QE measurement setup at JLab

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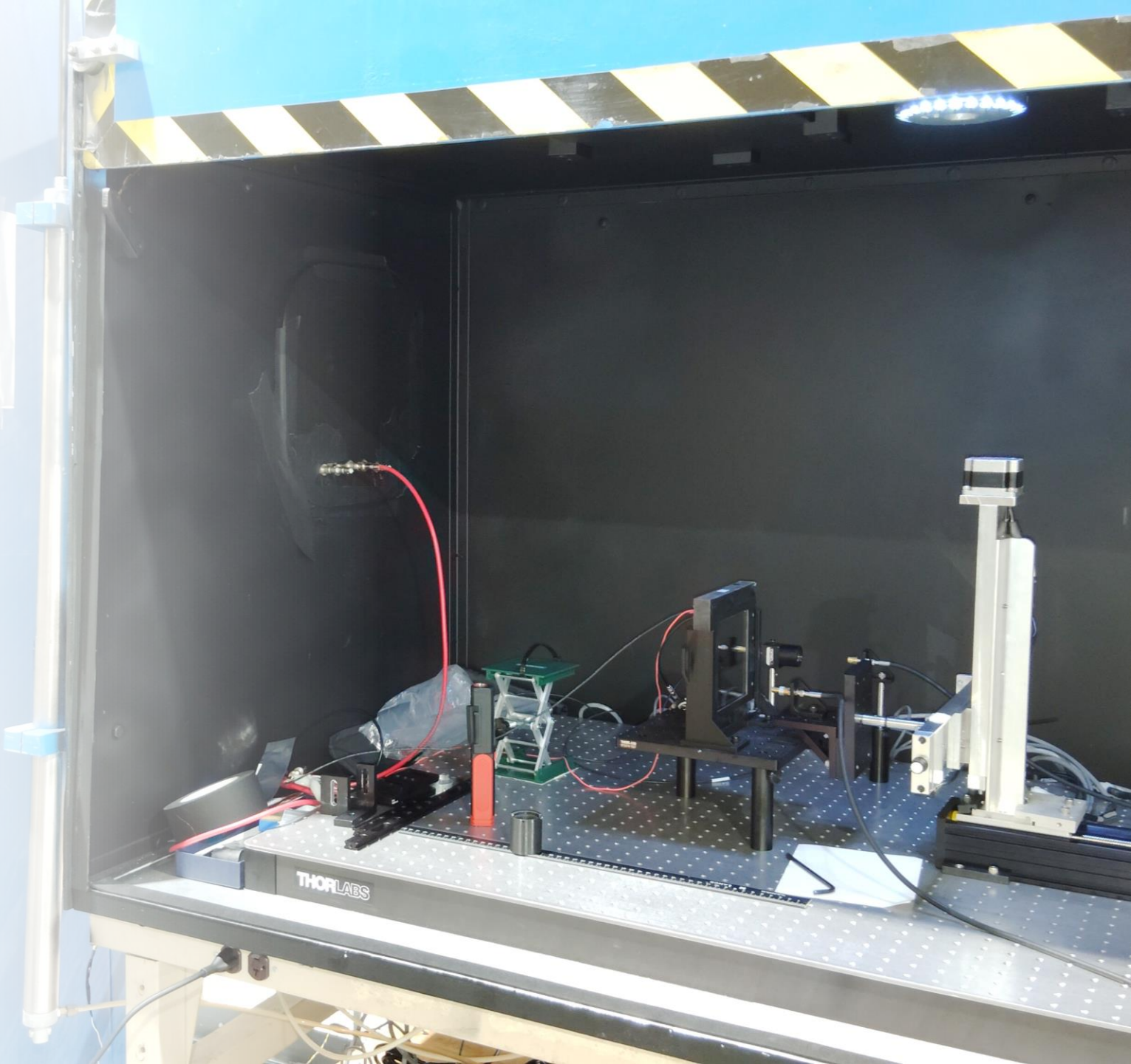
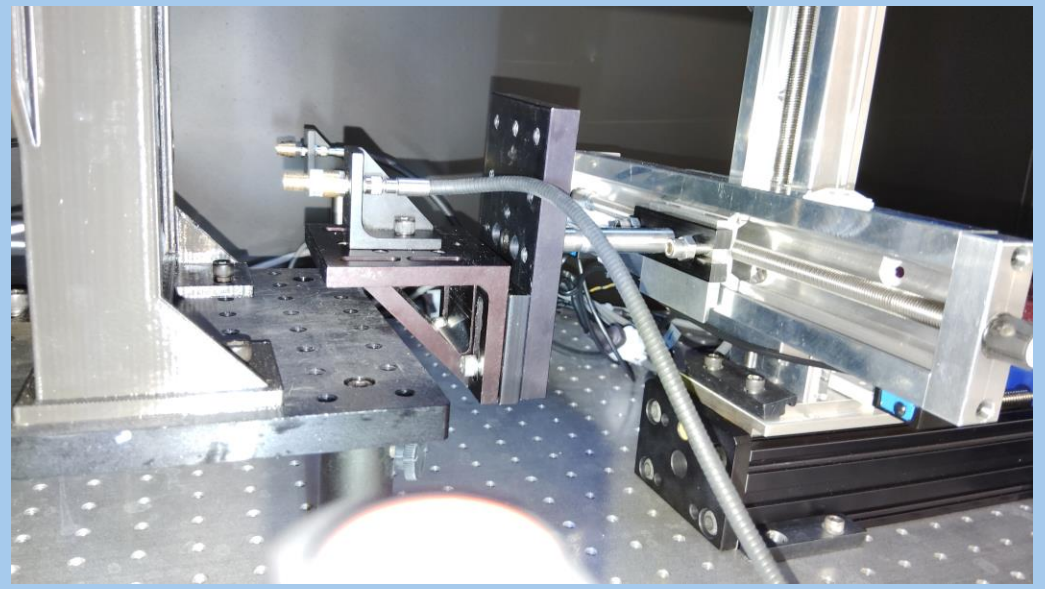
ePIC pfRICH General meeting,
July 18, 2024

Dark box and readout electronics

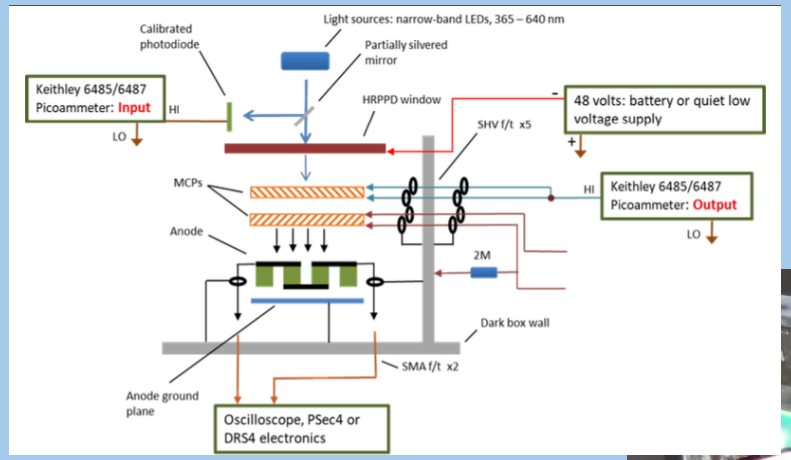
- Voltage source and Read out electronics:
- 2x Keithley 6487 picoammeter
  - continuously monitor referen ce photodiode
  - For HRPPD readout

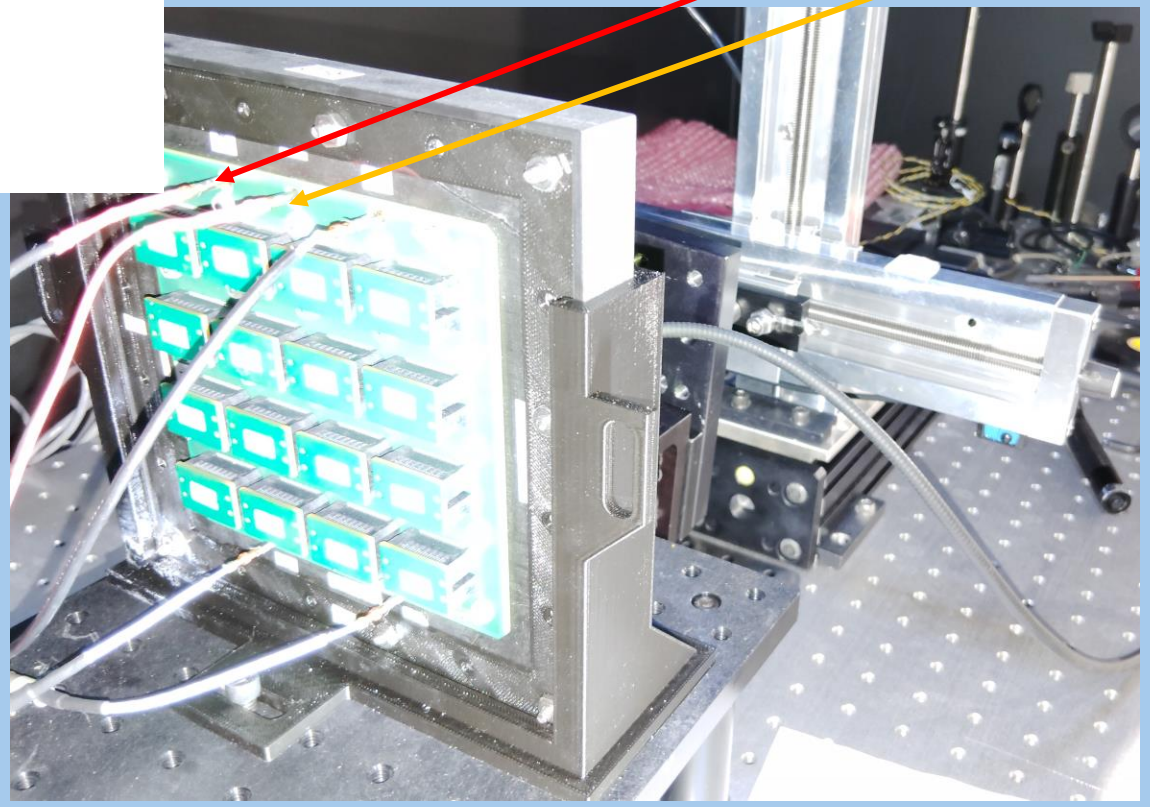


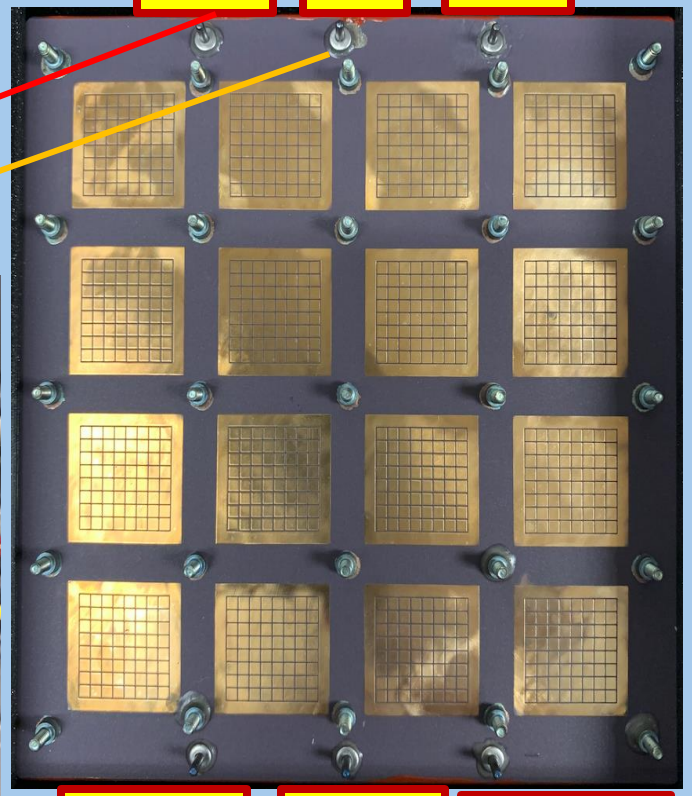
Setup close look-up



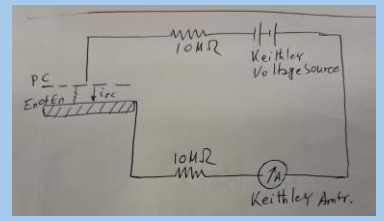
1. HRPPD
2. Light source LED+ 400um fiber
3. Calibrated Hamamatsu S2281 photodiode
4. XYZ motion stage Velmex







- The first initial tests were done by applying -100V on PC
- Read out from MCP-ENT
- All other connectors were terminated

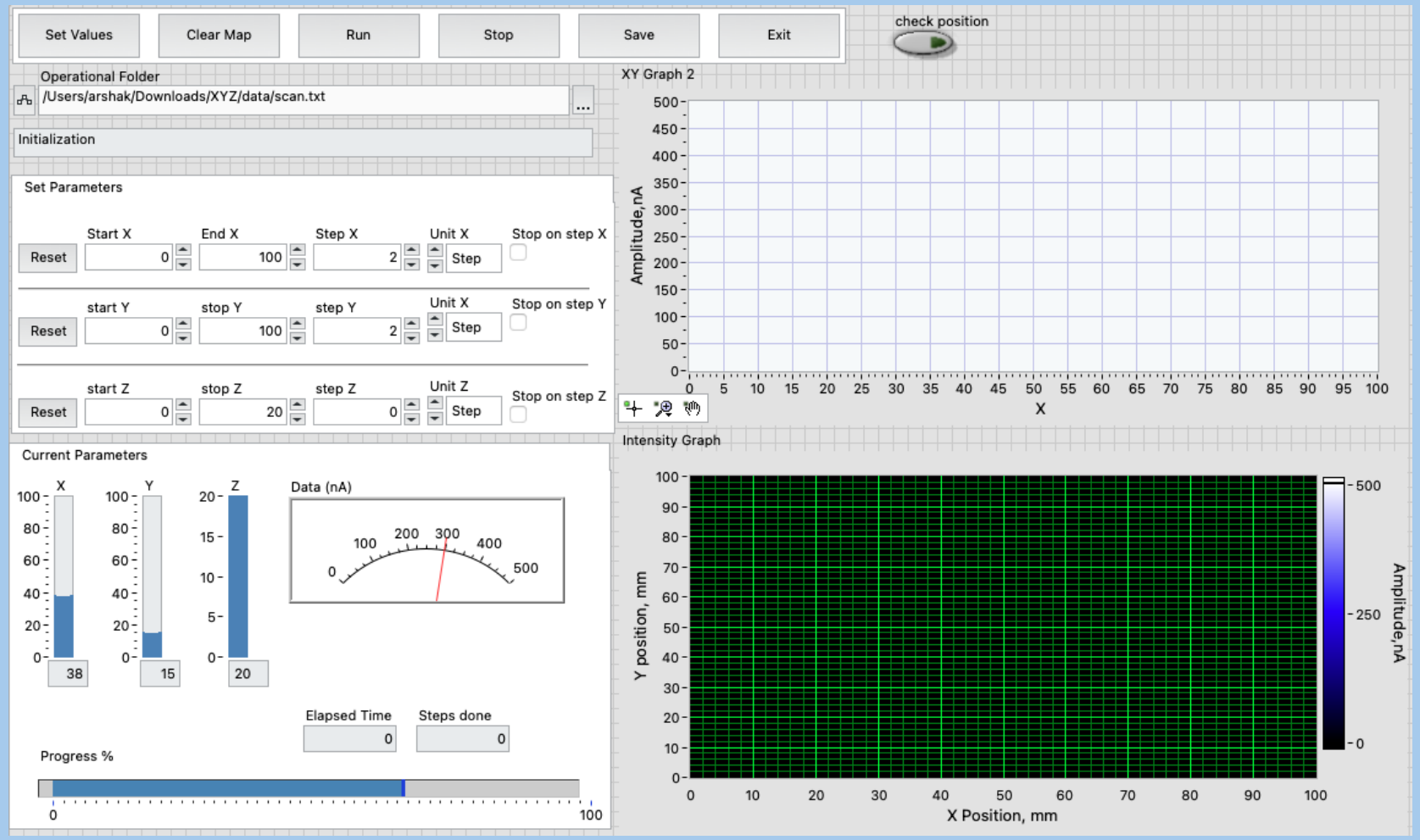


Connection schematic
Thanks to Chandra and Alexander

Light source and shape

- As a light source 470-472nm LED was used and delivered via 400um Y-shape 50/50 fiber
- Focused by lens
- Beam diameter on HRPPD and reference photodiode is ~1.5-2mm

XYZ motion stage controlling GUI



LabView based GUI to control 2x Desy chained VELMEX and in-situ readout

1+5 main steps for QE calculation

STEP 1 having in hand the sensor that needs to be measured, willingness and setup

Step 2: Correct the HRPPD current for the dark current

Step 3: Calculate the incident optical power

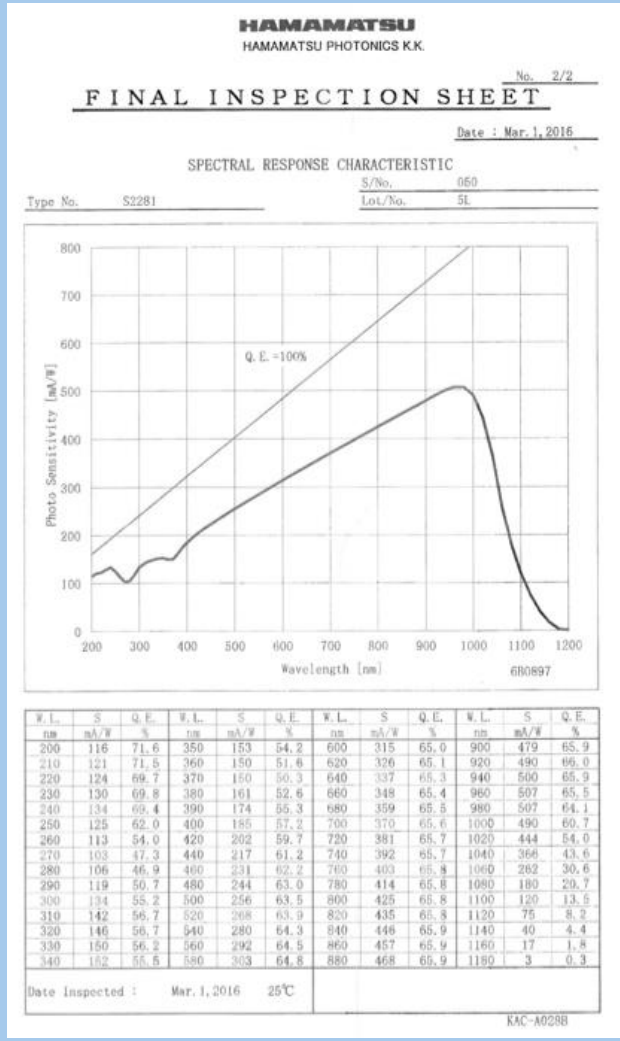
Step 4: Calculate the number of incident photons

Step 5: Calculate the number of electrons generated by the HRPPD

Step 6: Calculate the quantum efficiency (QE)

$$QE = Np/Ne \times 100\%$$

The QE of HRPPD is ~14.5-14.9%



HAMAMATSU
HAMAMATSU PHOTONICS K.K.

No. 2/2

FINAL INSPECTION SHEET

Date : Mar. 1, 2016

SPECTRAL RESPONSE CHARACTERISTIC

Type No. S2281 S/No. 050 Lot/No. 5L

W.L. nm	S mA/W	Q.E. %	W.L. nm	S mA/W	Q.E. %	W.L. nm	S mA/W	Q.E. %	W.L. nm	S mA/W	Q.E. %
200	116	71.6	350	153	54.2	600	315	65.0	900	479	65.9
210	121	71.5	360	150	51.6	620	326	65.1	920	490	66.0
220	124	69.7	370	150	50.3	640	337	65.3	940	500	65.9
230	130	69.8	380	161	52.6	660	348	65.4	960	507	65.5
240	134	69.4	390	174	55.3	680	359	65.5	980	507	64.1
250	125	62.0	400	185	57.2	700	370	65.6	1000	490	60.7
260	113	54.0	420	202	59.7	720	381	65.7	1020	444	54.0
270	103	47.3	440	217	61.2	740	392	65.7	1040	366	43.6
280	106	46.9	460	231	62.2	760	403	65.8	1060	262	30.6
290	119	50.7	480	244	63.0	780	414	65.8	1080	180	20.7
300	134	55.2	500	256	63.5	800	425	65.8	1100	120	13.5
310	142	56.7	520	268	63.9	820	435	65.8	1120	75	8.2
320	146	56.7	540	280	64.3	840	446	65.9	1140	40	4.4
330	150	56.2	560	292	64.5	860	457	65.9	1160	17	1.8
340	152	55.5	580	303	64.8	880	468	65.9	1180	3	0.3

Date Inspected : Mar. 1, 2016 25℃

KAC-A028B