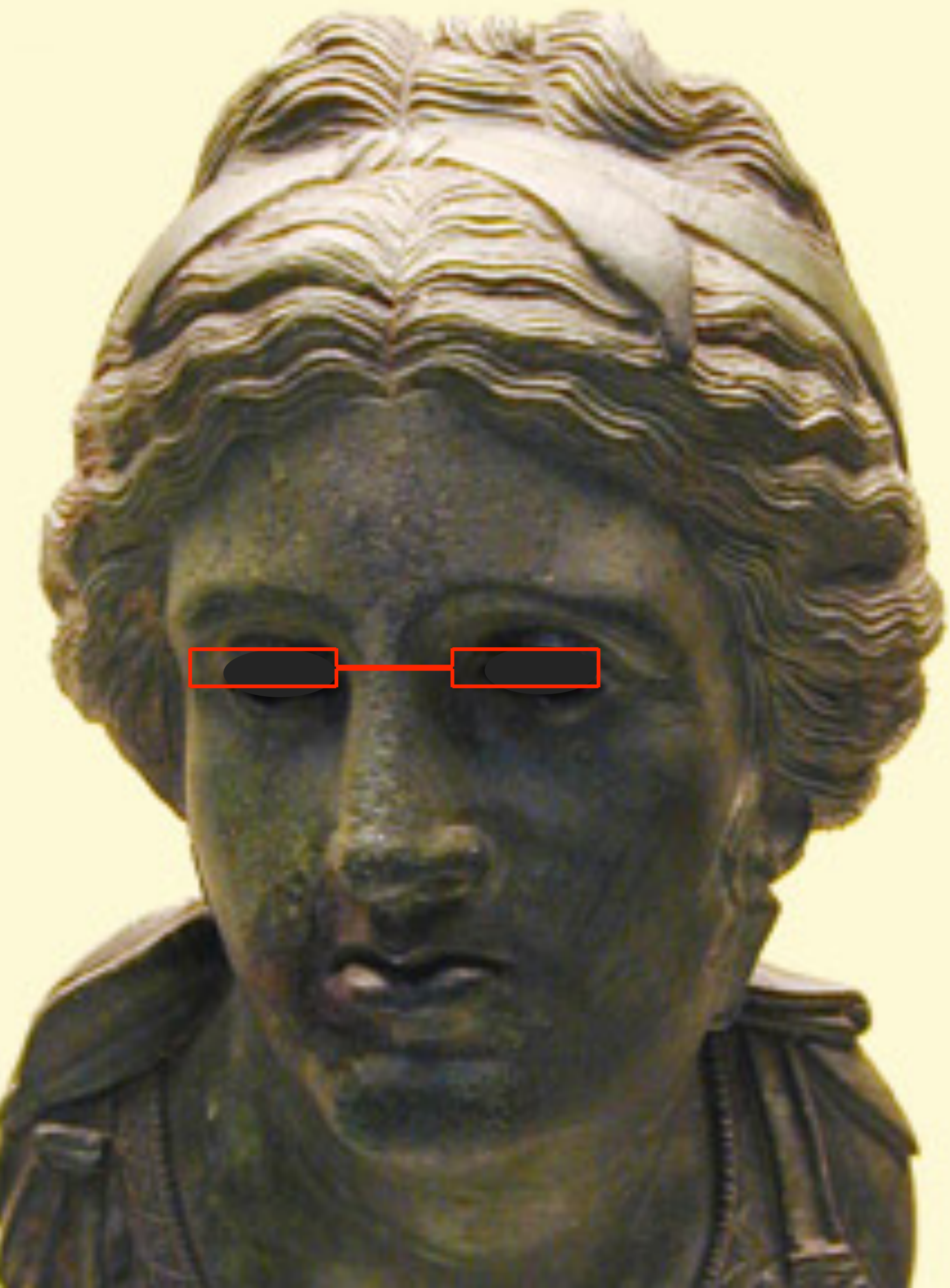

Auroral emission at Jupiter *through Juno's UVS eyes*

Denis Grodent
Bertrand Bonfond
G. Randy Gladstone
Jean-Claude Gérard
Jacques Gustin
Aikaterini Radioti
Maïté Dumont
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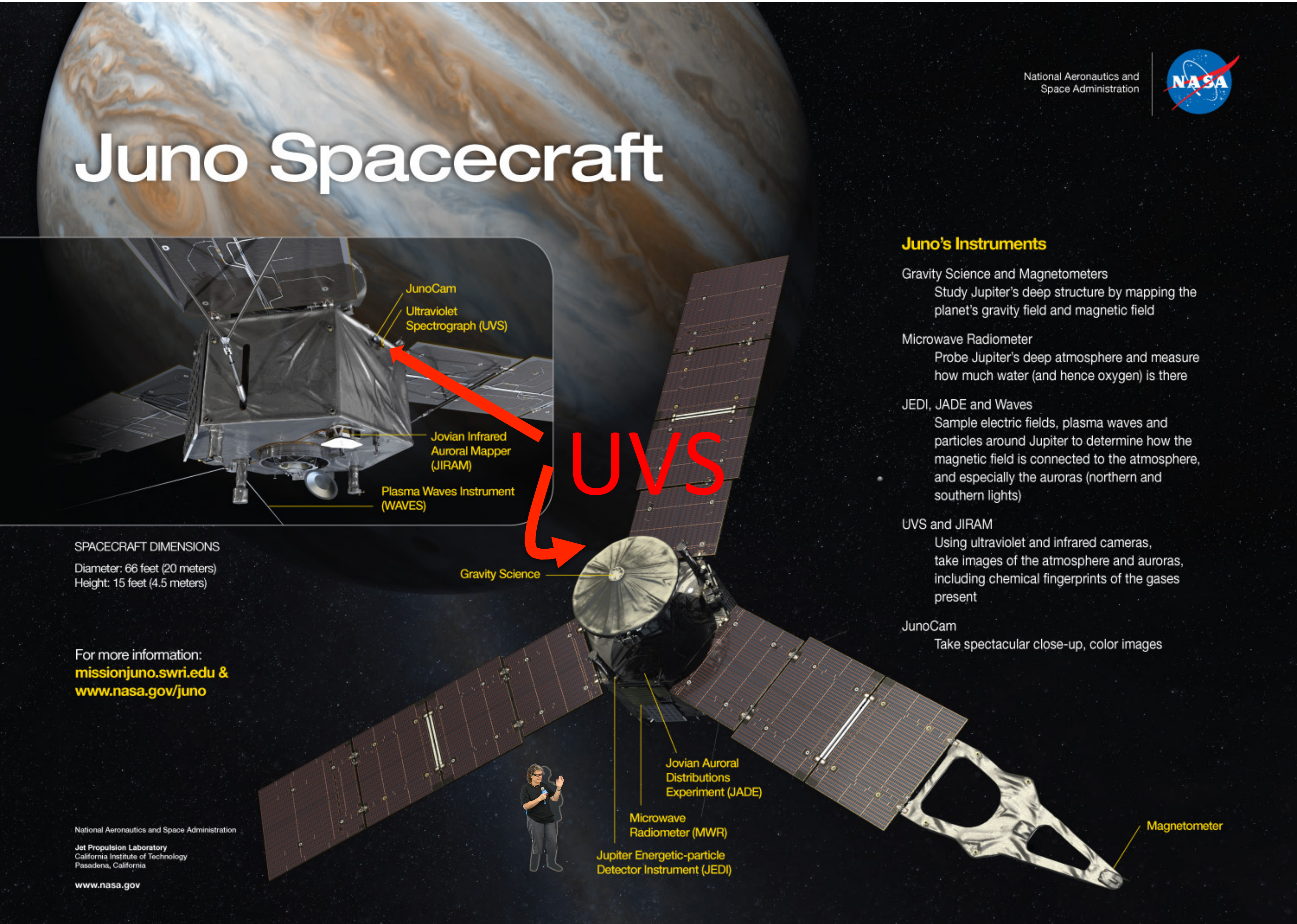
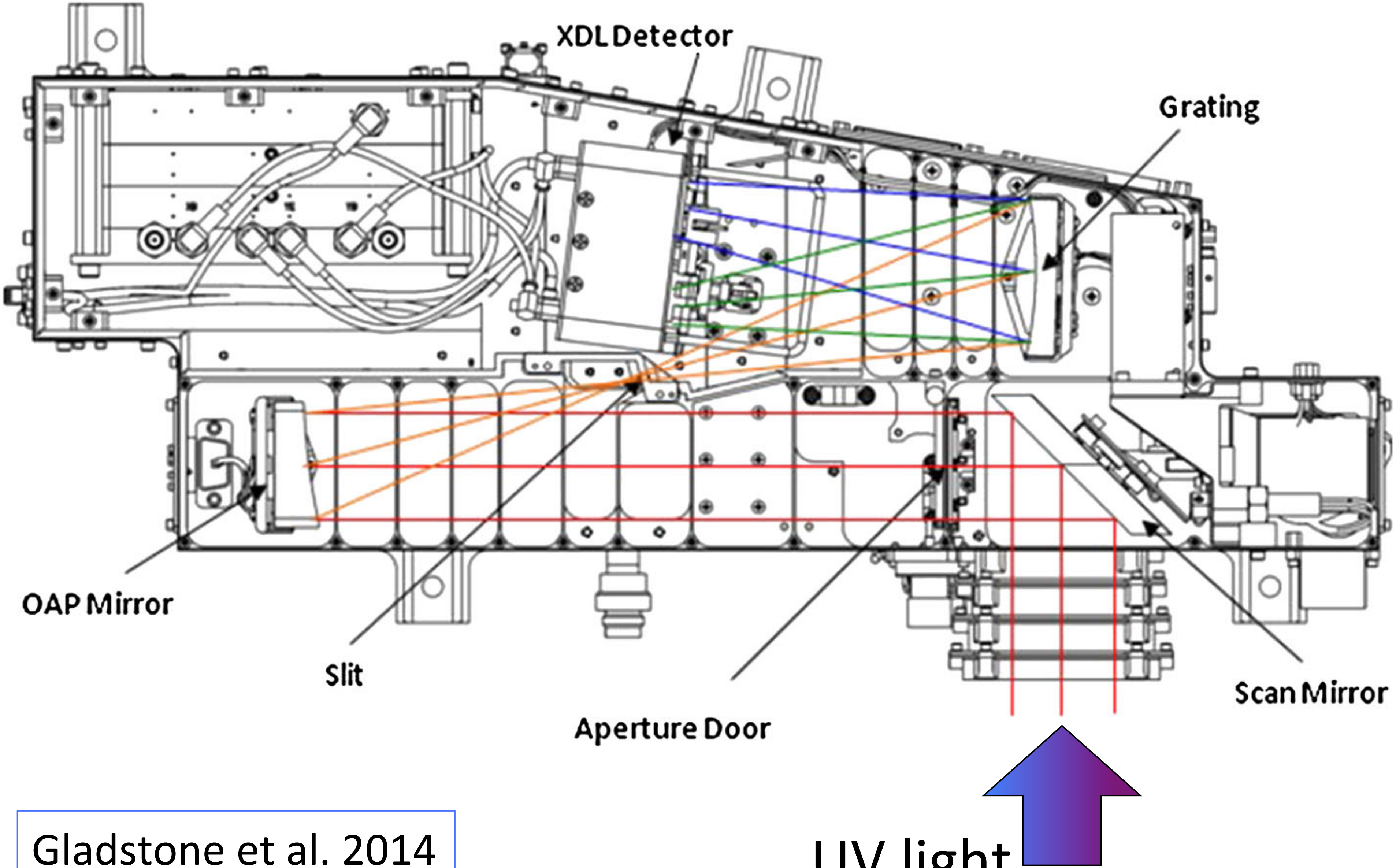
the Juno Science Team

LPAP, Université de Liège, Belgium
Southwest Research Institute, USA

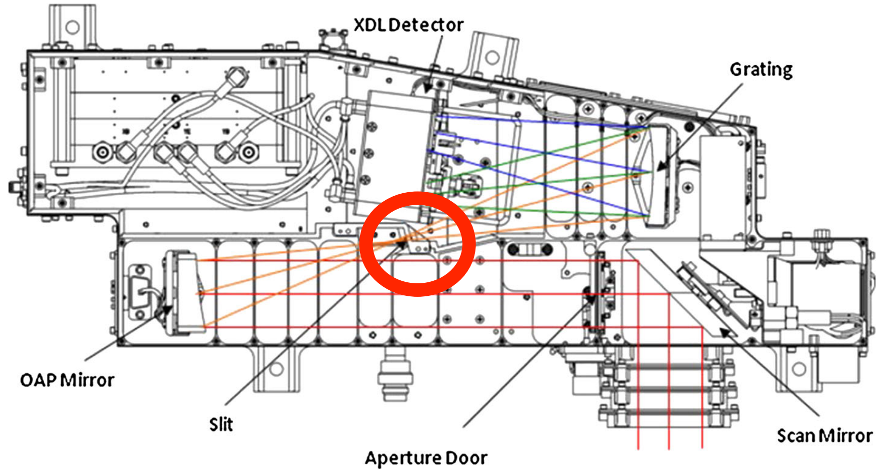


D. Grodent ULg

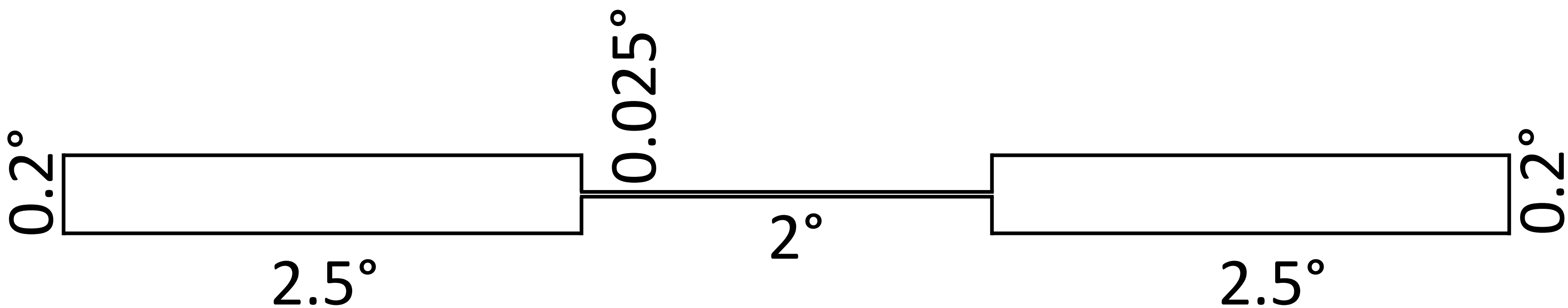
Juno UltraViolet Spectrograph UVS (PI: G.R. Gladstone)



Gladstone et al. 2014



Dog bone shaped slit

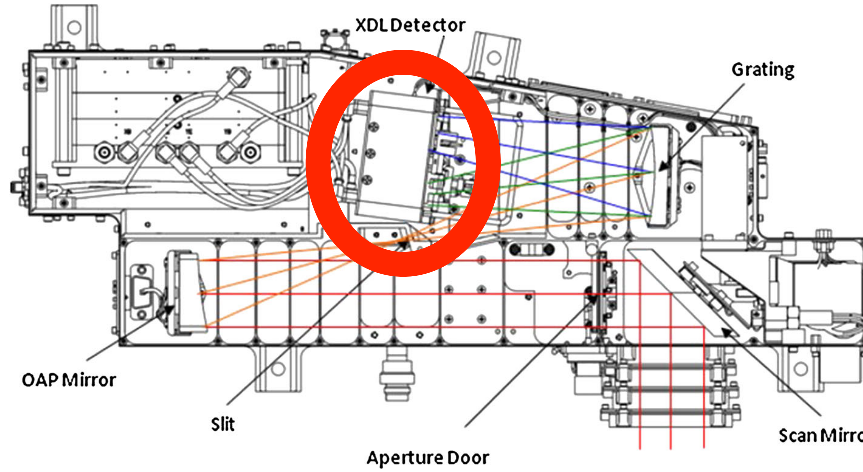


D. Grodent ULg

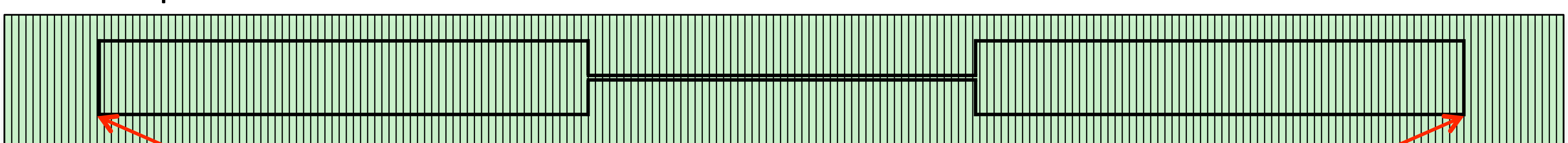
Slit projected onto XDL MCP detector

256 "pixels" (spatial) / 2048 pixels (spectral)

electronically digitized pixels



<- 256 px ->



higher spatial res.

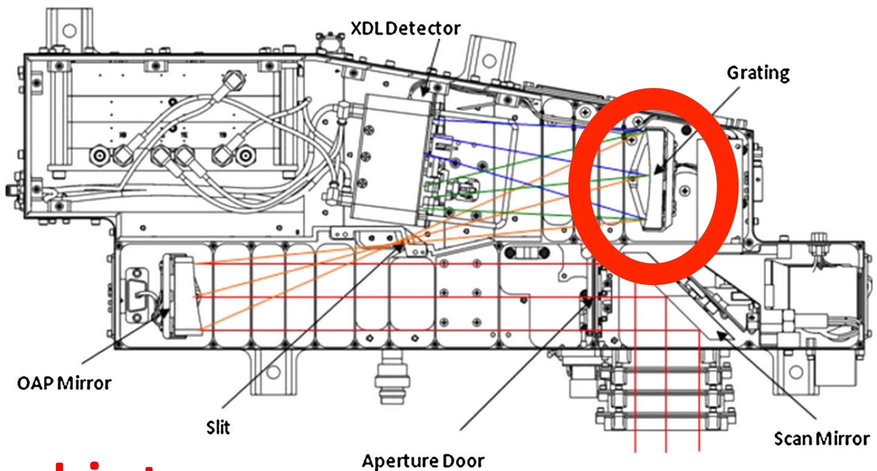
200 illuminated pixels

D. Grodent ULg

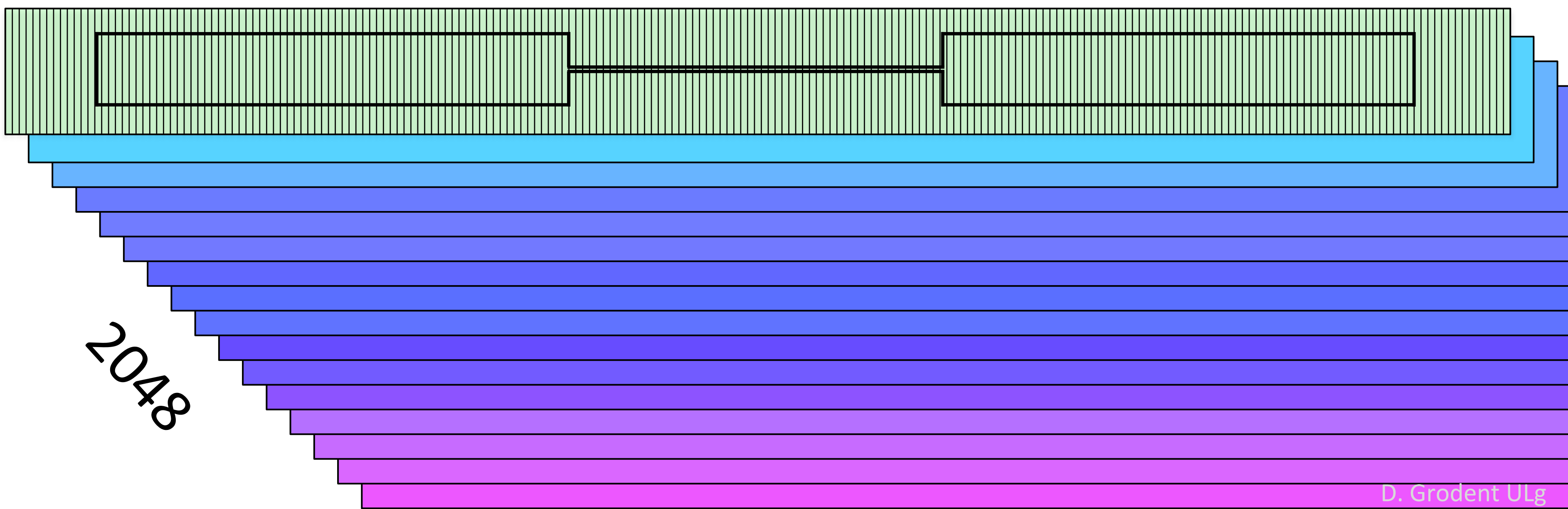
Slit projected onto XDL MCP detector
256 "pixels" (spatial) / 2048 pixels (spectral)

Toroidal diffraction grating

PSF < 0.6 nm

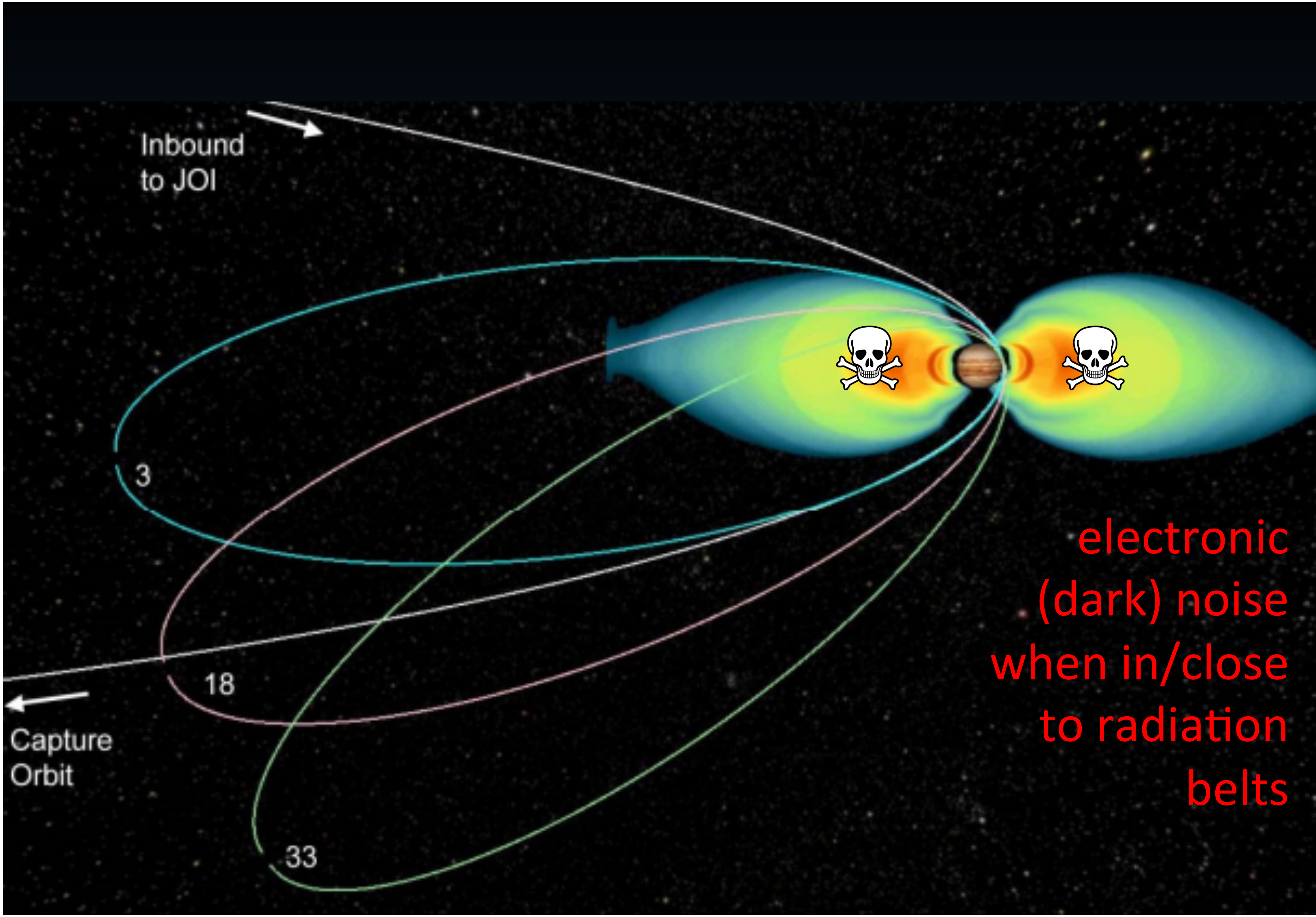


"Data Cube" (x , t , λ) Events List



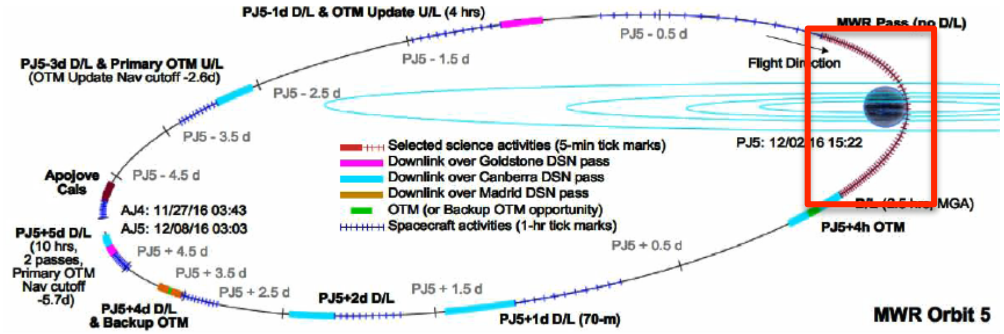
D. Grodent ULg

Juno orbit

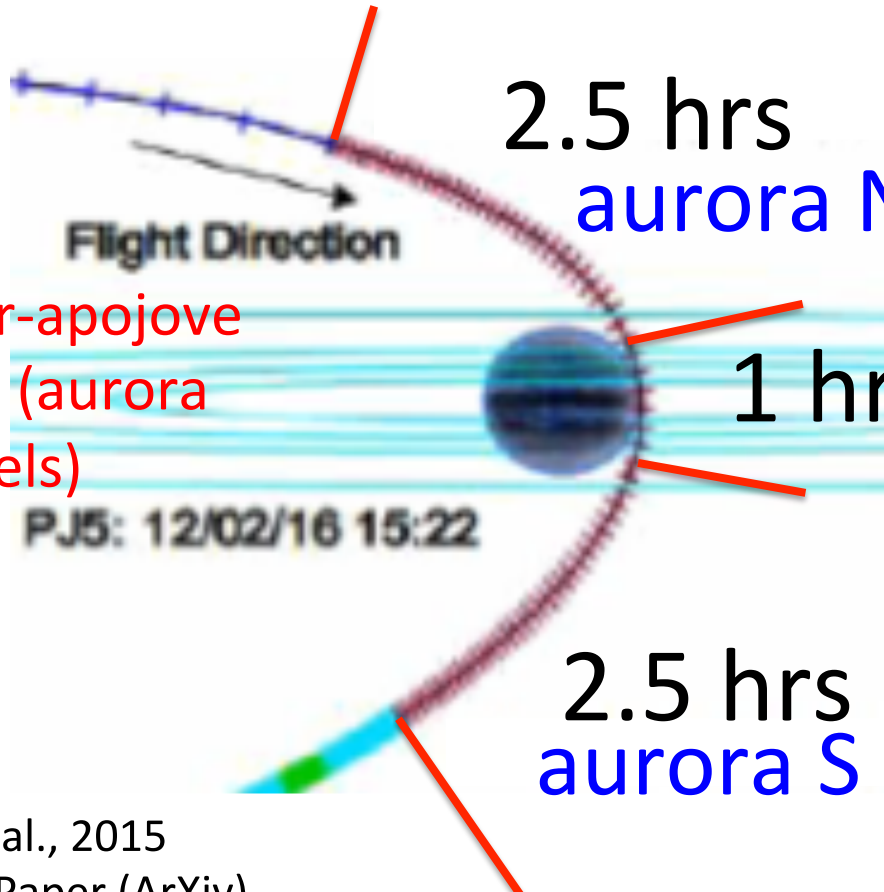


D. Grodent ULg

33 14-Day orbits



UVS segment:
~6 hours of continuous operations



2.5 hrs
aurora N

1 hr

2.5 hrs
aurora S

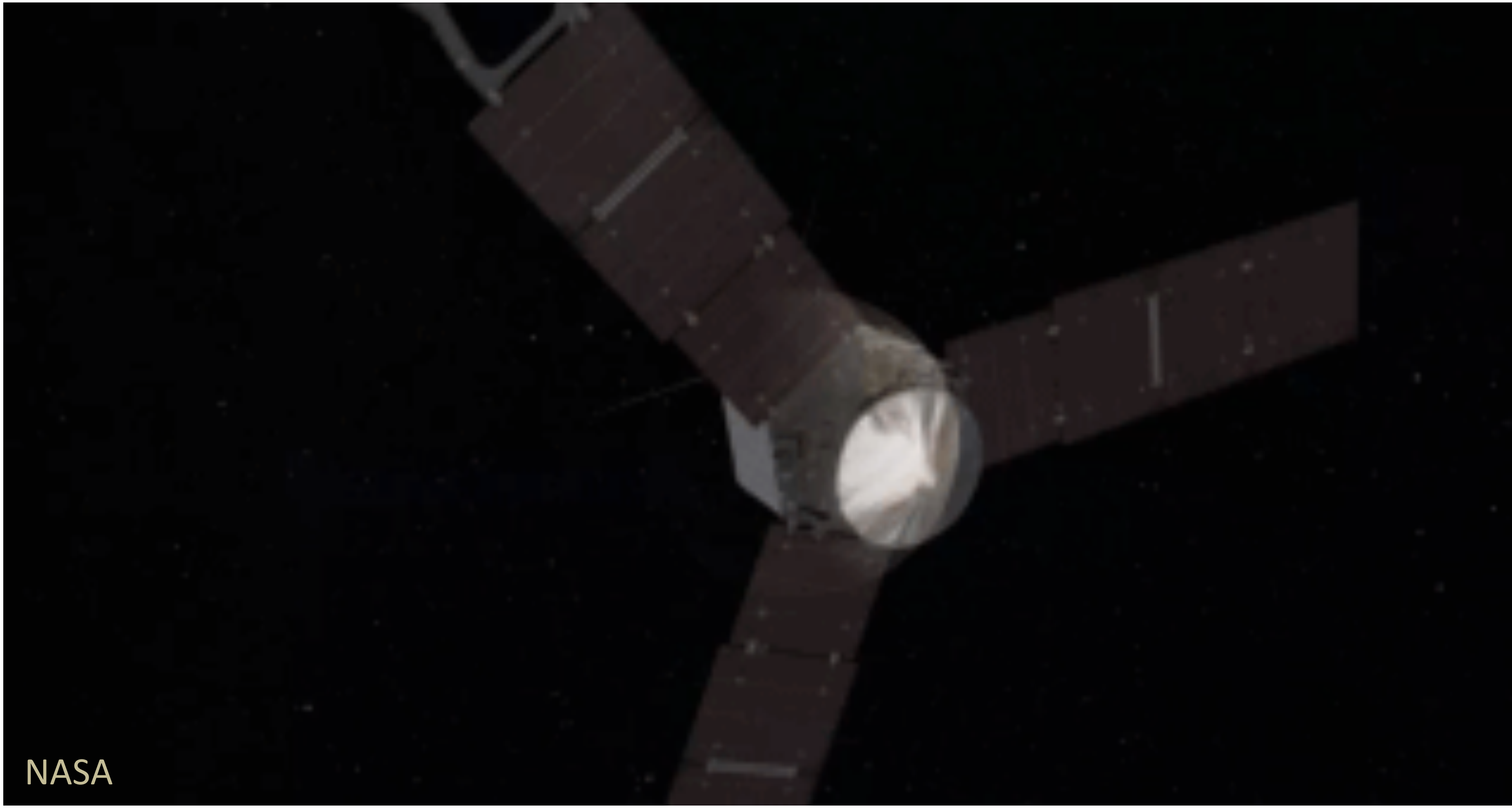
Also near-apojove UVS obs. (aurora ~few pixels)

UVS observes aurora
< 2% of orbit

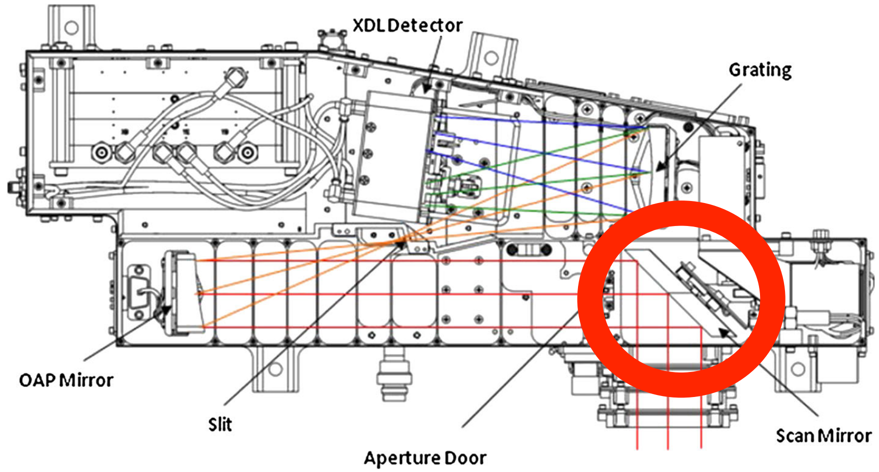
we need HST for the rest (> 98%) of the time

Grodent et al., 2015
HST White Paper (ArXiv)

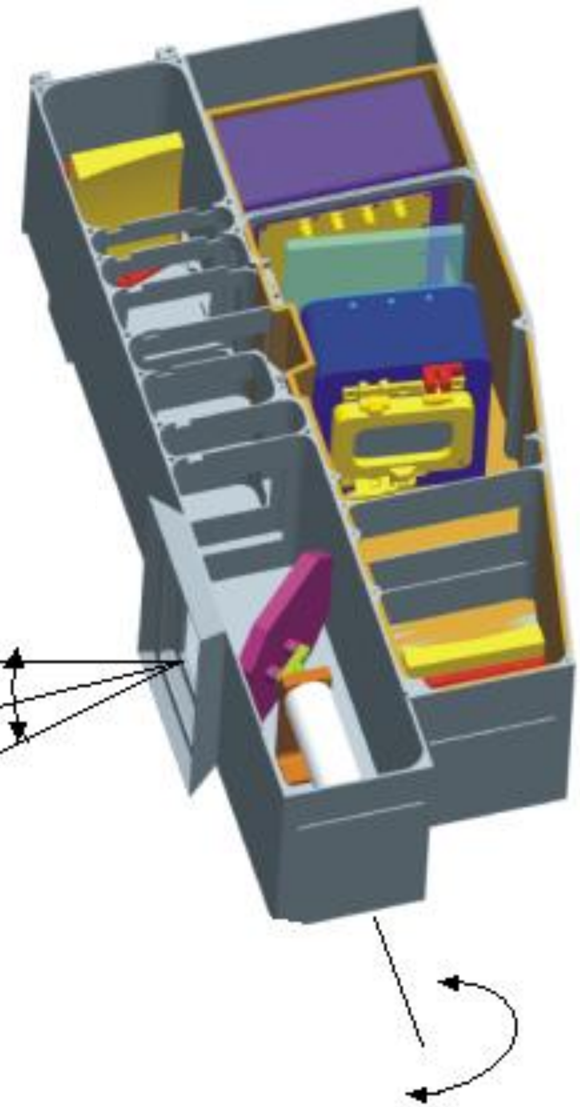
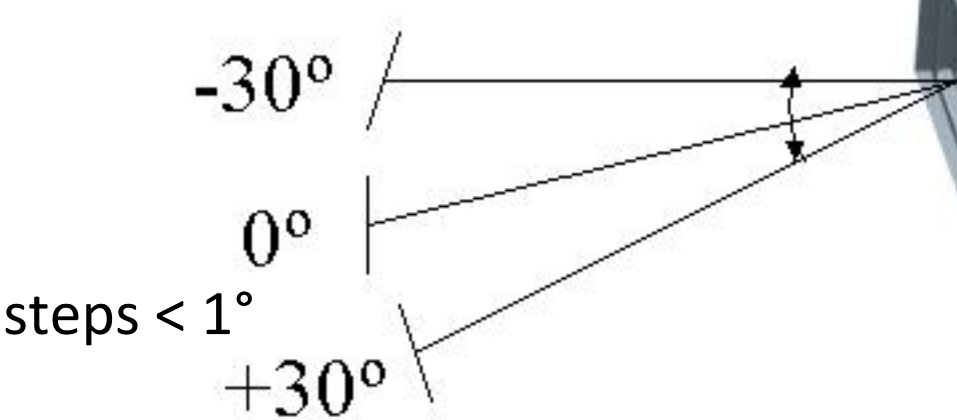
Juno is spin stabilized at 2 RPM: 1 rotation every 30 seconds in a plane containing the UVS boresight



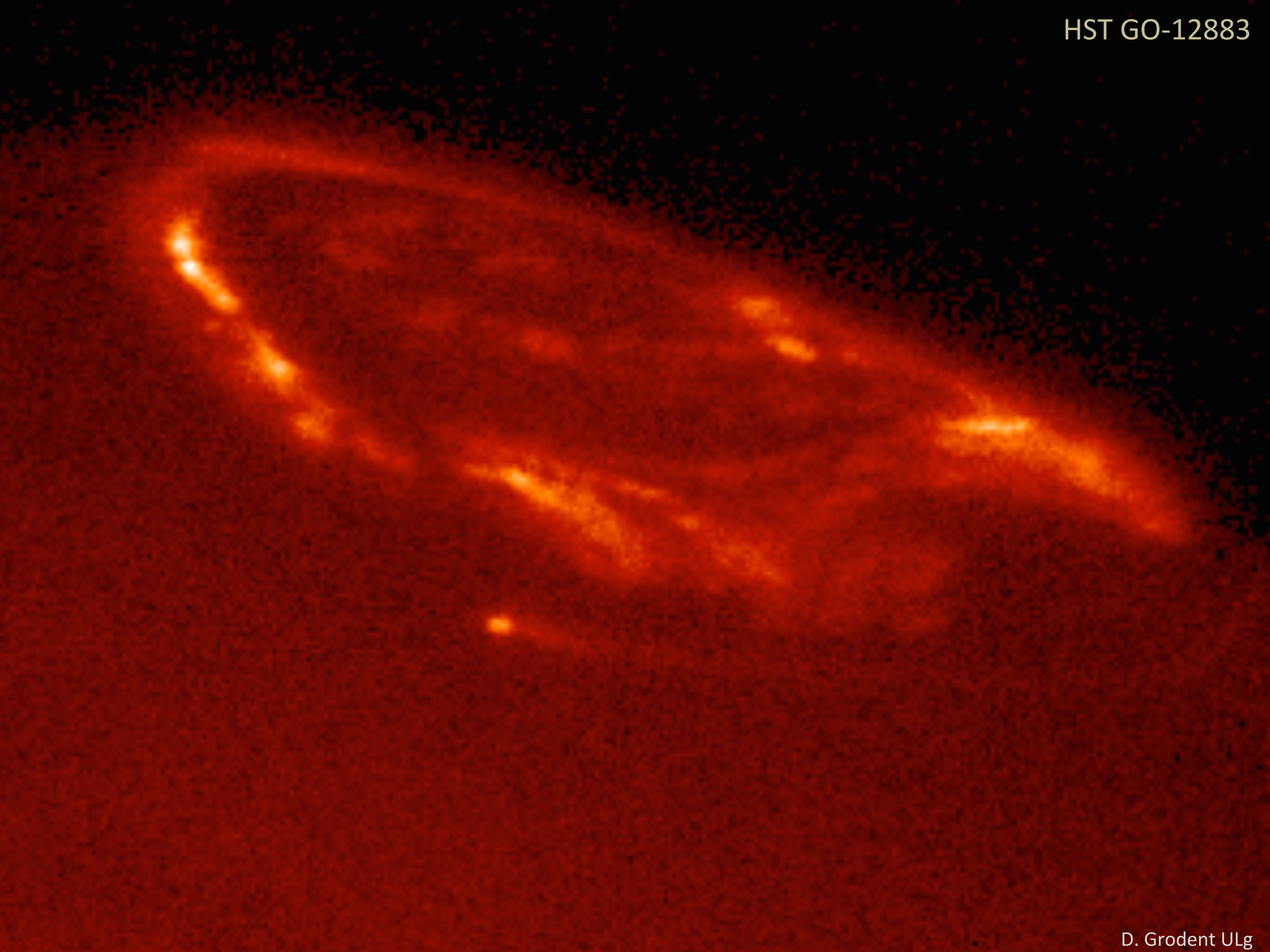
Use this rotation to scan the auroral region

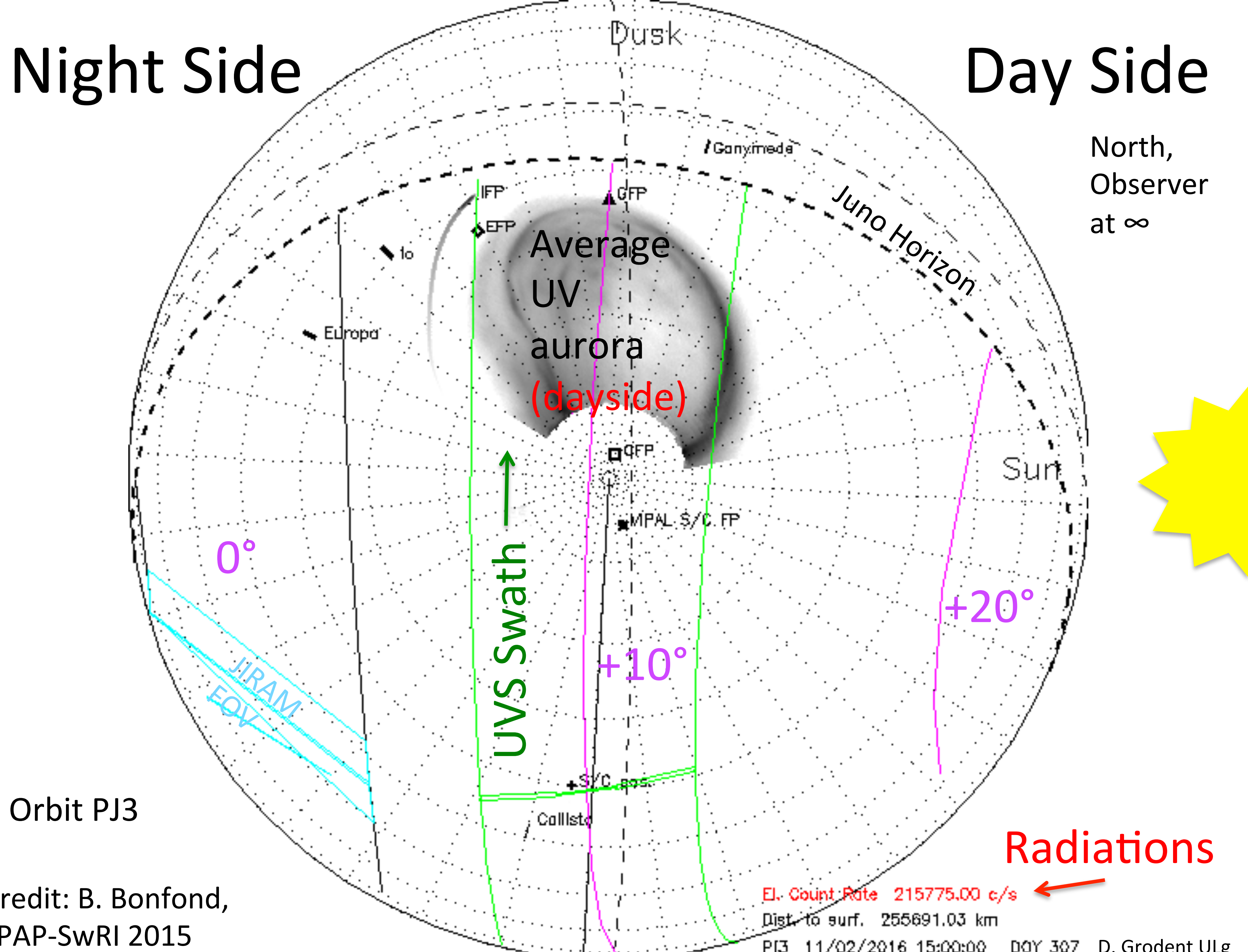


Scan Mirror

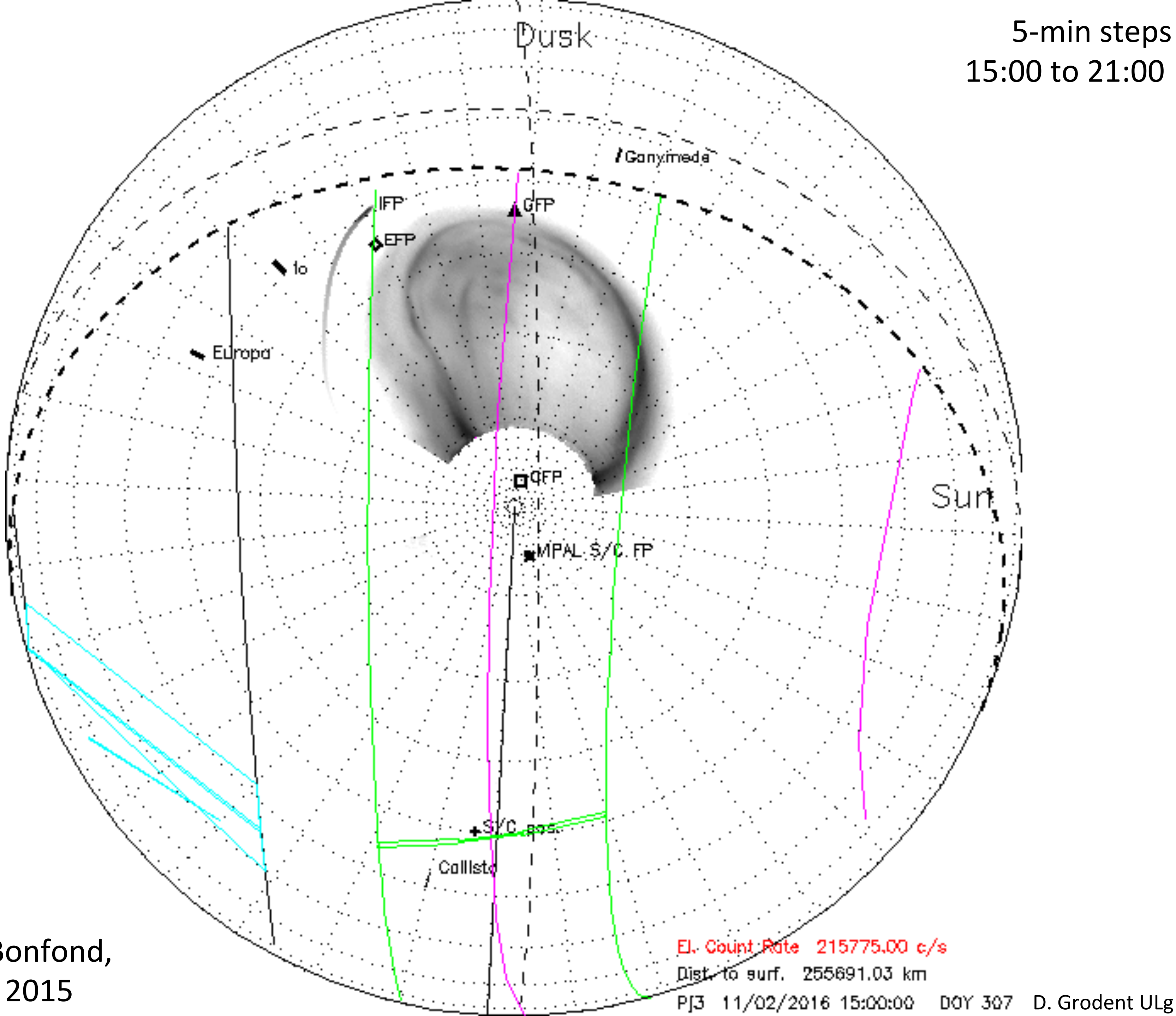
D. Grodent ULg


HST GO-12883
D. Grodent ULg



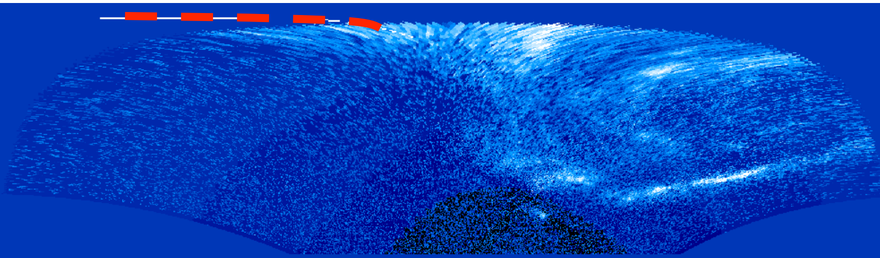
Credit: B. Bonfond,
LPAP-SwRI 2015

5-min steps
15:00 to 21:00



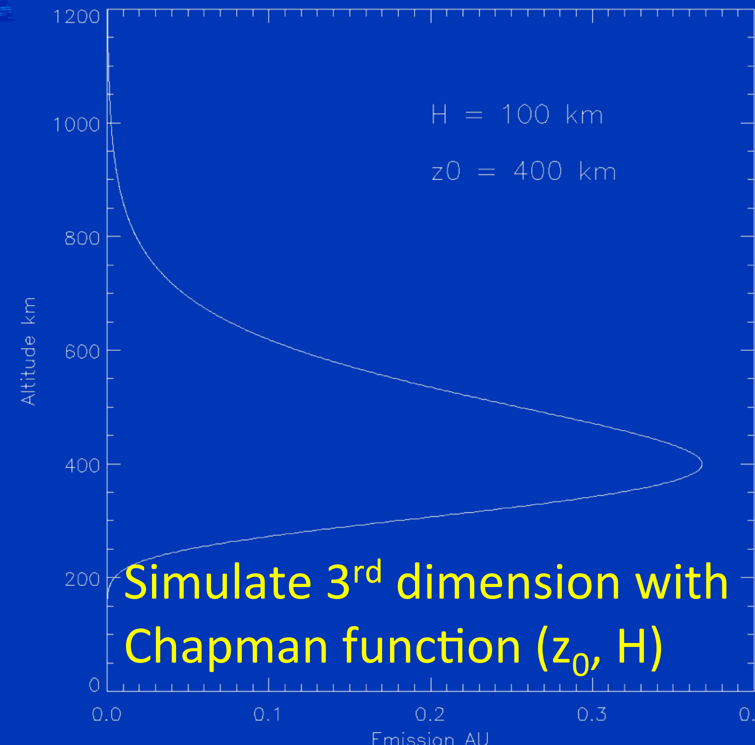
Credit: B. Bonfond,
LPAP-SwRI 2015

latitude



Extrapolate missing aurora

longitude (S3)



Simulate 3rd dimension with Chapman function (z_0, H)

2D map of HST aurora

$\Longrightarrow$ Build 3D map

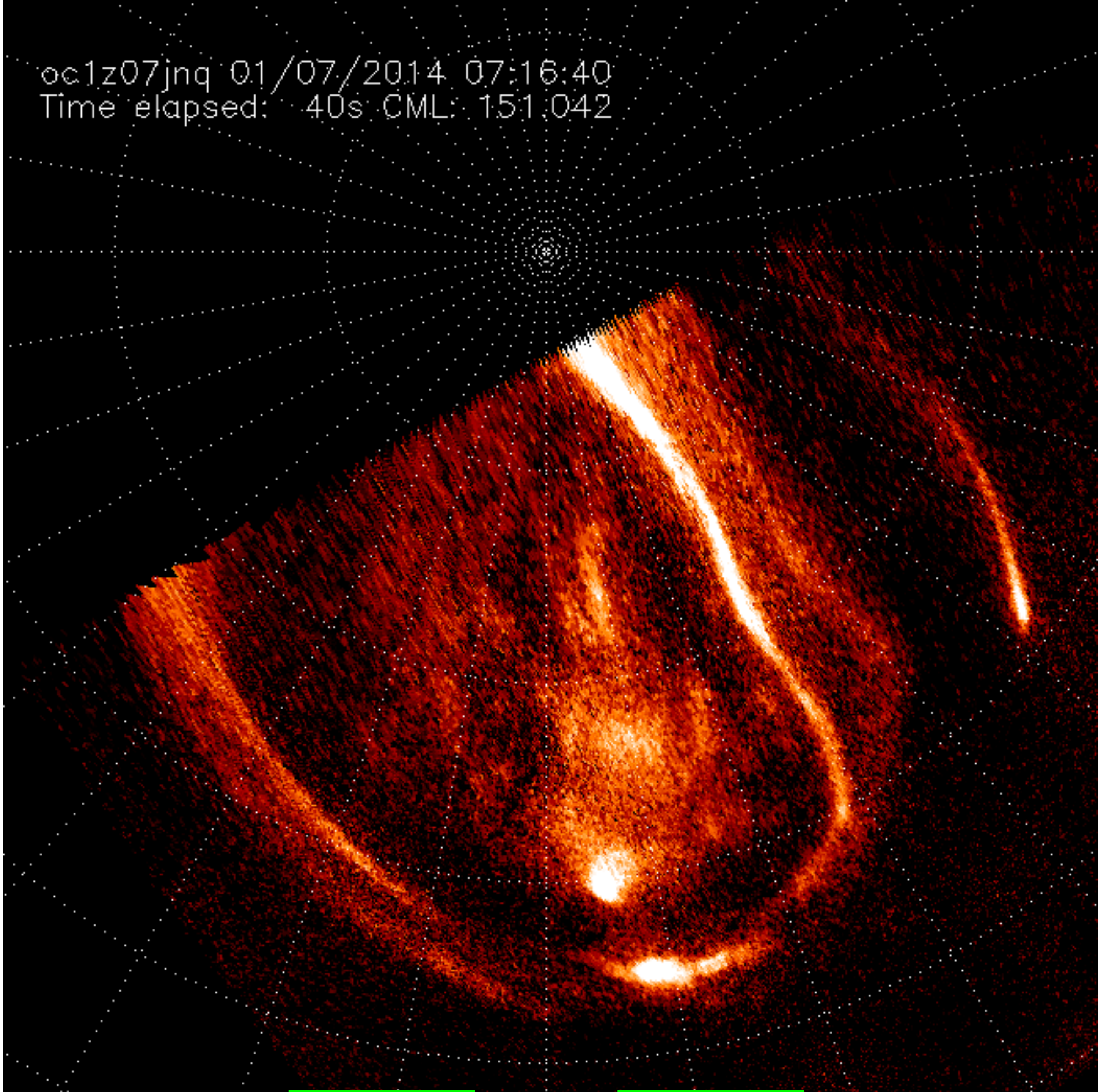
Use 143 maps accumulated for 10 sec (STIS ttag)

$\Longrightarrow$ 4D

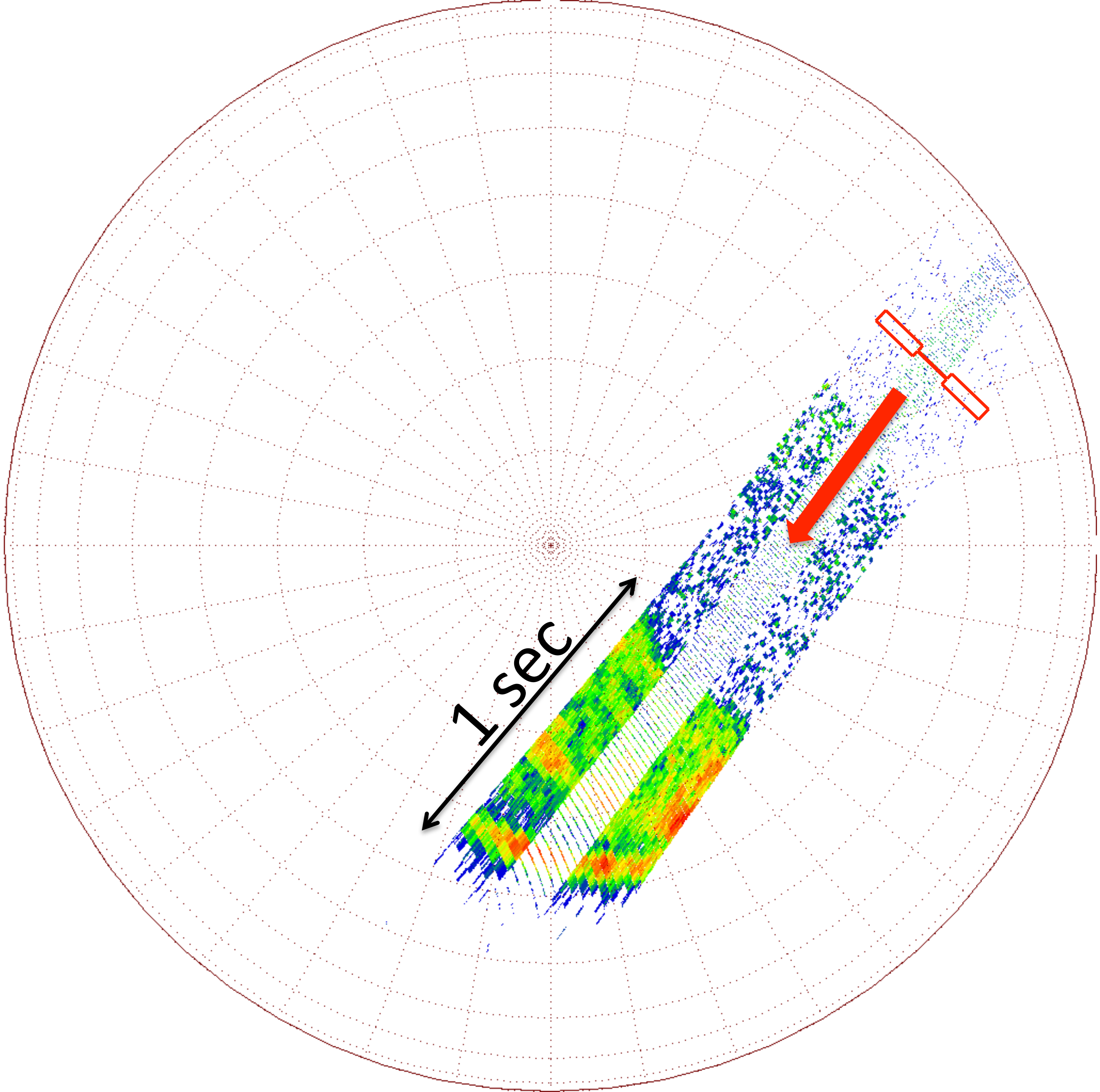
Build H_2 spectrum for each pixel

$\Longrightarrow$ 5D

D. Grodent ULg



D. Grodent ULg

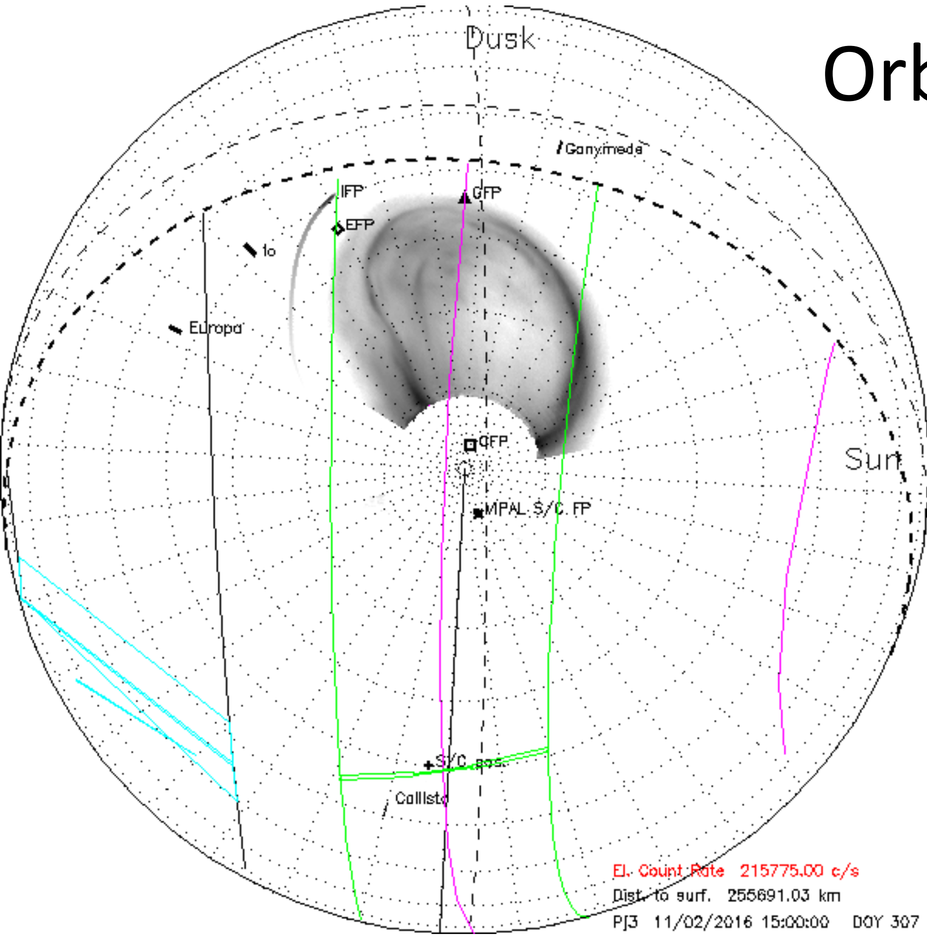


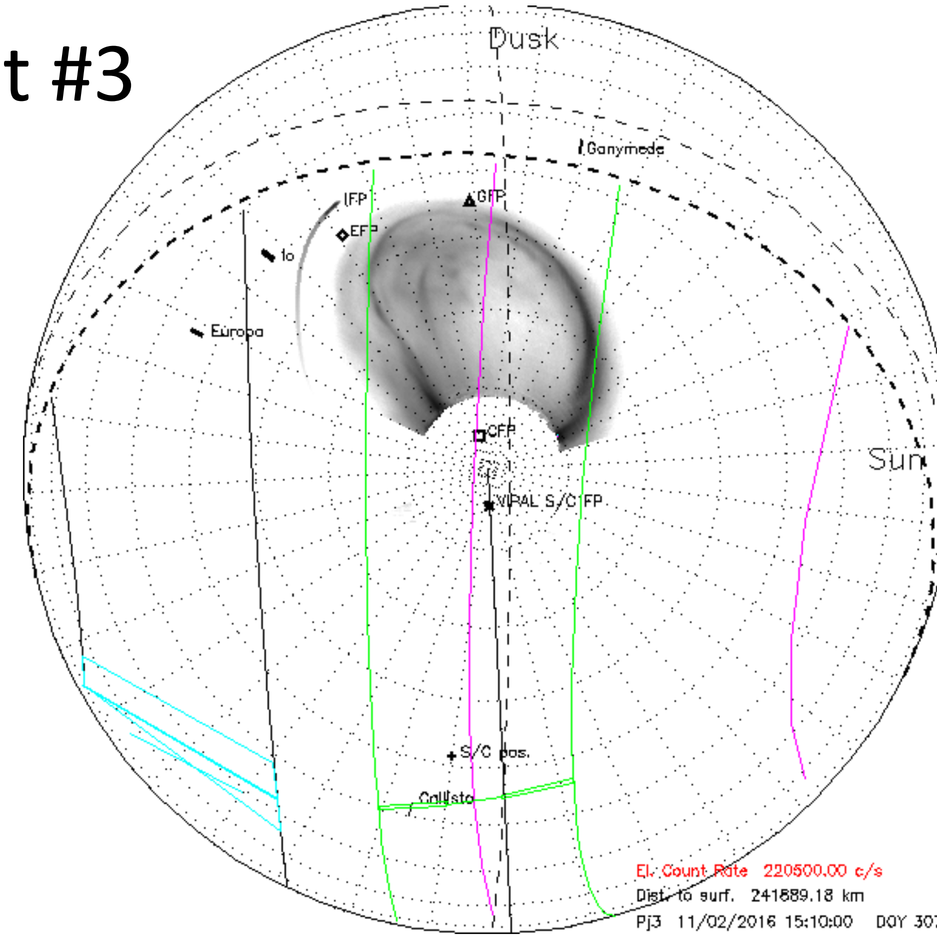
D. Grodent ULg

Start: 02 Nov 2016 15:00:04

End: 02 Nov 2016 15:10:34

Orbit #3



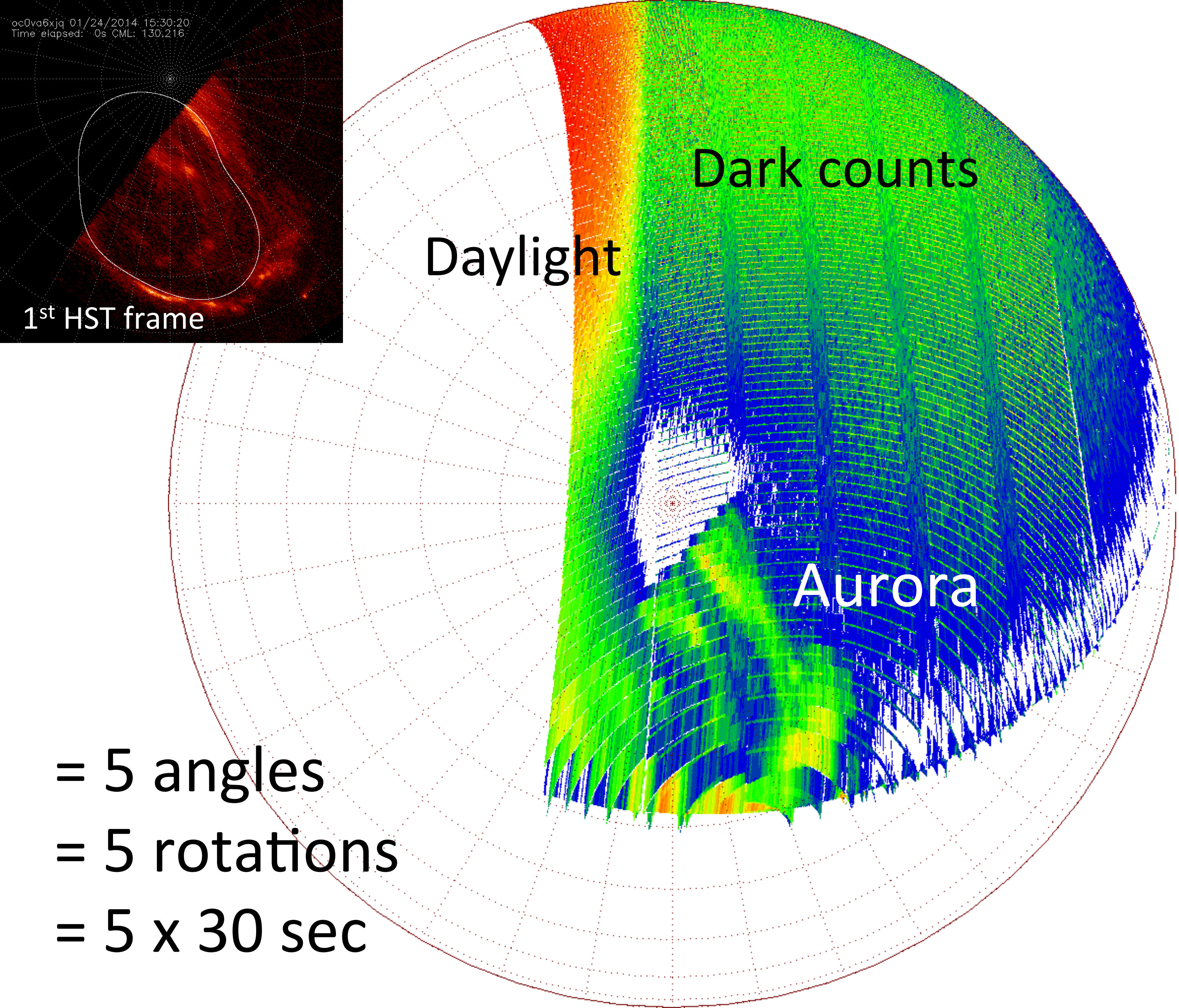


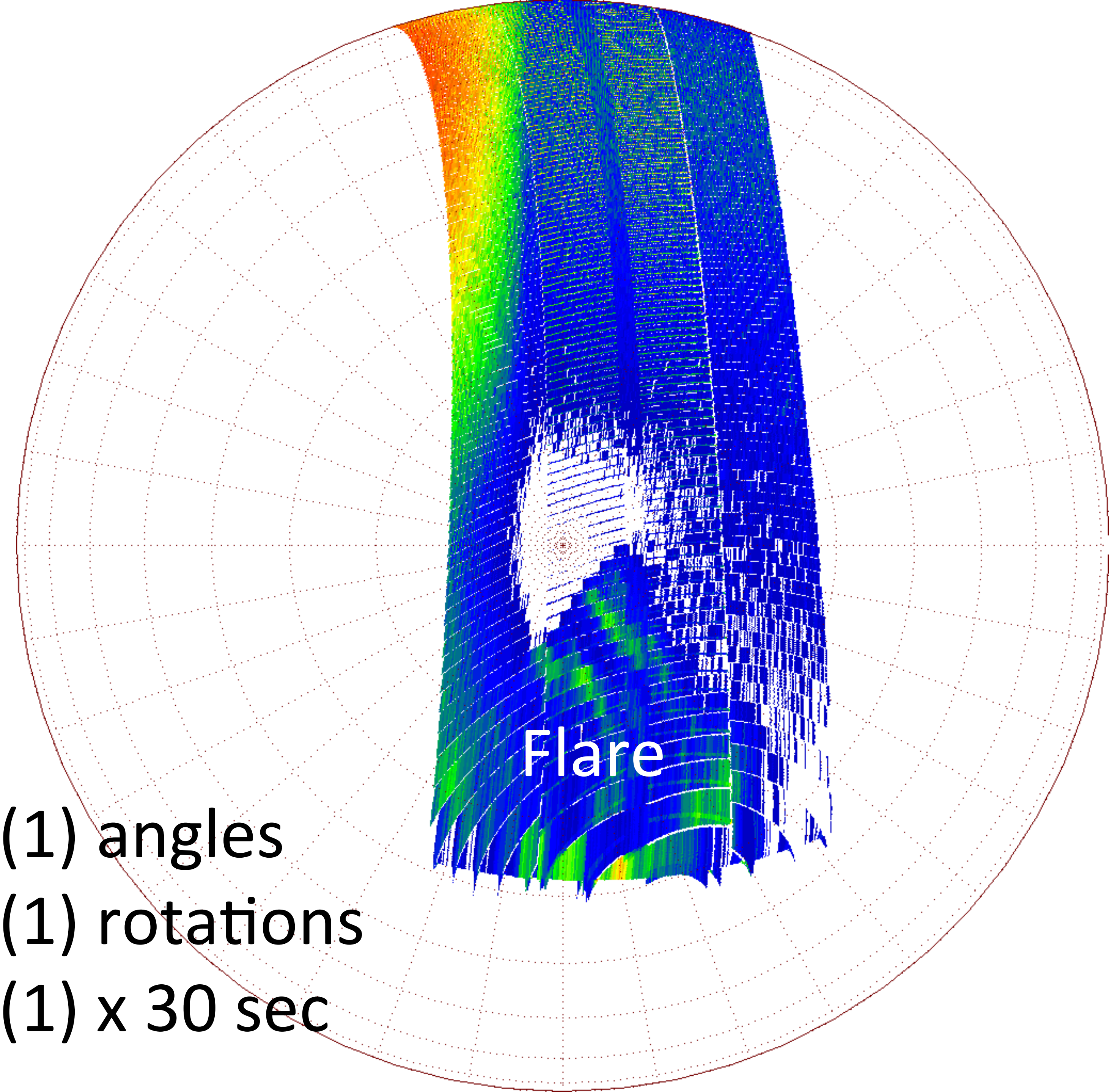
Aurora sitting on dayside terminator
(50% night-50% day)

Altitude$_{start}$ = 3.6 R_J

Instantaneous spat. res. ~ 156 km x 893 km / pix^2

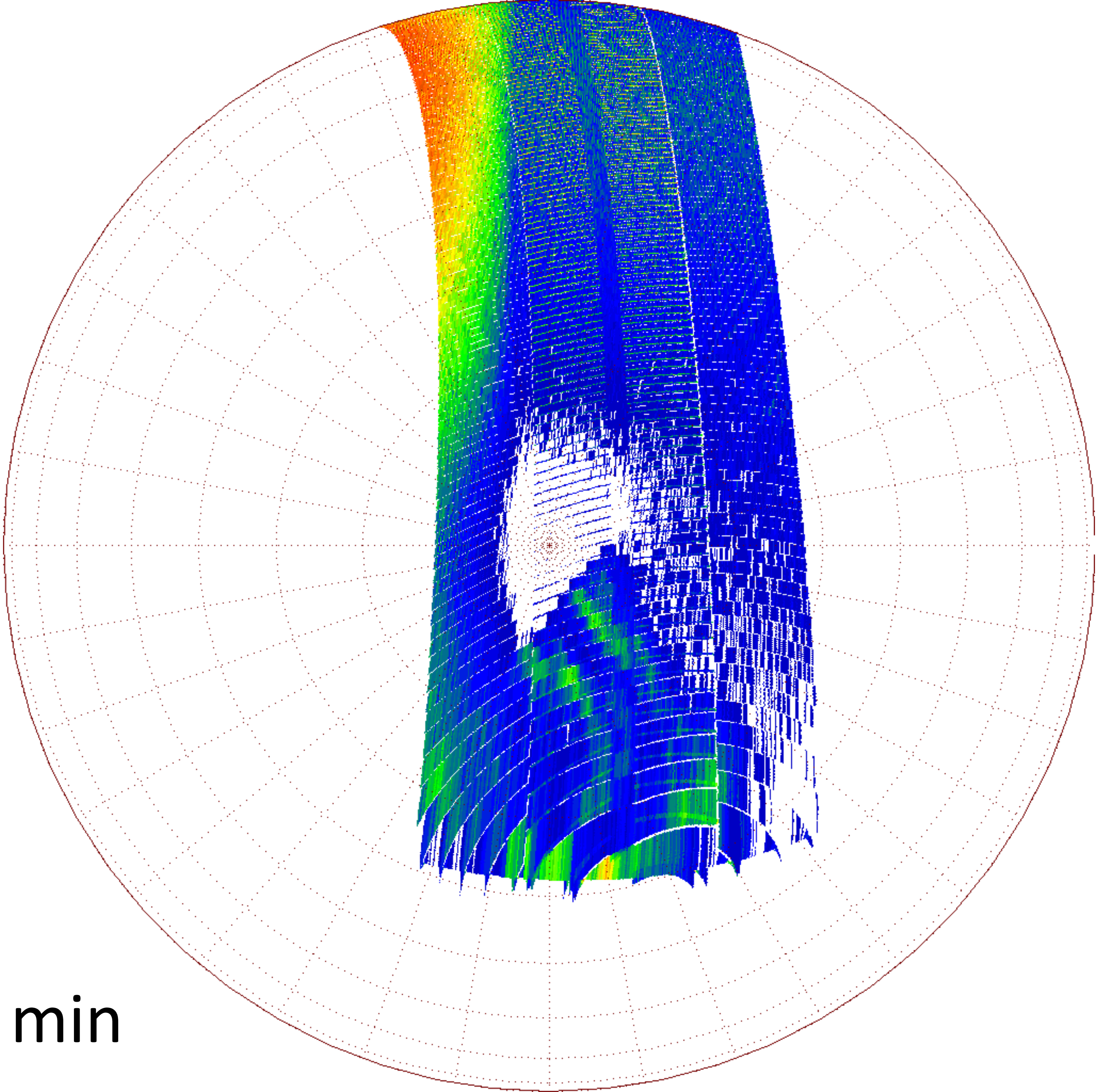
Dark count rate ~ 216 kC/s


oc0va6xjq 01/24/2014 15:30:20
Time elapsed: 0s CML: 130.216
1st HST frame
Dark counts
Daylight
Aurora
= 5 angles
= 5 rotations
= 5 x 30 sec



= 2 (1) angles
= 2 (1) rotations
= 2 (1) x 30 sec

D. Grodent ULg



10.5 min

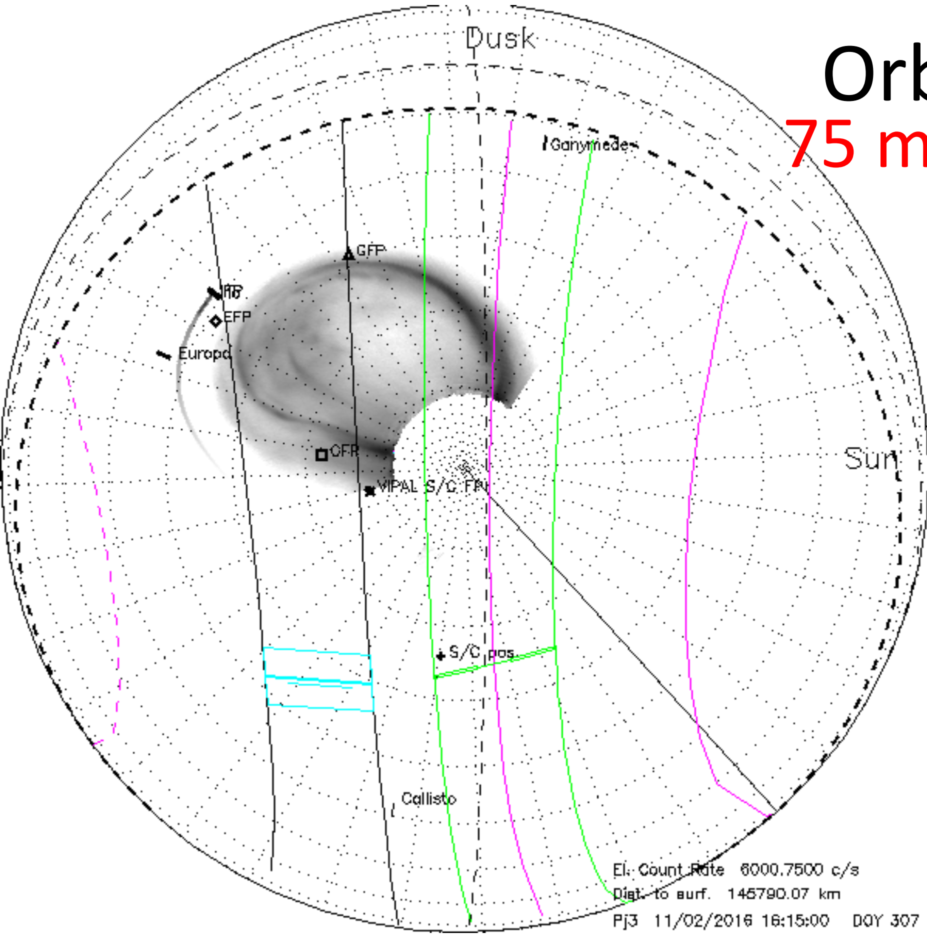
D. Grodent ULg

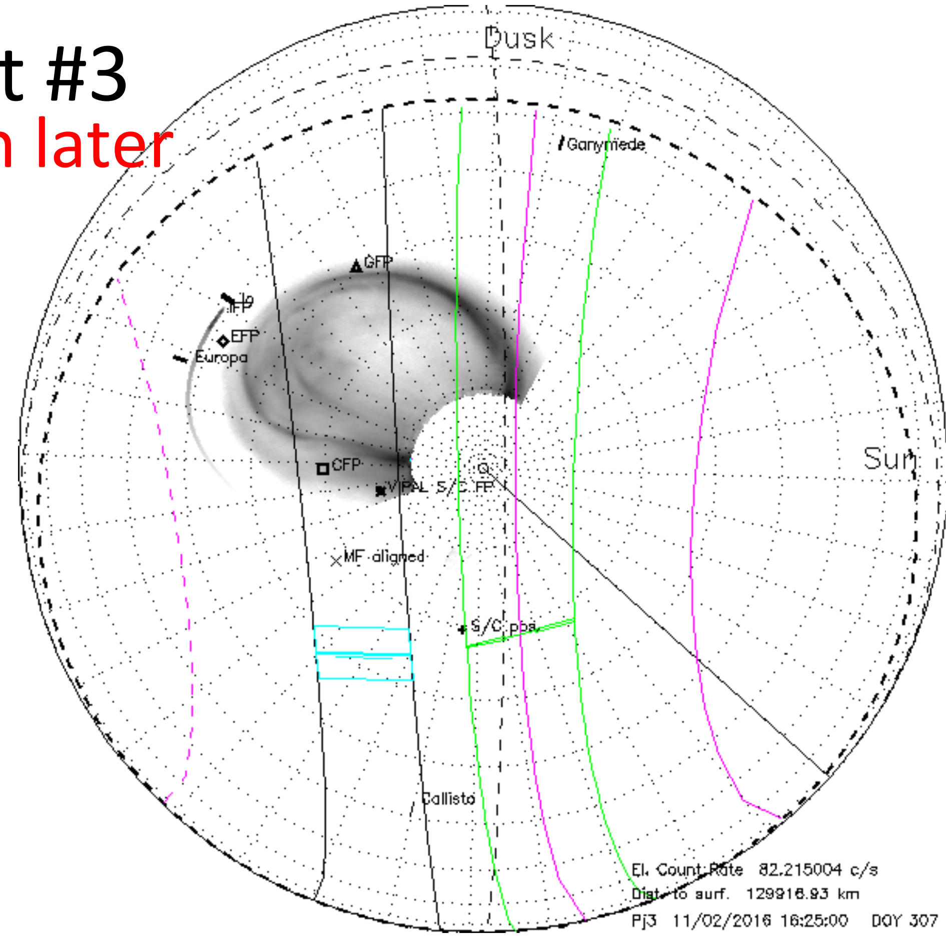
Start: 02 Nov 2016 16:15:04

End: 02 Nov 2016 16:23:04

Orbit #3

75 min later





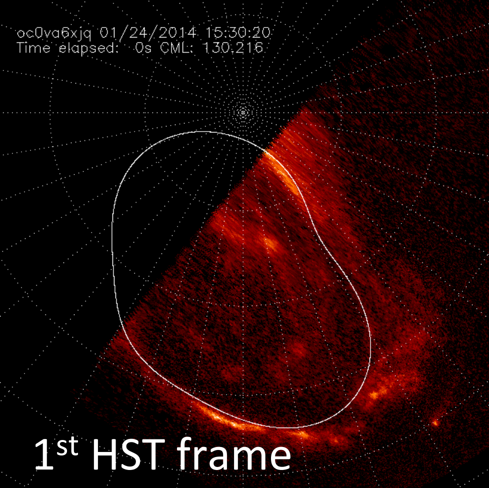
Aurora almost fully in nightside

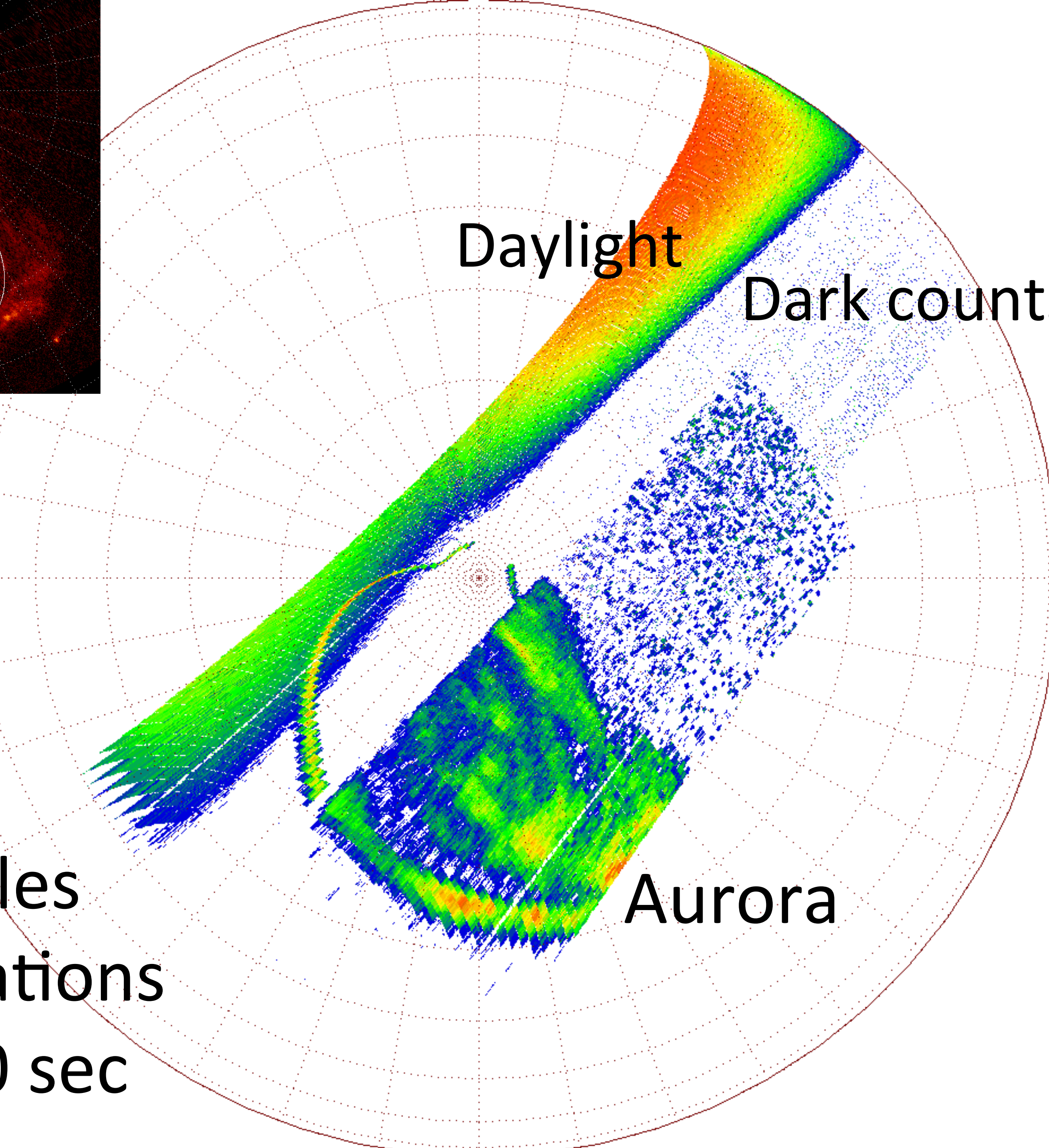
Altitude$_{start}$ = 2.04 R_J

Instantaneous spat. res. ~ 89 km x 509 km / pix^2

Dark count rate ~ 6 kC/s

D. Grodent ULg



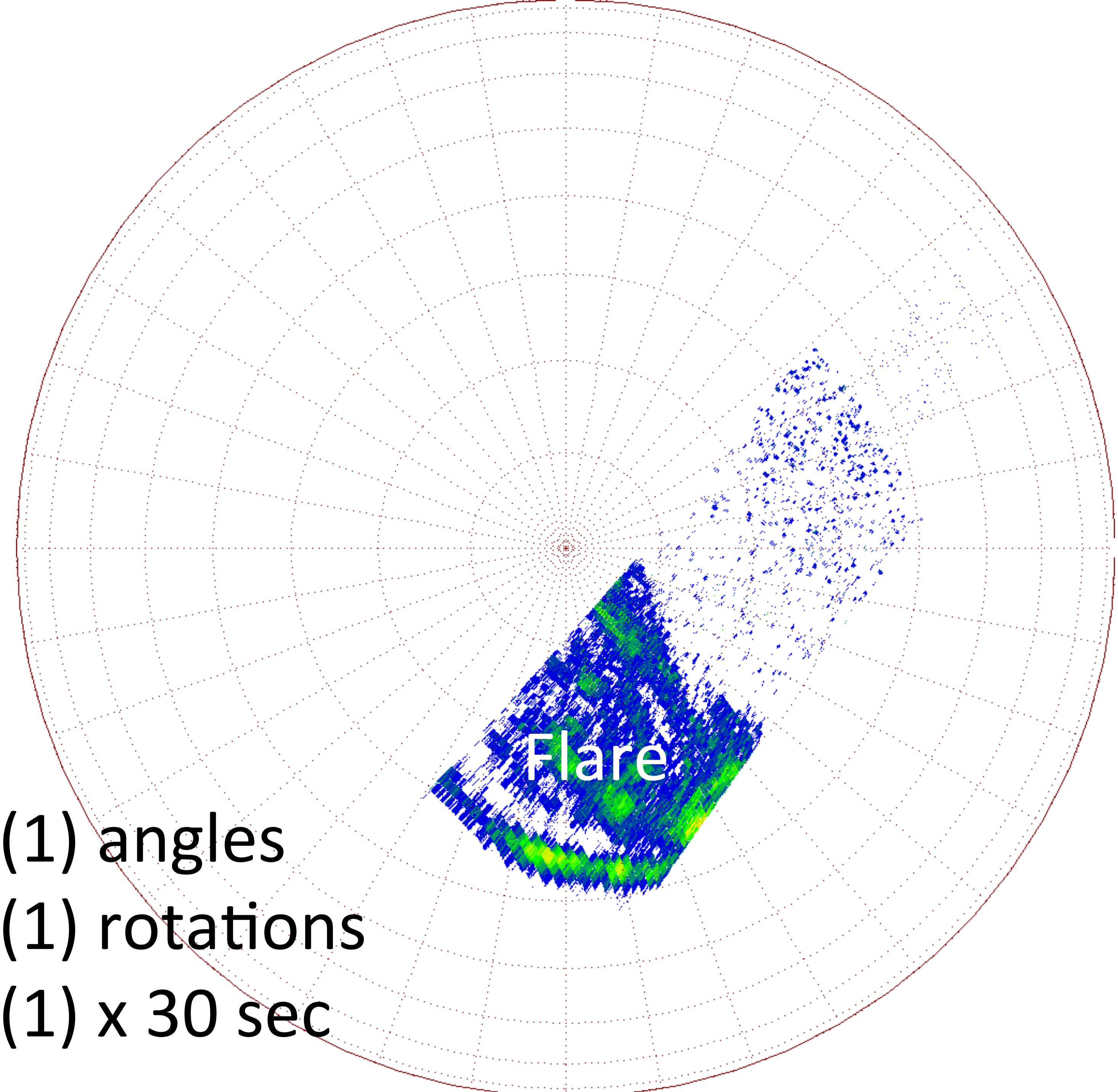


= 5 angles

= 5 rotations

= 5 x 30 sec

D. Grodent ULg

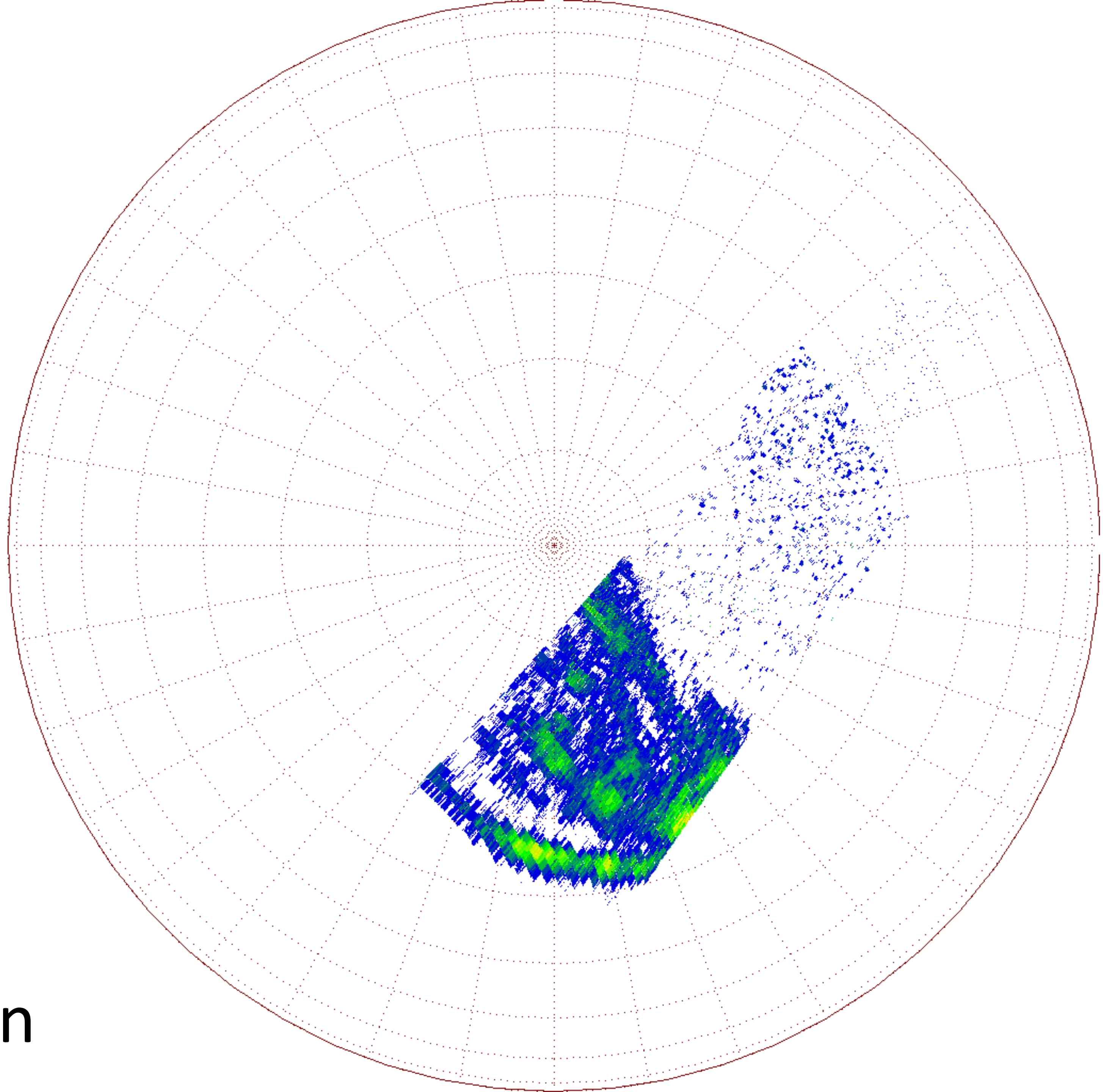


= 2 (1) angles

= 2 (1) rotations

= 2 (1) x 30 sec

D. Grodent ULg



8 min

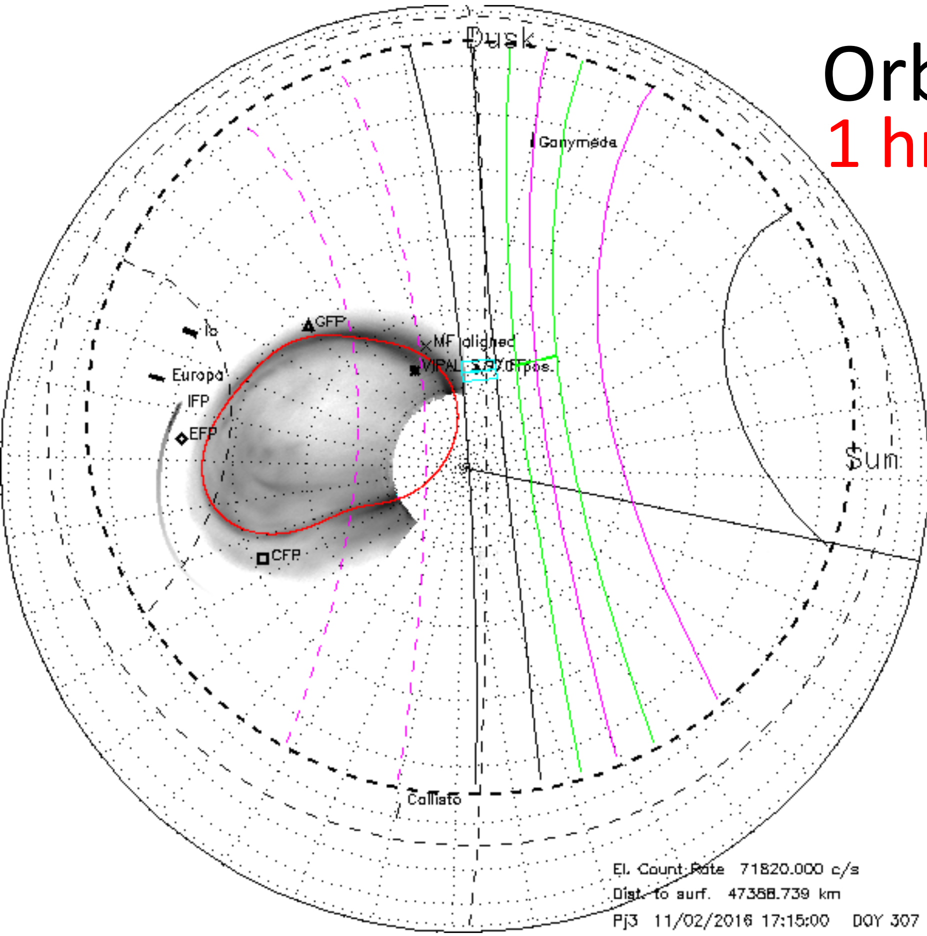
D. Grodent ULg

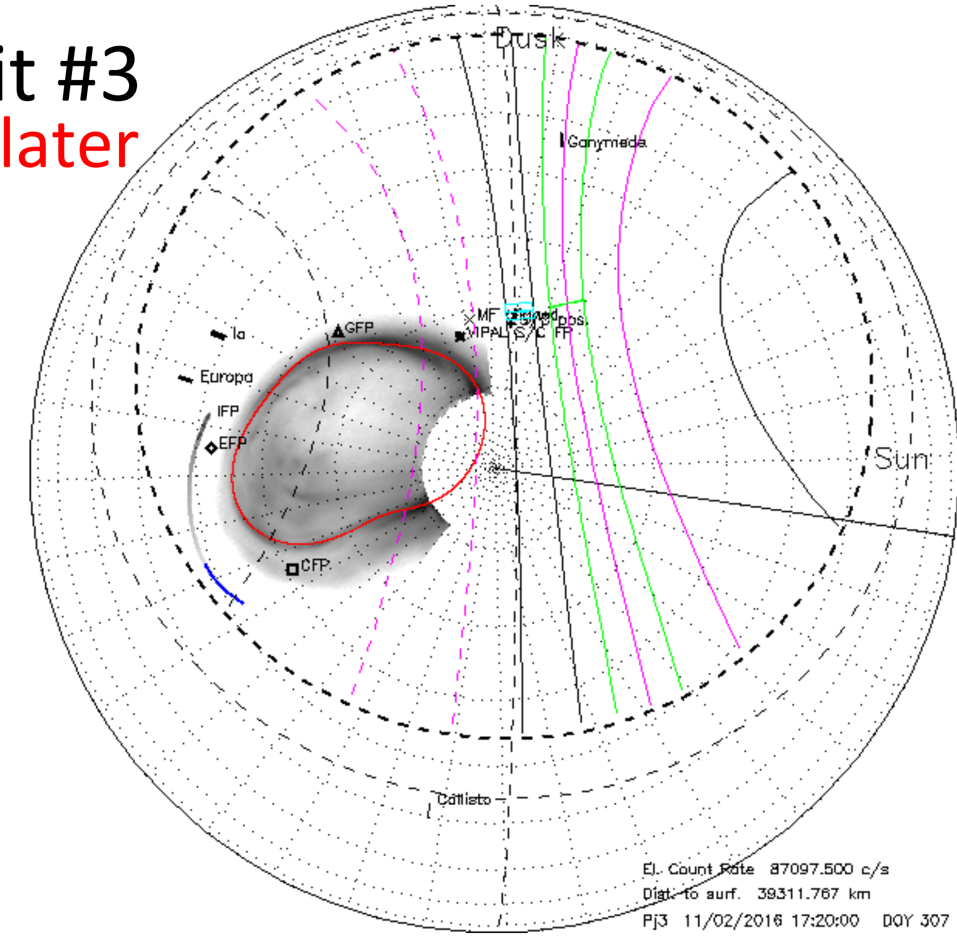
Start: 02 Nov 2016 17:15:04

End: 02 Nov 2016 17:19:04

Orbit #3

1 hr later





Aurora fully in nightside

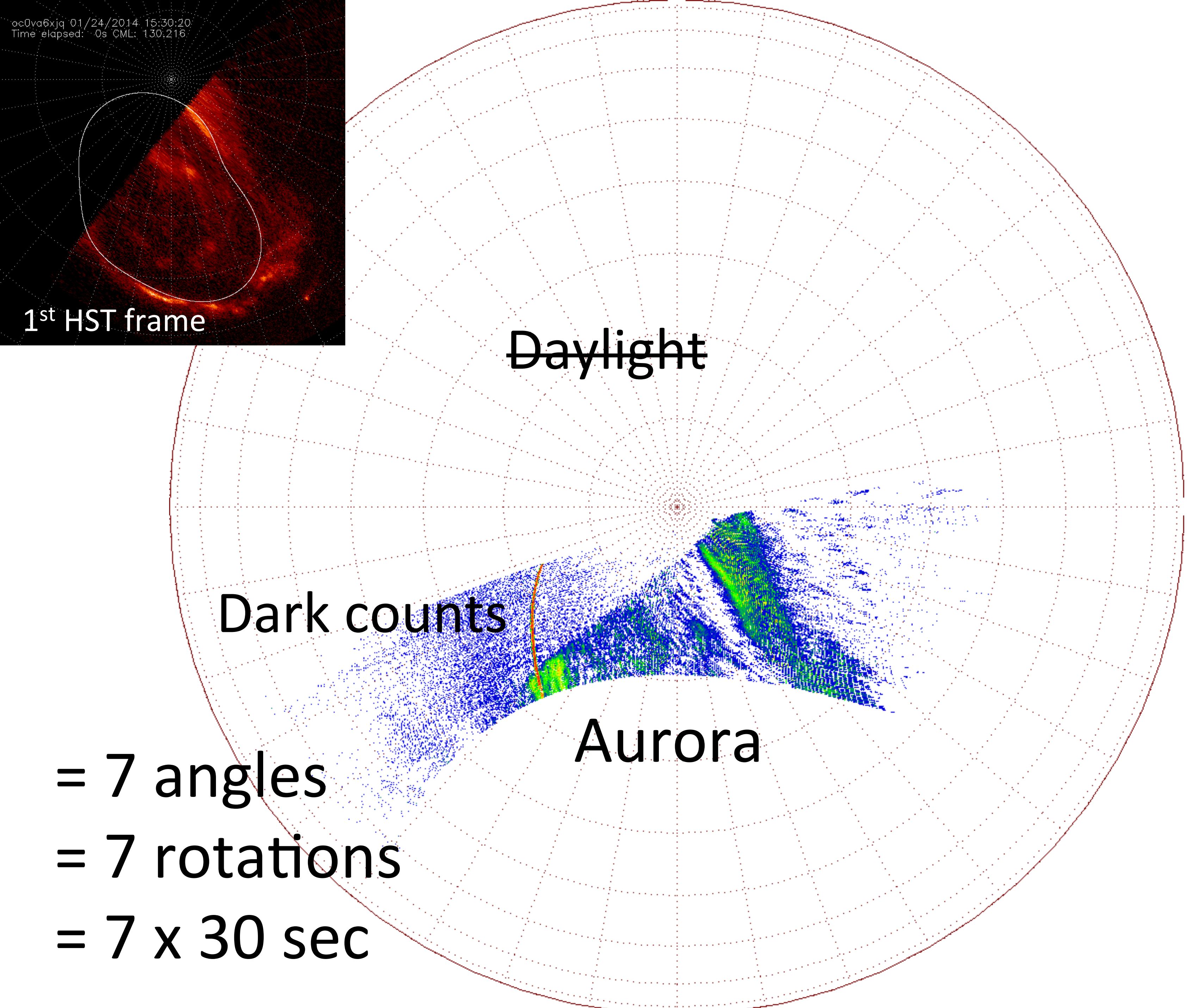
S/C magnetic footprint on main emission

Altitude$_{start}$ = 0.66 R_J

Instantaneous spat. res. ~ 29 km x 165 km / pix^2

Dark count rate ~ 72 kC/s

D. Grodent ULg



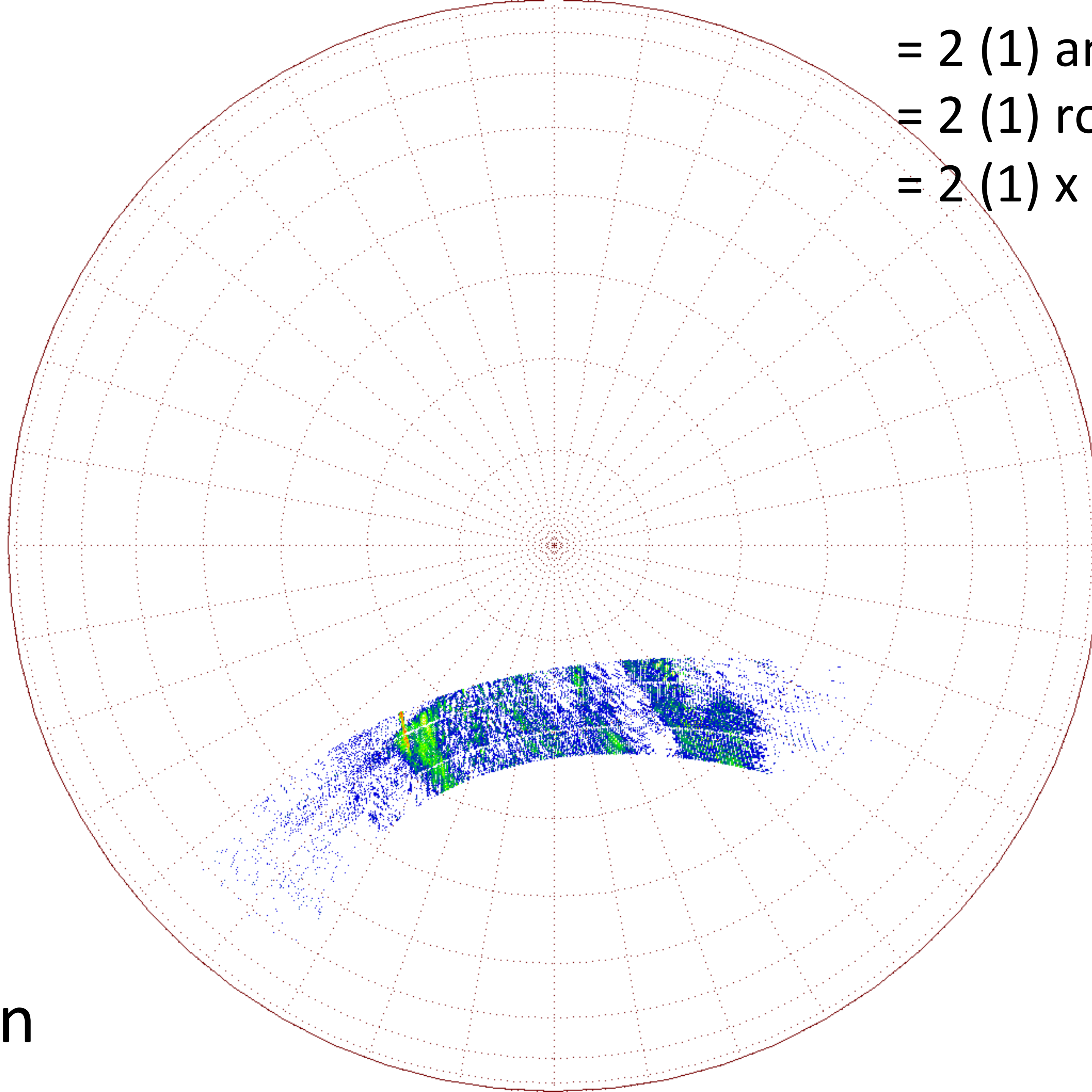
= 7 angles

= 7 rotations

= 7 x 30 sec

D. Grodent ULg

= 2 (1) angles
= 2 (1) rotations
= 2 (1) x 30 sec



4 min

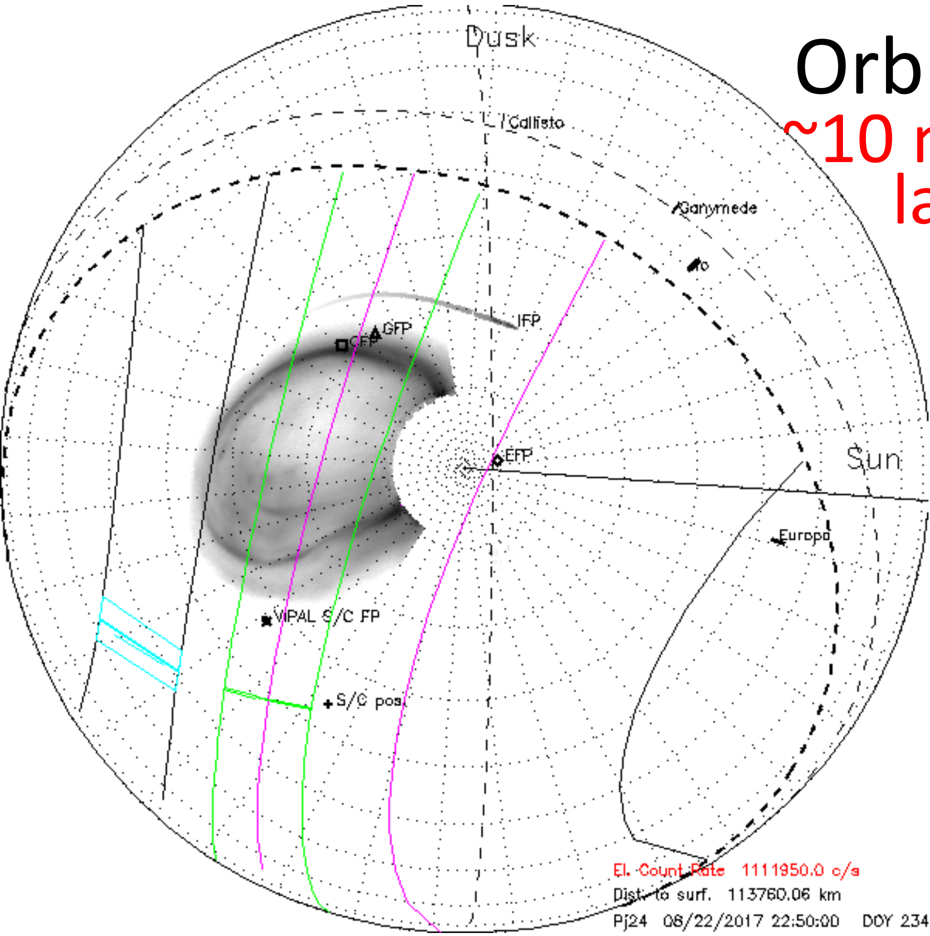
D. Grodent ULg

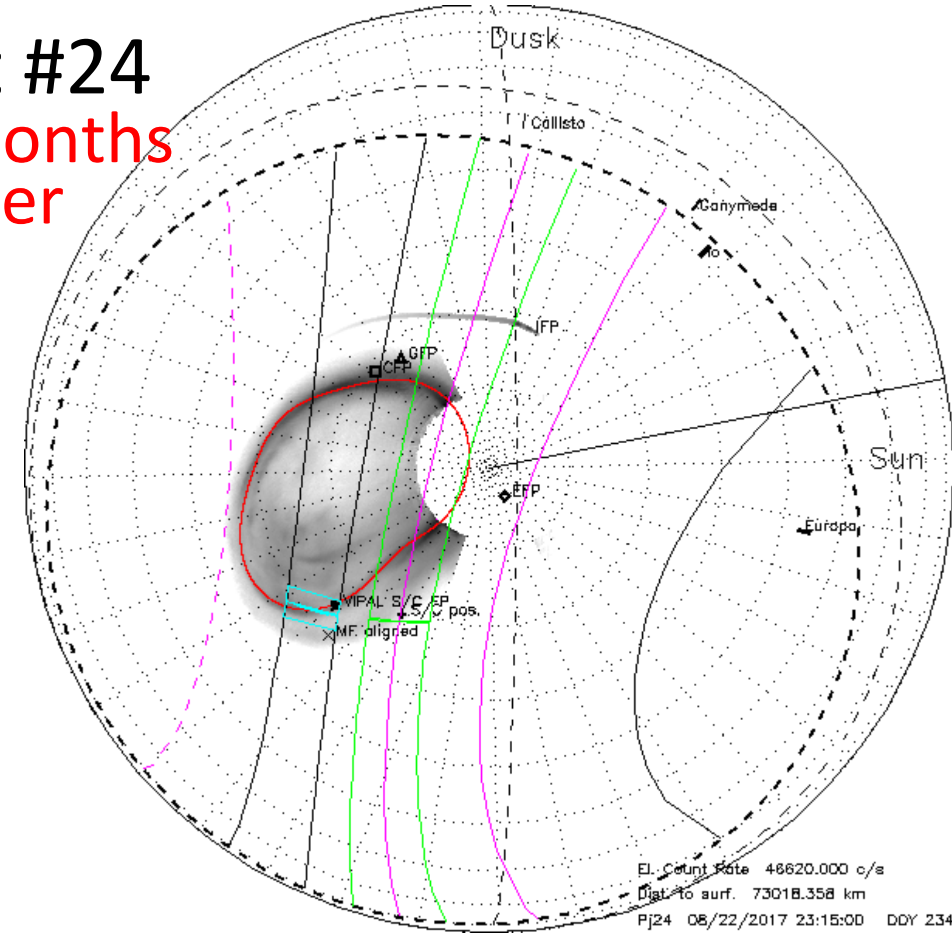
Start: 22 Aug 2017 22:49:53

End: 22 Aug 2017 23:12:48

Orbit #24

~10 months later





Aurora fully in nightside

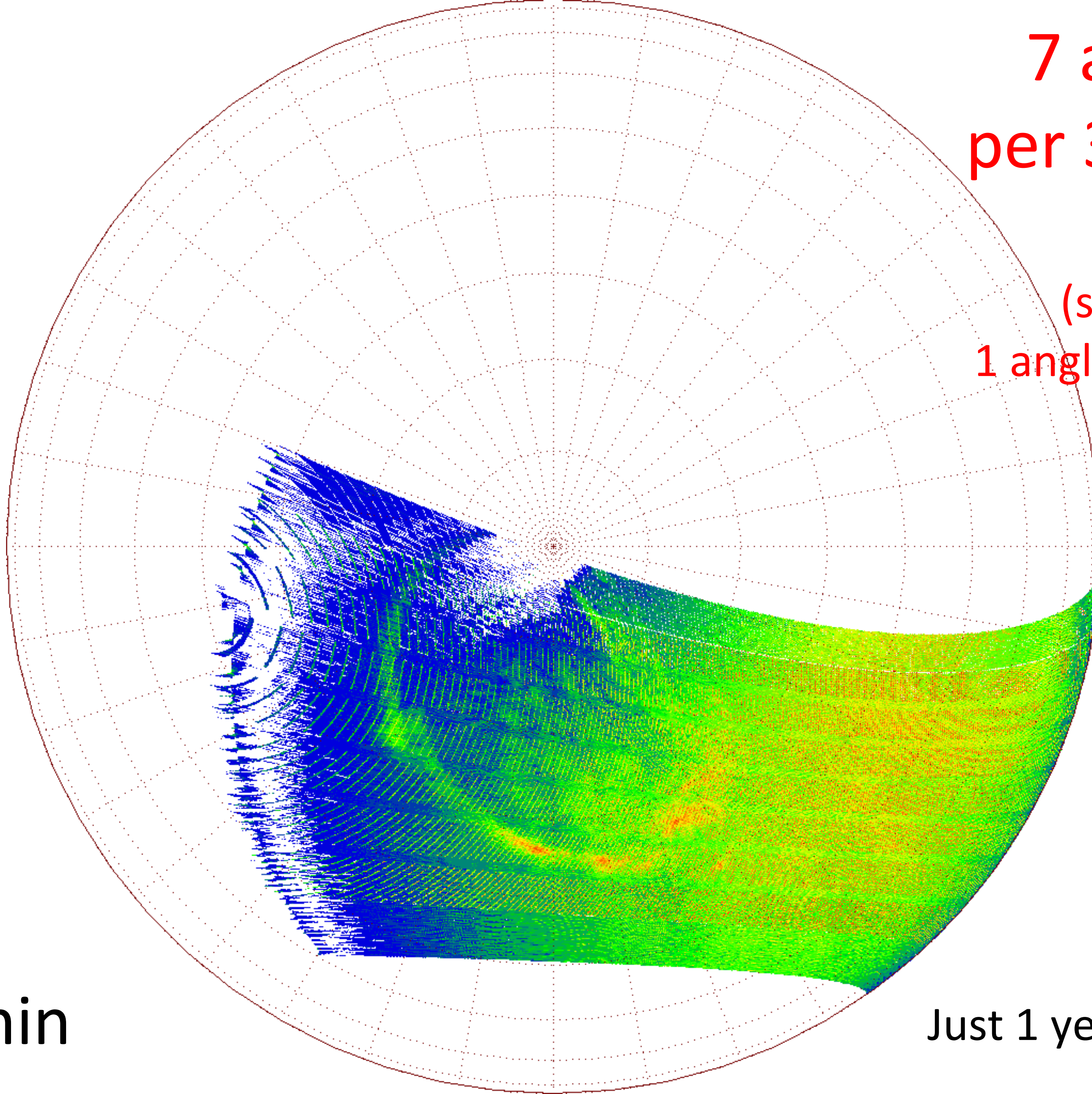
S/C magnetic footprint on main emission

Altitude$_{start}$ = 1.6 R_J

Instantaneous spat. res. ~ 70 km x 397 km / pix^2

Dark count rate ~ 1112 kC/s $\Longrightarrow$ 40 kC/s

D. Grodent ULg



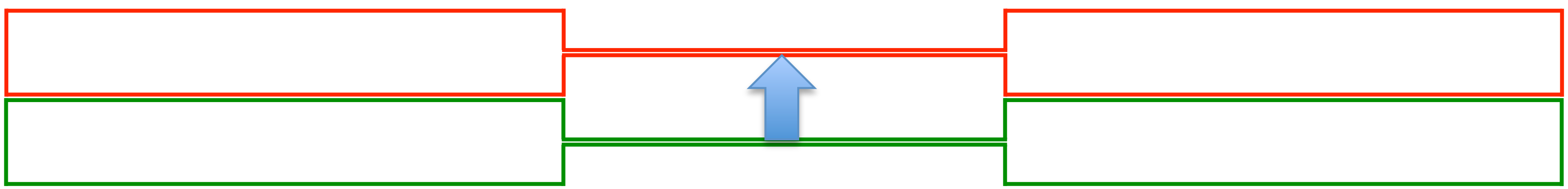
7 angles
per 30 sec
frame
(should be
1 angle/frame)

23 min

Just 1 year to go!

D. Grodent ULg

0.017 s



D. Grodent ULg