A trade-off study of the WFI field of view

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INTRO AND AIM

We performed a trade-off study of the Athena WFI field of view (f.o.v.) taking into account a square and a circular f.o.v. In the latter case, the WFI corners would not be exposed to cosmic X-rays and could be used as particle background monitors, simultaneously to the observation.

The resulting loss of area would concern only regions of low sensitivity. So, how many and which kind of AGN would be lost?

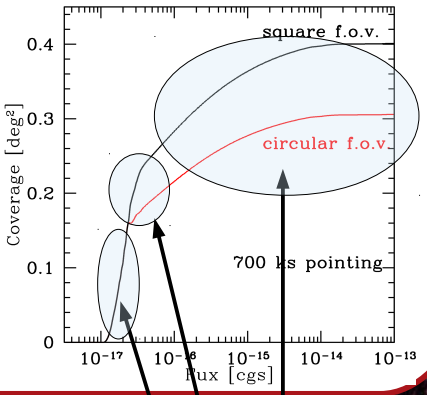
In this poster we report some results derived from simple computations; for both of the two f.o.v. shapes, we folded the Aird+10 XLF with the Athena sky-coverage (assuming the CDF2 configuration and Γ=1.8) of a deep (700 ks) pointing to derive the number of detectable AGN.

Although the absolute numbers are affected by huge uncertainties, the relative numbers (i.e. the fraction of AGN retrieved with the circular f.o.v. with respect to the square f.o.v.) depend only on the different sky-coverages and are therefore much more robust.

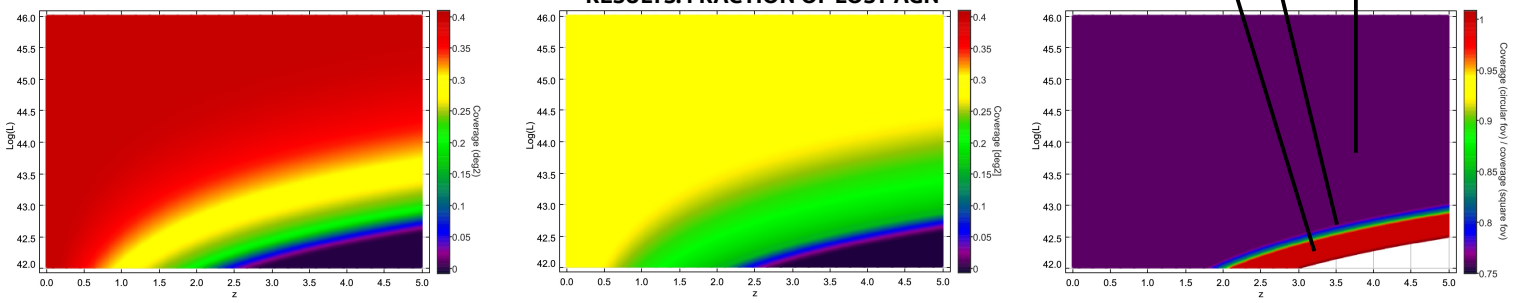
SKY-COVERAGE

We derived the circular-f.o.v. sky-coverage by rescaling the square-f.o.v. sky-coverage by a factor corresponding to the fractional area loss (considering also the CCD gaps), and then connecting the new curve to the original one at faint fluxes.

This method preserves both the dependency on the source confusion at medium-to-bright fluxes (where the ratio between the two sky-coverages is ~0.77) and the coverage drop at faint fluxes, which is not affected by the removal of the detector corners.

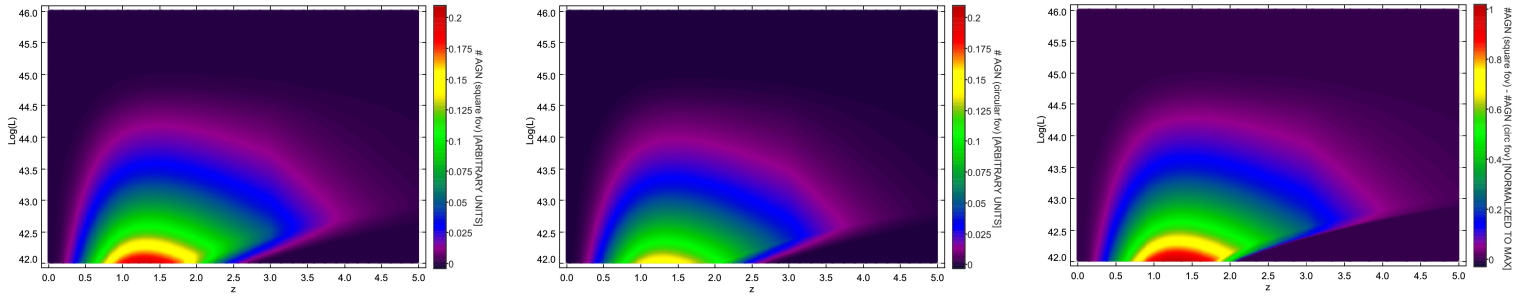


RESULTS: FRACTION OF LOST AGN



From left to right, the area covered at each redshift and luminosity assuming the square f.o.v. and the circular f.o.v., and their ratio. For most of the parameter space, reducing the f.o.v. results in a net loss of ~23% of the area. After a narrow transitional region, at high-redshift and low-luminosity (corresponding to fluxes close to the flux limit) there is no area loss. Folding the XLF with the sky-coverages in the two cases over the whole range of z and L gives **the fraction of sources retrieved using the circular f.o.v. with respect to the square f.o.v., which is ~0.77.** This number is a direct consequence of the ratio of the two sky-coverages. Right figure can therefore be read also as the fraction of AGN retrieved in the circular case w.r.t. the square case as a function of z and L.

RESULTS: CLASS OF LOST AGN



From left to right, the number (in arbitrary units) of AGN detectable assuming the square f.o.v. and the circular f.o.v., and their difference, normalized to the maximum (e.g. for each AGN not detected at logL=42 and z=1.3, there is 0.2 AGN not detected at L=43.5 and z=2). A 700 ks Athena pointing will therefore preferentially detect **low-luminosity AGN at z=1-1.5**. This is due to the XLF shape and evolution, the shape of the sky-coverage curve and volume effects. **This class of AGN is also what is preferentially lost (in absolute number) due to the area reduction** (right figure).

CHECKS

Very similar results (in terms of fractions and preferential class of AGN lost) are found with different starting assumptions:
a shallow pointing (100 ks)
or
assuming Γ=1.4
or
using different XLF models (Ueda+14, Miyaji+15)
or
assuming the Athena PROP configuration.

An additional 10-15% of lost AGN must be accounted for when passing from the PROP to the CDF Athena configurations.

For comments, questions and suggestions please talk to me or send an email to fabio.vito@unibo.it

IMPACT ON HIGH-REDSHIFT AGN

Two requirements were identified for the WFI survey to characterize the z>6 AGN population with Athena:
1) flux limit of 2.4 x 10^{-17} cgs over 2.4 deg^2
2) flux limit of 7.2 10^{-17} cgs over 52.7 deg^2
According to the Athena SWG 2.1 and assuming the CDF2 configuration, the deep (14 x 700 ks pointings) and shallow (290 x 100 ks pointings) surveys strategy would allow the detection of
1) ~10 AGN at z=6-7 and logL=43-43.5
2) ~10 AGN at z=8-10 and logL=44-44.5
From our calculations the resulting numbers are:

	z=6-7, logL=43-43.5	Z=8-10, logL=44-44.5
Square fov	~16 AGN (100%)	~15 AGN (100%)
Circular fov	~13 AGN (~81%)	~12 AGN (~80%)

A part from the absolute numbers (affected by large uncertainties), the fractions tell us that reducing the Athena f.o.v. results in a net loss of ~20% of the high-redshift AGN considered for the above-mentioned requirements.