Bug with NeutronHP (9.4 and 9.5)

Neutron background studies for CDMS (**Shielding** physics list)

- High rate of $^{65}\mathrm{Cu}(n,\alpha)^{62}\mathrm{Co}$ (should be zero)
- Missing $^{10}\mathrm{B}(n,\alpha)^{7}\mathrm{Li}$ (should be few percent)

In Shielding builder, cross-section datasets were registered as

```
  BGGxsNeutron=new G4BGGNucleonInelasticXS(G4Neutron::Neutron());
  FindInelasticProcess(G4Neutron::Neutron())->AddDataSet(BGGxsNeutron);

  NeutronHPJENDLHEInelastic=new G4NeutronHPJENDLHEInelasticData;
  FindInelasticProcess(G4Neutron::Neutron())->AddDataSet(NeutronHPJENDLHEInelast
ic);
```

Intention was that BGG cross sections were valid for 3–91 GeV, HP cross-sections below 3 GeV

In fact, first registered dataset took precedence everywhere, even where JENDL was valid

Energy Validity Ranges?

G4VCrossSectionDataSet has interface to specify validity range

```
public: // Without Description
  inline void SetMinKinEnergy(G4double value);
  inline void SetMaxKinEnergy(G4double value);
```

In practice, this seems to be ignored

- Physics lists and builders don't specify energy ranges
- CSDS themselves don't specify energy ranges in ctor (as models do)
- First registered dataset is used exclusively

Energy Validity Ranges?

Should cross-section registry inquire and respect validity ranges?

Should data sets themselves set a "known" or "best" validity range in constructor?

Physics lists/builders could override default where appropriate

Registry could arbitrate as is done for overlapping models