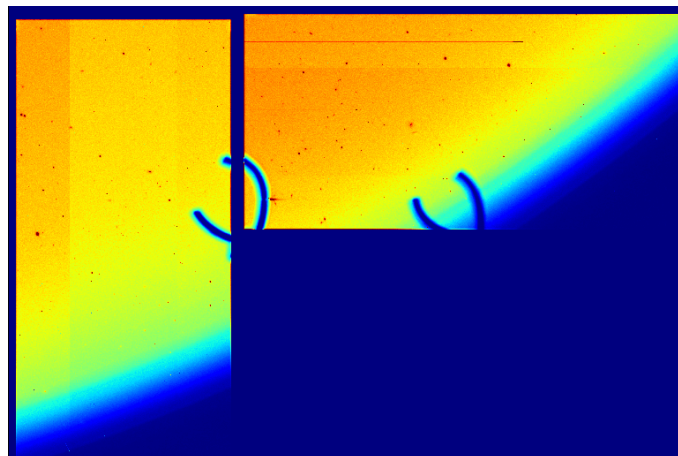


# Investigation of shadows and light emissions on HSC images around the edge of the field-of-view

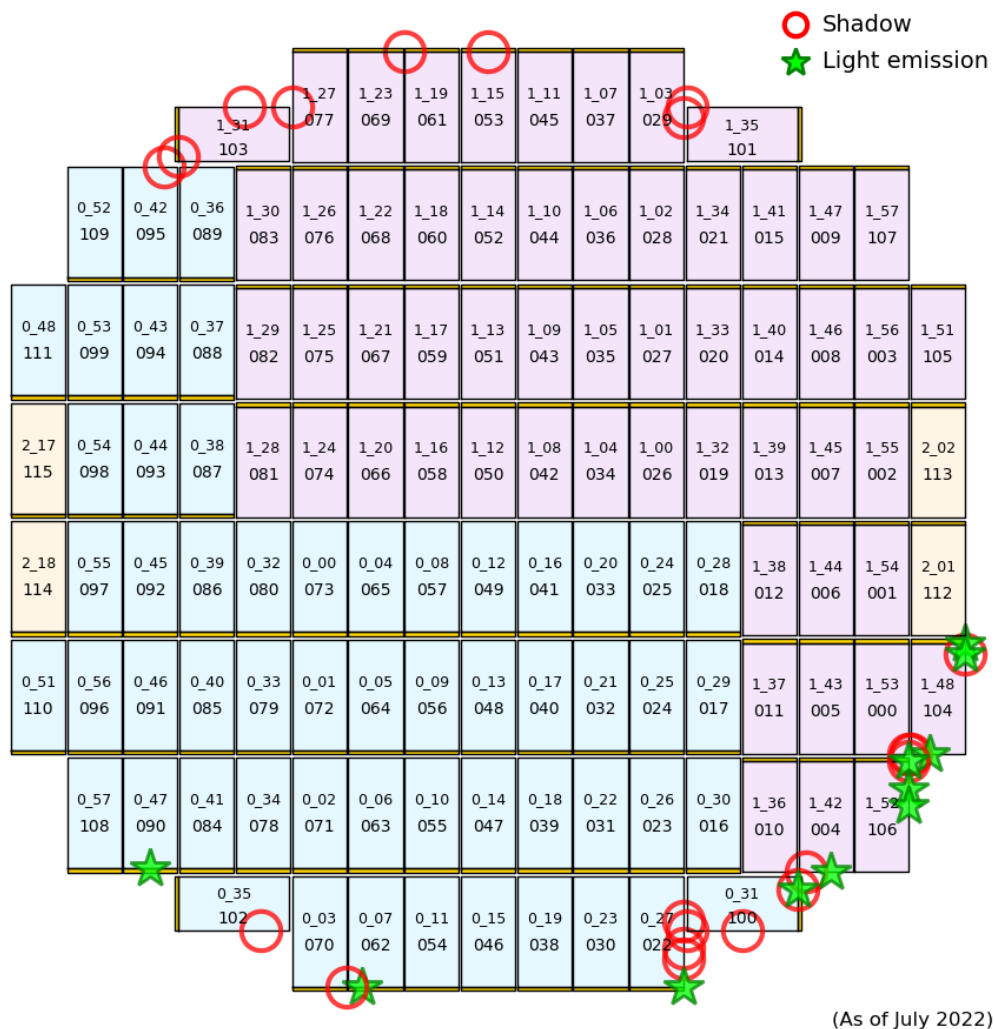
October 2022

- It has been found that arc-shaped shadows occasionally appeared on the images of HSC's CCDs which are located on the edge of the field-of-view. In addition, local light emissions from CCD edge also occurred around some of the shadow positions.
- These shadows are likely to be caused by fragments of cable ties which seem to be caught between CCDs and the edge of the dewar. We actually confirmed two pieces of cable tie fragments by visual inspection from the dewar window.
- As a result of our investigation of HSC archival data, we found 23 cases of shadows and/or light emissions probably due to cable ties on 17 CCDs. This fact indicates that a plurality of cable tie fragments are widely scattered in the inside of the dewar.
- The shadow/light emission cases started from 2017 and have rapidly increased since 2021. Many of the cases occurred in the area around CCD 100 (0\_31).
- Direction of such shadows often changes at a timing when the telescope moves largely. Most of the light emissions disappeared within a short time, while some cases continued intermittently for several days.
- There seems to be no significant influence on science data from this issue in most cases because such shadows and light emissions occur around the edge of the field-of-view where the sensitivity is comparatively low due to vignetting.

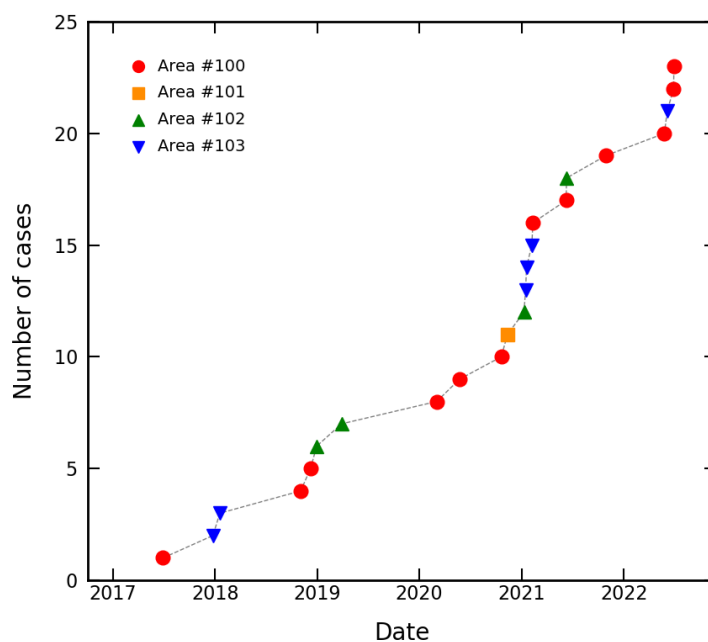


Summary of the known cases of shadows and light emissions probably due to cable tie fragments.

Case ID	Date (UT)	CCD	Channel	Event
Case01	2017/06/29	104 (1.48)	ch4	Shadow and light emission
Case02	2017/12/24	103 (1.31)	ch4	Shadow
Case03	2018/01/18-02/12	061 (1.19)	ch1,2	Shadow
Case04	2018/11/03	022 (0.27)	ch1	Light emission
Case05	2018/12/08-09	022 (0.27)	ch1,2	Shadow
	2018/12/11-14	022 (0.27)	ch1	Shadow
Case06	2018/12/30	102 (0.35)	ch1	Shadow
Case07	2019/03/29	070 (0.03)	ch1	Shadow
Case08	2020/03/03-19	004 (1.42)	ch1	Shadow
	2020/03/19	004 (1.42)	ch1	Light emission
Case09	2020/05/24-25	004 (1.42)	ch1	Shadow
Case10	2020/10/20-2021/01/07	004 (1.42)	ch1	Shadow
	2020/10/20-23	100 (0.31)	ch1,2	Shadow and light emission
Case11	2020/11/11-13	029 (1.03)	ch4	Shadow
	2020/11/11-13	101 (1.35)	ch1	Shadow
Case12	2021/01/09-18	062 (0.07)	ch3,4	Light emission
Case13	2021/01/15-18	095 (0.42)	ch1,2	Shadow
Case14	2021/01/18	077 (1.27)	ch1	Shadow
Case15	2021/02/06	053 (1.15)	ch2,3	Shadow
Case16	2021/02/10	104 (1.48)	ch1,4	Shadow
	2021/02/10-11	104 (1.48)	ch4	Shadow and light emission
Case17	2021/06/09-10	106 (1.52)	ch4	Shadow and light emission
Case18	2021/06/10	090 (0.47)	ch2,3	Light emission
Case19	2021/10/28	104 (1.48)	ch1,2	Shadow and light emission
Case20	2022/05/26-27	000 (1.53)	ch4	Shadow
	2022/05/26-27	106 (1.52)	ch4	Shadow and light emission
Case21	2022/06/05-07	095 (0.42)	ch1	Shadow
	2022/06/28-07/06	095 (0.42)	ch1,2	Shadow
	2022/06/28	103 (1.31)	ch1	Shadow
Case22	2022/06/28-07/01	022 (0.27)	ch1,2	Shadow
	2022/06/28-07/01	100 (0.31)	ch1,2	Shadow
Case23	2022/06/29-30	000 (1.53)	ch4	Shadow
	2022/06/29-07/04	106 (1.52)	ch4	Shadow and light emission

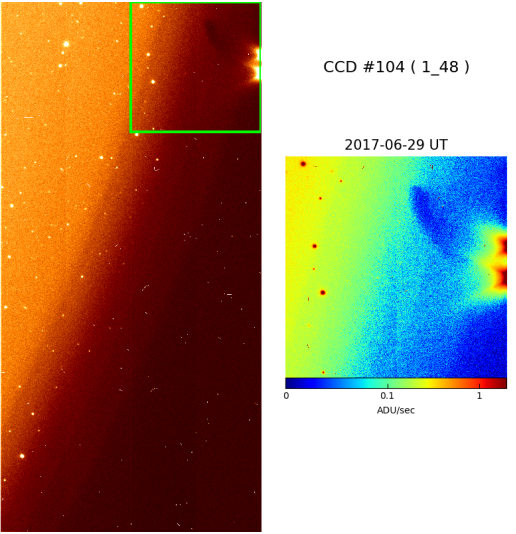
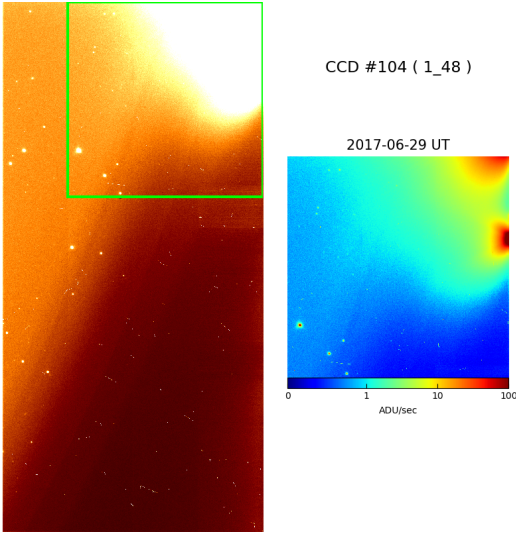


Positions of shadows and light emissions probably due to cable tie fragments.

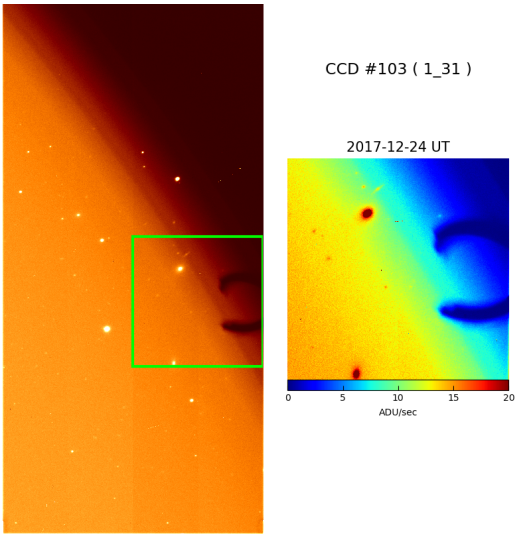


Time series plot of the known cases of shadows and light emissions.  
 ( “Area #100” means the region around CCD 100 (0.31) )

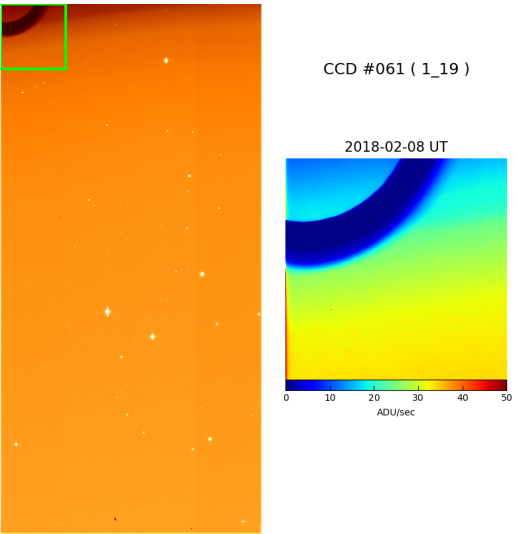
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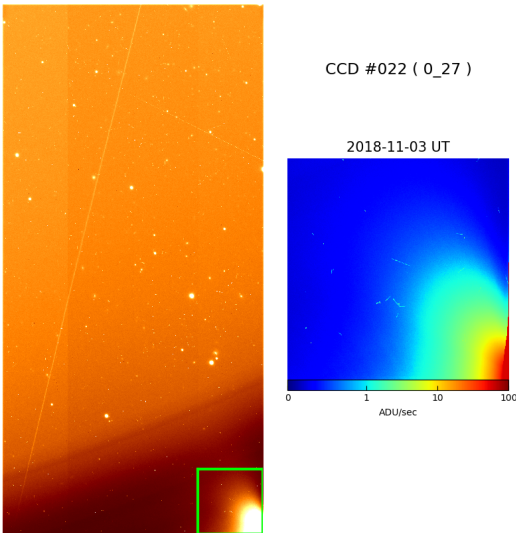
Case 02:



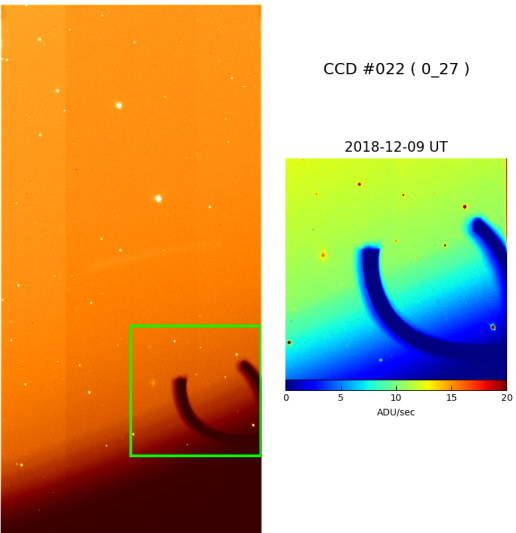
Case 03:



Case 04:

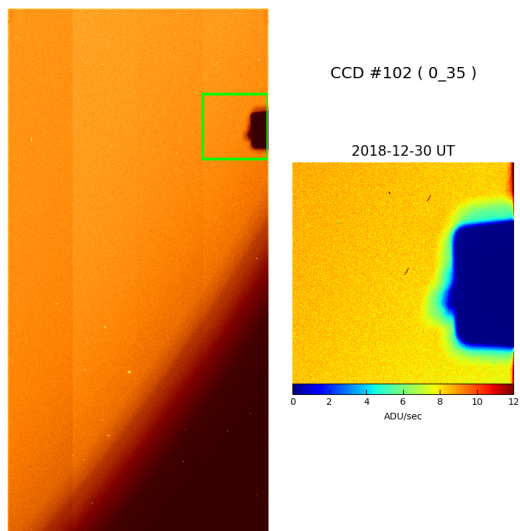


Case 05:

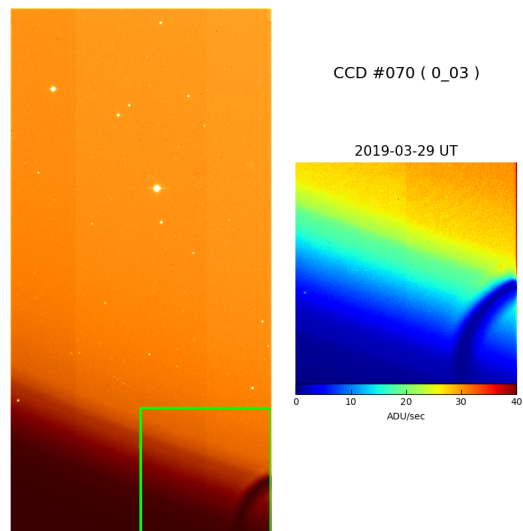




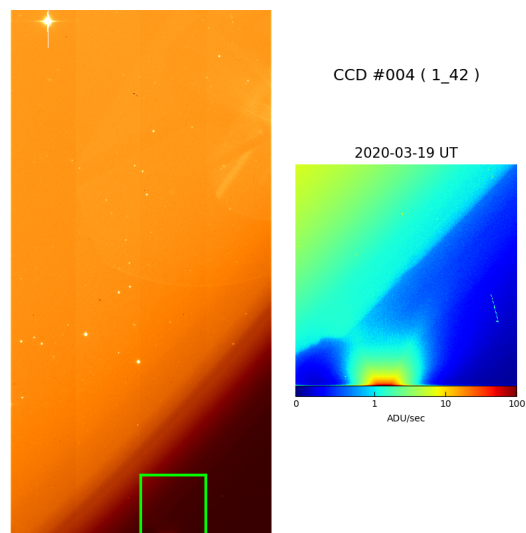
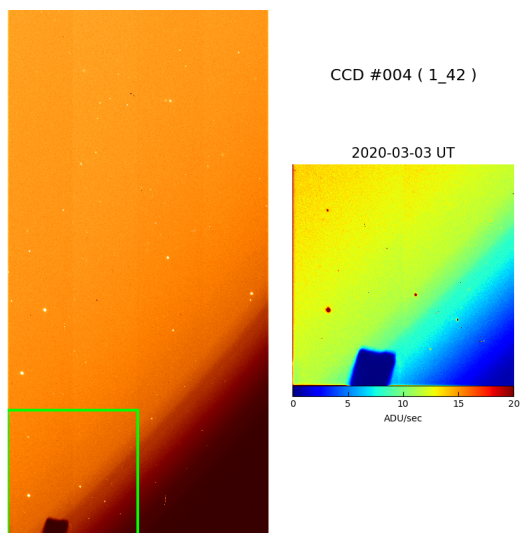
Case 06:



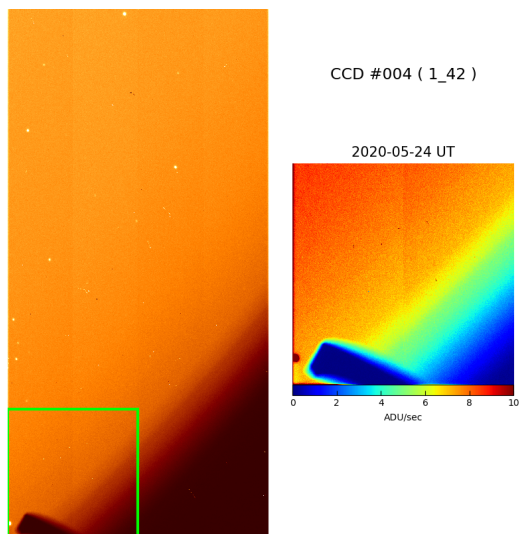
Case 07:



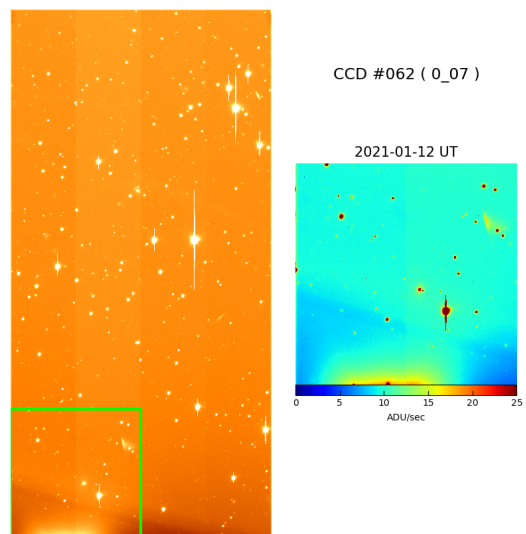
Case 08:



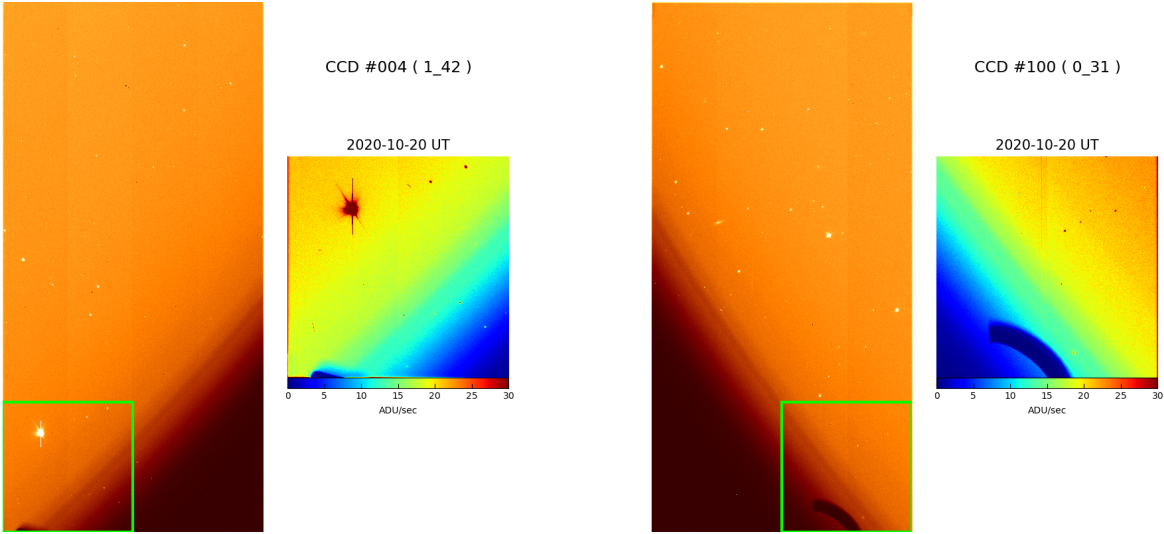
Case 09:



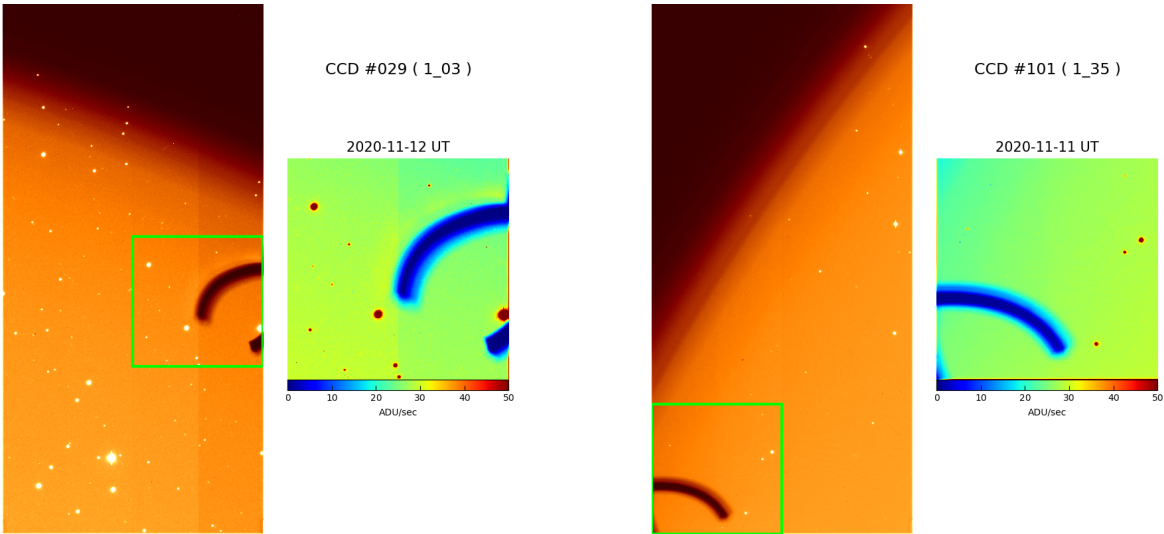
Case 12:



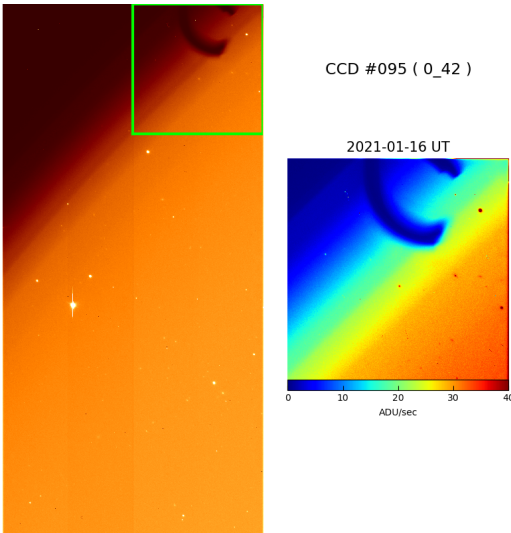
Case 10:



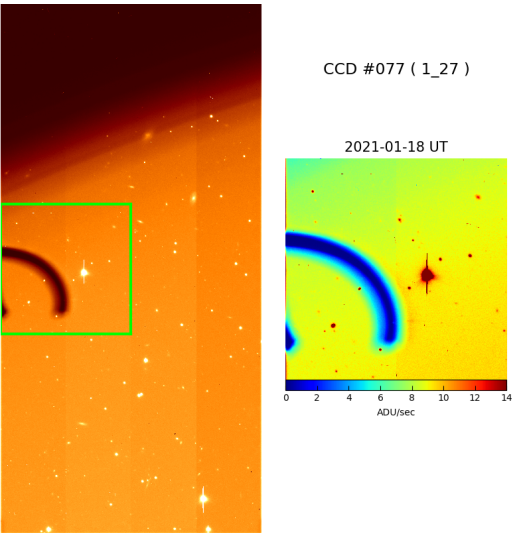
Case 11:



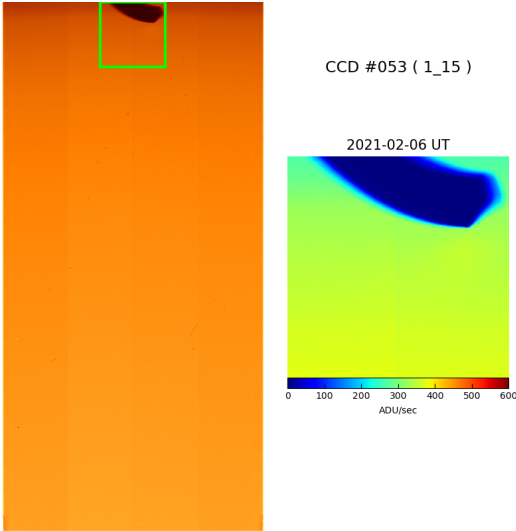
Case 13:



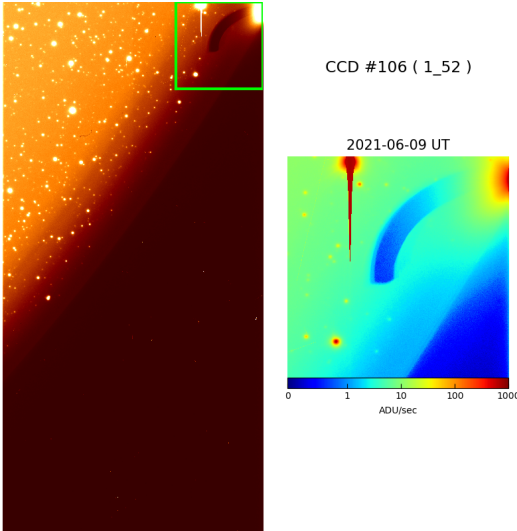
Case 14:



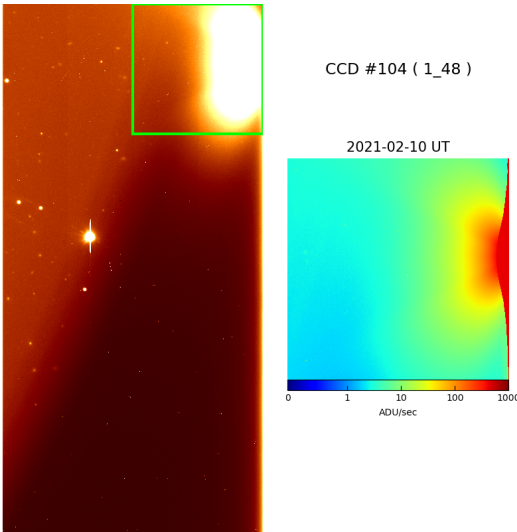
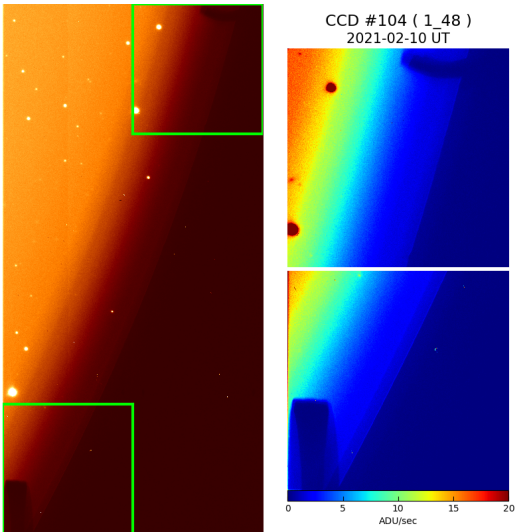
Case 15:



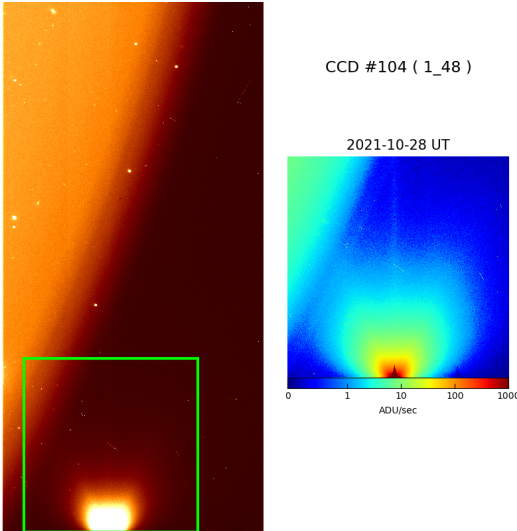
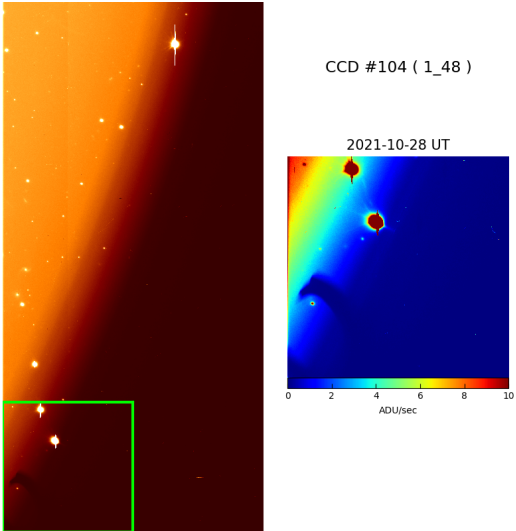
Case 17:



Case 16:

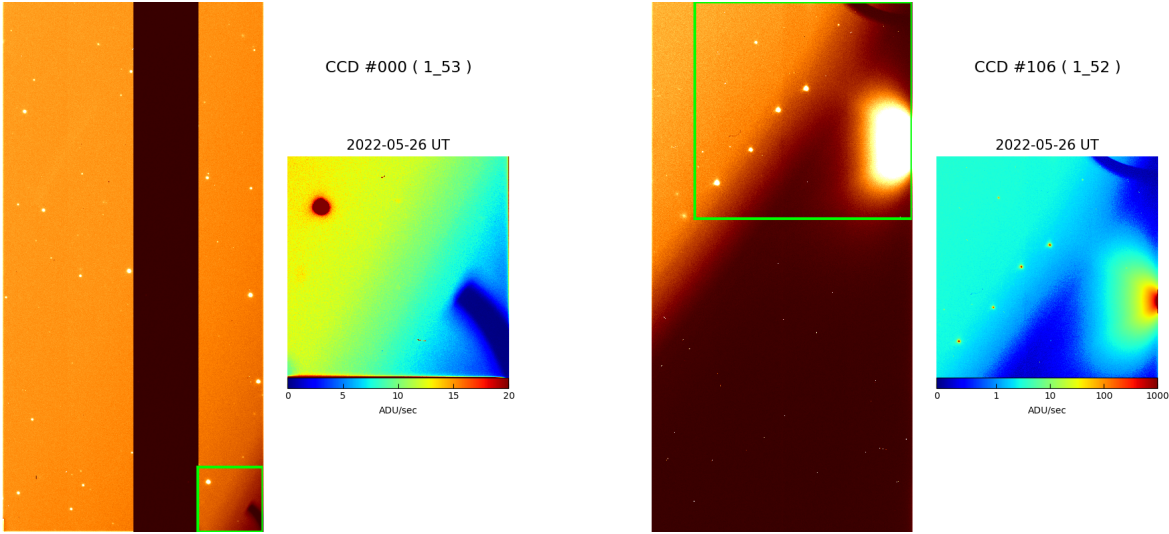


Case 19:

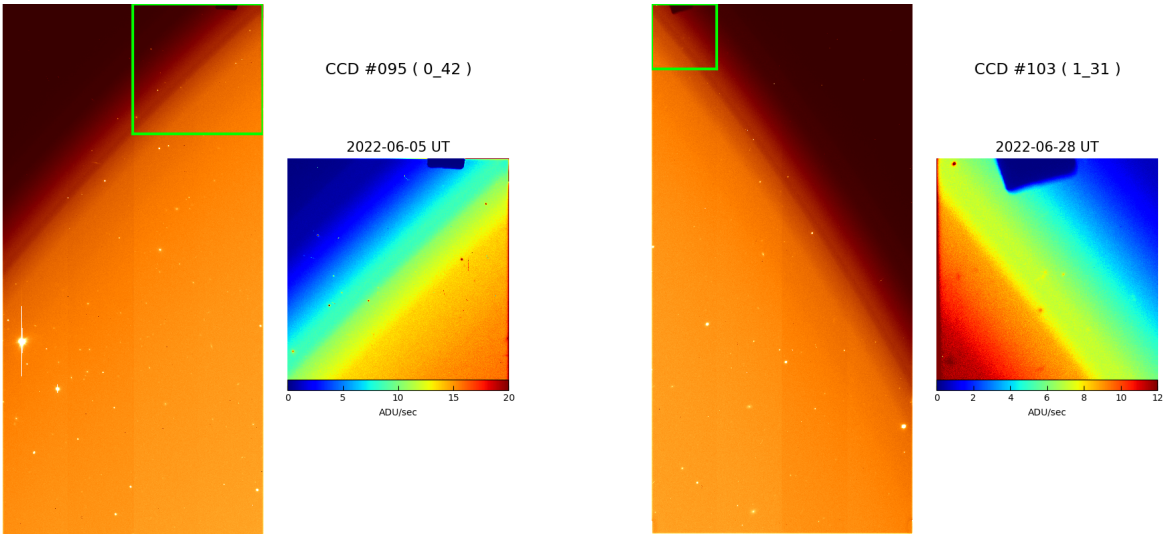




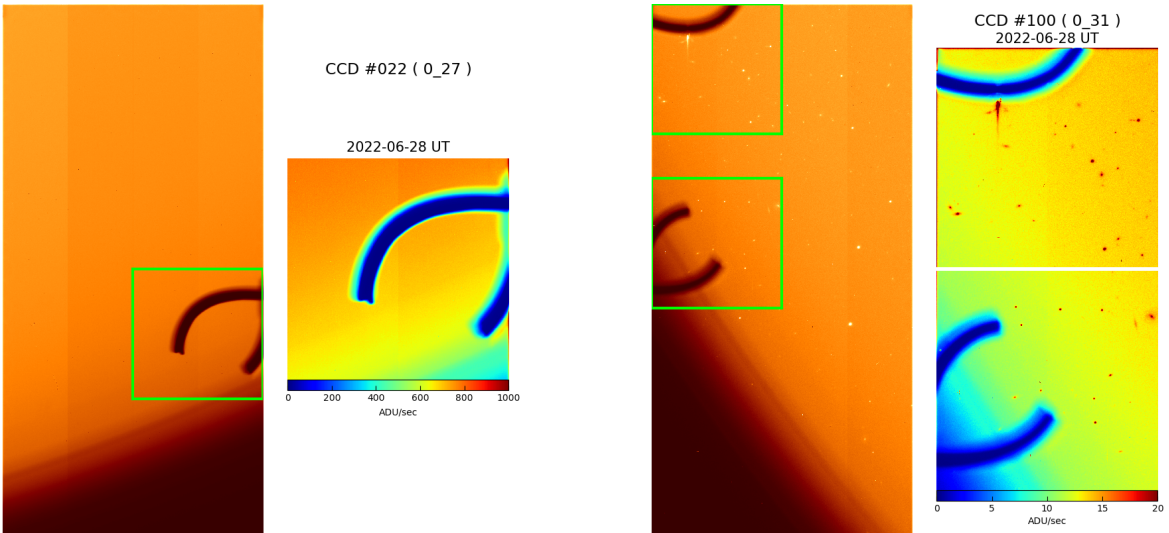
Case 20:



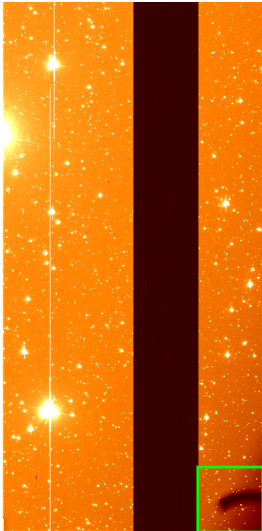
Case 21:



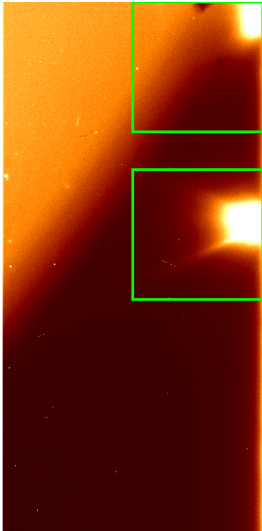
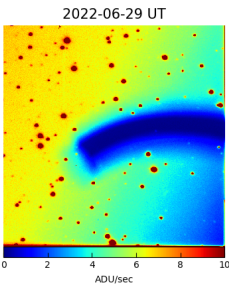
Case 22:



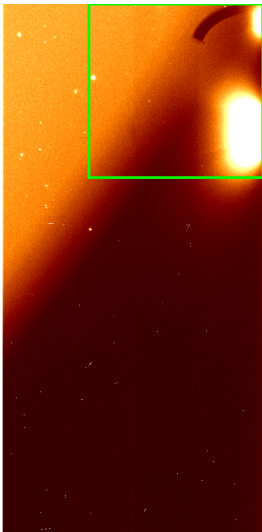
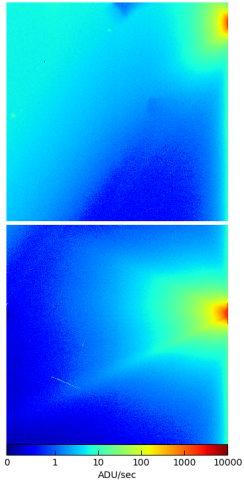
Case 23:



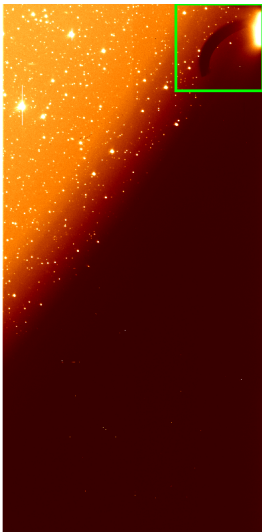
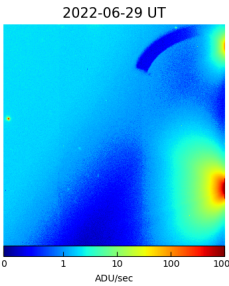
CCD #000 ( 1\_53 )



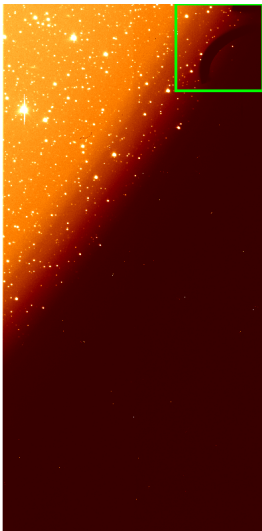
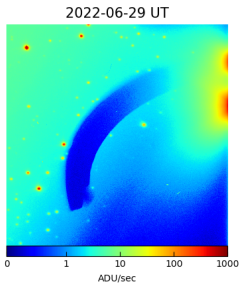
CCD #106 ( 1\_52 )  
2022-06-29 UT



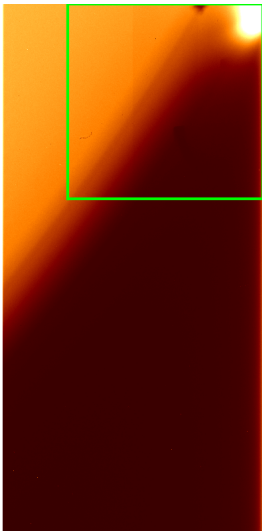
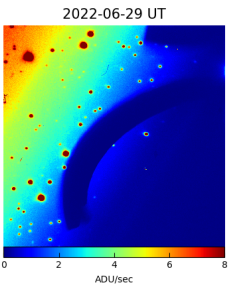
CCD #106 ( 1\_52 )



CCD #106 ( 1\_52 )



CCD #106 ( 1\_52 )



CCD #106 ( 1\_52 )

