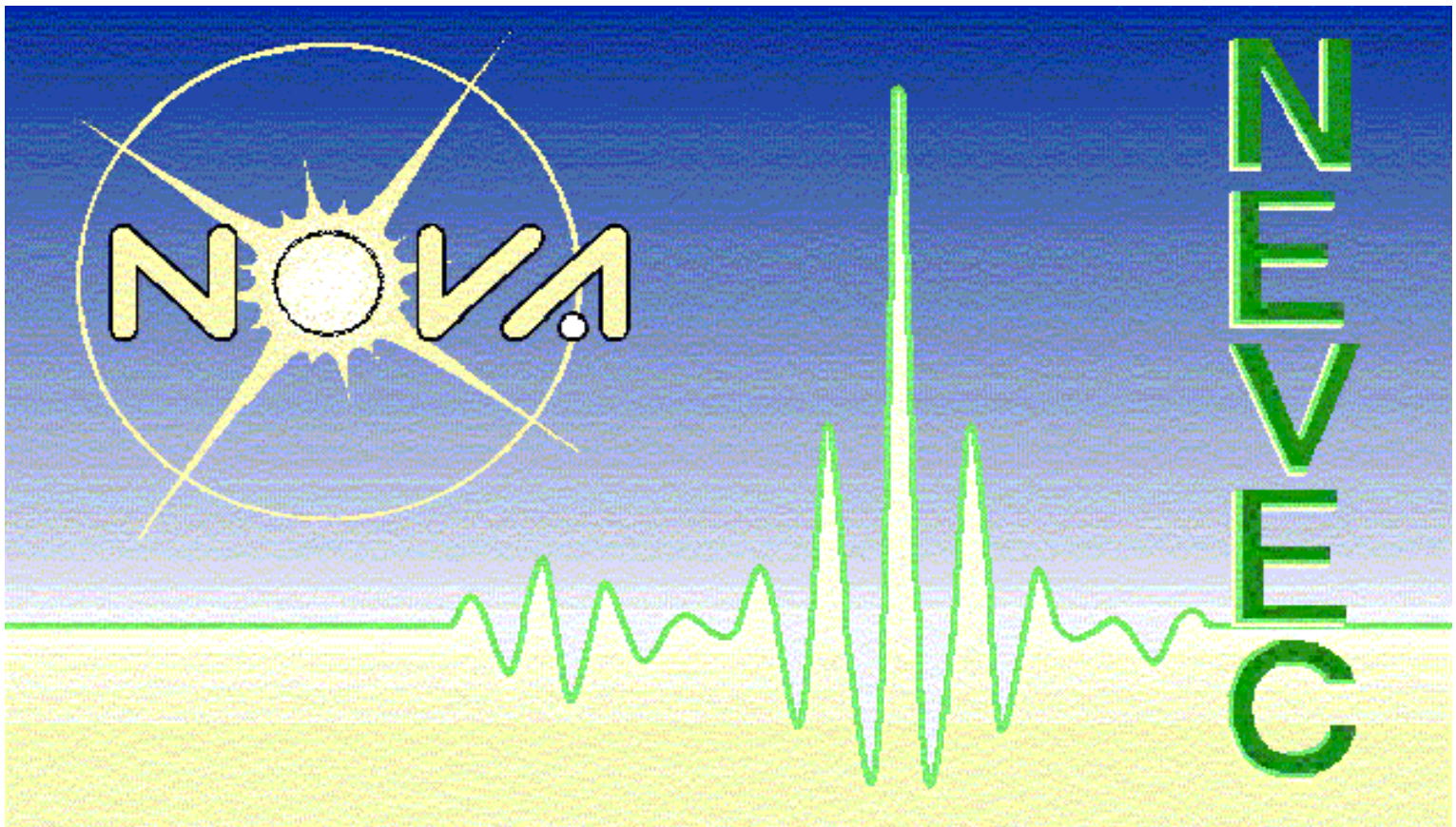
NEVEC

NOVA **E**SO **V**LTI **E**xpertise **C**enter



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1. Introduction

This paper gives an overview of previous, current, and future activities of NEVEC. These include work on MIDI, PRIMA (including a pre-PRIMA survey), concepts for next generation VLTI instruments (e.g. homothetic mapping, nulling, MIDI upgrade), VLTI's calibrators program, instrument models, data formats (FITS binary table format), commissioning, education in interferometry (e.g. Leiden summer school 2000), algorithm development, and scientific exploitation of VLTI data.

Special attention will be give to the Dutch interest to participate in the development of next generation VLTI instruments.

2. People involved

- E.J. Bakker, I. Percheron, J. Meisner, J. de Jong, and D. Hartmann
  NEVEC staff at the University of Leiden
- G.K. Miley, W. Jaffe, R. Le Poole, H.J.A. Röttgering, and B. Heijligers
  University of Leiden
- A. Glindemann, ESO
- L.B.F.M. Waters, and R. van Boekel, University of Amsterdam
- W. Cotton, NEVEC guest from NRAO
- L. d'Arcio, NEVEC guest from SRON
- W. Boland, NOVA

3. Memorandum of understanding between NOVA and ESO

The NOVA-ESO VLTI Expertise Centre (NEVEC) is a joint venture between the Netherlands research school for astronomy (NOVA) and the European Southern Observatory (ESO).

NEVEC headquarter is located at Leiden Observatory with an additional office at the University of Amsterdam.

NEVEC is funded by NOVA and formulated in a Memorandum of Understanding signed at the University of Amsterdam on 31 May 1999, and inaugurated on 26 May 2000 at Leiden Observatory.

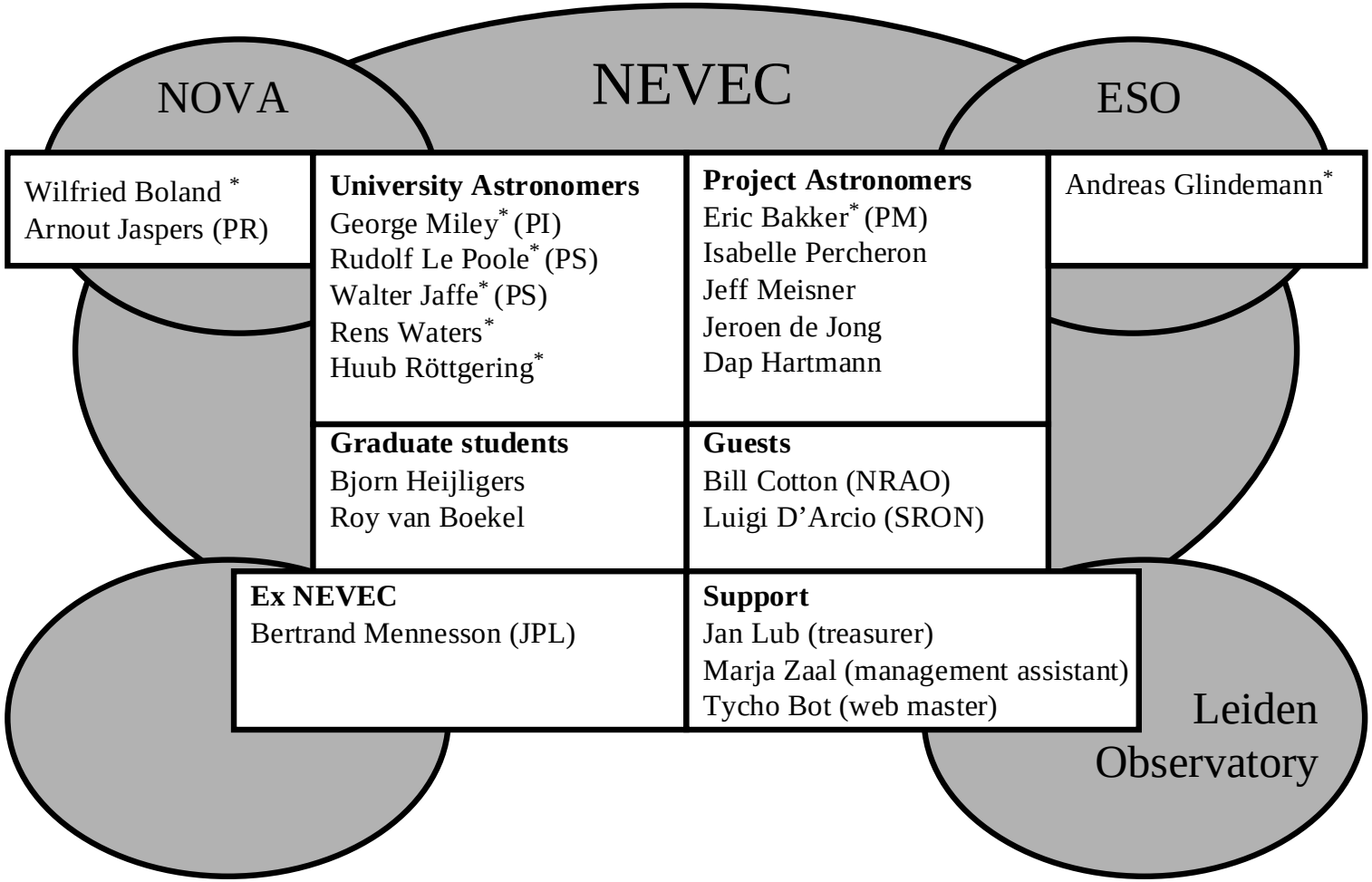
4. Mission statement

1. Development of instrument modelling, data reduction, and calibration techniques for VLTI.

2. Accumulation of expertise relevant for a second-generation VLTI instrument.

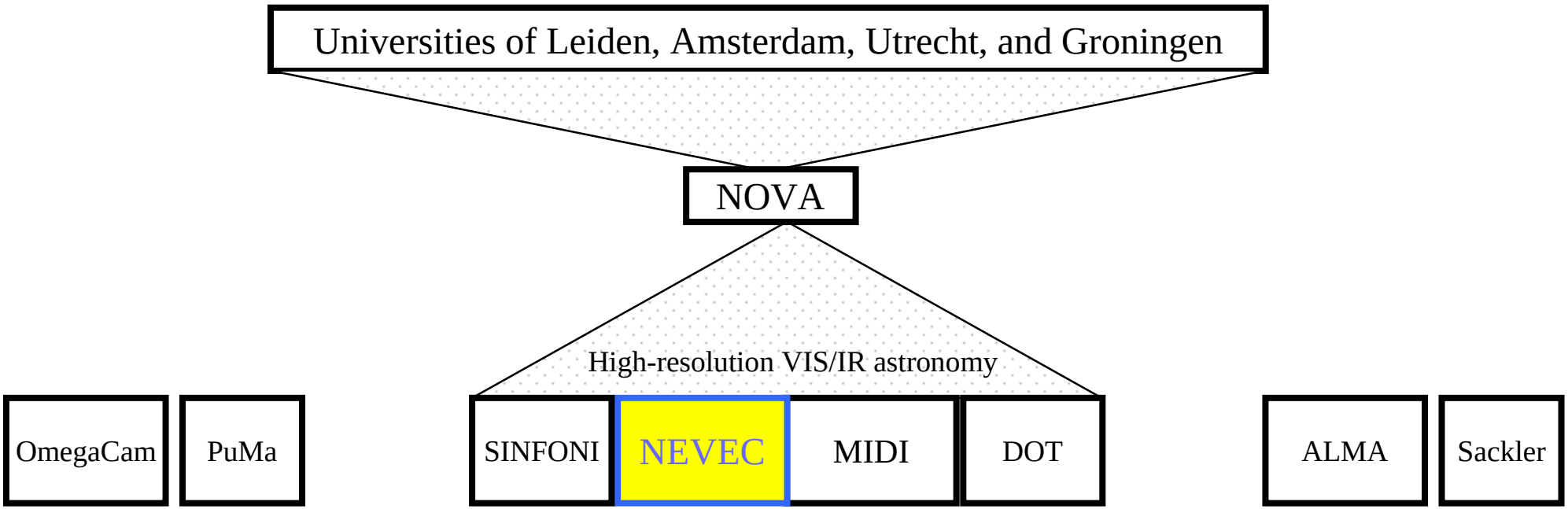
3. Education in VLTI.

5. NEVEC's human resources



PI: Principal investigator, PS: Project scientist, PM: Project manager, * :NEVEC management team

6. NOVA's instrumentation program



7. NEVEC's work breakdown structure

Work package 00: management
Work package 01: MIDI
Work package 02: PRIMA
Work package 03: next generation instruments
Work package 04: instrument calibration
Work package 05: instrument models
Work package 06: data formats
Work package 07: commissioning
Work package 08: education
Work package 09: algorithms
Work package 10: science
Work package 11: interfaces

Work package 00: management

The activities executed in the framework of this work package are focussed on the management team and project management of NEVEC. Management includes supervision of 18 FTE funded by NOVA (1999-2005) (of which 10 FTE for an ESO task list, 3 FTE for MIDI software development, and 5 FTE for open research). University staff and NEVEC guests provide additional person-power. Management requires co-ordination of activities of 15 scientist involved, distributed over two locations (headquarter at Leiden observatory, second location at the University of Amsterdam), with a total person-power consumption of about 6 FTE/year.

Work package 01: MIDI

In close collaboration with the Max Planck Institute for Astronomy at Heidelberg, the Observatory of Paris Meudon, and ASTRON at Dwingeloo (NL), NEVEC designs and develops software to operate and analyse data from MIDI.
The main NEVEC efforts are focussed on two software modules, the Near Real-Time System (NRTS), and the Expert Workbench Station (EWS), which both process the detector data to extract scientific information, and overall software management. Additionally NEVEC works on theoretical development of fringe tracking algorithms, operating analysis, template files, overall MIDI sensitivity, commissioning.

Work package 02: PRIMA

For adaptive optics and phase referencing for interferometry to work at their best, a bright point source as reference object is required within the isoplanetic patch of the science object. Given the small size of the isoplanetic patch, the number of reference objects for PRIMA around a science object is restricted. This work package uses the following approach: first select a reference object, followed by looking for science objects within the isoplanetic patch of that reference object.
(Richichi et al., 2001)

Work package 03:
next generation instruments

The current VLTI is able to combine light from two telescopes coherently, to be extended to three beams when AMBER is commissioned. In order to coherently combine the light of up to eight telescopes a beam combination techniques needs to be applied. Possibilities are closure phase and homothetic mapping.

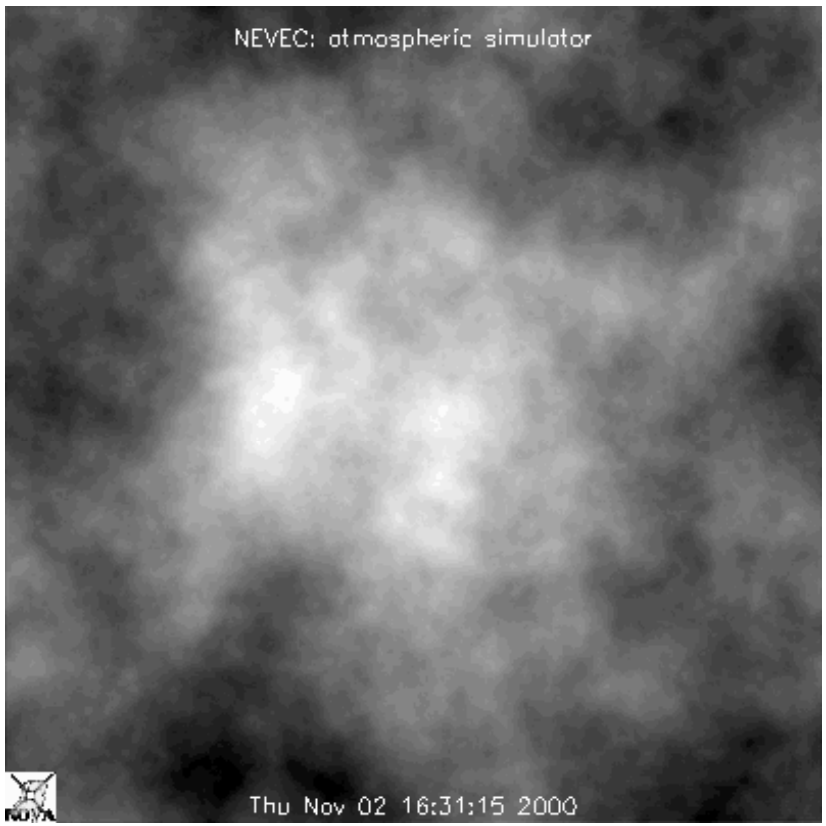
Within this work package NEVEC conducts a theoretical study aiming at improving our understanding of homothetic mapping and developing a conceptional design of a homothetic mapper for the VLTI (Le Poole 2001, Glindemann et al. 2001, Haniff and Buscher 2001, Paresce et al. 2001).

Work package 04: instrument calibration

The VLTI calibrators program: the objective is to provide a catalogue with a sufficient number of sources having a known angular diameter, either from direct measurements from the VLTI or other interferometers or from indirect estimates. The compiled data base can be used to calibrate the instrumental visibility factor both in the near-IR and the mid-IR ranges (AMBER and MIDI). (Richichi and Percheron, 2001)

Work package 05: instrument models

The objective of this work package is to develop software modules for the VLTI's end-to-end model. The end-to-end model has been developed by ESO within the scope of the VLTI but could also be used for dynamic simulation of other astronomical telescopes. The entire toolbox is currently being maintained at ESO. NEVEC is involved in maintaining and improving the atmospheric simulator.



Work package 06: data formats

NEVEC, in the persons of Jaffe and Cotton, has played a leading role in establishing FITS Binary Table formats for storing optical/IR interferometric data. The goal was to establish formats for both the instrumental configurations and the data in various stages of reduction. A generic format for "all" optical interferometers was developed along with specialisations for the VLTI and two specific instruments: MIDI and VINCI. The VLTI version has been transferred to ESO for maintenance.

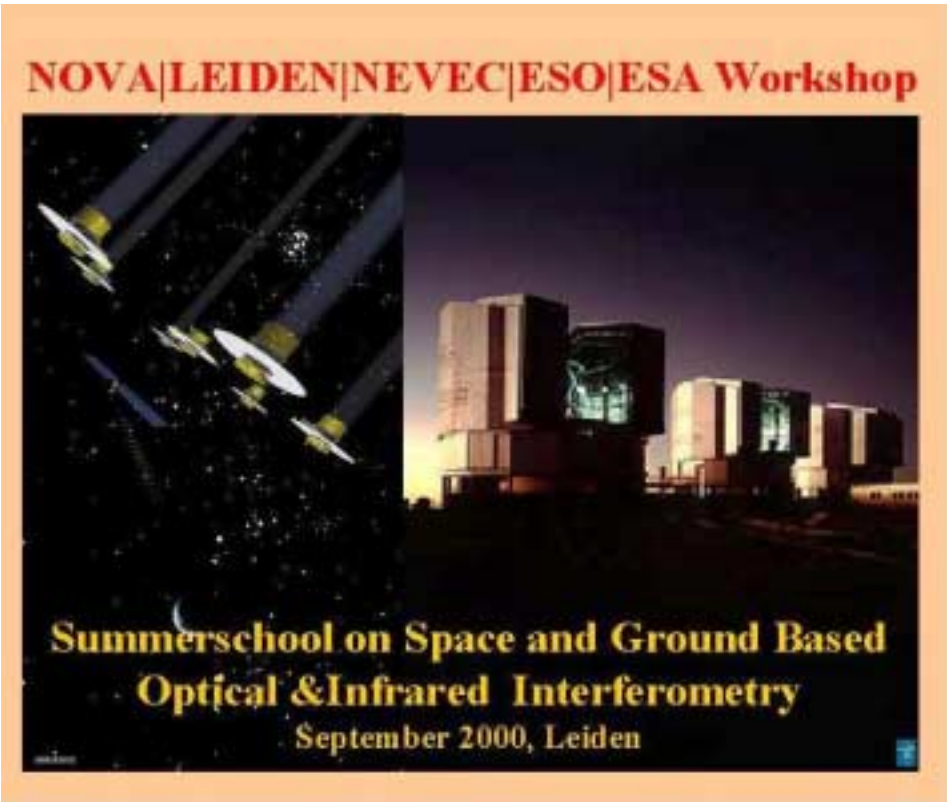
In addition to establish the standards, Jaffe and Cotton have developed software, in IDL and C respectively, to access and manipulate data in these formats.

Work package 07: commissioning

The objective of this work package is to support ESO in commissioning VLTI instruments.
The first VLTI instrument to coherently combine the light from two telescopes is VINCI. NEVEC provides support to ESO in active commissioning of VINCI at Paranal, in software development to process and analyze VINCI data. Finally NEVEC is involved in the data analysis (technical and scientific) of VINCI data in order to improve the performances of the VLTI.

Work package 08: education

A number of activities have been conducted including the organisation of a summer school from 18 to 22 September 2000 at Leiden Observatory on ``Space and Ground based Optical and Infrared interferometry" Percheron et al. 2000.



Work package 09: algorithms

The objective of this work package is to develop and analyse algorithms for phase tracking/delay estimation and group delay tracking. This analysis could be applied to the current VLTI hardware and also to the VLTI infrastructure feeding a superior fringe tracker utilizing a photon-counting NIR detector (such as the STJ). The goal would be to enable fringe tracking (and thus coherent integration) using the faintest possible reference star. To reach this objective, a study is conducted described as analysis, development, and testing (using simulated data) of fringe tracking algorithms for interferometric instruments using spectrally dispersed detection.

Work package 10: science

The objective of this work package is to facilitate, initiate, and execute the scientific exploitation of VLTI data by mobilising the scientific community with a focus on:

- Active Galactic Nuclei
- Circumstellar disks
- Evolved stars
- Astrometry

The required data will be obtained through:

- VLTI Science Demonstration Time
- MIDI guaranteed time
- Observing proposals for AMBER, MIDI, and PRIMA

Work package 11: interfaces

The objective of this work package is to support the Dutch involvement in VIS/IR interferometry through providing an interface between ESO and ESA, and the non-profit organisations and industries within the Netherlands.

8. NEVEC achievements

- Lead software development for MIDI (with MPIA Heidelberg)
- Participate in VLTI commissioning (as part of the ESO team)
- Define VLTI FITS binary table (in close collaboration with ESO)
- Execute VLTI calibrators program (in close collaboration with ESO)
- Execute pre-PRIMA survey (in close collaboration with ESO)
- Organise the optical/infrared summer school 2000 (for ESO and ESA)

9. The road ahead

• Participate in consortium to build a next generation VLTI instrument aiming at faint source science and wide field imaging. Possibilities include:

- MIDI operating at 20 micron (Leinert et al. 2001)
- MIDI multi-beam
- GENIE (nulling)
- eight beam combiner using fibers, integrated optics, and STJs

• Continue involvement with VLTI by providing support to ESO to work on VLTI related questions and problems.

10. References

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11. Acknowledgement

NEVEC acknowledges the ESO VLTI team for their contribution to making this joint venture between NOVA and ESO a success.

12. How to contact NEVEC

Dr. Eric J. Bakker
Leiden Observatory, University of Leiden
NEVEC (NOVA ESO VLTI Expertise Center)
J.H. Oort Building, Niels Bohrweg 2
P.O. Box 9513, 2300 RA Leiden, The Netherlands
Telephone: +31 (0)71 527 5811/5833
Fax: +31 (0)71 527 5819
E-mail: bakker@strw.leidenuniv.nl
WWW: http://www.strw.leidenuniv.nl/~bakker
WWW: http://www.strw.leidenuniv.nl/~nevec