RadioNet3 Board Meeting
Hotel Mercure Cité Mondiale, Bordeaux, February 25, 2015

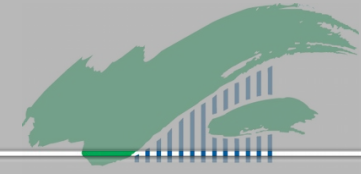JRA – HILADO

Marco de Vos

Science & Technology Facilities Council

CSIRO

SKA AFRICA
SQUARE KILOMETRE ARRAY

LOFAR

UNIVERSITE D'ORLEANS

JIVE
JOINT INSTITUTE FOR VLBI IN EUROPE

iram
Institut de
Radioastronomie
Millimétrique

ESO

INAF ISTITUTO NAZIONALE DI ASTROFISICA

ASTRON
Netherlands Institute for Radio Astronomy

Max-Planck-Institut
für Radioastronomie

UNIVERSITÉ BORDEAUX 1
Sciences Technologies

UNIVERSITY OF OXFORD

ONSALA RYMDOBSERVATORIUM
CHALMERS TEKNISKA HÖGSKOLA

RadioNet

SRON
Netherlands Institute for Space Research

TUDelft
Delft University of Technology

l'Observatoire de Paris

UNIVERSITAS NICOLAI COPERNICI
TORUN

Turun yliopisto
University of Turku

Fraunhofer
IAF

KASI Korea Astronomy and Space Science Institute

ph1 Universität zu Köln

MANCHESTER 1824

UNIVERSITY OF CAMBRIDGE

Universidad de Alcalá

VENTSPILS AUGSTSKOLA

A"
Aalto University

GOBIERNO DE ESPAÑA
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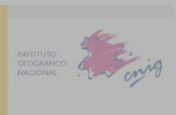
Hilado – General description

- Create optimized prototype software and demonstrator processing pipelines that improve the capabilities of currently planned software packages for existing and emerging radio telescopes.

- Thus increase the potential of the RadioNet user community in opening up those facilities for the more demanding scientific applications.

- **Optimisation of CASACore and of CASA applications**

- **Fast Transient Imager**

- **Large solvers for ALMA and the SKA**

- **Bringing it to the user**

Contract No: 283393

RadioNet3 Hilado – Status

- Deliverables realised on time

- Three upcoming deliverables will be delayed by 4 months (WP1-3)

- Technical work in WP1 and WP4 (almost) completed

- Expected completion well within RadioNet3 period

Deliverables

Del. no.	Deliverable title	Task	Nature	Month	Date
10.1	Detailed activities plan, including top-level architecture of libraries and final selection of benchmark platforms, confirming their availability (including compilers etc.).	Mgt	R	~~12~~ 16	2013/05/02
10.2	Report on optimisation studies, indicating resulting improvement and guidelines for prototyping and benchmarking	1	R	18	2013/06/25
10.3	Report on the comparison of data formats, specifying the key characteristics of optimal formats for various phases in the imaging chain, indicating where and how readily available solutions can be applied	1	R	18	2013/06/27
10.4	Report specifying the requirements and architecture of the Fast Transient Imager, including identification of target hardware platforms.	2	R	18	2013/08/09
10.5	Scientific publication on the application and adaptation of parallel solvers for large astronomical datasets, in particular detailing the application on new hardware platforms.	3	D, R	~~18~~ 21	2013/10/22
10.6	Prototype code of improved ParselTongue library, to form a scripting interface to the prototype code developed in D02 and D09 in particular.	4	P	~~24~~	2014/04/10
10.7	Optimised prototype software (in the repository), showing the actual performance gain from the optimization studies, and ready to be verified on the benchmark platforms	1	P	30	2014/06/29
10.8	Prototype software for the demonstration of the solvers on a variety of hardware platforms.	3	P	30	2014/06/30
10.9	Prototype FTI application (code in repository) for use on the target hardware platforms.	2	P	30	2014/06/29
10.10	Scientific publication on the results of the demonstrator, and the overall performance gains obtained for large scale imaging applications.	1	D, R	38	2015/06
10.11	Scientific publication with the results from the FTI demonstrator application on the selected hardware platforms using real-time data from LOFAR.	2	D, R	38	2015/06
10.12	Scientific publication of the results of demonstrator of large parallel solvers for huge astronomical datasets on the selected hardware platforms, detailing the improvements obtained.	3	D, R	38	2015/06
10.13	Demonstrator pipelines (code in repository) for the selected applications, including a standard imaging pipeline, giving end-users access to parameters in the solvers and components through the improved ParselTongue libraries.	4	D	38	2015/02/27
10.14	Final report integrating the three benchmark studies and the demonstrator pipelines	1,2,3	R	42	2015/10

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Hilado – Achievements 2014, Outlook 2015
WP1: Optimisation CASACore &c

- Implemented improved table query functionality through SQL-like extensions

- Performance improvements for table usage on future file systems
  - Reduced # of files; adapted to cluster file systems ('Lustre')

- Performance instrumentation added (memory and table usage)

- Improved parallelism through multithreading

- Cooperation with NRAO: CASA builds with standard Casacore
  - In final testing phase

- Working on publication on table system for A&C (D10.10)

HILADO WP1 is complete on successful build of new Casacore-based Casa (release expected by June 2015)

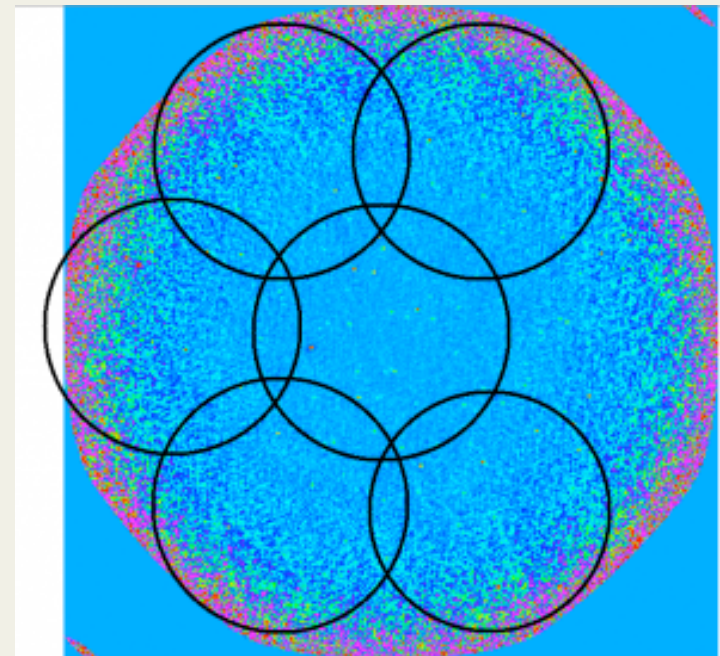# *Hilado* – Achievements 2014, Outlook 2015
WP2: Fast Transient Imager

- Implemented concurrency in filling and reading visibility measurement set

- De-mixing improvements through multi-directional calibration

- Implemented plugin facility in NDPPP to incorporate existing Python code

- Application of FTI-results: work on TraP (transients extraction from images) at UvA (AARTFAAC)

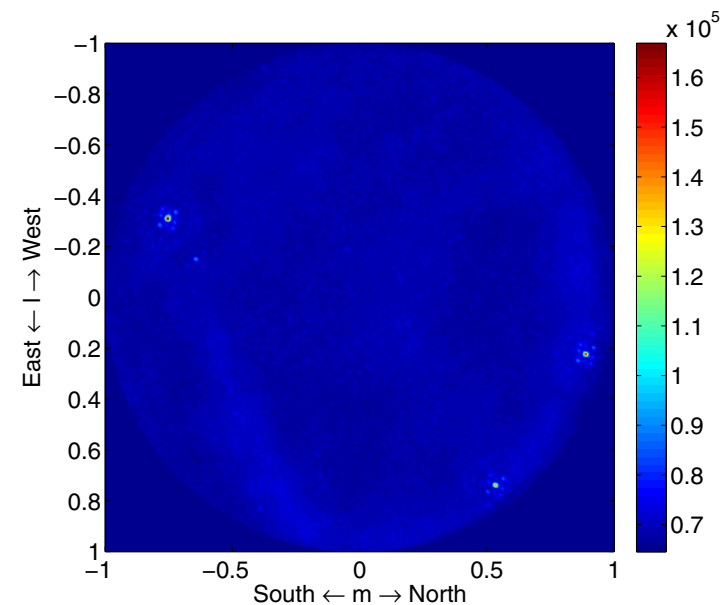Remaining work:

- De-mixing speed and Imaging speed improvements

Achievements

- ◻ Both polarised and non-polarized algorithm introduced within NDPPP

- ◻ Study on scalar and polynomial smoothing over multiple frequencies/time slots

- ◻ Initial work for introduction into CASACore

- ◻ Continuing use within Meqtrees

- ◻ Direction Dependent Effects studies

- ◻ Positive costs and feasibility studies within SKA

Fig. 13. Calibrated all-sky image at 59.67 MHz made with the 288-antenna AARTFAAC system.

Remaining work

- Incorporation of StEFCal within CASACore and other pipelines

- Publication of paper(s) on applications of theory and application

- Completion of work on multiple frequencies/time slots using polynomial and other smoothing

- Use of StEFCal as low level engine within calibration strategies, and for baseline-dependent averaging (important for SKA)

- DDE studies continuing (O.Smirnov & Co.)

- Possible revisiting StEFCal within hybrid computing (CPU and GPU)

Many topics: priorities to be established at March 2015 meeting

Hilado – Achievements 2014, Outlook 2015
WP4: Bringing it to the User

- Completed: interface between SWIFT (U-Chicago, Argonne) – ParselTongue

- Completed: DFG analysis/execution for Casa

- Prepared: example pipeline

- In debugging phase: DFA code

- In progress: tying the above together (D10.13)
  - Delivered end of February, 2015
  Concludes the work in HILADO WP4

Hilado – Issues

- **Late deliverables**
  - D10.10 – D10.12: due month 38, delayed until month 42 (relative to start of RadioNet3)

Hilado – Dissemination plan

◻ *Mid Term Review comment:*

The consortium has clear plans for the exploitation of foreground knowledge generated in the JRAs and expects to utilise the outcomes in: …

2) new software systems/pipelines in CASA and LOFAR and calibration approaches for current telescopes (ALMA, VLA, MeerKat) and for the SKA (Hilado).

◻ Collaboration with NRAO: <u>June release of CASA based on new Casacore</u>

◻ sharing results with users needs to be improved: <u>CALIM workshop on HILADO 2015 planned (August?)</u>

◻ Results are and must be implemented in packages governed by Open Source licences and are published in academic journals/conferences

◻ WP1: CASACore optimisations: A&C publication

◻ In addition, for large solvers: <u>Non-polarised algorithm and applications published in A&A, Polarized algorithm presented and published at URSI Conference. Large solvers used for MeerKat</u>

Hilado – Remaining Project Period

- WP1: CASACore
  - Done after successful build of Casa (expected June 2015)

- WP2: FTI
  - De-mixing speed and Imaging speed improvements

- WP3: Large Solvers
  - Incorporation in existing pipelines; hybrid implementation
  - Finish polynomial and other smoothing; DDE studies
  - Use in calibration strategies, and for baseline-dependent averaging
  - Publication of paper(s) on theory and application

- WP4: Bringing it to the User
  - Tying components together (expected by end of February 2015)

On track to be finished within RadioNet3 timeframe