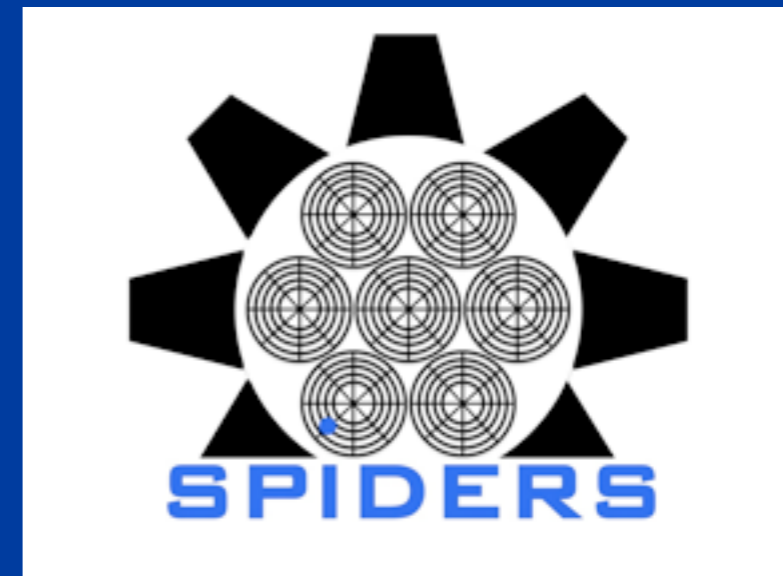


A SPIDERS Ancillary with BOSS

Optical Spectra and Color Properties of X-ray selected AGN

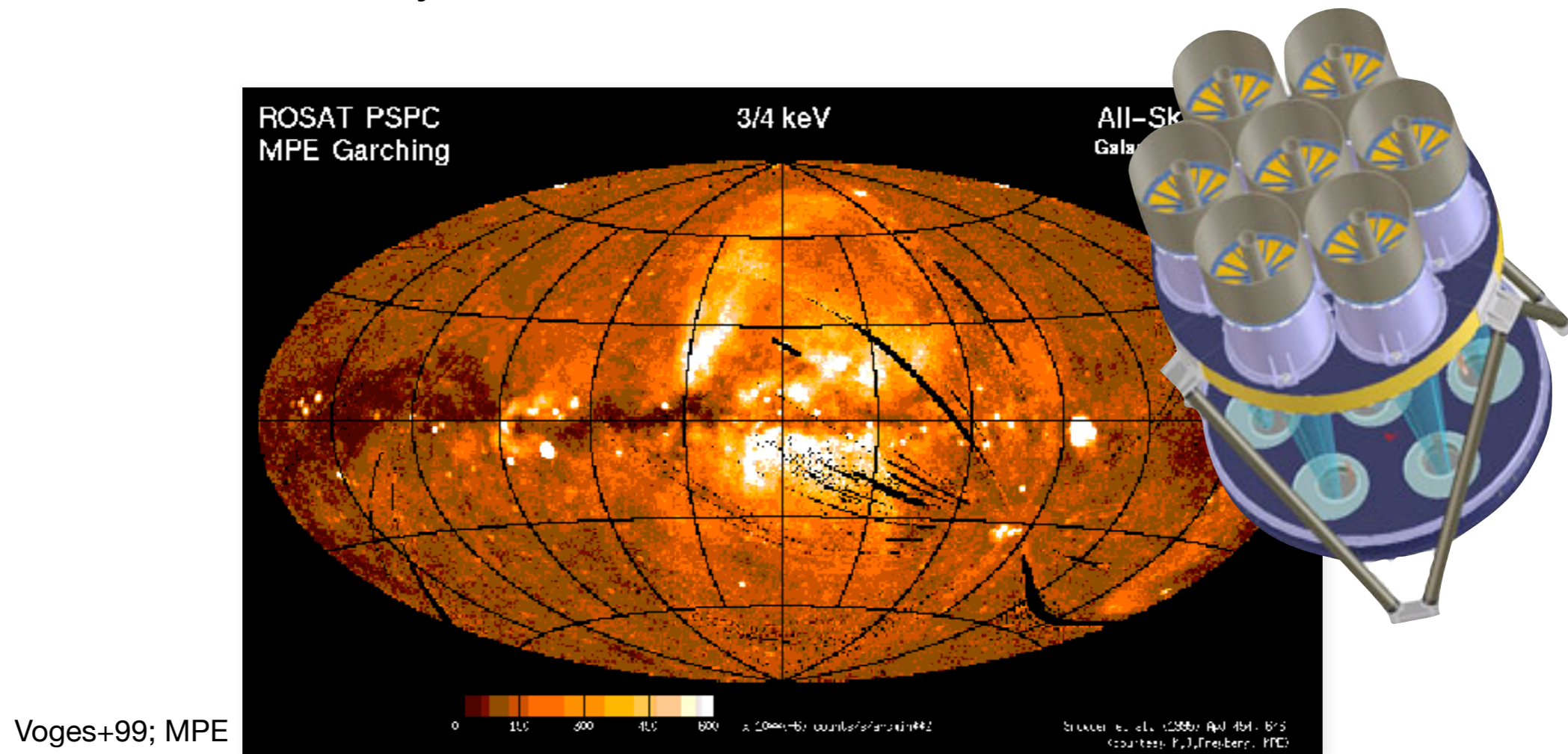


Marie-Luise Menzel, MPE
eROSITA Meeting, Potsdam

What are the strengths of X-rays to detect AGN?

From ROSAT to eROSITA

- strengths of X-rays: less affected by obscuration, suffer low contamination by star-forming processes
- access to a broad variety of AGN

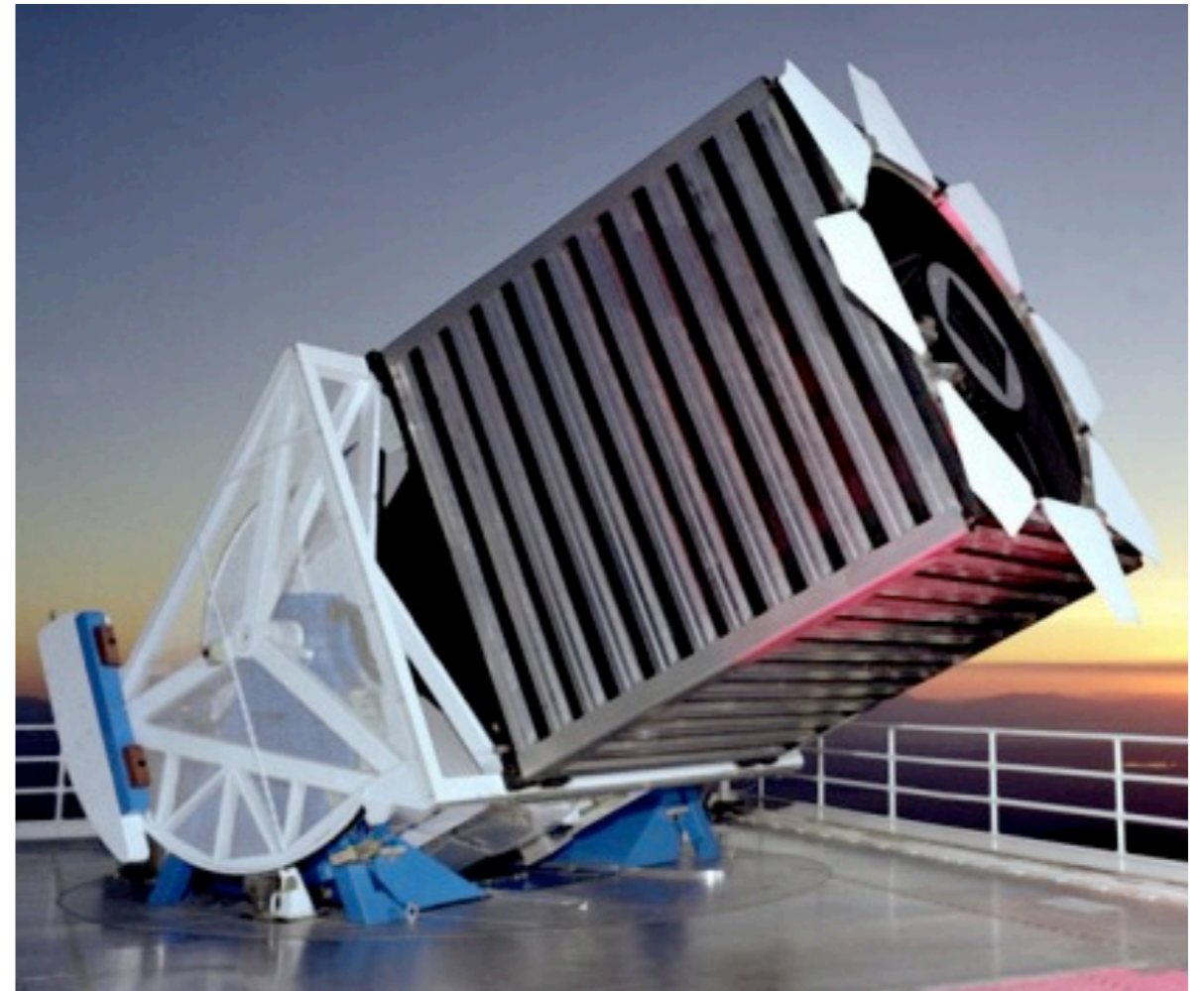
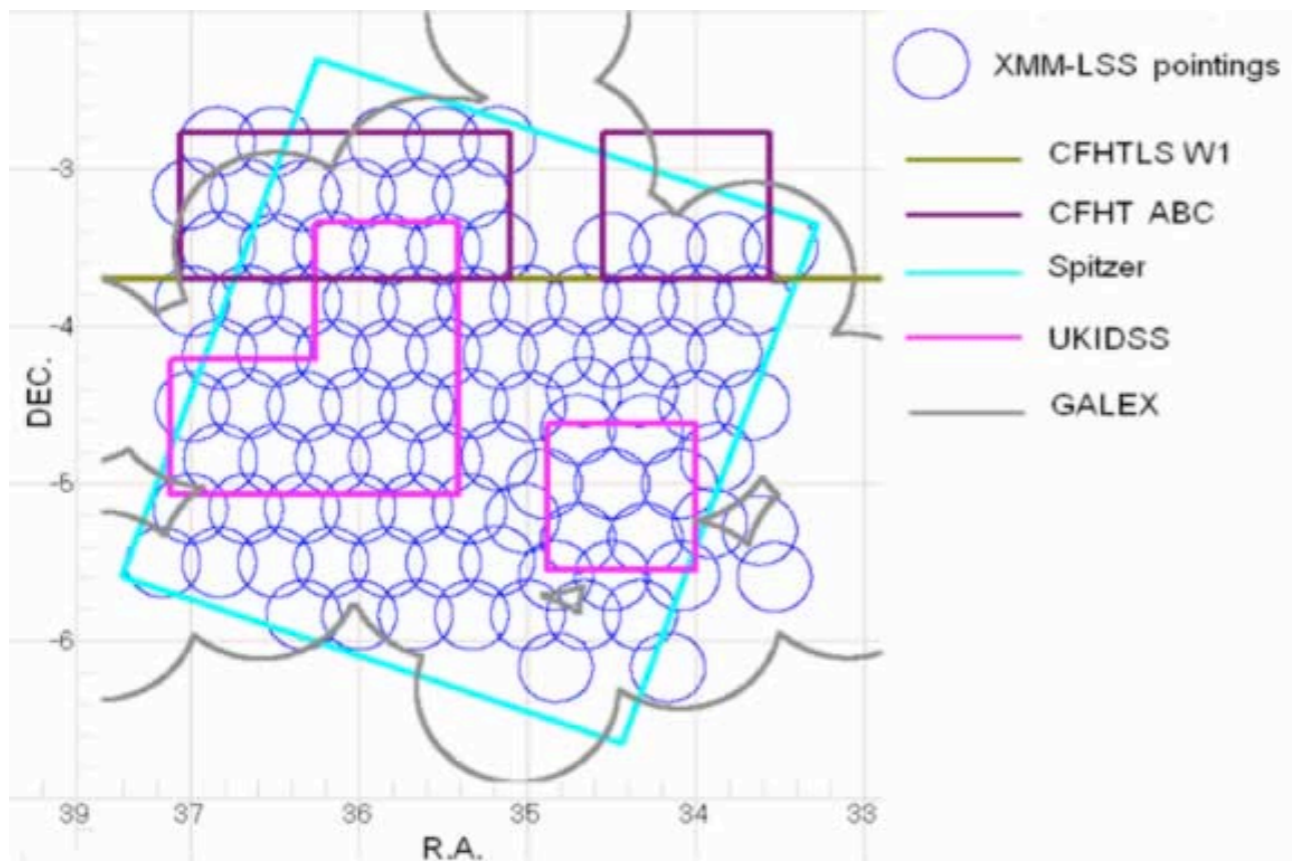


all-sky observation of AGN:

- ROSAT: $F(0.1-2.4 \text{ keV}) \sim 2 * 10^{-12} \text{ erg cm}^{-2} \text{ s}^{-1}$, 2 AGN deg⁻²
- eROSITA: $F(0.5-2.0 \text{ keV}) \sim 1 * 10^{-14} \text{ erg cm}^{-2} \text{ s}^{-1}$, 90 AGN deg⁻²

What do we expect from SPIDERS?

BOSS Ancillary Survey in the XMM-XXL



- XMM-XXL area ($\sim 22 \text{ deg}^2$)
- overlap with optical (SDSS), infrared (WISE), radio, UV surveys

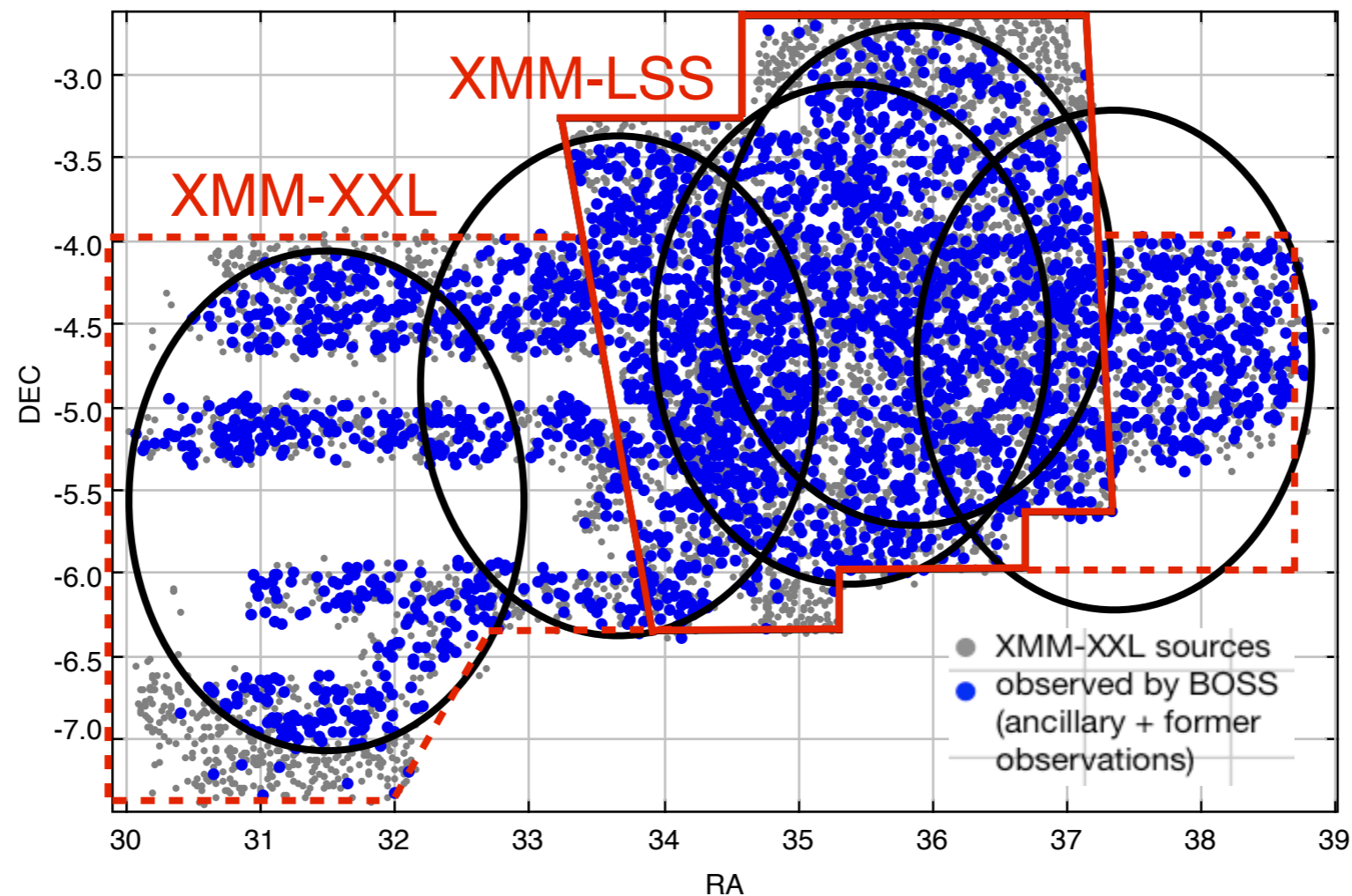
- spectroscopic follow-up with BOSS
(2012: PI Green & Merloni, TDSS/SPIDERS,
2013: PI Georgakakis, SPIDERS)

What do we expect from SPIDERS?

BOSS Ancillary Survey in the XMM-XXL

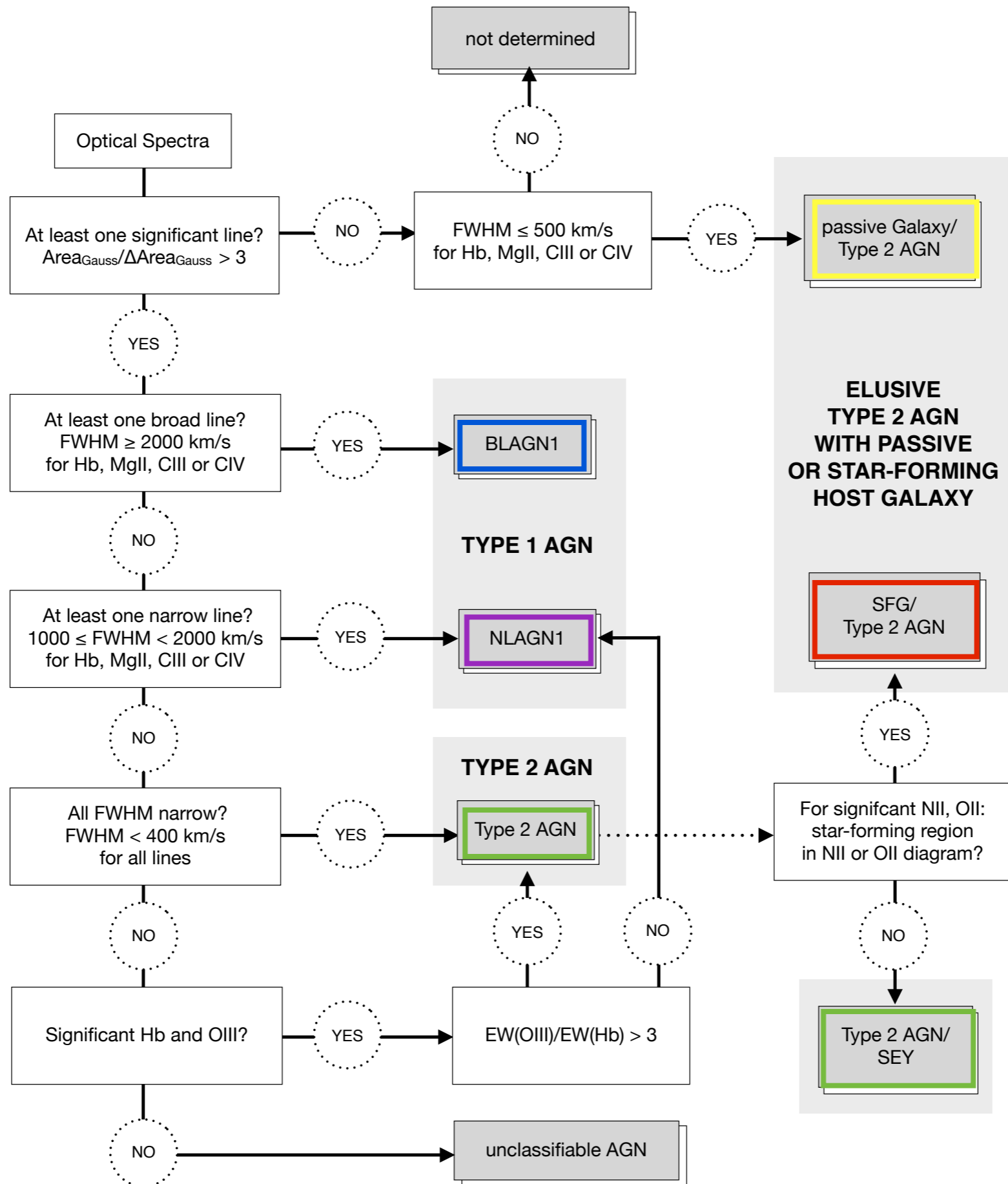
1. Processing of X-ray catalogue
2. Matching of XMM and SDSS catalogue
3. BOSS observations
4. Visual inspection of subset
5. Refitting of spectra with wrong BOSS-redshift
6. Classification based on emission line properties
7. Matching with WISE and eBOSS-XDQSO

	Ancillary Programs	eRASS 8 ($1 * 10^{-14}$)
X-ray sources	8445	1928
BOSS observed	3386	1143
reliable redshift with stars	2716	1070



Ancillary Program

Classification of X-ray spectra

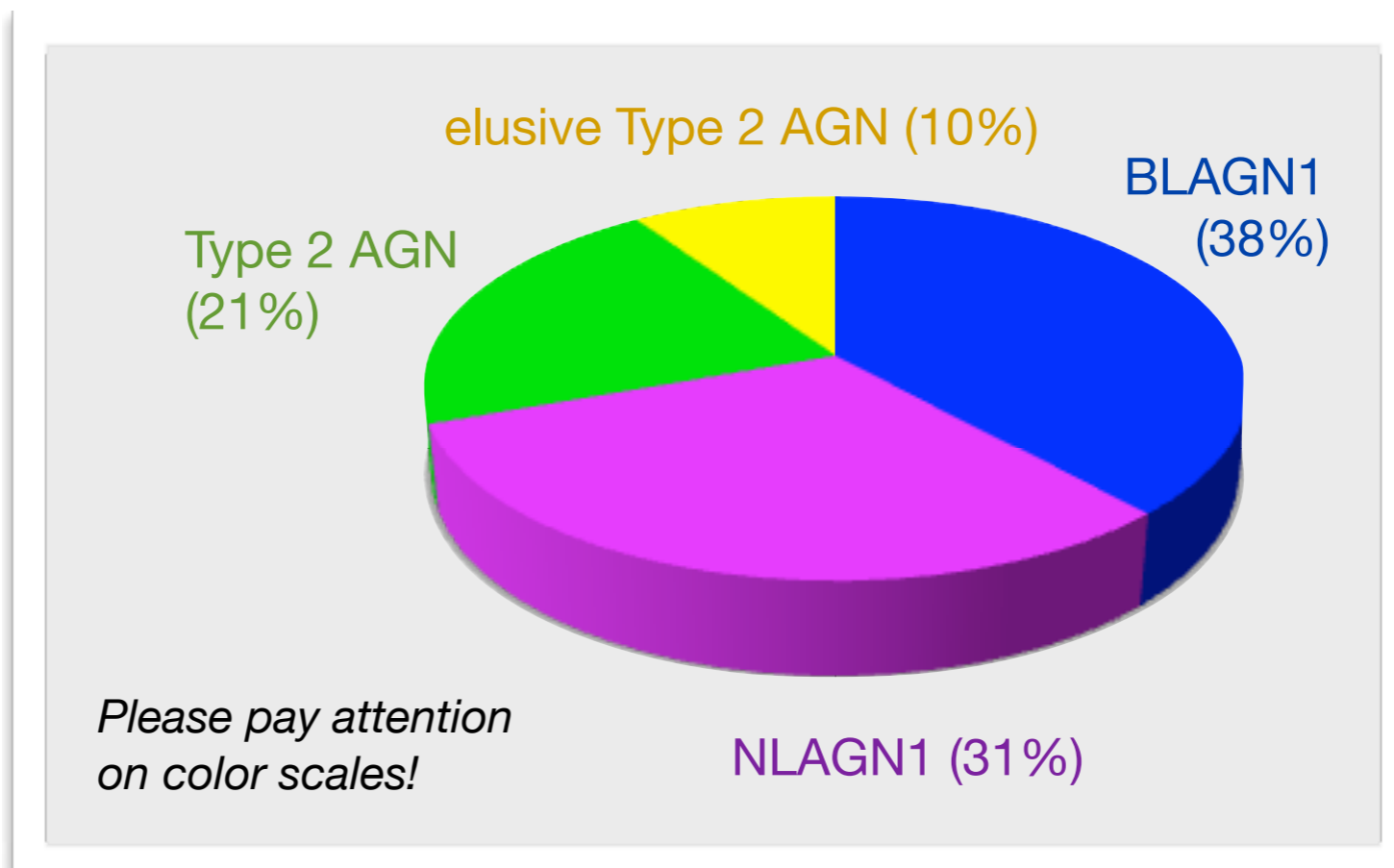


Menzel et al. 2014
in prep.

Ancillary Program

Classification of X-ray spectra

- combination of „classic“ classification schemes
(Caccianiga, Kauffmann, Kewley, Mendelez, Lamareille ...)
- spZline file with emission line information:
Flux, FWHM, EW of 10 emission lines
(Balmer Lines, Ly α , CIII, CIV, MgII, NV, OII, OIII)
- applied classes:

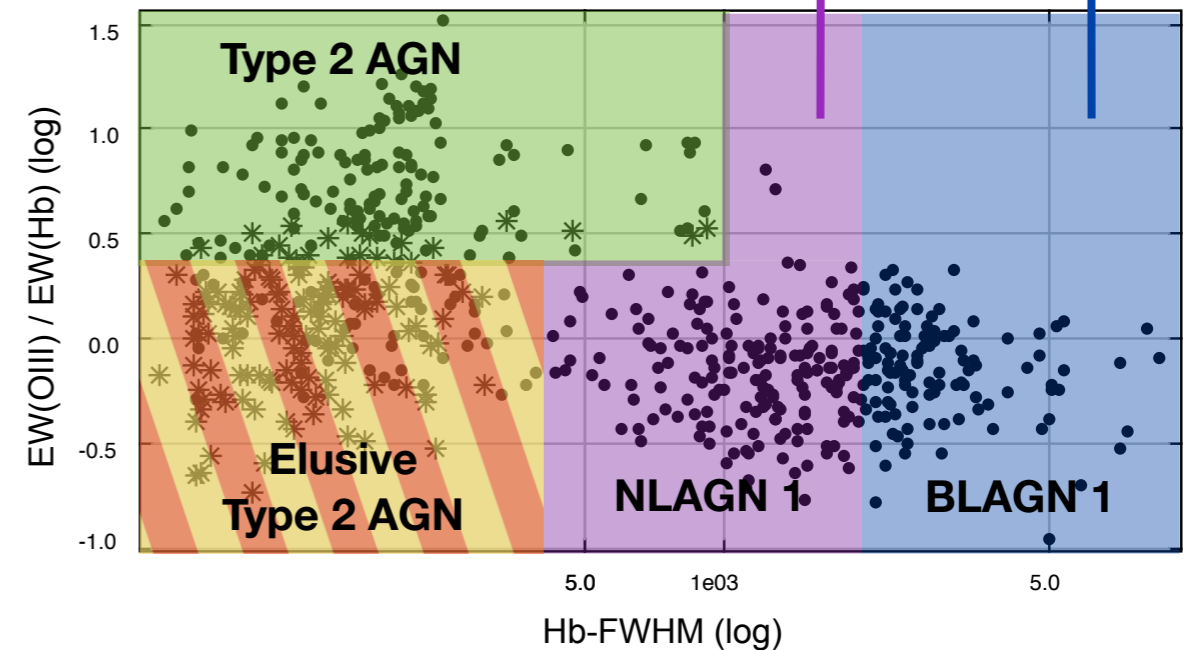
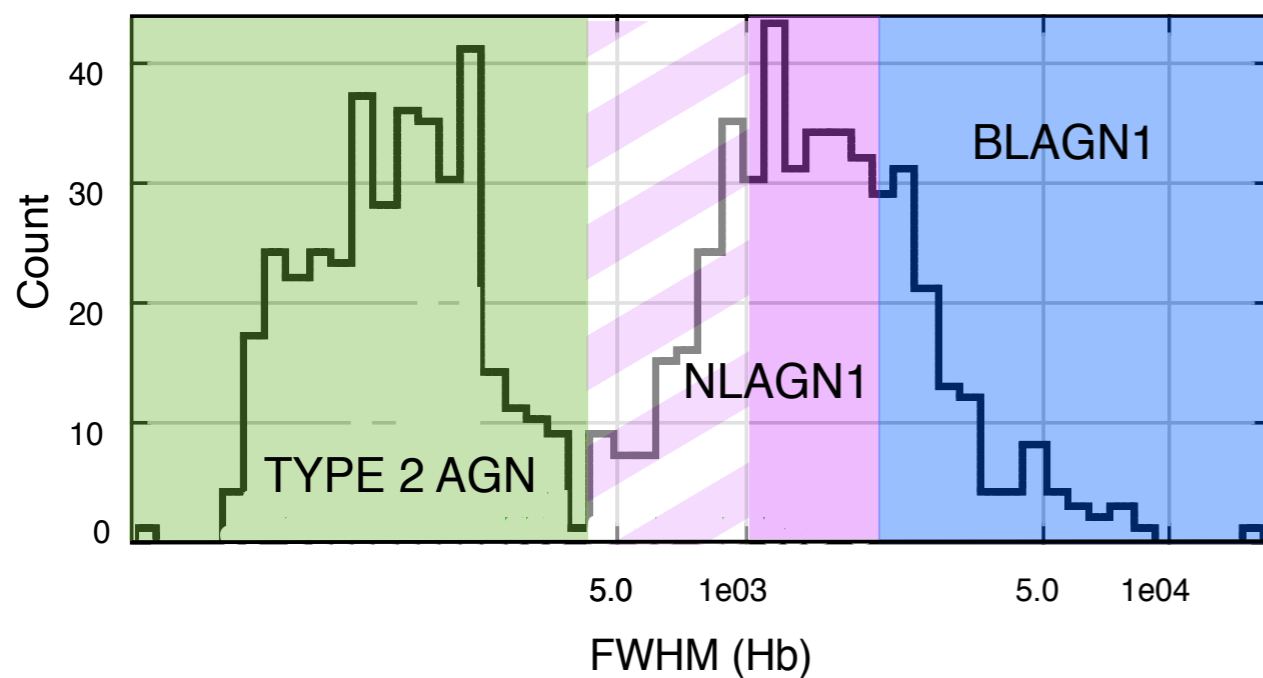
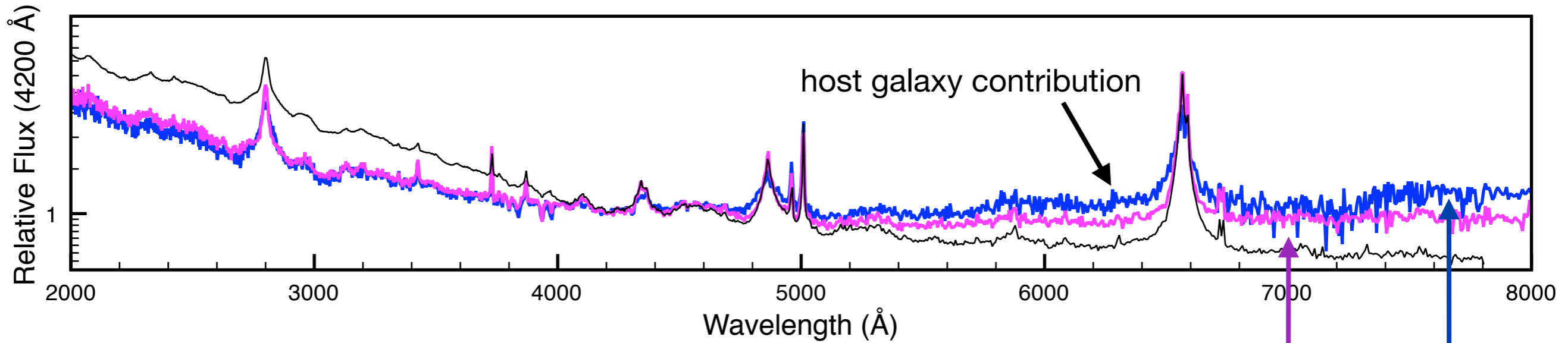


Ancillary Program

Classification of X-ray spectra

- SDSS template: QSO
- BLAGN1
- NLAGN1

BLAGN1/NLAGN1 (stacked spectra, $0 < z < 1$)

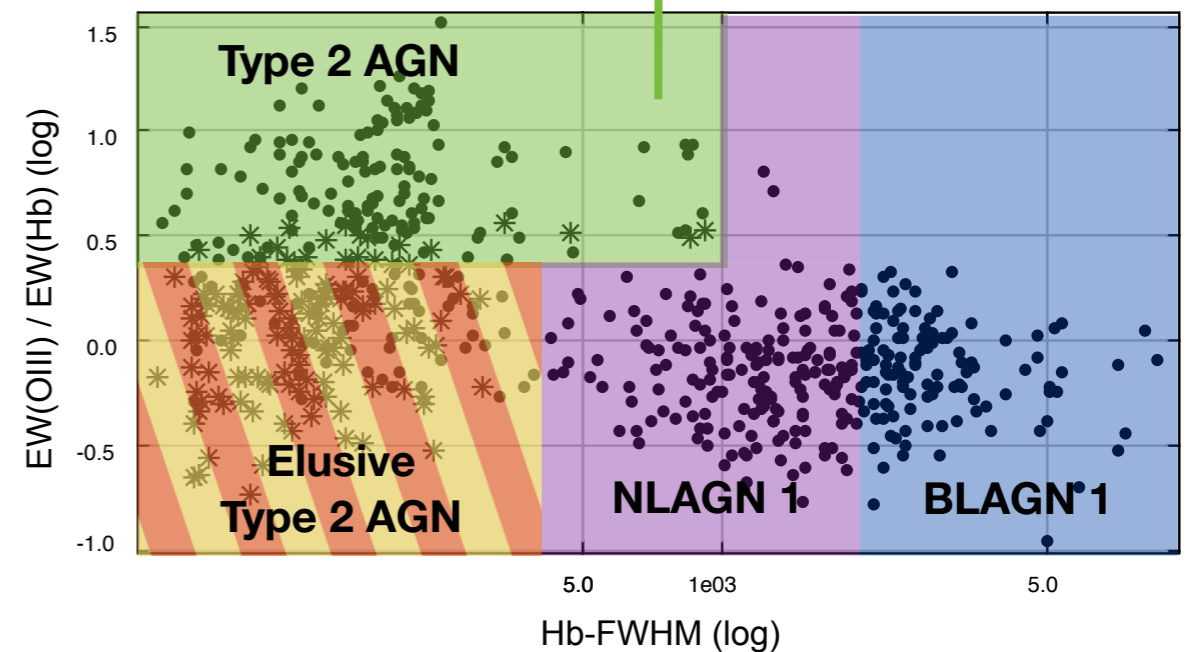
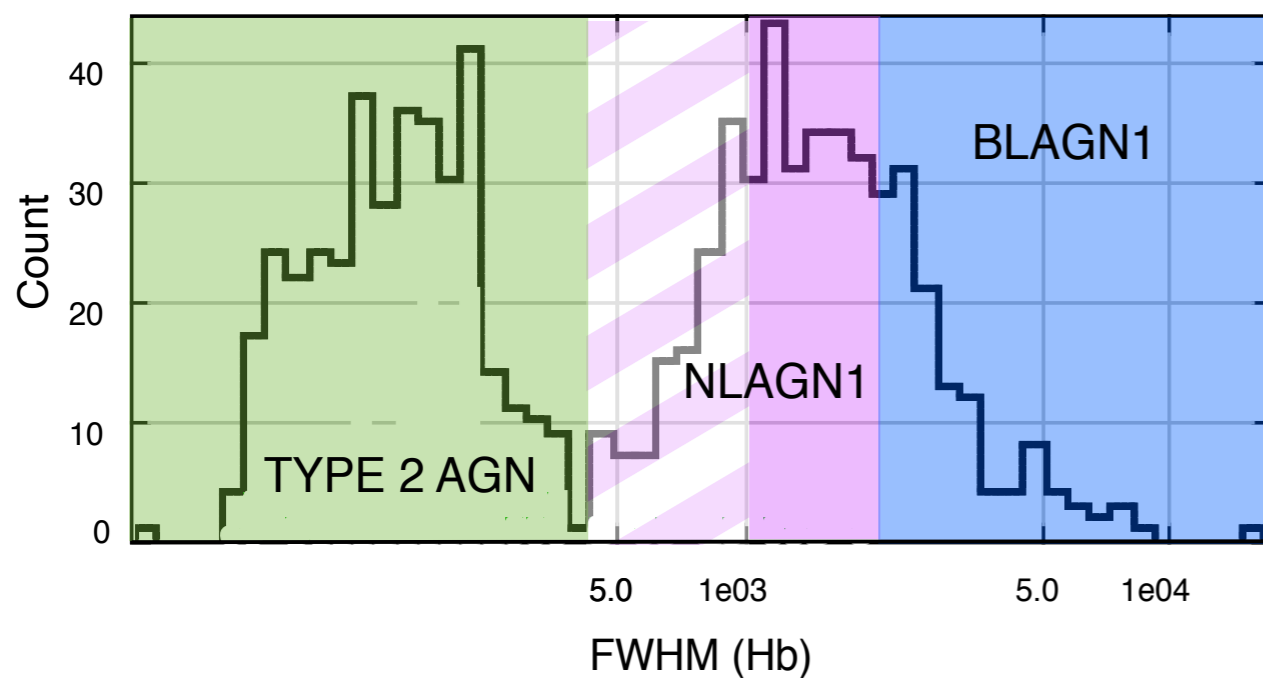
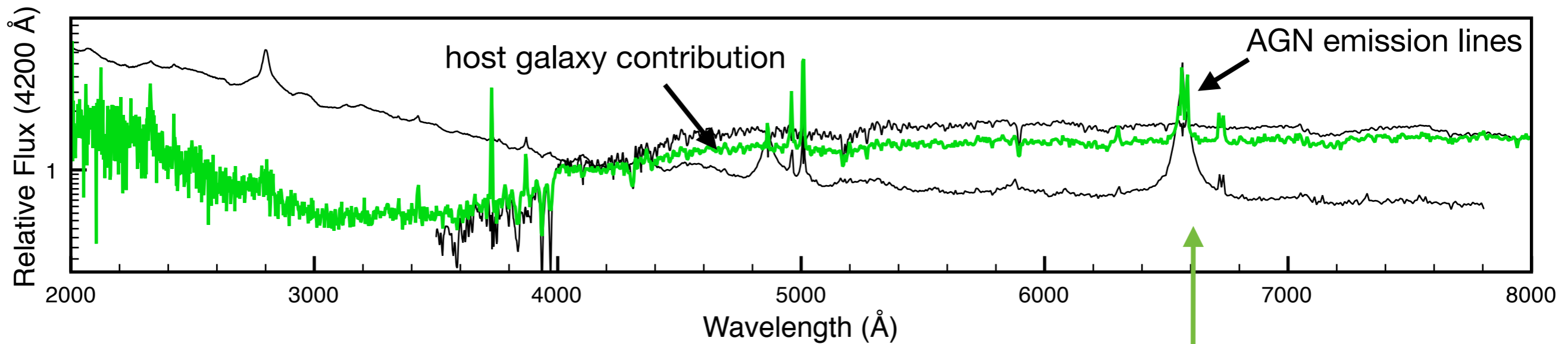


Ancillary Program

Classification of X-ray spectra

- SDSS templates: QSO, early type galaxy
- Type 2 AGN

TYPE 2 AGN (stacked spectra, $0 < z < 1$)

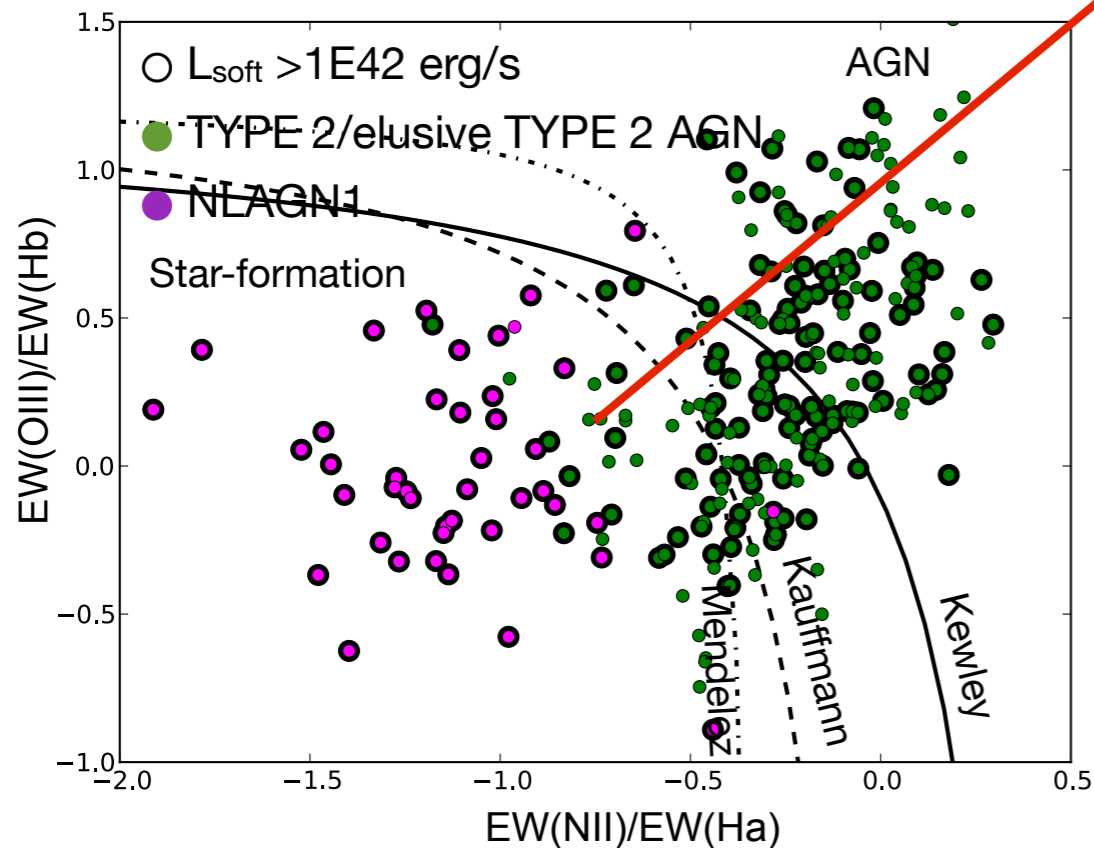
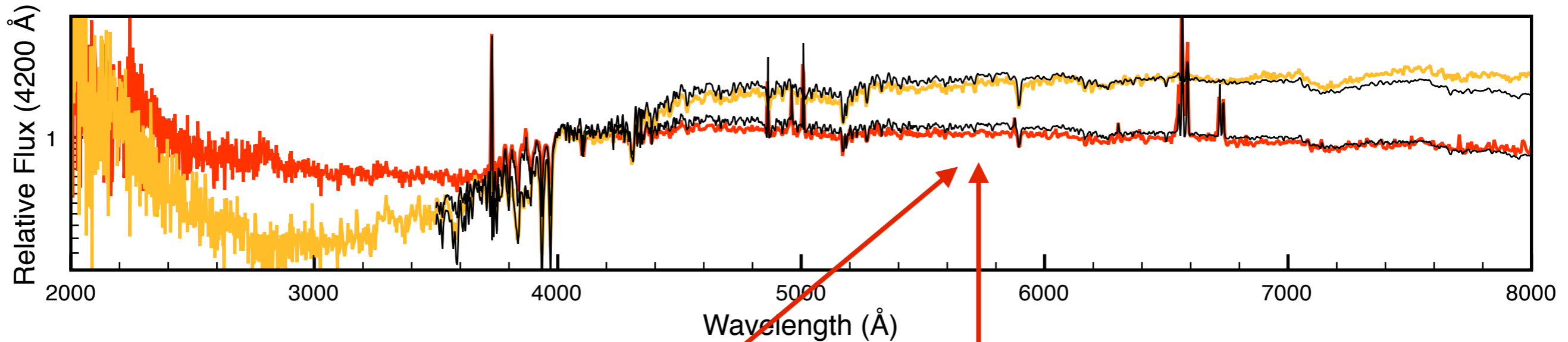


Ancillary Program

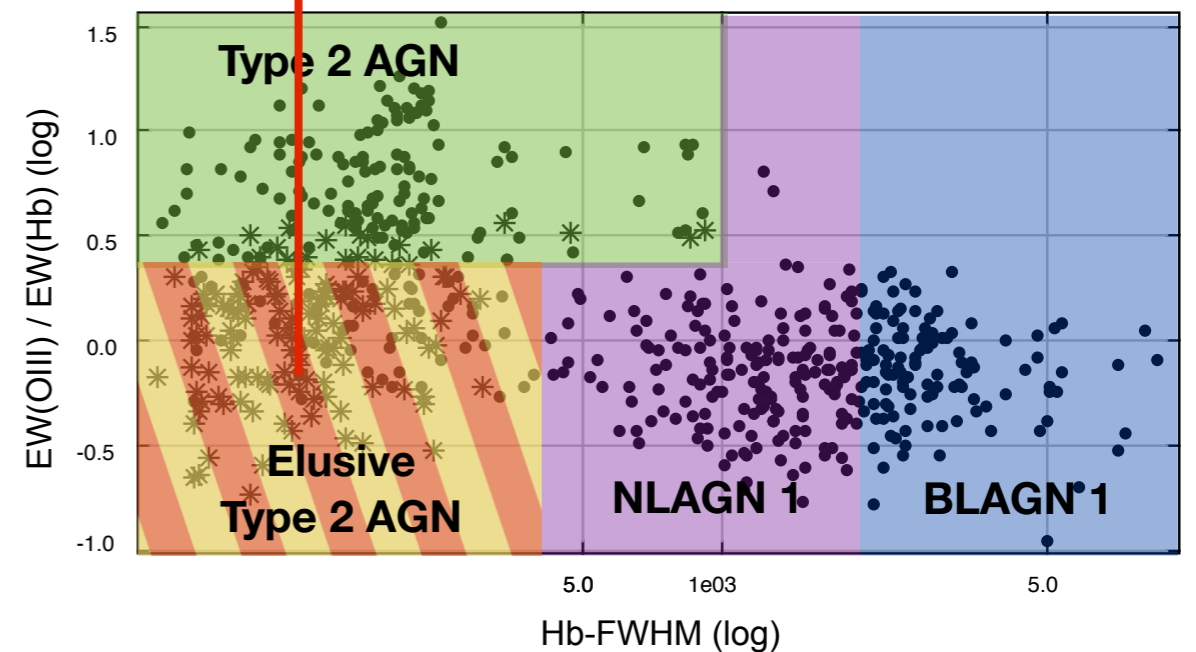
Classification of X-ray spectra

- SDSS templates: early type and late type galaxy
- obscured Type 2 AGN with passive host galaxy
- obscured Type 2 AGN with star-forming host galaxy

elusive TYPE 2 AGN (stacked spectra, $0 < z < 1$)



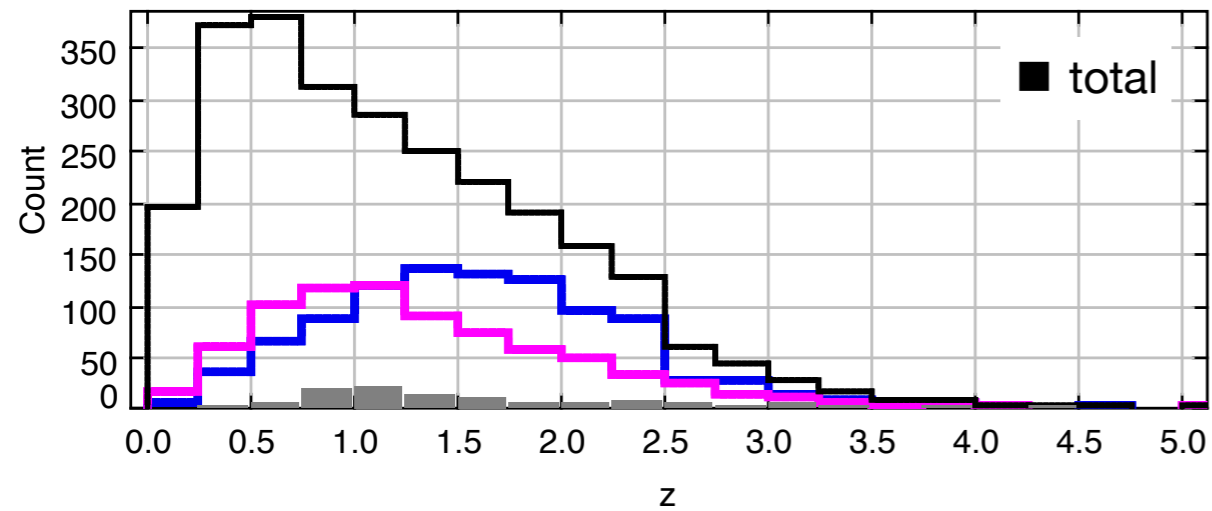
& EW(OII)/EW(Hb)
(Lamareille+)



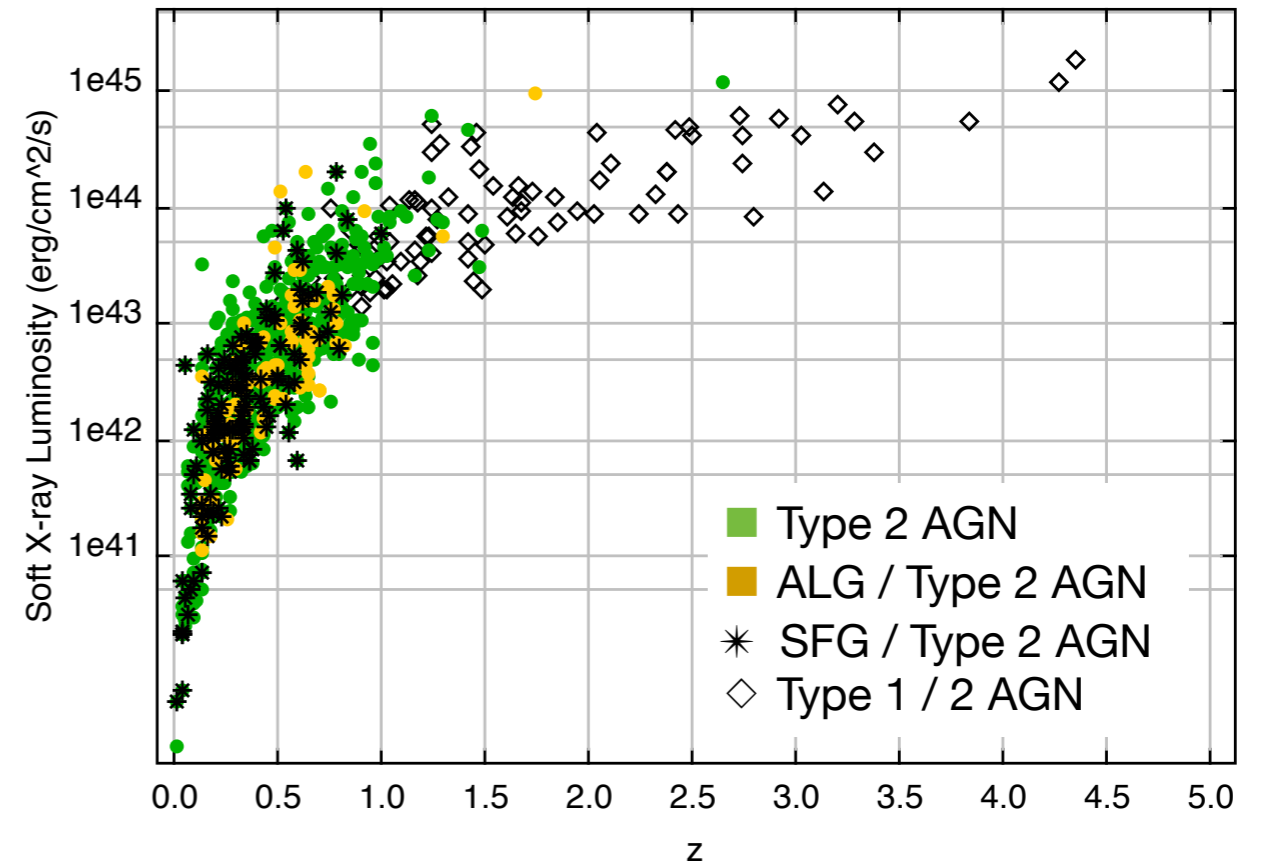
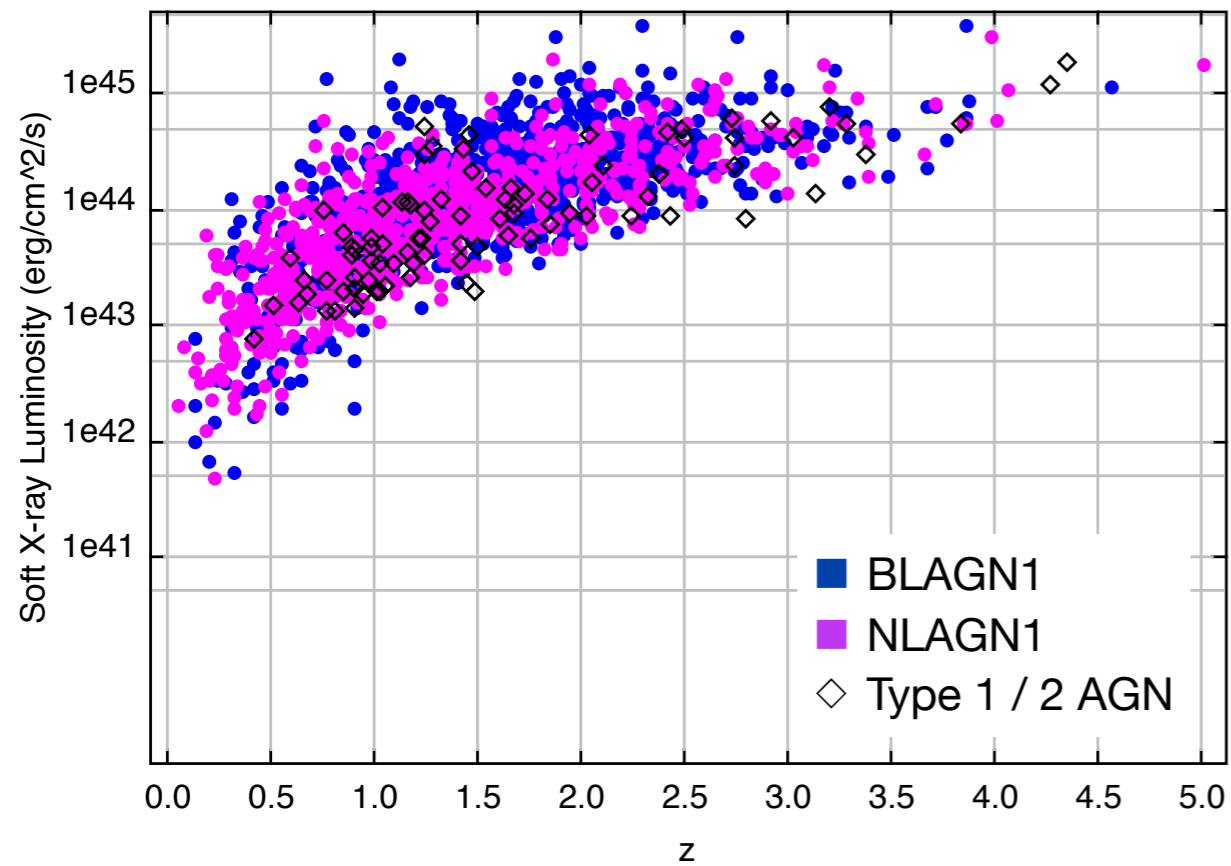
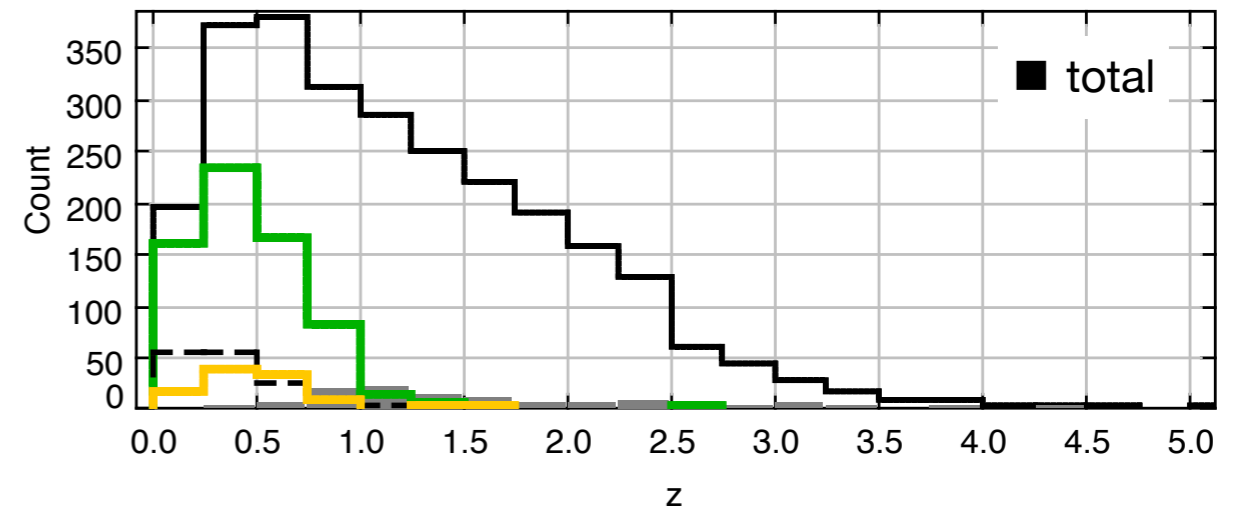
Ancillary Program

Redshift and Luminosity Distribution

TYPE 1 AGN



TYPE 2 AGN



Color Properties

XDQSO-Selection

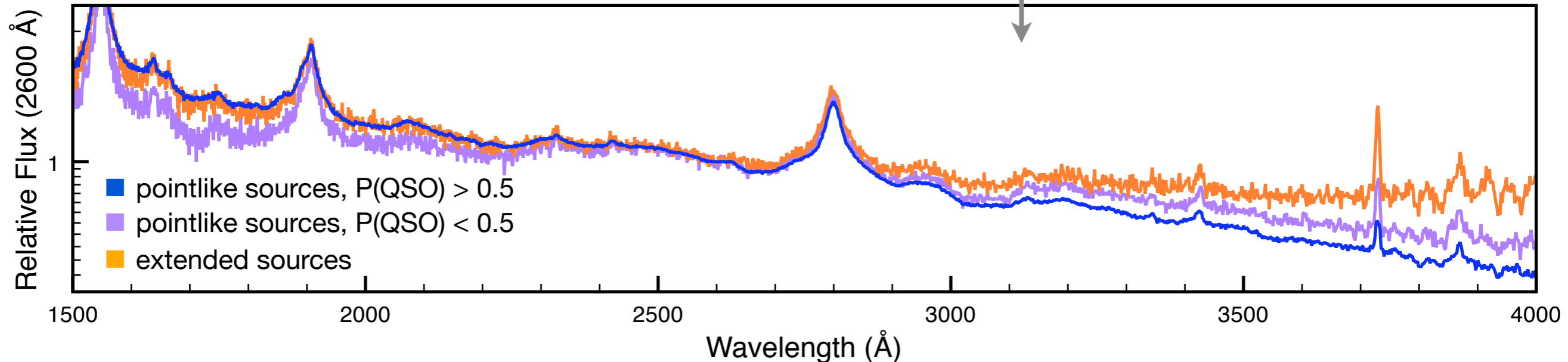
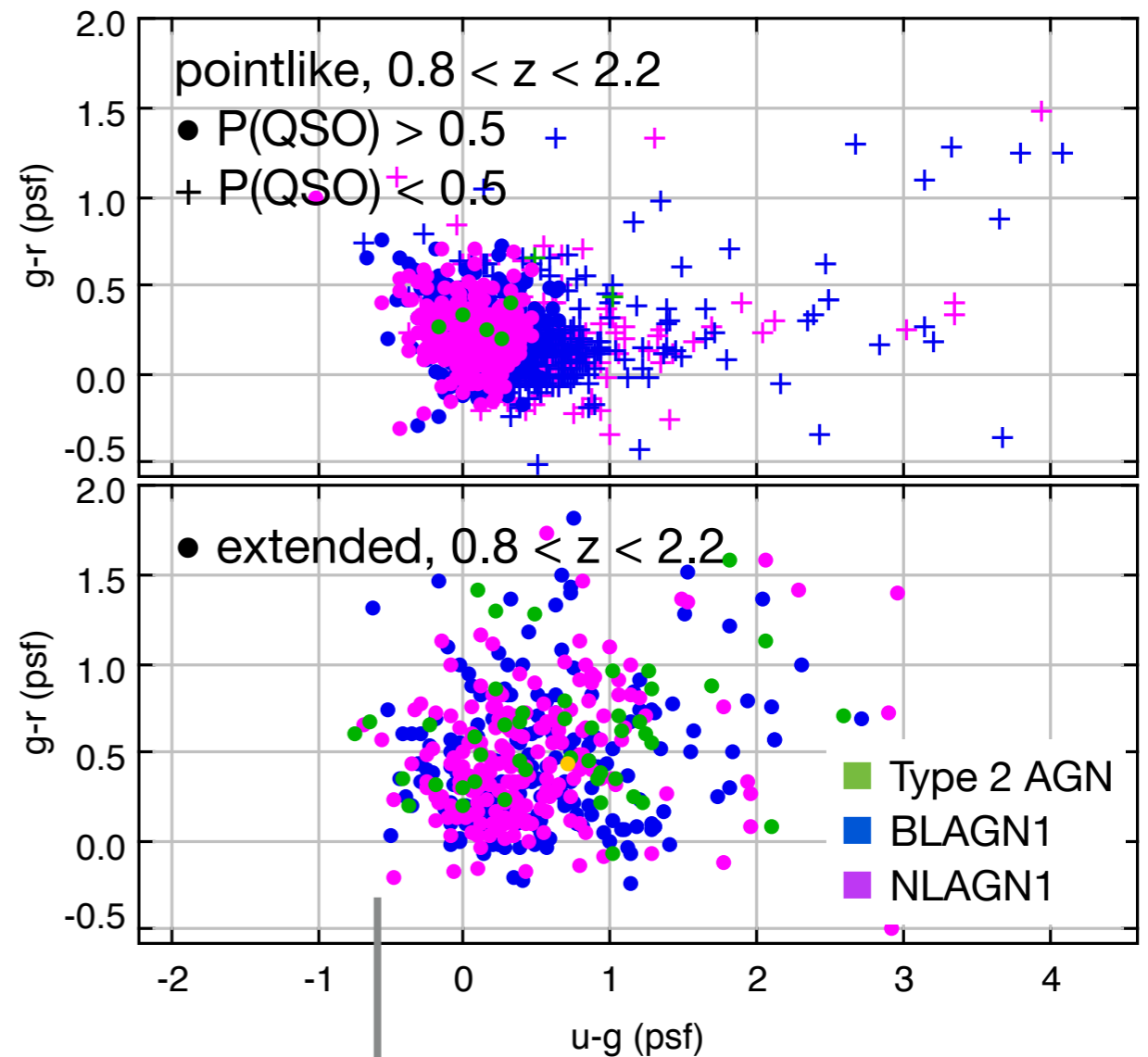
- XDQSO selection criteria (Bovy+10)
- assignment of $P(\text{QSO})$ to pointlike sources in $0.8 < z < 2.2$



pointlike Type 1 AGN
 $0.8 < z < 2.2$



red Type 1 AGN
host galaxy dominated Type 1/2 AGN
extended AGN
 $z < 0.8, z > 2.2$



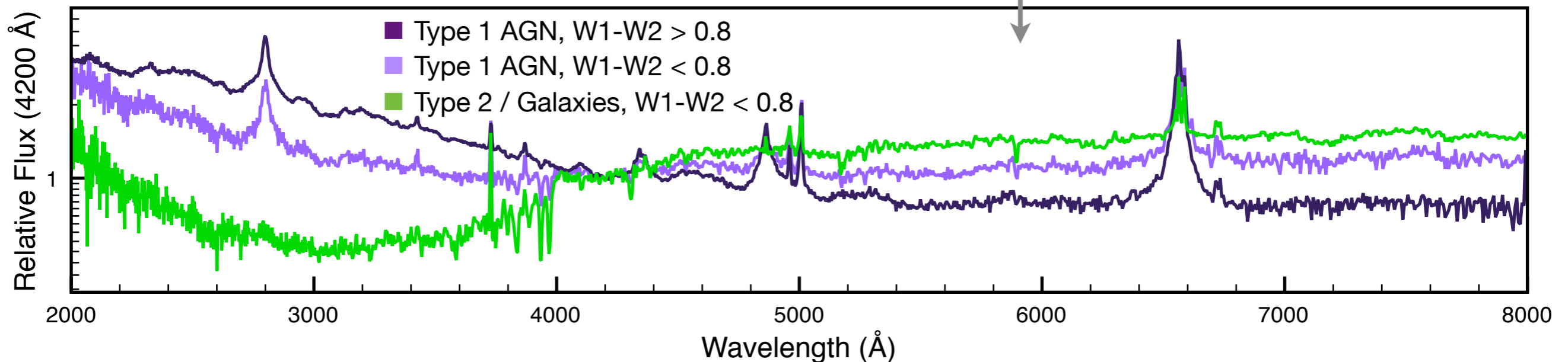
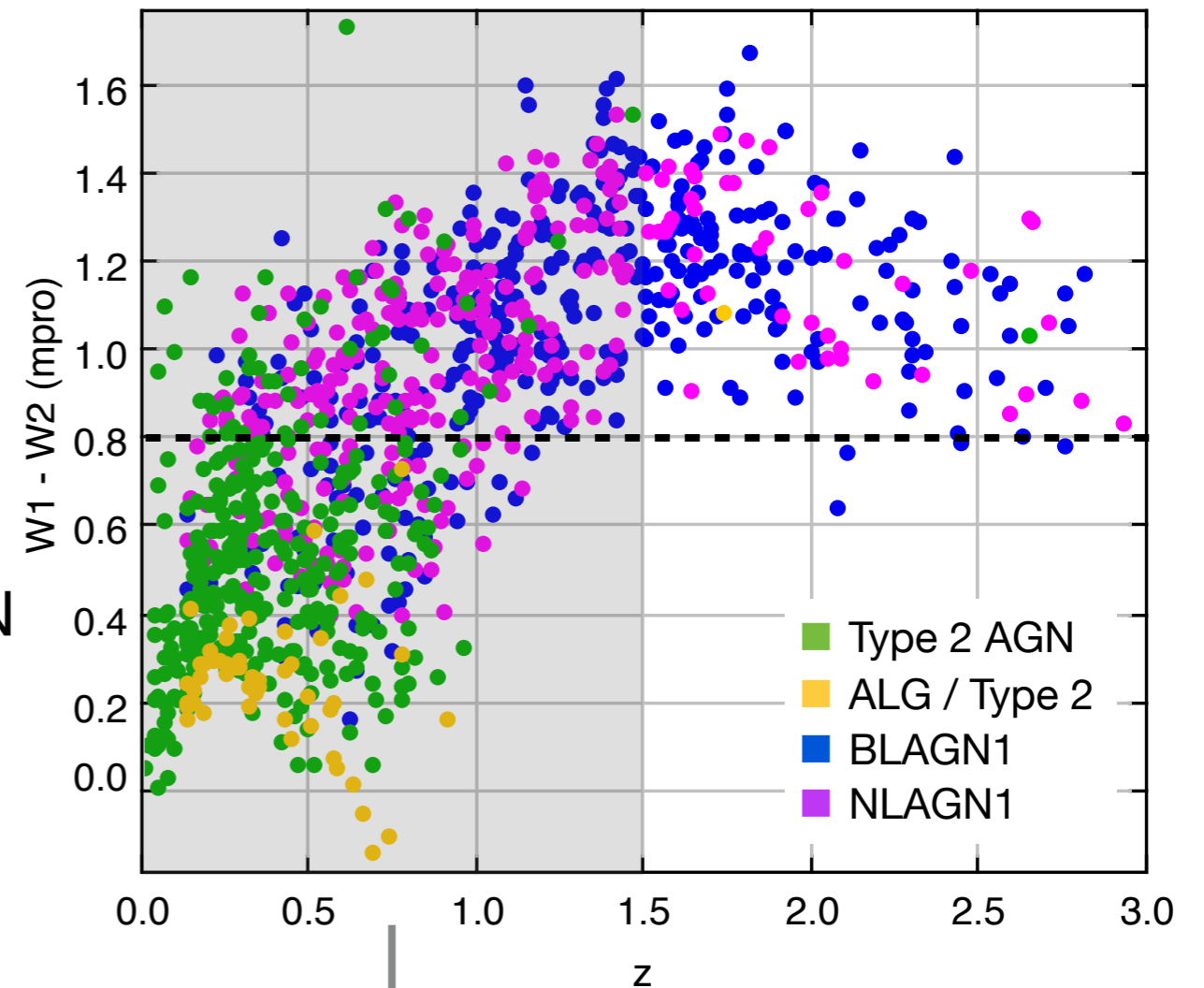
Color Properties

Infrared Color Selection

- WISE selection criteria (Stern+12)
- AGN selection with $W1-W2 > 0.8$

✓ Type 1 AGN
 $0 < z < 3$

✗ host galaxy dominated Type 1/2 AGN
 $0 < z < 1$



Multiwavelength-Selection of AGN

Summarizing Strengths

What are the strengths of X-rays to detect AGN?

	X-ray	XDQSO	WISE
morphology:	pointlike/ extended	pointlike	pointlike/ few extended
redshift range:	0 - 5	0.8 - 2.2	0 - 3
obscuration:	little affected	excluded	not affected
host galaxy / SF:	little affected	excluded	contaminated by galaxies



access to great variety of AGN

BOSS Science Pipeline (A. Bolton+)

Some Updates from Utah SDSS-III/IV Conference 2014



Current Performance:

- PCA basis: fits most significant details in signal, very flexible
- full automation: does not require routine inspections



Current Performance:

- PCA basis: fits many details in noise, missing connection between redshift models and physical parameters



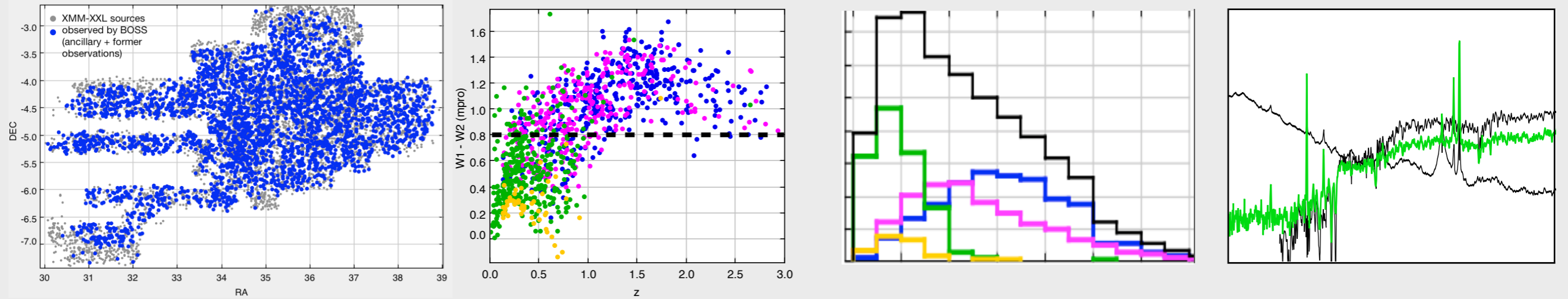
Plans for SDSS-IV:

- python based pipeline: „redmonster“ (beta-release for BOSS post-shutdown)
- main driver: redshift measurement and classification

- further design drivers: non-negative physical models, robustness against unphysical PCA solutions (e.g. at low S/N), joined likelihood functions over z and physical parameters
- costum configurabilty of spectral templates for different target classes

- afterburner pipeline: cooperation with science working groups
- for QSO: no more visual inspection expected

Summary



- Ancillary in XMM-XXL is the **largest contiguous spectroscopic survey** of X-ray selected AGN (~ 2600 reliable redshifts)
- development of **new AGN classification** based on emission line characteristics
- new class of BOSS-targets: **Type 2 AGN** and Type 1 AGN with strong **host galaxy** component
- template contribution to redmonster pipeline

Thanks to: MPE - A. Merloni, K. Nandra, A. Georgakakis, M. Salvato
BOSS - I. Paris, A. Bolton, Y. Shen and many more