

# CTA-1DC

PyFACT and *ctools* analysis examples

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# Workflows

## PyFACT

**IACT DATA**  
EVL (+ARF/RMF)

**pfmap**

**pfspec**

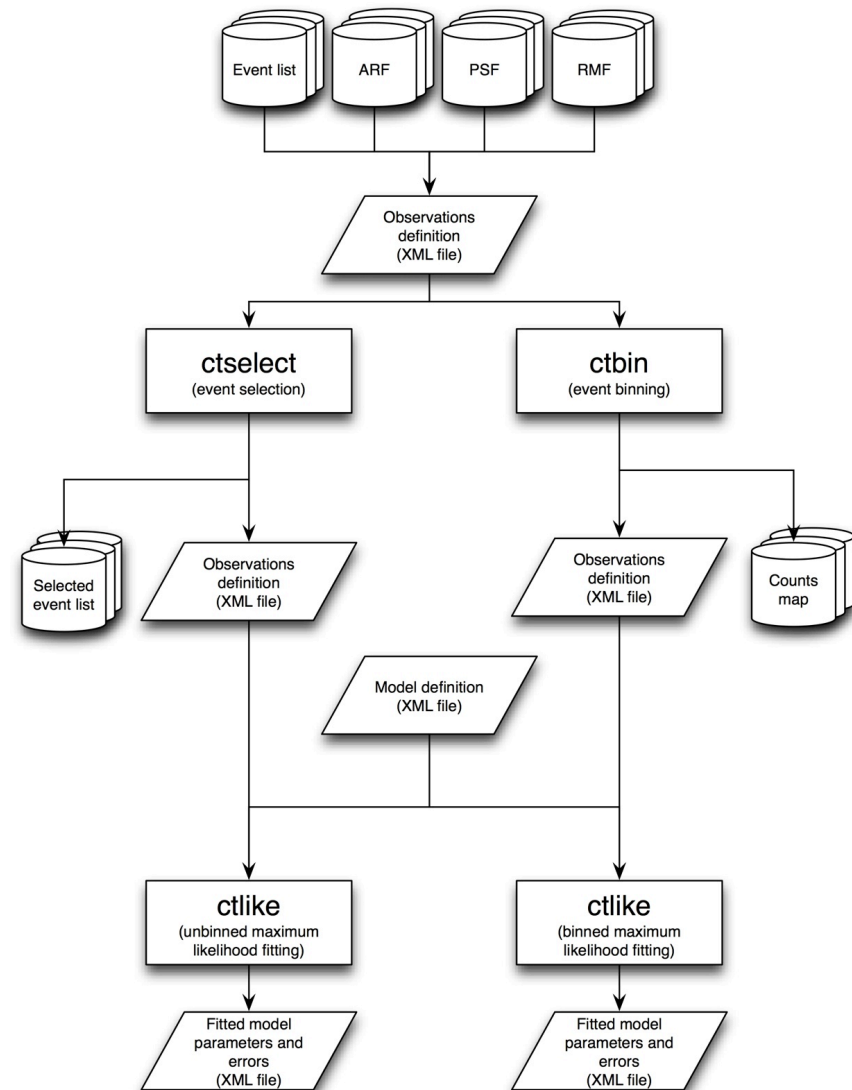
**FITS images**  
Excess,  
significance,  
background, ..

**PHA**  
Signal, excess,  
background

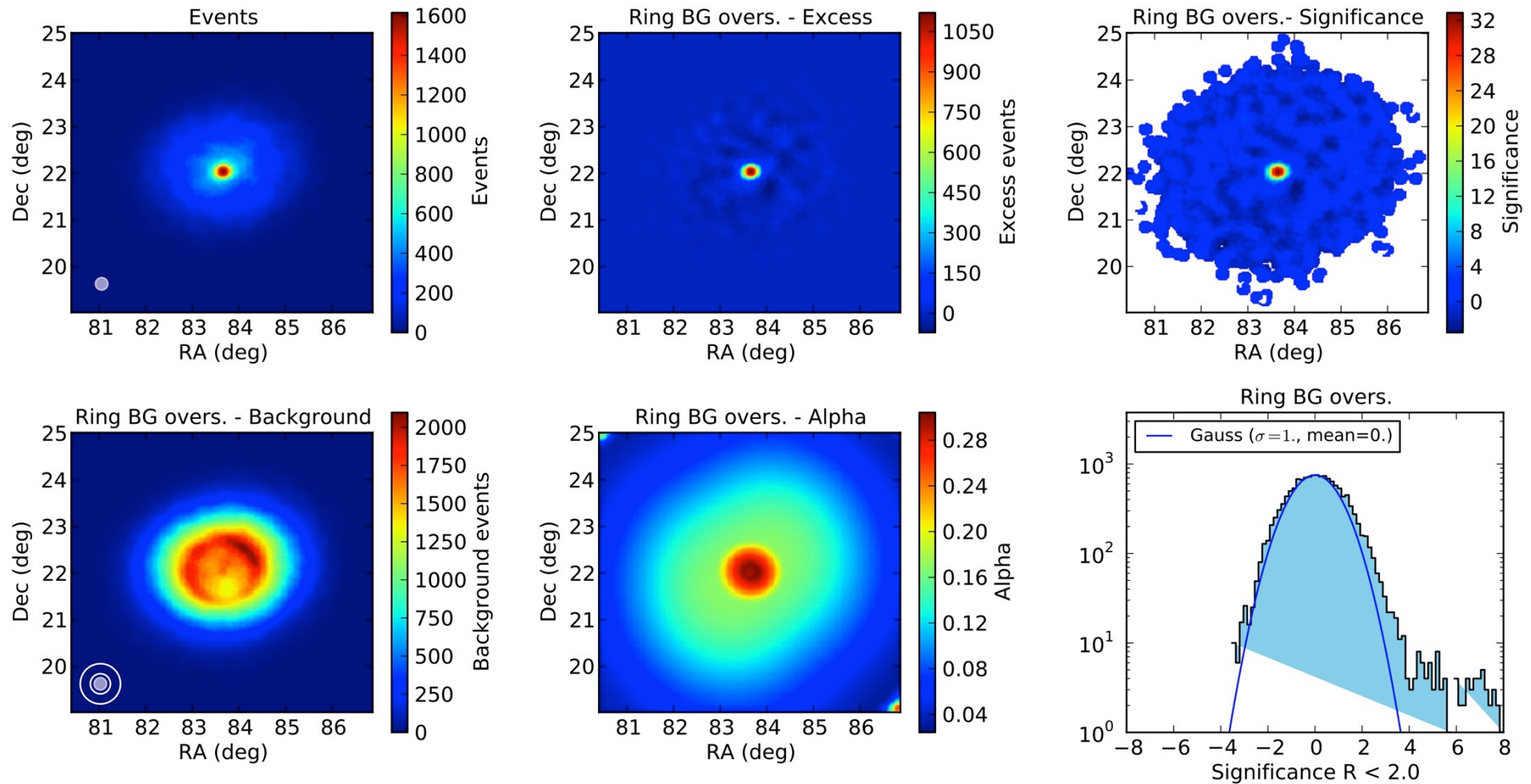
**fv, ds9, APpy,  
sherpa, ..**

**xspec,  
sherpa, ...**

## ctools

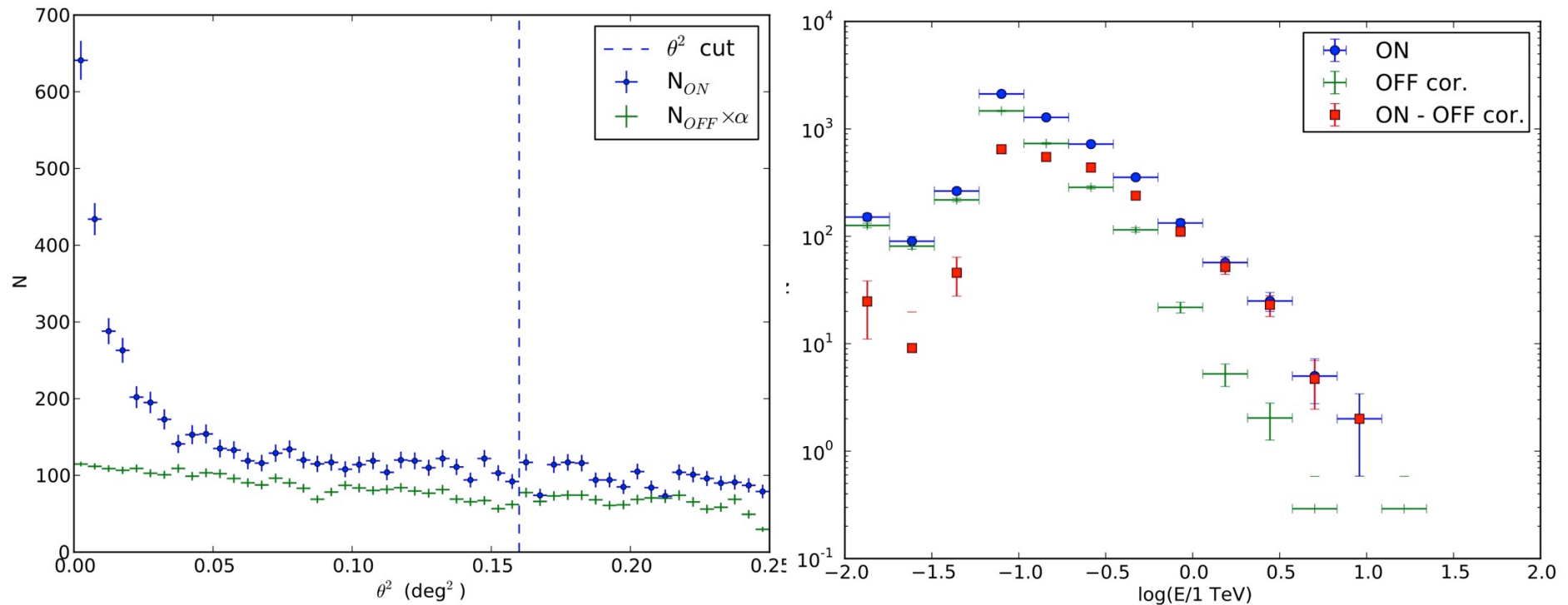


# pfmap - Crab (MAGIC)

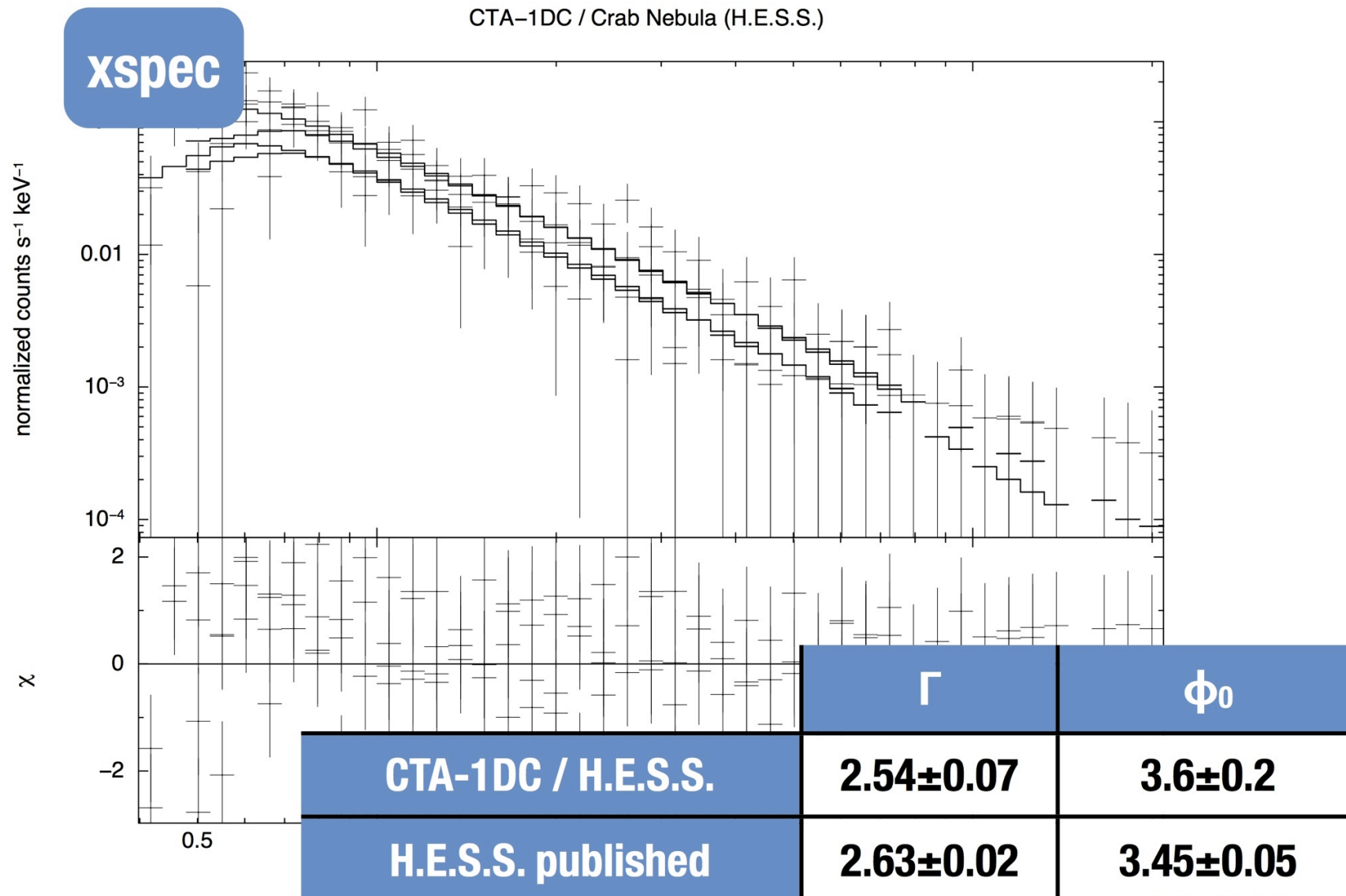


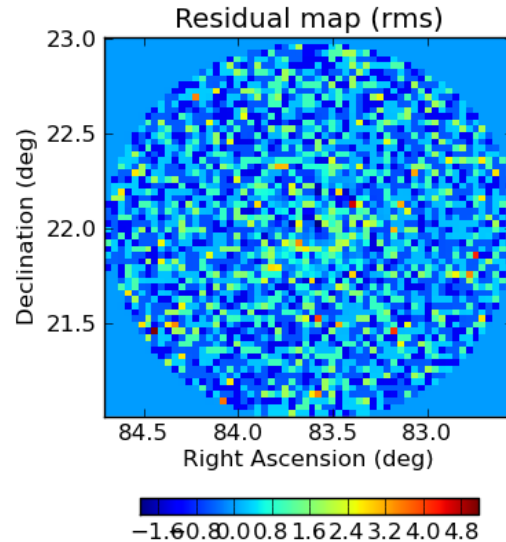
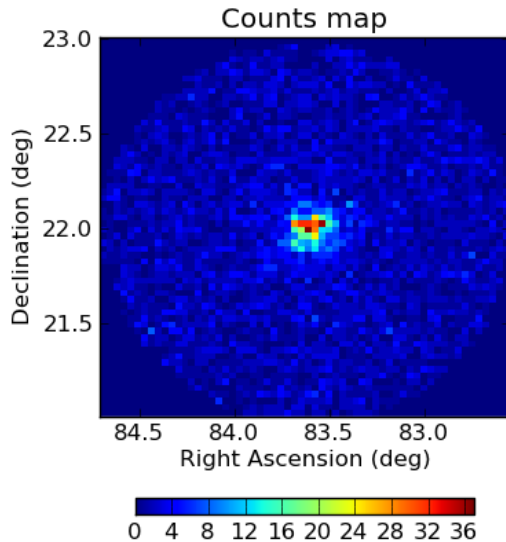
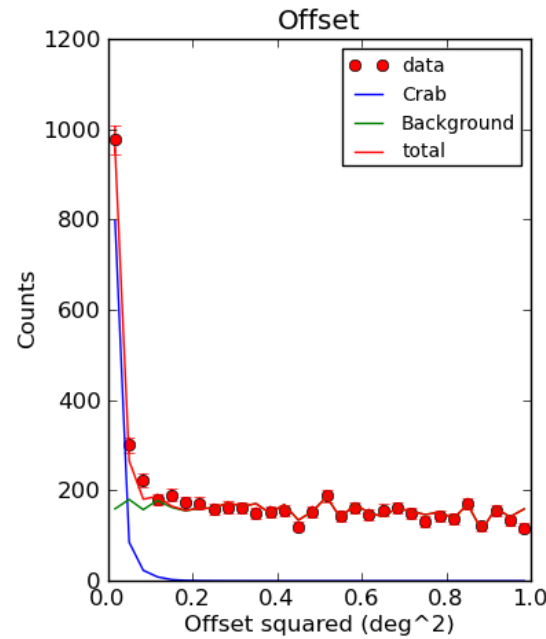
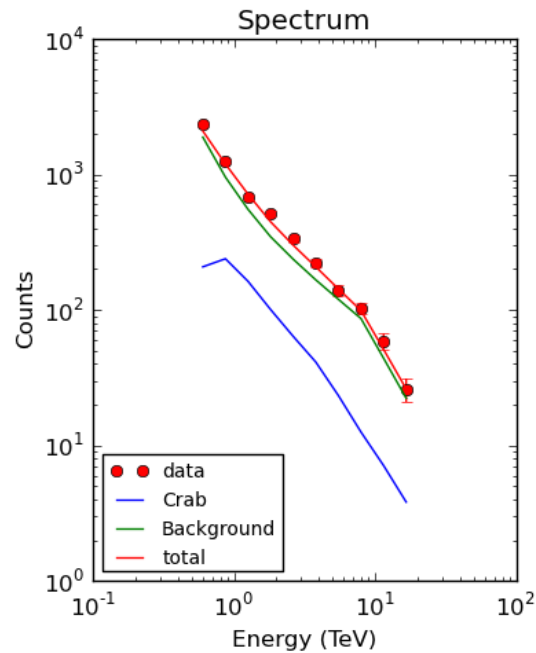


# pfspec – Crab (MAGIC)



# pfspec – Crab (HESS) XSPEC analysis





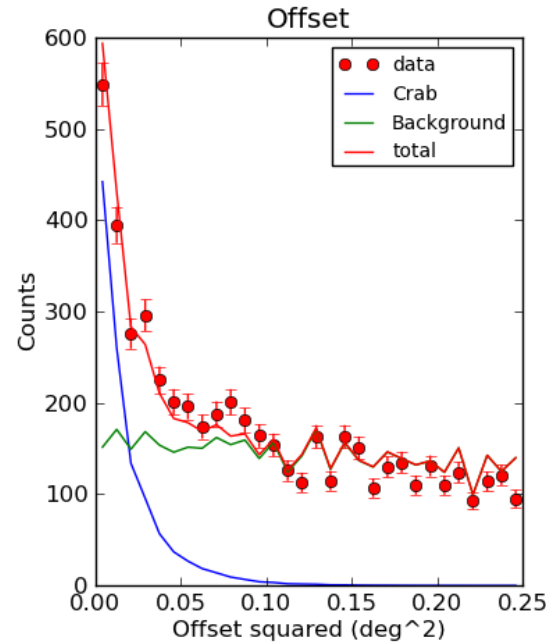
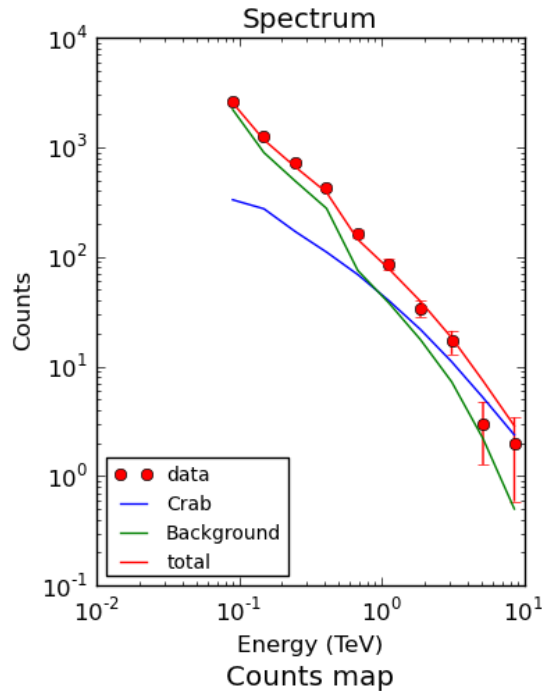
## Binned analysis

$\alpha = 83.619 \pm 0.002$  (83.633)  
 $\delta = 22.025 \pm 0.002$  (22.015)  
 $\Phi_1 = 4.51 \pm 0.18$  ( $3.45 \pm 0.05$ )  
 $\Gamma = 2.68 \pm 0.06$  ( $2.63 \pm 0.01$ )

## Unbinned analysis

$\alpha = 83.620 \pm 0.002$  (83.633)  
 $\delta = 22.027 \pm 0.002$  (22.015)  
 $\Phi_1 = 4.48 \pm 0.18$  ( $3.45 \pm 0.05$ )  
 $\Gamma = 2.68 \pm 0.06$  ( $2.63 \pm 0.01$ )

# ctools – Crab (MAGIC)

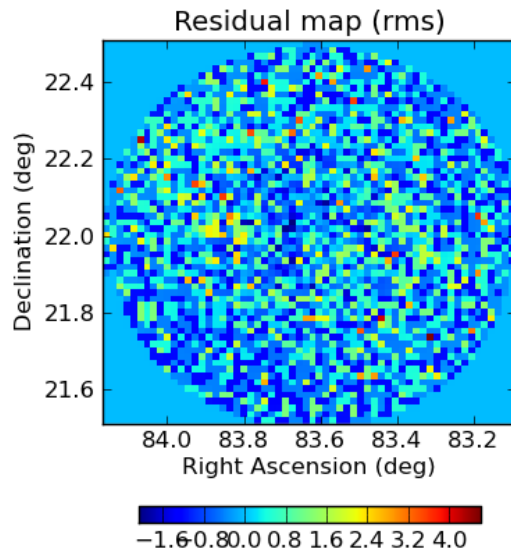
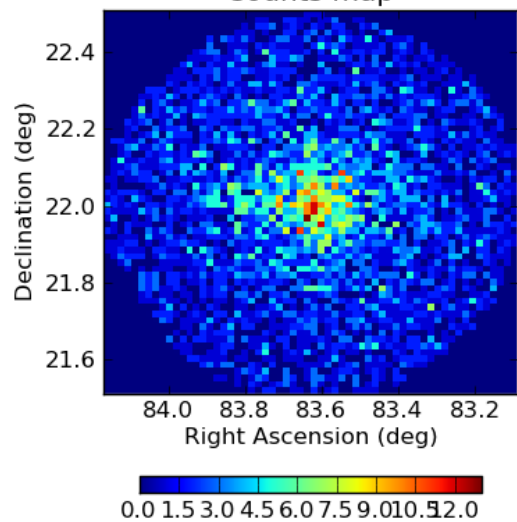


## Binned analysis

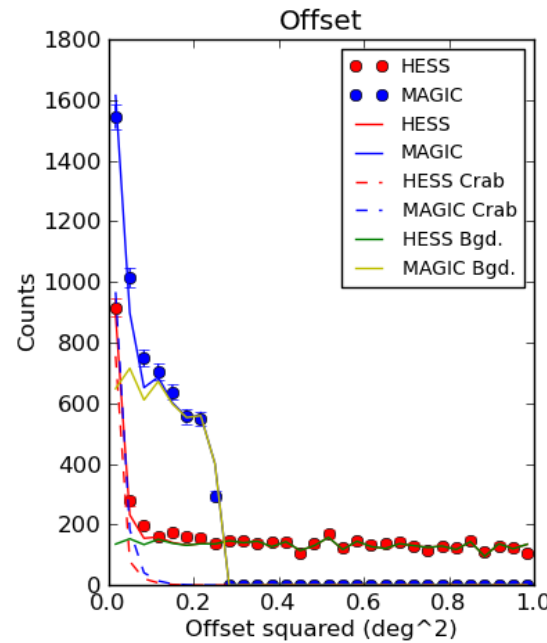
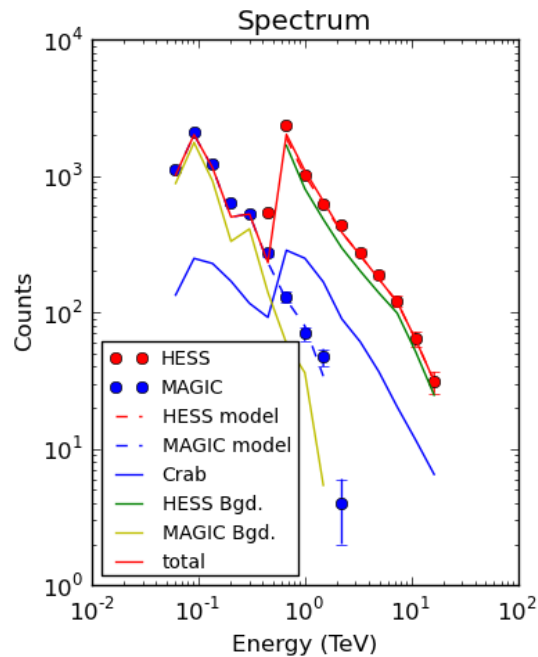
$\alpha = 83.641 \pm 0.003$  (83.633)  
 $\delta = 22.026 \pm 0.003$  (22.015)  
 $\Phi_{0.3} = 7.73 \pm 0.32$  ( $5.7 \pm 0.2$ )  
 $\Gamma = 2.58 \pm 0.05$  ( $2.48 \pm 0.03$ )

## Unbinned analysis

$\alpha = 83.640 \pm 0.003$  (83.633)  
 $\delta = 22.025 \pm 0.003$  (22.015)  
 $\Phi_{0.3} = 7.67 \pm 0.32$  ( $5.7 \pm 0.2$ )  
 $\Gamma = 2.60 \pm 0.05$  ( $2.48 \pm 0.03$ )



# ctools – Crab (combined HESS+MAGIC)



## Binned analysis

$$\alpha = 83.625 \pm 0.002 \text{ (83.633)}$$

$$\delta = 22.025 \pm 0.002 \text{ (22.015)}$$

$$\Phi_1 = 4.09 \pm 0.13 \text{ (3.45} \pm 0.05)$$

$$\Gamma = 2.50 \pm 0.03 \text{ (2.63} \pm 0.01)$$

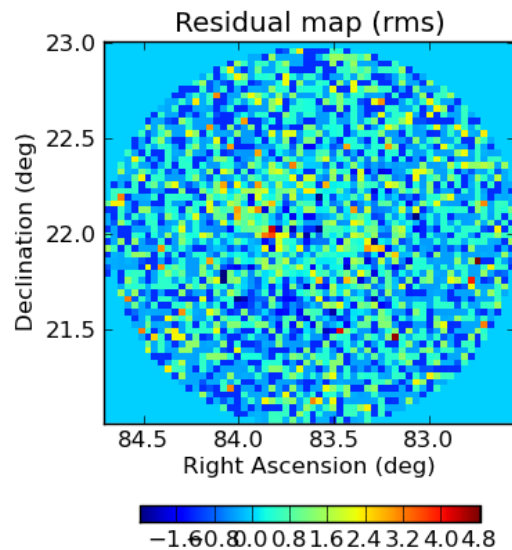
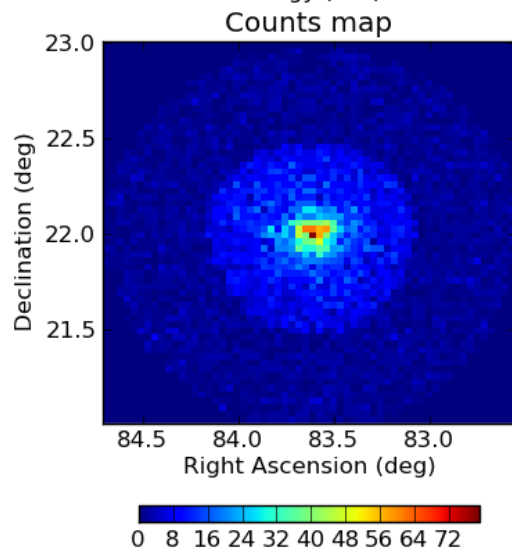
## Unbinned analysis

$$\alpha = 83.625 \pm 0.002 \text{ (83.633)}$$

$$\delta = 22.026 \pm 0.002 \text{ (22.015)}$$

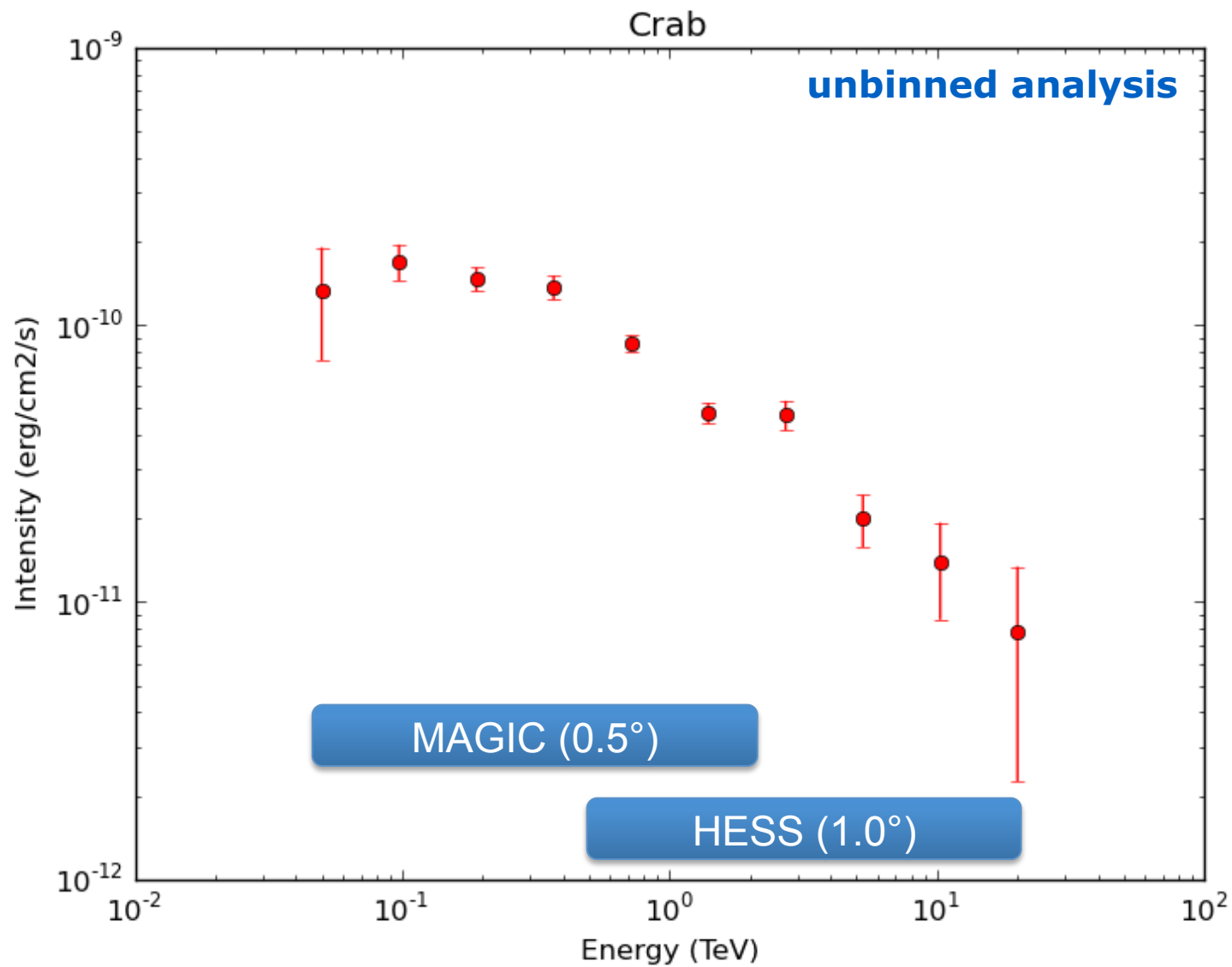
$$\Phi_1 = 4.09 \pm 0.13 \text{ (3.45} \pm 0.05)$$

$$\Gamma = 2.49 \pm 0.03 \text{ (2.63} \pm 0.01)$$





# *ctools* – Joint HESS+MAGIC Crab spectrum



# Conclusions

Some tools exist to play around with CTA-1DC data

Analysis results come close to expected results, although there are still some issues (e.g. *ctools* flux normalizations ~30% too high; *pfspec* background normalization too low for MAGIC data)

We're still in the learning phase, more validations of data and IRF format (and their correct interpretation) and tools is needed