

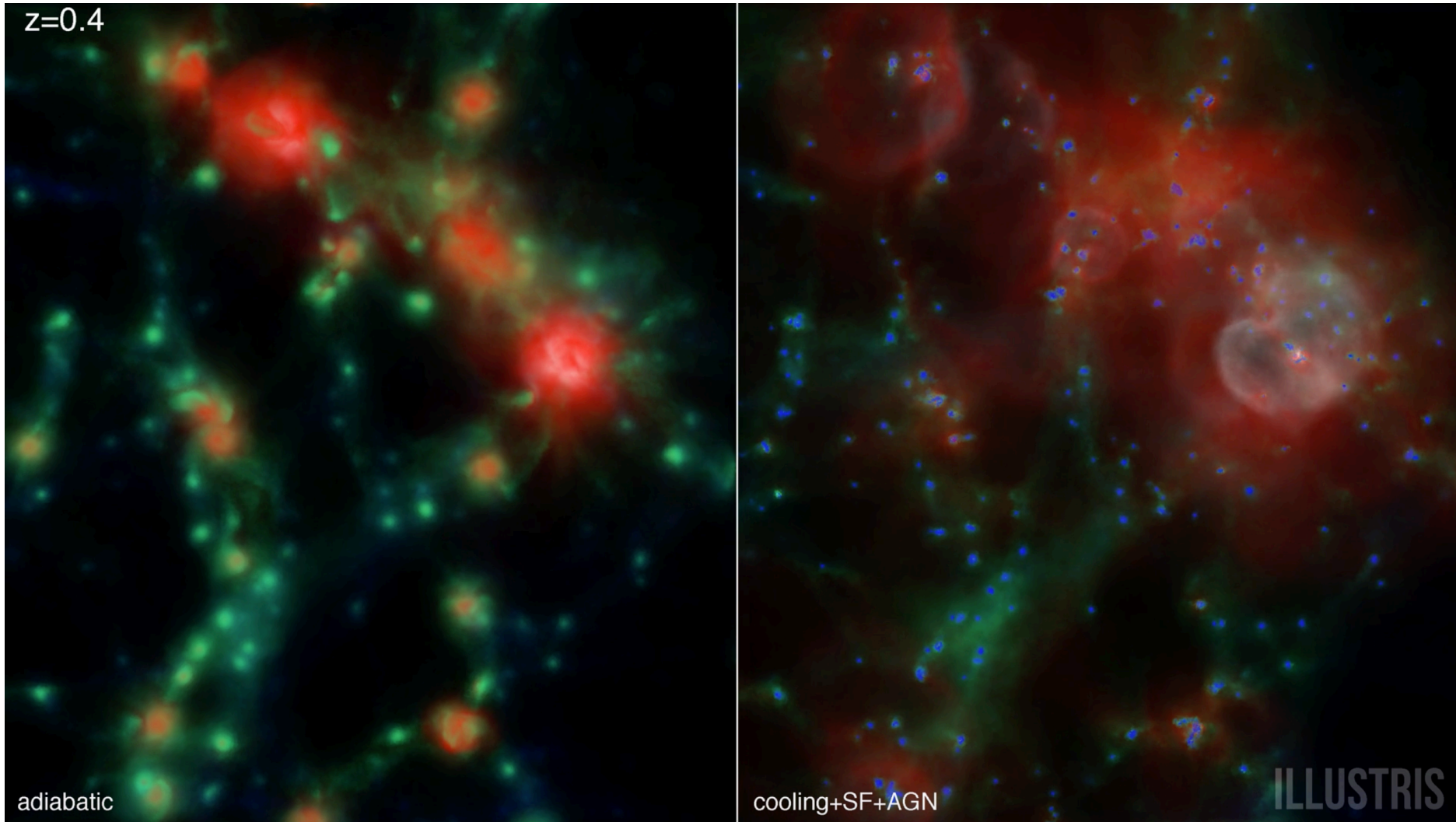
Particle content, morphology and jet power: all jets are not equal

Judith Croston

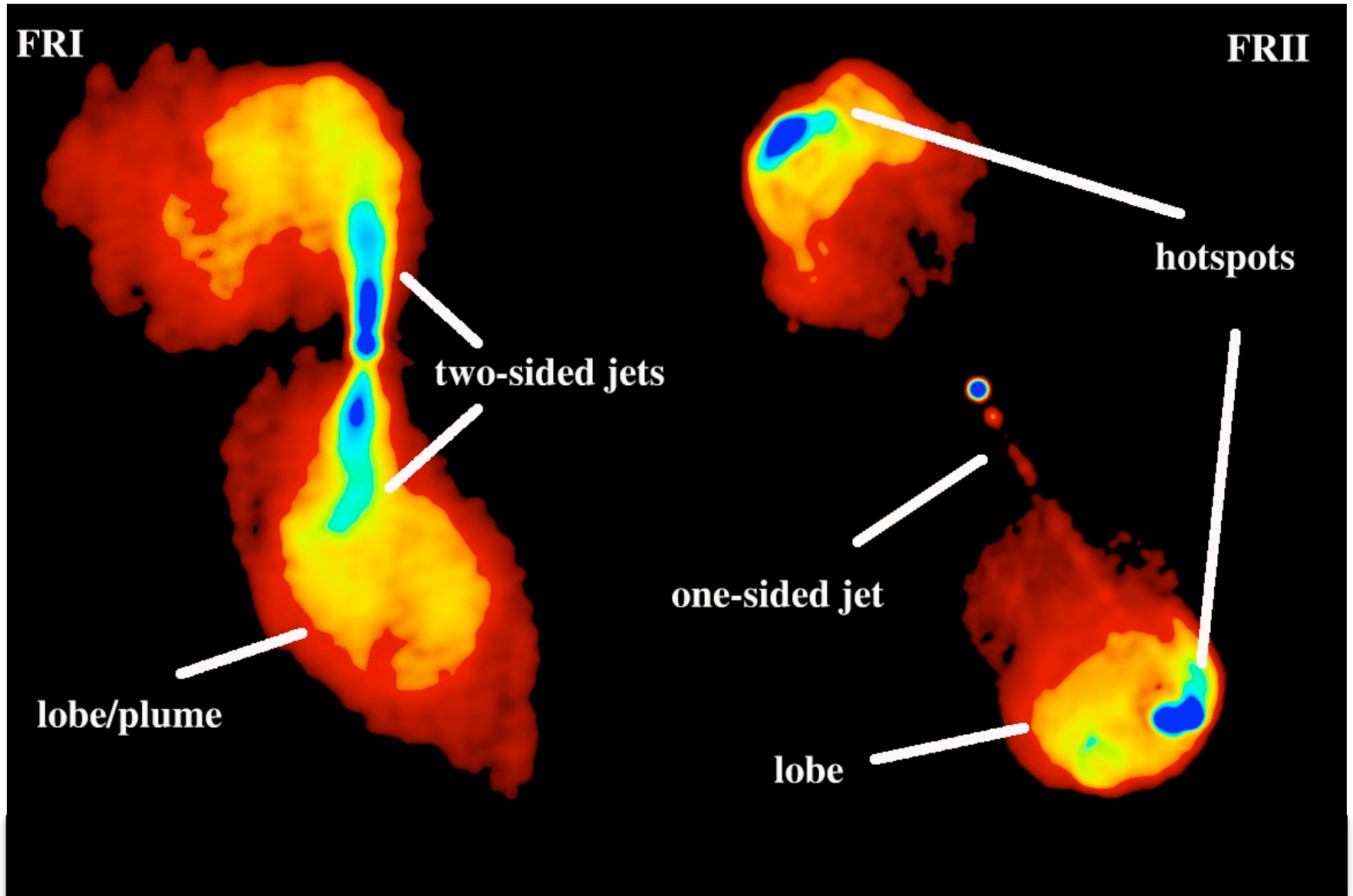
Thanks to Judith Ineson (Southampton) and
Martin Hardcastle (Herts)

see Croston+ 2018 (MNRAS 476 1614)

Motivation

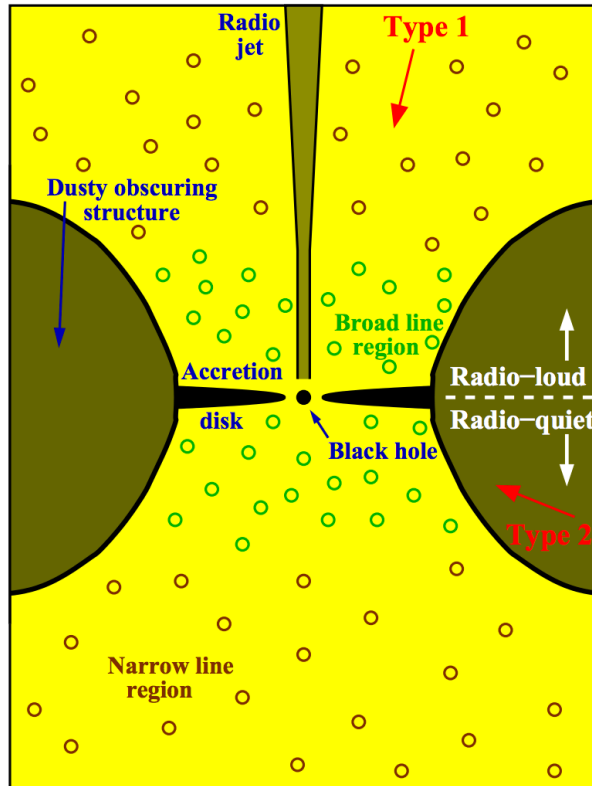


All jets are not equal

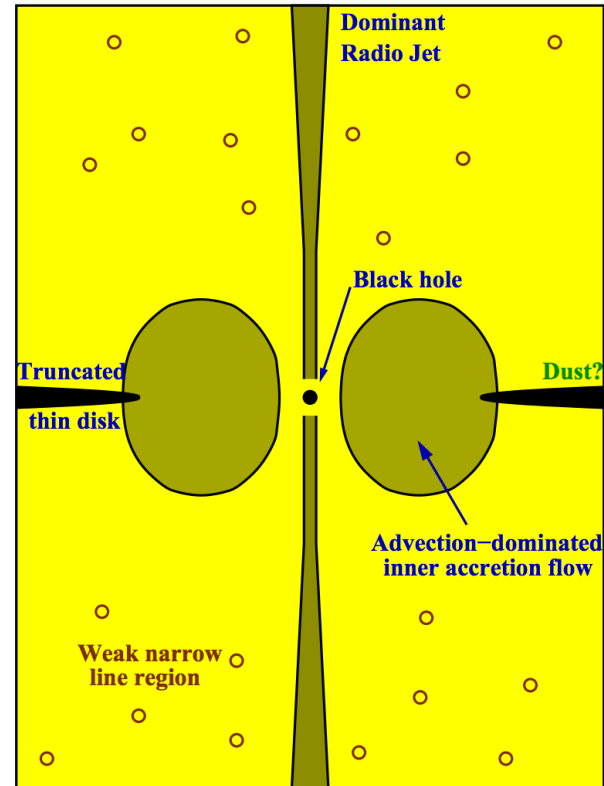


All jets are not equal

Same jets!

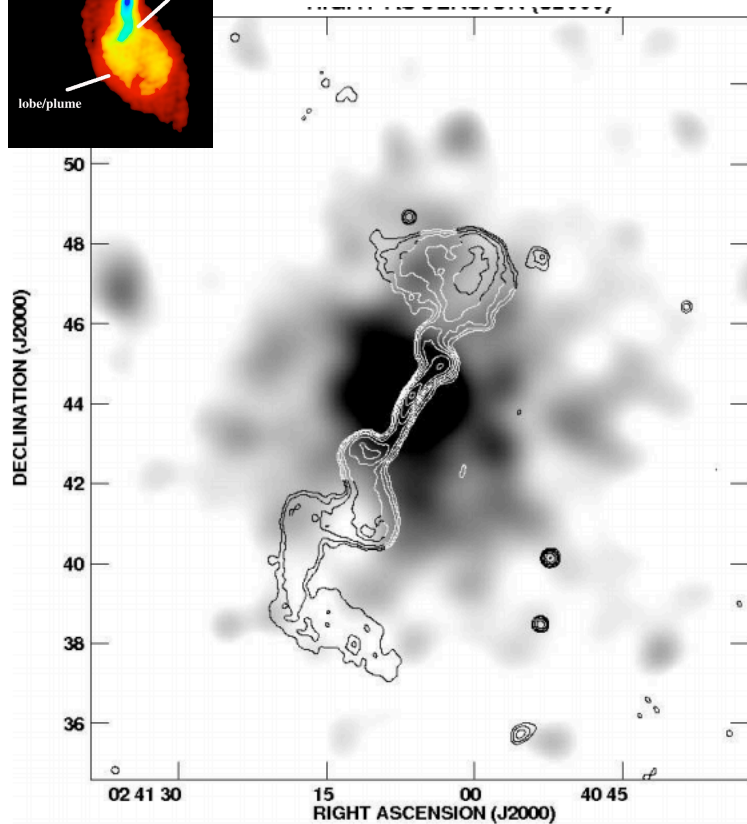
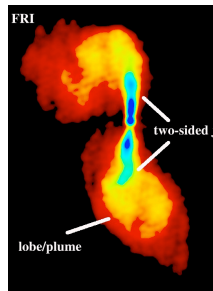


Radiative mode
= High Excitation RG (HERG)

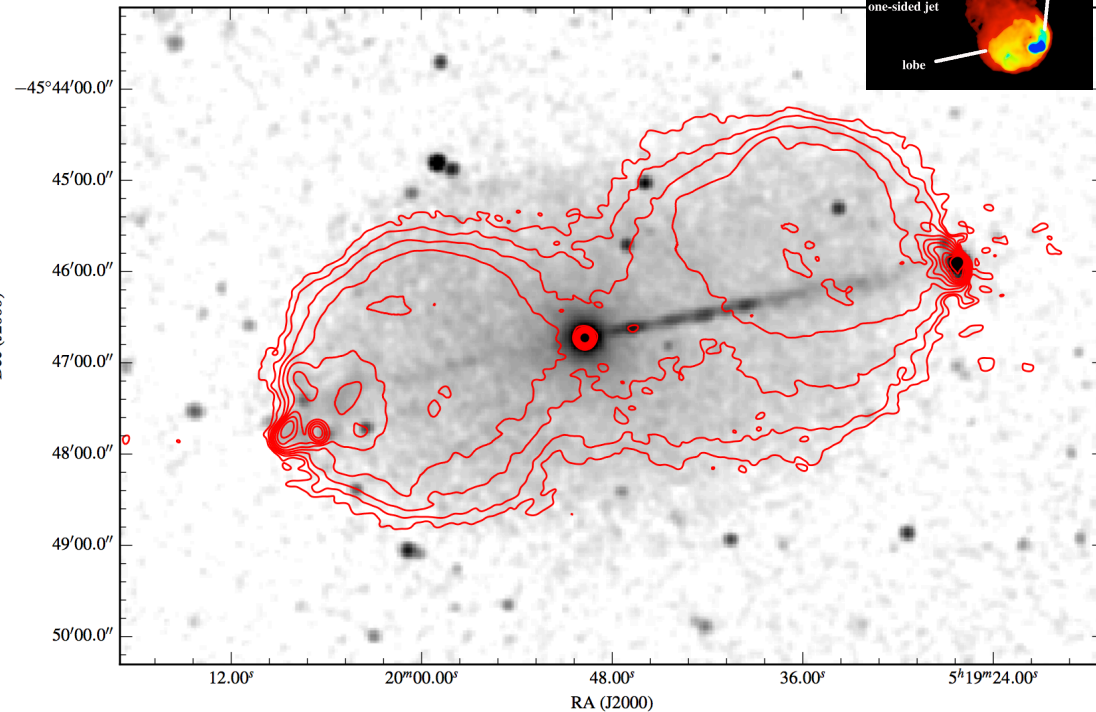
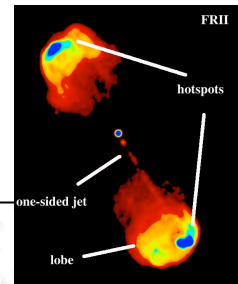


Jet mode
= Low Excitation RG (LERG)

Methods for inferring lobe particle content and energetics

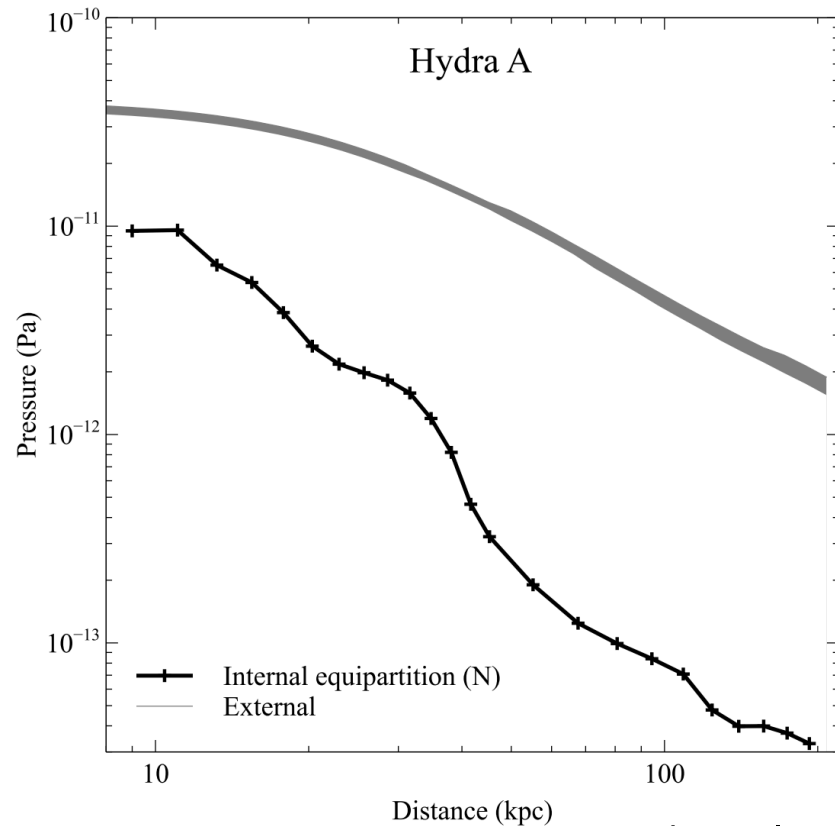
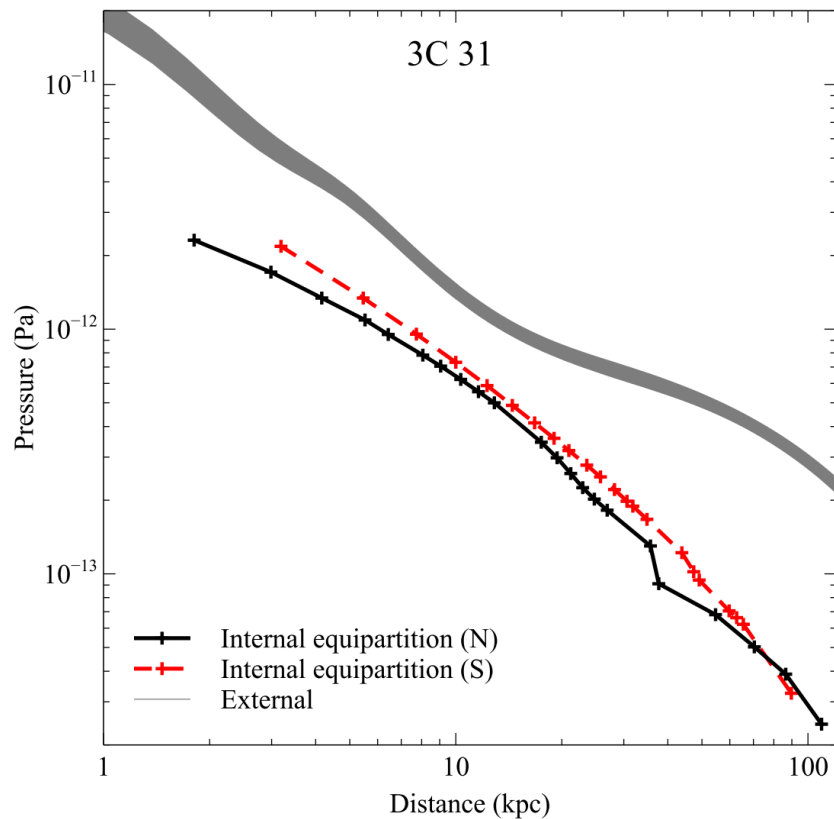
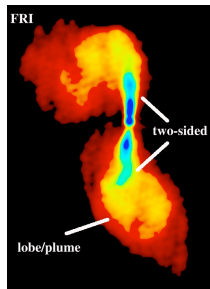


Pressure comparisons



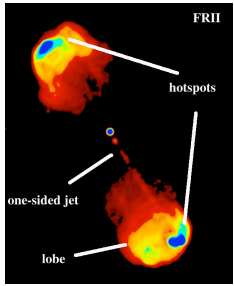
X-ray inverse-Compton emission from lobes

FRI energetics from pressure balance

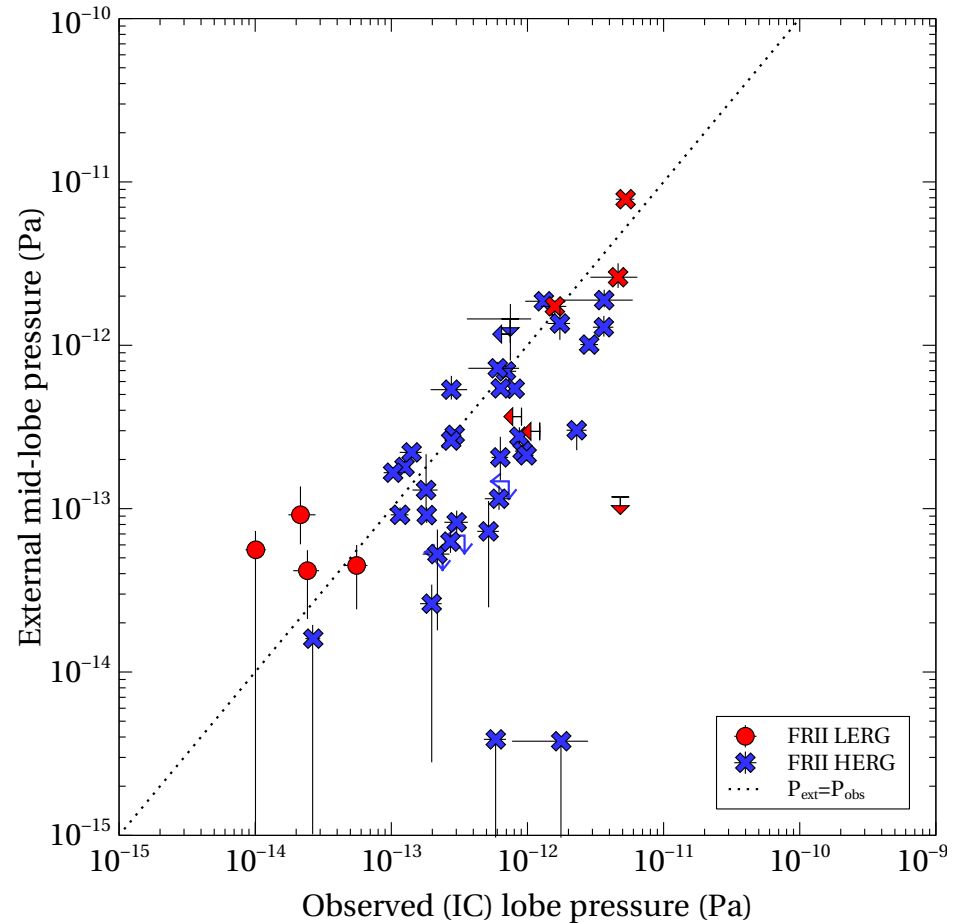
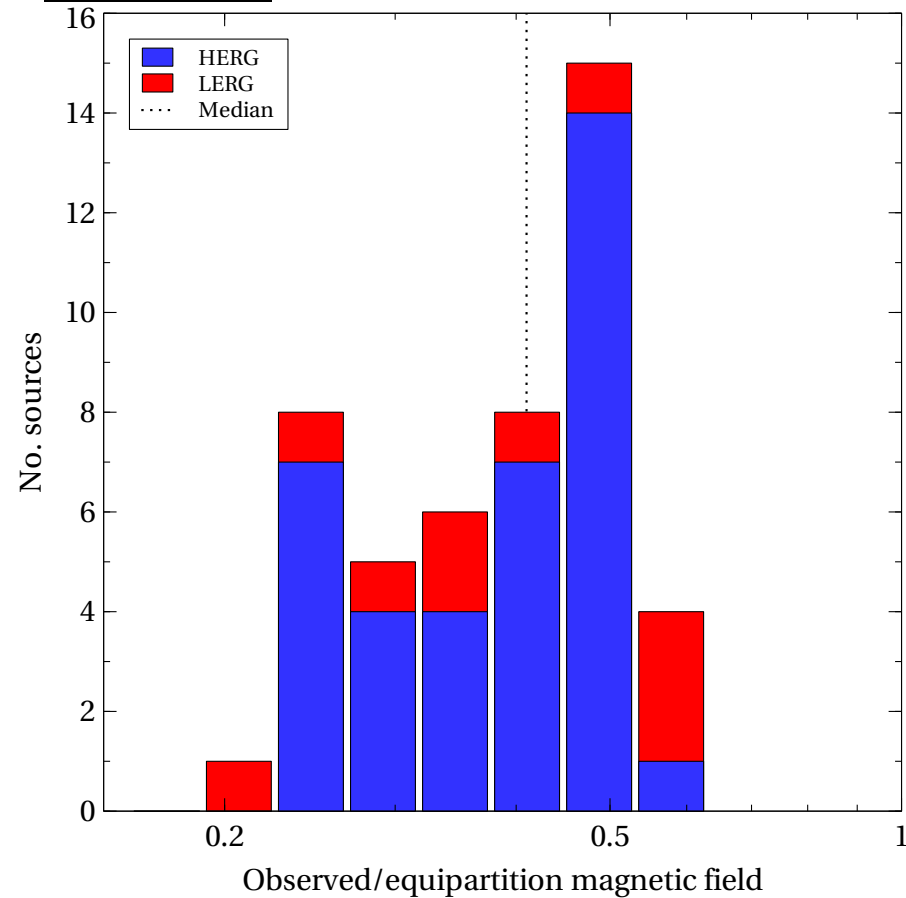


Croston & Hardcastle 2014

See also Morganti+ 1988, Birkinshaw & Worrall 2000,
Croston+ 2003, 2008, Dunn & Fabian 2004, Bîrzan+ 2008, Heesen et al. 2018

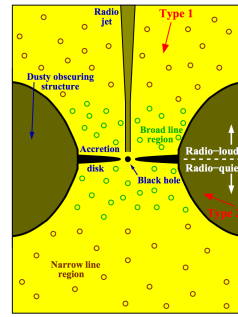
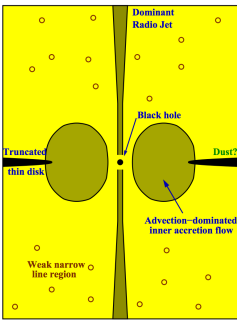


FRII energetics from inverse-Compton emission

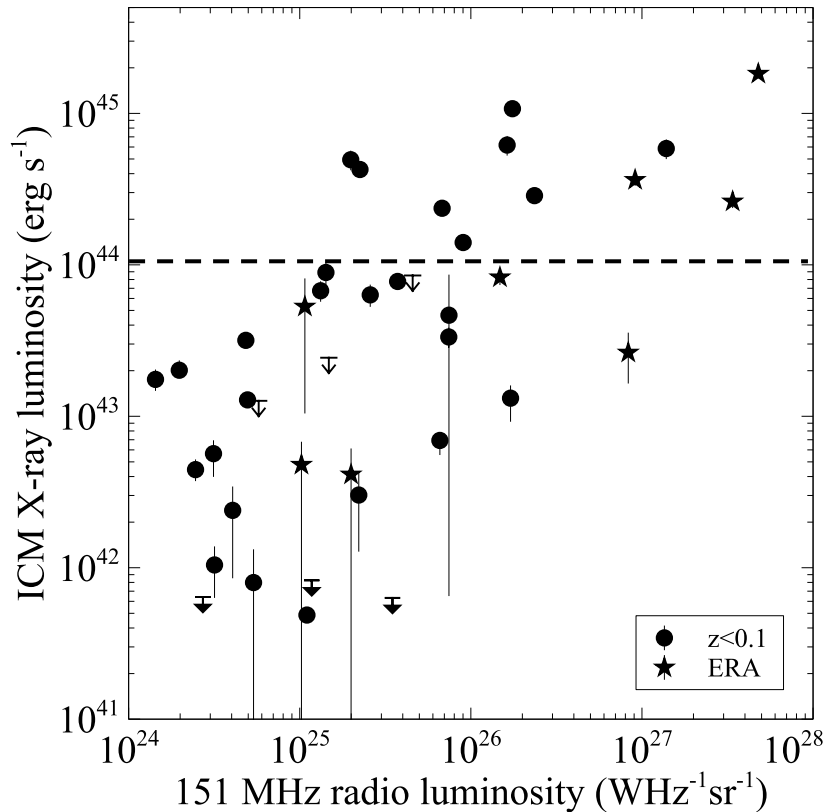


Ineson, JC et al. 2017 MNRAS 467 1586 & see **Judith Ineson's poster**

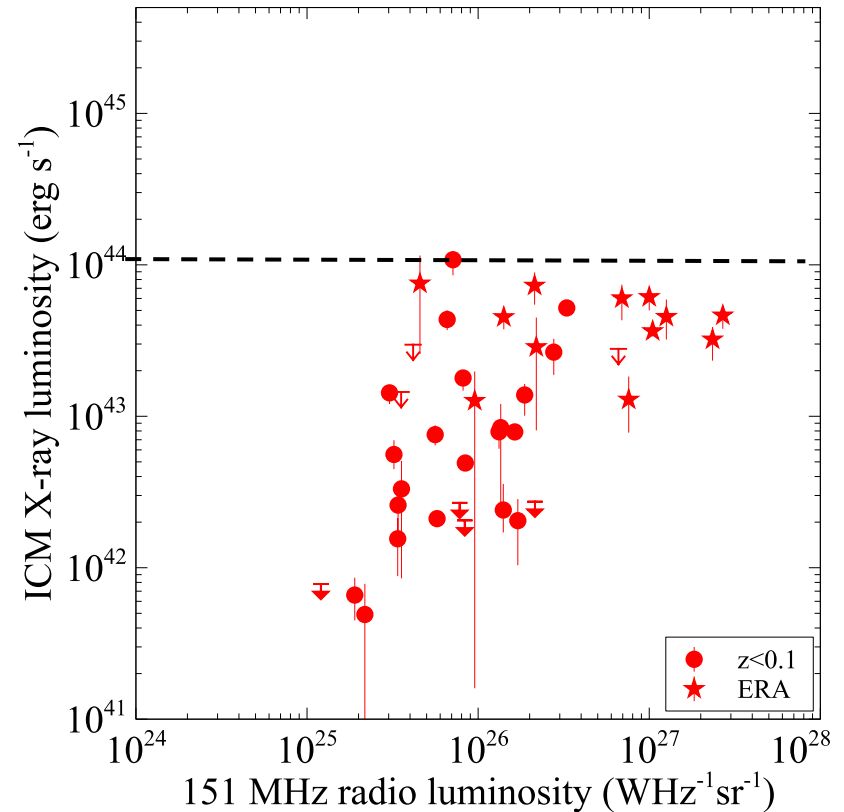
A comprehensive view of radio-galaxy environments



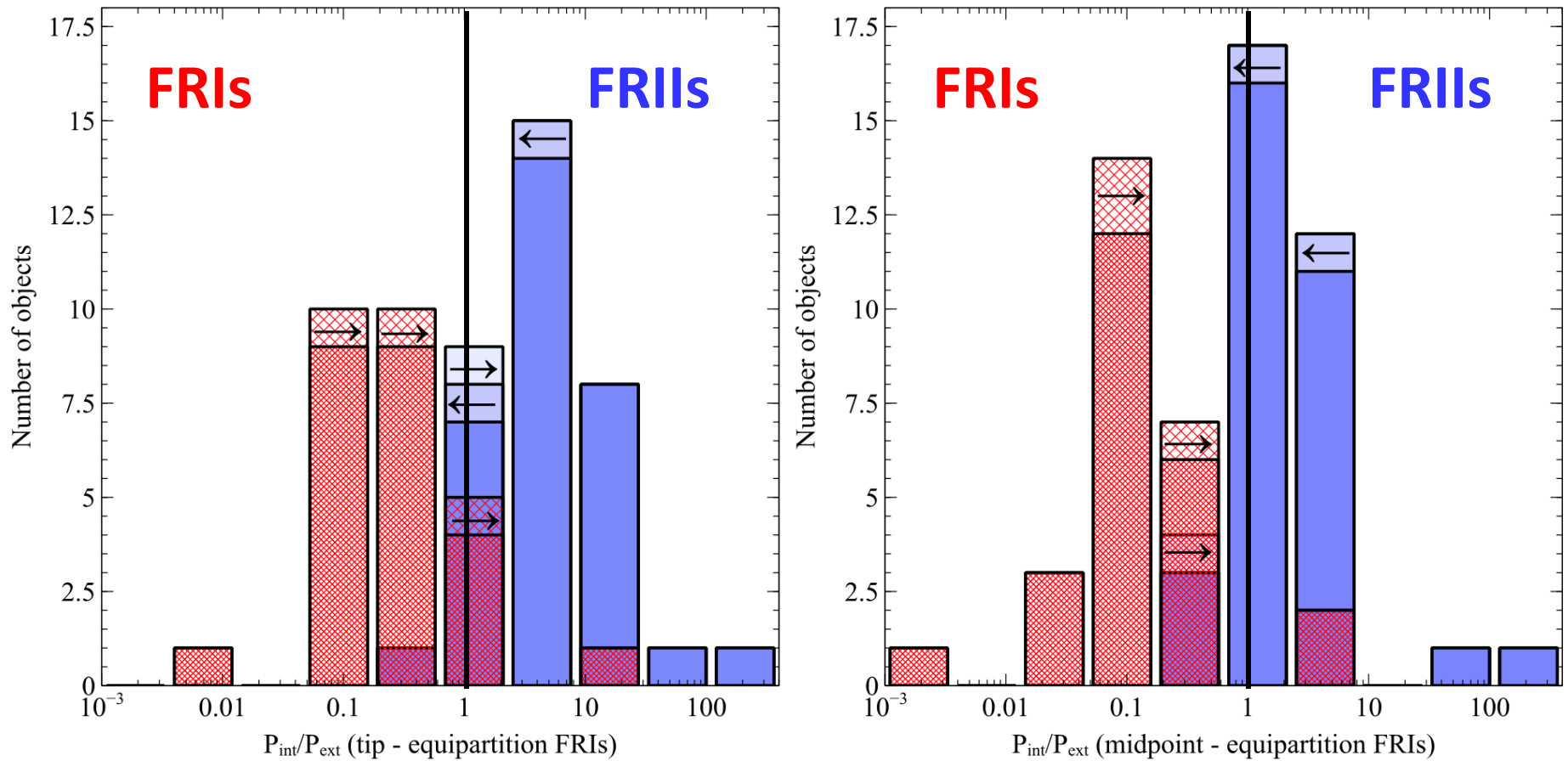
LERGs (low accretion rate jets)



HERGs (high accretion rate jets)

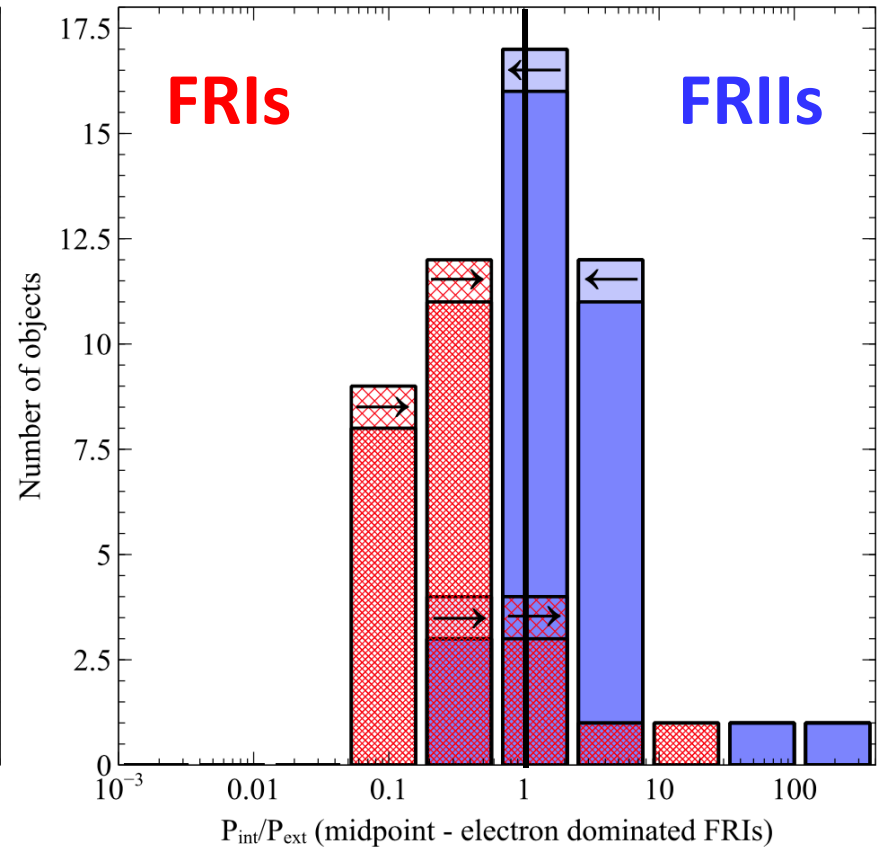
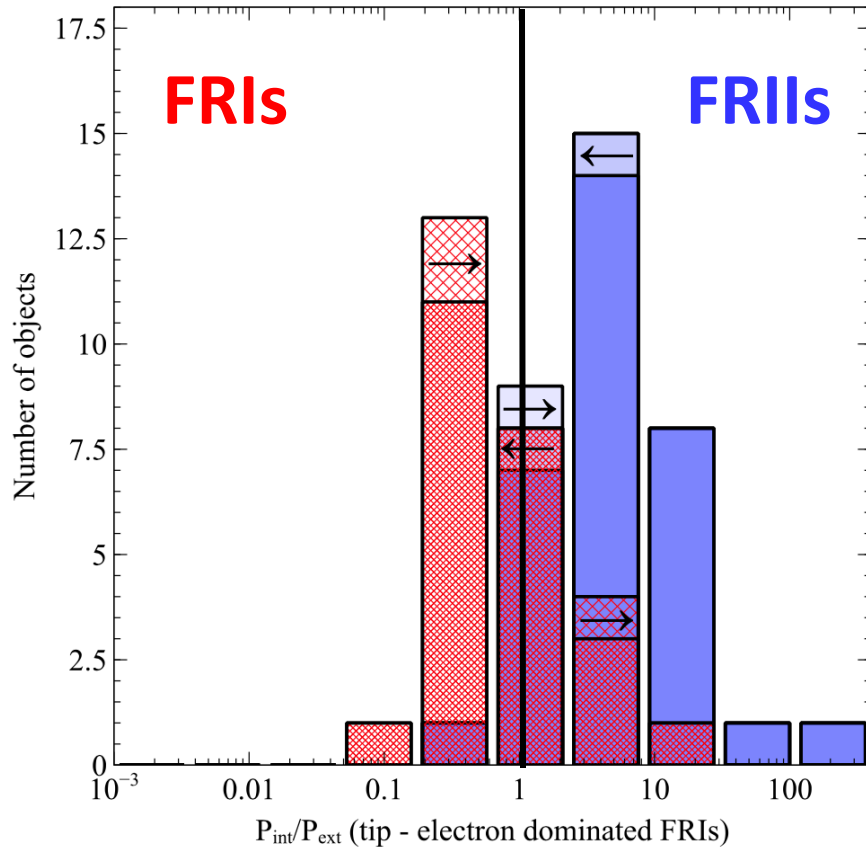


Systematic pressure comparison



see Croston+ 2018 (MNRAS 476 1614)

"FRII-like" energetics

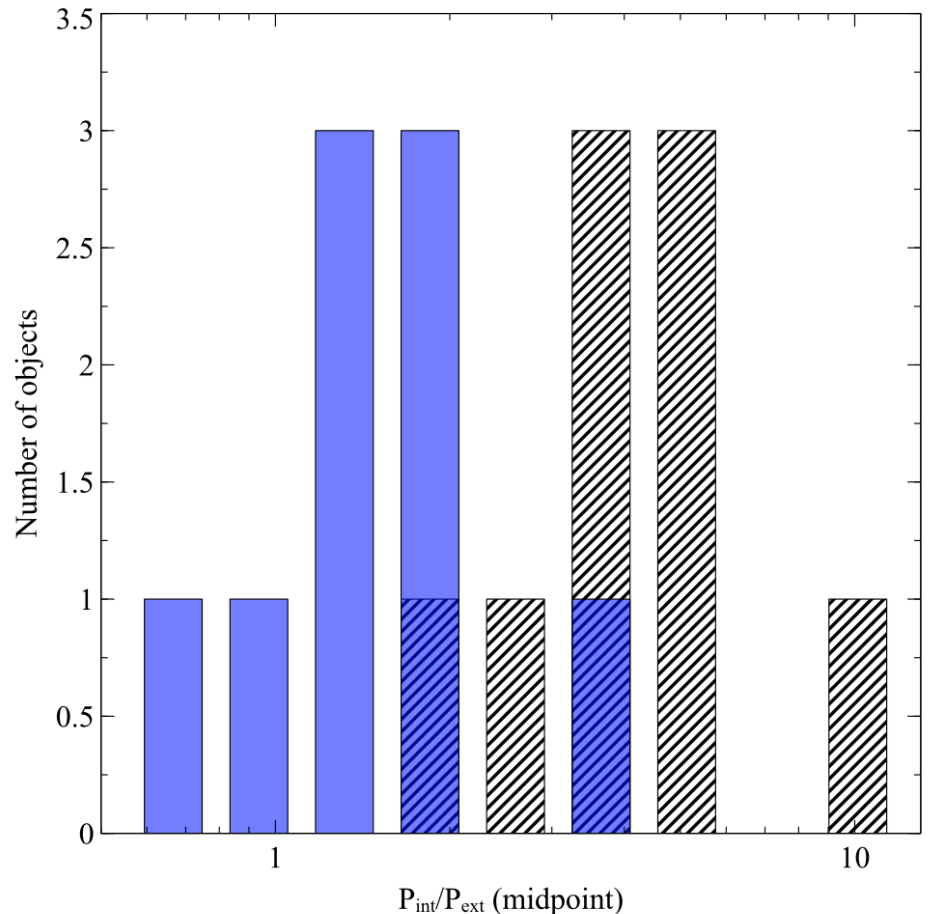


NB. Ruled out by FRI
IC limits in 7 cases

see Croston+ 2018 (MNRAS 476 1614)

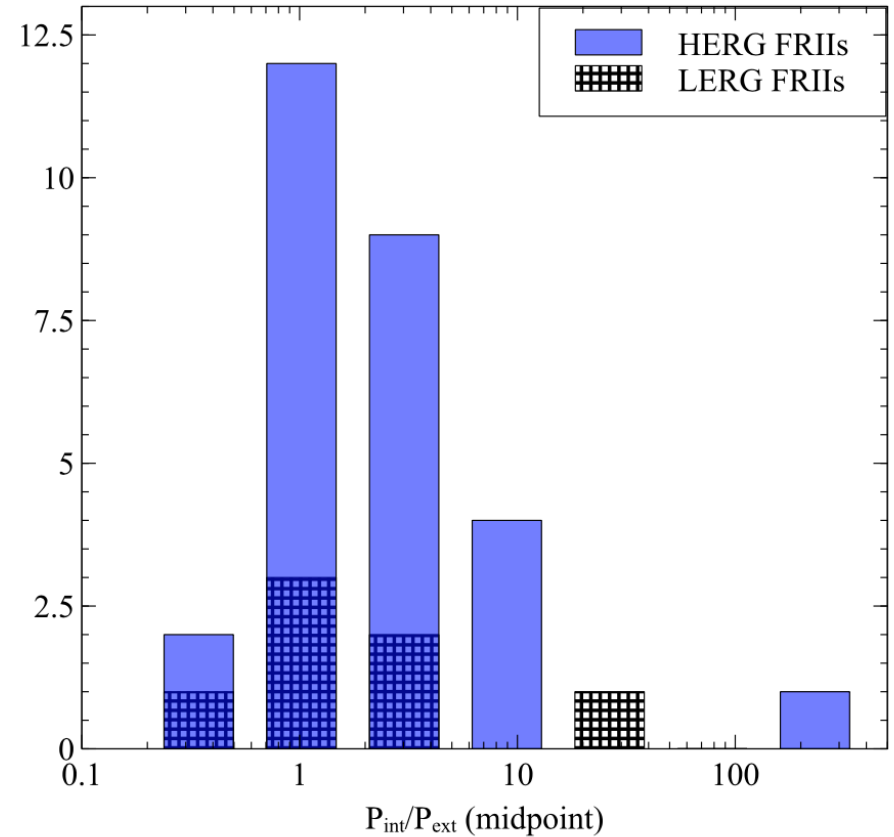
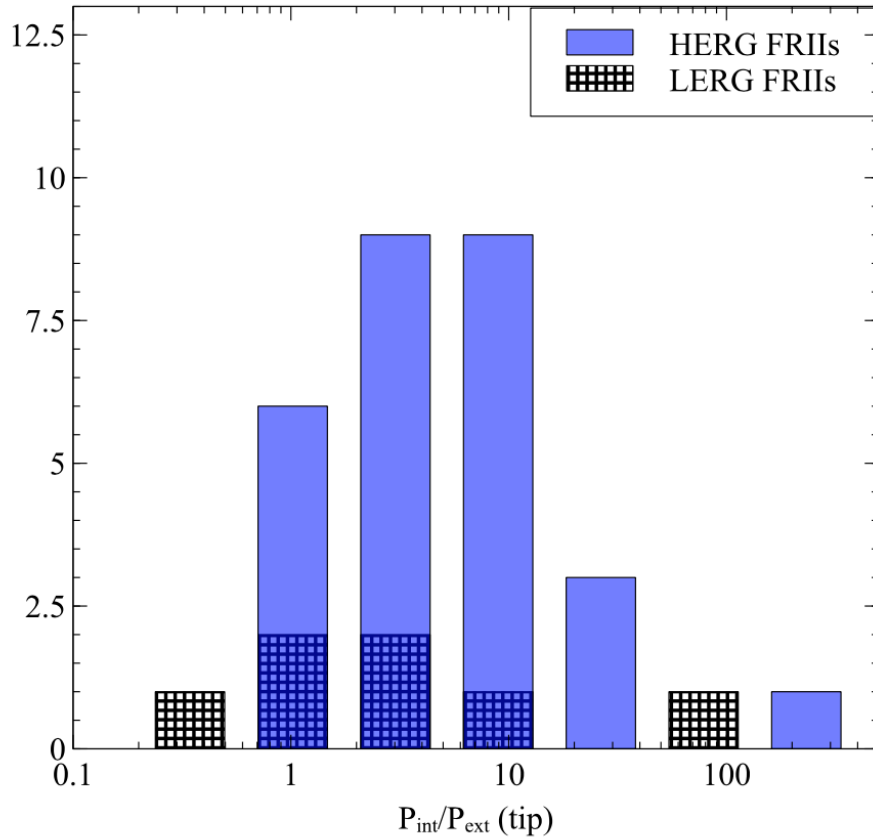
Why can't FRIs and FRIIs have the same energy balance?

- FRIs with FRII-like sub-equipartition fields ruled out by IC limits in 7 cases
- Substantial proton content in FRIIs would overpressurise lobes at midpoints and "pinch" points.



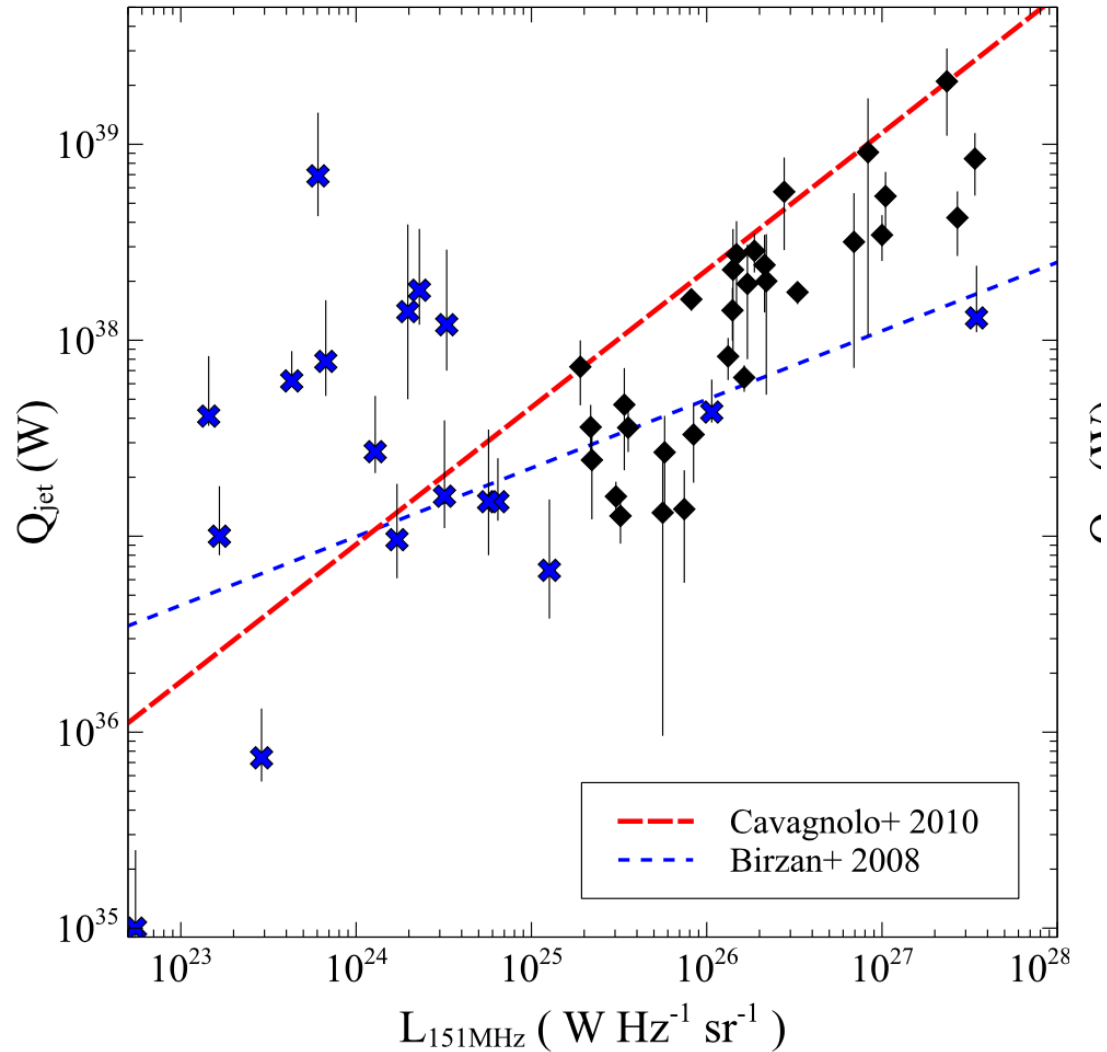
see Croston+ 2018 (MNRAS 476 1614)

Does particle content depend on morphology or accretion mode?

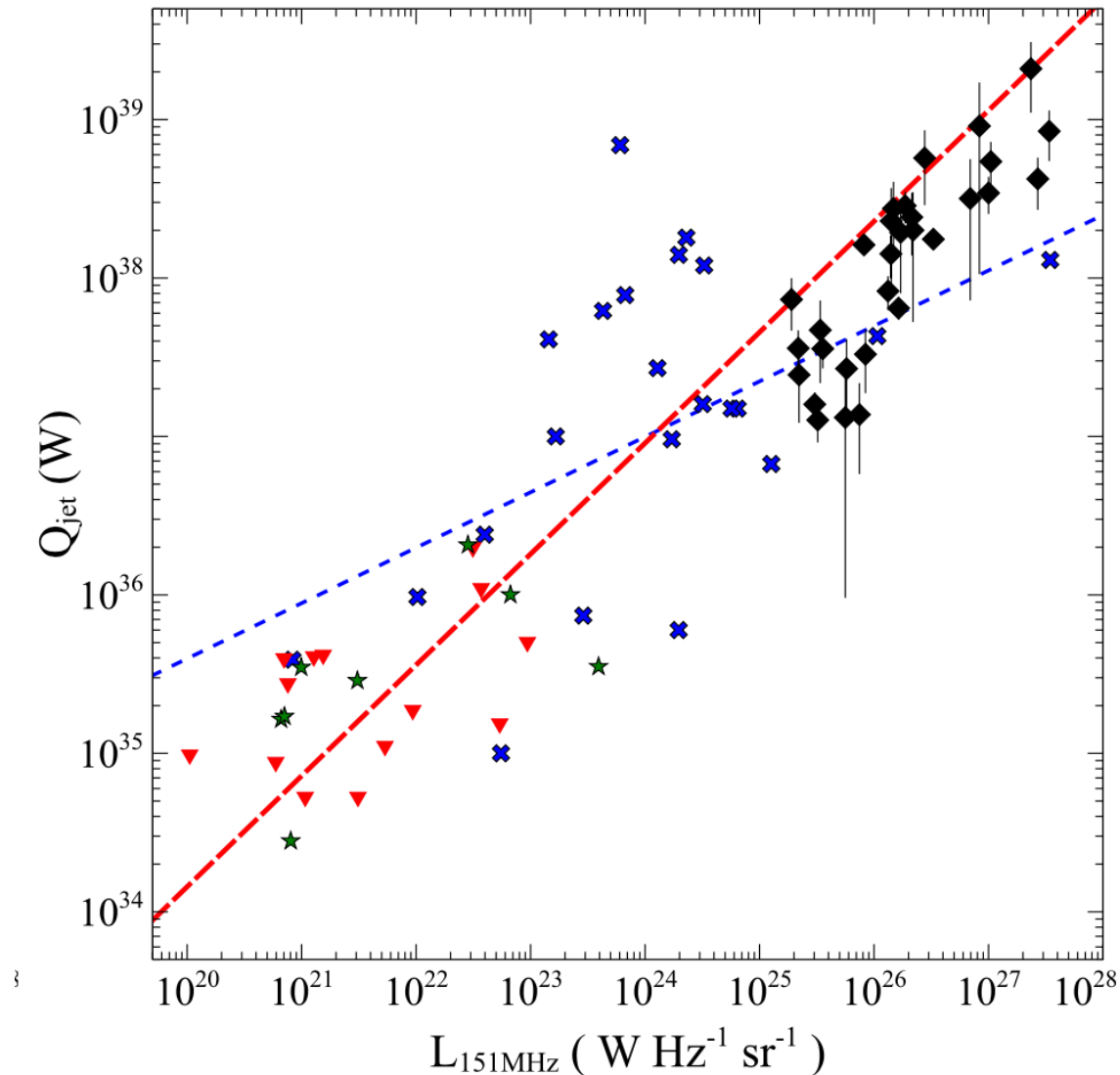


see Croston+ 2018 (MNRAS 476 1614)

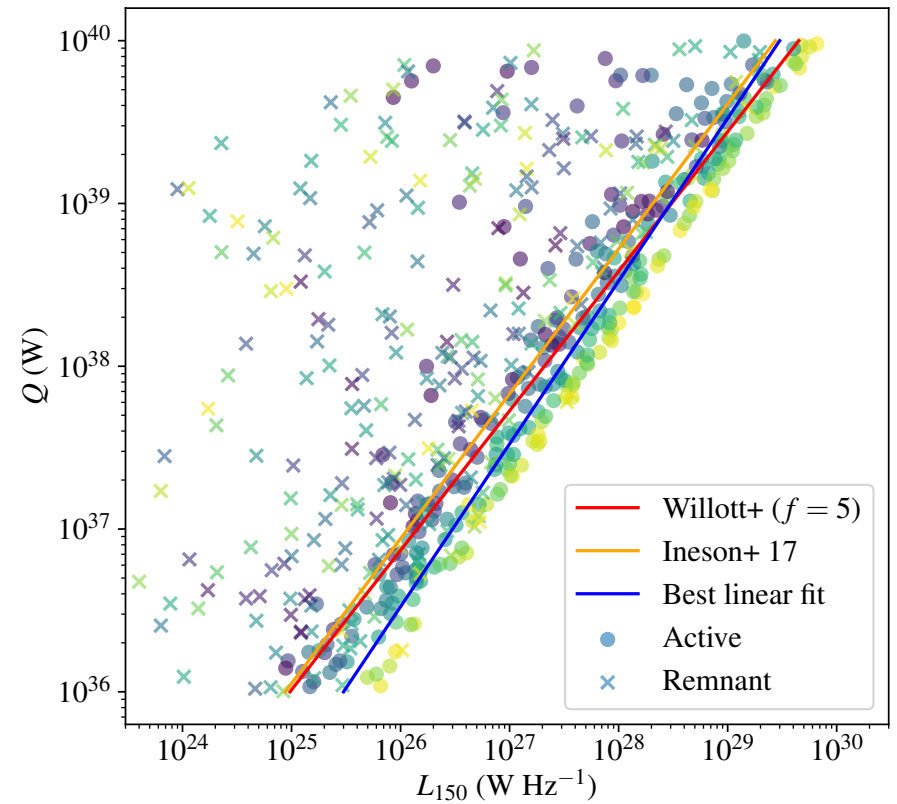
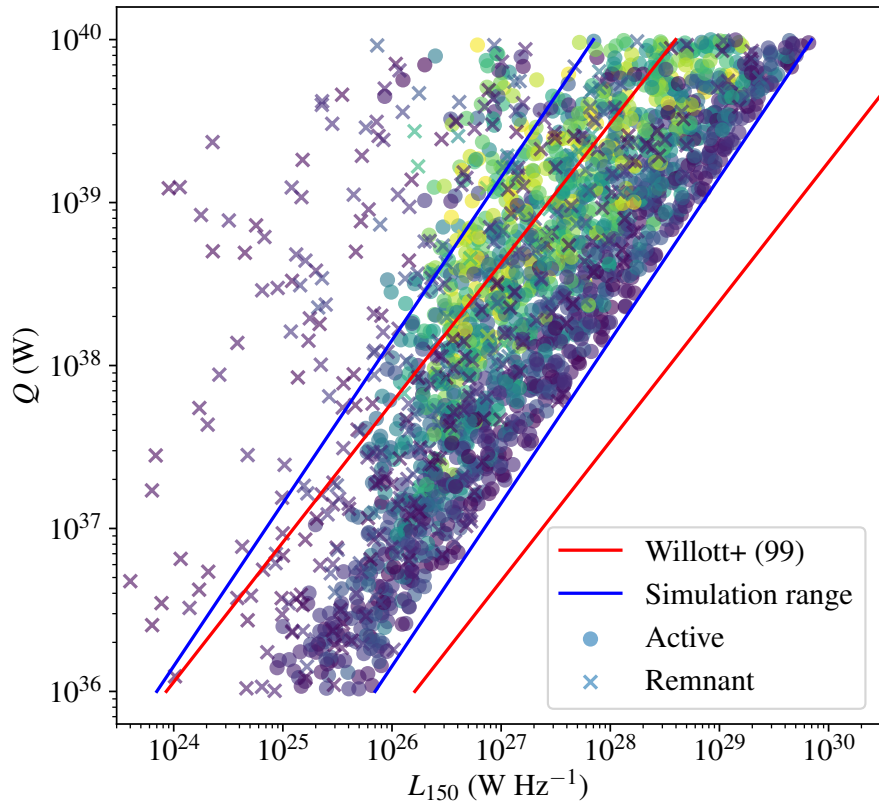
Implications for feedback estimates



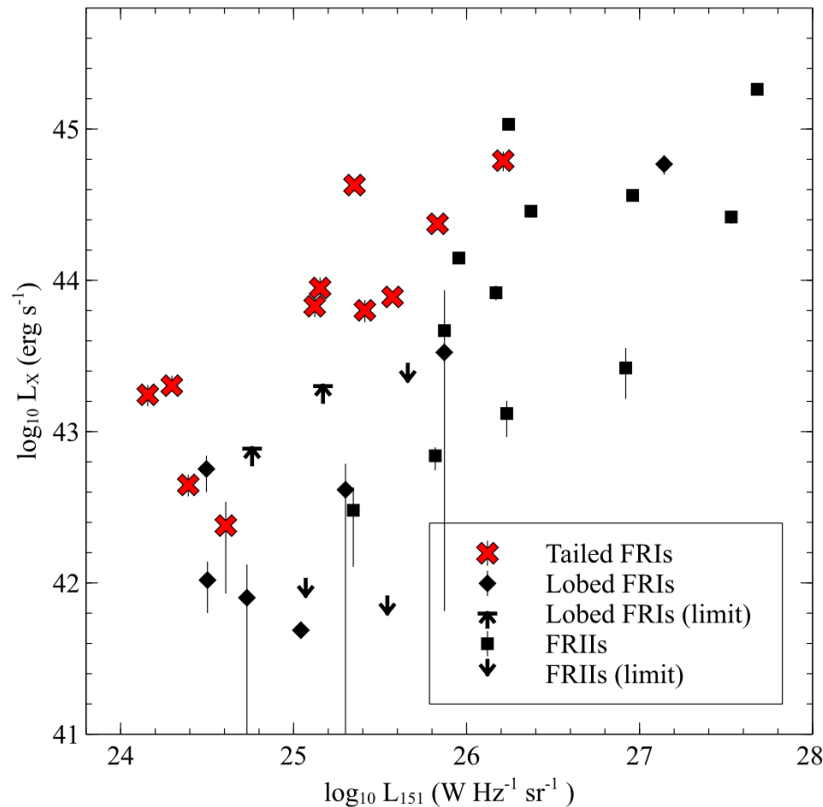
Implications for feedback estimates



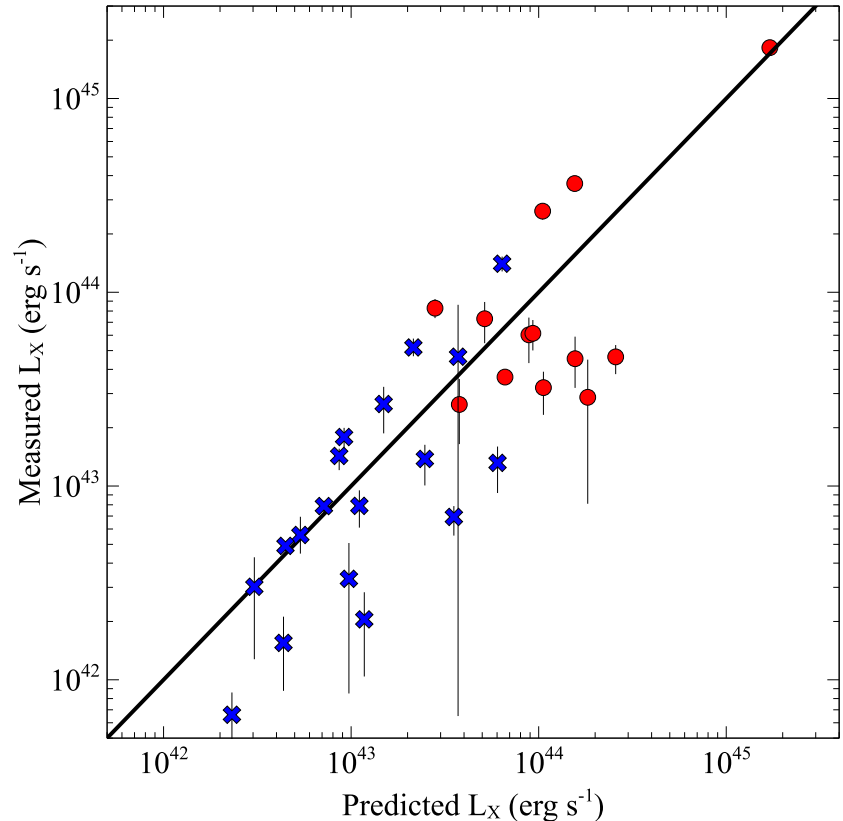
Jet power and morphology



Predicting environments from radio properties



Croston+ 2017 MNRAS



Croston+ 2018

It works if you choose your sample carefully...

Summary

Systematic X-ray study of radio-galaxy environments and energetics has taught us:

- FRI and FRII radio galaxies have **different particle content** and **energy balance**
- FRIs best explained by significant **proton contribution from entrainment/mixing**, not present in more “pristine” FRIIs
- This affects **relationship between jet power and radio observables** (but so do many other factors)

Vital to understand the make-up of your population (including life stages!) before trying to infer jet power or feedback effects