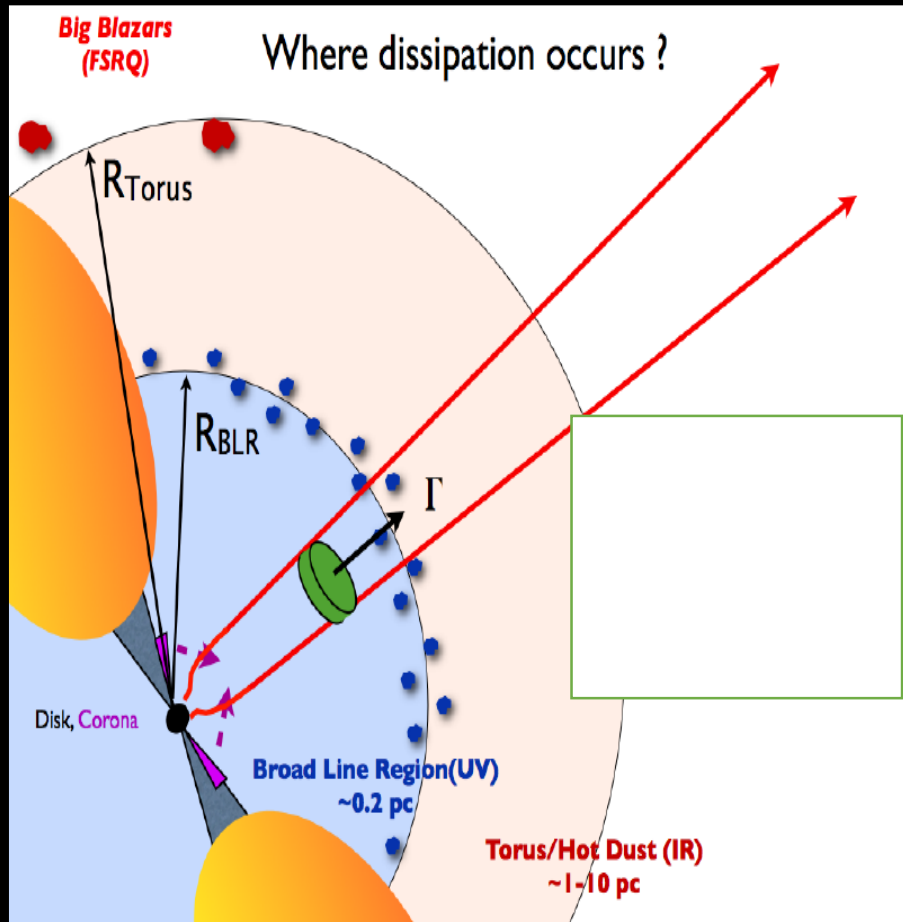


Locating the blazar zone

Connection between VHE and MWL
events?

Elina Lindfors

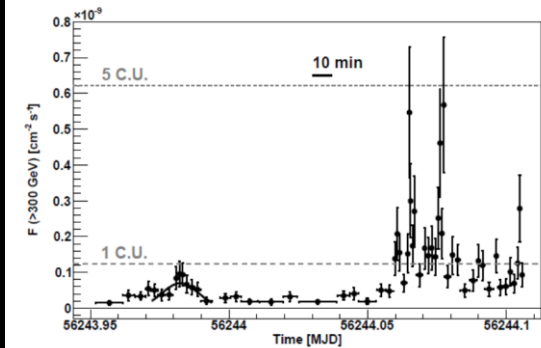
Long standing question



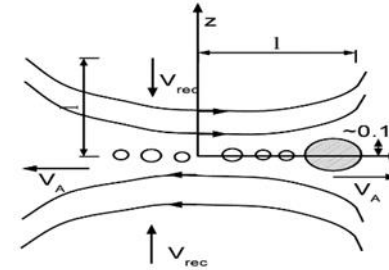
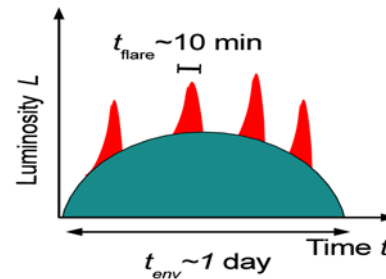
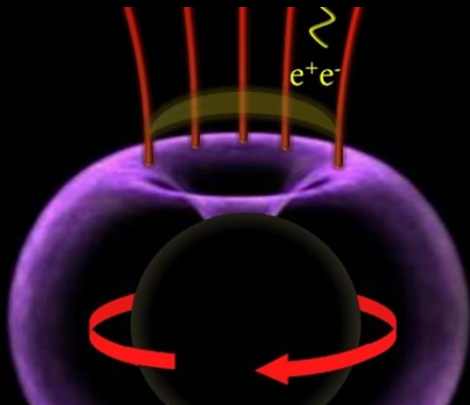
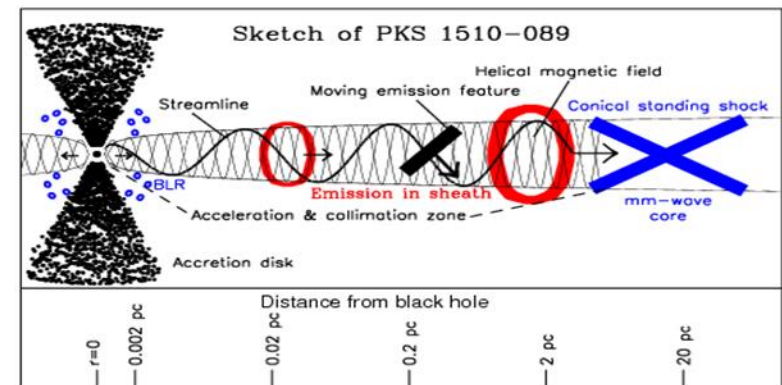
- Inside BLR traditionally favored by theoreticians
- BLR absorbs gamma-rays => expect signatures in gamma-ray spectra => not observed by Fermi
- Timing of the gamma-ray flares with respect to events for which we know the location = VLBI

Fast VHE gamma-ray flares

- Observed from FSRQs, BL Lacs and radio galaxies
- Variability timescales less than 30 minutes, fastest ~ 5 minutes
- Different emission models
- Where do these events happen in the jet? Small emission region \neq close to black hole

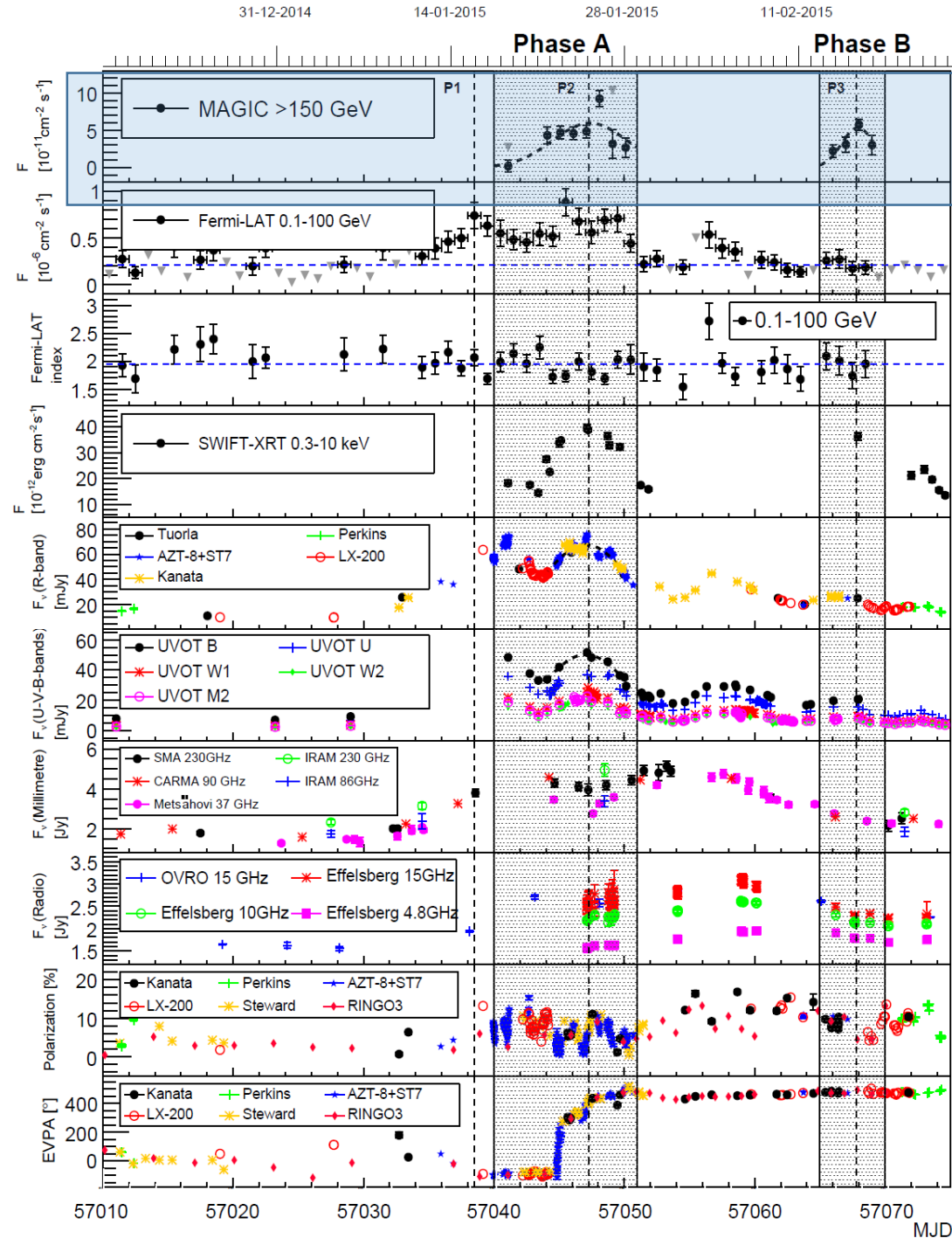


Aleksić et al. 2014. *Science*



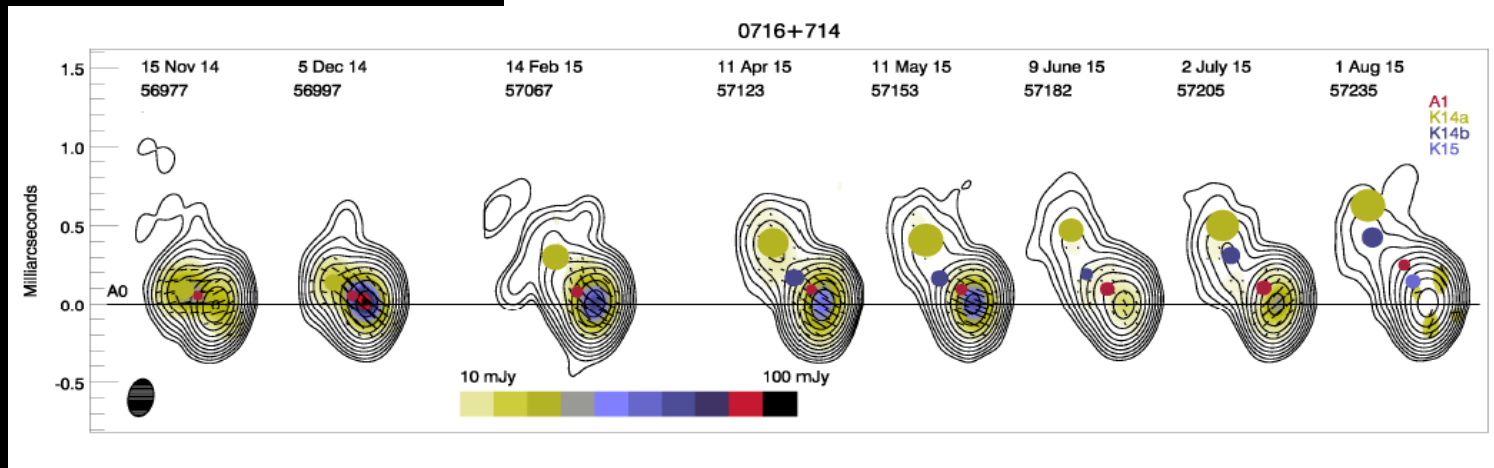
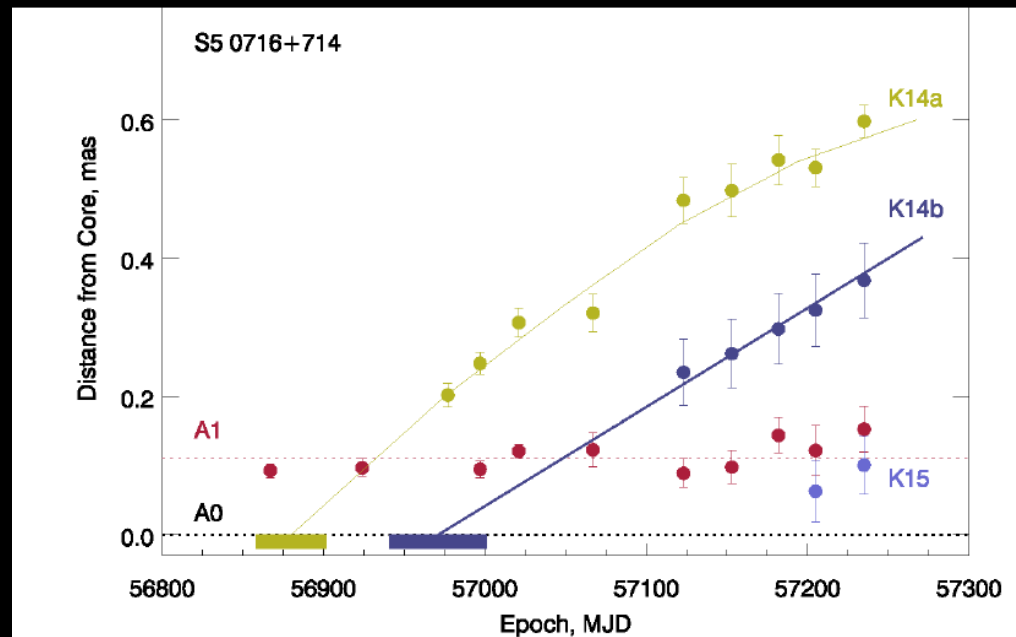
S50716+714 flaring state in January 2015

- High state (radio, optical, GeV gamma-rays) started in the beginning of January 2015
- Phase A: flare in radio, optical, X-rays, gamma-rays, very fast rotation of optical EVPA
- Phase B: flare in X-rays and VHE gamma-rays



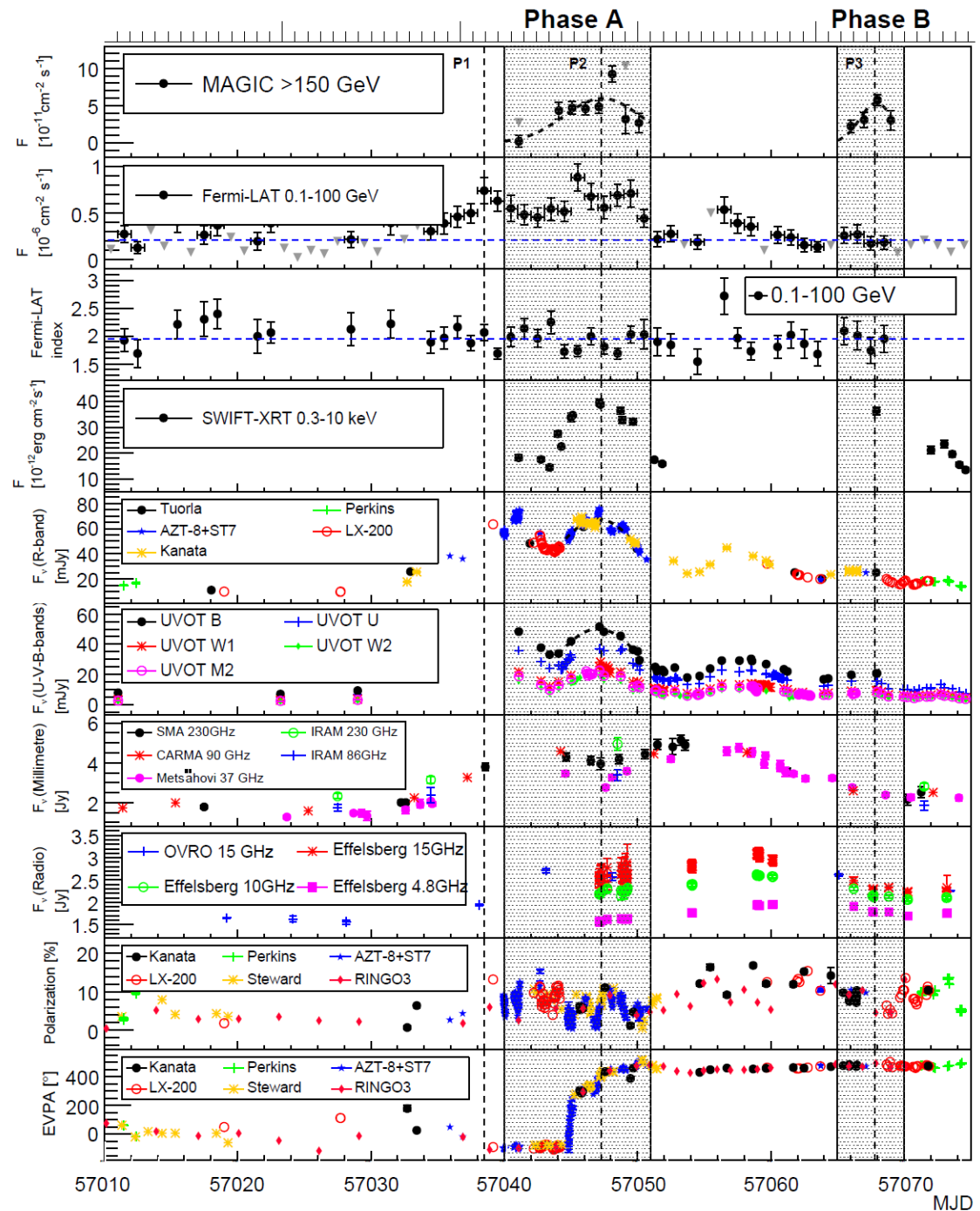
What was happening in the jet?

- Component K14b passes through the stationary feature A1 at MJD 57050 \pm 30 days
- Average size of A1 is (0.049 \pm 0.020) mas, it will take K14b (35 \pm 13) days to pass A1



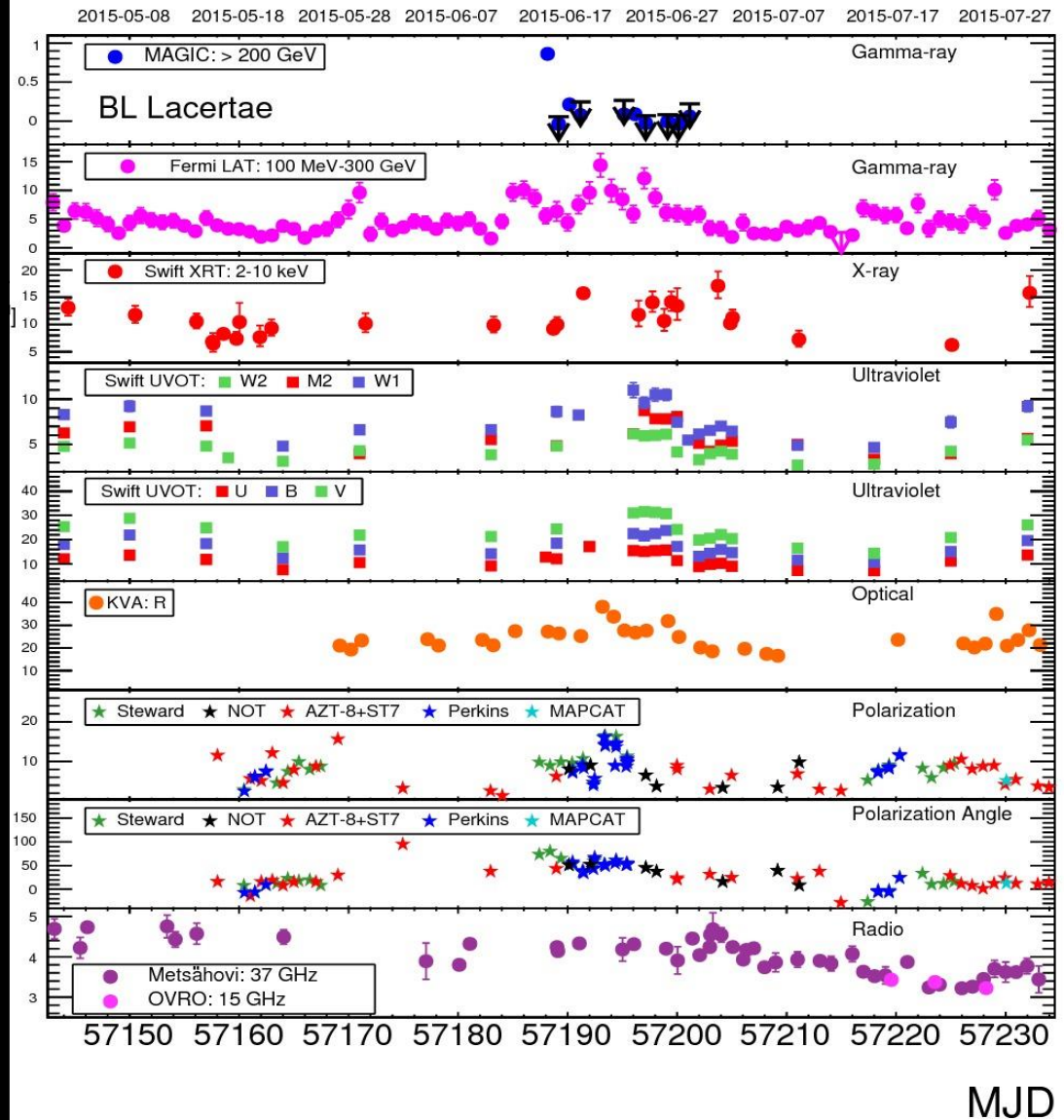
Light curves +VLBA

- The time it takes for K14b to pass A1 fits very well with the duration of 34 days of the elevated gamma-ray flux in the Fermi light curve MJD 57032 to 57066.
- In this scenario the TeV detections can be associated with the entrance and exit of the superluminal knot in and out of the recollimation shock (A1).



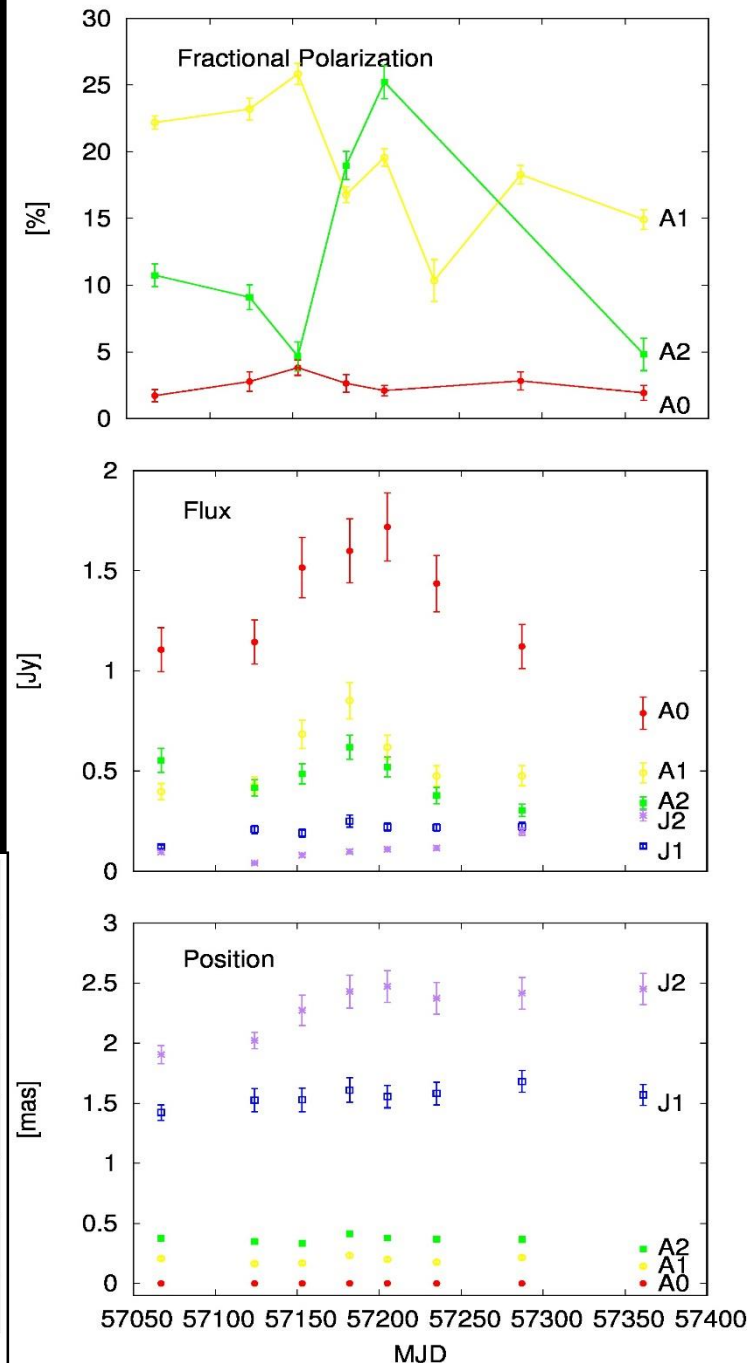
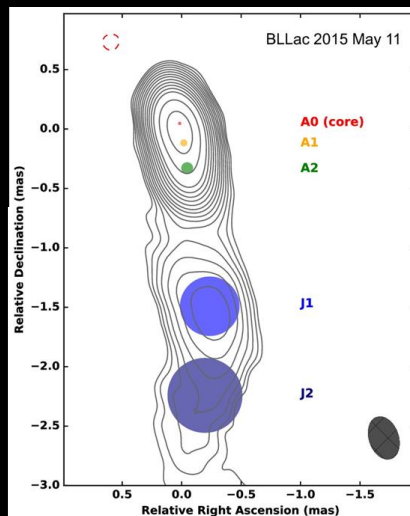
BL Lacertae flaring state in June 2015

- High state (optical, GeV gamma-rays) started in the May 2015
- Radio, X-rays no major flares
- Optical polarization: rotation of EVPA with >90 degrees, starting around the night of fast VHE flare



What was happening in the jet?

- No clear ejection of new component, but the quasi-stationary components A1 and A2 make it very difficult to detect new components.
- Brightening of the core
- Increase of polarized flux density
- Maybe a new component anyhow?



Comparison with the other two fast VHE flares from BL Lacertae

	Peak flux >200GeVx10 ⁻¹⁰ /ph/cm2/s	Decay Timescale Minutes	Gamma+ optical	X-ray	Optical polarization	VLBA jet
VERITAS f1 2011	3.4+-0.6	13+-4	High	Low	Drop in %, rotation 90 degrees	New knot
MAGIC 2015	1.5+-0.3	26+-8	High	Low	Drop in %, rotation 90 degrees	Brightening of the core, Tentative new knot
VERITAS f2 2016	4.2+-0.6	36+-8	High	Low	Drop in %, rotation 90 degrees	Brightening of the core, Tentative new knot

Observational
bias?

Monitoring with CTA for locating the blazar zone

- Difficult to conclude on the connection, when most of the observations are during the flares
- Difficult to conclude on the connection, when VHE light curves mostly consist of upperlimits
- With CTA: unbiased monitoring with great sensitivity
- The MWL monitoring observations to support the CTA monitoring are crucial.

