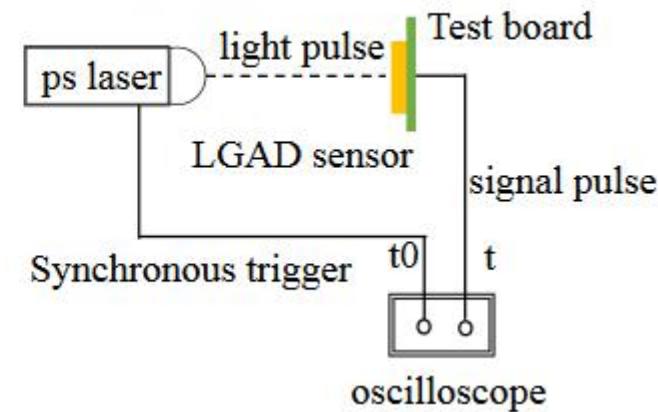
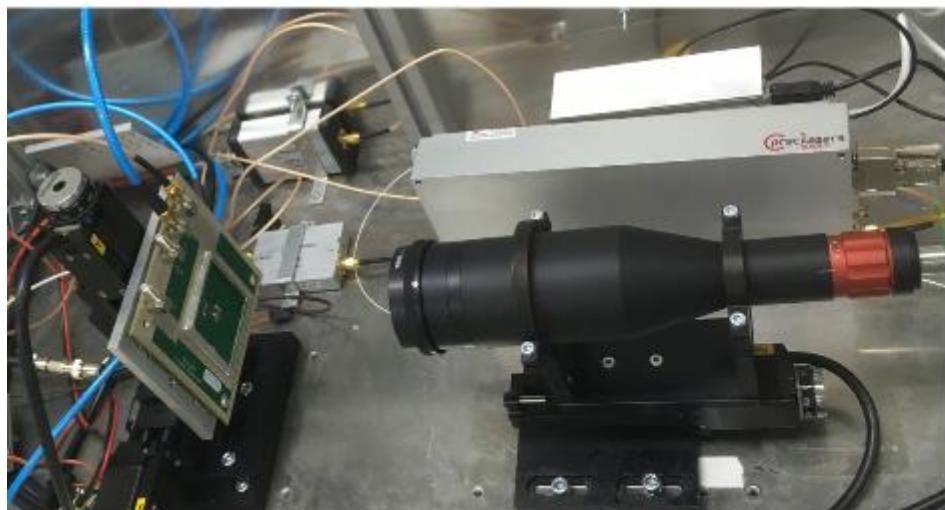


Time Resolution for NDL LGAD sensor

Suyu Xiao
from IHEP ATLAS Group
2019.5.16

Test system & Sensors

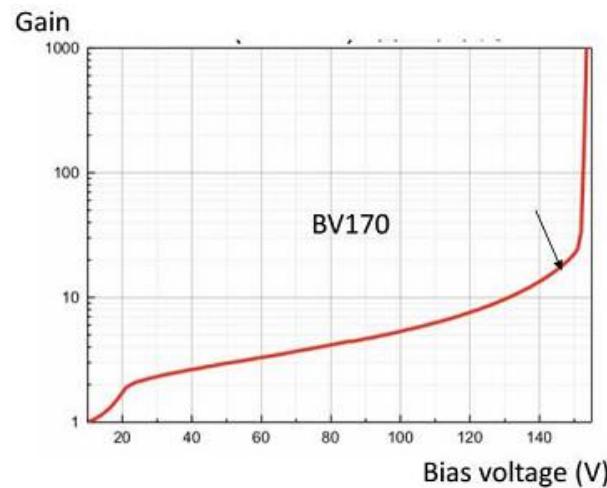
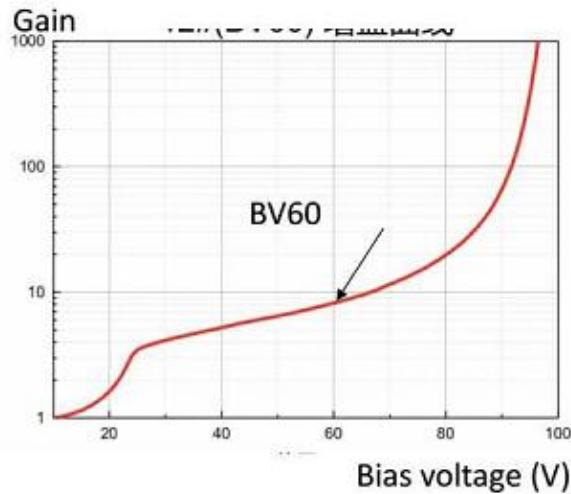
- Pico second laser: 1064nm wave length, 7.5 ps pulse width, 20.97MHz frequency
- Oscilloscope: Lecroy 8254M, 2.5 GHz bandwidth, 40GS/s sample rate
- High voltage power supply: Keithley 2410
- Low voltage power supply: 1.4V for amplify



NDL LGAD sensor	Test Board
BV60	Beam_test_brd-0001
BV170	Beam_test_brd-0008

from Yuzhen's slides:
<https://indico.ihep.ac.cn/event/9895/contributions/17/material/slides/2.pdf>

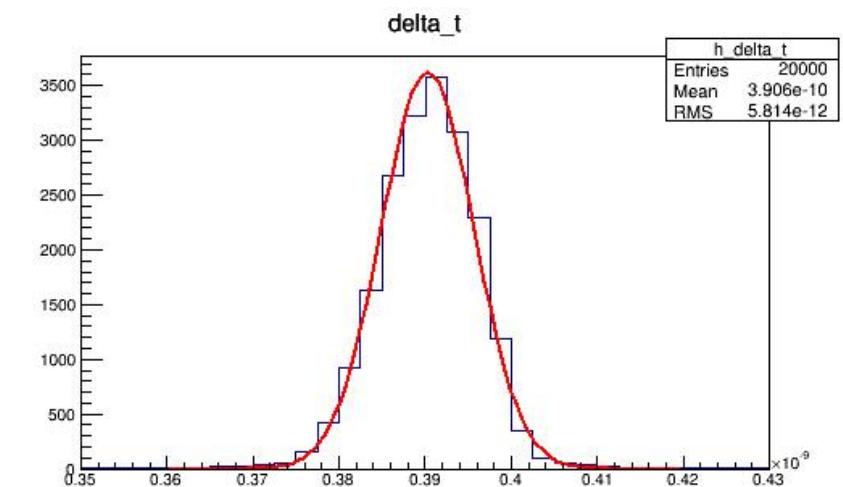
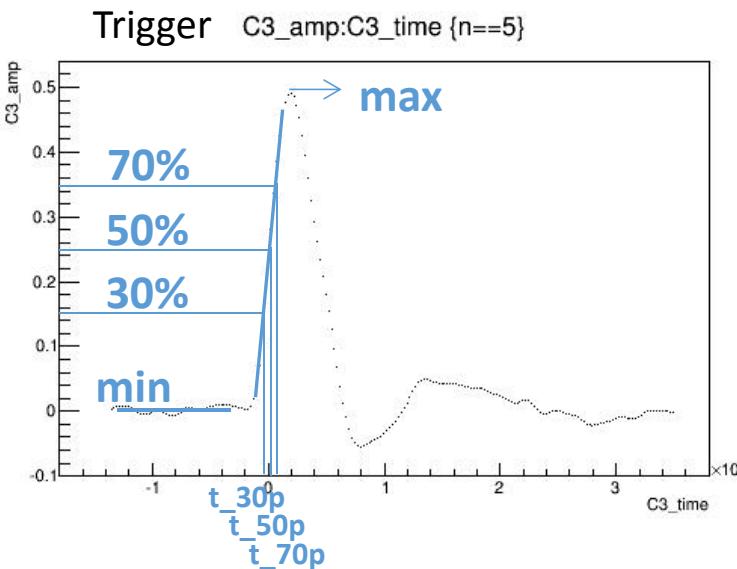
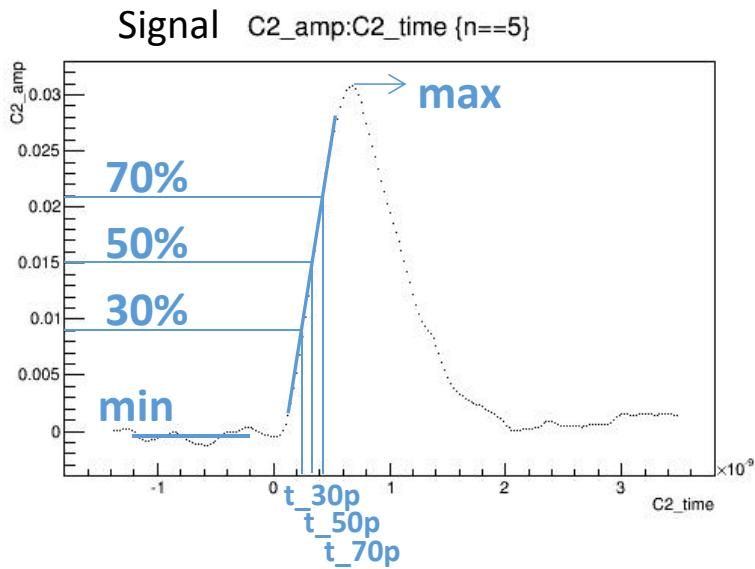
Data taking



from Liaoshan, Baohua, Zhijun

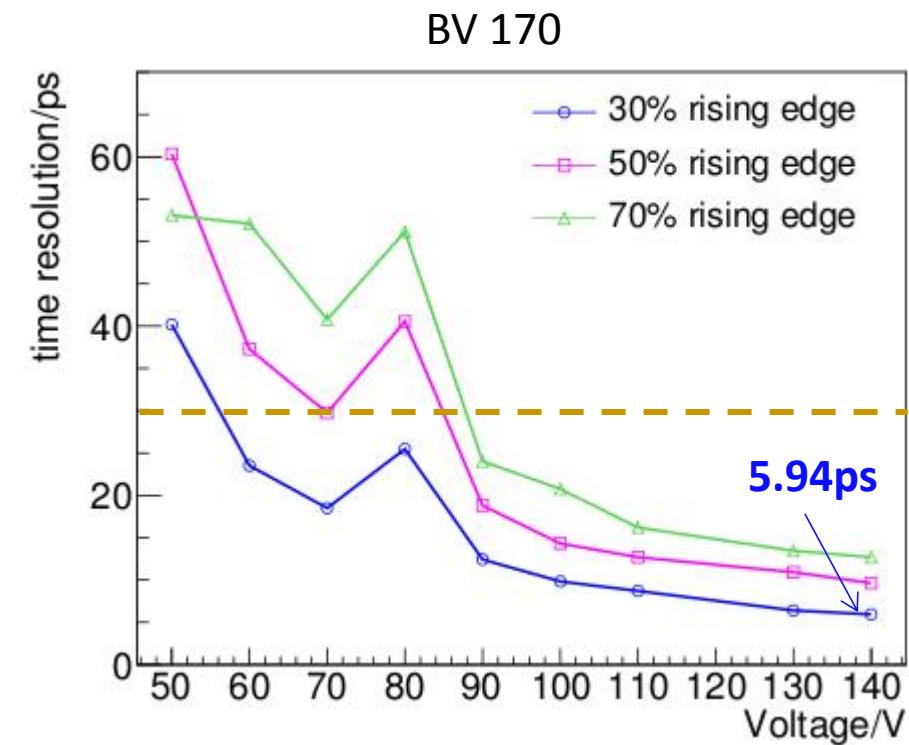
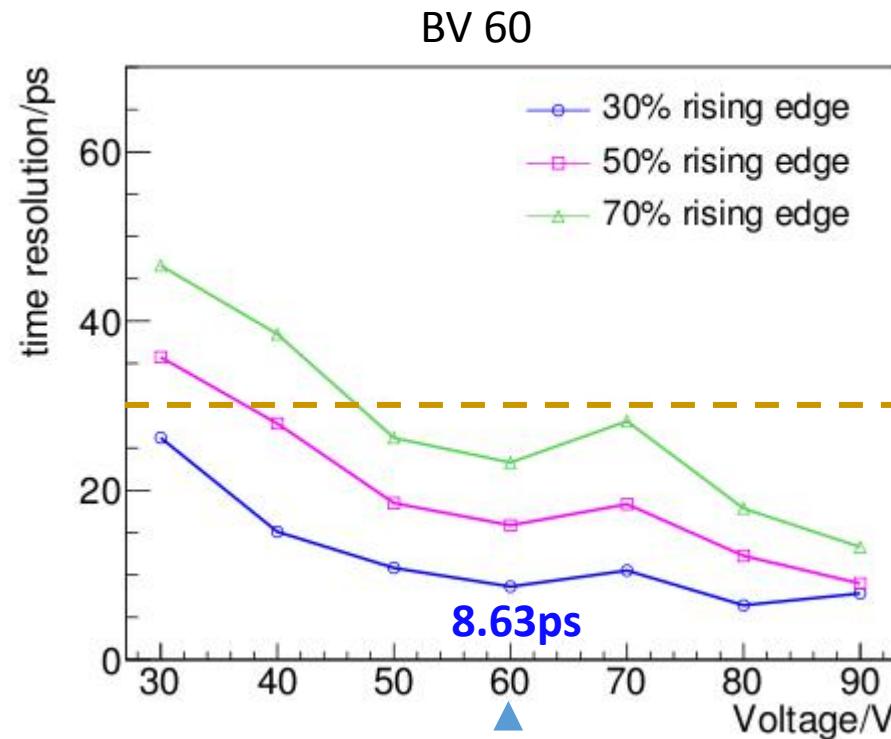
- BV60 Breakdown at $\sim 90V$
 - Voltage at 30V-90V, 7 point
 - 20,000 waveforms saved for trigger & signal respectively
- BV170 Breakdown at $\sim 150V$
 - Voltage at 50V-140V, 9 point (120V was lost)
 - 20,000 waveforms saved for trigger & signal respectively

Analysis method



- Draw amp v.s. time distribution
- Get Max(data from measurement) & Min(fit result) of Amp
- Fit rising edge, get t_{30p} when we get 30% amp
- Calculate Δt , fit

Time resolution



- 30ps(dark-orange dashed line) resolution can be achieved.
- BV60 works well when 60V is applied.
- BV170 has better time resolution with voltage going higher(up to 140V).
- Lower rising edge threshold leads to better time resolution.

Thanks!

Back-up

BV60

Sigma	30p	50p	70p
30V	11.1302	15.1748	19.7692
40V	6.4167	11.8462	16.3332
50V	4.6021	7.8559	11.1261
60V	3.6641	6.7399	9.8885
70V	4.4709	7.8003	11.9629
80V	2.7292	5.2103	7.5879
90V	3.3225	3.8194	5.6493

FWHM = Sigma * 2.355 for Gaussian distribution

BV170

Sigma	30%	50%	70%
50V	17.0606	25.6229	22.5505
60V	9.9838	15.8277	22.1209
70V	7.8538	12.6262	17.3104
80V	10.5642	16.6087	20.6760
90V	5.2731	7.9824	10.2016
100V	4.1745	6.0803	8.8109
110V	3.6977	5.3895	6.8795
130V	2.7201	4.6389	5.7128
140V	2.5229	4.0905	5.3936

BV170

80V

