



# Update on the large-scale cosmic-ray anisotropy search at the highest energies by the Telescope Array Experiment

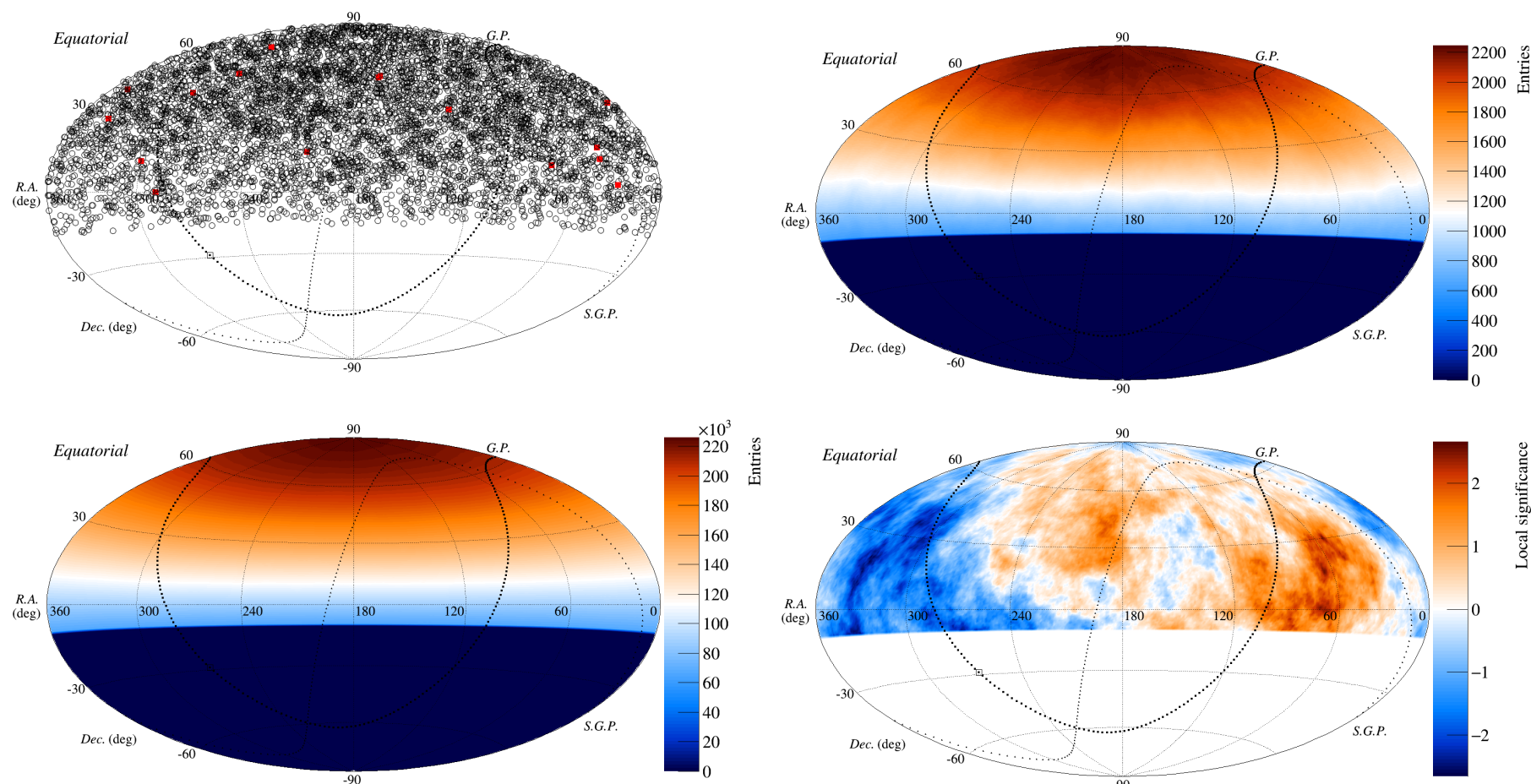
Toshihiro Fujii (Kyoto University) on behalf of Telescope Array Collaboration, Mail: [fujii@cr.scphys.kyoto-u.ac.jp](mailto:fujii@cr.scphys.kyoto-u.ac.jp)



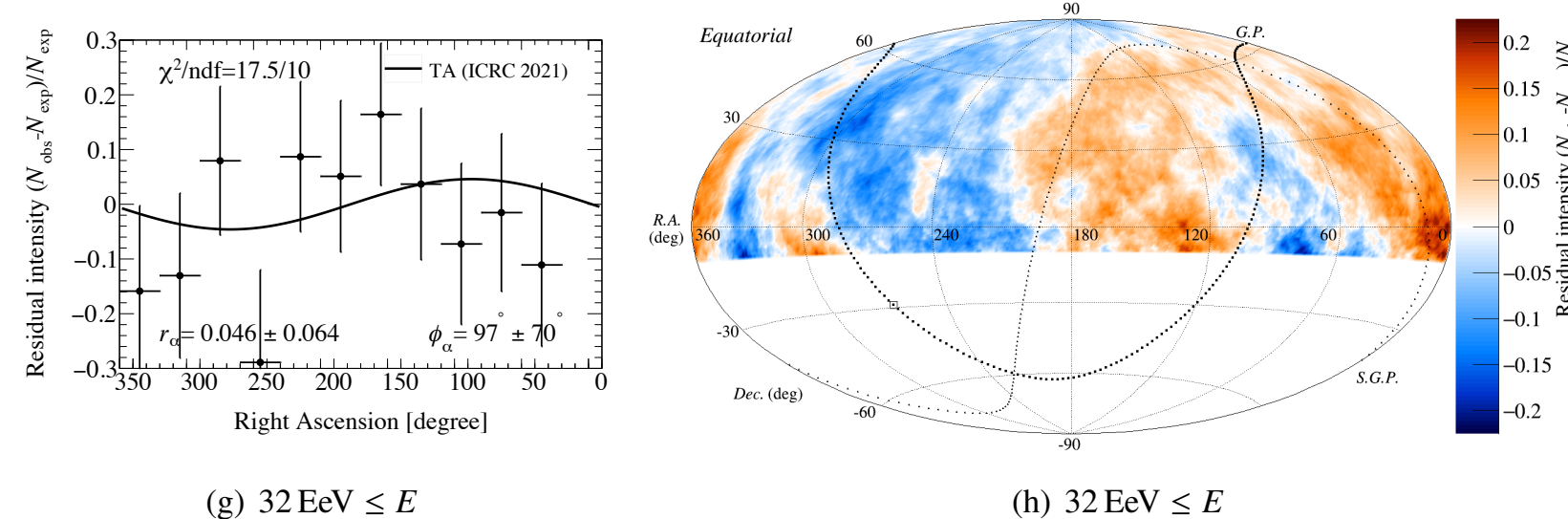
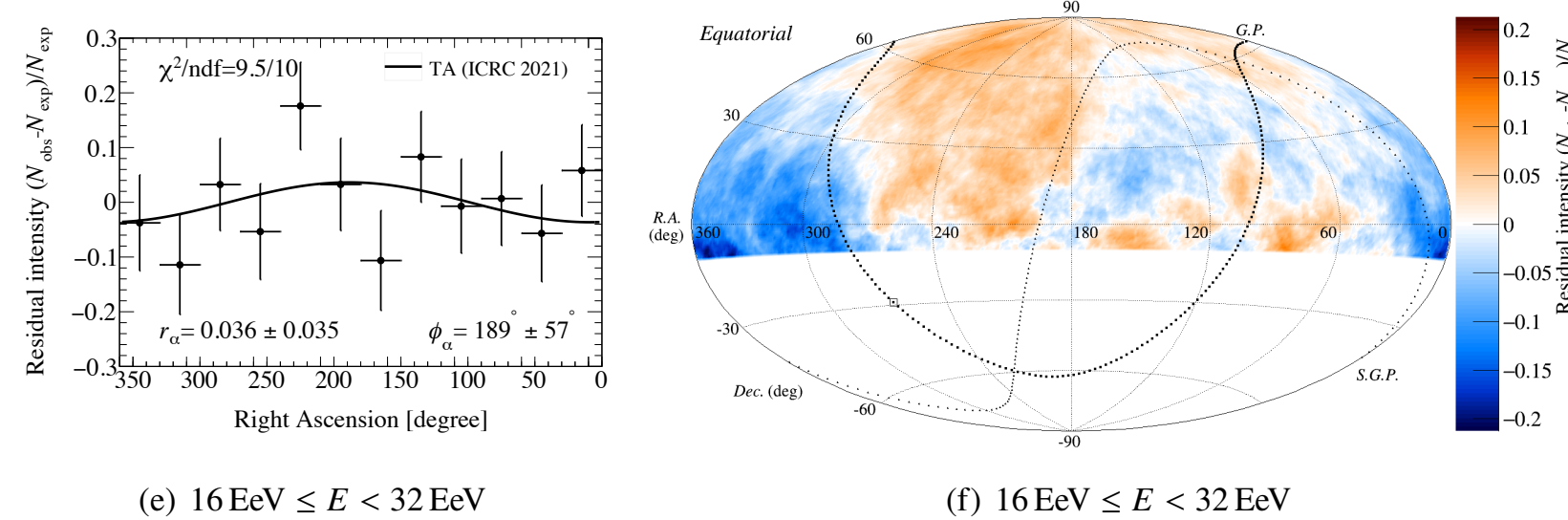
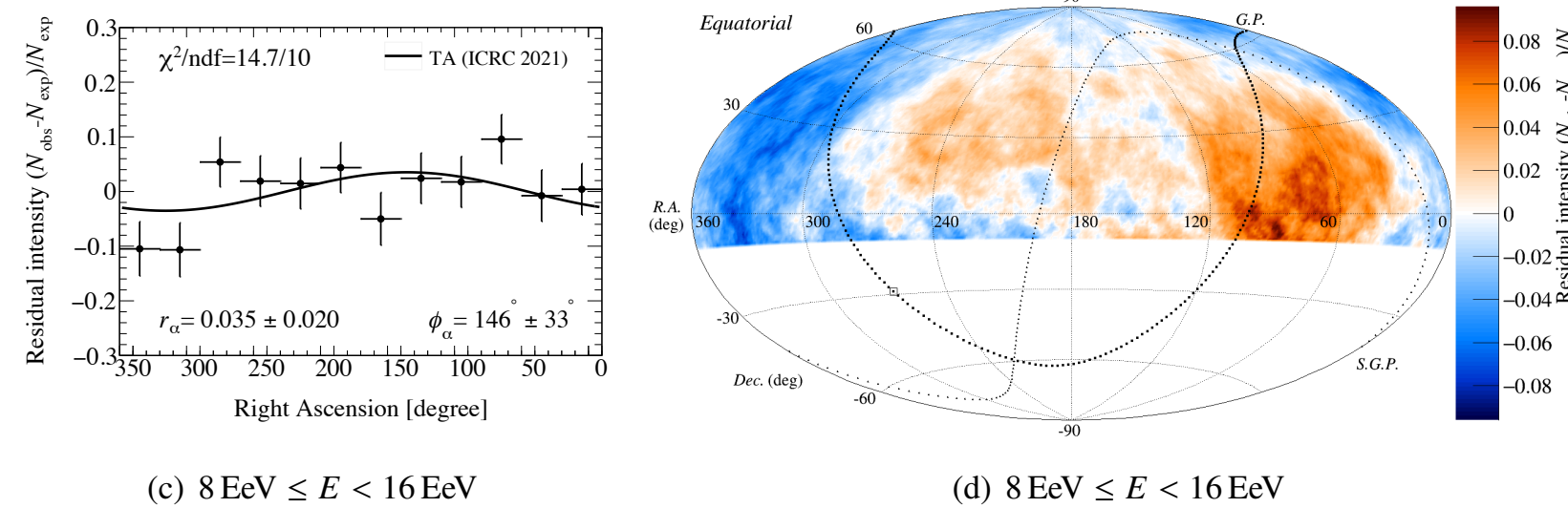
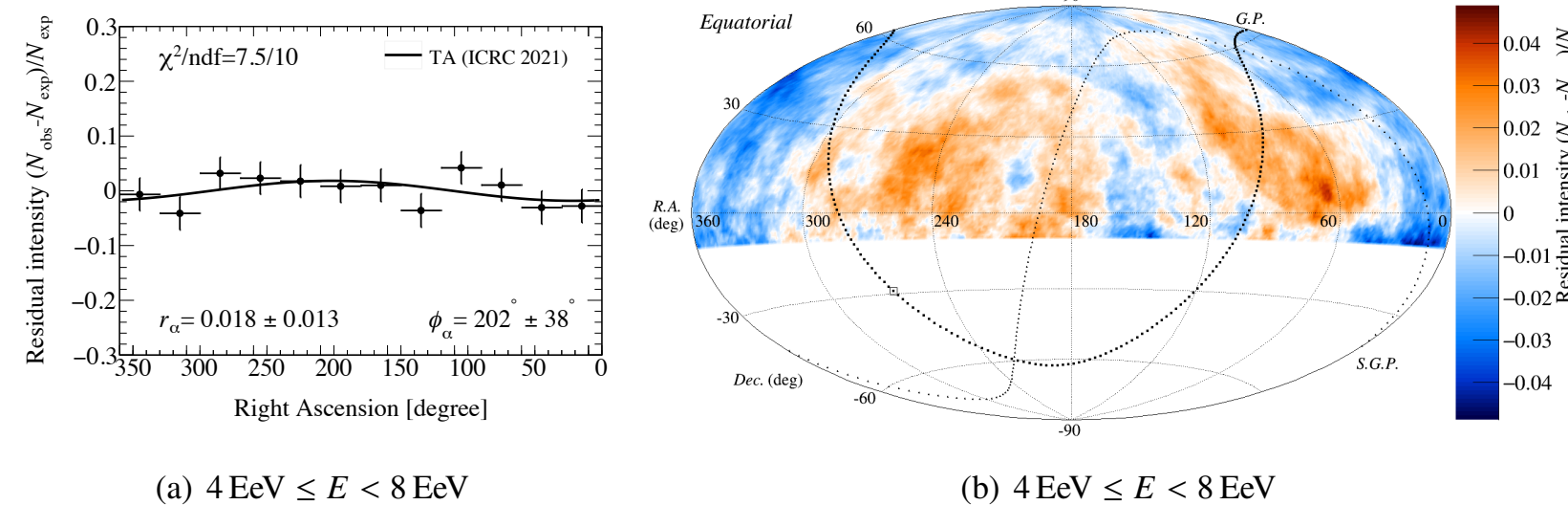
## Data set for dipole search

- Telescope Array surface detector
  - Largest cosmic ray detector in northern hemisphere
  - 700 km<sup>2</sup>, Utah, USA
- Data: 2008/05/11 - 2020/05/11 (12 yrs)
  - 6518 events above 8.8 EeV

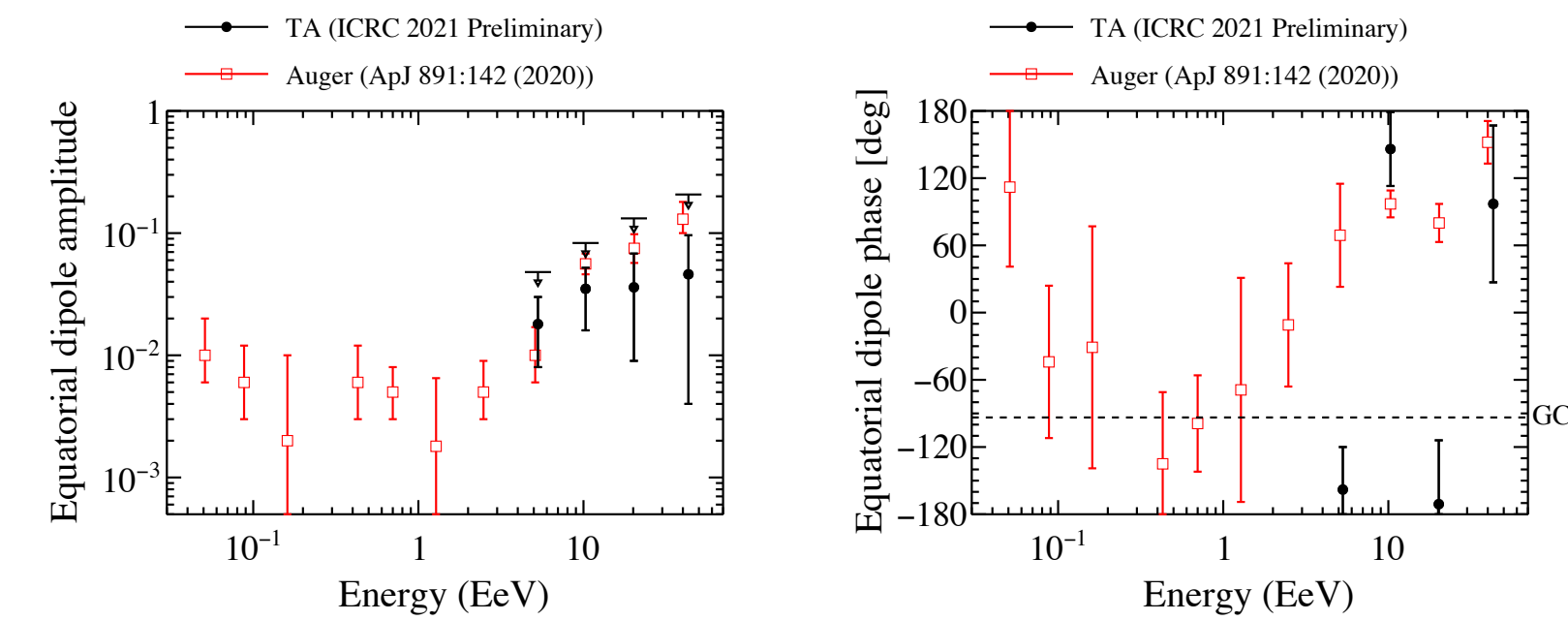
## Sky-map calculation



## Energy dependent search



## Upper limits of dipole structure



$E$ [EeV]	$E_{\text{med}}$ [EeV]	$N$	$r_\alpha$ [%]	$\phi_\alpha$ [°]	$r_\alpha^{\text{UL}}$ [%]
$8.8 \leq E$	13.0	6518	$3.1^{+1.6}_{-1.6}$	$134 \pm 34$	7.6
$4 \leq E < 8$	5.3	13361	$1.8^{+1.2}_{-1.0}$	$202 \pm 38$	4.8
$8 \leq E < 16$	10.3	5446	$3.5^{+1.7}_{-1.9}$	$146 \pm 33$	8.3
$16 \leq E < 32$	20.2	1623	$3.6^{+3.2}_{-2.7}$	$189 \pm 57$	13.2
$32 \leq E$	43.2	595	$4.6^{+5.0}_{-4.2}$	$97 \pm 70$	20.7

## Summary

- Search for large scale anisotropy using 12 yrs data of the Telescope Array surface detector
  - No significant dipole structure
  - Need more statistic
  - Consistent result with Auger reported dipole
- Further data collection by TA and the on-going upgrade of TA×4 will be essential for further studies

## Reference

Telescope Array Collaboration, T. Abu-Zayyad et al., *Nucl. Instrum. Meth.* **A689** (2013) 87–97  
 Telescope Array Collaboration, R. U. Abbasi et al., *Astrophys. J. Lett.* **898** (2020), no. 2 L28  
 Pierre Auger Collaboration, A. Aab et al., *Science* **357** (2017), no. 6537 1266–1270,  
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## Dipole search result above 8.8 EeV

