Study of the gamma-ray emission from 3HWC J1928+178

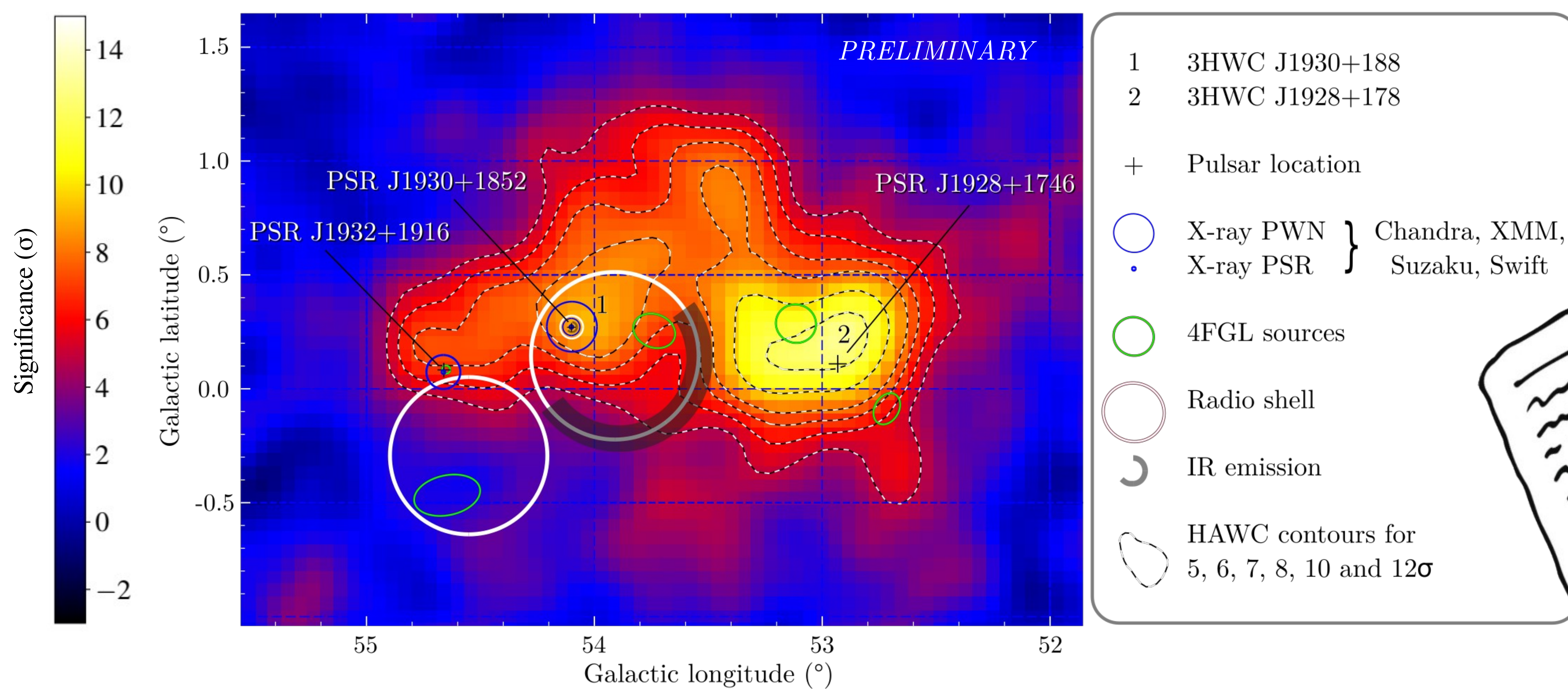**A. Jardin-Blicq[1,2], H. Zhou[3], V. Marandon[4] on behalf of the HAWC collaboration**

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PSR J1928+1746
Distance D = 4 kpc
Age = 82 kyr
Period P = 68.7 ms
$\dot{P}$ = 1.32 10^{-14}
$\dot{E}$ = 1.6 10^{36} erg s^{-1}

Detected in radio
No detection in X-ray

HAWC significance map (1523 days, analysis bins 4-9) and multiwavelength information

PRELIMINARY

1   3HWC J1930+188
2   3HWC J1928+178
+   Pulsar location
○   X-ray PWN   } Chandra, XMM,
·   X-ray PSR   Suzaku, Swift
○   4FGL sources
○   Radio shell
☽   IR emission
⌇   HAWC contours for 5, 6, 7, 8, 10 and 12σ

PSR J1930+1852
PSR J1932+1916
PSR J1928+1746

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Detection by H.E.S.S.
Using an analysis adapted to extended sources, H.E.S.S. reported significant gamma-ray emission from the source 3HWC J1928+178
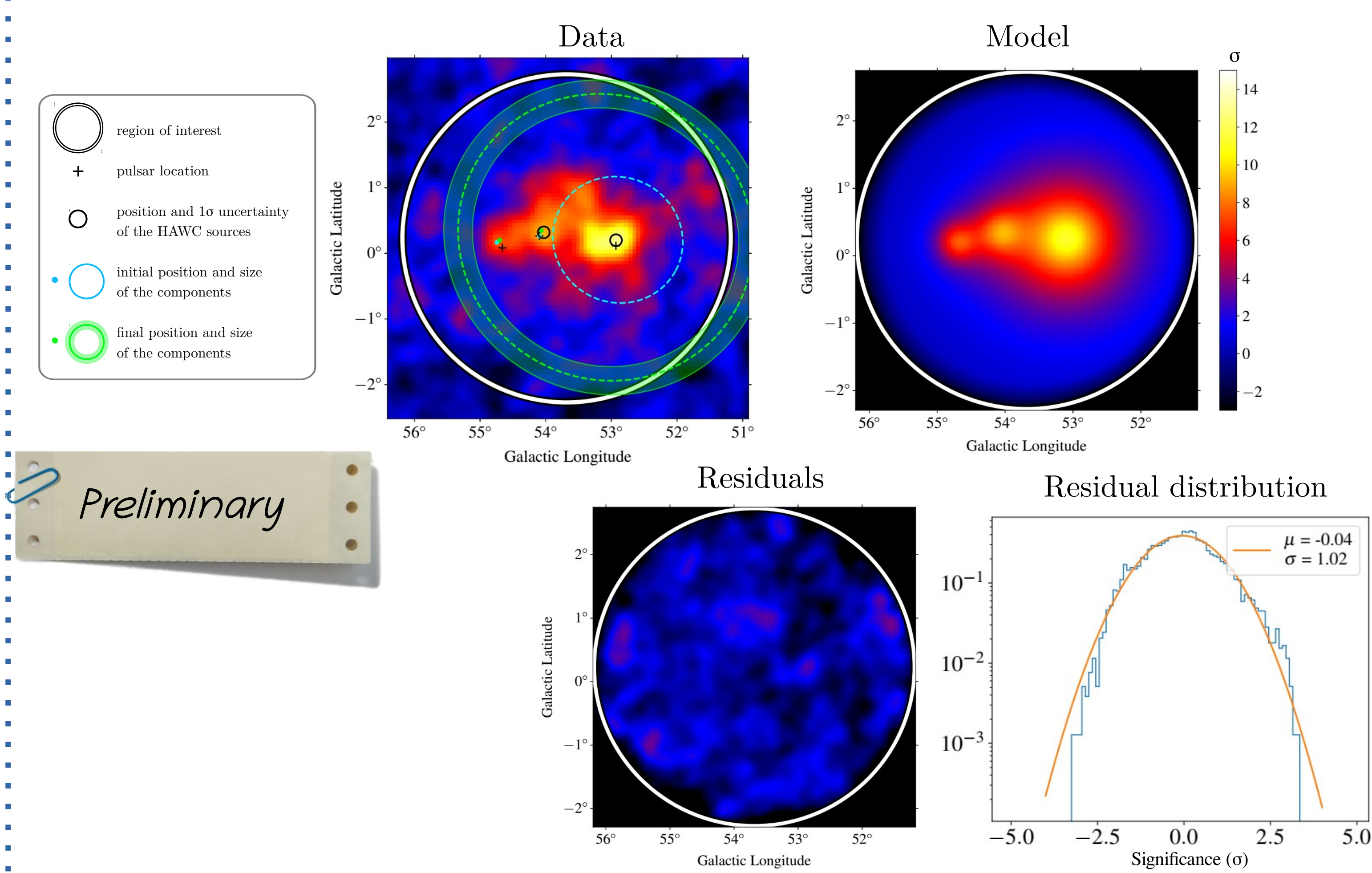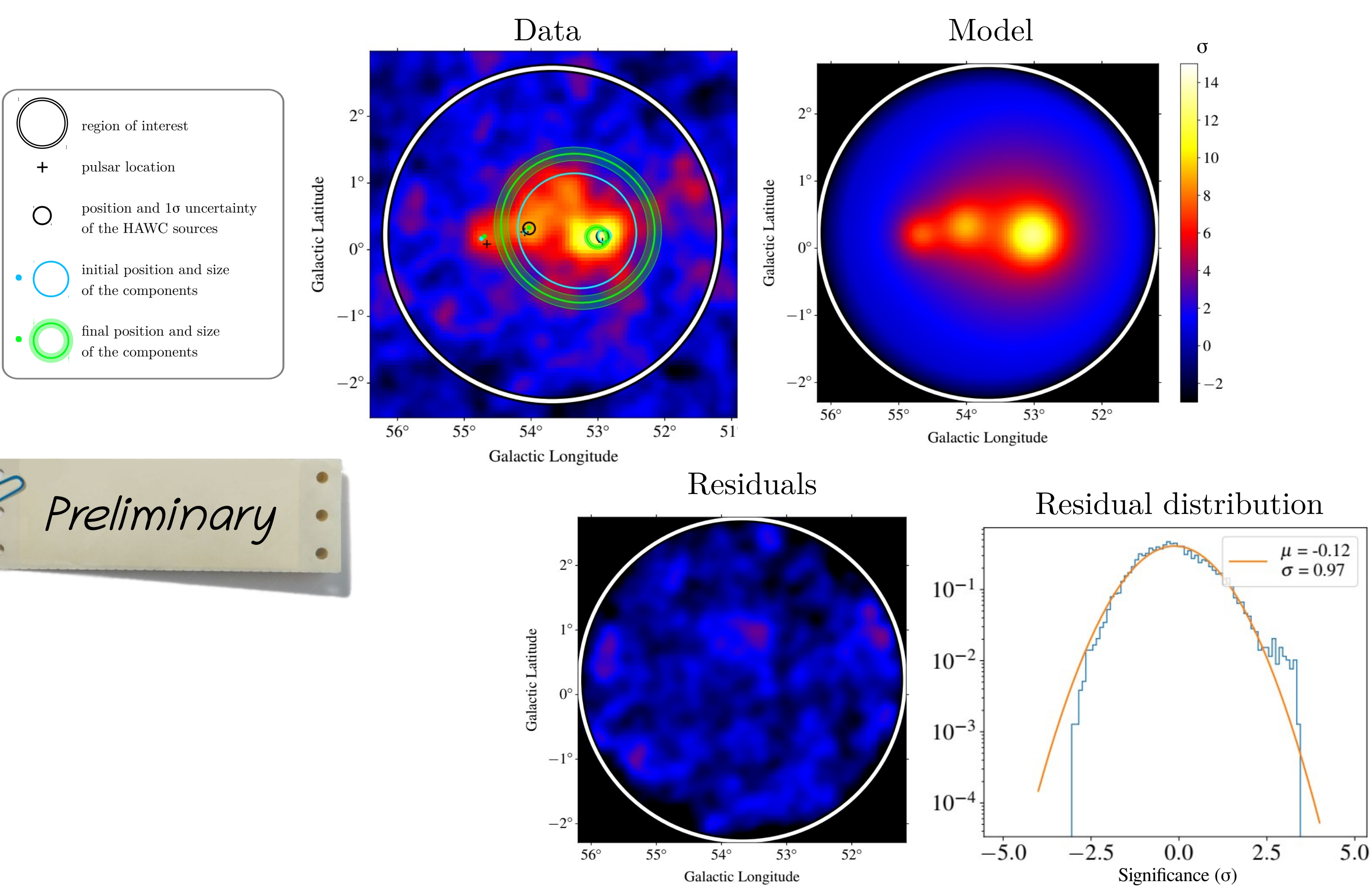
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4 components model

- 1 point source for 3HWC J1930+188
- 1 point source for PSR J1932+1916
- 1 extended source (symmetric Gaussian) for 3HWC J1928+178
- 1 extra extended source (symmetric Gaussian) for the remaining extended emission

Data   Model

Preliminary

Residuals   Residual distribution

μ = -0.12
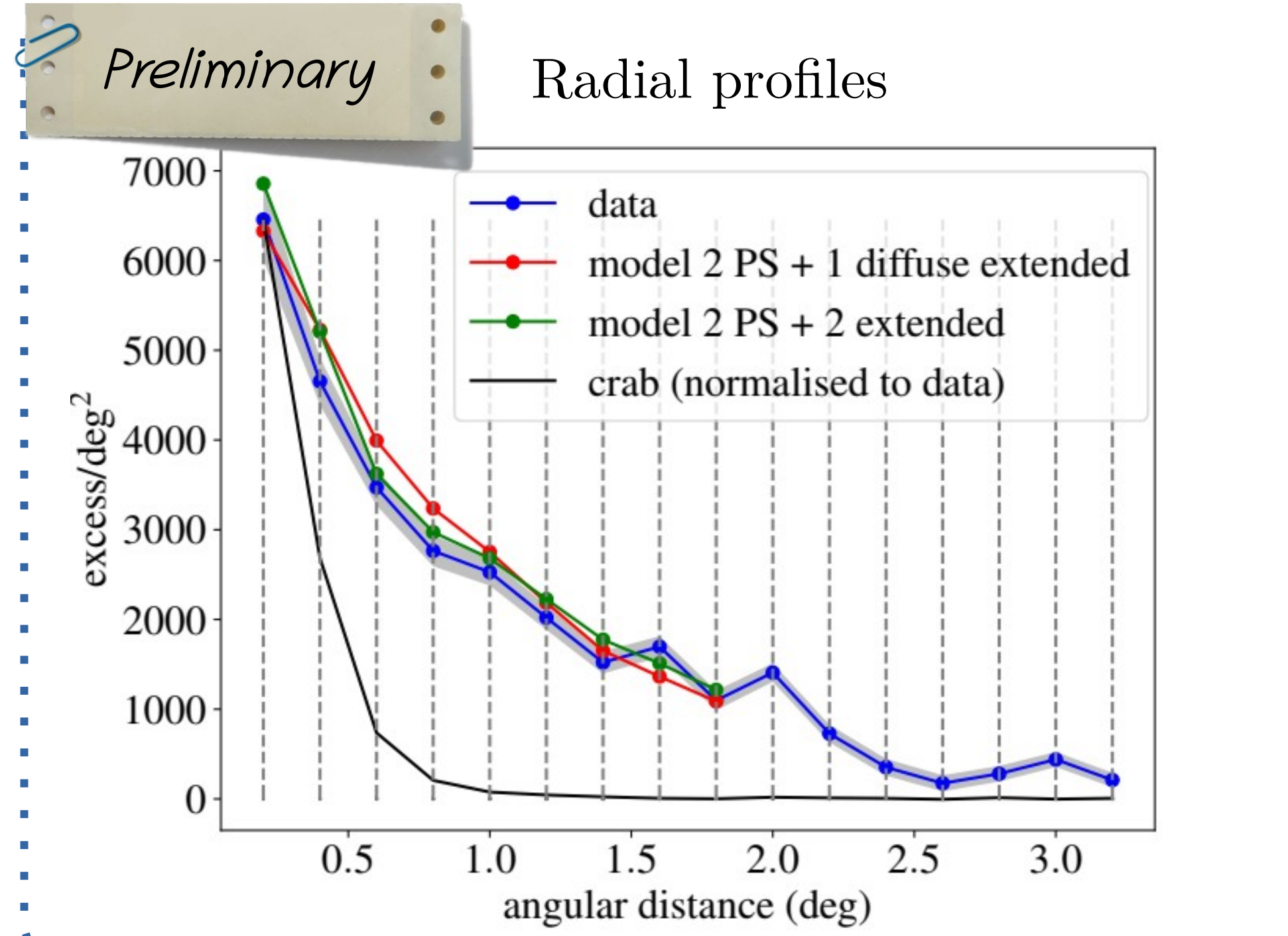σ = 0.97

Diffusion model

- 1 point source for 3HWC J1930+188
- 1 point source for PSR J1932+1916
- 1 extended source with continuous particle diffusion for 3HWC J1928+178
  The gamma-ray flux as a function of the distance d is approximately proportional to $f_d = \frac{1.22}{\pi^{3/2} r_d (d + 0.06 r_d)} exp(-d^2/r_d^2)$

Data   Model

Preliminary

Residuals   Residual distribution

μ = -0.04
σ = 1.02

Properties of 3HWC J1928+178 from the fit, assuming inverse Compton scattering of e⁻ on CMB photons as main radiation mechanism

	3HWC J1928+178
Angular size (68%)	$0.25°_{\pm0.05}$
Diameter	~ 37 pc
Energy flux [1-100 TeV]	$2.51_{\pm0.8}$ 10^{-12} erg cm^{-2} s^{-1}
Spectral index	-2.04 ± 0.17
γ-ray luminosity	5.6 10^{33} erg s^{-1}
Total energy	2.1 10^{46} erg
Energy density	0.04 eV cm^{-3}

Preliminary

Radial profiles

- data
- model 2 PS + 1 diffuse extended
- model 2 PS + 2 extended
- crab (normalised to data)

Properties of 3HWC J1928+178 from the fit

	3HWC J1928+178
Diffusion radius	$2.27°_{\pm0.2}$
Diameter	~ 340 pc
Energy flux [1-100 TeV]	$3.8_{\pm0.4}$ 10^{-11} erg cm^{-2} s^{-1}
Spectral index	$-2.56_{\pm0.05}$

3HWC J1928+178, a gamma-ray halo candidate ?
- Powered by PSR J1928+1746 – rather old pulsar
- No X-ray counterpart
- Extended gamma-ray emission
- ε_{IC} = 0.04 cm^{-3} < ε_{ISM} = ~ 1 eV cm^{-3} assuming IC scattering as gamma-ray emission mechanism
- Possibly originates from electrons cooling down and diffusing away from their source