# EPIC-pn FIFO reset exposure correction in SAS-7.1

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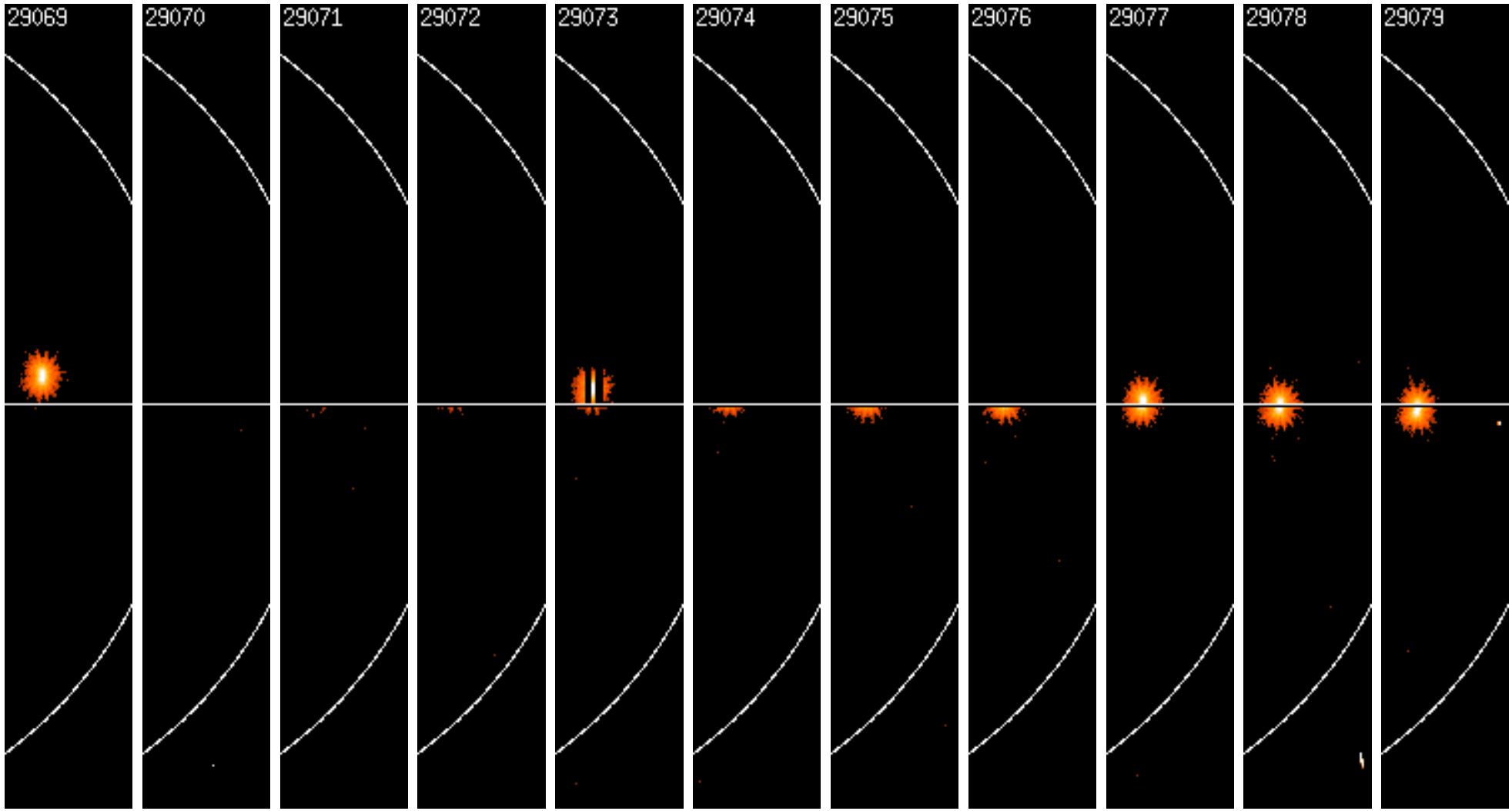
## Motivation (splinter May 2006):

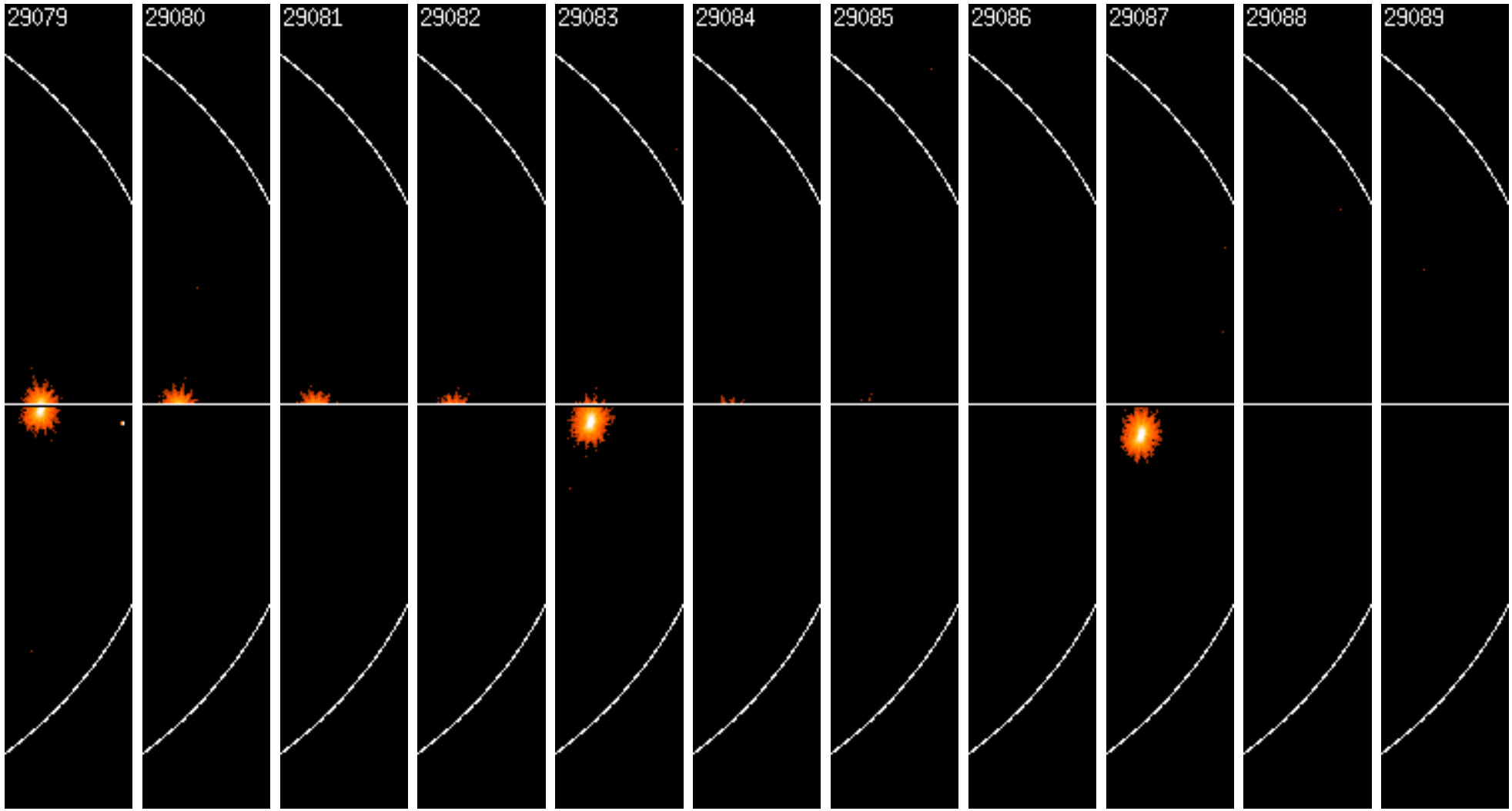
- gaps in data of a few frame times length (shortest GTI: 20 FT, PNAUX2)
- constant sources are not constant (good calibration)
- effect needs to be calibrated
- FIFO resets have not been handled yet (in time resolved way)
- different ways to implement exposure correction

# Sirius passing through FOV: III




after 1 full frame: 3 – 4 completely empty frames

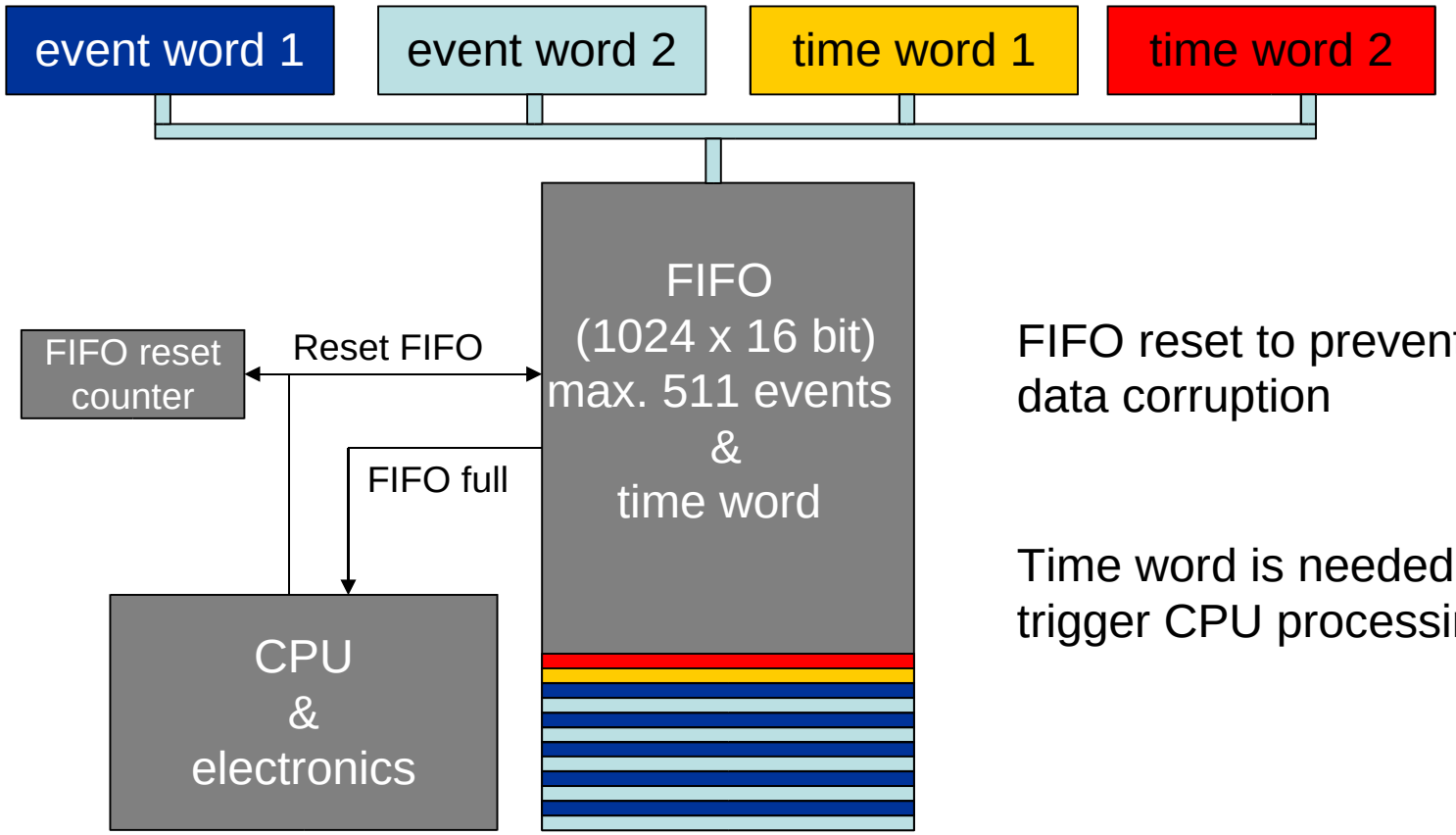
# Sirius passing through FOV: IV




after 1 full frame: 3 – 4 completely empty frames

# Data readout chain

EPIC-pn event data input




FIFO reset to prevent data corruption

Time word is needed to trigger CPU processing

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# FIFO reset information in telemetry

- **PNPMH1: F1936, F1937, F1938, F1939, 8s time resolution**
- **PNAUX2: NABOVE-NDEFA, resolution 20 FT (e.g. 1.5s in FF mode)**
- **PNAUX1: FTCOARSE=FFFF, resolution 1 FT**

**length of FIFO reset deadtime interval?**

# FIFO reset information in SAS processing: epframes

- **SAS_VERBOSITY.ge.5**
- **PNAUX2: NABOVE-NDEFA > 512 (NABOVE-NDEFA > 0)**

```
epframes:-  Number of FIFO AUX2 overflows in Q0:              141
epframes:-  Number of FIFO AUX2 deficiencies in Q0:           299
epframes:-  Exposure loss due to FIFO overflows in Q0:     13.442 [s]
```

- **PNPMH1: F1936, F1937, F1938, F1939: incremental counters**

```
epframes:-  FIFOreset =      315
epframes:-  FIFOdiff  =        0   # =     1692
epframes:-  FIFOdiff  =        1   # =        2
epframes:-  FIFOdiff  =        2   # =      107
epframes:-  FIFOdiff  =        3   # =       16
epframes:-  FIFOdiff  =        4   # =        5
epframes:-  FIFOdiff  =        5   # =        2
epframes:-  FIFOdiff  =        8   # =        1
epframes:-  FIFOdiff  =       13   # =        1
```

- **PNAUX1: FTCOARSE=FFFF (oal)**

```
epframes:-
    spurious 32767-frames: 76
```

# FIFO reset information in SAS processing: EXPOSUnn

```
FIFOLOSS= 1.34420000000000E+01 / [s] Exposure loss due to FIFO AUX2 overflows
FIFOOVER=                  141 / Number of FIFO AUX2 overflows
```

- **above example: sum of good time intervals: 14617.435 [s], but e.g. Crab:**

```
epframes:-  Number of FIFO AUX2 overflows in Q1:            5087
epframes:-  Number of FIFO AUX2 deficiencies in Q1:          415
epframes:-  Exposure loss due to FIFO overflows in Q1:    151.694 [s]

epframes:- sum of good time intervals [s]  =            1880.40273
```

- **how to implement time-resolved deadtime effects?**

# FIFO reset information in SAS-7.1

- **criterion: PNAUX2: NABOVE-NDEFA $>$ 512**
- **same interface as for MIPs: PNAUX2: NDISCLIN**
- **statistical correction, averaged over 20 frames**
- **deadtime per FIFO reset: XMM_MISCDATA_0022.CCF: FIFO_DEADTIME_FF ...**
- **implemented mode dependent values, but not rate dependent**

# Summary + conclusions

- SAS-7.1 includes time-dependent correction of FIFO exposure losses
- relevant for bright sources (TI mode) or high background (FF eFF LW modes)
- not relevant for SW mode
- CCF values may need to be tuned