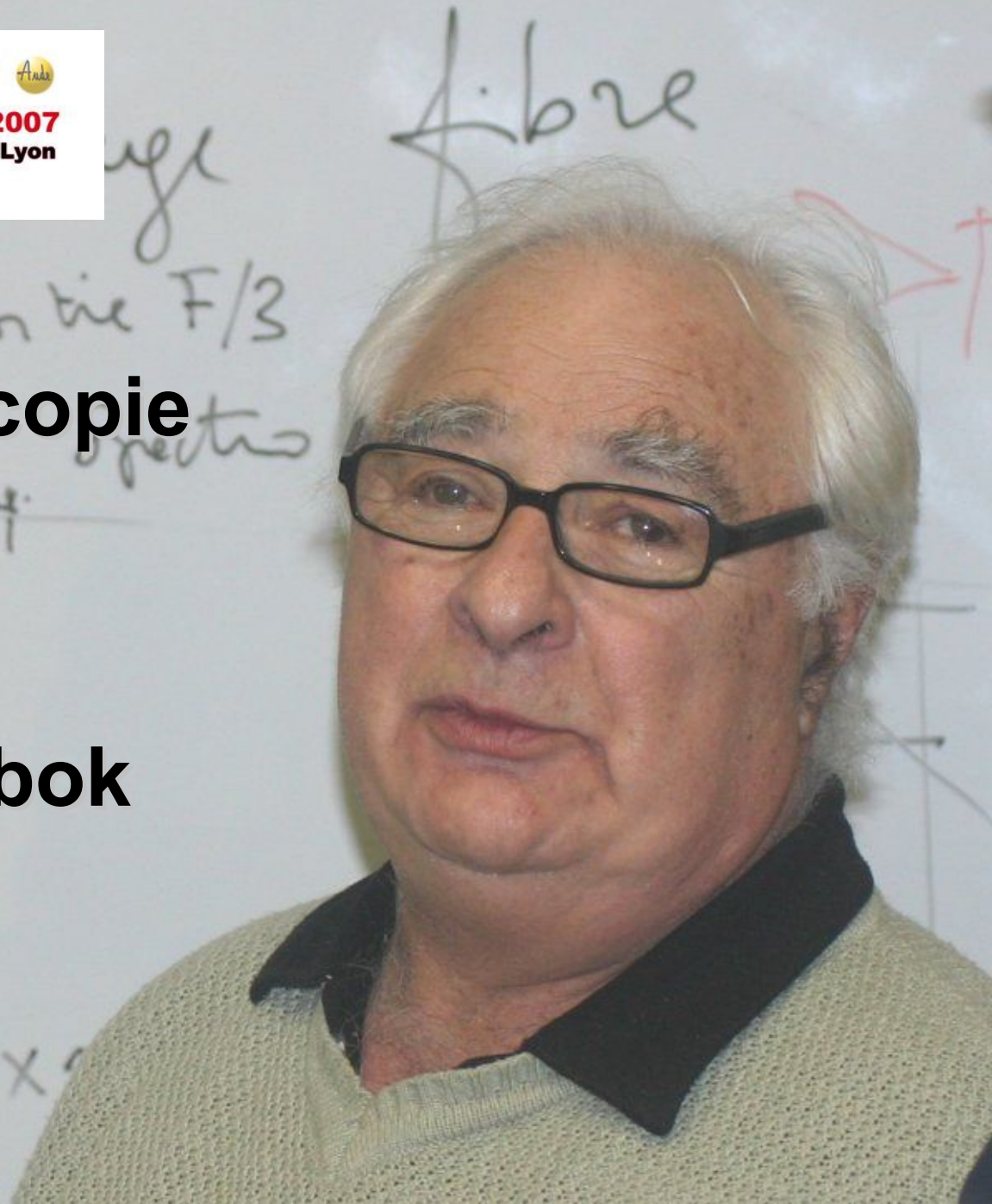
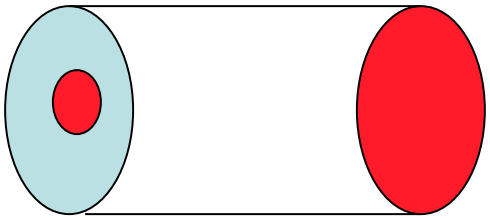
WETAL 2007
Week-end Technique d'Astronomie de Lyon

La spectroscopie à fibre

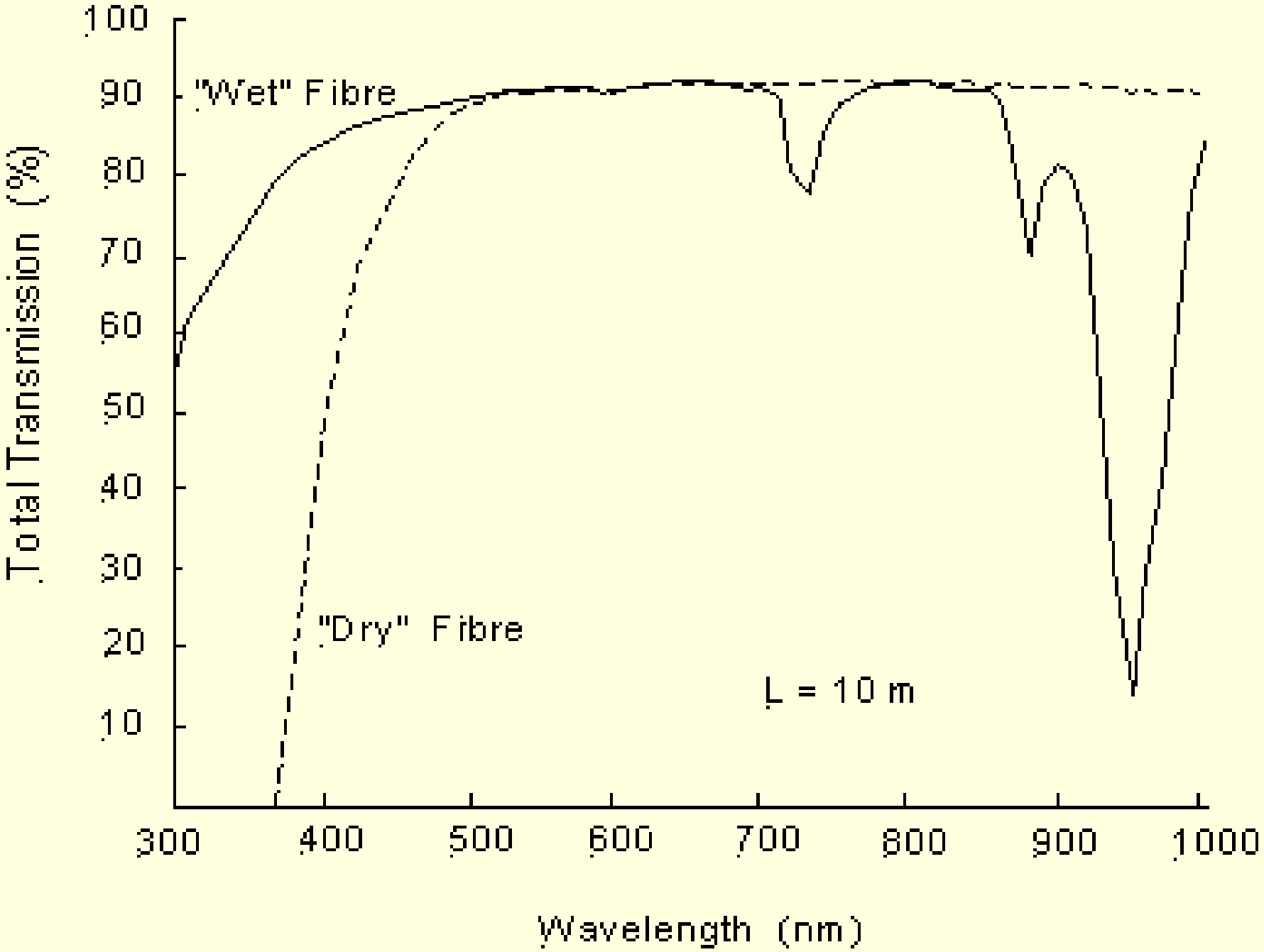
Atelier Paul Felenbok

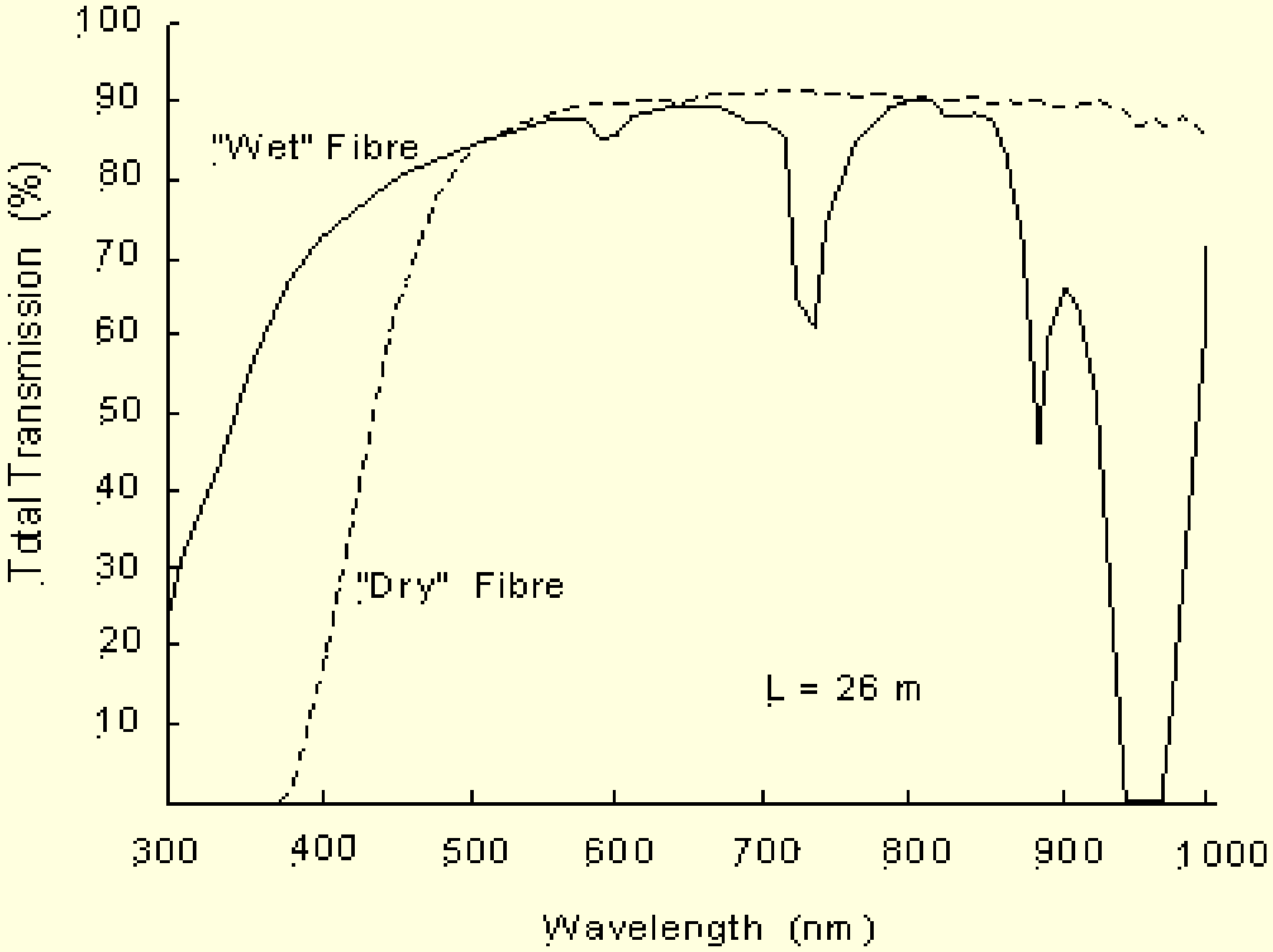


Faisceau entrée

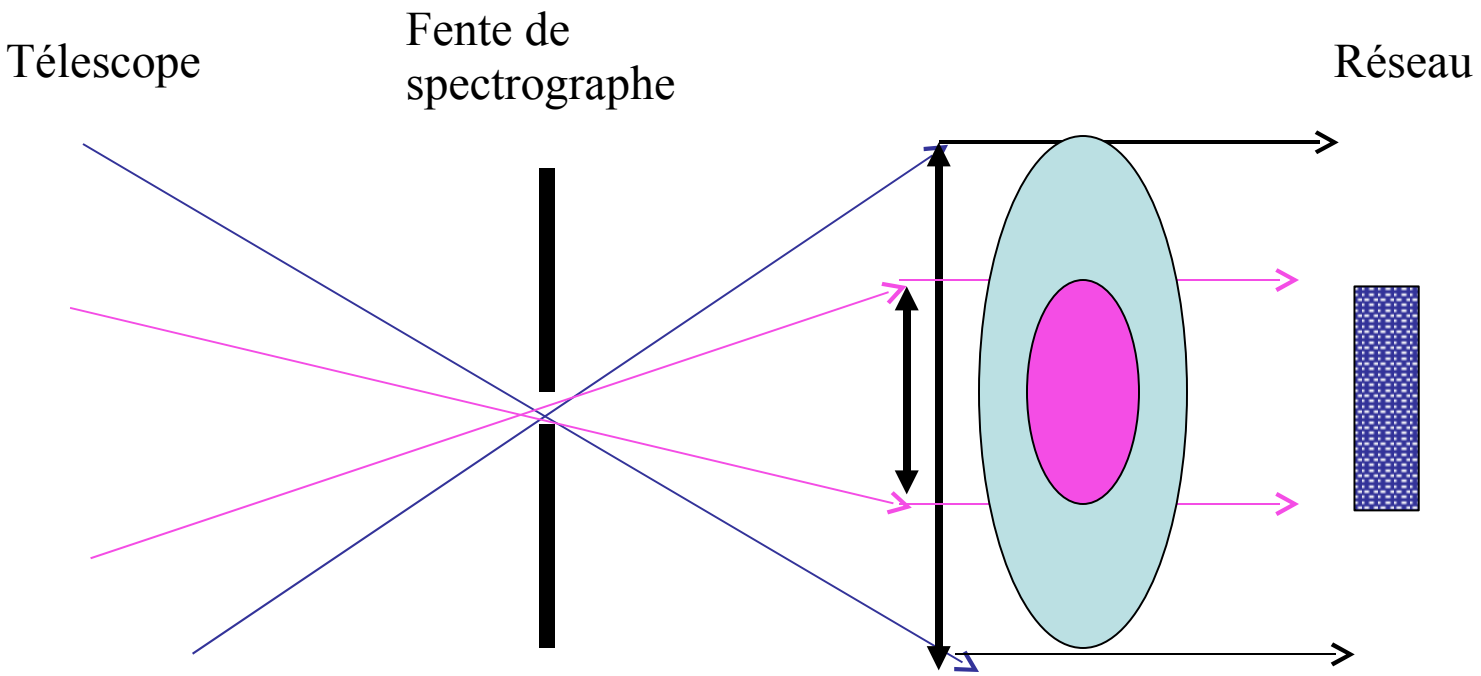


Faisceau de sortie du diamètre de la fibre


100
90
80
70
60
50
40
30
20
10
Total Transmission (%)
"Wet" Fibre
"Dry" Fibre
L = 10 m
300
400
500
600
700
800
900
1000
Wavelength (nm)

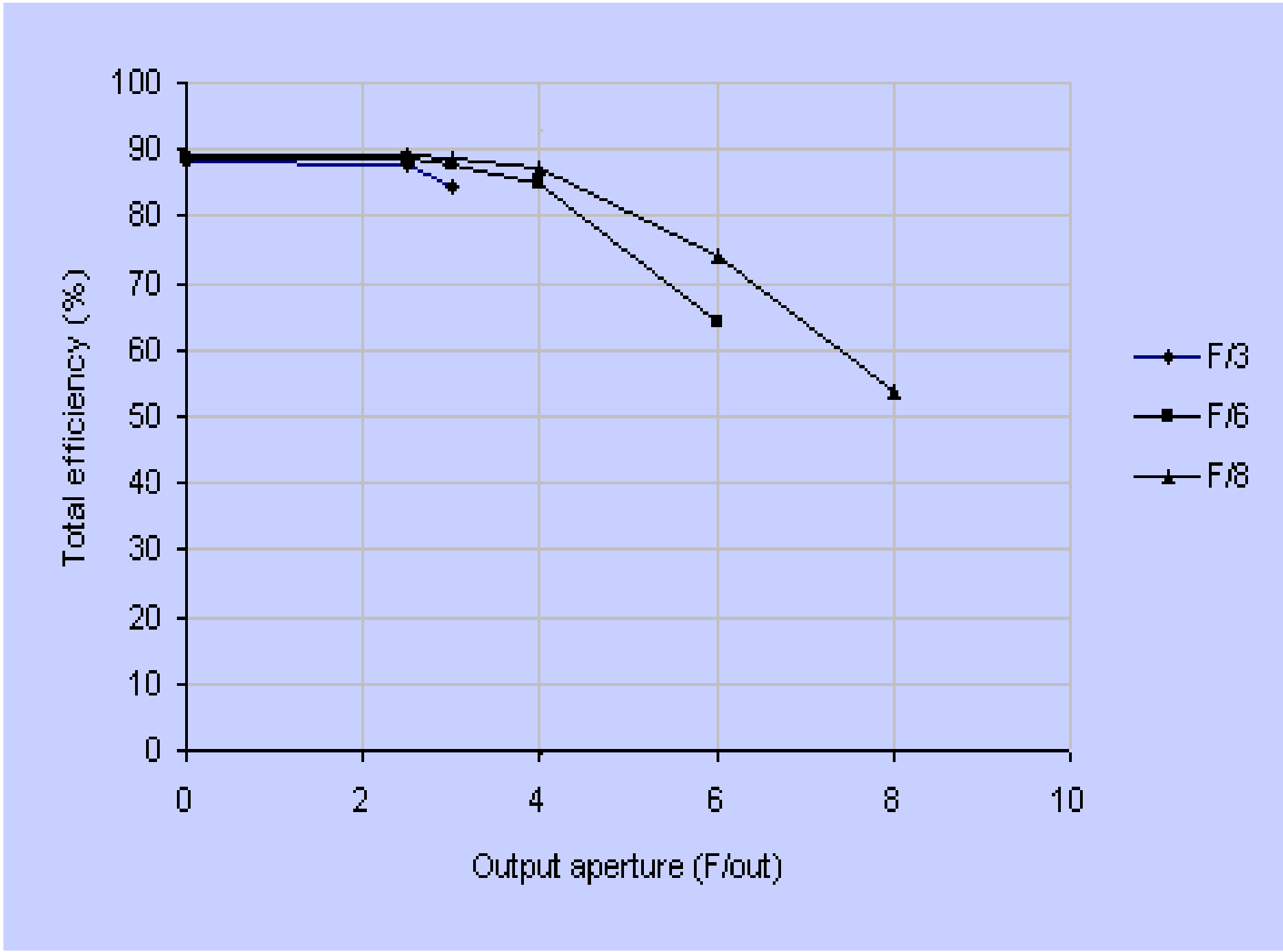

100
90
80
70
60
50
40
30
20
10
Total Transmission (%)
"Wet" Fibre
"Dry" Fibre
L = 26 m
300
400
500
600
700
800
900
1000
Wavelength (nm)

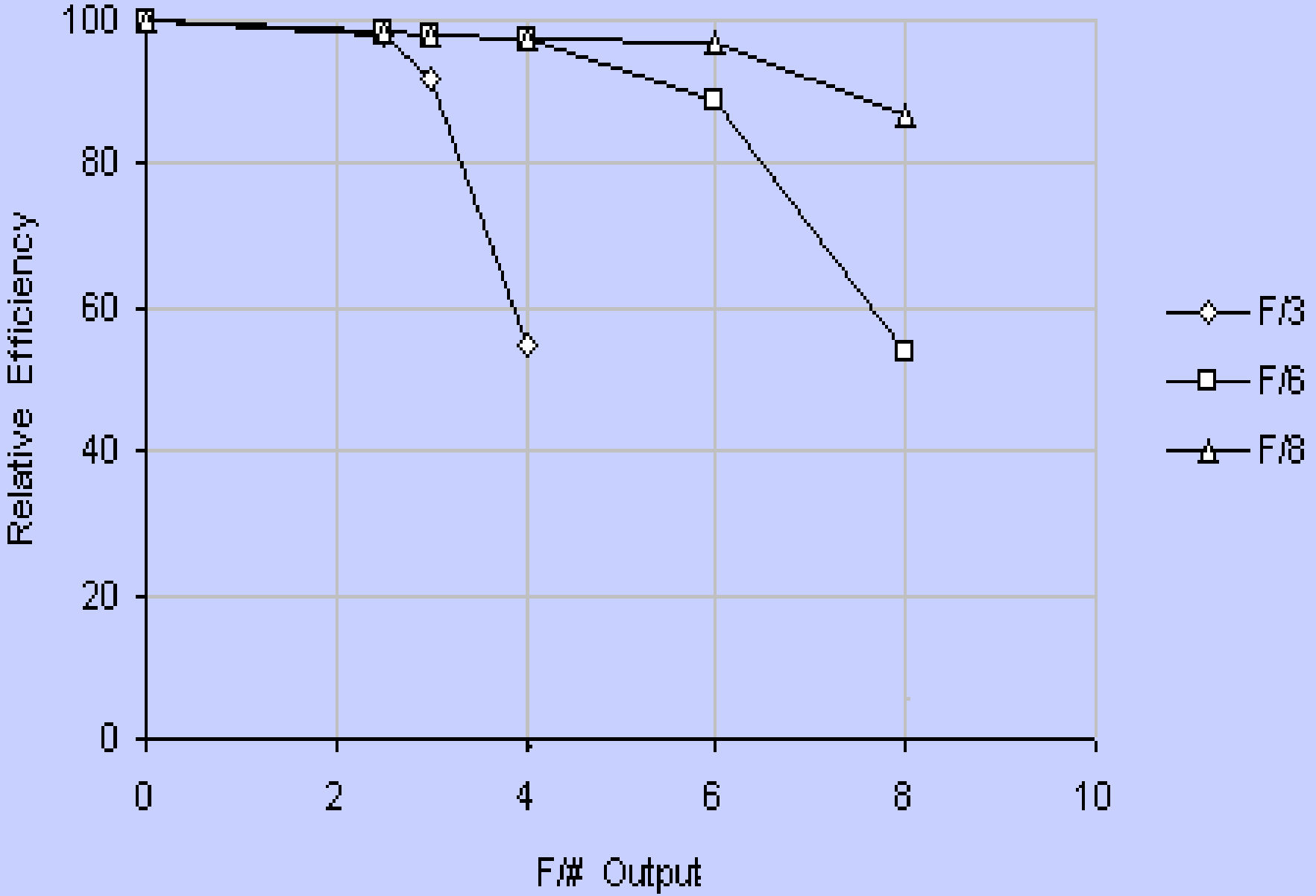
Ouverture des faisceaux

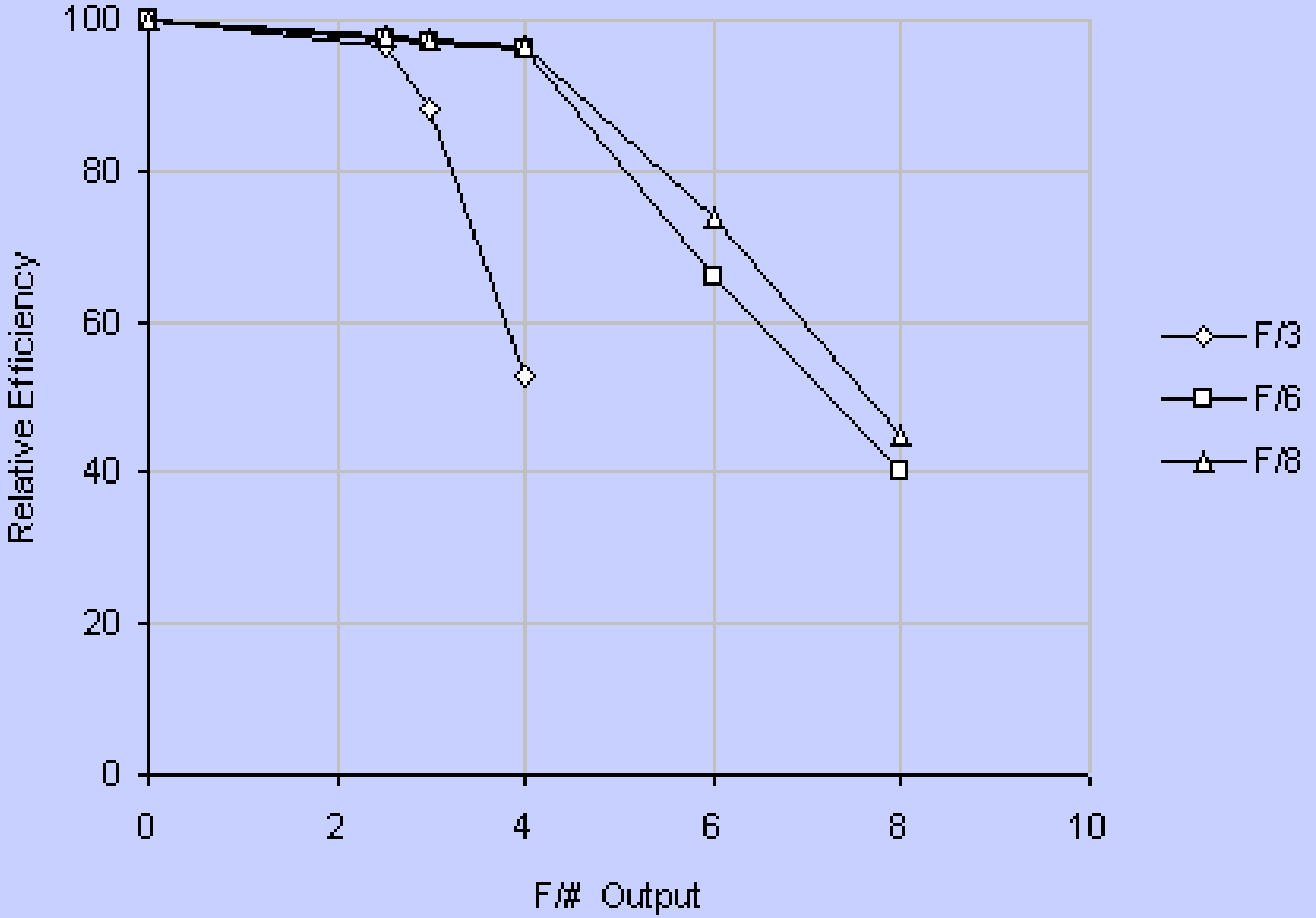


Adaptation d'ouverture si non, perte considérable de lumière

Avec les fibres : attention à la FRD (Focal Ratio Degradation)


100
90
80
70
60
50
40
30
20
10
0
Total efficiency (%)
0
2
4
6
8
10
Output aperture (F/out)
F/3
F/6
F/8


100
80
60
40
20
0
Relative Efficiency
0
2
4
6
8
10
F/# Output
F/3
F/6
F/8


100
80
60
40
20
0
Relative Efficiency
0
2
4
6
8
10
F/# Output
F/3
F/6
F/8

Quelques lois simples de la spectrographie

$\sin i + \sin i' = nk\lambda$

n = nb de raies du réseau
k = ordre du réseau
λ = longueur d'onde

$\cos i' di' = nkd\lambda$

Dans le cas Littrow, $i' = i$, donc $2\sin i = nk\lambda$

$2\ tgi/di = \lambda/d\lambda = R$, la résolution du spectrographe

$dx = f\ di$, donc **$R = 2tgi.f/dx$**

f est la focal de la chambre
dx est l'élément résolu

Un réseau blasé à 45° tgi = 1 c'est un R1
63° tgi = 2 c'est un R2
73° tgi = 4 c'est un R4

Un spectrographe avec un réseau R1, une focale de chambre de 250mm, un élément résolu de 0.025mm (2,5 fois un pixel de 10 µm), **R= 20 000**

Pour ce spectrographe, $2\sin i = nk\lambda$ $\sin i = 0.7$

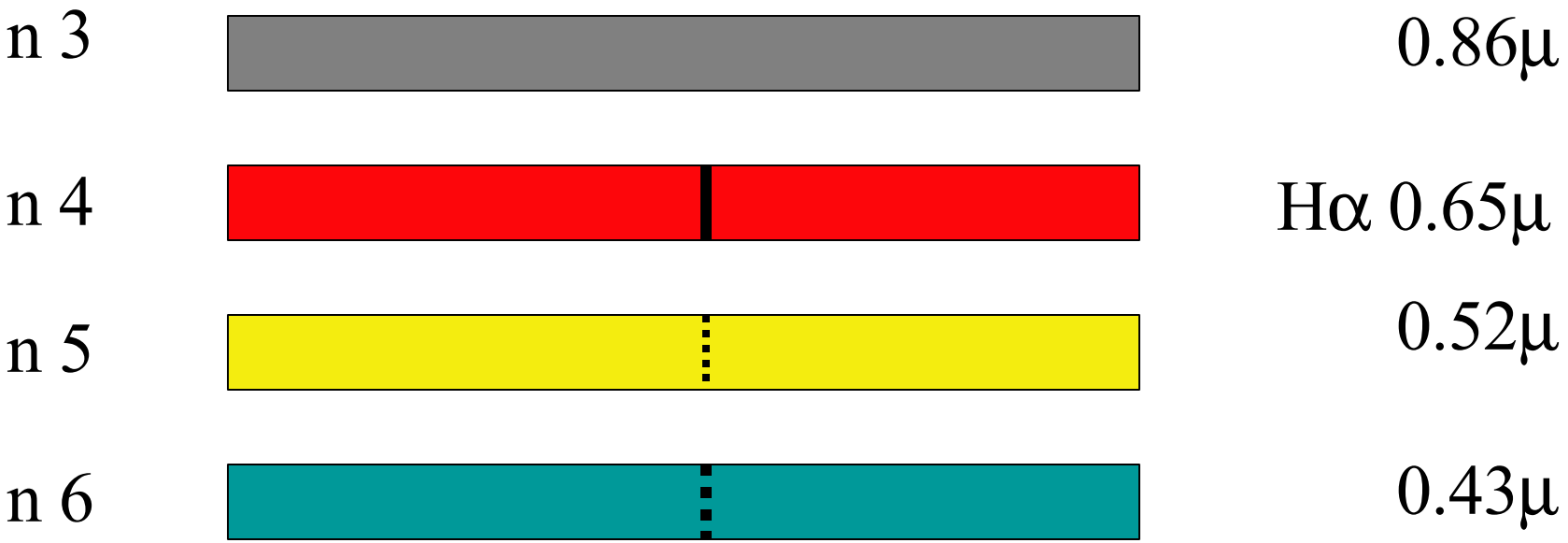
Pour **Hα, λ = 0,65μ** donc $1.4 = 0.65\ nk$

nk vaut donc 2.15 avec n tr/μ

Pour avoir **Hα** dans l'ordre **1**, n = **2150 tr/mm**

Pour avoir **Hα** dans l'ordre **4**, n = **500 tr/mm**

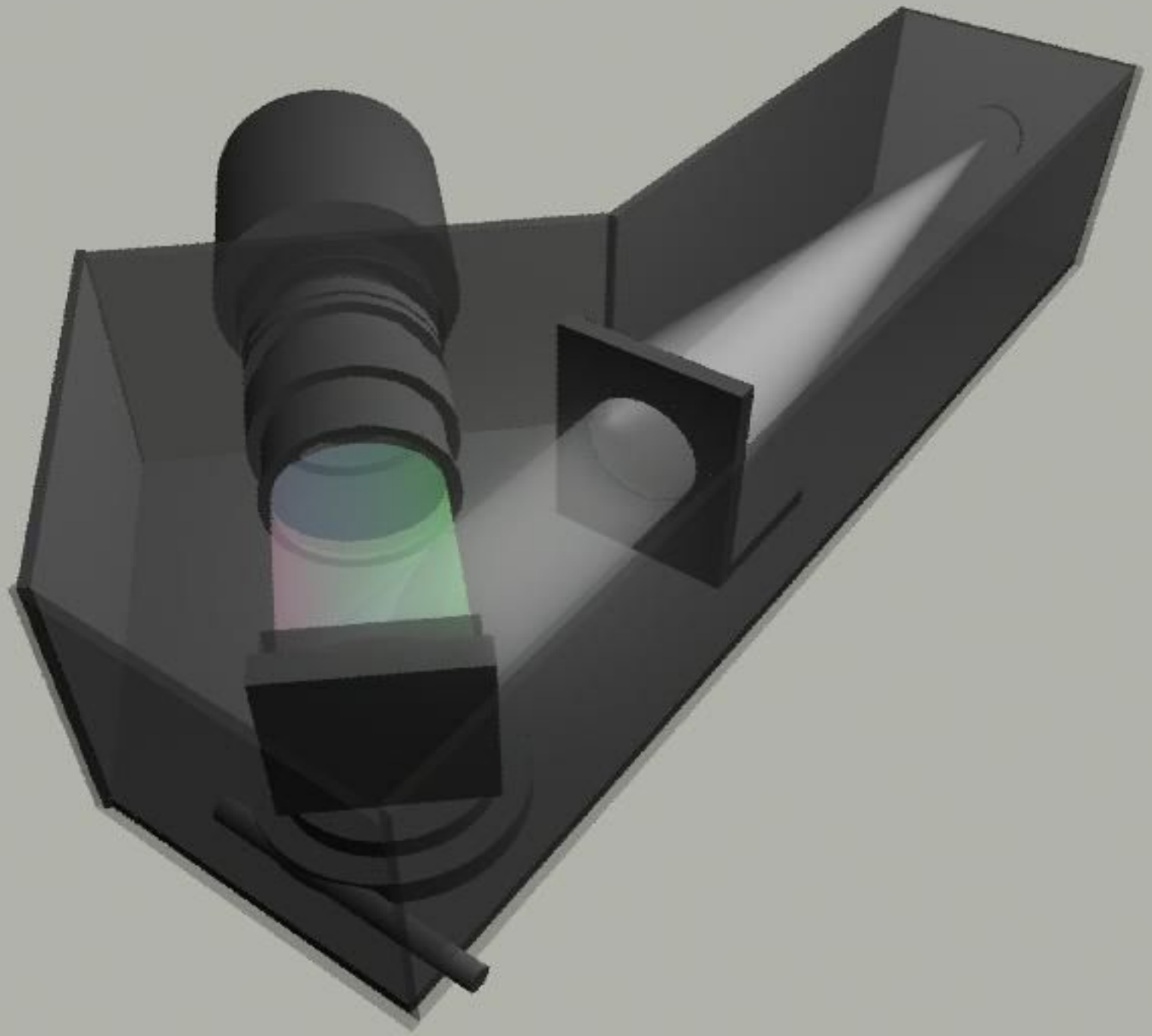
Superposition des ordres dans le visible

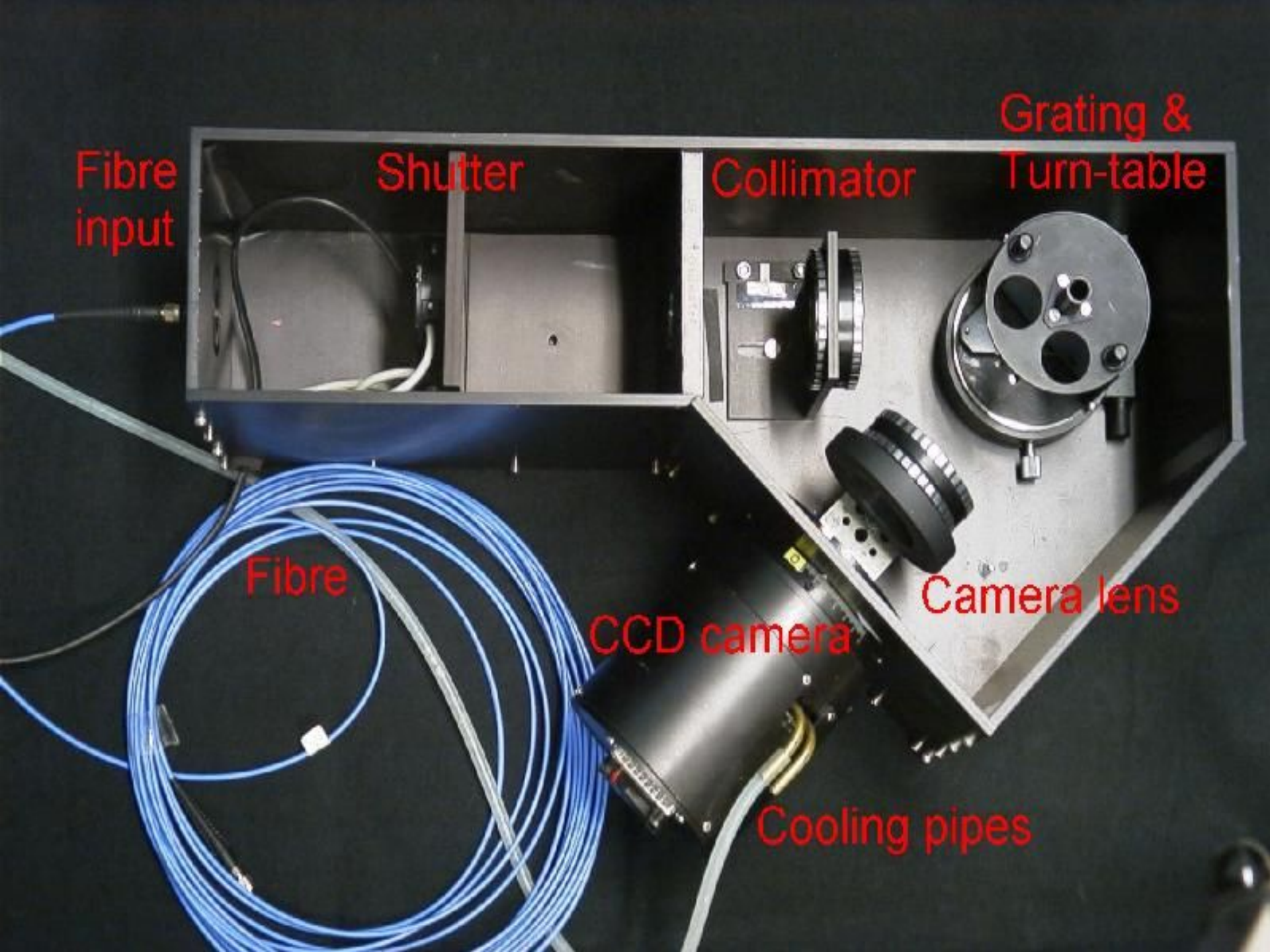


Séparation des ordres par filtres colorés ou 2D

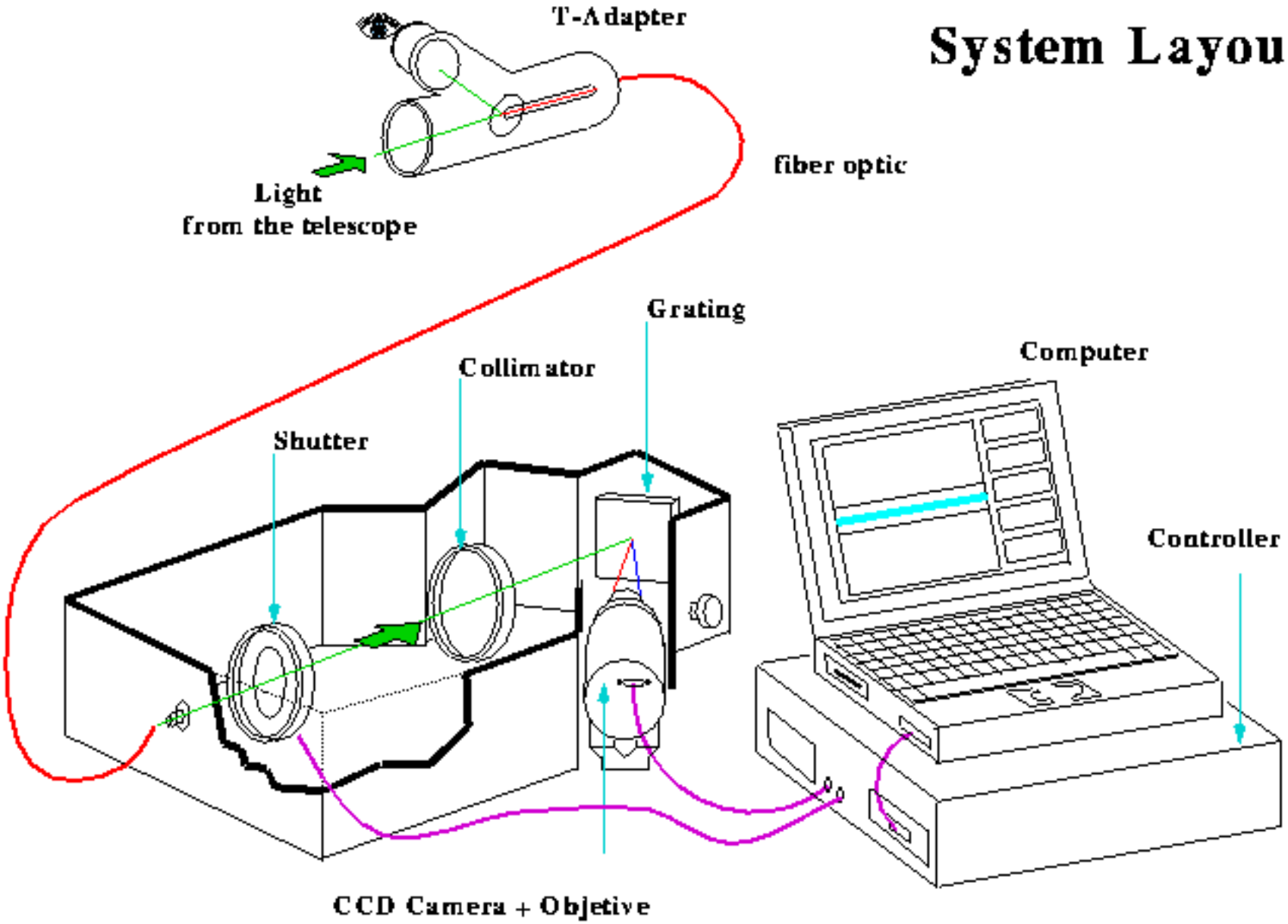
FIASCO

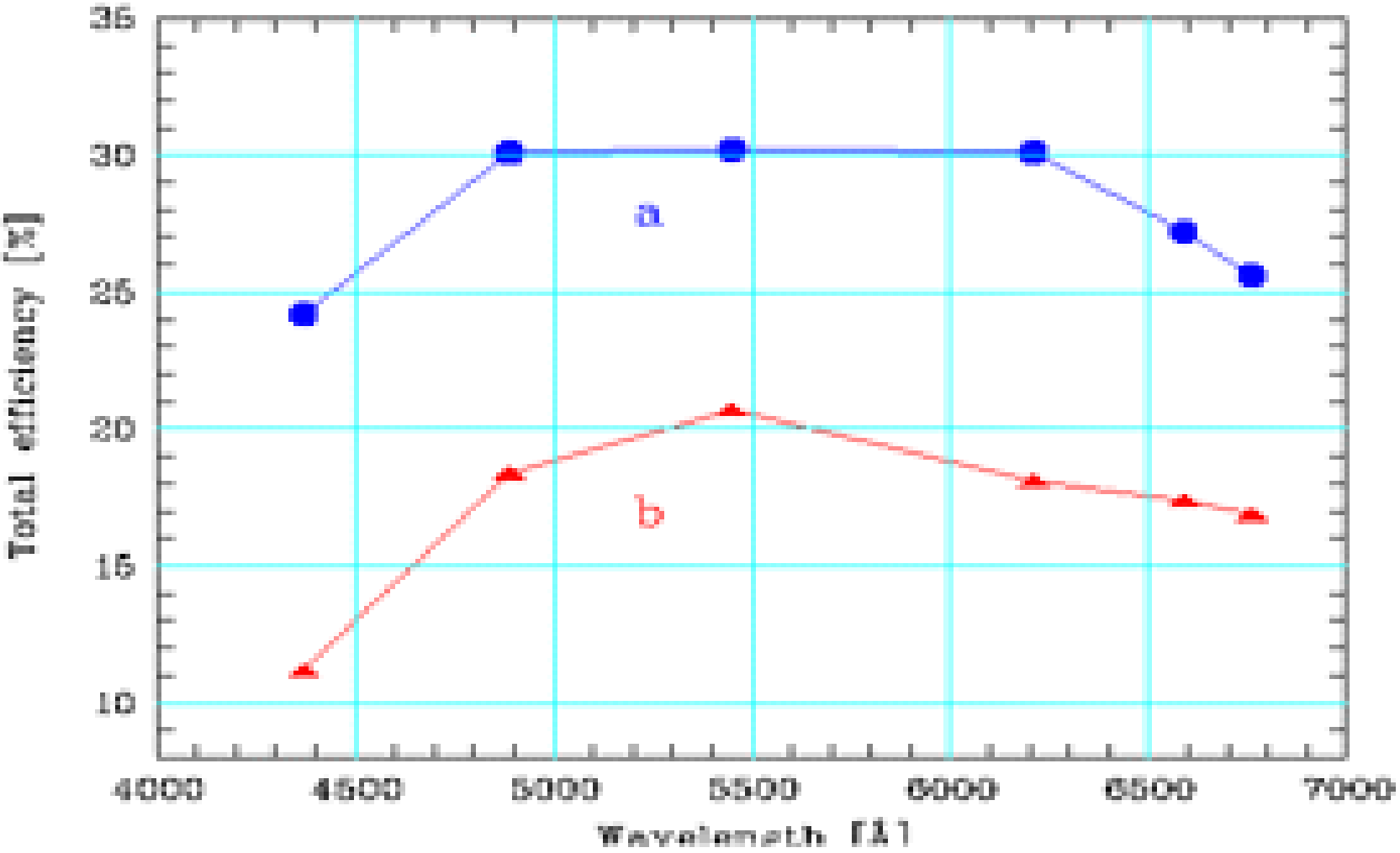
And the second generation came with FIASCO (FIbre Amateur Spectrograph Casually Organized).
We've built three of these spectograph, the first one with a 512x512 front illuminated CCD camera as detector (in fact, the same camera as in PONCHADO). The second one with a 512x512 back illuminated CCD camera. These first two cameras were manufactured by Hale Research (UK) unfortunately out of the market nowdays. The third FIASCO was built with a 1024x1024 back illuminated CCD camera from Finger Lakes (USA).



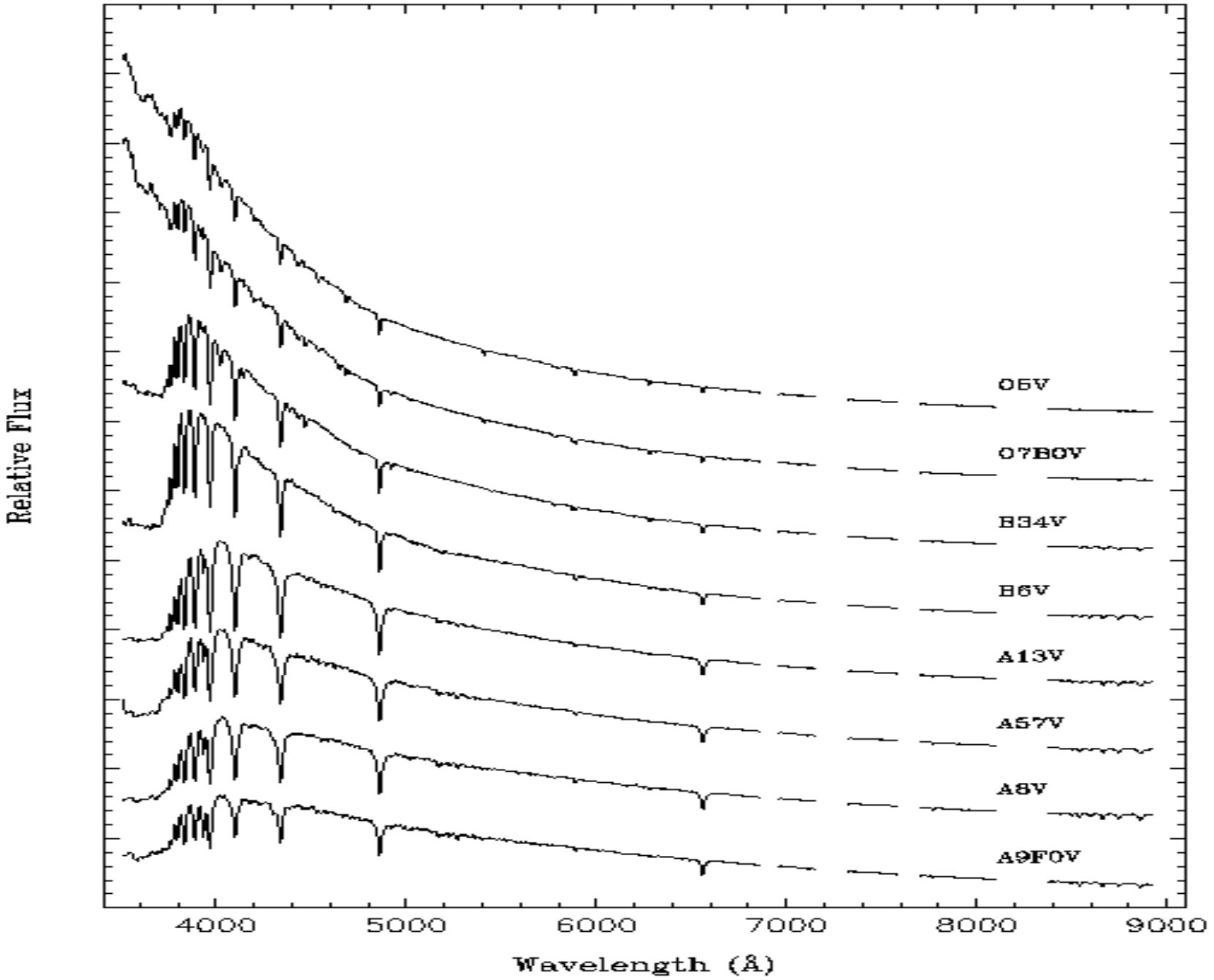

Fibre input
Shutter
Collimator
Grating & Turn-table
Fibre
CCD camera
Camera lens
Cooling pipes

System Layout





These curves show the total throughput of the fibre
and spectrograph optics: 135 microns fibre (including FRD);
Collimator; Grating (a) 600 grooves/mm and blazed to 500 nm,
(b) holographic 1200 grooves/mm; and objective Canon f 100


Relative Flux
O5V
O7B0V
B3 4V
B6V
A1 3V
A5 7V
A8V
A9F0V
4000
5000
6000
7000
8000
9000
Wavelength (Å)

Credit: The information of this page has been borrowed from University of Oregon (Department of Physics)

All of the relevant technical details about this data can be found in the Astrophysical Journal paper by Silva and Cornell (1992)