Tour of First PAS Measurements

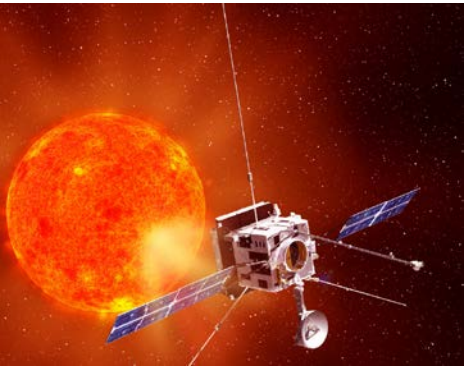
PAS/SWA team

Main points:

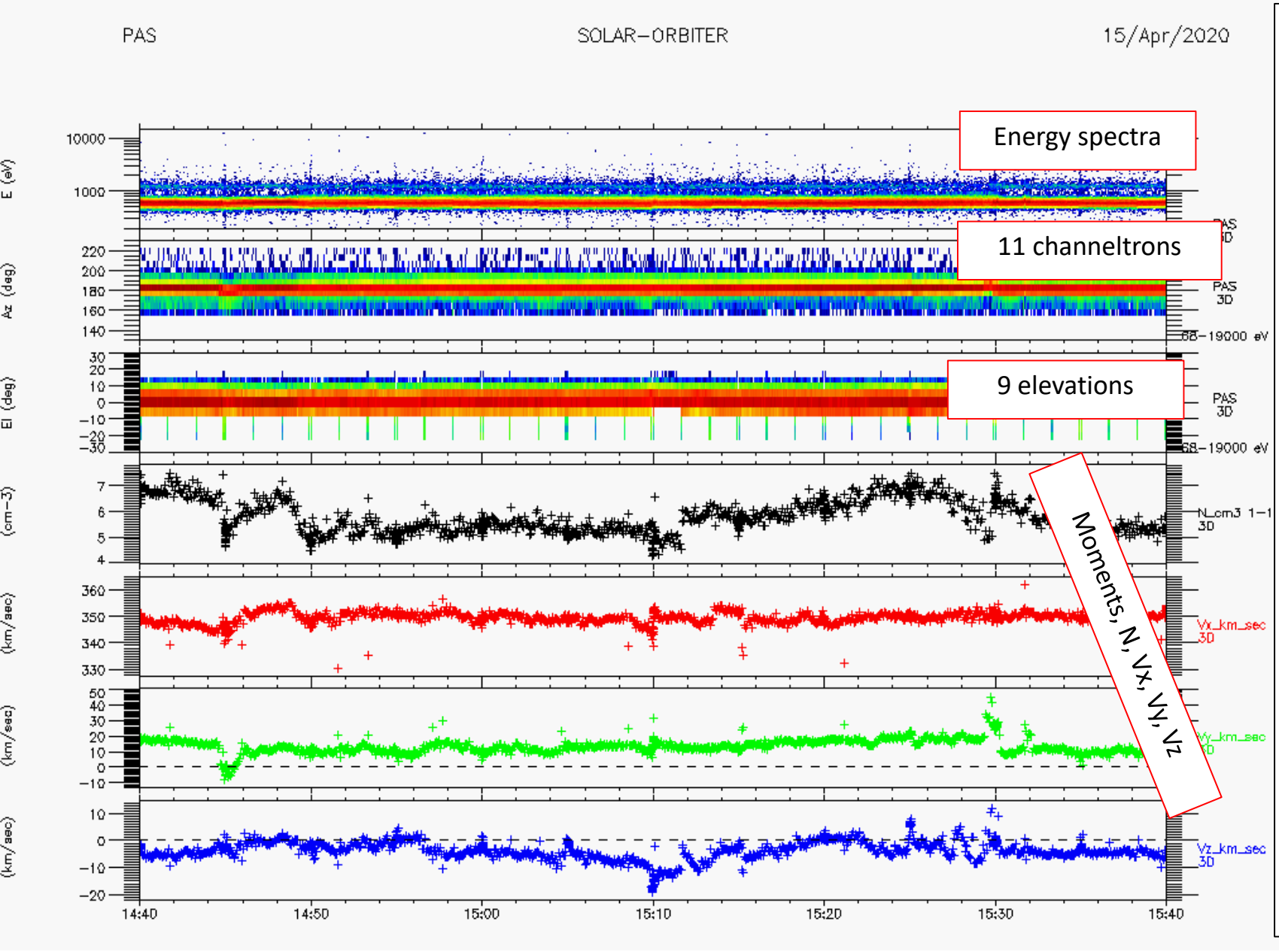
1) PAS appears to be a very nice tool.

2) We perhaps already see 'things' in SW that was not described before.

3) The L0 -> L2 software is (almost) ready. Scientifically meaningful measurements will be timely delivered to the community.



PAS commissioning - April, 14 th and 15 th – First data



First hour of PAS working in nominal scientific mode.

The nominal mode consists in:

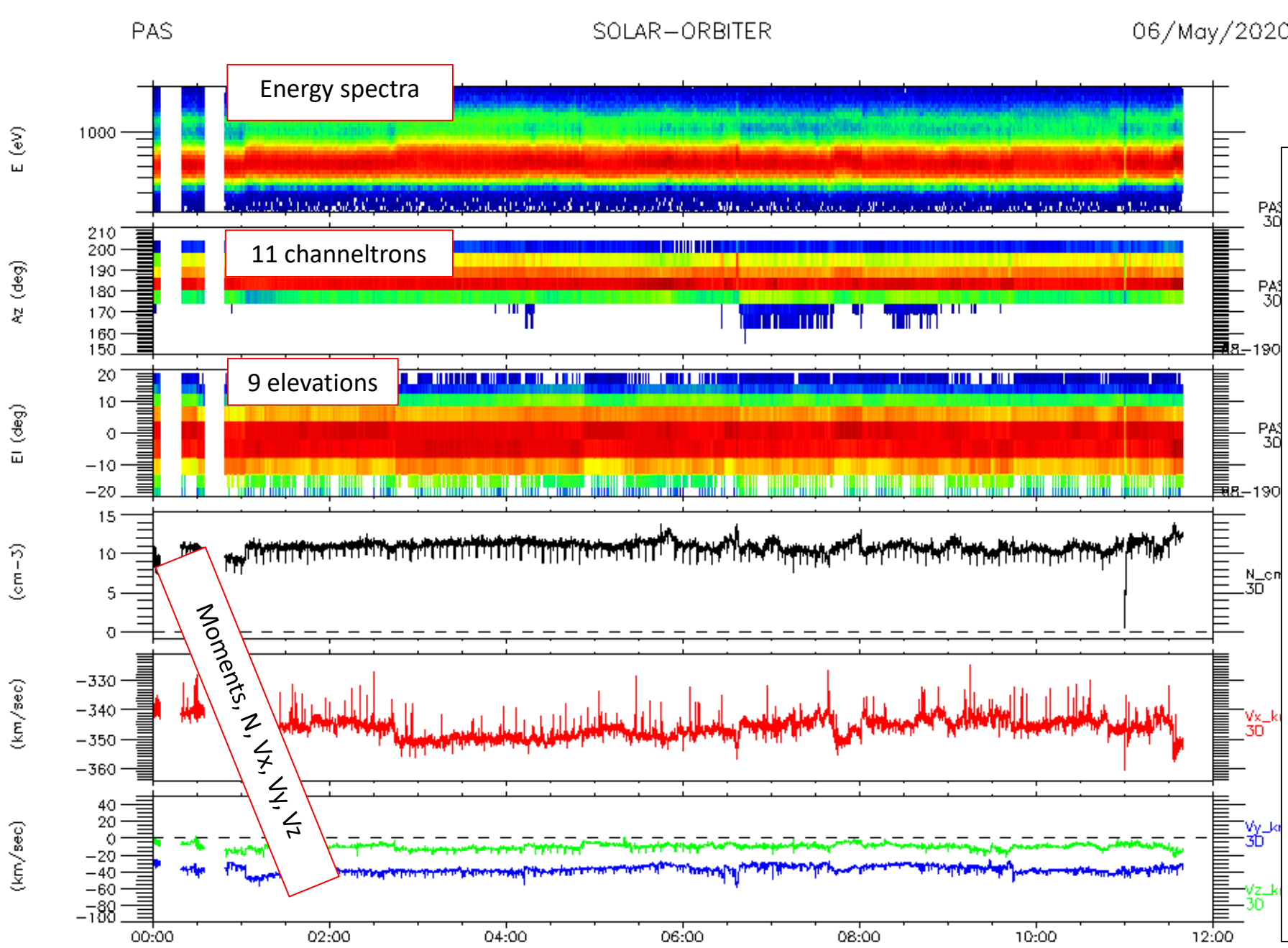
1) Reduced distribution each 4 s
(5 ele. , 11 cha., 48 E)

2) Full 3 D each 100 s for peak tracking
(9 ele. , 11 cha., 96 E)

3) 8 s snapshots each 300 s. Here, we run a fast mode, at 4 Hz cadence.
(3 ele. , 11 cha., 48 E)

Work very well. Counts are those expected.
Ground moments seem very fine.

Some details to tune



12 hours of continuous measurements.

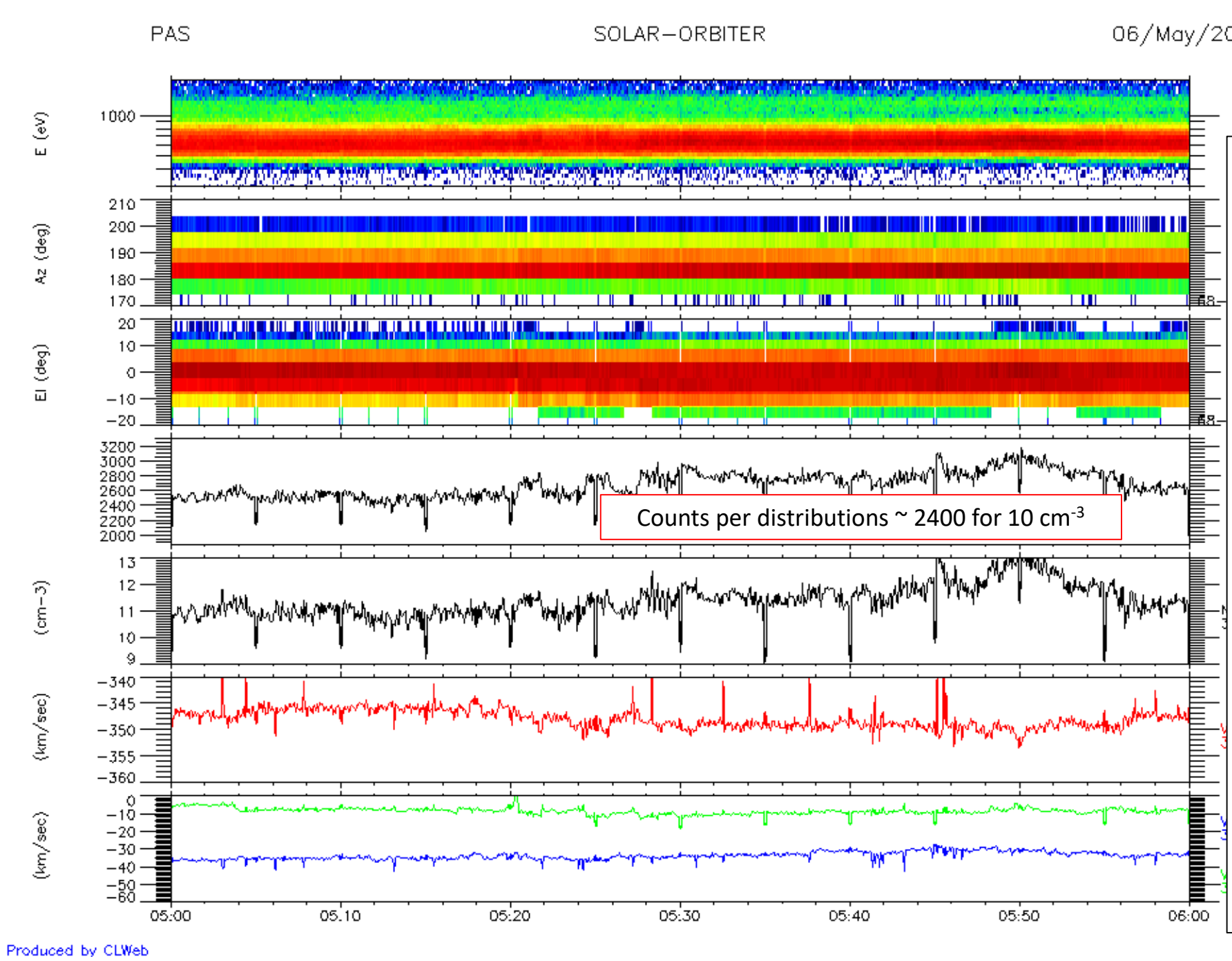
Very close to routine operation.

- Regular spikes in density are linked to the snapshots. *We use (3 ele. , 11 cha., 48 E) and loose part of elevation. (5 ele. , 11 cha., 32 E) will be more adapted.*

- Isolated spikes in velocity are linked to isolated individual counts in phase space. *We start to implement a 'cleaming' procedure.*

What is the statistical accuracy of these measurements ?

Produced by CLWeb



Short note on statistical accuracy.

Density:

2400 counts corresponds to ~ 10 cm^{-3}

Sqrt(N)/N ~ 0.02 **(2%)**

2 σ ~ 100 counts or 0.4 cm^{-3}

Typically, for 2 σ :

5 ± 0.3 cm^{-3}, 10 ± 0.4 cm^{-3}

20 ± 0.56 cm^{-3} , 40 ± 0.8 cm^{-3}

Velocity:

$\delta V/V \sim Sqrt(T/<E>)/Sqrt(N)$ ~ 0.25 %

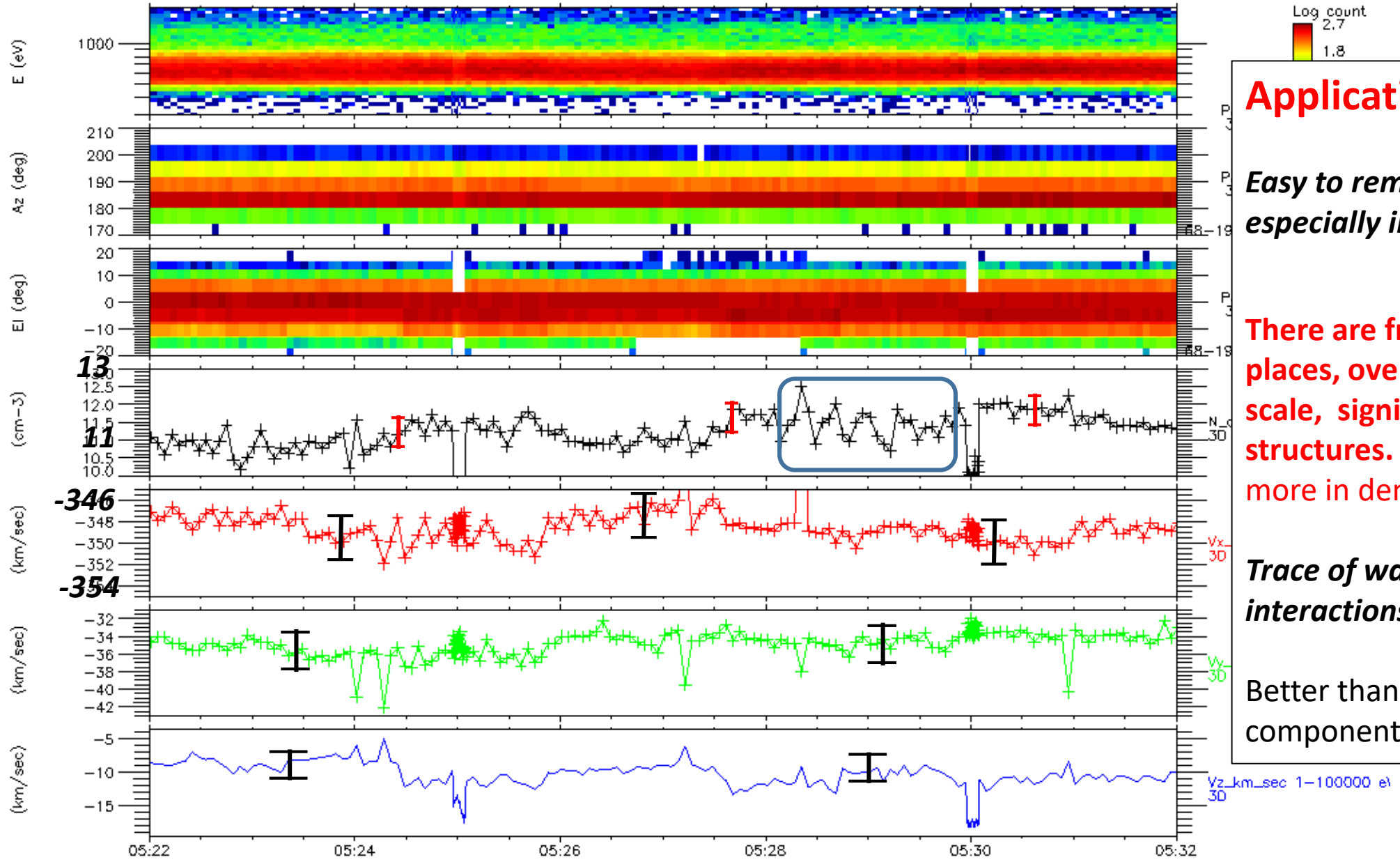
(Moore, 1998, Gersham, 2014)

Typically, for 2 σ : 350 ± 2 km/s

Angular accuracy: ~ 2°

To be refined for each component.

To be done for T (but physical meaning ?)



Applications.

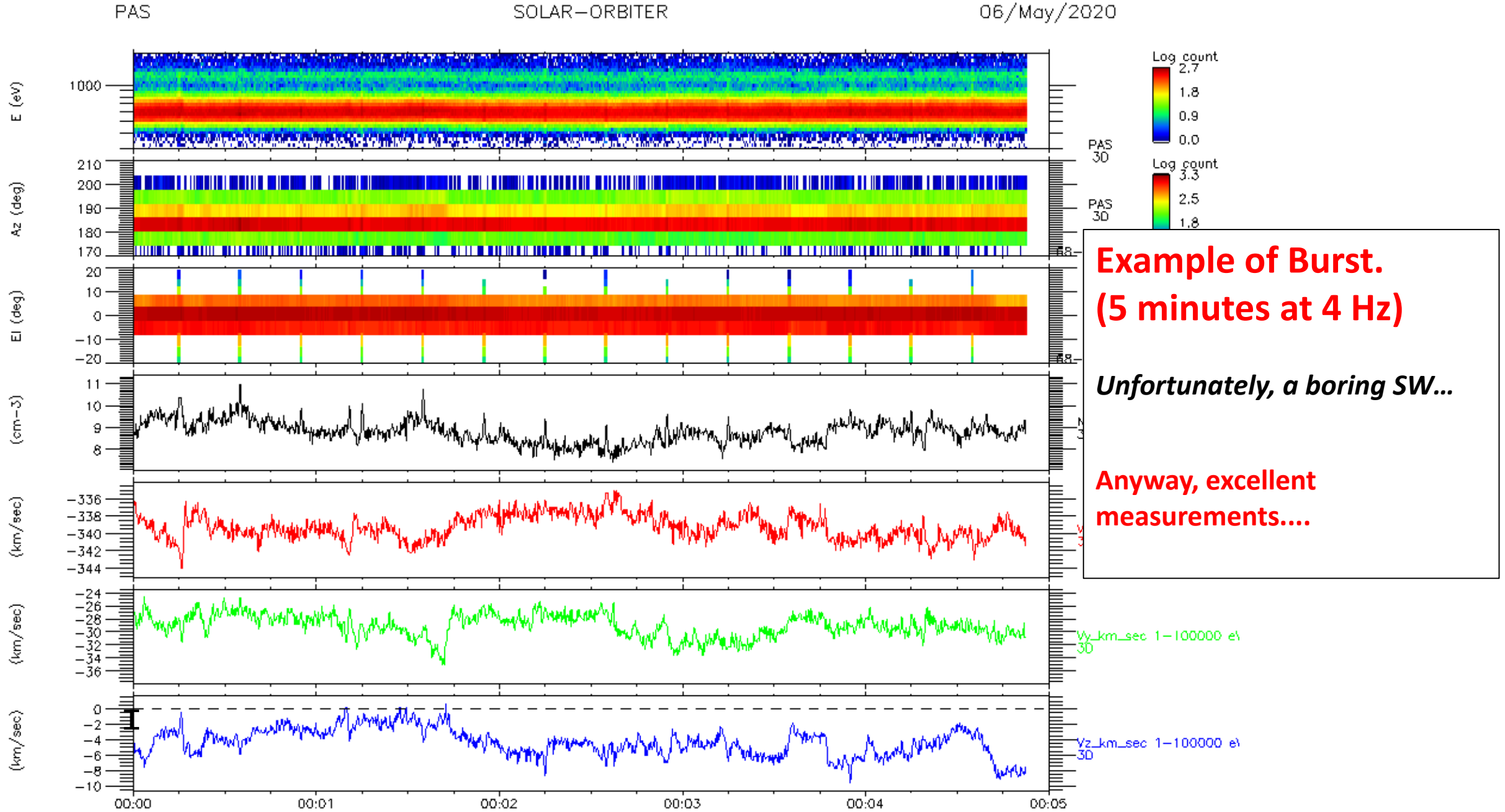
Easy to remove single peaks, especially in Vx,Vy,Vz

There are from places to places, over minute time scale, significant wavy structures. Here, they are more in density**.**

Trace of wave/particle interactions ?

Better than +/- 2 km/s for V-components ?

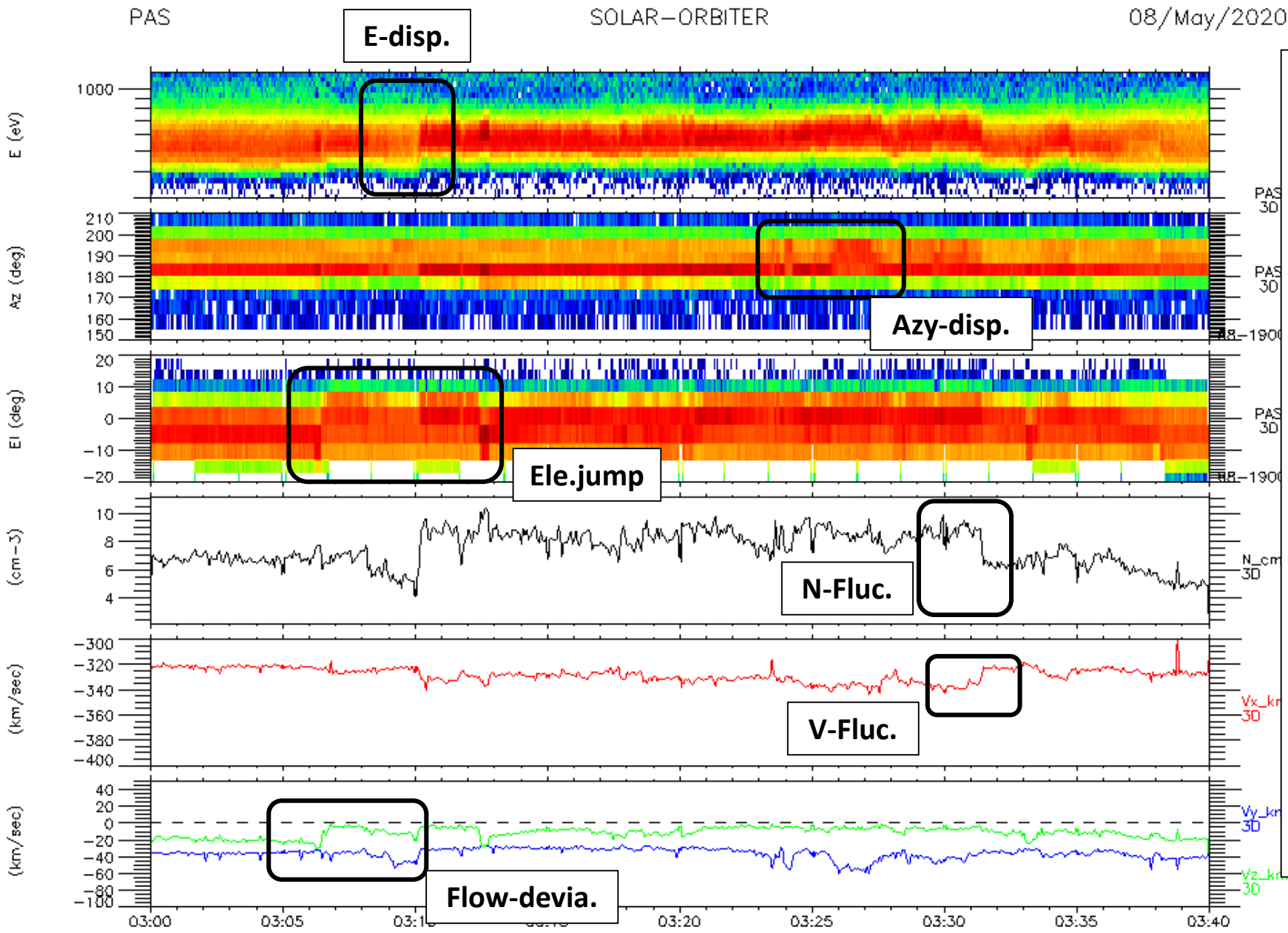
Produced by CLWeb



Example of Burst.
(5 minutes at 4 Hz)

Unfortunately, a boring SW…

Anyway, excellent measurements....

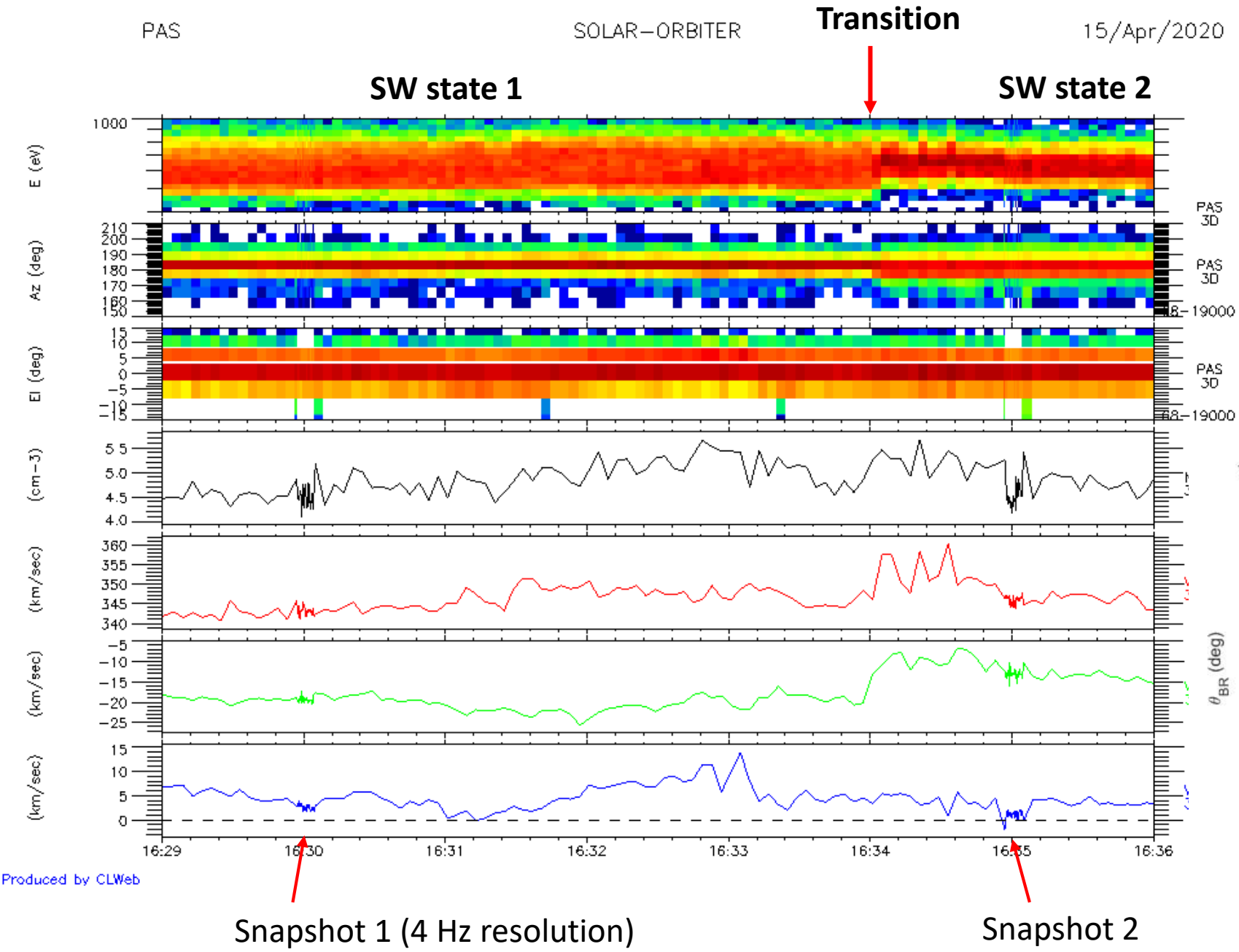


A perturbed SW (08/05)

For time periods of several 10 minutes, fast transitions between different 'forms' of SW.

Jumps in N, V, T and in the fine organization of the phase space distributions

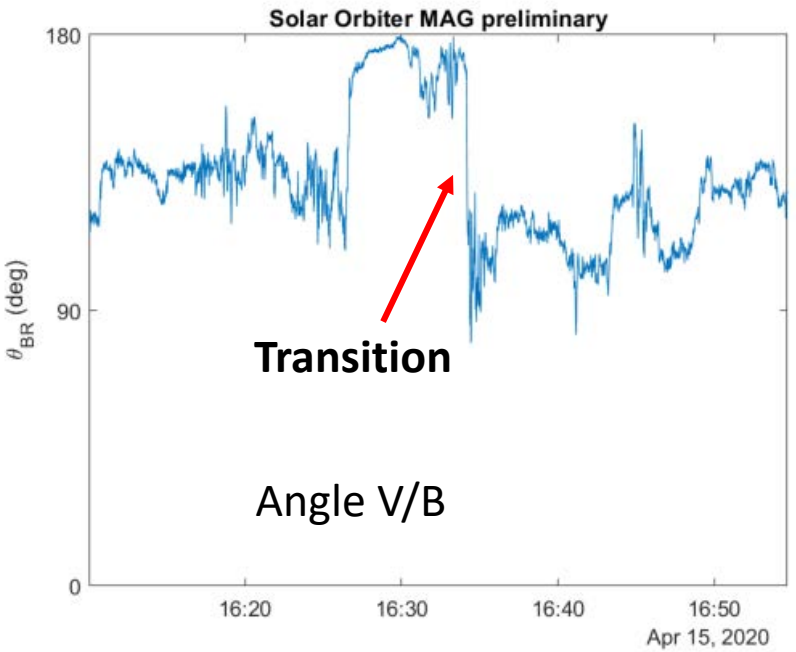
Amazing fine organization of the turbulent SW…

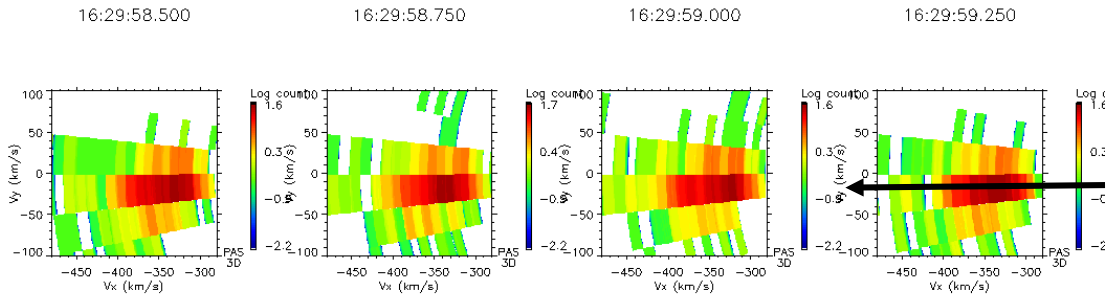


Observation of a SW perturbation. 15/04

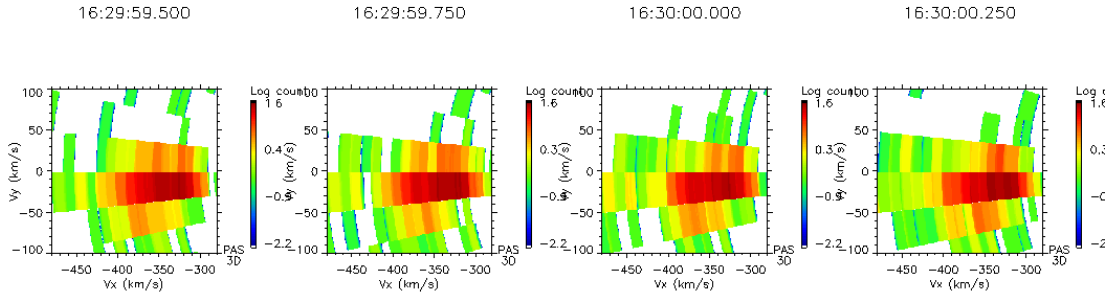
Sudden change of the SW parameters (anisotropy).

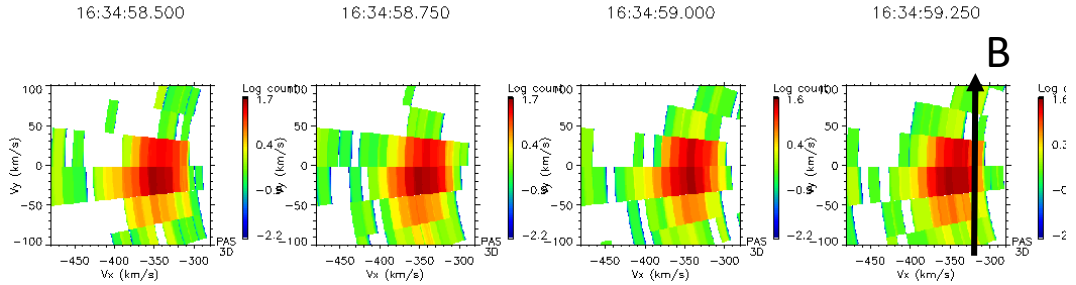
Correspond also to a perturbation seen with MAG





Snaphot 1. Center 16:30 . 4 Hz





Snaphot 2. (5 minutes later) Center 16:35 . Again 4 Hz

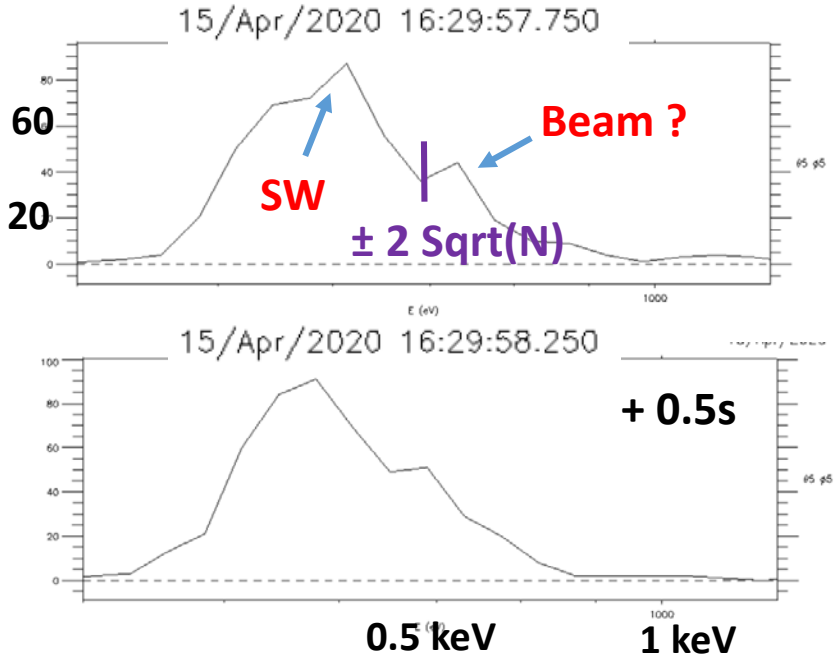
To increase statistics: average over 20 distributions (almost the whole snapshot).

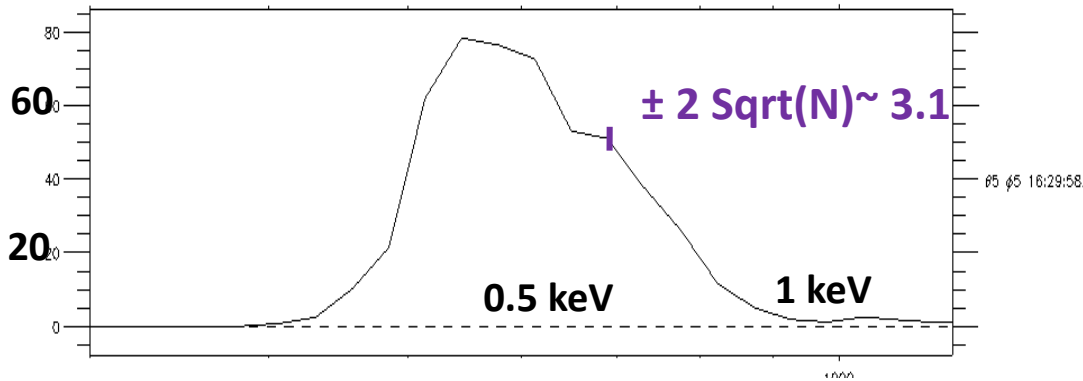
Produced by CLWeb

Same n, same V but a different solar wind.

Possible fast evolution of beam… (1s time scale)

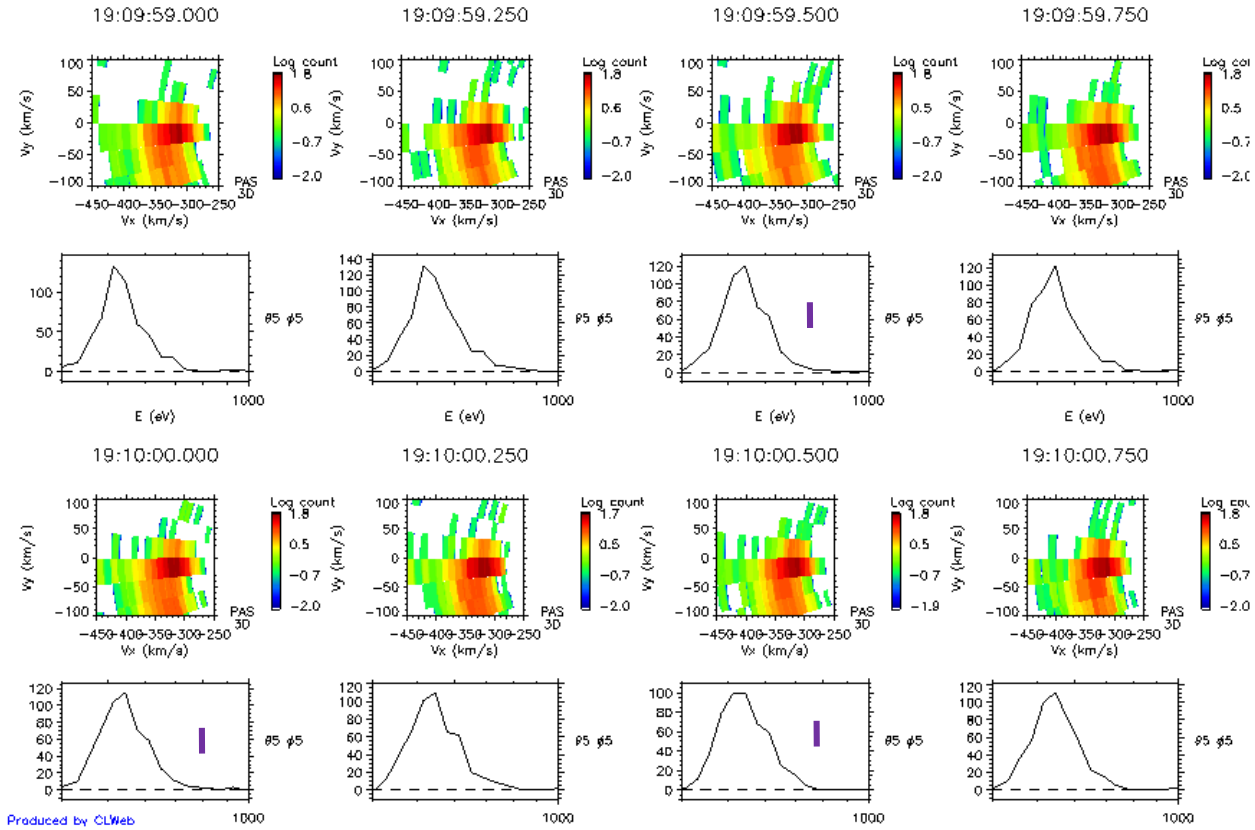
Is there really a beam ?





More than 1000 counts to define the beam.
When normalized, 2 **σ** ~ 3.1

The beam is real but difficult to follow its dynamics…



Secondary beam at 600 eV ?

Marginal at 2 sigma for single spectrum

Beam existence should be confirmed by summation.

Try 1 elevations ?

Better statistical tools (gaussian average)

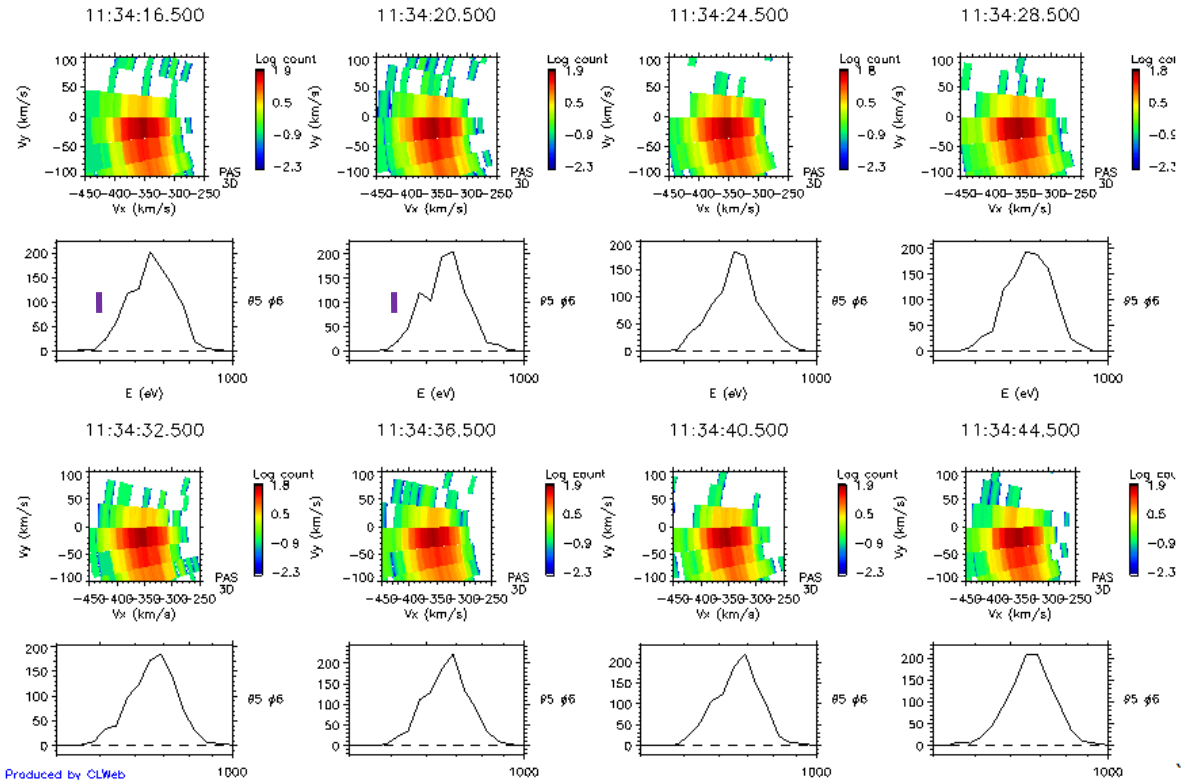
Things will better closer to Sun.

Example of marginally significant fluctuations.

Secondary beam dynamics

(Thanks to Tristan Hoellinger)

Secondary beam at 500 eV ?



New observations (?)

‘Double’ SW (08/05)

Observation of 2 peaks of equivalent density.

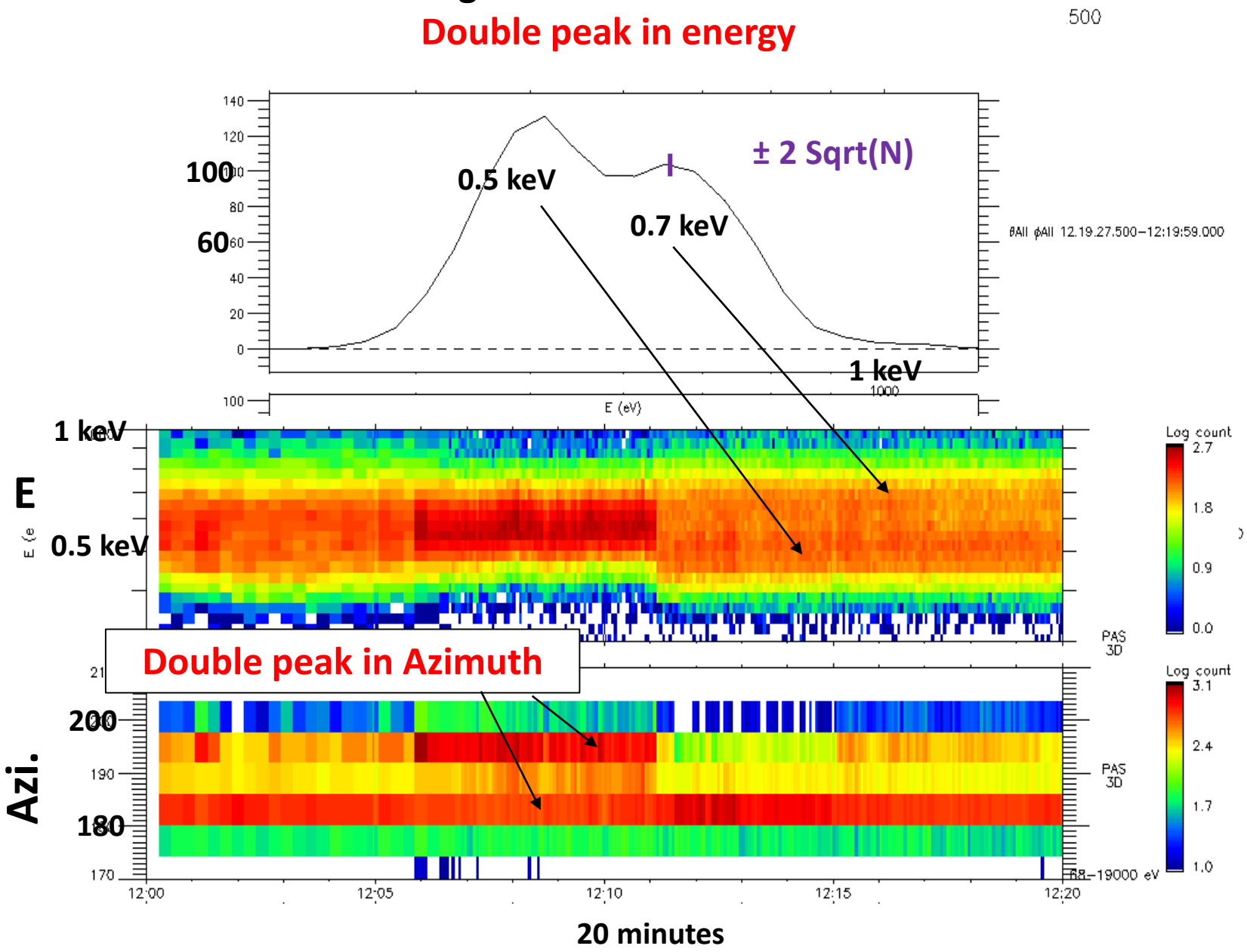
First separated in azimuth (12-15°) then in energy (200 eV).

Very sharp transition (~4 s)

What does it mean at kinetic scales ?

Average over 15 distributions

Double peak in energy



CONCLUSION

PAS works very well !

Minor defaults that are easy to correct.
'Ghosts' due to azimuthal asymmetry (come from an obligation of the design…).

Scientific performances are at 'rendezvous'.

When density > 8-10 cm^{-3} (typically, 150 counts on central peak**) and some adaptations (sum on a few distributions) , the statistics is sufficient for the study of kinetic processes (beams dynamics) at subsecond resolution.**

With PAS, a new chapter on SW dynamics, at kinetic scales…

Thanks to all the team and especially to Andrei