A French participation to SUMIRE/PFS

Marseille groupe LAM/CPPM

A. EALET (CPPM)

J.P. KNEIB (LAM)

E. PRIETO (LAM)

É. AUBOURG (APC/Paris)

Science Interest

Science Interests in France

Science interests

Strong interest in Cosmology/Extragalactic research

- In particular
  - BAO survey; target selection using photo-z
  - BAO using the Ly-alpha forest of distant quasars
  - Link weak-lensing with galaxy redshift surveys: halo mass measurements, cosmological constraints
  - Cosmic magnification
  - Strong lensing systems
  - High-z galaxy search

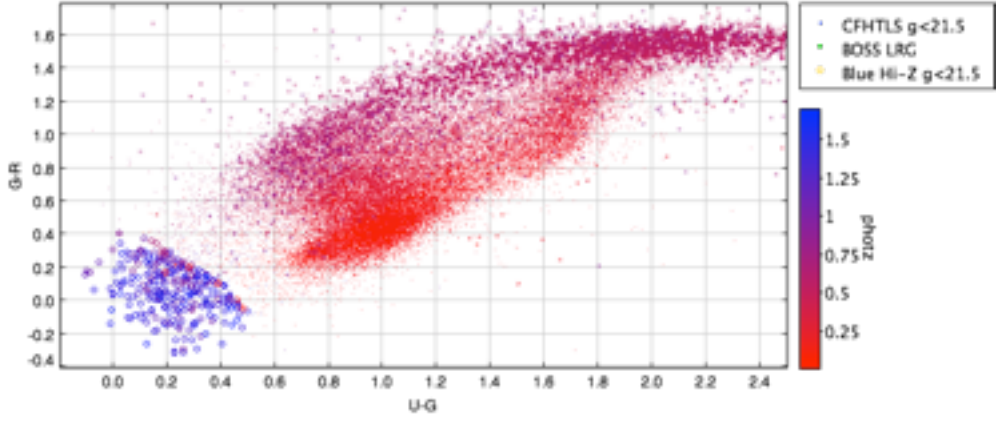
Marseille Heritage: Hardware & Science

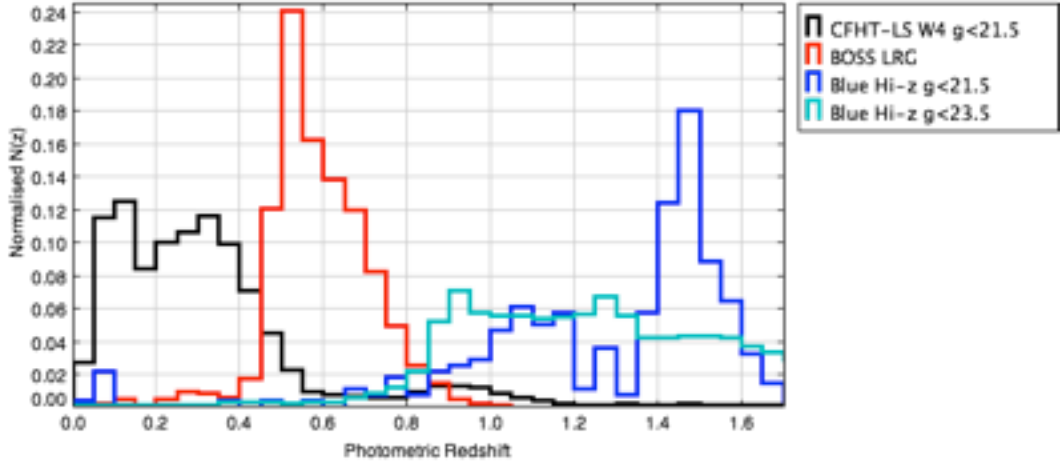
- VIMOS instrument (build by LAM + Italians)
- VVDS, VIPERS survey
- CFHT-LS photo-z, Cluster catalogue, SNLS spectroscopy
- COSMOS, zCOSMOS
- SNAP spectrograph/SNAP science case
- tools to prepare DE experiments (as Cosmos Mock Catalogue)
- BOSS (link WL+spectro redshift; test ELG selections)

BOSS Ancillary ELG survey

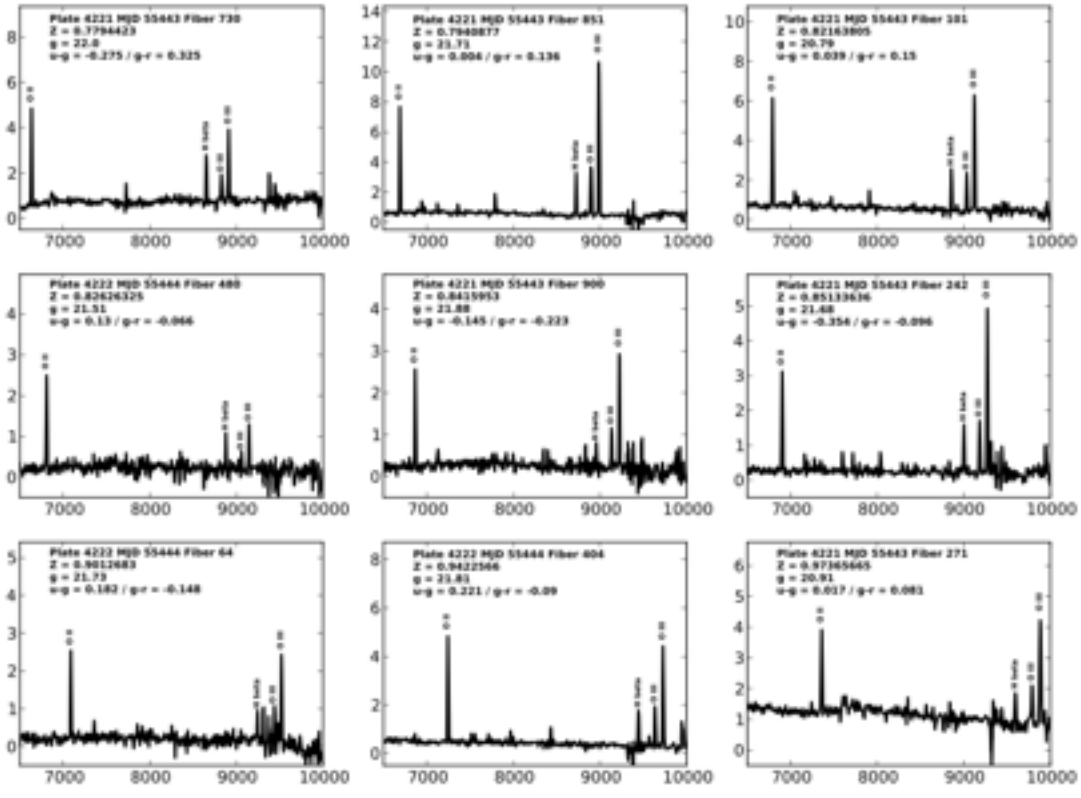
(JP Kneib, J.Companat, A.Ealet,S.Escoffier)

- ugr selection for 0.7<z<1.7 to be tested with the BOSS spectrograph this fall 2010
- other color selections possible like gri color (similar to DEEP2)





BOSS ELG Ancillary program (2000 targets 0.7<z<1.7)

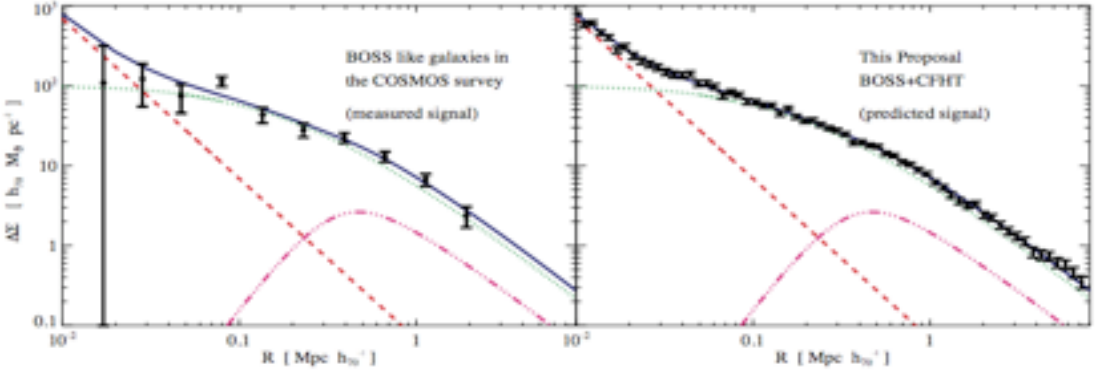


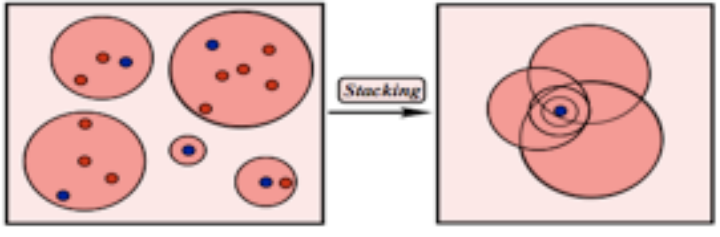
Issues of the ELG selection: quasar contamination (but it can be reduced if needed by measuring time-variability of quasars)

WL & Spectroscopy

- Combine WL & Spectroscopic information
- Framework: Halo Model
- Can put stringent constraints on the mass distribution but also Cosmology

Galaxy-galaxy lensing technique





CFHT WL forecast
measurement
in the Stripe 82
(on-going project)

SUMIRE/PFS
Hardware contribution (Marseille)

Spectrograph

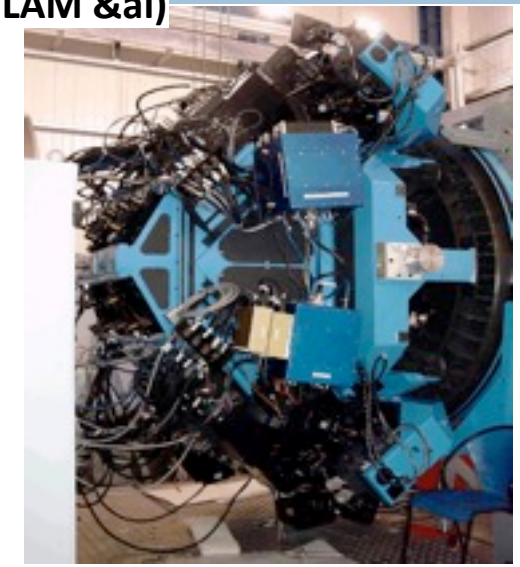
The Marseille technical heritage

- LAM* heritage on large survey spectroscopy = VIMOS builder (PI VVDS : O. Lefevre director of LAM)
- An integrated technical team between LAM and CPPM* in the context of SNAP/JDEM, to build an IFU spectrograph with slicer
- A full demonstrator has worked in 2006/2008 (see SPIE 2006/2008)
- Currently, the team has made some preliminary studies for BigBoss on a 5000 fibers spectrograph, and works on EUCLID (ESA mission)

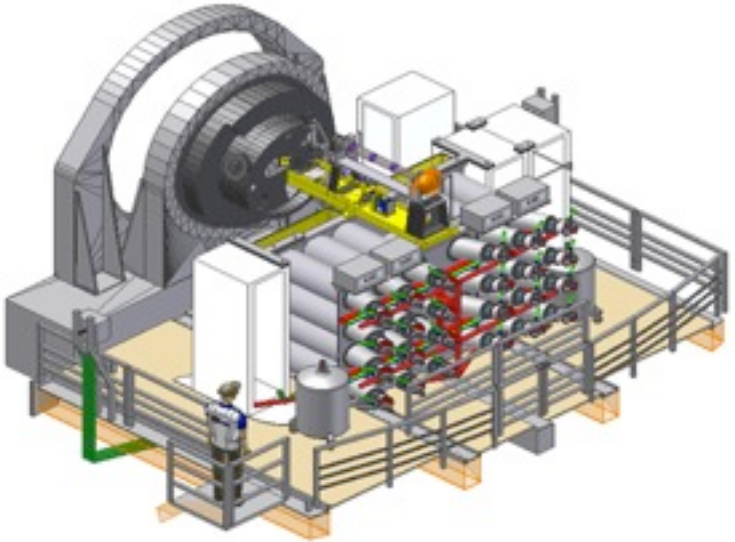
*LAM /INSU (Laboratoire d'Astrophysique de Marseille)
- Cosmology group head by JP Kneib
*CPPM/IN2P3 (Centre de physique des particules de Marseille)
-Dark energy research group leaded by A.Ealet

Marseille expertise spectroscopy/VLT-ESO

VIMOS (LAM &al)



MUSE (CRAL &al)



24 spectrographs:
24 detectors
No mechanism

Deliverables

- Marseille proposes to study and to deliver
  - Spectrograph concept
  - Spectrograph optics
  - Spectrograph mechanics
  - Spectrograph cryostat
  - AIT/V
  - Software

The Marseille group has done a first technical and feasibility study for a spectrograph

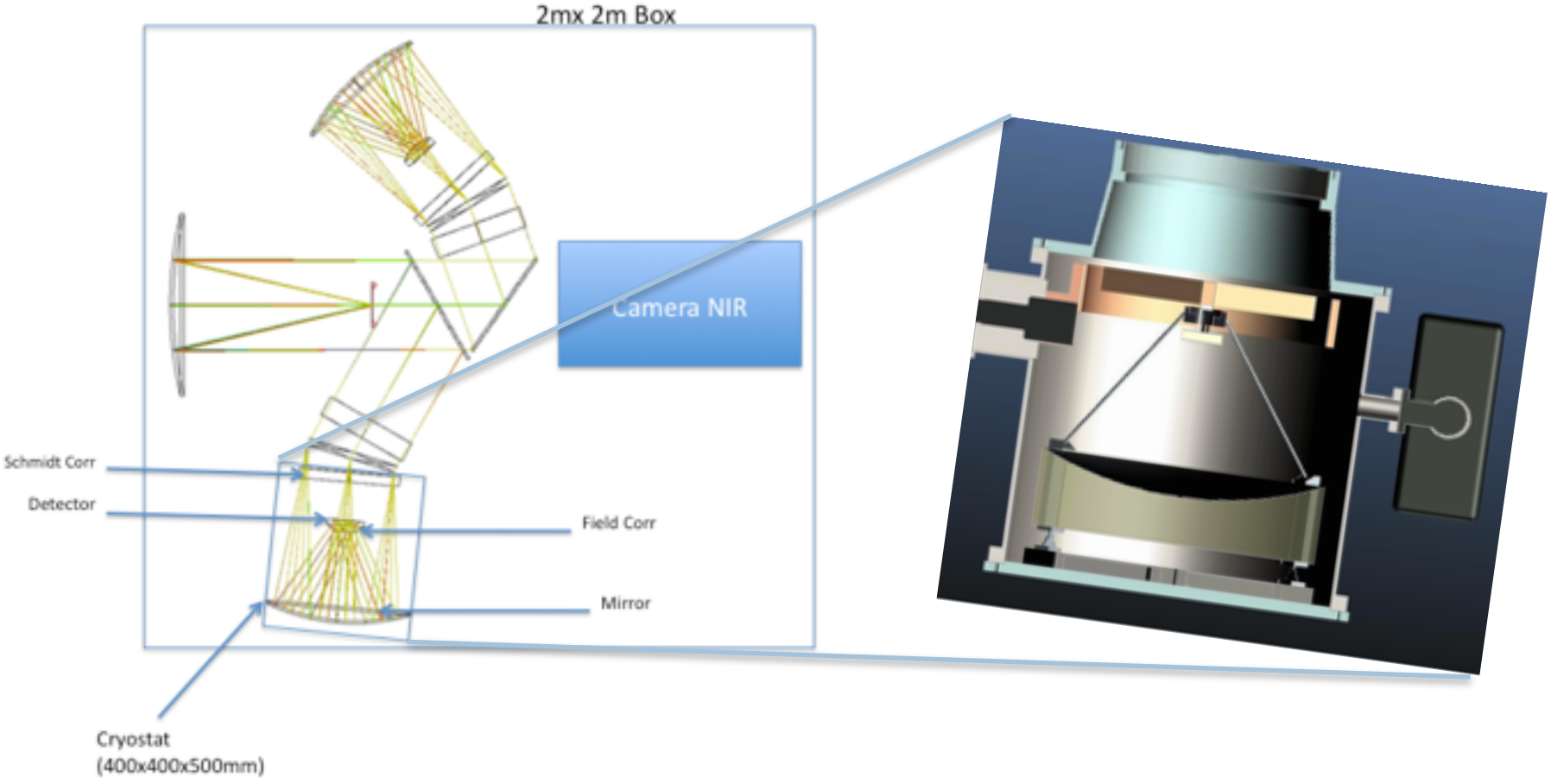
Work done in Marseille 2010

- Optical design using Schmidt concept
- Industrial evaluation for the manufacturing
- Preliminary development plan
- Optical performance evaluation

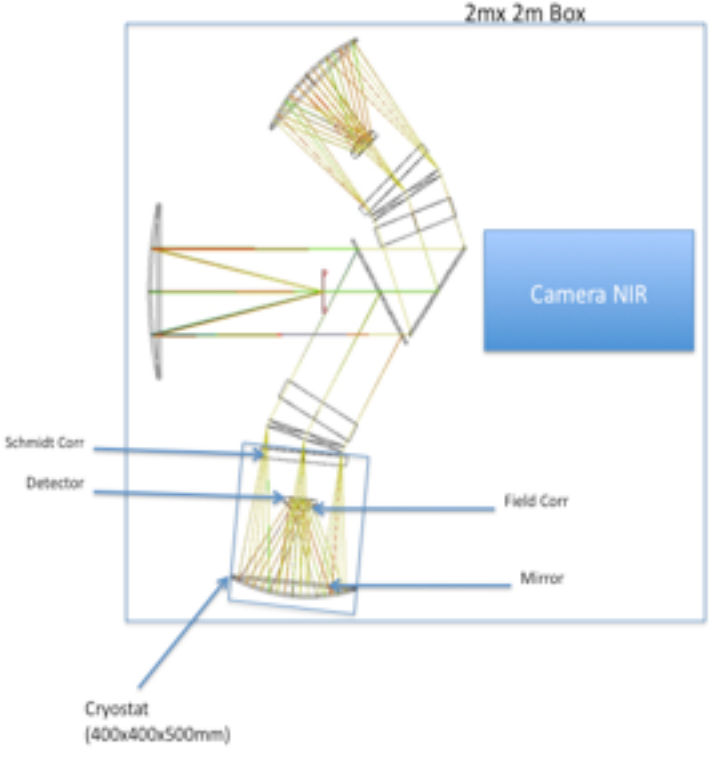
Optical concept specification

- Wavelength band: (0.36 – 0.6μm) and (0.6 – 1μm)
- 100μm fiber core
- 120mm entrance slit length
- 4kx4k detector (15μm pix)
- G: 0.5 (ie: 100μm fiber core imaged on 50μm: 3.33pix)
- F/2.2 collimator; F/1.1 camera
- Spectral dispersion:
  - Blue: 0.58Å/pix
  - Red: 0.97Å/pix

Spectrograph Concept



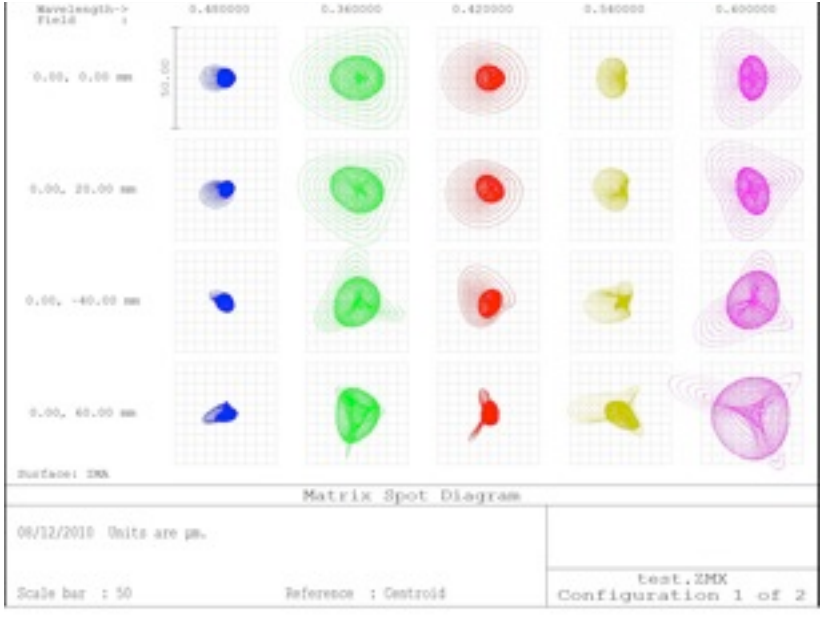
Optical Layout



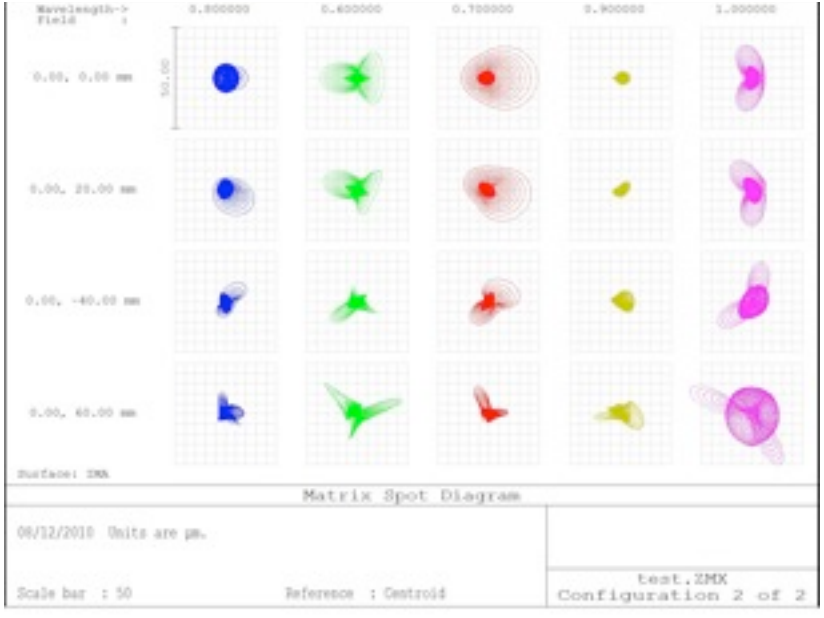
- Curved fiber slit
- Spherical collimator
- Two dichroics
- Collimator corrector dedicated to each channel (wavelength optimisation)
- Grating (280mm)
- Line density :
  - Blue: 777 ln/mm
  - Red: 472 ln/mm
- IR camera slot available
- 4 aspherical surfaces

Spot diagram

Blue Channel (box : fiber core size)



Red Channel (box: fiber core size)



Red channel better than blue
Spot smaller than fiber core image

Throughput

UV/visible/red

Optics: 93 %

Grating: 80%

Detector: 90%

Shadowing: 85%

total throughput: 57 %

- Included:

Specular reflexion

Internal transmittance

Dichroics

Detector support shadowing

- Not included:

Telescope

Fiber

Fiber couplings (FRD…..)

Conclusion

- France is interested in participating to PFS
- Strong expertise of the Marseille group in building spectrographs
- Marseille has made a first technical study: a spectrograph concept exists and is viable
- Need to assess the number of fibers, the real specifications for the spectrograph, the interface with fibers and detectors
- Ready to participate in a definition phase