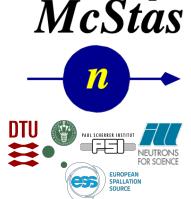


# Realistic Laue cameras

-<sup>2019 CSNS</sup>  
<sup>McStas</sup>  
<sup>School</sup>  
*Using McStas keywords and a look at polycrystal-  
samples*



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# Agenda

- ★ *A realistic Laue Camera – How to?*
- ★ *Polycrystals - how to describe them?*
- ★ *Combining a powder sample with a Single Crystal*
- ★ *Tricking the Single\_crystal...*
- ★ *A reminder of the GROUP and SPLIT keywords*
- ★ *The dangerous JUMP keyword*
- ★ *A look at the TOPAZ and SENJU instruments*

# TOPAZ

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Let us take a look at a couple of “real” instrument simulations  
of Laue Cameras:

They both reside in GitHub under today / 3\_Laue\_diffractometers\_TOPAZ\&  
SENJU/

1. **SNS TOPAZ**
2. J.PARC SENJU (aka. BL18)
3. J.PARC SENJU POLY

Here you need to also copy a datafile for the J-PARC source  
**“source\_BL18.txt”**

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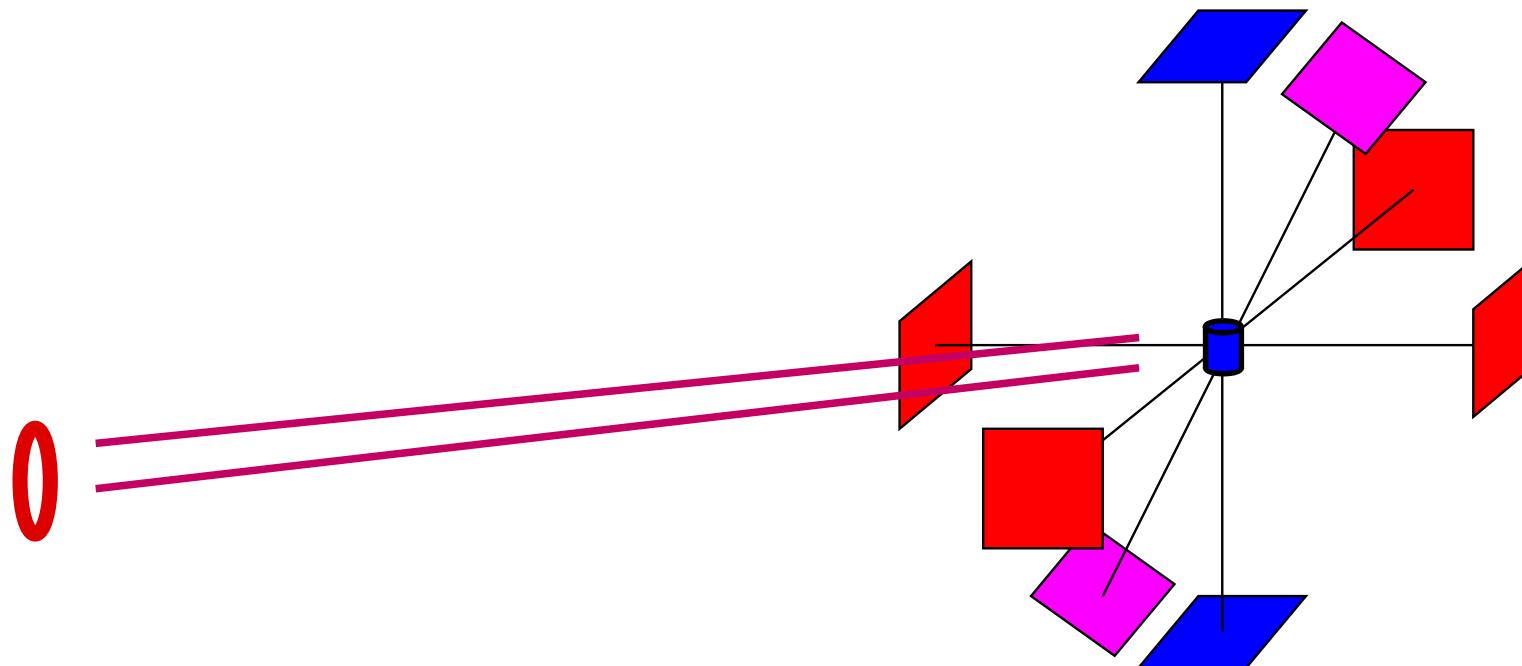
McStas



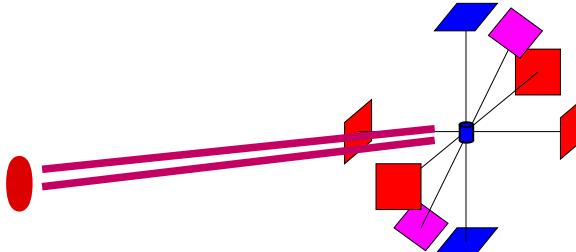
Surgeon General's Warning:  
There are lots of COMPONENTS here

# Real Laue camera

- A source and a guide system delivering neutrons to the sample.
- A (large) set of detectors that surround a sample.

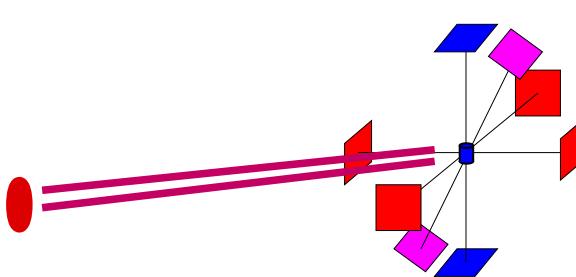


# Real Laue camera



*Easiest way to build detector bank with spherical geometry:*

- Use **Arms** on sample position but with rotations.  
... **Arms** cost almost nothing in computations
- One arm per detector pointing at its centre → rotate it by an appropriate amount.
- Place **Monitors** in a **GROUP**.
- Remember to use `restore_neutron=1`



# Real Laue camera

COMPONENT a1 = Arm()  
AT(0,0,0) RELATIVE sample  
ROTATED (90,0,0) RELATIVE sample

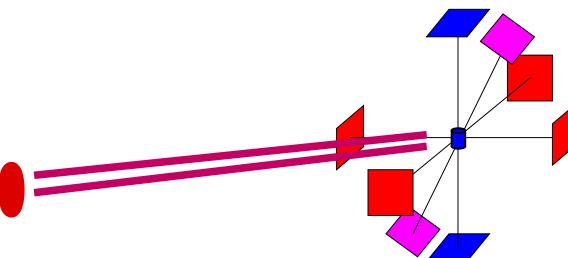
COMPONENT a2 = Arm()  
AT(0,0,0) RELATIVE sample  
ROTATED (-90,0,0) RELATIVE sample

COMPONENT a3 = Arm()  
AT(0,0,0) RELATIVE sample  
ROTATED (0,90,0) RELATIVE sample

COMPONENT a4 = Arm()  
AT(0,0,0) RELATIVE sample  
ROTATED (0,-90,0) RELATIVE sample'

COMPONENT a5 = Arm()  
AT(0,0,0) RELATIVE sample  
ROTATED (-60,0,0) RELATIVE sample'

....



# Real Laue camera

```
COMPONENT d1 = PSD_monitor( nx=101, ny=101,  
    filename="d1", xwidth= ... )
```

```
AT(0,0,0.5) RELATIVE a1  
GROUP detectors
```

```
COMPONENT d2 = COPY(d1)(filename="d2")  
AT(0,0,0.5) RELATIVE a2  
GROUP detectors
```

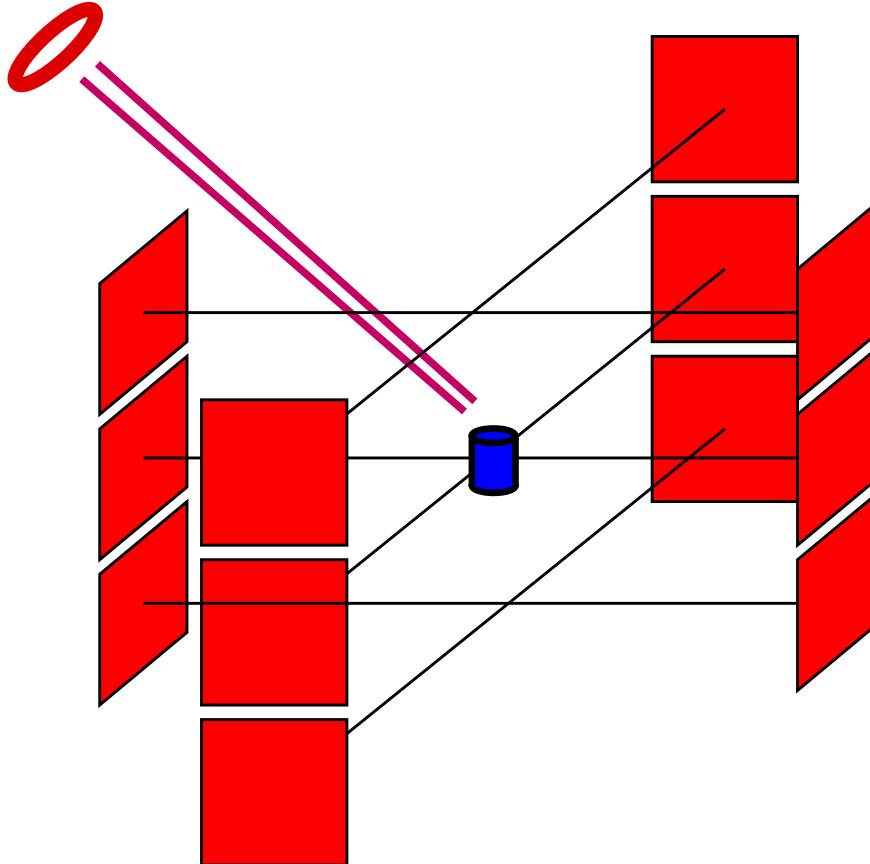
```
COMPONENT d3 = COPY(d1)(filename="d3")  
AT(0,0,0.5) RELATIVE a3  
GROUP detectors
```

```
COMPONENT d4 = COPY(d1)(filename="d4")  
AT(0,0,0.5) RELATIVE a4  
GROUP detectors
```

```
COMPONENT d5 = COPY(d1)(filename="d5")  
AT(0,0,0.5) RELATIVE a5  
GROUP detectors
```

....

# Cylindrical Laue camera



COMPONENT a1 = Arm()  
AT(0,0,0) RELATIVE sample  
ROTATED (90,0,0) RELATIVE sample

COMPONENT a2 = Arm()  
AT(0, **Y**,0) RELATIVE sample  
ROTATED (90,0,0) RELATIVE sample

COMPONENT a3 = Arm()  
AT(0, -**Y**,0) RELATIVE sample  
ROTATED (90,0,0) RELATIVE sample

COMPONENT a4 = Arm()  
AT(0,0,0) RELATIVE sample  
ROTATED (-90,0,0) RELATIVE sample

COMPONENT a5 = Arm()  
AT(0, **Y**,0) RELATIVE sample  
ROTATED (-90,0,0) RELATIVE sample

...

# J-PARC SENJU

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Here you need to also copy a datafile for the J-PARC camera  
**“source\_BL18.txt”**



Surgeon General's Warning:  
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# From single crystal / crystallites to powder....

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Single crystal



Polycrystal with a little disorder,  
i.e. a *preferred orientation, texture*



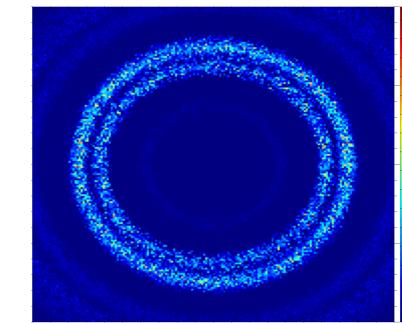
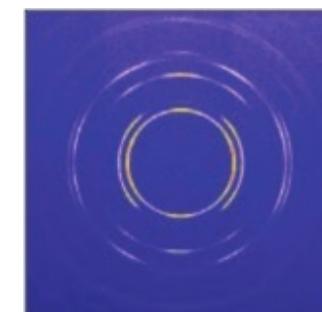
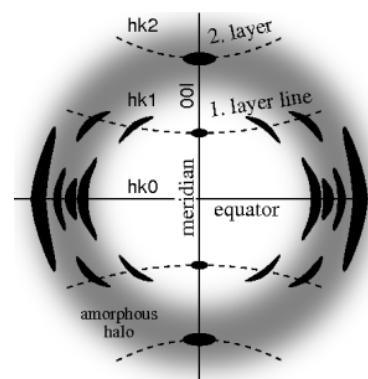
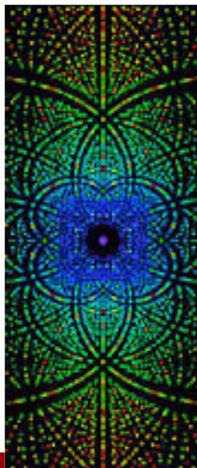
Powder with complete disorder



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*McStas*

  $n$



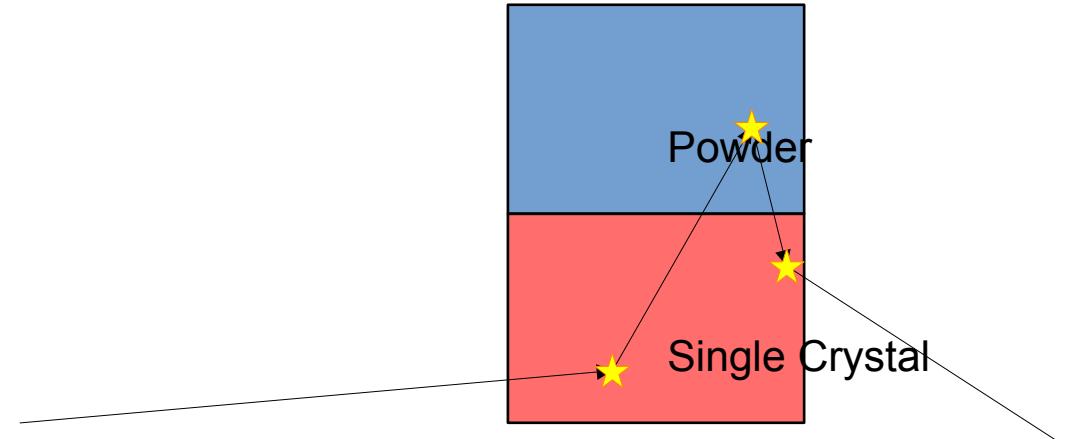
# Powder SX combination

- Use a **GROUP!**
- ... but also allow reentry – How?

```

COMPONENT a1 = Arm()
AT (0,0,0) RELATIVE sample_pos
EXTEND
%{
    sample_scatter=0;
%}
COMPONENT pow = PowderN( ... )
AT (0,h/2,0) RELATIVE a1
GROUP sample
EXTEND
%{
    if(SCATTERED) sample_scatter=1;
%}
COMPONENT sx = Single_crystal( ... )
AT (0,-h/2,0) RELATIVE a1
GROUP sample
EXTEND
%{
    if(SCATTERED) sample_scatter=1;
%}

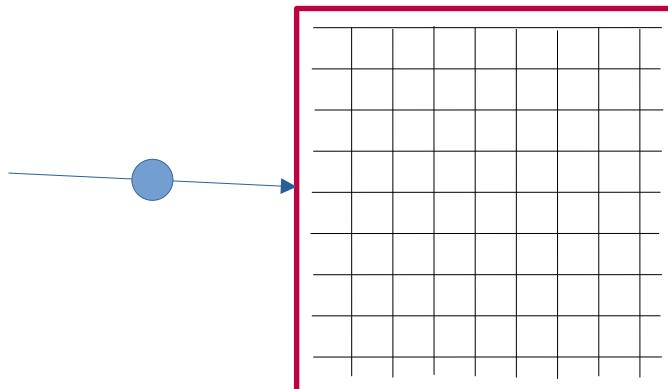
COMPONENT a2 = Arm()
AT (0,0,0) RELATIVE a1
WHEN (sample_scatter) JUMP a1
  
```



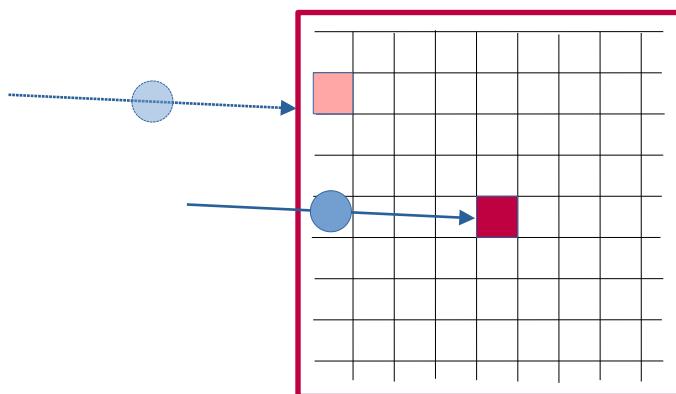
# Extending that idea

A polycrystal as many Single crystals

The idea: Cheat a single Single\_crystal into believing  
it is many...

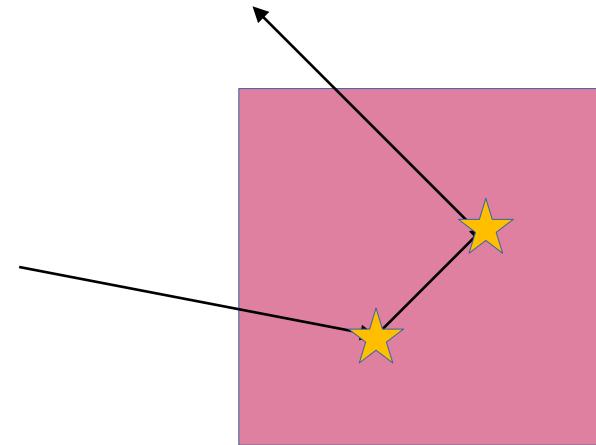
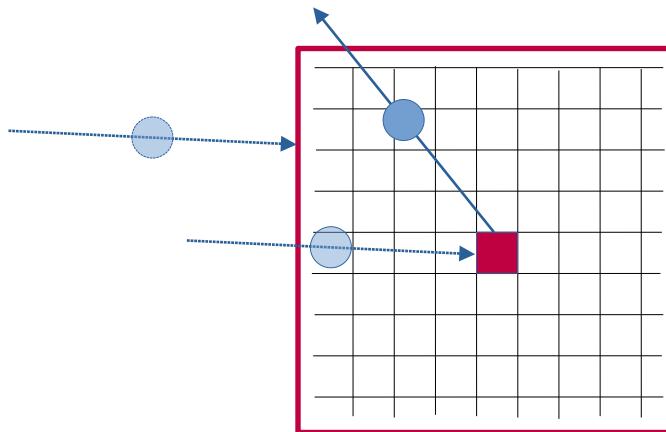


Apply translation



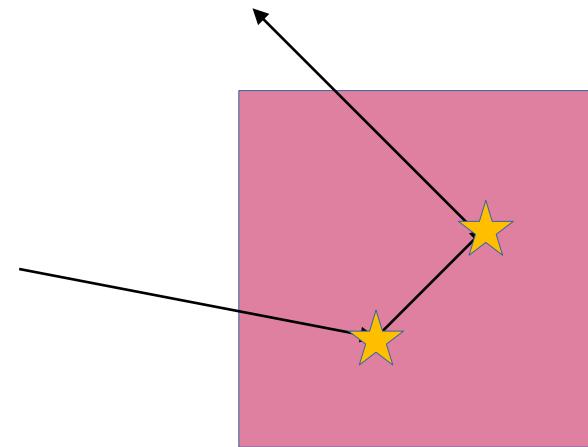
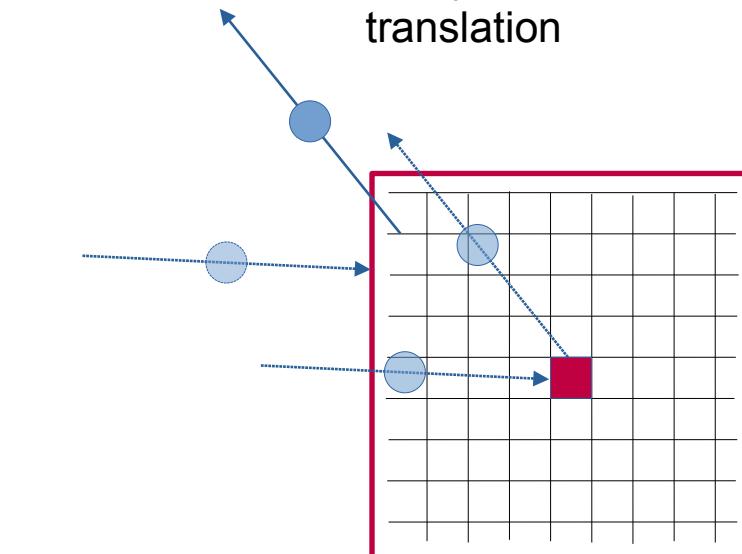
Apply translation

# Single\_crystal as polycrystal



Scattering events happen  
in the crystal  
neutron exits.

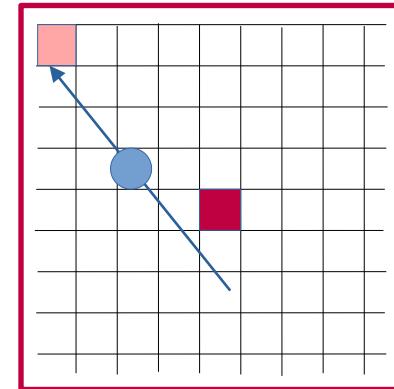
Apply translation

Apply inverse  
translation

Scattering events happen  
in the crystal  
neutron exits.

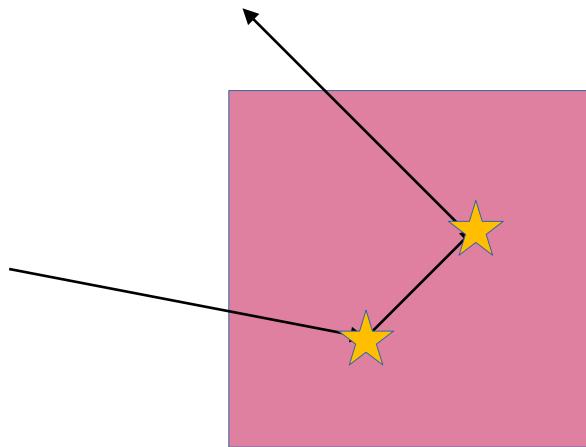
# Single\_crystal as polycrystal

Neutron may enter a new subcrystal...



Apply inverse translation

Apply translation



Scattering events happen  
in the crystal  
neutron exits.

# J-PARC SENJU POLY

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