KO ANR COMPASS

GEPI
Coordinateur: M. Puech

Roadmap instrumentale E-ELT

Instruments de 1ère lumière :

- ELT-CAM
- ELT-IFU

Chaque instrument à un espace des paramètres propres distinct des autres qui requière des simulations spécifiques

Principe :

Explorer ces espaces en suivant la Roadmap E-ELT et en « priorétisant » selon les participations françaises

Year	ELT-IFU	ELT-CAM	ELT-MIR	ELT-4 (MOS or HIRES)	ELT-5 (MOS or HIRES	ELT-6	ELT-PCS
2012	Decide science requirements, AO architecture.		VISIR start on-sky	Develop science requirements for MOS/HIRES			Call for proposals for ETD
2013			TRL Review	Call for proposals for MOS/HIRES			
2014							
2015				Selection ELT-MOS/HIRES		Call for proposals	
2016							
2017							TRL check
2018							TRL check
2019						Selection	TRL check
2020							TRL check
2021							TRL check
2022 Tel technical first light							
	Pre-studies taking the form of phase A or delta-phase A work and/or ESO-funded Enabling Technology Development (ETD)						
	Decision point						
	Development of Technical Specifications, Statement of Work, Agreement, **Instrument Start.**						

Definition (& Performances) of E-ELT instruments

Keeping in mind that when we talk about the VLT (They are 4 telescopes)

→ More than 12 instruments

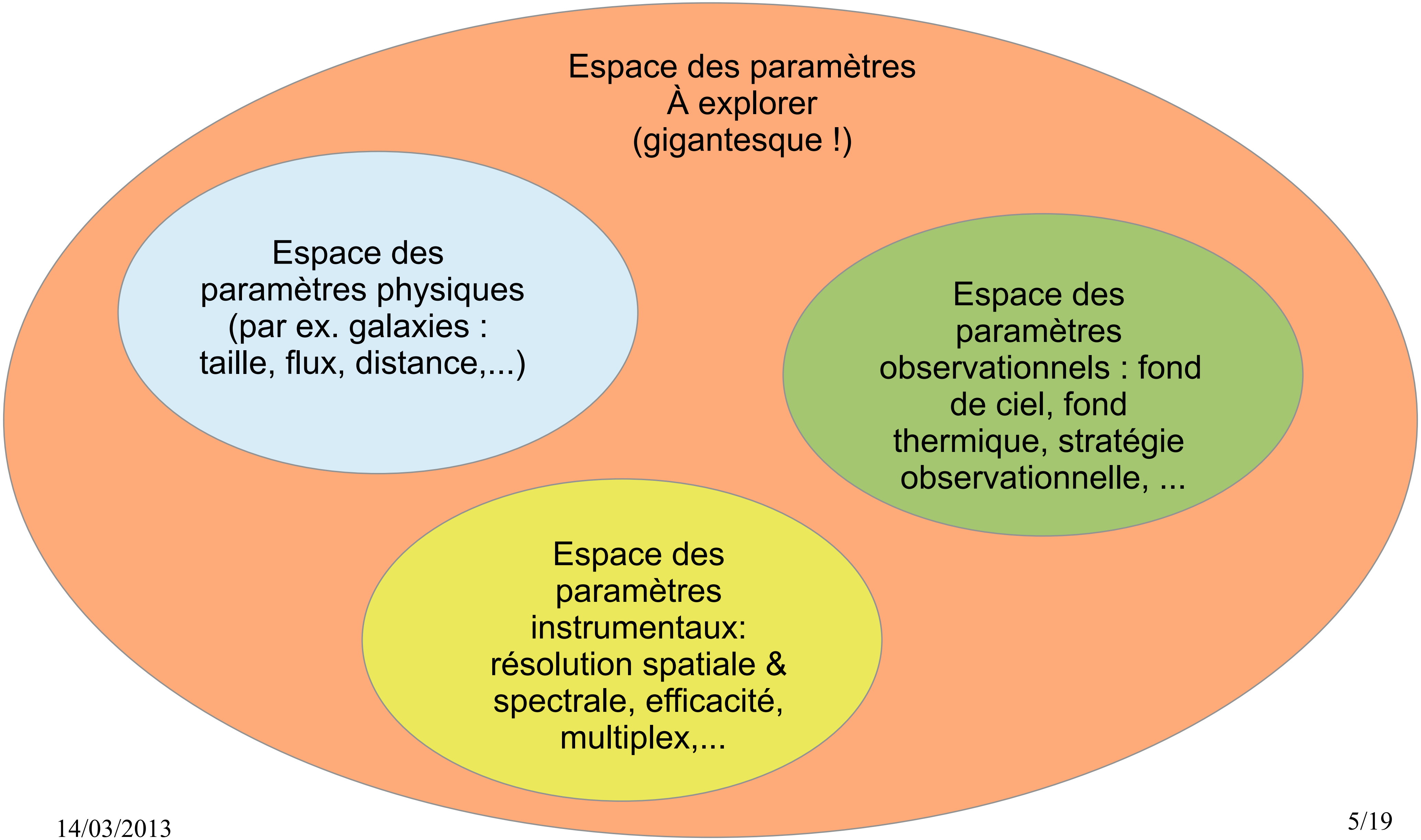
The E-ELT will be unique with few instruments

We must maximize the scientific return

Priorités françaises

- 1ère lumière :
  - ELT-CAM : Participation GEPI-LESIA
  - ELT-IFU : Participation LAM ?
- 1ère génération :
  - ELT-MOS : consortium international MOSAIC (France : GEPI-LESIA-LAM)
- COMPASS a un rôle majeur à jouer dans la simulation de ces instruments
- Planning ESO : décalage de 6-12 mois ?

Difficulté


Espace des paramètres
À explorer
(gigantesque !)
Espace des
paramètres physiques
(par ex. galaxies :
taille, flux, distance,...)
Espace des
paramètres
observationnels : fond
de ciel, fond
thermique, stratégie
observationnelle, ...
Espace des
paramètres
instrumentaux:
résolution spatiale &
spectrale, efficacité,
multiplex,...

Rôle du GEPI

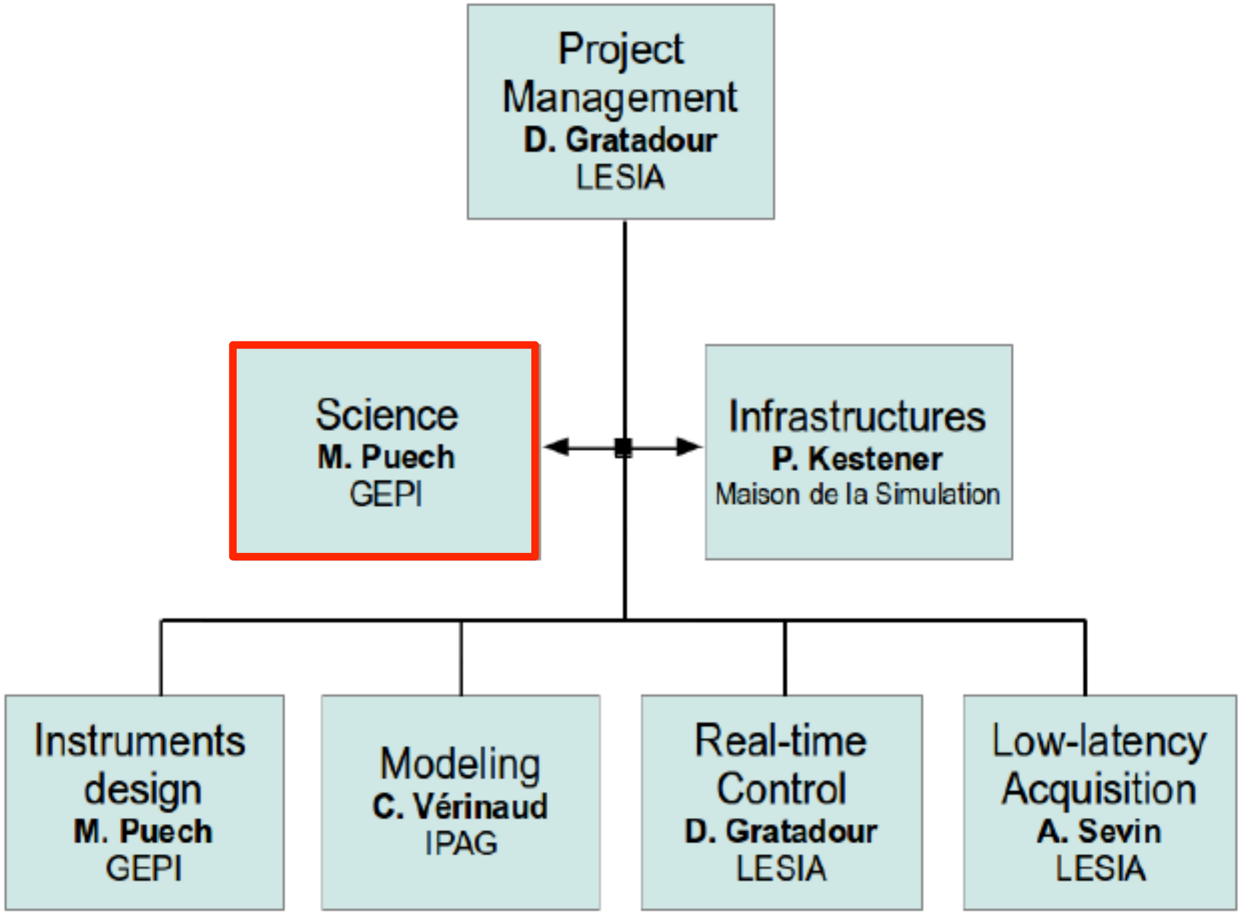
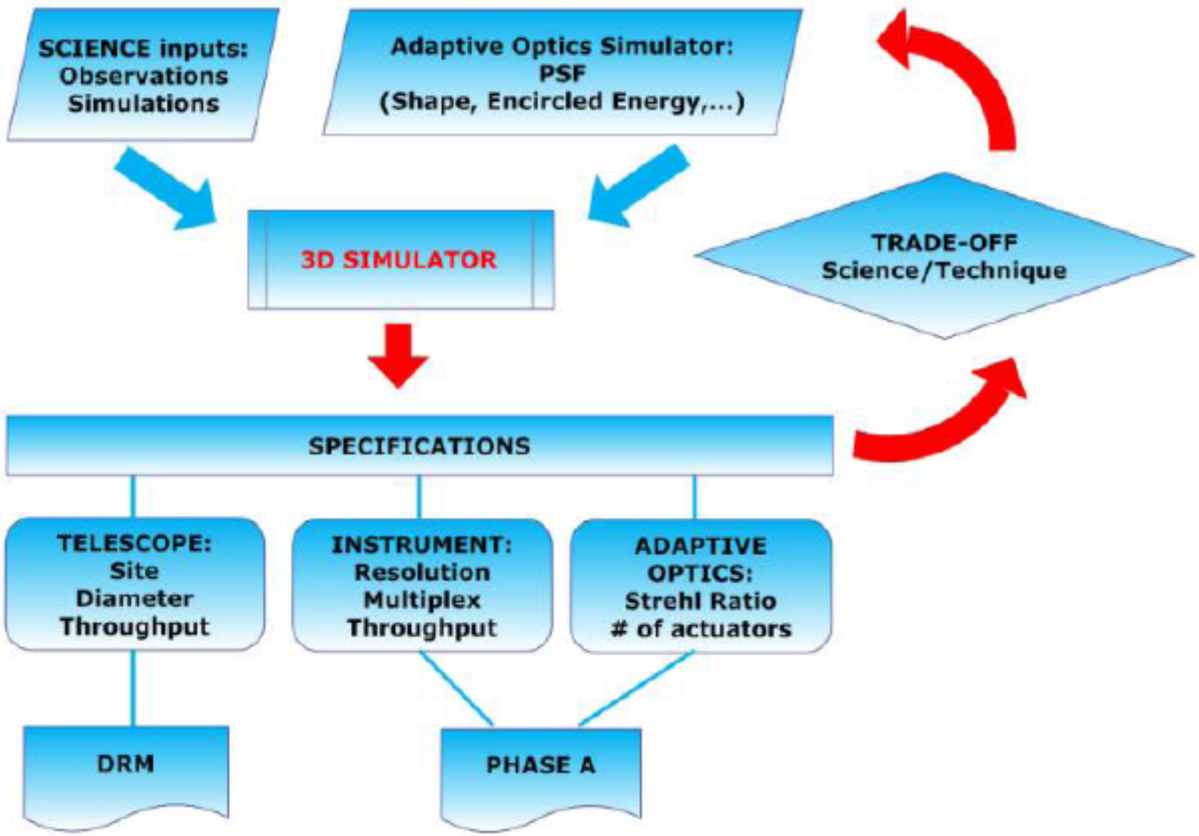


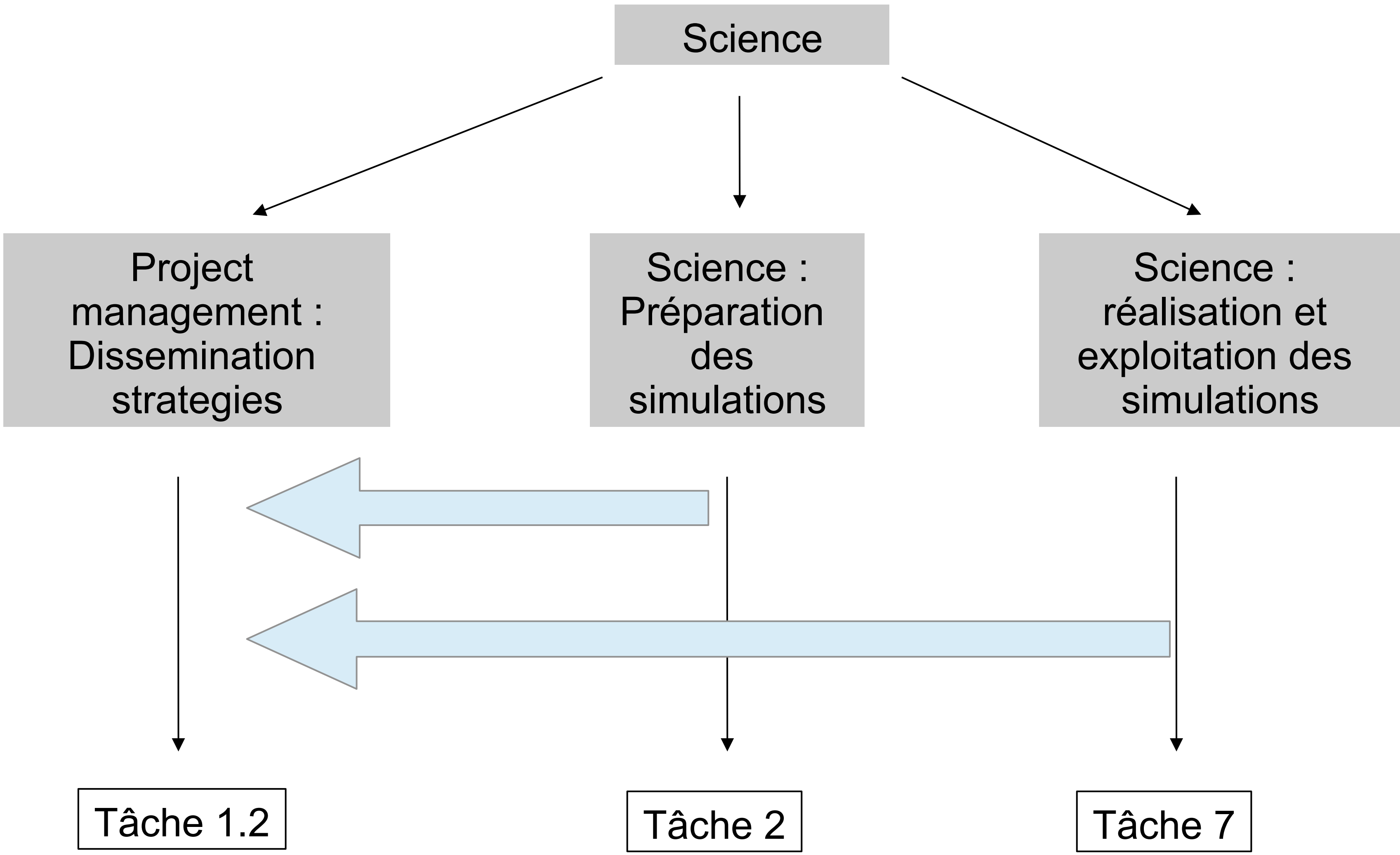
Illustration 2: COMPASS project structure

Objectifs scientifiques

Mise en place une plate-forme de simulation instrumentale :



Tâches sous la responsabilité du GEPI

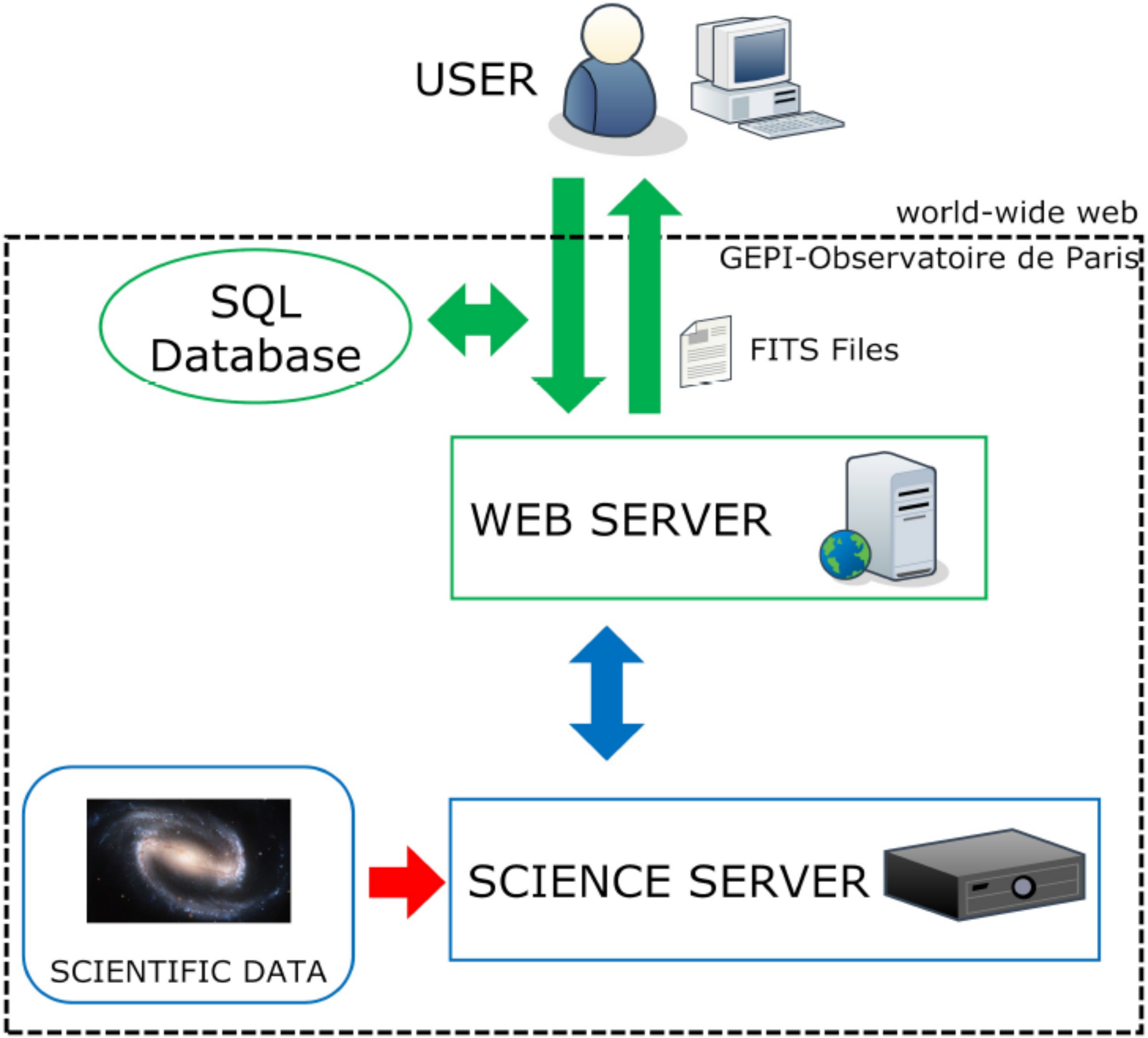


Tâche 1.2 : Mise en place des outils de simulation

Task 1.2 Dissemination strategies	**Resp: M. Puech** Total Staff : 8m.m;	Duration: 24m Temp. : 1 m.m

Objectives: Define and implement dissemination strategies
Contributors: M. Puech (2m.m), Y. Yang (1 m.m), S. Taburet (2m.m), I. Jégouzo (1m.m), T. Fenouillet (2m.m)
Content, Milestones and Outputs:
- Coordinate the interactions between *Science* and *Instrument design* tasks
- Organize regular progress meetings (every 2 months)
- Setting up and managing content for the AO PSF library
- Setting up and managing a web-based interface for running end-to-end instrument simulations for ELT-CAM, ELT-IFU, and ELT-MOS
- T0 + 9m: Preliminary version of the web-based interface
- **T0 + 24m : D1.2 – final public release of the web-based interface + AO PSF library**

Prototypes Phase A



Besoins matériels

- Un calculateur scientifique multi-CPUs pour répondre à la demande « nationale » : serveur Dell PowerEdge R810 (10kE)
- Serveurs web permettant un accès sécurisé et fiable au simulateur : 2xDELL Poweredge R410 (5kE total, un sur Paris, un sur Meudon)
- Développement et « publicité » du simulateur dans les conférences : 2xMacBook Pro x2 (total 4kE)

Tâche 2.1 : définition des paramètres à explorer et de la stratégie d'exploration

TASK 2 – SCIENCE		RESP: M. Puech
Task 2.1 Interfaces to instruments models	**Resp: M. Puech** Total Staff: 6m.m;	Duration: 2m Temp. : 2m.m

Objectives: Define interfaces between instrument and AO simulation codes

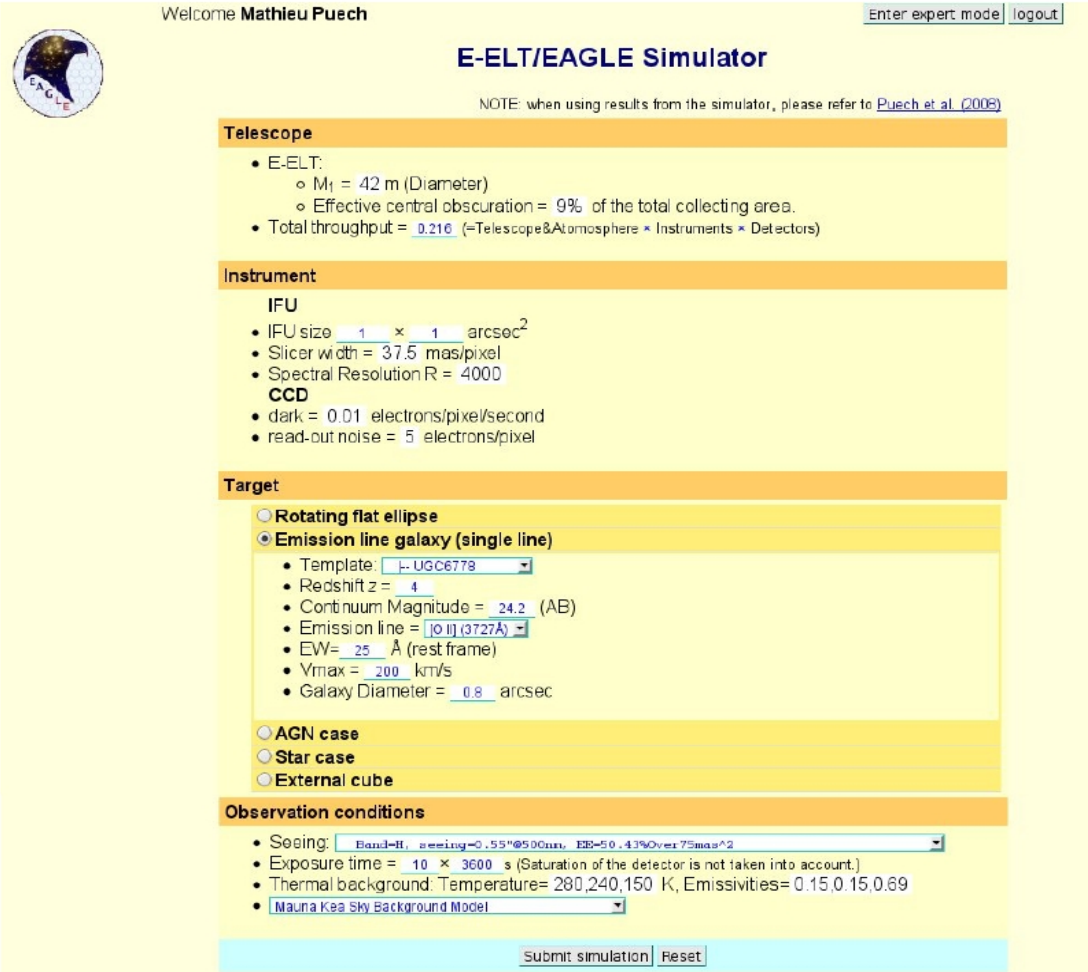
Contributors: M. Puech (1m.m), H. Flores (1m.m), K. Disseau (1m.m), D. Mouillet (1m.m), Post-doc GEPI (2m.m)

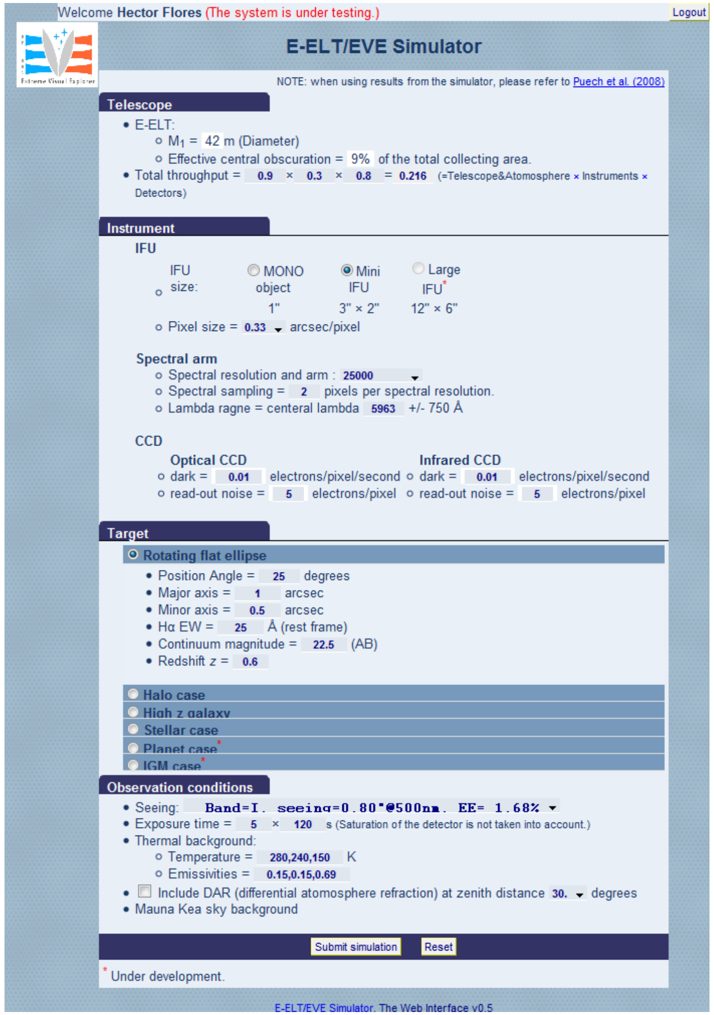
Inputs and/or relation to other tasks: Inputs from task 1.3 (Science req. document) and predecessor of task 2.2 *Preparatory studies*

Content, Milestones and Outputs:

- Split the simulation parameter space into instrument and AO simulation codes
- Define the content of the PSF library and associated parameter space
- Define the web-base interface for running end-to-end instrument simulations
- Define hardware communications between the web server and the science server
- **T0 + 2m : D2.1 - Interface document**

Prototypes Phase A





Prototypes préliminaires: manquent plusieurs aspect dans la simulation
Ciel, absorption telluriques etc.
et une base de données des galaxies proches.

Tâche 2.2 : préparation et test des données d'entrée des simulations

Task 2.2 Preparatory studies	**Resp: M. Puech** Duration: 4m Total Staff: 17m.m; Temp. : 8m.m

Objectives: Set up and first tests of software solutions for instrument simulations

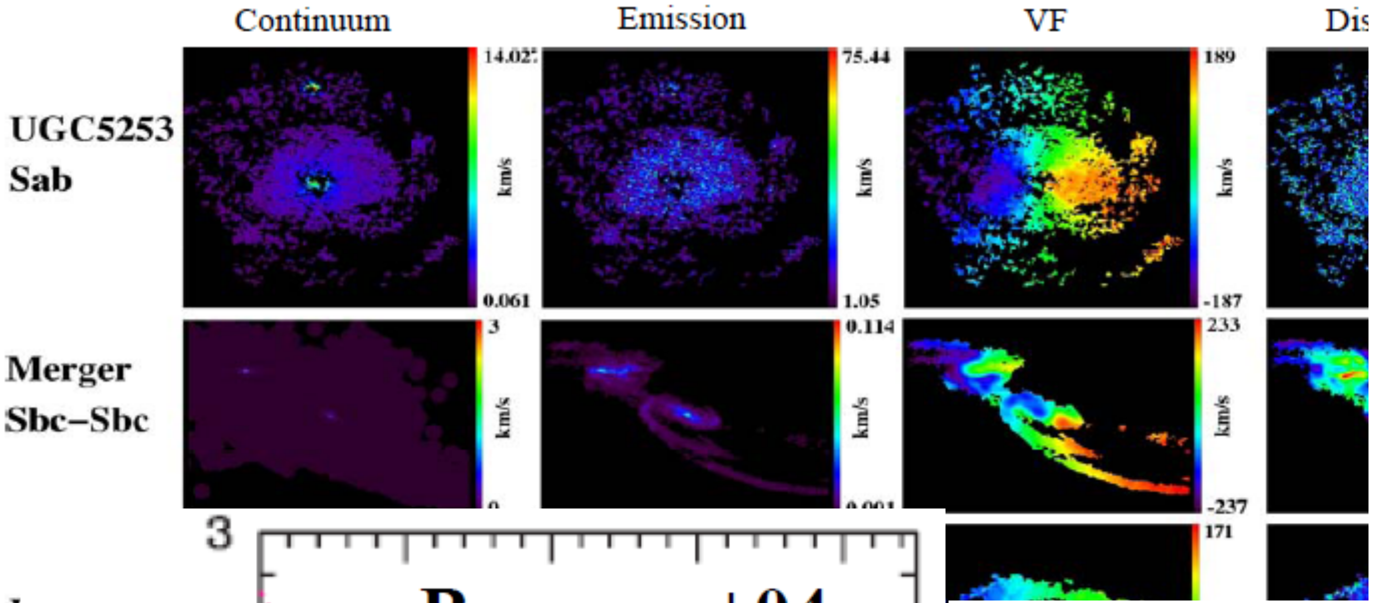
Contributors: M. Puech (2m.m), F. Hammer (2m.m), H. Flores (2m.m), K. Disseau (2m.m), Y. Yang (2m.m), S. Taburet (1m.m), I. Jégouzo (2m.m), Post-doc GEPI (4m.m)

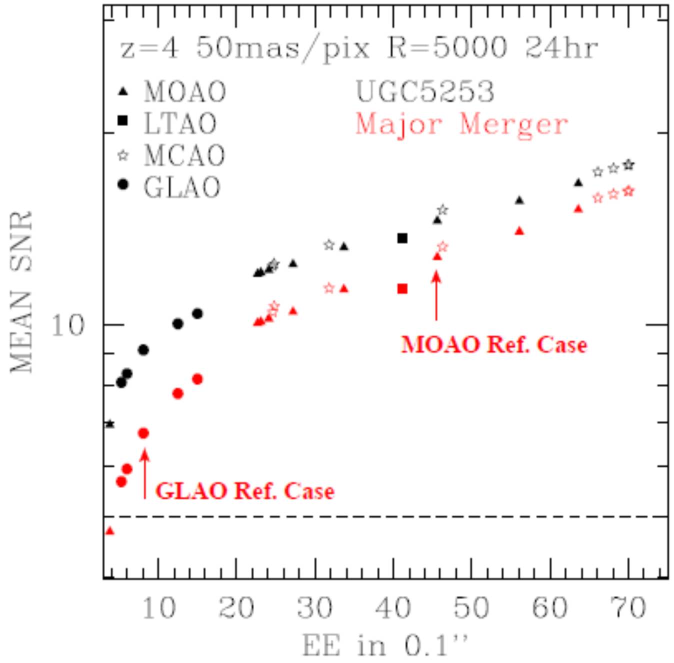
Inputs and/or relation to other tasks: Inputs from task 2.1 (*interfaces to instruments models*). Predecessor of task 7 *instruments design studies*.

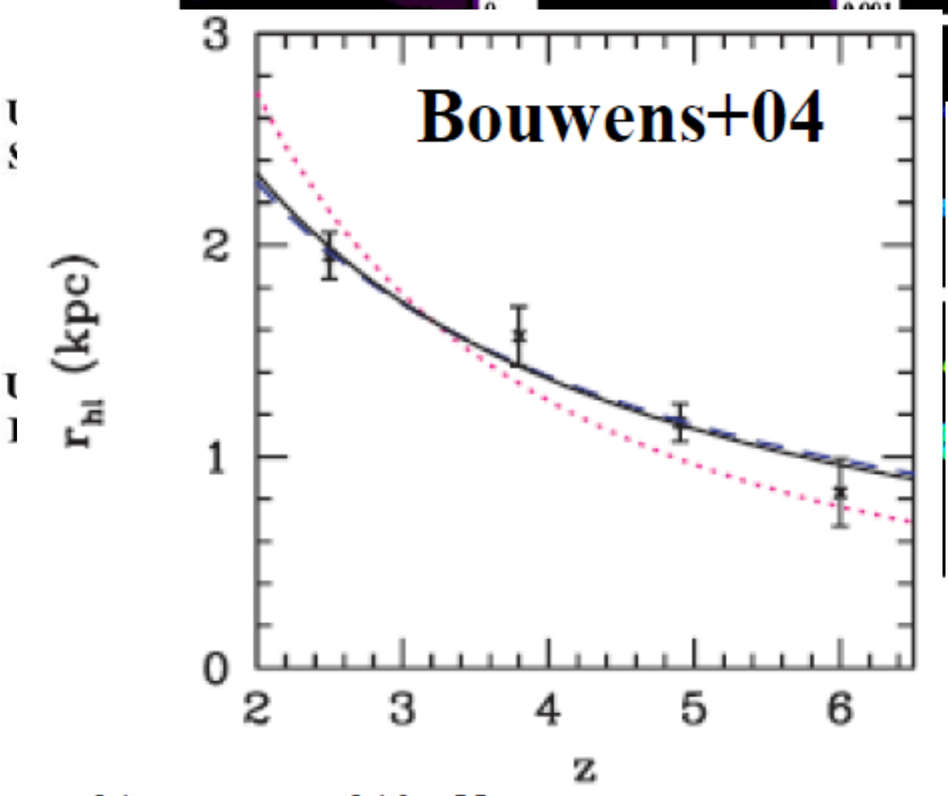
Content, Milestones and Outputs:

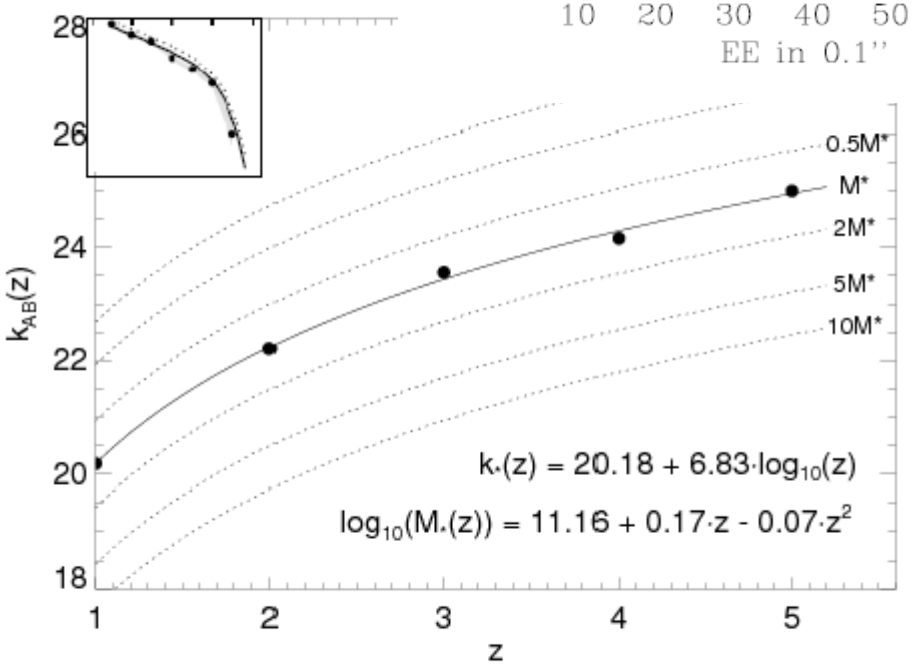
- T0+3m: Set-up and tests of hardware simulation tools. Define the astrophysical input data needed to run task 7
- T0+3m: Design of software solutions (public web site, web-based interface for instrument simulations, PSF library)
- T0+4m: Prepare the astrophysical data needed to run task 7
- T0+5m: Implementation of a preliminary version of the instrument simulation code. Implement the astrophysical data needed to run task 7
- T0+6m: Firsts tests of instrument simulations using simple astrophysical cases reproducing observations in the literature. Definition of scientific figures of merit for comparing simulated data of real observed cases in the literature. Science assessment of the instrument simulations

Exemple « galaxies »







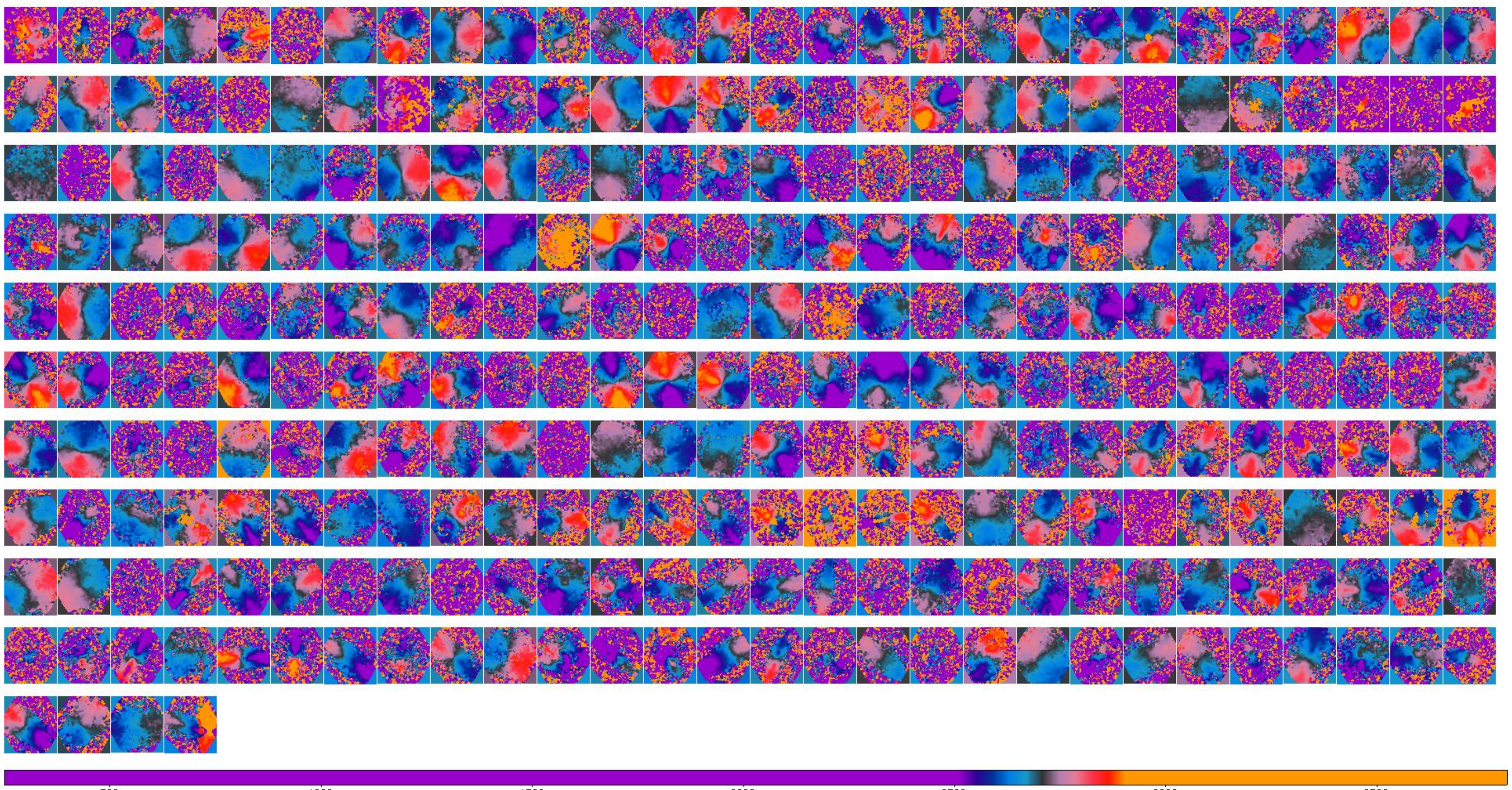


CALIFA

(Sanchez et al., 2012)

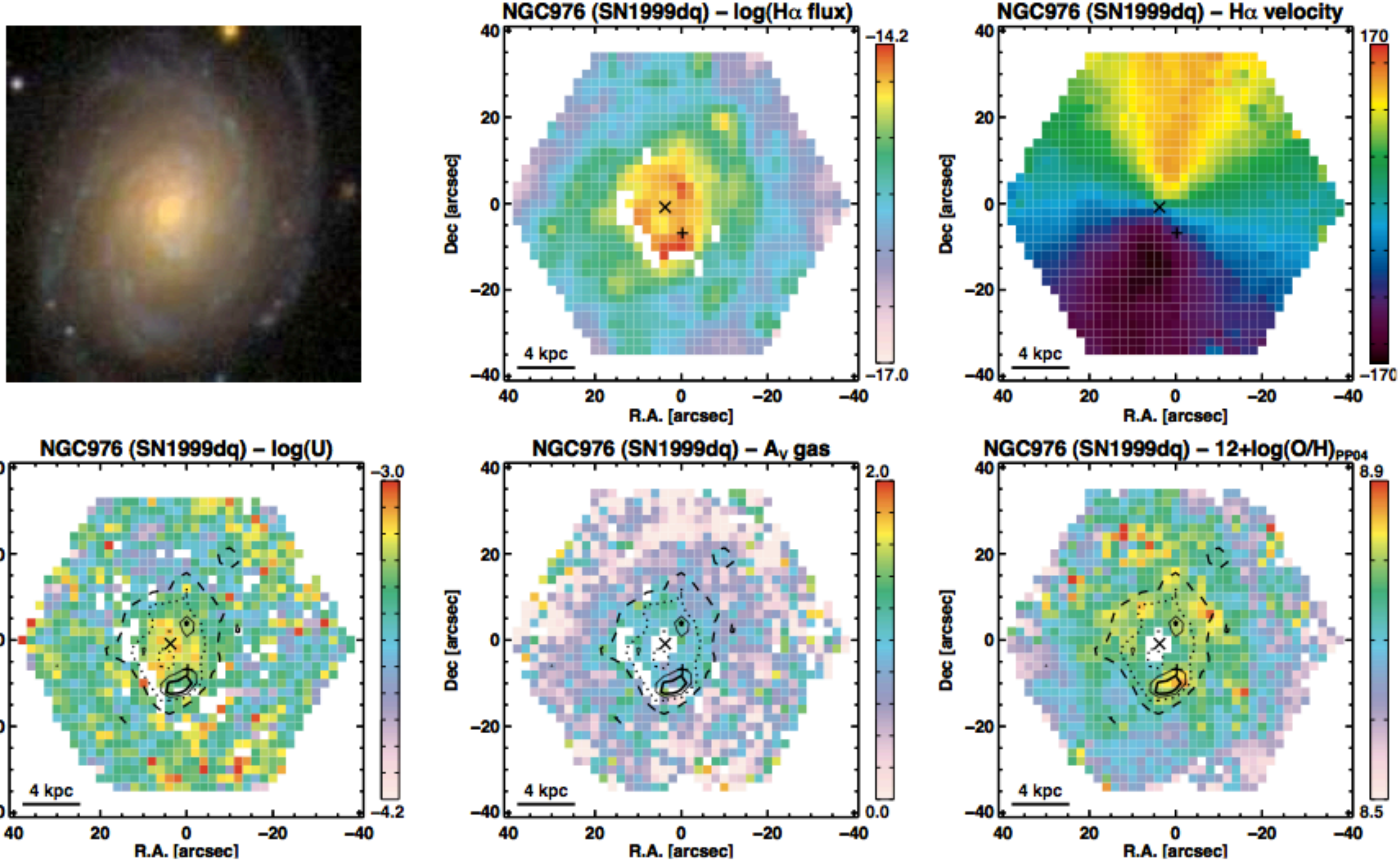
more than 600 galaxies selected on the SDSS survey

IFU: PMAS/PPAK at calar alto. 2D maps of :
(a) stellar populations: ages and metallicities;
(b) ionized gas: distribution, excitation mechanism and chemical abundances; and
(c) kinematic properties: stellar and ionized gas.



284 velocity field

MOSAIC


NGC976 (SN1999dq) – log(Hα flux)
NGC976 (SN1999dq) – Hα velocity
NGC976 (SN1999dq) – log(U)
NGC976 (SN1999dq) – A_V gas
NGC976 (SN1999dq) – 12+log(O/H)_PP04
Dec [arcsec]
R.A. [arcsec]
4 kpc
40
20
0
−20
−40
−14.2
−17.0
170
−170
−3.0
−4.2
2.0
0.0
8.9
8.5

To characterize the sky background: as usual need very good data …

How to

FLAMES/GIRAFFE
(VIS spectroscopy)

X-SHOOTER
(VIS &NIR spectroscopy)

FORS2
(VIS spectro. &
NB imaging)

Subaru
(narrow-band NIR imaging)

HAWK-I
(narrow-band NIR imaging)

+

Numerical methods

Should provide spatial variations up to a few arcmin² @ 0.9-1.0 μm

Conclusion of the ongoing work

FLAMES/GIRAFFE (VIS spectroscopy) → Rodrigues et al, 2012

X-SHOOTER (VIS &NIR spectroscopy) → J. Vernet work

FORS2 (VIS spectro.)
Numerical methods
→ Yang et al. 2012

+

FORS2 & HAWK-I (narrow-band)
Subaru (narrow-band NIR imaging)
→ Puech et al.2012 & K. Disseau

And the telluric lines?

The method (one of them Vacca et al 2003) we just need to include the telluric line in the simulator to study the effect on the S/N.

Tâche 7.2 : Mise en œuvre et exploitation des simulations

TASK 7 – E-ELT INSTRUMENTS DESIGN	RESP: M. Puech

Task 7.2 ELT-MOS / ELT-IFU	Resp: Post-doc GEPI Duration: 12m Total Staff: 23m.m; Temp.: 12m.m

Objectives: End-to-end simulations of IFU data for the E-ELT. Exploration of the science, observational and instrument parameter space. Impact on the instrument design.

Contributors: G. Rousset (1m.m), Post-doc GEPI (12m.m), M. Puech (2m.m), H. Flores (2m.m), F. Hammer (2m.m), K. Disseau (2m.m), Y. Yang (2m.m)

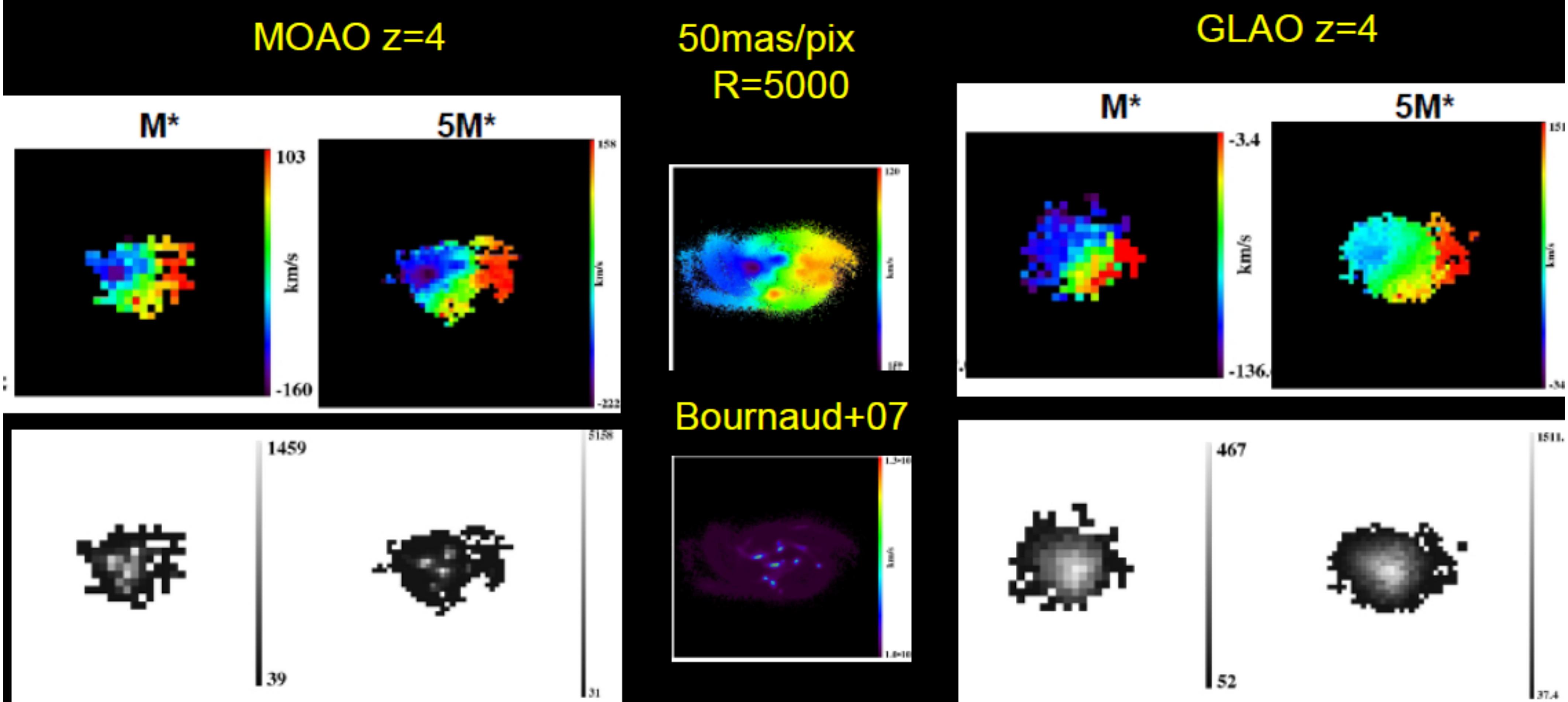
Inputs and/or relation to other tasks: Inputs from task 1.3 (*Science requirements*) and task 2.2 (*preparatory studies*)

Content, Milestones and Outputs:

- T0+13m: Definition of the parameter spaces
- T0+14m: ELT-IFU Simulation run. Library of 3D fake data for ELT-IFU.
- T0+17m: Analysis of ELT-IFU simulations. Impact on ELT-IFU design.
- T0+19m: ELT-MOS Simulation run. Library of 3D fake data for ELT-MOS.
- T0+22m: Analysis of ELT-MOS simulations. Impact on ELT-MOS design.
- **T0+24m: Final report (D7.2) and scientific paper**

Exemple (1) : E-ELT DRM

GLAO leads to smaller S/N compared with MOAO and will limit observations to smaller-mass galaxies. GLAO will impact strongly the recovery of Rotation Curves and detailed kinematics.

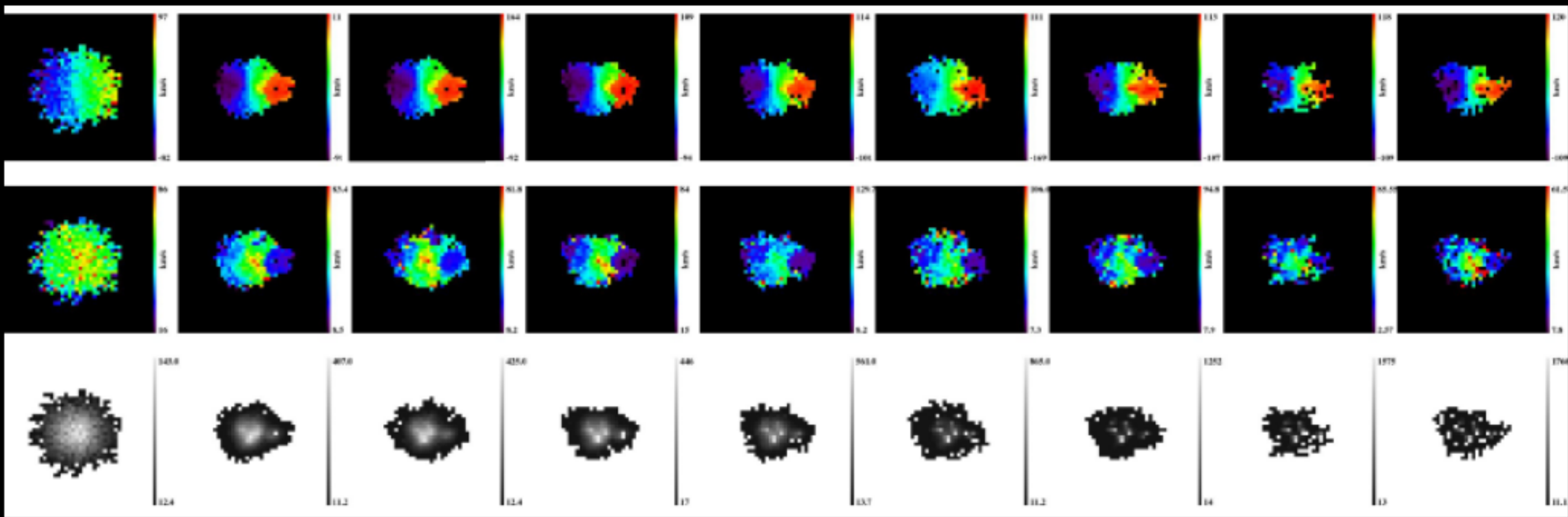


Exemple (2) : EAGLE Phase A

Clumpy Disks

Analogs with a range of EEs ... challenging since we consider a very small distant galaxy at z=4 with only 30A EQW (SINFONI data at z~2 show ~100A)

37.5mas/pix (EAGLE baseline)

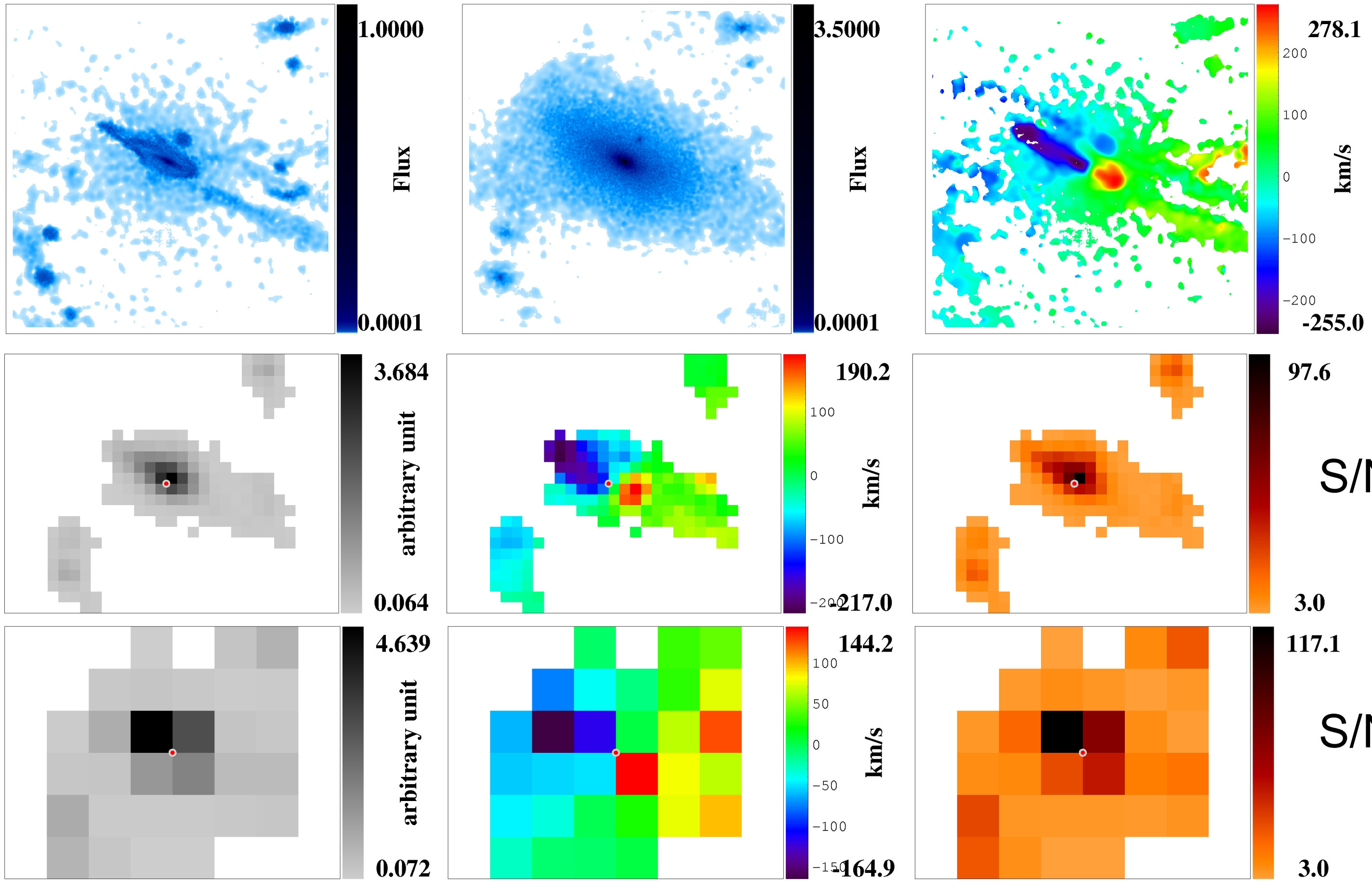


seeing 15% 61%

At about 20% can start to see clumpy structure, 30% is more robust

OPTMOS/EVE Phase A: Large IFU: detect and measure extended sources

m(AB)=24 galaxy at z=3 after 10 hours of integration



Top: the hydrodynamic model used as an input to the simulations (shown is the high resolution stellar distribution).

Middle: LI mode simulation. From left to right: flux distribution, velocity field, and the S/N map.

Bottom: same as above but using a spatial binning of 4x4 spaxels.

Delivrables

- Science : D2.1 « Interface definition document » T0+2m
- Infrastructures : D3.1b COMPASS website T0+24m
- Management : D1.2 Compass web-based interface T0+24m
- Instruments designs : D7.2 « ELT-IFU & ELT-MOS analysis report »

Personnes impliquées au GEPI

GEPI					
GEPI	Puech	Mathieu	Assistant astronomer	8	ELT instrumentation specialist, science and instruments design tasks coordinator
GEPI	Hammer	François	Astronomer	5	ELT science expertise (PI of OPTIMOS-EVE)
GEPI	Flores	Hector	Assistant astronomer	5	ELT instruments expertise (instrument scientist of OPTIMOS-EVE)
GEPI	Disseau	Karen	PhD student	5	ELT instruments preparatory studies. End-to-end simulations for ELT-MOS, link with AO
GEPI	Yang	Yanbin	Post-doc	5	Expertise in instrument simulations and software development
GEPI	Taburet	Sylvestre	Research engineer	3	IT expertise, webmaster of the simulation website
GEPI	Paillous	Michèle	Research engineer	2	Setup and maintenance of hardware
GEPI	Jégouzo	Isabelle	Engineer	4	Software development (website, database)

+ 1 post-doc de 2 ans à recruter