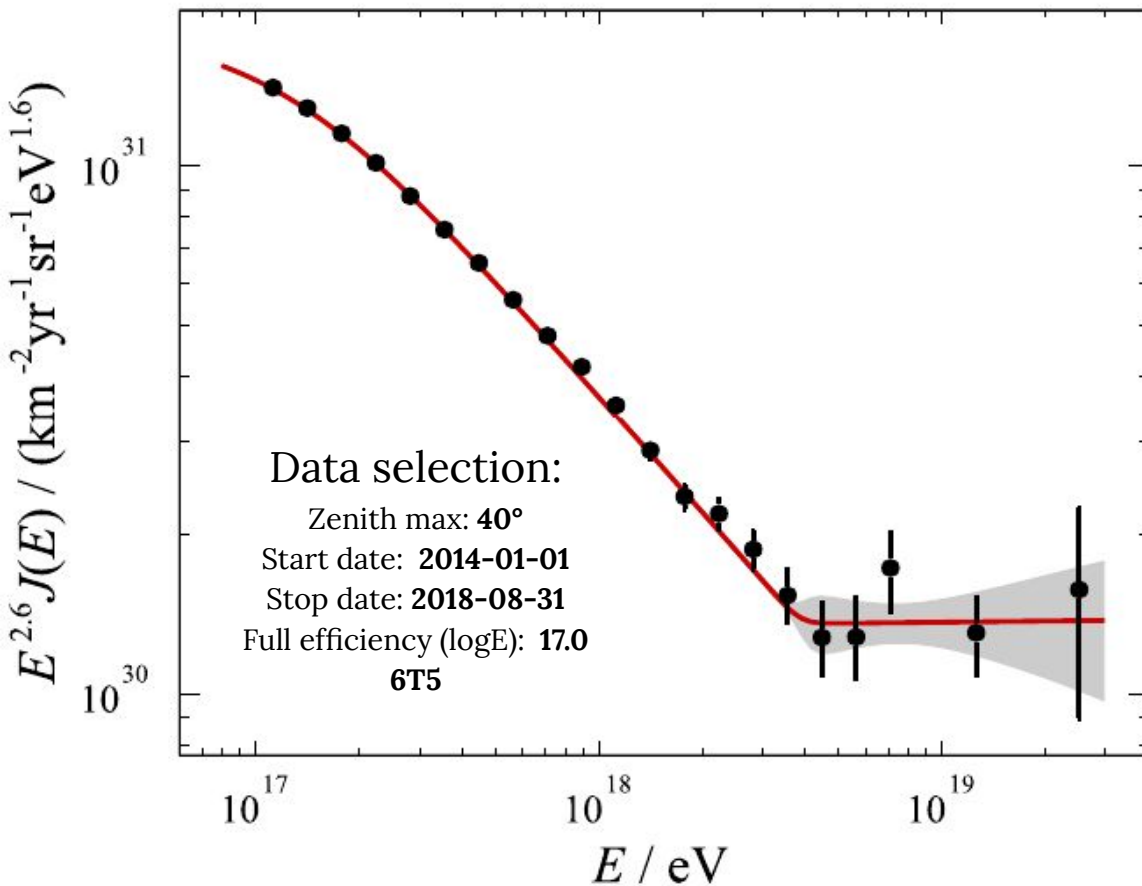
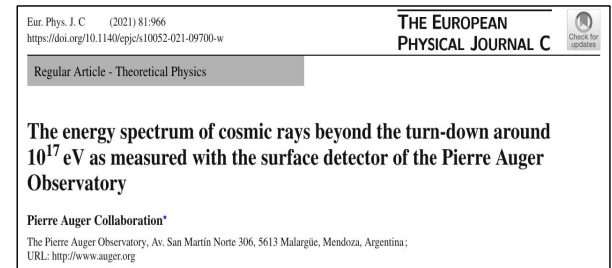


SD-750 Phase I: Effects of new triggers in the vertical energy spectrum

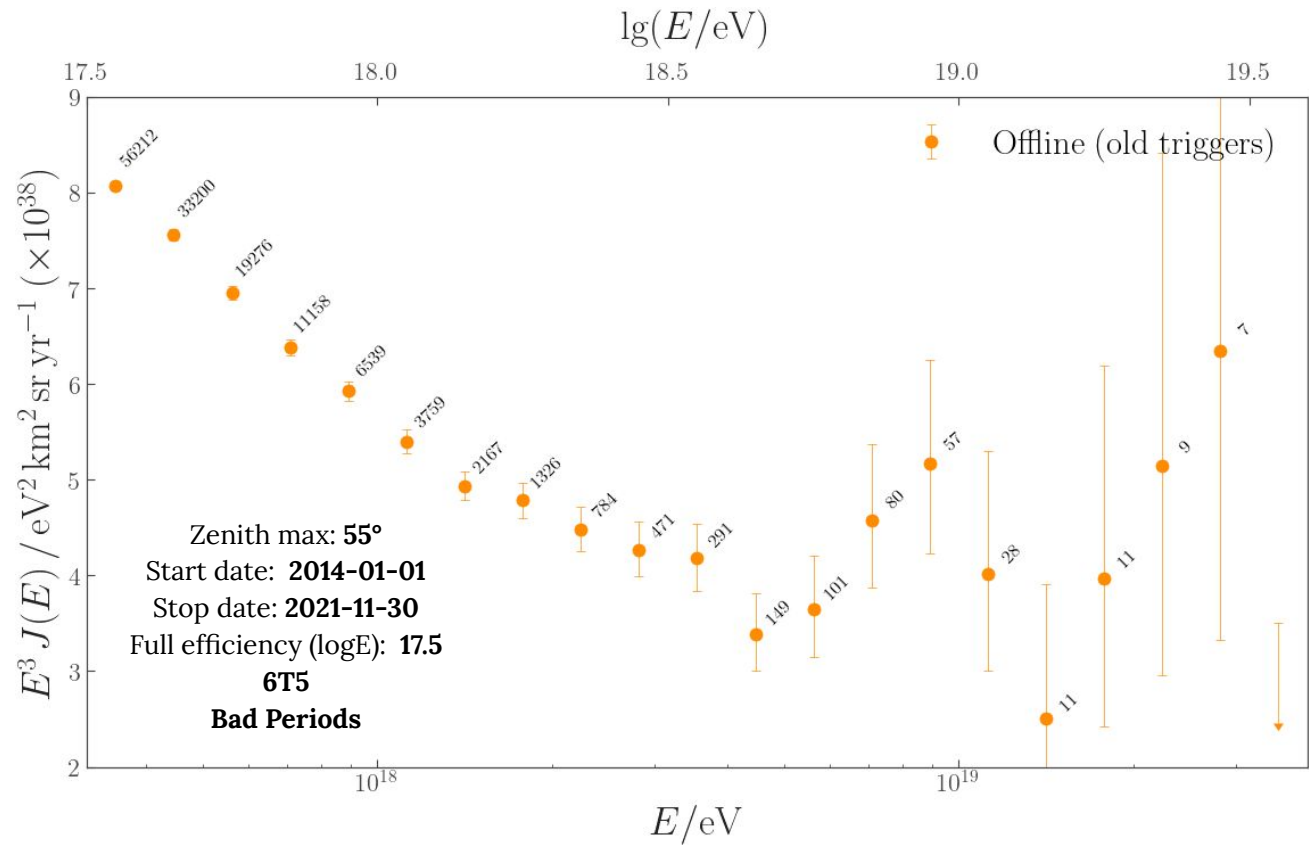


Last official spectrum:
 (EPJC 2021)
 Herald production
New triggers implemented



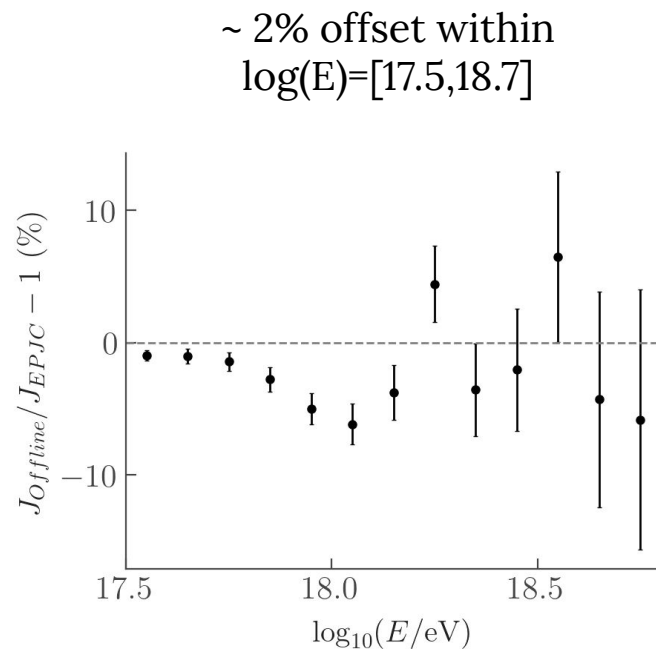
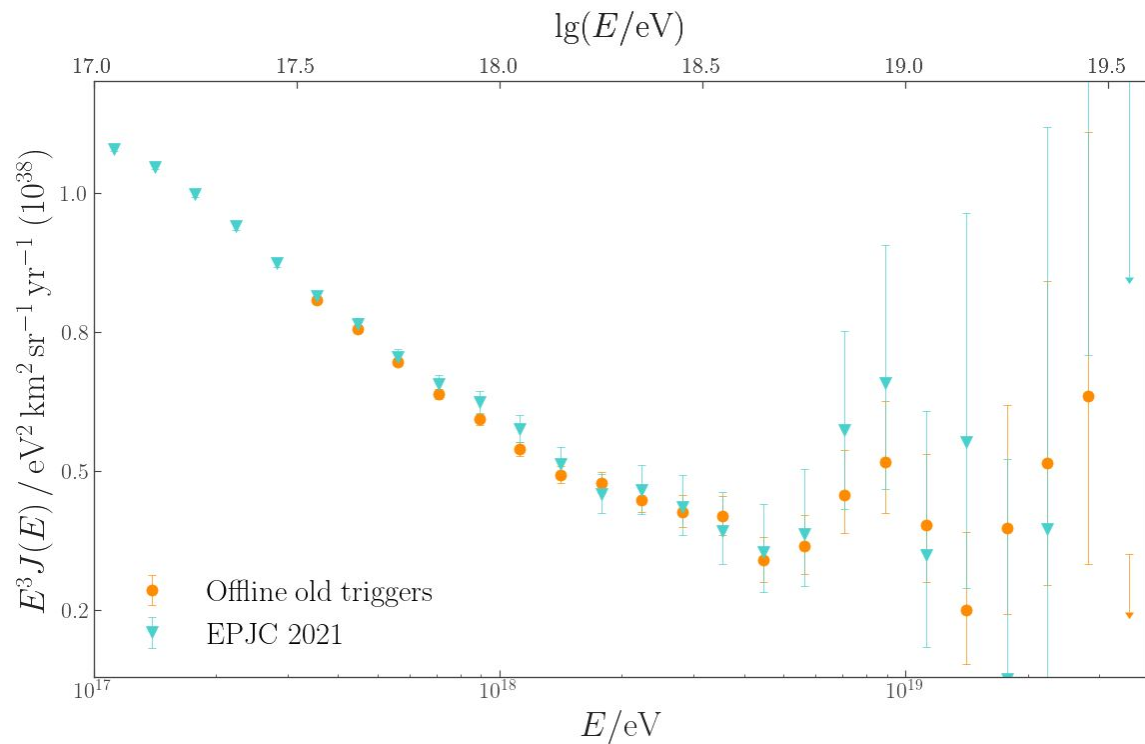
<https://doi.org/10.1140/epjc/s10052-021-09700-w>

Status of the current official production: *Observer icrc-2025 test 7*



Offline
Reconstruction with
new triggers **OFF**

Comparison Infill vertical raw spectrum



Enabling new triggers

Reconstruction
with new triggers
ON

Run in ITeDA servers

SdEventSelector_Infill.xml



```
<!-- Set stations with TOTd-only trigger to silent? -->  
<SilenceTOTdStations> 0 </SilenceTOTdStations>  
<!-- Set stations with MOPs-only trigger to silent? -->  
<SilenceMoPSSStations> 0 </SilenceMoPSSStations>
```

Two datasets
Observer
icrc-2025



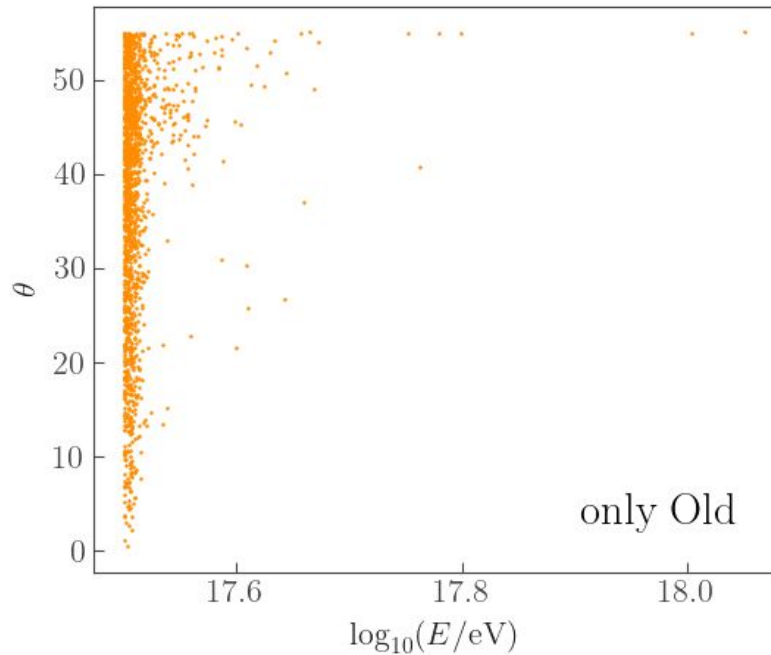
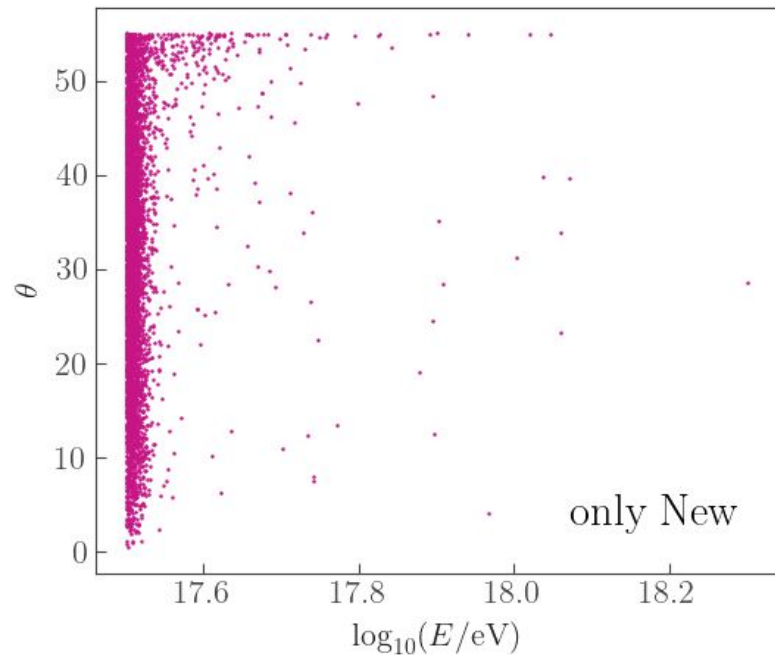
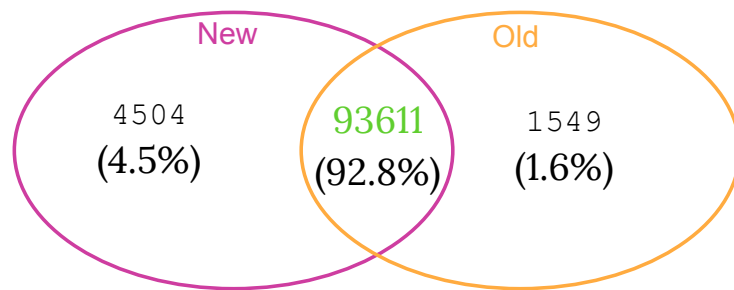
**old & new
triggers**



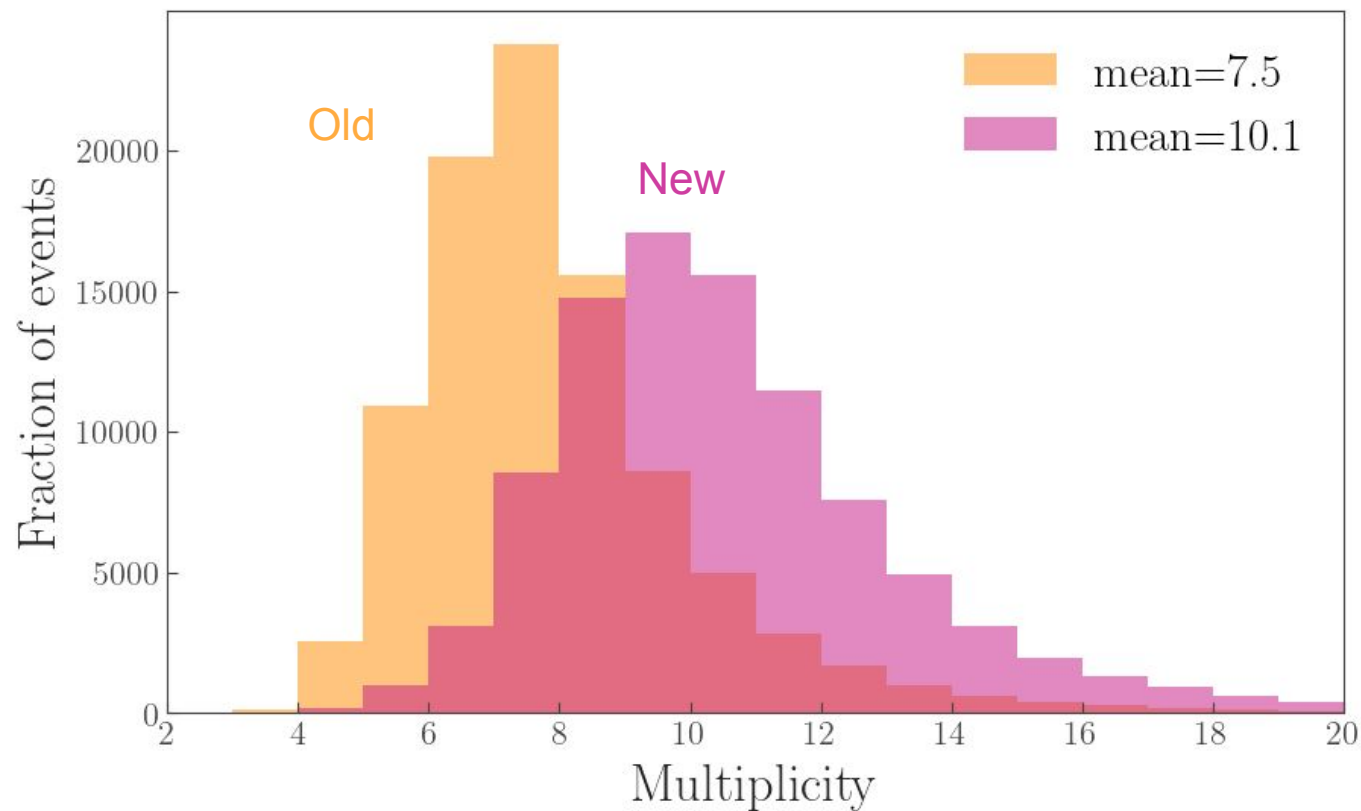
Zenith max: **55°**
Start date: **2014-01-01** (new triggers deployment)
Stop date: **2021-11-30** (end of phase I)
Full efficiency (logE): **17.5**
6T5
Bad Periods

Observer icrc-2025 (old & new tiggers comparison)

Total unique events: 99749

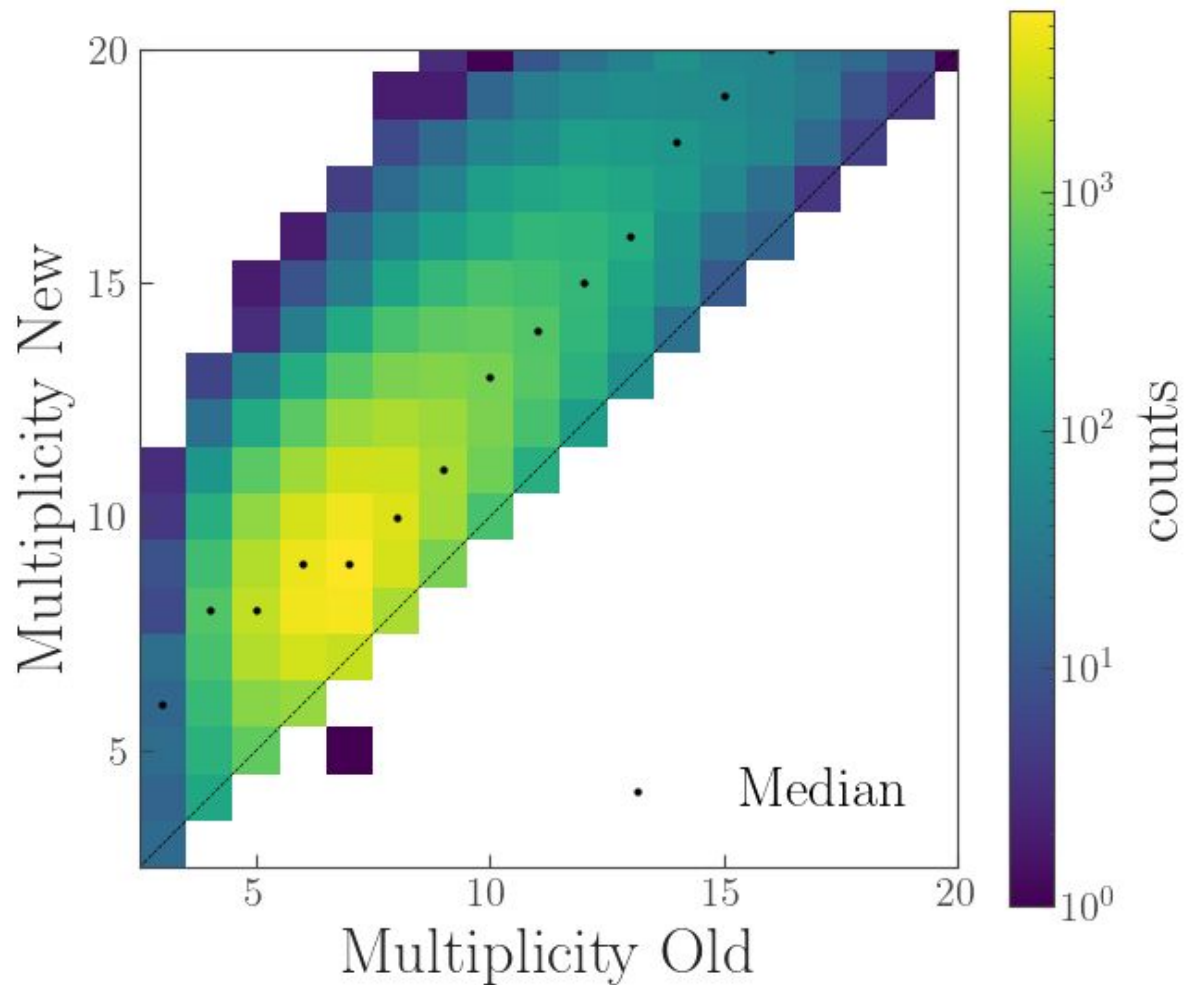


Observer icrc-2025 (old & new tiggers comparison)



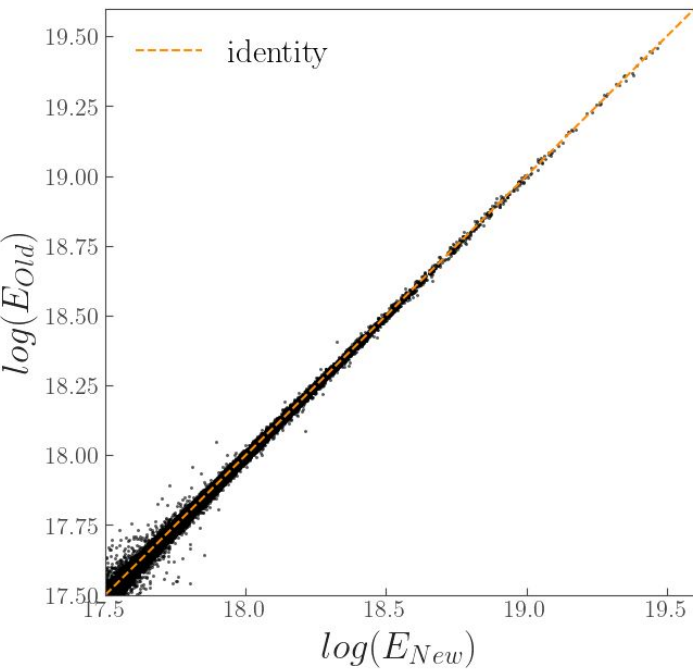
Multiplicity gain in spectrum

Observer icrc-2025 (old & new tiggers comparison)

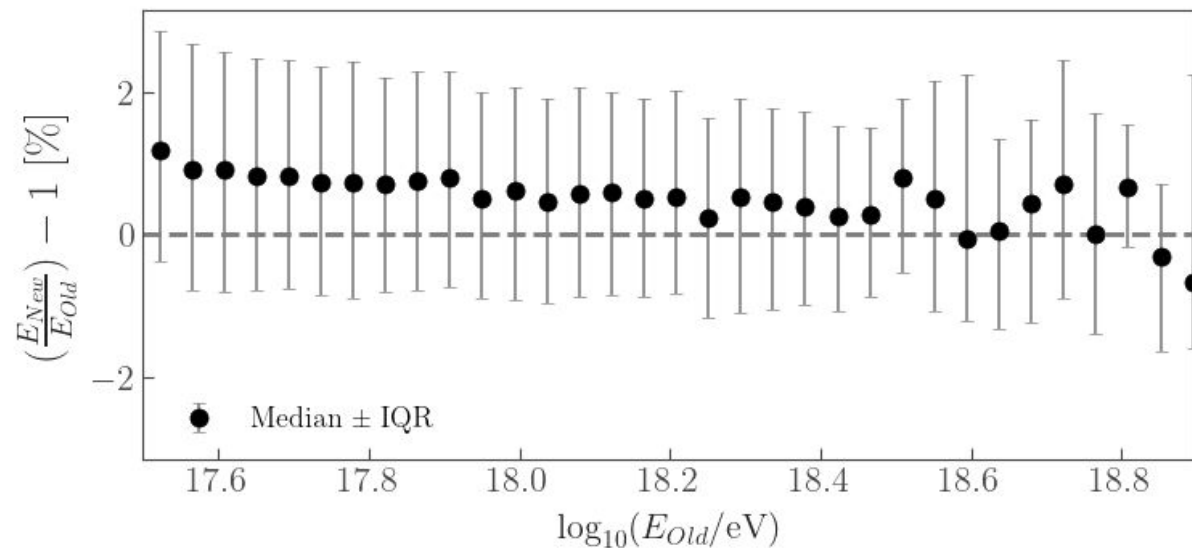


Observer icrc-2025 (old & new triggers comparison)

Energy

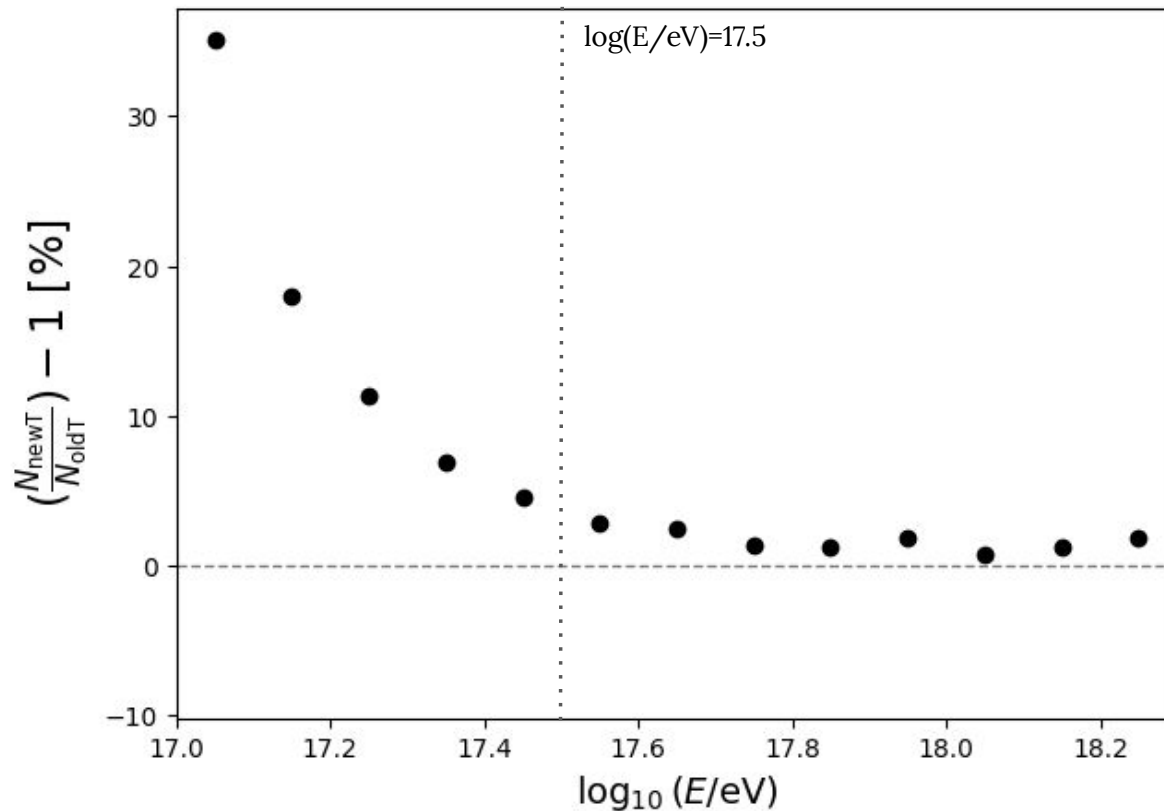


Differences $\sim 1.0\%$ in the whole energy range



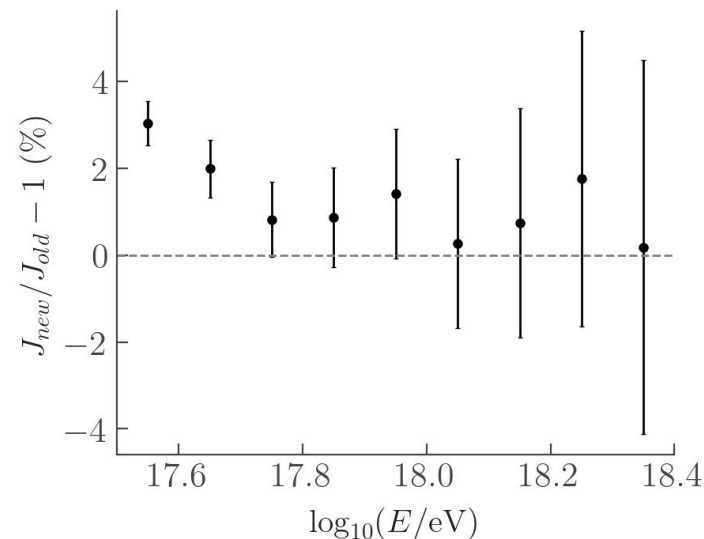
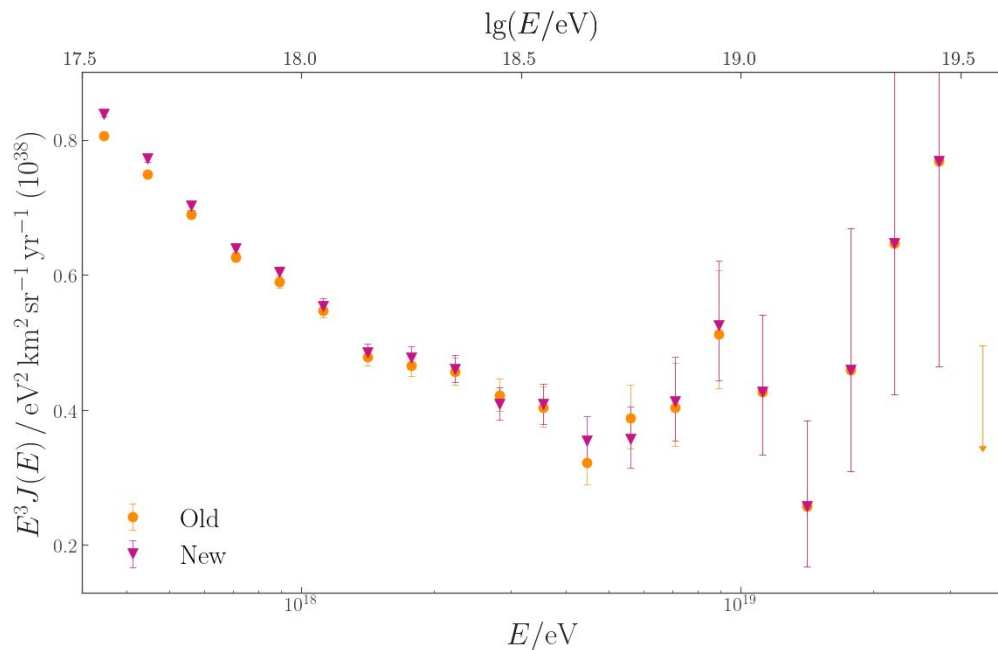
Observer icrc-2025 (old & new triggers comparison)

Earn in events per bins:



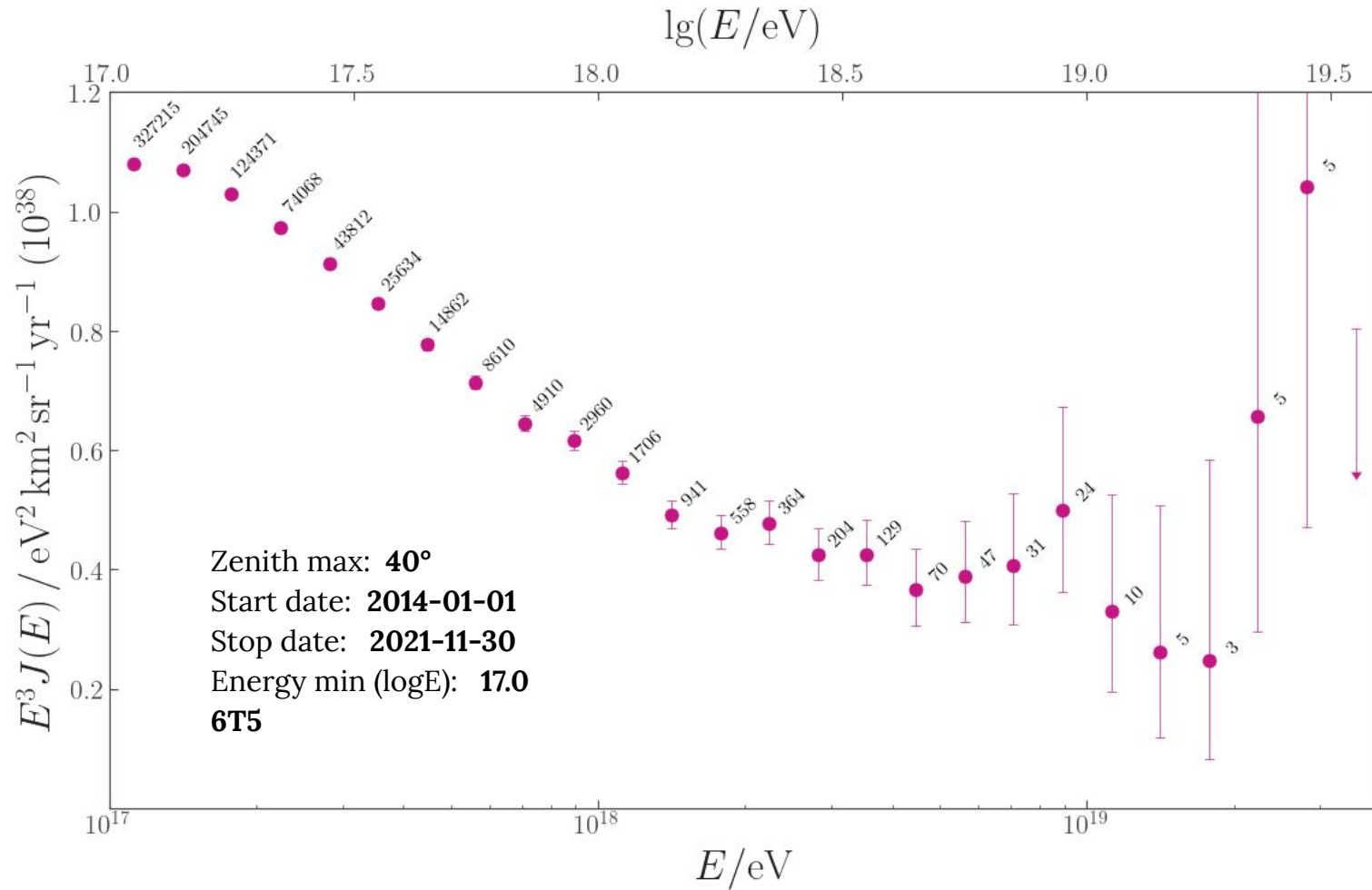
Raw Spectrum

- Start date: **2014-01-01**
- Stop date: **2021-11-30**
- Zenith max= **55°**
- Energy min (log(E/eV)): **17.5**
- exposure= 268,6 km²·yr·sr (Computed with app: <https://www0.mi.infn.it/auger/internal.html>)

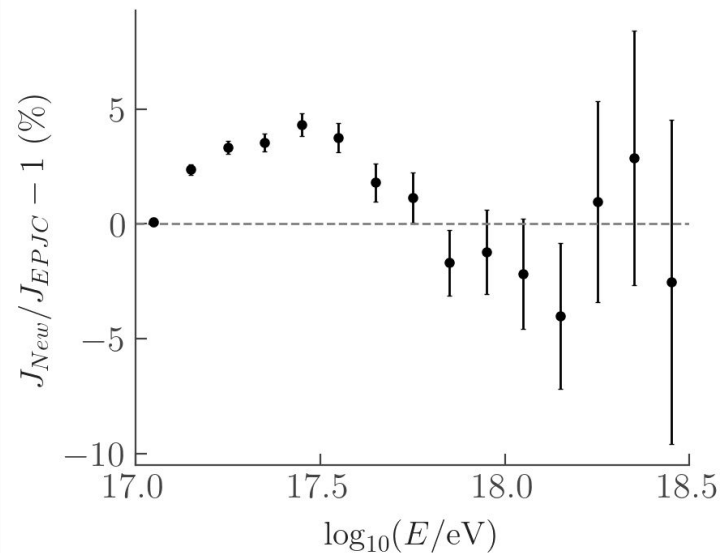
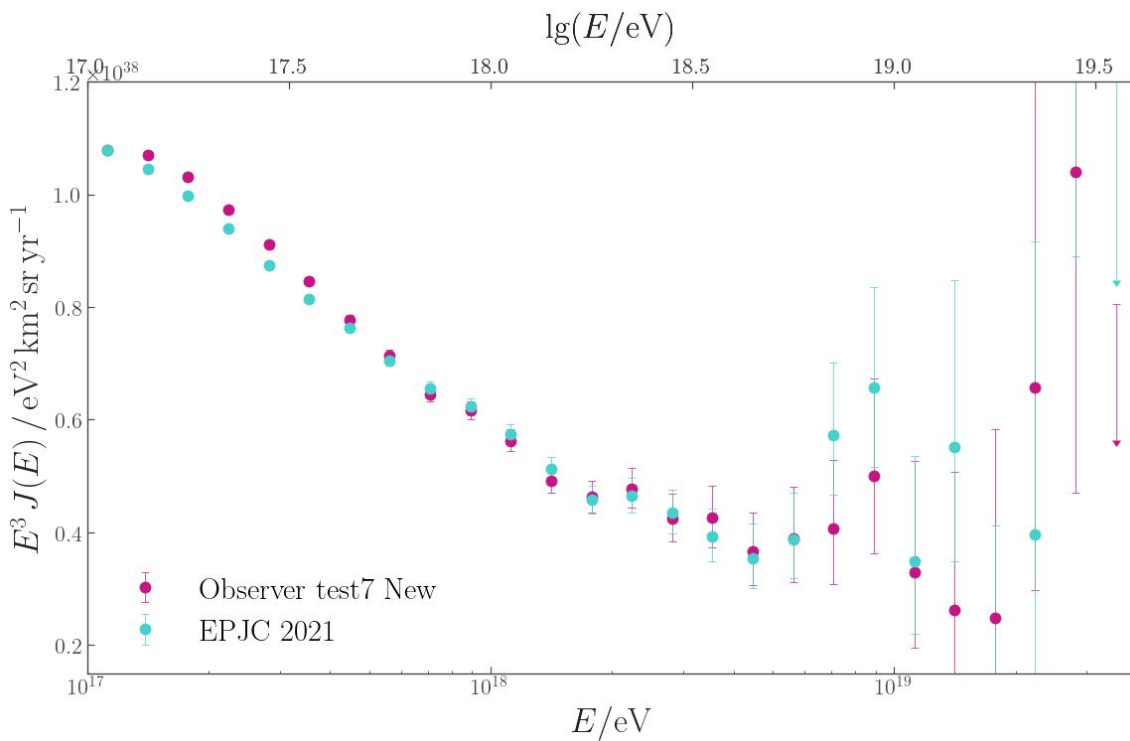


~2% bias in flux due to energy bias

SD-750 raw energy spectrum: Observer Test7 **new triggers** enabled



SD-750 raw energy spectrum: Observer new triggers & EPJC 2021



Agreement between ~5 %

SD-1500 vs SD-750 new triggers spectrums: Observer icrc-2025

Datasets: Observer icrc-2025 test 7

SD-750

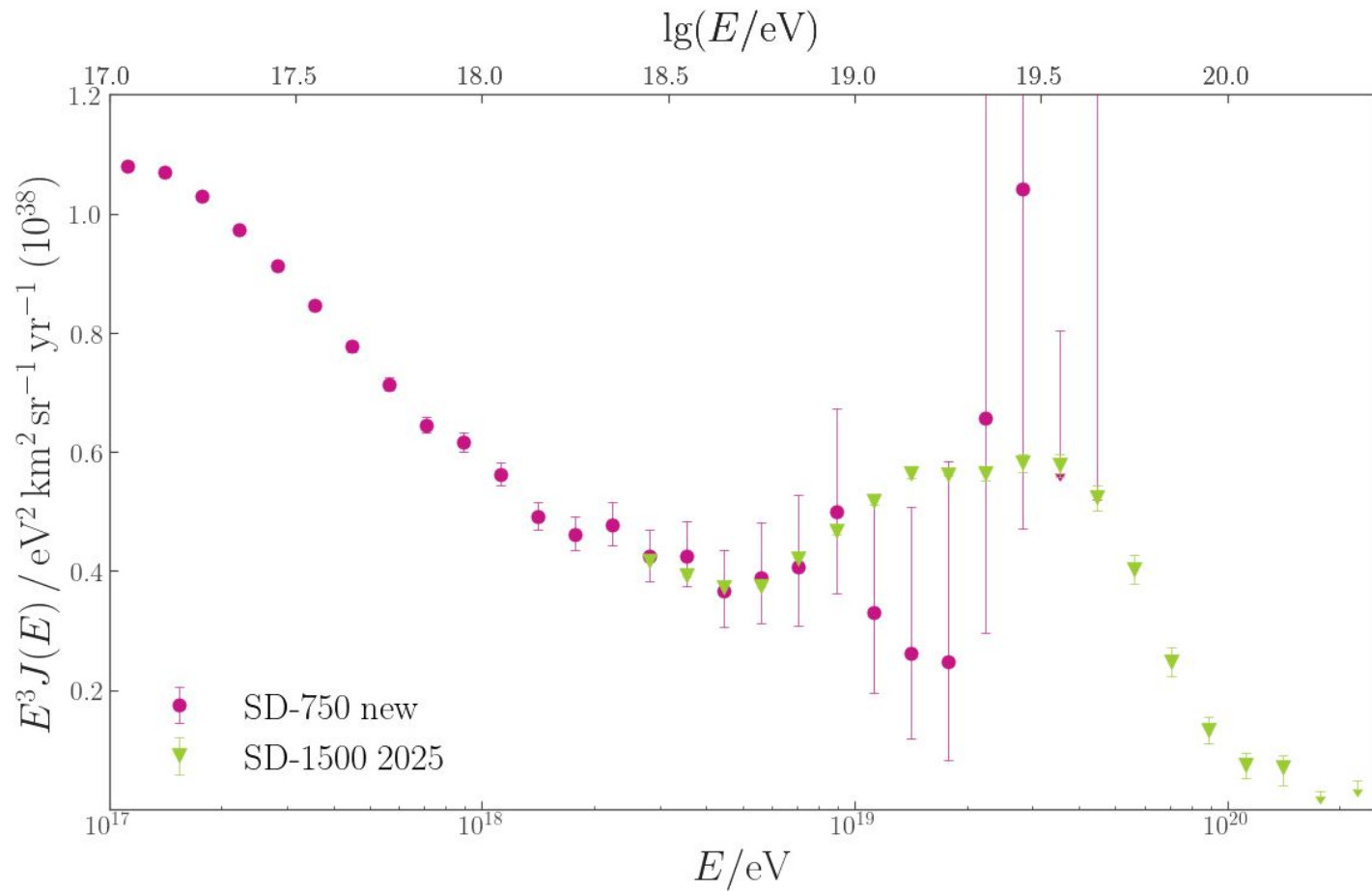
Zenith max: 40°
Start date: 2014-01-01
Stop date: 2021-11-30
Energy min (logE): 17
6T5
Bad Periods

SD-1500

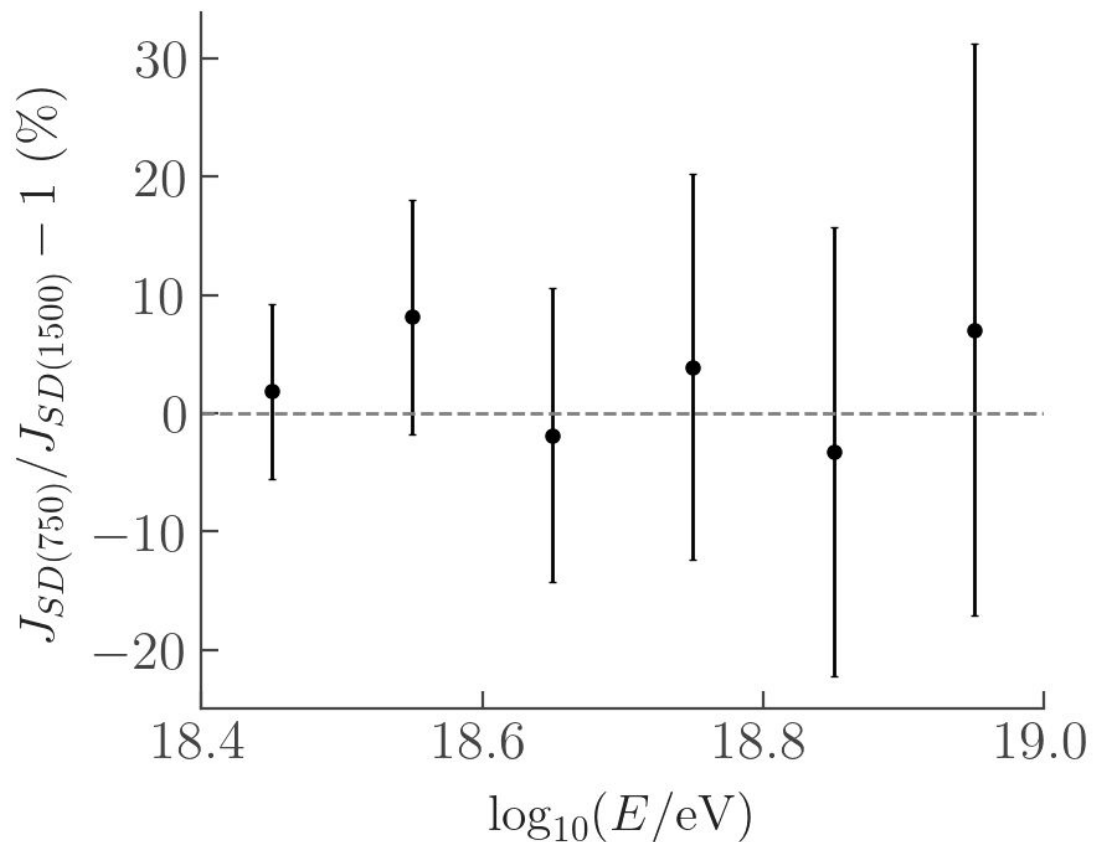
Zenith max: 80°
Start date: 2004-01-01
Stop date: 2022-12-31
Energy min (logE): 18.4
6T5
Bad Periods

<https://doi.org/10.48550/arXiv.2506.11688>

SD-1500 vs SD-750 new triggers spectra: Observer icrc-2025



SD-1500 vs SD-750 new triggers spectrums: Observer icrc-2025



**Agreement
between SD-750
and SD-1500
within 10%**

Summary

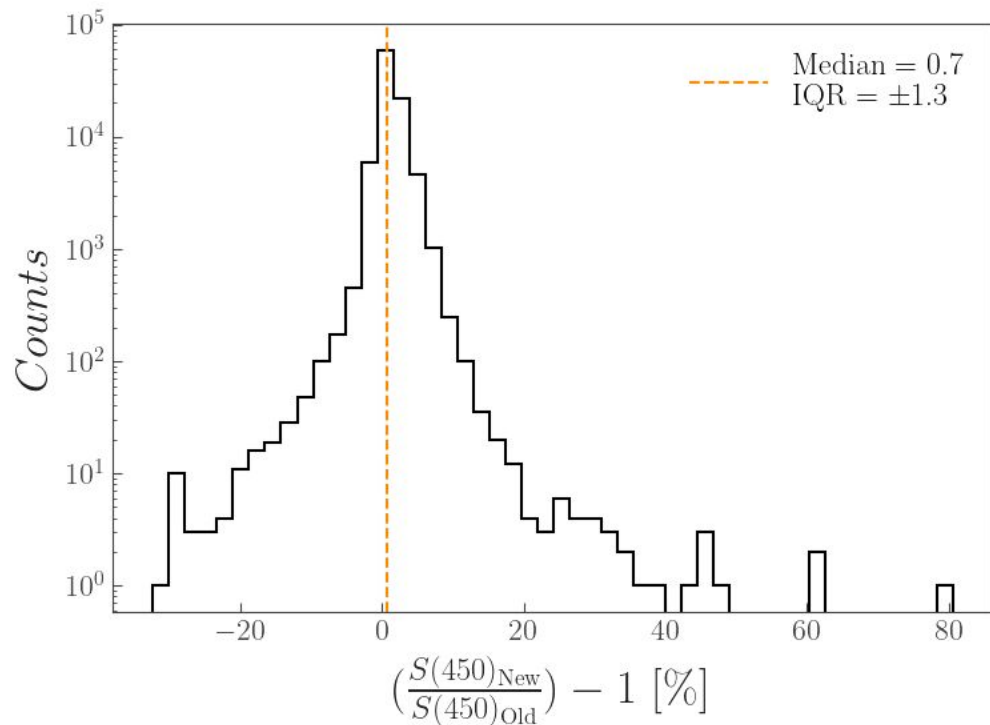
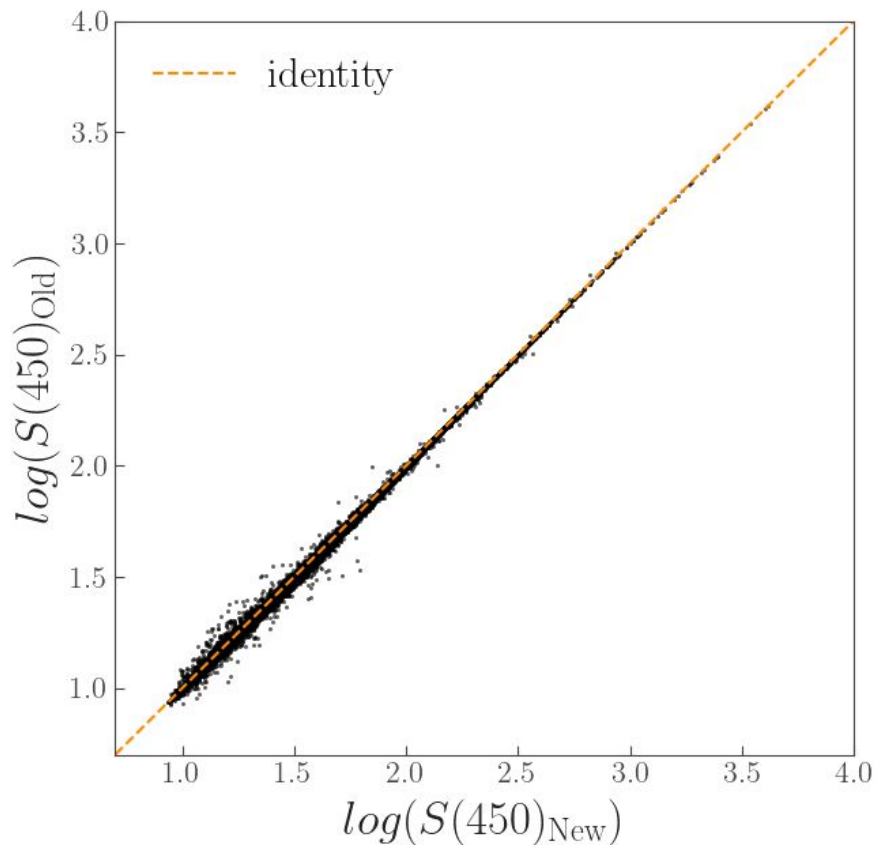
- SD-750 reconstruction enabling new triggers using Observer icrc-2025
- Systematic difference of $\sim 2\%$ in flux between reconstructions with/without new triggers
- Agreement within $\sim 5\%$ with EPCJ 2021 paper
- Agreement within $\sim 10\%$ with SD-1500 paper in ankle region

Outlook

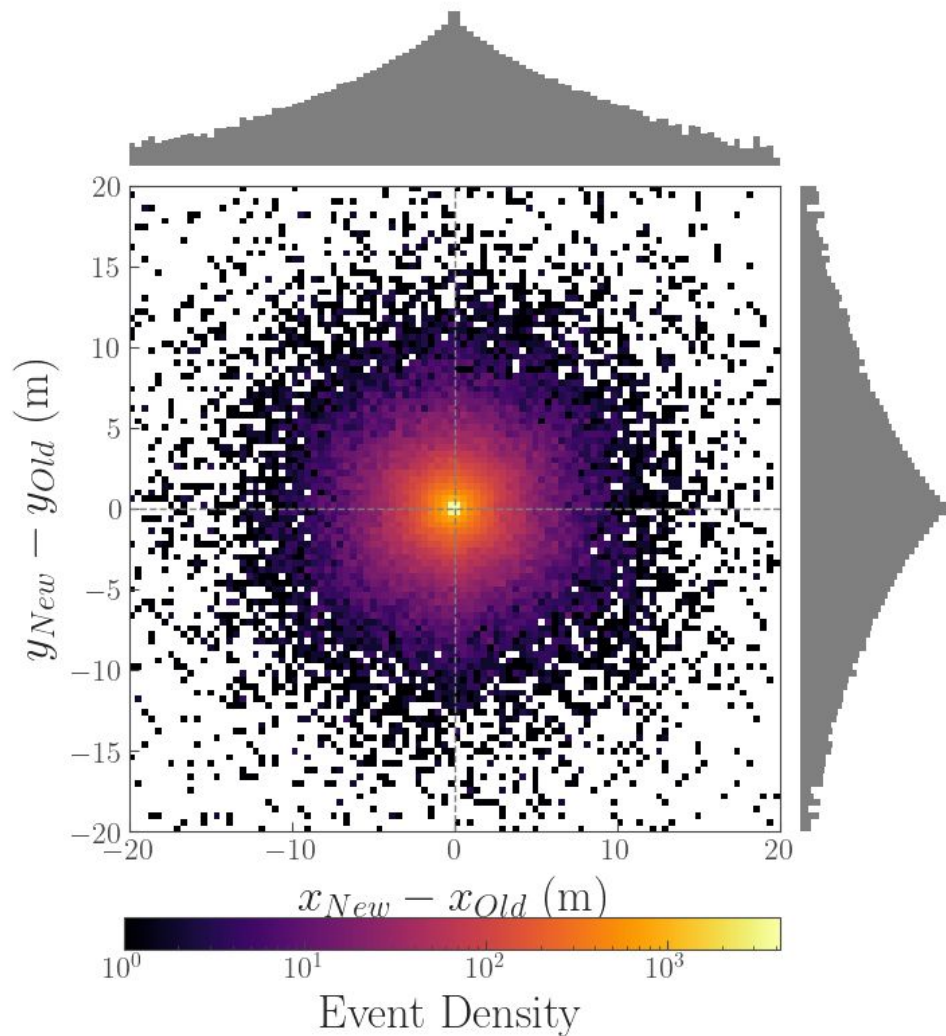
- Review quality cuts for SD-750 Phase I energy spectrum (dates, θ_{max} , full efficiency)
- Compare spectral features
- Towards a combined spectrum with the three SD arrays for Phase I (SD-1500, SD-750 and SD-433)

backup

Coincident events comparison: **S(450)**



Differences in core
reconstruction



Two datasets
Observer
icrc-2025 test7

**{ old & new
tiggers**



Zenith max: **40°**

Start date: **2014-01-01** (new triggers deployment)

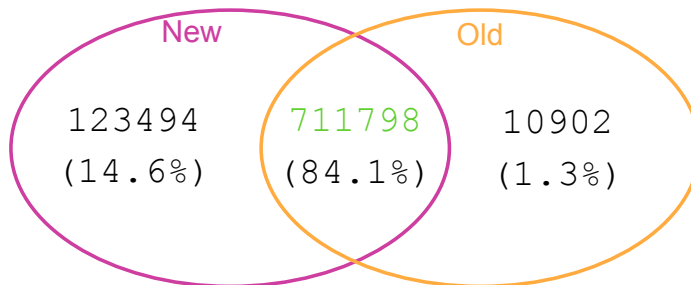
Stop date: **2021-11-30** (end of phase I)

Full efficiency (logE): **17**

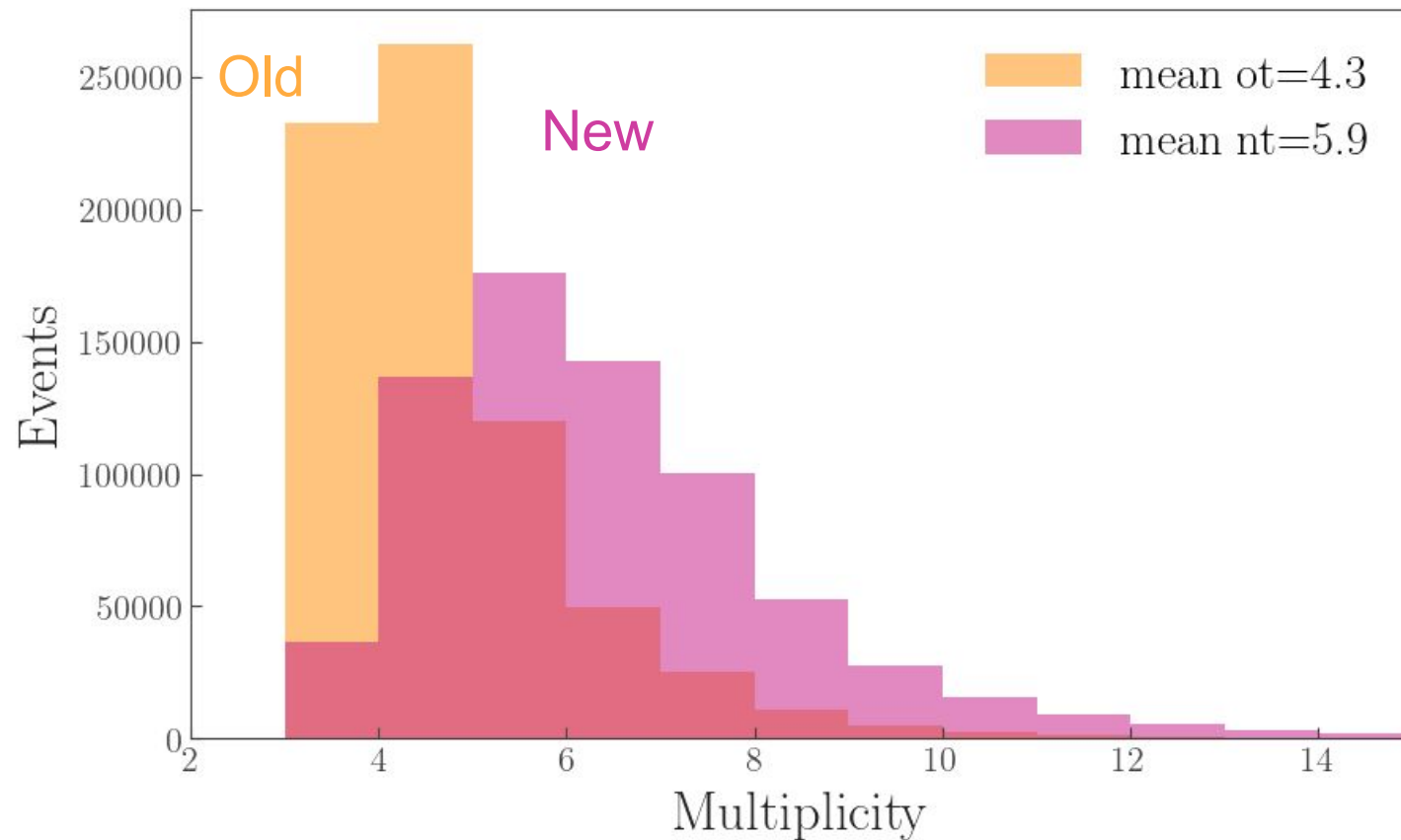
6T5

Bad Periods

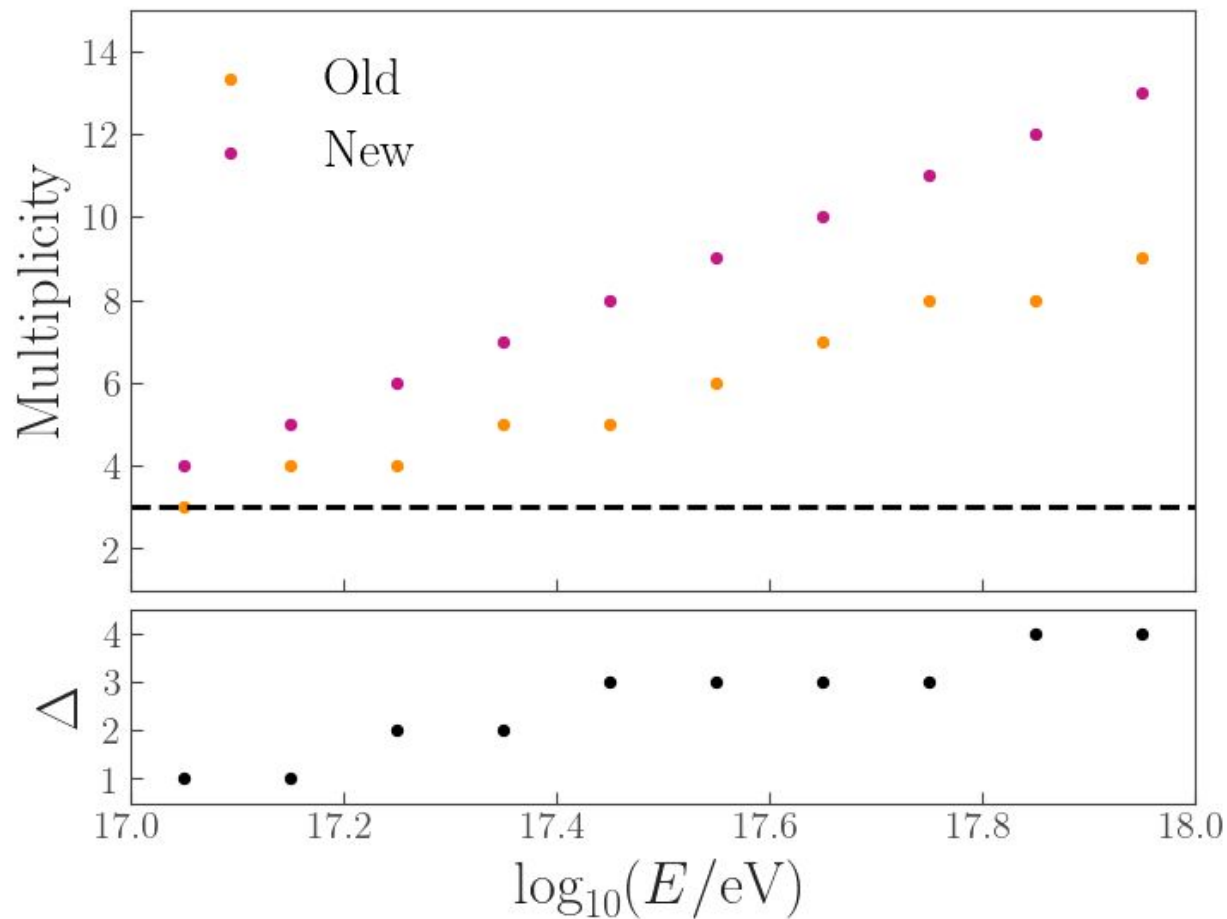
Total unique events:
846194

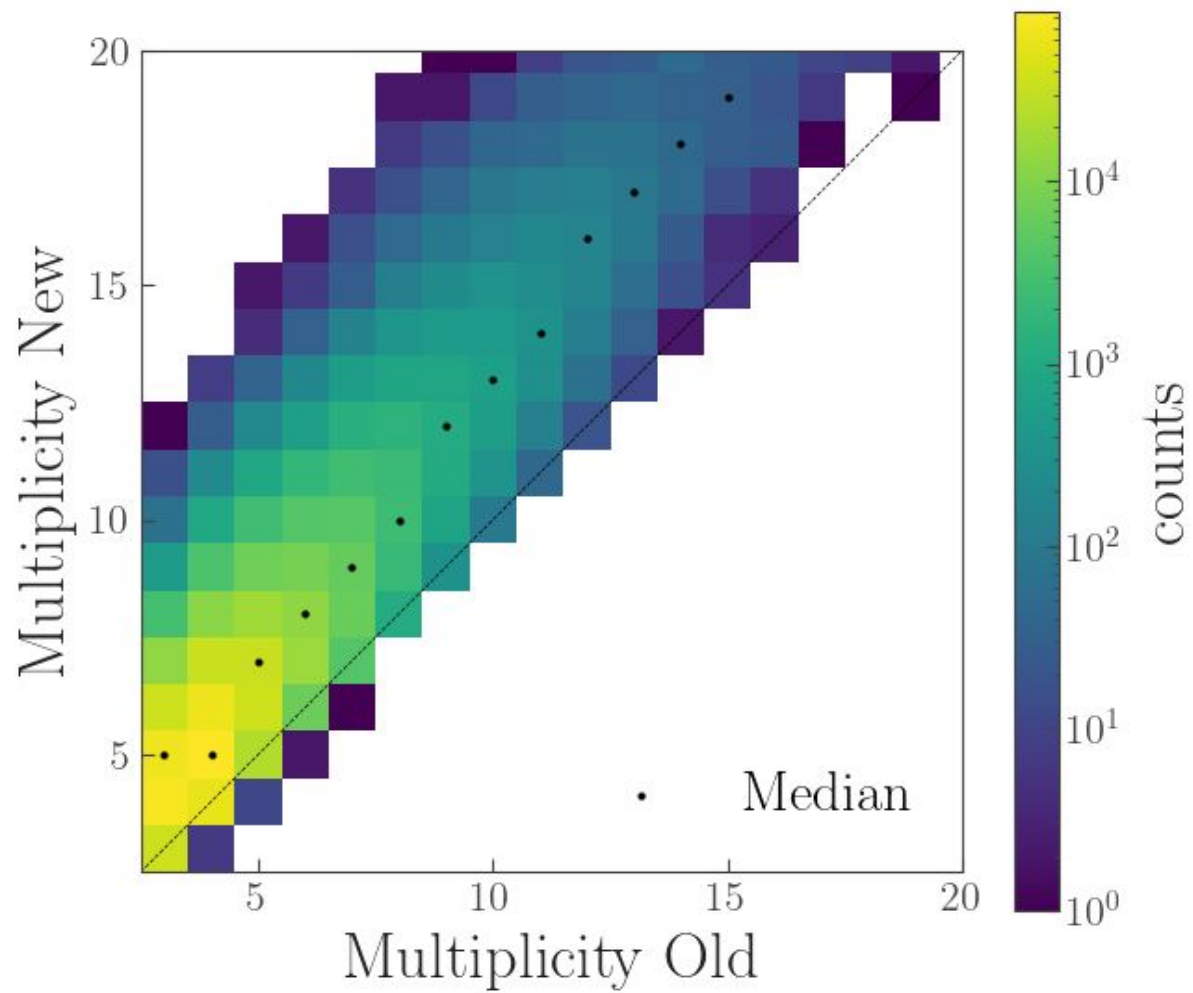


Observer icrc-2025 (old & new tiggers comparison)

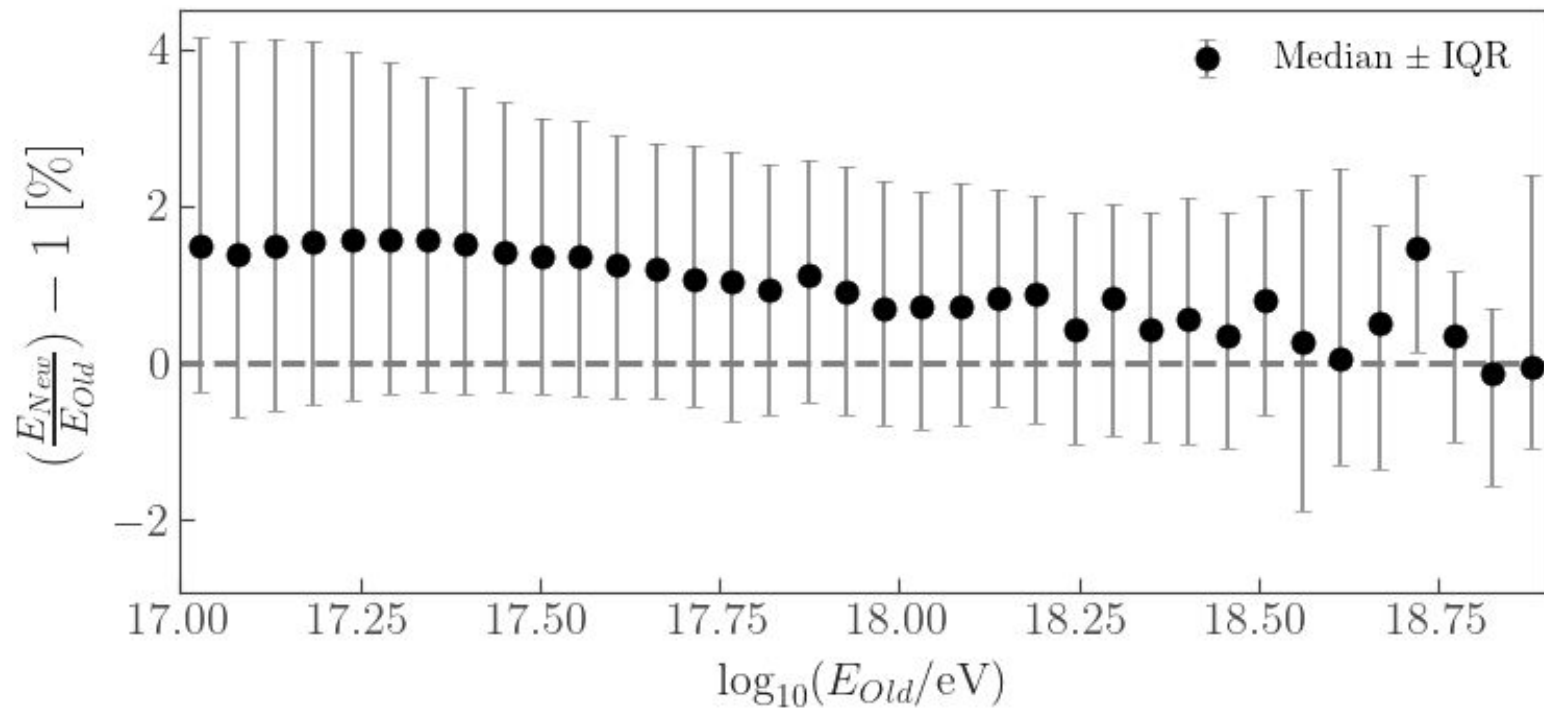


Observer icrc-2025 (old & new triggers comparison)



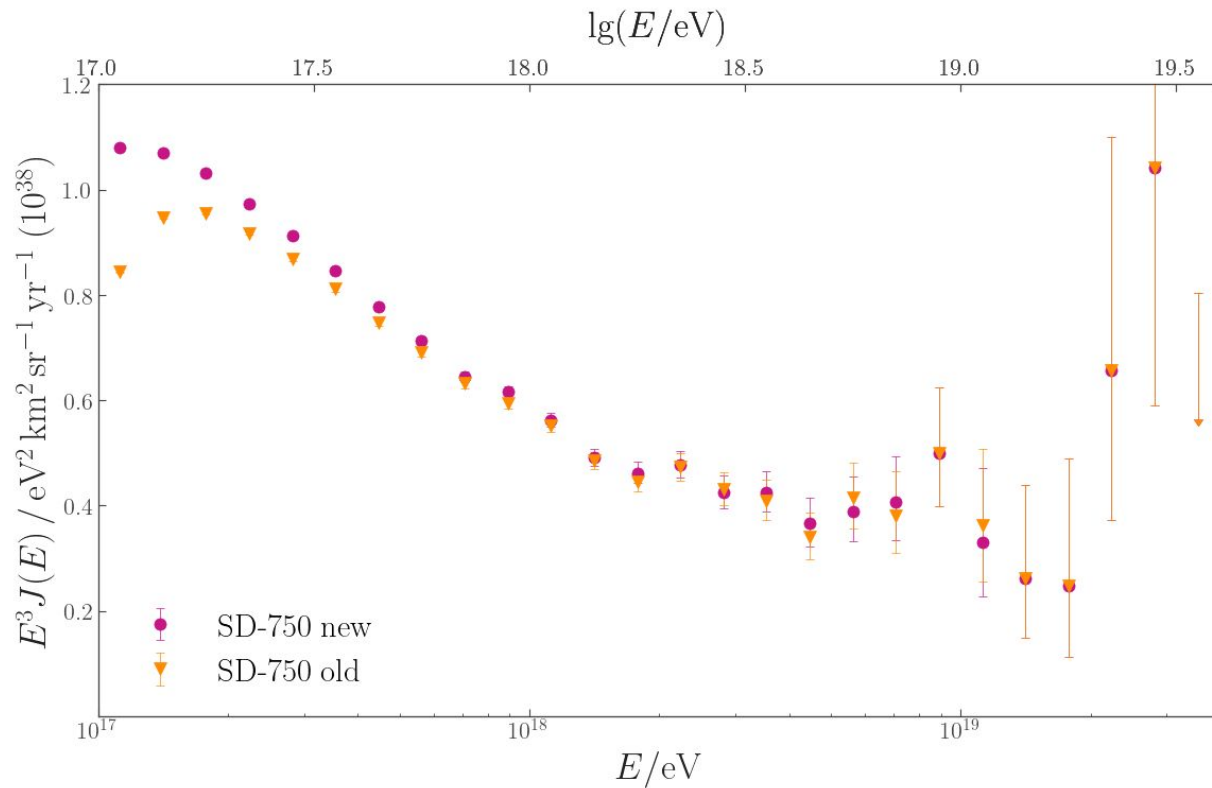


Observer icrc-2025 (old & new tiggers comparison)



Raw Spectrum

- Start date: **2014-01-01**
- Stop date: **2021-11-30**
- Zenith max= **40°**
- Energy min (log(E/eV)): **17.0**



Comments about exposure

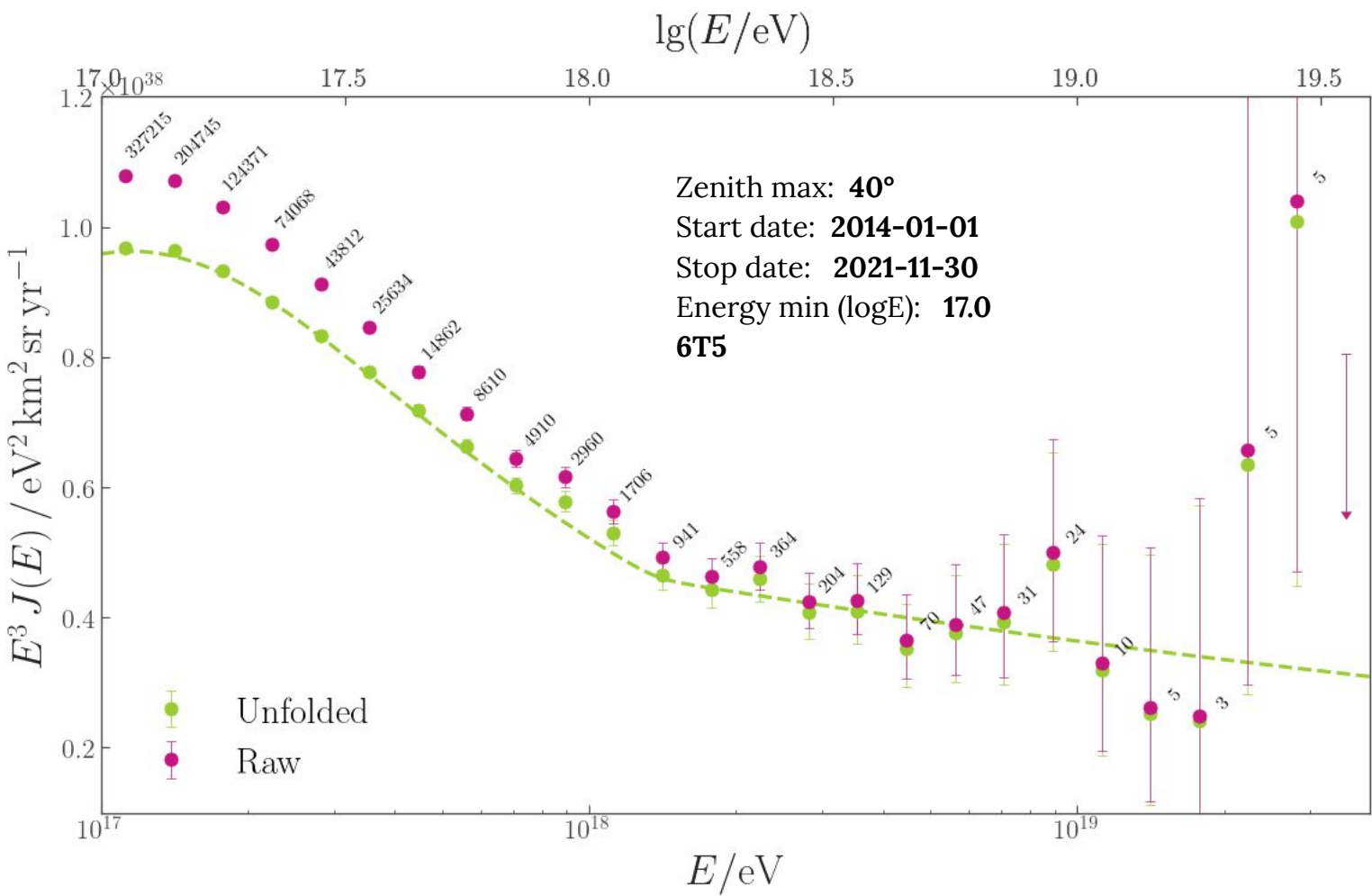
Time interval used for Infill paper:

Start date: **2014-01-01**

Stop date: **2018-08-31**

- Reported in EPJC 2021: **105.4 km²·yr·sr**
- Using Milano's exposure calculator (<https://www0.mi.infn.it/auger/internal.html>): **109.8 km²·yr·sr**
- **~ 5 % difference**

SD-750 energy spectrum: Observer Test7 new trigger enabled



Spectral parameters comparison: Some fixed parameters as in the EPJC paper

Parameter	EPJC 2021	This work (test7 new)
$J_0 / (\text{km}^2 \text{ yr sr eV})$	$(1.09 \pm 0.04) \times 10^{-13}$	$(1.15 \pm 0.05) \times 10^{-13}$
$\log_{10}(E_{01}/\text{eV})$	17.09 (fixed)	17.09 (fixed)
ω_{01}	0.49 ± 0.07	0.47 ± 0.07
γ_0	2.64 (fixed)	2.64 (fixed)
γ_1	3.34 ± 0.02	3.41 ± 0.02
$E_{12} / (\text{eV})$	$(3.9 \pm 0.8) \times 10^{18}$	$(1.4 \pm 0.3) \times 10^{18}$
ω_{12}	0.05 (fixed)	0.05 (fixed)
γ_2	2.6 ± 0.2	3.12 ± 0.06

Deviance ($\approx \chi^2$) = 33.9
ndof = 21.0
p-value = 0.037