better axes for a brighter future

Existing Requirement

- provision of multidimensional axes for plotting and analysis in NXdata (example 2d scan)

```
data/NXdata
       data[n,m,100,100]
               @signal=1
       xaxis[n,m]
       yaxis[n,m]
       q[100,100]
```

THIS CANNOT BE DONE IN NEXUS CURRENTLY

Existing schemes

axis

- attribute on axis dataset
- uses fortran numbering for dimensions

```
data/NXdata
       data[n,m]
               @signal=1
       maxis[m]
               @axis=1
data2/NXdata
       data[n,m,100,100]
               @signal=1
       maxis[m]
               @axis=3
```

maxis dataset cannot be reused for muliplte detectors of differing dimensions

axes

- attribute on detector dataset
- problem if detector dataset written by detector (for speed and division of responsibilities)
- does not allow for alternative axes

```
data/NXdata
       data[n,m]
               @signal=1
               @axes=:maxis
       maxis[m]
```

So both schemes have different problems already, mainly from the fact that their information is kept in attributes.

Also the @signal=1 attribute prevents the same data (e.g. from a temperature probe) to be used both as data in it's own right as well as as an axis for another dataset.

Attributes are evil.

to recap though: neither scheme allows the axis to have more than one dimension

Nice to have features

- alternative axes
- reuse of axes for different detectors
- ideally not require touch datasets written by detector directly

Proposal from CanSAS by Example

```
/ NXroot
   entry NXentry
       data NXdata
           @signal=I
           @I_axes=Temperature,Wavelength,Pressure,Q,Q
           @Q_indices=1,3,4
           @Wavelength_indices=1
           @Temperature_indices=0
           @Pressure_indices=2
                I: float[nTemperature,nWavelength,nPressure,128,512]
                Q: float[nWavelength,128,512]
                Wavelength: float[nWavelength]
                Temperature: float[nTemperature]
                Pressure: float[nPressure]
```

- add attributes to NXdata
- put @signal there
- keeping all information about the relationship of the dataset local to the group they are combined in makes sense
- *data_axes* tells us what the main purpose of an axis is
- *axis_indices* tells us what indices of the *data* you need to put into *axis* to give the corresponding axis value
- datasets that are not listes in *data_axes* are secondary axes by default
- backward compatible as it does not interfere with both existing schemes

More information: http://www.cansas.org/wgwiki/index.php/2012_Data_Working_Group_Report