AstroE-2 XIS-2 CCD Status

Mark Bautz, MIT CSR

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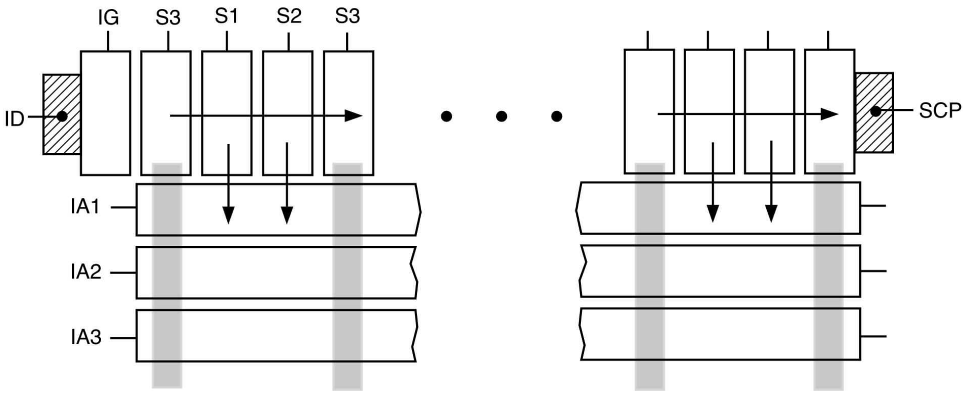
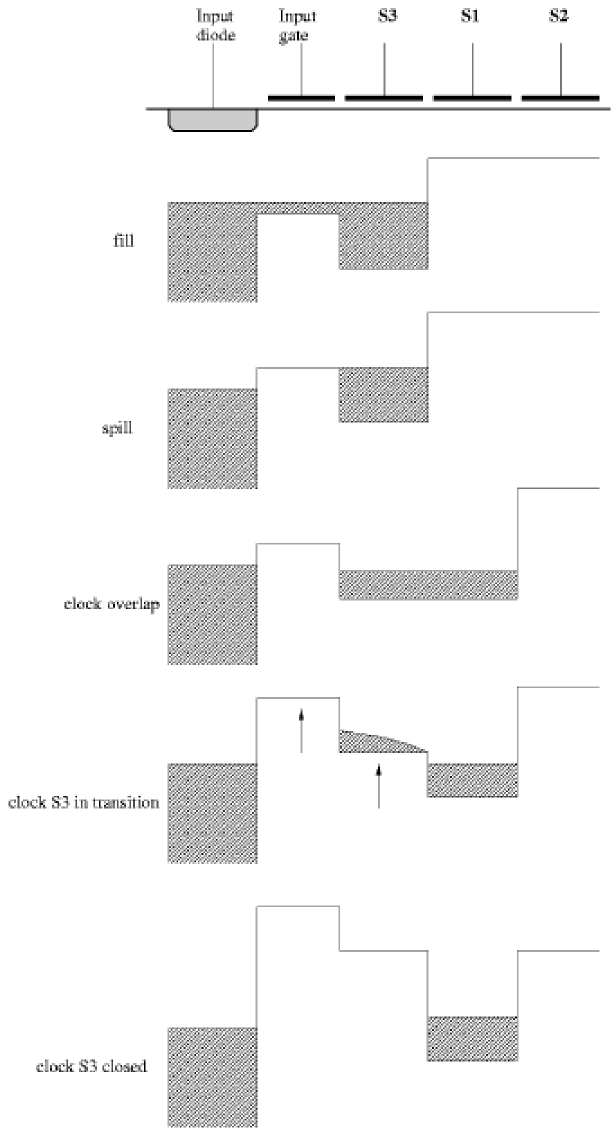
XIS-2 CCD

- XIS-2 CCD is Lincoln Laboratory CCID41, very similar to CCID17 used on ACIS and XIS-1
- Since ACIS devices were manufactured, Lincoln fabrication facilities have been upgraded to process 150mm wafers, so new photolithography masks are required.
- Production of new mask set offered opportunity for CCD enhancements.
- Principal functional difference between CCID41(XIS-2) and CCID17(ACIS) is addition of a charge injection register.
- Purpose of charge injection is to allow us at least to measure (and possibly also reduce) the effects of radiation-induced charge transfer inefficiency (CTI).

Proposed XIS Charge Injection Structure and Timing





Input register timing during injection

- An input register is added "above" the imaging area ("row 1025")
- During injection, input register is filled, pixel-by-pixel, from input diode, to create a line of charge which is then transferred through imaging area (IA)
- Adjustment of Input Gate (IG) to S3 potential allows precision control of quantity of injected charge: $\sigma_Q \sim 30\, e^-$, RMS

New Electronics Requirements For Charge Injection

- Compared with XIS-1, need two new signals: Input Diode (ID) and Input Gate (IG)
- Input Diode:
  - ⋆ Clocked signal with fixed high (=off) level and DAC-adjustable low.
  - ⋆ Must be clocked via dedicated sequencer bit.
  - ⋆ High (off) level must be high and positive (+11 V is fine); can be tied to existing scupper bias.
  - ⋆ Low (on) level must be positive and DAC-adjustable; 0-12 V in 256 steps is fine.
  - ⋆ For "redundant off" capability, desire high-end of low-level range to extend to +11V at least.
- Input Gate (IG):
  - ⋆ IG controls quantity of injected charge.
  - ⋆ IG is clocked with timing identical to existing serial register phase 3 (S3) clock.
  - ⋆ IG level must have small, precisely controlled offset relative to S3, with both coarse and fine adjustment.
  - ⋆ Coarse (non-commandable) adjustment of IG-S3 offset required to accomodate CCD-to-CCD variations. Accuracy ~ 0.1 V over range of ± 2 V.
  - ⋆ Fine, commandable IG-to-S3 offset used to adjust quantity of injected charge. Accuracy of 1 mV or better over range of 0V to -0.25V desired.
    (As IG-S3 becomes more negative, quantity of injected charge increases).

CCD Production Schedule: Assumptions

- 2 production lots, 12 wafers/lot, 11 devices/wafer.
- 20 packaged devices delivered to CSR (Note: 4 flight sensor bases + 1 spare required for XIS).
- For each lot (per Jim Gregory):
  - ⋆ Wafer fabrication start to LL wafer-level test takes 5 months.
  - ⋆ LL wafer-level test to delivery of first packaged device takes 0.5 months.
  - ⋆ LL wafer-level test to delivery of tenth packaged device takes 2 months.
- Flight devices will be taken from both lots.
- Lot 2 wafer fabrication will not start until proper functioning of Lot 1 devices is confirmed at MIT CSR.
- Calibration of one device takes 15 work days (one shift/day).

CCD Production Schedule Milestones

- **Lot 1 wafer fabrication begins** **15 Feb 2002**
- Lot 1 wafer test at LL begins 15 July 2002
- **First XIS-2 device at MIT CSR** **1 Aug 2002**
- Last (10th) Lot-1 device delivered to MIT CSR 15 September 2002
- **First calibrated device ready for sensor base** **15 October 2002**
- **Lot 2 wafer fabrication begins** **15 September 2002**
- Fourth calibrated Lot-1 device ready for sensor base 15 Dec 2002
- Lot 2 wafer test at LL begins 15 Feb 2003
- **First Lot-2 device at MIT CSR** **1 March 2003**
- **First calibrated Lot-2 device ready for sensor base** **1 April 2003**
- Last device delivered to MIT CSR 15 April 2003
- Fourth calibrated Lot-2 device ready for sensor base 1 June 2003

Need-by Dates for CSR CCD Test and Calibration

By July 1, 2002 we need:

- Qualified CCD package, including fixtures, procedures, flexprints and parts, for all Lot 1 devices.
- "Qualified" test containers (at least first $\sim$ 4 of 20)
- Analog electronics capable of charge injection (1st of 2 sets)

By August 15 2002 we need:

- Analog electronics capable of charge injection (2nd of 2 sets)
- Agreed-upon charge injection test/calibration plan and microcode.
- Full complement of 10 Lot 1 test containers.
  (Note: 10 test containers needed for each lot, for total of 20.)