

PMT gain test result comparison (SDU & IHEP)

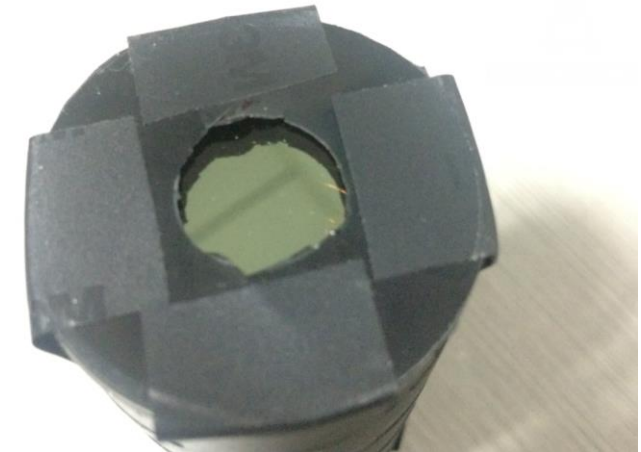
Ye Tian

Shandong University

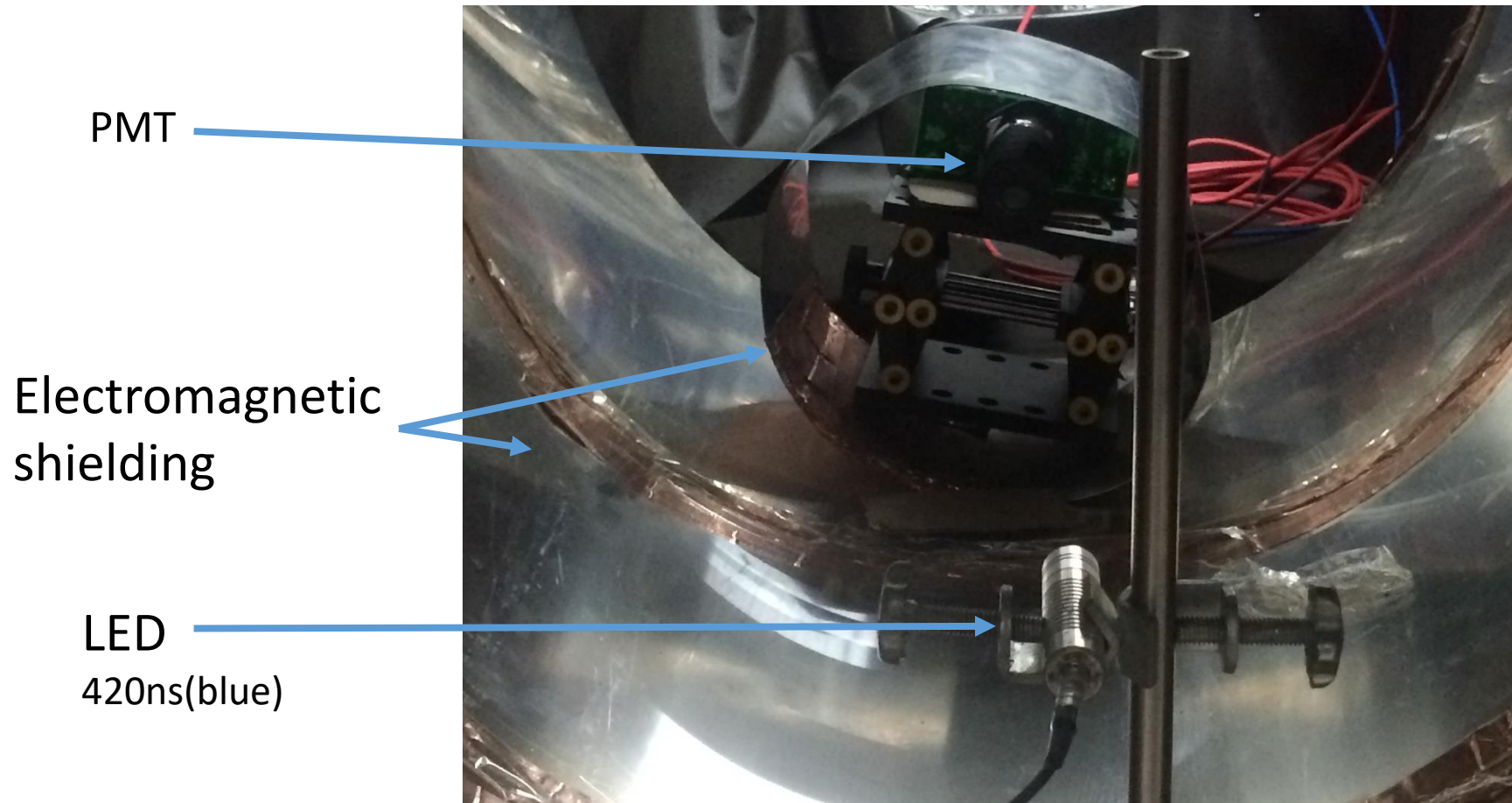
11/02/2017

Test description

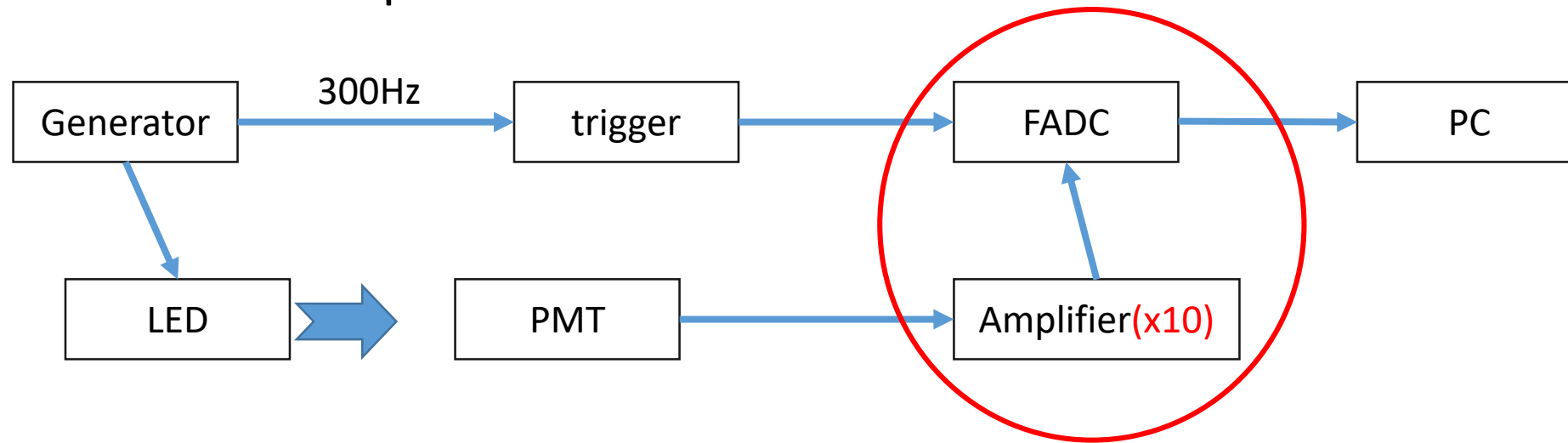
- 5 PMTs(R11101) are tested at Daya Bay(JUNO) PMT group in IHEP, Beijing
- SDU and IHEP both use same LED SPE method, difference only exist in DAQ system
- These PMTs are also tested in SDU by me(Ye) and Ang separately.
- **Ye's and Ang's test** using same method, the difference is Ang's test use the total area of PMT cathode window, but Ye's test only use the central area of PMT cathode window.
- All tests use same base divider:
K:DY1:DY2:DY3:DY4:DY5:DY6:DY7:DY8:DY9:DY10:P=2:1:1:1:1:1:1:1:1:1:1



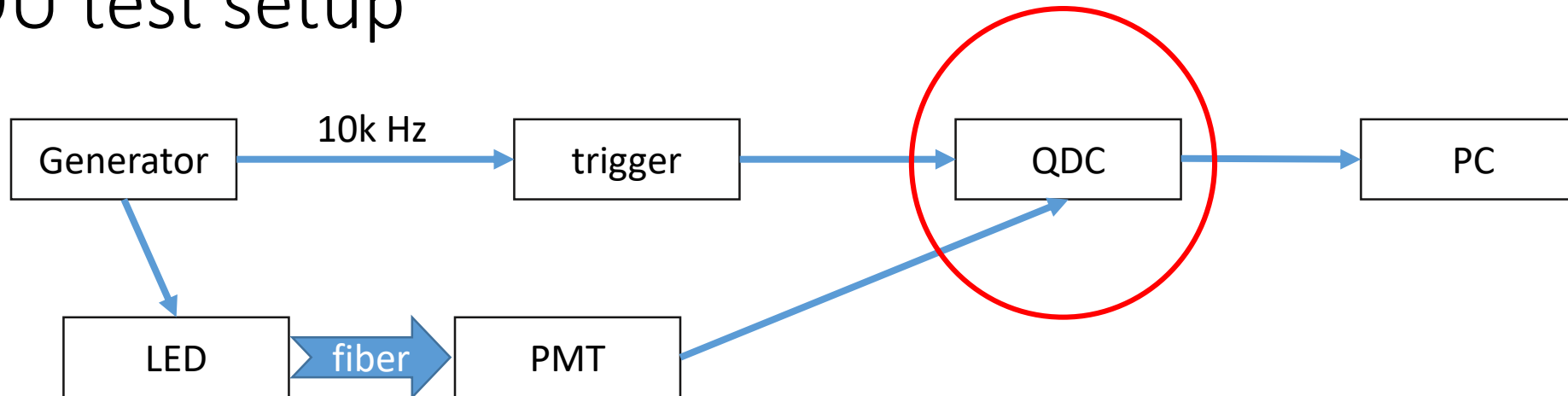
IHEP PMT gain test setup



IHEP test setup

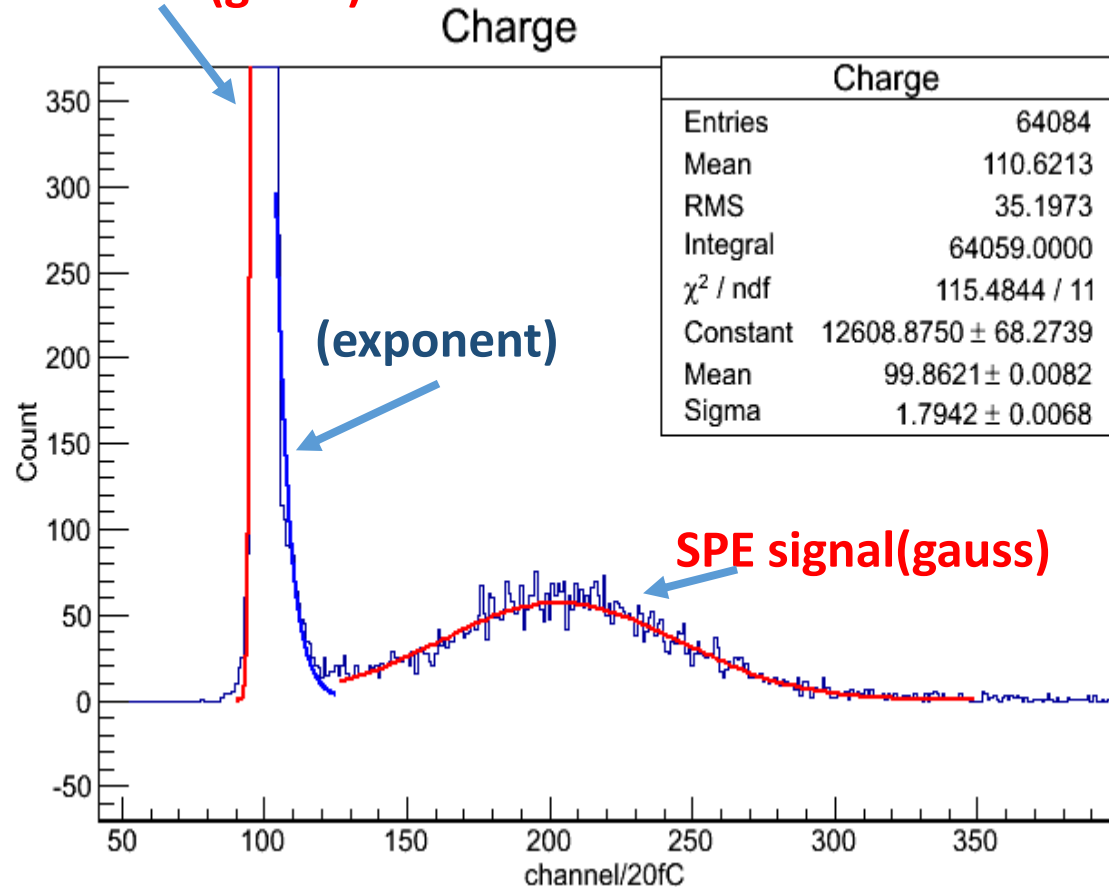


SDU test setup

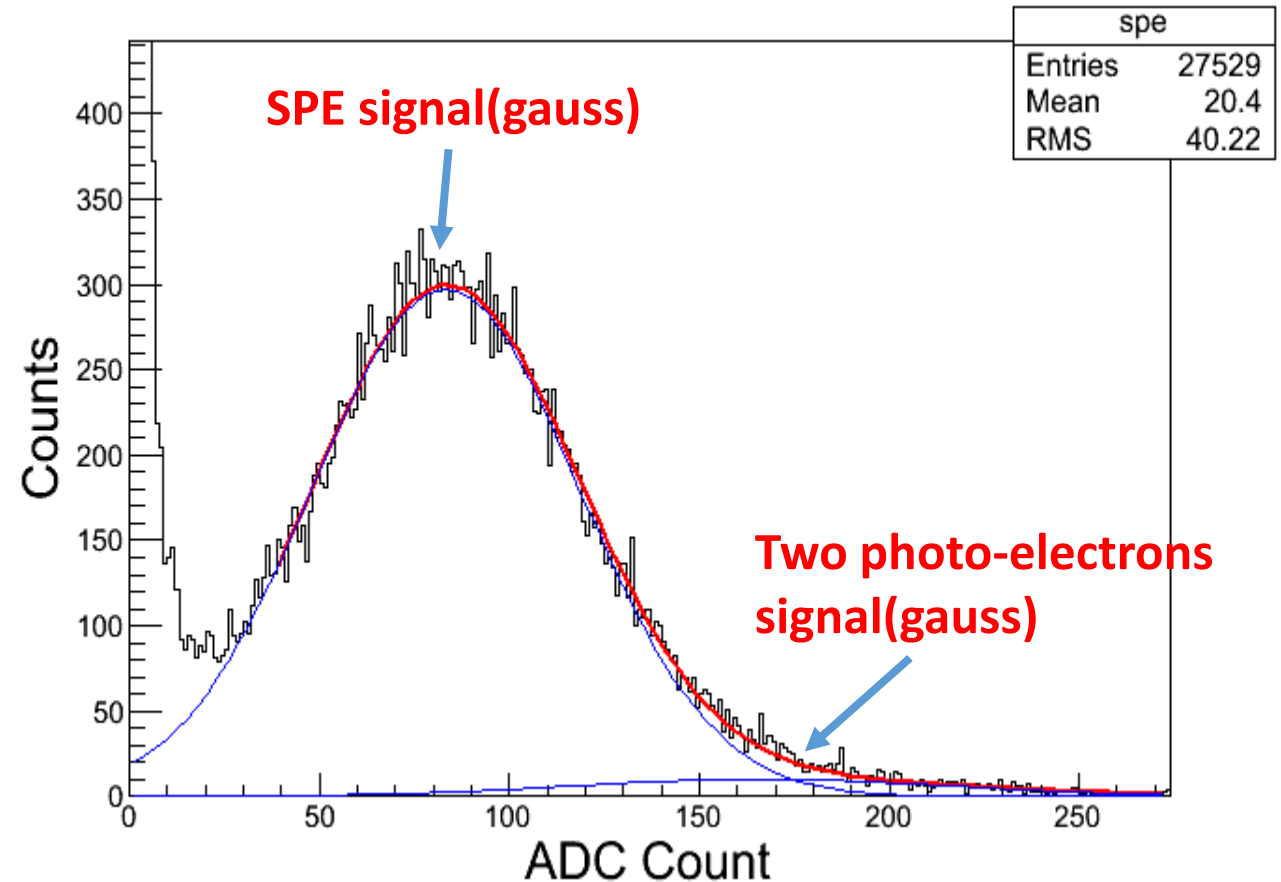


Fitting method comparison(two plots shows different PMT)

Pedestal(gauss)



IHEP fitting



SDU fitting

$$\text{Gain} = \frac{\text{Charge}_{\text{SPE}} - \text{Charge}_{\text{pedestal}}}{e}$$

Test result comparison

PMT	HV(V)	Ang's result (SDU)(10^6)	SP/SK (10^6)	Ye's result (SDU)(10^6)	Daya Bay (IHEP)(10^6)	SDU/IHEP Difference(%)
67668	1000		1.47	3.10	3.30	-6.1
	1100			6.68	6.648	0.5
	1200			12.42	12.625	-1.6
67693	1000	4.13	2.02	4.92	4.963	-0.86
	1100			9.97	10.12	-1.5
	1200			18.60	18.9	-1.6
67702	1000		1.194	2.36(bad fitting)	2.93	
	1100			5.40	5.564	-2.9
	1200			9.995	10.47	-4.5
67749	1000	4.59	2.38	5.12	5.249	-2.4
	1100			10.70	10.90	-1.8
	1200			20.50	21.00	-2.4
67689	1000	3.07	1.60	3.96(3.63)	3.652	8.4(-0.6)
	1100			8.25(7.53)	7.12	15.9(5.7)
	1200			15.4(14.18)	13.33	15.5(6.4)

Re-test result of 67689 in SDU, didn't figure out the reason of difference.

Summary

- The PMT gain test in SDU and IHEP have similar result
- Central area of PMT window has larger gain than edge area.
- SDU #3 will be re-tested and use new gain for calculation.
- A PMT with known gain that tested in SDU will be sent to THU. (the gain test result of THU PMT in IHEP should be reasonable.)