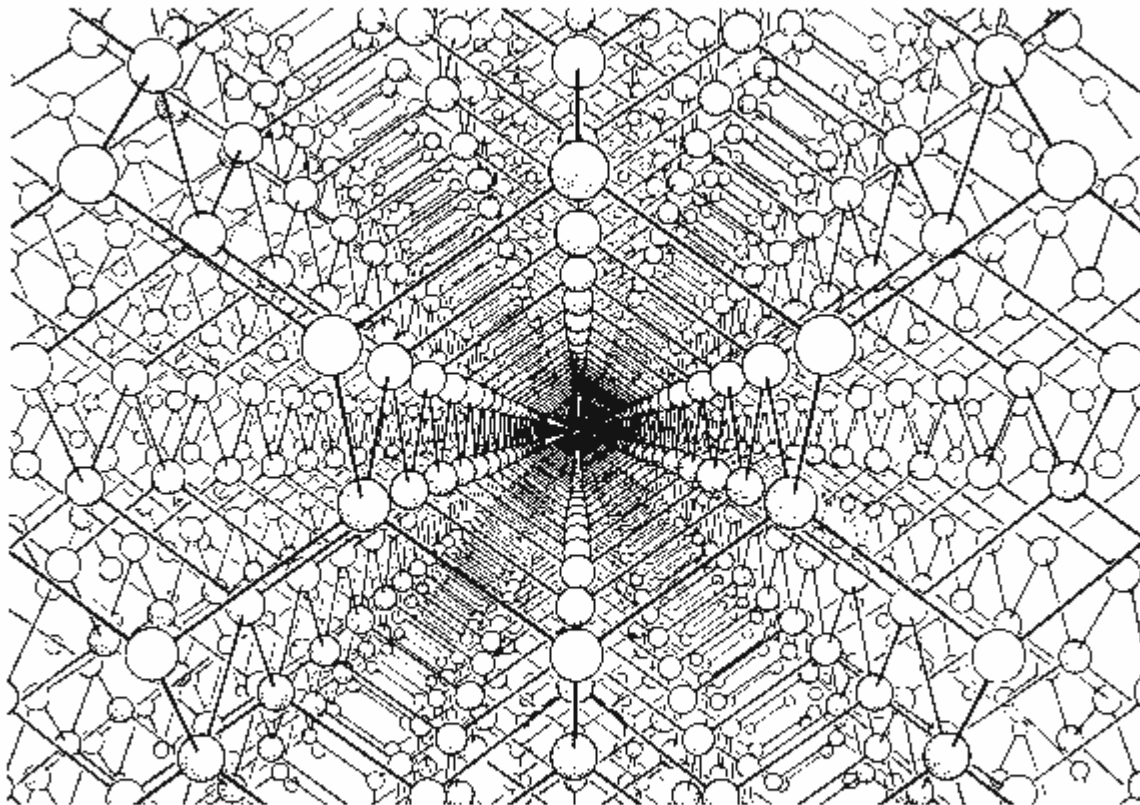


# Status of NoRHDia and

## Scope of the Workshop

- Participants
- Budget
- Objectives
- Deliverables
- Multiannual Plan
- Working Groups

**Novel Radiation Hard  
CVD Diamond Detectors for Hadron Physics**



**NoRHDia**

# NoRHDia

## Participating Countries

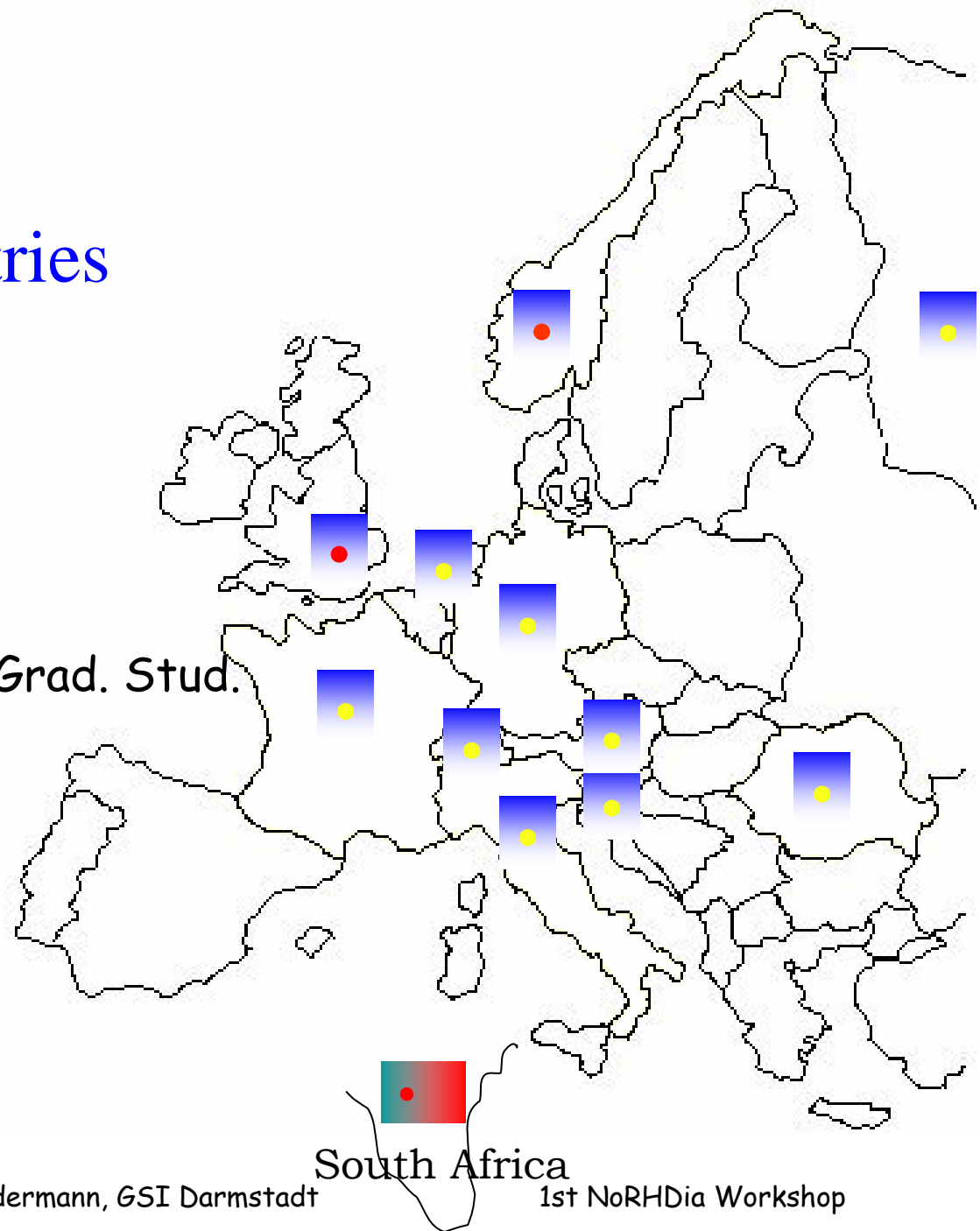
11 European Countries

1 African Country

~ 38 Senior Scientists, 3 Grad. Stud.

12 Research Institutes

2 Cooperating Industries



# Institutions involved in NoRHDia (official document)

No.	Participants involved in JRA11	Role	Man-Months
1	<b>INFN</b> <i>INFN-MI</i>	Electronics, ToF-detectors	12.6
3	<b>LUC</b>	Diamond growth	90
7	<b>CEA</b> <i>CEA-Saclay</i>	Sensor modelling	25.2
9	<b>DESY</b> <i>DESY-Zeuthen</i>	E-, ToF-detectors, modelling, electronics	64.8
14	<b>GSI</b>	E-, ToF-detectors, irradiations, detector characterisation, micro-beam mapping	118.8
21	<b>TUM</b>	Defect studies, transport properties	7.2
39	<b>IFIN-HH</b>	Electronics, ToF-detectors, modelling	54
<b>Other involved Institutions</b>			
	CERN, Geneva	Detector characterisation	21.6
	Karlsruhe Univ.	Detector characterisation, irradiations	39.6
	IJS, Ljubljana	Irradiations	10.8
	VERA Lab. Vienna	E-detectors	12.6
	Wits University, SA	Diamond substrates	

# NoRHDia Budget



# 2004 - 2006

---

➤	<b>Total</b>	<b>400 kEUR</b>
❖	Travel	55
❖	Electronics	20
❖	Material/tests	25
❖	Personnel (2 grad.stud., 1 postdoc)	300

---

➤	<b>Budget sharing between contractors</b>	
❖	GSI	310 kEUR
❖	LUC	80
❖	IFIN-HH	10

---

➤	<b>Distribution to all participants via the contractors</b>	
---	---	--

---

# NoRHDia collaborators (non-official)

## Participating Institutions

Limburgs Universitair Centrum, Belgium  
CEA LIST /Saclay, France  
DESY Zeuthen, Germany  
GSI Darmstadt, Germany  
  
University of Karlsruhe, Germany  
CERN Geneva, Switzerland  
WSI of the TU-Munich, Germany  
University of Milano, Italy  
NIPNE Bucharest, Romania  
IJS Ljubljana, Slovenia  
Vera Laboratory Vienna  
Kurtchatov Institute Moscow  
Wits Univ. of Johannesburg, South Africa

## Cooperating

Element Six  
IDE AS, Norway

## Contactpersons, Members

M. Nesladek♦, K. Haenen, S. Wenmackers, B. Roettens, nn  
P. Bergonzo, D. Trompson, C. Meier  
W. Lohmann, W. Lange, E. Kuznetsova  
E. Berdermann, M. Ciobanu, H. W. Daus, B. E. Fischer, A.  
Martemiyarov, P. Moritz, M Pomorski, P. Senger, H. Stelzer  
  
W. de Boer, E. Grigoriev, J. Bol  
P. Weilhammer, A. Oh, S. Roe  
C. Nebel\*, J. Carrido  
I. Iori, R. Bassini, A. Pullia  
M. Petrovici, M. Petris, A. Caragheorghopol, nn  
M. Mikuz, I. Mandic, V. Cindro  
W. Kutschera  
V. Liechtenstein  
S. H. Connell, E. Sideras-Haddad, A. da Costa, M. Rebak

## Industrial Partners

A. Whitehead, D. Twitchen  
D. Meier, B. Sundal, G. Maehlum

♦ presently CEA LIST/Saclay; \*presently AIST Tsukuba

# Objectives of NoRHDiA

A i m

→ RH SC-CVD diamond detectors for  
next generation Hadron Physics experiments

R & D

→ Growth and doping of SC-CVDD  
Substrates, size enlargement  
Study of the electrical & optical properties  
Development of suitable front end electronics

# Deliverables

- Prototypes (hybrids: detector + electronics)
  - ToF detectors for MIPs
  - $\Delta E$ , E- detectors for hadron spectroscopy
  
- □ Improved growth processes



# Impact of NoRHDia on the European Facilities

European facility	Networking/JRA within HadronPhysics
CERN - ALICE	SIM (N6), DIMUON (N4), NoRHDia(JRA11), ATOF (JRA12), HadrTh (N5)
CERN-COMPASS	TRANSV (N7), RICH (JRA9), GPD (JRA5), Gas Det (JRA4), NoRHDia(JRA11), HadrTh (N5)
COSY	EtaMeson (N4), Pol Targ (JRA8 NoRHDia(JRA11), HadrTh (N5), EM Cal (JRA2)
DESY - HERMES	TRANSV (N7), GPD (JRA5), Pol Targ (JRA8) NoRHDia(JRA11) HadrTh (N5)
ELSA	EuroTag (JRA3), Pol Targ (JRA8), HadrTh (N5)
ESRF - GRAAL	EuroTag (JRA3), Pol Targ (JRA8), HadrTh (N5)
GSI - CBM	SIM (N6), CBM (N1), FDAQ (JRA1), Gas Det (JRA4), NoRHDia(JRA11) ATOF (JRA12), HadrTh (N5)
GSI - HESR	SIDDH (JRA10), Pol Targ (JRA8), Int Targ (JRA7), NoRHDia(JRA11) HadrTh (N5)
GSI - PANDA	RICH (JRA9), HyperG (JRA6), FDAQ (JRA1), EM Cal (JRA2), Gas Det (JRA4), NoRHDia(JRA11) HadrTh (N5)
IASA	EM Cal (JRA2), HadrTh (N5)
LNF - DEAR	SIDDH (JRA10), NoRHDia(JRA11) HadrTh (N5)
LNF - FINUDA	HyperG (JRA6), NoRHDia(JRA11) HadrTh (N5)
LNF - KLOE	EtaMeson (N4), HadrTh (N5)
MAMI - A1	Pol Targ (JRA8) NoRHDia(JRA11) CompHP (N2), HadrTh (N5)
MAMI - A2	EtaMeson (N4), EuroTag (JRA3), Pol Targ (JRA8) NoRHDia(JRA11) HadrTh (N5), EM Cal (JRA2), CompHP (N2)
MAMI - A4	EM Cal (JRA2), CompHP (N2), HadrTh (N5)
MAXLAB	EuroTag (JRA3), HadrTh (N5)
NIC/ZAM	CompHP (N2), HadrTh (N5)
PSI	SIDDH (JRA10), NoRHDia(JRA11) HadrTh (N5)
TSL	EtaMeson (N4), HadrTh (N5)
ZIB	CompHP (N2), HadrTh (N5)

# Multi Annual Plan + Milestones

		JRA11: NoRHDia																
Deliverables / Tasks	M 01-12											M 13-24					M 25-37	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
<b>Mono-crystalline detector prototype</b>																		
Defect spectroscopy	█	█	█	█	█	█	█	█	█	█	█							
Charge collection properties																		
Detector characterisation																	█	
Growth of SC_CVDD(IMEC)	█	█	█	█	█	█	█	█	█	█	█							
Characterisation 3-5																		█
Growth of B-doped SC_CVDD																		
Characterisation 3-5																		█
Growth of p-i-n SC_CVDD																		
Characterisation 3-5																		█
<b>SC_1b substrates</b>																		
Feasibility studies area enlargement	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
Surface optimisation	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
<b>Fast amplifier</b>																		
Feasibility studies	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
Submission to electronics studies																		█
Submission to detector studies																		█
<b>Radiation hardness validation</b>																		
Protons , 1E17/cm, 30 MeV																		
Characterisation 3-5																		
Fast HIs 1E15/cm																		
Characterisation 3-5																		
Pions up to 1E17/cm																		
Characterisation 3-5																		
Neutrons up to 1E18/cm																		
Characterisation 3-5																		
HI m-beam to damage																		
Characterisation 3-5																		
Validation radiation hardness																		█
<b>Demonstrators</b>																		
E-T-Detectors&electronics																		
Compare PC_CVDDD																		
Validation technology																		█
Final report																		█

## Tasks - Working Groups

- Material growth and doping .....1
  - ❖ HPHT Ib Substrates
  - ❖ SC-CVDD growth
- Material characterisation .....2
  - ❖ X-ray diffraction topography
  - ❖ Raman mapping
  - ❖ Optical & electrical properties using solid state physics methodes
- Detector characterisation .....3
  - ❖ Charge collection efficiency
  - ❖ Homogeneity / Energy resolution
  - ❖ Timing properties
- Electronics I (spectroscopy) .....4
  - Electronics II (timing) .....5

# Monitoring procedure

- Progress reports
- Reports after each period
  - ❖ (incl. administrative and financial expenses description)
- Final reports