

FAST - data taking

Data taking and DAQ software

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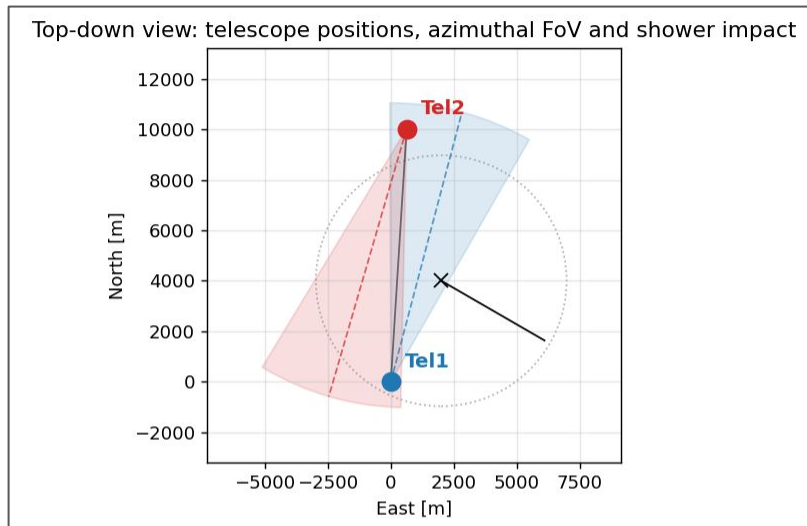
Data taken with external trigger from LL bay4 and the old and new electronics of FAST 1.

Data also taken only with new electronics and FAST internal trigger.

Data have been taken also with FAST 4 (in-field telescope) only, because the shutter at FAST 3 still does not work.

A small FoV coverage for FAST 1 and FAST 4 is expected.

Data analysis ongoing, but based on the first test the additional features were implemented into the FAST internal trigger as well as in the FAST DAQ software.



Data taking and DAQ software

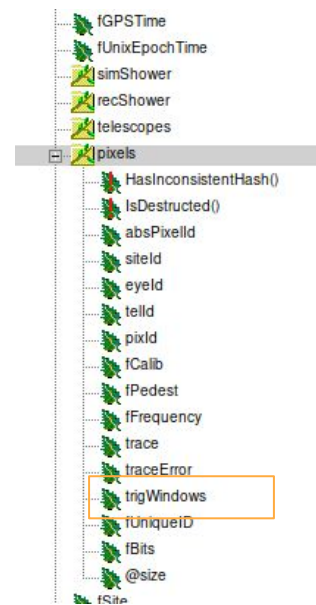
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=== SUMMARY ===
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```
Events: 126
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```
Duration: 103.978 s
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Avg rate: 1.2118 Hz
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```
=== TRIGGER WINDOW STATISTICS ===
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Channel	16	32	64	128	256	512		
CH0	0 (0.0%)		0 (0.0%)		0 (0.0%)		0 (0.0%)	0 (0.0%)
CH1	0 (0.0%)		0 (0.0%)		0 (0.0%)		0 (0.0%)	0 (0.0%)
CH2	0 (0.0%)		0 (0.0%)		0 (0.0%)		0 (0.0%)	0 (0.0%)
CH3	0 (0.0%)		0 (0.0%)		0 (0.0%)		0 (0.0%)	0 (0.0%)
CH4	35 (27.8%)		0 (0.0%)		0 (0.0%)		0 (0.0%)	0 (0.0%)
CH5	31 (24.6%)		0 (0.0%)		0 (0.0%)		0 (0.0%)	0 (0.0%)
CH6	37 (29.4%)		0 (0.0%)		0 (0.0%)		0 (0.0%)	0 (0.0%)
CH7	24 (19.0%)		1 (0.8%)		0 (0.0%)		0 (0.0%)	0 (0.0%)

Photo-electron calculation

Photo-electron calculation

We need some first guess on the transformation from PMT counts to number of photo-electrons

- need to know electronics, PMT gain-HV curve, something else?

I tried to estimate it based on the similar calculation like for FAST@TA a FAST@LL.

- expecting the same gain for all the PMTs
- FAST 1 - factor of 5
- checked on data comparison
- FAST 3,4 - just estimation without any checking on data

$$R = \frac{3}{A} = \frac{\overset{50}{\text{gain}} \cdot \overset{50}{\text{ATPL}} \cdot 2 \cdot 16384 \cdot 50}{2V \cdot 20ns} = \underline{8.2} \quad \text{OLD GUESS.}$$

$$g_1 = \frac{2 \cdot 10^4 \cdot \overset{500}{\text{ATPL}} \cdot 2 \cdot \overset{2^{12}}{6036} \cdot 50}{\boxed{1V} \cdot 20ns} = \underline{16.4} \quad \text{NOW GUESS. (fast-on-field)}$$

5.50	
2	
2.500	
1	

- 9 kV $\rightarrow$ 0.5V

DAQ (NEW) (FAST 1)

$$g_1 = \frac{\text{gain} \cdot 50 \cdot 2 \cdot 2^{14} \cdot 50}{2V \cdot 20ns} = \text{gain} \cdot 1.6408286 \cdot 10^{-4}$$

DAQ Coarse

$$g_2 = \frac{\text{gain} \cdot 500 \cdot 2 \cdot 2^{12} \cdot 50}{1V \cdot 20ns} = \text{gain} \cdot 8.2031479 \cdot 10^{-4}$$

$g_2^h = 5 g_1$

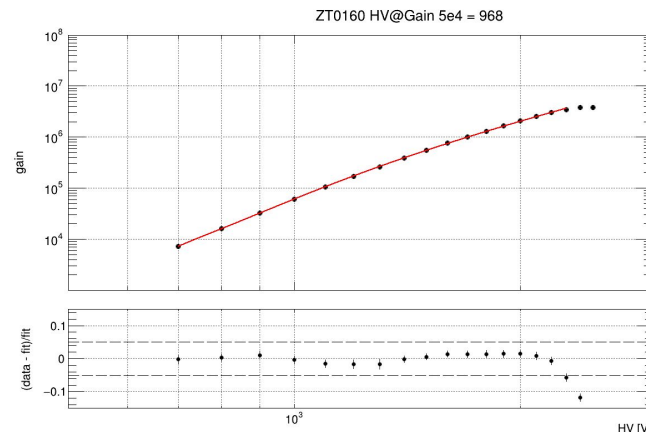
Photo-electron calculation

Next steps

- to check the formula
- to prepare conversion from PMT HV to its gain
- expectation of different correction factors

Example

- for older PMT from FAST1@LL



Event coincidences

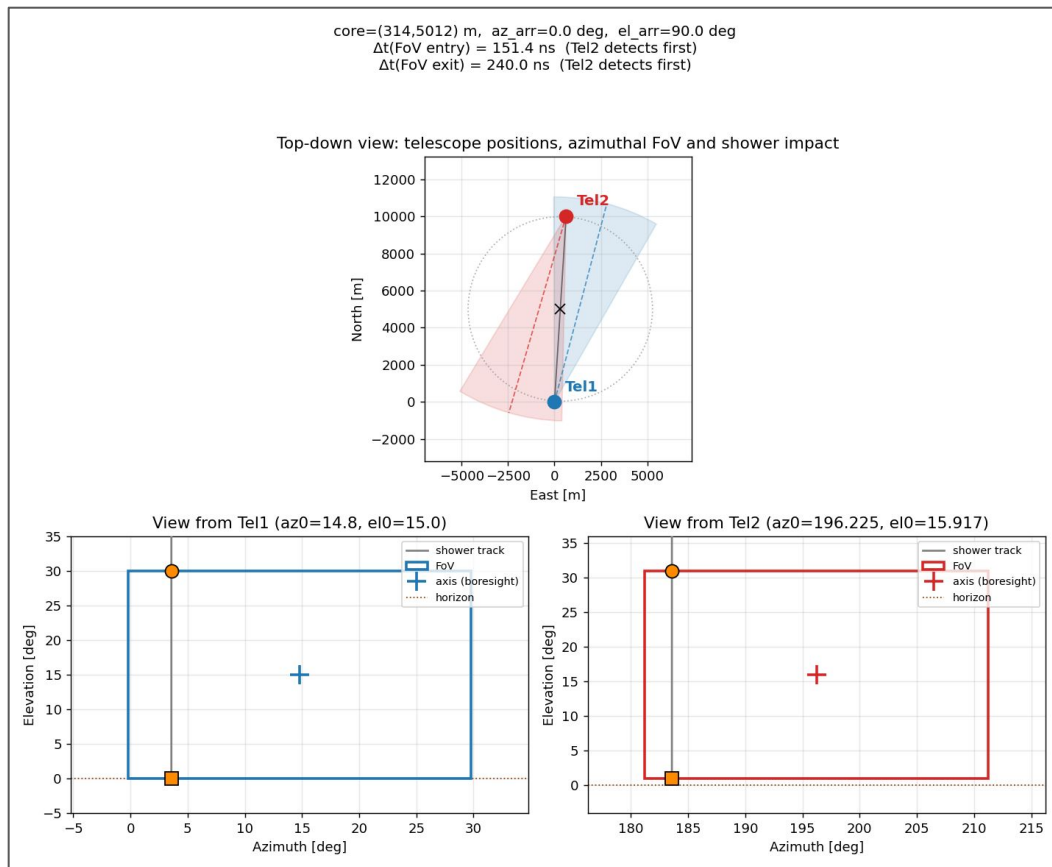
Event coincidences - based on timestamp

What time difference between telescopes detection could we expect?

- telescope distance
- telescope FoV
- shower geometry
- time difference as a first preselection

Example

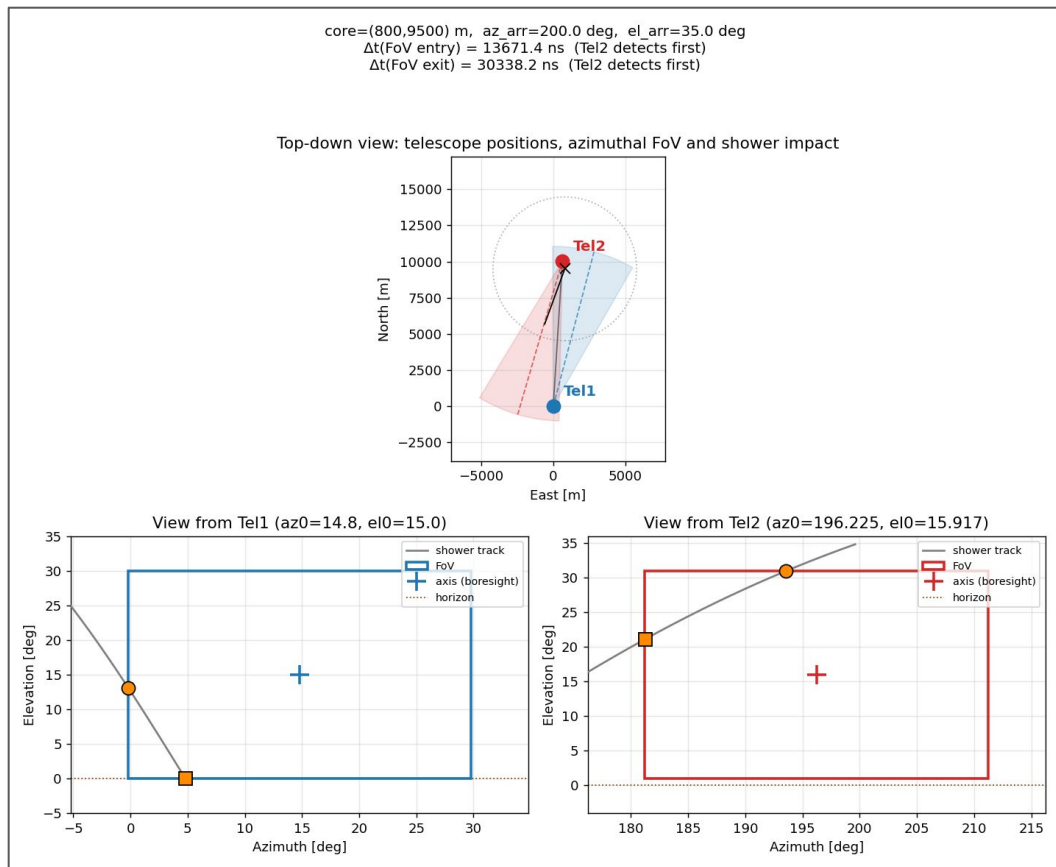
- shower in the middle



Event coincidences - based on timestamp

Example

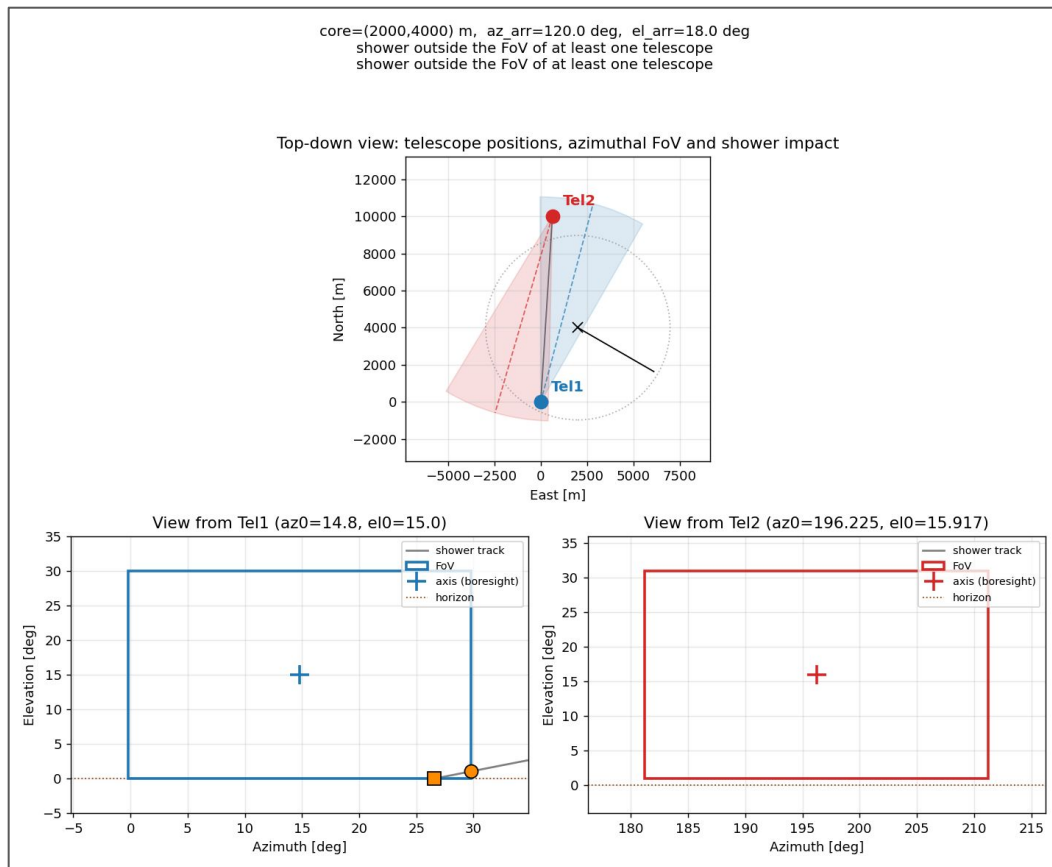
- shower behind Tel2
- shower distance to Tel1 closed to maximum
- FoV entry detection time difference $\sim 14 \mu\text{s}$



Event coincidences - based on timestamp

Example

- to test the shower outside at least of one telescope FoV

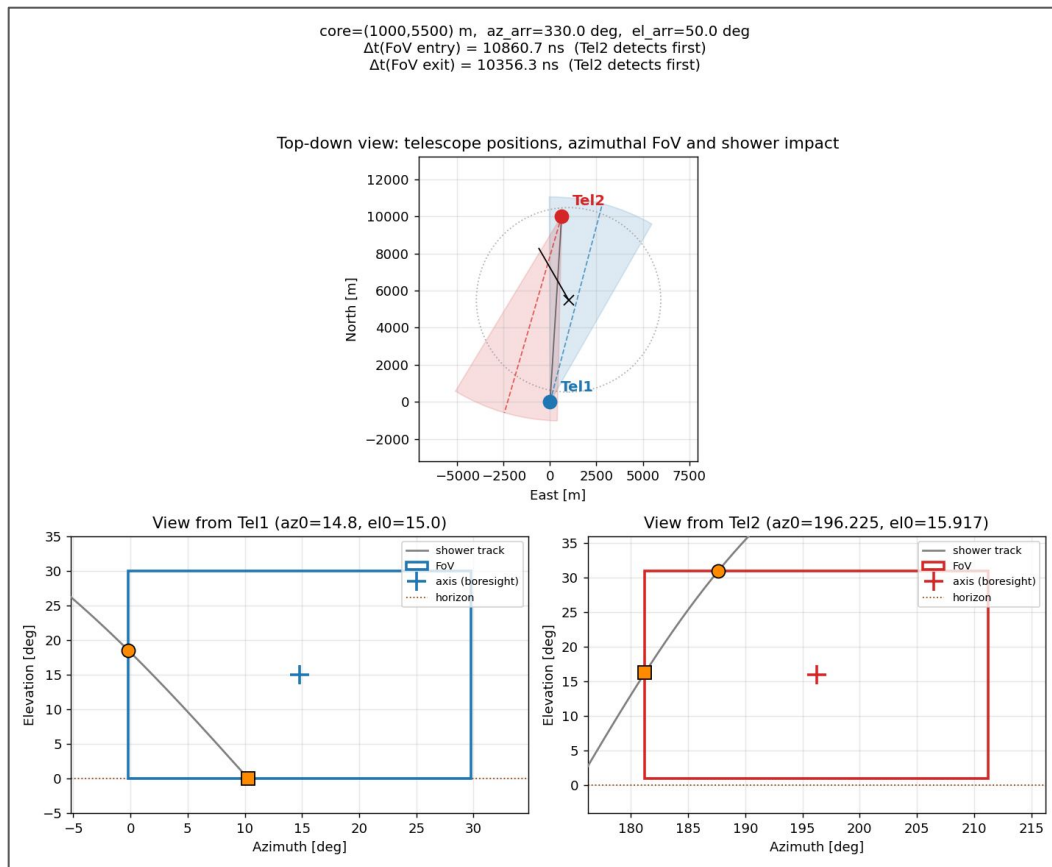


Event coincidences - based on timestamp

Example

- shower direction is very important in time difference estimation

More advanced analysis is planned covering FoV of “full” fast-in-field array (4 telescopes)



Summary

Data taking

- testing the new version of the software in the next night-shift period

Event coincidences

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