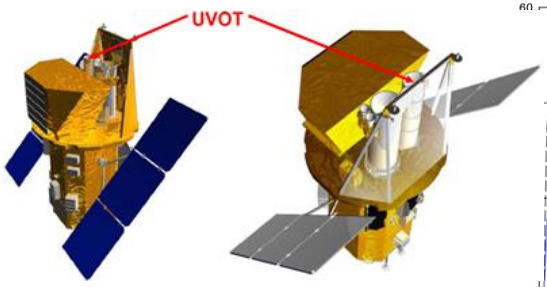
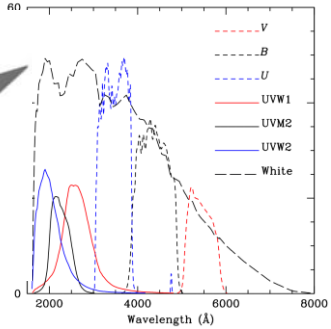
The Swift/UVOT Blazar image processing for multi-wavelength campaigns

F. Verrecchia, C. Leto, P. Giommi, and collaborators in Fermi/NuSTAR/Planck Teams

- Blazar multi-wavelength: past and present
- UVOT various results: collaborations
- Swift/UVOT Blazar catalog: work in progress

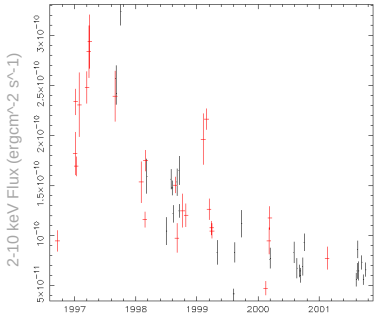




Blazar Multi-Wavelength campaigns@ ASDC

- **BeppoSAX data processing of Blazars:** (P. Giommi, et al., 2002, babs.conf...63G)

BeppoSAX Narrow Field Instrument (NFI) X-ray data processing on-going since 1996 to create updated Spectral Energy Distributions (SEDs), then in 2001-2002 a Blazar Wide Field Camera (WFC) processing began within the official catalog creation and brought to specific works for Mkn 501 (E.Massaro, et al., 2004, A&A,). SEDs included archival radio, and IR-optical-UV data but…



=>in 2004: ASDC one of the official Swift Data Centers

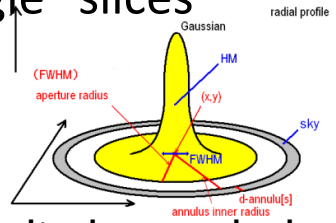
Blazars Swift/UVOT images data reduction:

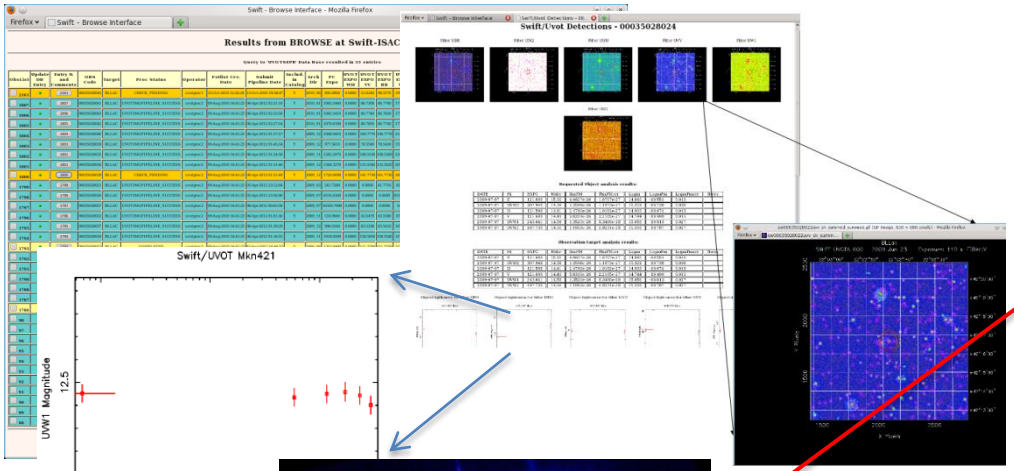
Blazars campaigns included Swift data processing in 2005-2006:

A dedicated archival data processing procedure development was planned in 2006 for the Swift Blazar key-project in collaboration with A. Antonelli, G. Tosti, E.Massaro, to process with HEAsoft tasks UVOT total exposure images and also single “slices” with aperture photometry and detection algorithm official tasks.

Also support the Swift/XRT surveys (“Serendipitous” and “Deep”).

Ex.: the Data Processing management system preview

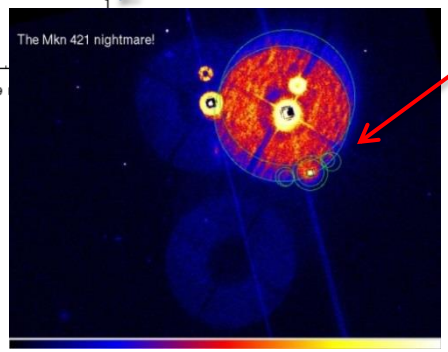


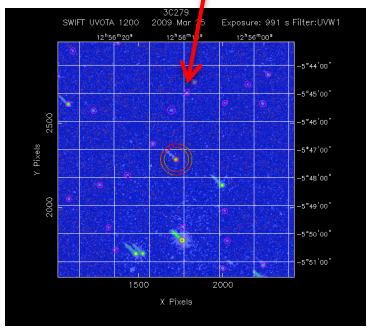


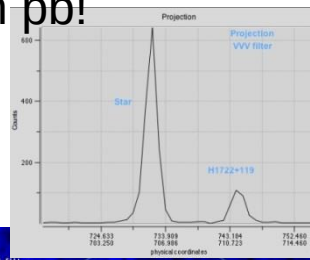
Careful revision of the results is needed, even inspecting the full SED, due to:

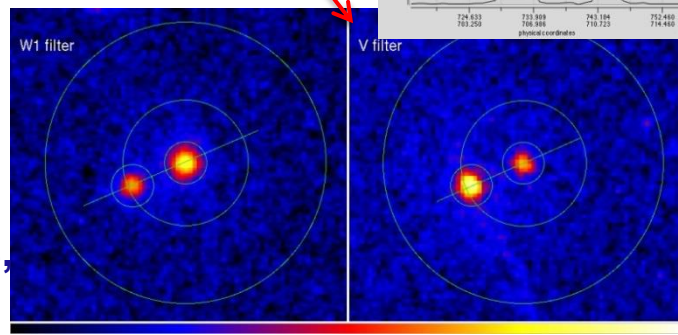
- not correct astrometry
- possible contaminating nearby objects, saturation and artifacts, and contaminated bkg
- uncorrect flux conversion pb!

=>verify SED validity









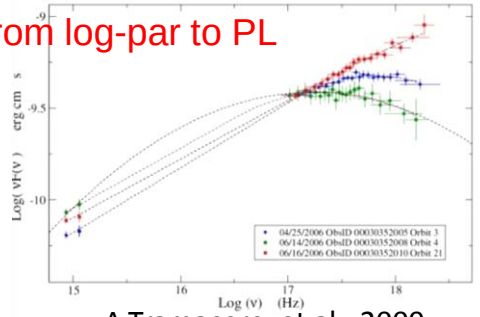
- **Data processing results: included in dedicated DB’s, will be enlarged including also light curves**

Blazars multi-frequencies campaigns with Swift:

- **Collaborations: with Fermi, Planck and NuSTAR Teams; some MAGIC work**
- **Comparison with official catalogues: UVOTSSC**

larger time coverage; dedicated analysis/verification

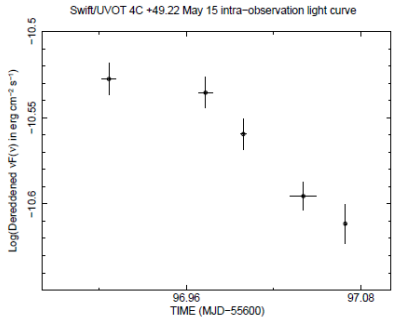
From log-par to PL



A.Tramacere, et al., 2009

- **Main Blazar SEDs papers: surveys & single sources**

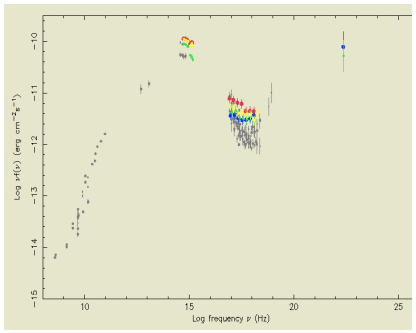
- A. Tramacere, et al., 2009, A&A 501, 879: Mkn421
- A.A. Abdo, et al., 2010, ApJ, 716, 30: SEDs of Fermi Blazars
- P.Giommi, et al., 2012, A&A, 541A, 160:Planck, Fermi, Swift
- A. Furniss,et al., 2015, ApJ, 812, 65: Mkn501 with NuSTAR
- M. Balokovic, et al., 2016, ApJ, 819, 156:Mkn421 with NuSTAR
- M.J. Valtonen, et al., 2016, ApJ, 819L, 37: OJ287 new flare,see Ciprini's talk!
- Ahnen, M.L., et al., 2016, MNRAS,459, 3271:VHE gamma-ray source H1722+119

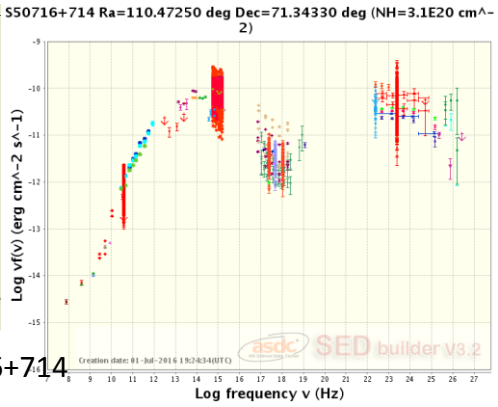


C.Cutini, et al., 2014

Variability studies: light curves, time resolved SEDs

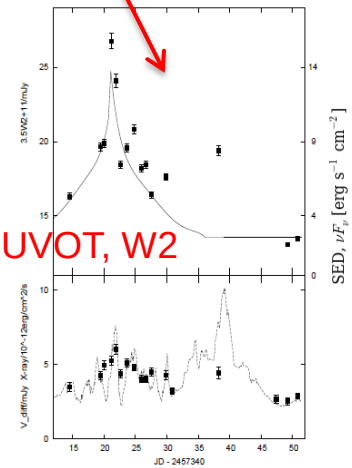
ASDC SED Builder tool:





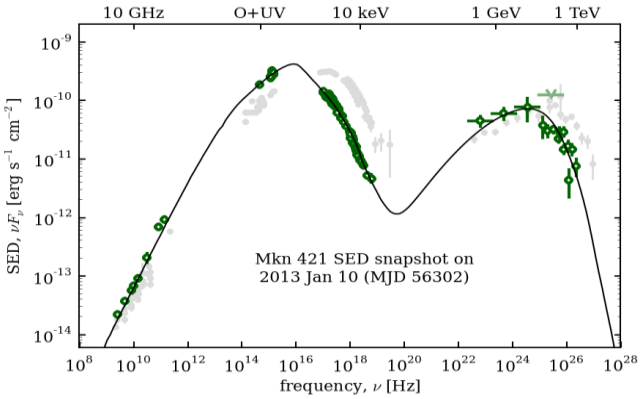
Archival improvement: S5 0716+714

SED evolution



UVOT, W2

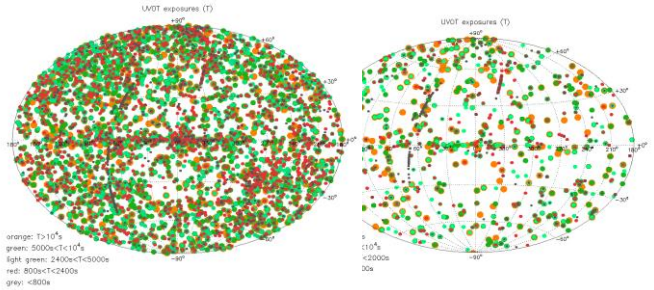
M.J. Valtonen, et al., 2016



courtesy M. Balokovic, 2016

Some results: detected various flux variation in a few objects; SED evolution

Recent updates:

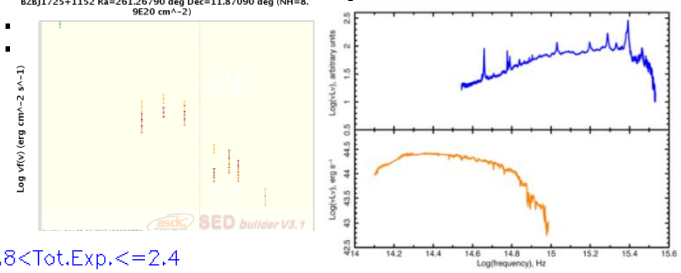


- **UVOT exposure evolution: e.g.2006->2009**

- **Reprocessing + processing updates: in 2015**

a complete reprocessing with new software and calibration started

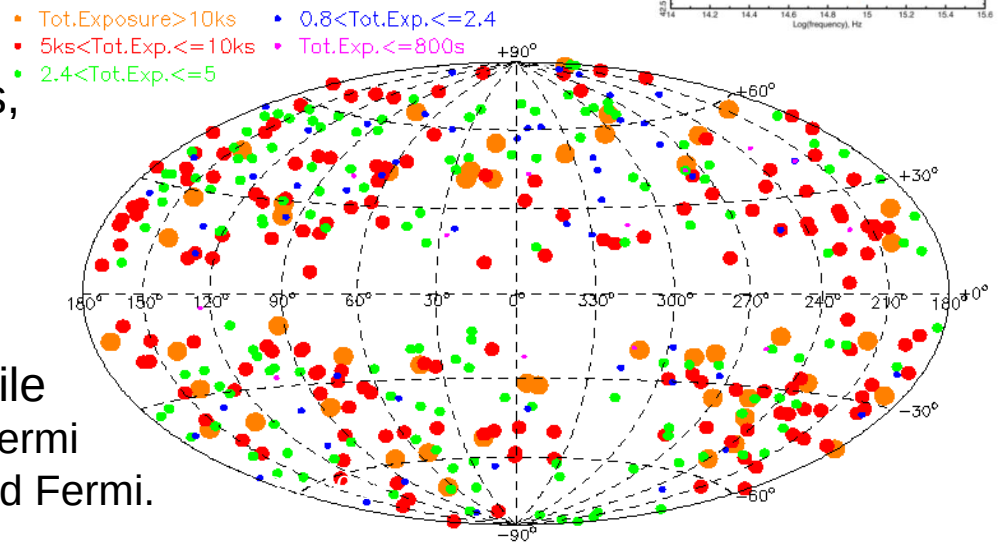
After revision of some results on some source, Mkn421 and 501, on summer 2015 a complete reprocessing with update HEAsoft version (v6.16) and CALDB was decided and started, together with further processing of obs.s contemporaneous to NuSTAR ones and the processing of new objects obs.s for Planck ones. Processing was completed on Dec. (~8000 obs.s). Revision of the results has continued in 2016, for pbs cited and:



- check source colors validity for all detections
- verify SED validity =>uncorrect flux conversion pb!

Galaxy contamination

Results: current Blazar sample covered: total ~**450** sources with ~32000 detections, **52** are TeV sources and:



- **191** FSRQ
- **184** BL Lacs
- 75 uncertain

Complete sample in a dedicated work, while 147 in future multi-frequency work with Swift, Fermi and NuSTAR data and 94 with Planck, Swift and Fermi.

Thank you