The status of the TALE surface detector array and TALE infill project

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ABSTRACT

Routine hybrid observations of the surface detectors (SD) in conjunction with the fluorescence detectors (FD) of the Telescope Array Low-energy Extension (TALE) began in November 2018. In this presentation, we will describe the simulation studies of detector aperture and resolution of the TALE SD, and report on the latest observation results other than the energy spectrum. We are also in the process of expanding the experiment by 50 SDs, with even smaller nearest-neighbor spacing, in order lower the energy threshold to match that of the Cherenkov-dominated events seen by the FD. Details of the upgrade and expected performance of this new extension will be discussed.

TA Low energy Extension (TALE) experiment

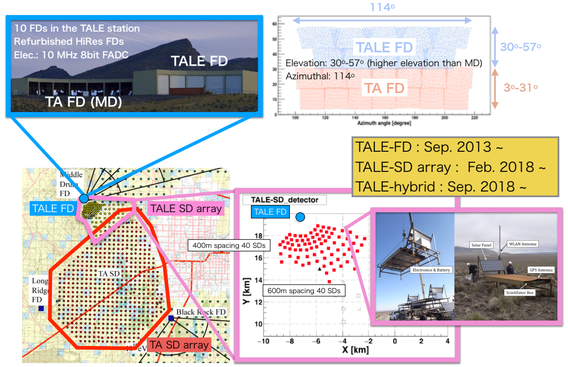
Transition of GCRs <=> EGCRs @ 2nd knee (?)

Target of TALE

(1) Studies of spectrum and composition
<= Hybrid observation with FDs plus SDs

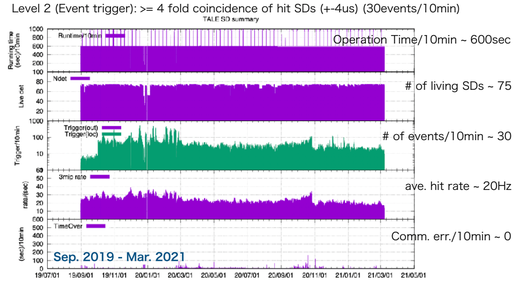
(2) Anisotropy study @ 2nd knee region
<= Uniform + high statistics with SD array

TALE hybrid



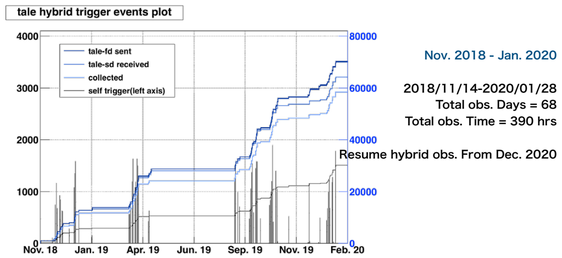
TALE SD array operation status

80 SDs covering about 20 km²
Routine operation from Sep. 2019
Triggering condition:
Level 0 (waveform recording): > 0.3 MIP (750Hz/SD)
Level 1 (SD hit): >3 MIPs (20Hz/SD)
Level 2 (Event trigger): >= 4 fold coincidence of hit SDs (+-4us) (30events/10min)



TALE hybrid operation status

80 SDs covering about 20 km²
Routine operation from Oct. 2018
Triggering condition:
SDs of > 0.3 MIPs within +- 32us of TALE FD trigger

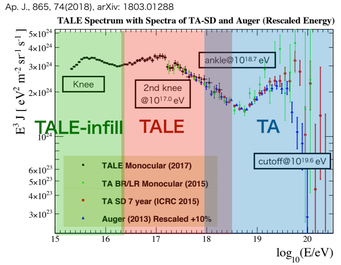


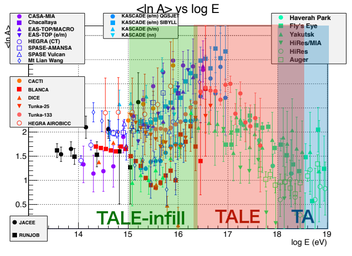
TALE-infill SD array

Extend FD+SD sensitivity down to "knee"

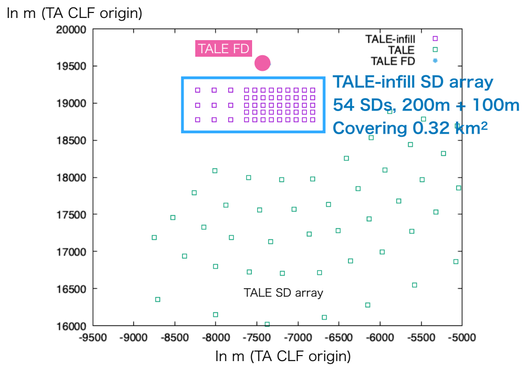
- Awarded a budget in 2019.
- 54 SDs with 100m/200m spacing
- Plan: installed in early 2022

Ap. J., 865, 74(2018), arXiv: 1803.01288

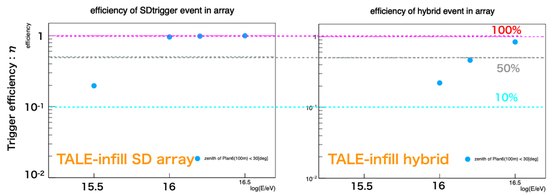




Extension of TALE: TALE-infill



Triggering efficiency of TALE-infill hybrid



5% efficiency energy ~ mode energy :
TALE-infill SD array : logE ~ 15.3
TALE-infill hybrid : logE ~ 15.8

Resolutions of TALE-infill hybrid