VDM groups/clusters reconstruction

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The Voronoi-Delauney algorithm for groups reconstruction

(Marinoni et al. 2002, Gerke et al. 2005)

The algorithm computes the **Voronoi-Delaunay mesh** and then the search is divided in 3 steps:

Phase 1 - 3-D identification of groups seeds
Phase 2 - Determining clustering strenght
Phase 3 - Adaptive scaling based on phase-2 richness

Phase 1: identification of groups seeds

A cylinder of radius **R1** and half-length **L1** is centered on each galaxy:

-R1 and L1 are input parameters

- all 1st order Delauney-connected galaxies inside the cylinder are called **“1 first order neighbours”** : these galaxies + central galaxy form a **seed**;

- if there are no Delauney-connected galaxies inside the cylinder, the galaxy is considered **isolated**.

→ R1 and L1 determine the number of seeds

Phase 2: Determining clustering strenght

A cylinder of radius **R2** and half-length **L2** is centered on the **phase-1 centre of mass**:

- R2 and L2 are input parameters

- all galaxies that are Delauney-connected to first order neighbours AND that are inside this cylinder are called **"second order neighbours"** : central galaxy + 1st order + 2nd order neighbours are the **core** of the group;

→(central galaxy + #1st + #2nd) = group **central richness N_{II}**

→ **N_{II} has to be corrected** as a function of redshift because of the **flux limit** of the sample:

$$N_{II}^{corr} = \left[\frac{\langle \nu(z) \rangle}{\langle \nu(zref) \rangle} \right]^{-1} N_{II}$$

→ <ν(z)> is the mean comoving number density at any given redshift z
→ zref is a zero-point redshift

Phase 3: Determining cluster dimensions and members

A cylinder of radius **R3** and half-length **L3** is centered on the **phase-2 centre of mass**:

- **R3** and **L3** depend on N_{II}^{corr}:

$$R3 = r(N_{II}^{corr})^{1/3} \qquad L3 = l(N_{II}^{corr})^{1/3}$$

where r and l are input parameters

- **all galaxies** not yet processed that are **inside this cylinder** are considered to be **members** of the group;

→(central galaxy + #1st + #2nd + #phase-3 new) = **group members**

Testing the VDM algorithm to VVDS-like mocks

(33% sampling rate, 275 km/s redshift error, $I_{AB} \leq 24$)

- **Completeness C** of a group catalogue: fraction of real groups that are successfully identified in the reconstructed catalogue

- **Purity P** of a group catalogue: fraction of reconstructed groups that correspond to real groups

→ **Trial and error** to identify the best set of parameters that maximize C, keeping P always above 0.5

Testing the VDM algorithm to VVDS-like mocks

(33% sampling rate, 275 km/s redshift error, $I_{AB} \leq 24$)

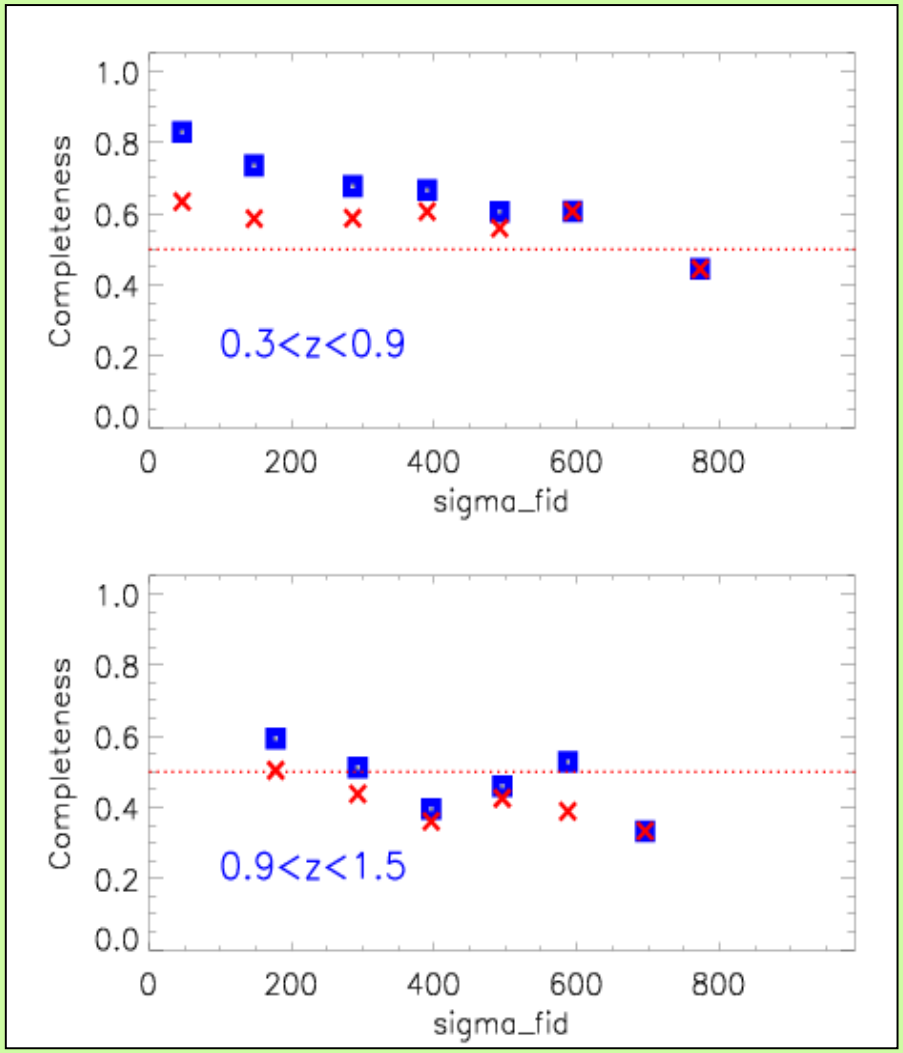
Best set (h^{-1} Mpc)					
R1	0.3	R2	0.5	r	0.55
L1	5.0	L2	6.0	1	15

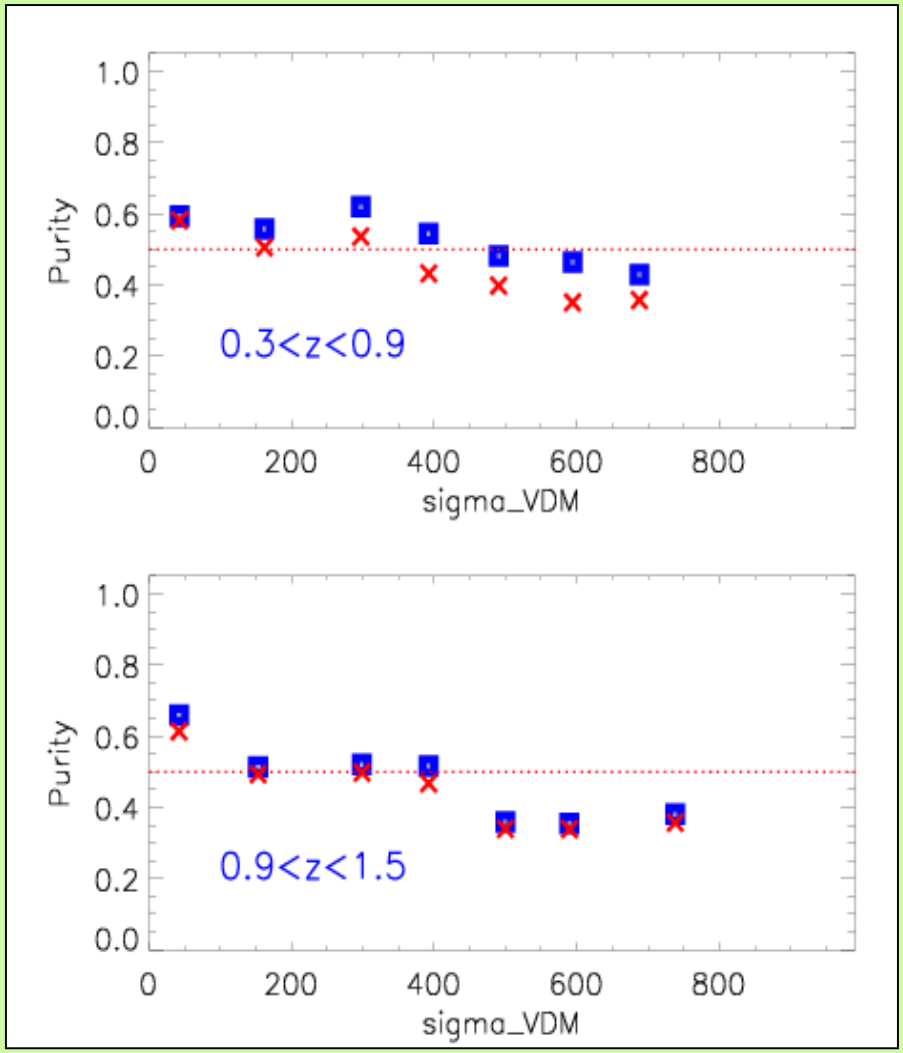
C1 = 79.2 % C2 = 72.0%

P1 = 55.6 % P2 = 49.4%

Testing the VDM algorithm to VVDS-like mocks

[R1= 0.3 L1 = 5.0 R2= 0.5 L2 = 6.0 r= 0.55 l = 15.0]





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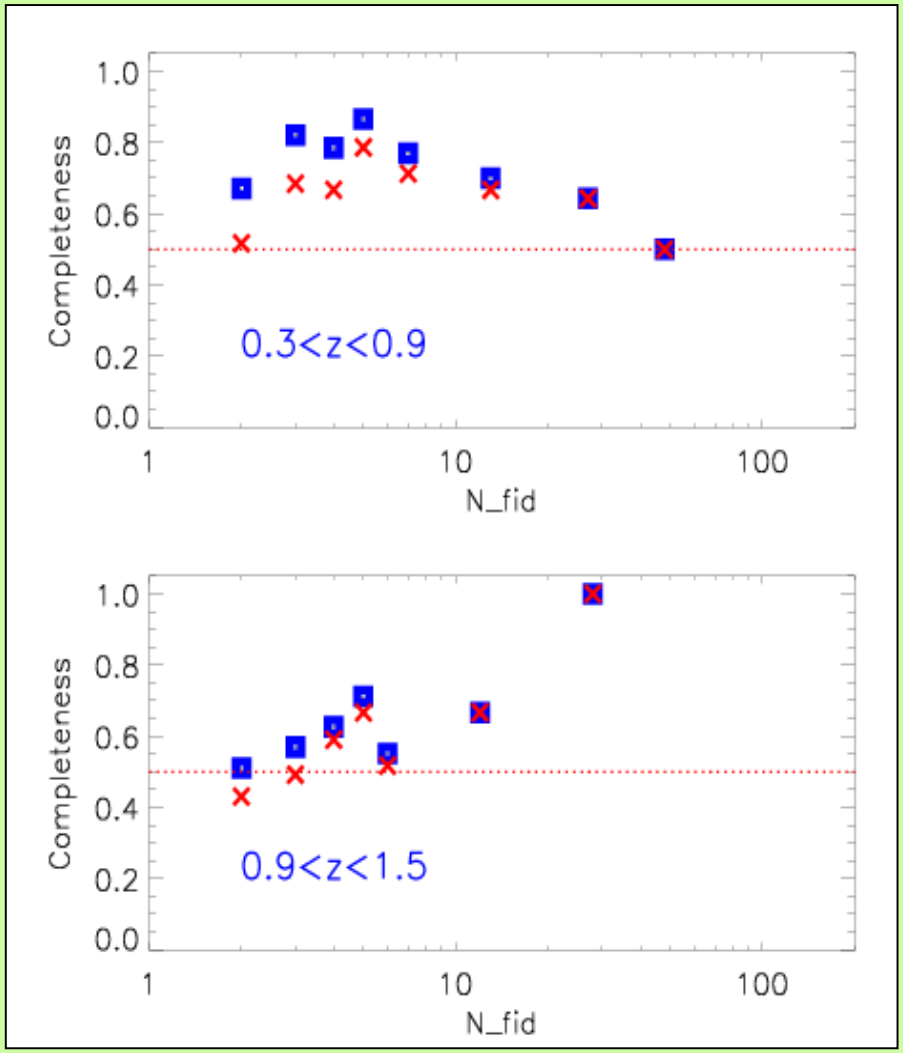

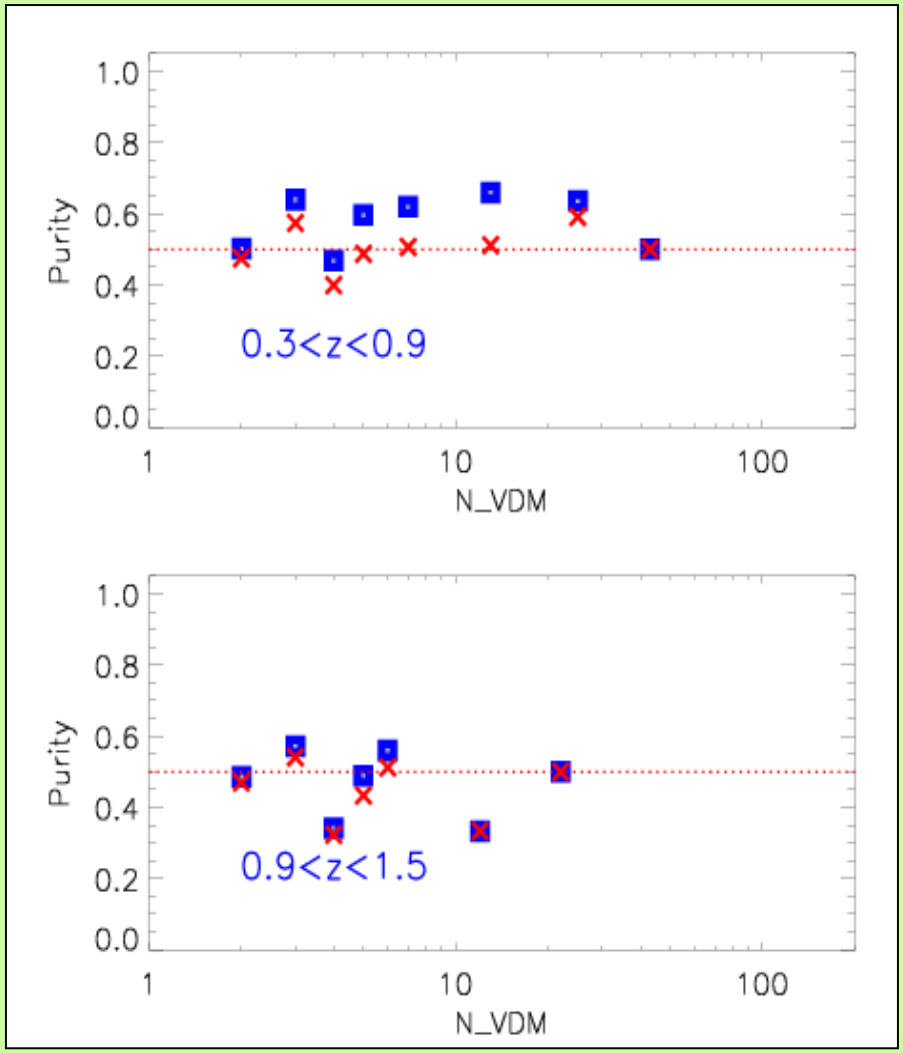

Mean intergalactic separation