ChiR1.0 - IV 测试

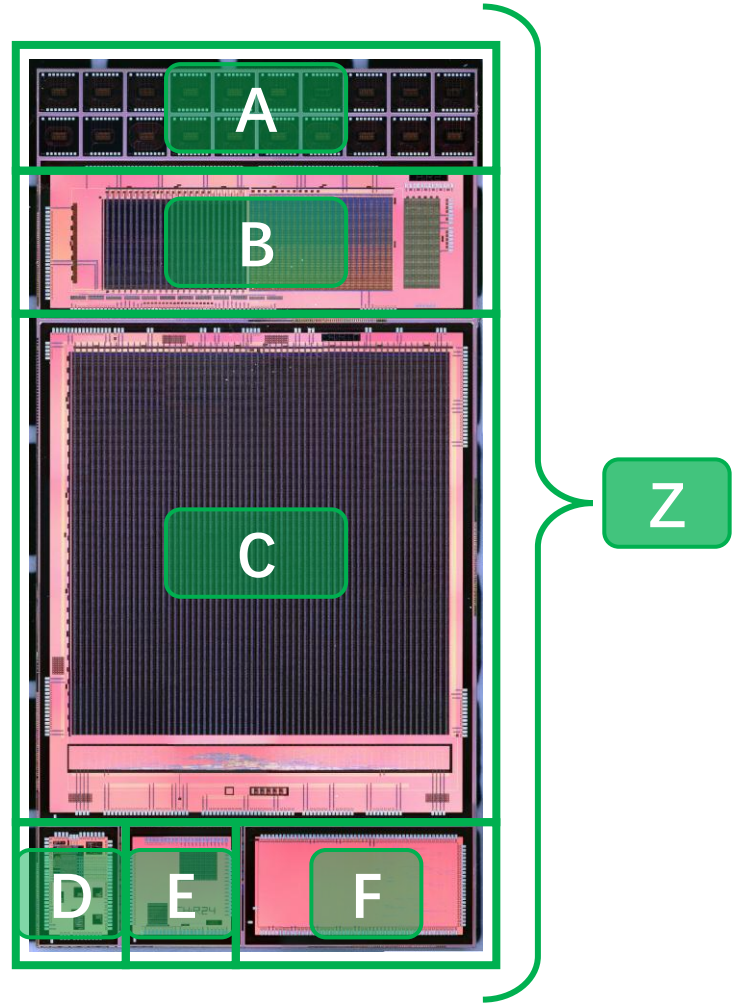
王博新，袁源，徐子骏

2026.08.18

准备：ChiR1.0 芯片库存列表

- ChiR 第一次流片

	A	B	C	D	E	F	Z	总数
数量	325	325	325	321	321	321	441	2,382



- 库存记录表
  - 按照晶圆、划片、所在的原装硅胶盒号、盒内的第几个芯片，对每一片唯一编号
  - 编号规则：

CH1001A103G → CH1001A103G

ChiR1.0 流片　AE0408.01晶圆　划片区域A　第1个芯片盒　左上起第3片　良品

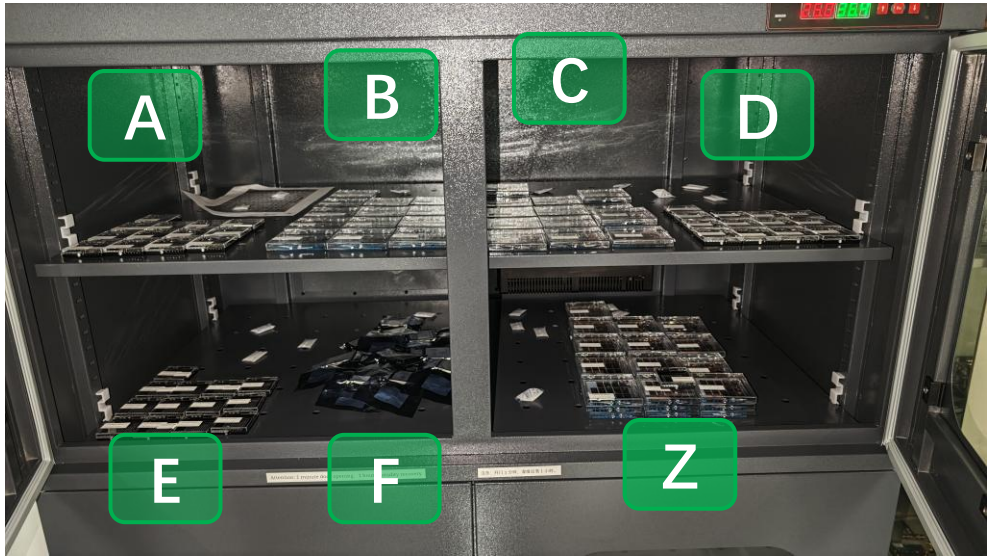
索引号	晶圆编号	划片	盒号	序号	是否良品	唯一编号	当前存放位置	入库时间	是否在库	取用时间	取用备注
1	AE0408p01	A	1	1	GOOD	CH1001A101G	物理楼106干燥柜	2026-07-20	1		
2	AE0408p01	A	1	2	GOOD	CH1001A102G	物理楼106干燥柜	2026-07-20	1		
3	AE0408p01	A	1	3	GOOD	CH1001A103G	物理楼106干燥柜（取用盒1）	2026-07-20	0	2026-07-27	测试20个阵列的IV
4	AE0408p01	A	1	4	GOOD	CH1001A104G	物理楼106干燥柜	2026-07-20	1		
5	AE0408p01	A	1	5	GOOD	CH1001A105G	物理楼106干燥柜	2026-07-20	1		
6	AE0408p01	A	1	6	GOOD	CH1001A106G	物理楼106干燥柜	2026-07-20	1		
7	AE0408p01	A	1	7	GOOD	CH1001A107G	物理楼106干燥柜	2026-07-20	1		
8	AE0408p01	A	1	8	GOOD	CH1001A108G	物理楼106干燥柜	2026-07-20	1		
9	AE0408p01	A	1	9	GOOD	CH1001A109G	物理楼106干燥柜	2026-07-20	1		

  - 已上传 IHEP Box，如有取用随时更新

准备：ChiR1.0 芯片库存列表

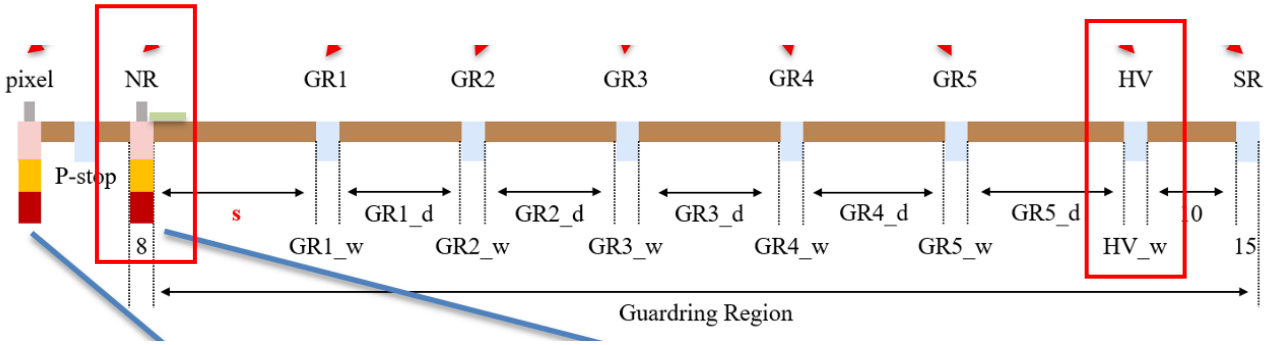
- 目前已全部收纳到三号厅 007 实验室的电子防潮柜内
- 已寄出（已出库）的情况：

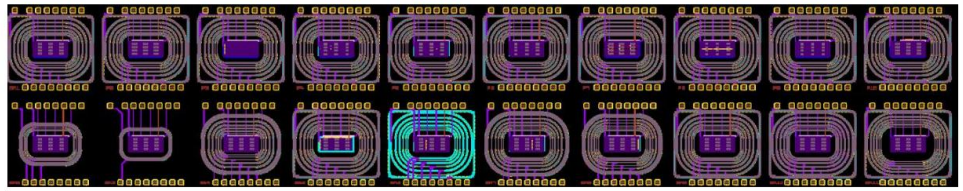
院所	日期	芯片列表	数量	签收人
西北工业大学	2026.07.20	CH10[04,05]F1[01-25]G	50，阵列F	魏晓敏
浙江大学	2026.08.11	CH1001A1[01,02]G CH10[02-13]A1[02,03]G	26，阵列A	朱宏博
大连民族大学	2026.08.14	CH10[01-13]D1[01,02]G CH10[02,06]D103G	28，阵列D	施展



ChiR1.0 A IV 测试配置

- ChiR1.0 子阵列 A
  - 以 GR1 为基准，P2~P10 为不同的像素设计，GR2~GR11为不同的保护环设计
- IV 测试
  - IV 测试的目的是获取击穿电压。
  - HV 接入 P 衬底，NR 接入 N-well ring，测量这两个 pad 的IV 即可。
  - **其他 pad 悬空**、双同轴电缆、2470源表进行 IV 扫描



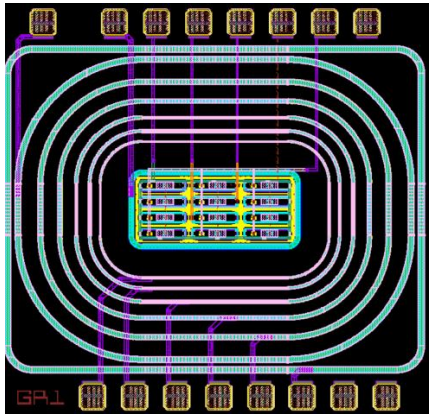


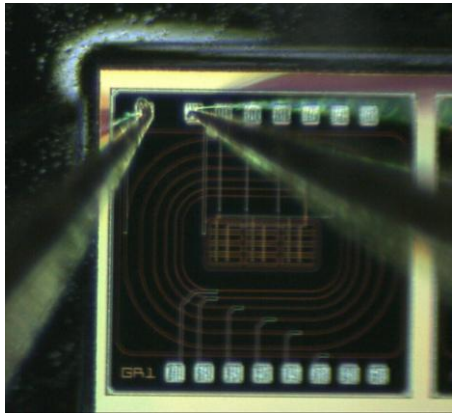
版图总览

GR1	P2	P3	P4	P5	P6	P7	P8	P9	P10
GR2	GR3	GR4	GR5	GR6	GR7	GR8	GR9	GR10	GR11

分布示意图

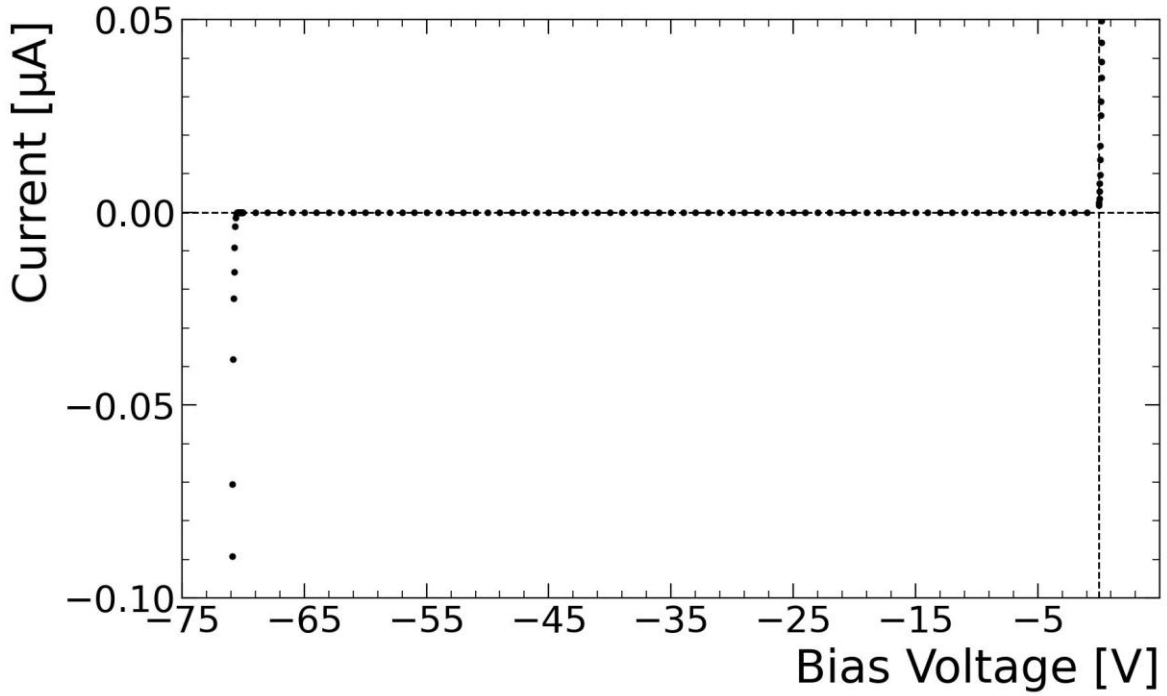
HV NR





准备：检验复现 COFFEE3 IV 图像

- 验证即将使用的源表+探针台是否可复现此前 -70V 击穿的 COFFEE3 IV 图像，以确认仪器和程序工作正常



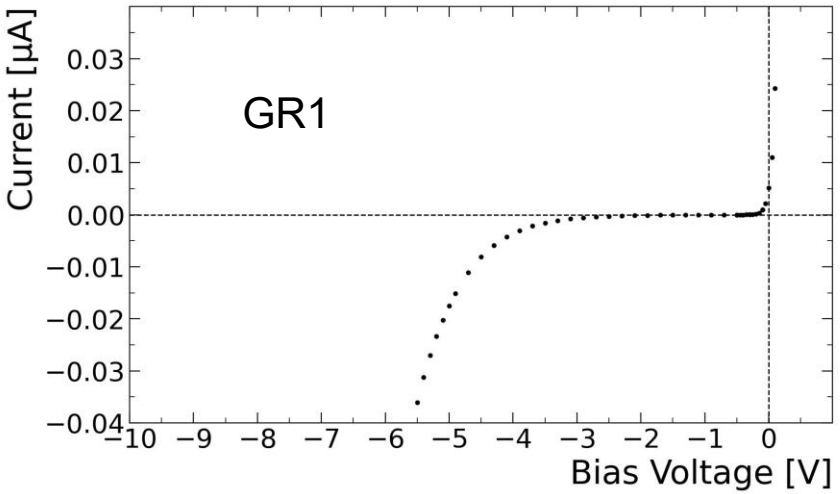
- 仪器和程序都成功复现了 COFFEE3 的 IV 特性，可靠性得以验证

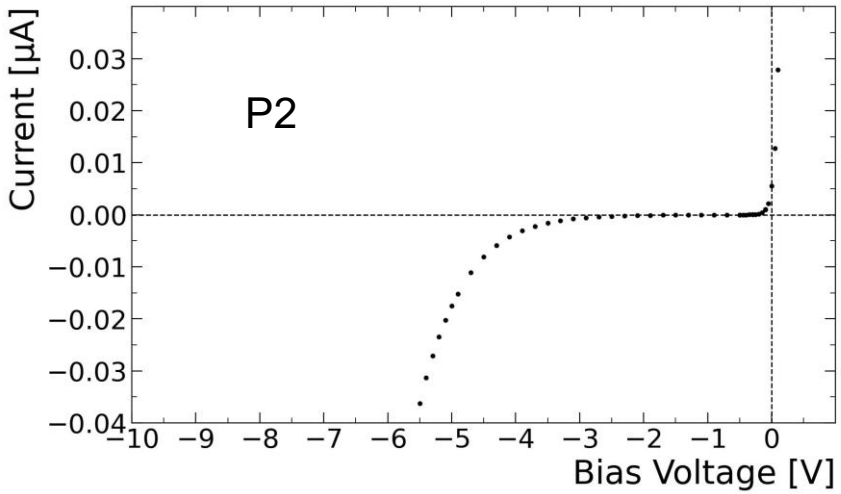
ChiR1.0 A IV 测试结果

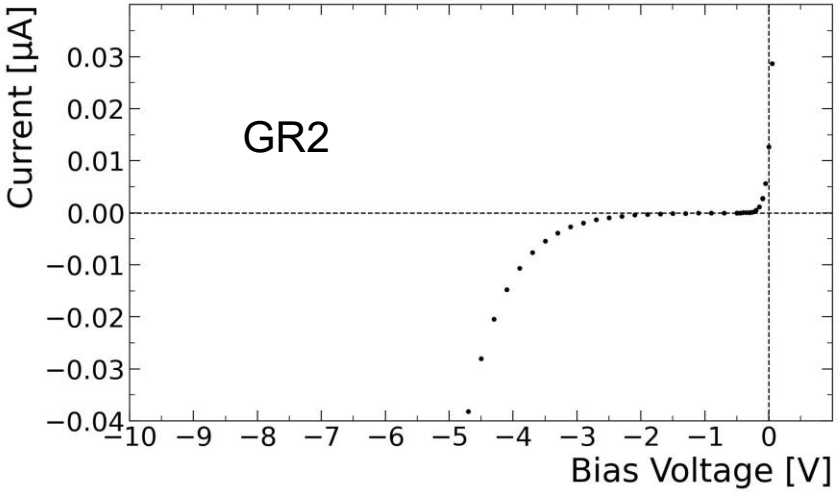
- 已测试：
  - CH1001A103G -- GR1, GR2, GR3, P2, P3
  - CH1002A101G -- GR1, GR2, GR3, ..., GR11, P2, P3, ..., P10
  - CH1003A101G -- GR1, GR2, GR3, P2
  - CH1004A101G -- GR1, GR2, GR3, P2
  - CH1005A101G -- GR1, GR2, GR3, P2
  - CH1006A101G -- GR1, GR2, GR3, P2
  - CH1007A101G -- GR1, GR2, GR3, P2
  - CH1008A101G -- GR1, GR2, GR3, P2, P3
  - CH1009A101G -- GR1, GR2, GR3, P2
  - CH1010A101G -- GR1, GR2, GR3, P2
  - CH1011A101G -- GR1, GR2, GR3, P2
  - CH1012A101G -- GR1, GR2, GR3, P2, P3
  - CH1013A101G -- GR1, GR2, GR3, P2

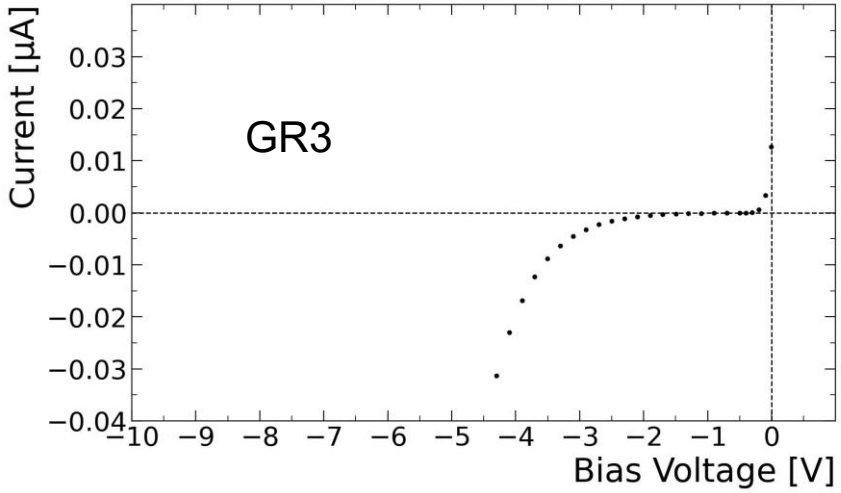
ChiR1.0 A IV 测试结果

- CH1001A103G



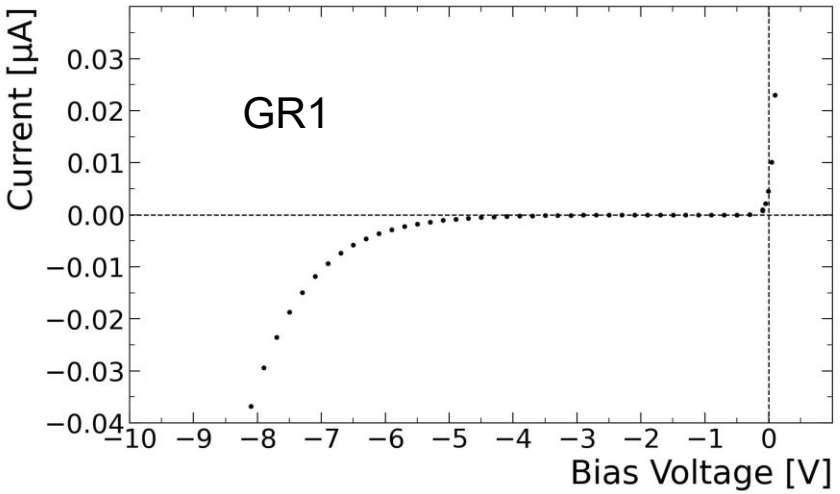


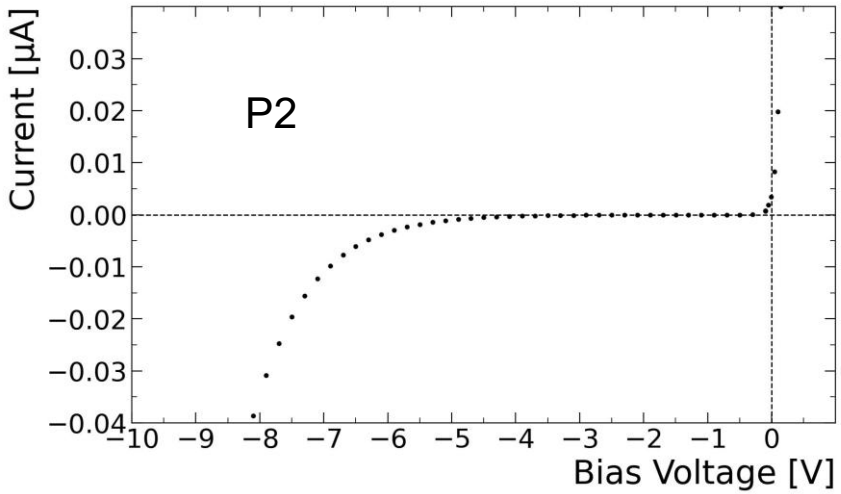


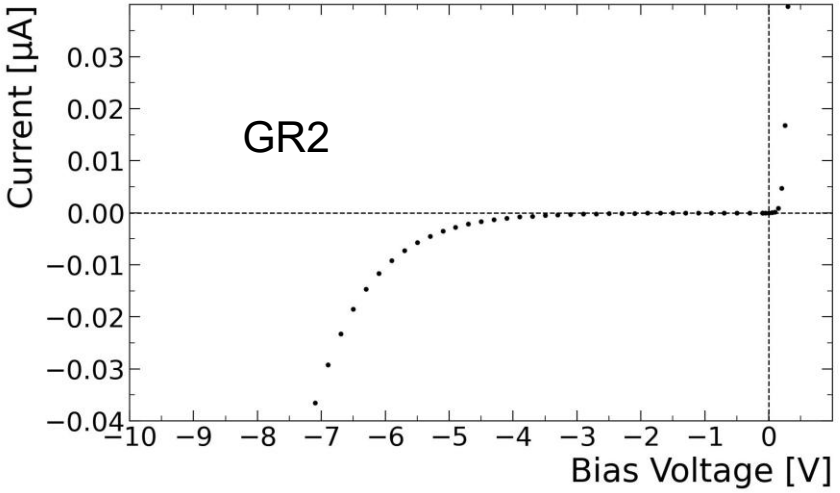


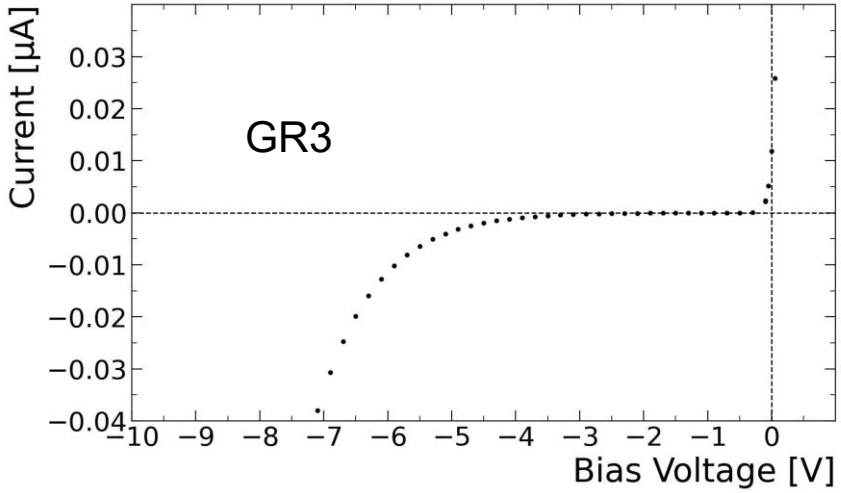
ChiR1.0 A IV 测试结果

- CH1002A101G



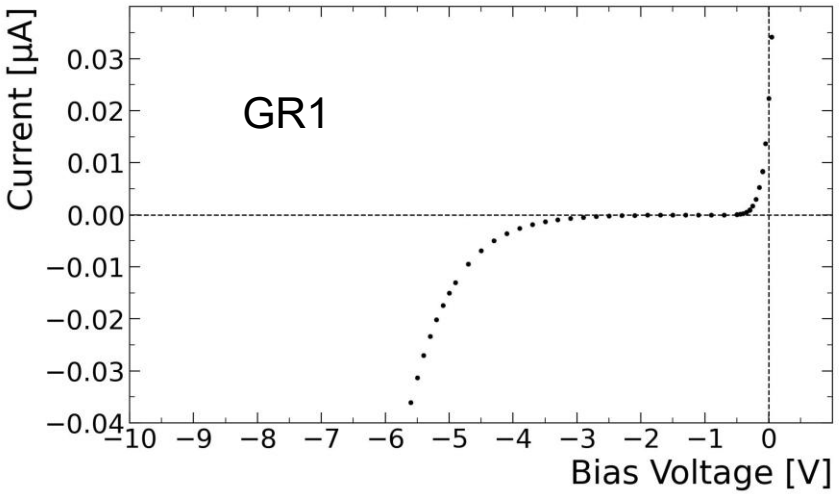


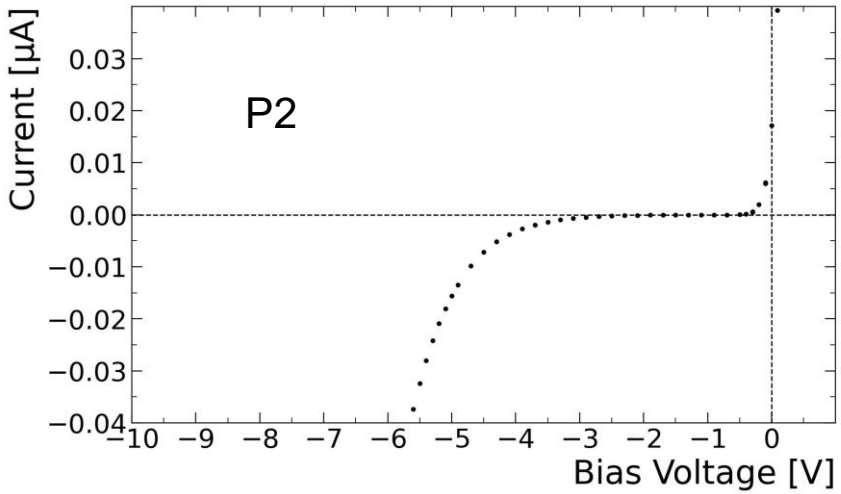


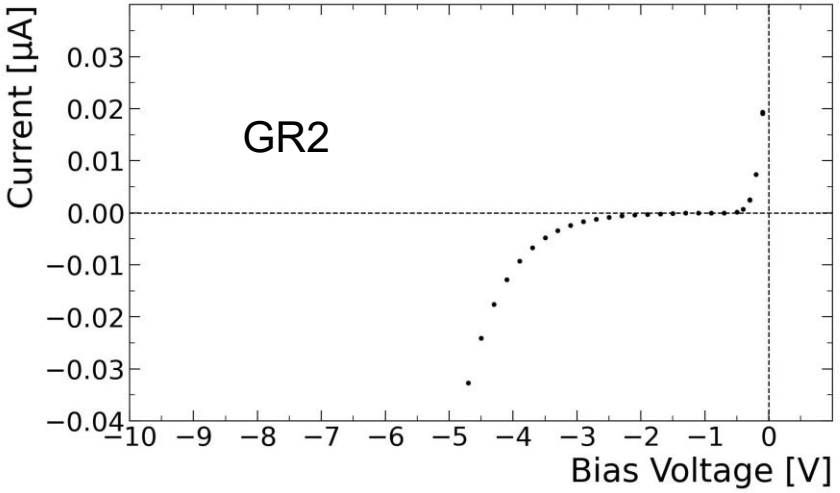


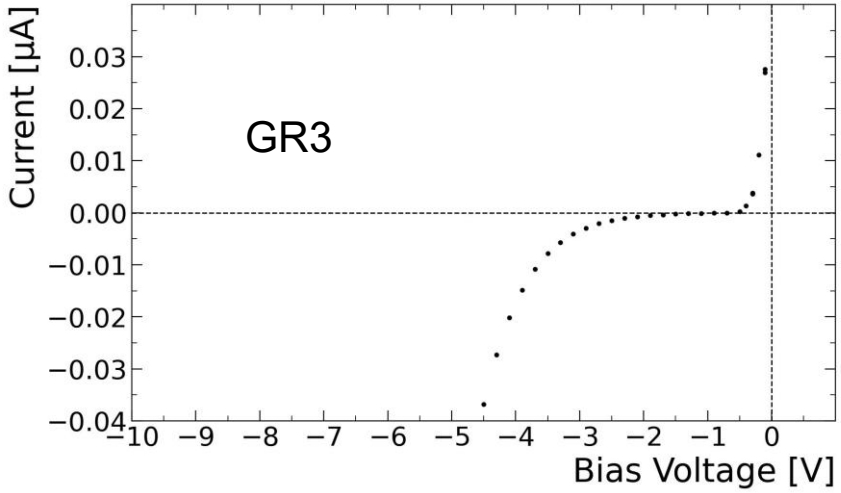
ChiR1.0 A IV 测试结果

- CH1003A101G



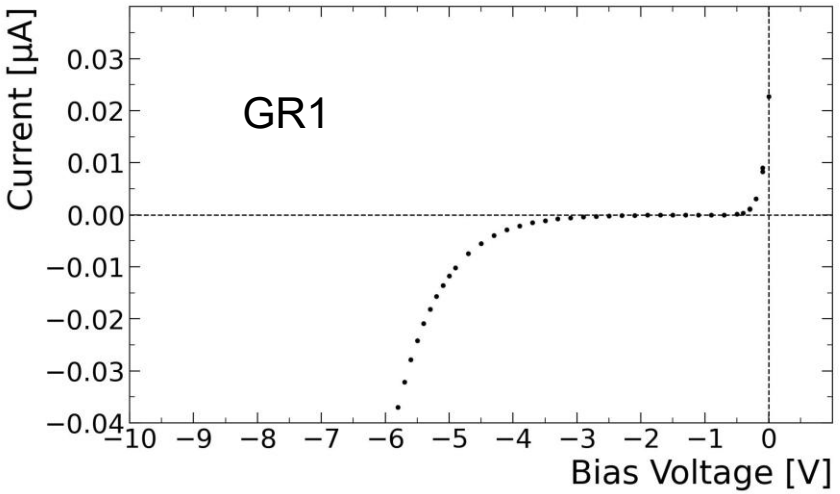


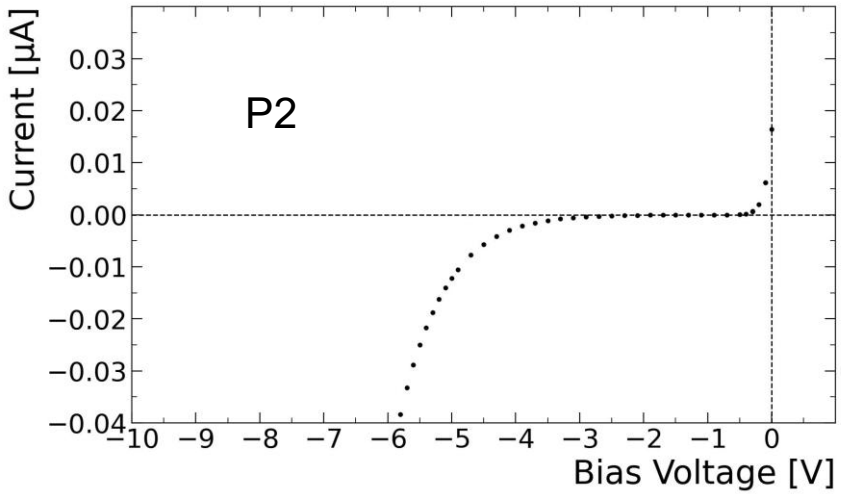


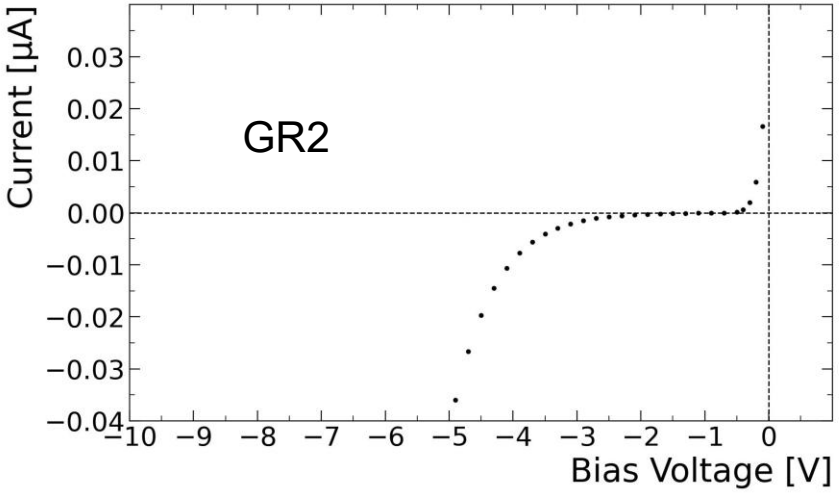


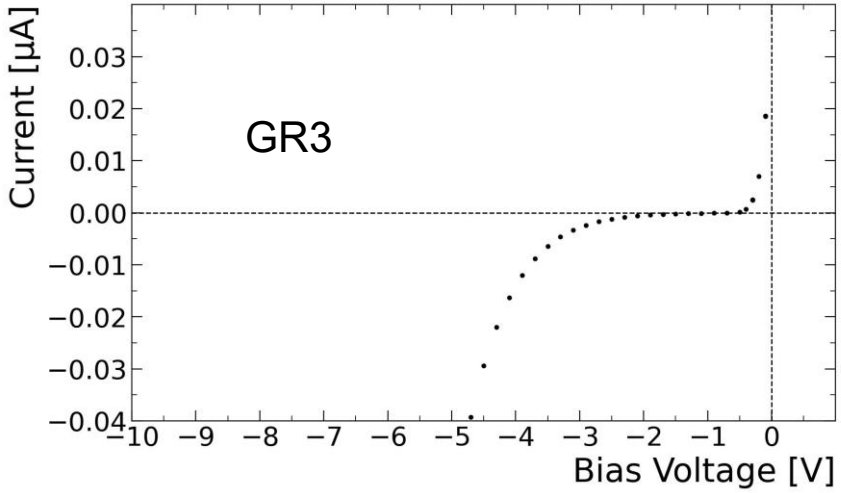
ChiR1.0 A IV 测试结果

- CH1004A101G



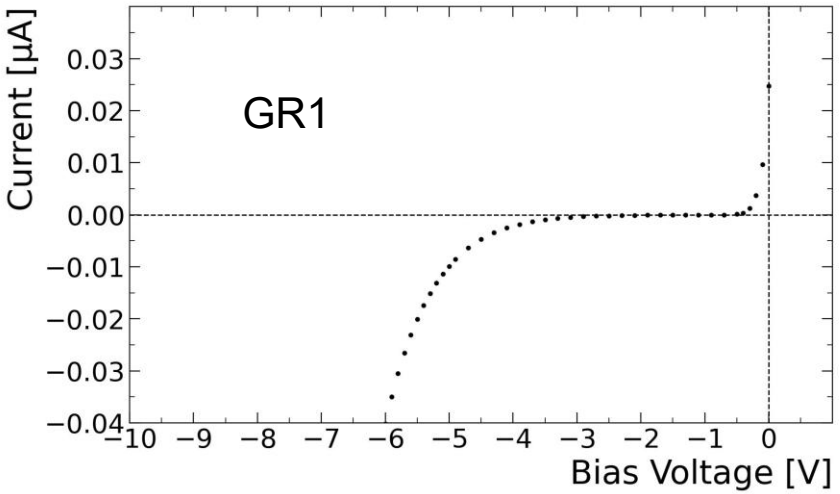


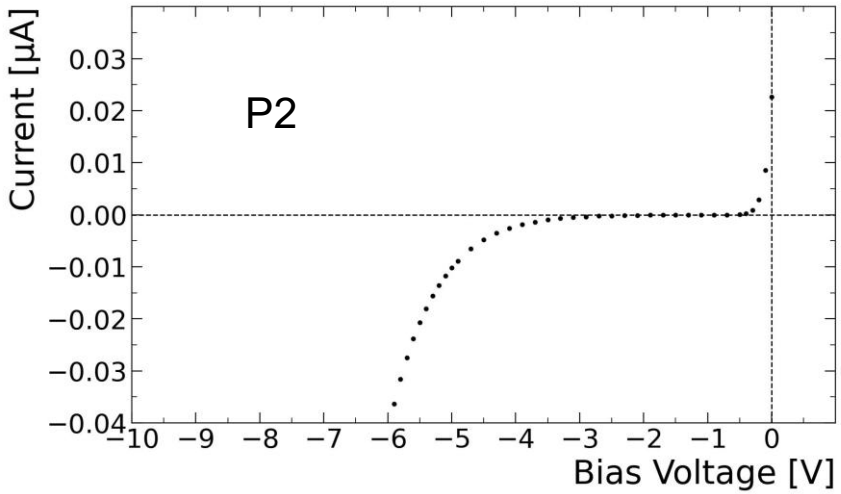


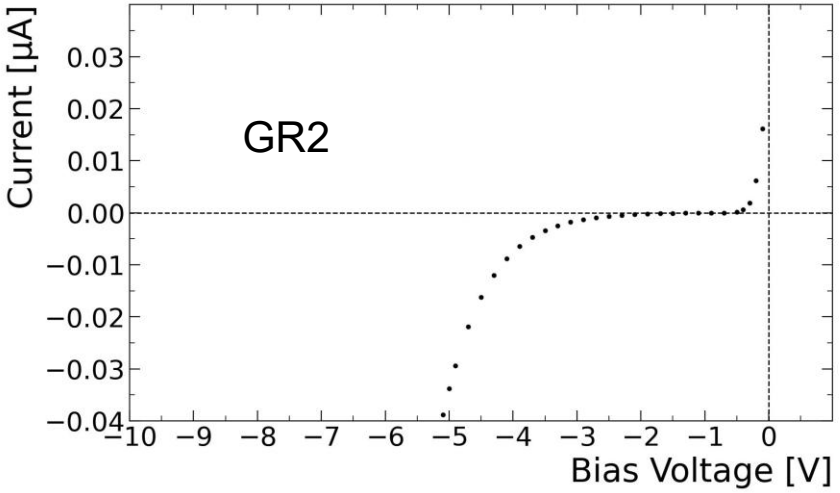


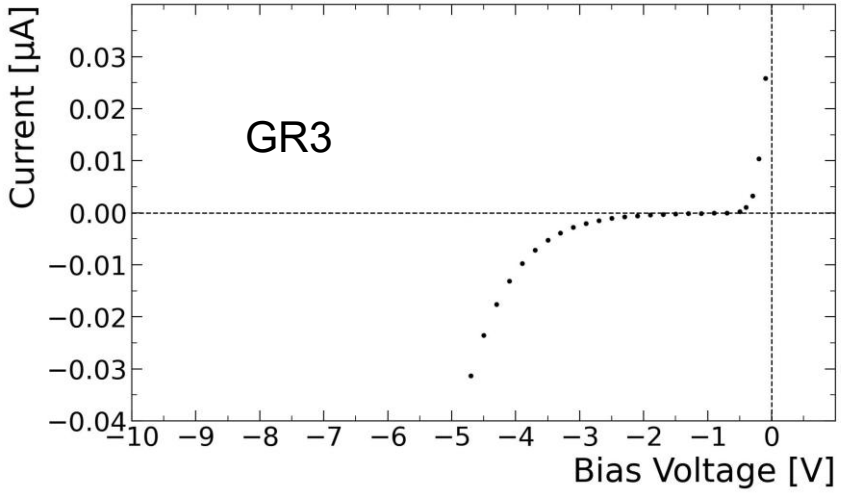
ChiR1.0 A IV 测试结果

- CH1005A101G



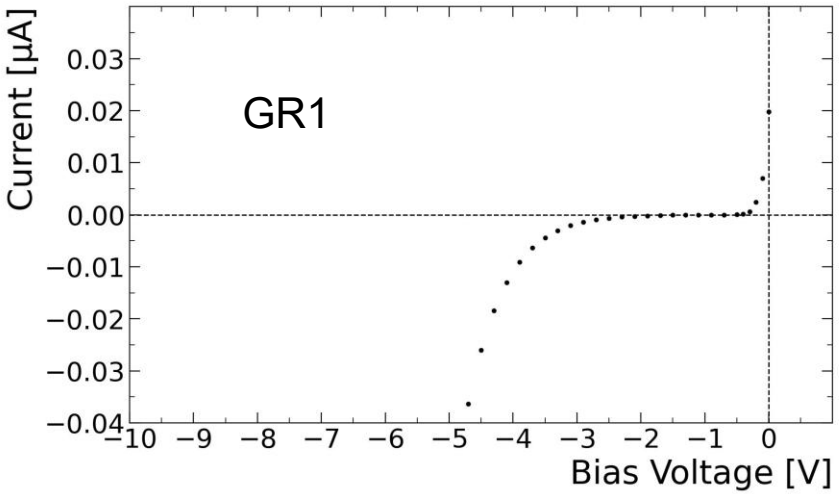


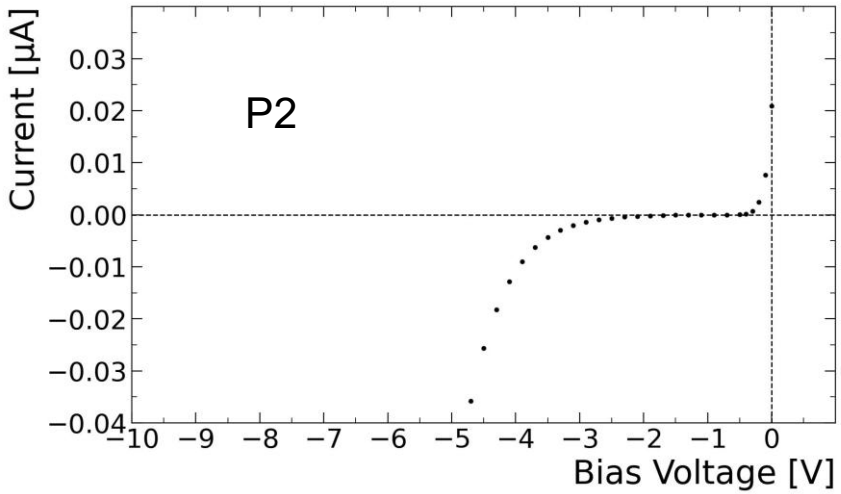


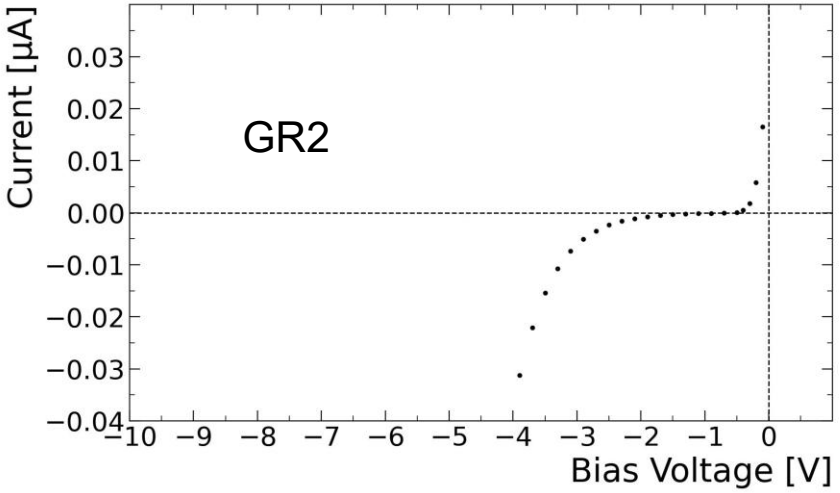


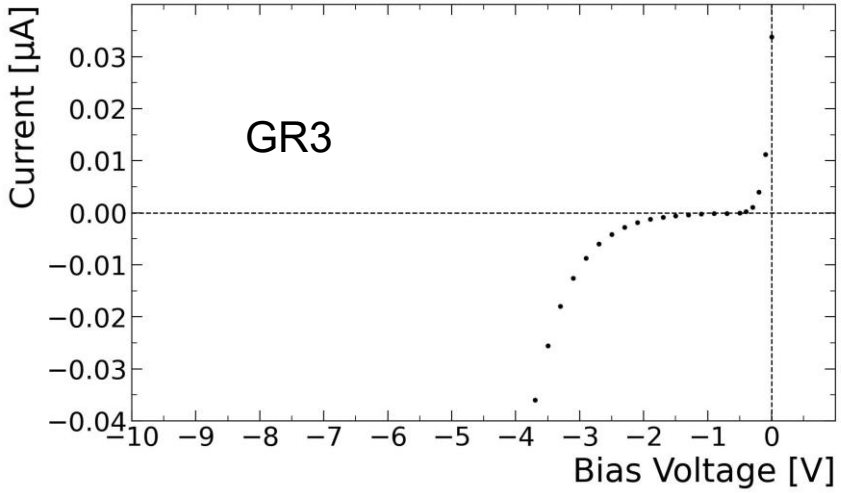
ChiR1.0 A IV 测试结果

- CH1006A101G



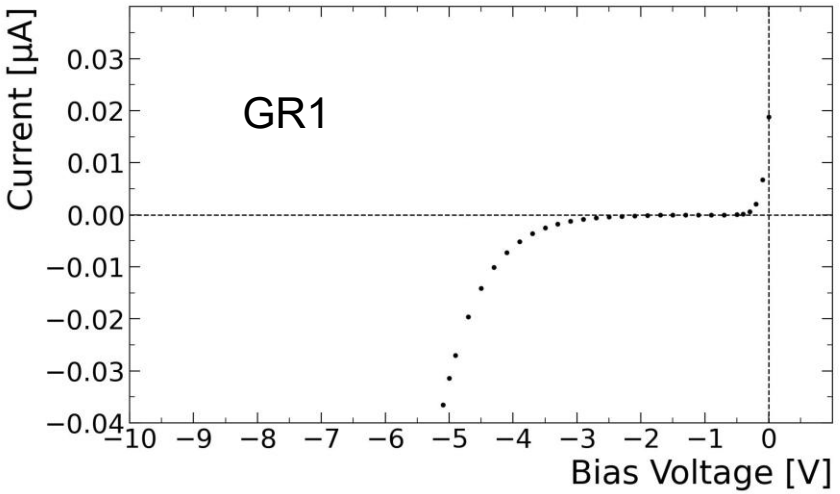


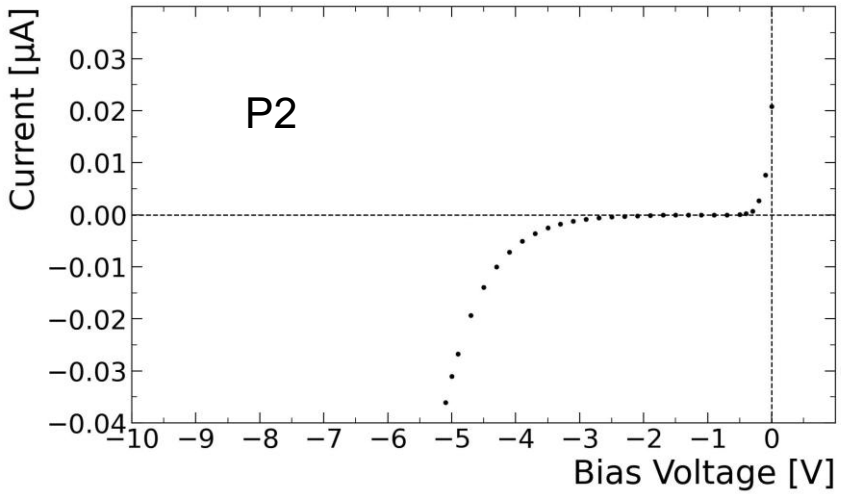


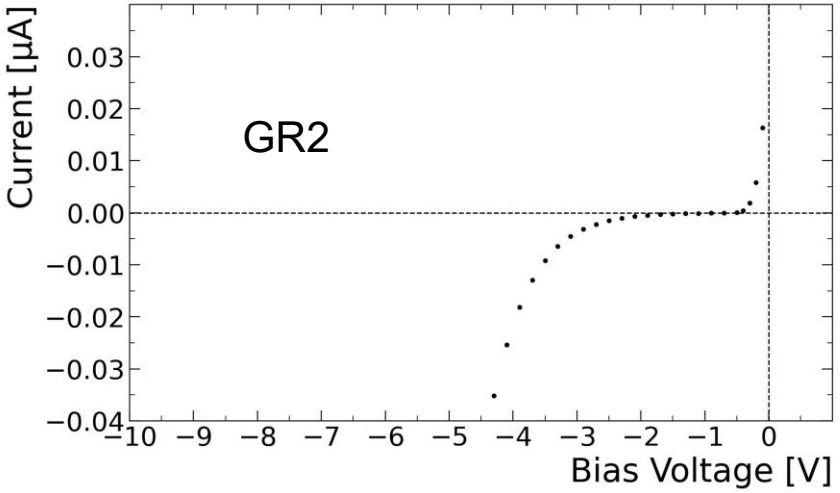


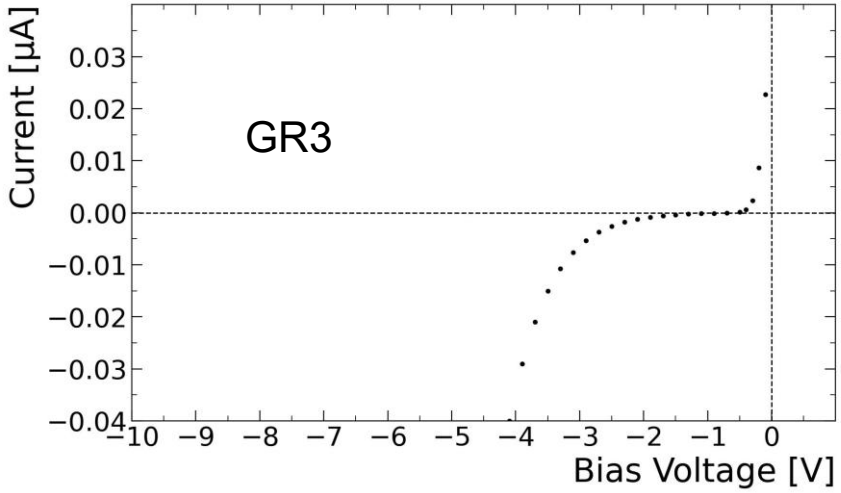
ChiR1.0 A IV 测试结果

- CH1007A101G



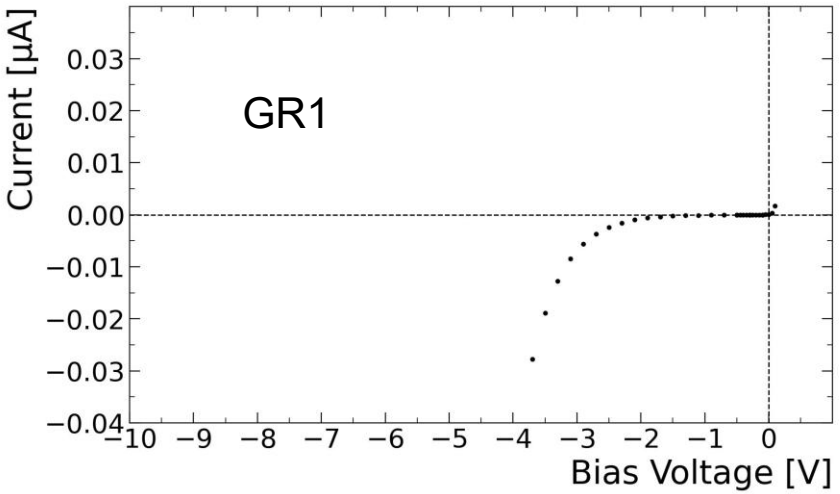


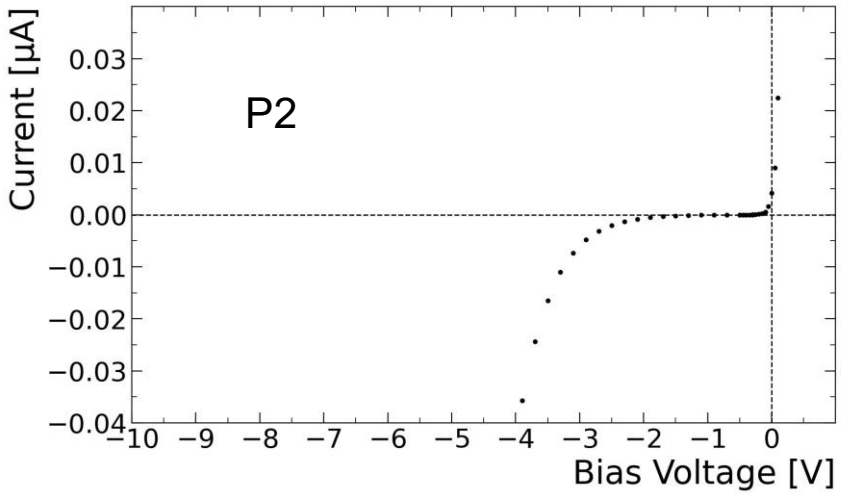


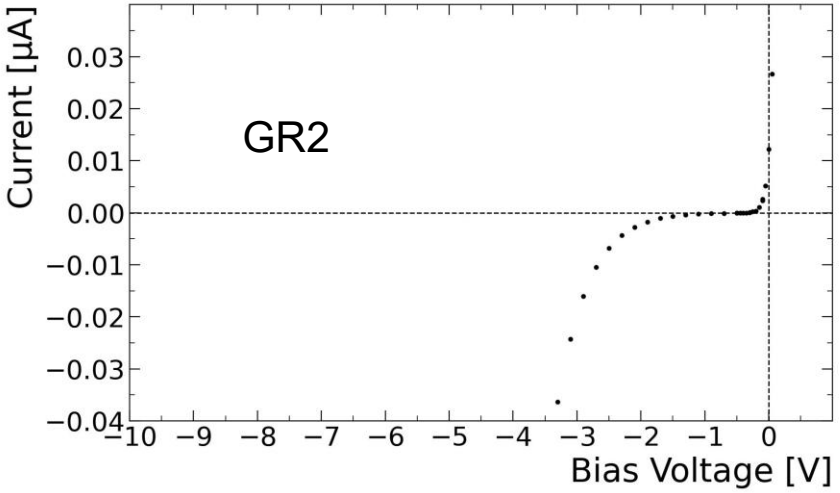


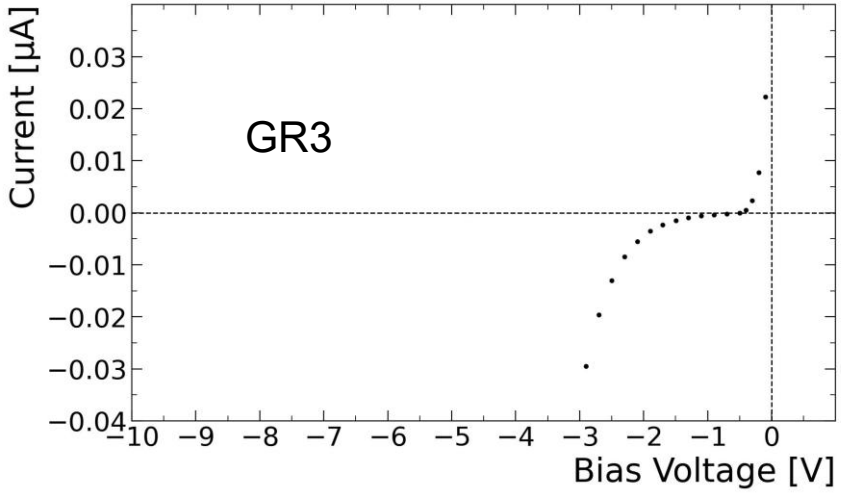
ChiR1.0 A IV 测试结果

- CH1008A101G



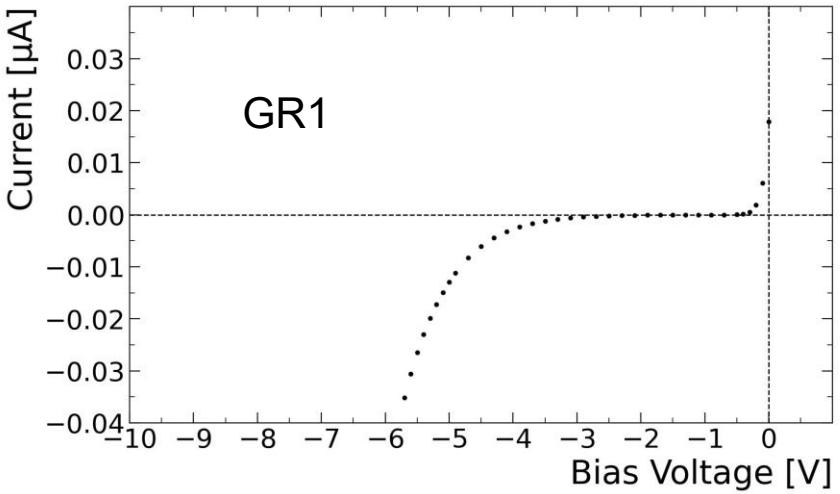


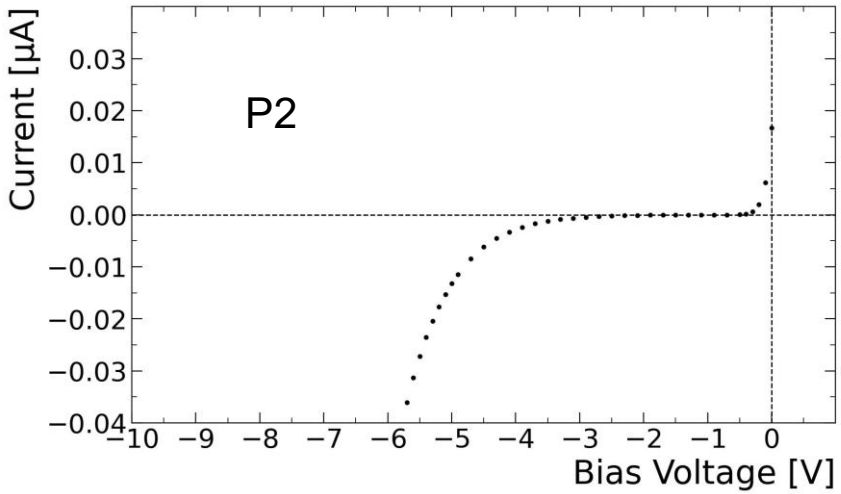


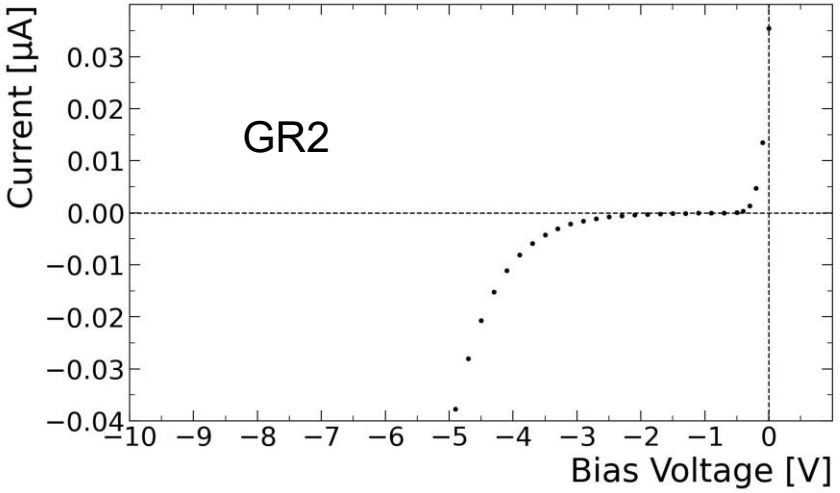


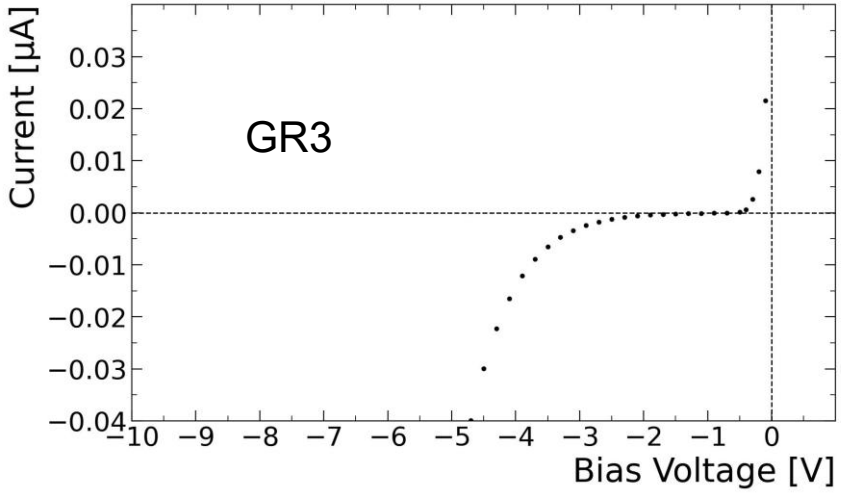
ChiR1.0 A IV 测试结果

- CH1009A101G



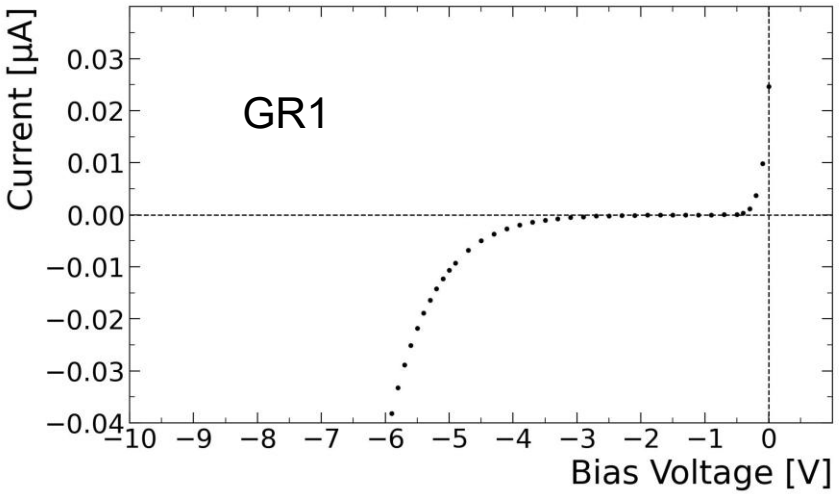


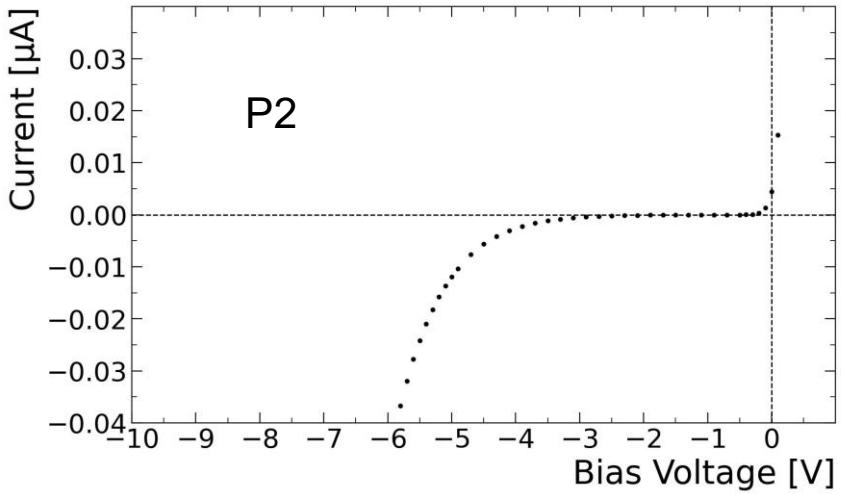


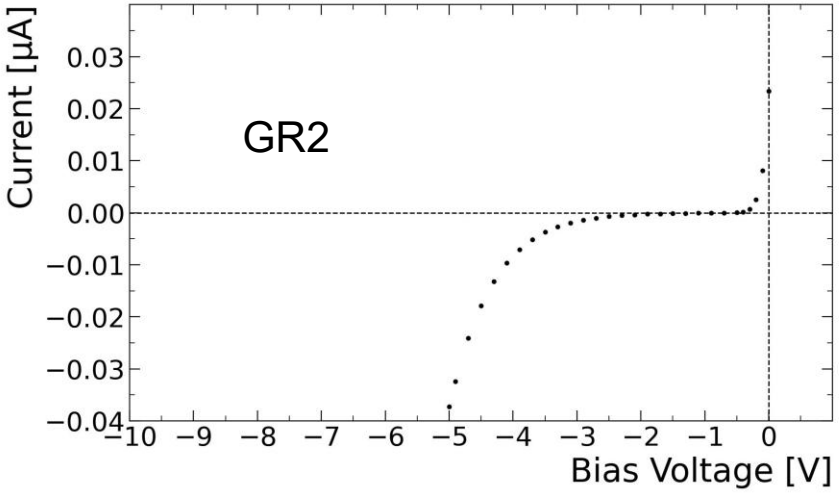


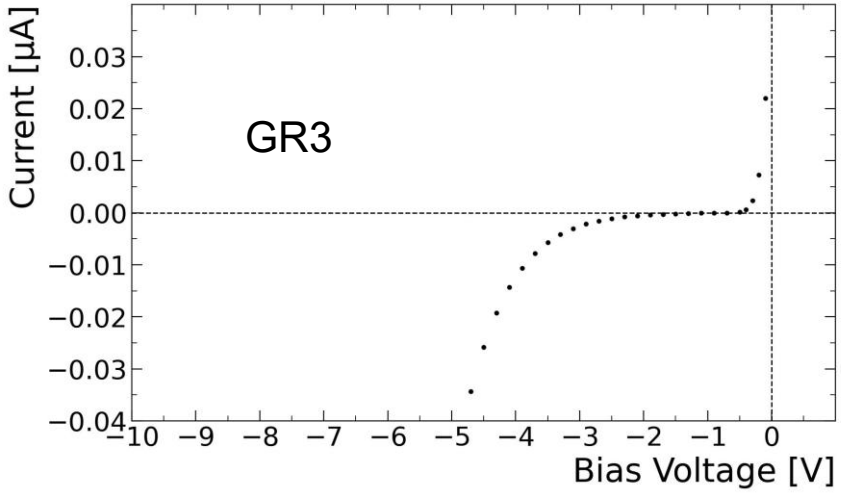
ChiR1.0 A IV 测试结果

- CH1010A101G



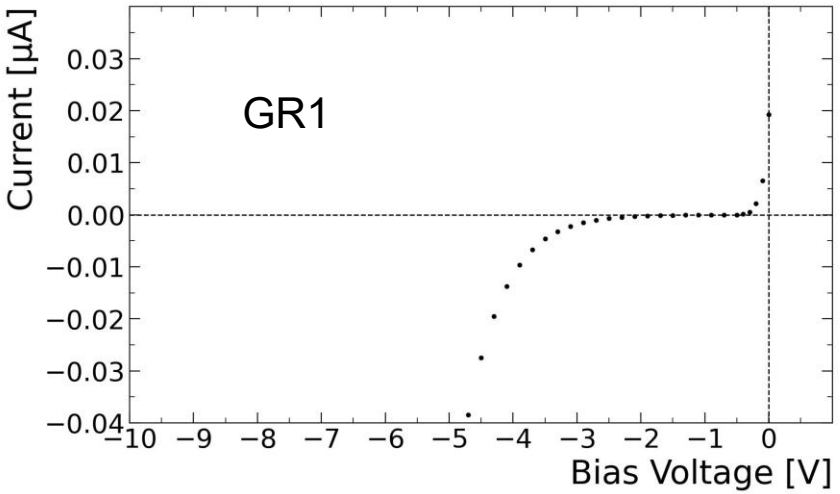


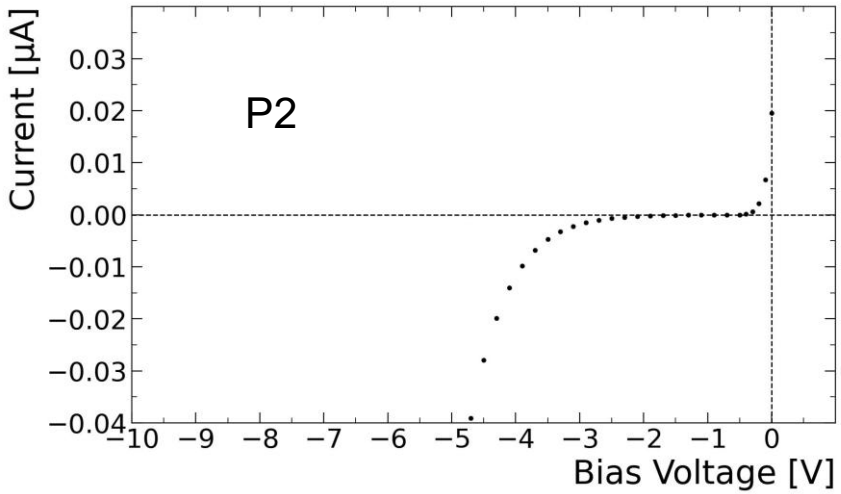


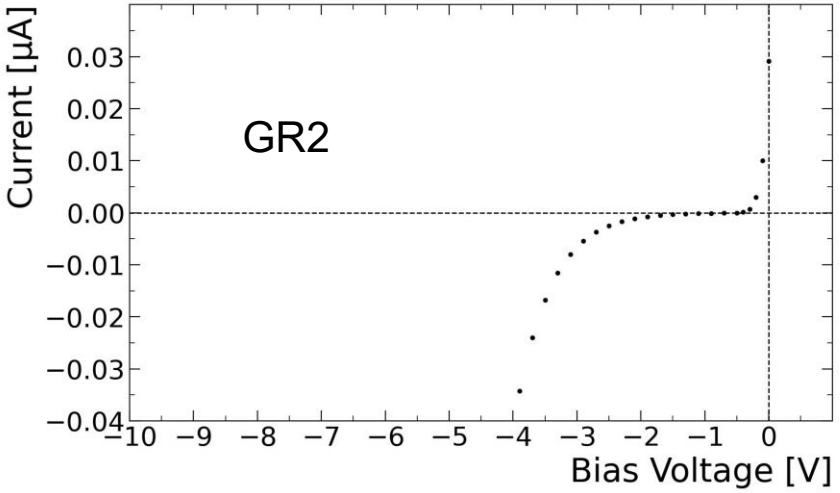


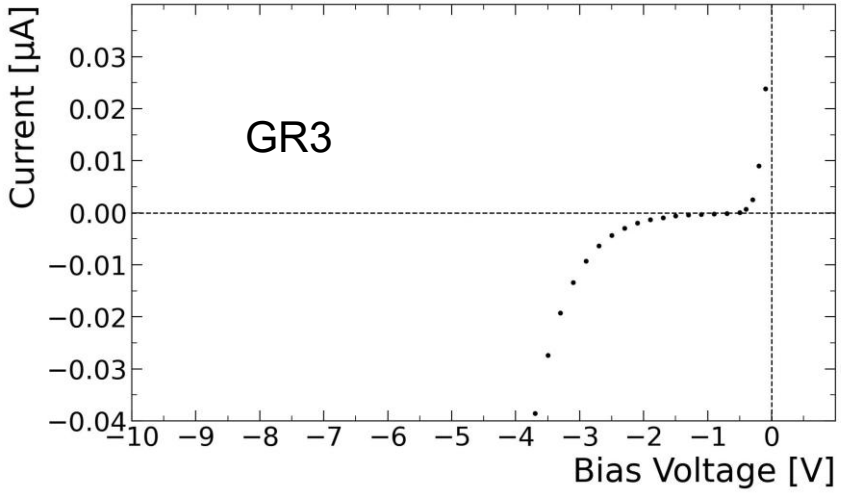
ChiR1.0 A IV 测试结果

- CH1011A101G



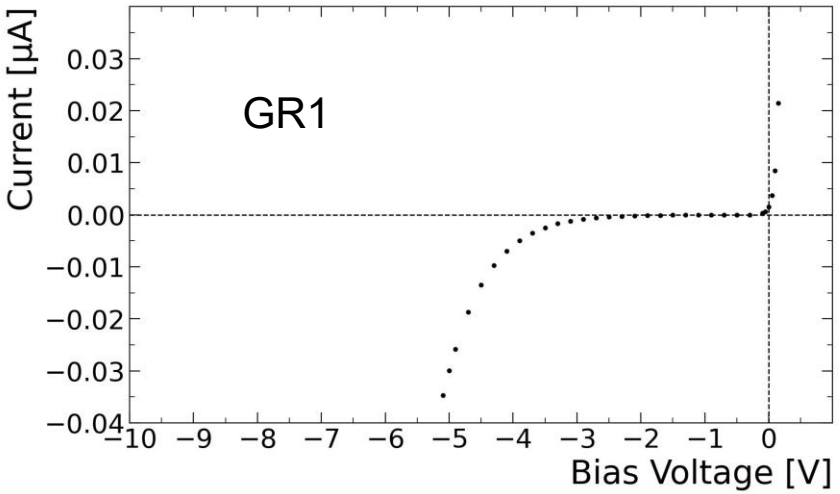


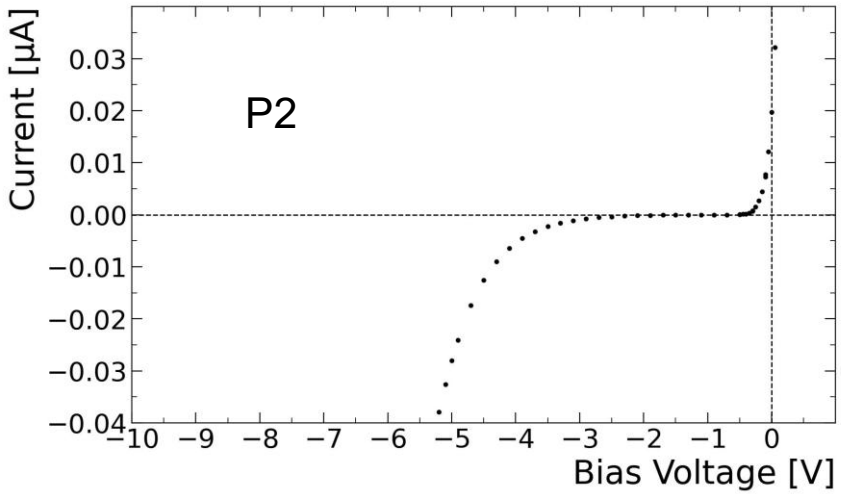


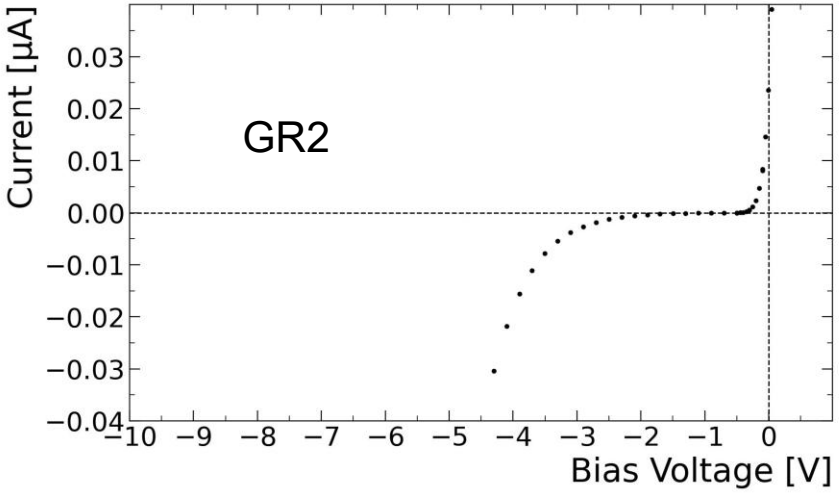


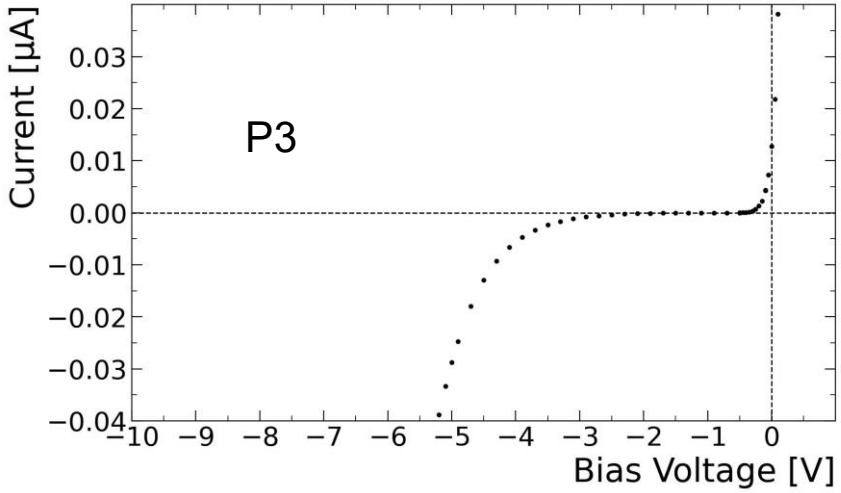
ChiR1.0 A IV 测试结果

- CH1012A101G



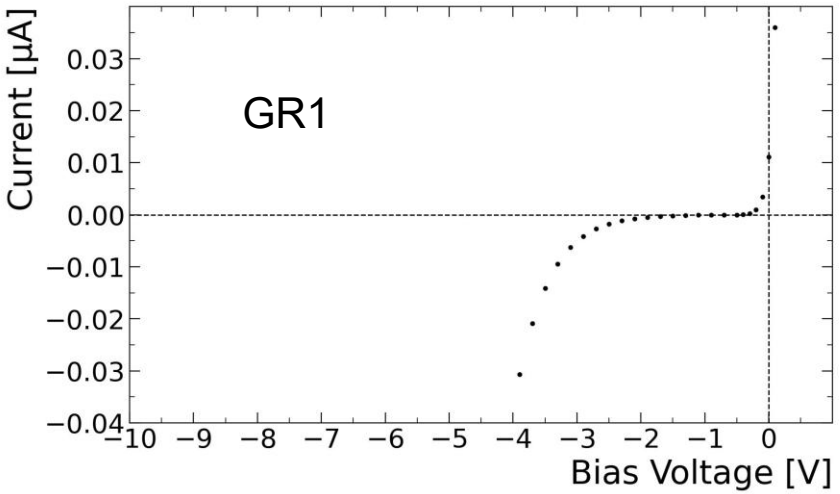


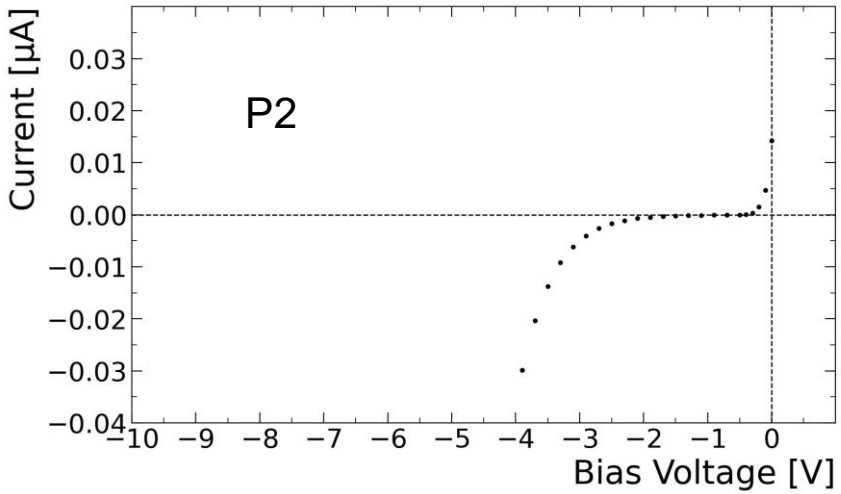


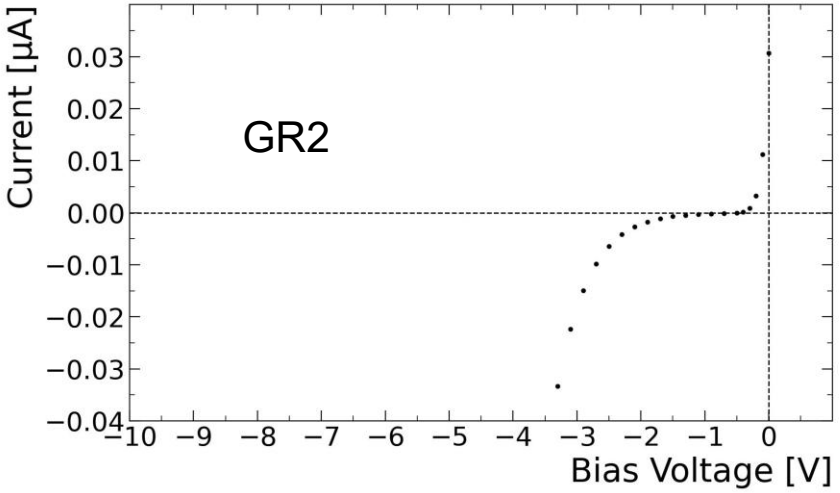


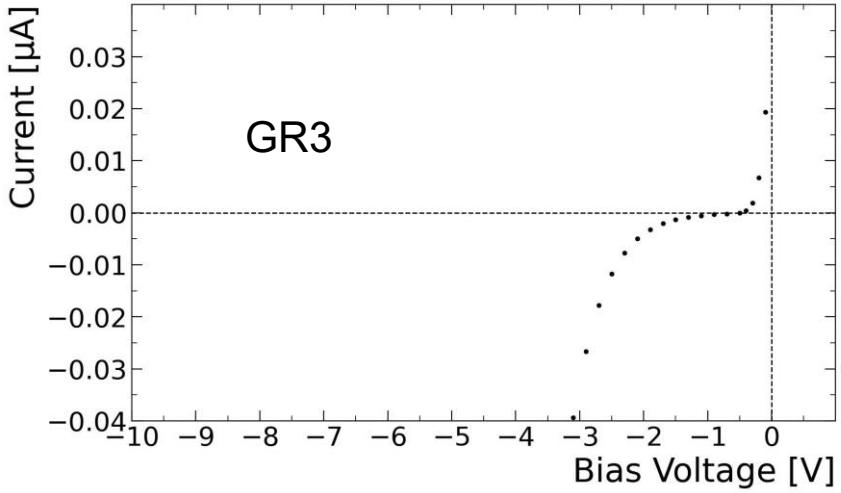
ChiR1.0 A IV 测试结果

- CH1013A101G



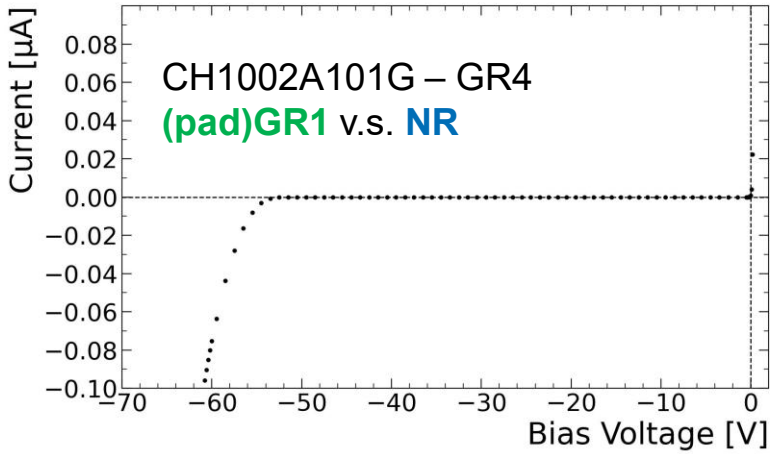


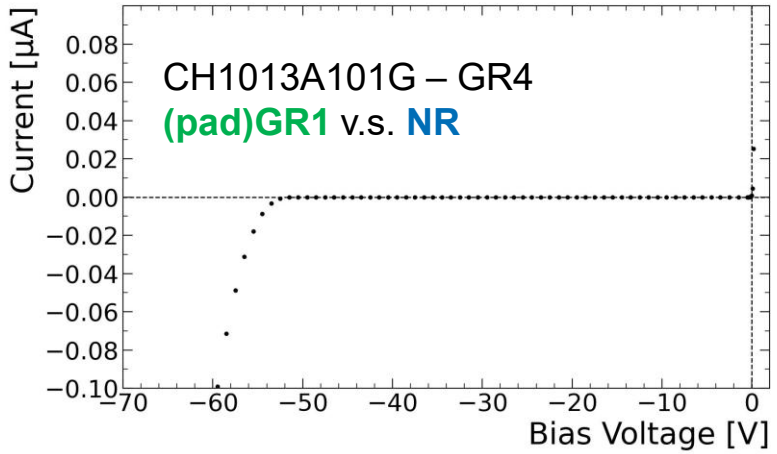


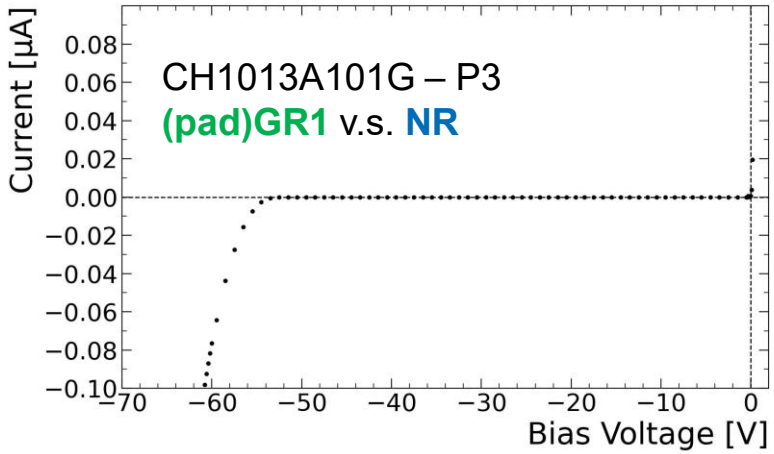


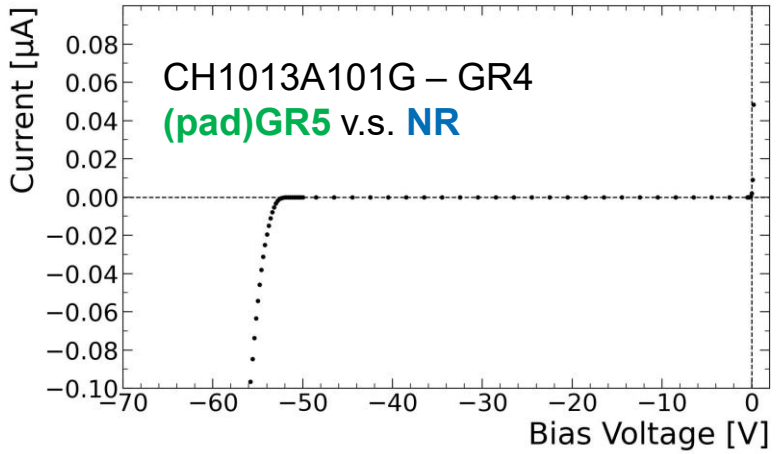
ChiR1.0 A IV 补充测试

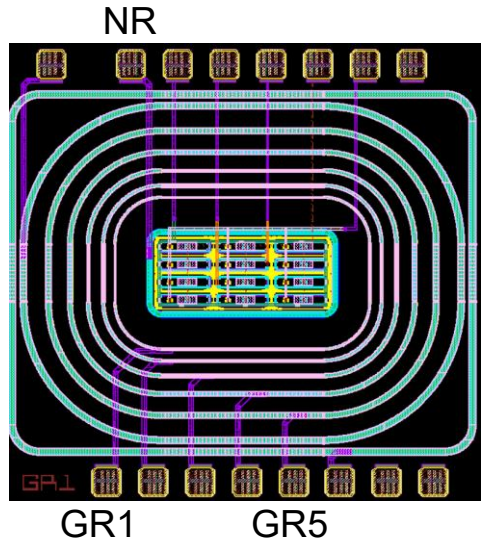
- 实际 IV 击穿电压远低于期望的 200 V，故检查其他 pad 之间的 IV 特性是否符合设计预期。
- 同一子阵列内：
  - **guard-ring v.s. NR**，GR 负高压，NR 接地，预期为二极管特性





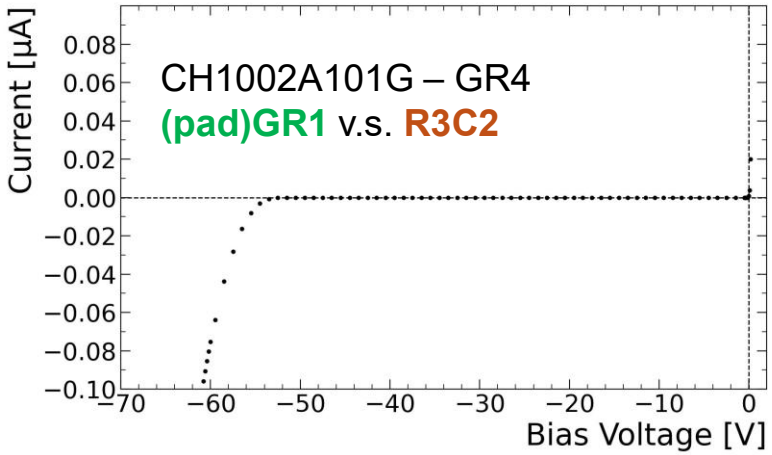


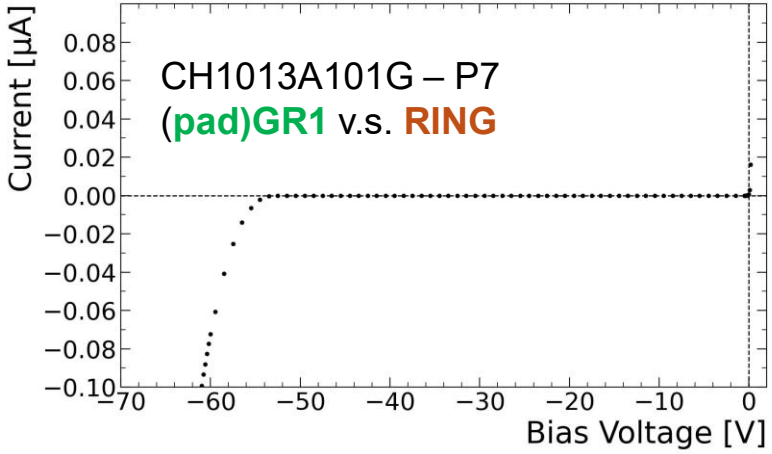


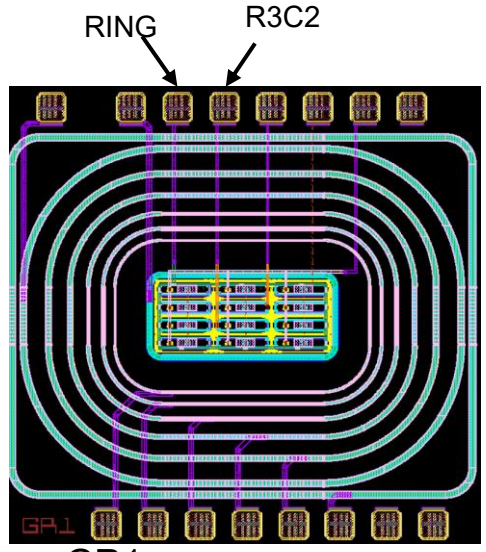


ChiR1.0 A IV 补充测试

- 同一子阵列内：
  - **guard-ring v.s. pixel**，GR 负高压，pixel 接地，预期为二极管特性

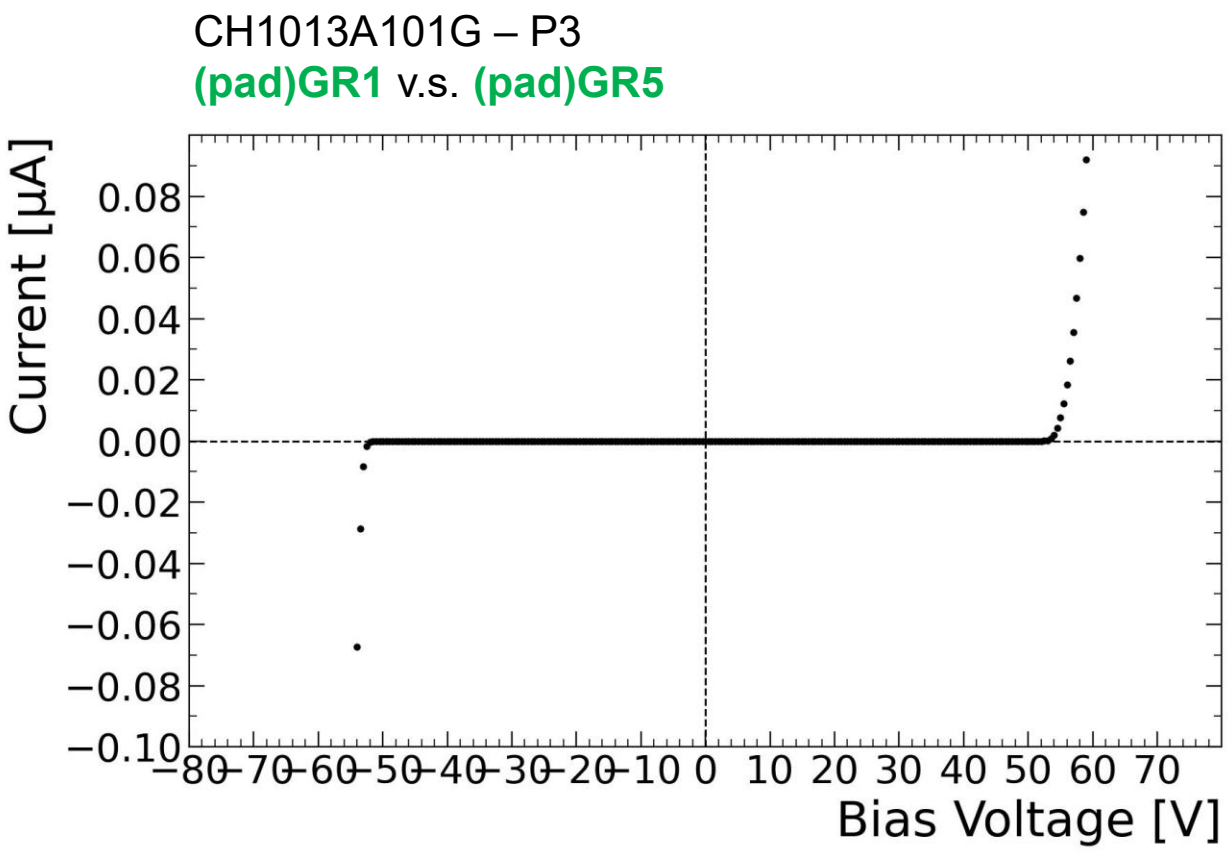


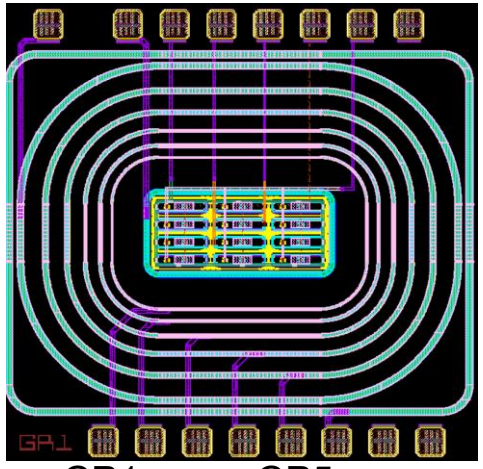




ChiR1.0 A IV 补充测试

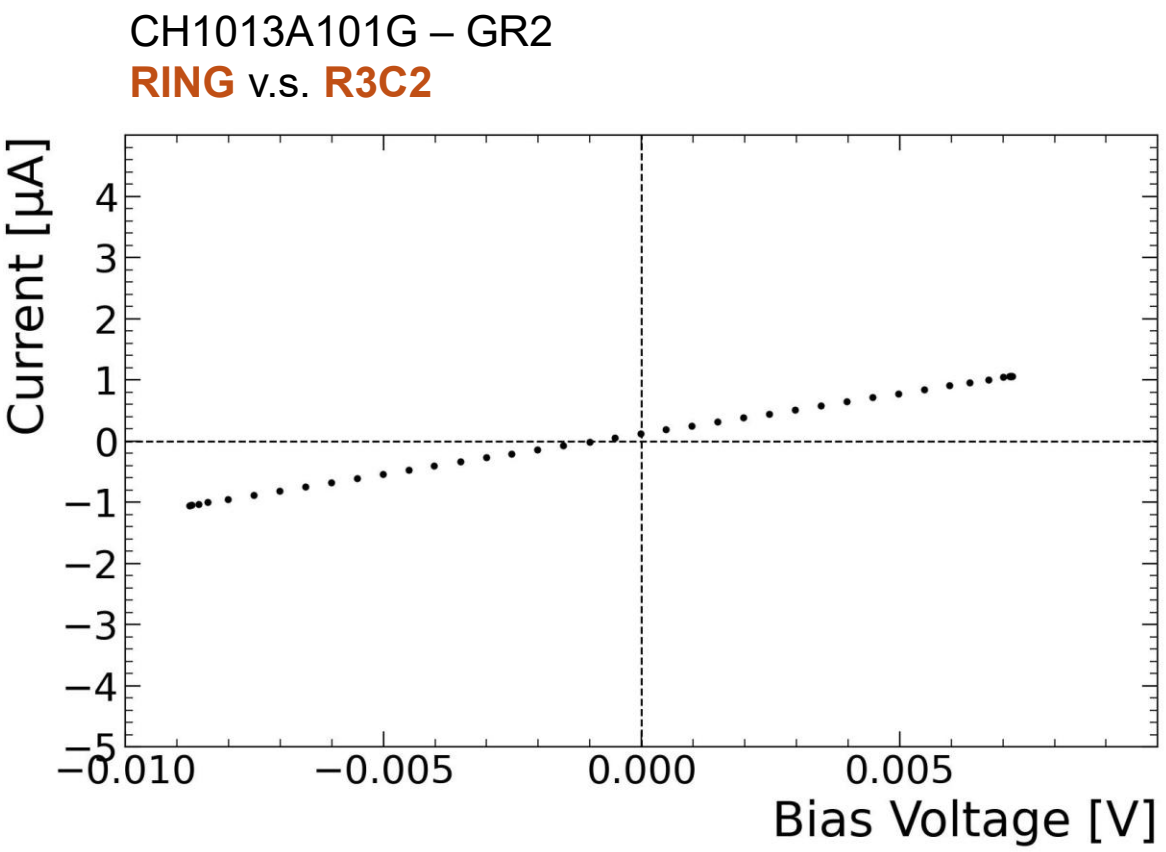
- 同一子阵列内：
  - **guard-ring v.s. guard-ring**，预期为电阻特性

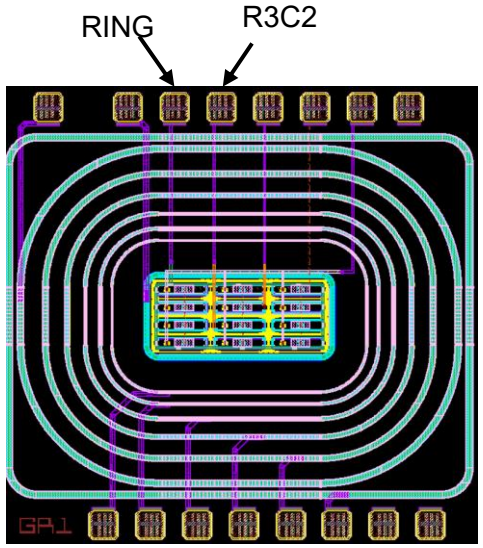




ChiR1.0 A IV 补充测试

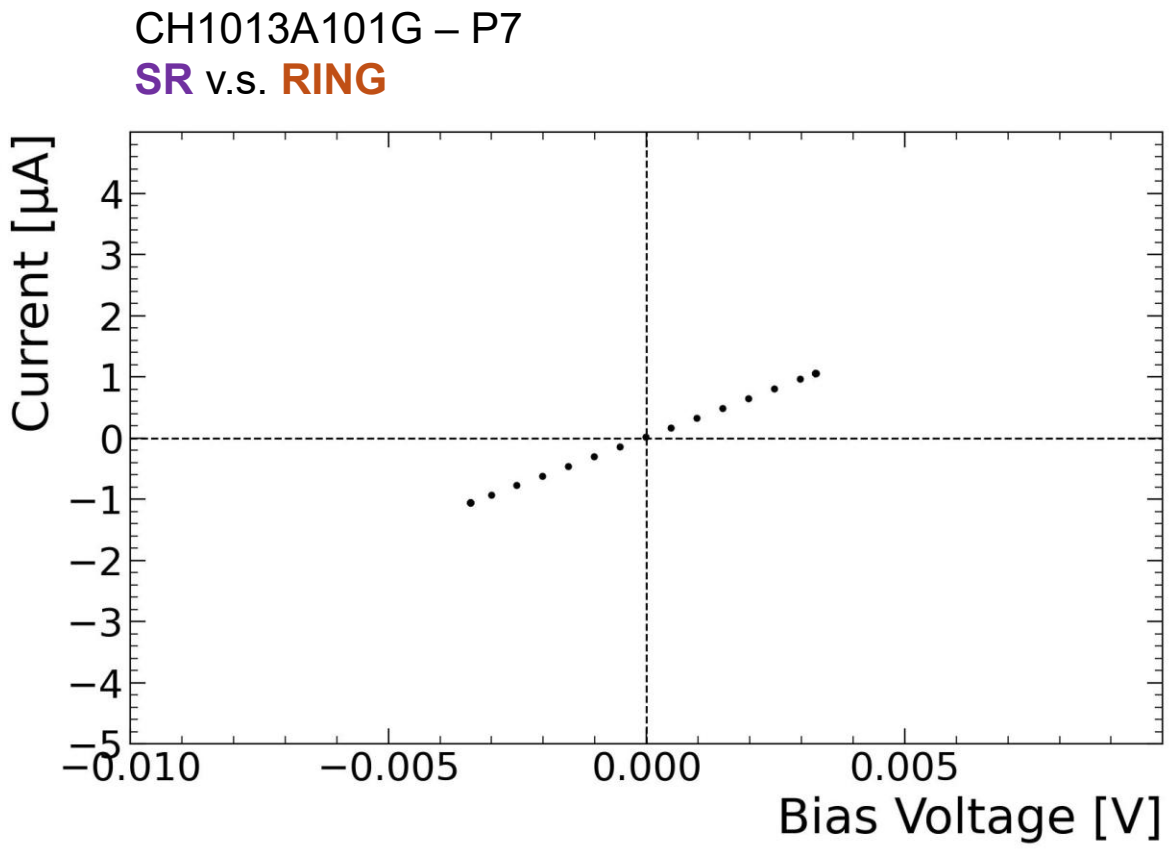
- 同一子阵列内：
  - **pixel v.s. pixel**，预期为三极管特性

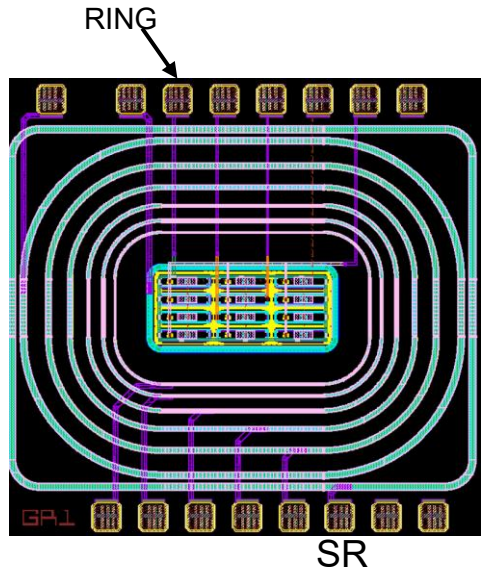




ChiR1.0 A IV 补充测试

- 同一子阵列内：
  - **SR v.s. pixel**，预期为二极管特性





ChiR1.0 A IV 补充测试

- 不同子阵列之间：
  - **HV v.s. NR**，HV 负高压，NR接地，预期为类似二极管 IV 特性

GR1	P2	P3	P4	P5	P6	P7	P8	P9	P10
GR2	GR3	GR4	GR5	GR6	GR7	GR8	GR9	GR10	GR11

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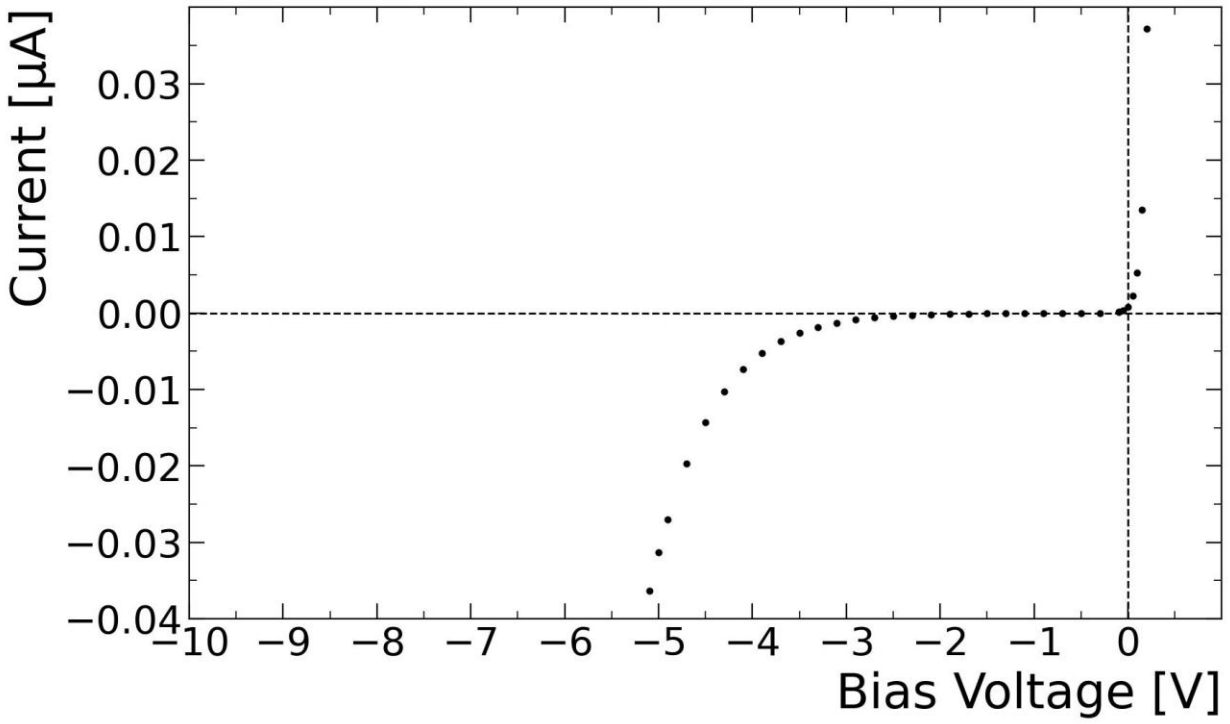
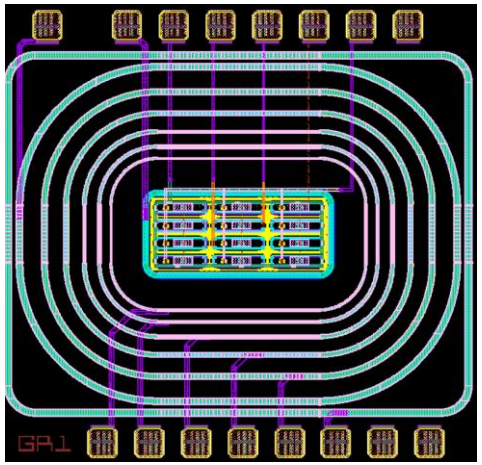
GR1-HV v.s. P2-NR



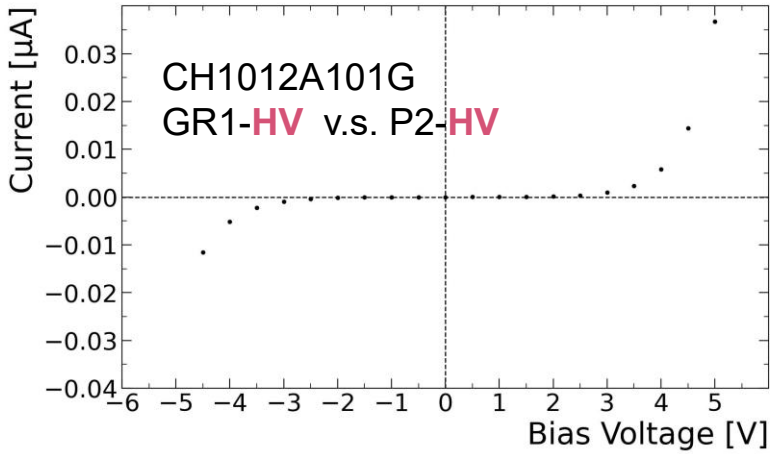
HV NR

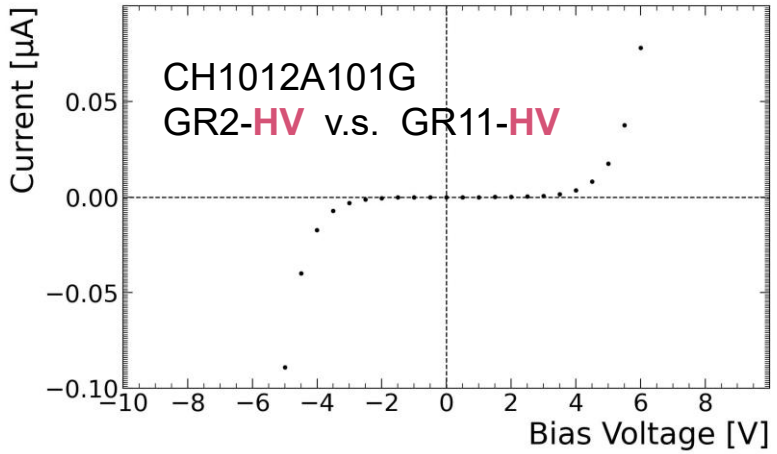


ChiR1.0 A IV 补充测试

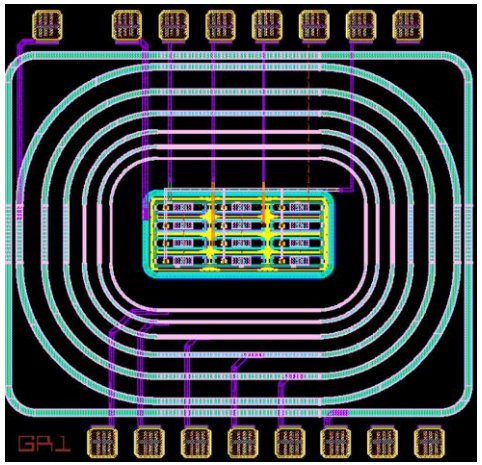
- 不同子阵列之间：
  - **HV v.s. HV**，预期为电阻特性

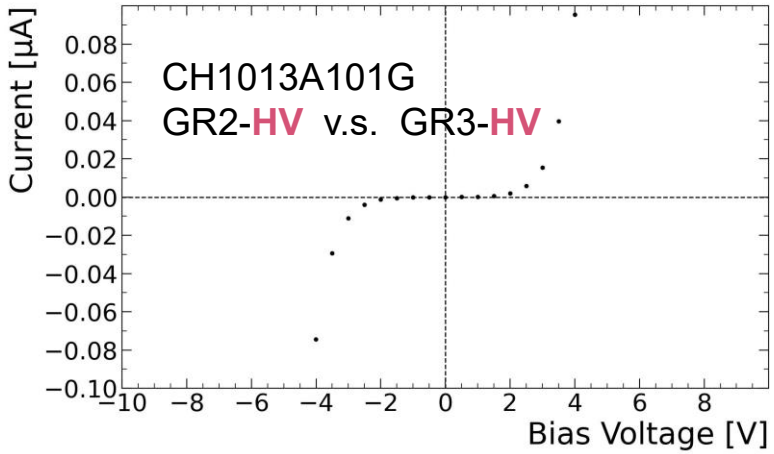
GR1	P2	P3	P4	P5	P6	P7	P8	P9	P10
GR2	GR3	GR4	GR5	GR6	GR7	GR8	GR9	GR10	GR11





HV NR

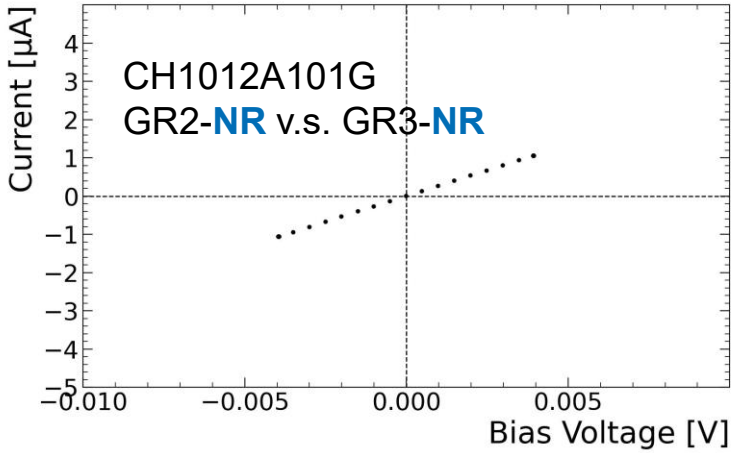


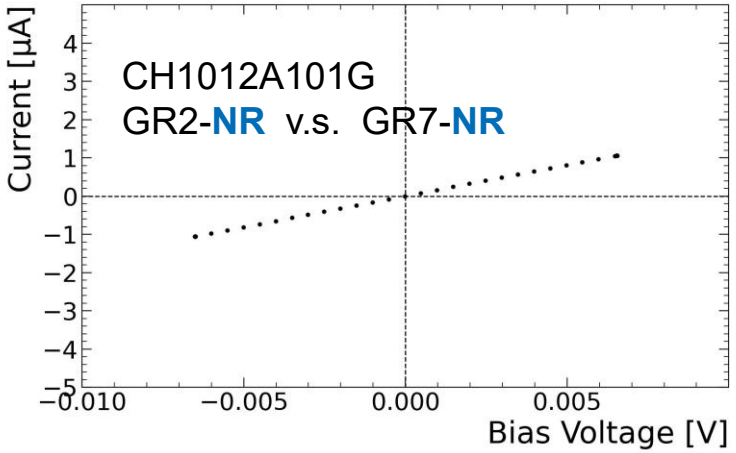


ChiR1.0 A IV 补充测试

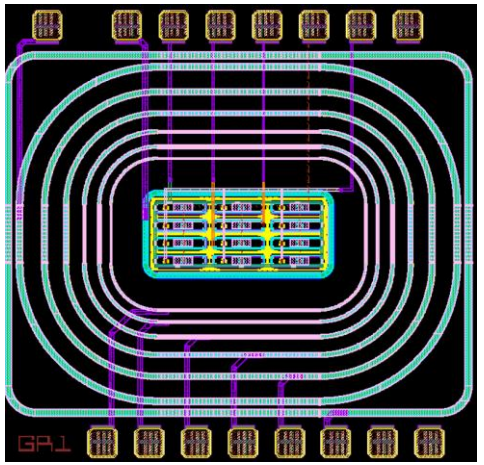
- 不同子阵列之间：
  - **NR v.s. NR**，预期为三极管特性

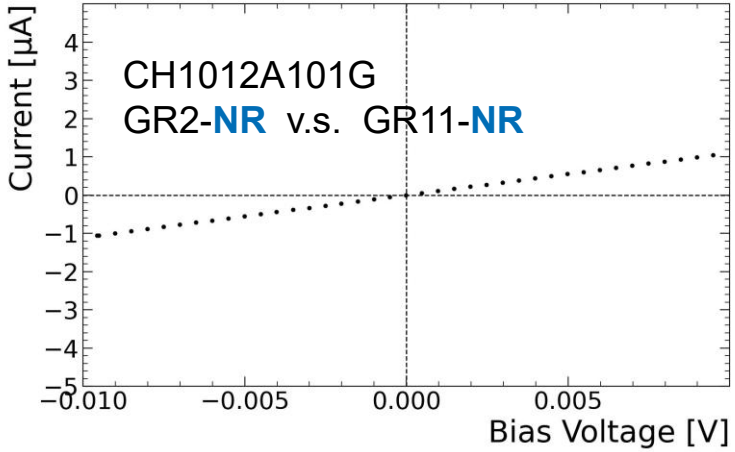
GR1	P2	P3	P4	P5	P6	P7	P8	P9	P10
GR2	GR3	GR4	GR5	GR6	GR7	GR8	GR9	GR10	GR11

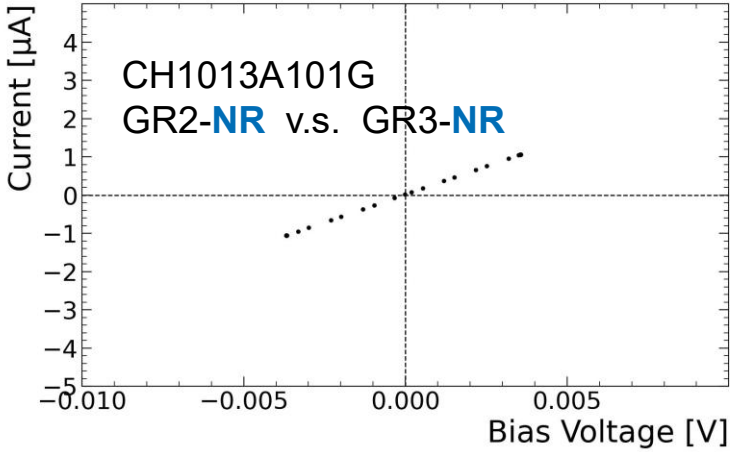




HV NR





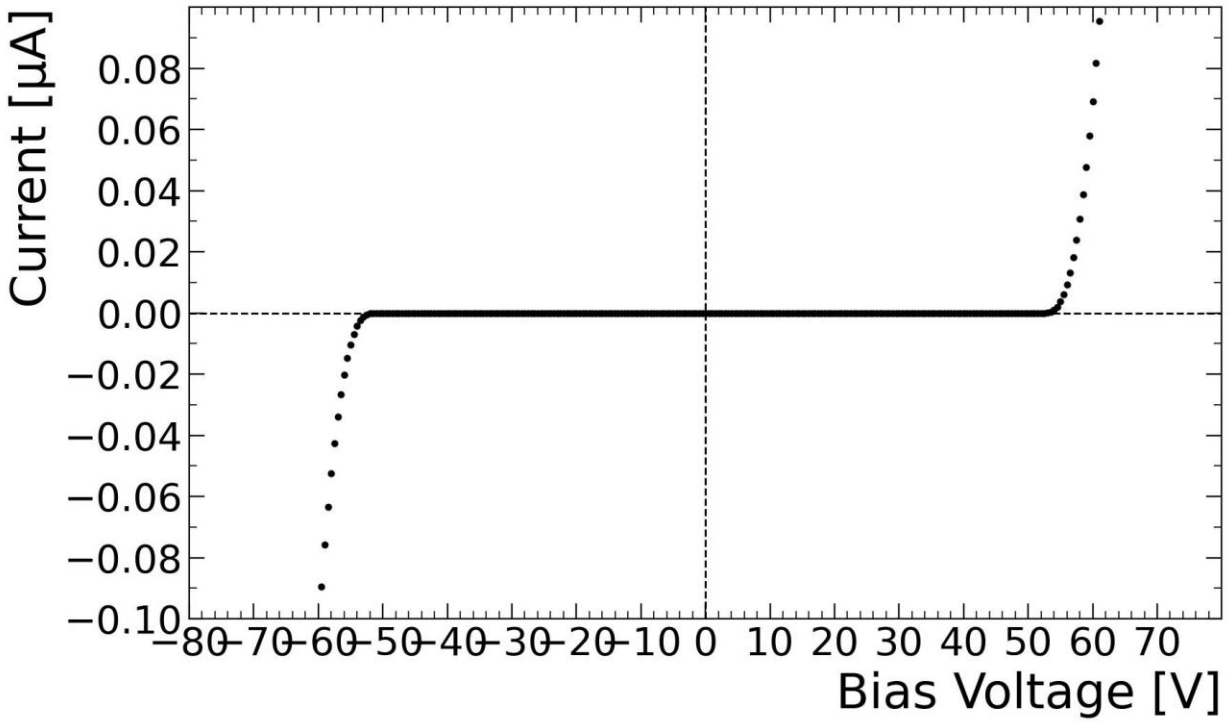


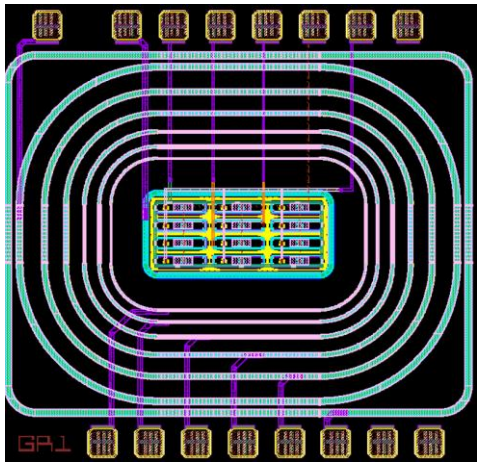
ChiR1.0 A IV 补充测试

- 不同子阵列之间：
  - **guard-ring v.s. guard-ring**，预期为电阻特性

GR1	P2	P3	P4	P5	P6	P7	P8	P9	P10
GR2	GR3	GR4	GR5	GR6	GR7	GR8	GR9	GR10	GR11

CH1013A101G
P3-(pad)GR1 v.s. GR4-(pad)GR1



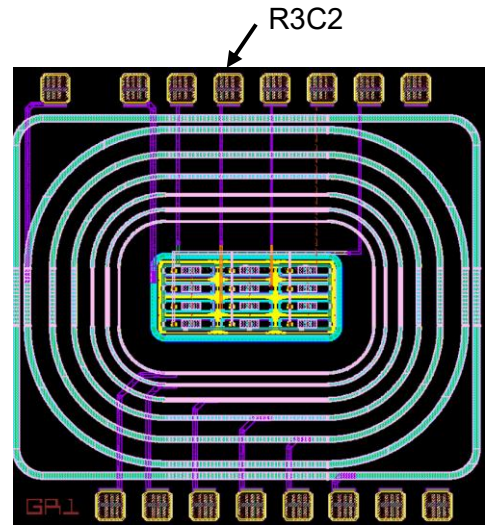


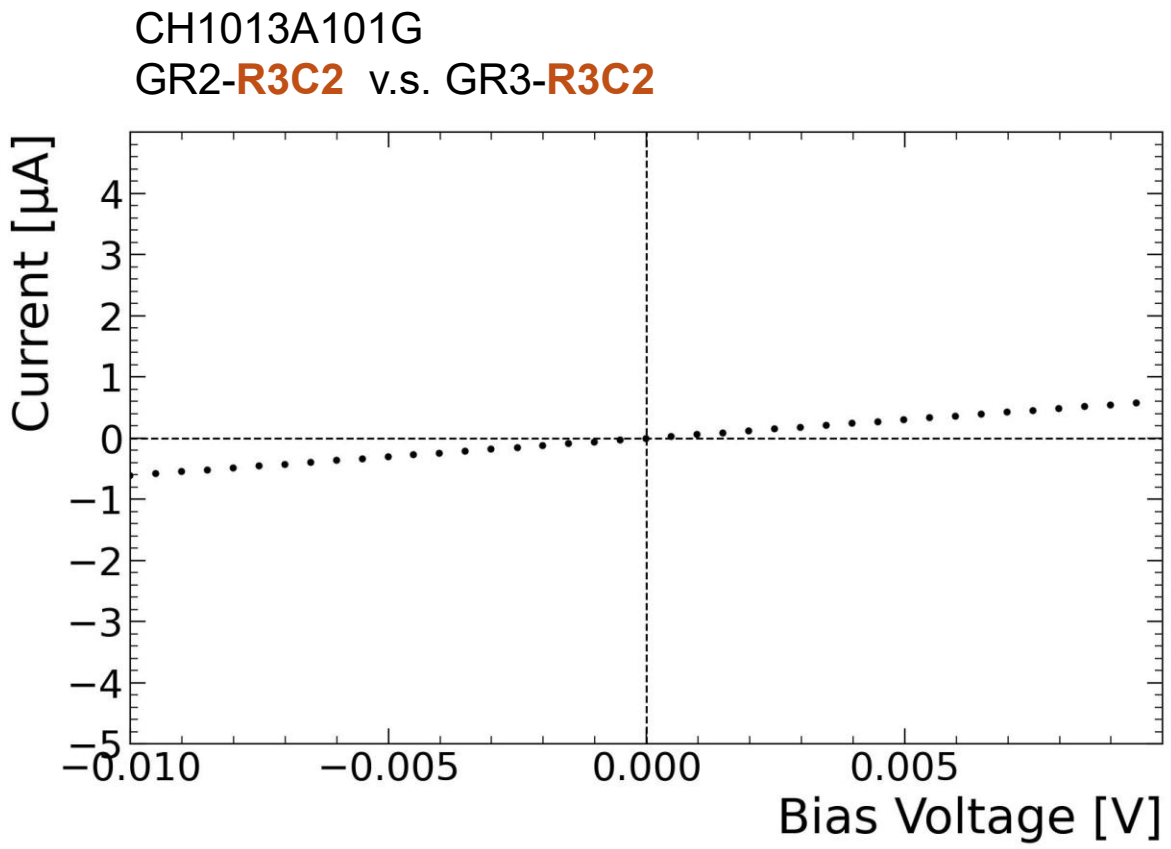
GR1

ChiR1.0 A IV 补充测试

- 不同子阵列之间：
  - **pixel v.s. pixel**，预期为三极管特性

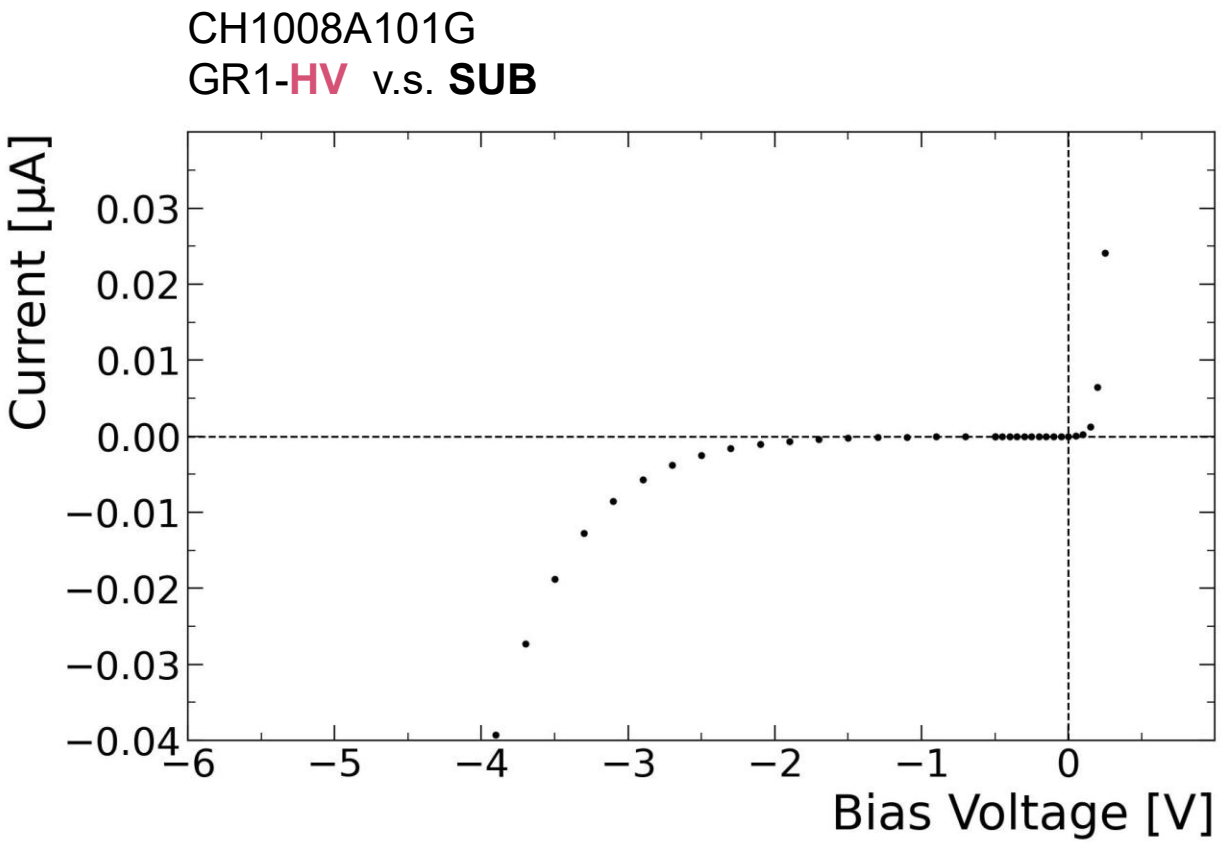
GR1	P2	P3	P4	P5	P6	P7	P8	P9	P10
GR2	GR3	GR4	GR5	GR6	GR7	GR8	GR9	GR10	GR11

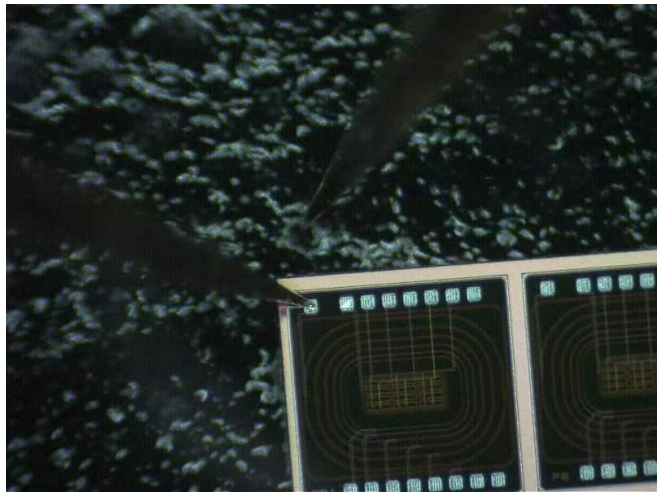




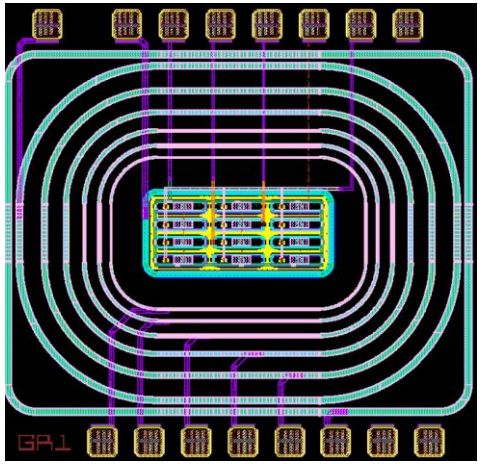
ChiR1.0 A IV 补充测试

- 不同子阵列之间：
  - **HV v.s. SUB**，HV 负高压，SUB 由碳导电胶引出



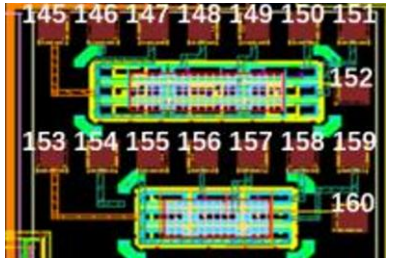


HV

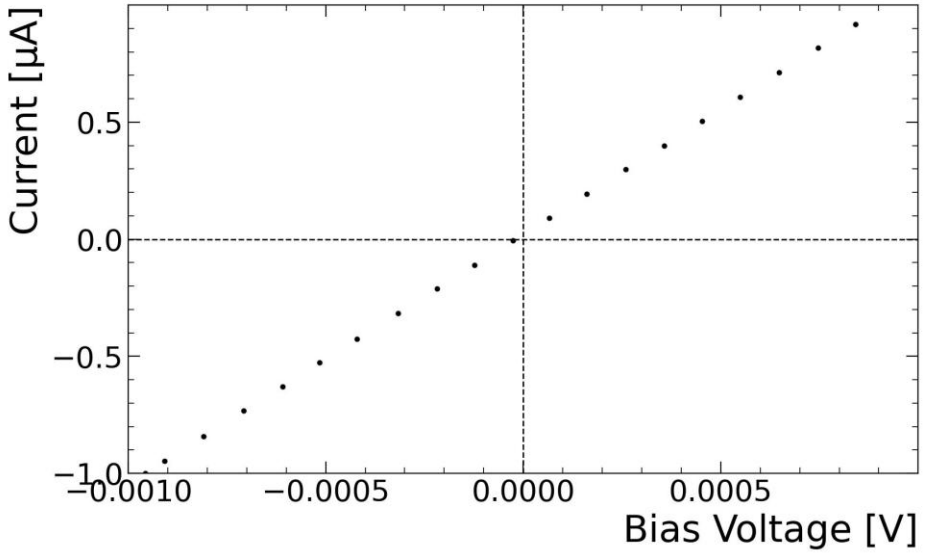


COFFEE3 验证

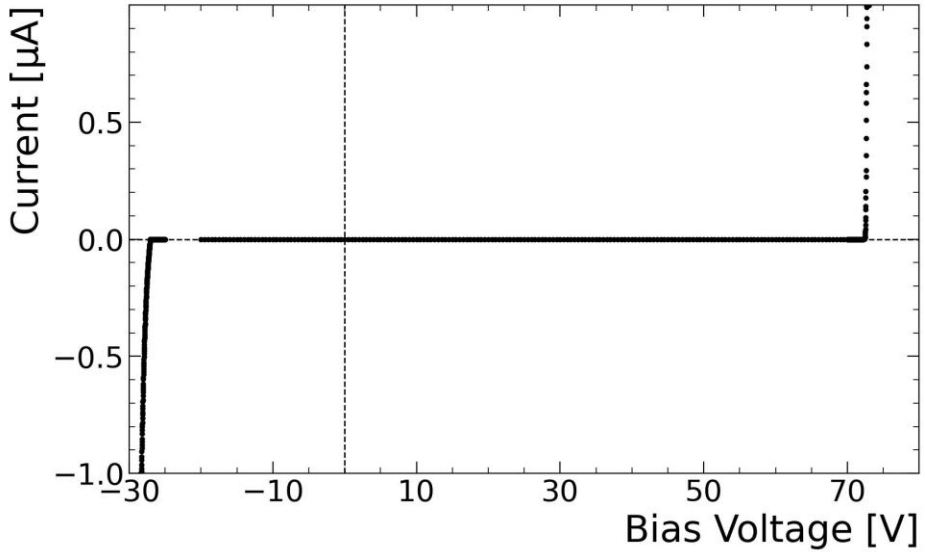
- 用已知符合预期的 COFFEE3 验证正常的 HV-HV 和 n-well 之间的 IV 特性



pad 145 v.s. 153 (pixel & pixel)



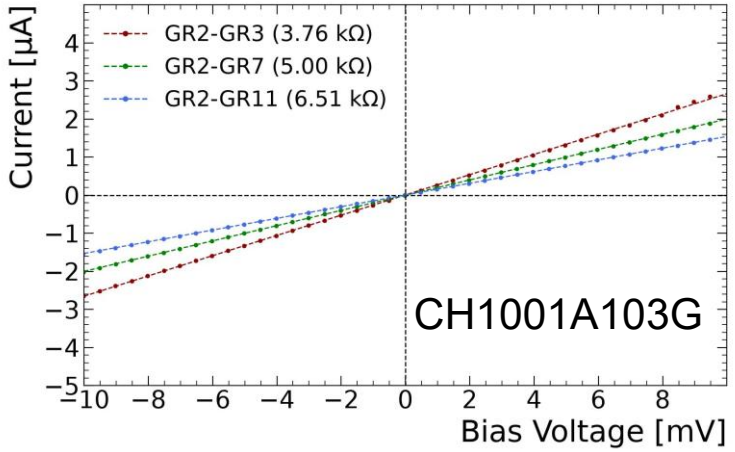
pad 148 v.s. 151 (HV & HV)

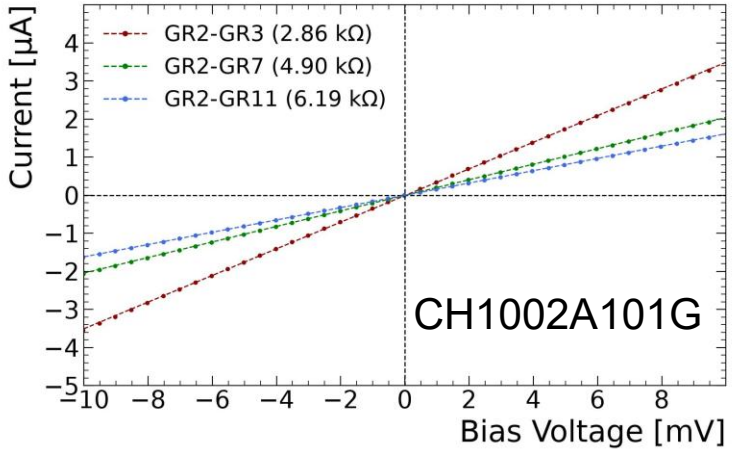


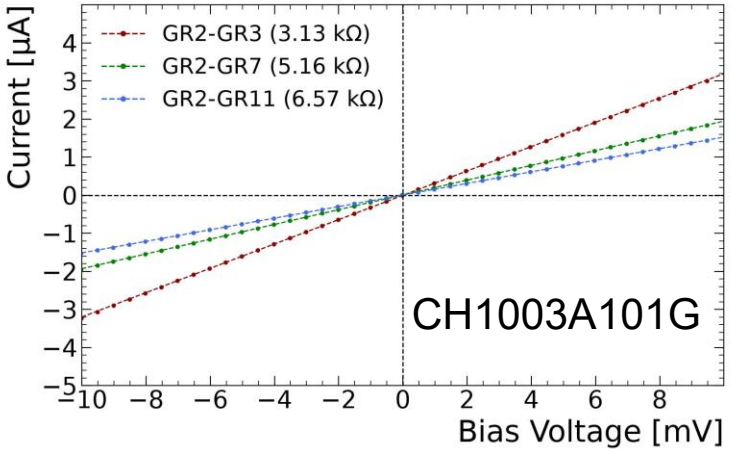
- HV – HV 和 n-well – n-well 两种 IV 特性与 ChiR1.0 的情况刚好相反

ChiR1.0 A IV NR-NR 接通测试

- 不同子阵列之间的 NR-pad 的 IV 测试，期望不同子阵列的 NR 之间绝缘或三极管特性。
- 对总共 13 种晶圆的 A 阵列芯片 GR2-GR3，GR2-GR7，GR2-GR11 之间的 NR 进行 IV 扫描，以判断注入参数是否产生影响。

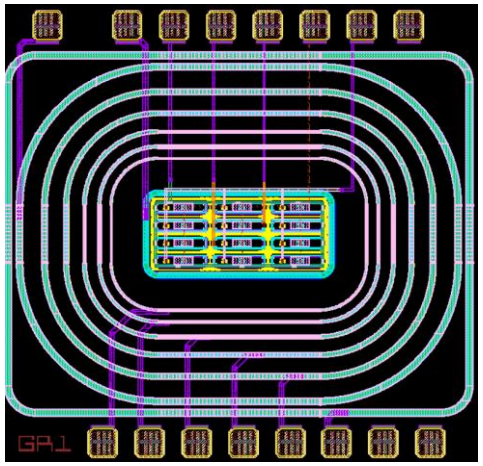




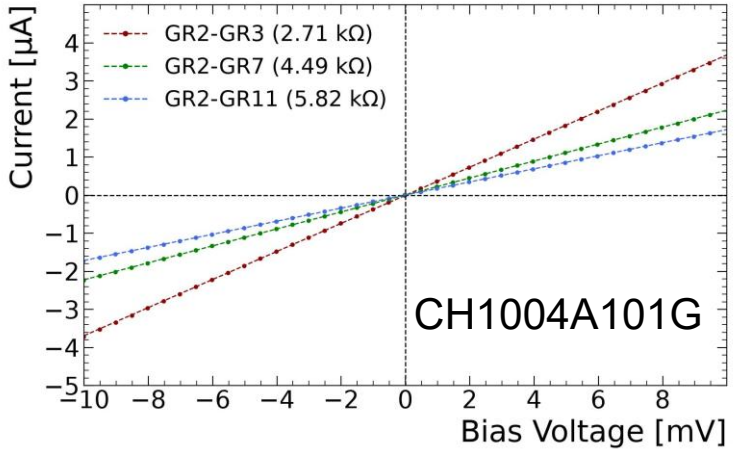


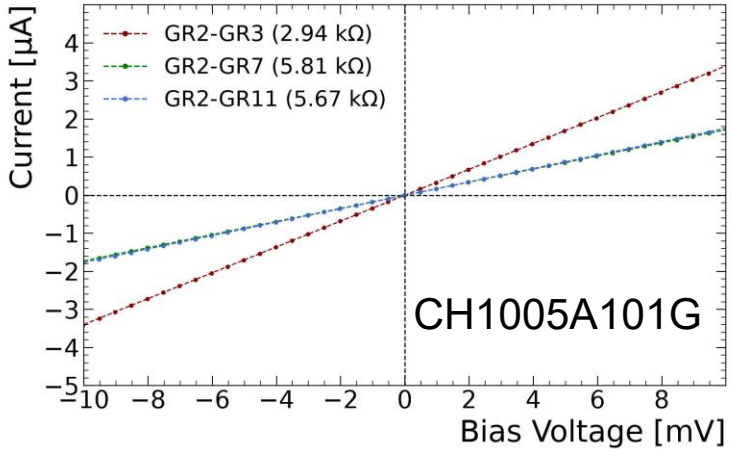
GR1	P2	P3	P4	P5	P6	P7	P8	P9	P10
GR2	GR3	GR4	GR5	GR6	GR7	GR8	GR9	GR10	GR11

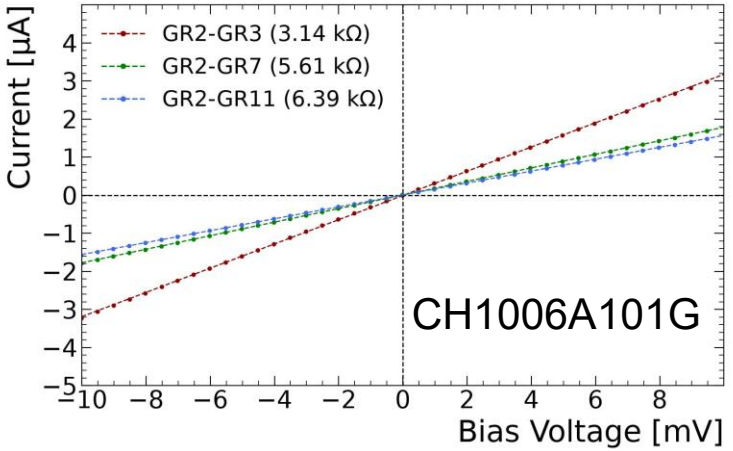
NR

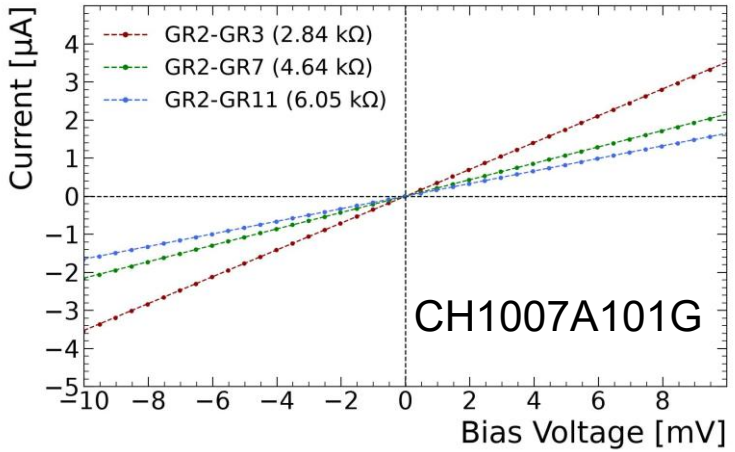


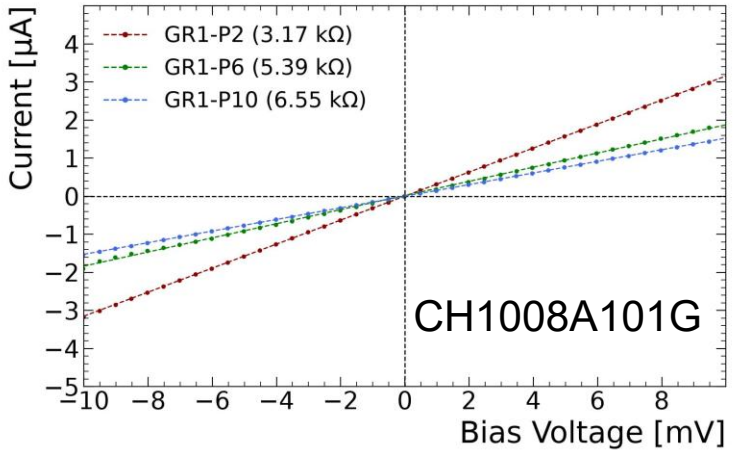
ChiR1.0 A IV NR-NR 接通测试

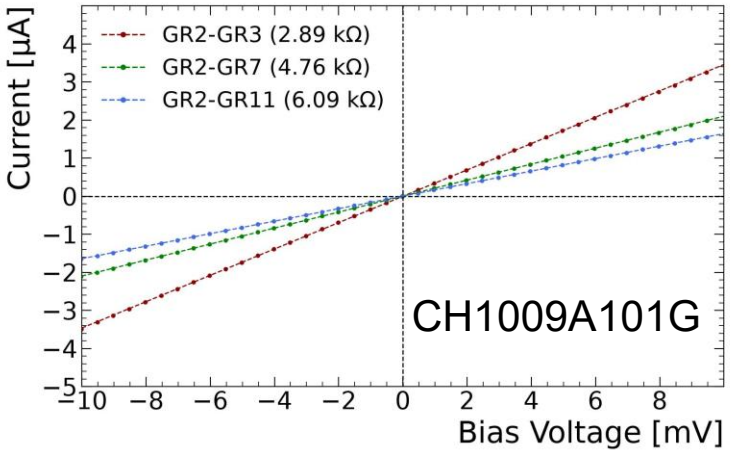




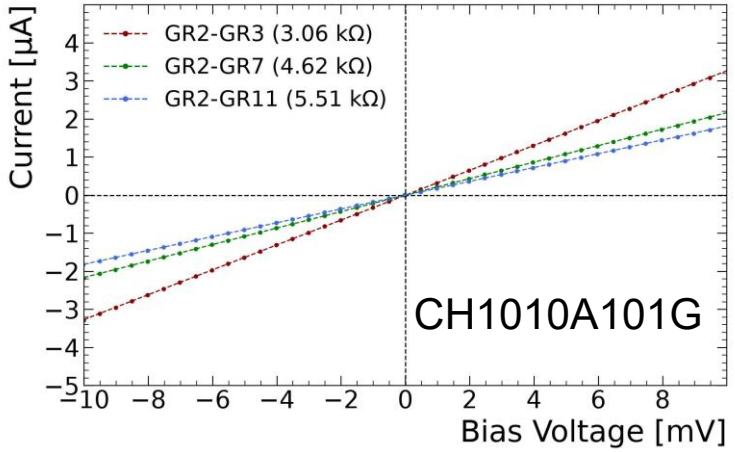


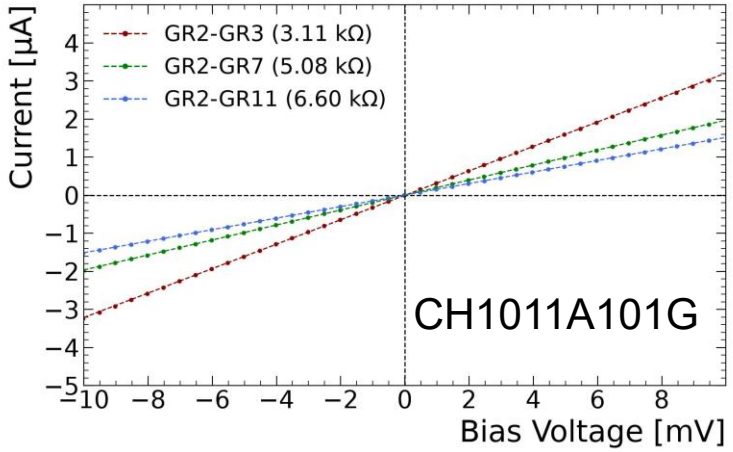


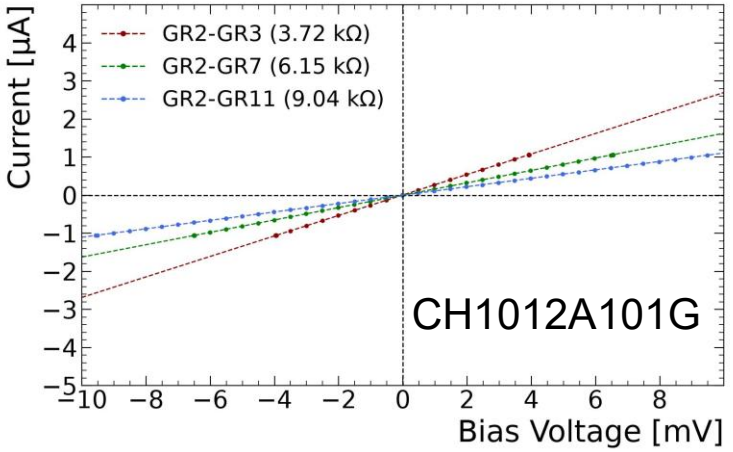


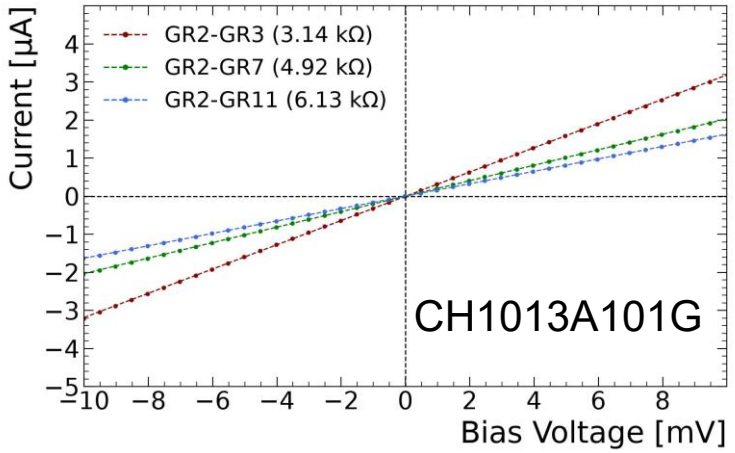


ChiR1.0 A IV NR-NR 接通测试







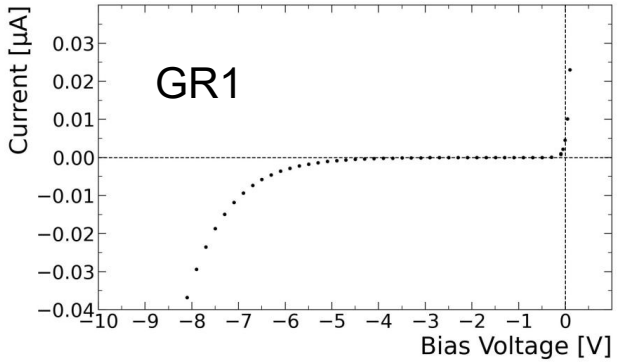


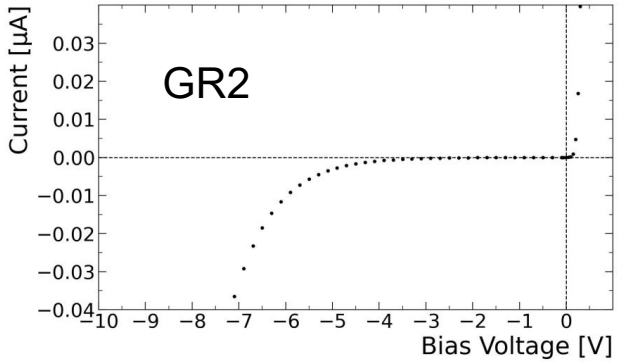
Summary

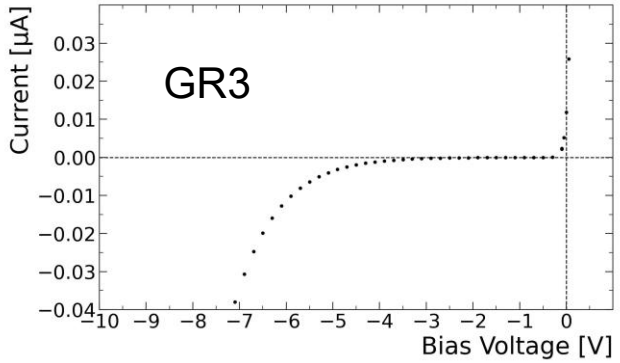
- IV 测试表明，**实际流片的击穿电压（~ 5 V 限流 1 μA）远低于设计指标（200 V）**，原因待查明。
- 本次流片的不同晶圆注入参数对击穿电压的影响不大，但 #02 晶圆不包含 DPW，相比其他晶圆的击穿电压有所提升；#12 晶圆不包含 VDNW，但击穿电压受其影响不显著；
- 其他补充的 IV 扫描表明，
  - 每个子阵列的 NR、像素 N-well 之间为纯电阻接通，而 HV、guard-ring 之间不是纯电阻；
  - guard-ring 与 NR 的击穿电压（~ 50 V）显著高于 HV 与 NR 的击穿电压（< 5V）
  - 推测：ChiR1.0 基底可能表现为低阻 n 型，而不是高阻 p 型

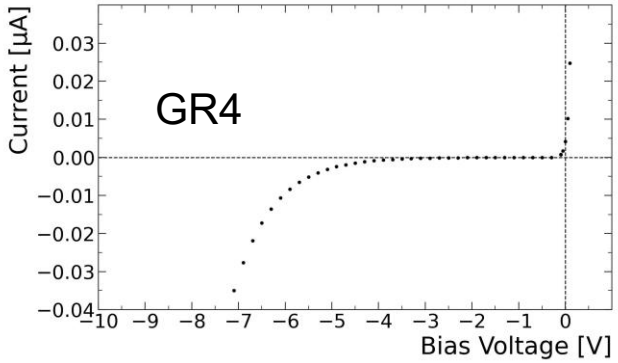
Thank you for your attention!

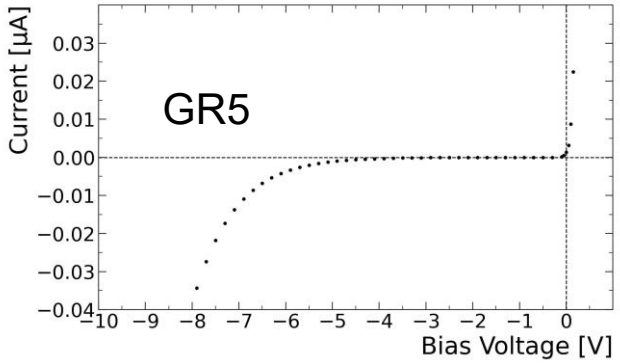
Backup: CH1002A101G 全部 20 个 IV 测试结果

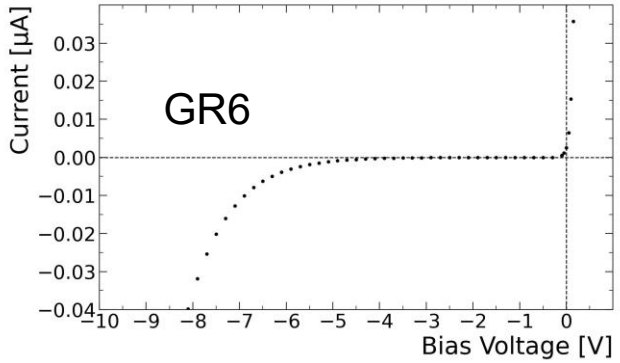


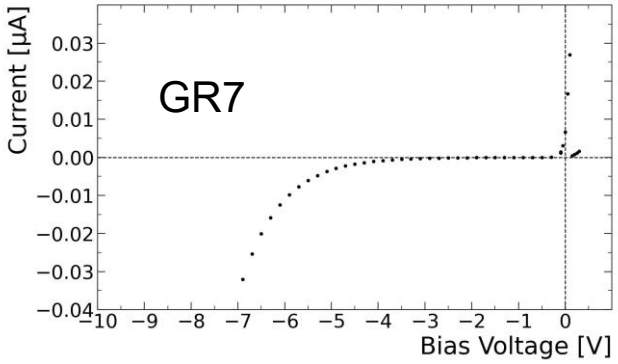


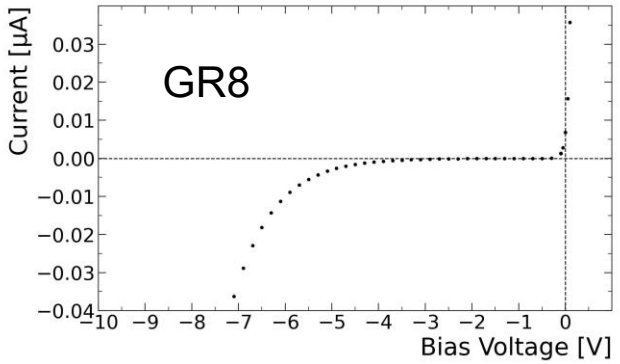


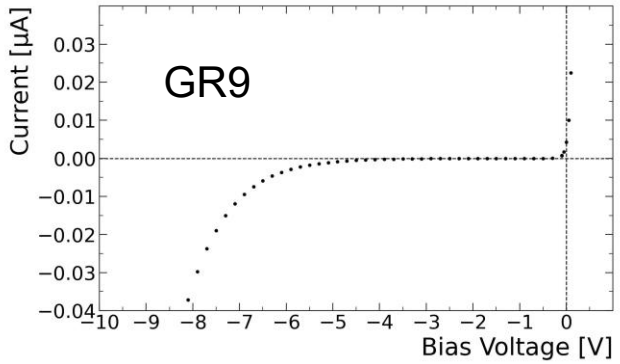




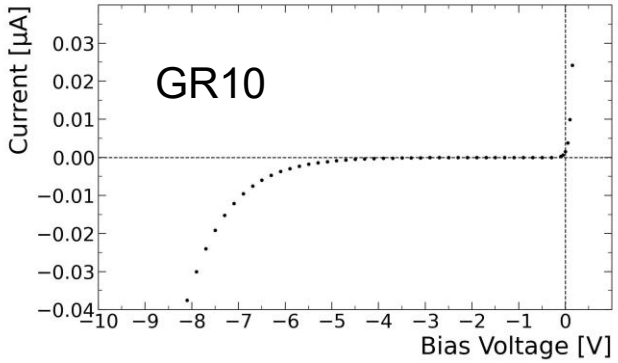


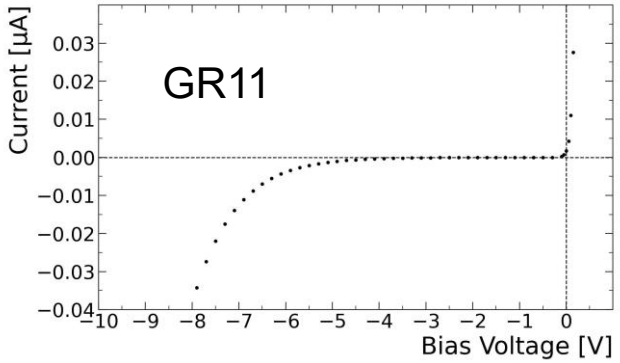


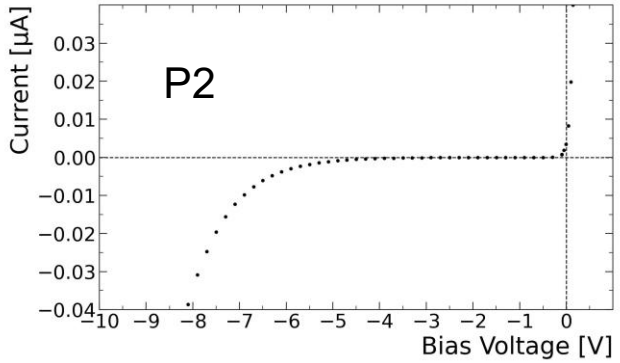


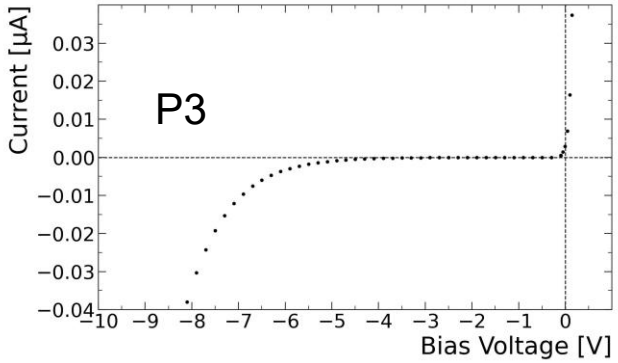


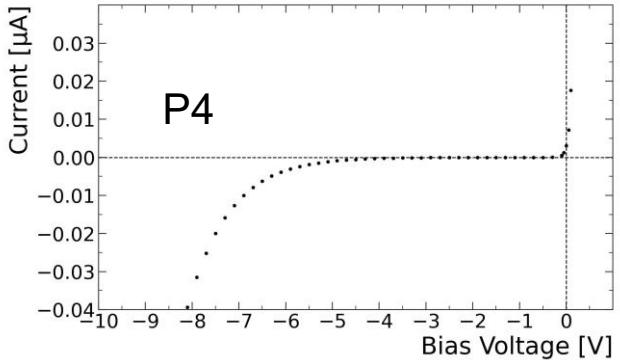
Backup: CH1002A101G 全部 20 个 IV 测试结果

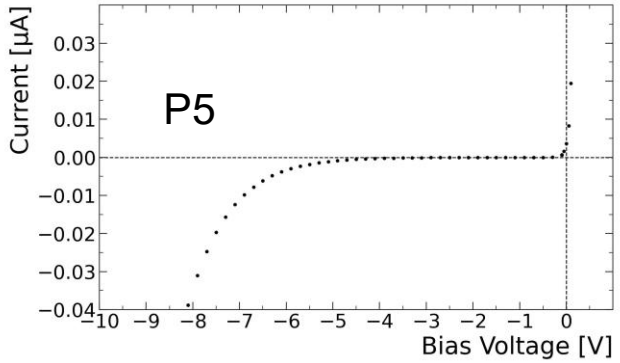


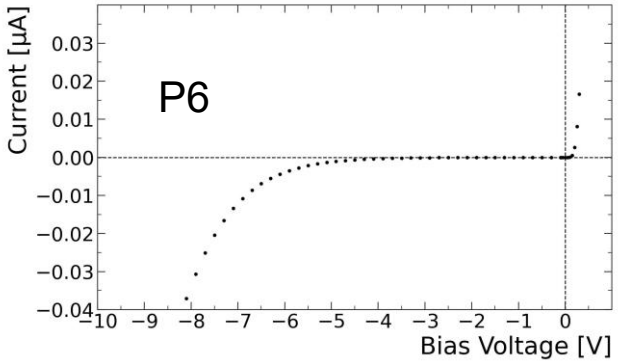


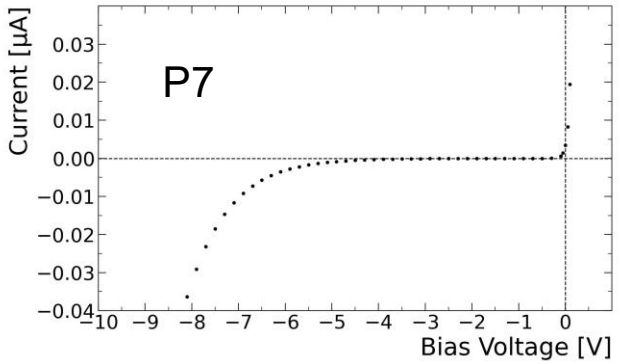


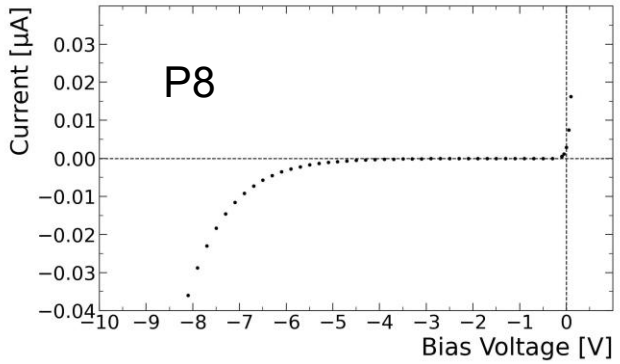












Backup: CH1002A101G 全部 20 个 IV 测试结果