



**The Spanish VIA-SKA project**  
**an Iberian Industry-Academia example**

PI. Lourdes Verdes-Montenegro  
PM. Juande Santander-Vela

(IAA-CSIC)  
CTAER, Fractal  
23/11/2012

*The Square Kilometer Array: a large Scale ESFRI Infrastructure, From the Cosmos to the Cities of the future*

*Lisbon, Portugal, 30th November 2012*



**The Spanish VIA-SKA project**

**Feasibility study of the Spanish Technological  
Participation in the SKA**

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## Scientific Network (J. C. Guirado, Univ. Valencia)

Acción Complementaria para Red Española SKA  
UV, IAA, CAB, OAN, UB, IEEC, UGR, UJ, IAC, IFCA, UPTC

**June 2011:** kick-off meeting in CSIC showed broad and strong scientific interest of Spanish researchers in SKA

High-priority in MICINN document

“Building the science of XXI century”

**September 2011:** MICINN request Spain to participate in SKA as an Observer

## Industry Participation (L.Verdes-Montenegro, IAA-CSIC)

Feasibility study of the Spanish technological participation in  
SKA (VIA-SKA)

Granted with 75.000€ in November 2011

Subprogram for International Scientific Infrastructures  
Ministry for Economy and Competitiveness



<http://www.via-ska.es/ska/>

- **Participants**

CSIC: IAA, CAB, ICE, IFCA

IGN - OAN

Instituto de Astrofísica de Canarias

Universities of Granada, Barcelona, Cantabria, Valencia, Jaén, Carlos III, and Politécnica de Cartagena

National Institute for Aerospace Technology (INTA)

- **In collaboration with**

CTAER (Advanced Technological Center for Renewable Energies)

FRACTAL SLNE

**MoU for SKA-Spain in preparation by**

Universidad de Valencia

Vicepresidence for Science and Technology (CSIC)

# INFORMATION AND DISSEMINATION



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**VIA-SKA** is the name of the project led by the Instituto de Astrofísica de Andalucía (CSIC) for studying the feasibility of the Spanish Industrial Participation in the Square Kilometre Array (SKA). This project has been funded by the Ministerio de Ciencia e Innovación (MICINN) and includes researchers and engineers from the Instituto Geográfico Nacional, Universidad de Granada, Universidad de Barcelona, Universidad Carlos III, Instituto de Física de Cantabria / Universidad de Cantabria, Universidad de Valencia, Centro de Astrobiología and Instituto Astrofísico de Canarias.

**Lastest news**

**BIOSTIRLING4SKA project at the "Radio Astronomy: a driver for innovation in renewable energy" workshop**  
Lourdes Verdes-Montenegro (VIA-SKA Principal Investigator, IAA-CSIC) was invited to present the BIOSTIRLING4SKA project at the "Radio Astronomy: a driver for innovation in renewable energy" workshop that took place the 9th of October at Brussels.

**SKA precursor telescope ASKAP opens in Australia**  
The official opening ceremony of CSIRO's Australian Square Kilometre Array Pathfinder (ASKAP) and the Murchison Radio-astronomy Observatory (MRO) took place the 5th of October 2012 in Western Australia.

**More news ...**

**November 2012 Current Month**

Mon	Tue	Wed	Thu	Fri	Sat	Sun
29	30	31	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	1	2

**Events**

- **SKA: Strategic Position and Future Opportunities for Spanish Industry** (2012-11-23 - Instituto de Física y Química Rocasolano (CSIC, Serrano, 119 - Madrid))
- **RadioNet Advanced Radio Astronomy** (2012-11-13 - JBCA, University of Manchester, UK)

## VIA-SKA + SKA INFORMATION

# INFORMATION AND DISSEMINATION



A screenshot of a web browser showing the VIA-SKA website. The title bar says "VIA-SKA Home". The address bar shows the URL "https://www.via-ska.es/ska/". The page content includes a large banner image of a field filled with white birds, with the "VIA-SKA" logo overlaid. On the left, there is a sidebar with links: Site Search, Home, Introducing SKA (which is circled in red), SKA in Spain, Events, News, Documents, Gallery, How to join, Contact, Links, and Observatorio Areas. Below the sidebar, there is a main content area with a "Site Search" box, a "Latest news" section featuring a photo of a group of people and a link to "renewable energy" work, and a "More news ..." link. The main content area also contains the "Introducing SKA" section, which includes a brief description of the Square Kilometre Array, a paragraph about its potential impact, and a list of links for more information.

## VIA-SKA + SKA INFORMATION

# INFORMATION AND DISSEMINATION



VIA-SKA Home

VIA-SKA is the name of (CSIC) for studying the Square Kilometre Array Ciencia e Innovación (I) Instituto Geográfico Nacional Universidad Carlos III, I Universidad de Valencia,

Introducing SKA

SKA in Spain

Lastest news

renewable energy" work

More news ...

VIA-SKA is the name of the project led by the Instituto de Astrofísica de Andalucía (IAA-CSIC) for studying the feasibility of the Spanish Industrial Participation in the Square Kilometre Array (SKA). This project has been funded by the Ministerio de Ciencia e Innovación (MICINN) and includes researchers and engineers from the Instituto Geográfico Nacional (IGN), Universidad de Granada (UGR), Universidad de Barcelona (UB), Universidad Carlos III de Madrid (UC3M), Instituto de Física de Cantabria (IFCA-CSIC), Universidad de Cantabria (UC), Universidad de Valencia (UV), Centro de Astrobiología (CAB-INTA/CSIC) and Instituto Astrofísico de Canarias (IAC).

VIA-SKA is funded by an action of the Subprograma de Actuaciones Relativas a Infraestructuras Científicas Internacionales [Programa Nacional de Internacionalización de la I+D, Convocatoria 2011].

As part of the actions of the VIA-SKA project, a survey of Spanish industry is being performed in order to identify the actors that could have technological profiles relevant to the SKA project. The intention is to introduce the SKA project to Spanish Industry and identify companies interested in a prospective participation in SKA.

In case of interest, companies are invited to participate in VIA-SKA in the following way: companies will be requested to provide their contact details that will be included in the VIA-SKA mailing lists and the company information that shall be registered in the VIA-SKA web portal, where the company technological skills and SKA work packages best matching those skills will be identified.

The identification of Spanish Industry's interest and capabilities is a necessary step to support the official Spanish participation in the SKA project.

The need for a quick response by Spanish industry at this point is driven by the SKA schedule. The preparation of the SKA WBS/SOW for the Pre-construction Phase Work Packages has been performed during 2012 and the preparation of Stage 1 is on-going, with the proto-consortia self-organizing in order to participate in the Request

VIA-SKA + SKA INFORMATION

# DOSSIER FOR INDUSTRY

- SKA Project
- Schedule
- Goals of VIA-SKA
- How to participate

Distributed to > 80 companies with technological profiles of interest



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## Lastest news



### Dual site agreed for Square Kilometre Array telescope

The Members of the SKA Organisation today agreed on a dual site solution for the Square Kilometre Array telescope, which will benefit from the already existing ASKAP and MeerKAT precursor dishes, maximising the investments already made by both Australia and South Africa.

**VIA-SKA** Estudio de viabilidad de la participación industrial española en el SKA

**What is SKA?**

The Square Kilometre Array (SKA) will be a multi-purpose interferometer of thousands of antennas linked together to provide a collecting area of one square kilometre and distributed in an area nearly the size of a continent. The SKA will be 50 times more sensitive than any other radio instrument and will survey the sky at least 10,000 times faster than the best current-day telescopes. Signals from separated antennas shall be combined via high-speed data links to a central processor, providing an angular resolution equivalent to that of a telescope with a diameter of more than 3000 km.



In order to achieve both high sensitivity and high-resolution images of the radio sky, the antennas of the SKA will be densely distributed in the central region of the array, and then logarithmically positioned in groups (more spaced at extremes) along several spiral arms extending up to 3000 km from the central core.



Three antenna types, high-frequency dishes and mid & low-frequency aperture arrays, will be used to provide continuous frequency coverage from 70 MHz to 10 GHz. In the lower (70-400 MHz) and middle (400-1400 MHz) part of the frequency band, two different types of antenna, aperture arrays, will act as a radio wide-angle lens and will be used to observe very large areas of the sky simultaneously. In the higher (1.2-10 GHz) part of the frequency band, the SKA will use 3000 dish antennas, each about 15 m wide, which will operate as a radio camera to provide high quality images.

The signal from the receiving elements will be transported back by optical fibres carrying up to 420 Gbit/sec per dish and 16 Tbit/sec per aperture array to a central processing engine where the data will be handled to form Images and time series, and to combat the effect of radio frequency Interference (RFI) signals.

Frequency Range	70 MHz To 10 GHz
Sensitivity Area / System Temp	5000 mJyK (400 μJy in 1 minute) between 70 And 300 MHz
Survey Figure-Of-Merit	$4 \times 10^7 - 2 \times 10^{10} \text{ m}^2 \text{K}^2 \text{deg}^2$ depending on sensor technology and frequency
Field-Of-View	200 square degrees between 70 And 300 MHz 1-200 square degrees between 0.9 And 1 GHz 1 square degree maximum between 1 And 10 GHz
Angular Resolution	<0.1 arcsecond
Instantaneous Bandwidth	Band Centre ± 50%
Spectral (Frequency) Channels	16384 per band per baseline
Calibrated Polarisation Purity	10000:1
Synthesised Image Dynamic Range	>1000000
Imaging Processor Computation	$\sim 10^{17}$ operations/second
Final Processed Data Output	10 Gbit/second

Two locations are under consideration: Southern Africa and Australia-New Zealand. In Australia the SKA would stretch all the way to New Zealand, and in Southern Africa it would stretch to the Indian Ocean Islands. The final site decision will be made in 2012 and will be based on several factors including the operating and infrastructure costs, as well as levels of radio interference.

The SKA will be one of the key next generation instruments, with potential for fundamental breakthroughs in Radioastronomy, and, at the same time, will drive technological development in other areas of social impact, such as high-speed data distribution, massive data processing, or in the generation, storage and distribution of renewable energy, among others.

The total target cost for SKA is 1500 M€.

May 2 Current

	Mon	Tue	Wed	Thu	Fri	Sat
30	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	1	2	3

**Events**

- The SKA Power Challenge (2012-06-20 - Moura, Portugal)
- SKA Project Office visit to Spanish solar plants (2012-05-28 - Sevilla, Spain)

# CAPACITY MAP OF SPANISH INDUSTRY

To identify technological niches for Spanish Contributions to SKA WPs

**January 2012:** List of Spanish companies and technological centres with capacities for SKA

Companies with the relevant experience or that have participated in other large infrastructures such as CERN, ESRF, ITER, ESO & CTA

More than 80 companies were identified

First contact e-mail to introduce VIA-SKA and request confirmation to be kept in the distribution list

**May 2012:** Interested companies interested sent the information to be registered in the VIA-SKA web portal

The complete list of registered public institutions and companies can be displayed



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## Public Centers

VIA-SKA is a project funded by MICINN project and are registered in this web pa

- CAB-INTA-CSIC
- CTAER
- IAA-CSIC
- IAC
- ICE-CSIC
- IFCA-CSIC
- INTA
- OAN
- Universidad Carlos III
- Universidad de Cantabria
- Universidad de Granada
- Universidad de Valencia
- Universidad Politécnica de Cartagena

## Industry

The following industrial firms, organizations or associations have confirmed their interest in SKA project and are registered in the VIA-SKA web portal.

- ACITURRI
- ALTRAN INNOVACIÓN, S.L.
- ARIEMA Energía y Medioambien
- Asociación Industrial de Óptica, i
- Asturfeito
- CRISA
- Cryovac S.L.
- DEIMOS Space S.L.U.
- EMPRESARIOS AGRUPADOS Inte
- Fractal SLNE
- GMV Aerospace and Defence S.A
- GTD
- HTS (High Technology Solutions,
- IDOM
- IK4-TEKNIKER
- INEUSTAR
- INSA, Ingeniería y Servicios Aero

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Fractal SLNE

FRACTAL S.L.N.E. is a private technological company specialized in astronomical instrumentation and scientific software.

We use the know-how accumulated by our team during more than 20 years working at public Research Centers and Universities to develop our customer's projects. We focus our services mainly on the Research Centers and Universities that need to carry out Instrumentation and Software projects, establishing fruitful relationships to fulfill the goals.

FRACTAL has an expert, stable and committed team. We cover the subjects of Astronomy, Management, System Engineering, Optics, Opto-mechanics, Mechanics, Electro-mechanics, Cryogenics, Detectors, Data Acquisition Systems, and Software (Real Time Systems, Distributed Systems, Mechanisms Control, Data Base, Telescope's Control Systems and Data Reduction).

Web page link: <http://www.fractal-es.com/>





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The following form allows obtaining very easily the list of public and/or private organizations that have expressed their interest in a particular Work Package and/or could provide expertise in a specific domain.

The list of Work Packages includes the Work Packages, as defined by the SKA Project.

The list of expertise domains includes all the capacities that shall be required for carrying out the Work Packages.

Each organization registered in the VIA-SKA web portal has identified their interests and their technical capabilities, providing also an overview about previous projects that this organization has carried out. All provided information has been reviewed before being registered. This form facilitates the access to the registered data, filtering organizations by Work Packages and/or areas of expertise in order to quickly map the capabilities of the registered organizations.

**Form allowing an easy search of public and/or private organizations registered in VIA-SKA filtering by WP or Expertise domains**

### Capacity map form

Name	<input type="text"/>
Institution type	Private company
SKA Work Package of interest	Low Frequency Aperture Array
Expertise domains	FPGA design





#### Site Search

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The following form allows obtaining very easily the list of public and/or private organizations registered in VIA-SKA that have expressed their interest in a particular Work Package and/or could provide a determinate capacity (expertise domain).

The list of Work Packages includes the Work Packages, as defined by the SKA Project Office, for the SKA Stage 1.

The list of expertise domains includes all the capacities that shall be required for carrying out the SKA Stage 1 Work Packages.

Each organization registered in the VIA-SKA web portal has identified their interest in the different Work Packages and their technical capabilities, providing also an overview about previous projects that this organization has carried out. All provided information has been reviewed before being registered. This form facilitates the access to the registered data, filtering organizations by Work Packages and/or areas of expertise in order to quickly map the capabilities of the registered organizations.

### Capacity map form

**Name****Institution type**

✓ Low Frequency Aperture Array

Signal and Data Transport / Sync and Timing

Central Signal Processor

Science Data Processor

Telescope Manager

Power

Site and Infrastructure

Science

Management and Engineering

**SKA Work Package of interest**

A row of four dark grey silhouettes of people standing in a line, representing the categories of expertise domains.



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The following form allows obtaining very detailed information about organizations that have expressed their interest in a specific expertise domain.

The list of Work Packages includes the VIA-SKA Work Packages.

The list of expertise domains includes a subset of the VIA-SKA Work Packages.

Each organization registered in the VIA-SKA Work Packages has provided information about their technical capabilities, providing a detailed description of what they can offer. All provided information has been collected in a central database, filtering organizations based on their technical capabilities and interests. The registered organizations can update their data, filtering organizations based on their technical capabilities and interests.

## Capacity map form

Name

Institution type

SKA Work Package of interest

Expertise domains



Analog ASIC design

Analog beamforming hardware

Analog beamforming software

Analog filterbank design

Analog sensors

Analog signal processing

Antenna system beam profile measurement

Antenna system sensitivity measurement

Cabling

Civil engineering

Control system design

Cooling: Cryogenics

Cooling: Heat recovery

Cooling: Thermal insulation

Cost modelling

Cryogenic LNAs (450MHz-2GHz)

Digital ASIC design

Digital beamforming

Digital Fieldbuses

Digital filterbank design

Digital sensors

Digital signal processing

Digital signal transport networks

Dipole antenna array construction

Dipole antenna array design

Dish antenna construction

Dish antenna design

Electro-magnetic compatibility design

FFT digital signal processing

FPGA computing

FPGA design

High Performance Computing: event-based computing

High Performance Computing: GPU computing

High Performance Computing: grid computing

High-accuracy timing systems

High-voltage electrical engineering

Logistics engineering

Low-RFI Power conversion

Mechatronics

Mechanical engineering

Mechanical tooling

Monitoring software and systems

Non-cryogenic LNAs (70MHz-450MHz)

Photovoltaic solar thermal energy

Power engineering

Power engineering: budgeting



in VIA-SKA

: capacity

age 1.

ge 1 Work

Packages  
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# CAPACITY MAP

ÁREAS TECNOLÓGICAS	EMPRESAS									
	ACTUALIZADA	AUDIO	ALTRAN INNOVACIÓN	ANTENA	ASTURIETEC	CRUSA	CRYOVAC	DEUTSCH	IMPRESARIOS AGRUPADOS	FRACTAL
Analog ASIC design	x									
Analog beamforming hardware	x	x								
Analog beamforming SW	x									
Analog silicon design	x									
Analog sensors	x									
Analog signal processing	x									
Antenna system beam profile measurement	x									
Antenna system sensitivity measurement	x									
Cabling										
Civil engineering										
Control system design	x									
Cooling: Cryogenics	x	x								
Cooling: Heat recovery	x	x								
Cooling: Thermal insulation	x	x								
Cost modelling										
Cryogenic LNAs (450MHz-2GHz)	x									
Digital ASIC design	x									
Digital beamforming	x									
Digital fullbase	x									
Digital filterbank design	x									
Digital sensors	x									
Digital signal processing	x									
Digital signal transport networks	x									
Dipole antenna array construction	x	x								
Dipole antenna array design	x	x								
Dish antenna construction	x	x								
Dish antenna design	x	x								
Electro-magnetic compatibility design										
FFT digital signal processing	x									
FPGA computing	x									
FPGA design	x									
High Performance Computing: event-based computing	x									
High Performance Computing: GPU computing	x									
High Performance Computing: grid computing	x									
High-accuracy timing systems	x	x								
High-voltage electrical engineering	x	x								
Logistics engineering										
Low-Eff Power conversion										
Mechanics										
Mechanical engineering	x	x								
Mechanical tooling	x	x								
Monitoring SW and systems	x	x								
Non-cryogenic LNAs (70MHz-45MHz)	x	x								
Photovoltaic solar thermal energy	x	x								
Power engineering	x	x								
Power engineering: budgeting	x	x								
Power measurement	x	x								
RF engineering: 0.01-0.15 m (2-30GHz)	x									
RF engineering: 0.1-2.30 m (30-21GHz)	x									
RF engineering: 0.1-5-6.7 m (450MHz-2GHz)	x									
RF engineering: 0.7-4 m (70-450GHz)	x									
RF engineering: risk assessment	x									
RF interference management										
RF interference sensitivity										
RF optical design	x									
RF optical simulation	x									
RF system simulation	x									
RFJ shielding										
Risk assessment										
Sensor networks										
SW engineering	x									
SW engineering: behavioral modelling	x	x								
SW engineering: data modelling	x	x								
SW engineering: high-performance computing algorithms	x	x								
SW engineering: human-computer interaction	x	x								
SW engineering: quality assurance	x	x								
SW engineering: requirements analysis	x	x								
SW engineering: risk assessment	x	x								
SW engineering: structural modelling	x	x								
SW engineering: system simulation	x	x								
Synchronization and timing equipment										
System engineering	x	x								
Thermal-electric compatibility	x									
Wafer digital signal processing	x									
Wideband receiver design	x									

Areas of expertise and SKA WPs of the registered companies

SKA Work Packages	EMPRESAS									
	ACTUALIZADA	AUDIO	ALTRAN INNOVACIÓN	ANTENA	ASTURIETEC	CRUSA	CRYOVAC	DEUTSCH	IMPRESARIOS AGRUPADOS	FRACTAL
Dish-array element										
Low Frequency Aperture Array										
Signal and Data Transport / Sync and Timing	x									
Central Signal Processor	x									
Science Data Processor	x									
Tlescope Manager	x									
Power	x	x								
Site and Infrastructure	x									
Science	x									
Management and Engineering	x	x								

# CAPACITY MAP

ÁREAS TECNOLÓGICAS	EMPRESAS									
	ACTURRI	AUDIO	ALTRAN INNOVACIÓN	ARIMA	ASTURFEITO	CRISA	CRYOVAC	DEIMOS	FRACTEL	IDOM
Analog ASIC design	x									
Analog beamforming hardware	x	x								
Analog beamforming SW			x							
Analog blockset design			x							
Analog sensors			x							
Analog signal processing			x							
Antenna system beam profile measurement			x							
Antenna system sensitivity measurement			x							

SKA Work Packages											
Dish-array element	ACITURRI	AUDIO	ALTRAN INNOVACIÓN	ARIAMA	ASTURFEITO	CRISA	CRYOVAC	DEIMOS	EMPRESARIOS AGRUPADOS	FRACTEL	IDOM
Low Frequency Aperture Array		x	x	x	x	x	x	x	x	x	x
Signal and Data Transport / Sync and Timing				x		x			x		
Central Signal Processor	x			x	x	x	x	x	x	x	x
Science Data Processor				x	x	x	x	x	x	x	x
Telescope Manager	x			x	x	x	x	x	x	x	x
Power		x	x	x	x	x	x	x	x	x	x
Site and Infrastructure		x			x		x		x		x
Science											
Management and Engineering	x	x	x	x	x	x	x	x	x	x	x

RFI shielding	x	x	x	x	x	x	x	x	x	x	x
Risk assessment											
Sensor networks											
SW engineering	x	x	x	x	x	x	x	x	x	x	x
SW engineering: behavioral modelling	x	x	x	x	x	x	x	x	x	x	x
SW engineering: data modelling	x	x	x	x	x	x	x	x	x	x	x
SW engineering: high-performance computing algorithms	x	x	x	x	x	x	x	x	x	x	x
SW engineering: human-computer interaction	x	x	x	x	x	x	x	x	x	x	x
SW engineering: quality assurance	x	x	x	x	x	x	x	x	x	x	x
SW engineering: requirements analysis	x	x	x	x	x	x	x	x	x	x	x
SW engineering: risk assessment	x	x	x	x	x	x	x	x	x	x	x
SW engineering: structural modelling	x	x	x	x	x	x	x	x	x	x	x
SW engineering: system simulation	x	x	x	x	x	x	x	x	x	x	x
Synchronization and timing equipment											
System engineering	x	x	x	x	x	x	x	x	x	x	x
Thermal-electric compatibility	x										
Wafer digital signal processing	x										
Wideband receiver design											

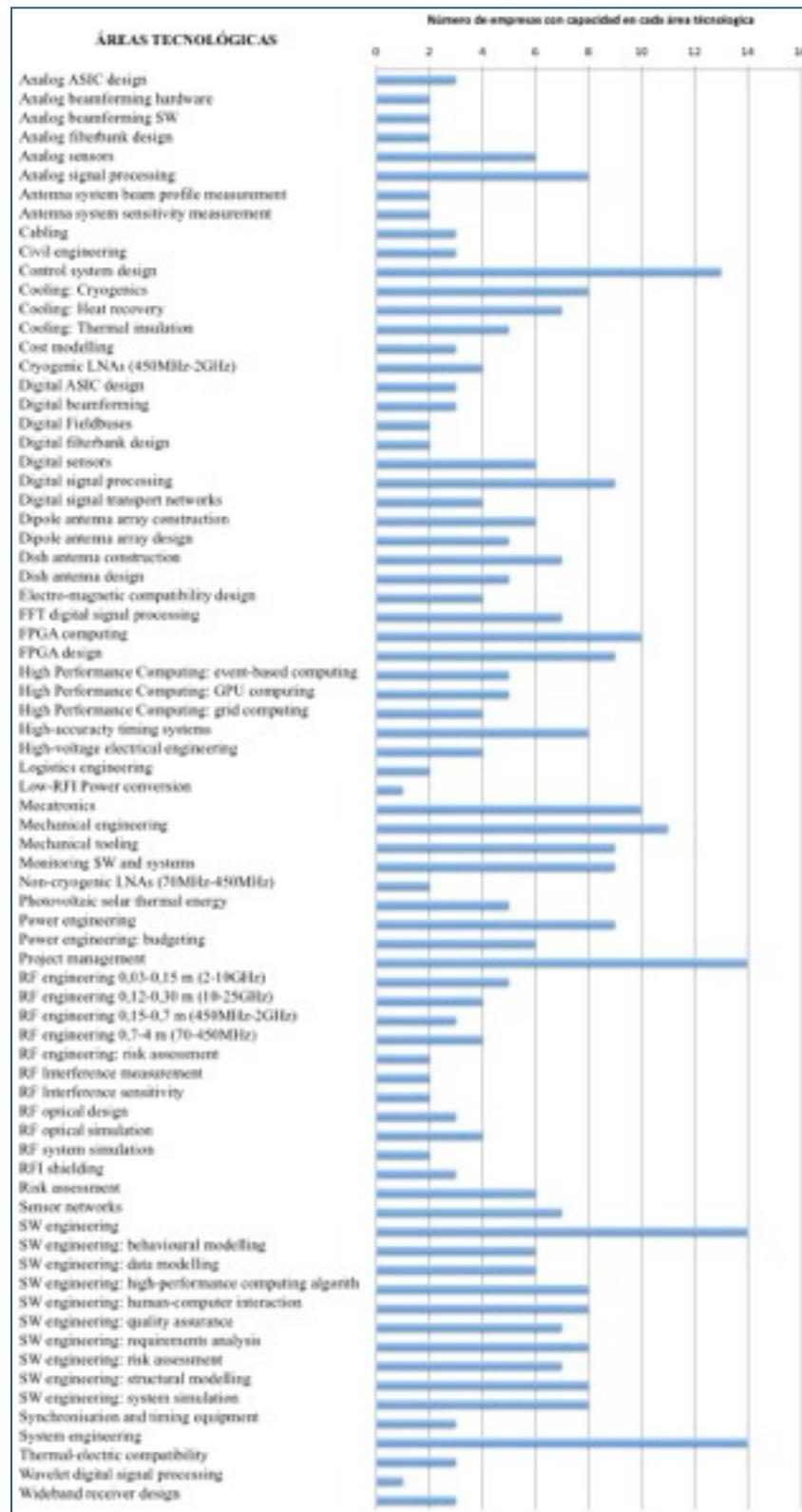
Areas of expertise and SKA WPs of the registered companies

## ÁREAS TECNOLÓGICAS

ÁREAS TECNOLÓGICAS	EMPRESAS																														
	ACITURRI	AIDO	ALTRAN INNOVACIÓN	ARIEMA	ASTURFEITO	CRISA	CRYOVAC	DEIMOS	EMPRESARIOS AGRUPADOS	FRACTAL	GMV	GTD	HTS	IDOM	IK4-TEKNIKER	INSA	INTEGRASYS	ISOFOTON	IXION Industry & Aerospace	JEMA	LIDAX	PROCON SYSTEMS	SCHWARTZ-HAUTMONT	SENER	SEVEN SOLUTIONS	TAFCO METAWIRELESS	TECNOBIT	TELSTAR Vacuum Solutions	THARSIS TECHNOLOGY	TTI	VINCI ENERGIA
Analog ASIC design																									x	x	x	x	x		
Analog beamforming hardware																									x	x	x	x	x		
Analog beamforming SW																	x								x	x	x	x	x		
Analog filterbank design																	x								x	x	x	x	x		
Analog sensors	x															x	x							x	x	x	x	x			
Analog signal processing						x										x	x	x						x	x	x	x	x			
Antenna system beam profile measurement	x																x														
Antenna system sensitivity measurement	x																x														
Cabling						x																							x		
Civil engineering											x				x										x						
Control system design	x					x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
Cooling: Cryogenics							x	x							x	x	x							x			x	x			
Cooling: Heat recovery								x				x	x	x							x			x		x	x				
Cooling: Thermal insulation							x				x	x								x				x			x				
Cost modelling												x	x	x																	
Cryogenic LNAs (450MHz-2GHz)											x			x					x									x			
Digital ASIC design							x																		x	x	x	x			
Digital beamforming						x									x													x			
Digital Fieldbuses							x													x				x							
Digital filterbank design															x				x								x				
Digital sensors	x					x									x	x									x	x	x	x			
Digital signal processing	x					x				x		x		x	x	x	x	x					x	x	x	x	x				
Digital signal transport networks							x			x		x		x	x	x							x			x					
Dipole antenna array construction	x				x				x			x		x	x	x												x			
Dipole antenna array design	x								x			x		x	x	x												x			
Dish antenna construction	x	x			x				x			x		x	x	x					x					x					
Dish antenna design	x								x			x		x	x	x											x				
Electro-magnetic compatibility design							x		x			x		x	x	x	x								x		x				
FFT digital signal processing							x			x		x		x	x	x	x					x	x	x	x	x	x				
FPGA computing							x			x		x		x	x	x	x	x	x	x	x	x	x	x	x	x					
FPGA design						x			x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x					
High Performance Computing: event-based computing							x			x	x													x	x	x	x				
High Performance Computing: GPU computing							x		x		x	x						x					x			x					
High Performance Computing: grid computing							x		x		x	x			x																
High-accuracy timing systems						x	x		x	x	x	x		x	x	x	x	x	x			x			x						

PCA design	x	x	x	x	x	x	x	x	x	x
High Performance Computing: event-based computing	x	x	x	x	x	x	x	x	x	x
High Performance Computing: GPU computing	x	x	x	x	x	x	x	x	x	x
High Performance Computing: grid computing	x	x	x	x	x	x	x	x	x	x
High-accuracy timing systems	x	x	x	x	x	x	x	x	x	x
High-voltage electrical engineering						x	x	x	x	x
Logistics engineering				x				x		
Low-RFI Power conversion									x	
Mechatronics	x			x	x	x	x	x	x	x
Mechanical engineering	x		x	x	x	x	x	x	x	x
Mechanical tooling	x			x	x	x	x	x	x	x
Monitoring SW and systems	x	x	x	x	x	x	x	x	x	x
Non-cryogenic LNAs (70MHz-450MHz)					x	x				x
Photovoltaic solar thermal energy	x				x	x	x	x	x	x
Power engineering		x	x	x	x	x	x	x	x	x
Power engineering: budgeting		x	x	x	x	x		x		
Project management	x	x	x	x	x	x	x	x	x	x
RF engineering 0,03-0,15 m (2-10GHz)				x	x	x	x			x
RF engineering 0,12-0,30 m (10-25GHz)					x	x				x
RF engineering 0,15-0,7 m (450MHz-2GHz)					x	x				x
RF engineering 0,7-4 m (70-450MHz)					x	x		x	x	x
RF engineering: risk assessment					x				x	x
RF Interference measurement						x				x
RF Interference sensitivity					x					x
RF optical design	x					x				x
RF optical simulation	x					x				x
RF system simulation					x					x
RFI shielding					x					x
Risk assessment		x	x	x	x	x	x	x	x	x
Sensor networks			x	x	x	x	x	x	x	x
SW engineering	x	x	x	x	x	x	x	x	x	x
SW engineering: behavioural modelling		x	x	x	x	x	x	x	x	x
SW engineering: data modelling		x	x	x	x	x	x	x	x	x
SW engineering: high-performance computing algorithms		x	x	x	x	x	x	x	x	x
SW engineering: human-computer interaction	x	x	x	x	x	x	x	x	x	x
SW engineering: quality assurance		x	x	x	x	x	x	x	x	x
SW engineering: requirements analysis		x	x	x	x	x	x	x	x	x
SW engineering: risk assessment		x	x	x	x	x	x	x	x	x
SW engineering: structural modelling	x	x	x	x	x	x	x	x	x	x
SW engineering: system simulation	x	x	x	x	x	x	x	x	x	x
Synchronisation and timing equipment					x	x	x	x		
System engineering	x	x	x	x	x	x	x	x	x	x
Thermal-electric compatibility						x			x	
Wavelet digital signal processing								x		x
Wideband receiver design					x					x

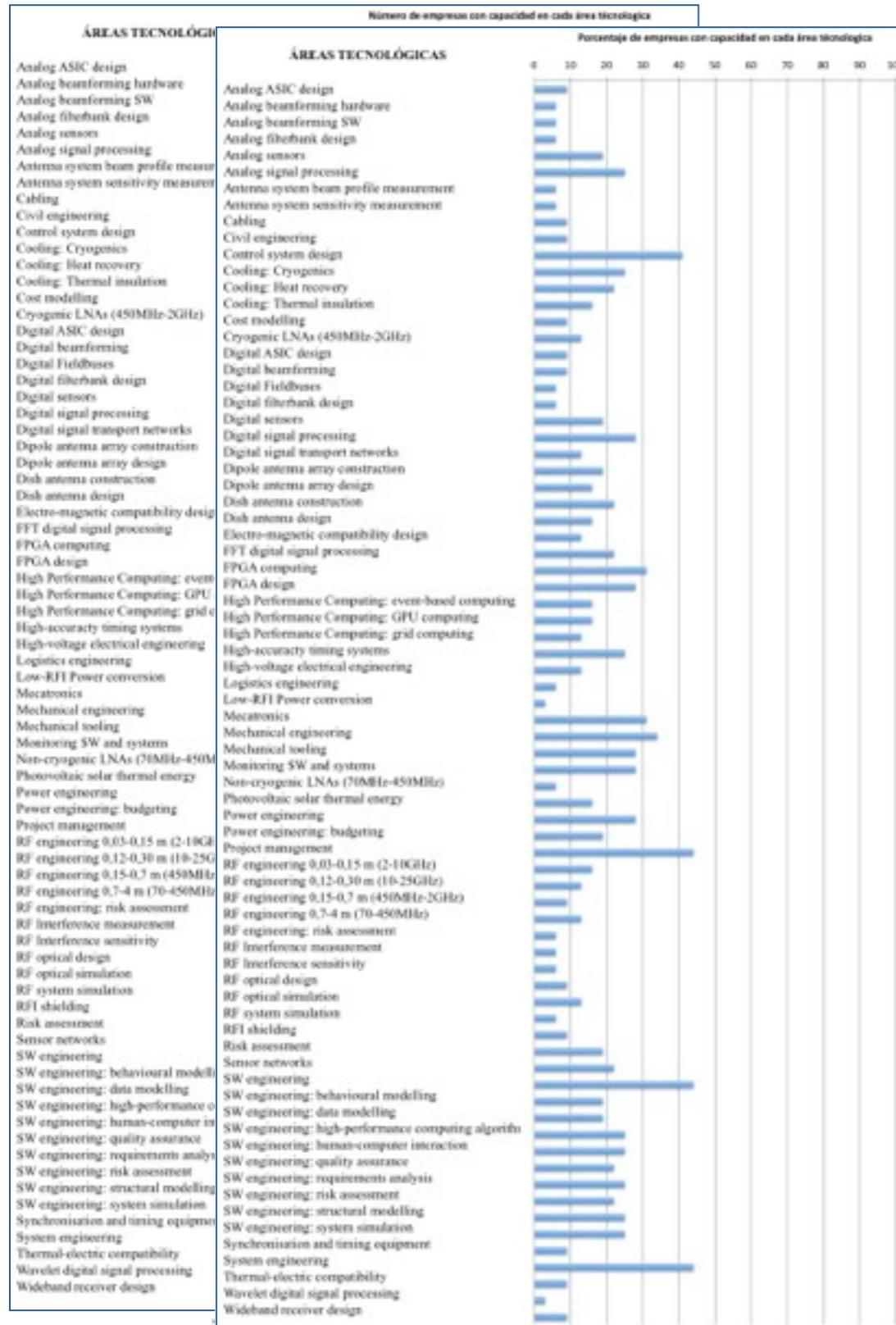
# CAPACITY MAP



Number of companies per expertise area and SKA WP



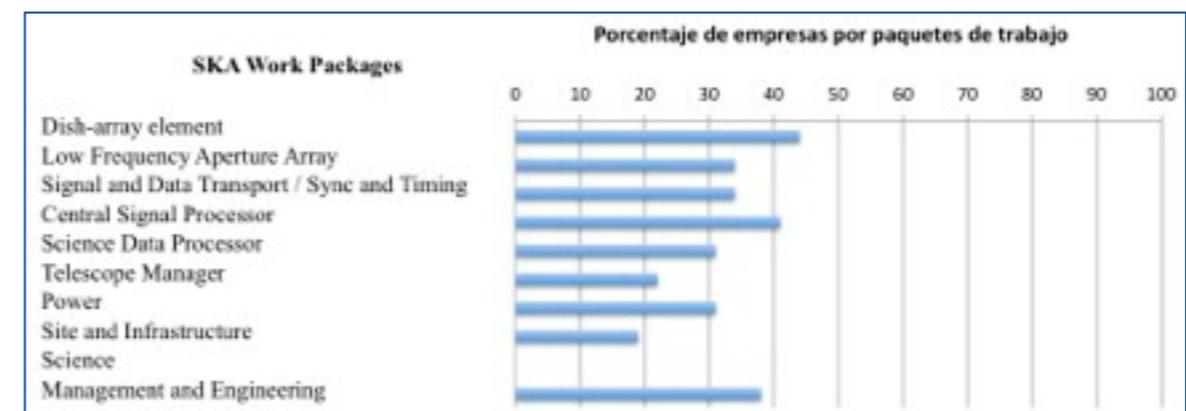
# CAPACITY MAP



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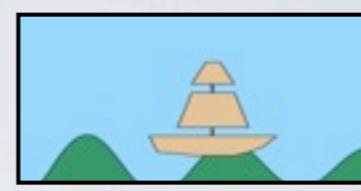


% of companies (regarding the total number) per expertise area and SKA WP



## Interaction with international consortia for strategic alliances

- Active presence in virtually all SKA events



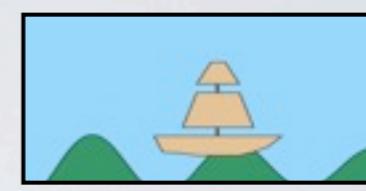
- **Membership to ESKAC** (European SKA Consortium):

Netherlands, UK, France, Italy, Germany, Portugal, Sweden, Radionet, now  
Spain

- **Membership to AERAP**

## Interaction with international consortia for strategic alliances

- Active presence in virtually all SKA events



- Membership to ESKAC (European SKA Consortium):

Netherlands, UK, France, Italy, Germany, Portugal, Sweden, Radionet, now  
Spain

- Membership to AERAP

## Promotion of participation/leadership in WPs

- Participation in preparation of WBS/SoW: the SKA Project Office accepted to include 9 VIA-SKA members in the WBS Working Groups

## Expression of Interest (EoI)

Date	Description
<b>10 to 27 April</b>	SKA Office prepare Expression of Interest (EoI) documentation, review and update.
<b>30 April</b>	SKA Office issue EoI
<b>14 May</b>	SKA Office receives EoI responses
<b>25 May</b>	Report the results of EoI process to the Interim Director General and the Board of the SKA Organisation for consideration
<b>June</b>	SKA Office facilitates consortium forming and addresses gaps that have been identified from the results of the EoI process.

**SKA.TEL.DSH (Dish Arrays)**

**IFCA-CSIC/DICOM-UC, NTE-SENER**

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SKA.TEL.LFAA (Low Frequency Aperture Arrays)	IFCA-CSIC/DICOM-UC, UC3M
SKA.AI.MFAA (Medium Frequency Aperture Arrays)	IFCA-CSIC/DICOM-UC, UC3M
SKA.AI.PAF (Phased Array Feeds)	IFCA-CSIC/DICOM-UC
SKA.AI.WBSPF (Wide-Band Single Pixel Feeds)	IFCA-CSIC/DICOM-UC

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SKA.AI.MFAA (Medium Frequency Aperture Arrays)	IFCA-CSIC/DICOM-UC, UC3M, INTA
SKA.AI.PAF (Phased Array Feeds)	IFCA-CSIC/DICOM-UC, INTA
SKA.AI.WBSPF (Wide-Band Single Pixel Feeds)	IFCA-CSIC/DICOM-UC
SKA.TEL.SDP (Science Data Processor)	IAA-CSIC, IFCA-CSIC/DICOM-UC

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SKA.AI.PAF (Phased Array Feeds)	+ IT (Portugal), ASTRON, Fraunhofer, MPIfR (Germany)
SKA.AI.WBSPF (Wide-Band Single Pixel Feeds)	
SKA.TEL.SDP (Science Data Processor)	
SKA.TEL.PWR (Power)	CTAER, IAA-CSIC

Support letter from Abengoa, Isofotón, Ariema

# SKA WORKING PACKAGES

## Spanish Participation in proto-consortia

- Science 
- Management
- System Engineering & Requirements
- Dish Arrays 
- Aperture Arrays 
- Signal & Data Transport 
- Sync & Timing 
- Central Signal Processor
- Science Data Processor 
- Telescope Manager 
- Power 
- Site & Infrastructure

- **Participation in proto-consortia:**

MeerKAT

- Dishes (IFCA/DICOM-CSIC, SENER?) ----- Coordinated by Australia
- Aperture Arrays Low and Mid (UC3M and IFCA-CSIC/DICOM) ----- Netherlands
- Science Data Processor (IAA-CSIC) ----- UK (Univ. Cambridge)
- Signal and Data Transport (Univ. Granada, 7 Solutions) ----- UK (UMan)
- Synchronization & Timing (Univ. Granada, 7 Solutions) ----- UK (UMan)
- Telescope Manager (GTD) ----- India (telecon right now!)
- POWER EoI

**ICTs  
&  
POWER**

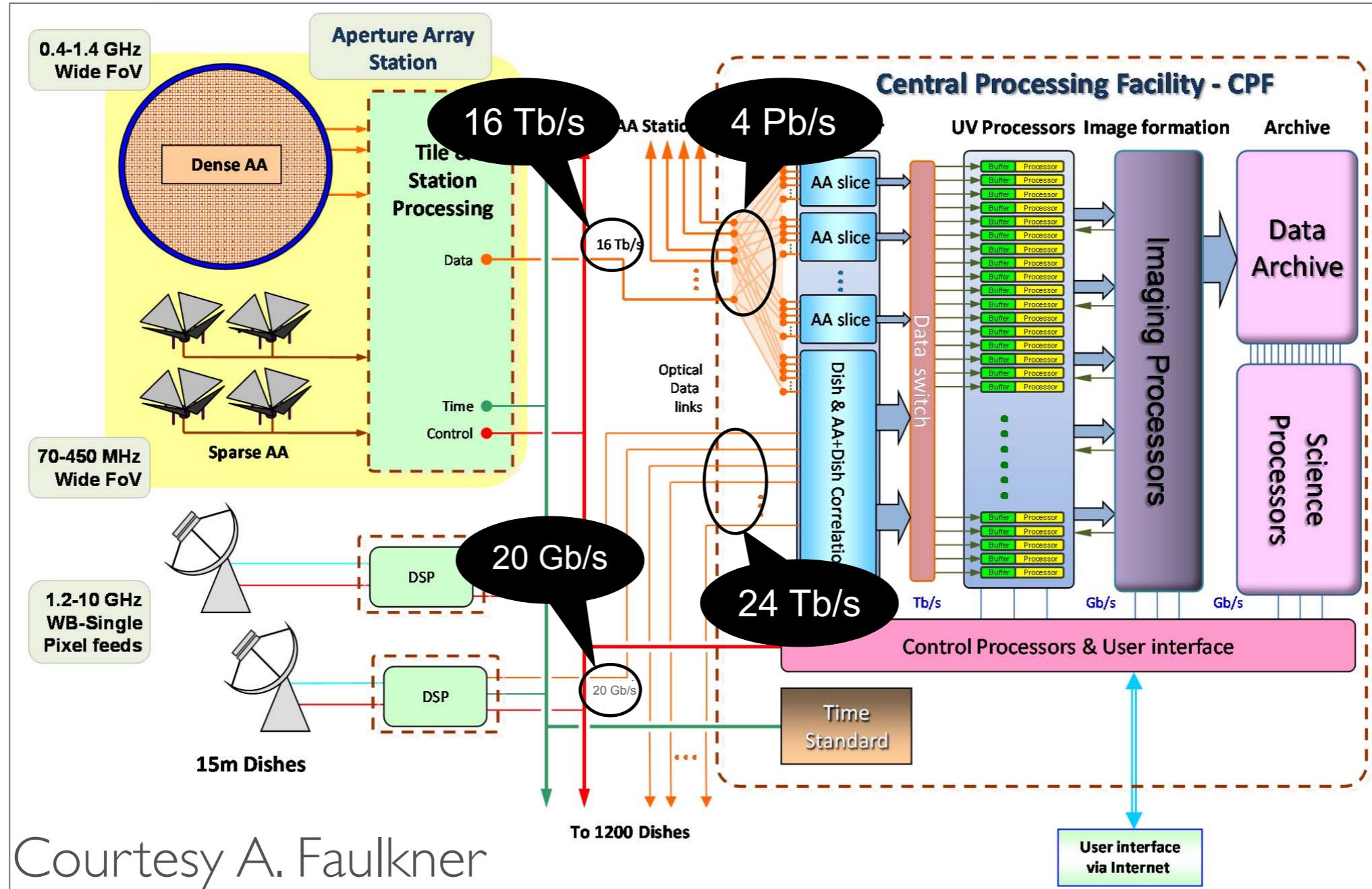
# Massive Data Flow, Storage & Processing



## SKA<sub>2</sub> wide area data flow

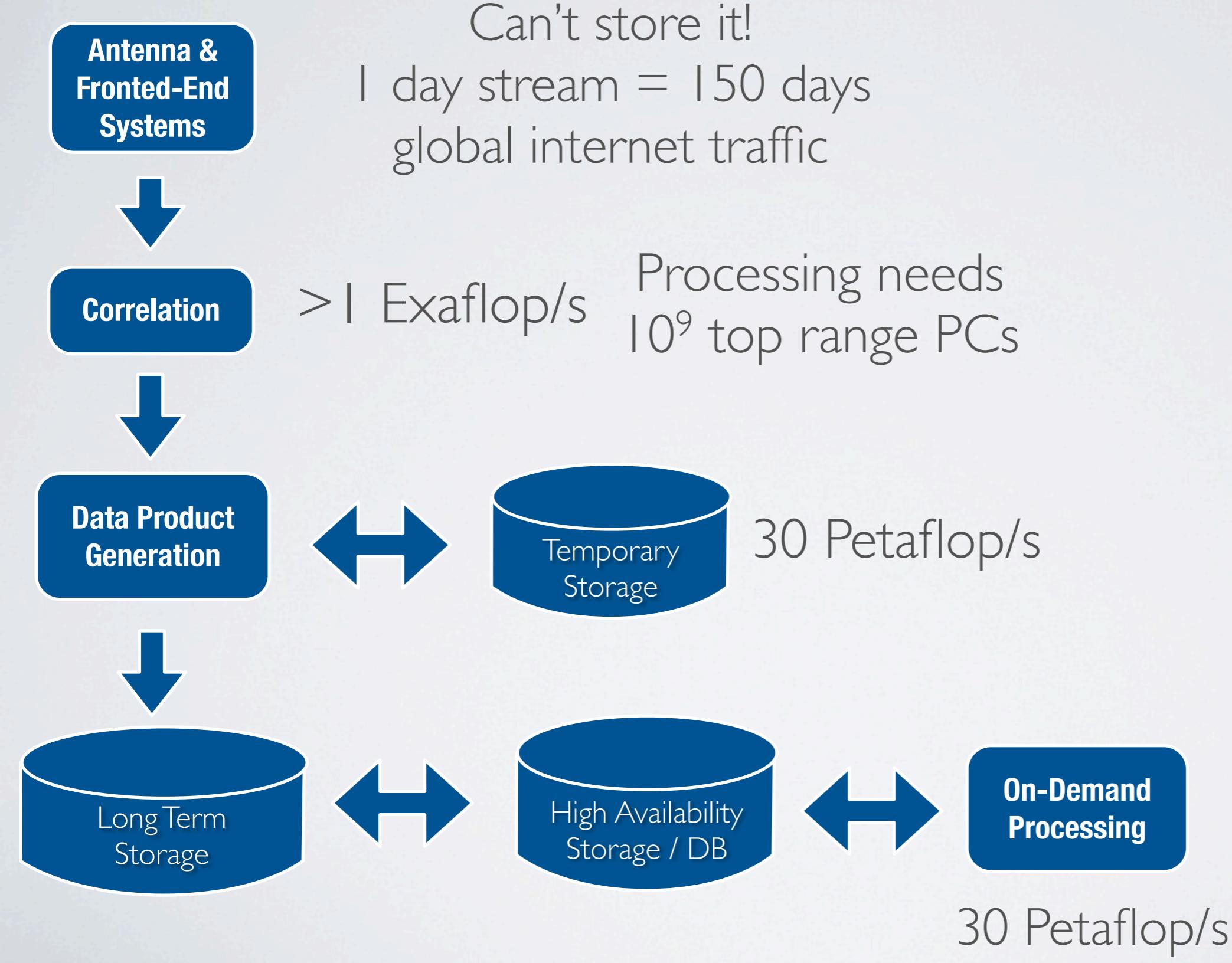


UNIVERSITY OF  
CAMBRIDGE

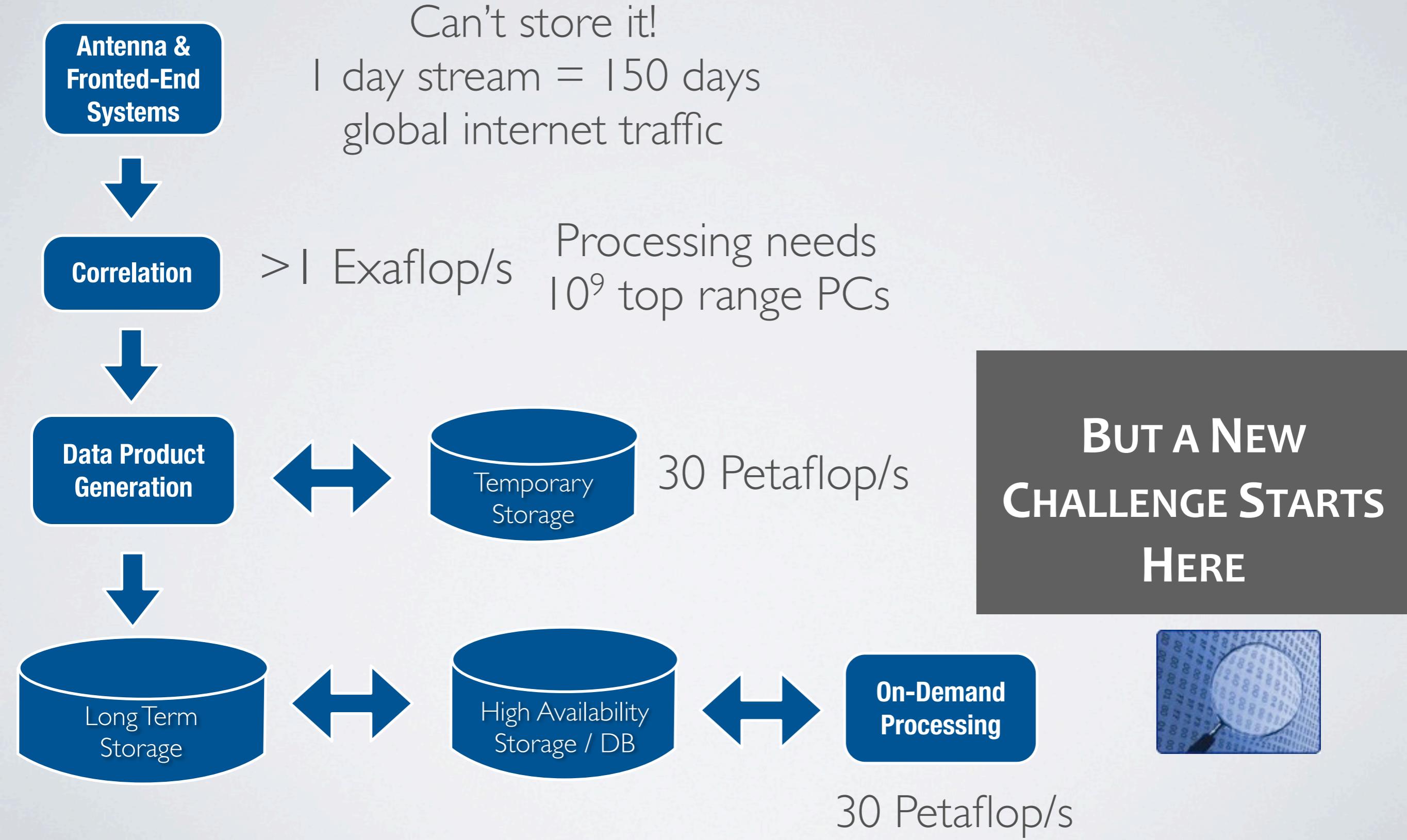


Courtesy A. Faulkner

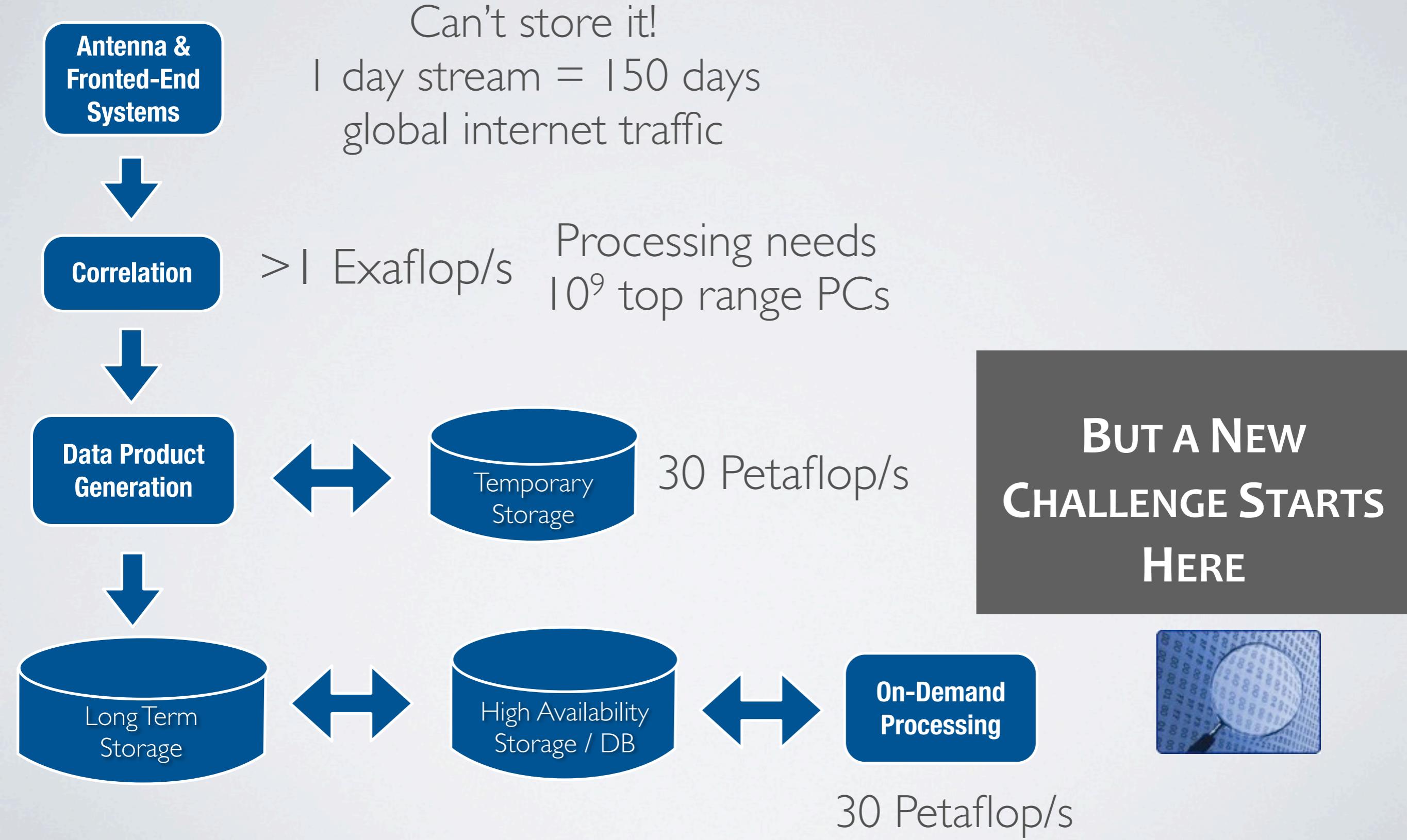
# Massive Data Flow, Storage & Processing



# Massive Data Flow, Storage & Processing



# Massive Data Flow, Storage & Processing



# Massive Data Flow, Storage & Processing

Antenna &  
Fronted-End  
Systems



Correlation



Data Product  
Generation

Can't store it!  
1 day stream = 150 days  
global internet traffic

A disruptive change in the methodology is  
required  
e-Science

Temporary  
Storage

30 Petaflop/s

Long Term  
Storage



High Availability  
Storage / DB



On-Demand  
Processing

30 Petaflop/s

BUT A NEW  
CHALLENGE STARTS  
HERE





Workflow

4Ever



**iSOCO**  
enabling the networked economy



The University  
of Manchester

MANCHESTER  
1824



# IAA-CSIC CONTRIBUTION

**EU FUNDED FP7 STREP PROJECT  
DECEMBER 2010 – DECEMBER 2013**

1. Intelligent Software Components (iSOCO, Spain)
2. University of Manchester (UNIMAN, UK)
3. Universidad Politécnica de Madrid (UPM, Spain)
4. Poznan Supercomputing and Networking Centre (PSNC, Poland)
5. University of Oxford (OXF, UK)
6. Instituto de Astrofísica de Andalucía (IAA, Spain)
7. Leiden University Medical Centre (LUMC, NL)

Technological **infrastructure** for the **preservation** and **efficient retrieval** and **reuse** of scientific workflows in a **range of disciplines**

## Core Competencies (Tech)

- Digital Libraries
- Workflow Management
- Semantic Web
- Integrity & Authenticity
- Provenance
- Information Quality

## Case Studies

- Astronomy (IAA-CSIC)
- Genome-wide Analysis and Biobanking

## Goals

**Archival, classification, and indexing of scientific workflows** and their associated materials in scalable semantic repositories

**Creation of scientific communities** to collaboratively share, reuse, and evolve workflows and their parts

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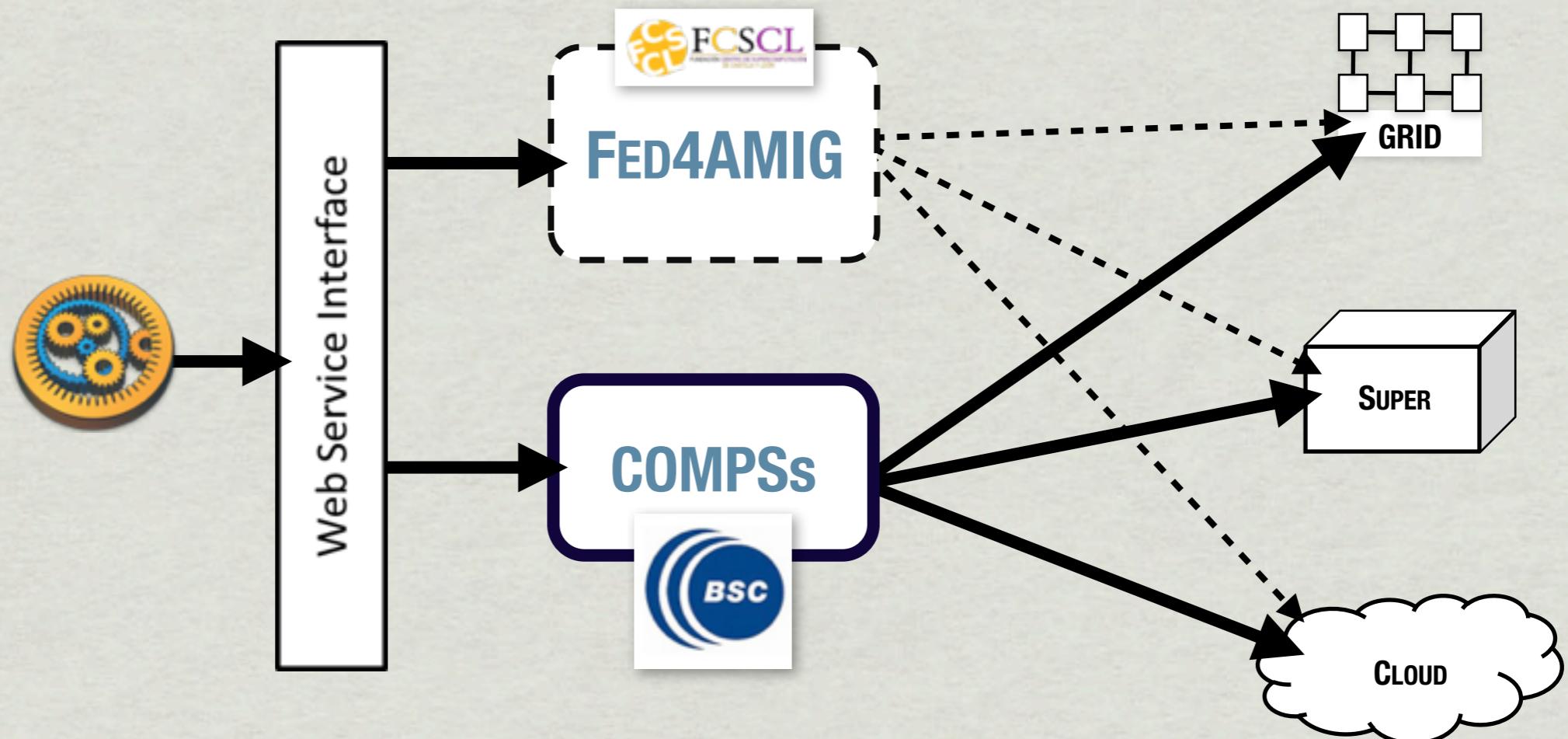
TARGETING ALREADY ESTABLISHED  
COMMUNITIES: MyEXPERIMENT,  
VIRTUAL OBSERVATORY

# AMIGA4GAS

IN PARTNERSHIP WITH  
BSC, FCSCL

AMIGA for the GTC, ALMA, and  
SKA Pathfinders

CLOSE COLLABORATION WITH THE  
PORTUGUESE IBERGRID INITIATIVE



- \* Porting the Taverna workflow engine to supercomputing environments
- \* Development of an integration layer for automatic workflow deployment



PRESENTED BY  
UNIVERSITY OF  
MANNHEIM



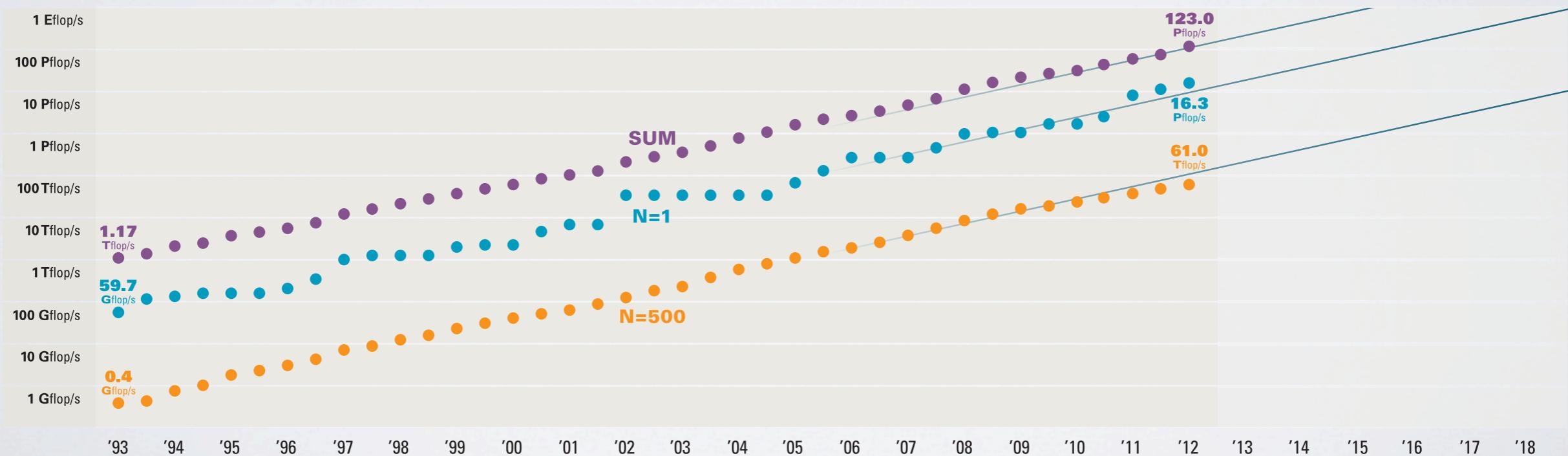
Lawrence Berkeley  
National Laboratory

FIND OUT MORE AT  
[www.top500.org](http://www.top500.org)

	NAME	SPECS	SITE	COUNTRY	CORES	R <sub>max</sub> Pflop/s
1	<b>Sequoia</b>	IBM BlueGene/Q, Power BQC 16C 1.60 GHz, Custom interconnect	DOE / NNSA / LLNL	USA	1,572,864	16.33
2	<b>K computer</b>	Fujitsu SPARC64 VIIIfx 2.0GHz, Tofu interconnect	RIKEN AICS	Japan	705,024	10.51
3	<b>Mira</b>	IBM BlueGene/Q, Power BQC 16C 1.60 GHz, Custom interconnect	DOE / SC / ANL	USA	786,432	8.153
4	<b>SuperMUC</b>	IBM iDataPlex DX360M4, Xeon E5-2680 8C 2.70GHz, Infiniband QDR	Leibniz Rechenzentrum	Germany	147,456	2.897
5	<b>Tianhe-1A</b>	NUDT YH MPP, Xeon X5670 6C 2.93 GHz, NVIDIA 2050	NUDT/NSCC/Tianjin	China	186,368	2.566

## PERFORMANCE DEVELOPMENT

## PROJECTED





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MANNHEIM

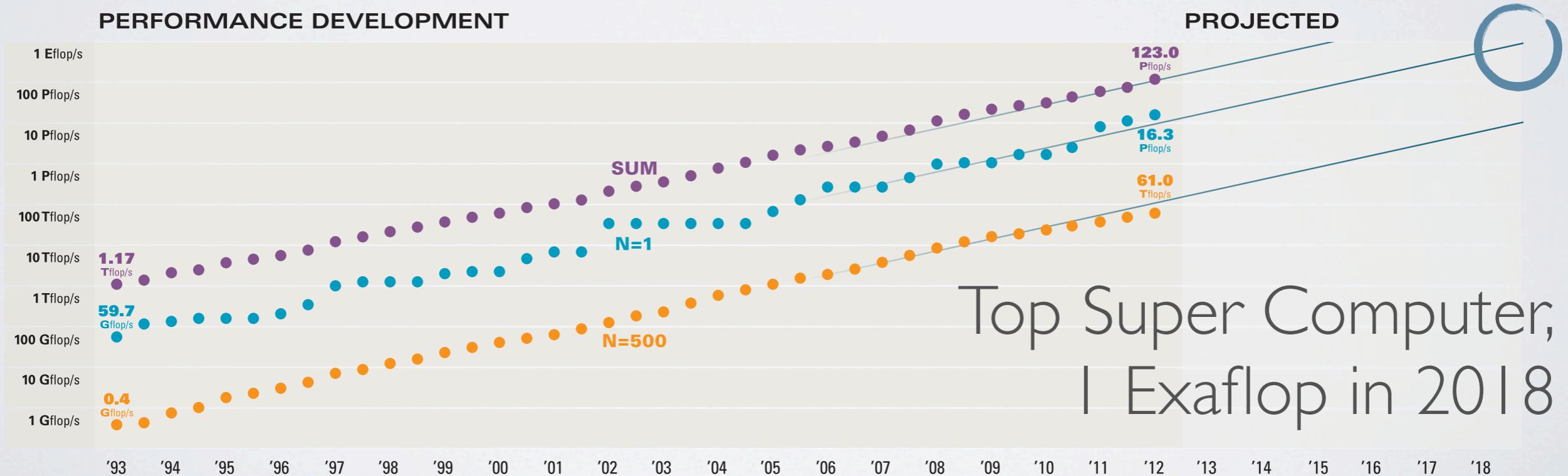


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### PERFORMANCE DEVELOPMENT



| Gigaflops = 0,5W

| Exaflops = 500MW

Target: 100MW

**NOT ONLY HOW MUCH, BUT HOW**

| Gigaflops = 0,5W

| Exaflops = 500MW

Target: 100MW

## NOT ONLY HOW MUCH, BUT HOW

- Far from man-made radio frequency emission (hence power supplies)
- Geographically distributed
- 24/7 operation
- Cooling of digital electronic
- Sustainable
- Reliable
- Affordable
- Projections from pathfinders and precursors: SKA will be power limited

With Renewable Energy

- **Direct transfer of technology**
  - Computational resources consume 1.5% of power in the World
  - 1600 millions people with no access to electric power
- **Demostrator for Sustainable Mega Science Infraestructuras with 0% carbon footprint**



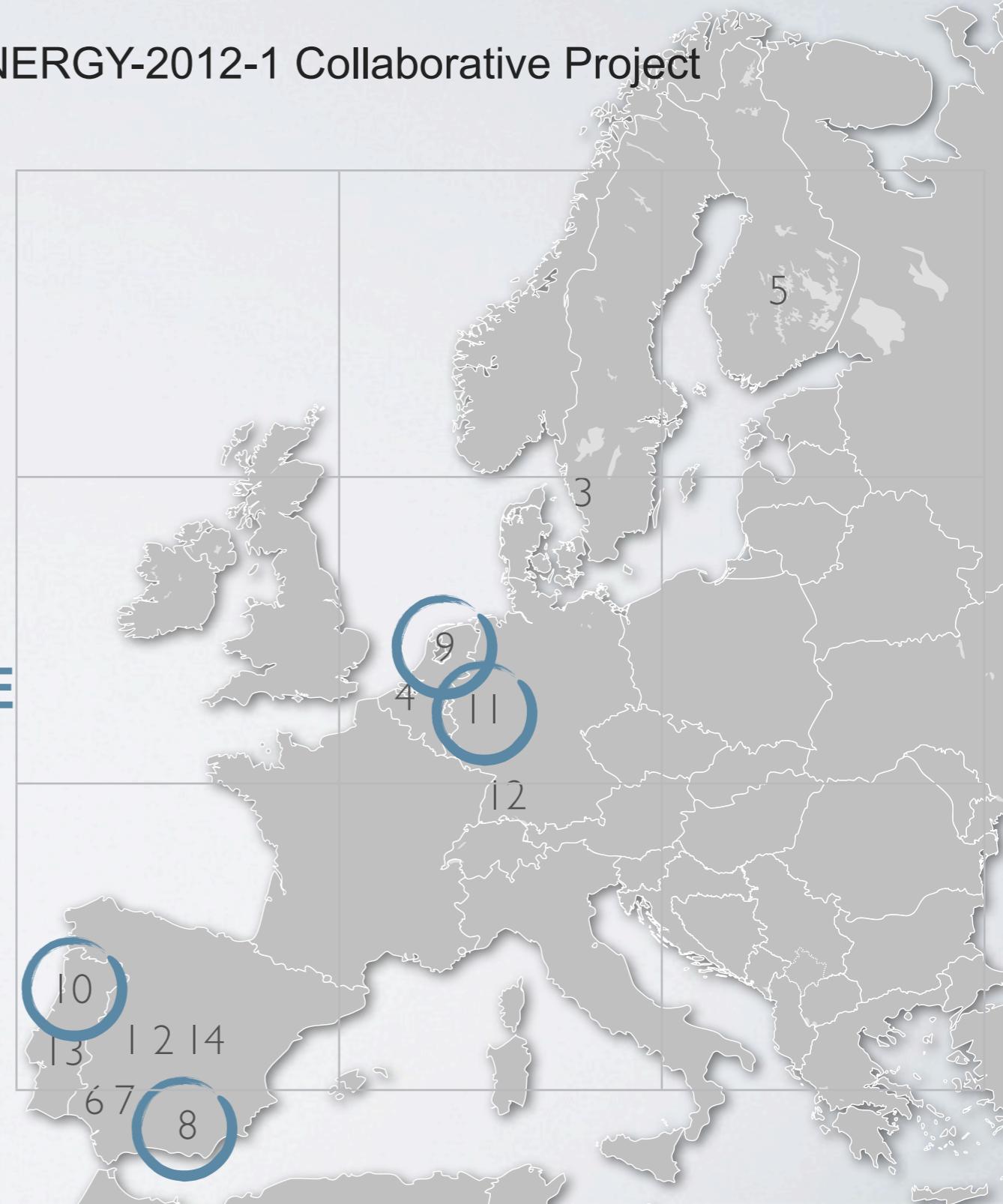
- Positioning of Spanish industry at international level

Link of BIOSTIRLING proposal to SKA

## **BIOSTIRLING4SKA**

**Dish Stirling systems for SKA. FP7-ENERGY-2012-1 Collaborative Project**

1. GESTAMP RENEWABLE INDUSTRIES (GRI)
2. ALENER SOLAR
3. CLEANERGY
4. AGC GLASSEUROPE
5. UNIVERSITY OF JYVÄSKYLÄ (JYU)
6. CENTRO TECNOLOGICO AVANZADO DE ENERGIAS RENOVABLES (CTAER)
7. U. SEVILLE (US)
8. CSIC-IAA
9. ASTRON
10. IT AVEIRO
11. MPIfR
12. FRAUNHOFER-ISE
13. LÓGICA
14. GESTAMP SOLAR STEEL (GSS)

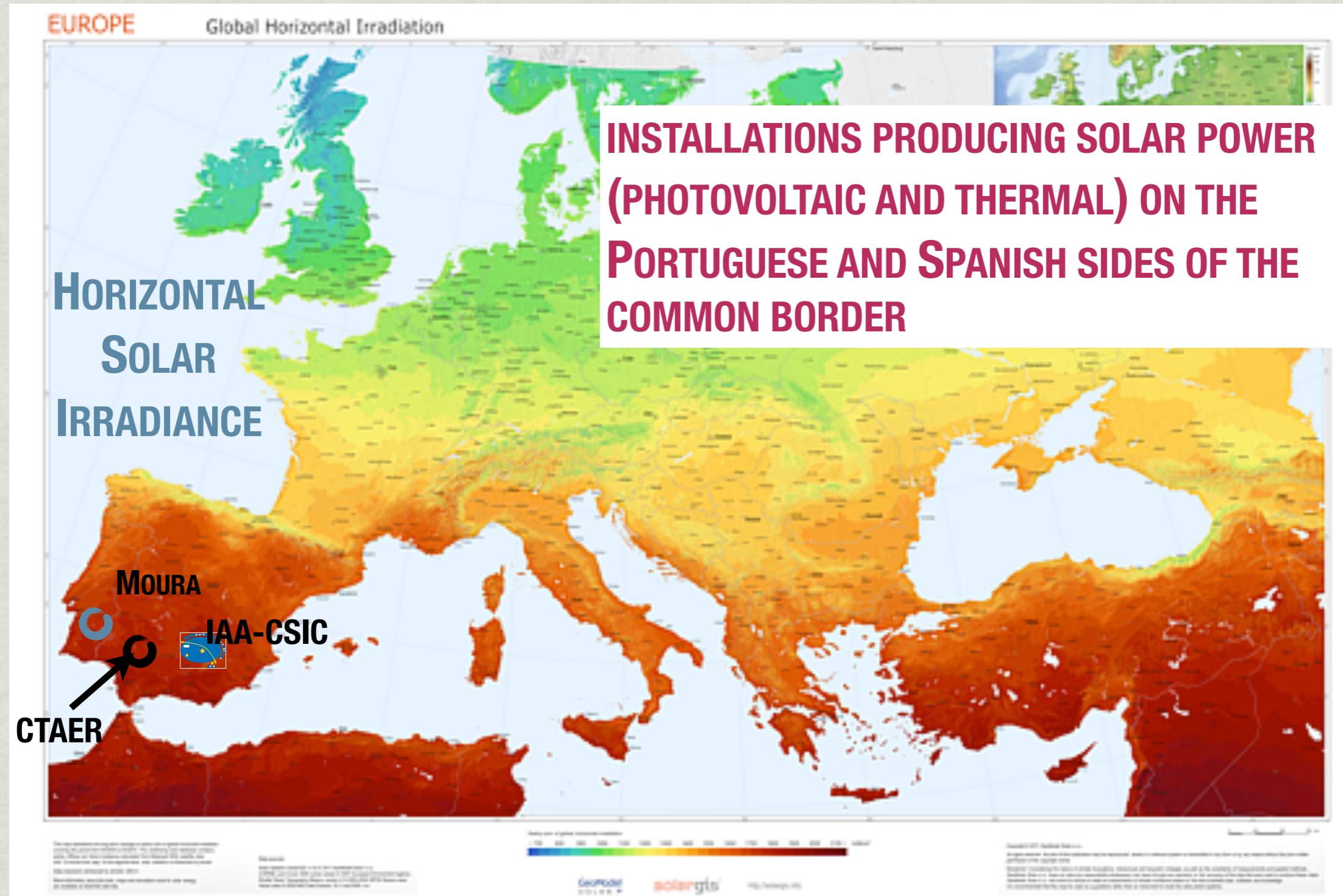


- **Positioning of Spanish industry at international level**

- Link of BOSTIRLING proposal to SKA **BOSTIRLING4SKA**
- Invitation to present BOSTIRLING in AERAP event:
  - Special mention by Britta Thomsen, Eurodeputy, Vice-chair of the European Parliament's Committee on Industry, Research and Energy
- Visits to Sevilla
  - SKA Project Office (May 2012)
  - Co-organizers of Workshop

## The Power Challenges of Mega-Science Infrastructures: the example of SKA

**Moura, Portugal and Sevilla, Spain  
20th-21st June 2012**

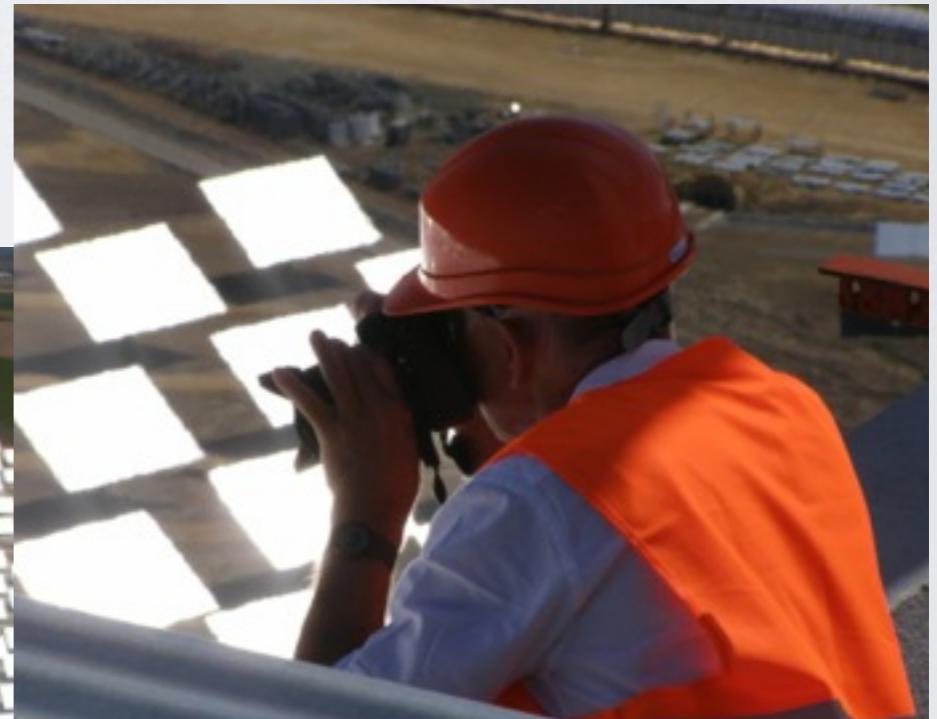


INTEREG funds with Portugal (Moura SKA  
demonstrator 200 km from Sevilla)

# SKA PROJECT OFFICE VISIT TO ABENGOA SOLAR FACILITIES (PS10, PS20) IN SEVILLA

**28th May 2012**

- SKA Org. Office: Georgina Harris and Robert Millenaar



- Jose Ramón Sánchez (MINECO)
- Maria Luisa Revilla y Borja Izquierdo (CDTI)
- Representantes de ABENGOA
- Miguel Ángel Vázquez (ISOFOTON)
- Rafael Luque (ARIEMA)
- Domingos Barbosa (IT Aveiro)
- André van És (ASTRON)
- Matilde Fernández (IAA - CSIC)
- Lourdes Verdes-Montenegro Atalaya (VIA-SKA, IAA-CSIC)
- Ana Pérez (VIA-SKA; FRACTAL)
- Valeriano Ruiz, Gonzalo Lobo, Manuel Silva, Sol Luca de Tena (CTAER)





MINISTERIO  
DE ECONOMÍA  
Y COMPETITIVIDAD



# SKA: *Strategic Position & Future Opportunities for Spanish Industry*

Instituto de Química  
Física Rocasolano, CSIC  
Madrid  
23/11/2012





 Universidad  
Carlos III de Madrid

**INSTITUTO  
GEOGRÁFICO  
NACIONAL**  *cniig*

**V**NIVERSITAT  
**D** VALÈNCIA

 *ugr* | Universidad  
de Granada

 **Inducencia astro CTAER**  
Centro Tecnológico Avanzado de Energías Renovables  
ANDALUCÍA



**70+ participants**



MINISTERIO  
DE ECONOMÍA  
Y COMPETITIVIDAD



**CSIC**  
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS



**VIA-SKA**



**Strategic position in SKA roadmap**  
**Results of capacity map**



MINISTERIO  
DE ECONOMÍA  
Y COMPETITIVIDAD



Daniel Segovia (Carlos III University. AAs)

*Academic centers in the consortia*



MINISTERIO  
DE ECONOMÍA  
Y COMPETITIVIDAD



VIA-SKA



Georgina Harris (SKA Organization Office)

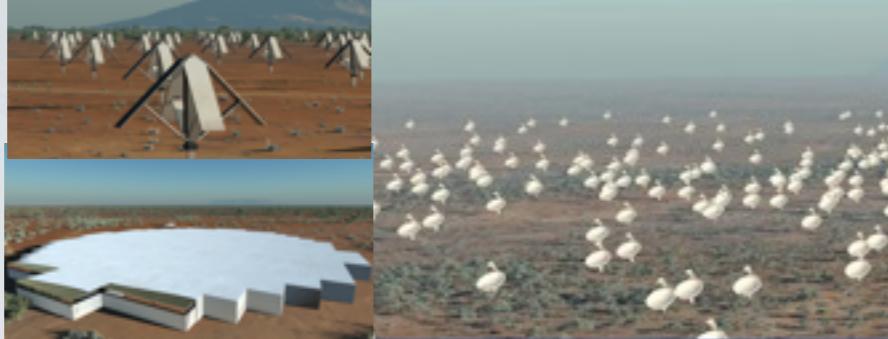
**SKAO Office Q&A**



MINISTERIO  
DE ECONOMÍA  
Y COMPETITIVIDAD



**CSIC**  
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS



Manuel Gallas  
Abengoa NT



**15 Presentations from companies**



**The Spanish VIA-SKA project**

THANK YOU FOR YOUR  
ATTENTION

*The Square Kilometer Array: a large Scale ESFRI Infrastructure, From the Cosmos to the Cities of the future*

*Lisbon, Portugal, 30th November 2012*

