



GE21 Production Site Readiness at PKU

Yong Ban, Cheng Chen, Chuqiao Jiang, Zihan Liang, Meng
Lu, Hongji Ma, **Dayong Wang**, Ke Wang, Zihua Xue

Peking University

The 24th GEM workshop Oct.1,2019



The team



- Yong Ban (50% time), Physicist, GEM assembly and test.
- Dayong Wang (50% time), Physicist, GEM assembly and test.
- Hongji Ma (100% time), engineer,, GEM assembly and test.
- Zhihua Xue (50% time), engineer,, GEM R&D, test.

Staff

- Zihan Liang (70% time), PhD student, GEM assembly and test.
- Ke Wang (50% time), M.S. student, GEM assembly and test.
- Chuqiao Jiang (30%), PhD student, GEM assembly and test.
- + 3~5 students (~2 person-year), GEM assembly and test.

Current Students

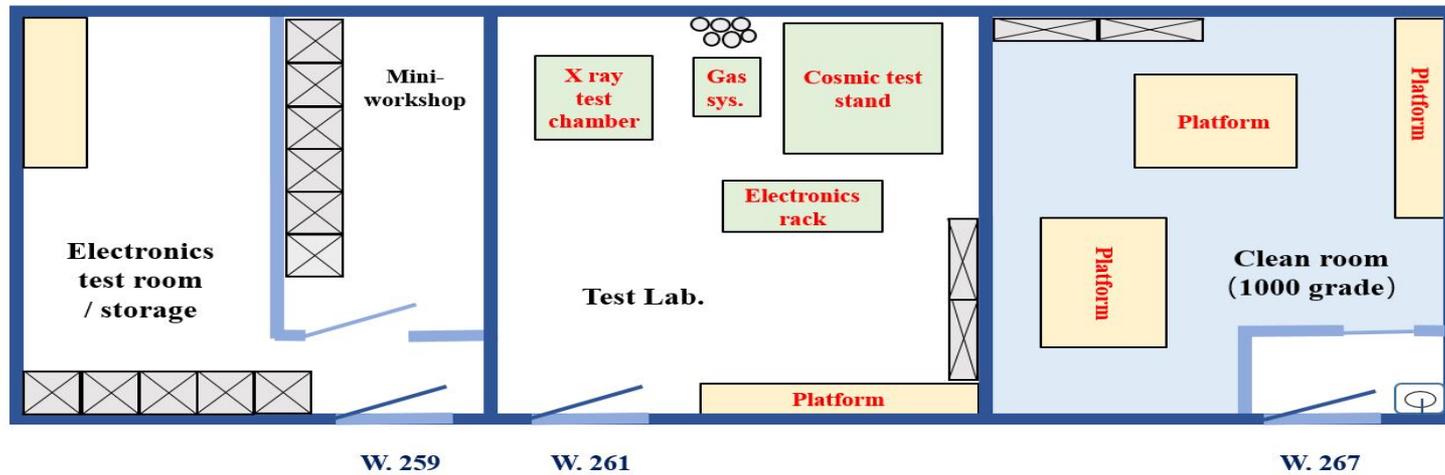


- Dr. Aera Jung (90% time), postdoc, GEM assembly and test, to join in Dec 2019

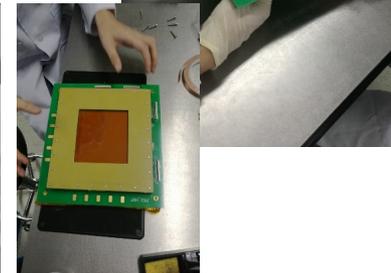
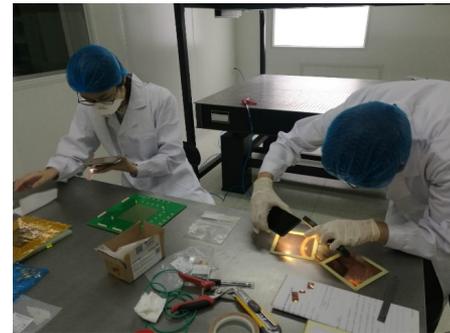
Sun Yetsen Univ. Beihang Univ. and Tsinghua Univ. plan to send students join the GEM assembly and test at PKU site.



Laboratory Layout



~120m² in total



A 10x10cm GEM prototype has been assembled in our cleanroom. The foils were purchased from CERN, the structure, readout board, HV divider etc. were designed and produced in PKU.

Electronics Procured

CAEN NIM8303/60W	Crate	1
CAEN N93B	Dual Timer	1
ORTEC 142PC	Preamplifier	2
ORTEC 474	Amplifier	2
ORTEC 974A	Quad-Counter/Timer	1

Pico-ammeter



KEITHLEY model 6482

Leak Detector



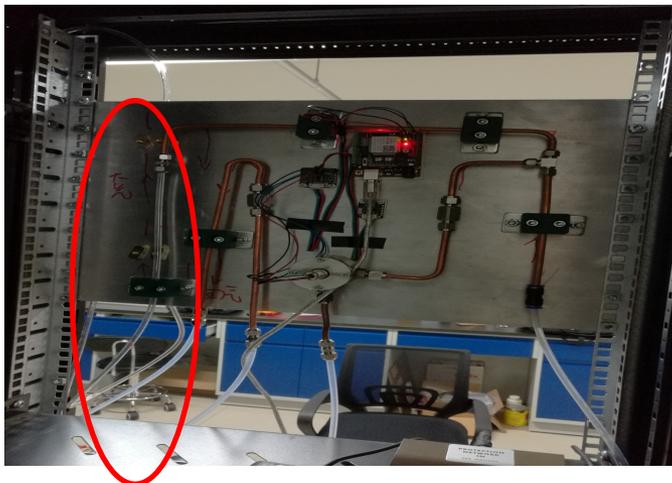
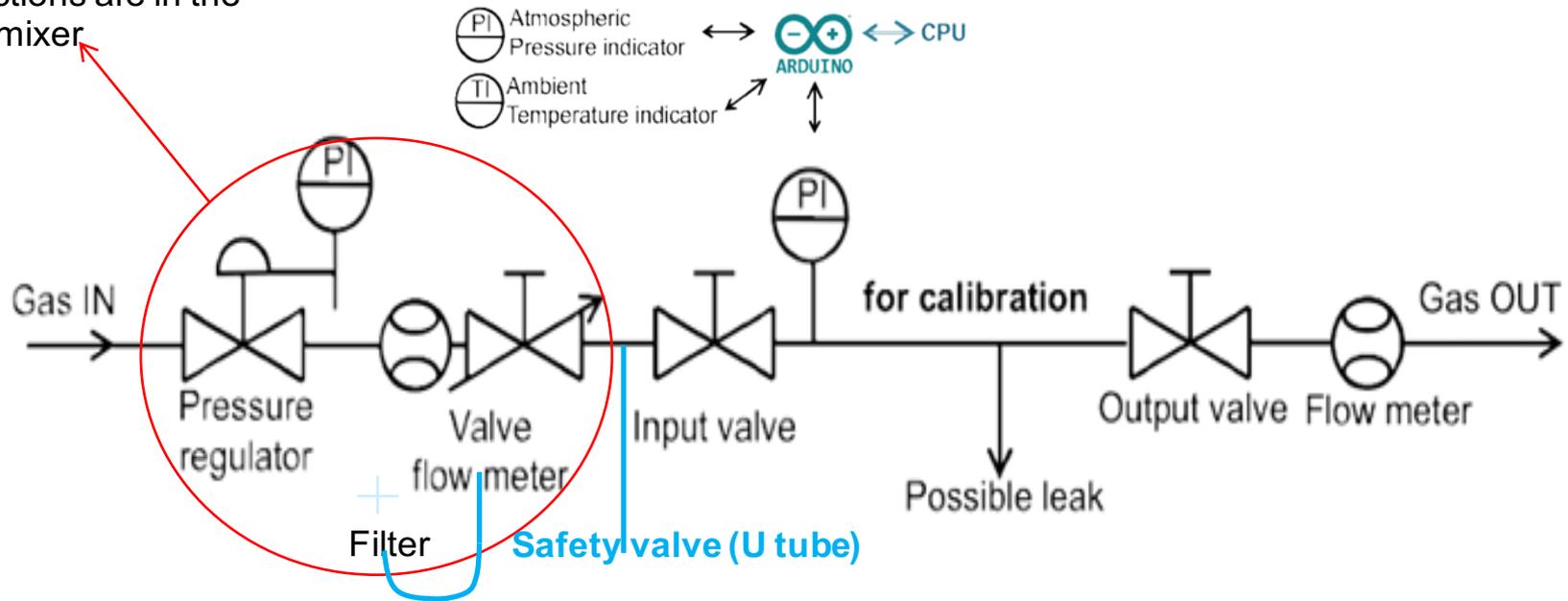
Gas	Minimum leak rate
Helium(He)	1.0×10^{-5} cc/sec
Argon(Ar)	1.0×10^{-4} cc/sec
Carbon Dioxide	1.0×10^{-4} cc/sec
Refrigerant	1.0×10^{-4} cc/sec
H ₂ :He=40:60	1.0×10^{-5} cc/sec

QC2 status: Ready

A gas-tight plexiglass box (can host largest GE2/1 GEM foil section) was setup in cleanroom, for the case of long term test of GEM foil in N_2 . The gas pipe and HV cable routing is ready.



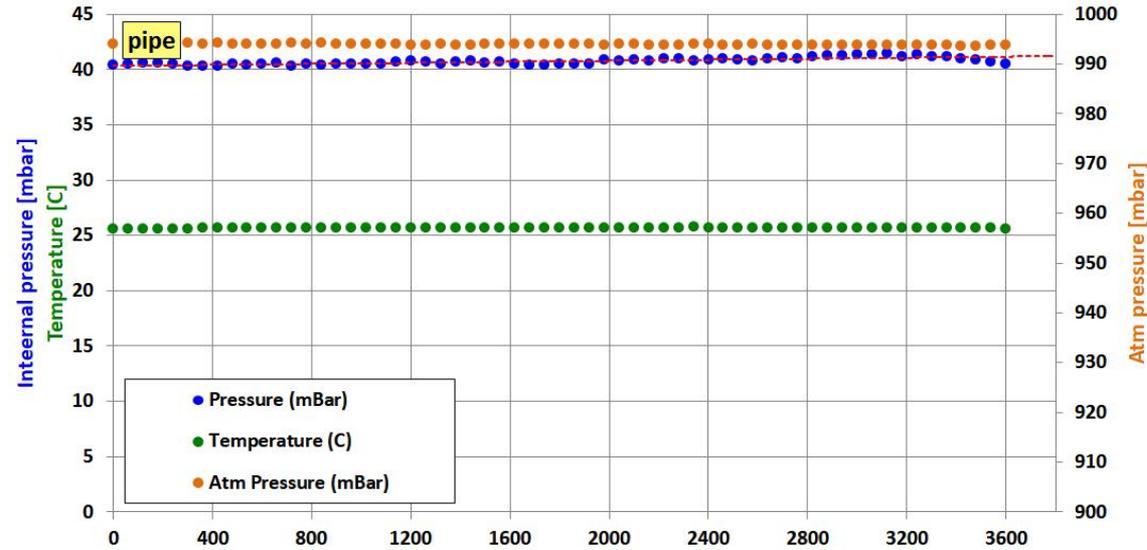
Functions are in the gas mixer



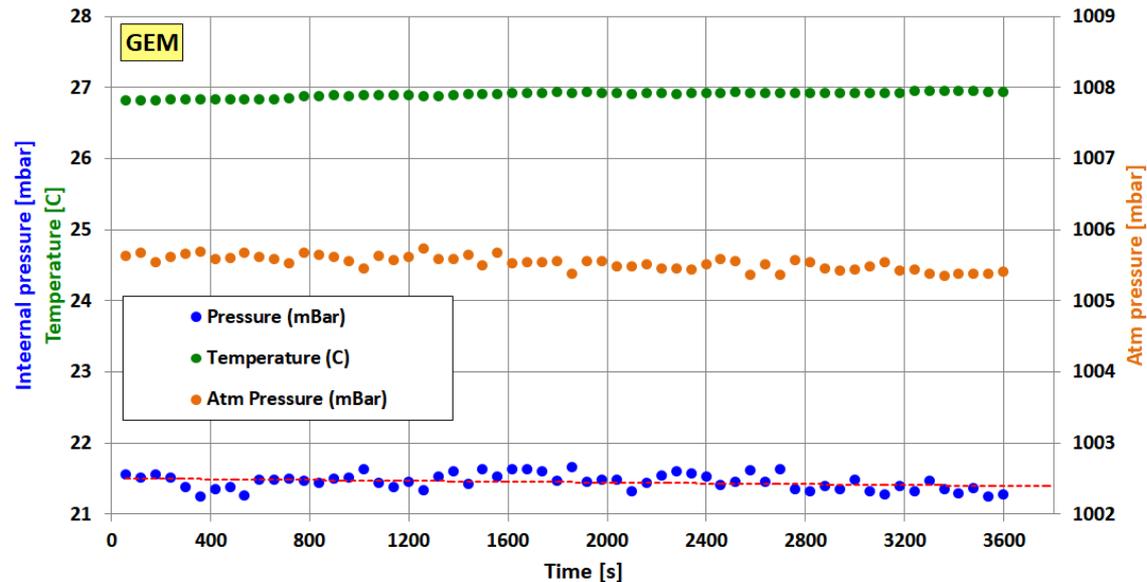
- ❑ The gas system has reached the requirements,
- ❑ the small GEM detector passed the gas leakage test.



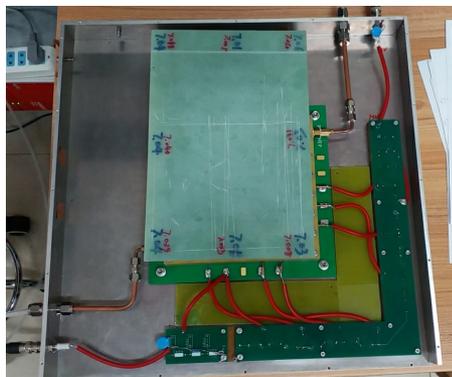
QC3 test results w/ small GEM



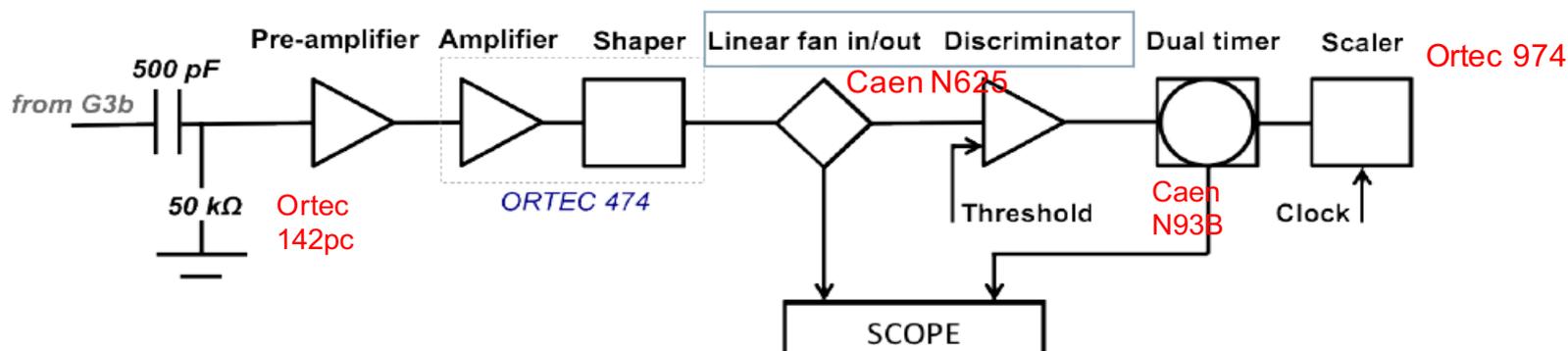
Calibration



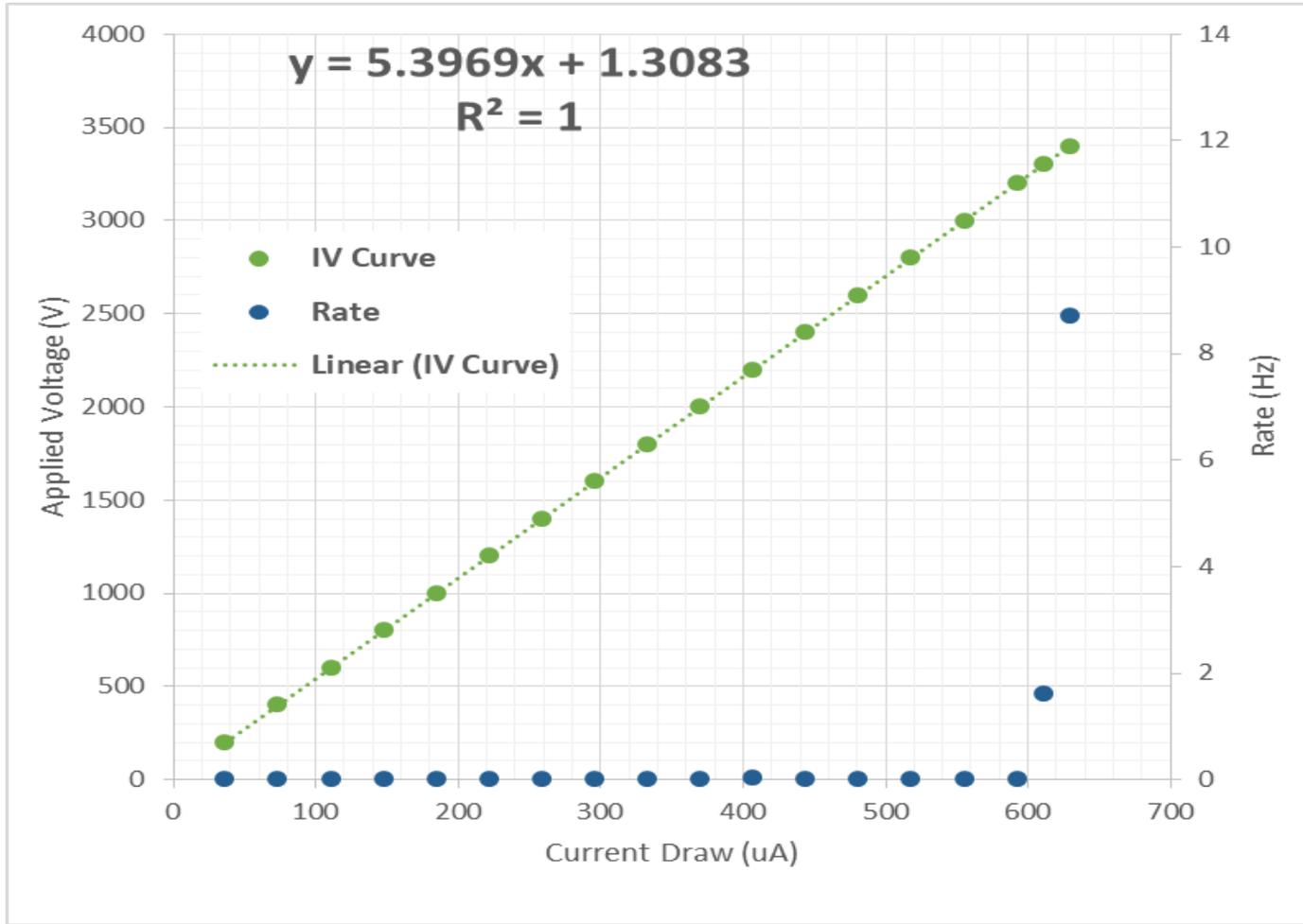
QC3 result: Gas System + GEM

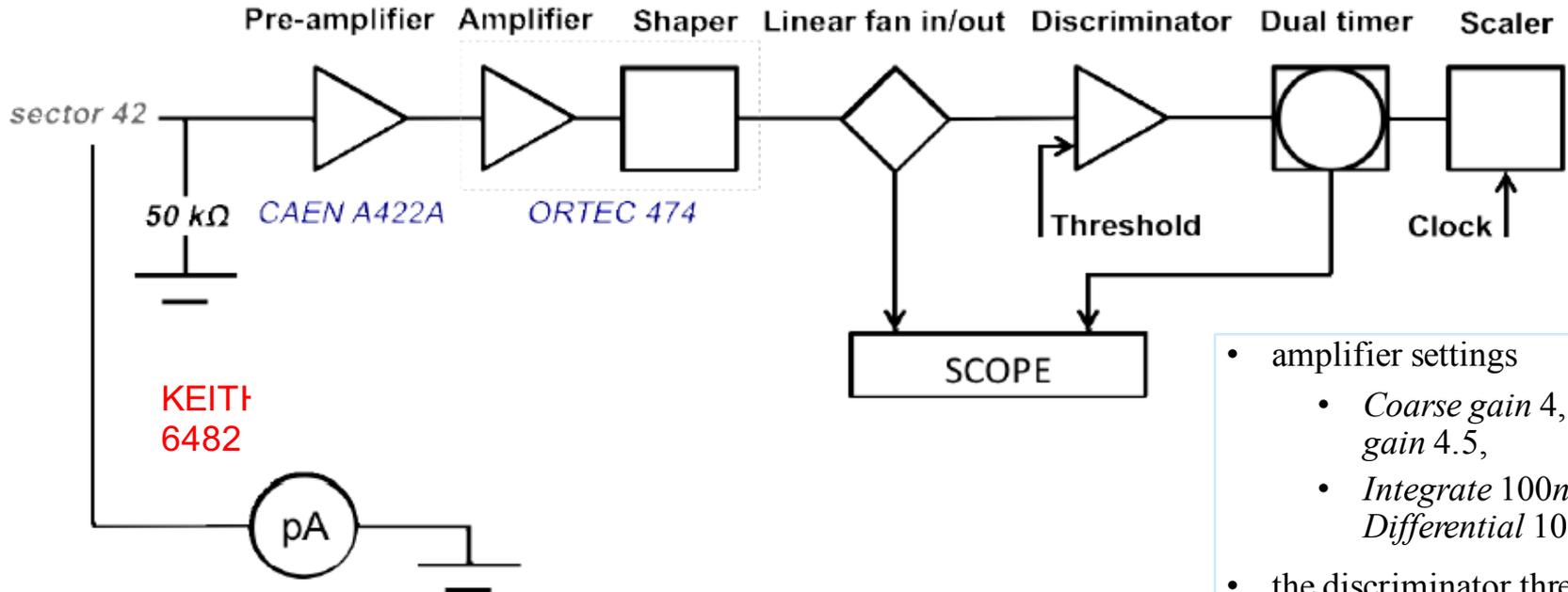


- amplifier settings
 - *Coarse gain 4,*
 - *Fine gain 4.5,*
 - *Integrate 500ns and Differential 500ns*
- the discriminator threshold
 - -140mV



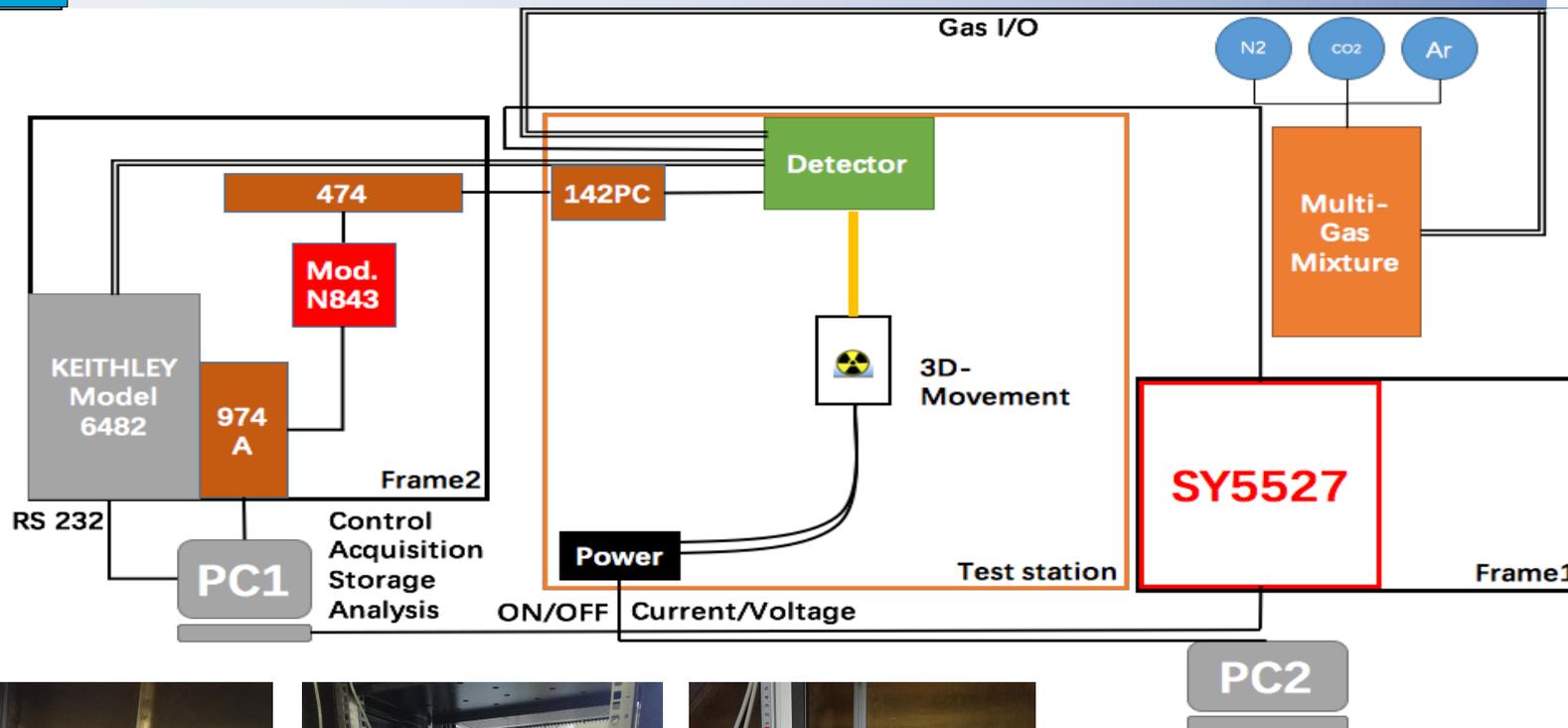
QC4: IV Curve measured





- amplifier settings
 - *Coarse gain 4, Fine gain 4.5,*
 - *Integrate 100ns and Differential 100ns*
- the discriminator threshold
 - -100mV

- ❑ All needed electronics for QC5 (SRS, APV25 etc.) ordered
- ❑ part of them were delivered, the remaining should come soon.
- ❑ Then the QC5 DAQ system could be installed and debugged at CERN with the help of 904 group before transported back to PKU.



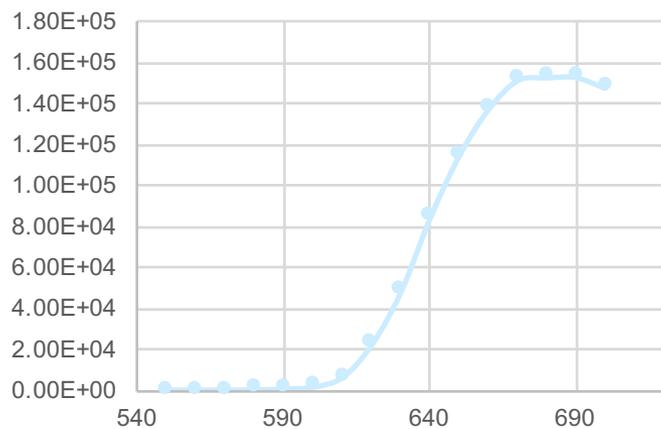


QC5: preliminary results

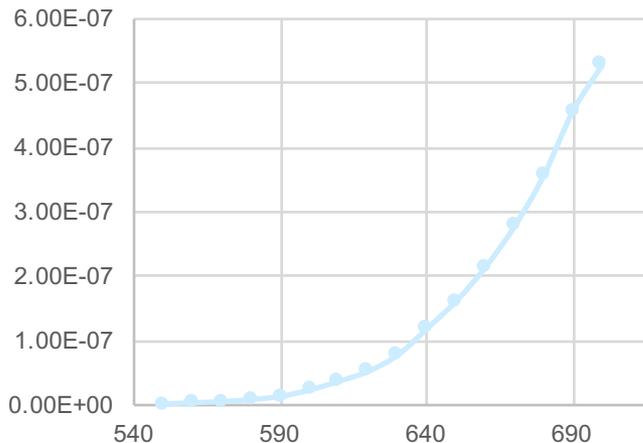


sy5527			974 (60s)		6482 (from readout-PCB)			
V0set (V)	Imon (uA)	Vmon (V)	X-ray off (counts)	X-ray on (counts)	x1: X-ray off (nA)	x1: X-ray on (nA)	y1: X-ray off (nA)	y1: X-ray on (nA)
2970	549.9	2969	22054	31662	-0.32	-3.36	-0.09	-0.1
3025	560.2	3024	27267	33039	-0.3	-4.96	-0.09	-0.11
3078	570	3076.5	27665	35337	-0.286	-6.94	-0.07	-0.12
3132	580	3131	16607	31208	-0.356	-10.03	-0.08	-0.13
3186	590	3185	16787	55435	-0.36	-15.17	-0.07	-0.12
3240	600	3239	17723	109779	-0.36	-25.3	-0.067	-0.16
3293.5	610	3292.5	17851	400267	-0.34	-38.8	-0.06	-0.16
3347.5	620	3346.5	17373	1358150	-0.34	-54.2	-0.07	-0.28
3401.2	630	3400	17623	2905409	-0.37	-79.7	-0.08	-0.3
3455.1	640	3455	26968	5074568	-0.41	-120.7	-0.08	-0.3
3509	650	3508	26948	6898297	-0.45	-163.4	-0.09	-0.5
3563	660	3561.5	27489	8250288	-0.57	-216	-0.09	-0.5
3616.5	670	3615.5	27111	9095203	-0.7	-280	-0.09	-0.5
3668.5	680	3668	16878	9164602	-0.8	-359	-0.09	-0.4
3724.2	690	3723	18301	9174096	-0.96	-459	-0.09	-0.4
3778.5	700	3777	18724	8857670	-1.44	-530	-0.09	-0.3

Rate

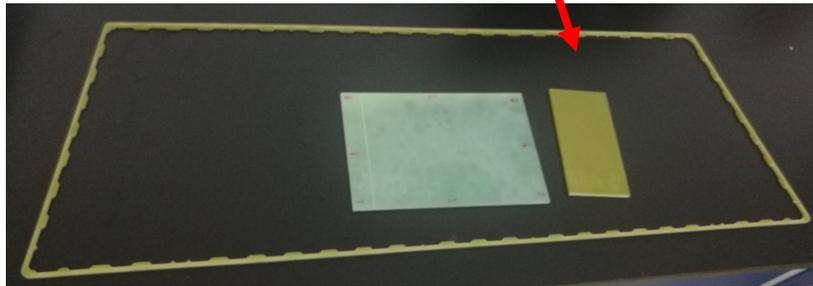
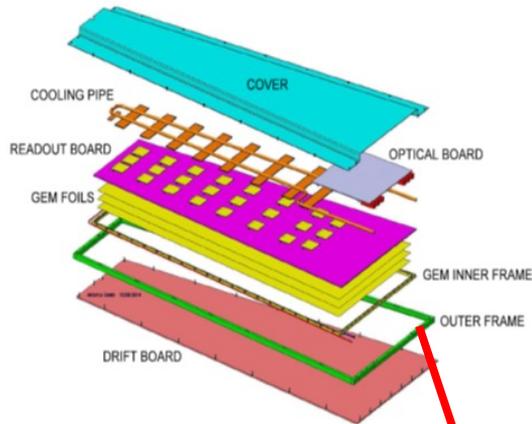


Current

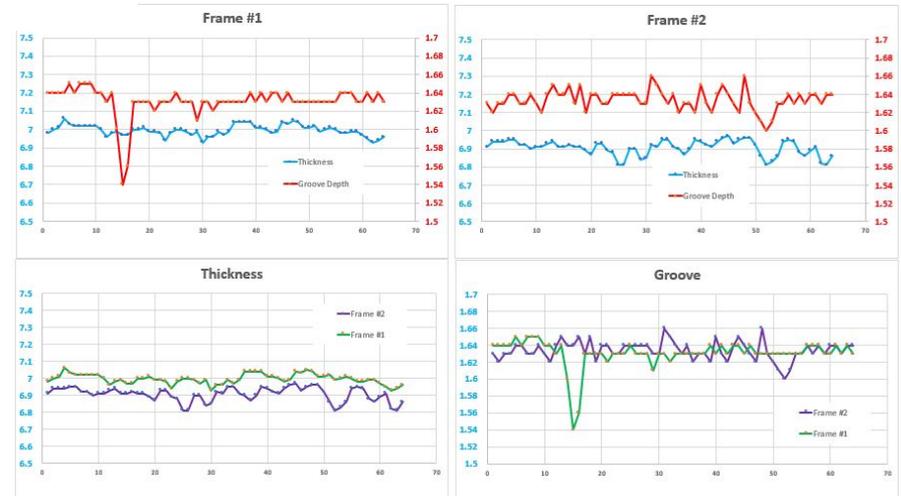
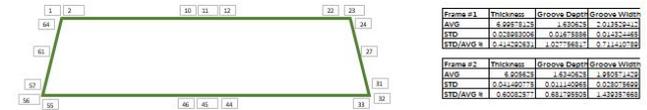


The effective gain could be derived :
 being checked

- We asked two firms in Beijing to produce a few GE2/1 frame samples, two frames from different firm were brought to CERN and were tested.
- The tolerance of the sample produced by Axicomb company is acceptable by GEM standard, although the thickness calibration need to be improved.
- Next: to produce a set of GE2/1 (8 frames) with coating for further test.



FR4 GE2/1 frame samples



Test results



Summary



- ❑ PKU preparation for GE21 production site progress well.
- ❑ All QC steps with small GEM are done (stage-1)
- ❑ Ready for further certification procedures; Detailed arrangement to be further discussed
- ❑ Aim to achieve all the steps and be on time for production

Thanks!