

Deconvolution of fiber spectra in IFU spectrographs

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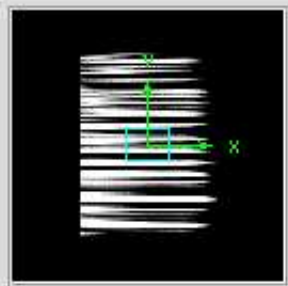
The problem

Fibers are very packed and the spectrum of one superposes to the other in the spatial direction.

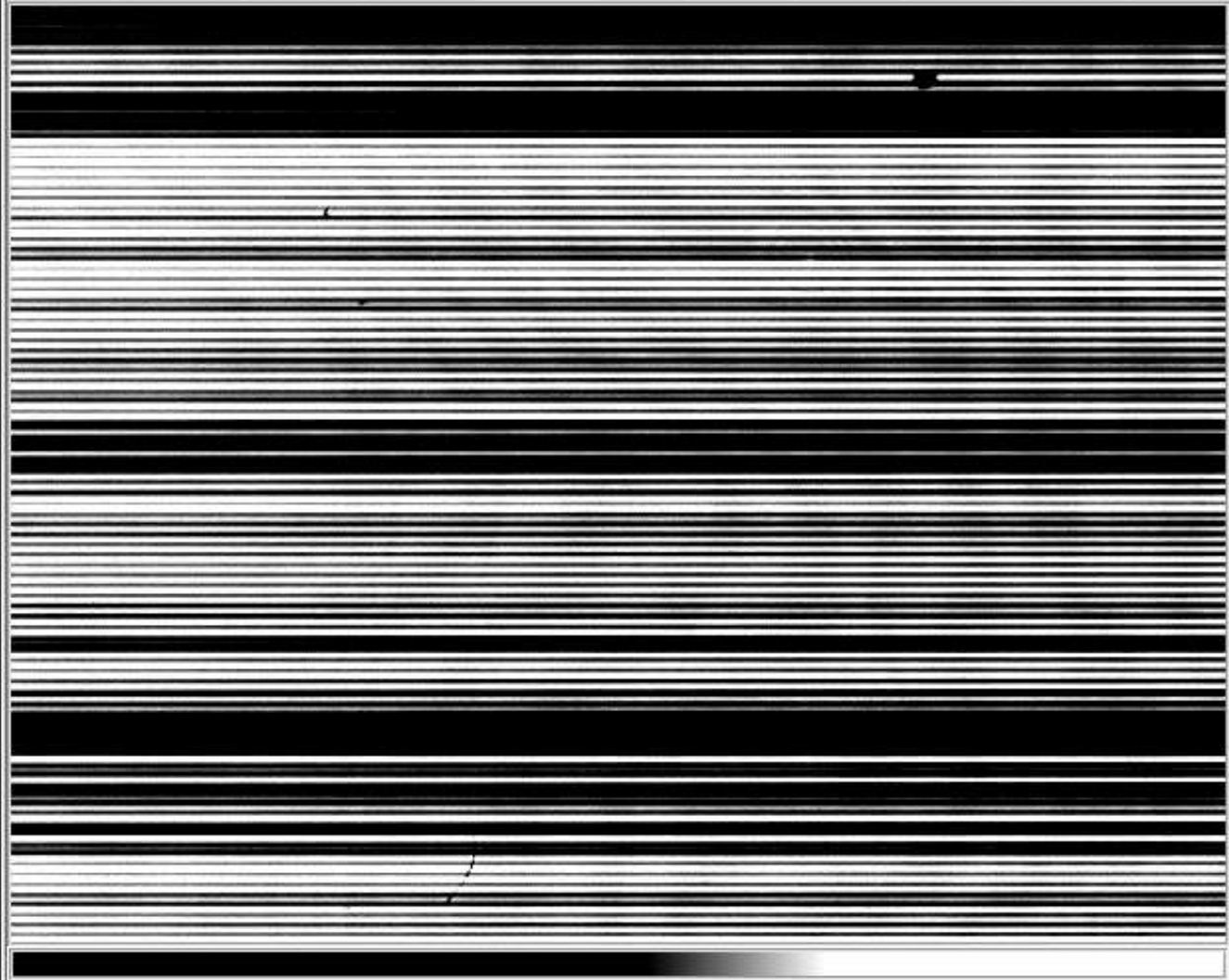
SAOImage ds9

File Edit Frame Bin Zoom Scale Color Region Analysis Help

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WCS	<input type="text"/>			
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Image	X	<input type="text"/>	Y	<input type="text"/>
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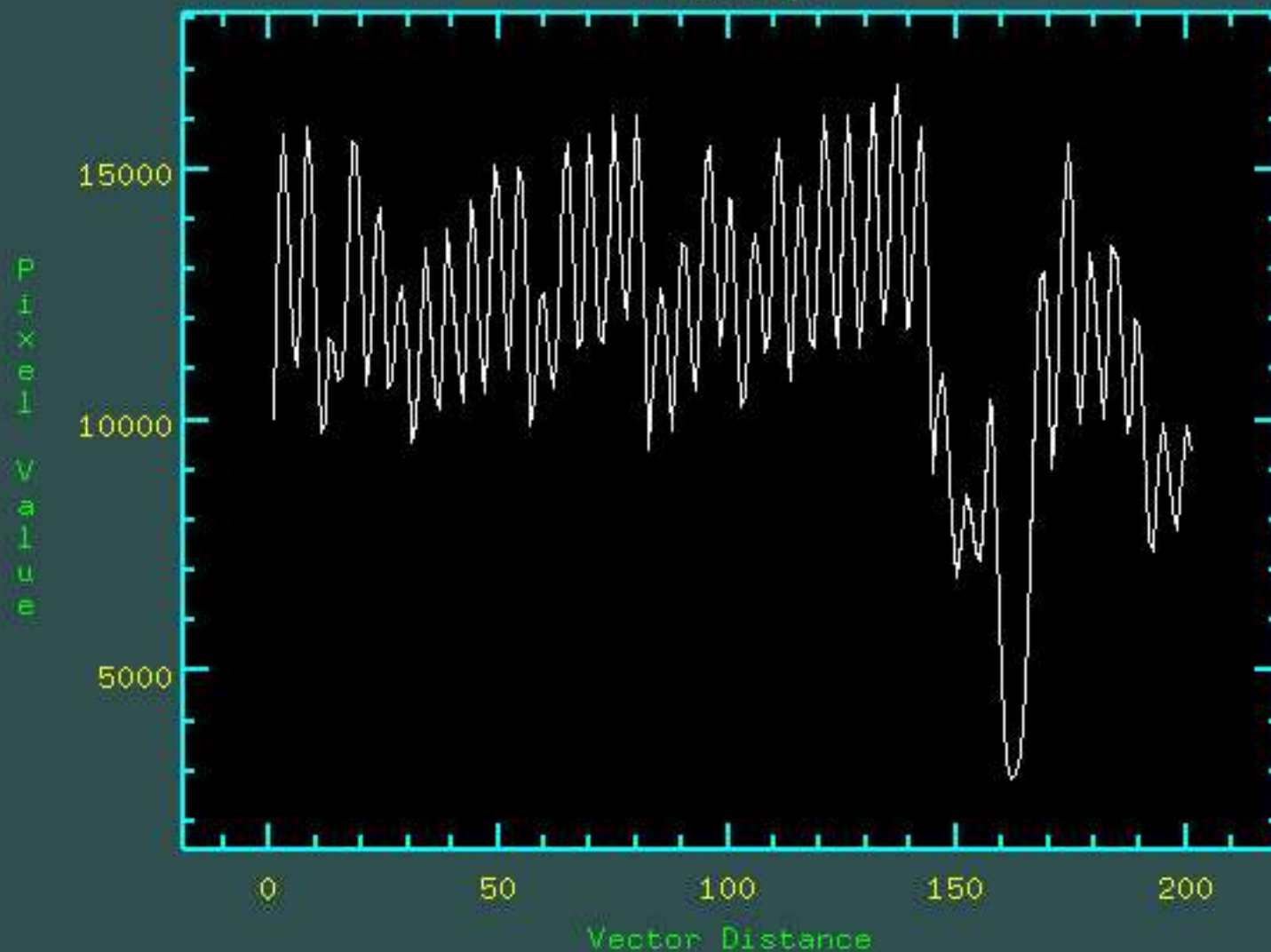


File	Edit	Frame	Bin	Zoom	Scale	Color	Region			
new	delete	reset	clear	single	tile	blink	first	prev	next	last



X xgterm <2>

NOAO/IRAF V2.12EXPORT kanaan@chamaeleon Mon 19:35:42 17-Nov-2003
fla0001: Vector 1028,0,1463,0 to 1028,0,1663,0 naverage: 1
Flat Cup

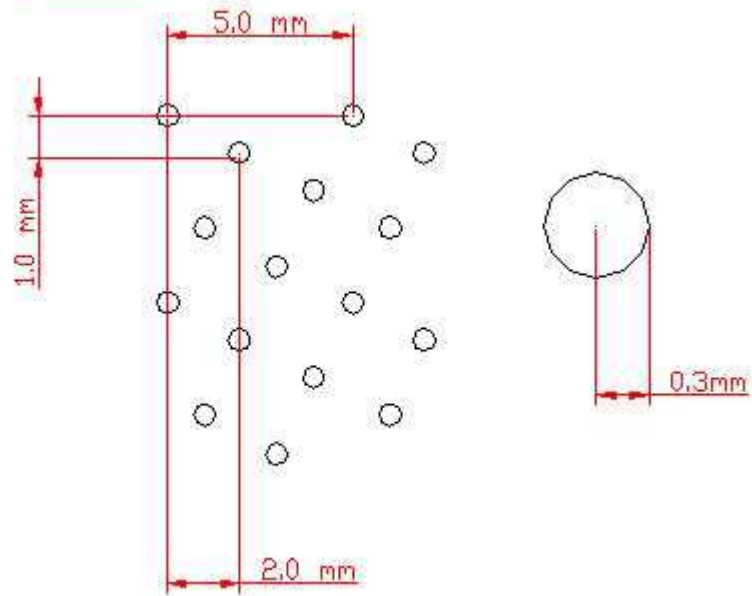
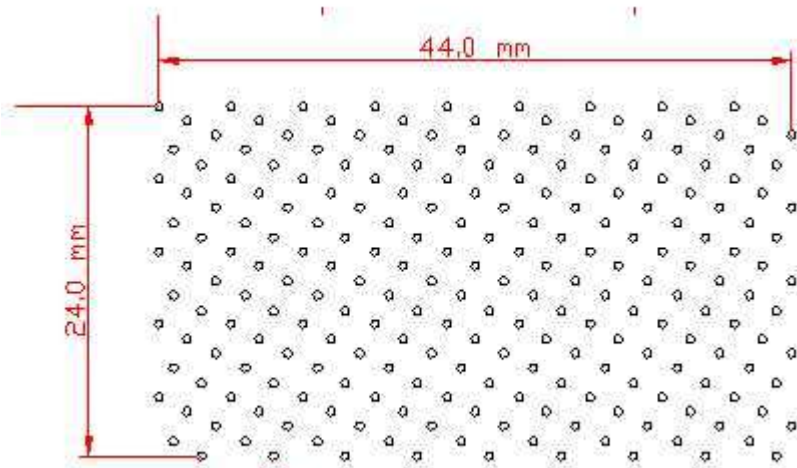


The Solution

If (and only if), we know the position and width of the spectrum, of each fiber for all wavelengths on the CCD, then it is possible to determine the amount of light incident upon each fiber.

We can do that by fitting the amplitude of Gaussian profiles to column cuts (perpendicular to dispersion) across the detector. The number of Gaussians in the fit equals the number of fibers.

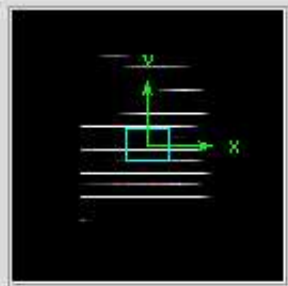
As the amplitude is the only free parameter the fit is linear (fast and with a unique solution).



SAOImage ds9

File Edit Frame Bin Zoom Scale Color Region Analysis Help

File	mask-00-00-0001			
Value	634.824			
WCS				
Physical	X		Y	
Image	X	973.000	Y	1545.000
Frame3	Zoom	1.000	Ang	0.000

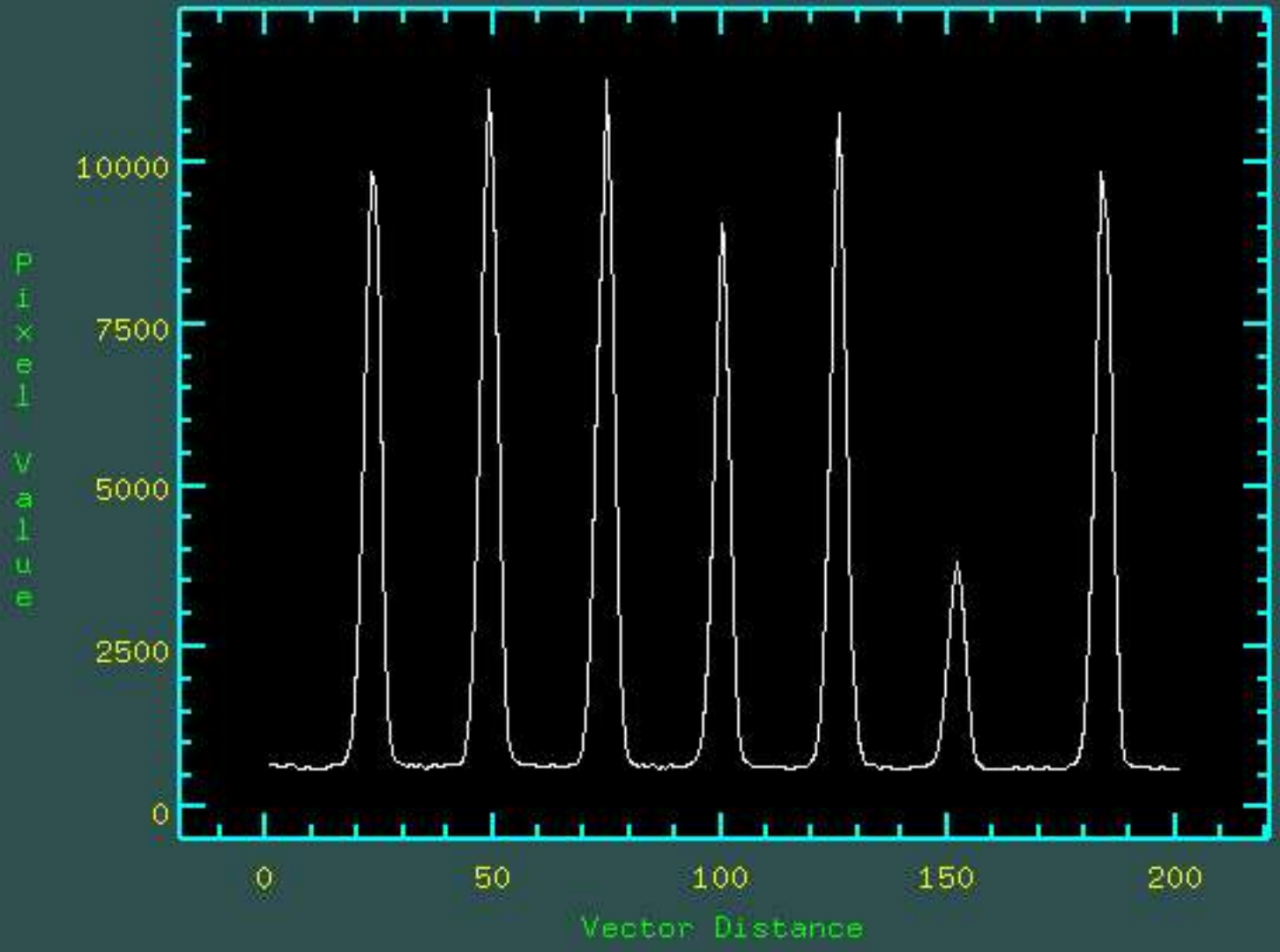


File	Edit	Frame	Bin	Zoom	Scale	Color	Region			
new	delete	reset	clear	single	tile	blink	first	prev	next	last

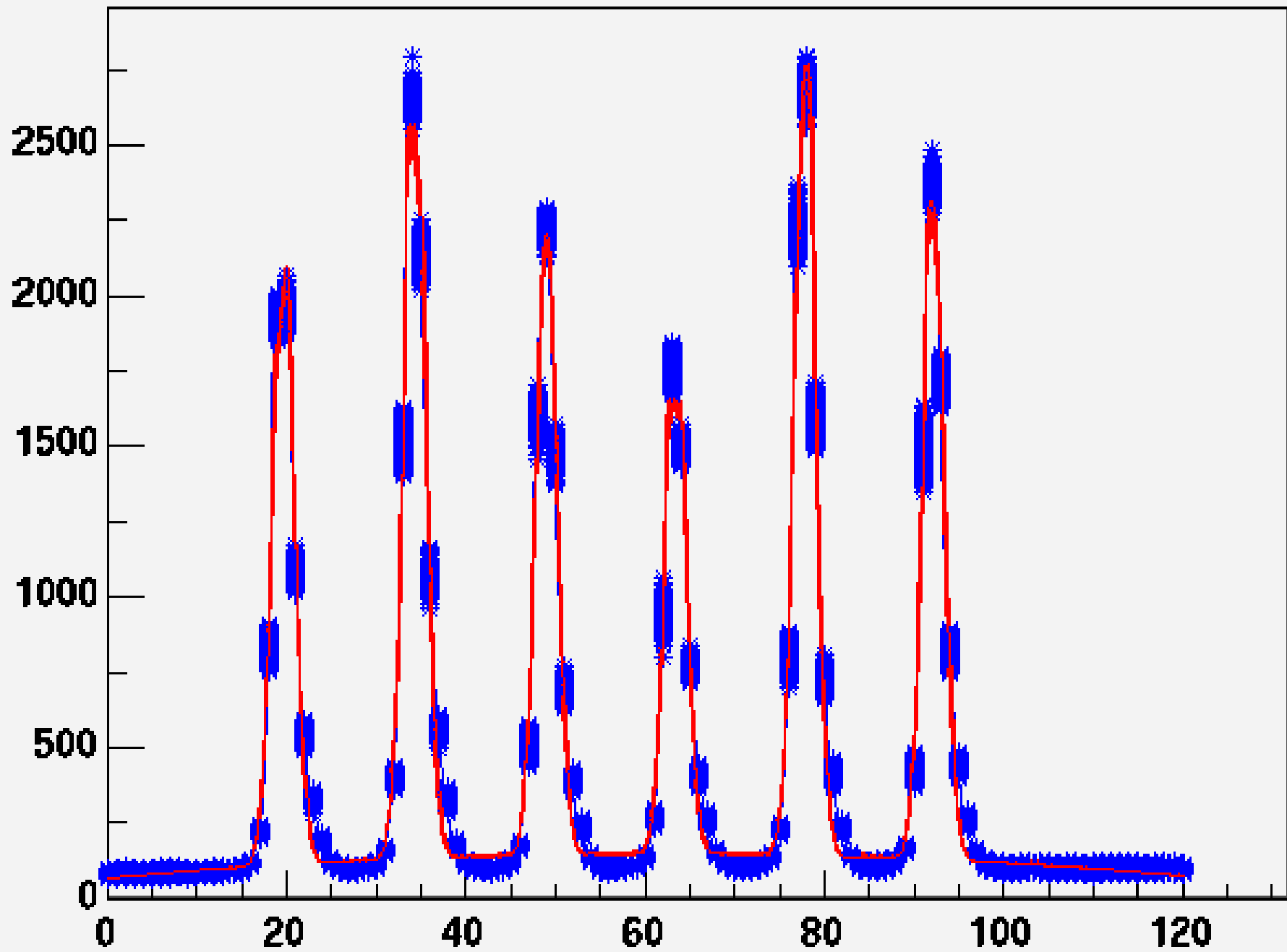


xgtem <2>

NOAO/IRAF V2.12EXPORT kanaan@chamaeleon Mon 19:40:40 17-Nov-2003
mask-00-00-0001: Vector 1028,0,1463,0 to 1028,0,1663,0 naverage: 1
Mascara Pos 1



Blue - data / Red - Fit



First column

Second column

22.976294	2.782051	4518.129551	22.971247	2.759398	6040.768151
52.263676	2.772491	4754.801525	52.266361	2.773320	6327.607861
77.889743	2.584905	4447.021684	77.889737	2.597942	5917.558567
103.563609	2.636976	4713.733319	103.565300	2.642508	6293.958630
129.424372	2.669595	3537.411800	129.428874	2.676539	4711.005995

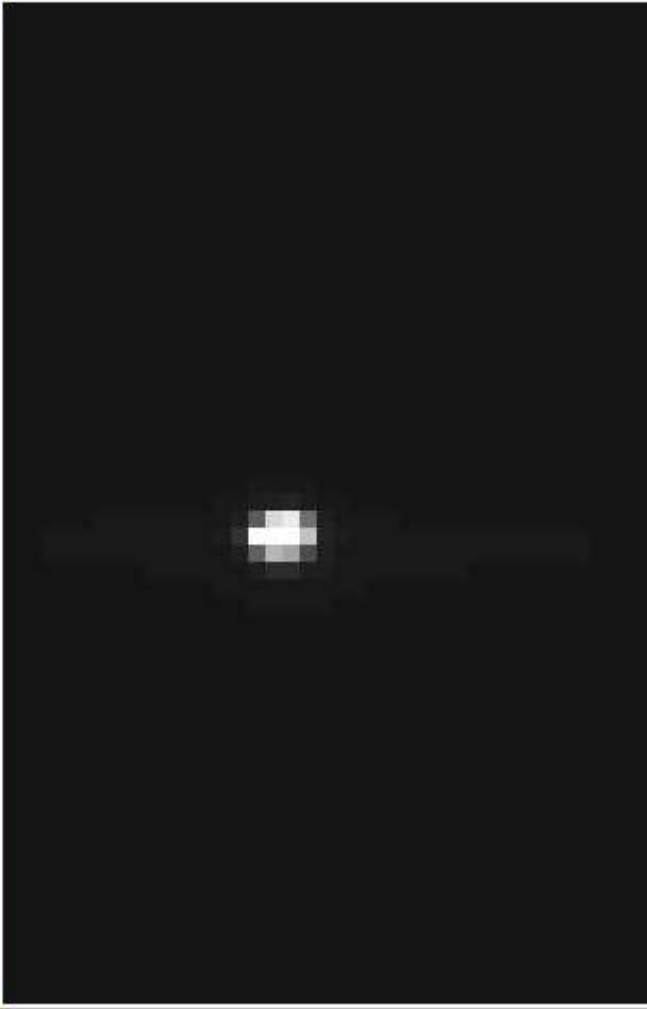
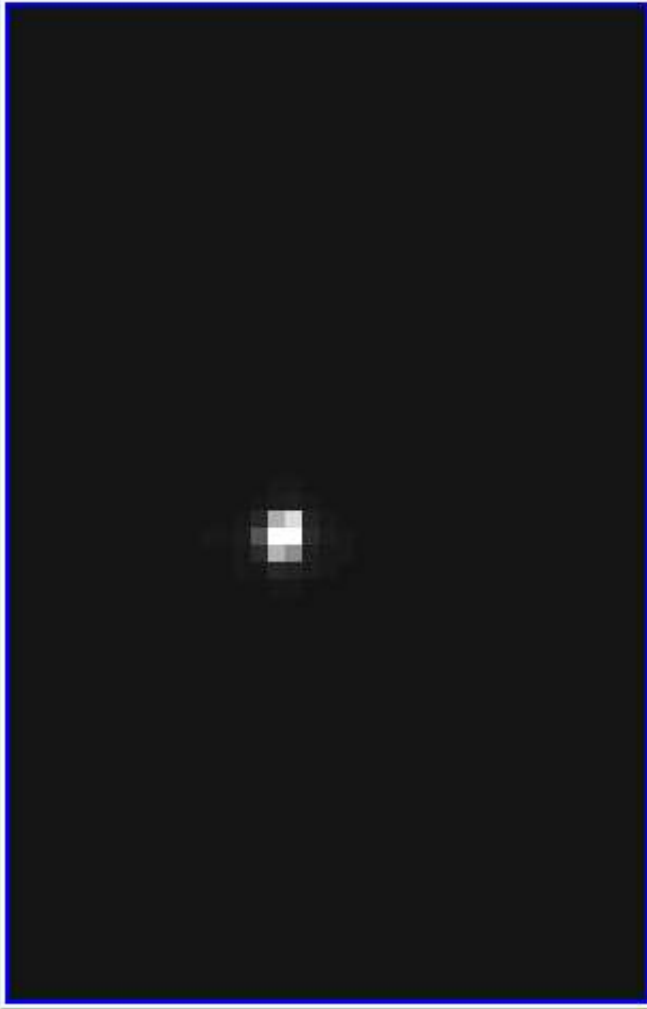
SAOImage ds9

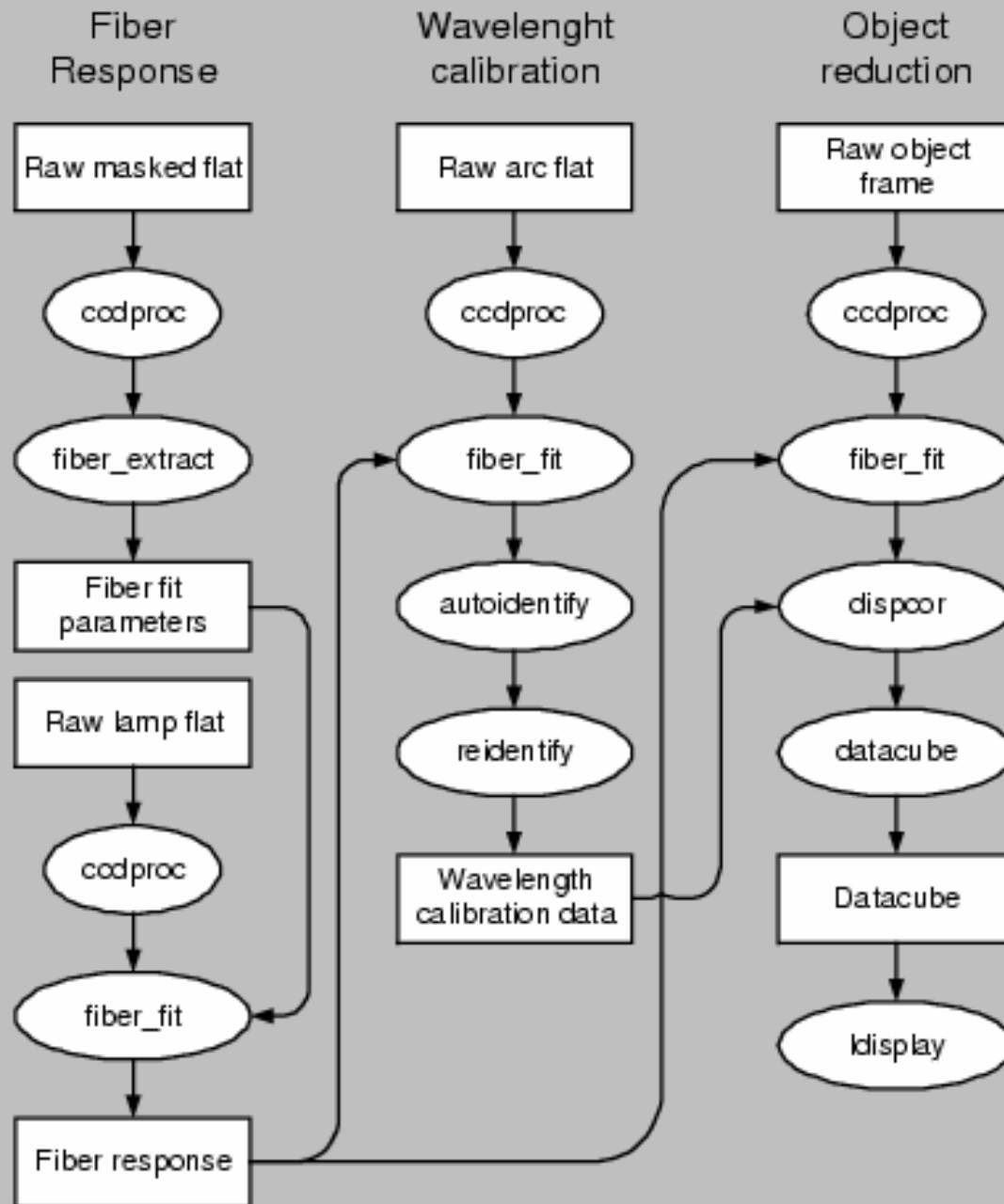
File Edit Frame Bin Zoom Scale Color Region Analysis Help

File	obj0002.lin.ldisp			
Value	<0			
WCS				
Physical	X		Y	
Image	X	10.375	Y	26.500
Frame1	Zoom	8.000	Ang	0.000



File	Edit	Frame	Bin	Zoom	Scale	Color	Region			
new	delete	reset	clear	single	tile	blink	first	prev	next	last





A complete IRAF package is currently in use for EUCALYPTUS data reduction.

<http://www.astro.ufsc.br/~kanaan/ifu>

The software will need some adaptations to run smoothly on SOAR, but it is modular enough that most fundamental differences can simply be reconfigured by changing configuration files.

How far can we go? That is, how much can we pack?

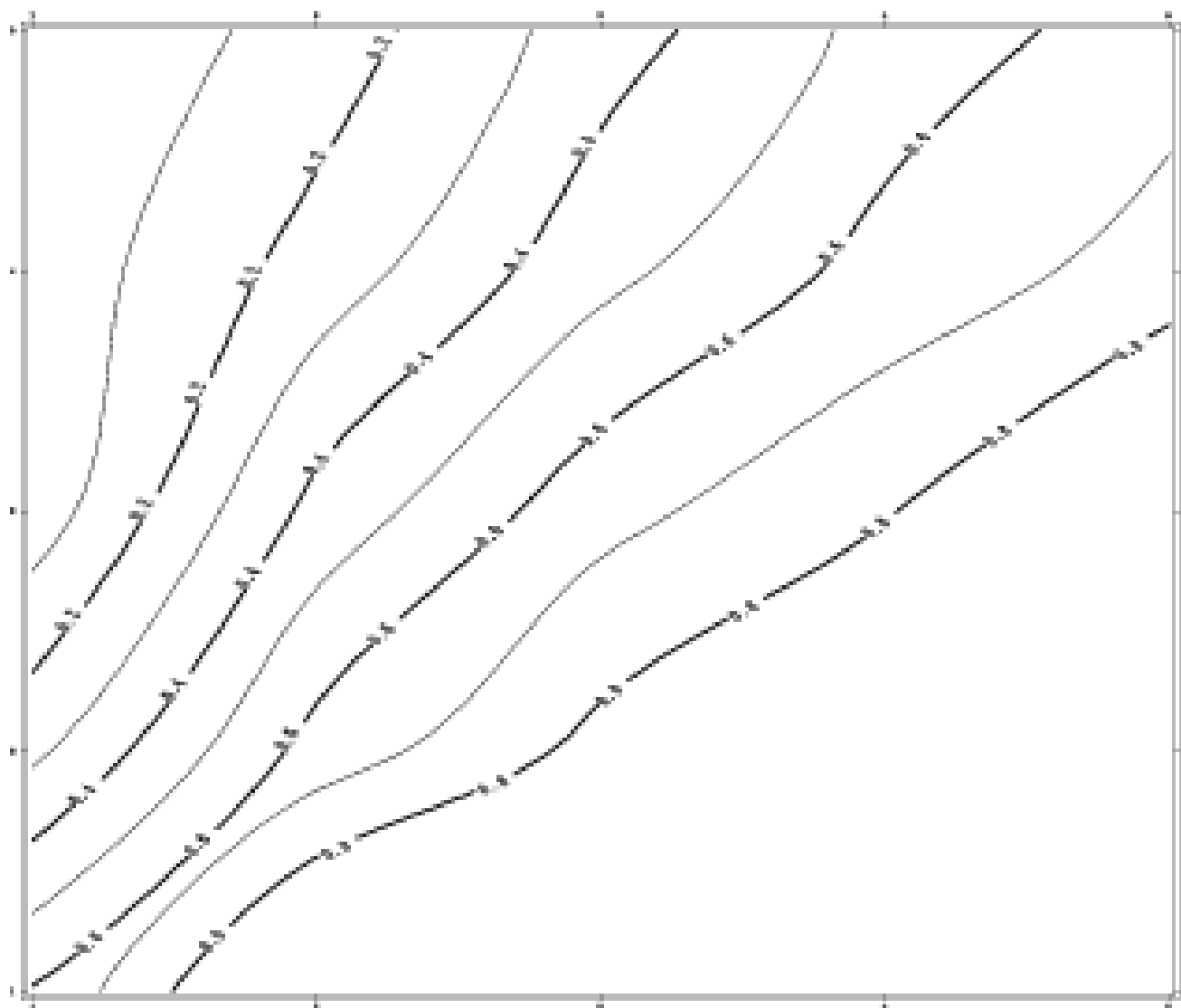
To answer that, we wrote a simulator to produce different situations of fiber spacing (a) and fiber width (s).

We then created artificial IFU spectra of different characteristics and extracted these spectra using Gaussian fits and aperture extraction.

The final goal is to map this out contamination as a function of a , s , SN and sampling rates.

For now, take a look how it is at high SN (=100):

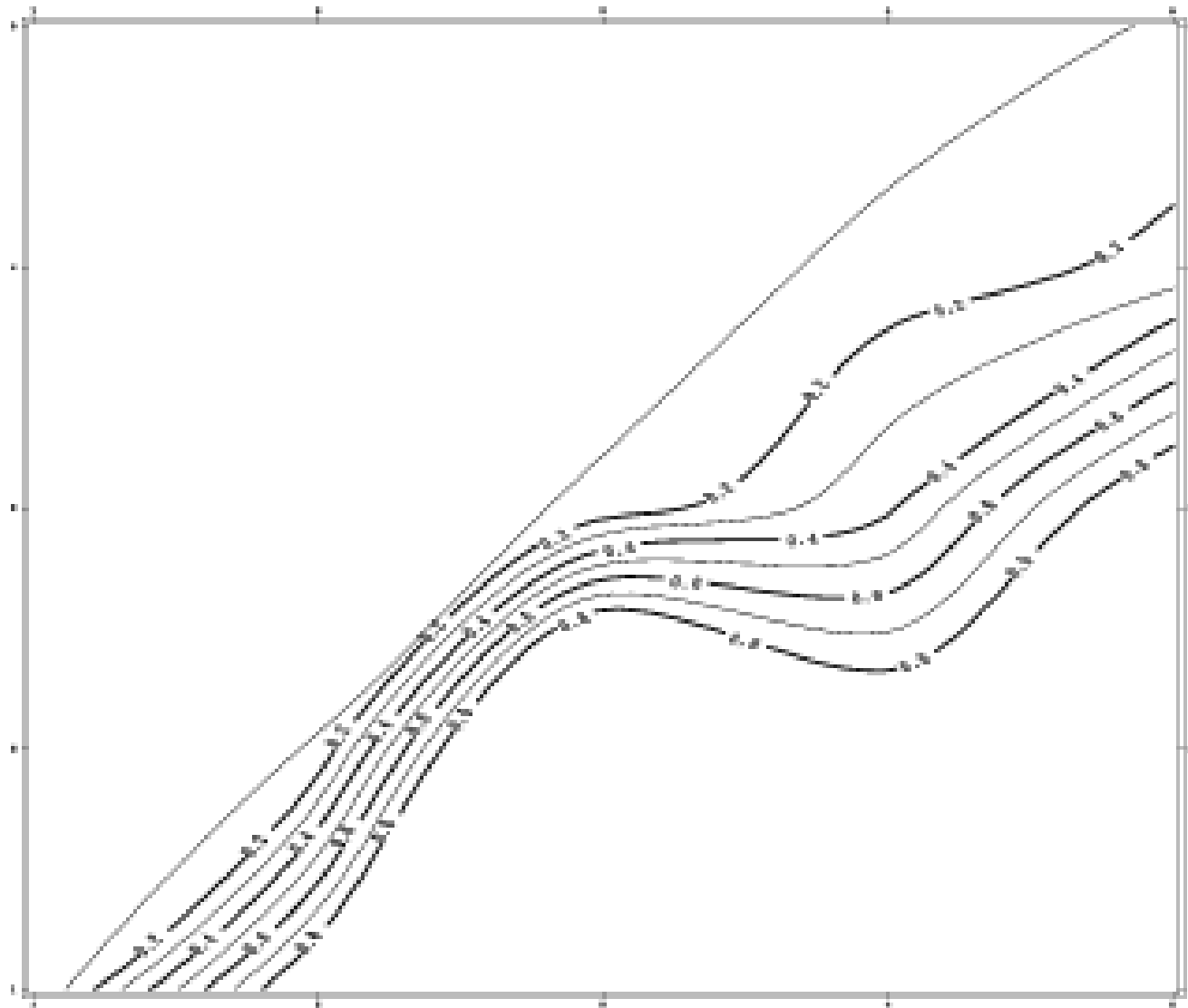
Aperture extraction - y spacing - x fibers width in sigmas



contoured from 8.1 to 0.0, interval = 0.1

SKAO/IRAF 22.1000002 kassio@chamelaon Mon 22:08:16 19-Nov-2006

Gaussian fits - y spacing - x fibers width in sigma



contoured from 0.1 to 0.0, interval = 0.1

RMAS/IRAP VL-10051002 kumar@kumar-0000 Sun 20:07:03 17-Nov-2000

To see results from users, visit posters:

51 , João Francisco dos Santos

17, Alexandre Oliveira + João Steiner

To be done:

- 1) Improve documentation
- 2) Improve error handling (it currently works fine if you do everything right)
- 3) Prepare for changes when SIFS is ready to go on SOAR.
- 4) Run the simulations for other values of SN.
- 5) Write / adapt 3D analysis software. (not part of original “contract”)

