5. OVERVIEW OF INDIVIDUAL RESEARCH PROGRAMS

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Introduction

With the ability to analyze and visualize local resolved texture by neutron imaging a great tool is created for better understanding of the history of the material (cultural heritage sample). It is important knowledge for any kind of manufactured material like jewelry, weapons, sculpture … as the texture shows the manufacturing history. In addition archeological samples embedded in rocks and stones will show the history of the environment in terms of deformation, sedimentation and metamorphosis conditions. All the texture information is available nondestructive and in combination with the real space 3D model. In order to establish texture imaging by neutron radiation, the method has to be developed and tested from simple basic textured material (single crystal and single phase) in small steps to more advanced systems like rolled or recrystallizes metal samples and finally geological samples with multiphase systems and large variation in grain size.

A set of wavelength dependent neutron radiography images under certain orientations is needed to calculate the ODF and understand the texture. To determine the sufficient number of single images for ODF calculation several test materials with different known textures are required. This has to be developed in an iterative process from single crystal orientation to polycrystalline multiphase and multitexture material as especially geological samples represent the most complex textures.

As an important outcome a user-friendly software package should be available which should be tested at different facilities with different type of samples. Consistent results from these facilities are strongly required to encourage the cultural heritage community in accepting the method. The typical end user has only basic knowledge of texture and neutron imaging and has to rely on the correctness of the measurement and analyses.

Experimental facility

The new neutron imaging facility DINGO at the OPAL reactor at ANSTO is currently in the construction phase. Completion of the construction phase and start hot commissioning phase with first friendly user commences begin 2013. The general instrument characteristics are based on Monte Carlo simulations by McStas.

Neutron beam characteristics:

- L/D: 500 – 1000
- Flux at sample position: 4.75 x 10^7 n/scm^2
- Beam size: 100 x 100 mm^2 and 200 x 200 mm^2

Specification of DINGO facility
Flight tube Helium filled
Sample stage:

- xyz-travel length: 400mm
- Load: 500kg

Detector:

- IKON-L water-cooled 2048 x 2048 pixel
- Set of different size scintillator screens

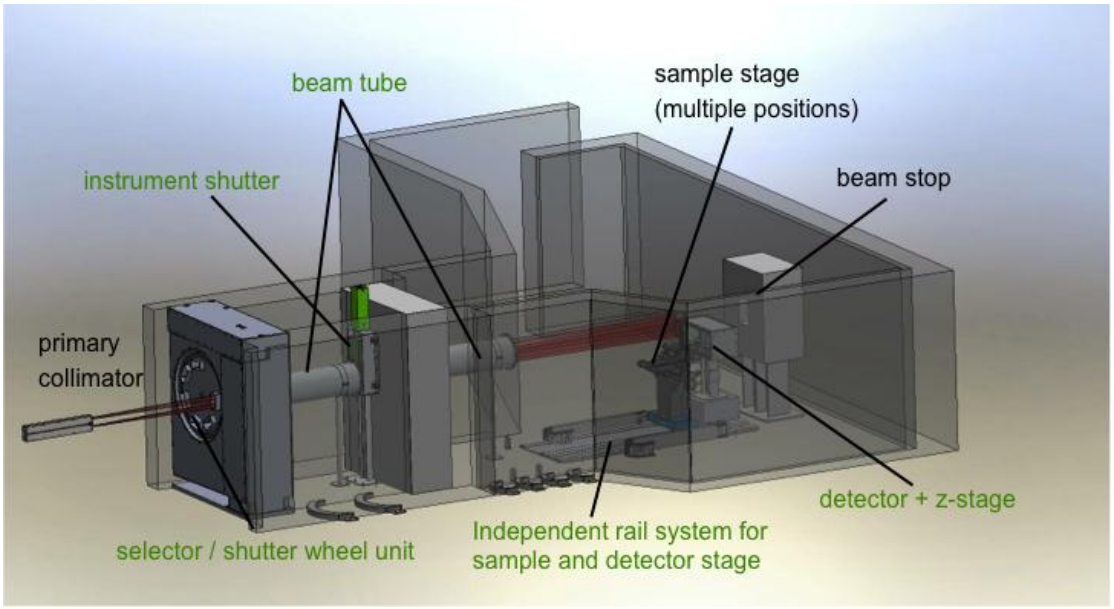

Figure 1 – Schematic view of DINGO facility

Workplan year1:

- Finalize the DINGO imaging station and commence hot commissioning phase with first friendly users
- Start a PhD thesis and hire candidate on texture analyses by neutron imaging Bragg-edge scanning method in cooperation with Helmut Scheaben (Geomathematics and Geoinformatics, TU Bergakademie Freiberg, Germany)
- Develop first theoretical model to describe the texture analysis by Bragg-edge scanning method
- Define set of test sample with known texture (single crystal, large crystal polycrystalline material and strong textured polycrystalline material)
- Apply for beam time at PSI and/ or HZB, FRM II for first test measurements
- Simulate time of flight setup for the neutron imaging instrument DINGO at OPAL as feasibility study to prepare a capital investment case

Main objective	Sub objectives	Year 1				Year 2				Year 3			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Build DINGO facility for neutron imaging	Installation of instrument components	X	X										
	Cold commissioning			X	X								
	Hot commissioning					X	X						
Upgrade to TOF neutron imaging	Planning, prepare capital investment case			X	X								
	Design phase					X	X						
	Procurement							X	X				
	Installation								X	X	X		
	Commissioning										X	X	
	Hand over and first experiments											X	X
Software development	Initiate open source platform		X										
	Start PhD project and looking for a candidate on texture analyses by Bragg-Edge scanning neutron imaging		X	X	X								
	Develop theoretical model				X	X	X	X					
	Define set of test samples				X	X							
	Develop first software package for simple textures						X	X	X	X	X		
	Relase software package											X	X