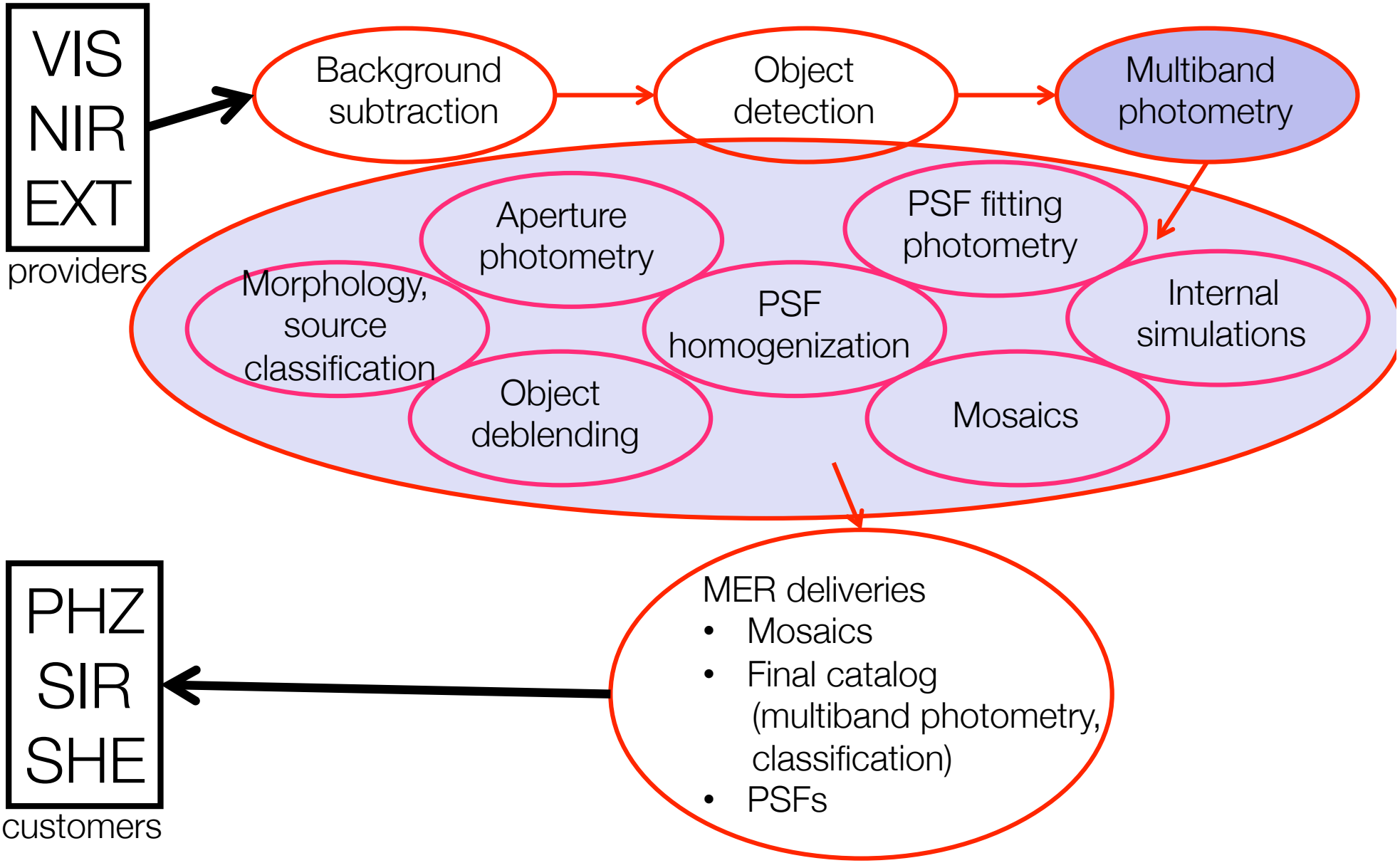
Euclid OU-MER

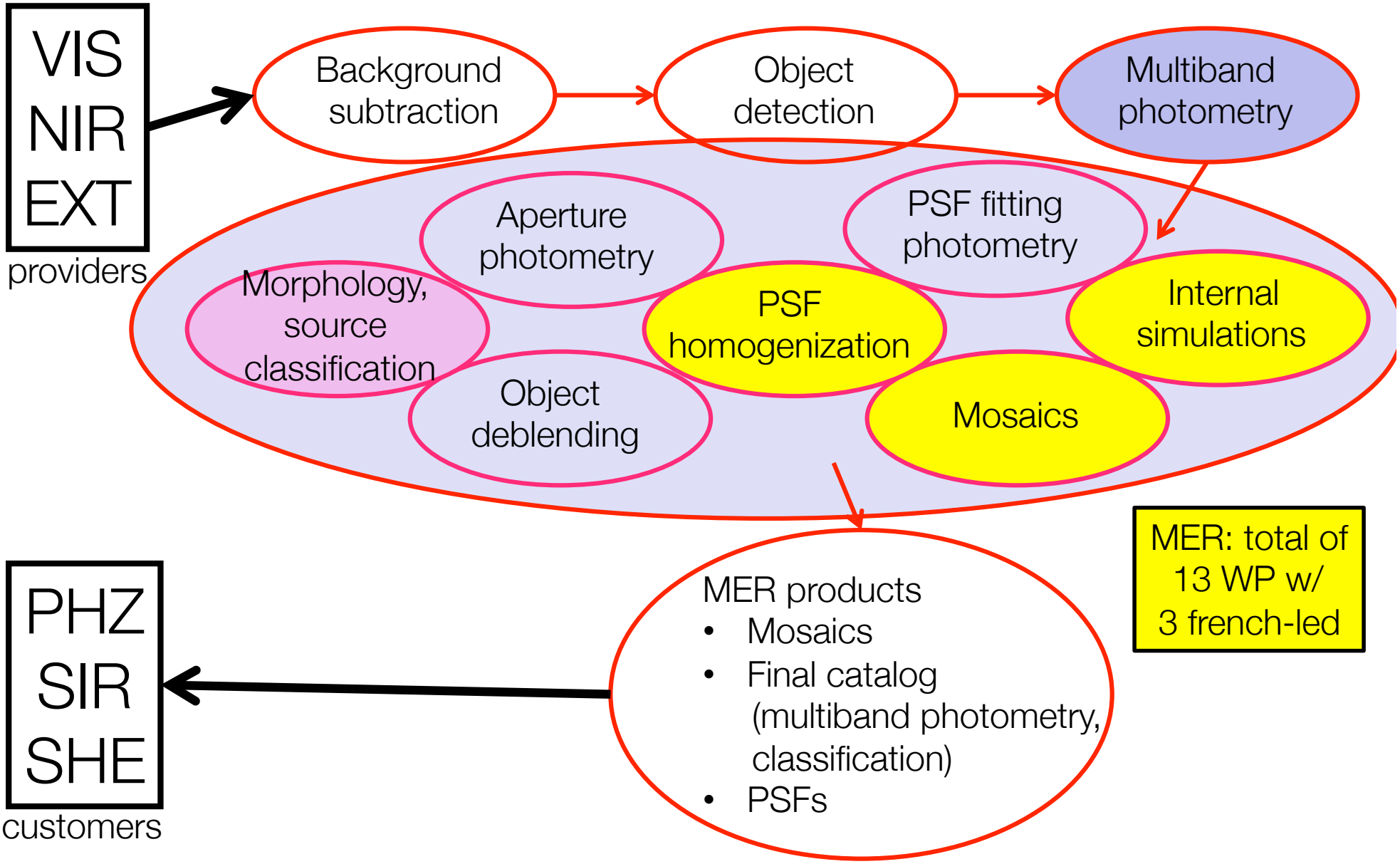
Hervé Dole et al.

MER tasks – 1.
MER photometry strategies – 2.
Pipeline Interface Reconciliation Meeting in Rome, December 2015 – 3.
Conclusions, perspectives – 4.

1. MER tasks


VIS
NIR
EXT
providers
Background subtraction
Object detection
Multiband photometry
Aperture photometry
PSF fitting photometry
Morphology, source classification
PSF homogenization
Internal simulations
Object deblending
Mosaics
MER deliveries
• Mosaics
• Final catalog (multiband photometry, classification)
• PSFs
PHZ
SIR
SHE
customers

1. MER tasks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MER products
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MER: total of 13 WP w/ 3 french-led
PHZ
SIR
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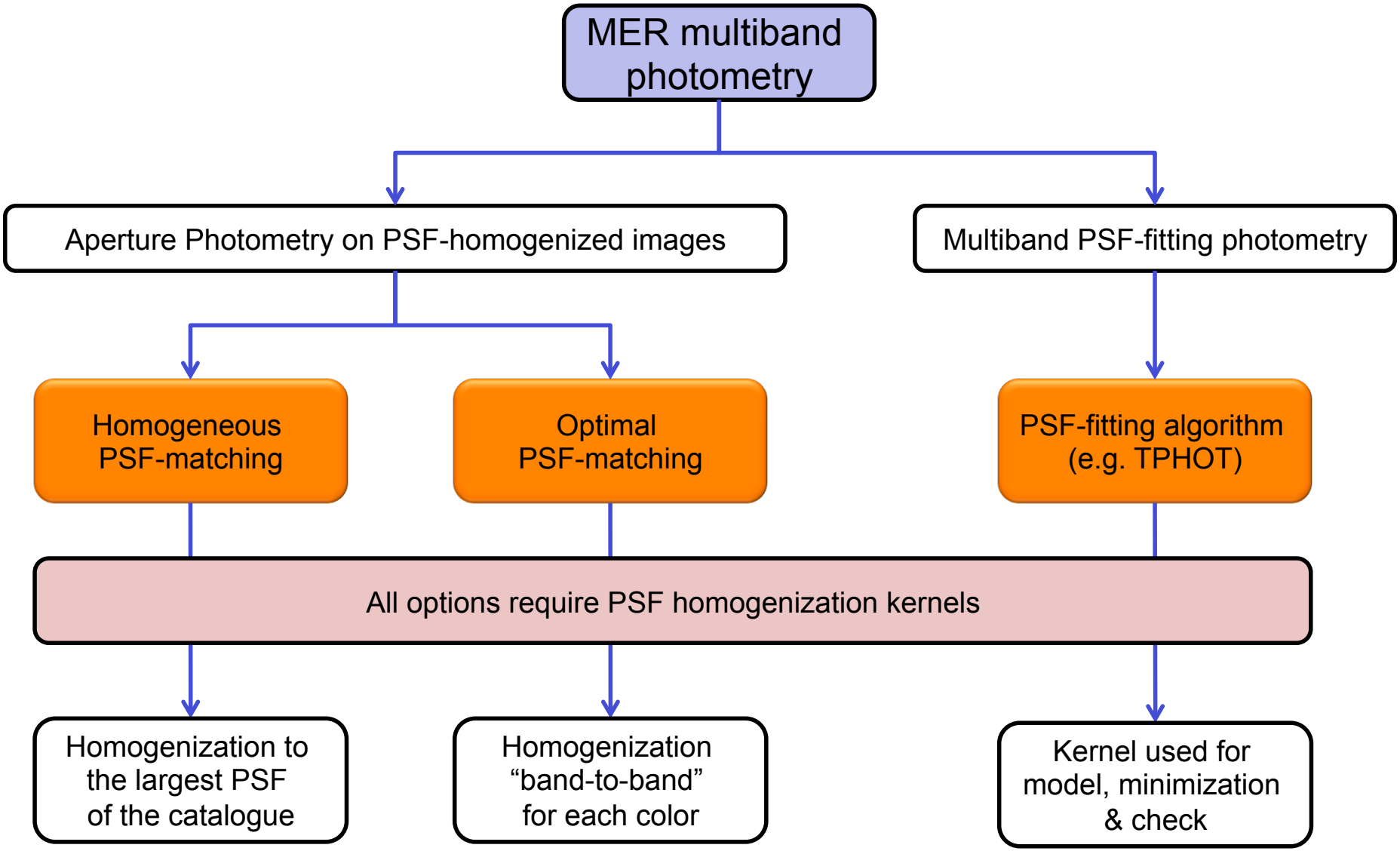
customers

2. MER photometry strategies



Courtesy Alexandre Boucaud

3. Pipeline Interface Reconciliation Meeting

- Interface Reconciliation Meeting, Rome Dec 1-2
  - http://wiki.cosmos.esa.int/euclid/index.php/OU-MER_Interface/Pipeline_Reconciliation_Meeting,_1-2_December_in_Rome,_Italy
- MER, VIS, NIR, SIR, PHZ, EXT, SHE, LE3, SGS, ST, WLSWG, SWG-NearbyUniv, SWG-Morphology (Duc, Huertas)
- Formulation commune des processus, des sujets et identification des interlocuteurs
- Topics: PSF, Mosaics, Object detection/Cataloguing/ Photometry, Morphology, interfaces

3. Pipeline Interface Reconciliation Meeting

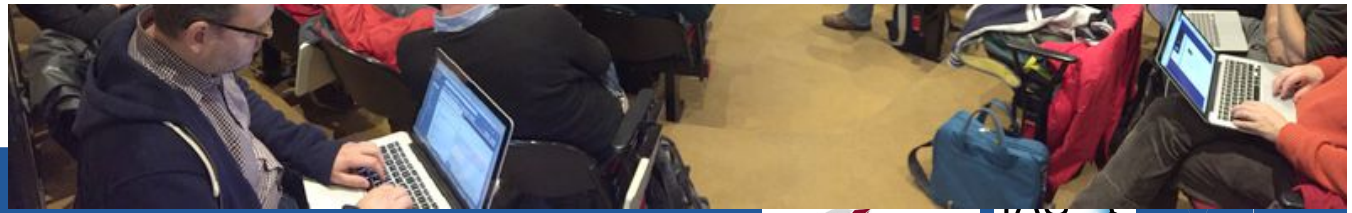
- PSF: models & mesurements

- *SHE takes the lead to develop the PSF model in the wavefront space and the sw tool to convert it to pixel space*
- *NIR, MER and PHZ should deliver a first guess of PSF requirements*
- *VIS will help and interact with SHE to validate and improve the PSF model*
- *SHE should keep SIM updated about the development of the PSF model*

- Mosaics

- Consensus that SWARP is a baseline solution. No major drawback is known - except that does not behave optimally for under sampled images (like NIR!!). Drizzle-like solution is worth exploring? Need to compare SWARP and Drizzle.

- *EXT is developing an improvement to better deal with PSF homogenization;*
- *VIS and NIR will deliver stacks of single pointing;*
- *VIS and NIR will provide a background map;*
- *VIS and NIR will take care of validating the stability of astrometry, flux calibration and background subtraction on the overlaps between pointings;*
- *MER is charged with producing the final mosaic of multiple pointings for final object detection;*
- *EXT will deliver all images within a singe area, either in the form of a single stack with homogenized seeing or individual images. Intermediate options (like making stacks only with images of similar quality) can be explored.*



3. Pipeline Interface Reconciliation Meeting

- Cataloguing / Object detection / Photometry

- *Consensus about the MER plan to obtain a single catalog that includes both a VIS- and NIR- selected objects. This catalog should be obtained by performing the detection on some optimal combination of VIS and NIR images. EXT images are not used for detection.*
- *Consensus that the deblending is a crucial step, and that available sw is not adequate to cope with the combination of spatial resolution and dynamic range of EUCLID images.*

- Morphology SWG: P-A Duc, M. Huertas

- *There are clearly many overlapping and mutually interesting developments between VIS, MER and Morphology SWG.*
- *Many of them are in the general field of innovative, non-parametric, machine learning methods to measure morphological parameters.*
- *M-SWG is keen to provide codes and help to deliver morphological parameters of Euclid galaxies.*
- *M-SWG is keen to re-define the list of parameters that must be computed, and put them in the revised version of the Legacy Requirement Document.*
- *MER and VIS welcome any advice and contribution from SWG members. The exact division of tasks between MER and VIS is to be defined.*

proximité SWG-OU souhaitable, à l'exemple de CL-SWG–LE3 ?

4. Conclusions, perspectives

- MER-PHZ Data Challenge #2 ongoing/done
- Protopipeline MER assembled

- Important Rome December Meeting

- Morphology: SWG & MER are already working (CEA/AIM, GEPI, IAS, OA Roma); will include VIS
  - Test of codes; meeting in january;
- Next Garage Days will have MER/EXT topics discussed
- Photometric quality in overdense regions (e.g galaxy clusters)
- Some challenges
  - PSF requirements: NIR (undersampling) / VIS (color) > MER > PHZ
  - Background subtraction

EXTRA SLIDES

PSF

MER: Rome meeting, Dec 2015 outcome

- How will the PSF be modeled?

Consensus on the need to have a single theoretical model for VIS and NIR; hopefully extended to EXT, if it is able to cope with the larger variations. No preference on pixel or wavefront space.

- What are the requirements for the PSF model?

No requirement for NIR. MER needs to estimate impact of NIR (undersampling) and VIS (color terms) PSF error.

- Will there be one PSF model in all OU's?

The wavefront description is impossible for EXT. SHE delivers single-image PSF. The PSF of stacked images must be computed explicitly;

- How will PSF be modeled in the pixel space?

Two options: analytic expression or grid-based. Depends on the accuracy ultimately possible with analytic expression. Since analytic expansions can be translated into grid, and not viceversa, the grid model is likely preferred.

- How will the PSF be measured?

SHE will provide VIS (NIR) with a model. VIS and NIR can test whether it is "good" on each image; in the long term SHE will refine the model with subsequent iterations.

- What are the expected errors in PSF determination? How are they measured?

Need to develop simulations to estimate the error budget and how it propagates;

- Are iterations needed between MER and VIS/NIR/EXT to improve PSF models?

Yes! See above.

Action items / responsibilities

- *SHE takes the lead to develop the PSF model in the wavefront space and the sw tool to convert it to pixel space*
- *NIR, MER and PHZ should deliver a first guess of PSF requirements*
- *VIS will help and interact with SHE to validate and improve the PSF model*
- *SHE should keep SIM updated about the development of the PSF model*

MOSAIC

MER: Rome meeting, Dec 2015 outcome

Starting questions

- Do we all agree on the definition of mosaics ?
- Are the constraints or requirements for the tiling strategy established? (tile = size,shape,pattern of the basic area for the cataloging pipeline)
- Who (MER/VIS/NIR/SIR/SHE/all) will set the tiling strategy?
- When and how are mosaics created?
- Is mosaic creation needed within the processing functions of VIS, NIR and EXT?
- Are there intrument-specific recipes for mosaicing, or can we use standard tools (like SWARP)?
- Do we have constraints due to astrometric description?
- How does the mosaicing strategy impact the creation of Euclid catalogues? What is the cataloguing cadence?
- Do we need intermediate-step catalogue when only incomplete data are available? In this case, how do we treat errors on the boundaries?

Summary of outcome

- Consensus that SWARP is a baseline solution. No major drawback is known - except that does not behave optimally for under sampled images (like NIR!!). Drizzle-like solution is worth exploring? Need to compare SWARP and Drizzle.

- *EXT is developing an improvement to better deal with PSF homogenization;*
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CATALOGUING

MER: Rome meeting, Dec 2015 outcome

Starting questions

- how do the definition and identification of objects impact core science (in particular SHE and SIR, but also legacy) analysis?
- What is the optimal detection strategy for shear measurements?
- How do we define “objects” for shear measurements?
- What is the optimal detection strategy for SIR spectral extraction?
- How do we identify and treat defects?
- is temporary cataloguing needed within the processing functions of VIS, NIR and EXT? is a global detection strategy needed?
- do we need to set requirements on flagging of defects and possible spurious detections ?

Outcome

- *Consensus about the MER plan to obtain a single catalog that includes both a VIS- and NIR- selected objects. This catalog should be obtained by performing the detection on some optimal combination of VIS and NIR images. EXT images are not used for detection.*
- *Consensus that the deblending is a crucial step, and that available sw is not adequate to cope with the combination of spatial resolution and dynamic range of EUCLID images.*
- *SHE require a somewhat aggressive deblending.*
- *This conflicts with the desire to avoid fragmentation of bright galaxies. Innovative methods should be developed to address this topic.*
- *Cluster of galaxies are a particularly important class of targets that can be missed if deb lending is inadequate. These are close to core science and should have a higher priority than local bright galaxies.*
- *The pre-existing knowledge (e.g. SDSS catalogs) should not be used to pre-select regions where bright galaxies or clusters exist, and should not be used to trigger specific deb lending algorithms. However, such knowledge could be used to validate these algorithms.*
- *Moving objects will be identified within VIS and NIR “fast” pipelines, immediately communicated and flagged avoid their inclusion in the final catalog.*
- *Other defects should be identified by the VIS and NIR pipelines and flagged.*
- *The region around bright stars should be identified and not included in the final catalog, taking also into account their extension in the EXT images.*
- *Temporary catalogs are comported within VIS and NIR Functions, but they should not be propagated into the final MER catalog.*
- *It is too early to decide upon a clear tiling strategy for catalogs computed in the very first stage of the operations. Two options have been discussed, limited to the first release of catalogs: one delivers successive catalogs in contiguous areas, following the acquisition of images. This strategy heavily depends on the reliability of the coaddition on the overlapping regions of subsequent exposures. This will have the advantage of delivering immediately a contiguous area. Another strategy plans the independent analysis of each satellite pointing, avoiding border regions. This strategy does not produce contiguous area but is not prone to errors in the astrometric and flux calibration in the early phase of the mission.*
- *For the final release of catalogs a pre-defined contiguous scheme of sub-tiling will be prepared for cataloguing the whole data.*

MORPOHOLGY

MER: Rome meeting, Dec 2015 outcome

- which morphology estimates are needed?
- which are of interesting for measuring shear and core science in general?
- How are deblending, morphological analysis and shear measurements connected?

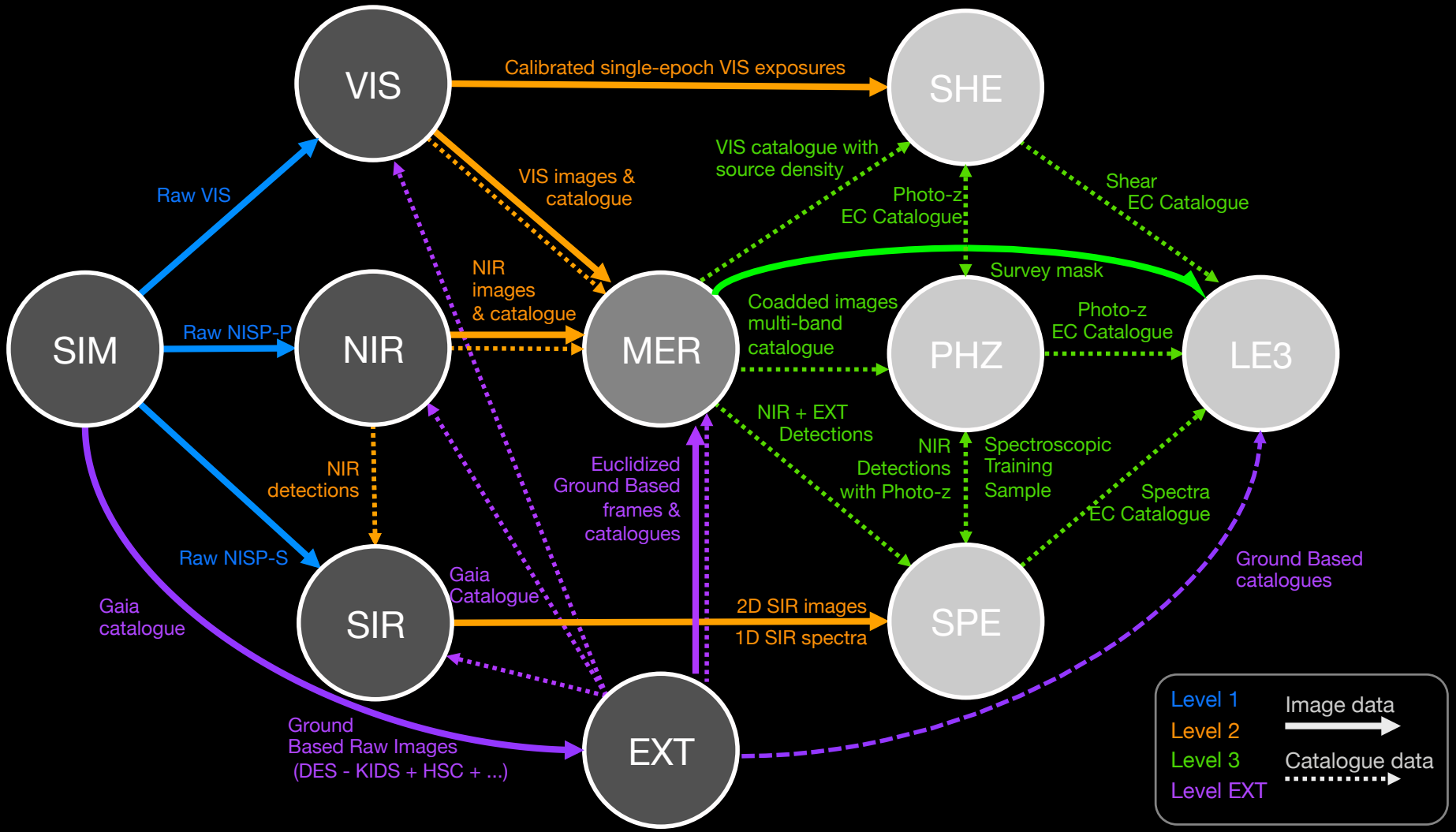
Summary of outcome

- *There are clearly many overlapping and mutually interesting developments between VIS, MER and Morphology SWG.*
- *Many of them are in the general field of innovative, non-parametric, machine learning methods to measure morphological parameters.*
- *M-SWG is keen to provide codes and help to deliver morphological parameters of Euclid galaxies.*
- *M-SWG is keen to re-define the list of parameters that must be computed, and put them in the revised version of the Legacy Requirement Document.*
- *MER and VIS welcome any advice and contribution from SWG members. The exact division of tasks between MER and VIS is to be defined.*

WHAT NEXT ?

- This coordination exercise should be continued;
- Marc Sauvage, Adriano Fontana and the other OU leads will coordinate to organize a proper follow up of this meeting. It is expected that a coordinator is appointed for each of the topic discussed at this meeting, and that further meetings and coordination activities will follow starting next year.
- This action will be somewhat parallel w.r.t the organization of the Garage Days;
- It is proposed that “Background subtraction” is added top the list of topic to discuss
- The interaction between OUs and SWG is crucial to achieve these goals.

Euclid SGS OU overview



HD, AB, July 2014 - adapted from Santiago Serrano, May 2014

work packages

red: IAS responsability in OU-MER as of Dec 1st, 2015

OU-MER
Lead: IT
Co-lead: FR, DE

SDC lead: IT

FR:
IAS, IRAP, APC

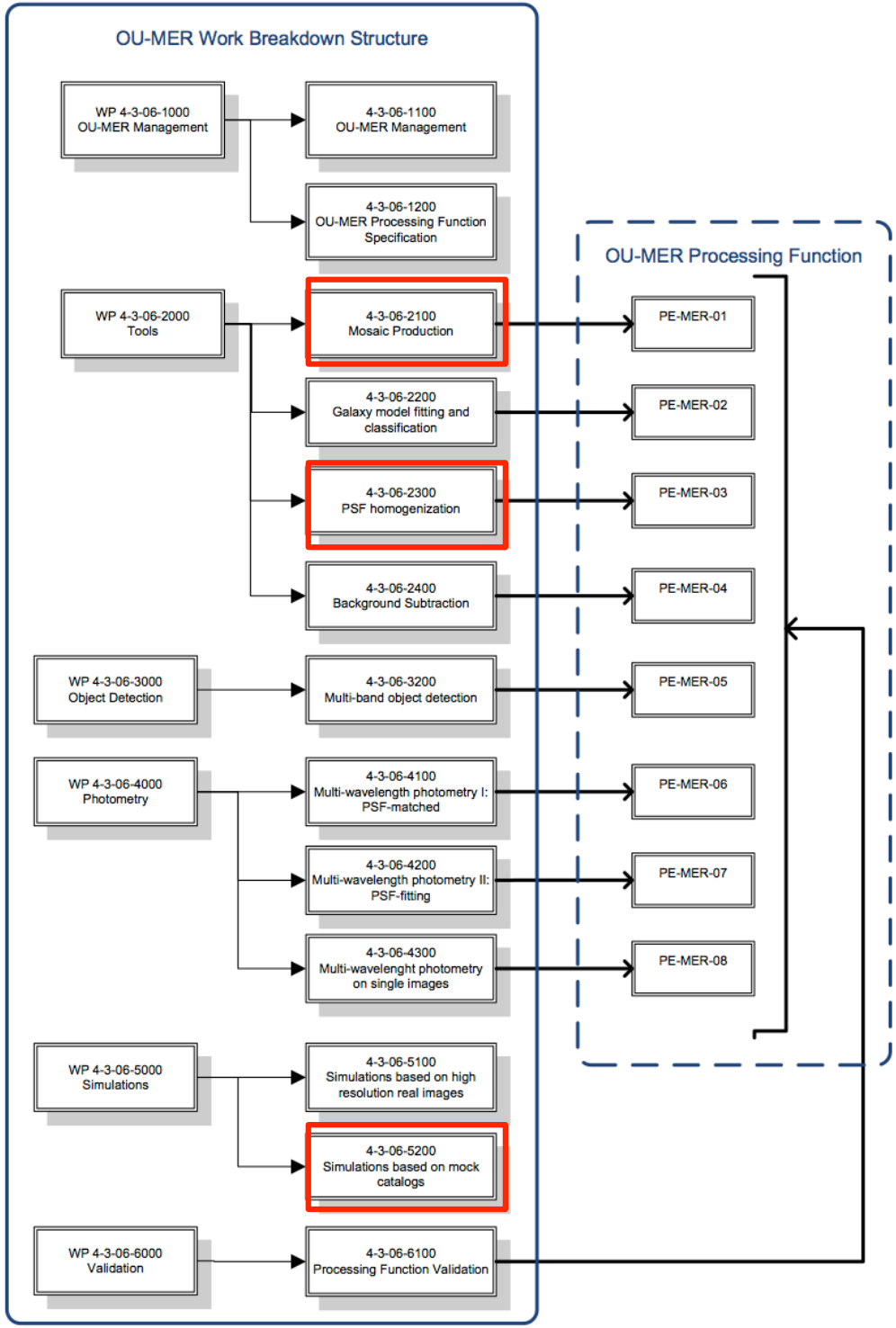
tools ->

multiband detection ->

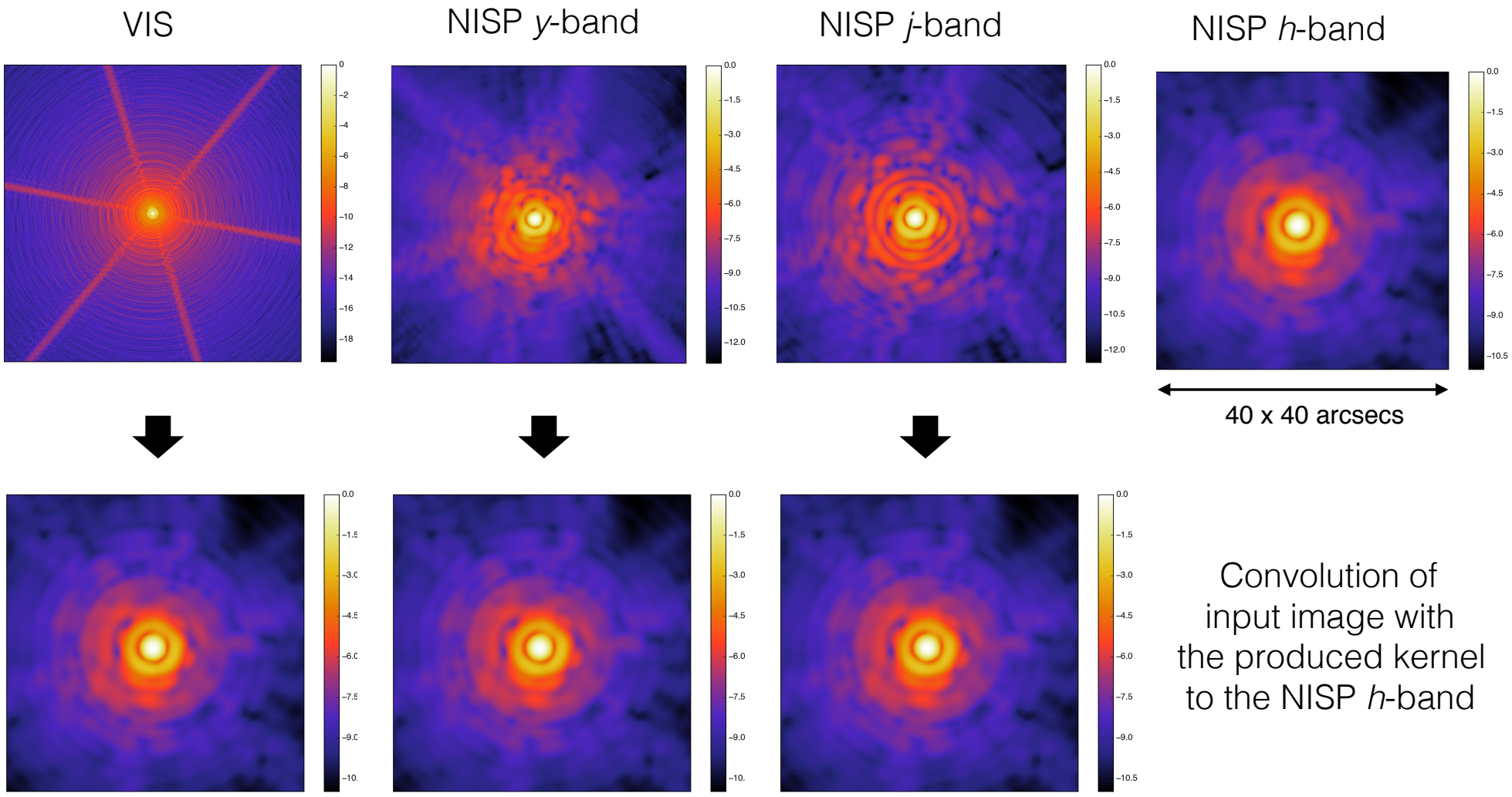
multi-wv photometry ->

sims ->

validation ->



Euclid PSF simulations



Convolution of input image with the produced kernel to the NISP *h*-band

premilinary simulated PSF kindly provided by OU-SIM P. Hudelot (IAP) and G. Seidel (MPIA)