Jupiter and Saturn impact detection project

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➢ Sixth impact flash discovery since 2010 by Ethan Chappell (TX, USA) on 2019.08.07
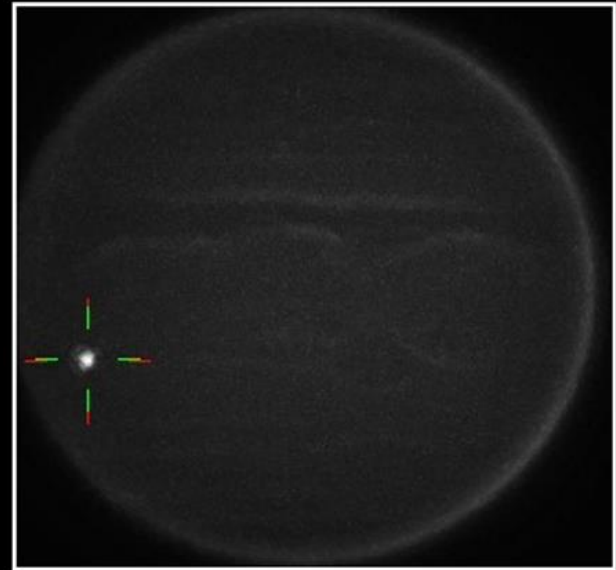
➢ First discovery using DeTeCt software !

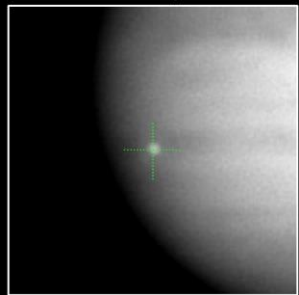**Impact discovery image**

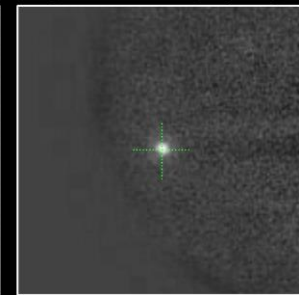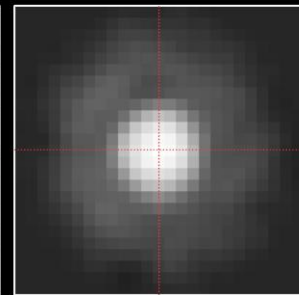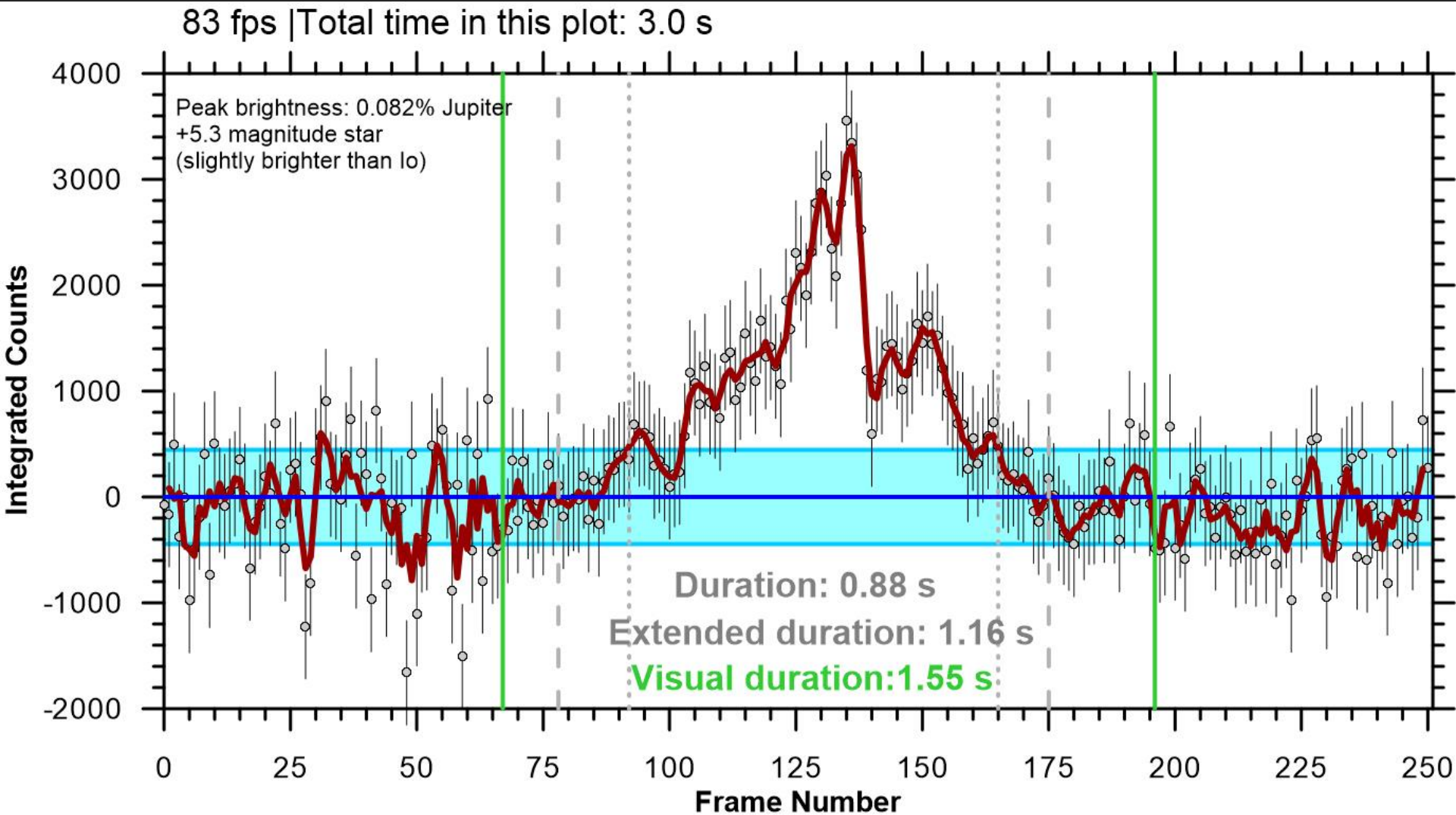Image generated with DeTeCt

Zoom over the impact area

Image after substracting Jupiter light

Zoom over the impact

Central flash and diffraction ring

Ethan Chappel and R. Hueso (UPV/EHU)

83 fps |Total time in this plot: 3.0 s

Peak brightness: 0.082% Jupiter
+5.3 magnitude star
(slightly brighter than Io)

Duration: 0.88 s
Extended duration: 1.16 s
Visual duration:1.55 s

Excellent quality observation, medium flash brightness, no simultaneous observation

- ➢ **Boost in project participation** in 15 months
  (+28% observers ,+62% observations, simultaneous observations now 6%)

- ➢ **Users** doing a **regular monitoring** for impact detection and/or **providing >10d** of Jupiter observation coverage
  (Z. Pujic, M. Jacquesson , B. Loyola, P. Rolet,)

- ➢ **Regular planetary observers** joining in analyzing their **old acquisitions archives**
  (C. Foster, M. Lewis, …)

- ➢ **Three discoverers in** the project
  (J. McKeon, S. Pedranghelu, E. Chappell) providing 3.3d of data

- ➢ **Professional initiatives** in the project
  (Hampton University, US – K. Sayanagi, Pic du Midi observatory, FR – F. Colas/S. Sylla)

- ➢ More **systematic additional check of the detection images** by M. Delcroix

DeTeCt impact frequency estimation (as of 2019.08.30)

Jupiter: ~8.5 impacts/year (96 observers ~112 000 videos ~129 days of videos)

Saturn: <24 impacts /year (30 observers ~>7 000 videos ~15 days of videos)

Impact flashes detection with DeTeCt software project/
Projet de détection de flash d'impacts avec le logiciel DeTeCt
by/par Marc Delcroix

Presentation of the project (EPSC2013, BAA workshop)

NEW! 14/05/2019: GRAPHICAL INTERFACE SOFTWARE VERSION / *NOUVELLE VERSION INTERFACE GRAPHIQUE du LOGICIEL*

Software download / téléchargement du logiciel for participating to the project / pour participer au projet
Documentation, Tutorial for detection images / Tutoriel pour les images de detection

Join the impact_detection Yahoo group for exchanges and support !

Jupiter
estimation of 8,5 impacts per year
total excludes 7,446 days of simultaneous observations

Observer	Duration	Number of videos	Date range
Total : 96 observers	128.690 days	115593 videos	2004/02/29 - 2019/09/11
Zac Pujic (Australia)	19.101 days	7764	2005/02/22 - 2019/07/29
Michel Jacquesson (France)	15.952 days	9427	2014/03/12 - 2019/09/11
Benito Loyola (USA)	15.618 days	14983	2018/02/17 - 2019/09/11
Paul Rolet (France)	14.527 days	11976	2012/09/07 - 2019/09/10
Manos Kardasis (Greece)	8.642 days	7288	2004/02/29 - 2018/09/07
Thomas Ashcraft (USA)	4.969 days	5886	2013/10/09 - 2016/11/30
Bernd Gaehrken (Germany)	4.098 days	5682	2016/03/06 - 2018/06/24
Clyde Foster (South Africa)	3.878 days	4753	2017/03/01 - 2019/08/18
Alan Coffelt (USA)	3.593 days	2605	2013/10/04 - 2018/05/14
Marc Delcroix (France)	3.208 days	2601	2006/04/13 - 2019/06/17
Christophe Pellier (France)	2.374 days	906	2012/02/20 - 2019/07/28
Agapios Elia (Cyprus)	2.197 days	2605	2013/11/09 - 2019/08/15
Sauveur Pedranghelu (France)	2.157 days	2640	2017/05/26 - 2019/07/29
Xavier Dupont (France)	2.062 days	1867	2012/08/16 - 2015/04/25
Hampton University Sayanagi Group (USA)	2.028 days	1543	2018/03/23 - 2019/03/29
Grant Blair (USA)	1.988 day	1874	2013/08/20 - 2016/04/21
Trevor Barry (Australia)	1.615 day	2425	2009/07/06 - 2012/12/30
Pascal Bayle (France)	1.494 day	1702	2012/11/30 - 2017/05/21
David Domine (France)	1.450 day	907	2016/02/25 - 2017/04/10
Jean-Luc Dauvergne (France)	1.361 day	1052	2016/05/04 - 2019/06/17
Torsten Mellenthin (Germany)	1.218 day	1416	2016/01/28 - 2017/06/24
Lammertus de Vries (Spain)	1.171 day	635	2009/08/03 - 2015/05/08
Pic du Midi (Colas/Delcroix/Dauvergne/Sylla) (France)	1.164 day	1861	2010/09/29 - 2019/06/15
Jocelyn Serot (France)	1.154 day	880	2014/01/10 - 2019/06/02
Stephane Gonzales (France)	1.131 day	1243	2013/12/20 - 2018/06/03
Matic Smrekar (Slovenia)	0.956 day	1648	2009/07/29 - 2019/06/10
Arnaud Claisse (France)	0.941 day	842	2014/01/19 - 2016/05/03
Jose Luis Peireira (Brazil)	0.900 day	1101	2019/01/30 - 2019/09/10
Paul Jones (USA)	0.819 day	723	2011/08/29 - 2015/04/05
Jean-Jacques Poupeau (France)	0.759 day	1143	2013/02/05 - 2016/03/23
Pascal Lemaire (France)	0.753 day	828	2012/08/01 - 2016/02/10

Saturn
estimation of less than 23,8 impacts per year
total excludes 0,018 days of simultaneous observations

Observer	Duration	Number of videos	Date range
Total : 30 observers	15.334 days	7157 videos	2005/02/04 - 2019/09/11
Zac Pujic (Australia)	5.252 days	2131	2005/02/04 - 2018/04/21
Marc Delcroix (France)	2.561 days	1104	2007/01/20 - 2019/06/16
Paul Rolet (France)	1.994 day	550	2015/05/12 - 2019/09/10
Manos Kardasis (Greece)	1.069 day	713	2008/03/10 - 2018/10/27
Sauveur Pedranghelu (France)	0.681 day	289	2019/06/03 - 2019/07/29
Benito Loyola (USA)	0.497 day	567	2018/07/11 - 2019/07/30
Oleg Zaharciuc (Moldova)	0.466 day	224	2016/05/22 - 2018/07/06
Pic du Midi (Colas/Delcroix/Dauvergne/Sylla) (France)	0.454 day	434	2012/08/06 - 2019/08/15
Grant Blair (USA)	0.445 day	255	2014/03/14 - 2016/04/24
Arnaud Claisse (France)	0.260 day	62	2015/05/21 - 2016/05/04
Philippe Chatelain (France)	0.251 day	26	2017/05/21 - 2019/05/31
Societe Astronomique de Touraine (France)	0.223 day	92	2014/03/14 - 2016/07/16
Stephane Gonzales (France)	0.195 day	89	2015/05/23 - 2017/06/05
Michel Miniou (France)	0.179 day	75	2019/07/19 - 2019/09/11
David Domine (France)	0.171 day	35	2016/04/23 - 2017/04/08
Alan Coffelt (USA)	0.150 day	56	2015/05/03 - 2017/04/26
Ioannis Bouhras (Greece)	0.108 day	89	2019/09/03 - 2019/09/06
Matic Smrekar (Slovenia)	0.092 day	88	2011/06/27 - 2019/05/08
Charles Galdies (Malta)	0.078 day	82	2014/06/08 - 2015/07/17
Emmanuel Thiers (France)	0.068 day	22	2016/05/06 - 2016/06/18
Blake Estes (USA)	0.055 day	79	2016/05/08 - 2016/05/13
Michel Jacquesson (France)	0.031 day	4	2019/09/03 - 2019/09/04
Adrien Marezac (France)	0.022 day	18	2017/06/11 - 2017/06/11
Martin Lewis (UK)	0.018 day	29	2019/07/03 - 2019/07/28
Ethan Chappel (USA)	0.012 day	7	2019/08/17 - 2019/08/17
Michel Legrand (France)	0.011 day	8	2018/07/16 - 2018/08/03
Denis Huber (France)	0.010 day	10	2019/07/20 - 2019/08/03
Torsten Mellenthin (Germany)	0.006 day	11	2017/04/01 - 2017/06/23
Jose Luis Peireira (Brazil)	0.005 day	5	2019/05/22 - 2019/05/22
Jean-Luc Dauvergne (France)	0.001 day	1	2019/06/01 - 2019/06/01

http://www.astrosurf.com/planetessaf/doc/project_detect.shtml

Many improvements since beginning of 2019

✓ **GUI**

✓ **Clearer messages** / log

✓ Creation of **zip file** to be sent to delcroix.marc@free.fr

✓ Results in log file more readable

✓ Name of log files more explicit

✓ **Counter of files** processed

✓ Support of **autostakkert session** files

✓ Diverse algorithm improvements (alignment, RoI, invalid acquisition detection,…)

✓ **Improvement of datation**

✓ (A lot of) bug fixes ;)

✓ **Regular releases available through github** https://github.com/DeTeCt-PSWS/DeTeCt-MFC

DeTeCt v3.2.20190014_x64   —   □   ×

File   Preferences   Help

Welcome to DeTeCt, software to help you to analyze videos of Jupiter to find flashes from impacts.
Pick a folder to select all videos in that folder and then click on the "Detect impacts" button below to run the software.

Execution log:

2019-09-14 23:02:10   WARNING: low probability impact in detection image but no impact detected by the algorithm.
2019-09-14 23:02:10   Computation time: 217 seconds, showing detection image (automatically closed in 3 seconds)…
2019-09-14 23:02:13
2019-09-14 23:02:13   ----- 11/12 : Jup_161_192436.ser start --------------
2019-09-14 23:02:13   Initializing capture: 678 frames @ 30 (22s duration)
2019-09-14 23:02:28   Differential photometry done, running impact detection…
2019-09-14 23:02:28   WARNING: low probability impact in detection image but no impact detected by the algorithm.
2019-09-14 23:02:28   Computation time: 15 seconds, showing detection image (automatically closed in 3 seconds)…
2019-09-14 23:02:31
2019-09-14 23:02:31   ----- 12/12 : 2019-08-07-0406_9-EC-R-Jup.ser start --------------
2019-09-14 23:02:31   Initializing capture: 12492 frames @ 83 (150s duration)
2019-09-14 23:06:13   Differential photometry done, running impact detection…
2019-09-14 23:06:13   ALERT: 1 HIGH PROBABILITY IMPACT DETECTED (frames 9246-9296, max @9282).
2019-09-14 23:06:13   Confidence: 8.39
2019-09-14 23:06:13   CHECK DETECTION IMAGES!
2019-09-14 23:06:13 - Computation time: 222 seconds, showing detection image (automatically closed in 3 seconds)…
2019-09-14 23:06:16 -
2019-09-14 23:06:16 - Total duration analyzed 9m31s (12 acquisitions processed in 14m30s)
2019-09-14 23:06:16 - In G:\work\Impact\tests\data_set\positives, please find:
2019-09-14 23:06:16 -   * log file DeTeCt.log
2019-09-14 23:06:16 -   * folder Impact_detection_run@2019-09-14_22-51-04 for checking images
2019-09-14 23:06:16 -   * zip file Impact_detection_run@2019-09-14_22-51-04.zip for sending
2019-09-14 23:06:16 -

Detect impacts

Improvement of interpretation of algorithm and detection images results

✓ Usage of minimum duration for flash candidate brightness change (0.6s)

✓ **Refinement of detection criteria**:

1. Differential photometry algorithm and intensity of brightness change

2. Contrast of brightest part in detection image

3. Adequation between algorithm and detection image
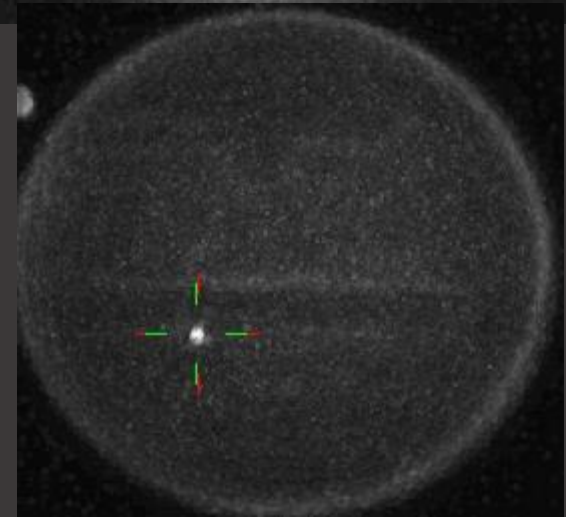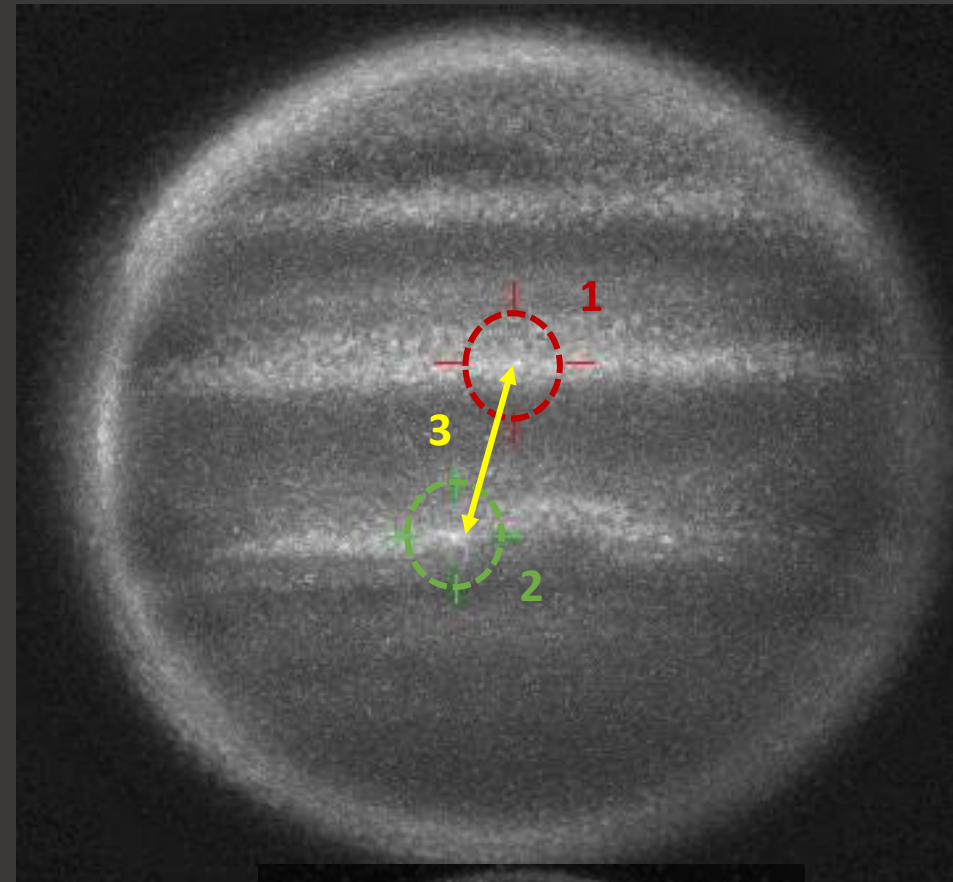
Refinement leads to:
3 impact detection classification through rating/probability (null, low, high)
implemented in v3.2 to decrease number of alerts

DeTeCt	false detections				real impacts	
	v1, v2	v3-v3.1.11	v3.1.12		v3-v3.	v3.1.12
nul	60,3%	60,3%	45,6%		15%	15%
low	0,0%	23,7%	49,6%			23%
high	39,7%	16,0%	4,8%		85%	62%

Detection report   — ☐ ✕

Your file(s) has(have) been analysed, log and detection images located in the "Impact_detection" folder in the root folder of this(these) file(s).
Please CHECK the DETECTION IMAGES in that folder, NO DETECTION ALSO MATTERS !

Please attach the zipped impact_detection folder (or the files - log and images) in an email and send them to delcroix.marc@free.fr

j2010-06-03-2031_0_AW_Red.ser: ALERT: 1 HIGH PROBABILITY IMPACT DETECTED (frames 3162-3205, max @3191).
    Confidence: 8.98
    CHECK DETECTION IMAGES!
Jup_L_03_06_2010_203058b.avi: ALERT: 1 HIGH PROBABILITY IMPACT DETECTED (frames 1302-1335, max @1326).
    Confidence: 4.91
    CHECK DETECTION IMAGES!
aoki.avi: WARNING: low probability impact in detection image but no impact detected by the algorithm.
tachikawa2.avi: ALERT: 1 HIGH PROBABILITY IMPACT DETECTED (frames 141-159, max @143).
    Confidence: 4.32
    CHECK DETECTION IMAGES!
ichimaru.wmv: WARNING: low probability impact in detection image but no impact detected by the algorithm.
20120910_063337_L_pipp.ser: ALERT: 1 HIGH PROBABILITY IMPACT DETECTED (frames 1128-1143, max @1135).
    Confidence: 51.61
    CHECK DETECTION IMAGES!
Jupiter_Impact_Gerrit_Kernbauer_170316_011744.avi: ALERT: 1 HIGH PROBABILITY IMPACT DETECTED (frames 2377-2406, max @2395).
    Confidence: 6.74
    CHECK DETECTION IMAGES!
Jup_001733_impact_JohnMcKeon.avi: ALERT: 1 HIGH PROBABILITY IMPACT DETECTED (frames 1157-1173, max @1167).
    Confidence: 14.06
    CHECK DETECTION IMAGES!
Jup_212501.avi: No impact detected by the algorithm.
Jup_212523 flash.ser: WARNING: low probability impact in detection image but no impact detected by the algorithm.
Jup_161_192436.ser: WARNING: low probability impact in detection image but no impact detected by the algorithm.
2019-08-07-0406_9-EC-R-Jup.ser: ALERT: 1 HIGH PROBABILITY IMPACT DETECTED (frames 9246-9296, max @9282).
    Confidence: 8.39
    CHECK DETECTION IMAGES!

See reports on searches of impacts on http://www.astrosurf.com/planetessaf/doc/project_detect.shtml

➢ **Open topics:**
  ➢ still many false detections with lower probability
  ➢ still a few non detected or low probability detected for real impacts

- ➤ **Project**
  - ❑ Help by a second member – Salma Sylla

  (check of detection images, algorithm improvement, …)
  - ❑ Pic du Midi T1M monitoring program

- ➤ **Software**
  - ❑ Differential photometry algorithm improvement
  - ❑ Auto update
  - ❑ Dozen of other tasks in to-do-list (any suggestion welcome)
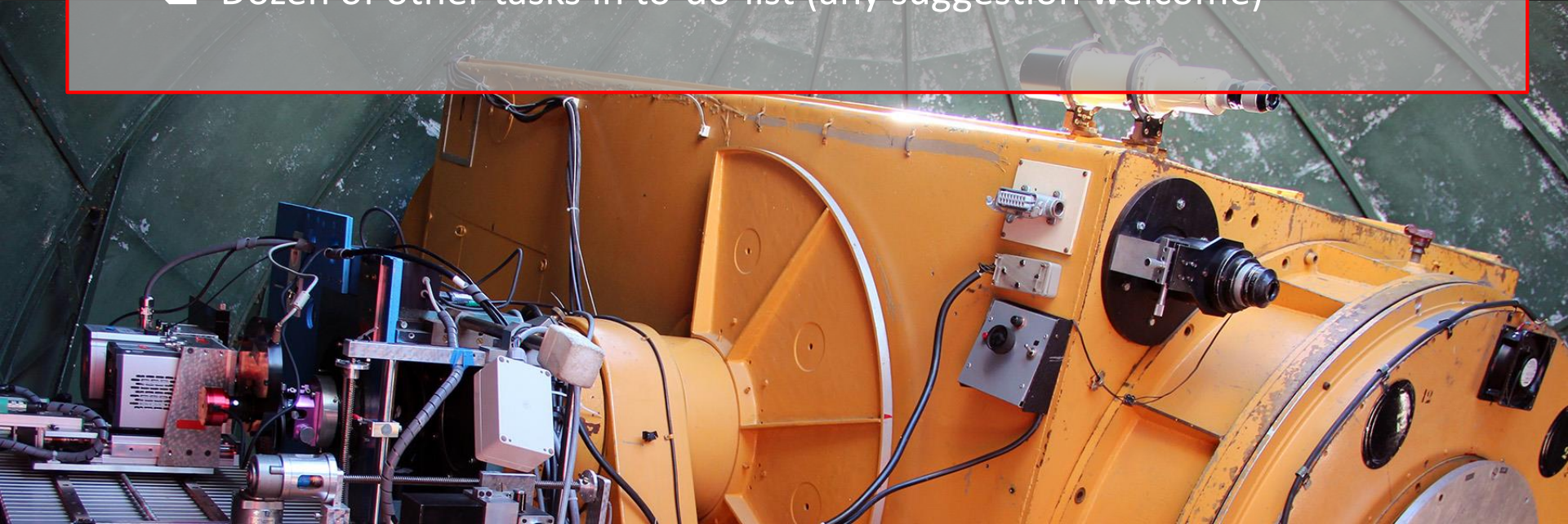
Takeaway

✓ **First impact flash detection** through DeTeCt

✓ Project **growing fast**

✓ Software with **regular improvements/updates**

❑ **Participate** to the project, you might be the 7th impact flash discoverer

❑ **Check and send** detection images / logs
delcroix.marc@free.fr

❑ Keep your version of **DeTect uptodate**
https://github.com/DeTeCt-PSWS/DeTeCt-MFC/releases/latest