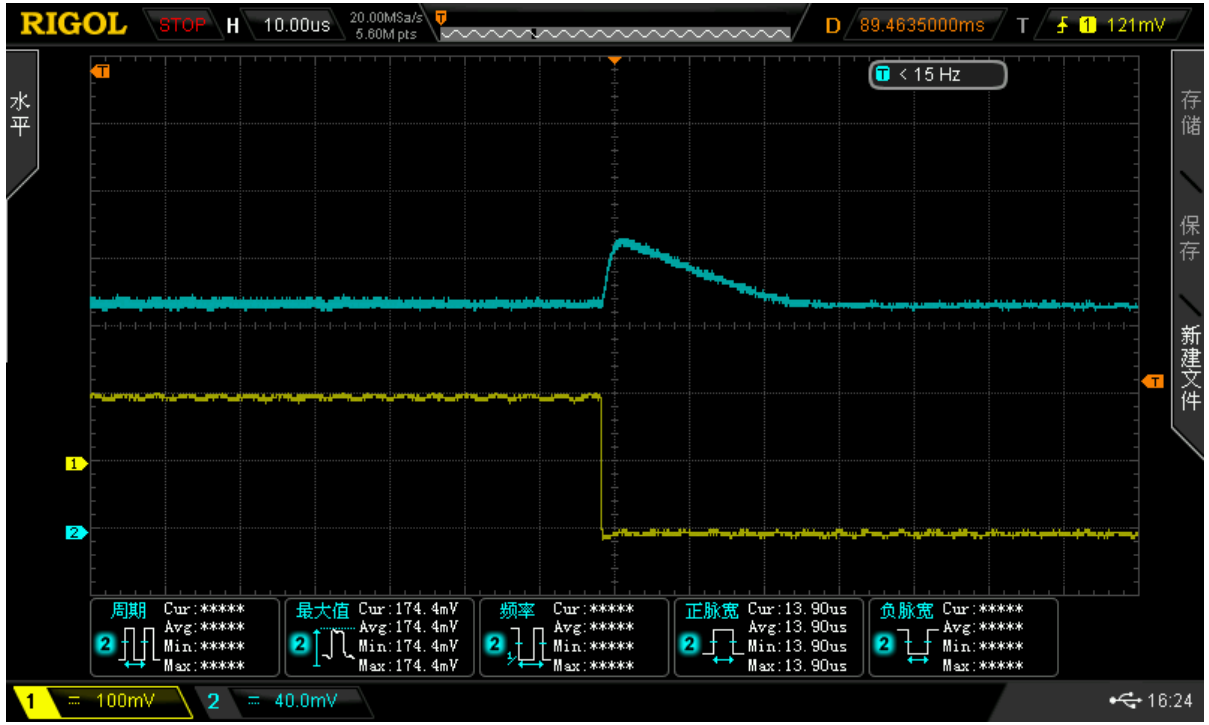

ARST_VREF=0.78V，CSA_VREF=0.62V，$\Delta V$ =0.16V，输入幅度为200mV，频率2Hz的方波信号，用示波器直接观测输出模拟信号，输出信号的上升时间大概4us，下降时间大概4ms。

# Topmetal-II- 单个像素模拟读出

输入幅度为200mV，频率2Hz的方波信号，用示波器直接观测单个像素输出的模拟信号

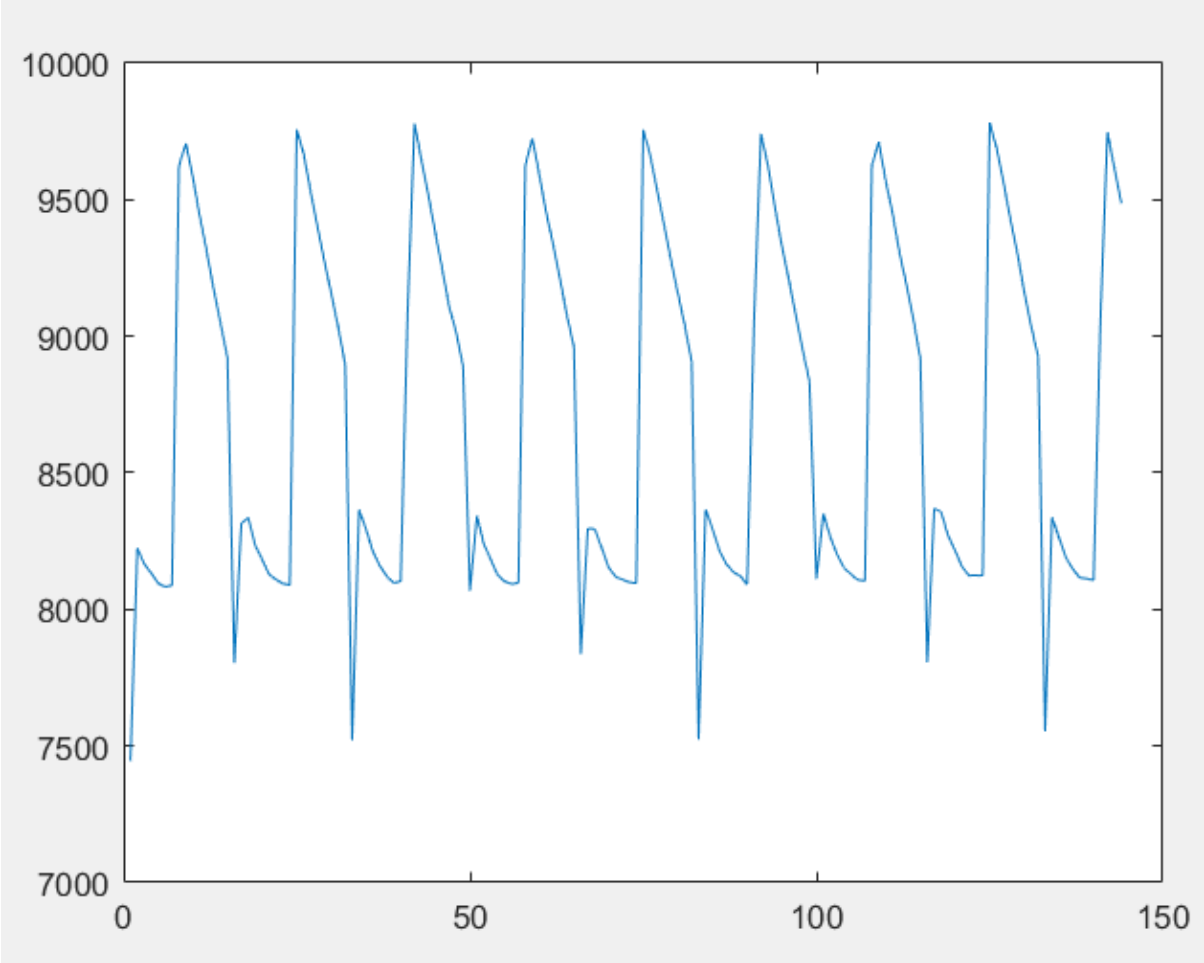



ARST_VREF=0.85V，CSA_VREF=0.62V，$\Delta V$ =0.23V
rise time: 3us，fall time: 350us

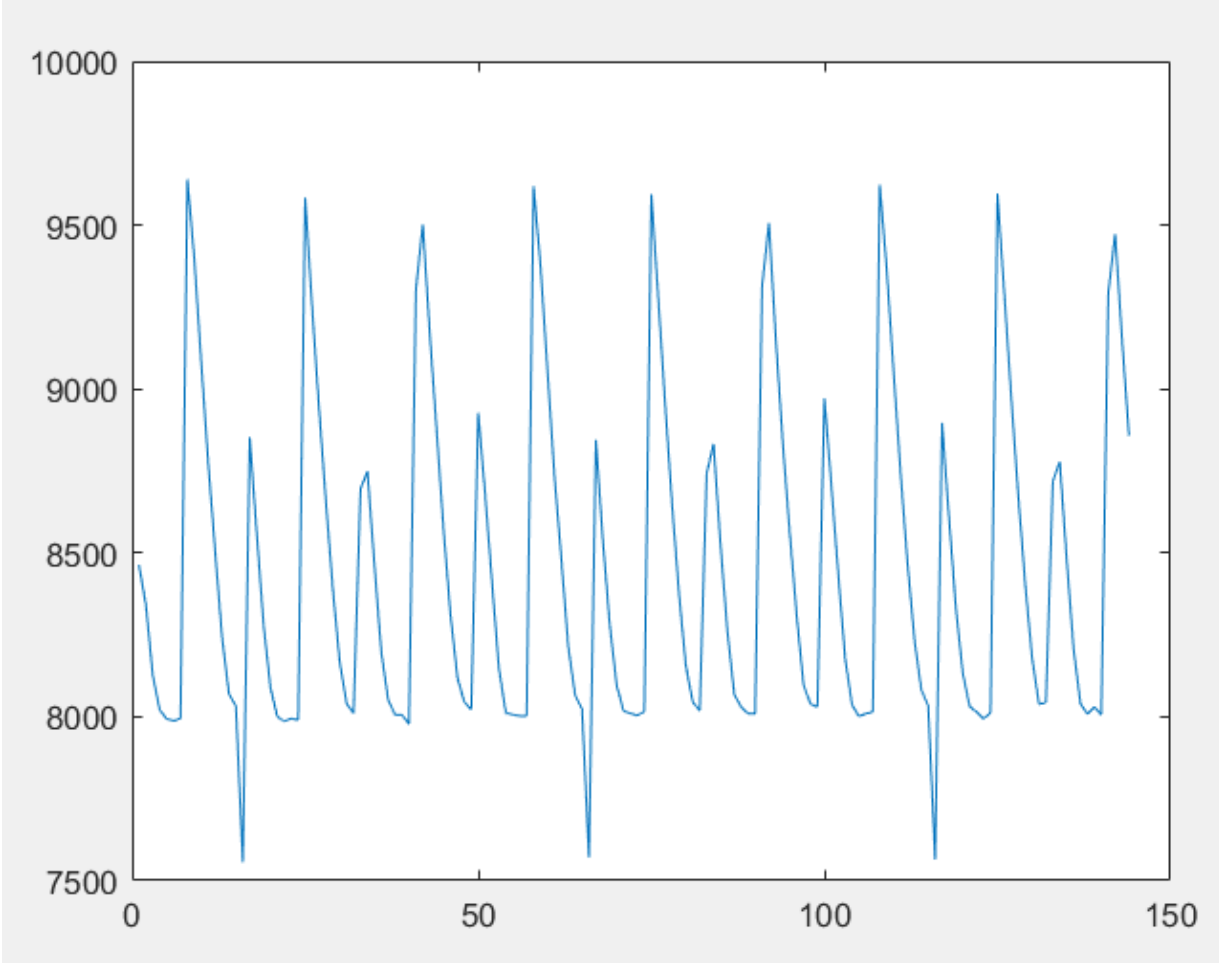



ARST_VREF=0.95V，CSA_VREF=0.62V，$\Delta V$ =0.33V
rise time: 2us，fall time: 20us

# Topmetal-II- 像素不一致性




第五个像素




第六个像素