TITLE and type of activity (Networking, Joint Research development):

High resolution, High rate Neutron detectors

Leading beneficiary: ISIS (for the want of a name at this point)

Partners: ILL, ESS, FZJ, TUM, CEA, CNR, BNC, PSI, LIP

Please do not forget evtl University partners!

Estimated budget (in person months, other direct cost) tentative distribution per partner

180 staff months 1.2M euro

Distribution: To be determined according to the level of commitment of partners

Abstract of your innovative activity: *(please make sure that you mention the following points)*

1. State of the Art

   In the FP7 II neutron detector JRA, neutron detectors are being developed which do not depend on the use of 3He. This work is principally aimed at large area detectors, with moderate to course resolution in the range 5 x 5 mm^2 to 20 x 20 mm^2 and moderate rate capability. The FP7 II detector JRA was set up to address the high cost and low availability of 3He. Since the FP7 II detector JRA was conceived, the cost of 3He has continued to rise and the availability has continued to decline. At the current rate of usage the stock of 3He in the USA will be exhausted by 2024. It is now difficult and expensive to obtain 3He for even the smaller neutron detectors required for many neutron scattering applications, including reflectometry, single crystal diffraction and high resolution powder diffraction. Good progress is being made within FP7 II to address the issues posed by the large area detectors, and it will be possible to build on this work to address development issues posed by their smaller counter parts. Nevertheless, extensive new detector technology will have to be developed to achieve the high position resolution and high data rates required for the smaller neutron detectors. Without this development and in the absence of 3He, it will not be possible for the facilities to realise their full scientific potential. This is particularly true of the ESS where peak data rates at what will be the world's most powerful will be very demanding.

2. What is new?

   There are a number of technologies which may be appropriate to meet the requirements of a high position sensitive, high rate detectors required. Potential detector technologies include scintillation detectors with WLS fibre readout, multiblade 10B gas detectors, GEM detectors, micromegas detectors and RPCs. This work would seek to determine the exact detector characteristics for the current and future requirements at new and existing sources. It would identify appropriate technologies, develop the most

appropriate, and produce one or more demonstration detectors that strive to meet the major requirements.

Why should it be done on a European consortium level (synergies)?

There are very few companies producing commercial neutron detectors. The required expertise to develop detectors of this type is spread amongst the neutron scattering facilities and universities. Even the facilities that are highly active in neutron detector development only have sufficient time and effort to pursue a small number of detector developments. Pooling the research effort between the facilities and universities is very effective in generating sufficient resources to pursue a new line of research in an appropriate time period.

3. How could your activity be connected with other methods and techniques (outside the neutrons community)?

   Neutron detectors with this resolution have potential application to the nuclear safeguards industry.

4. Is there any link with national initiatives/projects (e.g. national data initiatives, but also European roadmaps etc)?

   As well as enhancing the capability of national sources this work would seek to improve the potential of the detector capability at the two ESFRI sites, ILL and ESS. With the ESS coming on line in 2019, the need for appropriate detector technologies to meet requirements of what will be the world's most powerful pulsed neutron source is essential.

5. How is the user community involved in your activity? Benefit for the user (evtl for any specific science community?)

   This work is directly aimed at the neutron scattering community and others which require high resolution, high rate detectors of this type. At the start of the project the intention would be to involve the users in detailing the detector characteristics required to meet the needs of current and new instruments at the different facilities.