



ACE

The Antenna Centre of Excellence in Europe

Per Ingvarson

RUAG Aerospace Sweden, Göteborg

ACE technical coordinator



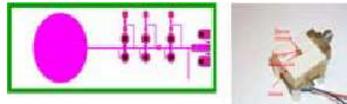
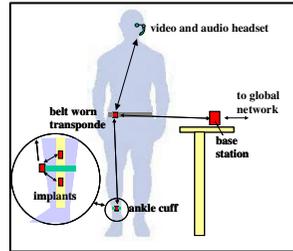
Why ACE?

Problems to be solved

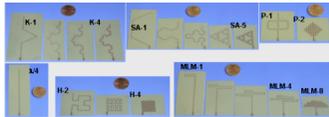
- No European antenna community
- Cooperation industry – university too weak
- Research not always relevant
- Too much duplication
- Little reuse of software and test facilities
- Little cooperation in PhD education
- Weak dissemination

a|e

Scope



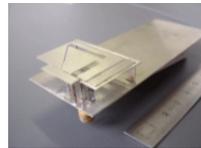
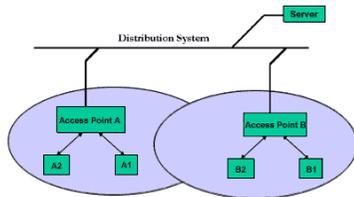
ACE for BAN



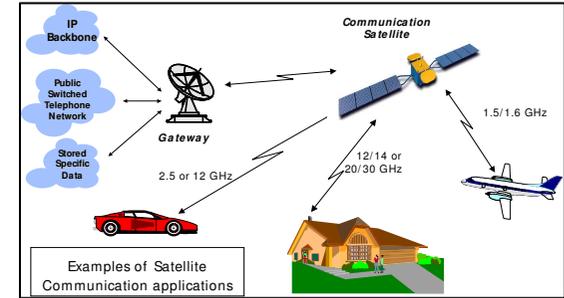
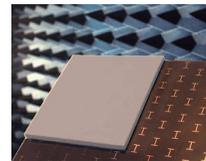
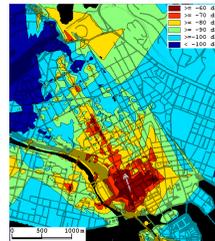
ACE for PAN



ACE for LAN



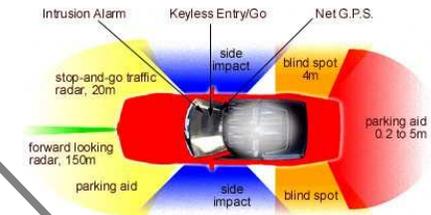
ACE for WAN



ACE for GAN via Satellites



ACE for RF-Sensors



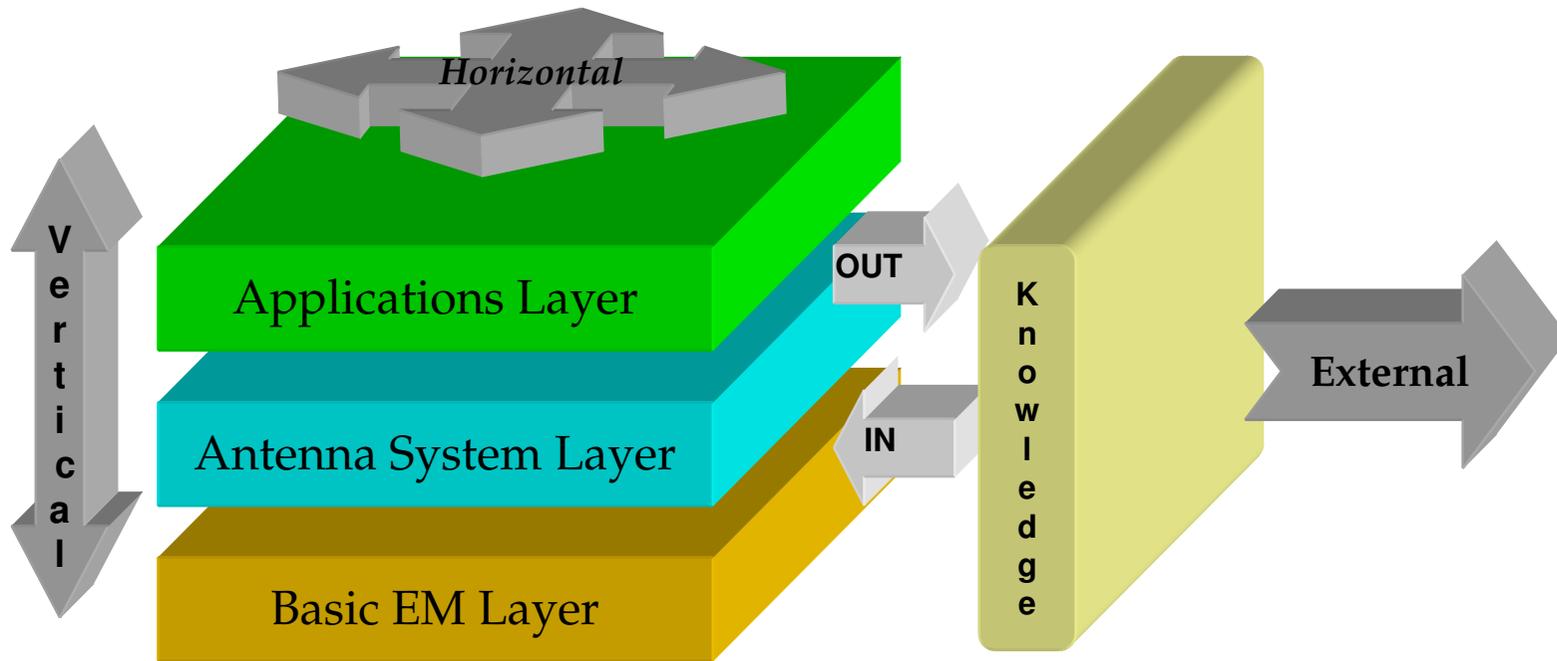


Size

- ACE has a duration of 2+2 years and started 1 January 2004
- ACE has 5400 + 5100 kEURO
- ACE has 51 participants from 17 countries
- ACE involves 323 researchers and 130 PhD students



Activities





Cooperation with wireless applications

Per Ingvarson

The aim was to increase the relevance of the research through information through

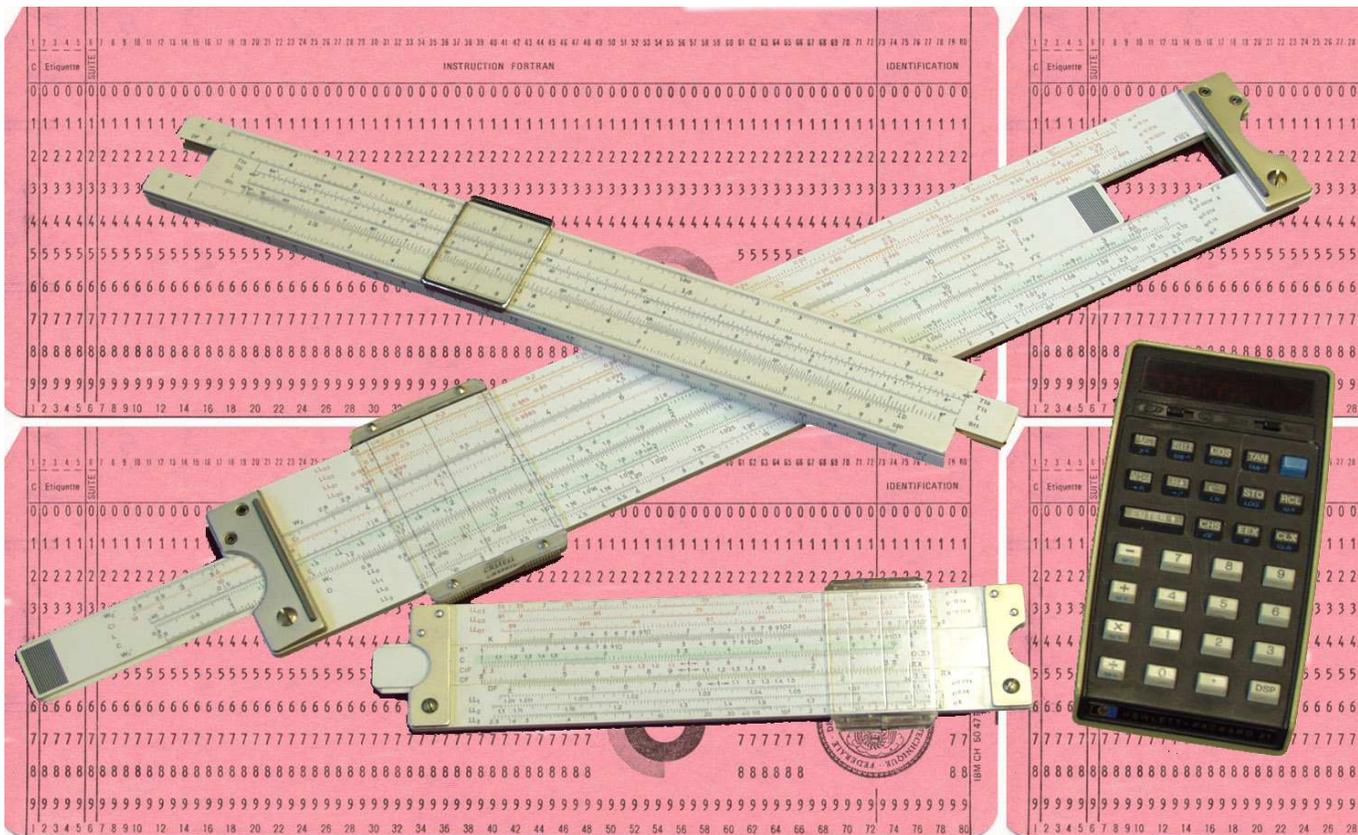
- Dedicated meetings with users, manufacturers and agencies
- Literature and conferences



Antenna software initiative

Guy Vandebosch, Raphaël Gillard

Much has happened the last 30 years...





Antenna software initiative

- General-purpose solvers are not sufficient
- Many special solvers are developed, but they are
 - not documented
 - not evaluated
 - not available
 - hard to combine



Antenna software initiative

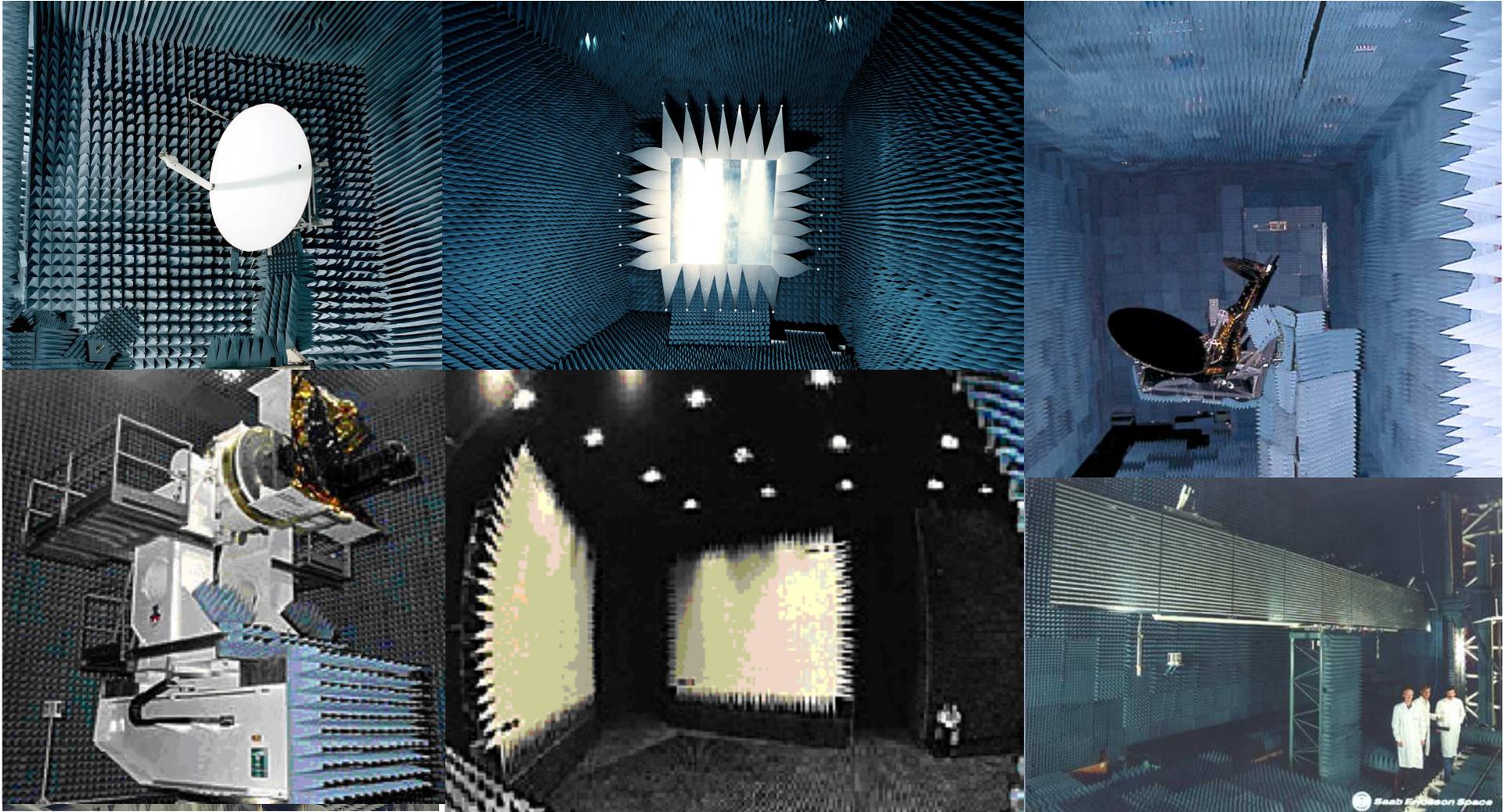
Accomplishments:

- Inventory of software
- Benchmarking
- Integration of selected software
- Standardization of data files and interfaces (EDI)



Antenna measurement techniques

Olav Breinbjerg

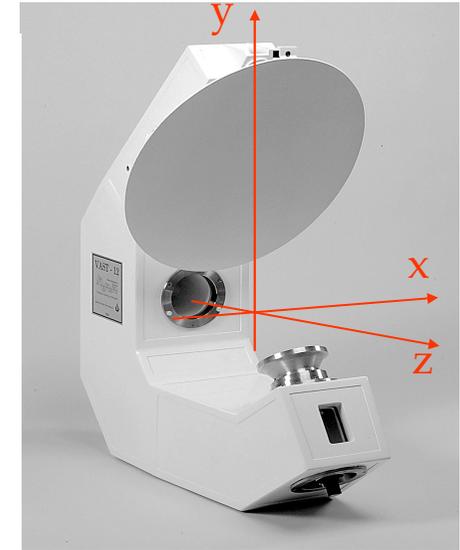
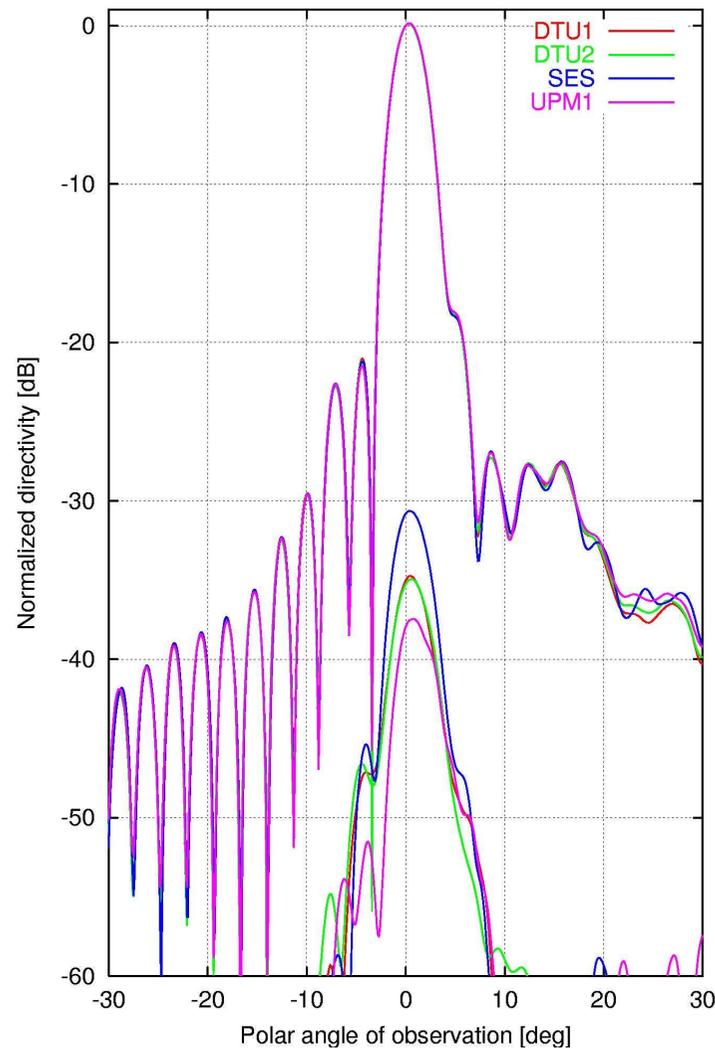
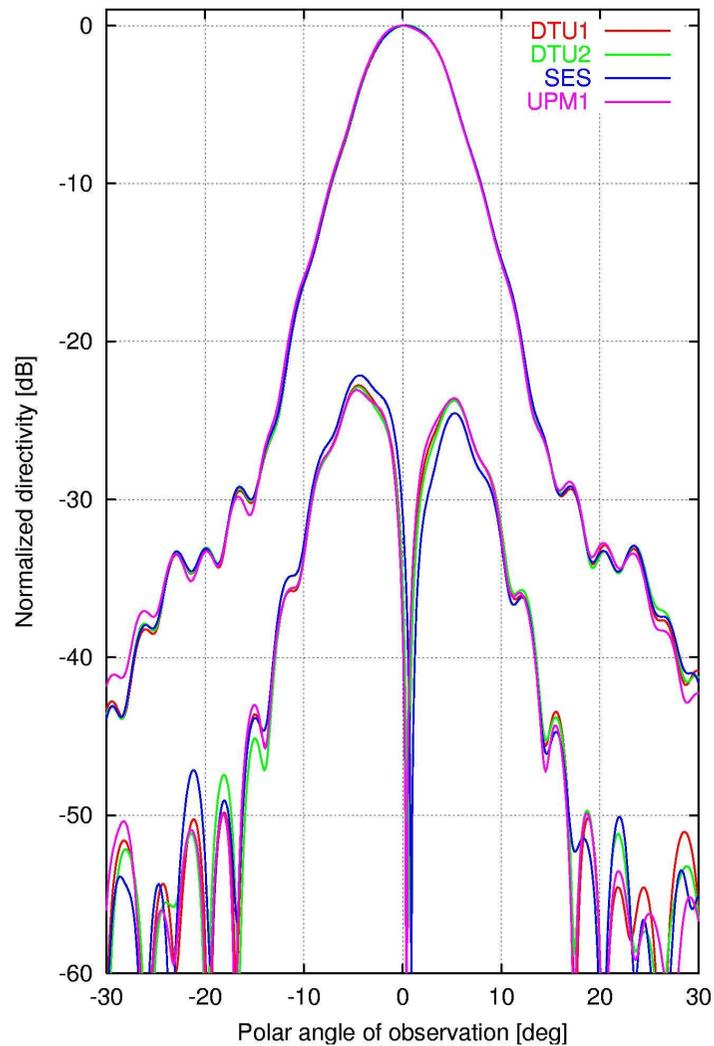


Test ranges at ESA and Saab Space

ARTIC workshop 2009-03-26



Antenna measurement techniques





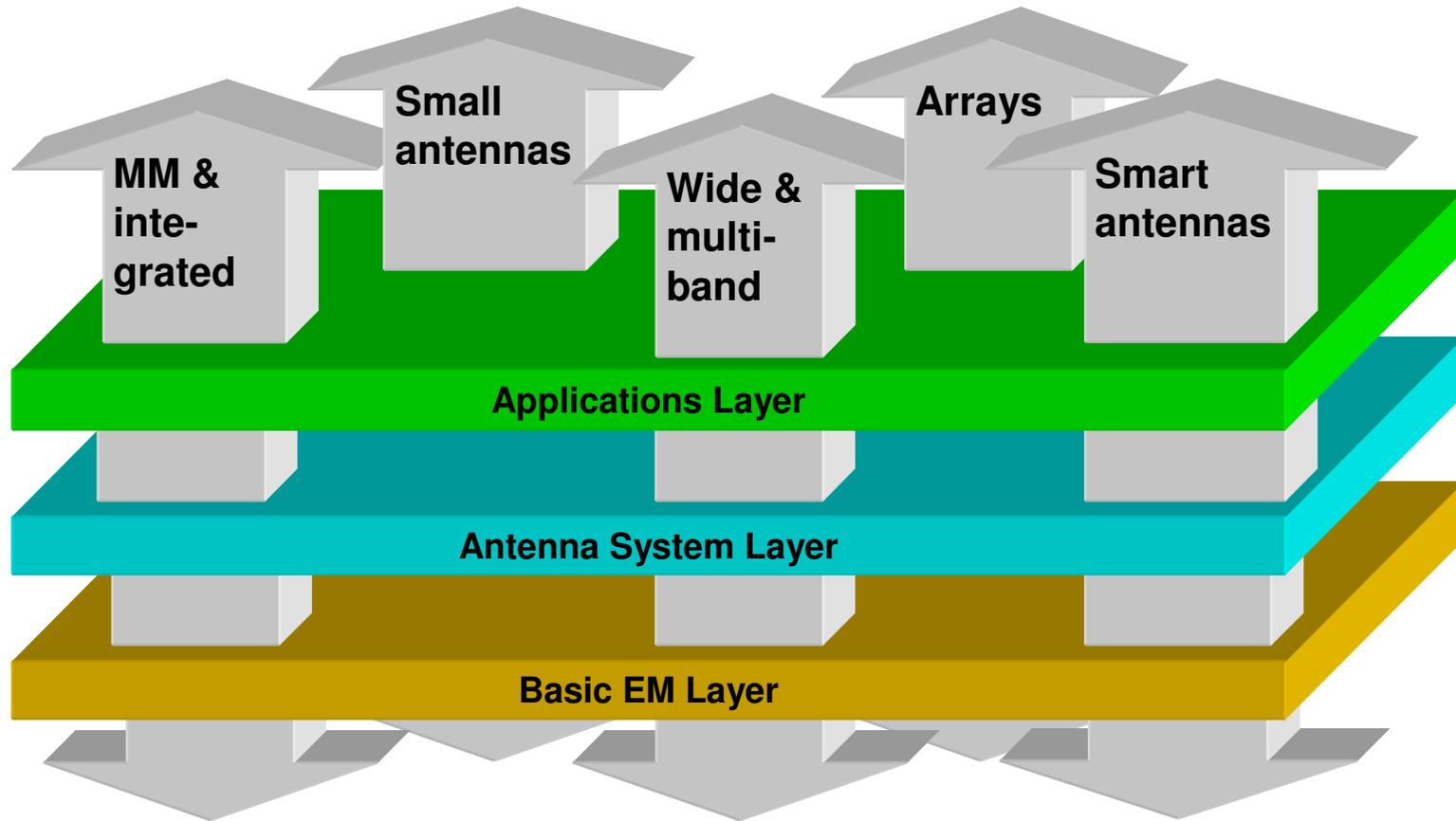
Antenna measurement techniques

Accomplishments:

- Test ranges mapped/known, benchmarked and available
- Procedures are compared and standardized
- Benchmarking antennas are available, both simple “do-it –yourself”, and advanced for sending around



Activities

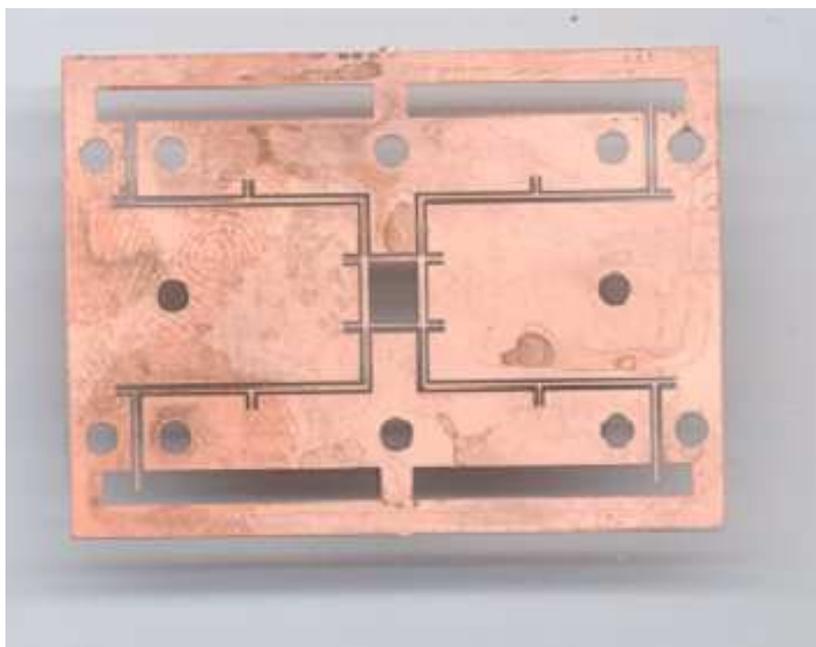




Millimetric/integrated antennas

Peter Hall

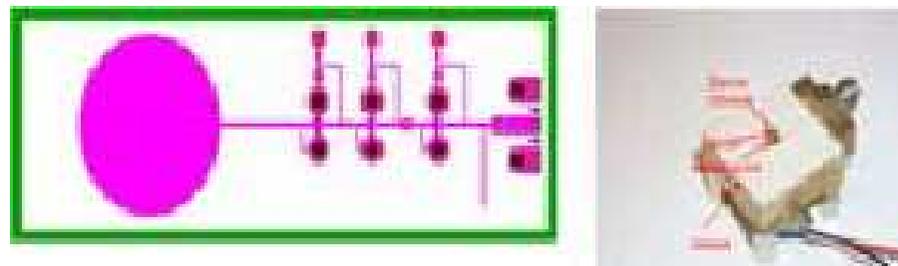
MILLIMETRIC ANTENNAS



*Micromachined couplers
(U. Birmingham)*

INTEGRATED ANTENNAS

Amplifiers, MEMS...



*Active integrated antenna
(University of Rennes)*

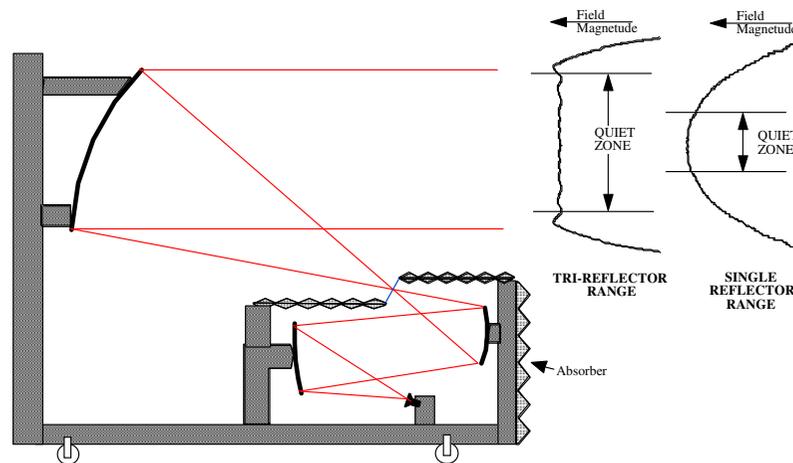
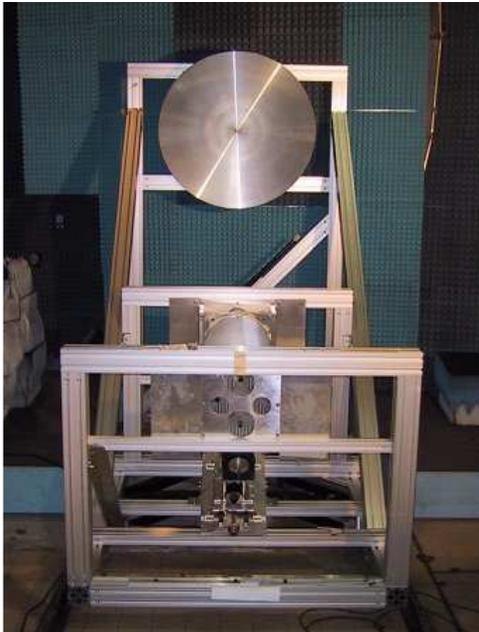
a|e Millimetric/integrated antennas

TECHNOLOGIES: Review, delta research

DESIGN: Assess, select and benchmark

MANUFACTURING: Manufacture and evaluate

TEST: Assess, test and evaluate



300 GHz tri-reflector (Queen Mary)

ARTIC workshop 2009-03-26



Millimetric/integrated antennas

Accomplishments:

- A unique multidisciplinary knowledge on all aspects of mm-wave and integrated antennas: Concepts, design tools, manufacturing, testing
- MEMS integration (cooperation with AMICOM)

This is the future for all high data rate communication, car radars...



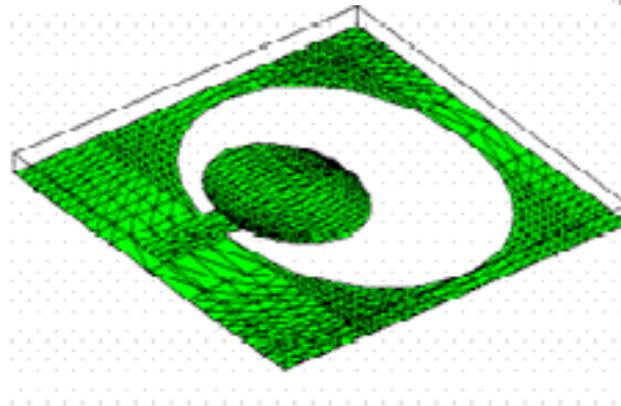
Small antennas

Marta Martínez Vázquez

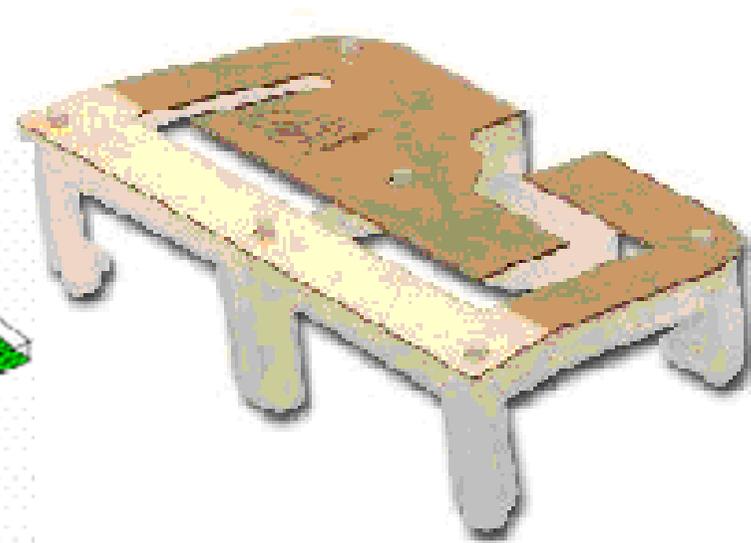
SMALL ANTENNAS



Cochlear implant for hearing aids



UWB antenna



Planar integrated antenna for mobile-phone (IMST)



Small antennas

TEST FACILITY BENCHMARKING



Test fixture for antenna test benchmarking (Chalmers University of Technology)



Small antennas

Accomplishments:

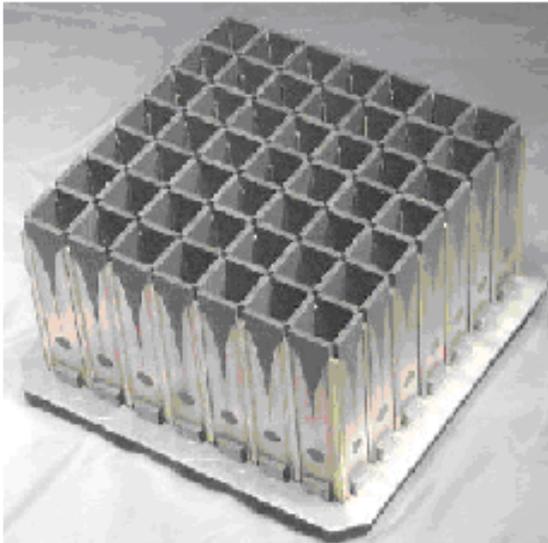
- Increased industry-university cooperation
- Better understanding of the fundamentals of small antennas
- New knowledge and designs for UWB and multifrequency antennas



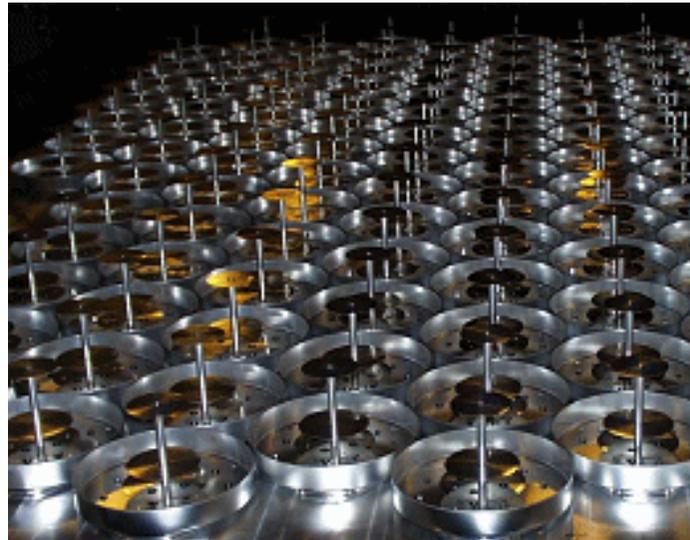
Wideband and multiband antennas

Peter Balling

RADIATORS wideband, multiband



*Wideband (2-6 GHz)
array tapered-slot
elements (FOI)*



*Tx/Rx elements
(Saab Space)*



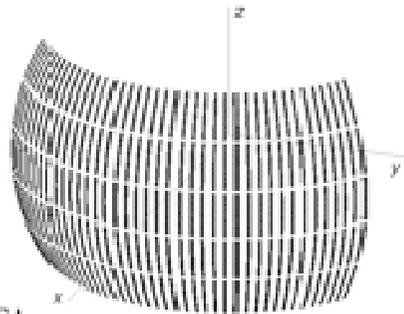
*Prefractal Sierpinski
monopoles
(Univ. Catalunya)*



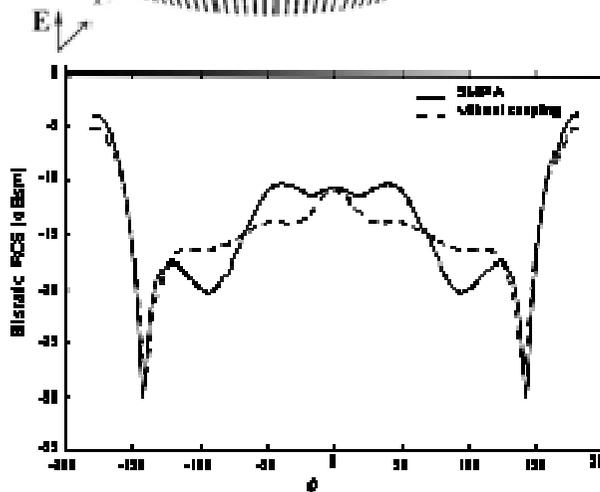
Wideband and multiband antennas

REFLECTOR SURFACE MODELS

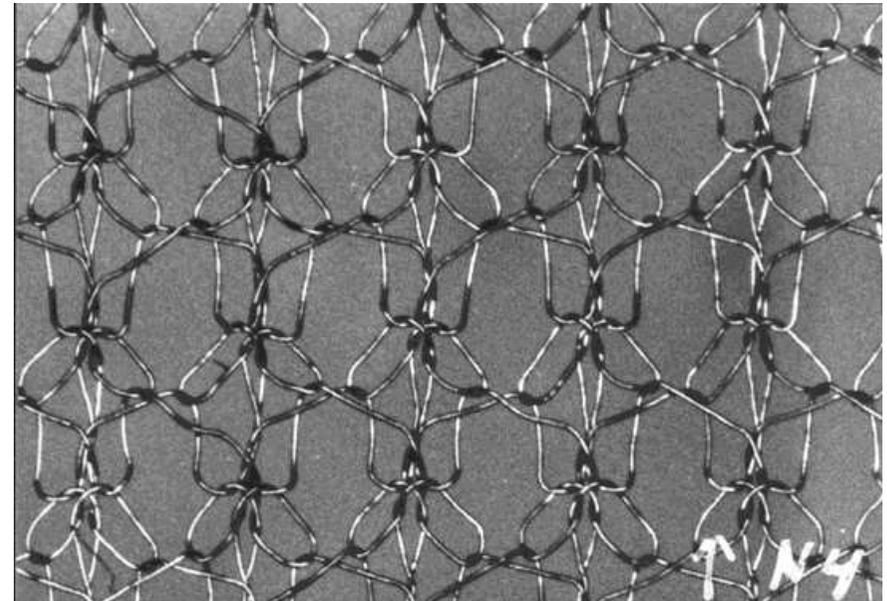
Dichroic, composite, wire-grid...



*FSS on curved shell
(Univ. Zagreb).*



*Bistatic RCS of FSS
in azimuthal plane.*



Mesh reflector

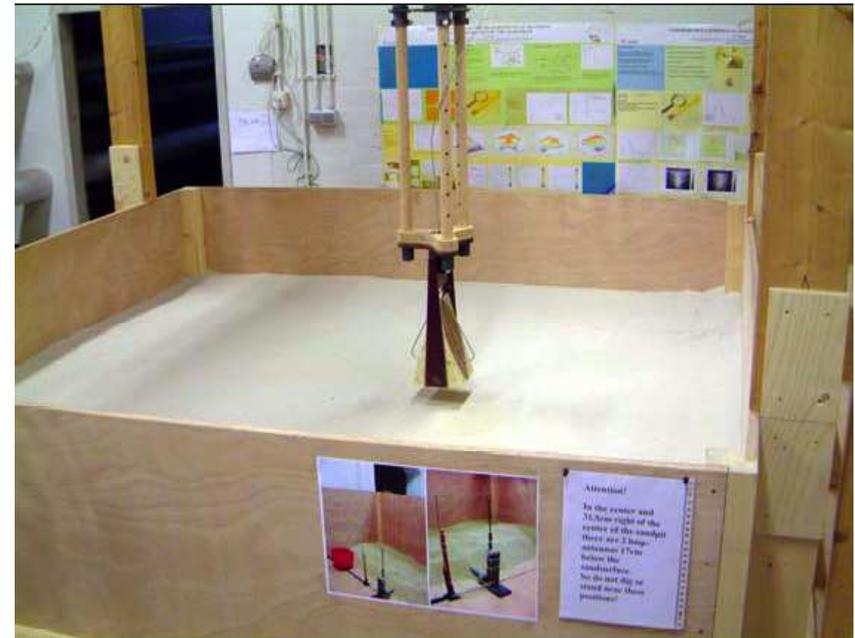


Wideband and multiband antennas

SURFACE PENETRATING RADARS



*Joint GPR antenna test facility
(Ørsted, Tech. Univ. Denmark)*



"Sand pit" GPR test facility (TU Delft)



Wideband and multiband antennas

Accomplishments:

- Wideband, UWB better known and understood
- Modelling of reflector surfaces (including FSS flat or curved) compared and improved
- GPR antennas benchmarked, common facilities opened, BPR also addressed

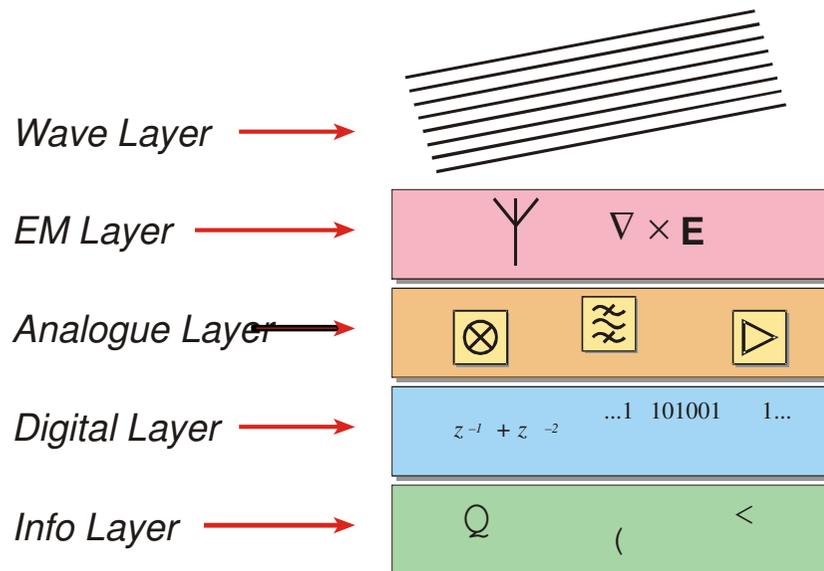


Planar and conformal arrays

G rard Caille

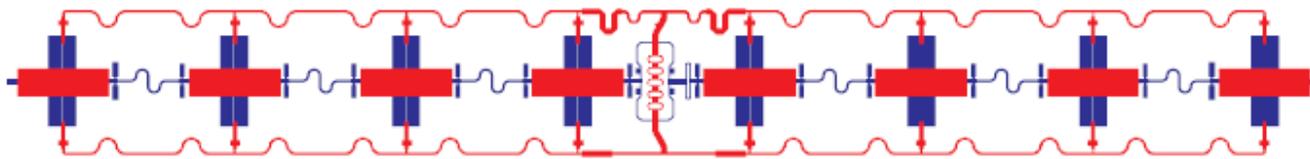
ACTIVE ANTENNAS ARCHITECTURE

Software models

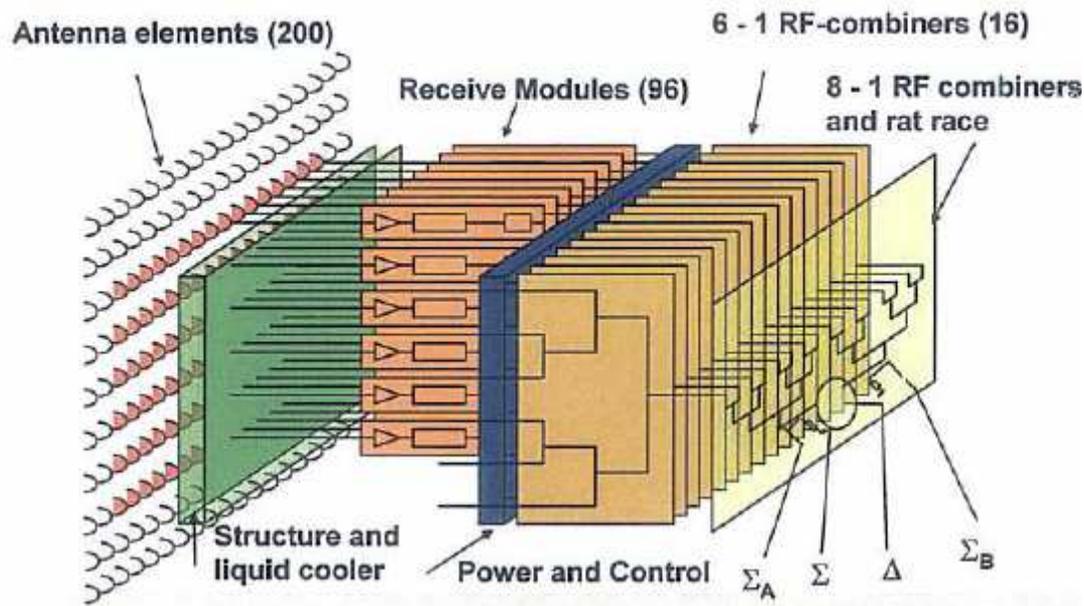


a|e Planar and conformal arrays

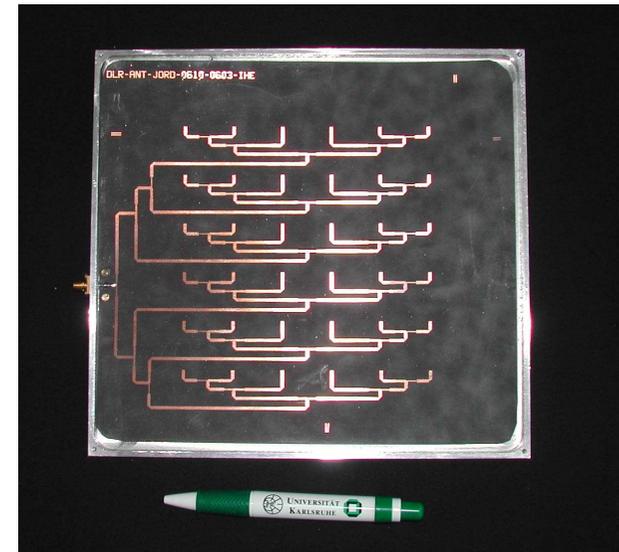
BEAM-FORMING TECHNIQUES Rf, optical, digital



Series-fed dipole array (Saab Space, EPFL, IDS)



Active Electronically Scanned Array (SMW)

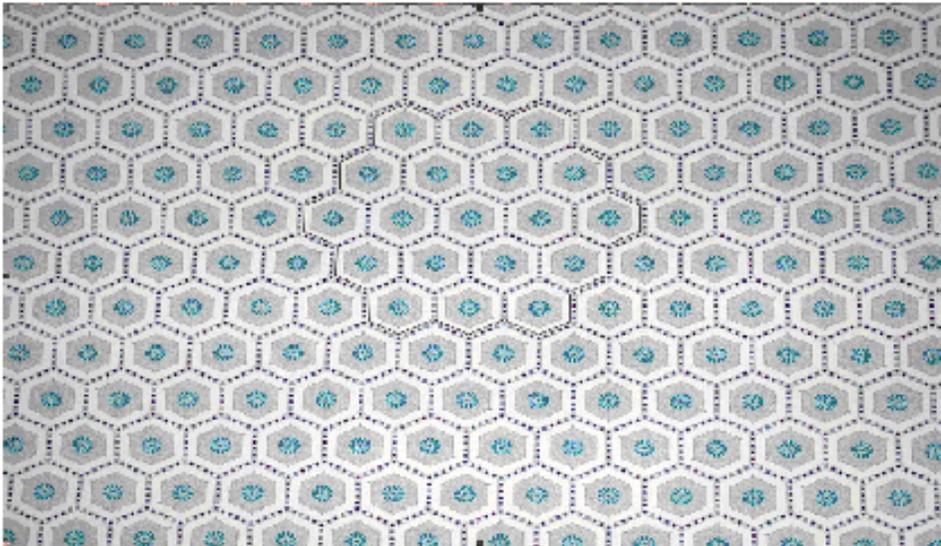


Parallel feed for patch array (Univ. Karlsruhe)

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a||e Planar and conformal arrays

REFLECTARRAYS



*Phase-controlled reflectarray_by
MEMS switches (Alcatel-Space &
Thales R&T)*

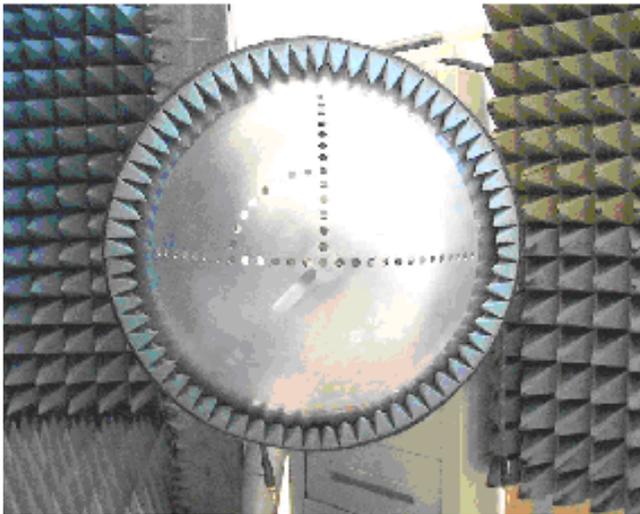


Multilayer Reflectarray (UPM)

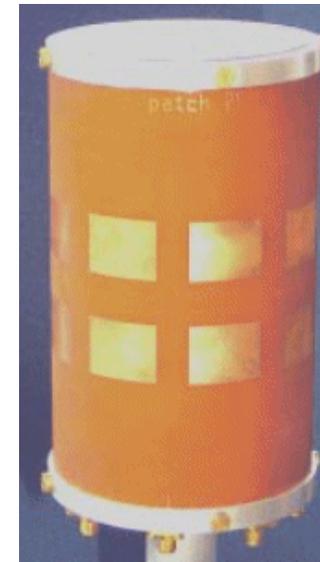
a|e Planar and conformal arrays

CONFORMAL ANTENNAS

Select conformal geometries; Compare modelling methods



Doubly curved conformal array to be integrated on aircrafts (Saab Microwave Systems)



Conformal antennas for base-station (University of Karlsruhe)



Wide-scanning conformal array (Alcatel Space, CASA & LEMA-EPFL)

a|e Planar and conformal arrays

Accomplishments:

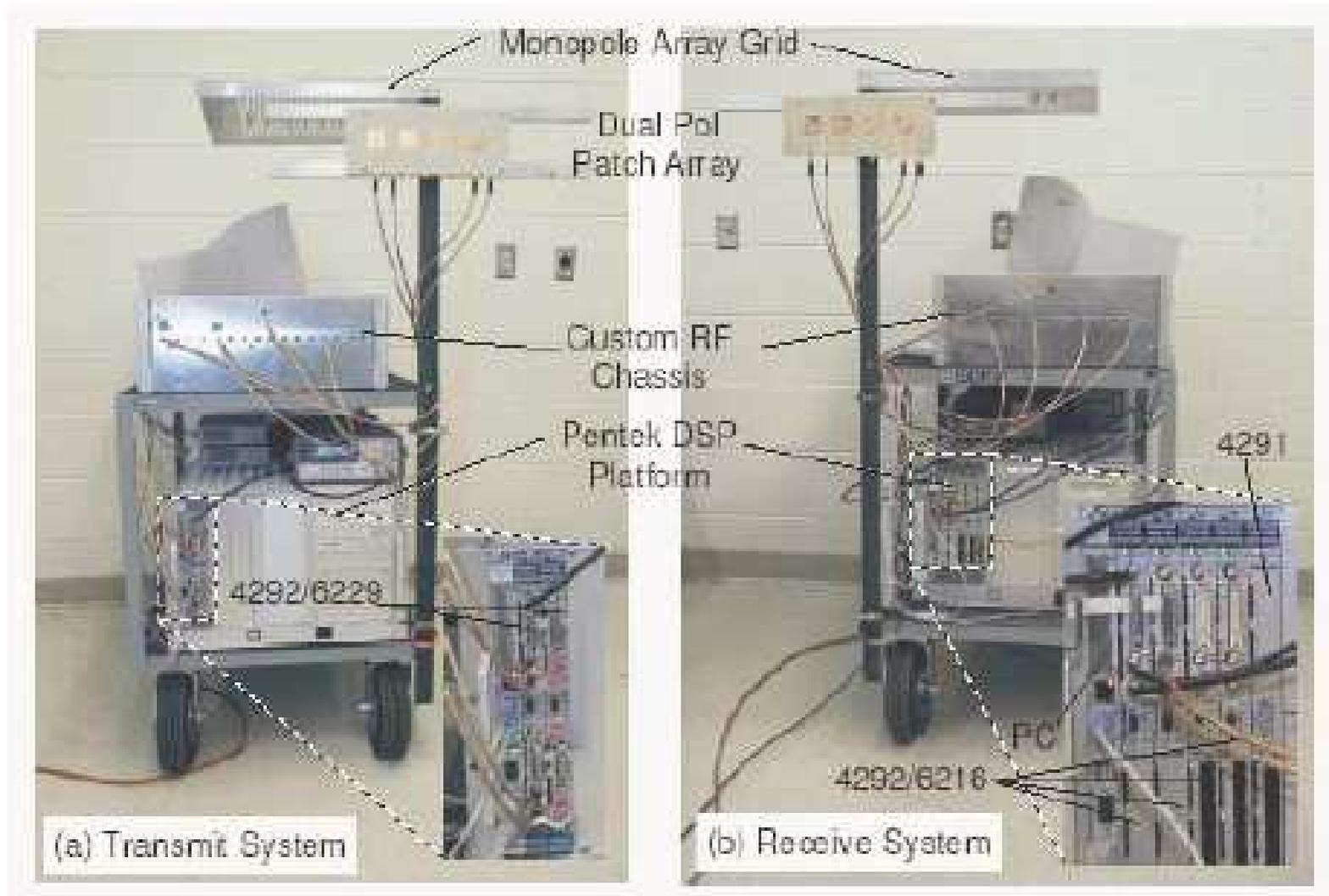
- Modelling of complete active array antennas established
- BFN types classified, compared and evaluated
- Reflectarray theory and design improved
- Conformal antenna software benchmarked, and combined



Smart antenna systems

Angeliki Alexiou

MIMO TEST BED

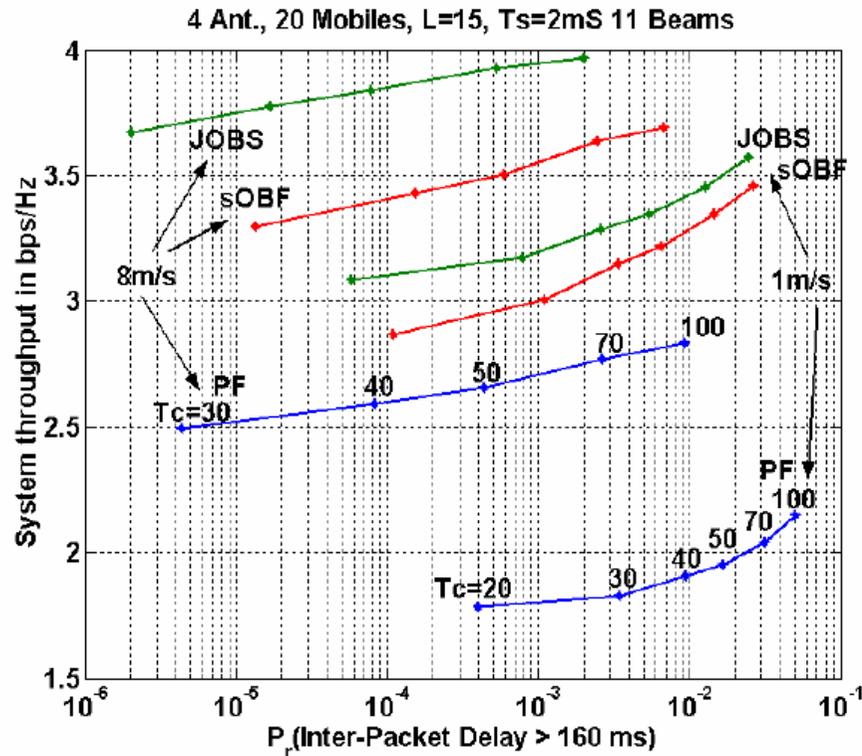


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2009-03-26



Smart antenna systems

SMART ANTENNAS



Cross layer optimisation based on joint scheduling and QoS criteria

Joint Opportunistic BF and Scheduling (JOBS)



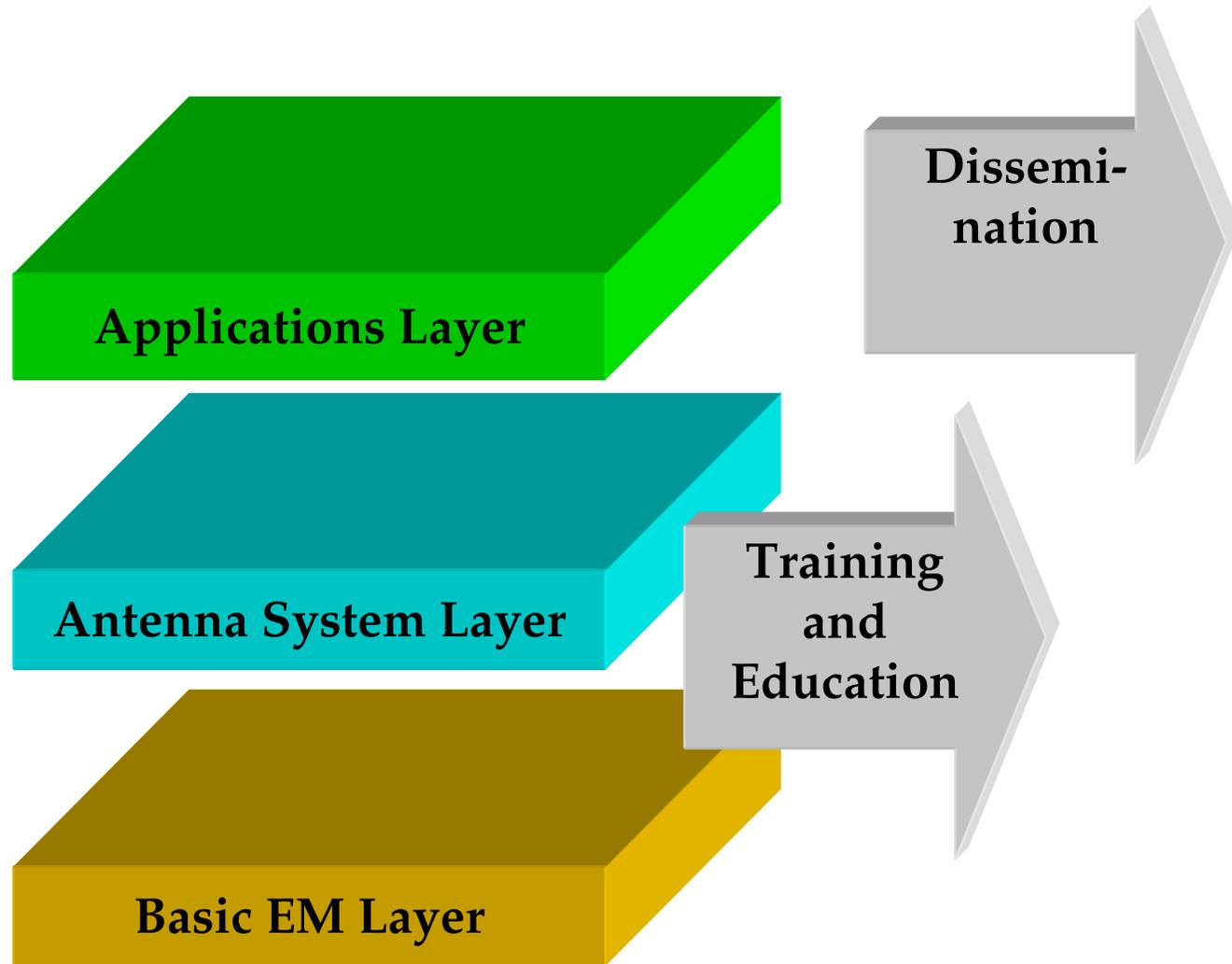
Smart antenna systems

Accomplishments:

- MIMO systems, MIMO channels, reconfigurable antenna arrays better understood
- MIMO testbeds established
- System and EM knowledge combined
- Context aware and cross layer optimisations for smart antennas



Activities





Training and education

Björn Lindmark

- Educational material available
- A virtual lab created

ANTENNAS
VCE
Virtual Center of Excellence

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Remote Execution

Introduction
How to
Available material
VLab home
Training & Ed. home
VCE home

Search

Introduction to the *Remote Execution* service

The aim of the remote execution is to provide users with a set of executable routines, which we call modules, that they can use as a base for easily building and testing their numerical algorithms. This service to allow the users to execute all the modules available on the server, without having to resort to executables or source codes. This can be achieved by executing the routines by remote access on the VLab server. In particular, this service offers two different solutions, to which correspond two different way to use the remote execution. On the one hand, users might only need some data to test their programs, in this case they want to execute the modules only to produce some results to compare with. On the other hand, users might need to link to a module from inside their code, as if he is linking a library.

Both solutions start with a database search to find the required function. In particular, different functions based either on different formulations or approximations and belonging to a different proprietary will be available for the same problem. At this stage, the users choose the desired module simply by clicking on the function name in the *Available material* section, and access the page in which all the features and requirements of the function will be explained, either to link the modules into their code or to obtain comparison data.

Student_1

```
test.for
call remote_execution
call remote_execution
call remote_execution
```

Partner 01

Module A
Module B

Partner 02

Module A
Module B

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Information Society
Technologies

VLab



ESoA European School of Antennas created

ARTIC workshop 2009-03-26

UNINA – Napoli, March 26-30, 2007
Coordinator: O. Bucci
Antenna Synthesis

CHALMERS – Gotheborg, April 16-20, 2007
Coordinator: P-S Kildal
Artificial EBG Surfaces and Metamaterials for Antennas

IMST – Düsseldorf, April 23-27, 2007
Coordinator: Dirk Manteuffel
Industrial Antenna Design

TNO - Den Haag, May 7-11, 2007
Coordinator: G. Gerini
Phased Arrays and Reflectarrays

TKK – Helsinki, May 21-25, 2007
Coordinator: A. Raisanen
Antenna Measurements for Millimeter and
Submillimeter Wavelengths

UPC – Barcelona, June 4-8, 2007
Coordinator: L Jofre
Compact Antennas

IETR - Rennes, June 18-22, 2007
Coordinator: K. Mahdjoubi, Laheurte
Microwave and Millimeter Wave Antenna Design

DTU – Copenhagen, July 2-6, 2007
Coordinator: O. Breimhjerg
Advanced Near Field Antenna Measurements Techniques

KTH – Stockholm, August 27-31, 2007
Coordinator: B. Lindmark
MIMO Communication Systems and Antennas

POLITO - Torino, September 10-14, 2007
Coordinator: G. Vecchi
Advanced Computational EM for Antenna Analysis

ESoA 2007



Analysis ■

Design ■

Measurements ■



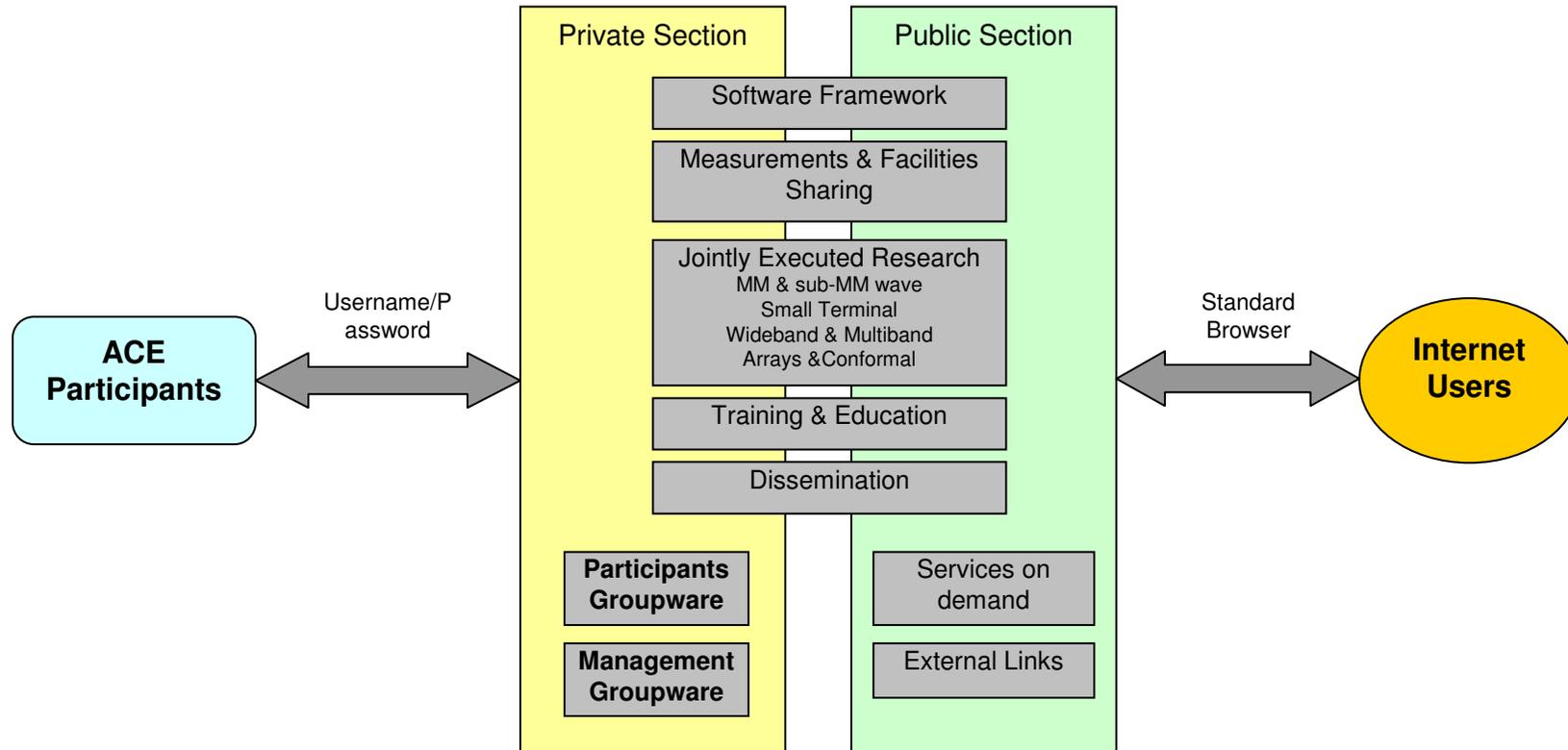
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Virtual centre of excellence

Bruno Casali



***The VCE is used in ARTIC
and EurAAP***

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work is continued in

