# Athena SWG2 Status

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# SWG2 TPs and Chairs

SWG2.1: Formation and growth of the earliest SMBHs (High-z AGN Population at z>6 and z>8) -- J. Aird and A. Comastri

SWG2.2: Understanding the build-up of SMBHs and galaxies (Heavily Obscured SMBH Growth at z~1-4 and galaxy co-evolution; incidence of massive outflows at z~1-4) -- F. Carrera, A. Georgakakis, S. Ueda

SWG2.3: Astrophysics of feedback in local AGN and star-forming galaxies (Mechanical energy and physics of z~0 AGN outflows; AGN and star formation winds in galaxies) -- G. Ponti, A. Ptak, Terashima

SWG2.4: The close environments of supermassive black holes (Geometry of disk/corona in AGNs, SMBH spin survey to constrain mergers vs. accretion history) -- M. Dovciak, G. Matt, G. Miniutti

SWG2.5: Physics of accretion (Galactic BH spins and winds/outflows, BHs, NSs, WDs, ULXs, SgrA*) -- C. Done, J. Miller, C. Motch

SWG2.6: Luminous extragalactic transients (Tidal disruption events and high-z GRBs) -- P. Jonker, P. O'Brien

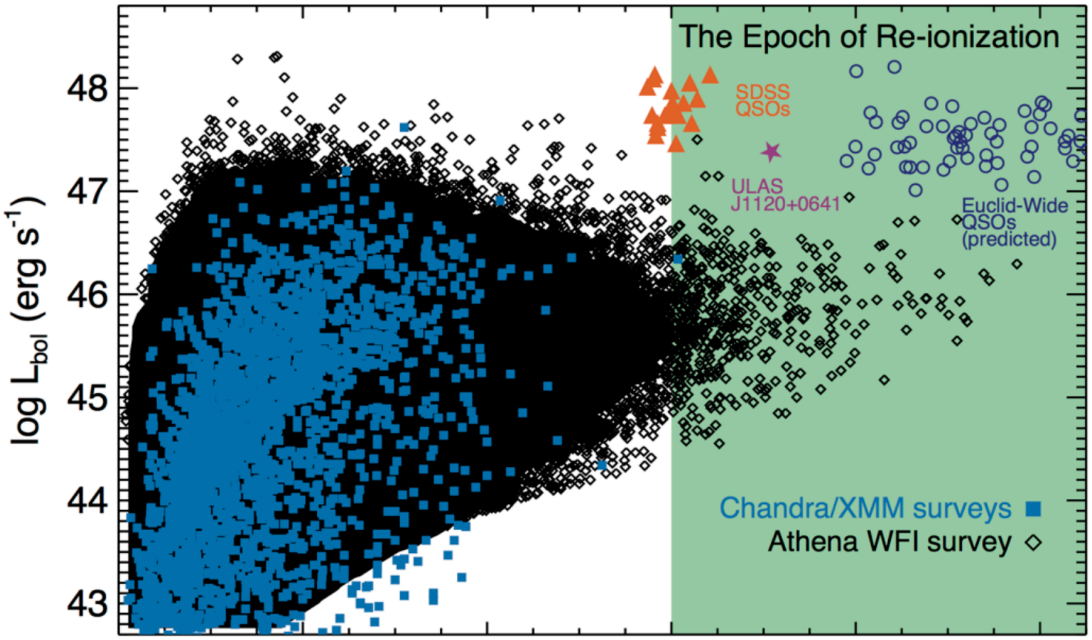
# Goals for Garching Meeting

- Review Level 1 requirements
- Ensure that all Level 2a requirements have been calculated and (re)assessed
- Identify pathway to establishing Level 2b requirements (and beyond)
- Optimize exposure times in Mock Observing Plan

# SWG2.1: Level 1 Requirements

## The formation and growth of the earliest supermassive black holes

- determine the nature of the seeds of the earliest growing SMBH (z>6), characterize the processes that dominated their early growth and investigate the influence of accreting SMBH on the formation of galaxies.
  - Populate the $L_X$-z plane at high redshift, **specifically: identify more than 400 AGN at z>6.**




Identify "typical" growing black holes at z>6 **and** measure the distribution of their accretion rates

(and ultimately a bunch of other properties: host stellar masses, SFRs, etc....)

# SWG2.1: L1 → L2

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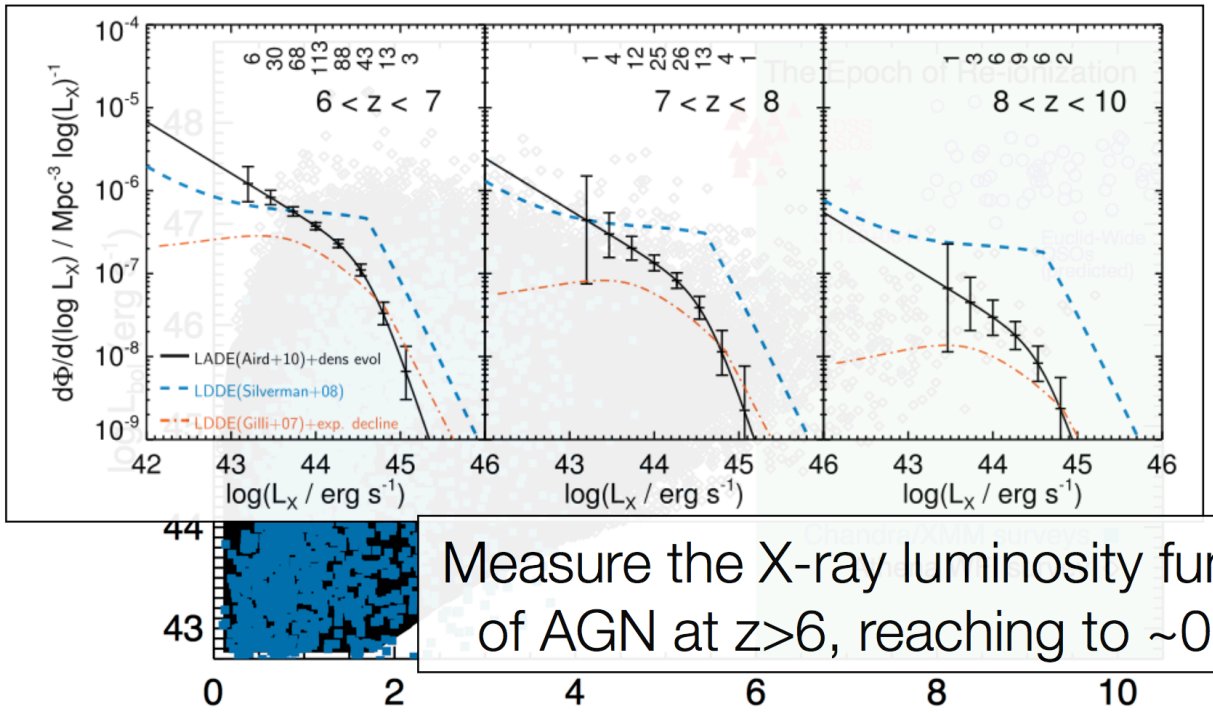


Identify "typical" growing black holes at z>6 **and** measure the distribution of their accretion rates

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Measure the X-ray luminosity function of AGN at z>6, reaching to ~0.1L*

# SWG2.1: L2a Requirements

Reach a point source sensitivity limit of

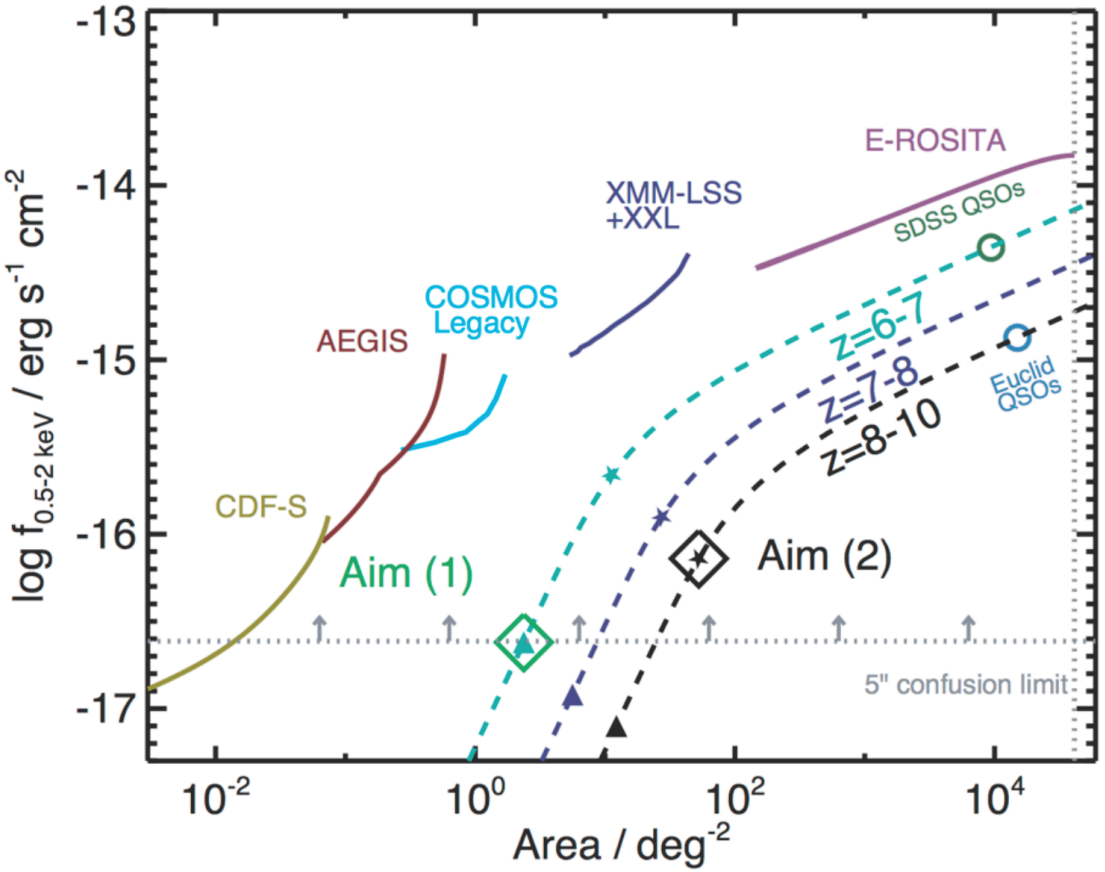
1) $f_{0.5\text{-}2keV} \leq 2.4\times10^{-17}$ erg s$^{-1}$ cm$^{-2}$ over 2.4 deg$^2$ in <7.2 Ms

and

2) $f_{0.5\text{-}2keV} = 7.2\times10^{-17}$ erg s$^{-1}$ cm$^{-2}$ over 52.7 deg$^2$ in <19.7 Ms

Driving requirements on **off-axis** point source sensitivity

- limited by source confusion -> **driving requirement on the off-axis PSF**



# SWG2.1: Grasp?

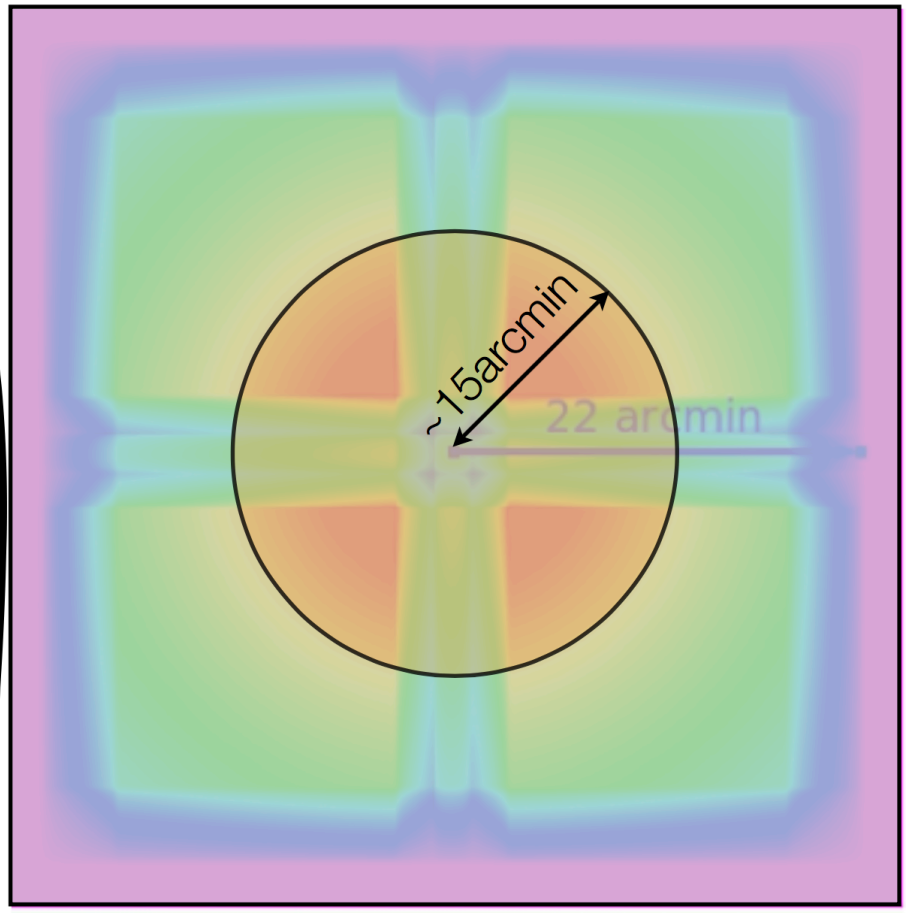
- Aim 1) $f_{0.5\text{-}2keV} < 2.4\times10^{-17}$ erg s$^{-1}$ cm$^{-2}$

5arcsec confusion limit

Relevant "field-of-view" is where 5arcsec or better PSF is achieved

over 2.4 deg$^2$ in <7.2 Ms

No. of pointings (useful FOV) → Exposure per pointing




Off-axis effective area requirement

(to reach $2.4\times10^{-17}$ erg s$^{-1}$ cm$^{-2}$ in available exposure time)

Also: particle background, stray light level

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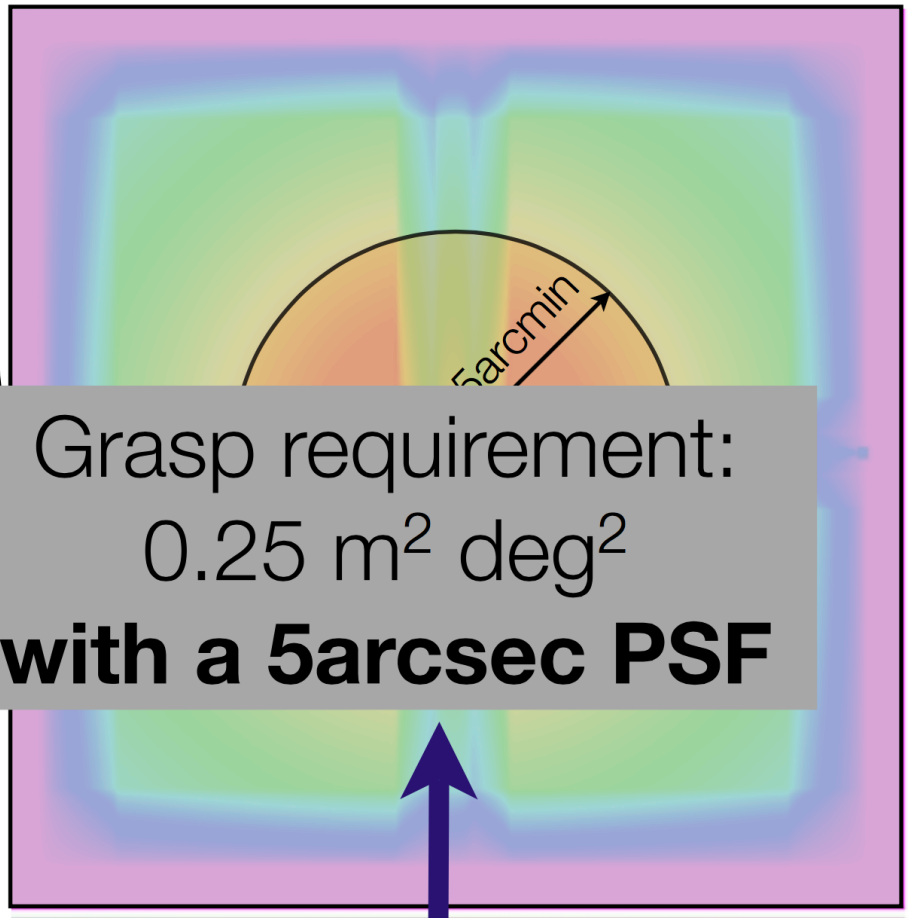


**Grasp requirement: 0.25 m$^2$ deg$^2$ with a 5arcsec PSF**

Off-axis effective area requirement
(to reach $2.4\times10^{-17}$ erg s$^{-1}$ cm$^{-2}$ in available exposure time)
Also: particle background, stray light level

# Major Open Issues at the Start of the November Meeting

- ***2.1:*** Grasp versus/and off-axis point source sensitivity (0.5-2 keV); are both fields necessary? If so, off-axis angle needed at 15', 20' or FoV-averaged?

- ***2.2:*** Do we need a 0.5-2 keV point source sensitivity requirement?

- ***2.3, 2.4 and 2.5:*** Requirement necessary on effective area at at 10 keV? If so, applicable to WFI and/or X-IFU?

# Major SWG2 Outcomes

- Confirmed that both grasp and **off-axis point source sensitivity** are not necessary for 2.1, 2.2: just the latter, provided that exposure times in which this sensitivity is to be achieved are also specified, since survey speed is given.

- **EA at 10 keV: suggested at least 400 cm$^2$** for 2.4 (reverberation studies); Willingale is producing new responses for simulations to refine this estimate.

- **Restructuring of 2.5 to incorporate ULXs and Sgr A*** (extremes of accretion) in 2.5.2.

- **Restructuring of 2.6: SNe moved to SWG3, TDEs now** comprise 2.6.2.

- **Reduction in MOP exposure time of ~4.7 Ms** determined by optimizing exposures across TPs, reducing ToO average projected exposure time to 75 ks from 100 ks.

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# FINALISATION OF REQUIREMENTS And Collecting the Results

| | Level 1 | Level 2a | MOP Entries | MOP Reduction | Goals |
|---|---|---|---|---|---|
| SWG1 | ✖ | ✖ | ✖ | ✖ | ✖ |
| SWG2 | ✓ | ✓ | ✓ | ✓✖ | ✖ |
| SWG3 | ✓✖ | ✖ | ✖ | N/A | ✖ |

- Collation of results
- Level 2b Status

# Remaining Open Issues for SWG2

- EA at 10 keV forthcoming, pending simulations with new responses.

- Timing requirement for 2.5 is being reviewed: 10 μs relative may be too demanding.

- Formulation of Level 2 requirements for 2.5.2 on ULXs and Sgr A* is now underway (Done, Porquet).