

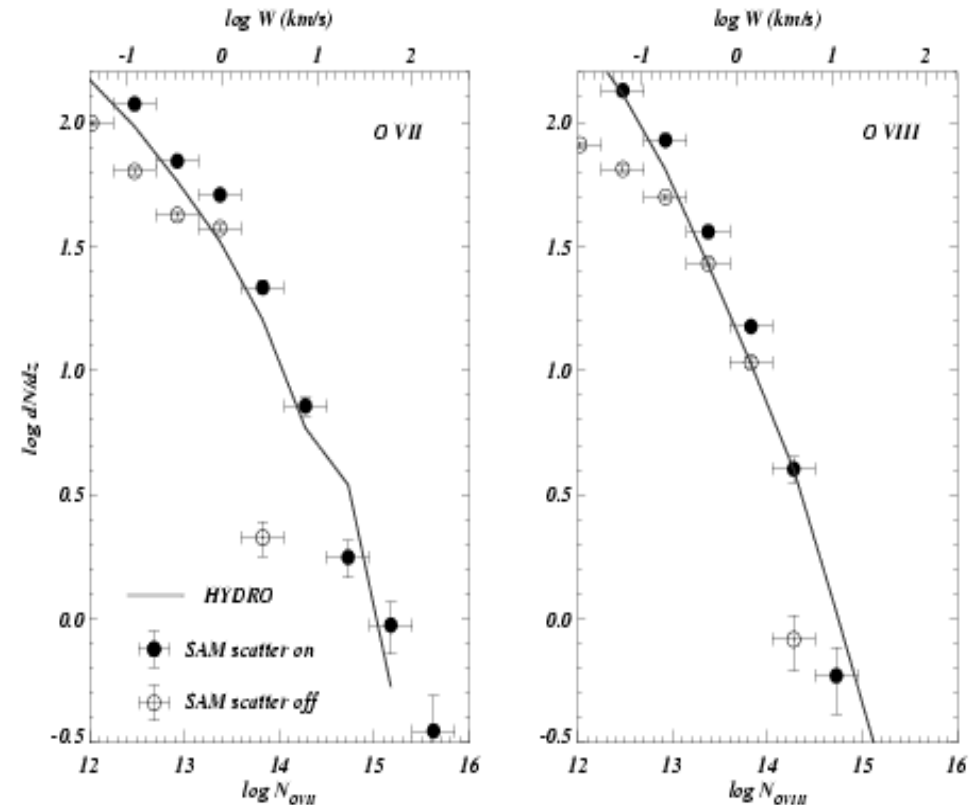
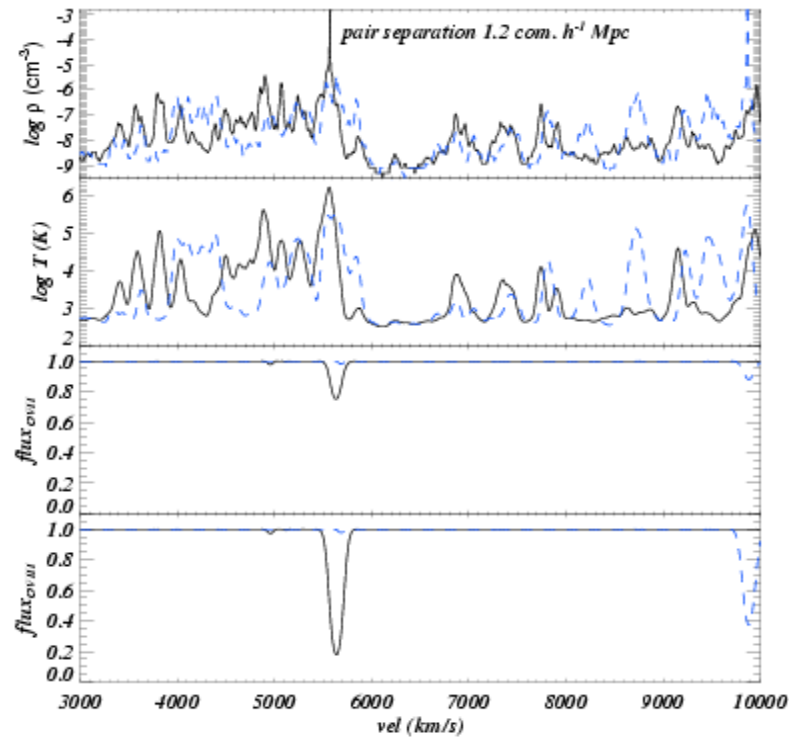
ESTREMO/WFXRT. WHIM Working Group

- Dutch Partnership and ESA call: updates.
- Telescope and Detector: updates.
- Absorption and Emission:
 - Available Simulations and Spectra
 - First results.
 - Ongoing work
- Absorption + Emission: GRB+follow-up scenario
- Absorption + Emission: Clusters' outskirts+AGN scenario.
- Absorption + Emission: Existing results and future analyses.
- Feedback from other WGs
- Open questions. Future simulations and analyses.
- Constraints from the current mission profile ?

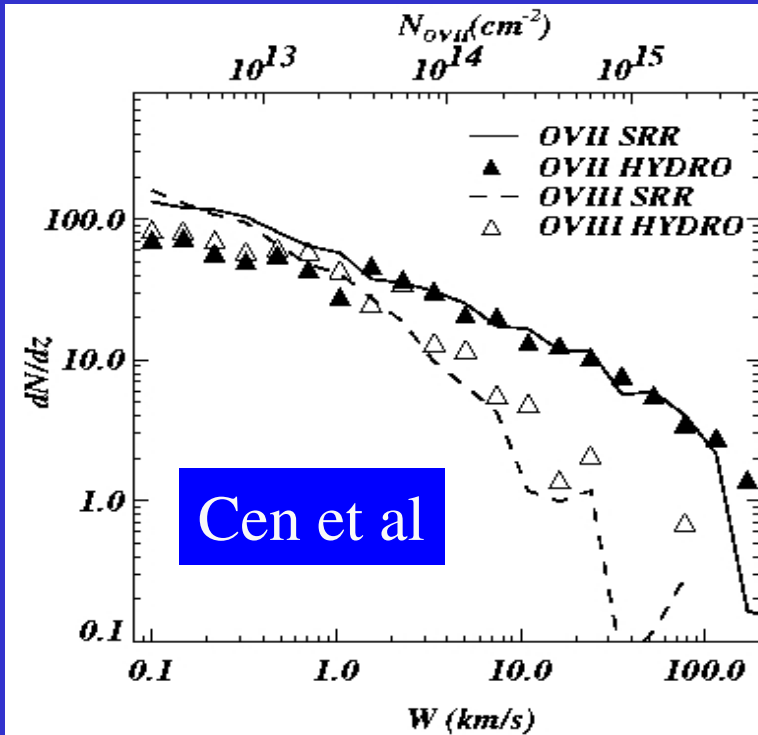
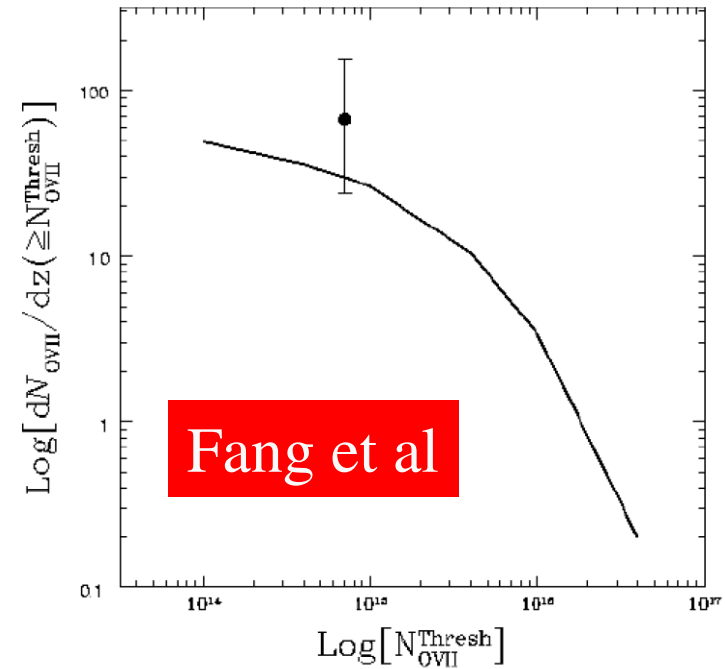
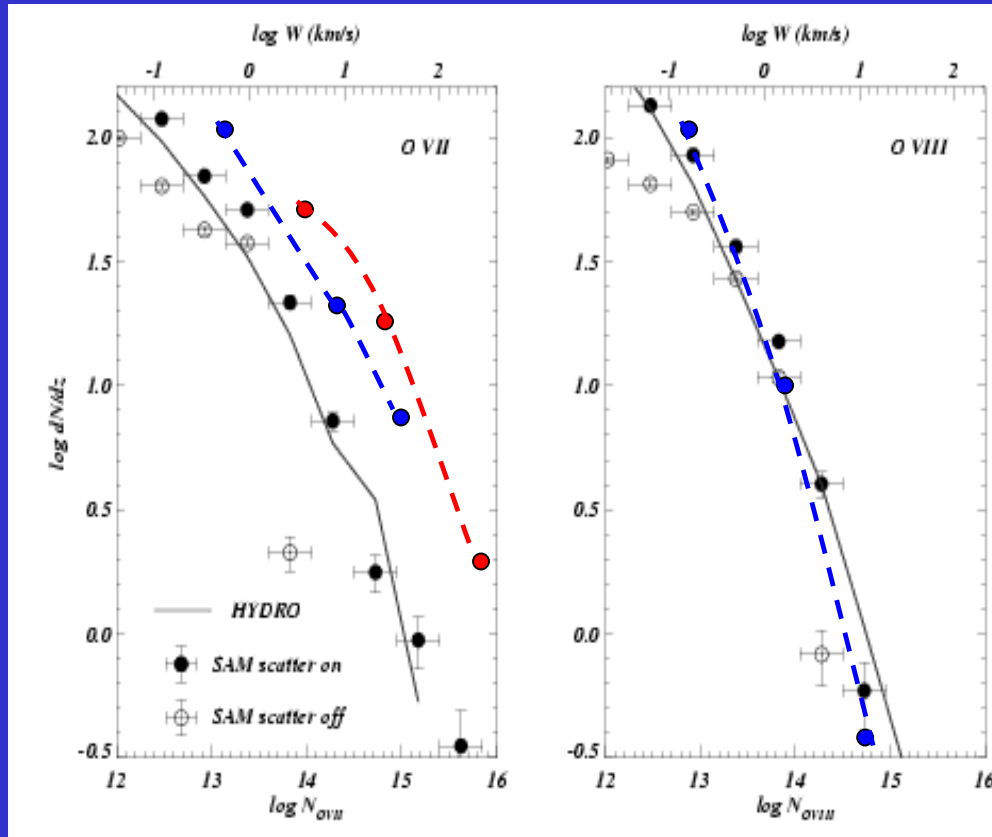
Bologna. Department of Astronomy. 31/3/06

Currently Available Mock Absorption Spectra

- Semi-analytic method calibrated on Cen et al. 2002 hydro simulations
- 5 independent line of sights out to $z=0.33$
- T, ρ, Z as a function of redshift.
- OVII and OVIII optical depth as a function of z .

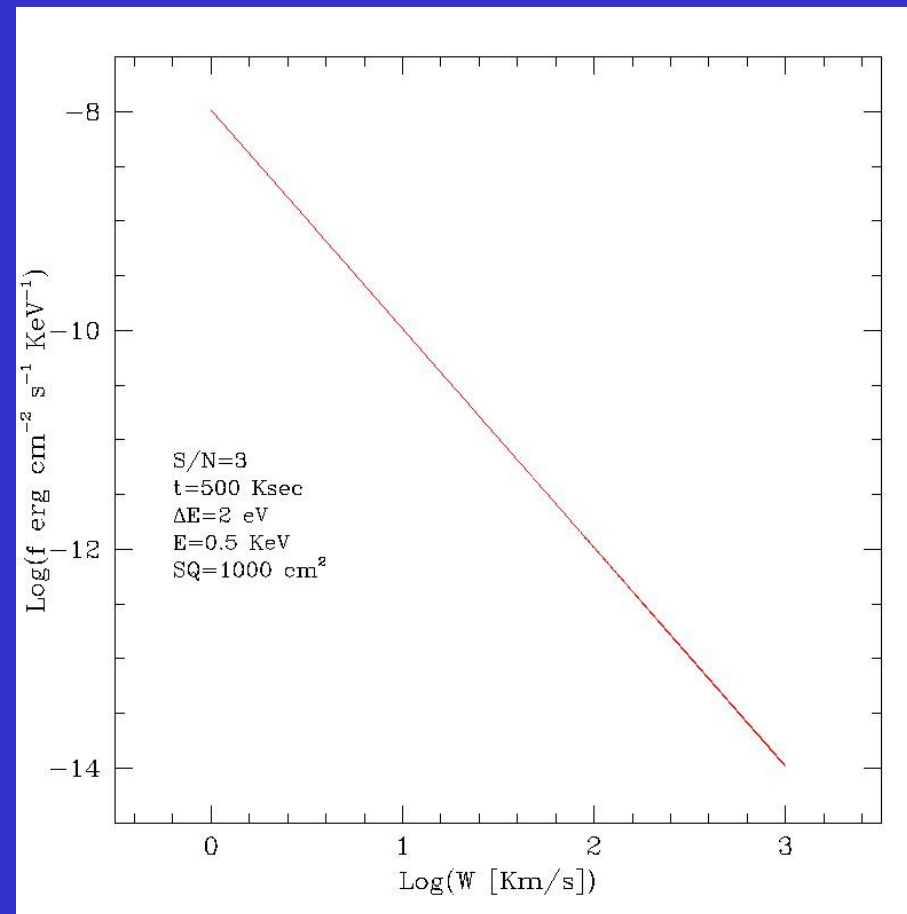


Number of absorbers per unit redshift.

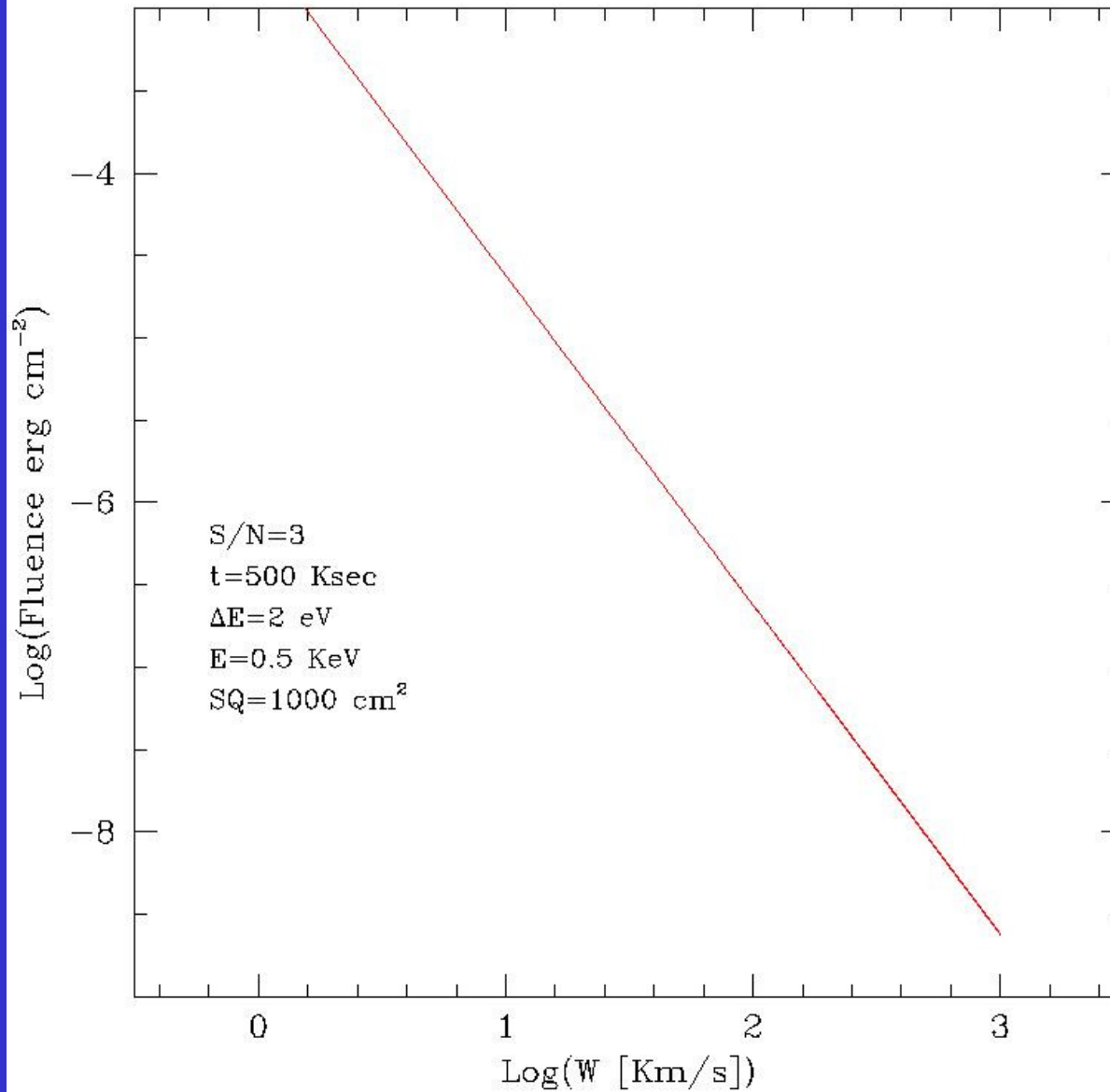


Detectability 1 (OVII)

$$F \approx 1.3 \times 10^{-12} \left(\frac{E}{1 \text{ keV}} \right)^{-1} \left(\frac{S/N}{3} \right)^2 \left(\frac{\Delta E}{10 \text{ eV}} \right) \times \\ \times \left(\frac{W_{abs}}{100 \text{ km/s}} \right)^{-2} \left(\frac{AQ}{10000 \text{ cm}^2} \right)^{-1} \left(\frac{t}{100 \text{ ksec}} \right)^{-1} \text{ erg cm}^{-2} \text{ s}^{-1} \text{ keV}^{-1}$$

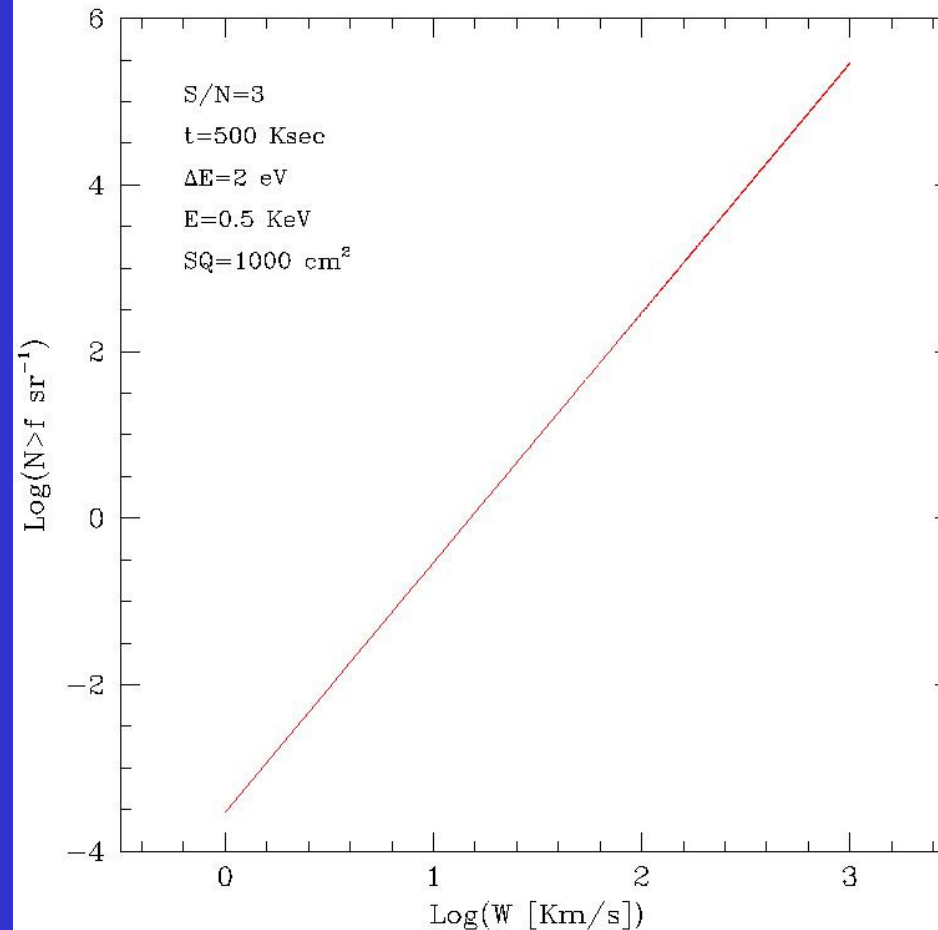


Detectability 2 (OVII)

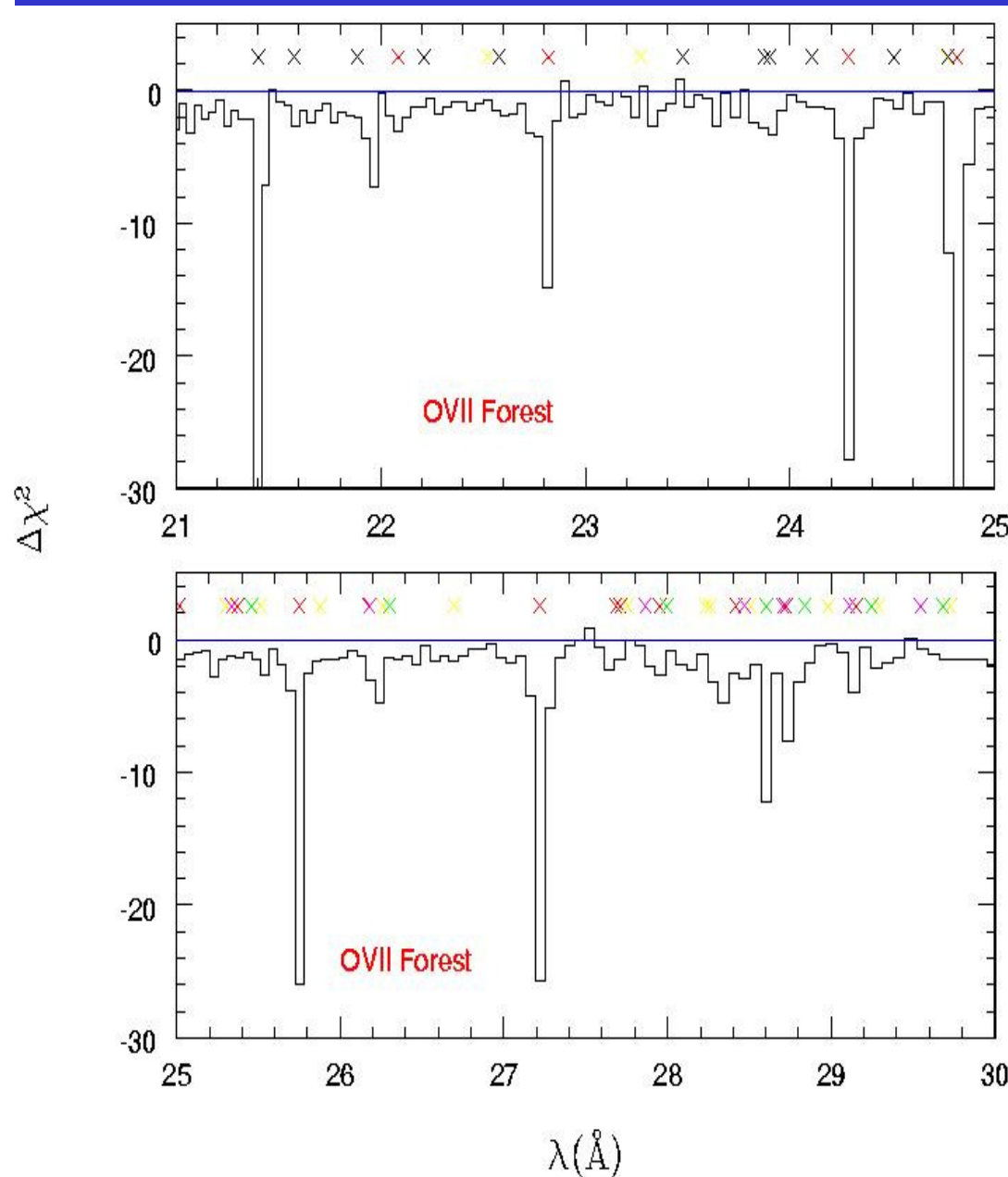


Detectability 3 (OVII)

$$\mathcal{N}(> F) \approx 100 \left(\frac{E}{1 \text{ keV}} \right)^{0.45} \left(\frac{S/N}{3} \right)^{-3} \left(\frac{\Delta E}{10 \text{ eV}} \right)^{-1.5} \times \\ \times \left(\frac{W_{abs}}{100 \text{ km/s}} \right)^3 \left(\frac{A Q}{10000 \text{ cm}^2} \right)^{1.5} \left(\frac{t}{100 \text{ ksec}} \right)^{1.5} \text{ sr}^{-1}$$



WHIM physical properties (Nicastro) 1



- MonteCarlo calibrated on Fang et al. hydro simulations.
- 15 absorption systems with $N(\text{OVII}) > 1e14$ out to $z=0.361$ (including 4 absorption systems observed along l.o.s. 1ES 1028+51)
- Power law 1ES 1028+51
- Flux= mCrab between 0.1-2.4 KeV in 100 Ksec (Fluence = $2e-6$ erg cm^2)
- Red=OVII K-alpha, Black=OVII K-beta, Green=NVI K-alpha, Yellow=OVI K-alpha, Magenta=NVII K-alpha

WHIM physical properties (Nicaastro) 2

- 53% of the system at least 1 ion detected with $S/N > 3$ (good to determine $dN(\text{OVII})/dz$ (47% confusion or misdetections).
- 23% the only detection is OVII
- In 40% of the systems 2 ions detected. Rough estimate of T .
- In only 13% of the systems 3 ions detected. Estimate of Ω_B
- Most of the information comes from a single, well detected filament. All other absorbers basically contribute in determining $dN(\text{OVII})/dz$.
- No Background included. Potential Problem ! A background model is required.
- CV absorption lines could be important (46-49 Å. Energy resolution becomes an issue).
- Does it make sense to go beyond $z=0.3$ (Galactic confusion, Effective Area)

Ongoing Work - absorption (Viel+Shaye)

- Semi-analytic spectra. Similar. More H-like and He-like ions.

Timescale: Early Next Week

- Short spectra from constrained simulations. 3C273 behind Virgo.

Timescale: 2 weeks.

- Long spectra from unconstrained SPH Hydro-simulations.

Box: 60 Mpc/h. 400^3 DM 400^3 GAS Softening: 2.5 Kpc/h comoving Simple star formation mechanism. No Feedback. Metallicity. Cooling UV background (QSO+ galaxies). No X-ray background. No Radiative transport. No Metal Cooling.

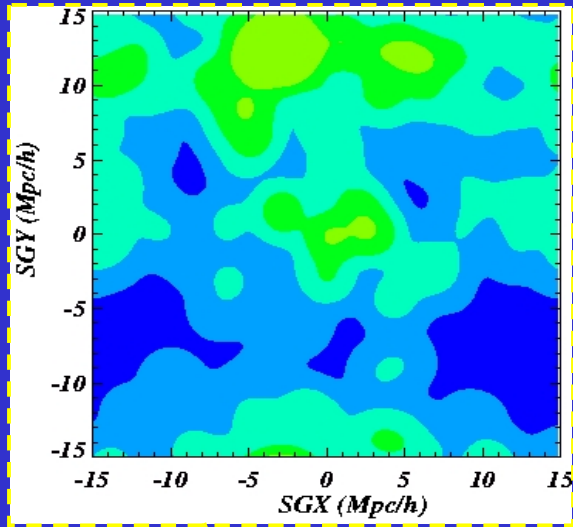
Currently Running ($z \sim 0.3$). Timescale: after Easter.

- Overwhelmingly Large Simulations (OWLS). Very large, state of the art, cosmological hydro simulations with metal cooling chemodynamics, feedback, winds. Especially suited for Reionization Epoch. Currently running on LOFAR-dedicated computer.

Timescale: 1 Month or more.

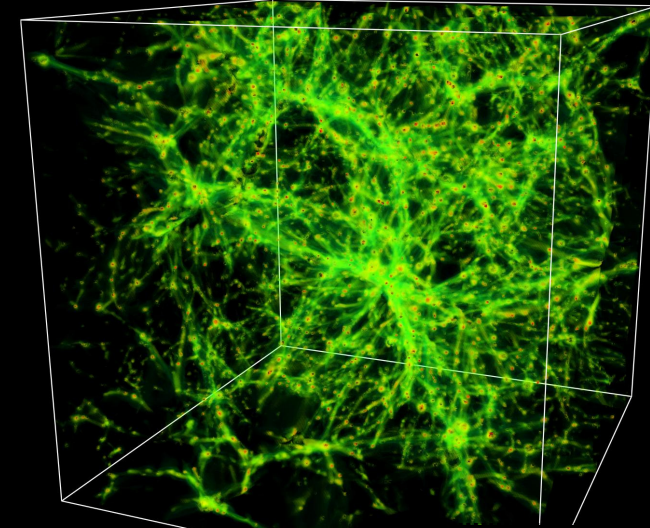
Tracing the local WHIM: method

Galaxy Light: Tully Catalog

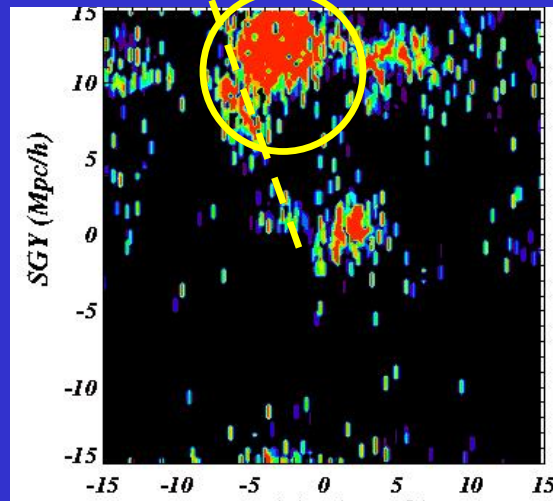


Biassing hypothesis
+
ADDING POWER

Eulerian Hydro-simulation. Flat Λ CDM
 $L=25$ Mpc/h. $l=32.6$ Kpc/h. Cen et al. 2003

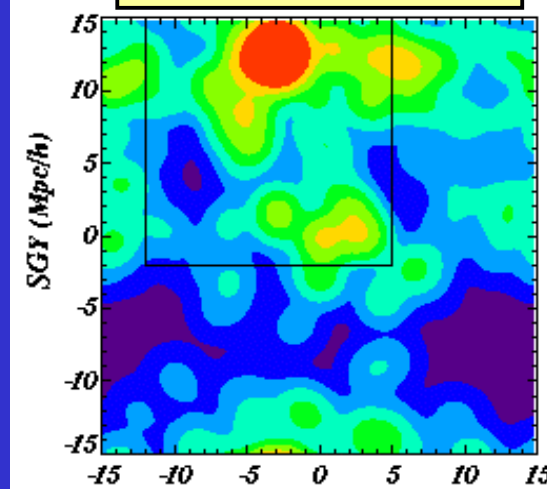


Gas properties

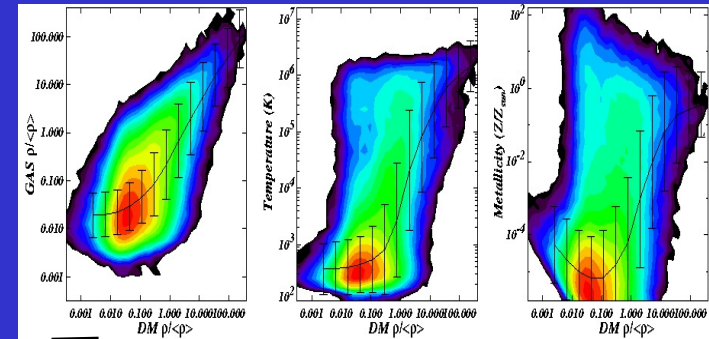


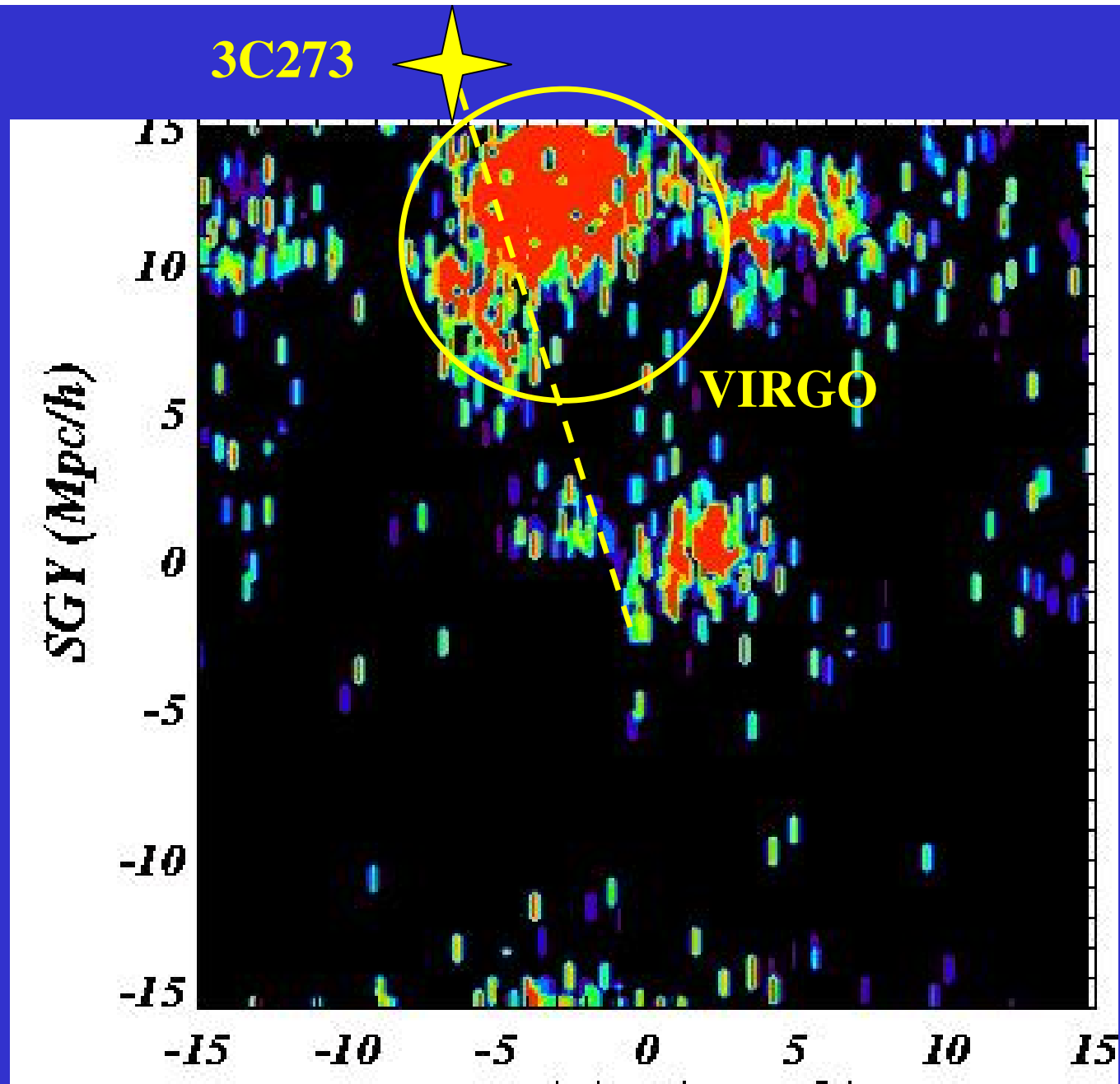
OVII distribution

IGM distribution



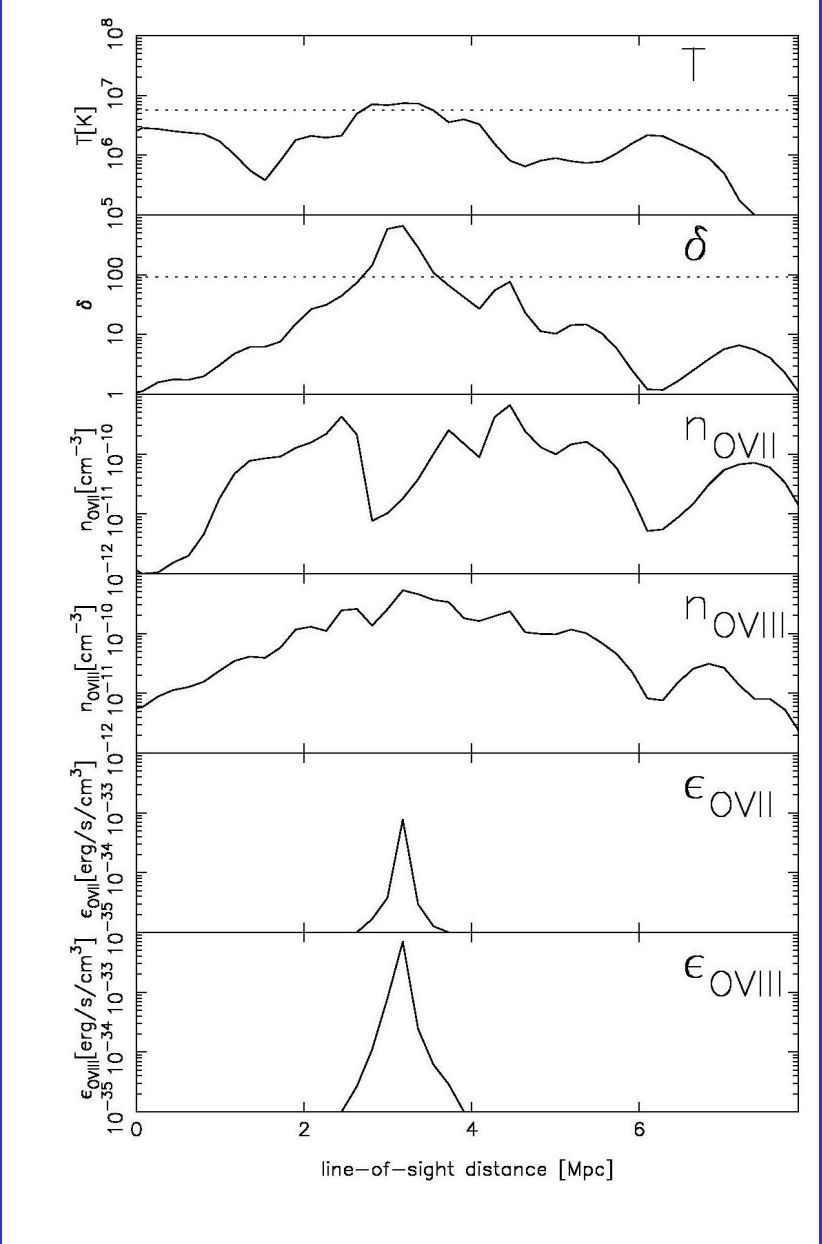
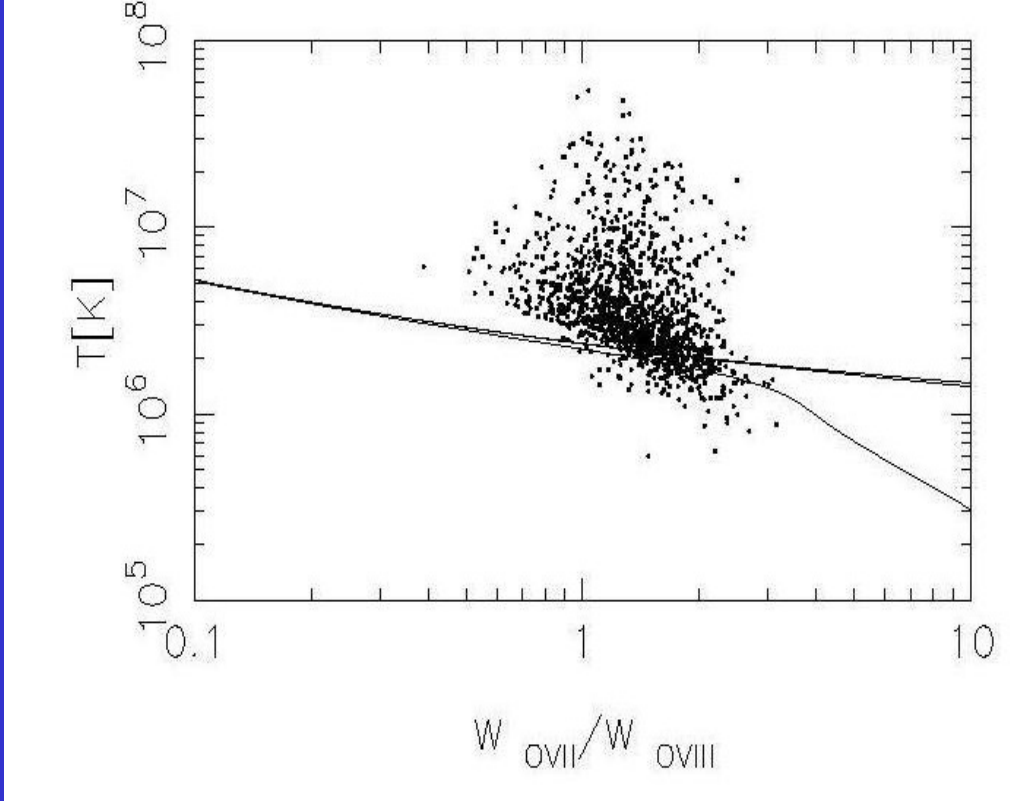
CLOUDY





GRB afterglow + X-ray observations follow up: Kawahara et al. 2005 analysis

- XEUS (afterglow) + DIOS (emission counterpart).
- Assuming absorption systems have been identified in OVII and OVIII (which happens in ~21% of the cases)
- 1 Msec observation with DIOS detect either emission lines in 20% of the cases (overall 4% of observations detect absorptions and at least 1 emission systems).
- In principle: T obtained from OVII and OVIII in absorption. And then gas density from one emission line W/o a-priori knowledge on metallicity.
- In practice: T and ρ are too inhomogeneous.



Looking for Clusters + background AGN pairs

Bright AGNs behind X-ray Clusters.

AGN+Cluster pairs when impact parameter $b < 3$ Mpc/h

- Blazars (>0.1 mCrab)+X-Clusters: 5 pairs
- QSO-WGA ($f > 10e-12$ erg cm⁻² s⁻¹)+X-Clusters: 15 pairs
- QSO-RASSnorsam ($f > 10e-12$)+X-Clusters: 4 pairs
- BLLac-WGA ($f > 10e-12$)+X-Clusters: 16 pairs