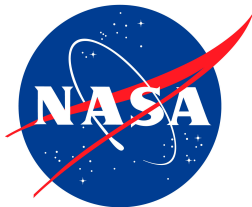
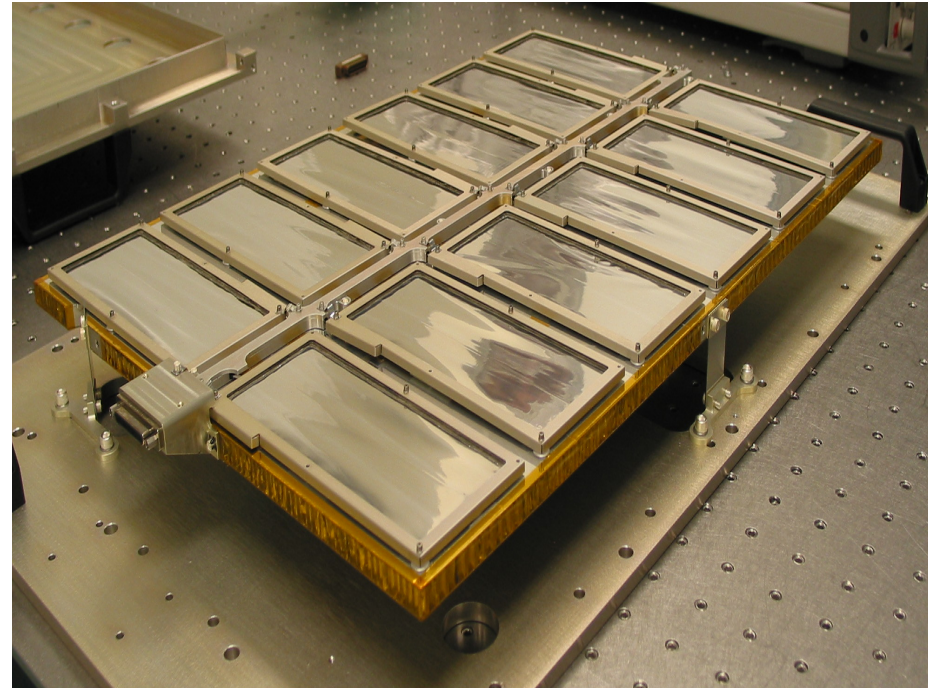
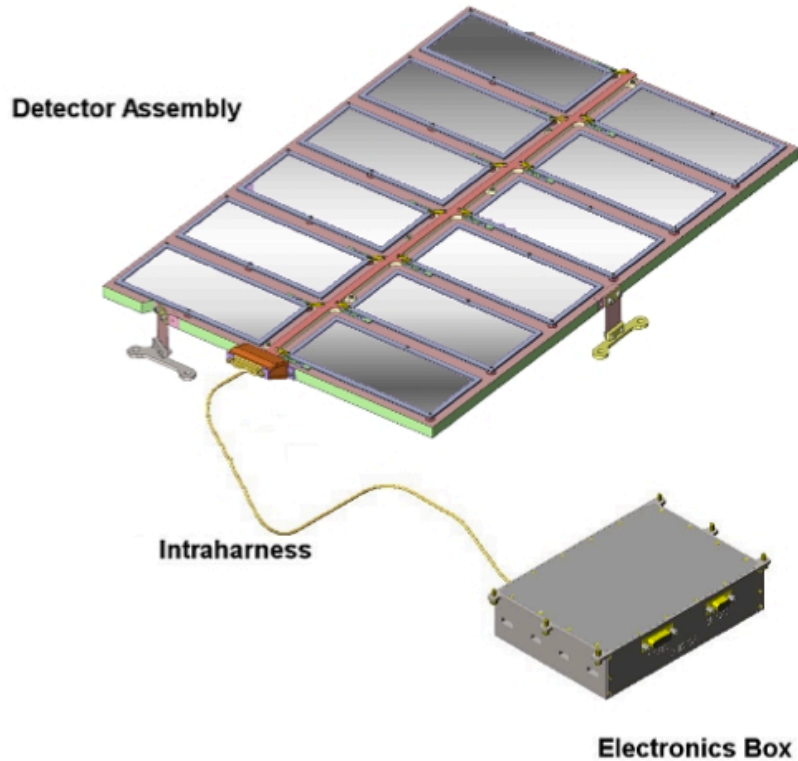


# New Horizons SDC PDS Review Pluto Data: January 2015 to July 2015

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U.C. Berkeley / SSL  
May 19, 2016



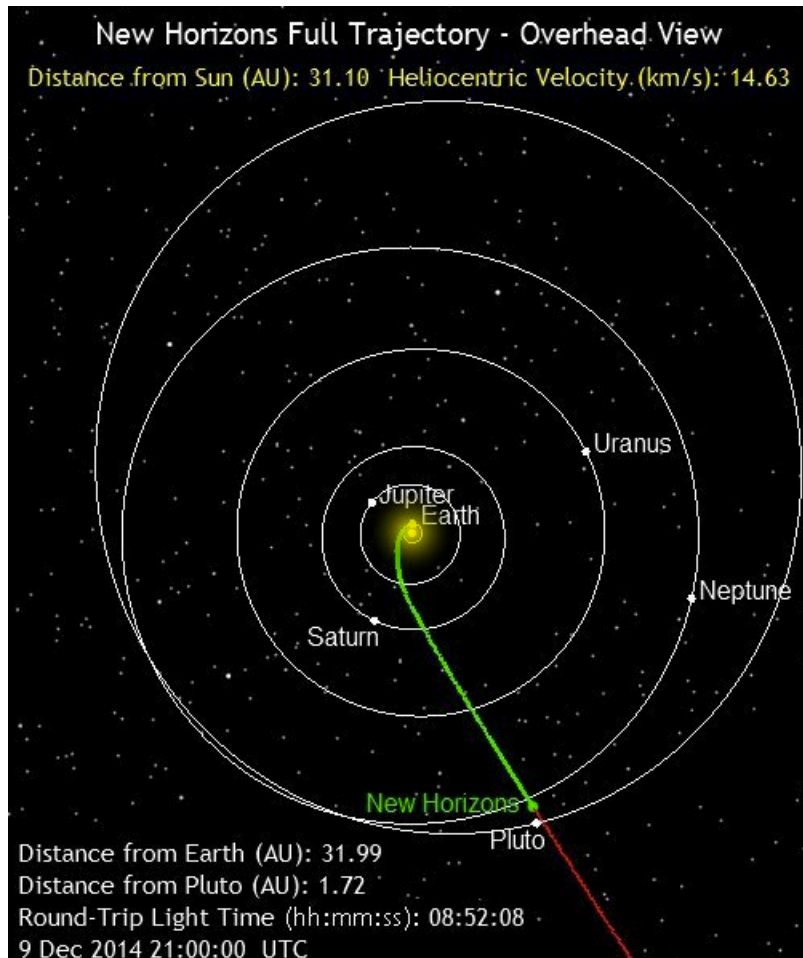
# SDC Instrument



SDC instrument:

- 14 detectors: 12 science (with 1 defunct), 2 reference
- electronics box for signal processing, telemetry/commands

# Previous & Current Releases



SDC launch, jupiter, and cruise datasets cover 1/2006 to 7/2014, Earth to approximately the orbit of Neptune

Three main data periods previously released by SDC:

- Launch: March 2006 – Dec 2006, mainly testing and checkout of instrument
- Jupiter: Dec 2006 – June 2007, small chunk of data taken post-Jupiter fly-by (note SDC was not on during close approach of Jupiter)
- Pluto-cruise: June 2007 – July 2014, main period of scientific data collection by SDC between the orbits of Jupiter and Pluto

Current dataset:

- Pluto Encounter: Jan 2015 – July 2015, Pluto approach and encounter
- 973 events

# SDC Raw Data

Index	Extension	Type	Dimension	View				
<input type="checkbox"/> 0	Primary	Image	0	Header	Image	Table		
<input type="checkbox"/> 1	DATA	Binary	6 cols X 32 rows	Header	Hist	Plot	All	Select
<input type="checkbox"/> 2	HOUSEKEEPING_SDC	Binary	9 cols X 0 rows	Header	Hist	Plot	All	Select
<input type="checkbox"/> 3	HOUSEKEEPING_0X004	Binary	37 cols X 1 rows	Header	Hist	Plot	All	Select
<input type="checkbox"/> 4	HOUSEKEEPING_0X00D	Binary	8 cols X 1 rows	Header	Hist	Plot	All	Select
<input type="checkbox"/> 5	HOUSEKEEPING_0X00A	Binary	5 cols X 1 rows	Header	Hist	Plot	All	Select
<input type="checkbox"/> 6	THRUSTERS	Binary	28 cols X 0 rows	Header	Hist	Plot	All	Select

Total Columns: 6  
Total Rows : 32

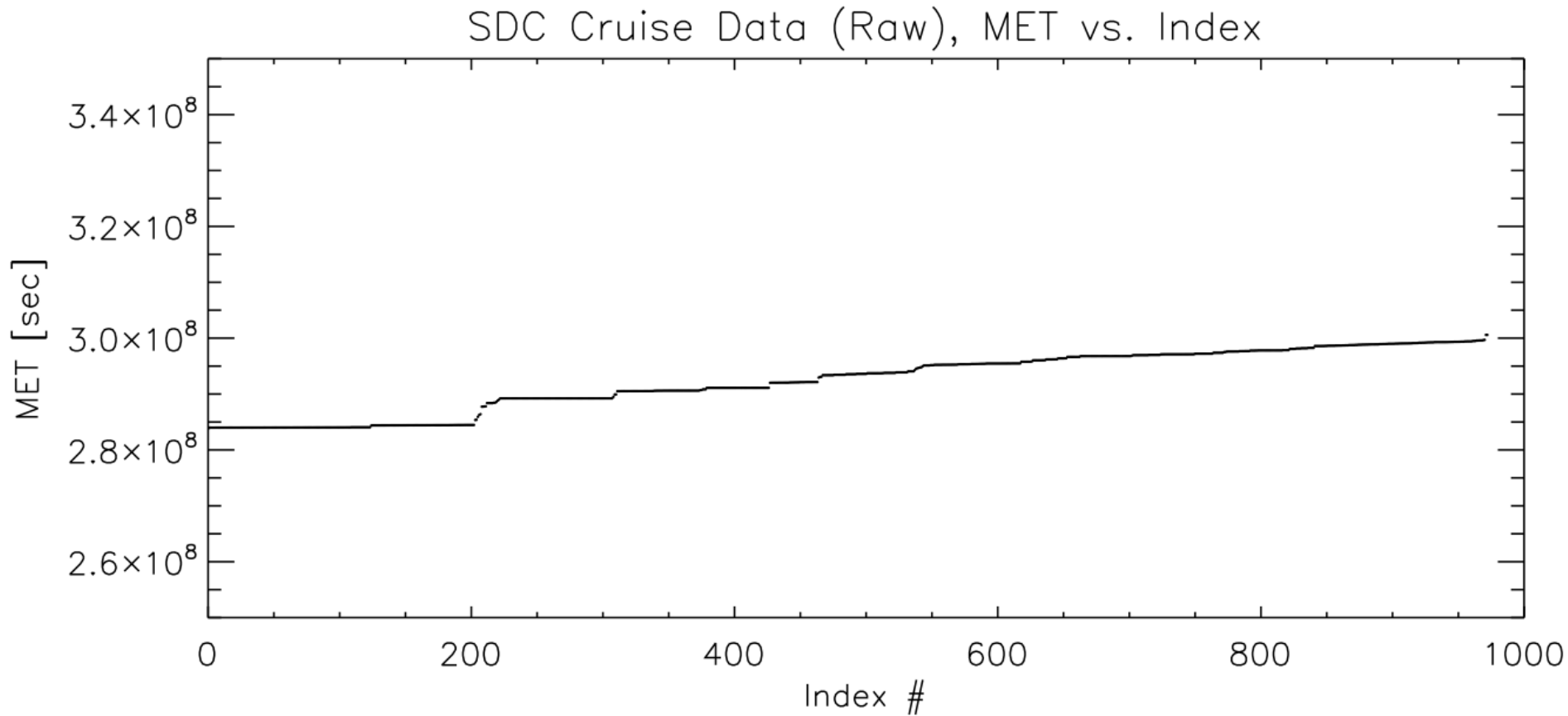
**Selected columns for display**

- Copy Number
- Channel ID
- Zero Fill
- Threshold
- Magnitude
- Time Stamp

Includes SDC raw scientific data, SDC housekeeping (engineering telemetry), New Horizons spacecraft housekeeping (0x004, 0x00D, 0x00A), and New Horizons thruster firing data

The SDC raw scientific data includes channel (detector) number, data threshold, data magnitude, and time stamp

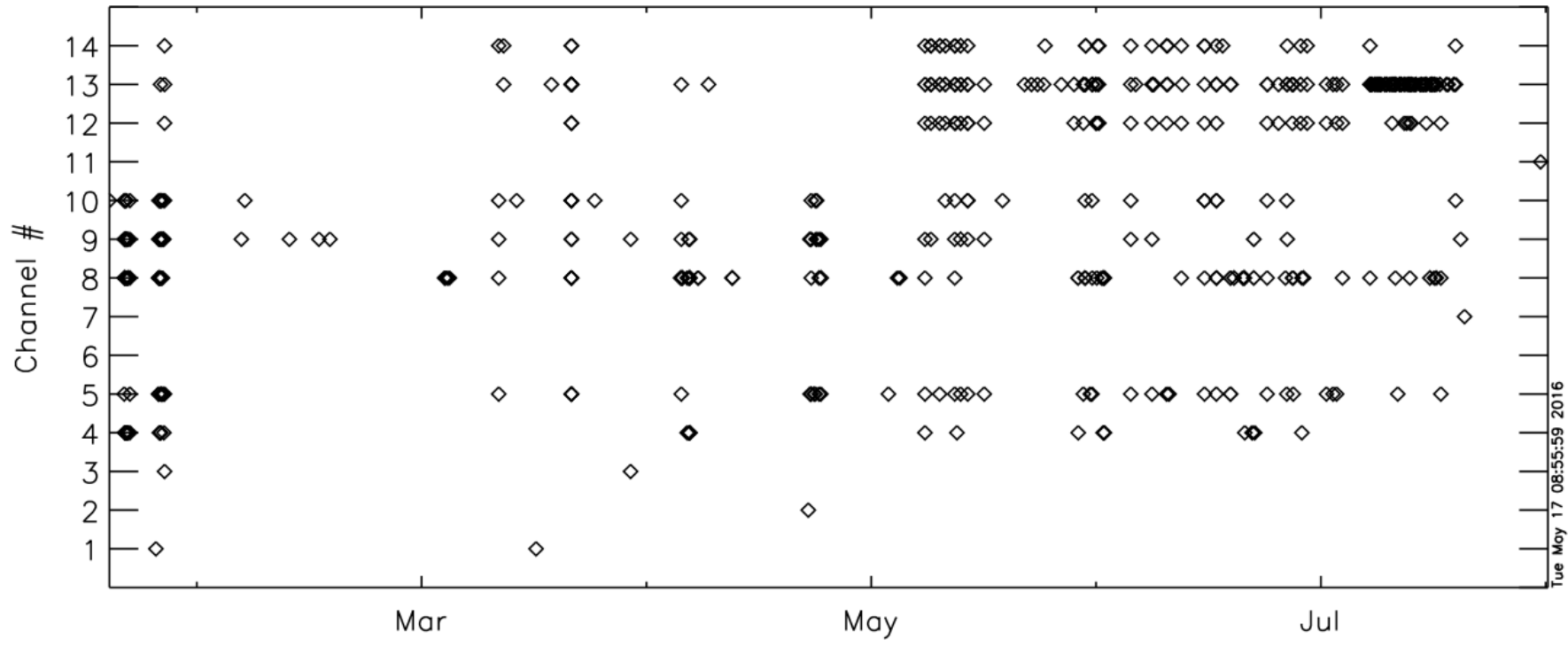
# SDC Raw Data: MET vs Count Number



Plot of Mission Elapsed Time versus entry looks good

Total number of events: 973

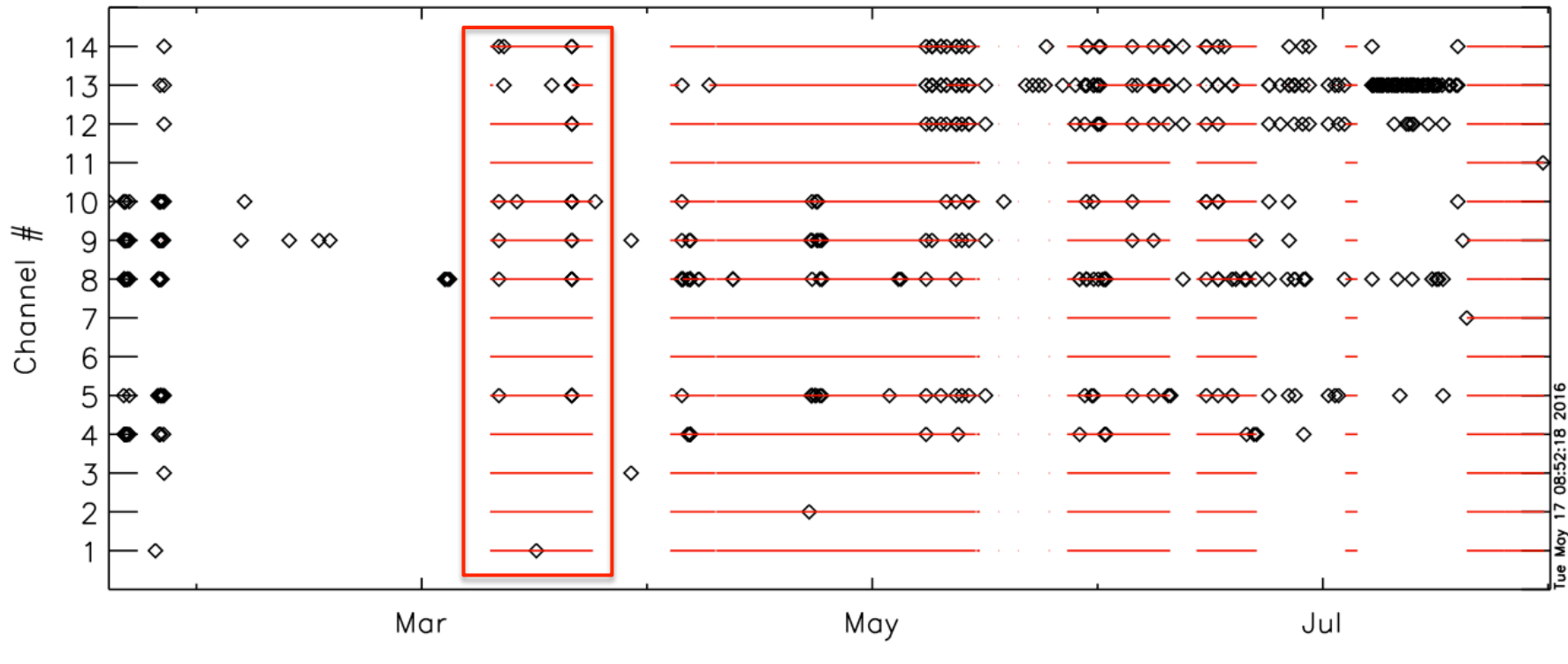
# SDC Raw Data: Channel vs Time



High degree of variability between channels

Presumably instrument autonomy rules are turning channels on or off in response to noise, but...

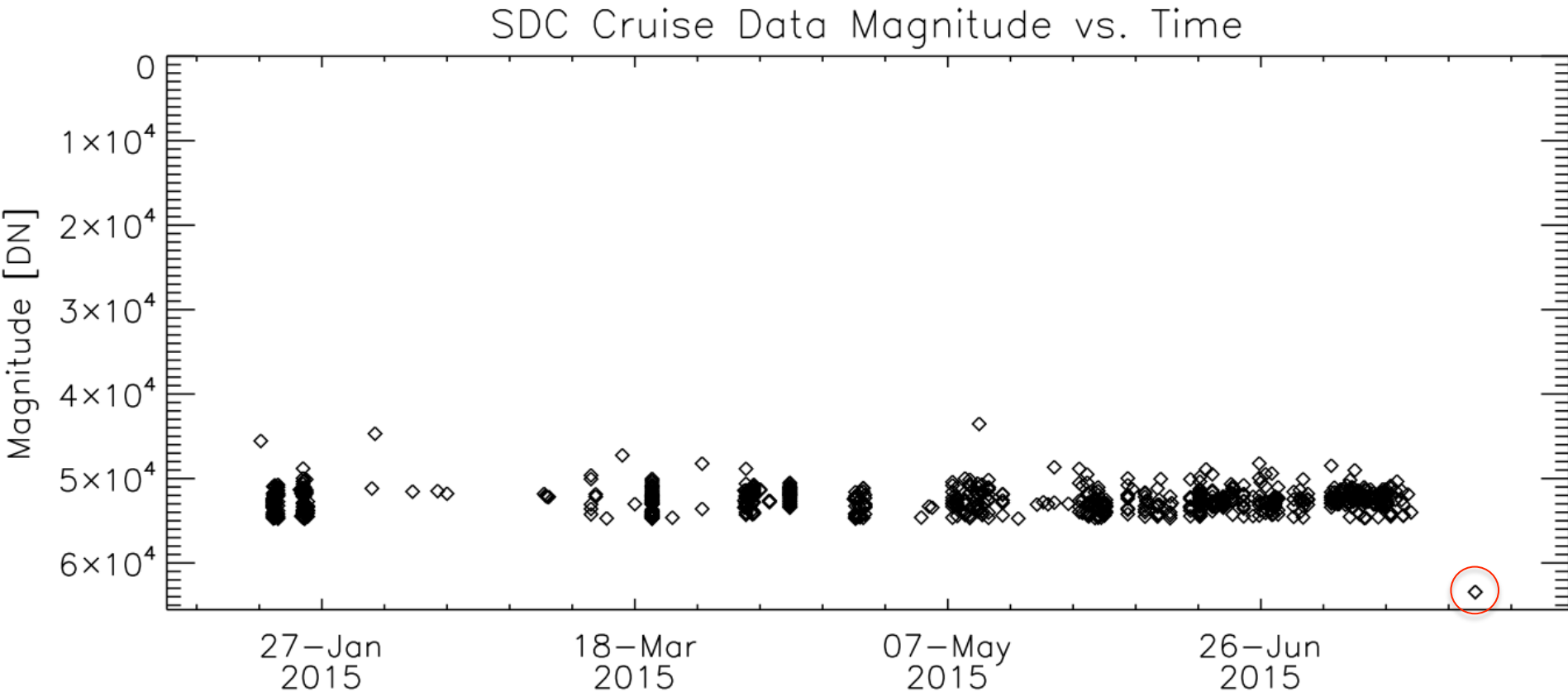
# SDC Raw Data: Channel vs. Time



The SDC on/off times file seems to be incorrectly compiled. There are hits where the on/off file says the channel should be OFF.

The red rectangle above highlights one example of a period when the on/off file says the channels should be off, but that also has hits in the data/ files.

# SDC Raw Data: Magnitude vs. Time



Note that the SDC magnitude scale is inversely proportional to the size of the impact (ranges from 65535 – 0 DN)

Events are all within typical range that has been previously observed by SDC

Very last event is anomalous?



# SDC Calibrated Data

Index	Extension	Type	Dimension	View
<input type="checkbox"/> 0	Primary	Image	0	Header Image Table
<input checked="" type="checkbox"/> 1	CALIBRATED_DATA	Binary	10 cols X 32 rows	Header Hist Plot All Select

Total Columns: 10  
Total Rows : 32

Selected columns for display

- UTC\_TIME
- MET
- CHANNEL
- CHARGE
- MASS
- MASS\_THRSH
- M\_SIGPLUS
- M\_SIGMINUS
- QUALITY\_FLAG
- IMP\_VEL

Display Table

Select All

Clear All

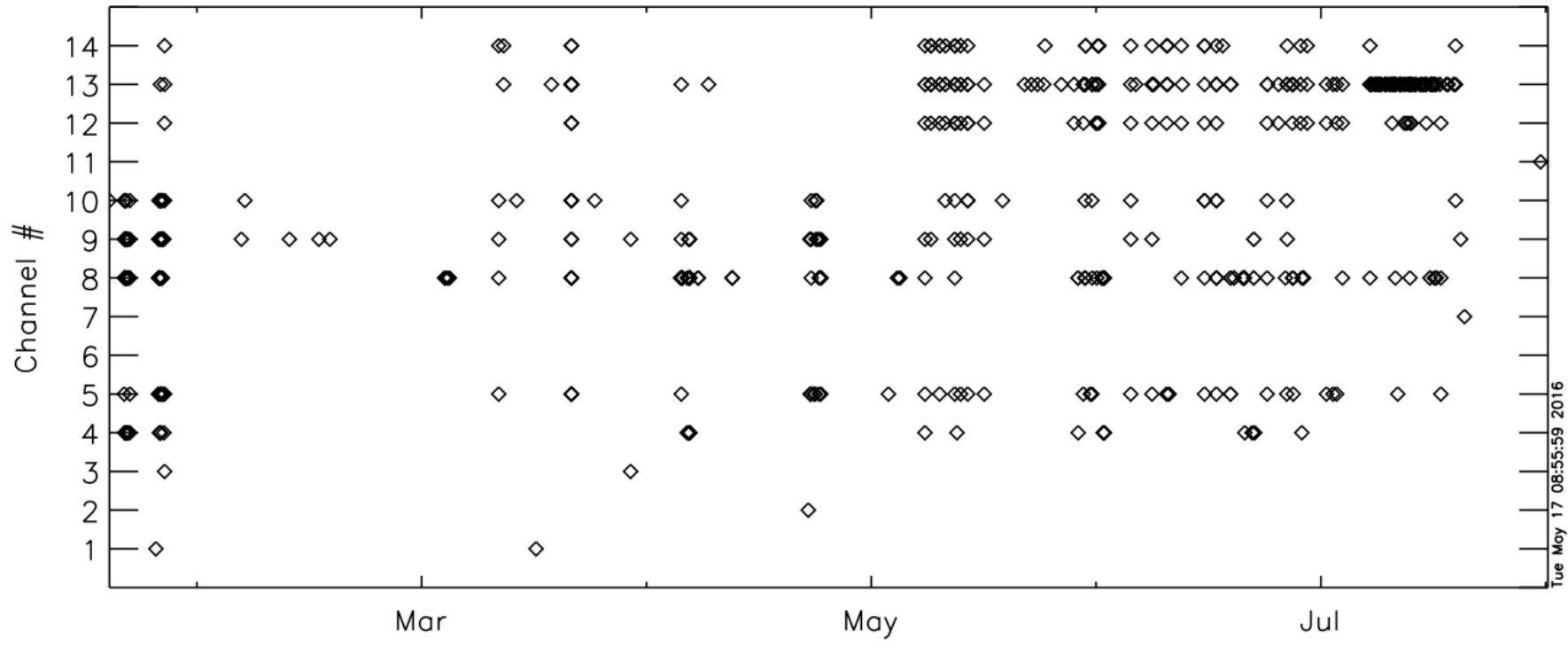
Cancel

Help

Includes SDC calibrated scientific data

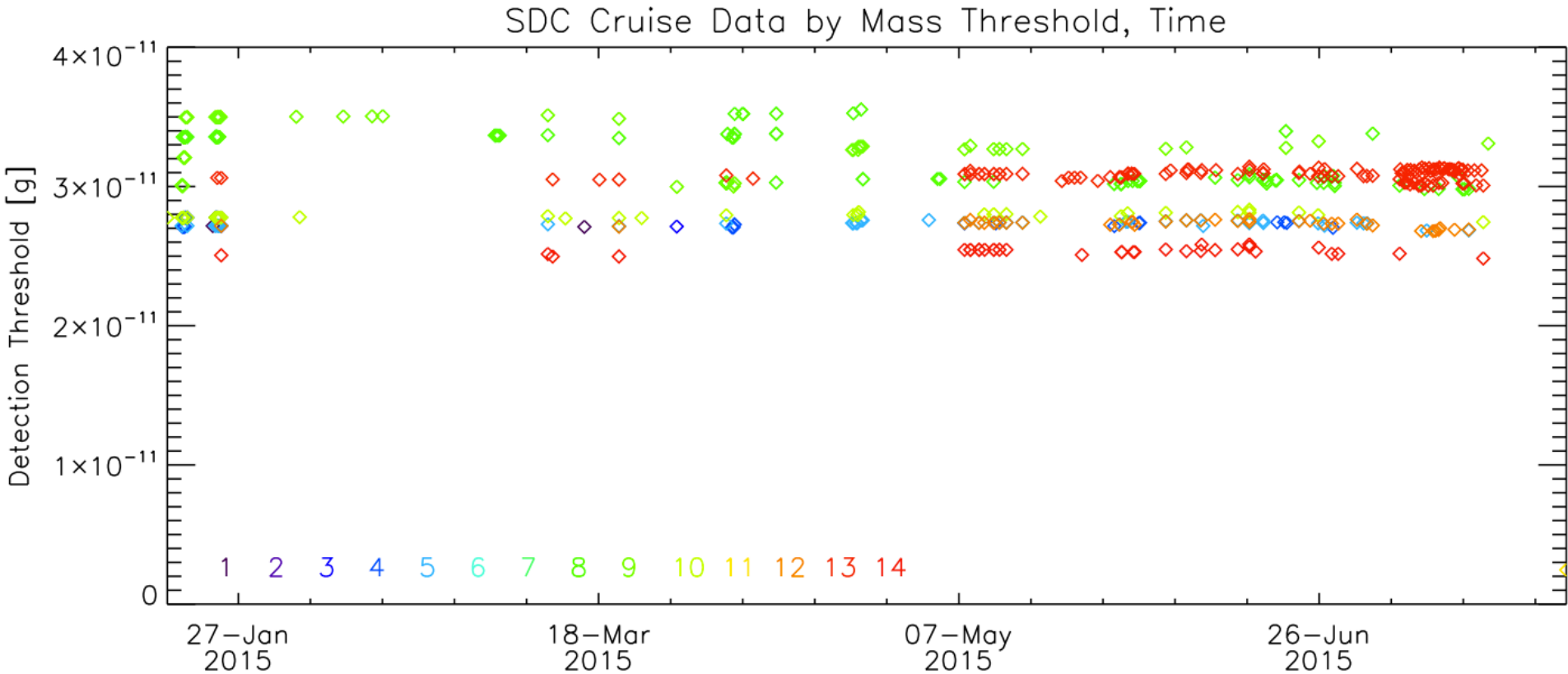
The SDC calibrated scientific data includes time, channel, charge, mass, mass threshold, error bars, quality flag, and theoretical SDC-dust relative impact velocity

# SDC Calibrated Data: Channel vs. Time



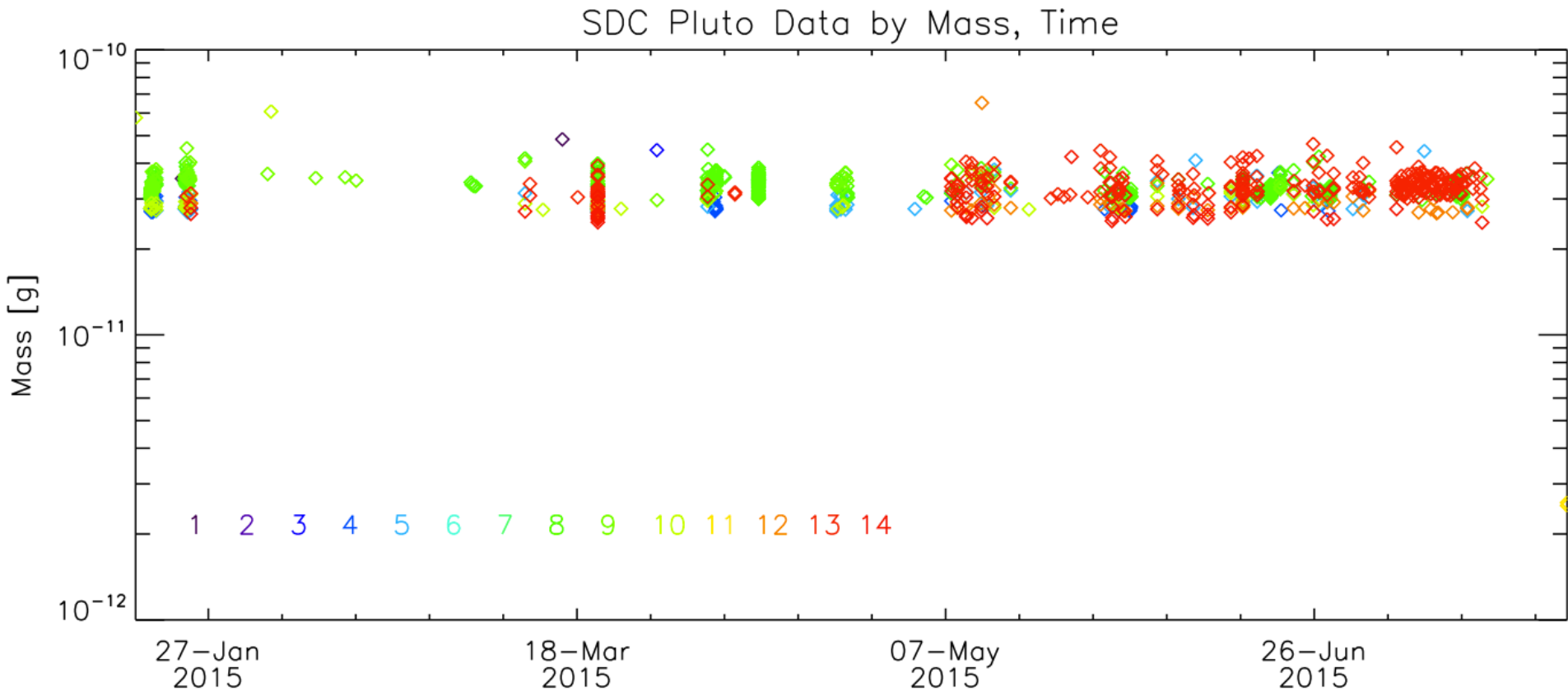
Number of events & timing matches with the SDC Raw dataset

# SDC Calibrated Data: Threshold vs. Time



Plot of Detector Threshold versus time looks good

# SDC Calibrated Data: Mass vs. Time



Pluto Encounter masses versus time for all channels

Note that the detection thresholds were set much higher than typical for the Encounter

## Liens:

- Metadata (sdc on/off times) are incorrectly compiled
- Seq\_sdc\_pluto.tab seems to be missing entries
  - Only entry is on 2015-01-12 for channels ON - is it really correct that the instrument was only commanded once?
- Nh\_mission\_trajectory.tab only goes through 2014-12-31
- Nh\_trajectory.tab is relevant only for Jupiter fly-by
  - Why have both nh\_mission\_trajectory.tab and nh\_trajectory.tab ?
- Sdc\_stim\_v0000.tab has no .lbl file associated with it
  - In fact, the .lbl text is in the .tab file

## Completeness:

- Raw and Calibrated data points are complete and accurate
- Adequate completeness of each data record (i.e., one dust hit)
- **Metadata (sdc on/off times) are incorrectly compiled**

## Intelligibility:

- **Documentation has some issues**
- SDC data are intelligibly formatted through FITS files, both raw and calibrated
- Metadata are straightforward through ASCII implementation

## Interpretability:

- Given the relatively simple nature of SDC operations, the data are straightforwardly interpretable; no issues noted here