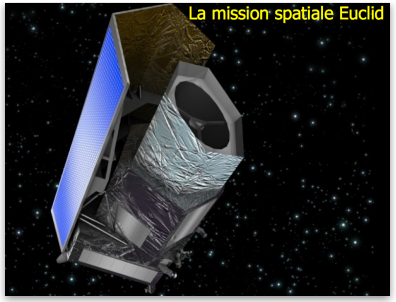
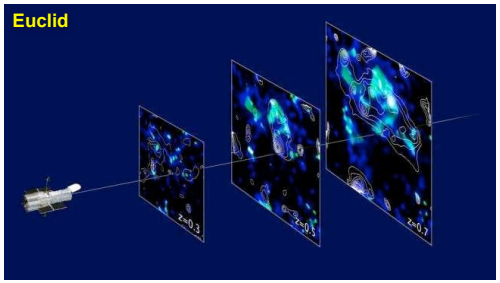
Euclid OULE3

Jean-Luc Starck
on behalf of the OULE3 team





- 234 people in the mailing list
- ~ 1/3 of them are active members
- Organized into 7 WorkPackages, each split into
  - Implementation WP
  - Verification WP

1. Internal Data
2. External Data
3. Galaxy Clustering (*)
4. **Clusters of Galaxies (*)**
5. **Weak Lensing (*)**
6. Time Domain
7. Milky Way and Nearby Galaxies

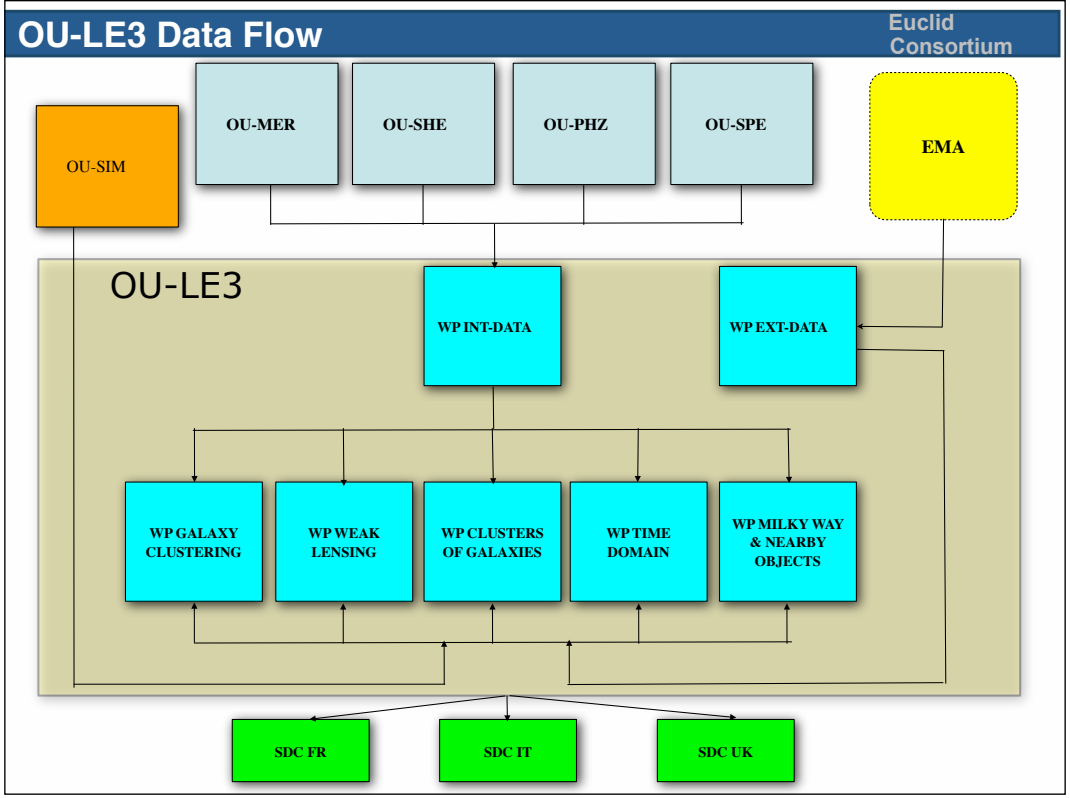
(*) Big WPs with ~30-50 members: ~ same size of other OUs…..

Activity since Dec 2013

- Meetings:
  - Regular (~monthly) teleconf between all OU-LE WP managers
  - **December 2013: Joint SWG-Cluster/LE3 meeting (Nice)**
  - February 2014: SGS OU-SWG "Garage Day" (Garching)
  - February 2014: Workshop "Agile for OU-LE3/SDC" in Trieste
  - **May 2014: LE3 meeting (Marseille)**
  - **July, September, November 2014: OG meeting (Milan, Orsay, Paris)**
  - **December 2014: Joint SWG-WL/OU-SHE/LE3 meeting (Paris)**

- SSR Documents:
  - RSD Document: V1.0 in July and V2.0 in October
  - Validation Plan Document: V1.0 in July and V2.0 in October
  - Development Plan Document: V1.0 in September and V2.0 in October

- Ongoing Activities in all WPs
  - **Code developments and comparisons**
  - **Validation**
  - **Code prototyping in relation with the SDC**


OU-LE3 Data Flow
Euclid Consortium
OU-SIM
OU-MER
OU-SHE
OU-PHZ
OU-SPE
EMA
OU-LE3
WP INT-DATA
WP EXT-DATA
WP GALAXY CLUSTERING
WP WEAK LENSING
WP CLUSTERS OF GALAXIES
WP TIME DOMAIN
WP MILKY WAY & NEARBY OBJECTS
SDC FR
SDC IT
SDC UK

OU-LE3 activity

- OU activity HAS CHANGED.

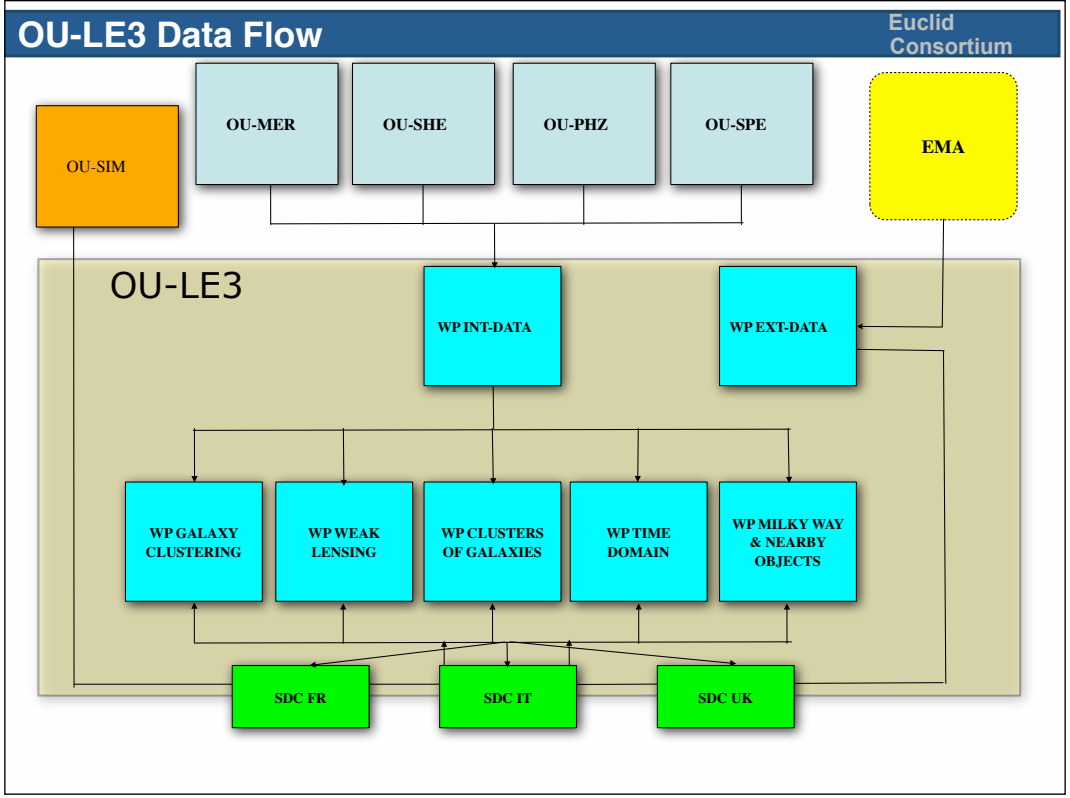
- We are now supposed to deliver algorithms in Python/C++, with the "help" of SDC developers.

- It also impacts our whole organization:

  - Coding in python/C++, and validate the final code.

  - OU members have to find the ***closest SDC developers***, and work closely with them.

  - Validation has to be done in several phases.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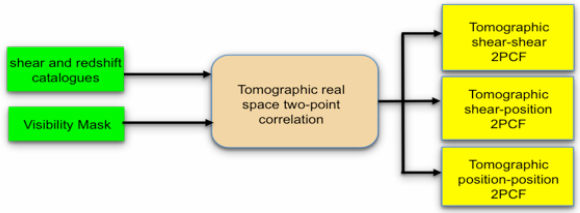
47 PFs:

Galaxy clustering: 6
Weak lensing: 9
Clusters: 15

Internal data: 4
External data: 3
Time Domain: 7
Milky Way and Nearby Galaxies: 3

Example of PF (2PCF for WL)



For 31 studied PFs:

PF Status	
a1 - No requirement exists and it is premature to start any development.	10
a2 - Requirements are inaccurate to start any development (several possible implementations)	4
b1 - No Requirement exists but the benchmarking or the development can be started.	9
b2 - Requirements are inaccurate but the benchmarking or the development can be started.	7
c - Requirements exist and are accurate enough to be able to select an algorithm.	1

Prototypes & Interaction with SDCs

- Different situation in different WPs

Weak Lensing WP:

- One code, already developed, publicly available and documented: Athena (c/c++)
- Now in the process to be imported in the SDC-FR

Galaxy Clustering WP:

- Merging of different codes for 2pt CF into a single one (c++)
- Similar situation for P(k) code

Clusters of galaxies:

- 6+1 different codes being compared in a “challenge”
- Variety of languages: fortran, c/c++, IDL
- One of the in the process of being imported in the SDC-IT

Athena Roadmap

Task	Deliveries				
Name	*First*	*Second*	*Third*	*Fourth*	*Further*
Fully C++ compliant	■				
Validation software	■				
Perfomance estimation {with bottleneck identification)			■		
Z parallelization		■			
Pallas euclidization			■		
Test with external representative data (MICE)		■			
Coupling with IAL				■	
Mock catalog					■
TIME:	Apr 2015	May 2015	Nov 2015	April 2016	
Code maturity level:	1A	1B	1B	2A	

1 - OU code

2 - code C++ python - conforme data model

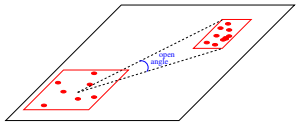
2a - donnees limites

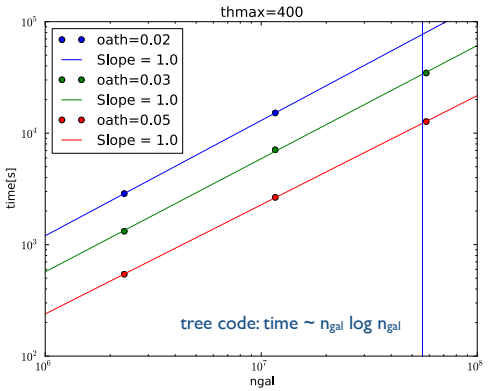
2b - niveau de representation de donnees

3a code developpement - niveau de qualite

3b code de production

Computing time of 2pt function (tree code; athena)





MICE simulations

Euclid: n_{gal} = 30 arcmin^{-2}.
In one z-bin, on 5000 deg2: N_{gal} = 55.8 Mio.

LE3 WL verification & validation

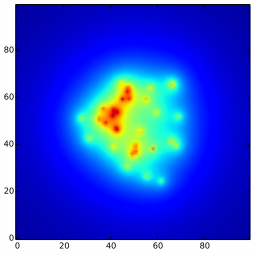
• Working towards a joint (SHE, LE3) weak lensing validation document that is linked to science and processing requirements
  - single reference point
  - avoid duplication of effort, and incomplete validation
  - maximise efficiency of validation tests

• Verified existing correlation function, pseudo-Cl, and mass mapping codes on simple planar random field simulations.

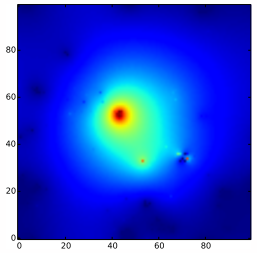
• Building code package that will produce fast, full-sky weak lensing simulations based on random fields
  - underlying signals known exactly → ideal for verification
  - going beyond Gaussianity by using correlated lognormal fields
  - includes clustering, realistic redshift distributions, later RSDs
  - well suited to incorporate key issues like masks, blending, photometric redshift biases, etc.

2D Mass Mapping

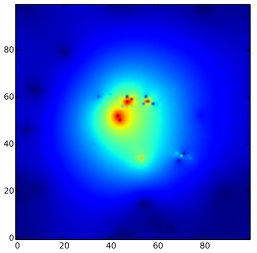
- Comparison of 2D mapping techniques for cluster studies [E. Jullo, S. Pires, M. Jauzac, J.-P. Kneib, 2014, Weak lensing galaxy cluster field reconstruction]
- Ongoing development of C++ mapping code using **individual** galaxy **positions**, **shears** and **flexion**.
- WL Peak Counting



Convergence simulation for a cluster with substructure



Reconstructed convergence from **shear alone**



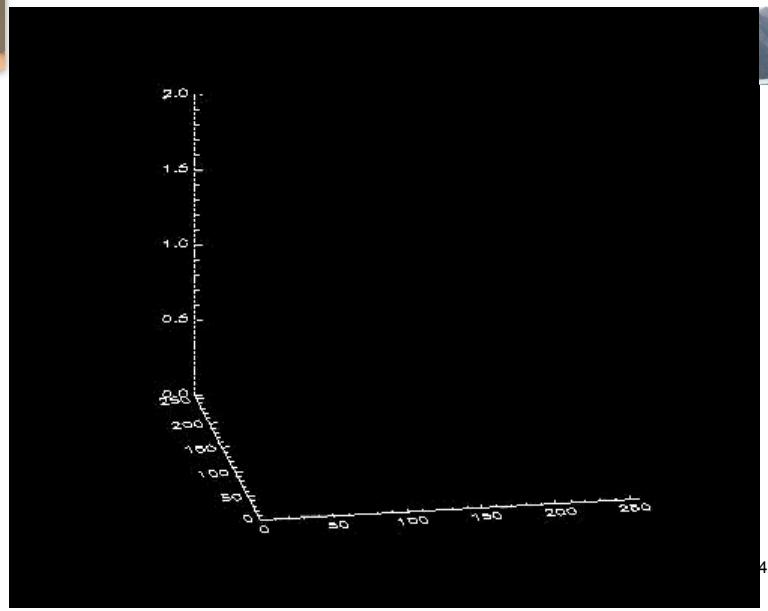
Reconstructed convergence from **shear and flexion**

=> The flexion information helps to **resolve substructure**

WL 3D Cosmo-Door is now open

A. Leonard, F.X. Dupe, and J.-L. Starck, "A Compressed Sensing Approach to 3D Weak Lensing", **Astronomy and Astrophysics** , 539, A85, 2012.

A. Leonard, F. Lanusse, J-L. Starck, GLIMPSE: Accurate 3D weak lensing reconstruction usiing sparsity, Astronomy and Astrophysics, MNRAS, 440, 2, 2014.



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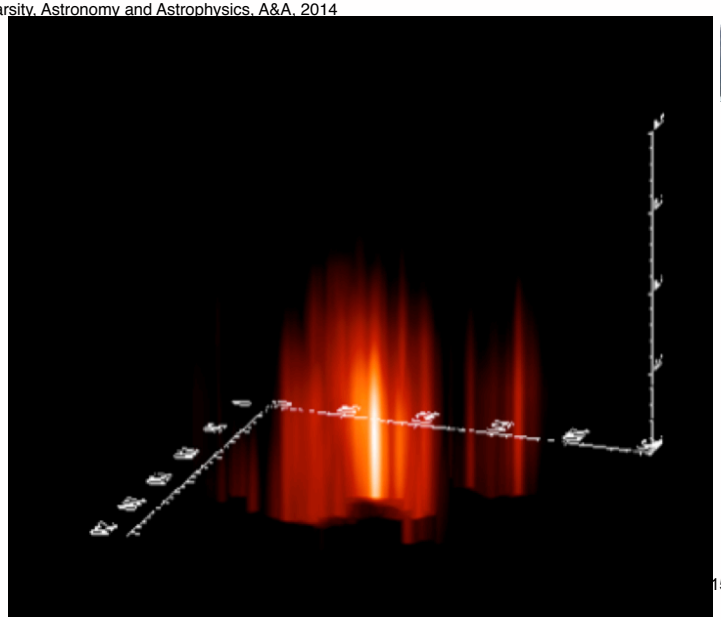
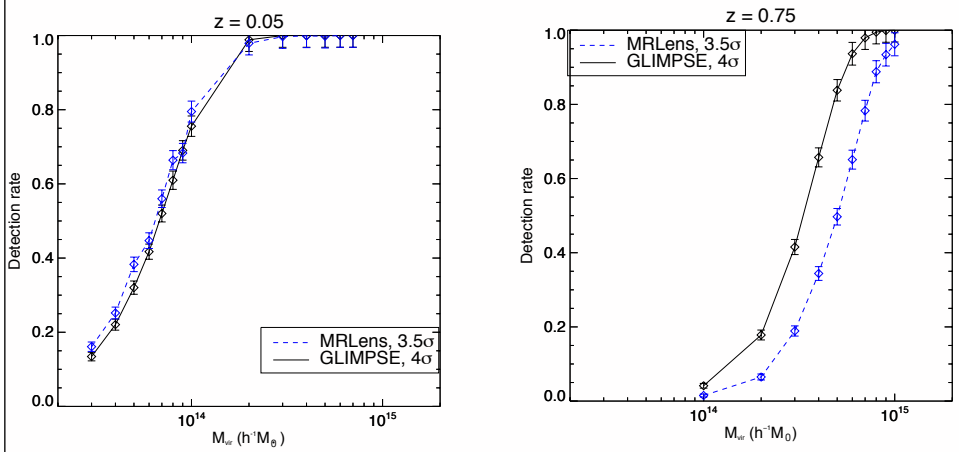


2D vs 3D comparison for cluster detection

Detection fractions are equivalent between 2D (blue) and 3D (black) at low redshift (left) but at **high redshift (right) the 3D is more efficient**.



- A. Leonard, F. Lanusse, J.-L. Starck, Weak lensing reconstructions in 2D & 3D: implications for clusters studies , submitted.

Conclusions 1/2

Implementation:

- Good progress on all WPs.
- Cannot define/implement some algorithms without requirement.

Validation:

- Missing requirements (from the SWGs).
- Validation criteria are still missing (from the SWGs).
- This has been raised in several levels and joint meetings with the SWG have been set up.

Documentation:

- better idea of the work to be done (i.e. PF), and the validation of the algorithm.

Conclusions on OU/SDC 2/2

- First integration with SDC under way (Athena code)

  Athena code = WL 2PCF code in C, available on the web and used in large projects (CFHTLens)

  Estimated Workforce required to achieve 2A maturity level from : 1.2 FTE

  LE3 has 47 PF .... and less than five software developers.

- LE3 will **NOT** achieve 100% PF at 2A maturity level for the PDR:

  - many requirements do not exist.

  - historical LE3 activity (i.e. algorithms development/evaluation) is still required.

- Consider **carefully** the use of third party software:

  - Due the lack of developers and the availability of lot of software.

  - Criteria:

    * Euclid scientific priority (2PCF and power spectra).

    * Coding language.

    * Availability and its use in the community.

    * Code owners are in Euclid (software support).

==> joint SDC-OU work before the PDR to identify for each PF if a third party software could be used.