Overview over Deglitching Methods and Deglitching with MMMS

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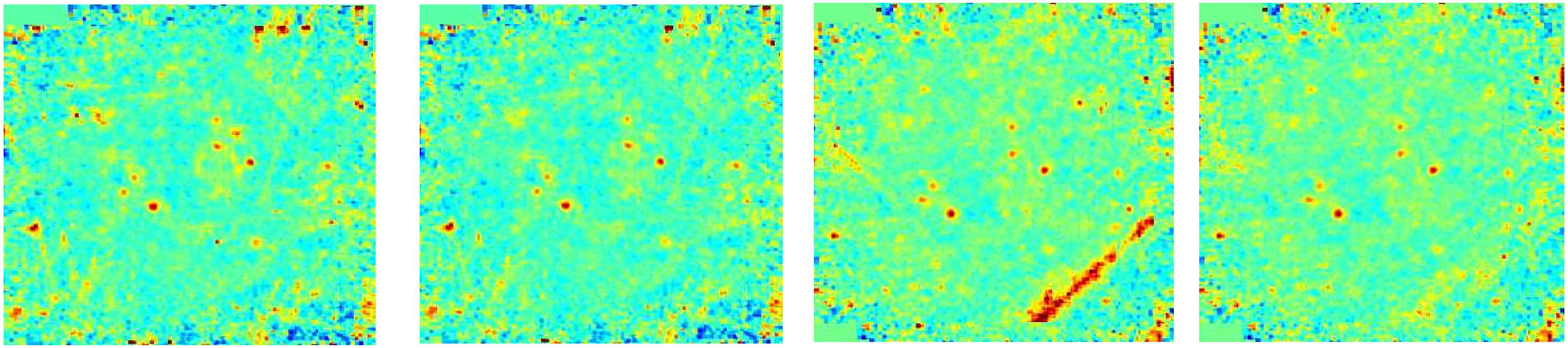
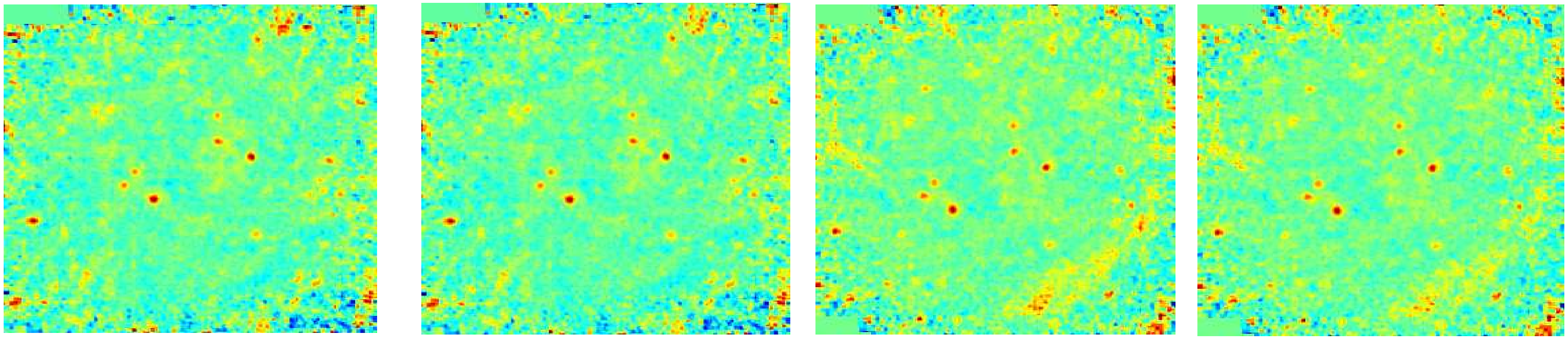
Overview

1. Comparison of all deglitching methods for
   a. faint sources
   b. extended and moderate bright point sources
   c. extended and bright point sources
   d. extremely bright point sources
2. The MMMS deglitcher
   a. description of the algorithm (of this version)
   b. cases where MMMS rejects the whole pixel
   c. amount of pixels masked
3. Scope of applications and possible future expansions

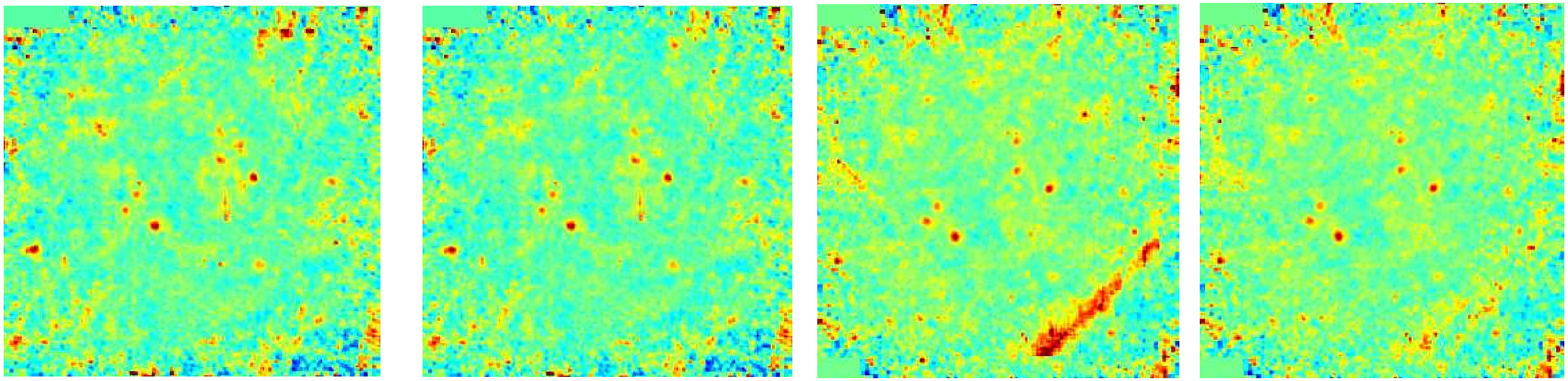
Faint Source (LW3) Measurement treated with different deglitching methods:



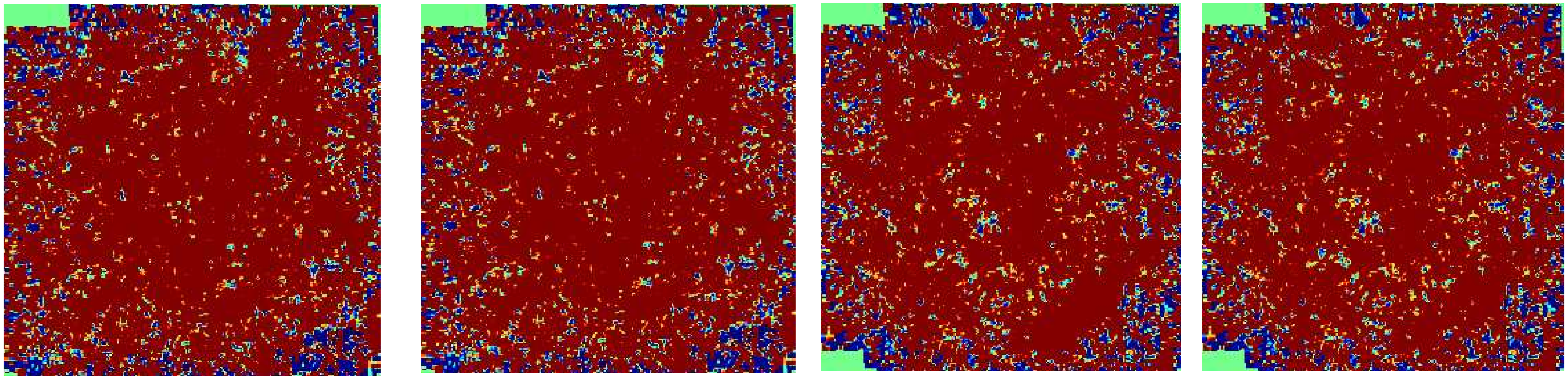
MM Deglitching



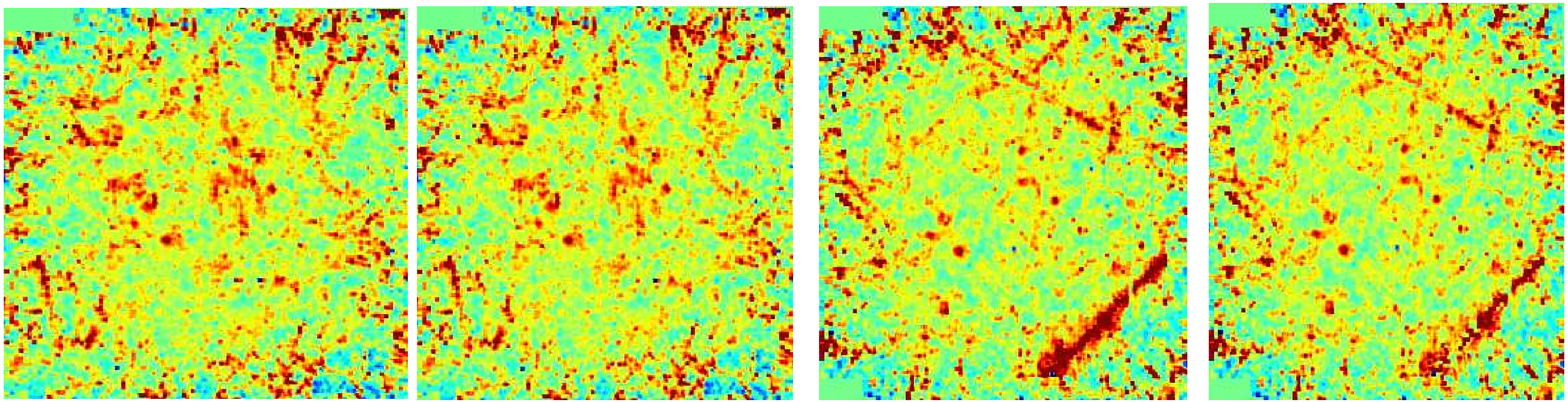
TEMP Deglitching



TCOR Deglitching



SPAT Deglitching

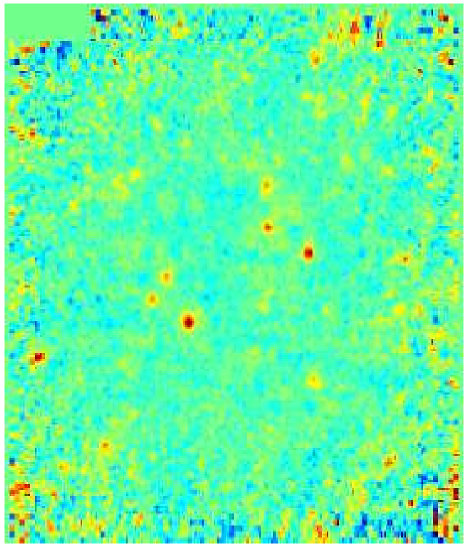


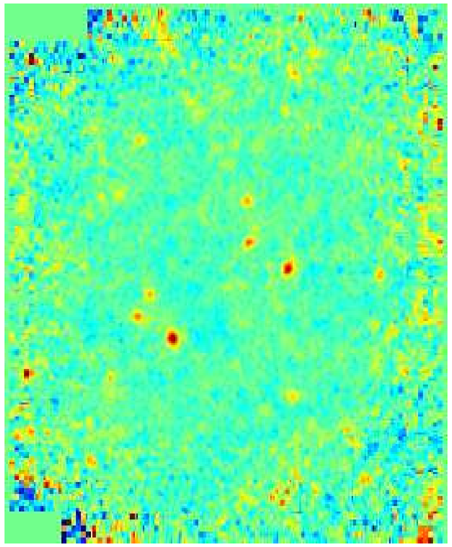
PART Deglitching

Ranking for faint Sources:

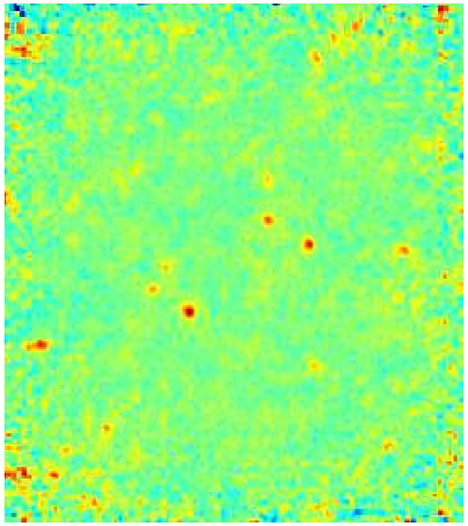
1) TEMP
2) MM
3) TCOR

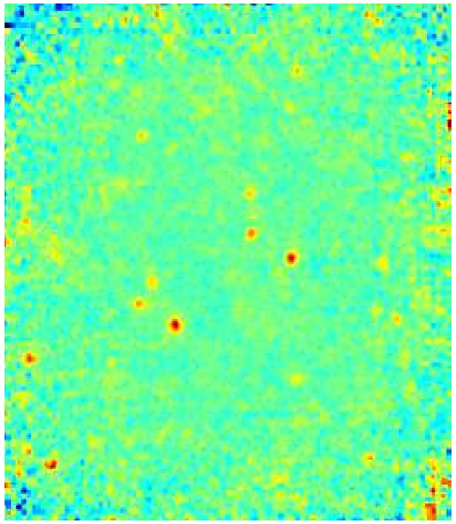
Not recommended: PART and SPAT



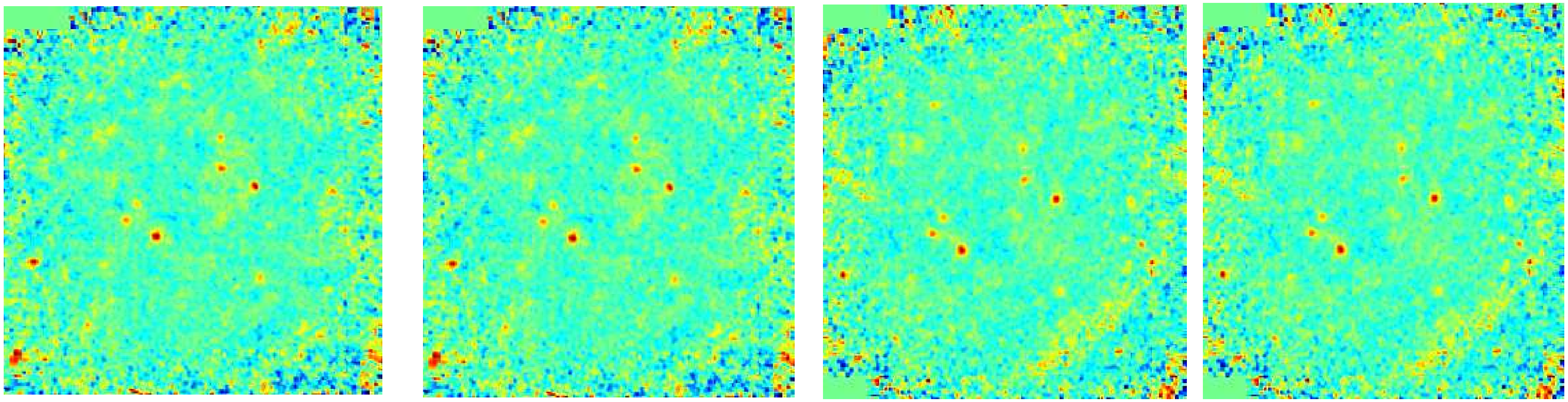


METCALFE Processing

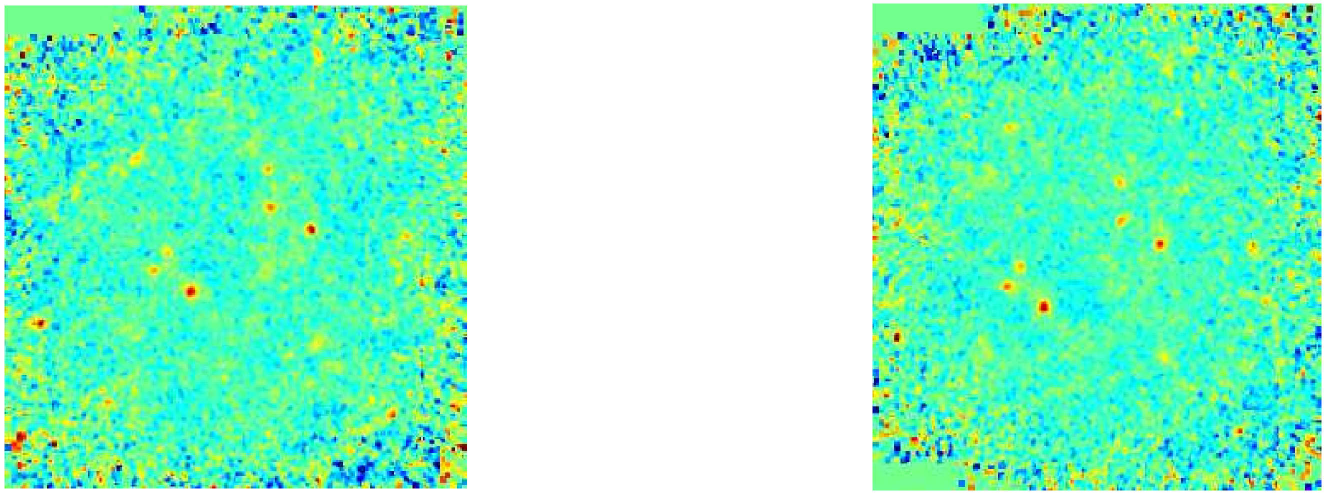




PRETI Processing

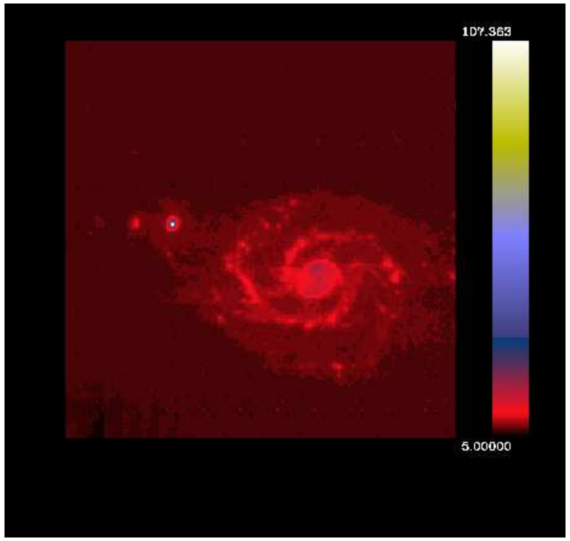


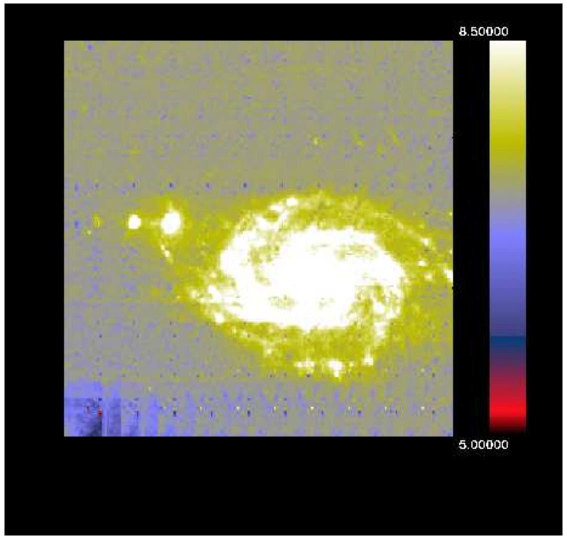
MMMS Deglitching



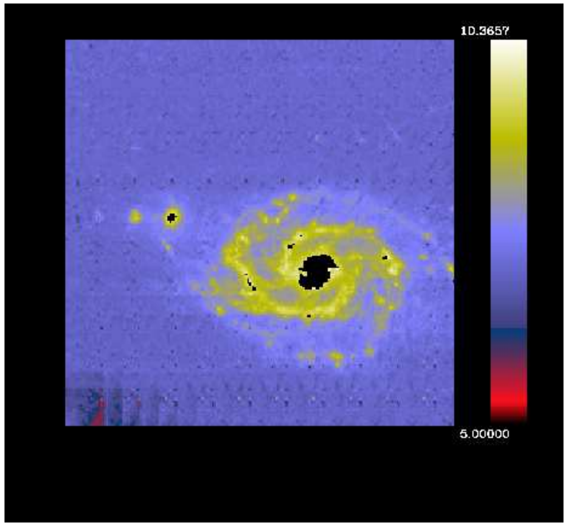
Final MMMS Processing with Tail and doubtful Pixel Rejection

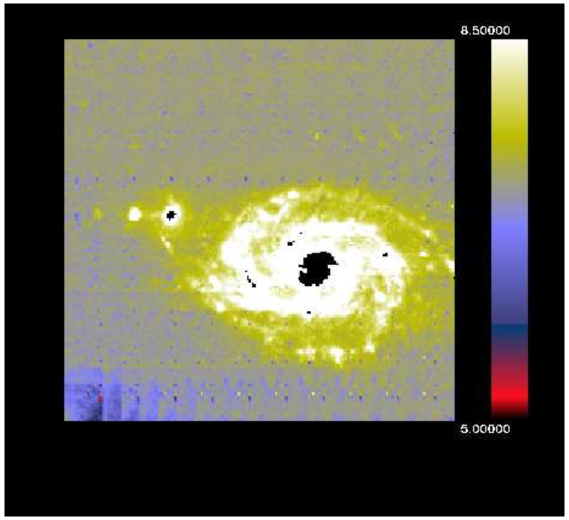
Extended and moderately bright point source Measurement treated with different deglitching methods



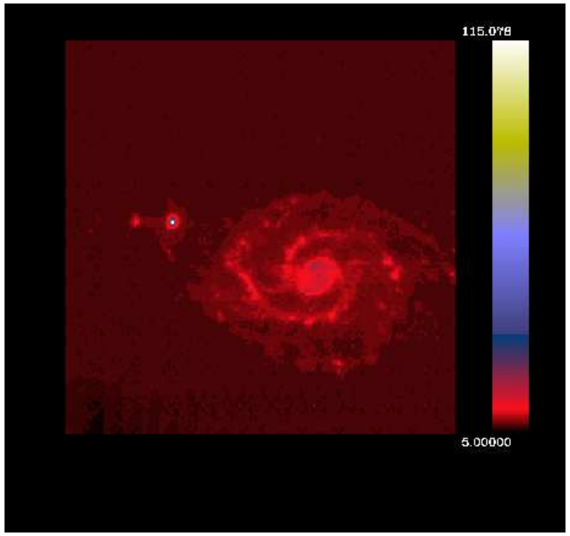


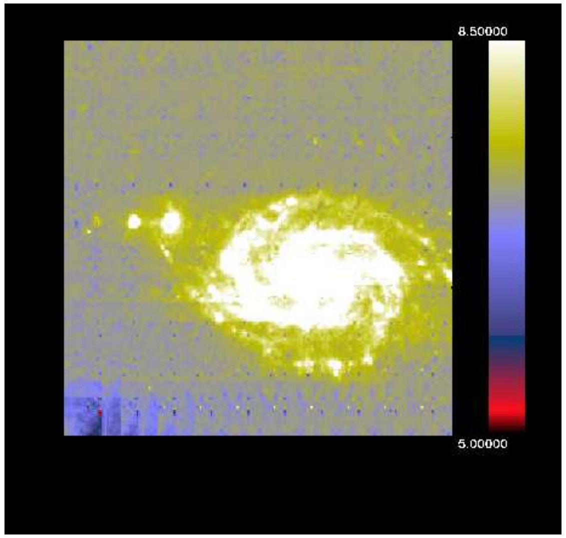
MM Deglitching



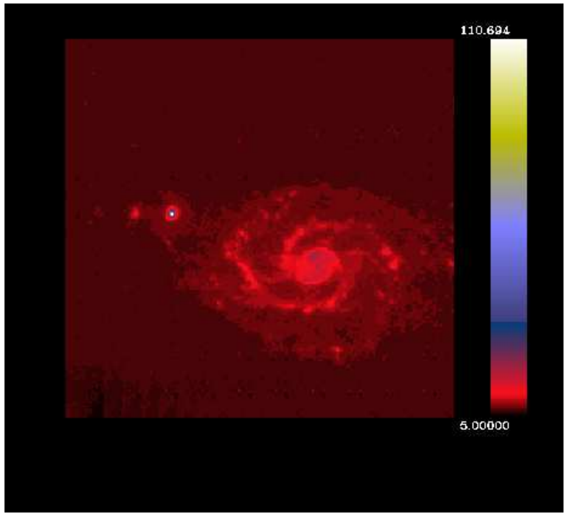


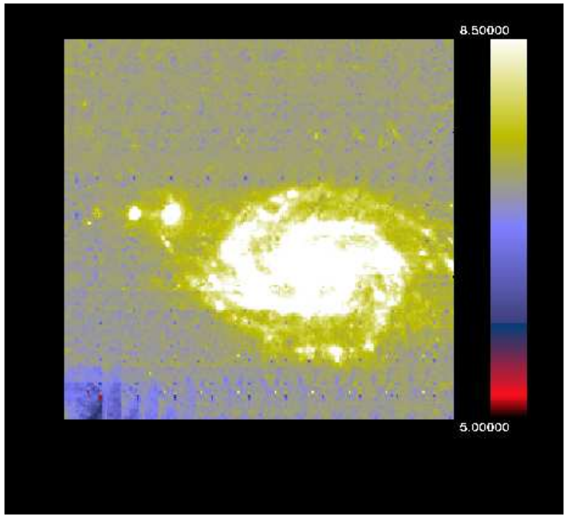
TEMP Deglitching



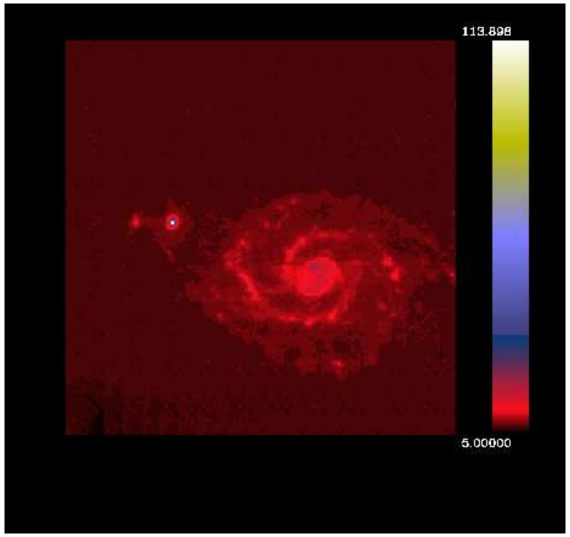


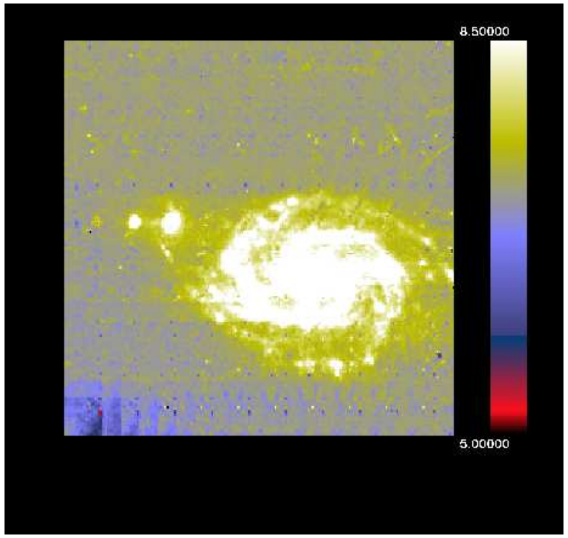
TCOR Deglitching





SPAT Deglitching



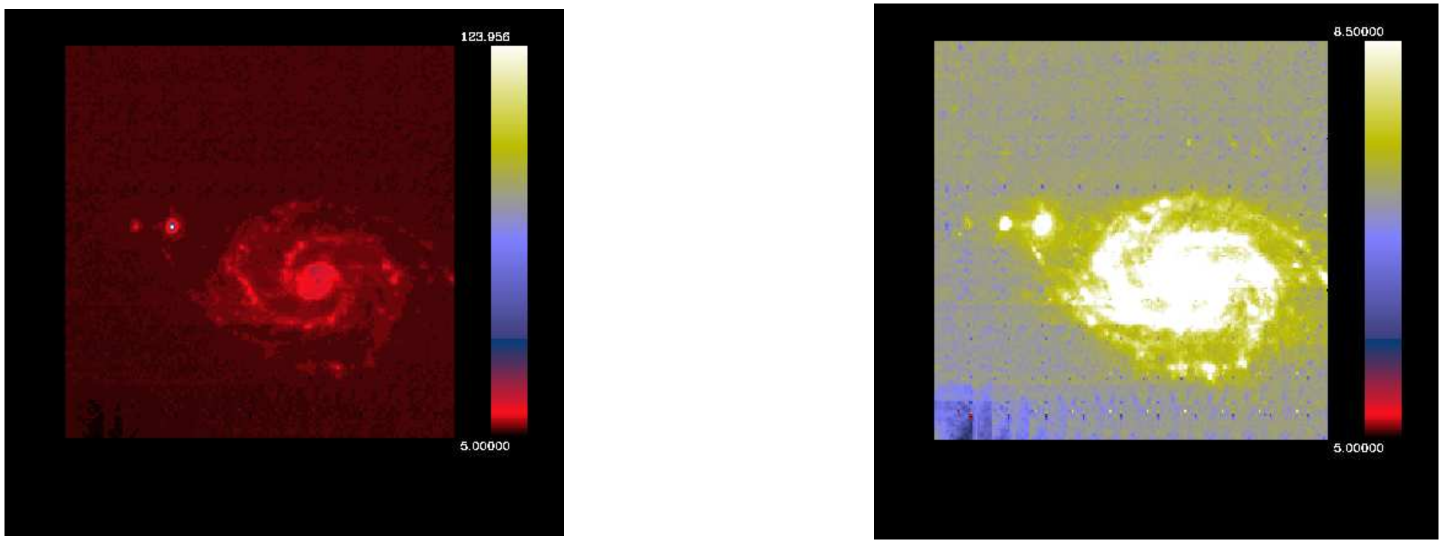


PART Deglitching

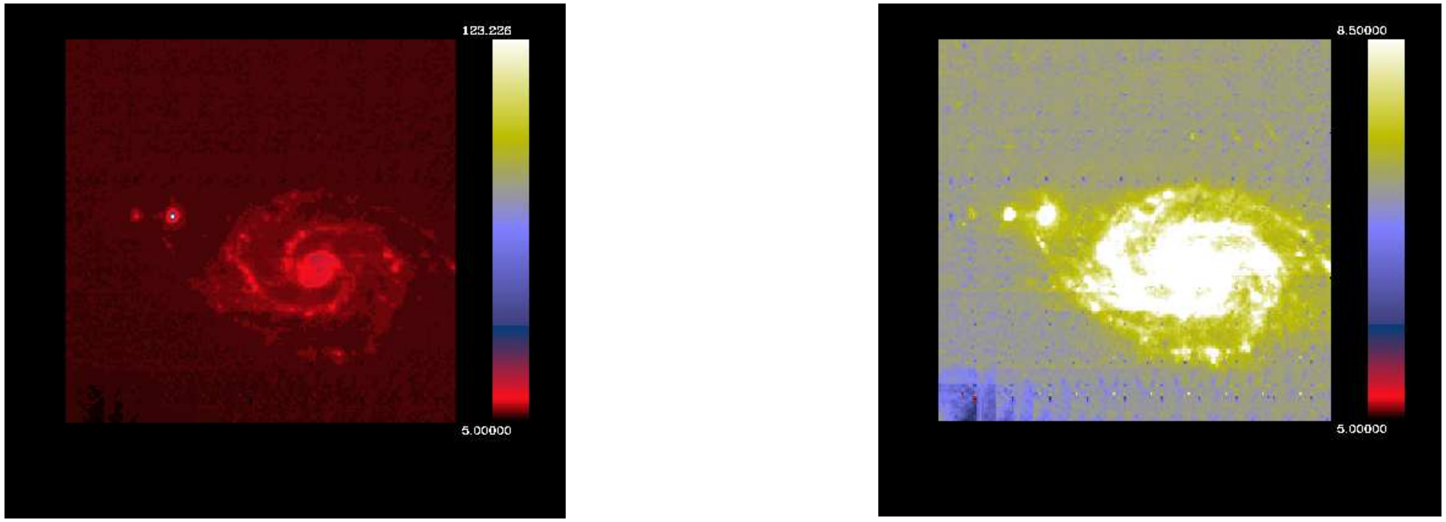
Ranking for extended and moderately bright Sources (flux conservation and optical appearance):

1) TCOR
2) MM
3) SPAT and PART

Not recommended: TEMP

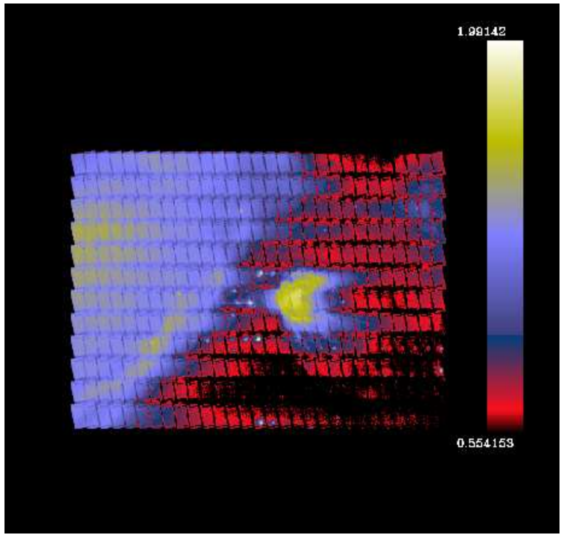


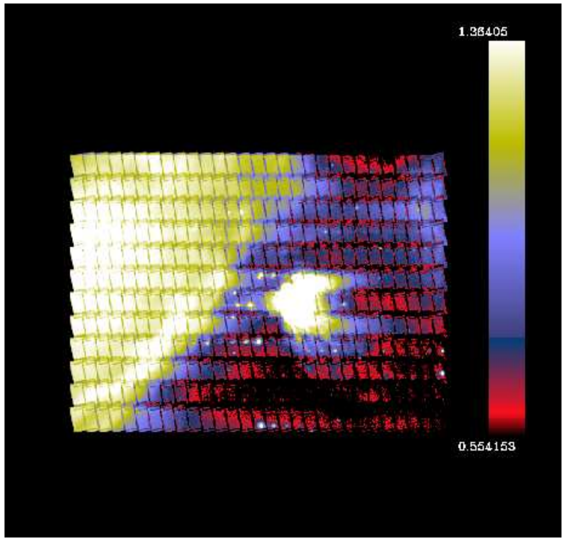
MMMS Deglitching



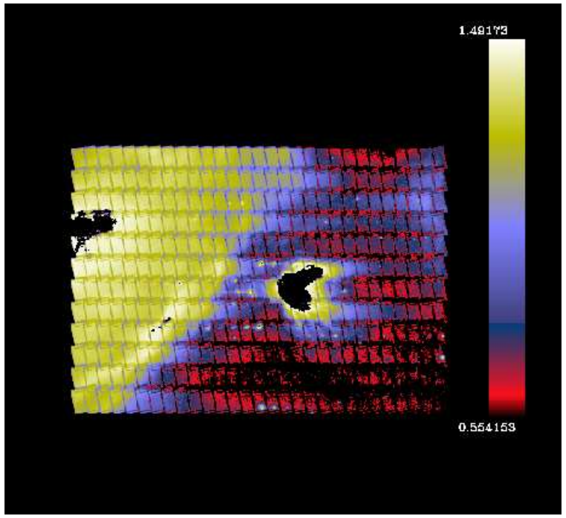
Global MMMS Deglitching

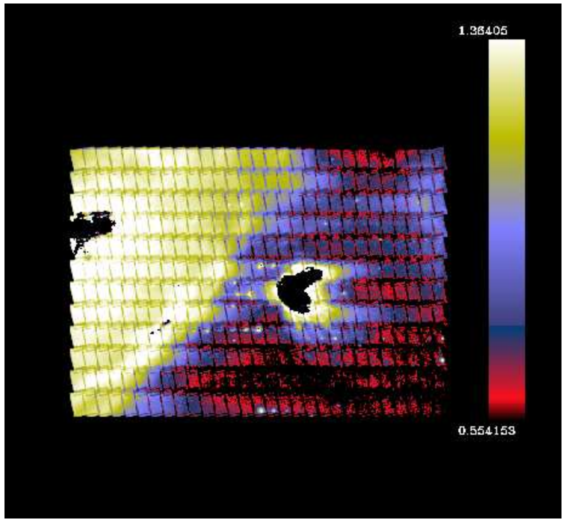
Extended and very bright point source Measurement treated with different deglitching methods



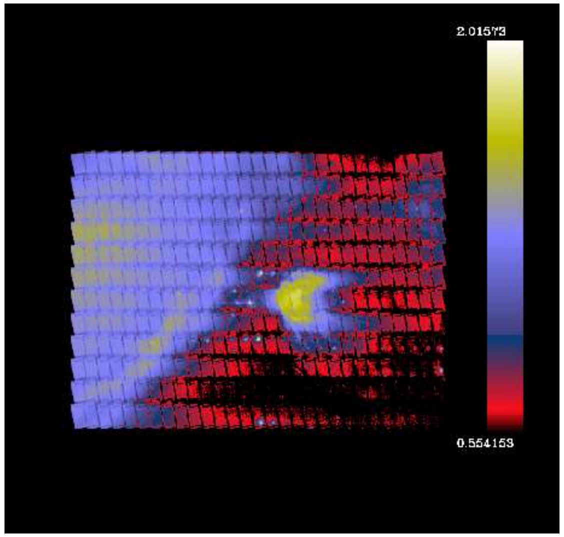


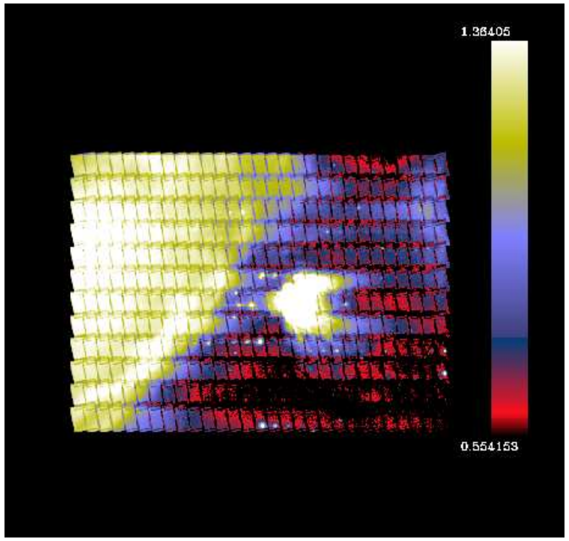
MM Deglitching



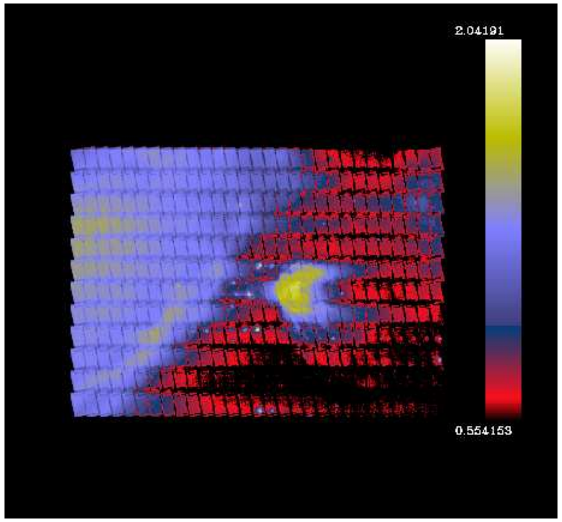


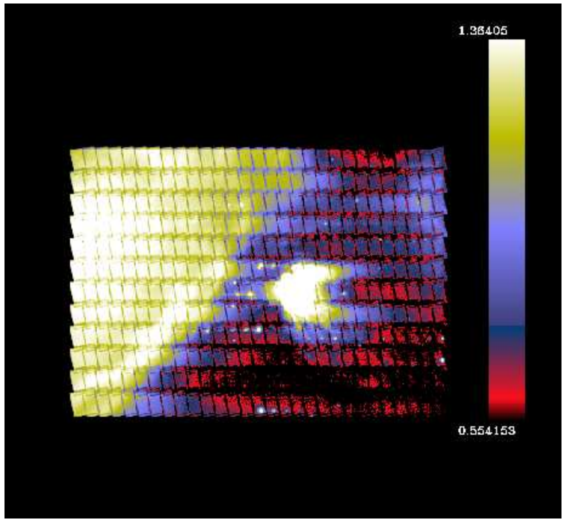
TEMP Deglitching



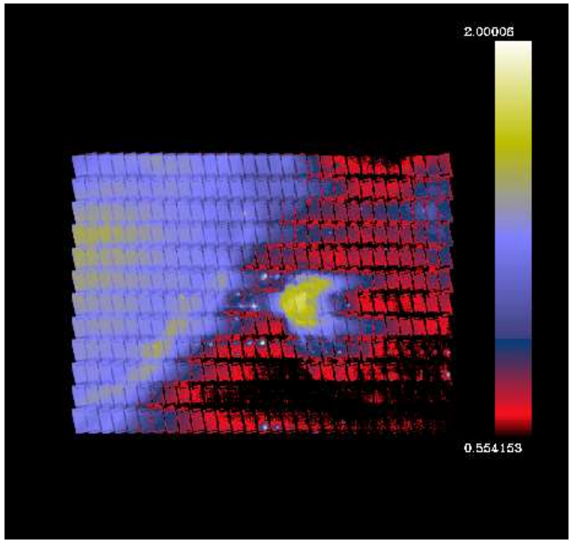


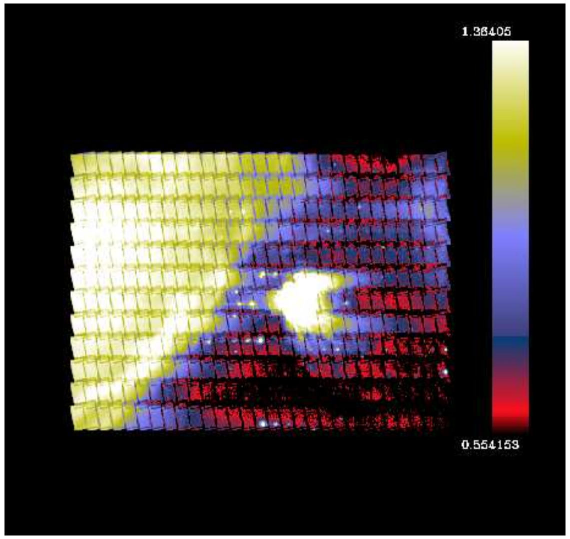
TCOR Deglitching





SPAT Deglitching



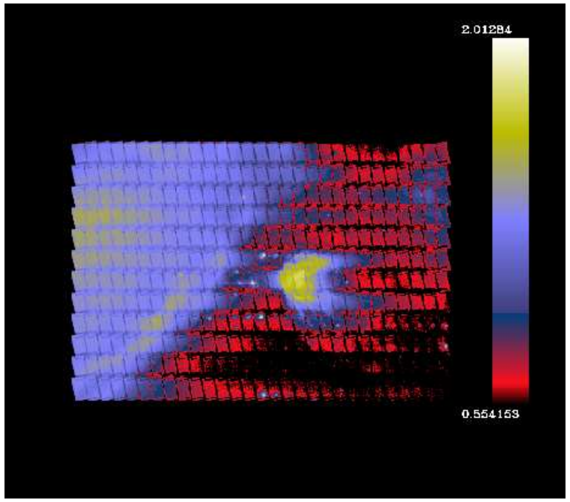


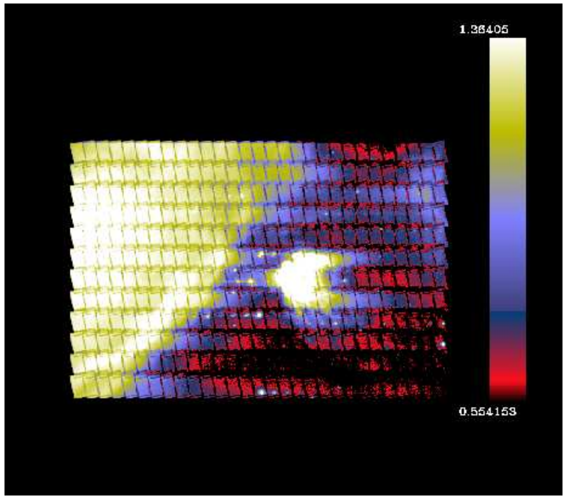
PART Deglitching

Ranking for extended and very bright Sources (flux-conservation and glitch-remainders):

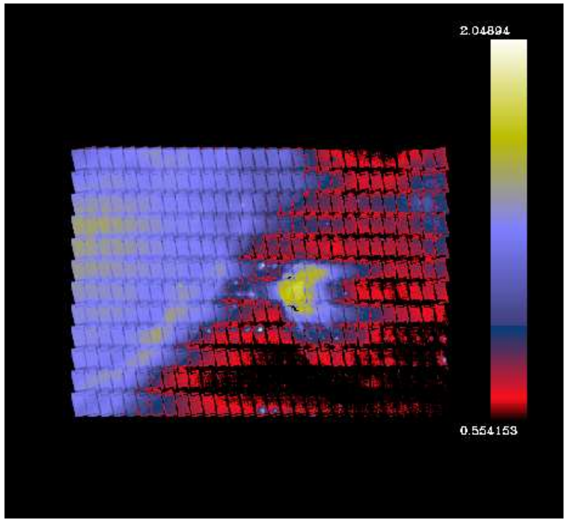
1) SPAT
2) MM
3) TCOR
4) PART

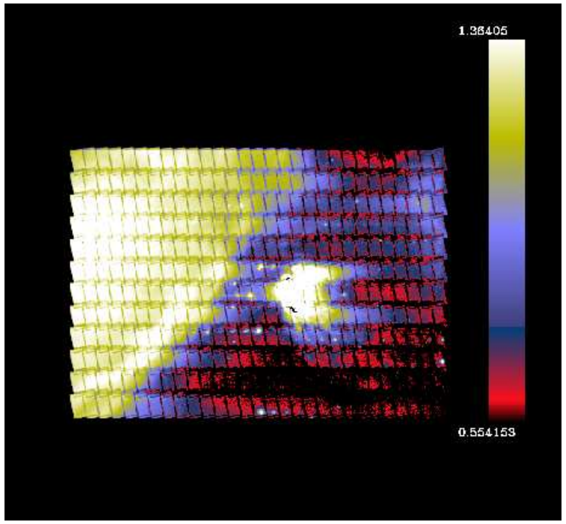
Not recommended: TEMP





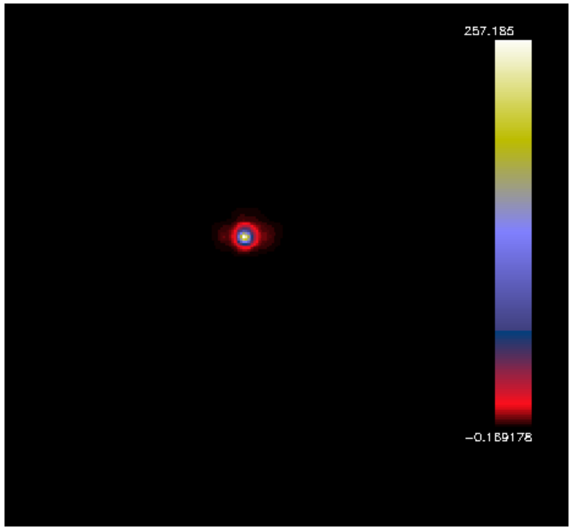
MMMS Deglitching

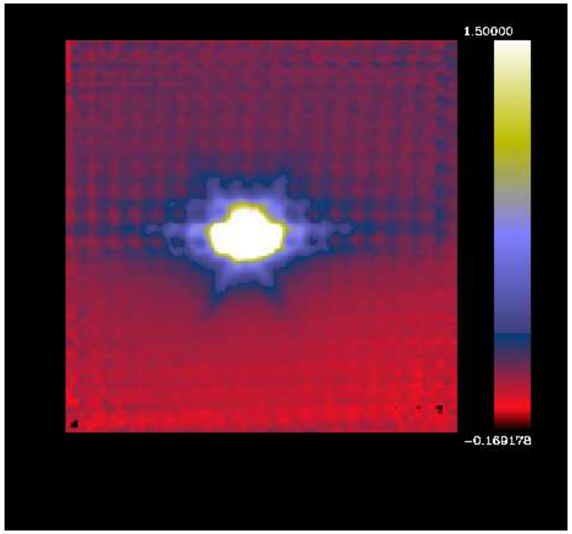




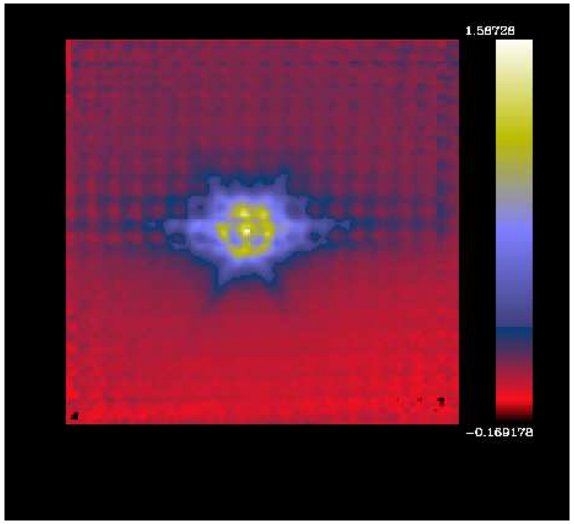
Global MMMS Deglitching

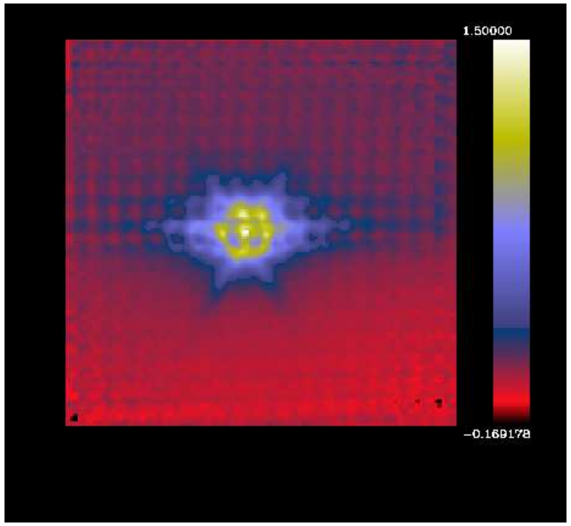
Very strong Source Measurement treated with different deglitching methods



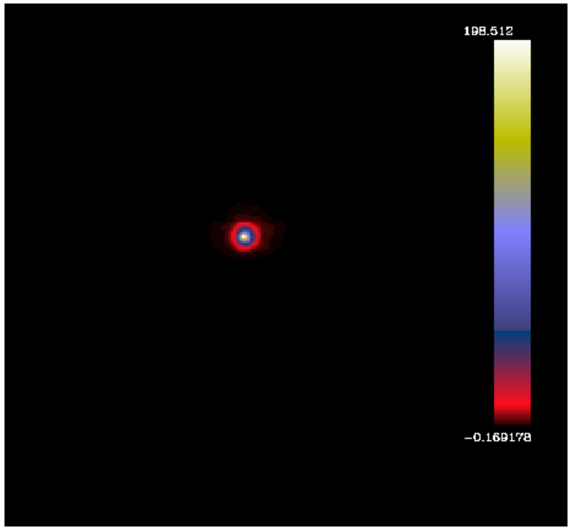


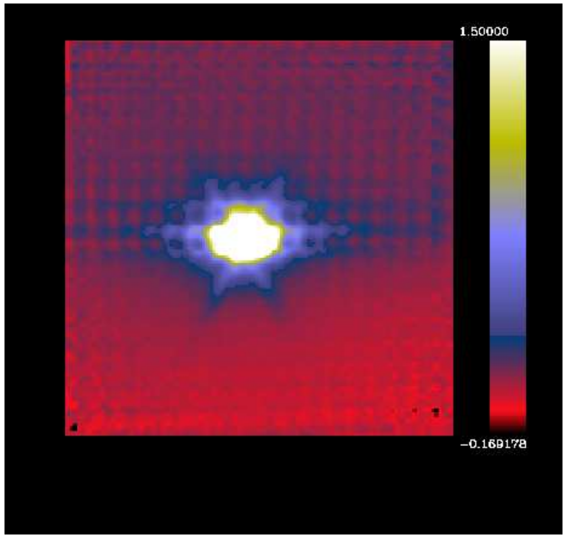
MM Deglitching



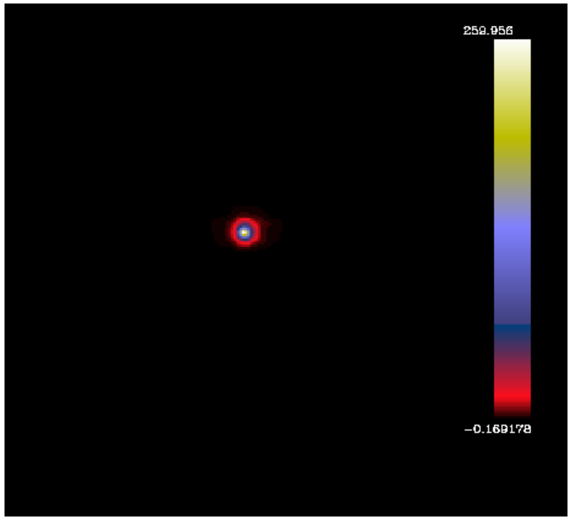


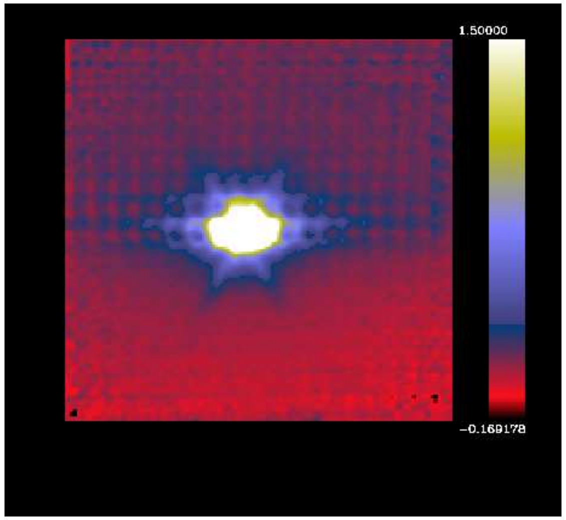
TEMP Deglitching



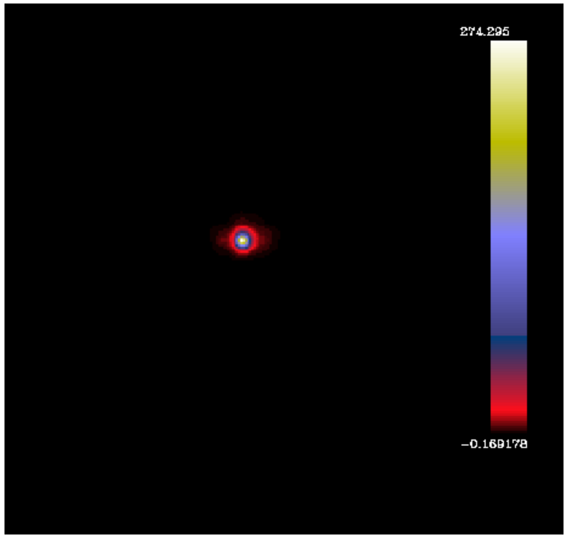


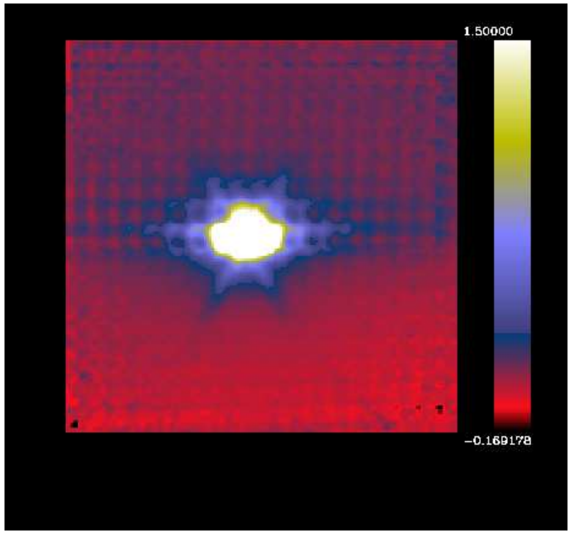
TCOR Deglitching





SPAT Deglitching



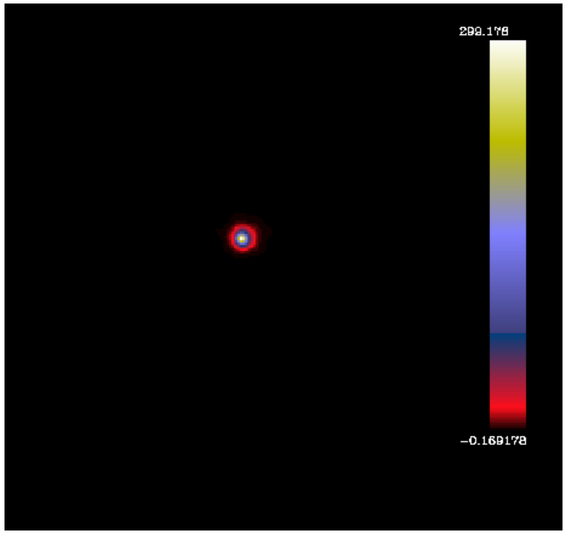


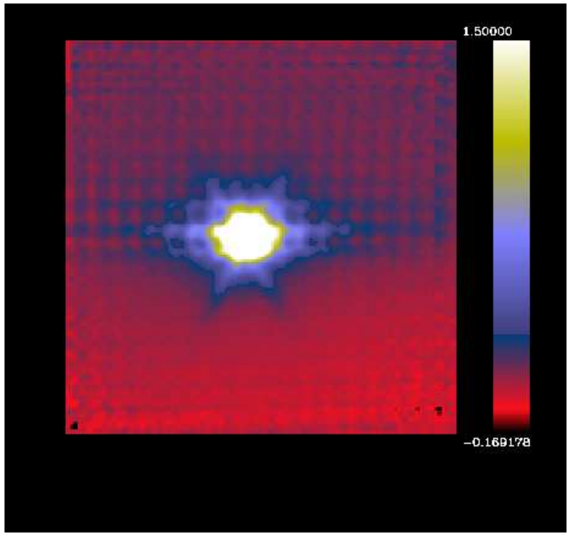
PART Deglitching

Ranking for very strong Sources:

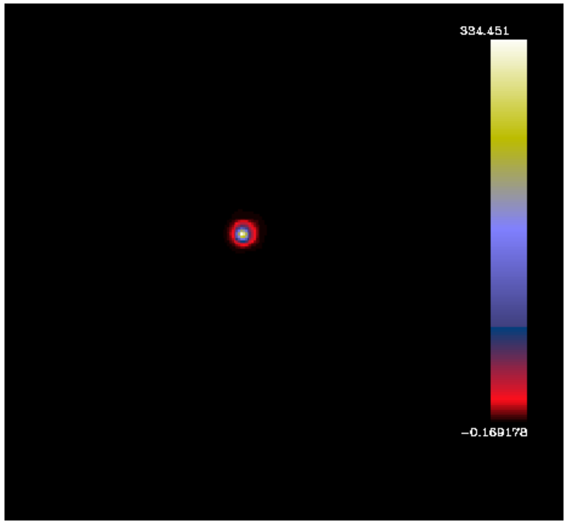
1) PART
2) MM and SPAT

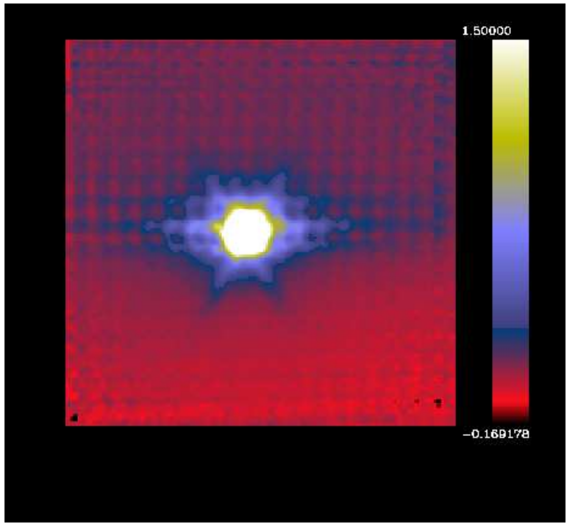
Not recommended: TCOR and TEMP





MMMS Deglitching





Global MMMS Deglitching
with Point-Source Recovery and Tail Rejection

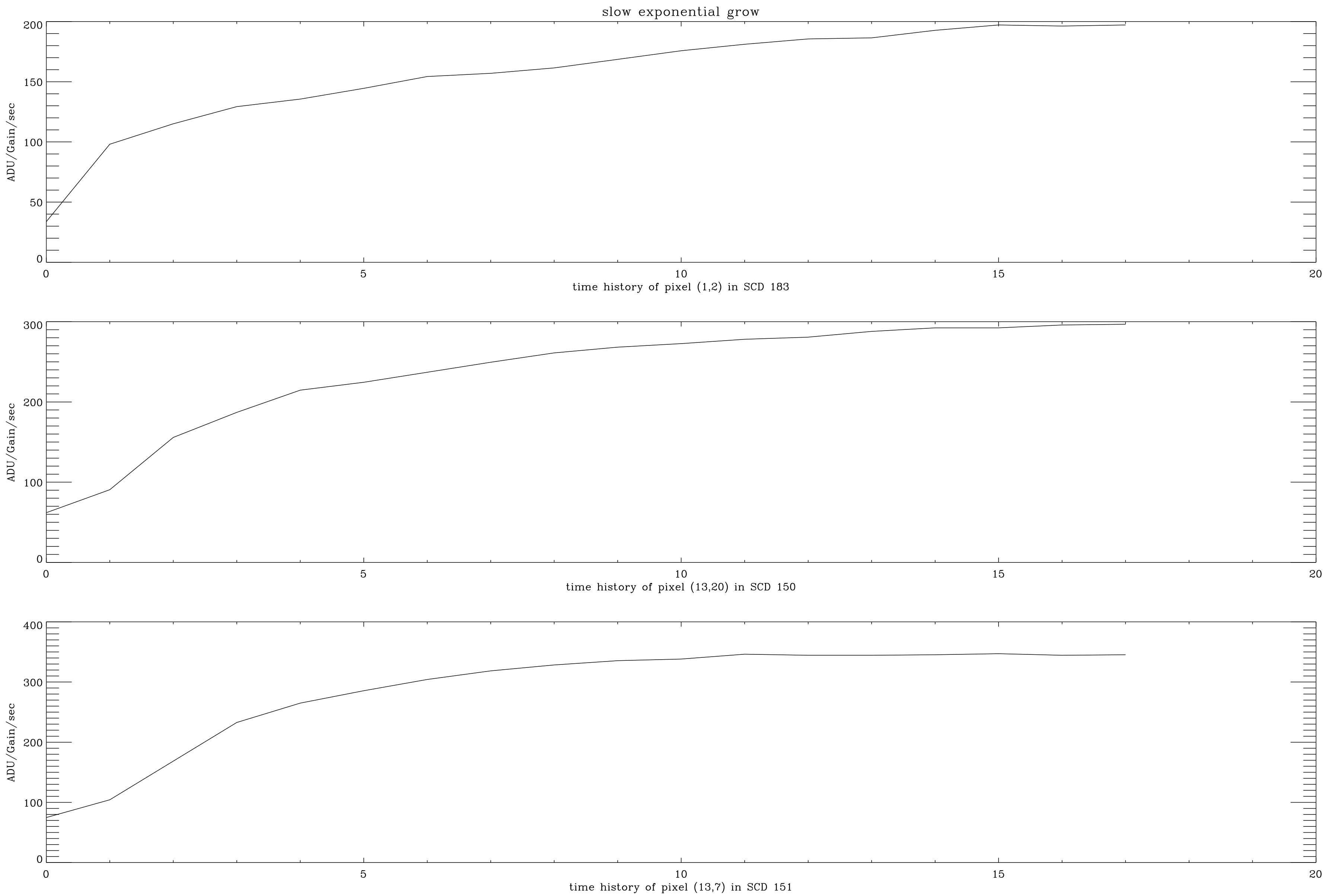
Algorithm of the MMMS deglitching

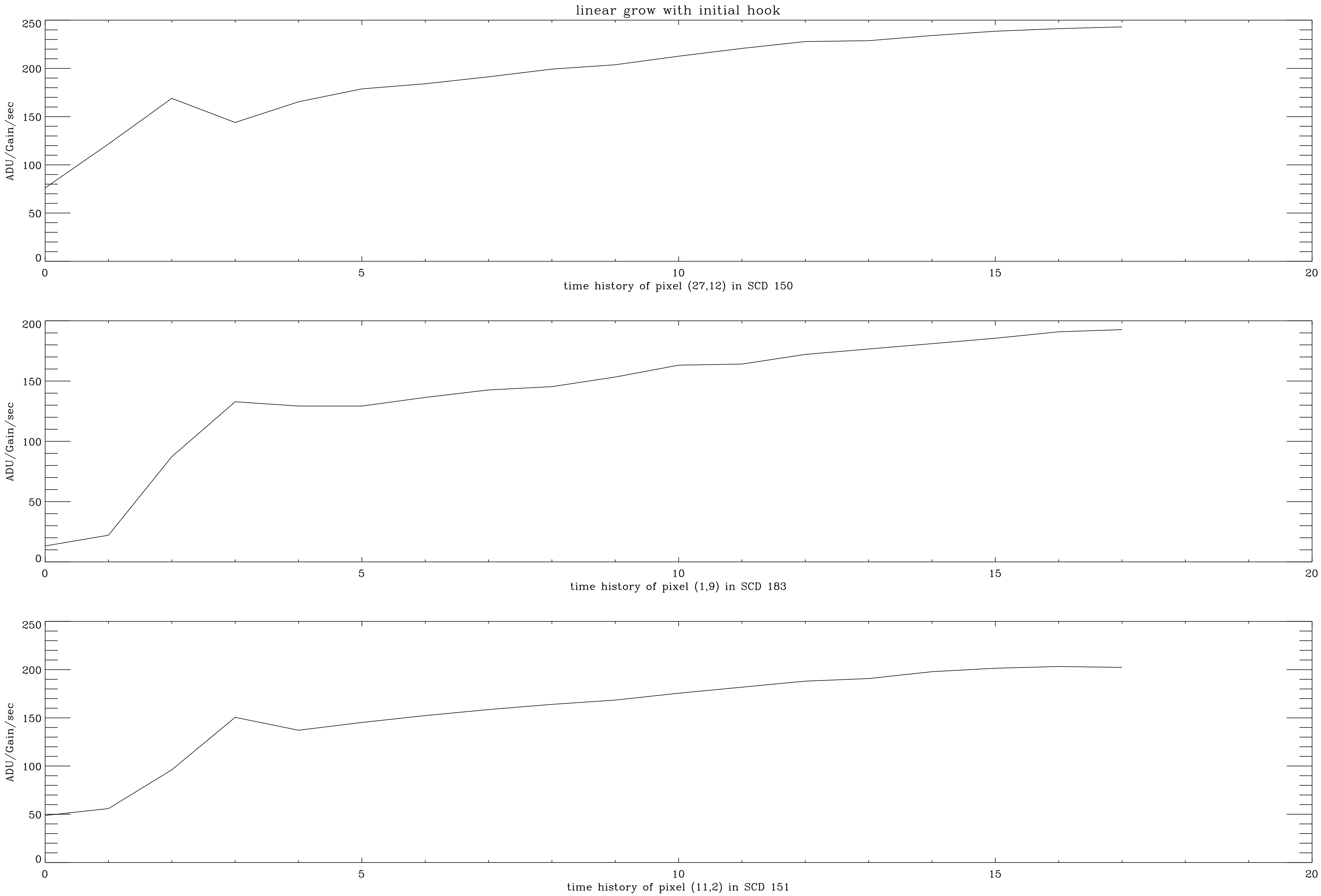
* iterative process
* "best" sigma clipping on a normalized cube (image value is subtracted per SCD)
* optional: threshhold of sigma clipping derived from whole cube instead per pixel
* optional: recovery of strong point-sources
* optional: glitch-tail rejection
* optional: masking of SCDs containing too few readouts

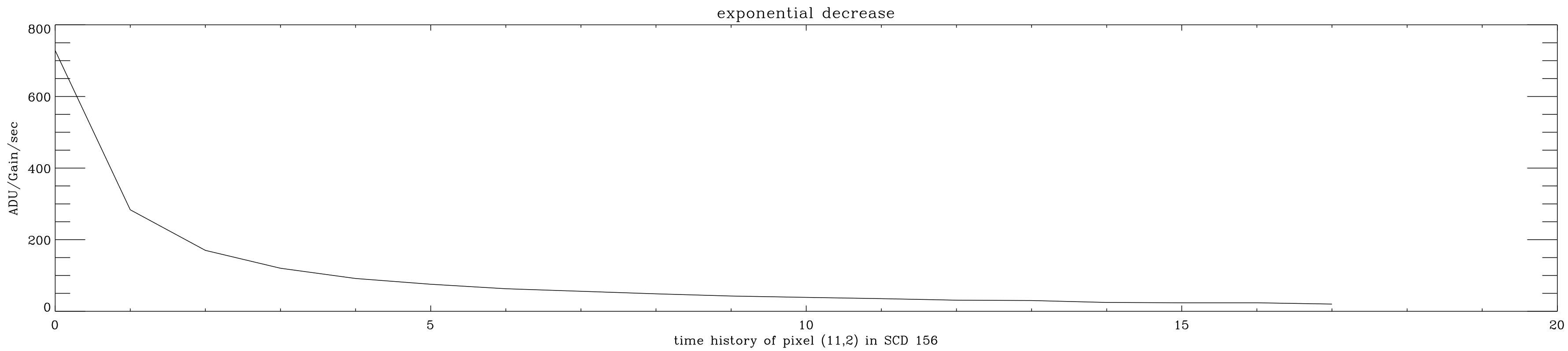
Cases when MMMS rejects the whole pixel

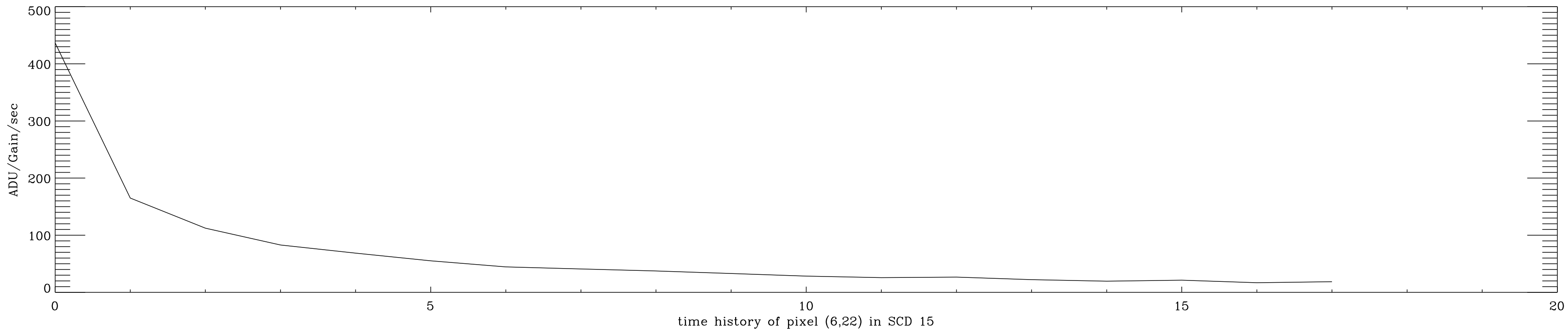
Observation of the Rho-Orph cloud investigated as an example:

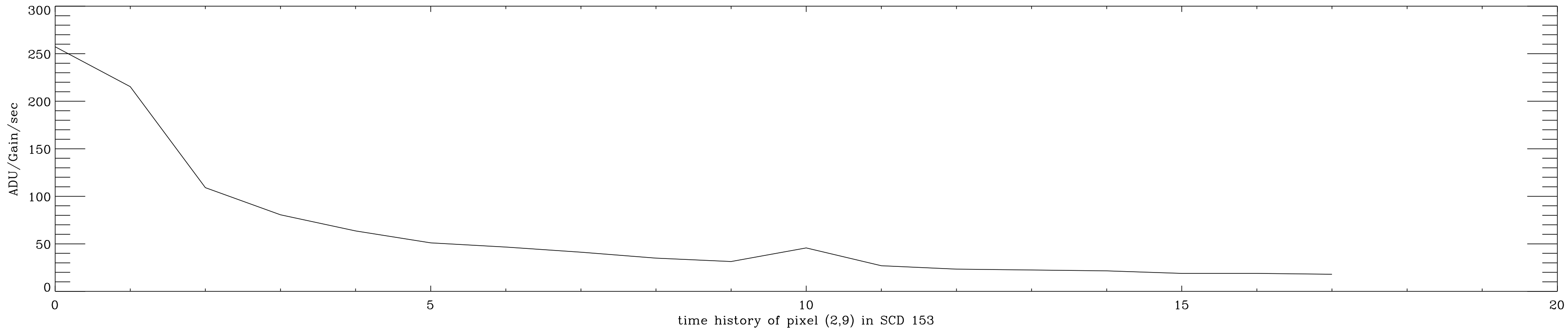
* "global" MMMS rejects 0.25% of all SCDs
* Over 50 % of the rejection cases (overall 825) were inspected
* "best" sigma clipping finds no solution in case of an un-typical pixel behaviour
  - o slow exponential growth
  - o linear grow with initial hook
  - o exponential decrease
  - o unlinear behaviour close to a strong point source

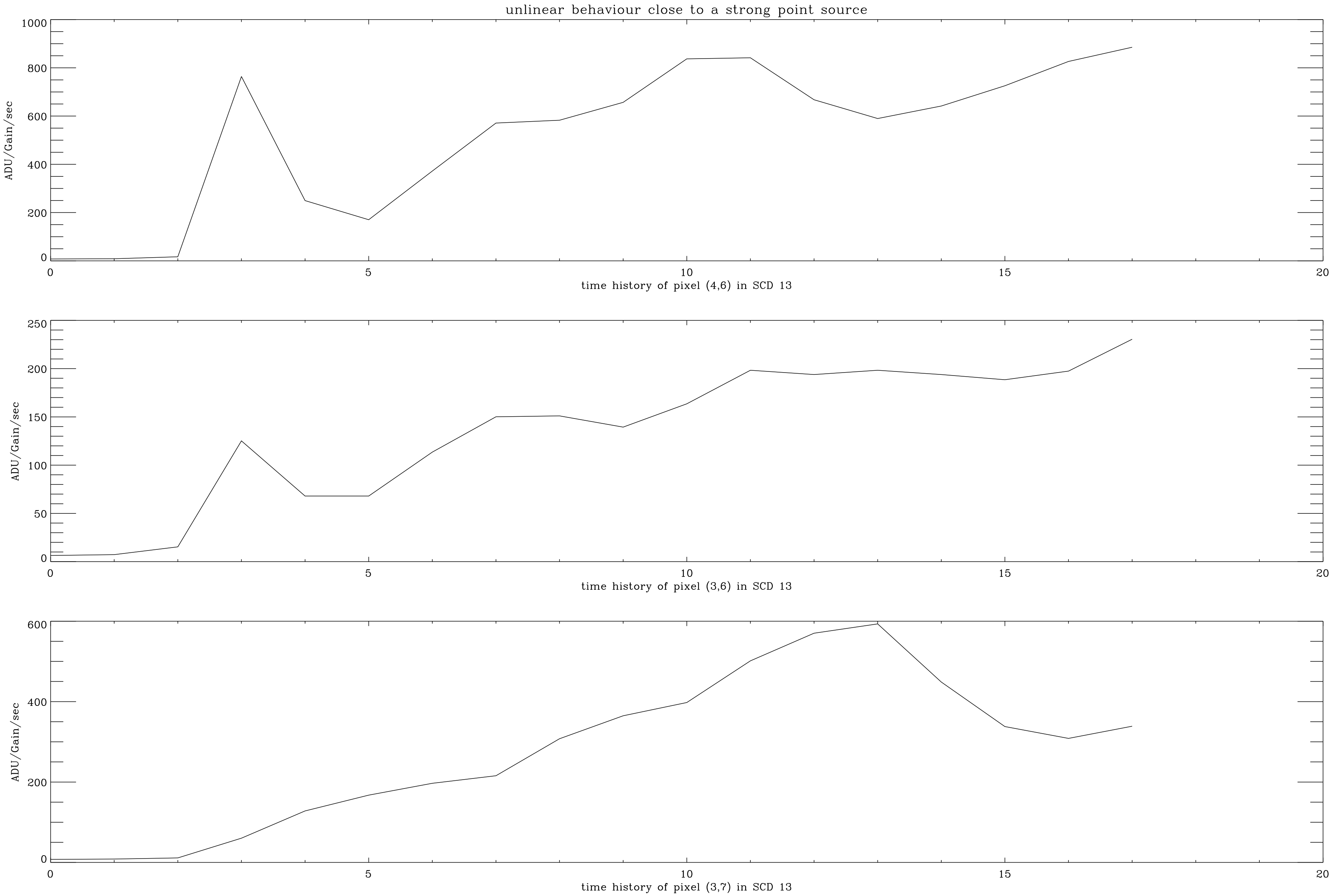

slow exponential grow
ADU/Gain/sec
time history of pixel (1,2) in SCD 183
ADU/Gain/sec
time history of pixel (13,20) in SCD 150
ADU/Gain/sec
time history of pixel (13,7) in SCD 151

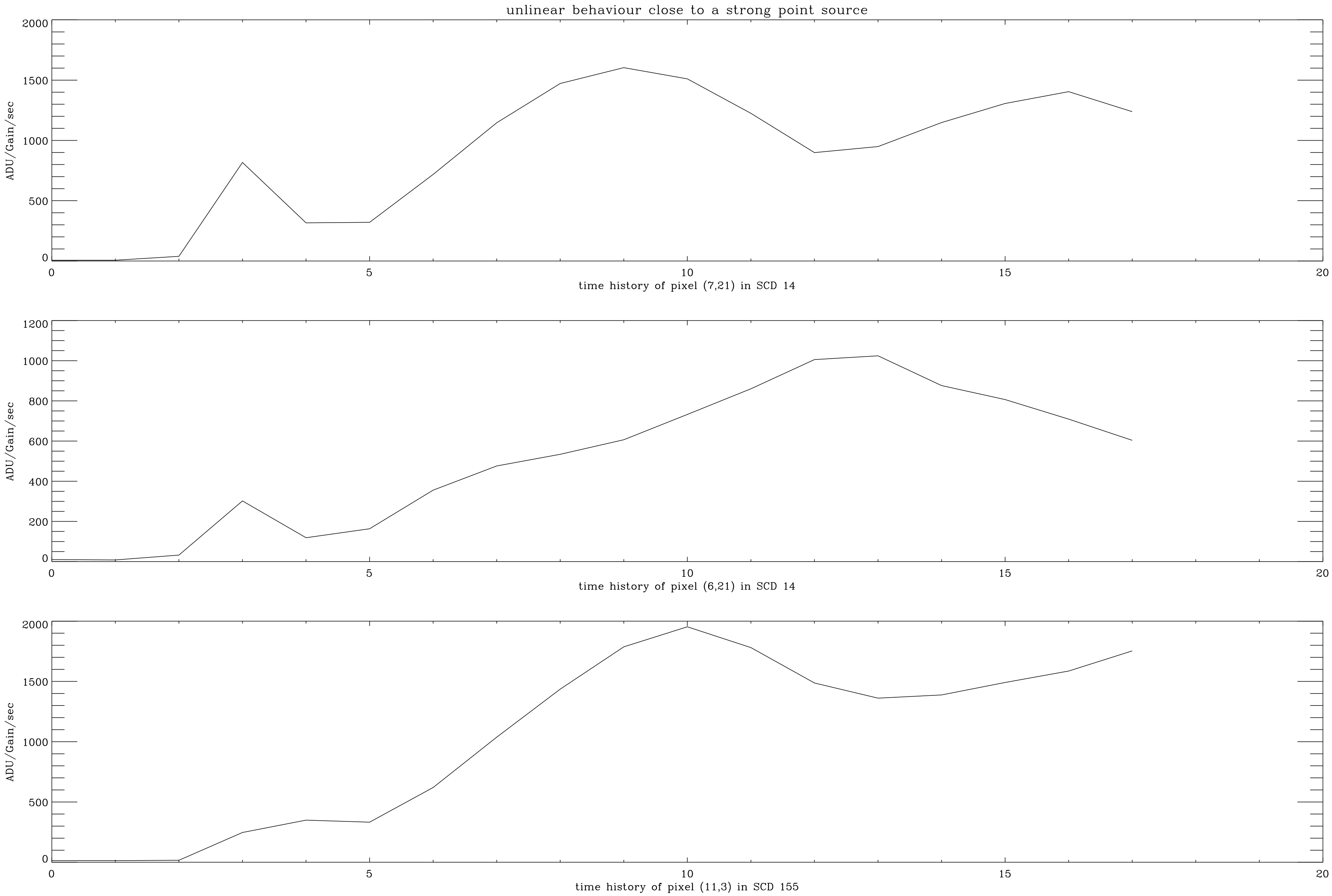

linear grow with initial hook
ADU/Gain/sec
time history of pixel (27,12) in SCD 150
ADU/Gain/sec
time history of pixel (1,9) in SCD 183
ADU/Gain/sec
time history of pixel (11,2) in SCD 151


exponential decrease
ADU/Gain/sec
800
600
400
200
0
0
5
10
15
20
time history of pixel (11,2) in SCD 156


ADU/Gain/sec
500
400
300
200
100
0
0
5
10
15
20
time history of pixel (6,22) in SCD 15


ADU/Gain/sec
300
250
200
150
100
50
0
0
5
10
15
20
time history of pixel (2,9) in SCD 153


unlinear behaviour close to a strong point source
1000
800
600
400
200
0
ADU/Gain/sec
0
5
10
15
20
time history of pixel (4,6) in SCD 13
250
200
150
100
50
0
ADU/Gain/sec
0
5
10
15
20
time history of pixel (3,6) in SCD 13
600
400
200
0
ADU/Gain/sec
0
5
10
15
20
time history of pixel (3,7) in SCD 13


unlinear behaviour close to a strong point source
ADU/Gain/sec
time history of pixel (7,21) in SCD 14
time history of pixel (6,21) in SCD 14
time history of pixel (11,3) in SCD 155

How many pixels are masked by MMMS?

1. **Faint Sources**
   local MMMS: 3.1% global MMMS: 3.3 %
   global MMMS with tail rejection: 3.8 %
   pixels masked by instrument and on-target flags: 10 %
2. **Extended and moderately bright Point Sources**
   local MMMS: 1.8% global MMMS: 1.9 %
   pixels masked by instrument and on-target flags: 7.6 %
3. **Extended and bright Point Sources**
   local MMMS: 2.0 % global MMMS: 2.2 %
   pixels masked by instrument and on-target flags: 23.1%
4. **Very bright Point Sources**
   local MMMS: 3.5 % global MMMS: 3.6 %
   global MMMS with tail rejection: 4.0 %
   pixels masked by instrument and on-target flags: 3.5 %

Scope and possible expansions

* MMMS appears to offer a stable deglitching method for all types of data
* As a by-product, non-stabilized data are masked, too
* MMMS will work especially well together in conjunction with transient correction routines

* On-target-flag will be ignored => recovery of significant amount of data
* Additional deglitching on ERD (RESET) level