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Construction of RHIC-STAR TOF and high rating MRPC

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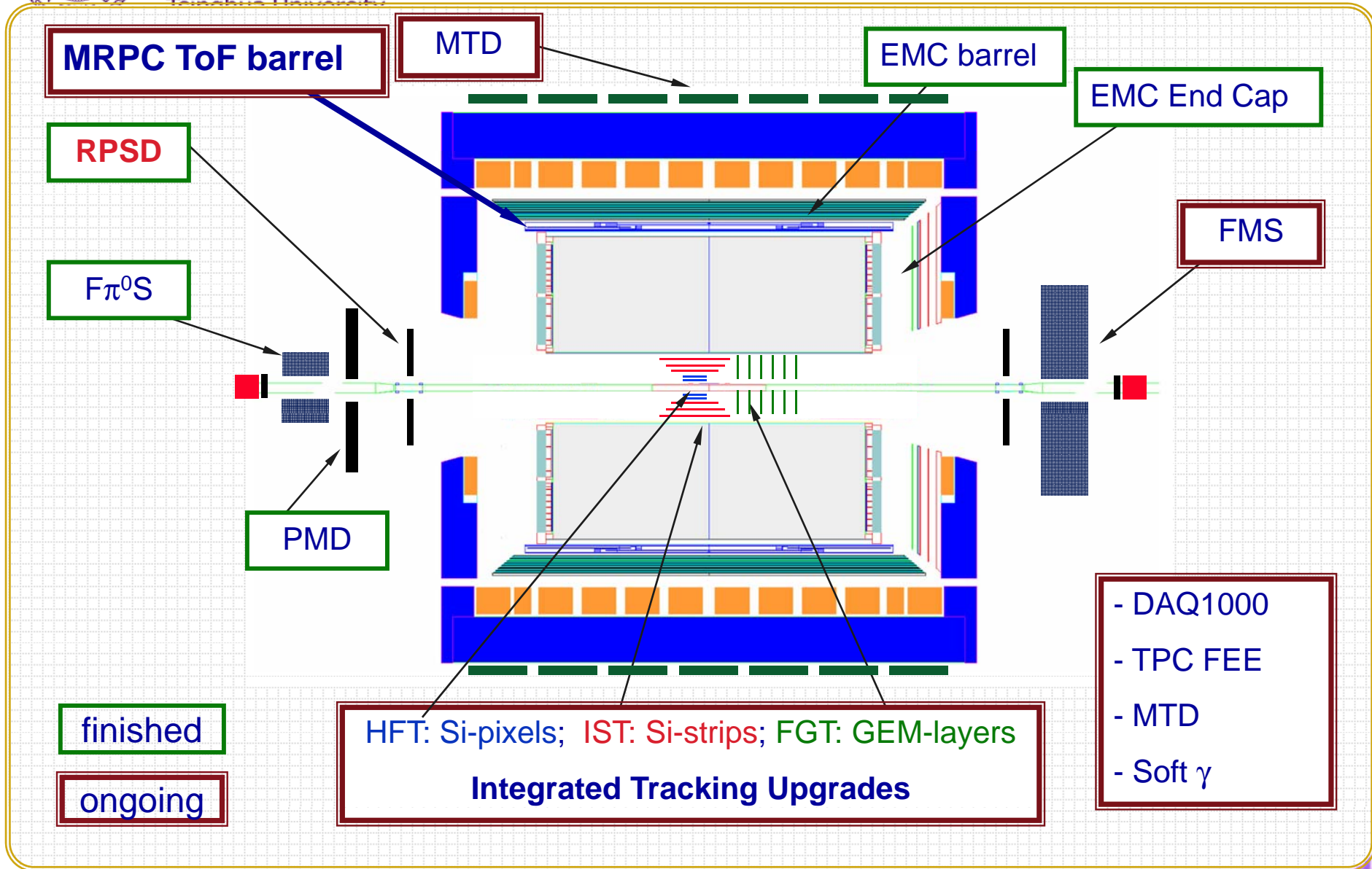
Beijing, 100084, China





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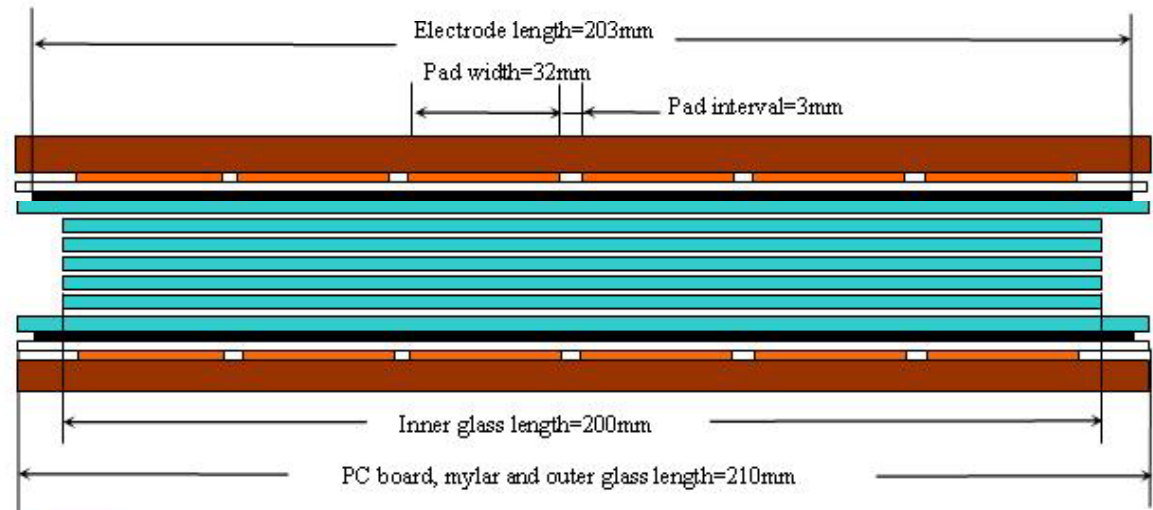
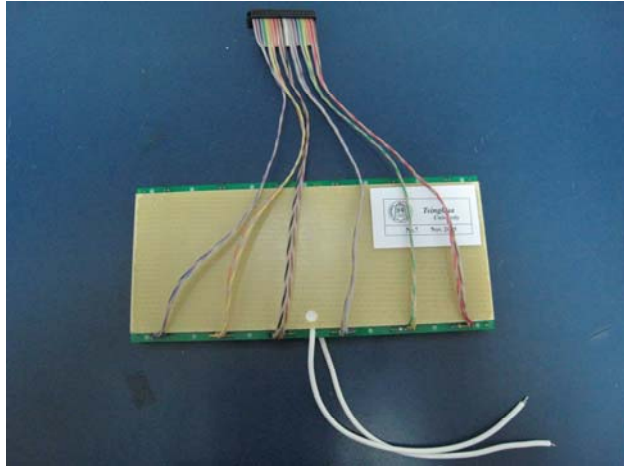
STAR Detector and Upgrades



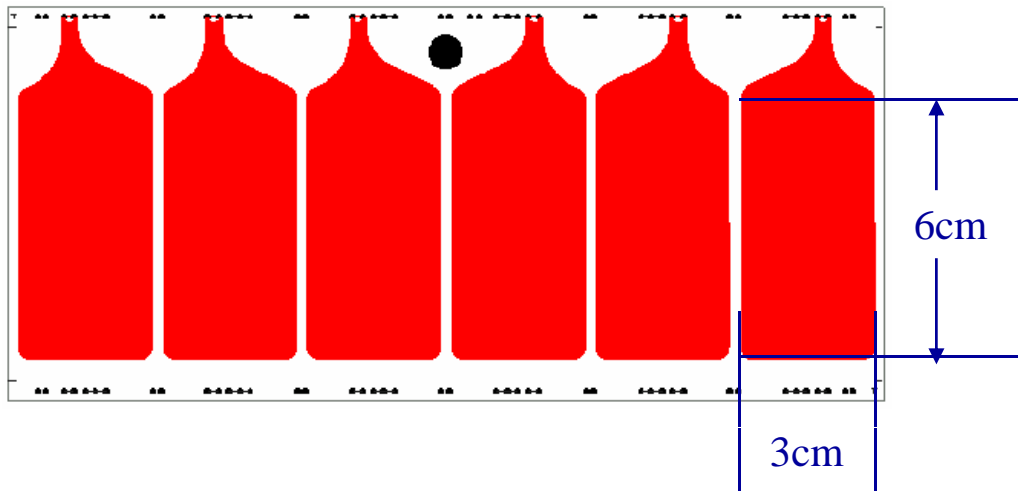


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MRPC used in STAR barrel TOF



- PC board
- Electrode (graphite)
- 0.54 mm thick glass
- pad
- mylar



Glass: 10^{12} - 10^{13} Ω .cm
Carbon tape: 100k Ω /
Gas gap: 6×0.22 mm
Working gas: 95% F134a+5% iso-butane
Time resolution: 80 ps
Efficiency >90%

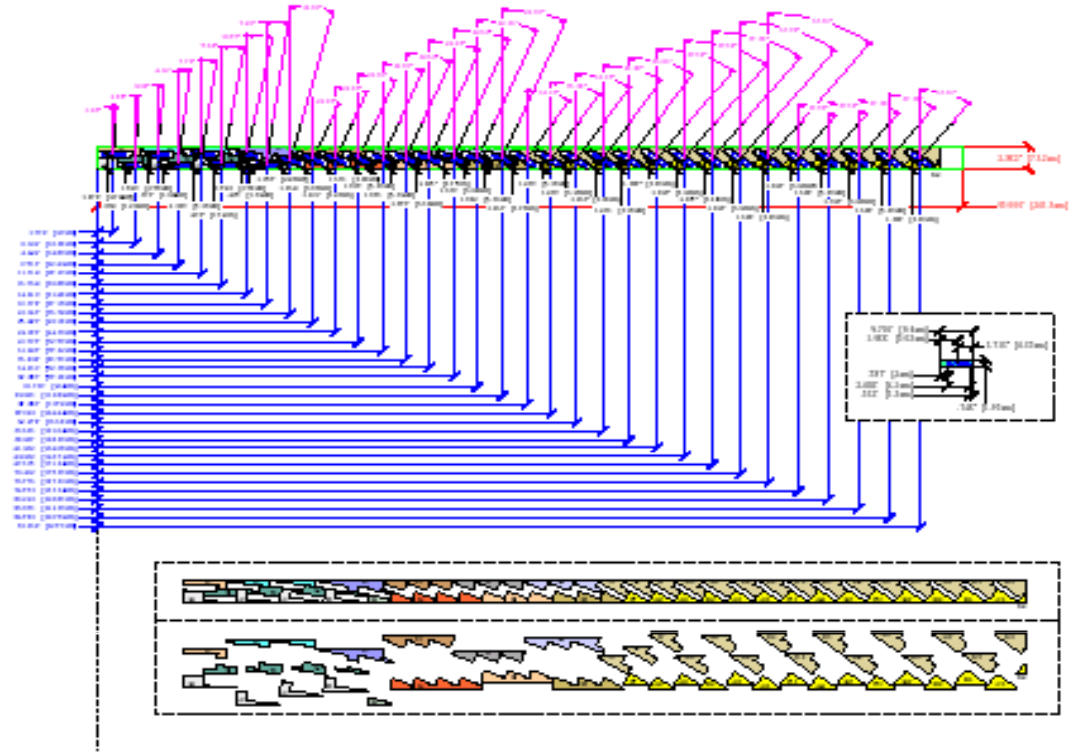
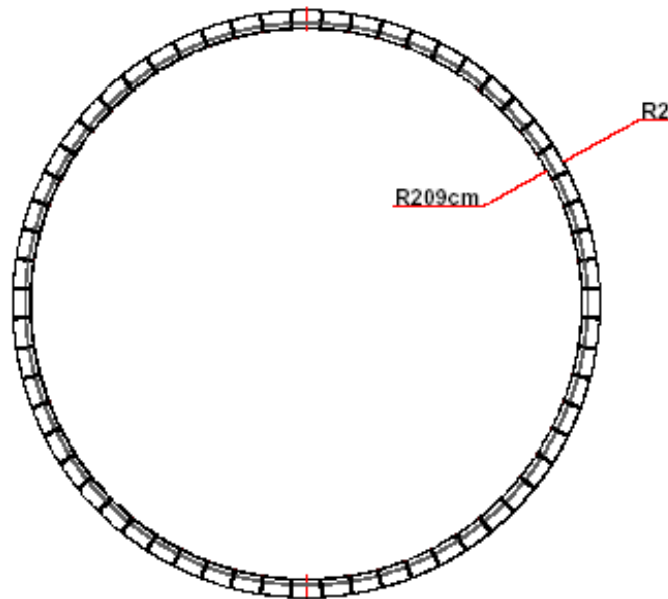
Rates capability: <1kHz/cm² !





Layout of STAR barrel TOF

STAR-TOF_r 在 ϕ 方向有 120 个 Tray (其中正负各 60 个), 每个 Tray 所张的 ϕ 角为 60 度。



Each tray consists of 32 MRPCs, total number of MRPCs of 126 trays is about 4032.





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MRPC Production Milestones

	2006						2007						2008			
	1/2	3/4	5/6	7/8	9/10	11/12	1/2	3/4	5/6	7/8	9/10	11/12	1/2	3/4	5/6	7/8
Prod Start																
132 MRPCs		→														
768 MRPCs		→														
1856 MRPCs		→														
2944 MRPCs		→														
4032 MRPCs		→														

**Beijing, Tsinghua University: 70% of total 4032 modules.
Hefei, USTC: the other 30% modules.**



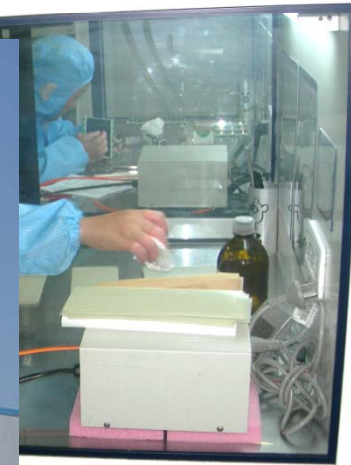


清华大学 STAR MRPC workshop @ Tsinghua

Outer scene of the workshop



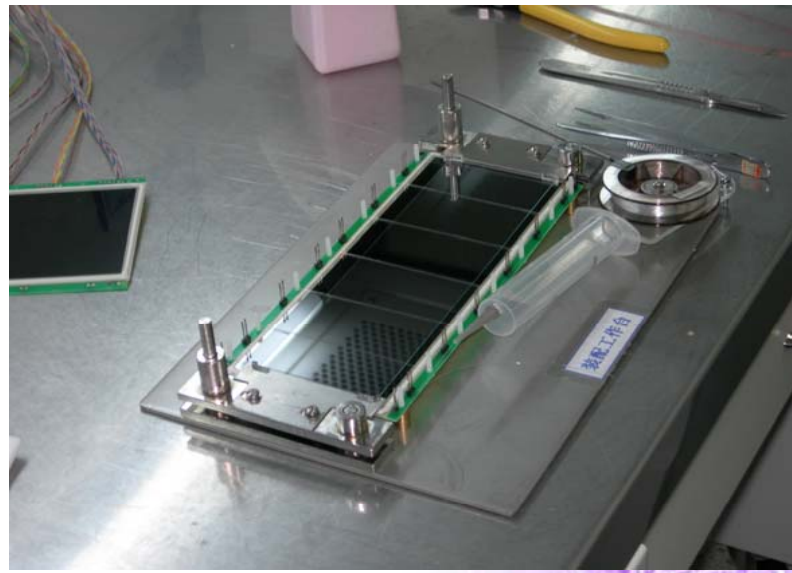
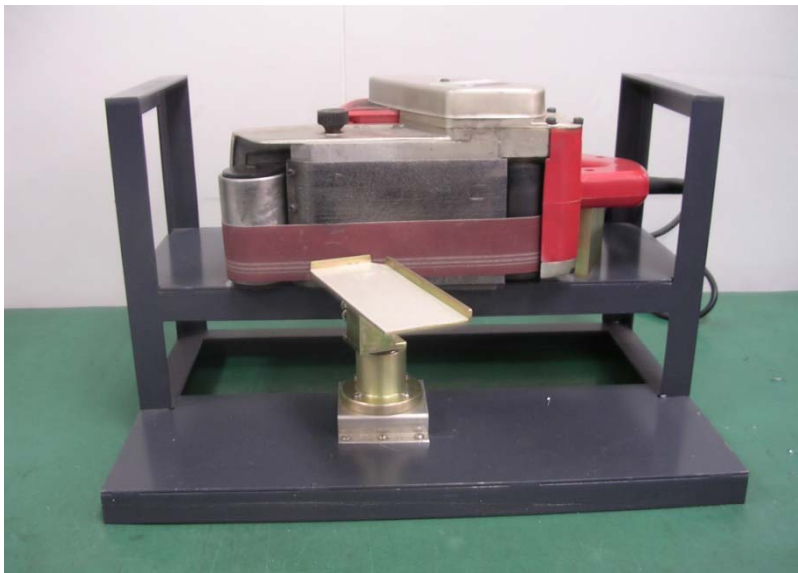
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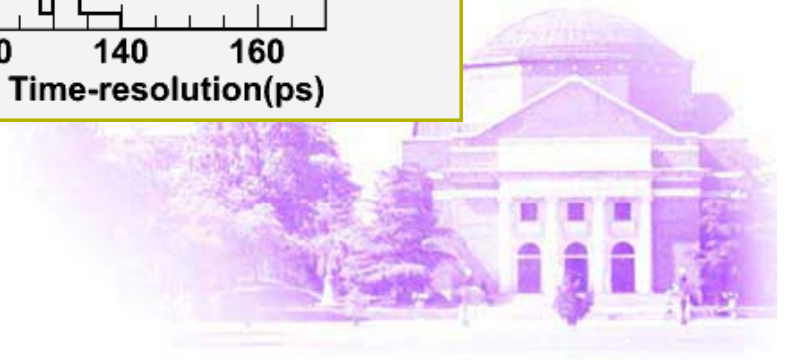
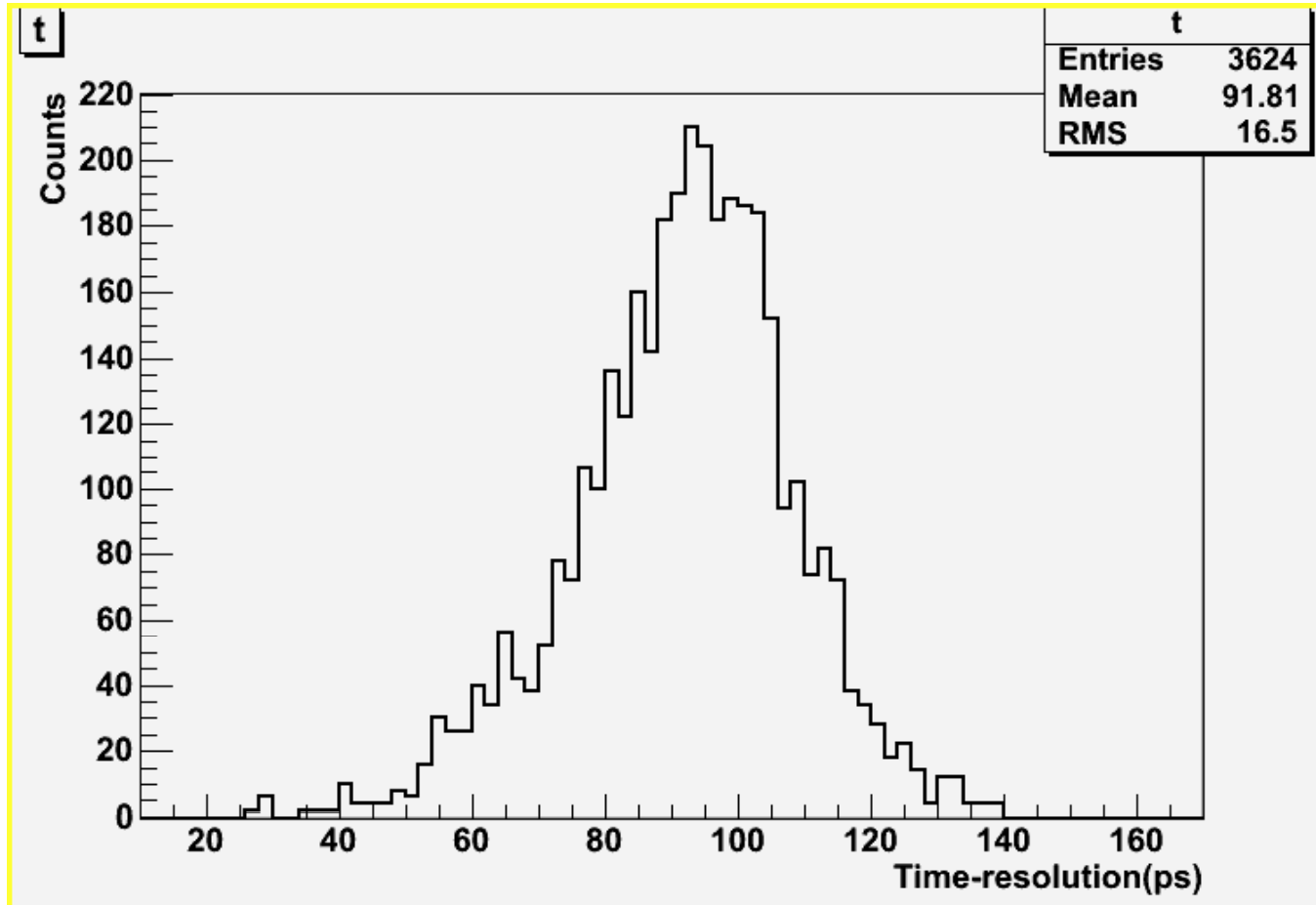
Production tools





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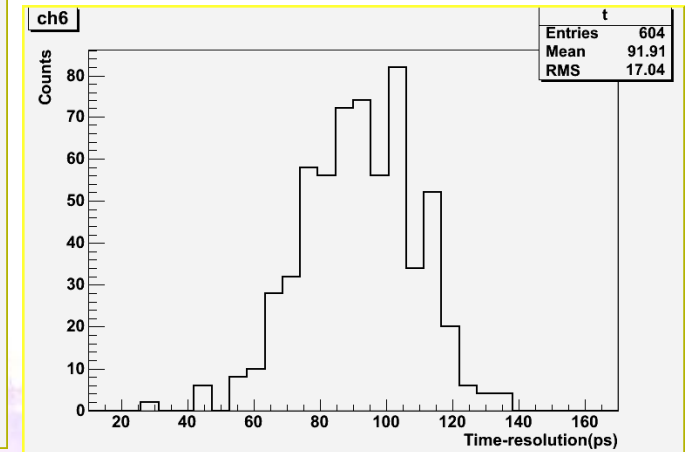
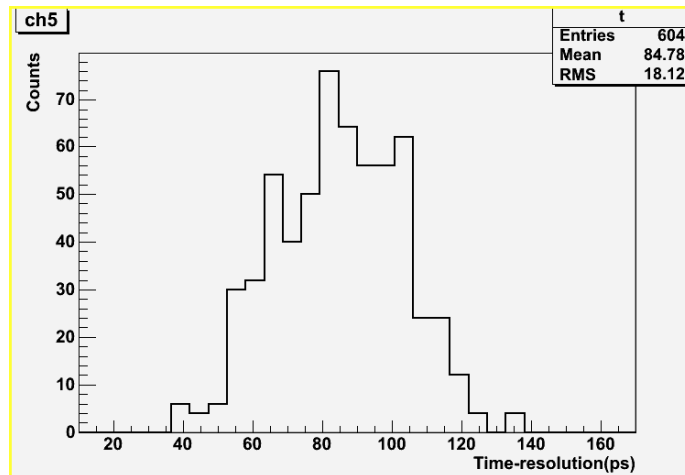
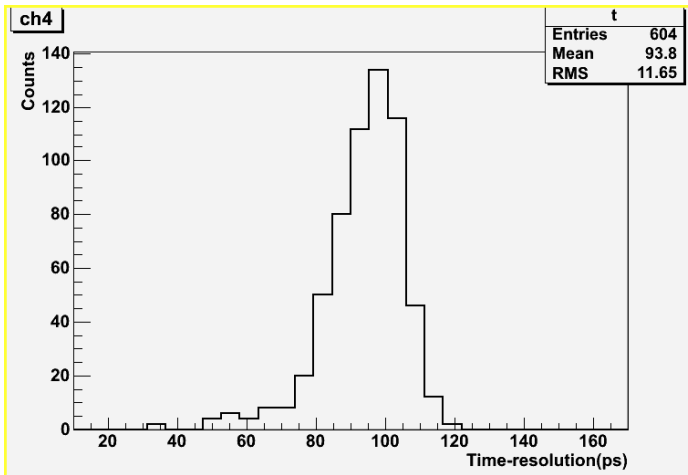
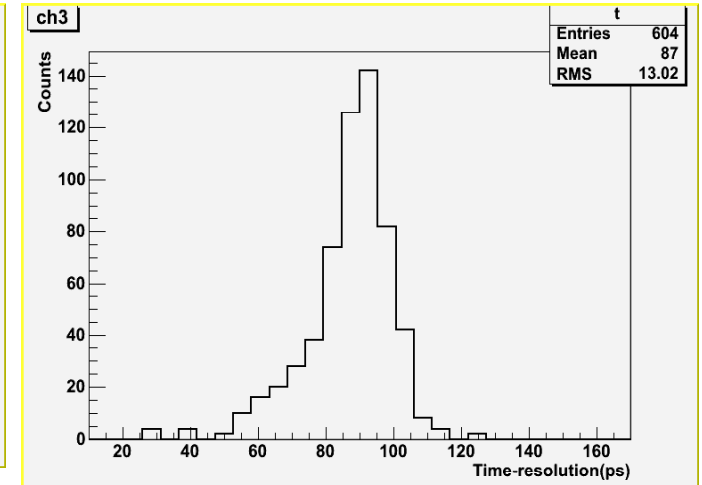
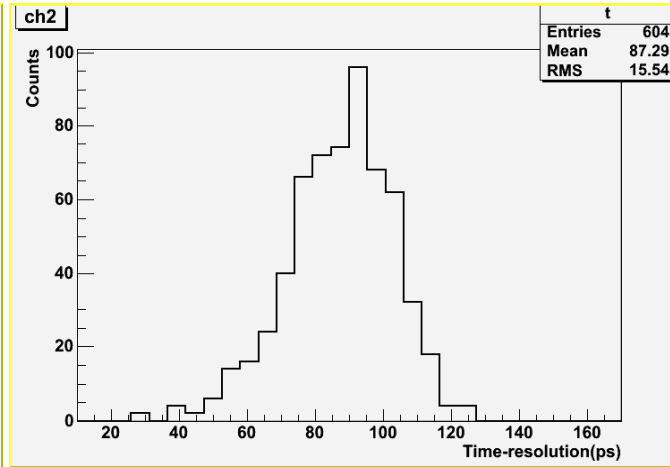
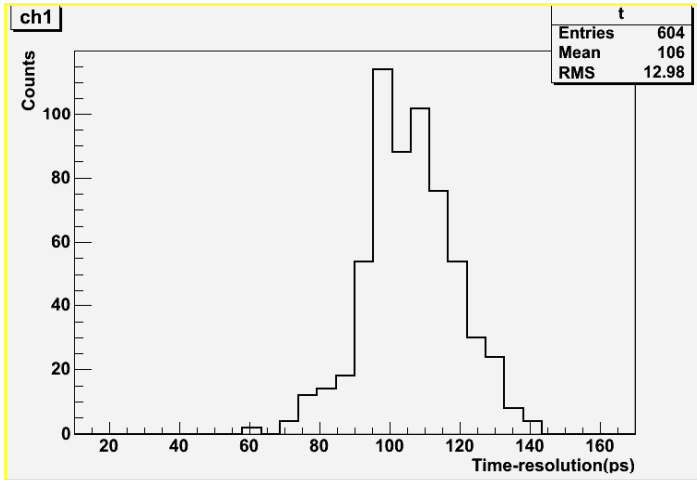
Time resolution Of 604 modules





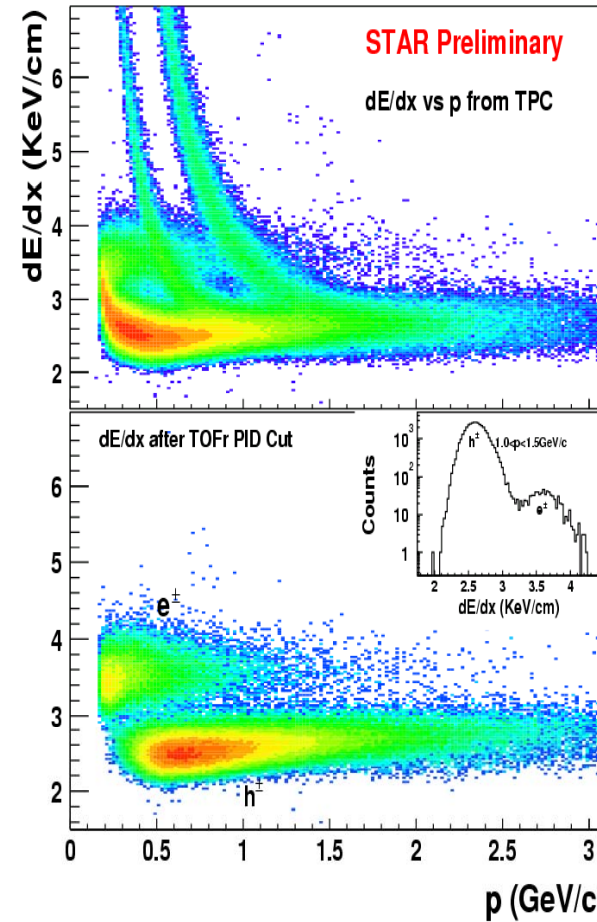
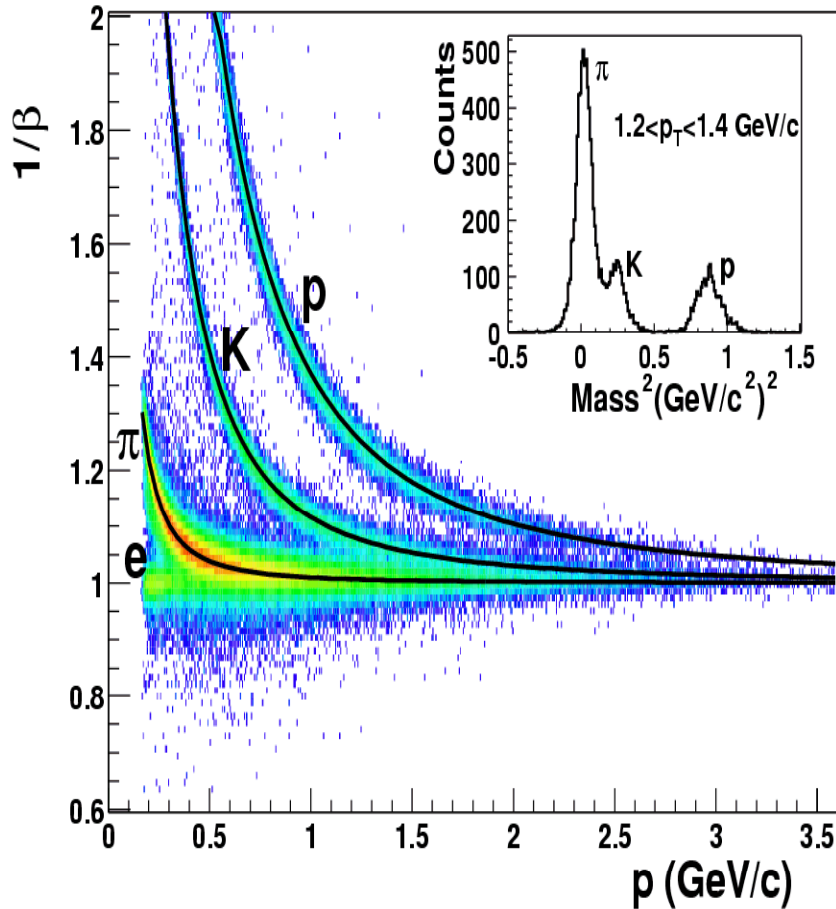
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Time resolution of each channel





STAR-TOF PID



PID:
 $\pi/K/p$: 1.7 GeV/c
 p .vs. $(\pi+K)$: 3 GeV/c

Clean electron PID can be obtained up to $P_T < 3$ GeV/c. \rightarrow
This is used to measure the semileptonic decay of open charm.





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Semiconductive glass and ceramics



Semiconductive glass
210mm*70mm*0.7mm
 $\sim 10^{10} \Omega \cdot \text{cm}$

Semiconductive ceramics
80mm*50mm*1mm
 $10^6 \sim 10^9 \Omega \cdot \text{cm}$

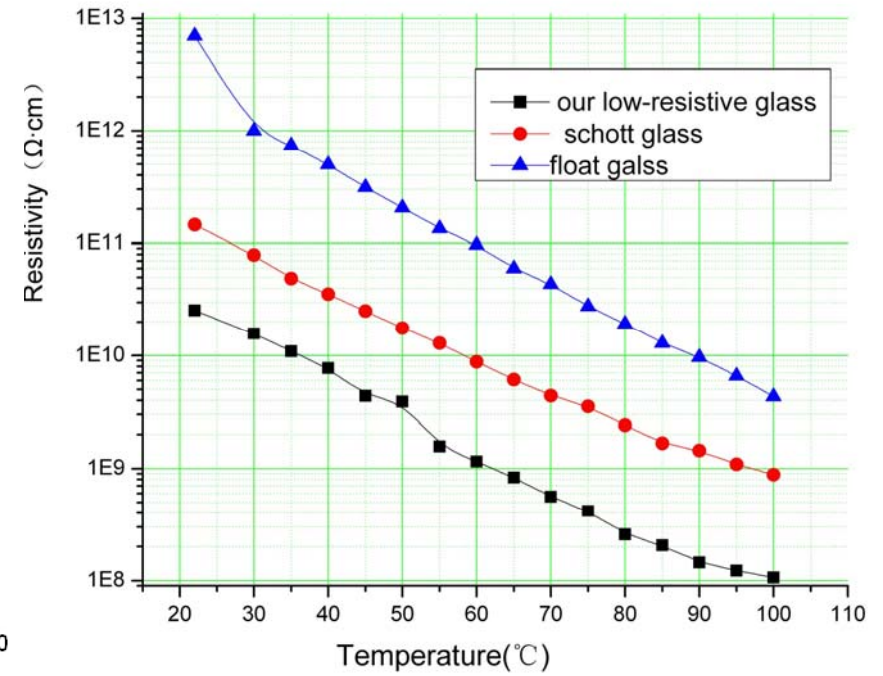
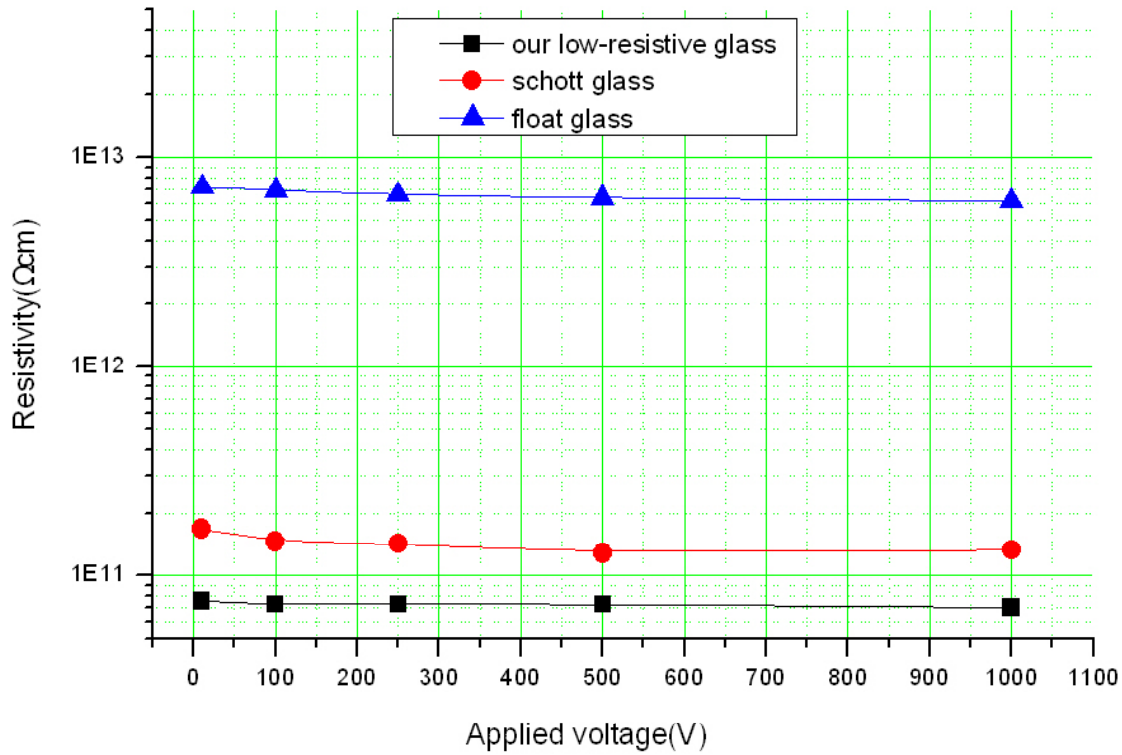




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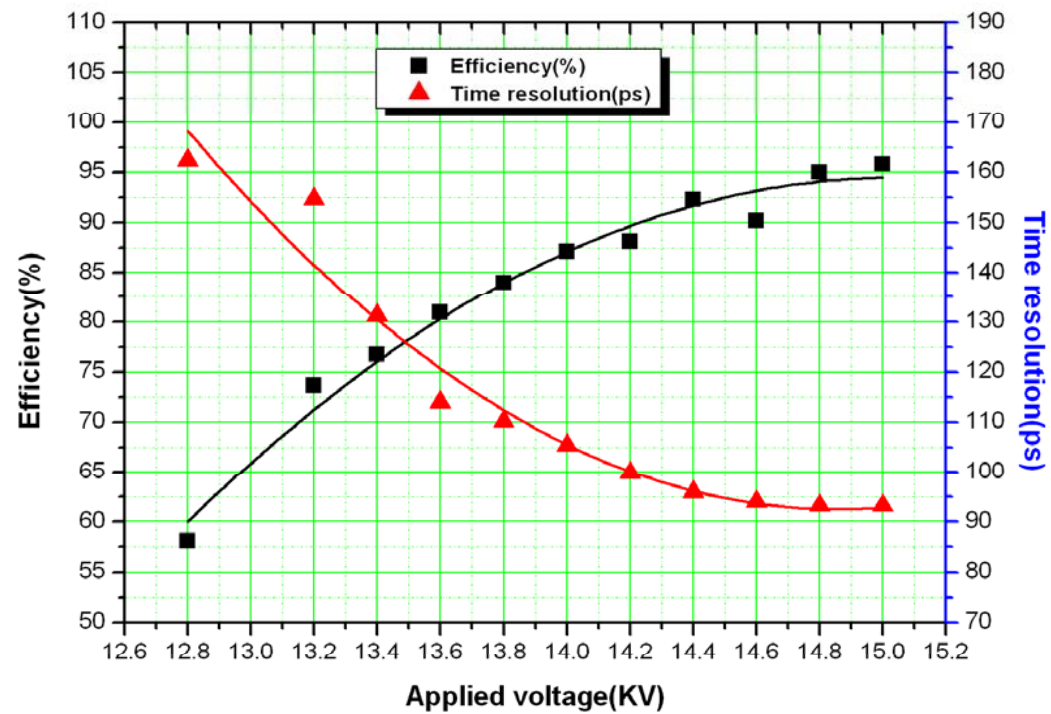
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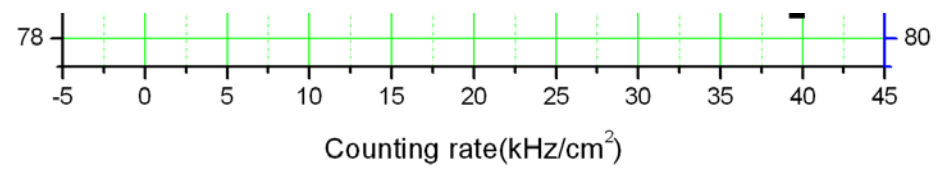
Resistivity changes with temperature





Efficiency and time resolution as a function of the applied voltage







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CASA

- Charge sensitive Amplifier and Shaper Amplifier
- Similar to PASA, an frontend ASIC developed for ALICE TPC readout, but with some new features:
 - 2pC max. input signals
 - 1-28mV/fC gain, programmable in 13 steps
 - 25-100ns shaping time, programmable in 4 steps
- 100% IP, full access for fine tuning and optimization for our dedicated applications

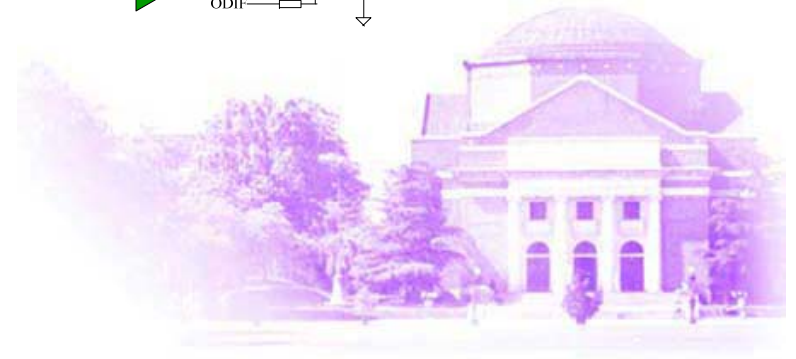
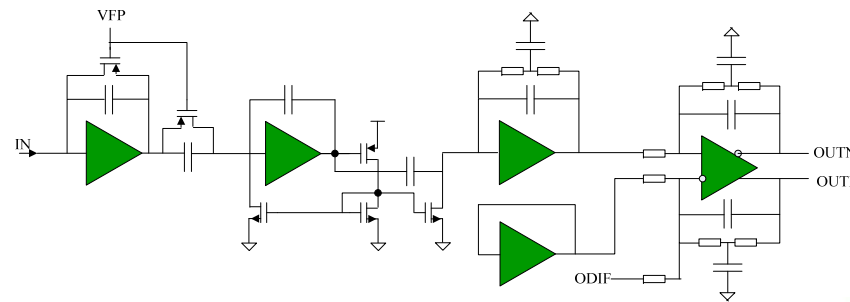




Main Functions

- A frontend ASIC for gas detectors with self-amplification, such as GEM, RPC
- 16 ch. Preamplifier + CR-(RC)⁴ shaper + buffer

Input Charge	10-1500 fC
SNR for MIP	>20:1
Gain (differential)	1-28 mV/fC, 13 steps
Shaping Time	25-100 ns, 4 steps
Output Swing	2 V p-p, differential
Drive Load	10pF
Crosstalk	<1%
Power Consumption	<10 mW/ch





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Test Results

- Density
 - 2.44mm x 2.90 mm die size (16 channels)
 - 105 μ m x 1241 μ m die area per channel
 - also in CPGA-84 package, 28.5mm x 28.5mm
- Static power consumption
 - 141.9 mW in total
 - 8.9mW/ch
- Crosstalk < 0.98%

