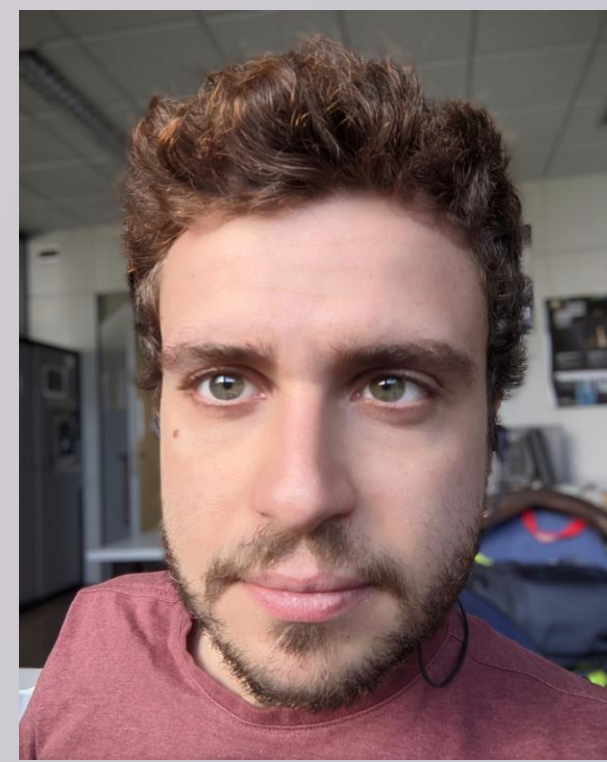


Radio Galaxies: does accretion always rhyme with jets power?



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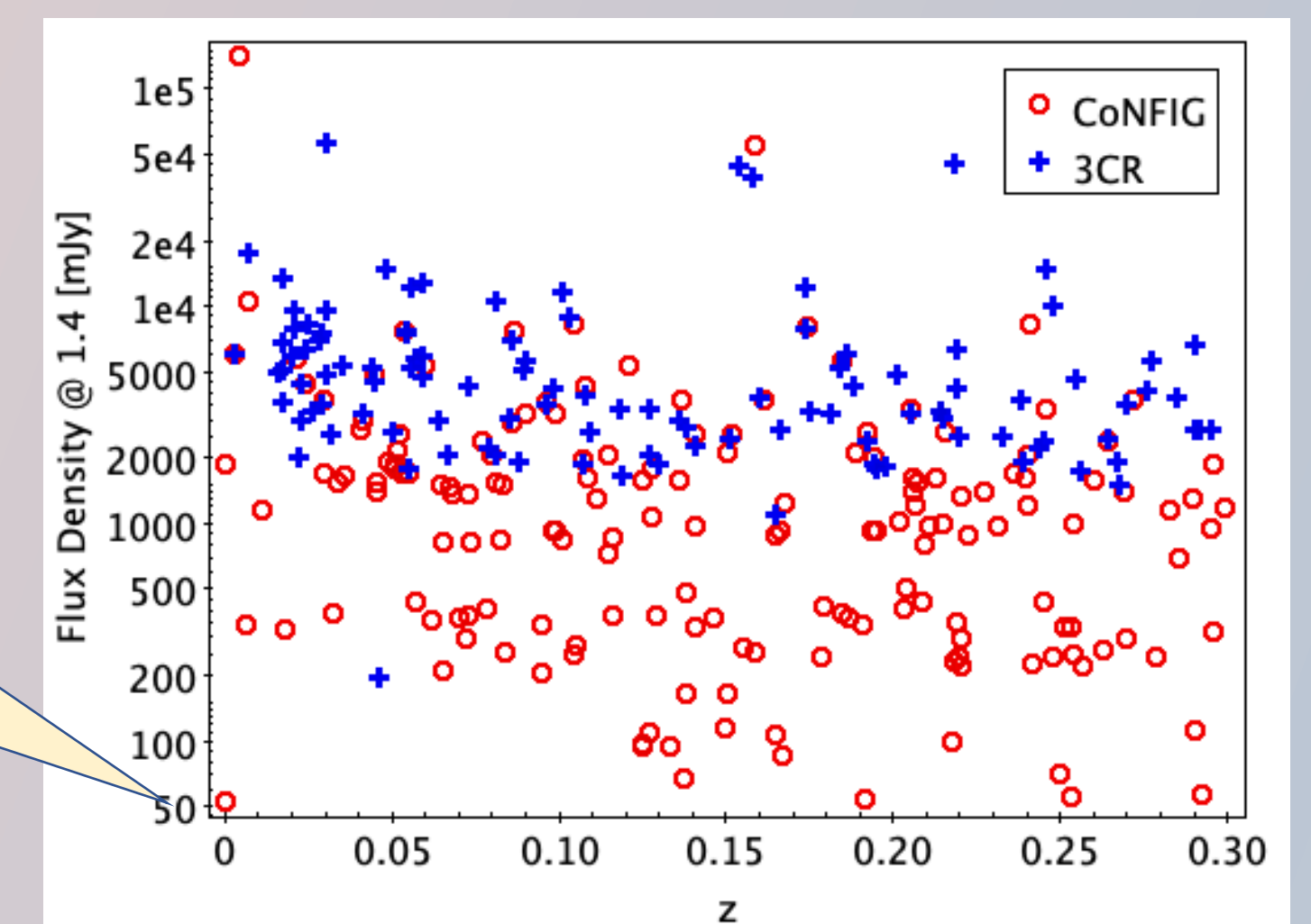
ABSTRACT: It is generally thought that accretion onto SMBH and ejection of relativistic jets are directly linked in radio galaxies (RG), i.e. *efficient accretion (Sakura-Sunyaev disk) -> powerful jets, inefficient accretion (ADAF-like disk) -> less powerful jets*. However, about a quarter of the local ($z < 0.3$) **3CR** sources have powerful jets but inefficient accretion flows (**FRII-LERG**). How can we explain this discrepancy? Two interpretations have been proposed by Macconi et al. (2020): 1) the ADAF-like regime of **FRII-LERG** is still able to launch powerful jets; 2) **FRII-LERG** are evolved sources probably more active in the past. We present here a study of the **CoNFIG** sample (Gendre et al. 2013) @ $z < 0.3$ (same z -range as in **3CR**) reaching a flux density limit of 0.5 mJy @ 1.4 GHz. Our preliminary results indicate that **FRII-LERG** are more similar to **FRI-LERG** than **FRII-HERG** in the mJy regime, making the evolutive scenario more appealing

IN THE PREVIOUS EPISODE:

The X-ray analysis of the **3CR** sample (see Macconi 2020 et al. for details) has shown that **FRII-LERG** have intermediate properties in terms of accretion (L_X/L_{Edd}) and obscuration. **FRII-LERG** have indeed accretion rates and column density generally lower than **FRII-HERG** (powerful RG with efficient accretion disk) but higher than **FRI-LERG** (low-power with inefficient accretion flow)

Expanding the sample to test the evolutive scenario:

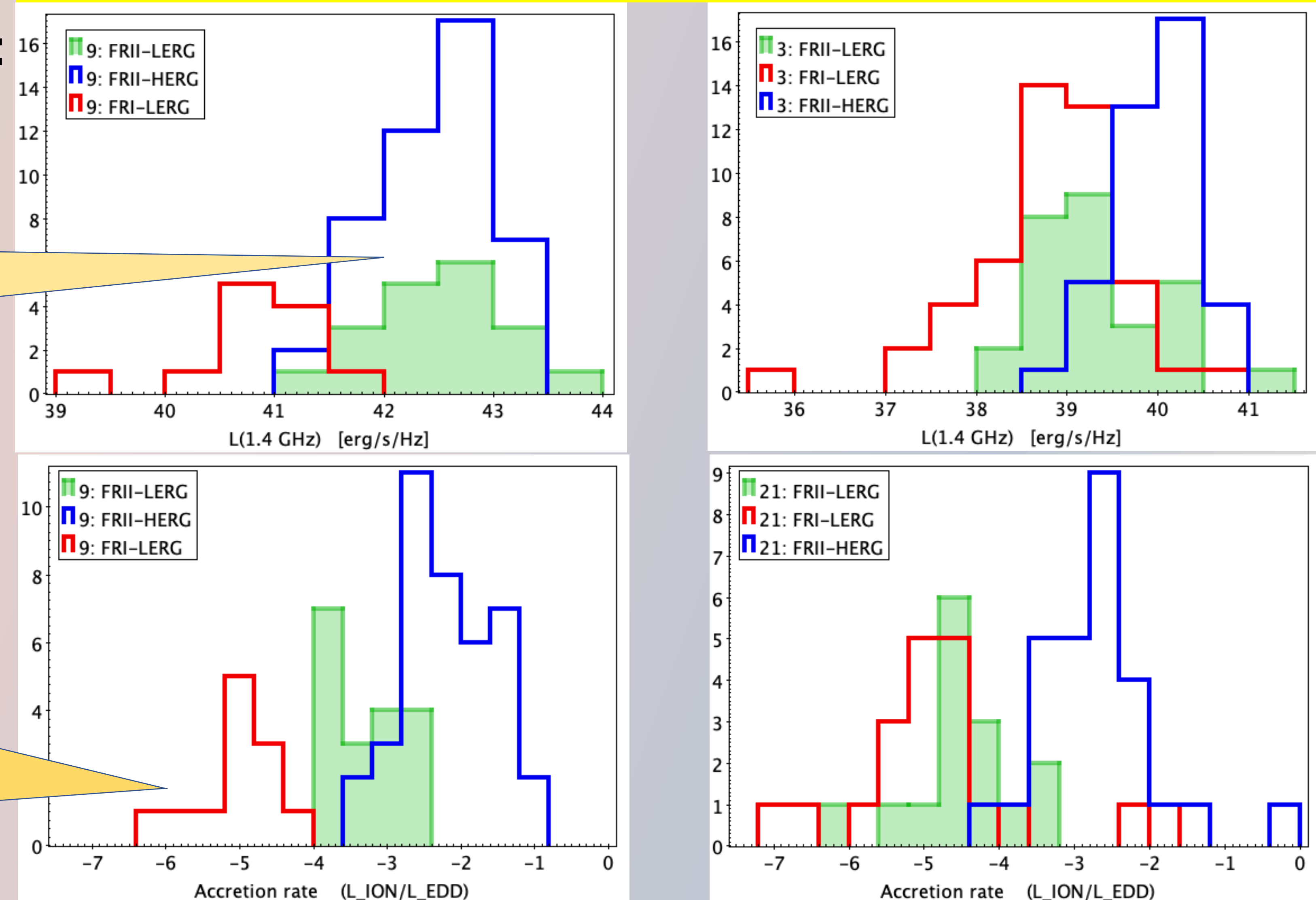
To test the different hypothesis proposed by Macconi et al (2020), the study of RG populations was extended down to the mJy flux densities. We considered the RG **CoNFIG** catalog assembled by Gendre et al. (2013). The analyzed sample consists of sources fainter than **3CR** (Jy-limited) sample at the same redshift range ($z < 0.3$)



The 3CR and CoNFIG samples comparison provides hints supporting the evolutive scenario:

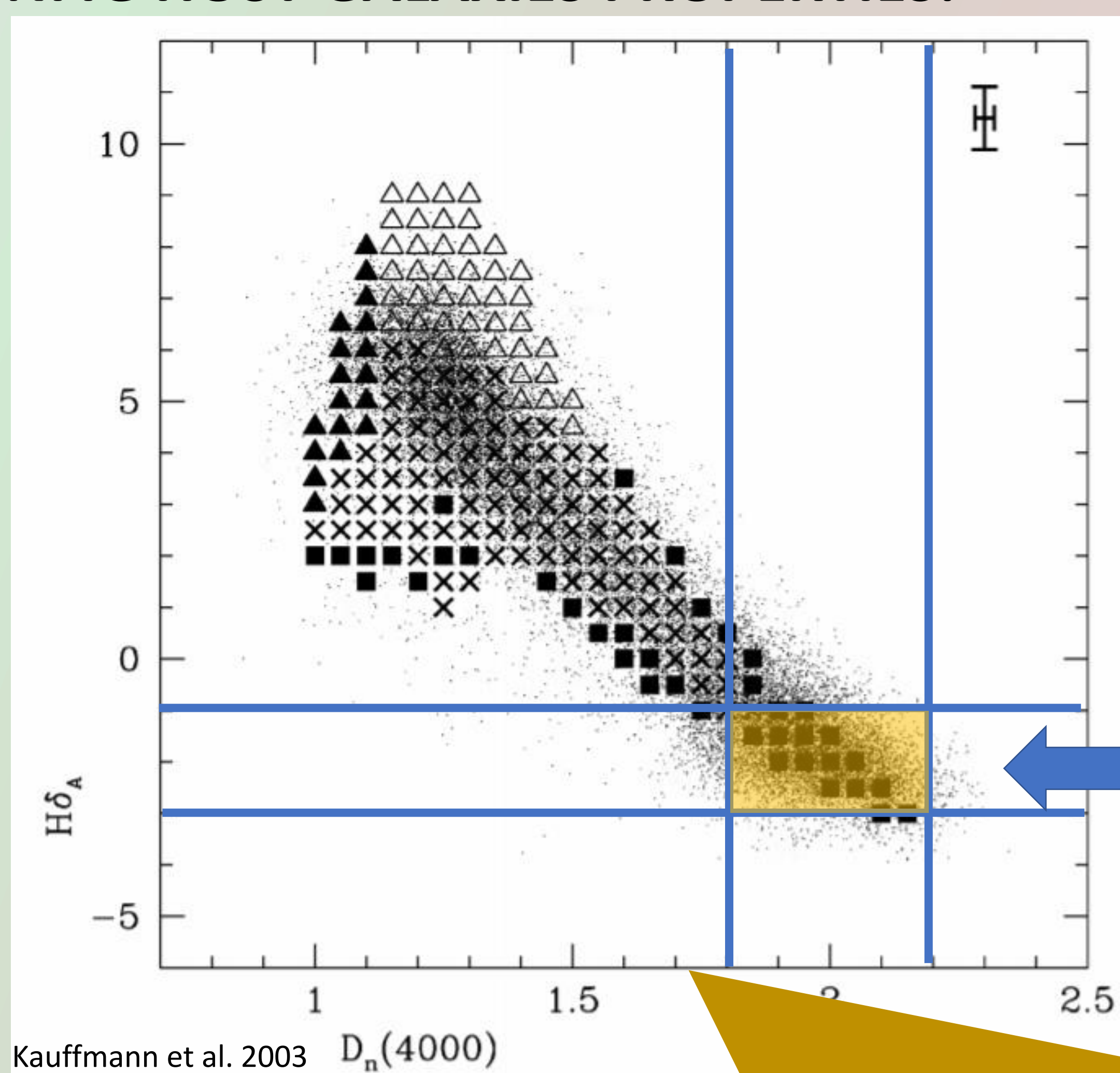
HINT 1: the **TOTAL** radio luminosity @1.4 GHz can be considered a proxy of the jet power averaged over time (Willott et al. 1999, Cavagnolo et al. 2010). The radio luminosities of **FRII-LERG** and **FRII-HERG** are similar in the **3CR** sample, but different in the **CoNFIG** sample. **FRII-LERG** have more **FRI** properties

3CR sample (Macconi et al. 2020) vs CoNFIG sample (Macconi et al. In prep. 2021)



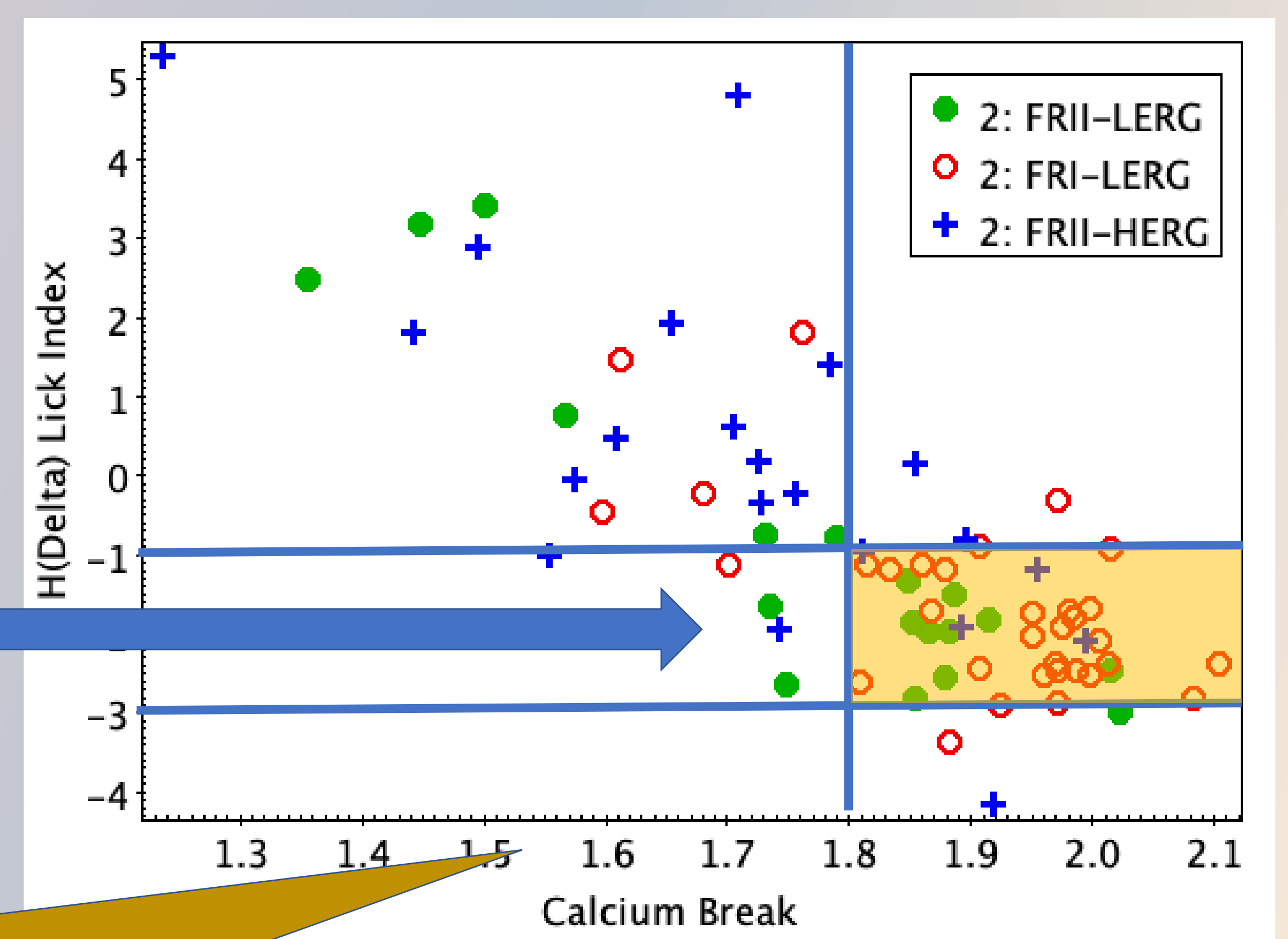
HINT 2: the OIII[5007 Å] line luminosity, once converted into ionizing luminosity (Buttiglione et al. 2009) and normalized by the Eddington luminosity, can be used as a powerful proxy of the accretion rate (Heckman 2004). The **3CR FRII-LERG** show intermediate accretion rates, while the **CoNFIG FRII-LERG** have an accretion rate comparable to that of **FRI-LERG**

CoNFIG HOST GALAXIES PROPERTIES:



Calcium break ($D_n 4000$) and $H(\delta_A)$ are two optical stellar-absorption line indices. If combined, they strongly constrain the mean stellar ages of galaxies and the recent SF activity (Kauffmann et al. 2003).

Red and dead region occupied by old galaxies. NO SF bursts over the past 2 Gyrs



HINT 3: **CoNFIG FRII-LERG** mainly fall in the region occupied by red and dead galaxies, On the contrary, **FRII-HERG** are spread in the zone filled by galaxies with a younger stellar population

1 + 2 + 3 agree with the evolutive scenario! mJy **FRII-LERG** are aged systems in which the further gas depletion has reduced the accretion rate and, as a consequence, the AGN ability to expel powerful jets

TO BE CONTINUED: To independently test the evolution, we are expanding our study to **3CR** and **3CRR** sources @ high redshift (up to $z=1$)