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## **SCIENCE AND TECHNOLOGY AGREEMENTS**

### **SOUTH AFRICA / (VARIOUS PARTNER COUNTRIES) PROGRESS REPORT**

Due date:

<b>SA Grant holder</b>	Brian Masara		
<b>Collaborators</b>	Dr Bryan Doyle - University of Johannesburg Prof Simon Connell - University of Johannesburg Prof Giovanni Hearne - University of Johannesburg		
<b>Title of Project</b>	Science at Synchrotrons Conference		
<b>Duration of project</b>	<b>From (YY/MM)</b>	8 February 2009	<b>To (YY/MM)</b> 14 February 2009
<b>Other sources of funding (specify)</b>			<b>Amount</b>
	Delegates' Registration Fees		R156 994.00
<b>1. Objectives of the project as stated in the accepted proposal</b>			
<p>The overall goal of the project was to increase synchrotron capacity in South Africa, capacity building and forging relationships that increase South African researchers' access to synchrotron radiation facilities. The following were the sub objectives of the conference</p> <ol style="list-style-type: none"> <li>1. To hold a three day School for Synchrotron Techniques in Research (aimed at post-graduate students and those new to Synchrotron Science). 9-11 February</li> <li>2. To hold a two day Synchrotron Users Workshop where South Africans could present results of their research. The workshop was also open to international participation. 12-13 February</li> <li>3. To organize a half-day Strategic Planning Workshop (developing the roadmap for Synchrotron Science in South Africa). 14 February</li> <li>4. To facilitate meetings between major synchrotron facilities' heads with DST and NRF to facilitate increased access of South African researchers to synchrotrons</li> </ol>			

## 2. Specify any changes to the above project objectives

N / A

## 3. Progress and outputs (highlight special achievements of research (max 300 words))

A total of 123 participants took part in the February 2009 science at synchrotrons conference. These were made up

- ◆ 65 Researchers and policy makers (including ~20 lecturers from Europe and USA)
- ◆ 58 Postgraduate students were present

A number of very senior representatives of the French, Italian and European synchrotron radiation facilities were amongst the international lecturers in attendance and productive meetings were held between them, SA scientists and the Department of Science and Technology (DST). Amongst the matters discussed were easier access to travel funds to access synchrotron radiation facilities and the drafting of a memorandum of understanding between the French synchrotron community and South Africa. The DST's support of the conference itself extended from substantial funding to providing state of the art conference facilities and the Minister of Science and Technology himself, Minister Mosibudi Mangena, was the guest of honour at the conference dinner.

1. A total of 39 papers were presented at the conference (see website <http://synchrotron.org.za/S@S2009/> ).
2. As a result of the conference, the NRF has signed a Memorandum of Understanding with the French synchrotron *SOLEIL* in which the NRF has put aside R500 000 a year for funding visits by South African scientists to access beamtime at *SOLEIL* at no cost, providing that the proposals are of sufficient merit to have been passed *SOLEIL* peer review. Long term visits by researchers or students will also be funded. A briefing session on this was held at the NRF on the 8th of June.
3. The European synchrotron *ESRF* is also in the process of preparing a similar Memorandum that they would like to put in place with the NRF.

## 4. Students trained in programme

58 Postgraduate students were trained in the following fields materials science, bio-sciences, geo-sciences and heritage sciences

These students were linked to the very high calibre and very dedicated visiting lecturers from the synchrotron community in a special Mentor-Mentee program. This program was specially designed to promote ongoing relationships between students and international experts, and to ensure the full participation of the students in the Workshop and the Research Conference part. The Mentor-Mentee program included special sessions between the students and the mentors. In these sessions the students applied the conference material to their own research. This culminated in student presentations. This was a highlight of the conference. The students showed an amazing capacity to integrate the conference material and to apply it to their own work. There was significant progress in this year's student participation to the previous conference. This is attributed to the success of the previous Mentor-Mentee session at the 2007 Science at Synchrotrons Conference. There was an emerging cohort of students who had already had successful beam-times at synchrotrons, and were able to present data from synchrotrons ... this was in fact quite spectacular data. This year's Mentor-Mentee session therefore had an additional component. New students were able to see the progress of previous students. The students in fact inspired themselves. A significant networking between students also occurred.

**5. Staff and student exchanged**

<b>Name</b>	<b>Place visited</b>	<b>Period of stay</b>
<p>No exchanges occurred, but the conference was optimised to promote future exchanges.</p> <p>Regarding students, there was the Mentor-Mentee program.</p> <p>Regarding Researchers, there was a special effort made to invite scientists who did not yet have contacts at Synchrotrons, and these scientists were also introduced to the visiting high calibre synchrotron experts. This was done using presentation sessions where SA scientists could present a scientific problem and the visiting experts could suggest how the new and powerful synchrotron techniques could be applied to that problem. Experience from the 2007 Science at Synchrotrons has indicated that this leads to several new collaborations.</p>		

**6. Indicate how the project has contributed to develop capacity and to facilitate and promote redress in S A – including gender and historically disadvantaged individuals (max. 200 words)**

58 students comprising 44 male and 14 females were trained. The students came from 6 provinces of South Africa including previously disadvantaged universities such as University of Limpopo, University of Zululand and Mafikeng - North West University. The summary of statistics by province is shown below

Province	Number of Students Trained
Gauteng	24
Cape Town & Western Cape	23
Limpopo	6
KwaZulu Natal (KZN)	4
North West	1

Synchrotrons are a premier and novel tool for research, They are not a Science in themselves. In this Conference, the aim is to grow the cohort of SA scientists to use this tool. The Synchrotron at first appears to be so complex and expensive, that this is a perceived barrier to access. However, using this Conference, we could show that collaborative networks could be built with international experts who would facilitate access to the synchrotrons and participate in the SA research programs. This participation starts for proposal discussion, formulation and submission, assisting with the sample collection and preparation phase, liaising the travel and the interaction with the beamline facilities, widening the circle of experts who will participate, co-supervision of students, assistance with development of the capacity to analyse the data, participation in the interpretation of the data. In fact, in the full cycle, SA Scientists and students gain access to calibre international colleagues. It is a mutually beneficial win-win situation, as the synchrotrons require excellent projects, excellent colleagues and excellent students themselves. With this model in mind, the set of Synchrotron related Schools and Workshops are carefully crafted to optimise the exposure of SA scientist to calibre international colleagues, and to involve students intimately in this process.

**7. Equipment purchased under the grant**

Item	Cost
N/A	

**8. Describe how the grant may have helped future co-operation, generate additional funds or prepare for joint applications to international programmes, (max. 100 words).**

The conference was aimed at generating the following deliverables :

- (i) International Networks for both students and researchers
- (ii) Research proposals - to be jointly worked on and submitted to the synchrotrons. This is very successful. Some SA scientists in fact brought samples with them. Others brought write-ups of potential projects. Scientists with established capacity to operate their research programs at synchrotrons were able to deepen their relationships, and also find new collaborators
- (iii) A further appreciation that it requires local excellence in order to be able to effectively exploit the premier research capacity of a synchrotron. Several groupings could discuss this point. For example, the NECSA proposal to purchase an X-ray Tomography system was discussed in a group and several users of the facility could discuss this together. This would enable the paleontological community to improve their local excellence and gain better access to international synchrotrons. Other contacts were made, where existing local facilities were learned of and arrangements made to collaborate locally and share these facilities. Local facilities are very important in pre-characterisation and background research which lays the foundation of a successful and meritorious application to a synchrotron
- (iv) We are aware of various research groups that have proceeded (SASOL, UJ and Wits at ESRF), or are in the process of proceeding (iThemba Labs and UCT at SOLEIL , iThemba Labs at Elettra and UJ to Diamond), to various Synchrotrons to execute research projects in 2009. This is largely as a result of interactions and collaborations encouraged at this Feb-09 and Feb-07 meetings.

**9. Results**

<b>9a. Scientific publications</b>	<b>Author</b>	<b>Title</b>	<b>Journal or Publisher</b>
Articles in referee-based scientific journals		This was not a conference that aimed to publish, it rather acts as an enabler of publishing. There was a large co-hort of scientists and students who could show synchrotron data that is expected to lead to papers and theses.	
Articles in other scientific journals and anthologies			
Books (monographs, textbooks, anthologies)			
Published papers from international scientific meetings/congresses			
Other reports, papers and presentations from scientific meetings		The essential statistics on the growth of capacity for SA scientists and students at Synchrotrons has been collated and presented at the conference (strategic workshops) , and will eventually form part of a report in this regard.	

<b>9b. Other results</b>	<b>Author/presenter</b>	<b>Title or activity</b>	<b>Publication/Date</b>
General dissemination			

(popular scientific articles etc)			
Conference and Workshop presentations			
Other (specify)		<p>The MoU between SOLEIL and SA was prepared and discussed at this Conference</p> <p>The foundations for similar MoUs with the ESRF and Elettra were laid.</p>	

### 10 Describe the impact on Industry / Community

There is a growing use of Synchrotrons by SA industry :

The study of stress and failure in turbine blades by **ESKOM** and collaborating Universities ;

The study of catalysis by **Sasol** ;

Foundations for a study of surfaces and interfaces relevant to the ultrahard composite materials based on diamond with **Element Six** were laid, and lead to several subsequent interactions, and this may still lead to further industry involvement ;

The study of materials science issues of Nuclear Fuel, where there has been an ongoing conversation with the **PBMR** company ;

The **SA Biotechnology** capacity, which will ultimately benefit SA innovation in industry ;

The training of a cohort of students in this highest level of technology in respect of ...

- ✓ Modern instrumentation
- ✓ Modern Data acquisition
- ✓ Remote control and automation
- ✓ High Performance computing
- ✓ Modern measurement methods
- ✓ Working with extremely high volumes of data
- ✓ Non-destructive testing
- ✓ Imaging of the Analysis for visual interpretation of data.


**The NRF would appreciate brief comments regarding your view of how the management and administration of this agreement has functioned, (max 100 words)**

The management has included the new Executive Office of the SAIP. This was their first conference. The benefit for us is that they have excellent relationships with the DST and the NRF, and they understand the Research Community. This conference in particular had a very close collaboration between the NRF, the DST and the community in order to properly benefit from the new evolving relationships with the International Synchrotrons, as well as the various international agencies such as the CNRS. This was an enormous benefit in the organisation and the administration of the Conference.

The iThemba LAB also facilitated the organisation of the conference by providing financial, transport and other resources.

**DECLARATION BY GRANTHOLDERS**

**I declare that the above information is correct:**

<b>Name of South Africa grant holder</b>	<b>Signature:</b>	<b>Date:</b>
Brian Masara		25 August 2009
<b>Name of International Collaborator</b>	<b>Signature: N/A</b>	<b>Date:</b>
<b>Head of Department (SA)</b>	<b>Signature:</b>	<b>Date:</b>
<b>Research officer (SA)</b>	<b>Signature:</b>	<b>Date:</b>

## Appendix 1 – Financial Statements

The summarised Income and Expenditure Statement is shown below a detailed statement from iThemba Labs is also attached (pdf)

### SUMMARY INCOME & EXPENDITURE STATEMENT

<b>PROJECT INCOME</b>	Amount ( R )	Total ( R )
1 NRF Grant	442,147.00	
2 Registration Fees	156,994.00	<b>599,141.00</b>
<b>PROJECT EXPENSES</b>		
1 Conference Running Expenses	84,770.00	
2 Sundry expenses	1,300.00	
3 Conference Printing & stationary	9,775.00	
4 Catering and Refreshments	118,774.00	
5 Accommodation T&S Sponsorships	355,737.00	<b>570,356.00</b>
<b>Project Surplus/ (Deficit)</b>		28,785.00



**Appendix 2: Summary of Papers Presented in various thematic areas**

Number	Field	Subfield	Name	Title
1.	Bio	MX	S Kimani	Activity, specificity and catalysis in the amidase from <i>Geobacillus pallidus</i> RAPc8 as revealed by the crystal structure
2.	Bio	MX	J van Wyk	Using random mutagenesis to investigate the relationship between structure and thermostability of a nitrile hydratase isolated from <i>Geobacillus pallidus</i>
3.	Bio	MX	J M Watermeyer	Structures of angiotensin-converting enzyme with novel domain-selective inhibitors inform drug design
4.	Bioscience		P. Dumas	Photodynamic Treated Cancer Cells investigated using Synchrotron Infrared Micro-spectroscopy and Fluorescence Microscopy
5.	Bio		G. Leonard	Towards the Rational Design of a Bacterial Biosensor
6.	Bio	Nano	RW Sparrow	SYNTHETIC BIOLOGY: THE DEVELOPMENT OF LIGHT HARVESTING AND ENERGY TRANSFER SYSTEMS.
7.	Heritage	Paleo	L.A. Norton	Investigation of the Tooth Replacement Patterns of a Tapinocephalid Dinocephalian using Synchrotron Microtomography Techniques
8.	Environment	bio	N. S. Mokgalaka	Application of Extended X-ray Absorption Fine Structure (EXAFS) and X-ray Near Edge Structure (XANES) Spectroscopies: Confirmation of metal absorption by indigenous plants established on gold mine tailings
9.	Environment	bio	W.J. Przybylowicz	Ni mapping in <i>Berkheya coddii</i> by Micro-PIXE and NEXAFS
10.	Heritage		L Jacobson	The application of synchrotron analytical techniques to the scientific study of heritage objects in South Africa. Part 1: inorganic materials.
11.			R Hart	A study of "Super Magnetic" minerals from the Vredefort impact crater
12.	Heritage		L Jacobson	The application of synchrotron analytical techniques to the scientific study of heritage objects in South Africa. Part 2: rock art paint and other organic materials.

Number	Field	Subfield	Name	Title
13.	Materials	Nano	B.T. Sone	Synthesis and characterization of electrospun WO <sub>3</sub> /PVA nanofibres deposited on TCO substrates in view of their potential application as hydrogen gas sensors
14.	Materials	Nano	C.B.Mtshali	The effect of Proton irradiation on Fullerene nano-rods
15.	Materials	Nano	H. M. Cele	VO <sub>2</sub> Nano-structured for UV-Vis Modulation Applications
16.	Materials	Nano	J.B. Kana Kana	Thermochromic Nanocrystalline Au-VO <sub>2</sub> Composite Thin Films Prepared by Radiofrequency Inverted Cylindrical Magnetron Sputtering
17.	Materials	Nano	KE Rammutla	Studies of the location of precious metals in sol-gel prepared nanocrystalline titania using XANES and XRD
18.	Materials	Nano	M.J. Sithole	Growth mechanism and photonic properties of ZnO nano-rods/platelets by Low temperature hydrothermal growth method
19.	Materials	Nano	B. D. Ngom	Structural, Morphological and Photoluminescence properties of Wdoped ZnO nanostructures.
20.	Materials	Nano	S. Khamlich	Synthesis and Characterization of nano-crystalline $\alpha$ -Cr <sub>2</sub> O <sub>3</sub> Arrays
21.	Materials		T d' Almeida	Time-Resolved X-Ray Diffraction on Laser-Shocked Crystals
22.	Materials		F de Beer	A National Centre for Radiography & Tomography Imaging at Necsa?
23.	Materials		HG Hearne	Pressure induced amorphization and amorphous-amorphous transition in nano-TiO <sub>2</sub> . A X-ray Absorption Spectroscopy study
24.	Materials		S Nsengiyumva	The mutual influence of krypton implantation and pre-existing stress states in polycrystalline alpha titanium
25.	Materials		T.P. Ntsoane	Depth-resolved studies of plasma sprayed HAp coatings
26.	Materials		A Venter	Residual and eigenstrain analyses of non-uniformly shaped shot-peened samples
27.	Materials		V Briois	In Situ X-ray Absorption Investigations of Chemical Reactions: Sol-Gel Chemistry and Heterogeneous Catalysis Applications
28.	Materials		P Sibuyi	Induced damage in SiC by protons irradiations
29.	Materials		D Dube	Grazing Incidence Small Angle X-Ray Scattering From Polished Diamond Surfaces

Number	Field	Subfield	Name	Title
30.	Materials	Catalysis	H.E. du Plessis	Diffraction and PDF study of Hägg carbide
31.	Materials		J. Härtwig	X-ray diffraction topographic 3d-study of the dendritic growth of Al-based alloys
32.	Materials		JP Itié	High Pressure Phase Transition in Titanate Perovskites
33.	Materials		SH Connell	Crystal Undulators as a Compact and Intense Source of Synchrotron Radiation
34.	Materials		F. Meneau	Time resolved X-ray scattering studies: in-situ nucleation and growth of zeolite; a study by small angle X-ray scattering
35.	Materials	Nano	A Gibaud	On the use of surface sensitive techniques to the properties of nanomaterials and surfaces
36.	Heritage		L Bertrand	SA rupestrian painting studies at SOLEIL
37.	Materials		B Doyle	Physics at the Surface
38.	Materials		A. Fontaine	Synchrotron radiation: an element-selective tool to image Magnetic nano-materials
39.	Overview		H Reichert	The European Synchrotron Radiation Scene - Status and Perspectives

**iThemba LABS - DETAILED INCOME STATEMENT**



Period ended 31 March 2009

Financial Year - 2009

Budget - 2009 PROJ 2

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Indiv. CC Manager Name: N HAASBROEK

Cost Centre SYNC

Account Number	Account Name	Current Month Actual	Year to Date Excl. Commit	Year to Date Commit	Year To Date Actual +Commit	Year To Date Budget	Year To Date Variance	Full Year Budget	Funds Available
<b>Income</b>									
15010	INT INC - GRANTS	-	-	-	-	-440,000	-440,000	-440,000	-440,000
Income - Internal		-	-	-	-	-440,000	-440,000	-440,000	-440,000
12300	SUNDRY INCOME	-	-12,991	-	-12,991	-228,000	-215,009	-228,000	-215,009
12305	REGISTRATION FEES	-23,014	-144,004	-	-144,004	-	144,004	-	144,004
Sundry/Other		-23,014	-156,994	-	-156,994	-228,000	-71,006	-228,000	-71,006
<b>Total Income</b>		<b>-23,014</b>	<b>-156,994</b>	<b>-</b>	<b>-156,994</b>	<b>-668,000</b>	<b>-511,006</b>	<b>-668,000</b>	<b>-511,006</b>

**Running Expenses**

26100	CONFERENCES & WORKSHOF	45,000	55,500	-	55,500	-	-55,500	-	-55,500
Conferences		45,000	55,500	-	55,500	-	-55,500	-	-55,500
26140	SERVICES-TECHNICAL	-	-	-	-	6,000	6,000	6,000	6,000
26141	SERVICES-ADMINISTRATIVE	-	-	-	-	40,000	40,000	40,000	40,000
Fees For Services		-	-	-	-	46,000	46,000	46,000	46,000
26200	ADVERTISING	-	-	-	-	21,000	21,000	21,000	21,000
Marketing		-	-	-	-	21,000	21,000	21,000	21,000
26482	FIN CHG. COMM/BANK	150	600	-	600	30,000	29,400	30,000	29,400
26483	SUNDRY EXPENSES	-	700	-	700	-	-700	-	-700
Other Expenses		150	1,300	-	1,300	30,000	28,700	30,000	28,700
26240	PRINTING	-	7,775	-	7,775	57,000	49,225	57,000	49,225
26241	STATIONARY	-	2,000	-	2,000	-	-2,000	-	-2,000
Printing & Stationery		-	9,775	-	9,775	57,000	47,225	57,000	47,225
26280	PURCHASES OTHER	-	29,270	-	29,270	-	-29,270	-	-29,270

Indiv. CC Manager Name: N HAASBROEK

Cost Centre SYNC

Account Number	Account Name	Current Month Actual	Year to Date Excl. Commit	Year to Date Commit	Year To Date Actual +Commit	Year To Date Budget	Year To Date Variance	Full Year Budget	Funds Available
Purchases		-	29,270	-	29,270	-	-29,270	-	-29,270
26325	REFRESH: OTHER	-	118,774	-	118,774	388,000	269,226	388,000	269,226
Refreshments		-	118,774	-	118,774	388,000	269,226	388,000	269,226
26400	AIR TICKET TRAVEL(NAT/STAI	1,920	1,920	-	1,920	-	-1,920	-	-1,920
26410	AIR TICKET TRAVEL(NAT/NON	-	143,335	-	143,335	120,000	-23,335	120,000	-23,335
26412	ACCOMMODATION(NAT/NON	-	209,979	-	209,979	-	-209,979	-	-209,979
26414	OTHER(NAT/NON STAFF)	503	503	-	503	-	-503	-	-503
Subsistence & Travel		2,423	355,737	-	355,737	120,000	-235,737	120,000	-235,737
26461	TELEPHONES CALLS & RENT/	-	-	-	-	6,000	6,000	6,000	6,000
Telephone Faxes & Post		-	-	-	-	6,000	6,000	6,000	6,000
<b>Total Running Expenses</b>		<b>47,573</b>	<b>570,356</b>	<b>-</b>	<b>570,356</b>	<b>668,000</b>	<b>97,644</b>	<b>668,000</b>	<b>97,644</b>
<b>Grand Total Expenses</b>		<b>47,573</b>	<b>570,356</b>	<b>-</b>	<b>570,356</b>	<b>668,000</b>	<b>97,644</b>	<b>668,000</b>	<b>97,644</b>
<b>Nett (Profit)/Loss</b>		<b>24,559</b>	<b>413,362</b>	<b>-</b>	<b>413,362</b>	<b>-</b>	<b>-413,362</b>	<b>-</b>	<b>-413,362</b>