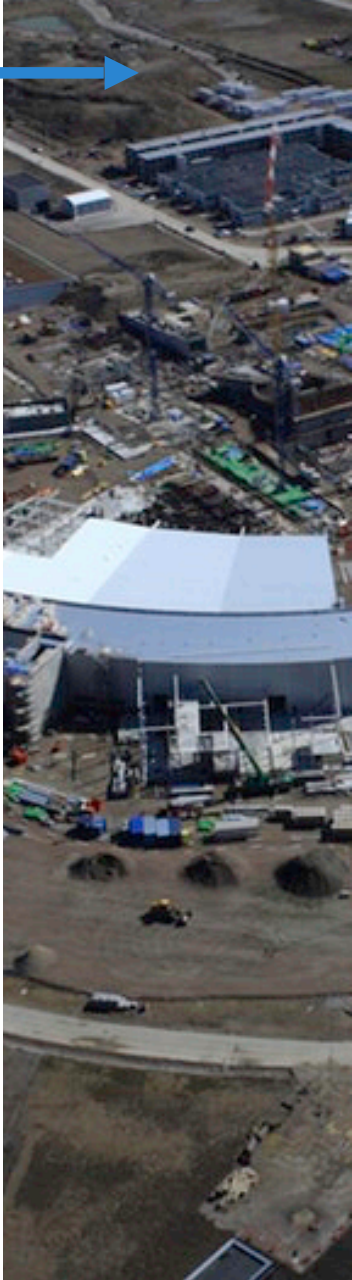
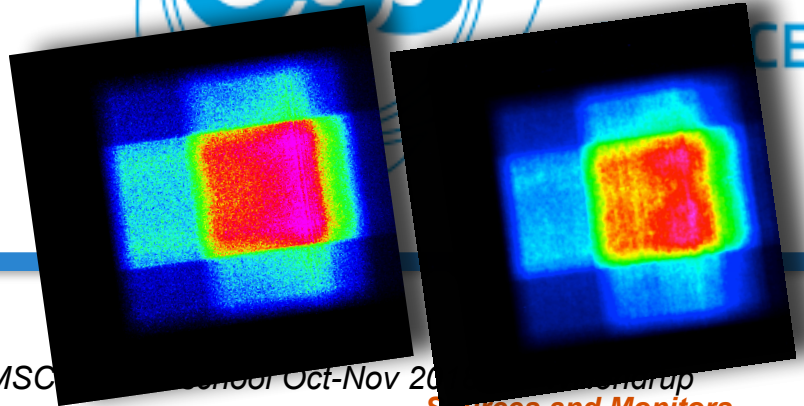
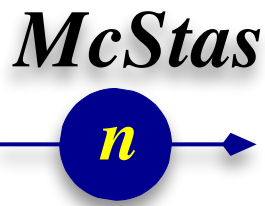


# Monitors & Sources



## McStas monitors & sources



# Access the docs

---

## In this session:

- \* Overview of existing Source and Monitor components
- \* Detailed description of the most commonly used ones
- \* How to 'call' them into a \*.instr file
- \* Practical Exercise using sources and monitors

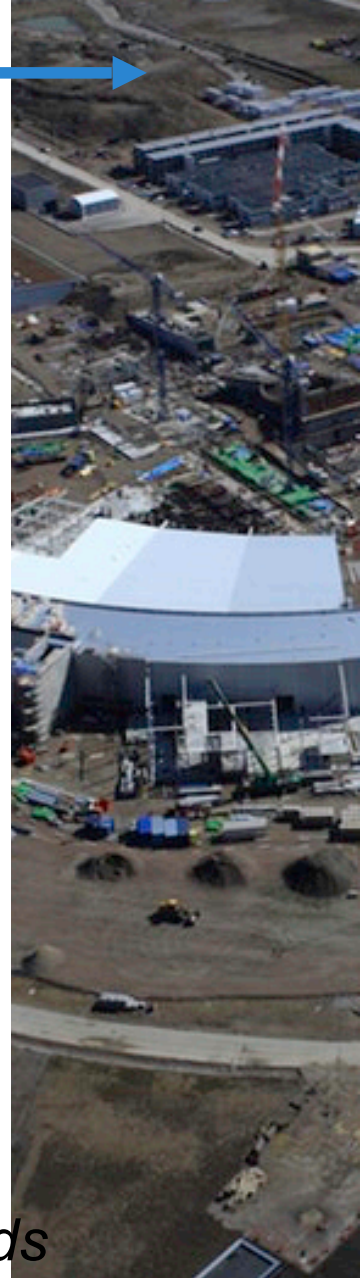
## **IMPORTANT:**

All (and more) of this information can be found in the online pdf component documentation, e.g.

<http://www.mcstas.org/documentation/manual/mcstas-2.3-components.pdf>

- is also distributed with your McStas installation - `mcdoc -c`

The component documentation along with the “`mcdoc component_you_are_searching_for`” command, are your best friends when using McStas



# Sources

## Mathematical:

- *Source\_simple.comp*
- *Source\_div.comp*

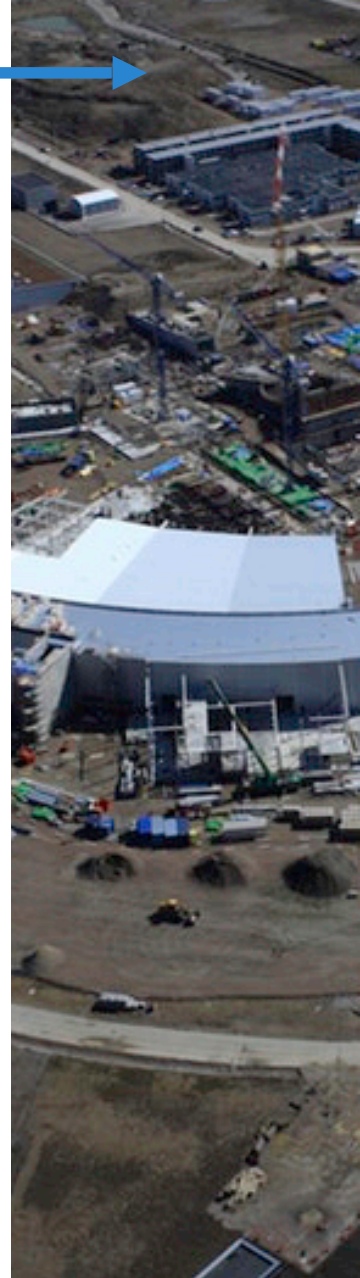
## Pulsed sources:

- *ESS\_moderator.comp*
- *Moderator.comp*
- *SNS\_source.comp (\*)*
- *ISIS\_moderator.comp (\*)*

## Reactors :

- Source\_Maxwell\_3.comp*
- Source\_gen.comp*
- Source\_gen4.comp*
- Source\_multi\_surfaces.comp (\*)*

(\*) contributed (can be found in /mcstas/installation/folder/**contrib**)



# Sources



Typing “*mcdoc*”, *mcdoc source*” or “*mcdoc moderator*” in your command shell, will reveal a list of available sources and moderators. Or you can search in the directories ‘*sources*’, ‘*contrib*’, and ‘*obsolete*’.

## Components and Instruments from the Library for *McStas*

Names in **Boldface** denote components that are properly documented with comments in the source code.

### Sources

Name	Origin	Author(s)	Source code	Description
<a href="#">Adapt_check</a>	Risoe	Kristian Nielsen	<a href="#">comp</a>	Optimization specifier for the Source_adapt component.
<a href="#">ESS_butterfly</a>	DTU	Peter Willendrup and Esben Klinkby	<a href="#">comp</a>	ESS butterfly moderator
<a href="#">ESS_moderator</a>	DTU	P Willendrup and E Klinkby, February 2014, derived from K Lefmann ESS_moderator_long	<a href="#">comp</a>	A parametrised pulsed source for modelling ESS long pulses.
<a href="#">Moderator</a>	Risoe	KN, M.Hagen	<a href="#">comp</a>	A simple pulsed source for time-of-flight.
<a href="#">Monitor_Optimizer</a>	<a href="#">ILL (France)</a>	<a href="#">Emmanuel Farhi</a>	<a href="#">comp</a>	To be used after the <b>Source_Optimizer</b> component
<a href="#">Source_Maxwell_3</a>	Risoe	Kim Lefmann	<a href="#">comp</a>	Source with up to three Maxwellian distributions
<a href="#">Source_Optimizer</a>	<a href="#">ILL (France)</a>	<a href="#">Emmanuel Farhi</a>	<a href="#">comp</a>	A component that optimizes the neutron flux passing through the Source_Optimizer in order to have the maximum flux at the <b>Monitor_Optimizer</b> position.
<a href="#">Source_adapt</a>	Risoe	Kristian Nielsen	<a href="#">comp</a>	Neutron source with adaptive importance sampling
<a href="#">Source_div</a>	Risoe	KL	<a href="#">comp</a>	Neutron source with Gaussian or uniform divergence
<a href="#">Source_gen</a>	ILL/Risoe	Emmanuel Farhi, Kim Lefmann	<a href="#">comp</a>	Circular/squared neutron source with flat or Maxwellian energy/wavelength spectrum
<a href="#">Source_simple</a>	Risoe	Kim Lefmann	<a href="#">comp</a>	A circular neutron source with flat energy spectrum and arbitrary flux
<a href="#">Virtual_input</a>	<a href="#">ILL</a>	<a href="#">E. Farhi</a>	<a href="#">comp</a>	Source-like component that generates neutron events from an ascii 'virtual source' filename.
<a href="#">Virtual_output</a>	<a href="#">ILL</a>	<a href="#">E. Farhi</a>	<a href="#">comp</a>	Detector-like component that writes neutron state parameters into an ascii-format 'virtual source' neutron file.

(\*) contributed (can be found in /mcstas/installation/folder/**contrib**)

# Sources

Typing “mcdoc”, “mcdoc source” or “mcdoc moderator” in your command shell, will reveal a list of available sources and moderators. Or you can search in the directories ‘sources’, ‘contrib’, and ‘obsolete’.

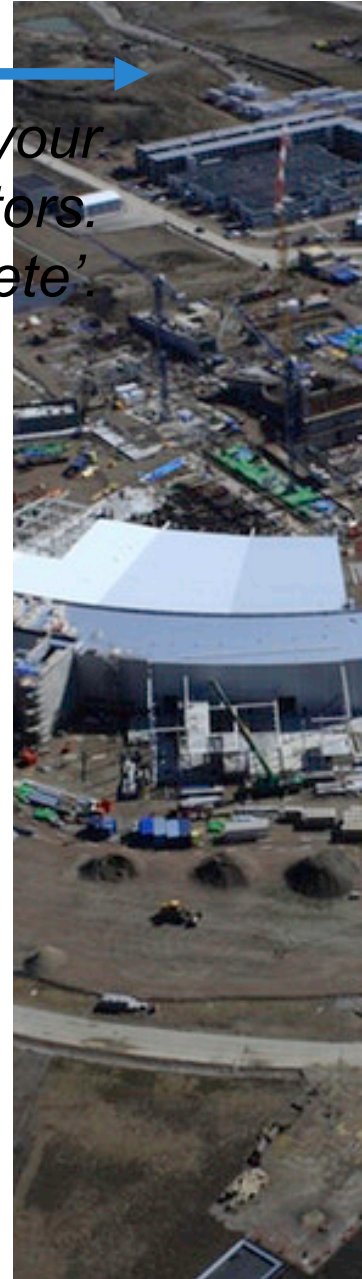
## Components and Instruments from the Library for McStas

Names in **Boldface** denote components that are properly documented with comments in the source code.

### Sources

Name	Origin	Author(s)	Source code	Description
<a href="#">Adapt_check</a>	Risoe	Kristian Nielsen	<a href="#">comp</a>	Optimization specifier for the Source_adapt component.
<a href="#">ESS_butterfly</a>	DTU	Peter Willendrup and Esben Klinkby	<a href="#">comp</a>	ESS butterfly moderator
<a href="#">ESS_moderator</a>	DTU	P Willendrup and E Klinkby, February 2014, derived from K Lefmann ESS_moderator_long	<a href="#">comp</a>	A parametrised pulsed source for modelling ESS long pulses.
<a href="#">Moderator</a>	Risoe	KN, M.Hagen	<a href="#">comp</a>	A simple pulsed source for time-of-flight.
<a href="#">Monitor_Optimizer</a>	ILL (France)	Emmanuel Farhi	<a href="#">comp</a>	To be used after the <b>Source Optimizer</b> component
<a href="#">Source_Maxwell_3</a>				
<a href="#">Source_Optimizer</a>	ILL (France)	Emmanuel Farhi	<a href="#">comp</a>	A co in or
<a href="#">Source_adapt</a>	Risoe	Kristian Nielsen	<a href="#">comp</a>	Neut
<a href="#">Source_div</a>				Neut
<a href="#">Source_gen</a>	ILL, Risoe	Emmanuel Farhi Kim Lefmann	<a href="#">comp</a>	Circ spect
<a href="#">Source_simple</a>				A si
<a href="#">Virtual_input</a>	ILL	E. Farhi	<a href="#">comp</a>	Sour filen
<a href="#">Virtual_output</a>	ILL	E. Farhi	<a href="#">comp</a>	Detector-like component that writes neutron state parameters into an ascii-format 'virtual source' neutron file.

**Steady-state sources  
(Reactors & PSI... )**



Folder/contrib )

# Sources

Typing “mcdoc”, “mcdoc source” or “mcdoc moderator” in your command shell, will reveal a list of available sources and moderators. Or you can search in the directories ‘sources’, ‘contrib’, and ‘obsolete’.

## Components and Instruments from the Library for *McStas*

Names in **Boldface** denote components that are properly documented with comments in the source code.

### Sources

Name	Origin	Author(s)	Source code	Description
<a href="#">Adapt_check</a>	Risoe	Kristian Nielsen	<a href="#">comp</a>	Optimization specifier for the Source_adapt component.
<a href="#">ESS_butterfly</a>	DTU	Peter Willendrup and Esben Klinkby	<a href="#">comp</a>	ESS butterfly moderator
<a href="#">ESS_moderator</a>		P Willendrup and E Klinkby, February 2014, derived from K Lefmann ESS_moderator_long	<a href="#">comp</a>	A pa
<b>Moderator</b>				A
<a href="#">Monitor_Optimizer</a>	ILL (France)	<a href="#">Emmanuel Farhi</a>	<a href="#">comp</a>	To b
<a href="#">Source_Maxwell_3</a>	Risoe	Kim Lefmann	<a href="#">comp</a>	Sour
<a href="#">Source_Optimizer</a>	ILL (France)	<a href="#">Emmanuel Farhi</a>	<a href="#">comp</a>	A co in or
<a href="#">Source_adapt</a>	Risoe	Kristian Nielsen	<a href="#">comp</a>	Neut
<a href="#">Source_div</a>	Risoe	KL	<a href="#">comp</a>	Neutron source with Gaussian or uniform divergence
<a href="#">Source_gen</a>	ILL/Risoe	Emmanuel Farhi, Kim Lefmann	<a href="#">comp</a>	Circular/squared neutron source with flat or Maxwellian energy/wavelength spectrum
<a href="#">Source_simple</a>	Risoe	Kim Lefmann	<a href="#">comp</a>	A circular neutron source with flat energy spectrum and arbitrary flux
<a href="#">Virtual_input</a>	ILL	<a href="#">E. Farhi</a>	<a href="#">comp</a>	Source-like component that generates neutron events from an ascii 'virtual source' filename.
<a href="#">Virtual_output</a>	ILL	<a href="#">E. Farhi</a>	<a href="#">comp</a>	Detector-like component that writes neutron state parameters into an ascii-format 'virtual source' neutron file.

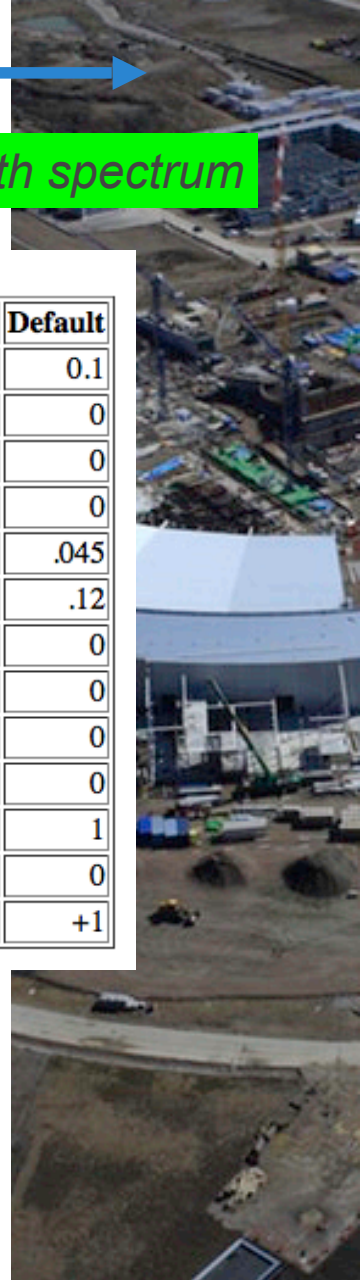
**Pulsed sources**

**(also SNS\_source and ISIS\_moderator in the contrib category)**



Folder/contrib )

# Sources



[Source\\_simple.comp](http://Source_simple.comp)

A Simple continuous source with flat energy/wavelength spectrum

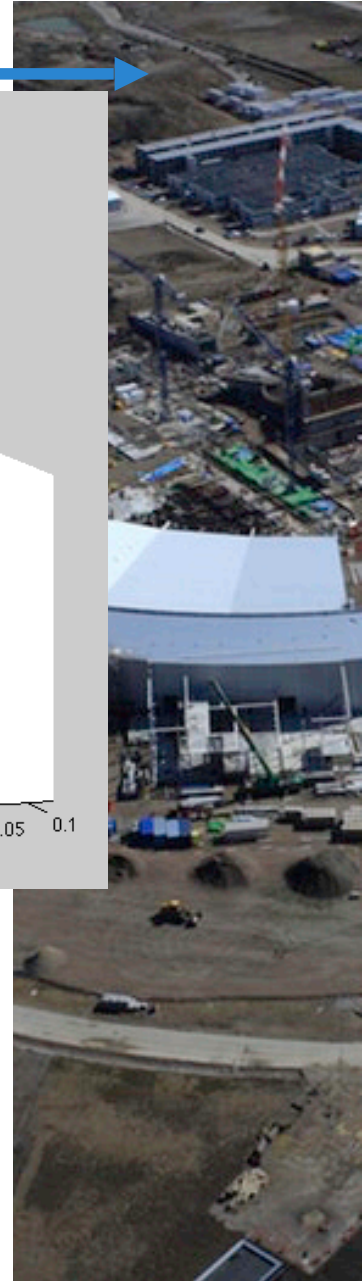
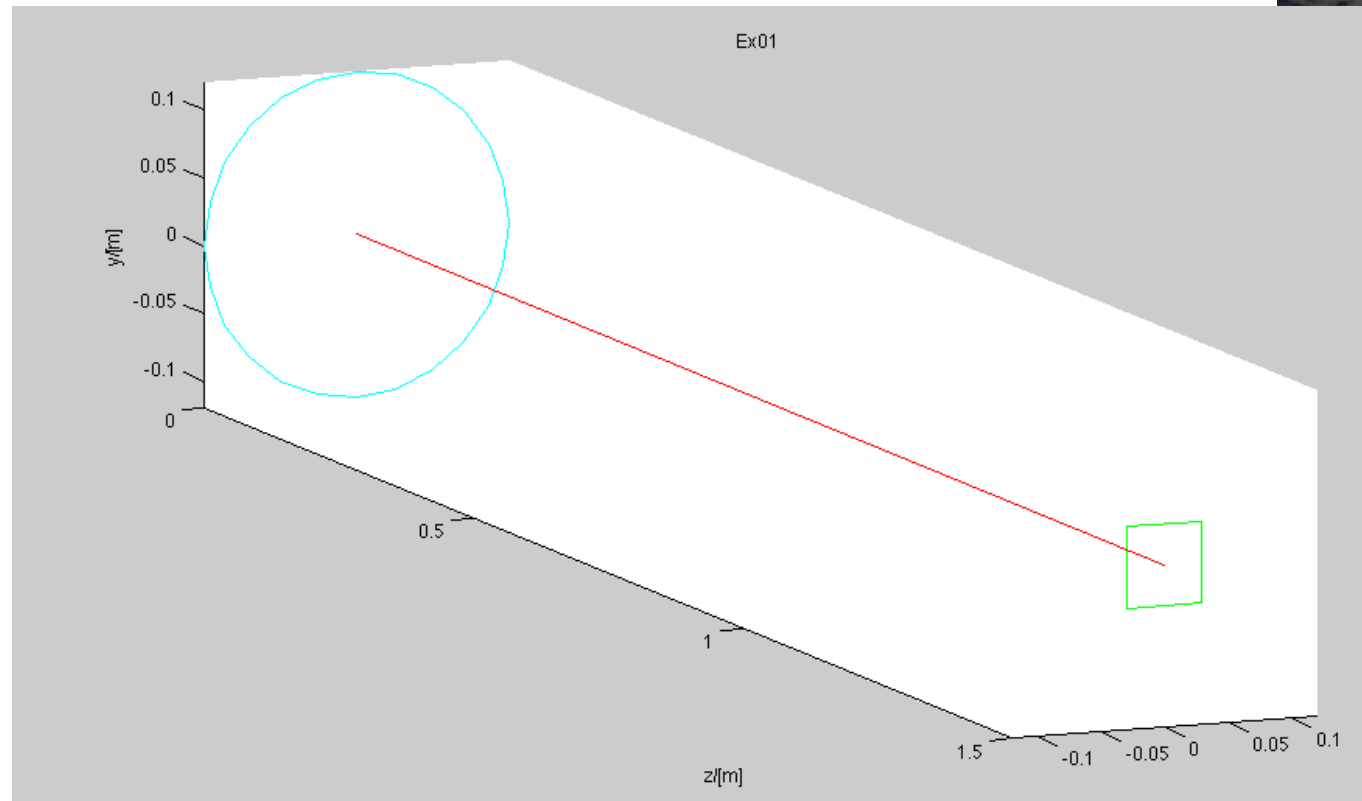
Parameters in **boldface** are required; the others are optional.

Name	Unit	Description	Default
radius	m	Radius of circle in (x,y,0) plane where neutrons are generated.	0.1
yheight	m	Height of rectangle in (x,y,0) plane where neutrons are generated.	0
xwidth	m	Width of rectangle in (x,y,0) plane where neutrons are generated.	0
dist	m	Distance to target along z axis.	0
focus_xw	m	Width of target	.045
focus_yh	m	Height of target	.12
E0	meV	Mean energy of neutrons.	0
dE	meV	Energy half spread of neutrons (flat or gaussian sigma).	0
lambda0	AA	Mean wavelength of neutrons.	0
dlambda	AA	Wavelength half spread of neutrons.	0
flux	1/(s*cm**2*st*energy unit)	flux per energy unit, Angs or meV if flux=0, the source emits 1 in 4*PI whole space.	1
gauss	1	Gaussian (1) or Flat (0) energy/wavelength distribution	0
target_index	1	relative index of component to focus at, e.g. next is +1 this is used to compute 'dist' automatically.	+1

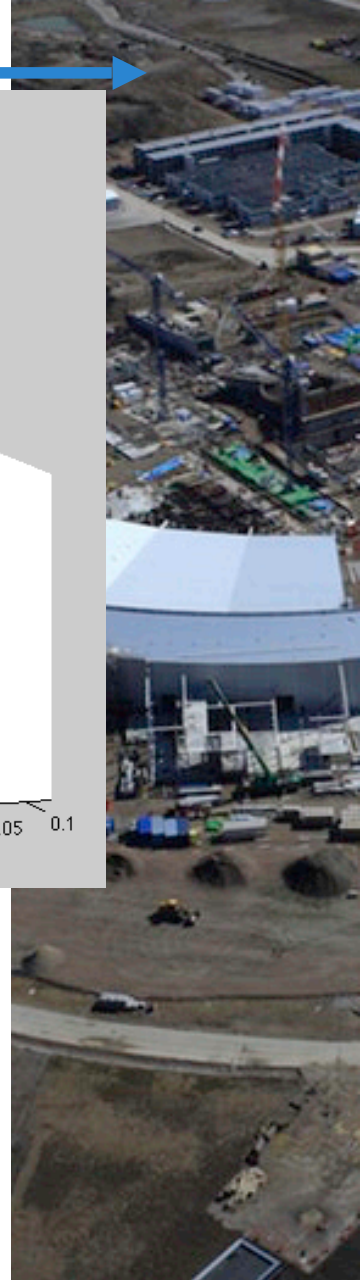
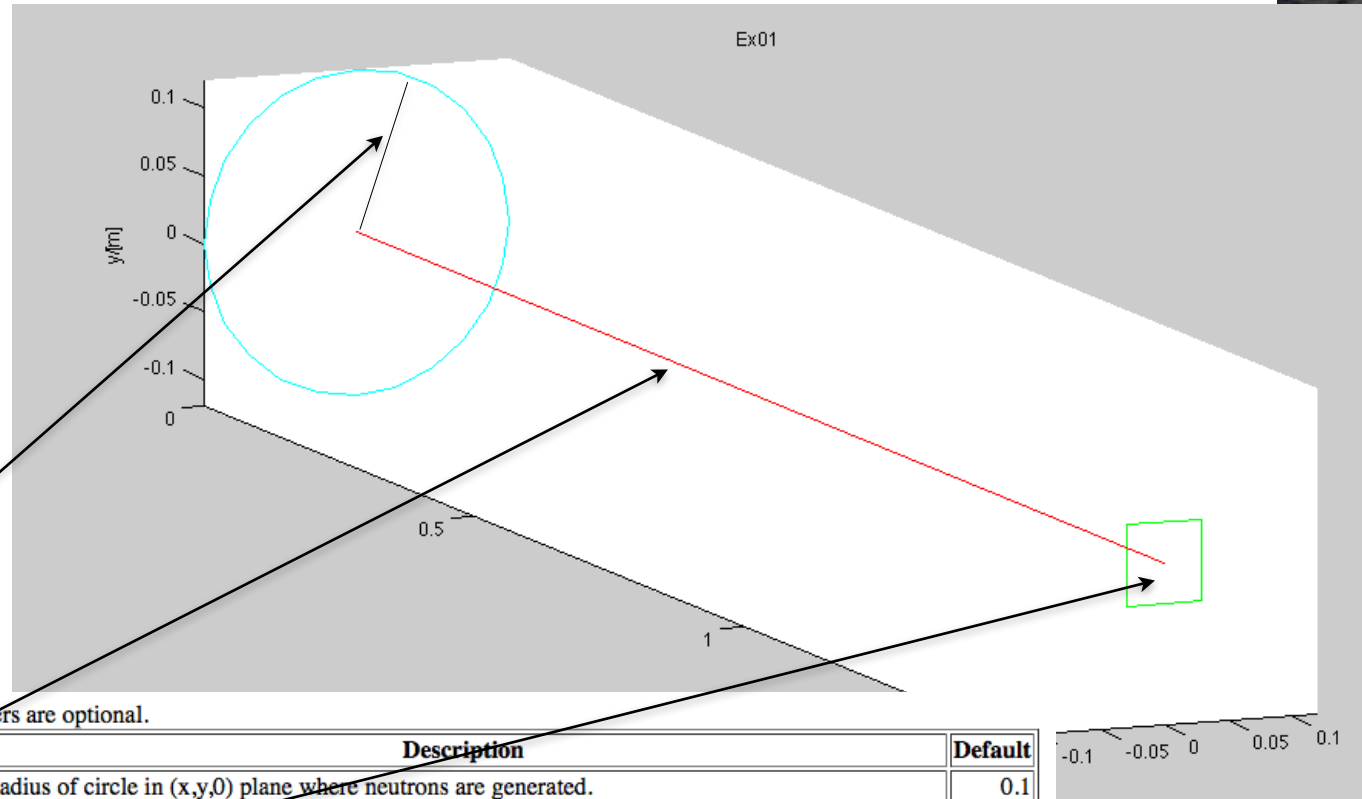
*What do we need the distance and target size for?*

*(let us take a small break and investigate this)*

# Sources

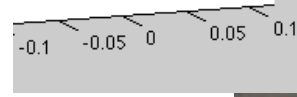


# Sources

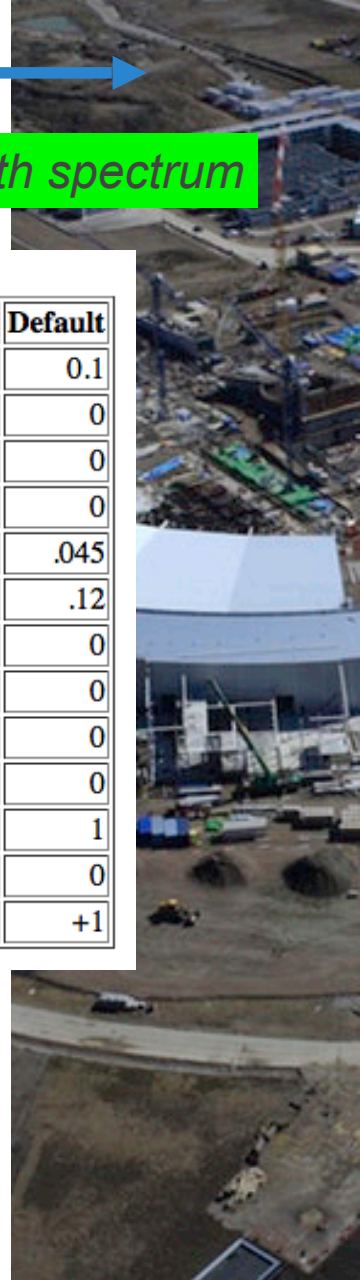


Parameters in **boldface** are required; the others are optional.

Name	Unit	Description	Default
radius	m	Radius of circle in (x,y,0) plane where neutrons are generated.	0.1
yheight	m	Height of rectangle in (x,y,0) plane where neutrons are generated.	0
xwidth	m	Width of rectangle in (x,y,0) plane where neutrons are generated.	0
dist	m	Distance to target along z axis.	0
focus_xw	m	Width of target	.045
focus_yh	m	Height of target	.12
E0	meV	Mean energy of neutrons.	0
dE	meV	Energy half spread of neutrons (flat or gaussian sigma).	0
lambda0	AA	Mean wavelength of neutrons.	0
dlambda	AA	Wavelength half spread of neutrons.	0
flux	1/(s*cm**2*st*energy unit)	flux per energy unit, Angs or meV if flux=0, the source emits 1 in 4*PI whole space.	1
gauss	1	Gaussian (1) or Flat (0) energy/wavelength distribution	0
target_index	1	relative index of component to focus at, e.g. next is +1 this is used to compute 'dist' automatically.	+1



# Source\_simple



[Source\\_simple.comp](#)

A Simple continuous source with flat energy/wavelength spectrum

Parameters in **boldface** are required; the others are optional.

Name	Unit	Description	Default
radius	m	Radius of circle in (x,y,0) plane where neutrons are generated.	0.1
yheight	m	Height of rectangle in (x,y,0) plane where neutrons are generated.	0
xwidth	m	Width of rectangle in (x,y,0) plane where neutrons are generated.	0
dist	m	Distance to target along z axis.	0
focus_xw	m	Width of target	.045
focus_yh	m	Height of target	.12
E0	meV	Mean energy of neutrons.	0
dE	meV	Energy half spread of neutrons (flat or gaussian sigma).	0
lambda0	AA	Mean wavelength of neutrons.	0
dlambda	AA	Wavelength half spread of neutrons.	0
flux	1/(s*cm**2*st*energy unit)	flux per energy unit, Angs or meV if flux=0, the source emits 1 in 4*PI whole space.	1
gauss	1	Gaussian (1) or Flat (0) energy/wavelength distribution	0
target_index	1	relative index of component to focus at, e.g. next is +1 this is used to compute 'dist' automatically.	+1

Example:

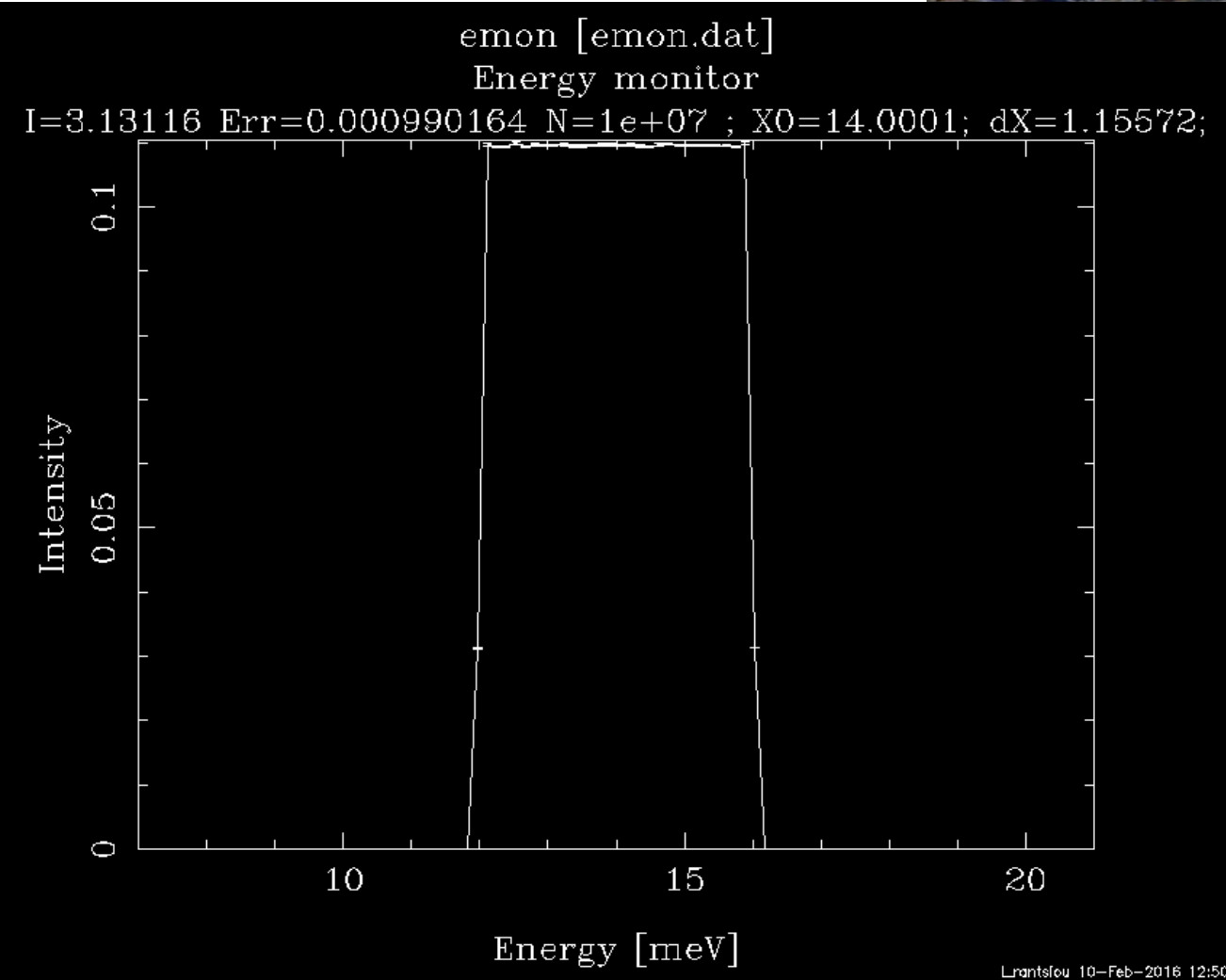
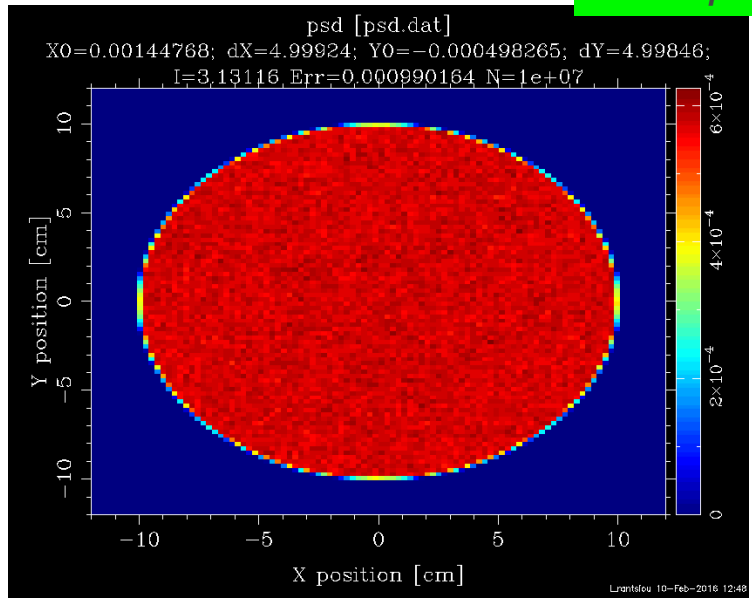
```
COMPONENT my_simple_source = Source_simple(radius=0.1, dist=2.0,
focus_xw=0.1, focus_yh=0.1, E0=14.0,
dE=2.0)
```

# Monitor output PSD / Emon

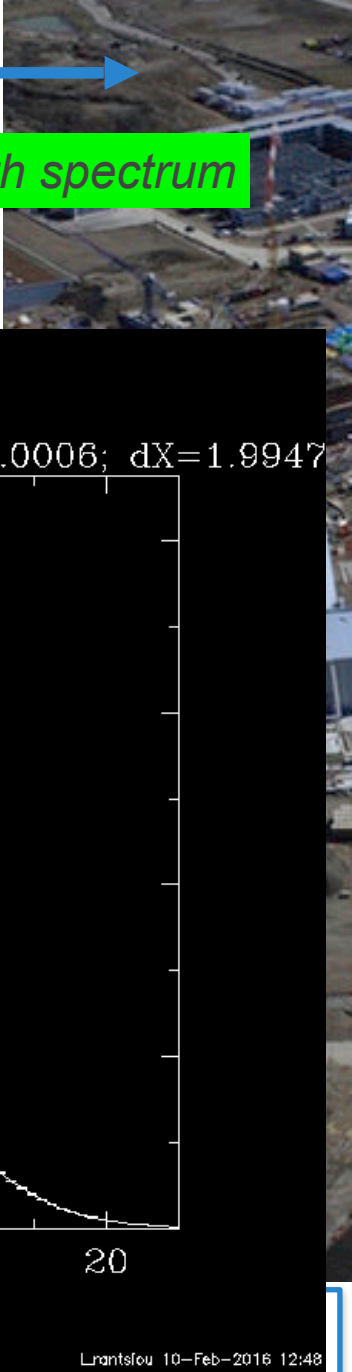


[Source\\_simple.comp](#)

A Simple continuous source with flat energy/wavelength spectrum

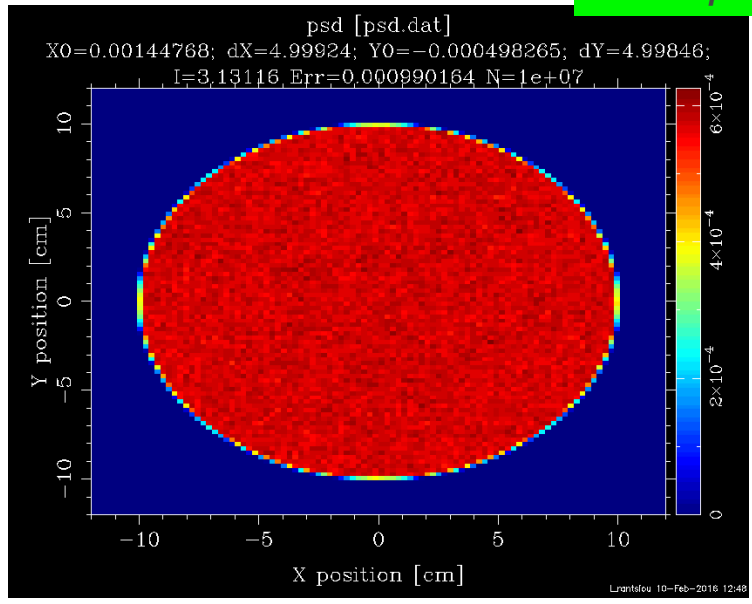


# Monitor output PSD / Emon

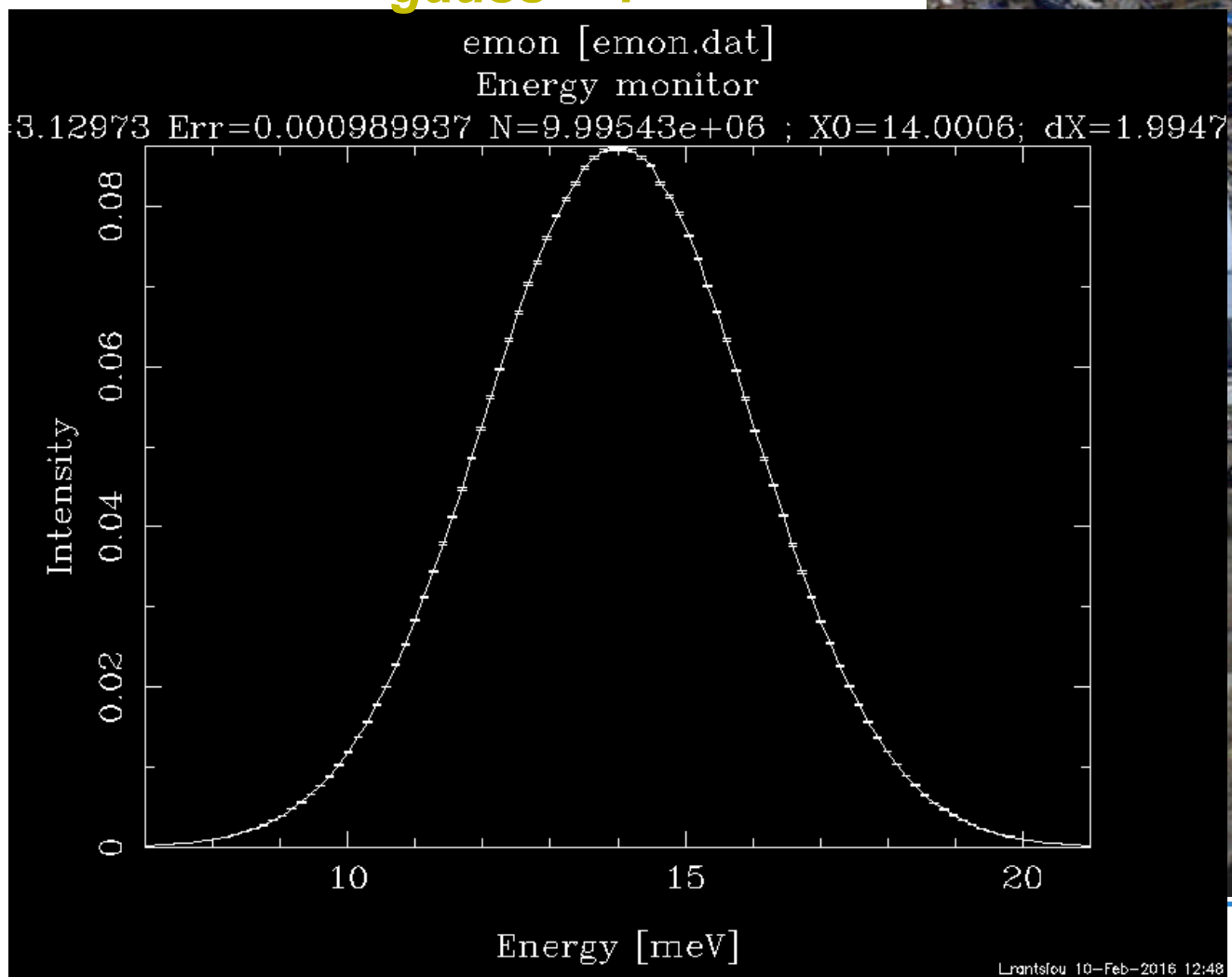


[Source\\_simple.comp](#)

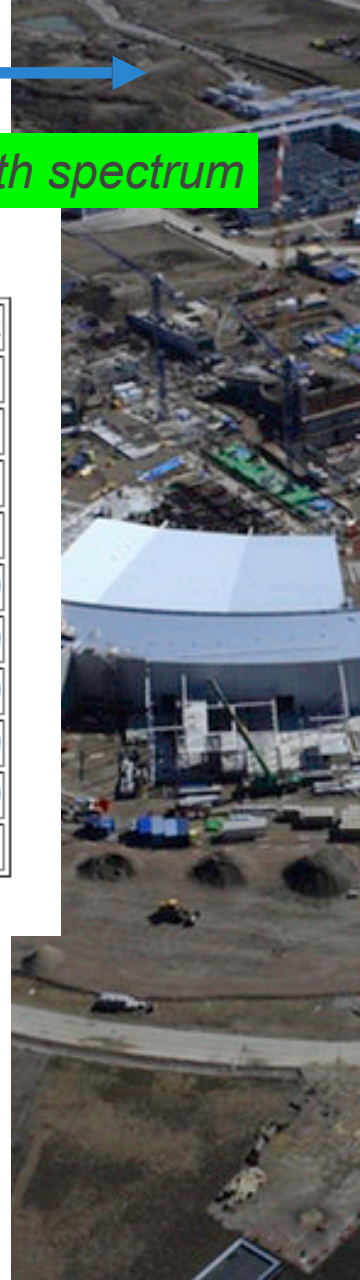
A Simple continuous source with flat energy/wavelength spectrum



*gauss = 1*



# Source\_div



[Source\\_div.comp](#)

**Input parameters**

*A Simple continuous source with flat energy/wavelength spectrum*

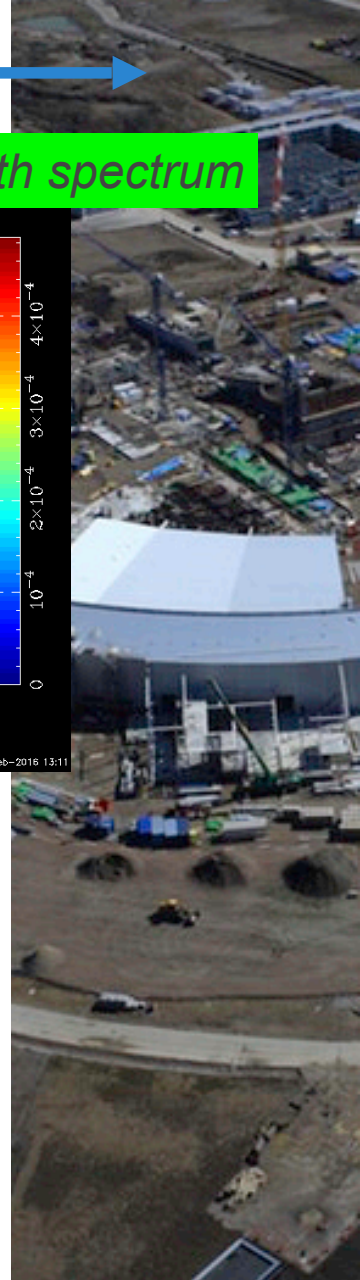
Parameters in **boldface** are required; the others are optional.

Name	Unit	Description	Default
<b>xwidth</b>	m	Width of source	
<b>yheight</b>	m	Height of source	
<b>focus_aw</b>	deg	FWHM (Gaussian) or maximal (uniform) horz. width divergence	
<b>focus_ah</b>	deg	FWHM (Gaussian) or maximal (uniform) vert. height divergence	
E0	meV	Mean energy of neutrons.	0.0
dE	meV	Energy half spread of neutrons.	0.0
lambda0	Ang	Mean wavelength of neutrons (only relevant for E0=0)	0.0
dlambda	Ang	Wavelength half spread of neutrons.	0.0
gauss	0 1	Criterion: 0: uniform, 1: Gaussian distributions	0
flux	1/(s*cm**2*st*energy unit)	flux per energy unit, Angs or meV	1

Example:

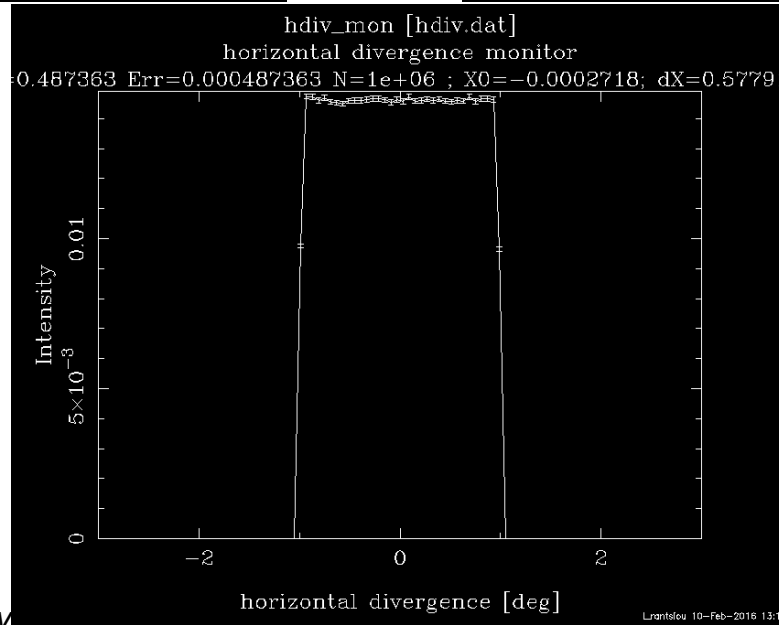
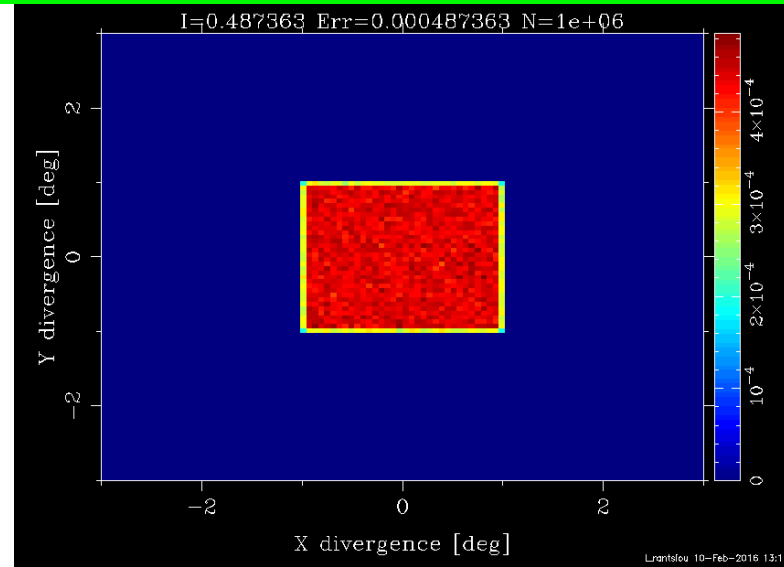
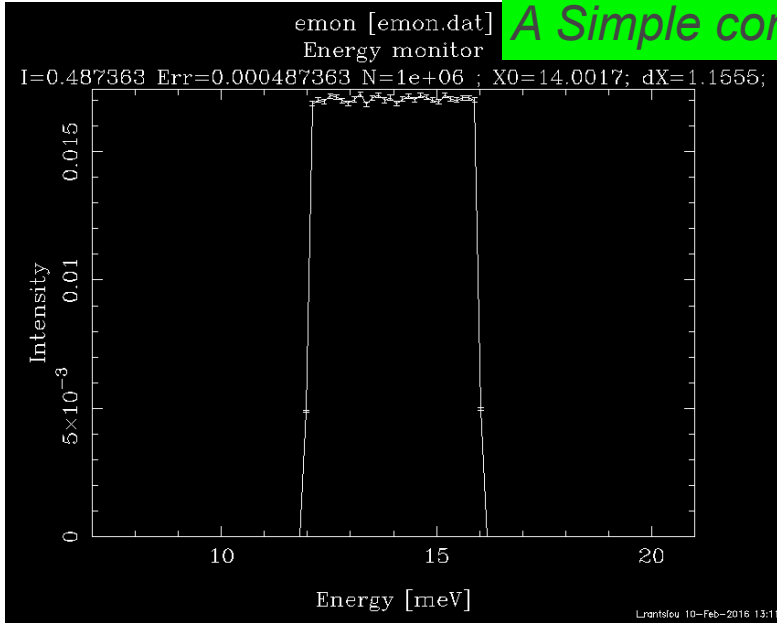
```
COMPONENT my_source_div = Source_div(xwidth=0.1, yheight=0.1,  
                                     focus_aw=2, focus_ah=2, E0=14, dE=2, gauss=0))
```

# Source\_div



[Source\\_div.comp](#)

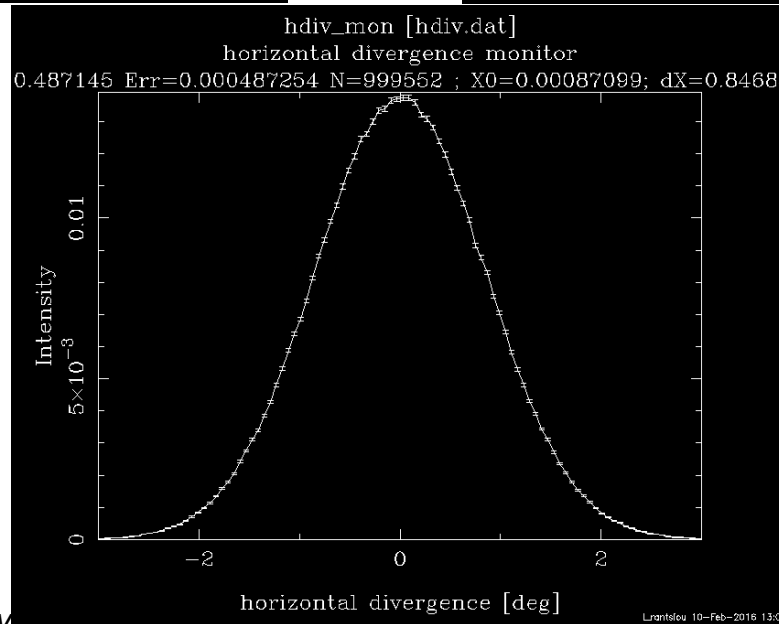
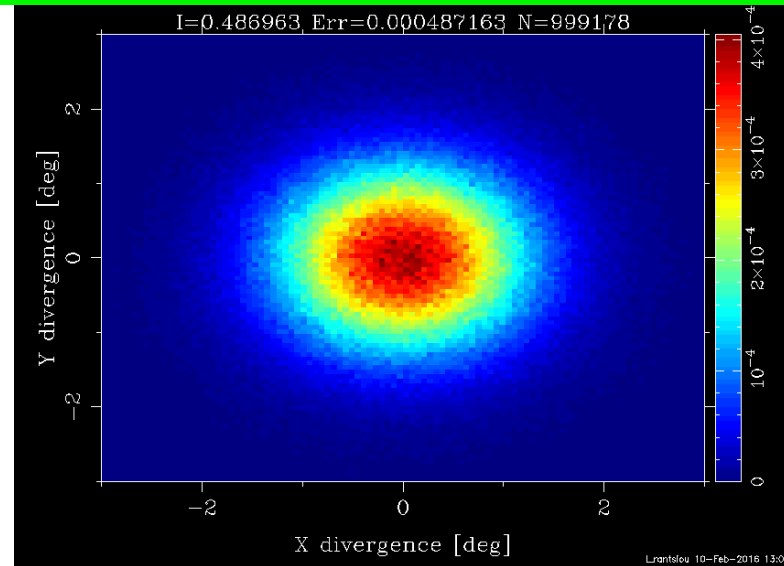
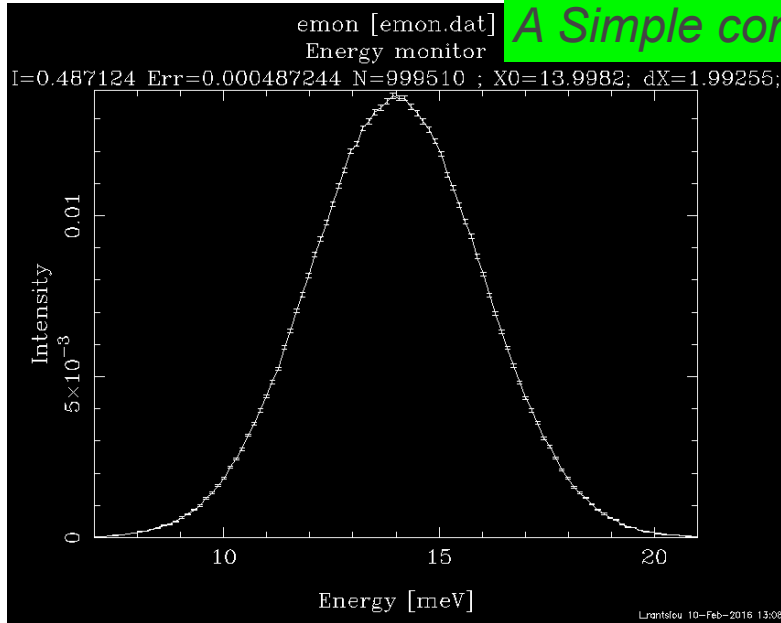
A Simple continuous source with flat energy/wavelength spectrum



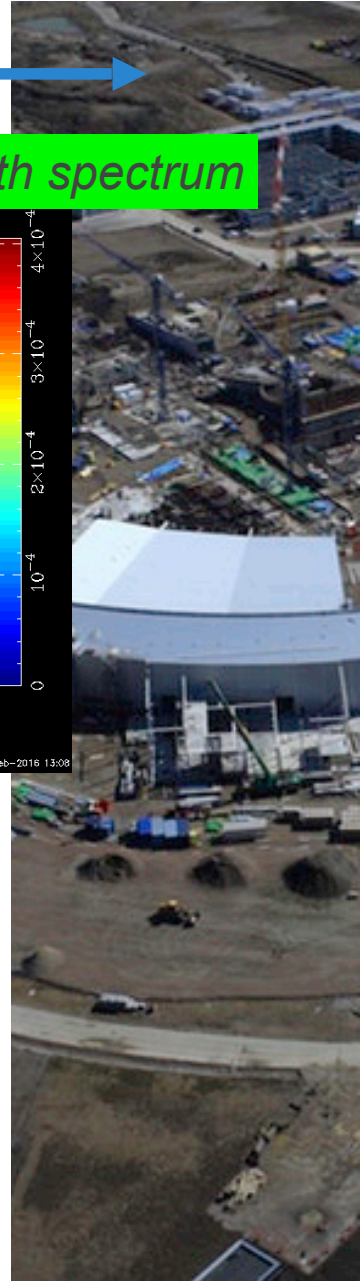
# Source\_div

[Source\\_div.comp](#)

A Simple continuous source with flat energy/wavelength spectrum



gauss = 1



# Source\_gen

## Source\_gen.comp

A general continuous source



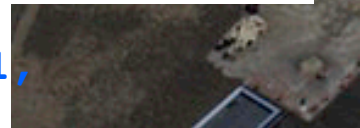
### Input parameters

Parameters in **boldface** are required; the others are optional.

Name	Unit	Description	Default
flux_file	str	Name of a two columns [lambda flux] text file that contains the wavelength distribution of the flux in either [1/(s*cm**2*st)] or [1/(s*cm**2*st*AA)] (see flux_file_perAA flag) Comments (#) and further columns are ignored. Format is compatible with McStas/PGPLOT wavelength monitor files. When specified, temperature and intensity values are ignored.	"NULL"
xdiv_file	str	Name of the x-horiz. divergence distribution file, given as a free format text matrix, preceeded with a line '# xylimits: xmin xmax xdiv_min xdiv_max'	"NULL"
ydiv_file	str	Name of the y-vert. divergence distribution file, given as a free format text matrix, preceeded with a line '# xylimits: ymin ymax ydiv_min ydiv_max'	"NULL"
radius	m	Radius of circle in (x,y,0) plane where neutrons are generated. You may also use 'yheight' and 'xwidth' for a square source	0.0
dist	m	Distance to target along z axis.	0
focus_xw	m	Width of target.	0.045
focus_yh	m	Height of target.	0.12
focus_aw	deg	maximal (uniform) horz. width divergence	0
focus_ah	deg	maximal (uniform) vert. height divergence	0
E0	meV	Mean energy of neutrons.	0
dE	meV	Energy spread of neutrons, half width.	0
lambda0	AA	Mean wavelength of neutrons.	0
dlambda	AA	Wavelength spread of neutrons, half width	0
I1	1/(cm**2*sr*AA)	Source flux per solid angle, area and Angstrom if I1=0, the source emits 1 in 4*PI whole space.	1
yheight	m	Source y-height, then does not use radius parameter	0.1
xwidth	m	Source x-width, then does not use radius parameter	0.1
verbose	0/1	display info about the source. -1 unactivate source.	0
T1	K	Temperature of the Maxwellian source, 0=none	0
flux_file_perAA	l	When true (1), indicates that flux file data is already per Angstrom. If false, file data is per wavelength bin.	0
flux_file_log	l	When true, will transform the flux table in log scale to improve the sampling.	0
Lmin	AA	Minimum wavelength of neutrons	0
Lmax	AA	Maximum wavelength of neutrons	0
Emin	meV	Minimum energy of neutrons	0
Emax	meV	Maximum energy of neutrons	0
T2	K	Second Maxwellian source Temperature, 0=none	0
I2	1/(cm**2*sr*AA)	Second Maxwellian Source flux	0
T3	K	Third Maxwellian source Temperature, 0=none	0
I3	1/(cm**2*sr*AA)	Third Maxwellian Source flux	0
zdepth	m	Source z-depth, not anymore flat	0
target_index	l	relative index of component to focus at, e.g. next is +1 this is used to compute 'dist' automatically.	+1

### Example:

```
COMPONENT my_source_gen = Source_gen(yheight=0.1, xwidth=0.1, Emin=1,
                                     Emax=3, I1=1e13, verbose=1, focus_xw=0.01,
                                     focus_yh=0.01)
```



# Source\_gen

## Source\_gen.comp

A general continuous source

### Input parameters

Parameters in **boldface** are required; the others are optional.

Name	Unit	Description	Default
flux_file	str	Name of a two columns [lambda flux] text file that contains the wavelength distribution of the flux in either [1/(s*cm**2*st)] or [1/(s*cm**2*st*AA)] (see flux_file_perAA flag) Comments (#) and further columns are ignored. Format is compatible with McStas/PGPLOT wavelength monitor files. When specified, temperature and intensity values are ignored.	"NULL"
xdiv_file	str	Name of the x-horiz divergence distribution file, given as a free format text matrix, preceeded with a line '# xylimits: xmin xmax xdiv_min xdiv_max'	"NULL"
ydiv_file	str	Name of the y-vert divergence distribution file, given as a free format text matrix, preceeded with a line '# xylimits: ymin ymax ydiv_min ydiv_max'	"NULL"
radius	m	Radius of circle in (x,y,0) plane where neutrons are generated. You may also use 'yheight' and 'xwidth' for a square source	0.0
dist		Distance to target along z axis.	0
focus_xw	m	Width of target.	0.045
focus_yh	m	Height of target.	0.12
focus_aws	deg	maximal (uniform) horz. width divergence	0
focus_ahs	deg	maximal (uniform) vert. height divergence	0
E0	meV	Mean energy of neutrons.	0
dE	meV	Energy spread of neutrons, half width.	0
lambda0	AA	Mean wavelength of neutrons.	0
dlambda	AA	Wavelength spread of neutrons, half width	0
I1	1/(cm**2*sr*AA)	Source flux per solid angle, area and Angstrom if I1=0, the source emits 1 in 4*PI whole space.	1
yheight	m	Source y-height, then does not use radius parameter	0.1
xwidth	m	Source x-width, then does not use radius parameter	0.1
verbose	0/1	display info about the source. -1 unactivate source.	0
T1	K	Temperature of the Maxwellian source, 0=none	0
flux_file_perAA	1	When true (1), indicates that flux file data is already per Angstrom. If false, file data is per wavelength bin.	0
flux_file_log	1	When true, will transform the flux table in log scale to improve the sampling.	0
Lmin	AA	Minimum wavelength of neutrons	0
Lmax	AA	Maximum wavelength of neutrons	0
Emin	meV	Minimum energy of neutrons	0
Emax	meV	Maximum energy of neutrons	0
T2	K	Second Maxwellian source Temperature, 0=none	0
I2	1/(cm**2*sr*AA)	Second Maxwellian Source flux	0
T3	K	Third Maxwellian source Temperature, 0=none	0
I3	1/(cm**2*sr*AA)	Third Maxwellian Source flux	0
zdepth	m	Source z-depth, not anymore flat	0
target_index	1	relative index of component to focus at, e.g. next is +1 this is used to compute 'dist' automatically.	+1

Source input can be an ASCII file!!

### Example:

```
COMPONENT my_source_gen = Source_gen(yheight=0.1, xwidth=0.1,
dist=1.5, focus_xw=0.01, focus_yh=0.01,
lambda0=1, dlambda=8,
flux_file='source.dat')
```

# Source\_Maxwell 3 ~ Source\_gen



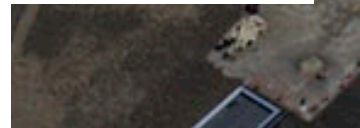
## Source\_Maxwell 3.comp

A continuous source with a maxwellian spectrum

### Input parameters

Parameters in **boldface** are required; the others are optional.

Name	Unit	Description	Default
flux_file	str	Name of a two columns [lambda flux] text file that contains the wavelength distribution of the flux in either [1/(s*cm**2*st)] or [1/(s*cm**2*st*AA)] (see flux_file_perAA flag) Comments (#) and further columns are ignored. Format is compatible with McStas/PGPLOT wavelength monitor files. When specified, temperature and intensity values are ignored.	"NULL"
xdiv_file	str	Name of the x-horiz. divergence distribution file, given as a free format text matrix, preceeded with a line '# xylimits: xmin xmax xdiv_min xdiv_max'	"NULL"
ydiv_file	str	Name of the y-vert. divergence distribution file, given as a free format text matrix, preceeded with a line '# xylimits: ymin ymax ydiv_min ydiv_max'	"NULL"
radius	m	Radius of circle in (x,y,0) plane where neutrons are generated. You may also use 'yheight' and 'xwidth' for a square source	0.0
dist	m	Distance to target along z axis.	0
focus_xw	m	Width of target.	0.045
focus_yh	m	Height of target.	0.12
focus_aws	deg	maximal (uniform) horz. width divergence	0
focus_ahs	deg	maximal (uniform) vert. height divergence	0
E0	meV	Mean energy of neutrons.	0
dE	meV	Energy spread of neutrons, half width.	0
lambda0	AA	Mean wavelength of neutrons.	0
dlambda	AA	Wavelength spread of neutrons, half width	0
I1	1/(cm**2*sr*AA)	Source flux per solid angle, area and Angstrom if I1=0, the source emits 1 in 4*PI whole space.	1
yheight	m	Source y-height, then does not use radius parameter	0.1
xwidth	m	Source x-width, then does not use radius parameter	0.1
verbose	0/1	display info about the source. -1 unactivate source.	0
T1	K	Temperature of the Maxwellian source, 0=none	0
flux_file_perAA	l	When true (1), indicates that flux file data is already per Angstrom. If false, file data is per wavelength bin.	0
flux_file_log	l	When true, will transform the flux table in log scale to improve the sampling.	0
Lmin	AA	Minimum wavelength of neutrons	0
Lmax	AA	Maximum wavelength of neutrons	0
Emin	meV	Minimum energy of neutrons	0
Emax	meV	Maximum energy of neutrons	0
T2	K	Second Maxwellian source Temperature, 0=none	0
I2	1/(cm**2*sr*AA)	Second Maxwellian Source flux	0
T3	K	Third Maxwellian source Temperature, 0=none	0
I3	1/(cm**2*sr*AA)	Third Maxwellian Source flux	0
zdepth	m	Source z-depth, not anymore flat	0
target_index	l	relative index of component to focus at, e.g. next is +1 this is used to compute 'dist' automatically.	+1



# Source\_Maxwell\_3

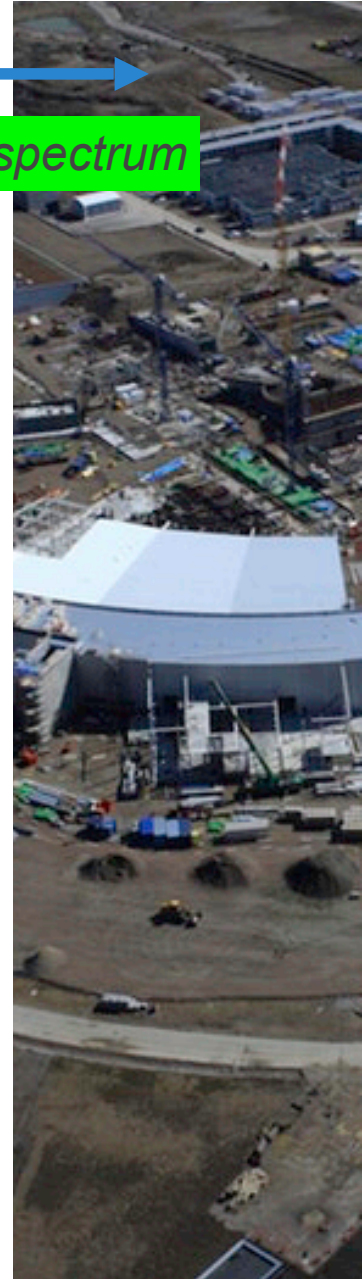
[Source\\_Maxwell\\_3.comp](#)

A continuous source with a maxwellian spectrum

## Input parameters

Parameters in **boldface** are required; the others are optional.

Name	Unit	Description	Default
size	m	Edge of cube shaped source (for backward compatibility)	0
yheight	m	Height of rectangular source	0
xwidth	m	Width of rectangular source	0
<b>Lmin</b>	AA	Lower edge of lambda distribution	
<b>Lmax</b>	AA	Upper edge of lambda distribution	
<b>dist</b>	m	Distance from source to focusing rectangle; at (0,0,dist)	
<b>focus_xw</b>	m	Width of focusing rectangle	
<b>focus_yh</b>	m	Height of focusing rectangle	
<b>T1</b>	K	1st temperature of thermal distribution	
T2	K	2nd temperature of thermal distribution	300
T3	K	3rd temperature of - - -	300
<b>I1</b>	in flux units, see above	[1/(cm**2*st*AA)] flux, 1	
I2	in flux units, see above	[1/(cm**2*st*AA)] flux, 2	0
I3	1/(cm**2*st*AA)	flux, 3 - - -	0
target_index	1	relative index of component to focus at, e.g. next is +1 this is used to compute 'dist' automatically.	+1
lambda0	AA	Mean wavelength of neutrons.	0
dlambda	AA	Wavelength spread of neutrons.	0



```
COMPONENT source = Source_Maxwell_3(yheight=0.156, xwidth=0.126,
                                     Lmin=0.1, Lmax=9.0, dist=1.5, focus_xw = 0.025,
                                     focus_yh = 0.12, T1=296.16, I1=8.5E11,
                                     T2=40.68, I2=5.2E11)
```

# Special sources

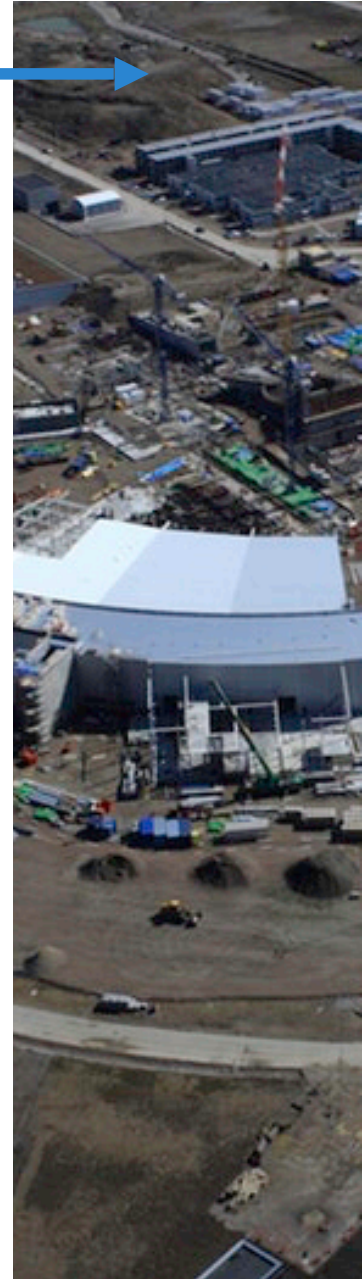
## Special Sources

### “Feedback” components:

- \* *Adapt\_check.comp*
- \* *Source\_adapt.comp*
- \* *Source\_Optimizer.comp*
- \* *Monitor\_Optimizer.comp*

### I/O mechanisms:

- \* *Virtual\_input.comp*
- \* *Virtual\_output.comp*
- \* ***Virtual\_mcnp\_ss\_input.comp***
- \* *Virtual\_tripoli4\_input.comp*
- \* ***Virtual\_mcnp\_ss\_output.comp***
- \* *Virtual\_tripoli4\_output.comp*
- \* *Vitess\_input.comp*
- \* *Vitess\_output.comp*
- \* *MCPL\_input.comp* (useful for MCNP/McStas coupling (\*))
- \* *MCPL\_output.comp* (useful for MCNP/McStas coupling (\*))



(\*) Kittelmann, et. al (2017) <https://arxiv.org/abs/1609.02792>

# Special sources



## “Feedback” components:

- \* *Adapt\_check.comp*
- \* *Source\_adapt.comp*
- \* *Source\_Optimizer.comp*
- \* *Monitor\_Optimizer.comp*

## Special Sources

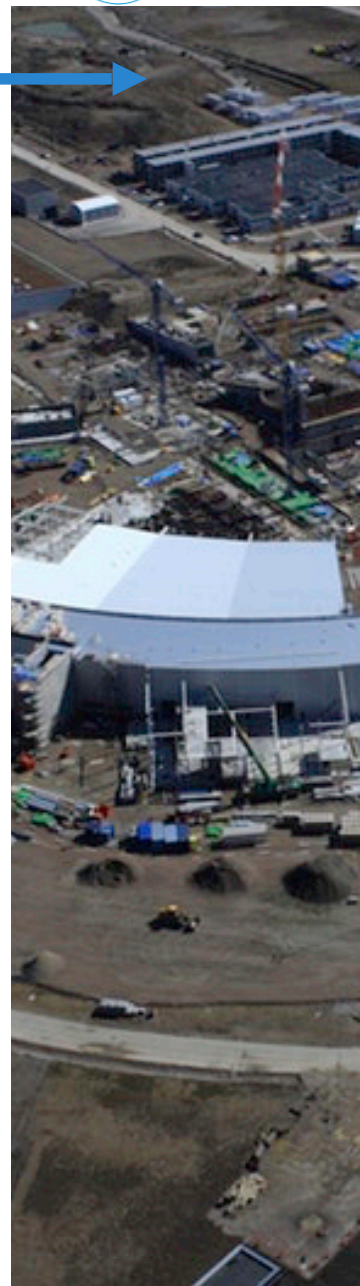
**Need more practical info on that?  
Ask the instructors (could say something on friday)**

- \* *Virtual\_input.comp*
- \* *Virtual\_output.comp*
- \* ***Virtual\_mcnp\_ss\_input.comp***
- \* *Virtual\_tripoli4\_input.comp*
- \* ***Virtual\_mcnp\_ss\_output.comp***
- \* *Virtual\_tripoli4\_output.comp*
- \* *Vitess\_input.comp*
- \* *Vitess\_output.comp*
- \* *MCPL\_input.comp* (useful for MCNP/McStas coupling (\*))
- \* *MCPL\_output.comp* (useful for MCNP/McStas coupling (\*))



(\* Kittelmann, et. al (2017) <https://arxiv.org/abs/1609.02792>

# Monitors



## Detectors and monitors

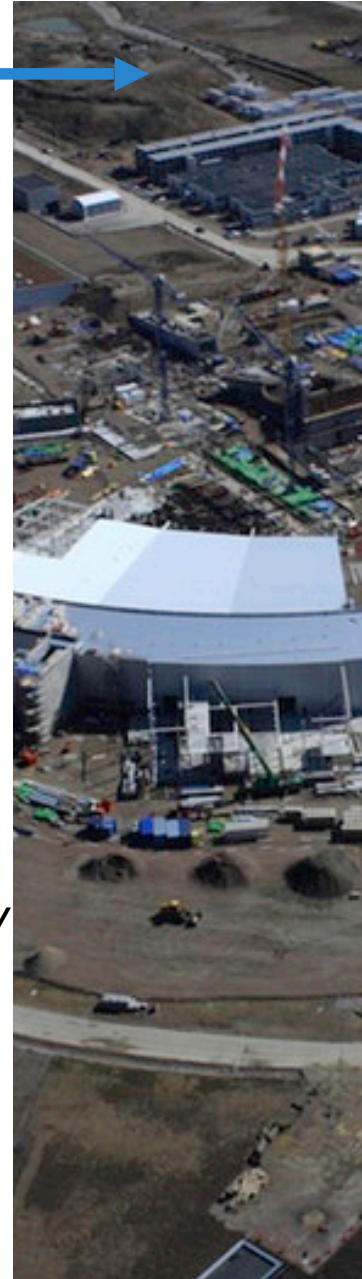
Name	Origin	Author(s)	Source code	Description
<a href="#">DivLambda_monitor</a>	Risoe	Kristian Nielsen	<a href="#">comp</a>	Divergence/wavelength monitor.
<a href="#">DivPos_monitor</a>	Risoe	Kristian Nielsen	<a href="#">comp</a>	Divergence/position monitor (acceptance diagram).
<a href="#">Divergence_monitor</a>	Risoe	Kim Lefmann	<a href="#">comp</a>	Horizontal+vertical divergence monitor.
<a href="#">EPSD_monitor</a>	Risoe	Kim Lefmann	<a href="#">comp</a>	A monitor measuring neutron intensity vs. position, x, and neutron energy, E
<a href="#">E_monitor</a>	Risoe	Kristian Nielsen and Kim Lefmann	<a href="#">comp</a>	Energy-sensitive monitor.
<a href="#">Hdiv_monitor</a>	Risoe	KL,	<a href="#">comp</a>	A divergence sensitive monitor.
<a href="#">L_monitor</a>	Risoe	Kristian Nielsen and Kim Lefmann	<a href="#">comp</a>	Wavelength-sensitive monitor.
<a href="#">MeanPolLambda_monitor</a>	Risoe	Peter Christiansen	<a href="#">comp</a>	Polarisation and wavelength sensitive monitor.
<a href="#">Monitor</a>	Risoe	Kim Lefmann	<a href="#">comp</a>	Simple single detector/monitor.
<a href="#">Monitor_4PI</a>	Risoe	Kim Lefmann and Kristian Nielsen	<a href="#">comp</a>	Monitor that detects ALL non-absorbed neutrons. Example: Monitor_4PI()
<a href="#">Monitor_nD</a>	<a href="#">ILL</a>	<a href="#">Emmanuel Farhi</a>	<a href="#">comp</a>	This component is a general Monitor that can output 0/1/2D signals (Intensity or signal vs. [something] and vs. [something] ...)
<a href="#">PSD_monitor</a>	Risoe	Kim Lefmann	<a href="#">comp</a>	Position-sensitive monitor.
<a href="#">PSD_monitor_4PI</a>	Risoe	Kim Lefmann and Kristian Nielsen	<a href="#">comp</a>	Spherical position-sensitive detector.
<a href="#">PSDev1_monitor</a>	Risoe	Kim Lefmann	<a href="#">comp</a>	A 2D Position-sensitive monitor. The shape is cylindrical with the axis vertical. The monitor covers the whole cylinder (360 degrees).
<a href="#">PSDlin_monitor</a>	Risoe	Kim Lefmann	<a href="#">comp</a>	Rectangular 1D PSD, measuring intensity vs. vertical position, x
<a href="#">PolLambda_monitor</a>	Risoe	Peter Christiansen	<a href="#">comp</a>	Polarisation and wavelength sensitive monitor.
<a href="#">Pol_monitor</a>	Risoe	Peter Christiansen	<a href="#">comp</a>	Polarisation sensitive monitor.
<a href="#">PreMonitor_nD</a>	<a href="#">ILL (France)</a>	<a href="#">Emmanuel Farhi</a>	<a href="#">comp</a>	Neutron parameters cross-correlation monitor.
<a href="#">Res_monitor</a>	Risoe	Kristian Nielsen	<a href="#">comp</a>	Monitor for resolution calculations
<a href="#">TOF2E_monitor</a>	Risoe	Kim Lefmann and Helmuth Schoeber	<a href="#">comp</a>	TOF-sensitive monitor, converting to energy
<a href="#">TOFLambda_monitor</a>	Risoe	KL	<a href="#">comp</a>	Time-of-flight/wavelength monitor.
<a href="#">TOF_cylPSD_monitor</a>	Risoe	Kim Lefmann	<a href="#">comp</a>	Cylindrical (2pi) PSD Time-of-flight monitor.
<a href="#">TOF_monitor</a>	Risoe	KN, M. Hagen	<a href="#">comp</a>	Rectangular Time-of-flight monitor.
<a href="#">TOFlog_mon</a>	Risoe	Kim Lefmann	<a href="#">comp</a>	Rectangular Time-of-flight monitor with logarithmic time binning.

# Monitors

## Semantics

- \* *In reality:*
  - \* *Monitor: intensity probe of the beam; transparent to neutrons; has efficiency <1%*
  - \* *Detector: should detect each and every neutron; as high efficiency as possible.*
  
- \* *In McStas:*
  - \* *In simulations we can program monitors and detectors to behave any way we like. We refer to both of those indistinguishably as ‘monitors’.*

*(With exception of PSD\_Detector that models a “physical” He<sup>3</sup> detector)*



# L\_monitor

[L\\_monitor.comp](http://L_monitor.comp)

1-D wavelength sensitive monitor

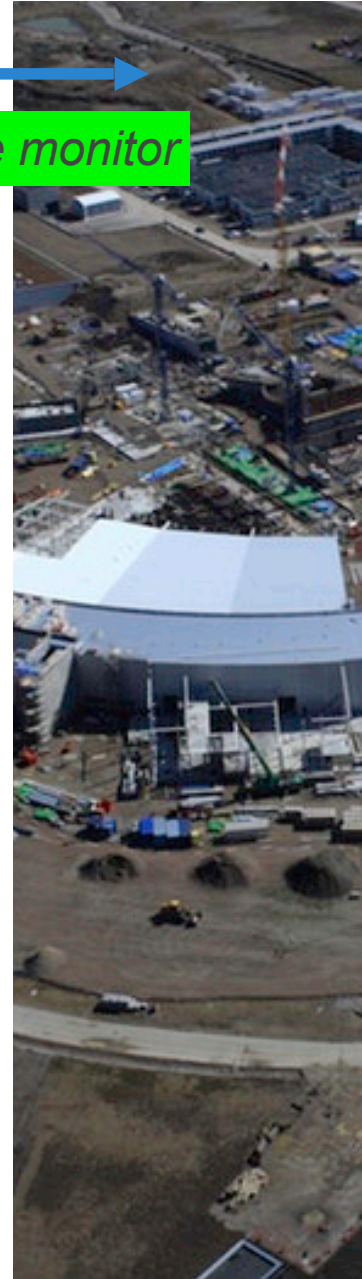
## Input parameters

Parameters in **boldface** are required; the others are optional.

Name	Unit	Description	Default
nL	1	Number of wavelength channels	20
filename	text	Name of file in which to store the detector image	0
xmin	m	Lower x bound of detector opening	-0.05
xmax	m	Upper x bound of detector opening	0.05
ymin	m	Lower y bound of detector opening	-0.05
ymax	m	Upper y bound of detector opening	0.05
xwidth	m	Width of detector. Overrides xmin,xmax.	0
yheight	m	Height of detector. Overrides ymin,ymax.	0
<b>Lmin</b>	AA	Minimum wavelength to detect	
<b>Lmax</b>	AA	Maximum wavelength to detect	
restore_neutron	1	If set, the monitor does not influence the neutron state	0

### Example:

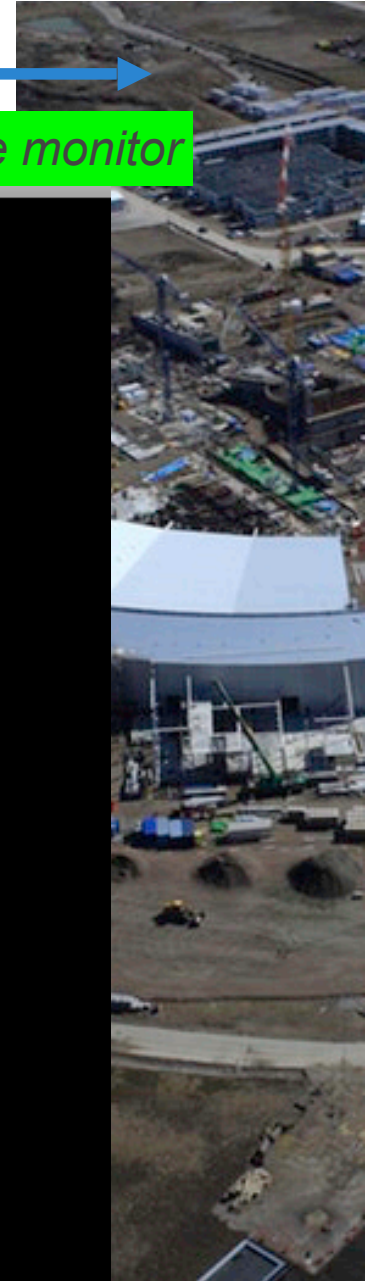
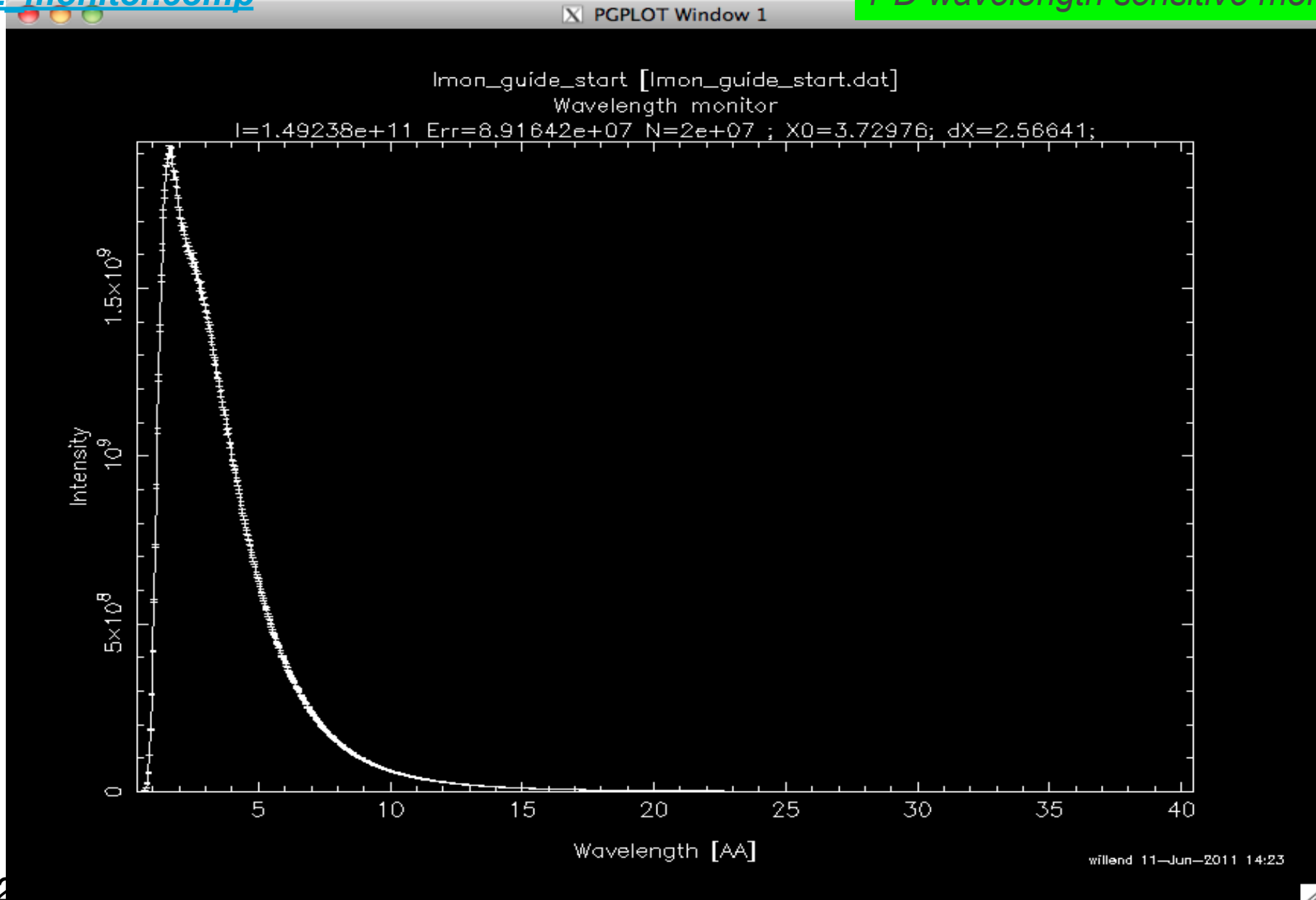
```
COMPONENT my_L_monitor = L_monitor(xmin=-0.1, xmax=0.1, ymin=-0.1,
                                     ymax=0.1, nL=20, filename="Output.L",
                                     Lmin=2, Lmax=10)
```



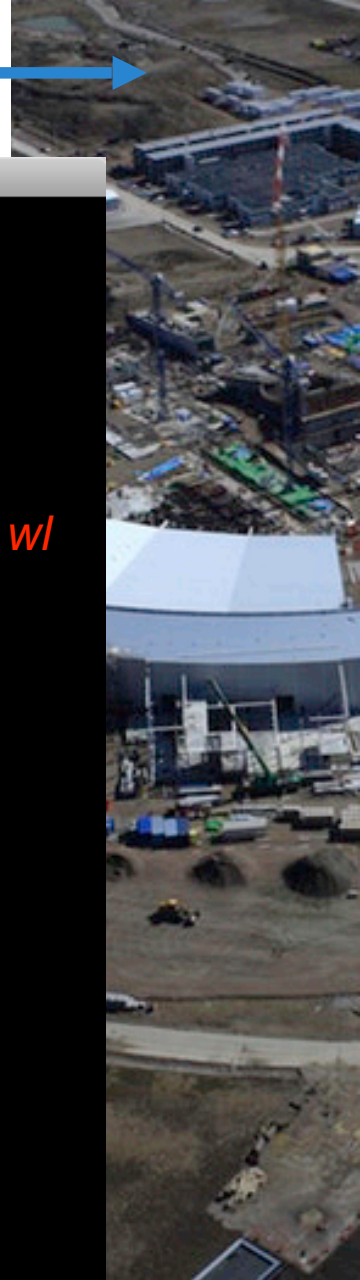
# L\_monitor

[L\\_monitor.comp](http://L_monitor.comp)

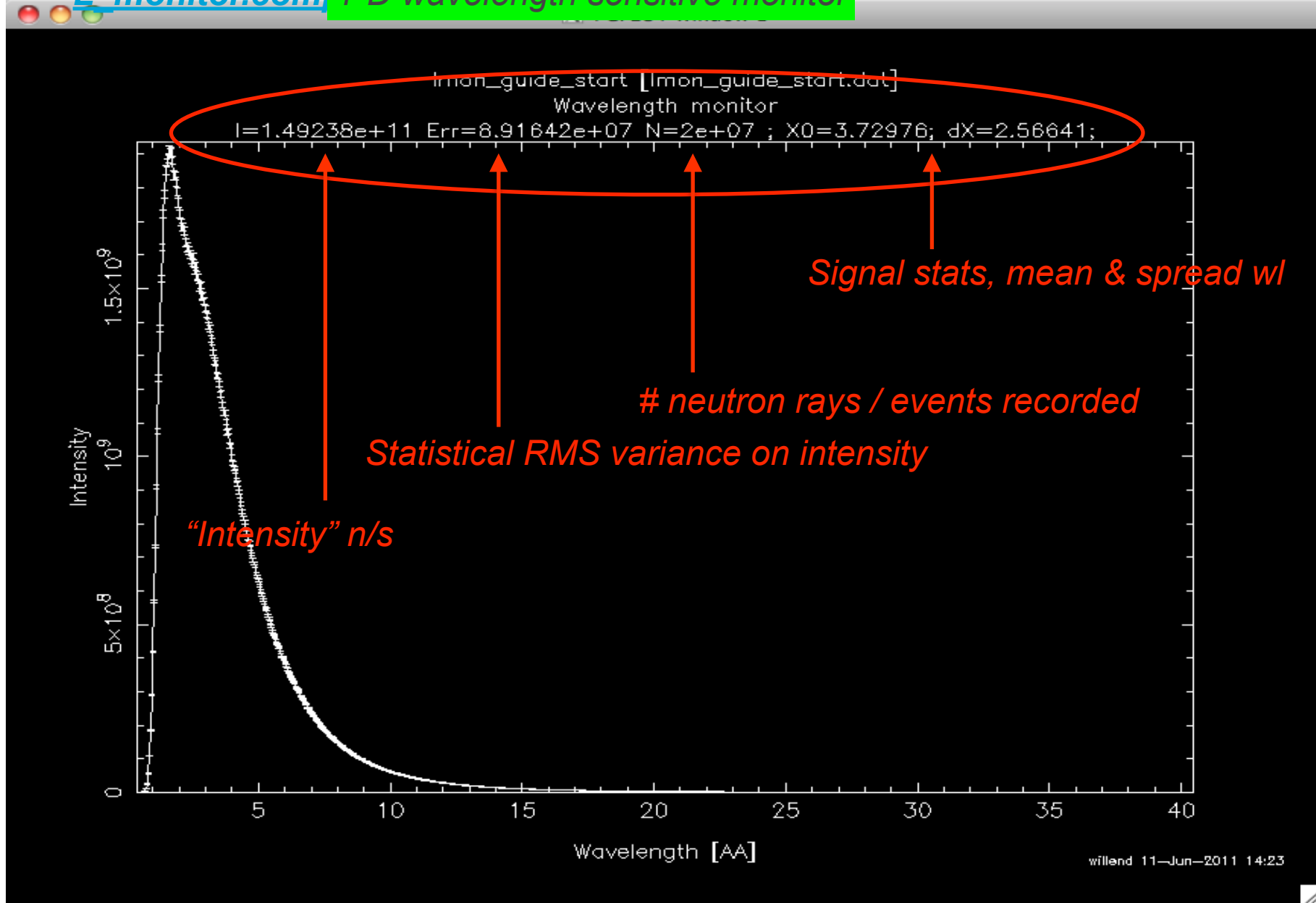
1-D wavelength sensitive monitor



# L\_monitor



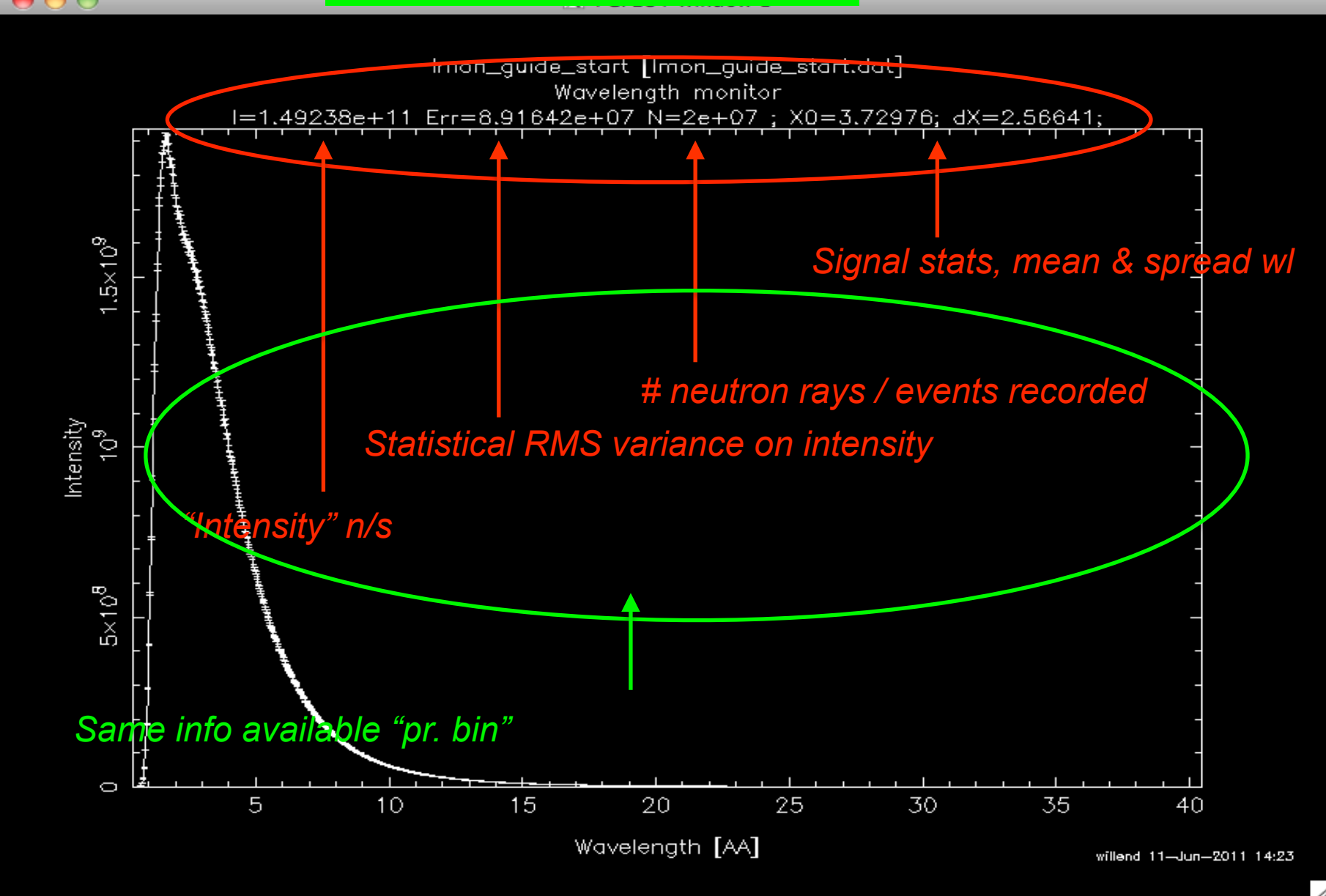
[L\\_monitor.com](http://L_monitor.com) 1-D wavelength sensitive monitor



# L\_monitor



[L\\_monitor.com](http://L_monitor.com) 1-D wavelength sensitive monitor



# PSD\_monitor

[PSD\\_monitor.comp](http://PSD_monitor.comp)

2-D position sensitive monitor

## Input parameters

Parameters in **boldface** are required; the others are optional.

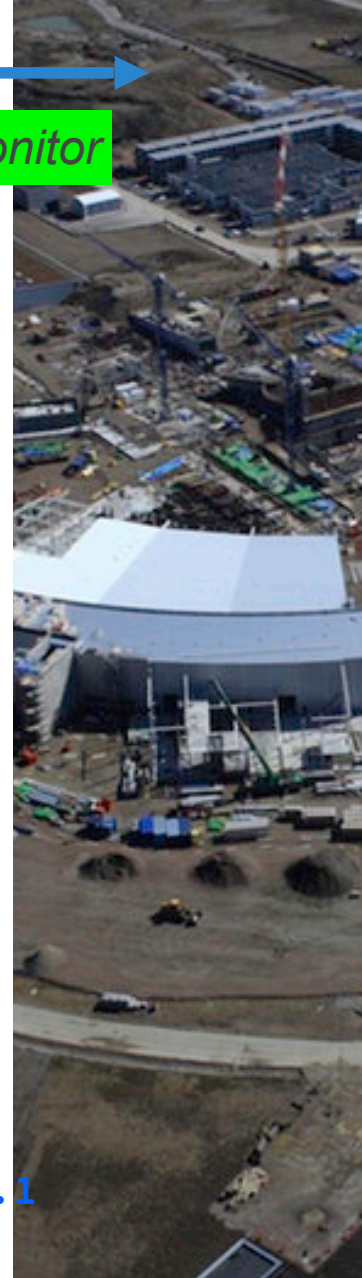
Name	Unit	Description	Default
<b>nx</b>	1	Number of pixel columns	90
<b>ny</b>	1	Number of pixel rows	90
<b>restore_neutron</b>	1	If set, the monitor does not influence the neutron state	0
<b>filename</b>	text	Name of file in which to store the detector image	0
<b>xmin</b>	m	Lower x bound of detector opening	-0.05
<b>xmax</b>	m	Upper x bound of detector opening	0.05
<b>ymin</b>	m	Lower y bound of detector opening	-0.05
<b>ymax</b>	m	Upper y bound of detector opening	0.05
<b>xwidth</b>	m	Width of detector. Overrides xmin,xmax.	0
<b>yheight</b>	m	Height of detector. Overrides ymin,ymax.	0

### Example:

```
COMPONENT my_PSD_monitor = PSD_monitor(xmin=-0.1, xmax=0.1, ymin=-0.1  

ymax=0.1, nx=90, ny=90,  

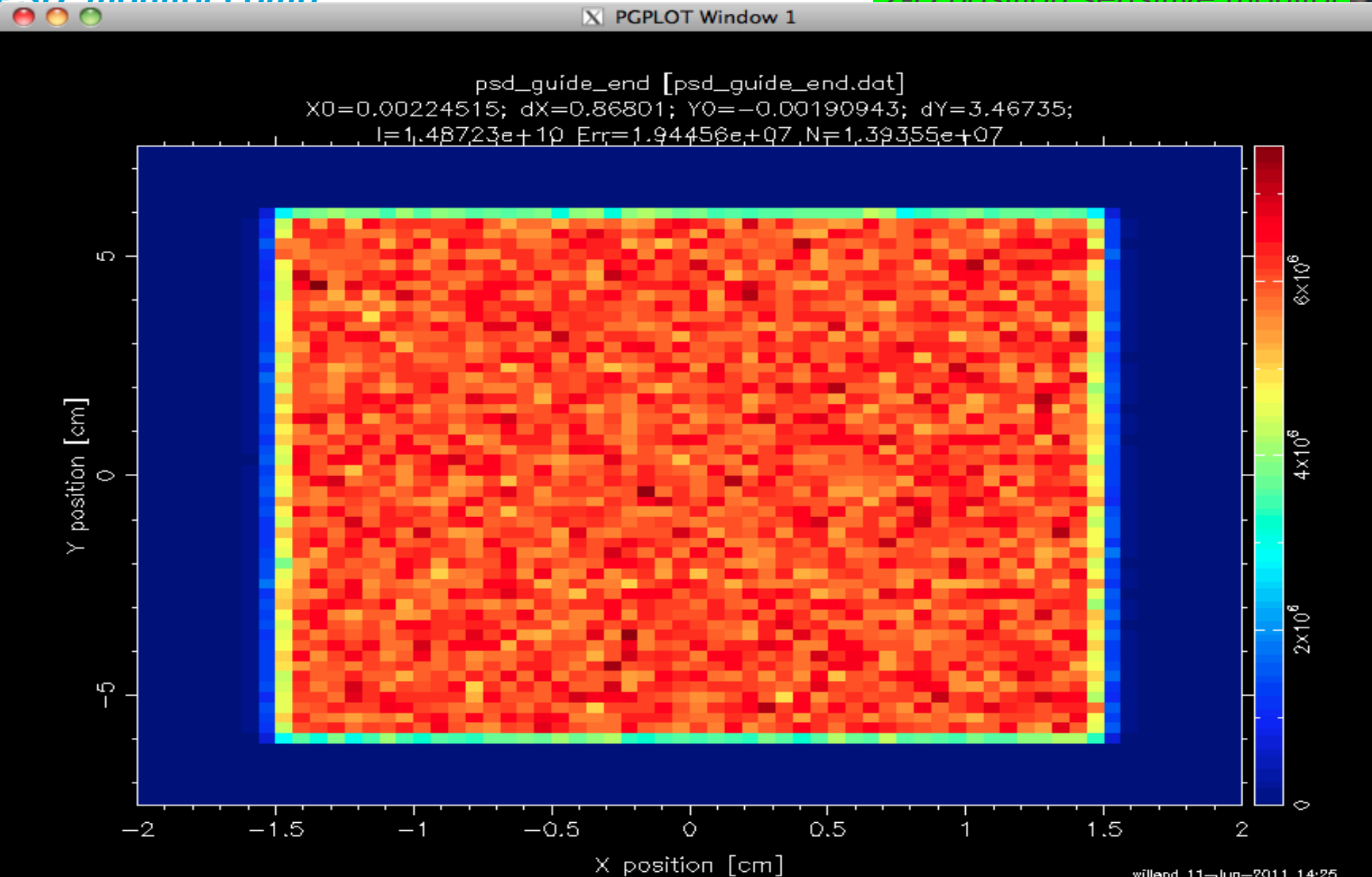
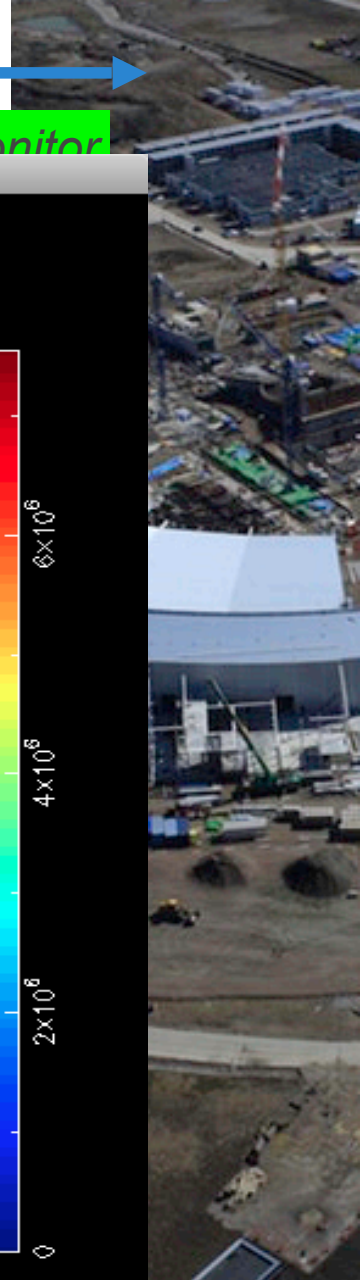
filename="Output.psd")
```



# PSD\_monitor

PSD\_monitor.comp

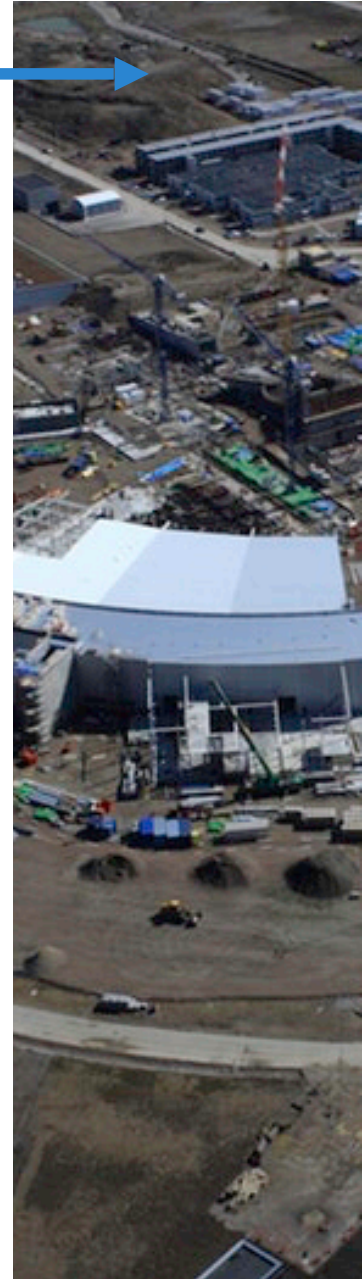
2-D position sensitive monitor



# More monitors

## More Monitors

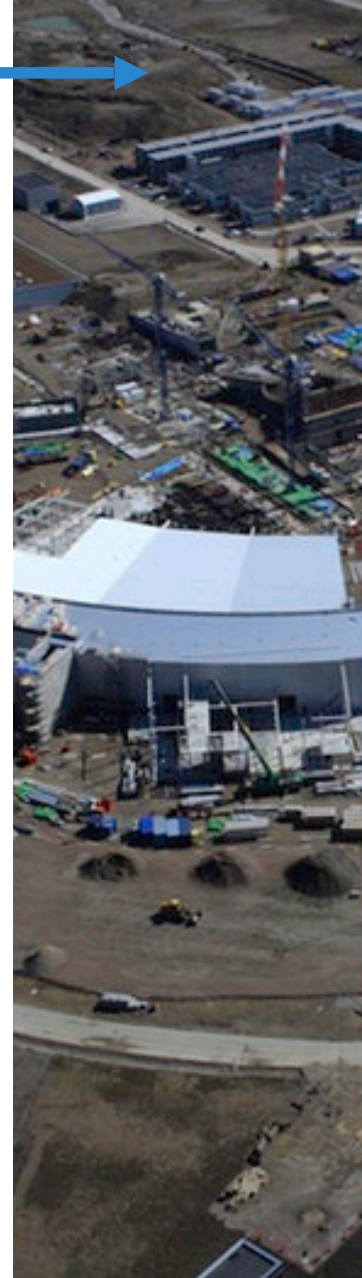
- \* *TOF\_monitor.comp*
- \* *E\_monitor.comp* (1-D energy sensitive monitor)
- \* *Res\_monitor.comp*
- \* *TOFLambda\_monitor.comp* (2-D TOF vs. wavelength monitor)
- \* *Divergence\_monitor.comp* (2-D divergence monitor)
- \* *EPSD\_monitor.comp*
- \* *DivPos\_monitor.comp* (2-D divergence and position monitor)
- \* *Brilliance\_monitor.comp*
- \* *DivLambda\_monitor.comp*
- \* *Monitor.comp*
- \* *Hdiv\_monitor.comp*
- \* *PSDlin\_monitor.comp*
- \* *PSD\_monitor\_4PI.comp*
- \* *Monitor\_Sqw.comp*
- \* *Pol\_monitor.comp*
- \* *Monitor\_4PI.comp*
- \* .....
- \* *Monitor\_nD*



# More monitors

## More Monitors

- \* *TOF\_monitor.comp*
- \* *E\_monitor.comp* (1-D energy sensitive monitor)
- \* *Res\_monitor.comp*
- \* *TOFLambda\_monitor.comp* (2-D TOF vs. wavelength monitor)
- \* *Divergence\_monitor.comp* (2-D divergence monitor)
- \* *EPD\_monitor.comp*
- \* *DivPos\_monitor.comp* (2-D divergence and position monitor)
- \* *Brilliance\_monitor.comp*
- \* *DivLambda\_monitor.comp*
- \* *Monitor.comp*
- \* *Hdiv\_monitor.comp*
- \* *PSDlin\_monitor.comp*
- \* *PSD\_monitor\_4PI.comp*
- \* *Monitor\_Sqw.comp*
- \* *Pol\_monitor.comp*
- \* *Monitor\_4PI.comp*
- \* .....
- \* *Monitor\_nD*



# More monitors

## More Monitors

- \* *TOF\_monitor.comp*
- \* *E\_monitor.comp* (1-D energy sensitive monitor)
- \* *Res\_monitor.comp*
- \* *TOFLambda\_monitor.comp* (2-D TOF vs. wavelength monitor)
- \* *Divergence\_monitor.comp* (2-D divergence monitor)
- \* *EPD\_monitor.comp*
- \* *DivPos\_monitor.comp* (2-D divergence and position monitor)
- \* *Brilliance\_monitor.comp*
- \* *DivLambda\_monitor.comp*
- \* *Monitor.comp*
- \* *Hdiv\_monitor.comp*
- \* *PSDlin\_monitor.comp*
- \* *PSD\_monitor\_4PI.comp*
- \* *Monitor\_Sqw.comp*
- \* *Pol\_monitor.comp*
- \* *Monitor\_4PI.comp*
- \* *Monitor\_nD*



# Monitor\_nD

[Monitor\\_nD.comp](http://Monitor_nD.comp)

A general monitor for 0D/1D/2D records

*The all-in-one , swiss-army-knife of monitors*

*Monitor\_nD can have almost any shape, and record any requested standard quantities*



# Monitor\_nD

[Monitor\\_nD.comp](#)

A general monitor for 0D/1D/2D records

## Input parameters



Parameters in **boldface** are required; the others are optional.

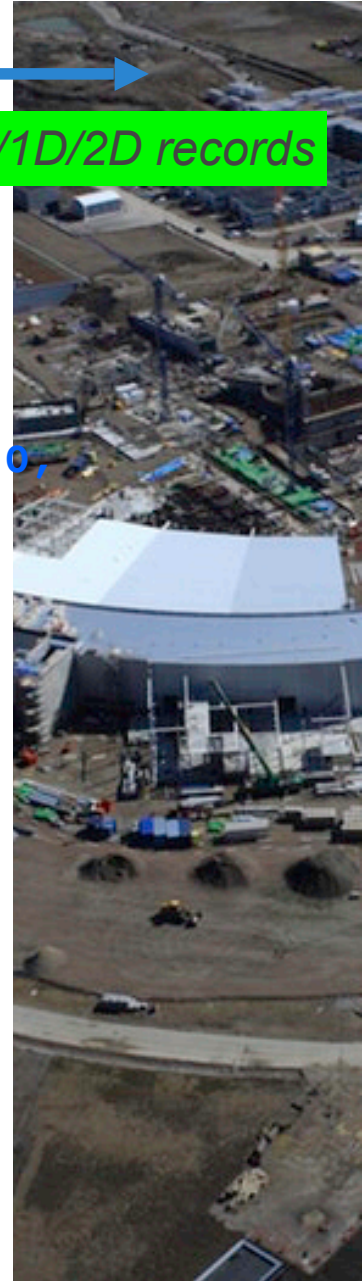
Name	Unit	Description	Default
user1	variable	Variable assigned to User1	FLT_MAX
user2	variable	Variable assigned to User2	FLT_MAX
user3	variable	Variable assigned to User3	FLT_MAX
xwidth	m	Width of detector.	0
yheight	m	Height of detector.	0
zdepth	m	Thickness of detector (z).	0
xmin	m	Lower x bound of opening	0
xmax	m	Upper x bound of opening	0
ymin	m	Lower y bound of opening	0
ymax	m	Upper y bound of opening	0
zmin	m	Lower z bound of opening	0
zmax	m	Upper z bound of opening	0
bins	l	Number of bins to force for all variables. Use 'bins' keyword in 'options' for heterogeneous bins	0
min	u	Minimum range value to force for all variables Use 'min' or 'limits' keyword in 'options' for other limits	-1e40
max	u	Maximum range value to force for all variables Use 'max' or 'limits' keyword in 'options' for other limits	1e40
restore_neutron	0/1	If set, the monitor does not influence the neutron state. Equivalent to setting the 'parallel' option.	0
radius	m	Radius of sphere/banana shape monitor	0
options	str	String that specifies the configuration of the monitor The general syntax is "[x] options..." (see <b>Descr.</b> ).	"NULL"
filename	str	Output file name (overrides file=XX option).	"NULL"
geometry	str	Name of an OFF file to specify a complex geometry detector	"NULL"
username1	str	Name assigned to User1	"NULL"
username2	str	Name assigned to User2	"NULL"
username3	str	Name assigned to User3	"NULL"

# Monitor\_nD

Monitor\_nD.comp



A general monitor for 0D/1D/2D records



## EXAMPLES:

```
COMPONENT MyMon = Monitor_nD( xwidth = 0.1, yheight = 0.1, zdepth = 0,
    options = "intensity per cm2 angle,limits=[-5 5],
    bins=10,with borders, file = mon1")
    options = "banana, theta limits=[10,130], bins=120, y"
    options = "multiple kx ky kz, auto abs log t, and list all neutrons"
```

```
COMPONENT MyMo = Monitor_nD(xwidth = 0.1, yheight = 0.1,
    user1=age, username1="Age of the Captain
    [years]",
    options="user1, auto")
```

*Mathematical:*

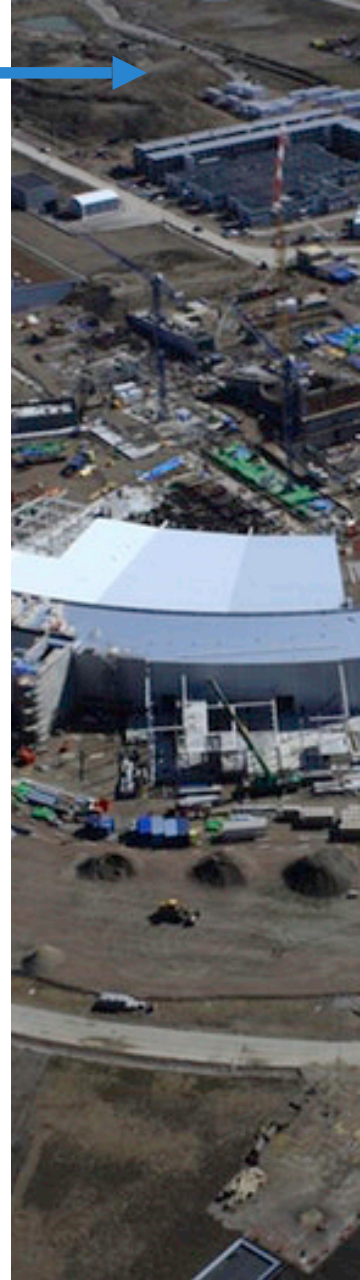
- *Source\_simple.comp*
- *Source\_div.comp*

*Pulsed sources:*

- *ESS\_moderator.comp*
- *Moderator.comp*
- *SNS\_source.comp (\*)*
- *ISIS\_moderator.comp (\*)*

*Reactors :*

- Source\_Maxwell\_3.comp*
- Source\_gen.comp*
- Source\_gen4.comp*
- Source\_multi\_surfaces.comp (\*)*



# A job for you...

## EXERCISE 1



- Create a new instrument file, named 'sources\_monitors\_ex.instr'.  
HINT: you can use the 'template.instr' file that exists in today's class folder and you can open it with the editor of your liking, or open it from the McStas gui by clicking either:
  - File → New (python) or
  - neutron site --> Templates --> template\_simple (perl)
- Add a source using the Source\_gen.comp component, with:
  - source dimensions: (w)0.132m X (h)0.164m
  - distance to target : 1.5 m
  - focus area: (w)0.03m X (h)0.12m
  - wavelength range: 0.1Å to 9.9Å
  - T1=27.63[K], I1=2.4E12 [n/s/cm<sup>2</sup>/st/AA], T2=130.76[K], I2=4.03E12[n/s/cm<sup>2</sup>/st/AA] , T3=309.33[K], I3=1.24E13[n/s/cm<sup>2</sup>/st/AA]
- Add the following monitors at two different distances from the source, at 1.5m and 4.5m:
  - PSD monitor (PSD\_monitor)
  - A linear PSD monitor for the y-direction (PSDlin\_monitor)
  - Wavelength monitor (L\_monitor)
  - 2D Divergence monitor (Divergence\_monitor)
  - Divergence-position monitor for the x-direction (DivPos\_monitor)