Tpc electronics TDR

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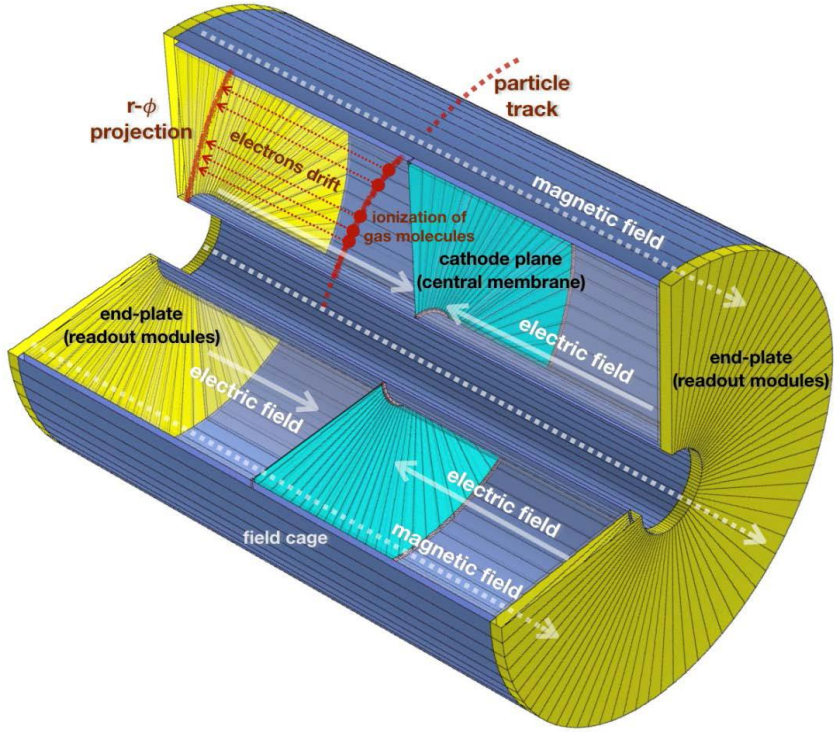
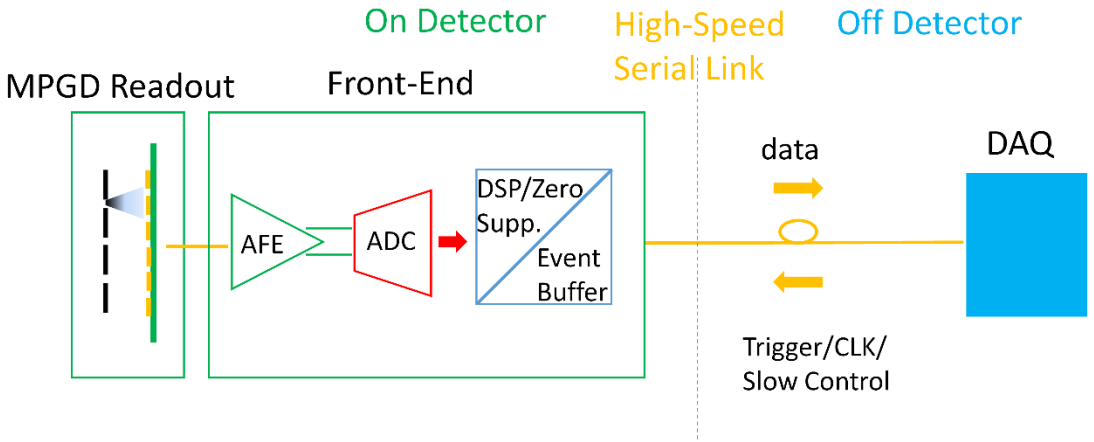
02/01/2024

TPC Electronics

- 主要指的是front-end部分，不包含DAQ
- 探测器方案
  - pad readout，pixel readout，两者皆有（空间、时间？）
  - 制冷：two phase CO2?
- DAQ
  - 接口：类似gbt的方案？
  - 如何扩展：模块化



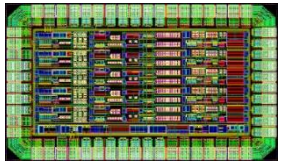


已有基础：WASA

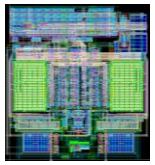
- 研制历程

2017

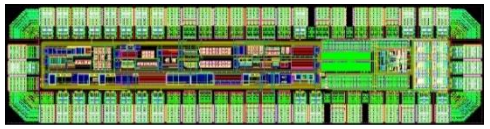
5ch Analog FEE



SAR ADC

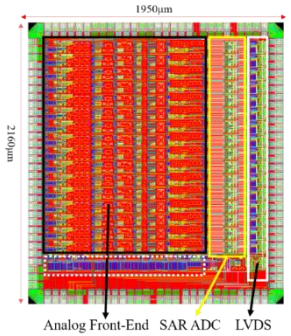


AFE+SAR ADC



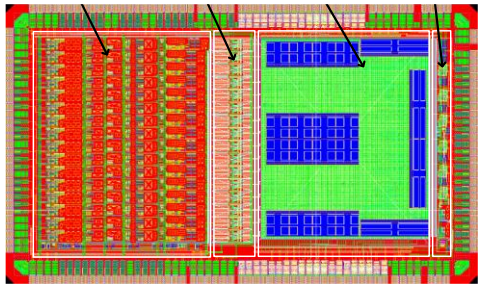
2019

WASA_v0



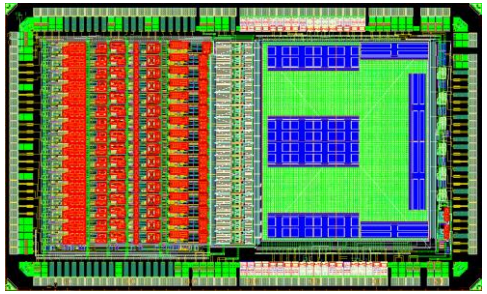
2021

WASA_v1p0

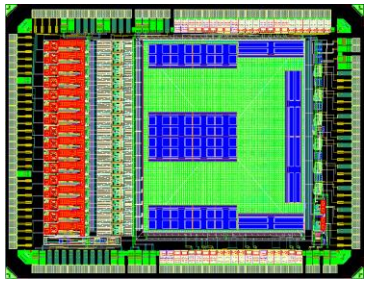


2022-2023

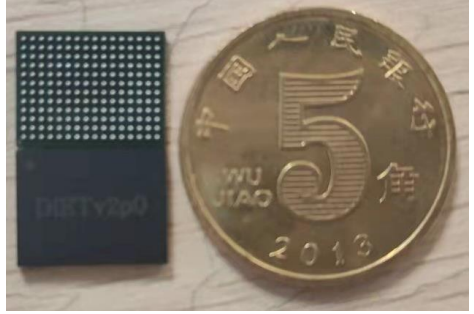
WASA_v1p1



WASA_DSP_v1p0



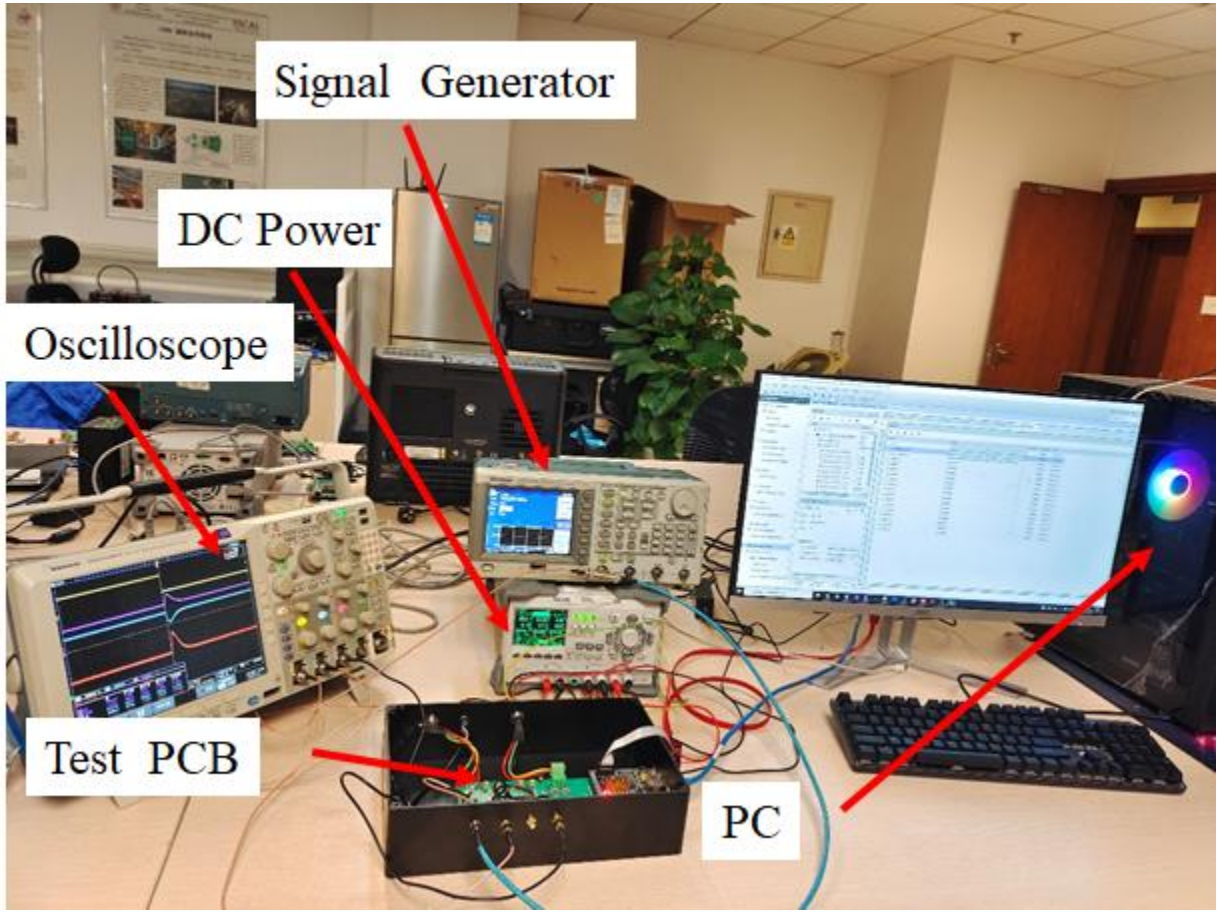
已有基础：WASA

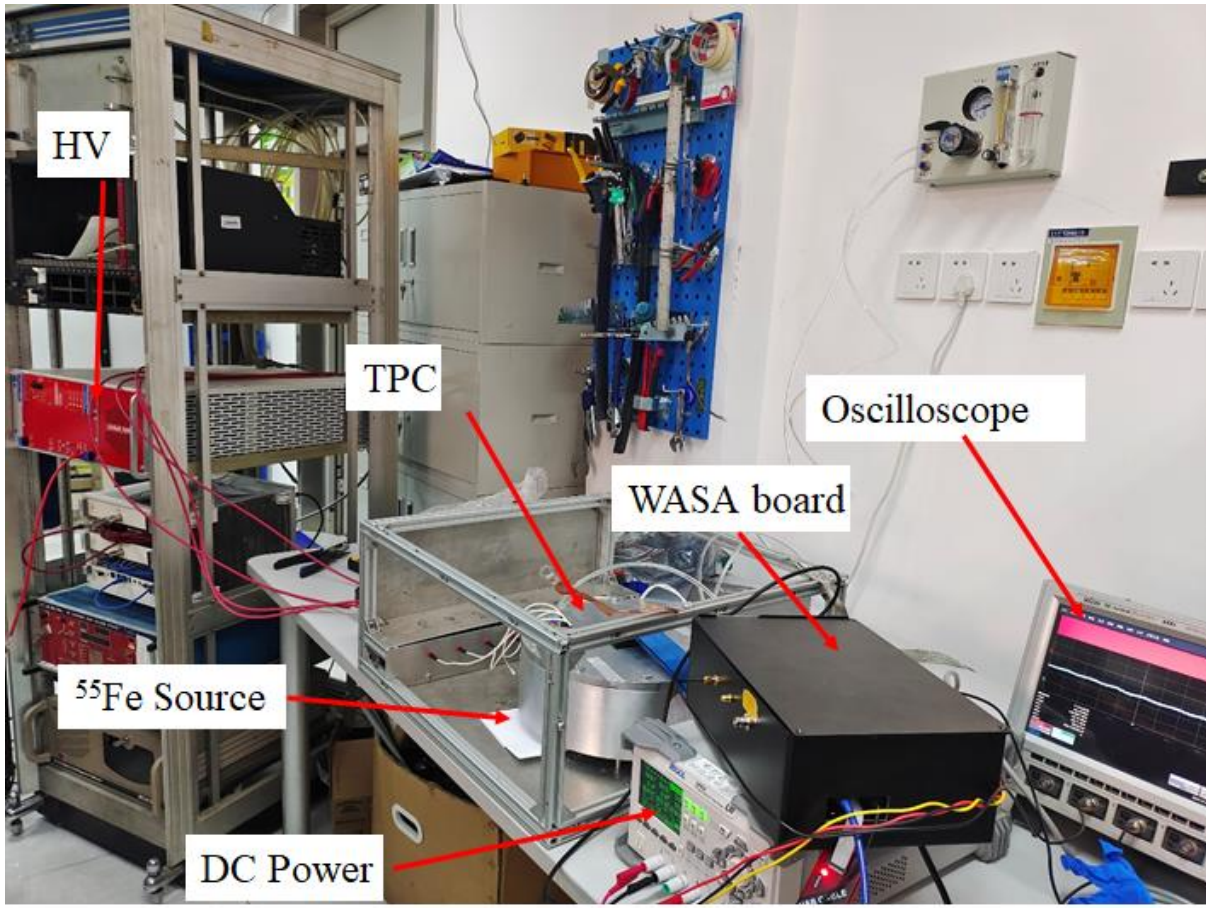


	PASA+ALTRO	Super-ALTRO	SAMPA	WASA
TPC	ALICE	ILC	ALICE upgrade	CEPC
Pad size	4x7.5 mm^2	1x6 mm^2	4x7.5 mm^2	1x6 mm^2
Number of channels	5.7× 10^5	1-2 × 10^6	5.7 × 10^5	2 x×10^6
Readout detector	MWPC	GEM/MicroMegas	GEM	GEM/MicroMegas
Gain	12 mV/fC	12-27 mV/fC	20/30 mV/fC	10-40 mV/fC
Shaper	CR-$(RC)^4$	CR-$(RC)^4$	CR-$(RC)^4$	CR-RC
Peaking time	200 ns	30-120 ns	80/160 ns	160-400 ns
ENC	370+14.6 e/pF	520 e	246+36 e/pF	569+14.8 e/pF
Sampler	Pipeline ADC	Pipeline ADC	SAR ADC	SAR ADC
Sampling rate	10 MHz	40 MHz	10 MHz	10-100 MHz
Resolution	10 bit	10 bit	10 bit	10 bit
Power (ana.)	11.7 mW/ch	10.3 mW/ch	9 mW/ch	1.4 mW/ch
Power (ADC)	12.5 mW/ch	33 mW/ch	1.5 mW/ch	0.8 mW/ch@40 MHz
Power (digital)	7.5 mW/ch	4.0 mW/ch	6.5 mW/ch	2.7 mW/ch@40 MHz
Total Power	31.7 mW/ch@10MHz	47.3 mW/ch@40 MHz	17 mW/ch@10 MHz	4.9 mW/ch@40 MHz
CMOS Process	250 nm	130 nm	130 nm	65 nm

已有基础：WASA

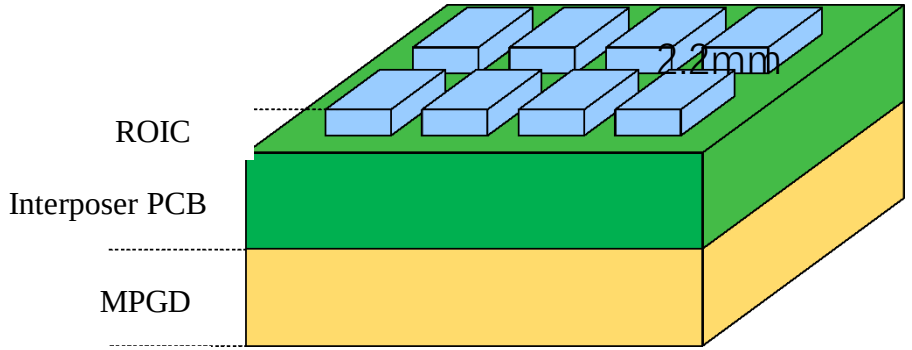
- 测试

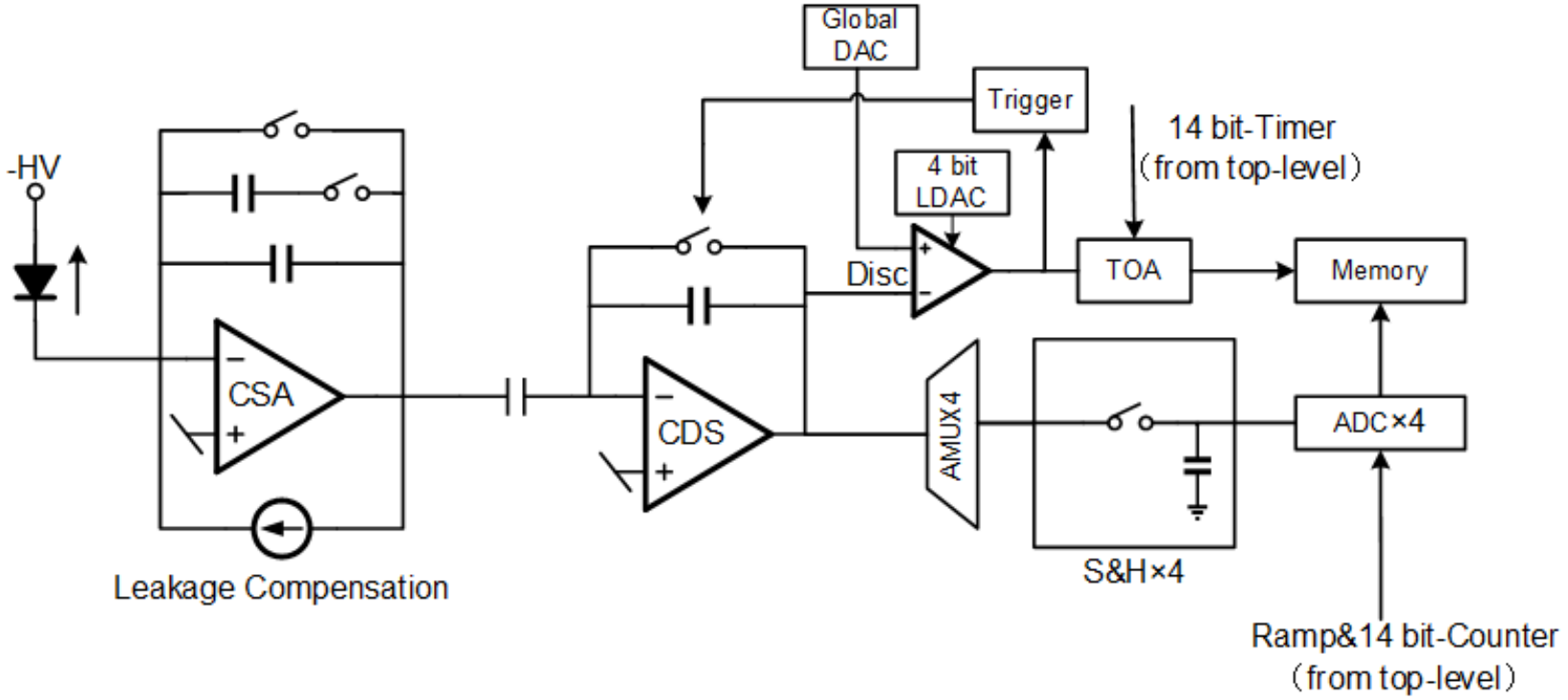

Signal Generator
DC Power
Oscilloscope
Test PCB
PC

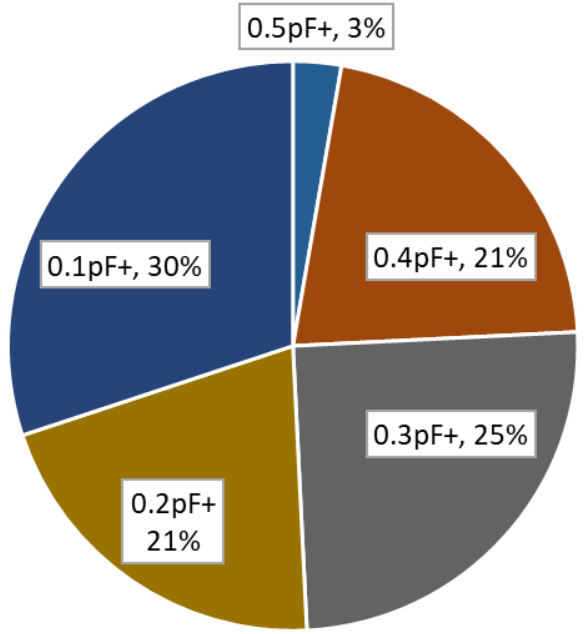

HV
TPC
Oscilloscope
WASA board
^{55}Fe Source
DC Power

已有基础

- Mini-pad or pixel readout







工作计划

- TPC前端读出电子学模块的研制
  - pad读出的TDR方案：~1k通道规模，探测器？
  - Mini-pad or pixel读出的TDR方案：32x32阵列的模块
- 芯片迭代
  - 定型前还需要1轮mpw
- TDR撰写
  - 参考LCTPC，提供一个初版
  - 组织和TPC探测器和DAQ的讨论