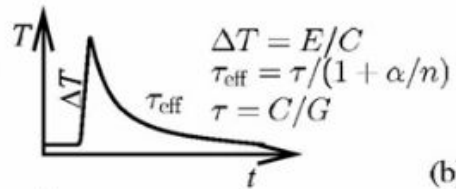
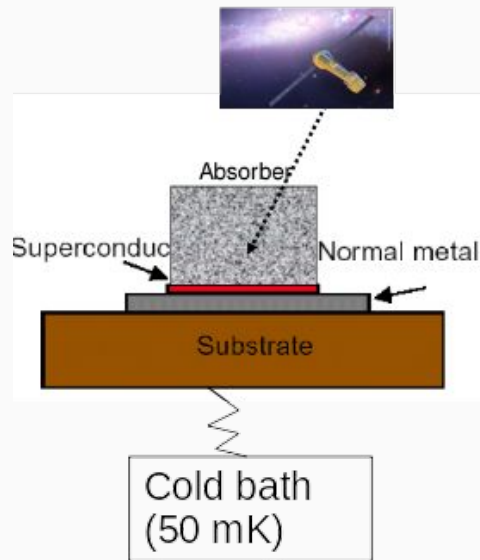




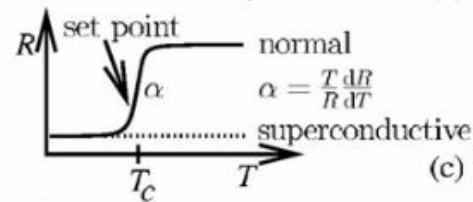
Software to process X-IFU event simulations

Bea Cobo

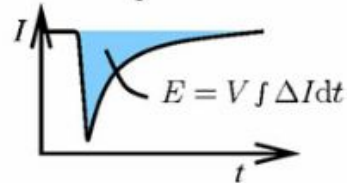
The context



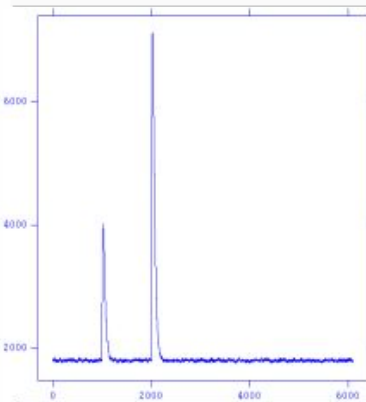
(b)



(c)



(d)



algorithms

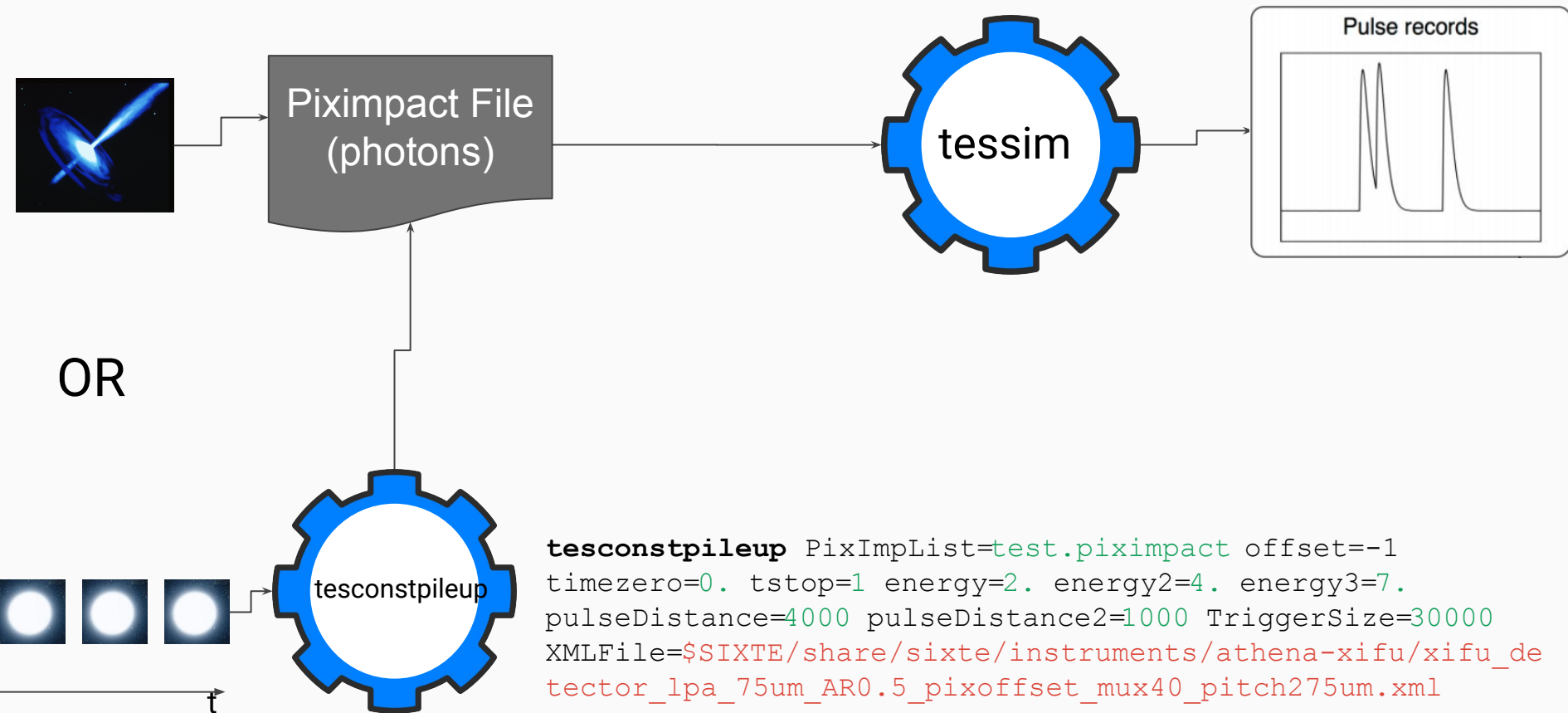


Photons 

detector 

pulses 

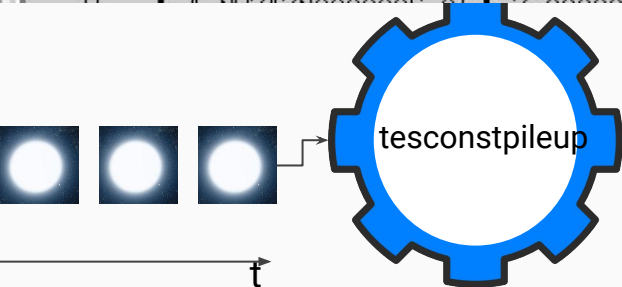
Time,
Energy



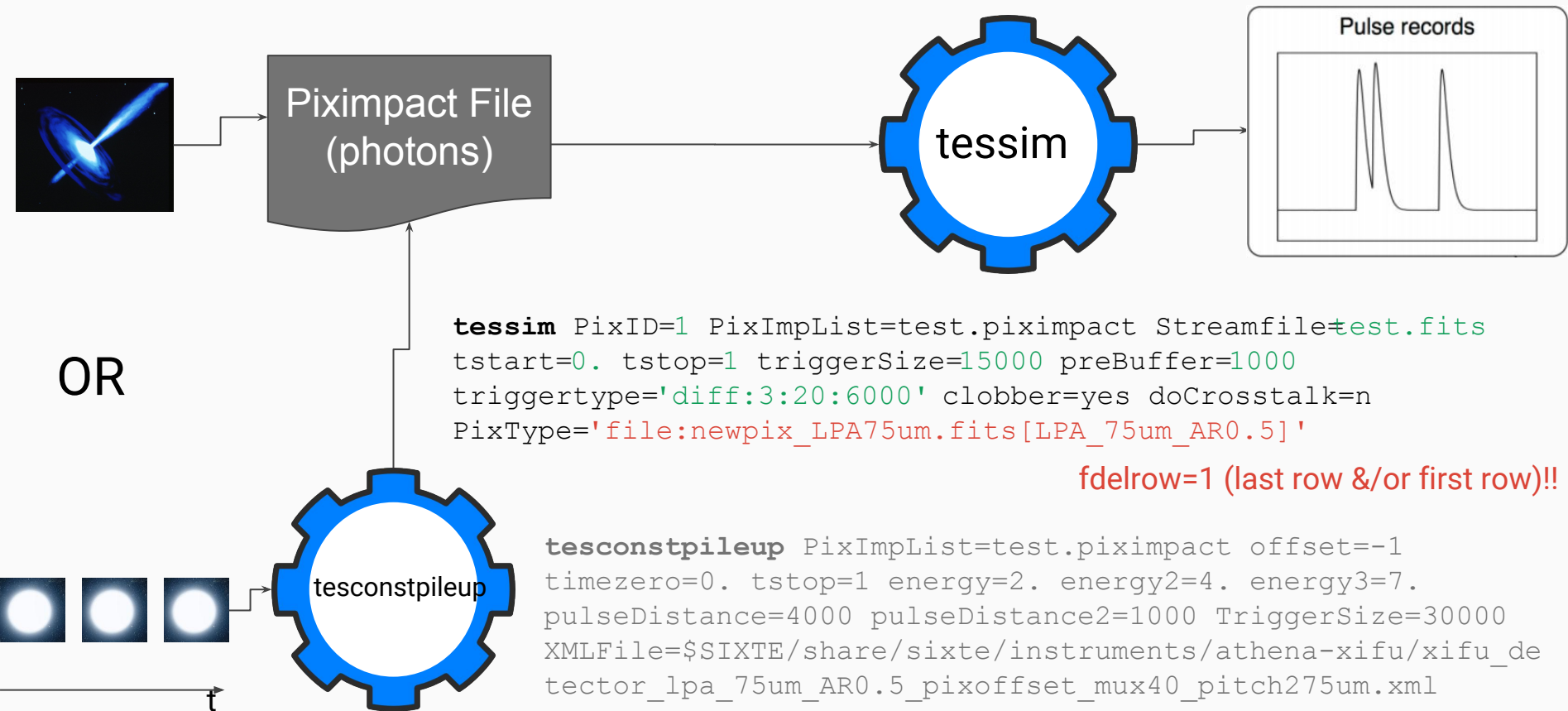
The data: simulated pulses

<https://sirena.readthedocs.io>

File Edit Tools Help						
	☒ TIME	☒ ENERGY	☒ X	☒ Y	☒ PH_ID	☒ SRC_ID
Select	D	E	D	D	J	J
☒ All	s	keV	m	m		
Invert	Modify	Modify	Modify	Modify	Modify	Modify
1	6.467200000000E-03	2.000000E+00	-9.623000000000E-03	2.000000000000E-06	1	0
2	3.206720000000E-02	4.000000E+00	-9.623000000000E-03	2.000000000000E-06	2	0
3	3.846720000000E-02	7.000000E+00	-9.623000000000E-03	2.000000000000E-06	3	0
4	1.991072000000E-01	2.000000E+00	-9.623000000000E-03	2.000000000000E-06	4	0
5	2.247072000000E-01	4.000000E+00	-9.623000000000E-03	2.000000000000E-06	5	0
6	2.311072000000E-01	7.000000E+00	-9.623000000000E-03	2.000000000000E-06	6	0
7	3.917472000000E-01	2.000000E+00	-9.623000000000E-03	2.000000000000E-06	7	0
8	4.173472000000E-01	4.000000E+00	-9.623000000000E-03	2.000000000000E-06	8	0



```
tesconstpileup PixImpList=test.piximpact offset=-1  
timezero=0. tstop=1 energy=2. energy2=4. energy3=7.  
pulseDistance=4000 pulseDistance2=1000 TriggerSize=30000  
XMLFile=$SIXTE/share/sixte/instruments/athena-xifu/xifu_de  
tector_lpa_75um_AR0.5_pixoffset_mux40_pitch275um.xml
```



The data: simulated pulses

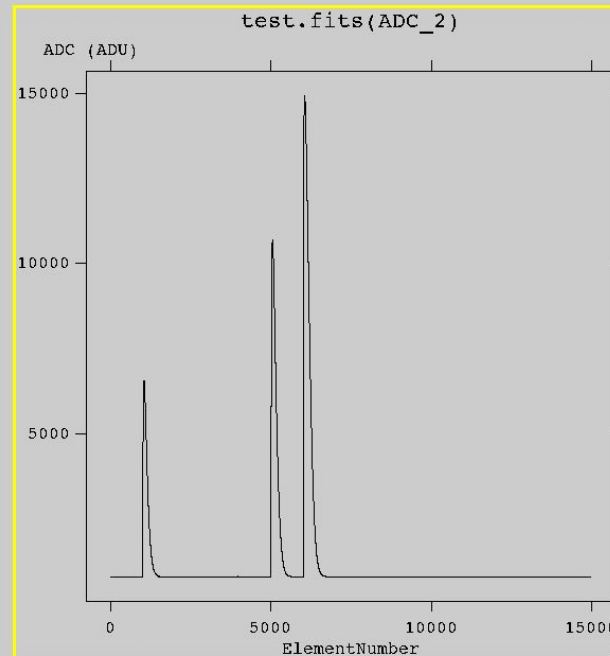
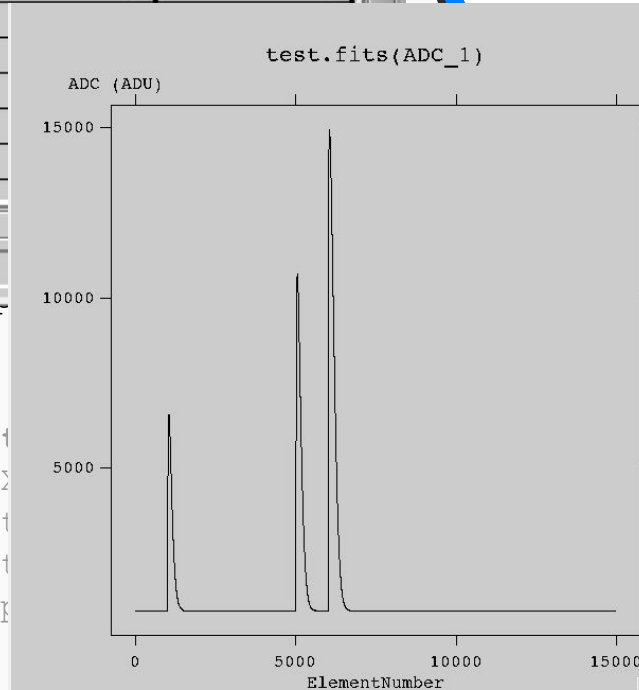
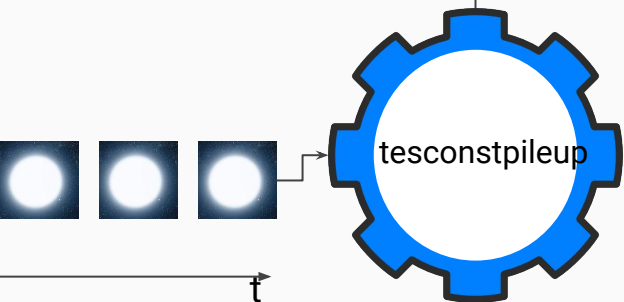
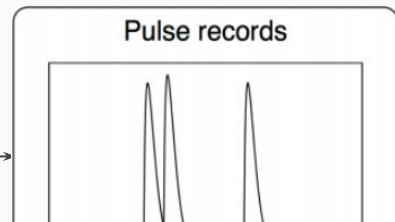
<https://sirena.readthedocs.io>

File Edit Tools Help

	TIME	ADC	PIXID	PH_ID
Select	1D	15000I	1J	1PJ
■ All	s	ADU		
Invert	Modify	Modify	Modify	Modify

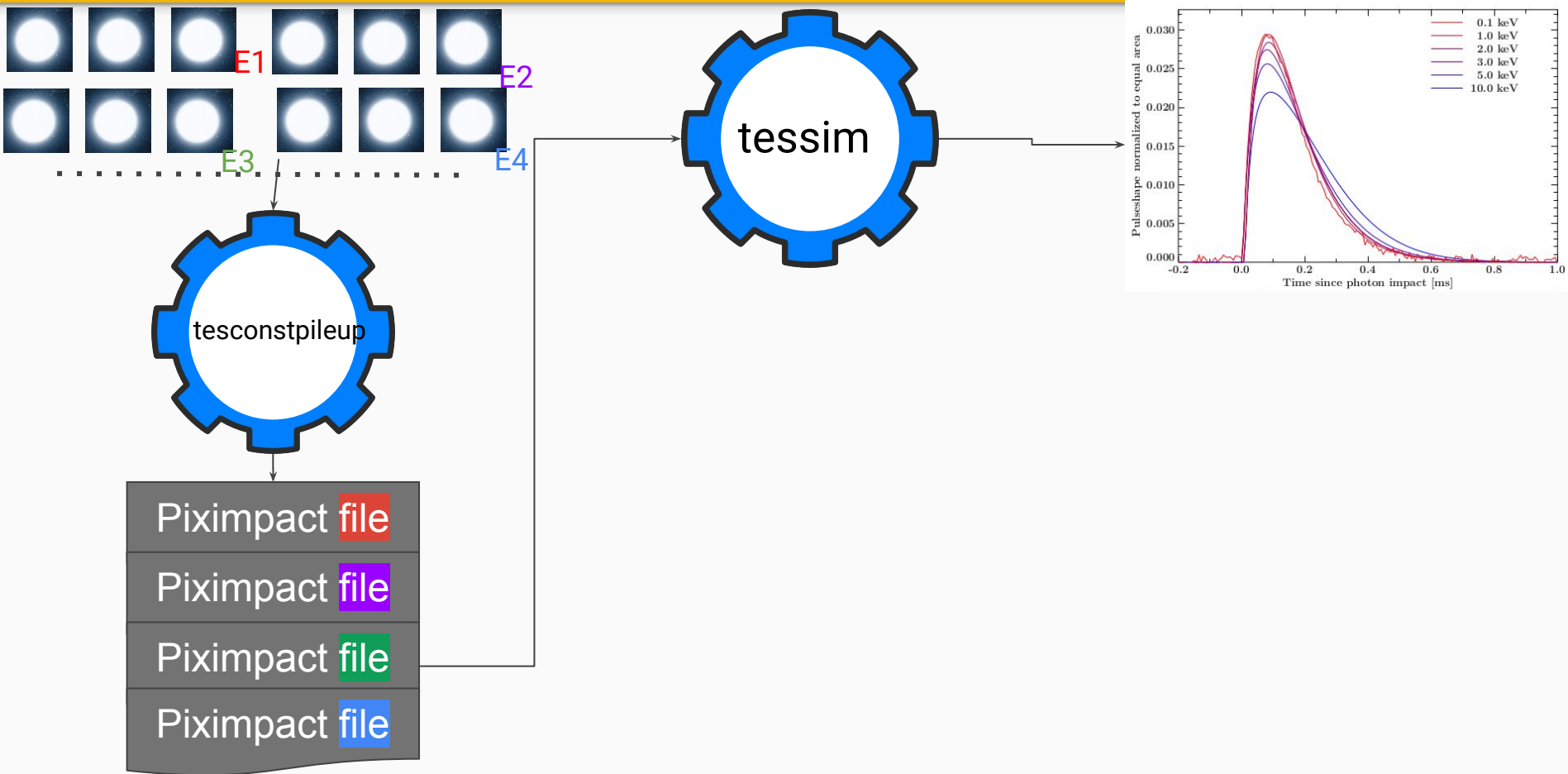
1	7.680000000000E-05	Plot	1
2	1.927168000000E-01	Plot	
3	3.853568000000E-01	Plot	
4	5.779968000000E-01	Plot	
5	7.706368000000E-01	Plot	
6	9.632768000000E-01	Plot	

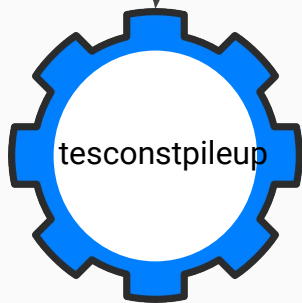
Go to: Edit cell:



The library: templates

<https://sirena.readthedocs.io>





Several monochromatic energies if different reconstruction methods to be tested

```
tesconstpileup PixImpList=mono1.piximpact energy=1. ....
tesconstpileup PixImpList=mono2.piximpact energy=2. ....
tesconstpileup PixImpList=mono3.piximpact energy=3. ....
tesconstpileup PixImpList=mono4.piximpact energy=4. ....
```

```
tesconstpileup PixImpList=mono6.piximpact clobber=yes
XMLFile=$SIXTE/share/sixte/instruments/athena-xifu/xifu_
detector_lpa_75um_AR0.5_pixoffset_mux40_pitch275um.xml
timezero=0. tstop=500 energy=6. pulseDistance=20000
TriggerSize=40000 offset=-1
```

The library: templates

<https://sirena.readthedocs.io>

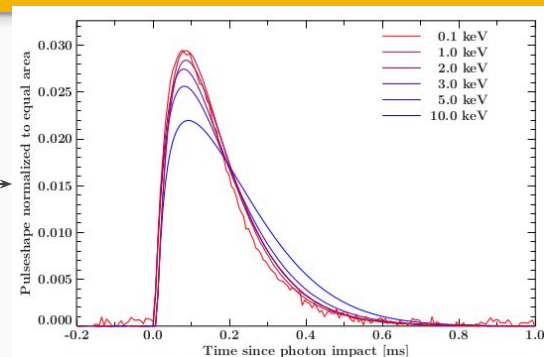
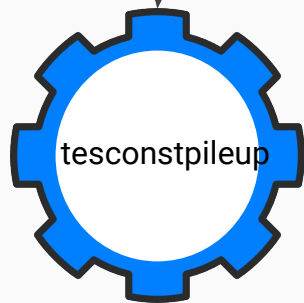


Several monochromatic energies if different

File Edit Tools Help						
Select	TIME	ENERGY	X	Y	PH_ID	SRC_ID
■ All	D	E	D	D	J	J
■	s	keV	m	m		
Invert	Modify	Modify	Modify	Modify	Modify	Modify
1	6.467200000000E-03	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	1	0
2	1.344672000000E-01	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	2	0
3	2.631072000000E-01	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	3	0
4	3.911072000000E-01	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	4	0
5	5.197472000000E-01	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	5	0
6	6.477472000000E-01	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	6	0
7	7.763872000000E-01	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	7	0
8	9.043872000000E-01	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	8	0
9	1.033027200000E+00	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	9	0
10	1.161027200000E+00	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	10	0
11	1.289667200000E+00	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	11	0
12	1.417667200000E+00	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	12	0
13	1.546307200000E+00	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	13	0
14	1.674307200000E+00	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	14	0
15	1.802947200000E+00	6.000000E+00	-9.623000000000E-03	2.000000000000E-06	15	0

The library: templates

<https://sirena.readthedocs.io>



Several monochromatic energies if different reconstruction methods to be tested

```
tessim PixImpList=mono1.piximpact Streamfile=mono1.fits...
```

```
tessim PixImpList=mono2.piximpact Streamfile=mono2.fits...
```

```
tessim PixID=1 PixImpList=mono6.piximpact preBuffer=1000  
Streamfile=mono6.fits tstart=0. tstop=500. doCrosstalk=n  
triggerSize=10000 Triggertype='diff:3:20:6000'  
PixType='file:newpix_LPA75um.fits[LPA_75um_AR0.5]'
```

fdelrow=1 (last row &/or first row)!!

The library: templates

<https://sirena.readthedocs.io>

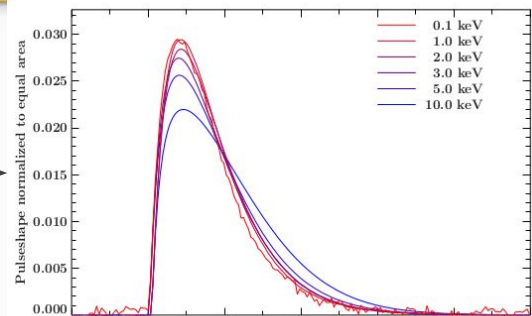


File Edit Tools Help

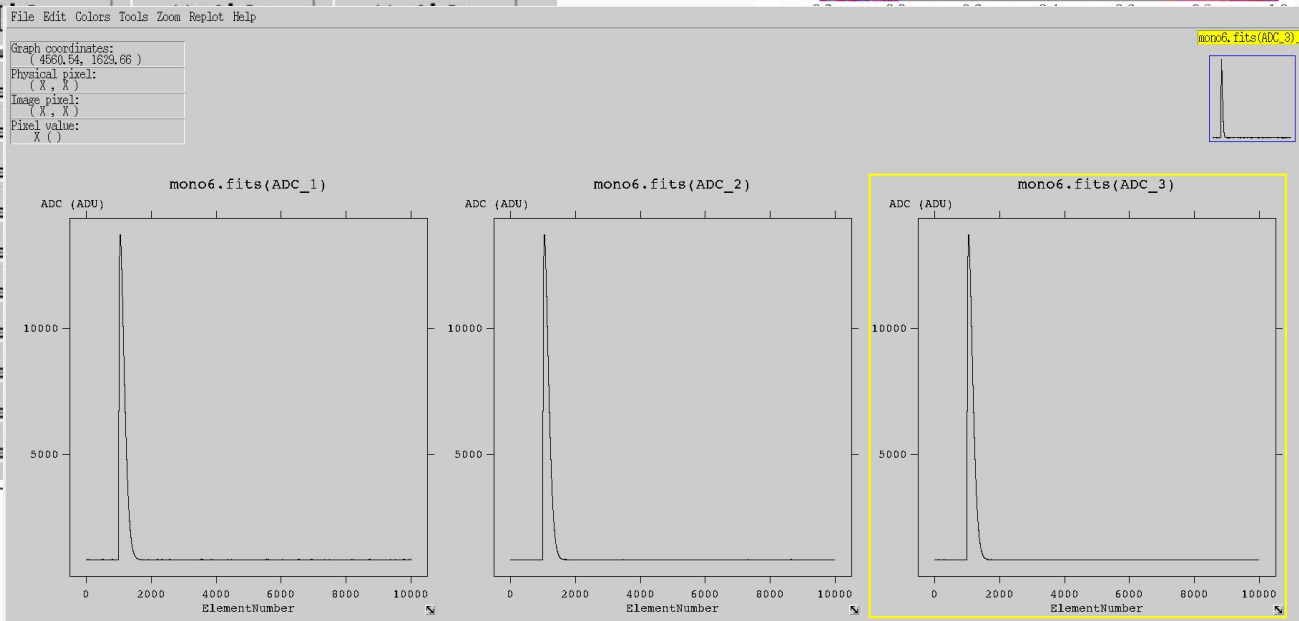
Select ☒ TIME 1D ☒ ADC 10000I ☒ PIXID 1J ☒ PH_ID 1PJ

☒ All s ADU

Invert Modify Mod

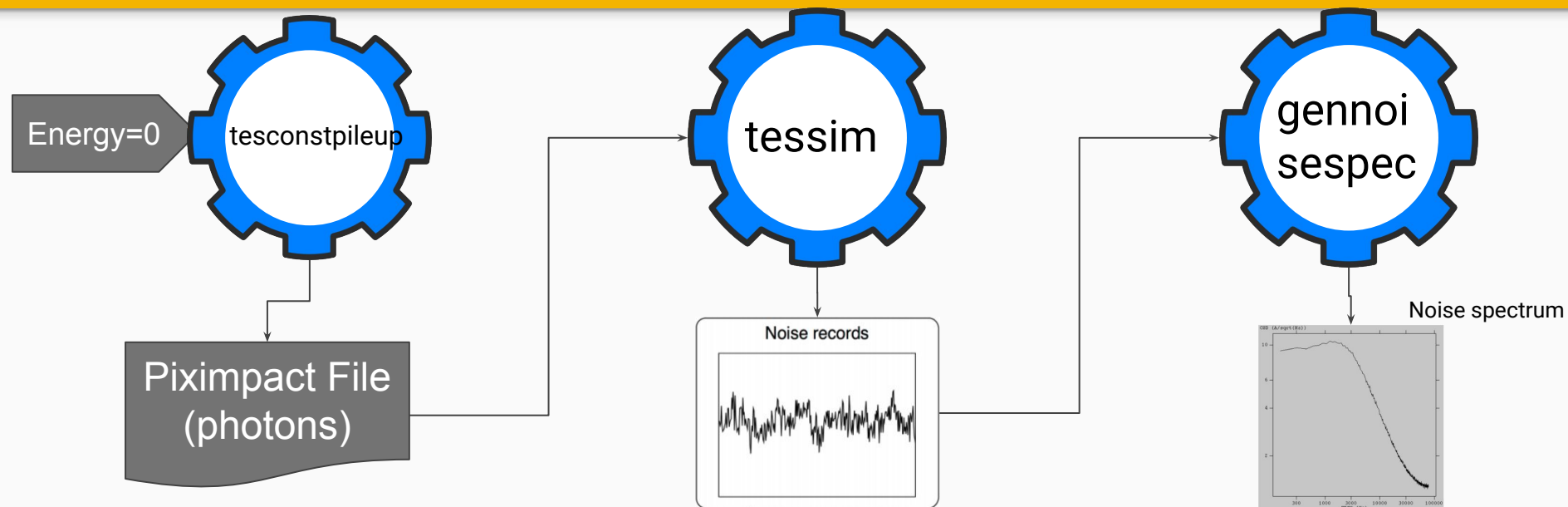


1	7.680000000000E-05	PI
2	1.280768000000E-01	PI
3	2.567168000000E-01	PI
4	3.847168000000E-01	PI
5	5.133568000000E-01	PI
6	6.413568000000E-01	PI
7	7.699968000000E-01	PI
8	8.979968000000E-01	PI
9	1.026636800000E+00	PI
10	1.154636800000E+00	PI
11	1.283276800000E+00	DT

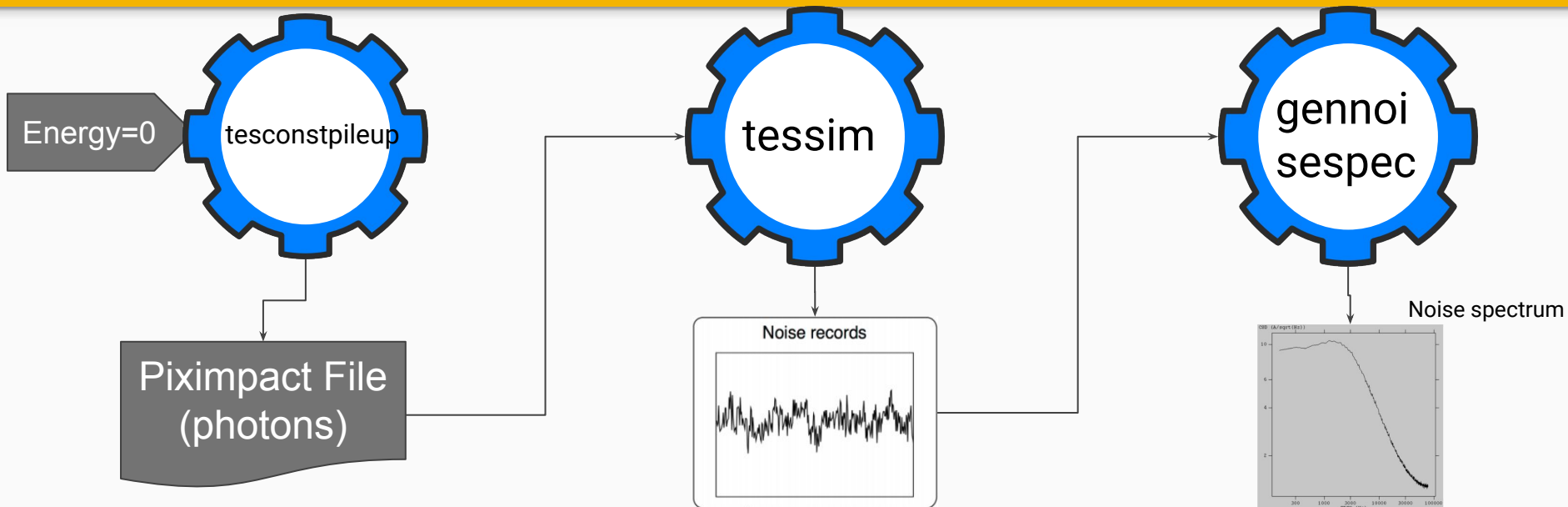


Piximpact file

Piximpact file

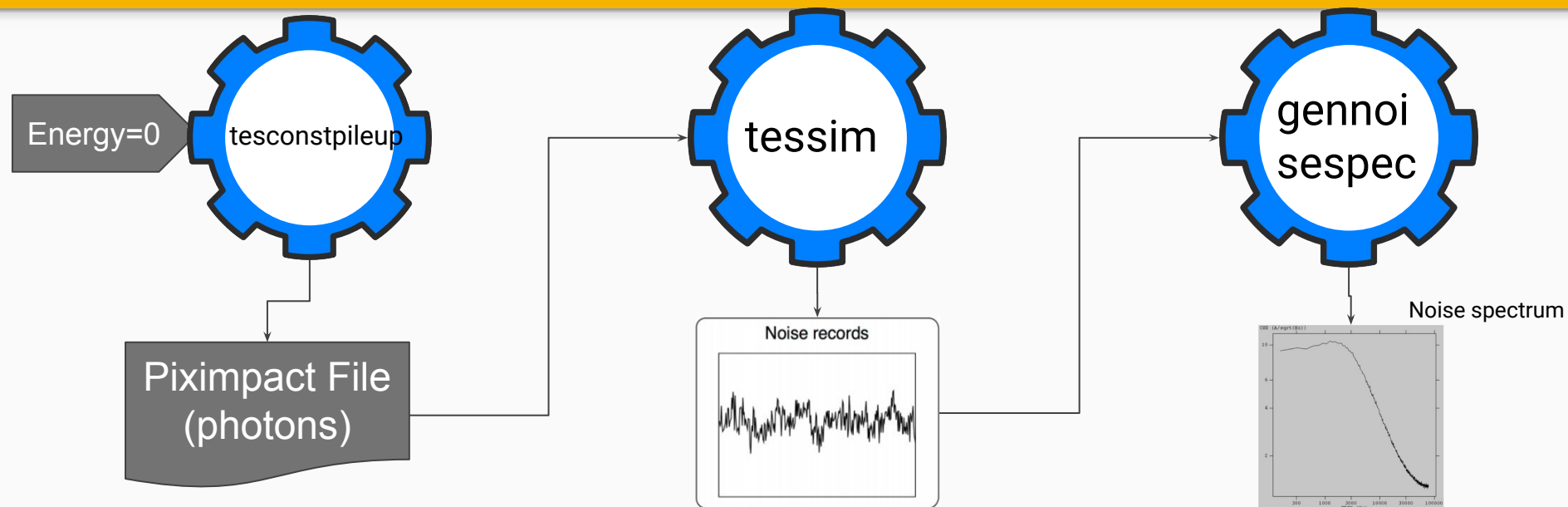


```
tesconstpileup PixImpList=noise.piximpact  
XMLFile=$SIXTE/share/sixte/instruments/athena-xifu/xifu_detector_lpa_75um_AR0.5_pixoffset_mux40_pitch275um.xml timezero=0.  
pulseDistance=1 tstop=100 energy=0.  
TriggerSize=10000 clobber=yes
```



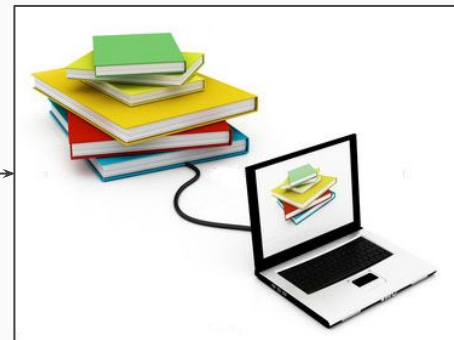
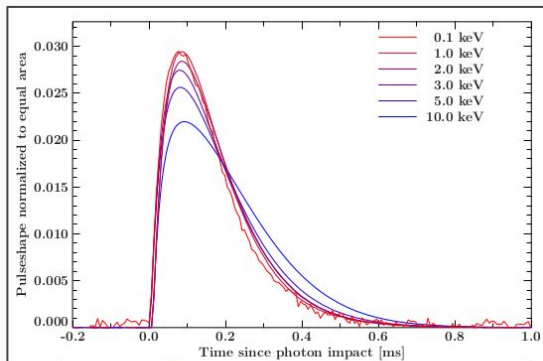
```
tessim PixID=1 PixImpList=noise.piximpact  
preBuffer=1000 Streamfile=noise.fits tstart=0.  
tstop=100. triggerSize=10000 Triggertype=noise  
PixType='file:newpix_LPA75um.fits[LPA_75um_AR0.5]'
```

fdelrow=1 (last row &/or first row)!!

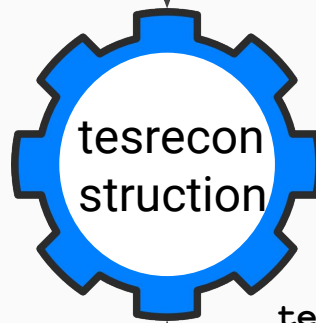


```
gennoisespec --inFile=noise.fits  
--outFile=noisespec.fits  
--nintervals=1000 --clobber=yes  
--intervalMinSamples=8192  
--pulse_length=8192
```

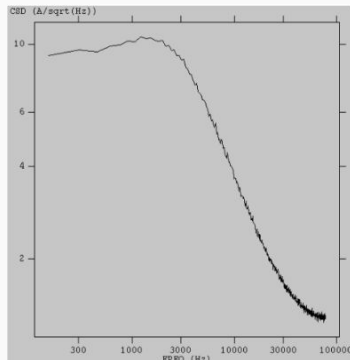
Isolated monochromatic pulses



Filters Library

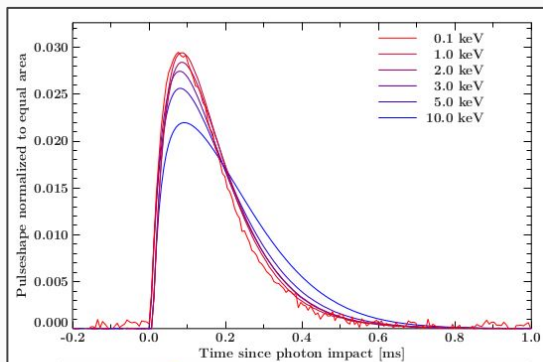


Noise spectrum

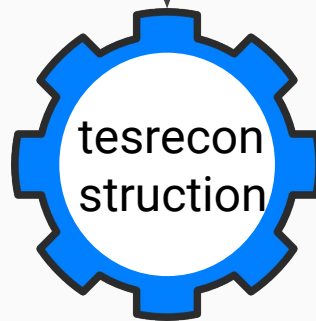
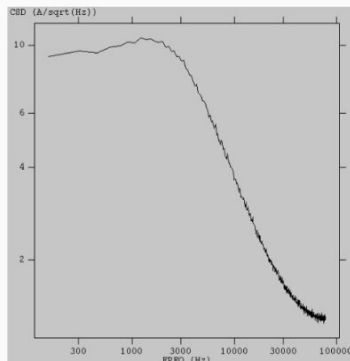


```
tesreconstruction RecordFile=mono6.fits
TesEventFile=tmp.fits Rcmethod=SIRENA mode=0
Pulselength=8192 LibraryFile=library.fits
NoiseFile=noisespec.fits monoenergy=6000.
EnergyMethod=OPTFILT XMLFile=$SIXTE/share/
sixte/instruments/athena-xifu/xifu_detector_lp
a_75um_AR0.5_pixoffset_mux40_pitch275um.xml
```

Templates



Noise spectrum



Filters Library

Other options:

(repeat if more energies)

EnergyMethod= I2R, I2RNOL, I2RFITTED

hduPRECALWN= yes

hduPRCLOFWM=yes

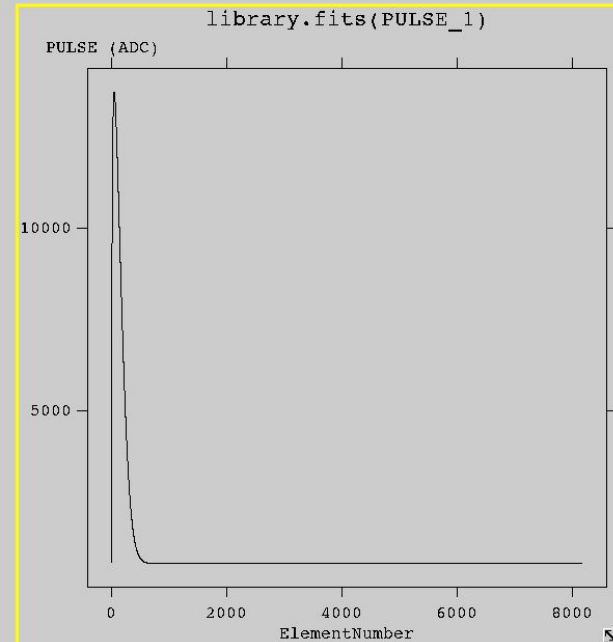
THE LIBRARY

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File Edit Tools Help				
Index	Extension	Type	Dimension	View
■ 0	Primary	Image	0	Header Image Table
■ 1	LIBRARY	Binary	6 cols X 1 rows	Header Hist Plot All Sele
■ 2	FIXFILTT	Binary	14 cols X 1 rows	Header Hist Plot All Sele
■ 3	FIXFILTF	Binary	14 cols X 1 rows	Header Hist Plot All Sele

File Edit Tools Help				
	■ ENERGY	■ PHEIGHT	■ PULSE	■ PULSEB0
Select	1D	1D	8192D	8192D
■ All	eV	ADC	ADC	ADC
Invert	Modify	Modify	Modify	Modify
1	6.000000000000E+03	1.293146182541E+04	Plot	Plot
Go to: Edit cell:				

File Edit Colors Tools Zoom Replot Help				
library.fits(PULSE_1)				
Graph coordinates: (X, X)				
Physical pixel: (X, X)				
Image pixel: (X, X)				
Pixel value: X ()				



Energy
hduP
hduP

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File Edit Tools Help

Index	Extension	Type	Dimension	View			
■ 0	Primary	Image	0	Header	Image		
■ 1	LIBRARY	Binary	6 cols X 1 rows	Header	Hist	Plot	All
■ 2	FIXFILTT	Binary	14 cols X 1 rows	Header	Hist	Plot	All
■ 3	FIXFILTF	Binary	14 cols X 1 rows	Header	Hist	Plot	All

File Edit Tools Help

Select	■ T8192	■ T4096	■ T2048	■ T1024
■ All	8192D	4096D	2048D	1024D
Invert	eV	eV	eV	eV
	Modify	Modify	Modify	Modify
1	Plot	Plot	Plot	Plot

Go to: Edit cell:

library.fits(T8192_1)

Graph coordinates:
(X, X)
Physical pixel:
(X, X)
Image pixel:
(X, X)
Pixel value:
X ()

library.fits(T8192_1)

T8192 (eV)

0
-0.2
-0.4
-0.6

0 2000 4000 6000 8000

ElementNumber

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<https://sirena.readthedocs.io>

File Edit Tools Help

Index	Extension	Type	Dimension	View			
0	Primary	Image	0	Header	Image		
1	LIBRARY	Binary	6 cols X 1 rows	Header	Hist	Plot	All
2	FIXFILTT	Binary	14 cols X 1 rows	Header	Hist	Plot	All
3	FIXFILTF	Binary	14 cols X 1 rows	Header	Hist	Plot	All

File Edit Tools Help

	ENERGY	F8192	F4096	F204
	1D	16384D	8192D	4096D
Select				
All	eV			
Invert	Modify	Modify	Modify	Modif
1	6.000000000000E+00	Plot	Plot	Plot

Go to:

Edit cell:

File Edit Colors Tools Zoom Replot Help

Graph coordinates:

(X, X)

Physical pixel:

(X, X)

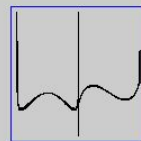
Image pixel:

(X, X)

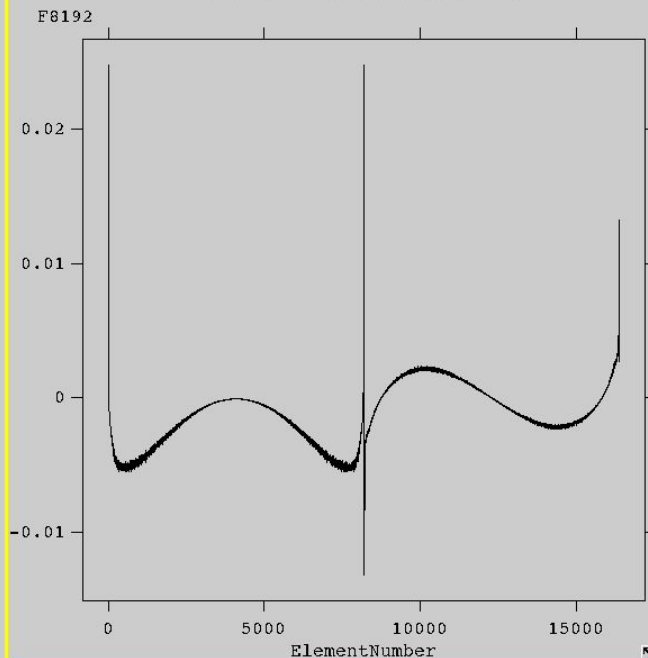
Pixel value:

X ()

library.fits(F8192_1)

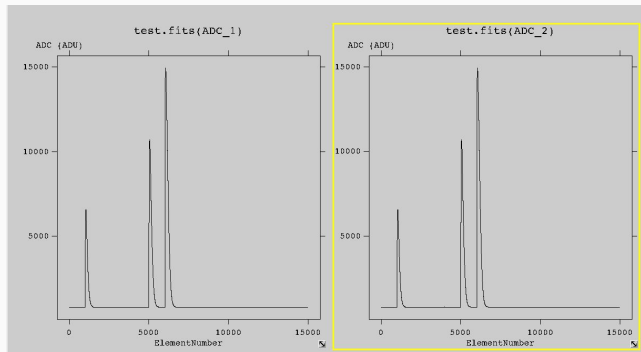


library.fits(F8192_1)

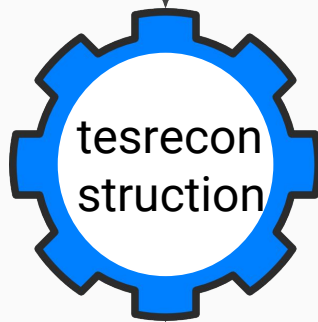
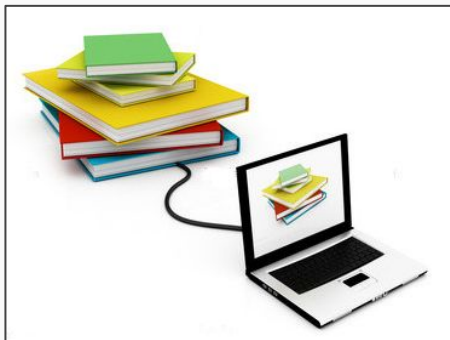


The reconstruction

The DATA



The LIBRARY



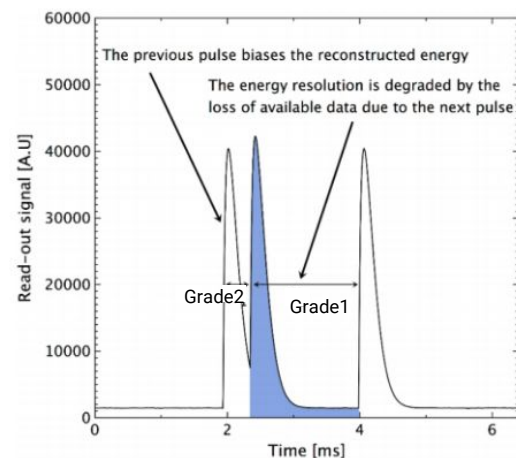
tesreconstruction

```
RecordFile=test.fits  
TesEventFile=test_evt.fits  
Rcmethod=SIRENA mode=1 OFLib=yes  
Pulselength=8192 clobber=yes  
LibraryFile=library.fits  
EnergyMethod=OPTFILT filtEeV=6000.  
XMLFile=$SIXTE/share/sixte/instrument  
s/athena-xifu/xifu_detector_lpa_75um_  
AR0.5_pixoffset_mux40_pitch275um.xml
```

The reconstruction

File Edit Tools Help

	TIME	SIGNAL	AVG4SD	ELOWRES	GRADE1	GRADE2
Select	1D	1D	1D	1D	1J	1J
■ All	s	keV		keV		
Invert	Modify	Modify	Modify	Modify	Modify	Modify
1	6.470400000000E-03	2.319954100899E+00	3.020000000000E+02	2.082087395392E+00	4000	8192
2	3.207040000000E-02	4.482405381252E+00	5.880000000000E+02	4.081981284467E+00	1000	4000
3	3.847040000000E-02	6.779118912276E+00	9.860000000000E+02	6.928376442533E+00	8192	1000
4	1.991104000000E-01	2.318965296821E+00	3.027500000000E+02	2.081670942690E+00	4000	8192
5	2.247104000000E-01	4.482320678275E+00	5.880000000000E+02	4.081981284467E+00	1000	4000
6	2.311104000000E-01	6.779061241896E+00	9.860000000000E+02	6.928376442533E+00	8192	1000
7	3.917504000000E-01	2.321603303870E+00	3.027500000000E+02	2.081670942690E+00	4000	8192
8	4.173504000000E-01	4.481478650941E+00	5.880000000000E+02	4.081981284467E+00	1000	4000
9	4.237504000000E-01	6.779306333947E+00	9.860000000000E+02	6.928376442533E+00	8192	1000



The reconstruction

File Edit Tools Help

	TIME	SIGNAL	AVG4SD	ELOWRES	GRADE1	GRADE2
Select	1D	1D	1D	1D	1J	1J
■ All	s	keV		keV		
Invert	Modify	Modify	Modify	Modify	Modify	Modify

1	6.470400000000E-03	2.319954100899E+00	3.020000000000E+02	2.082087395392E+00	4000	8192
2	3.207040000000E-02	4.4824				
3	3.847040000000E-02	6.7791				
4	1.991104000000E-01	2.3189				
5	2.247104000000E-01	4.4823				
6	2.311104000000E-01	6.7790				
7	3.917504000000E-01	2.3216				
8	4.173504000000E-01	4.4814				
9	4.237504000000E-01	6.7793				

