

# Horizon 2020 ERA Chair project „Expanding Potential in Particle and Radiation Detectors, Sensors and Electronics in Croatia – PaRaDeSEC”

<http://paradesec.irb.hr>



**Neven Soić**  
**Rudjer Boskovic Institute**  
**PaRaDeSEC project manager**





**Largest research institute in Croatia  
(850 employees, 450 Ph.D., multidisciplinary)**

**Mission:**

**Excellent science**

**Strong involvement in higher education**

**Leading contribution to the growth of  
the national economy**

**Vision:**

**Croatian EU centre of scientific  
excellence**

# RBI overview



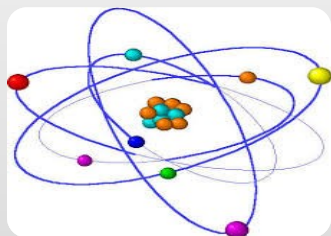
6% of Croatian  
researchers

% of Croatian  
publications

Croatian  
20 projects

atian  
ndex

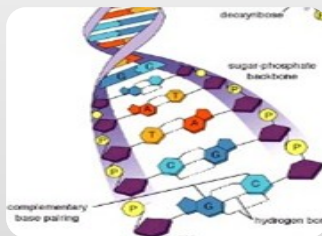
## PHYSICS



## CHEMISTRY



## LIFE SCIENCES



## ENVIRONMENT



## ICT



Electronics

Material physics

Experimental  
physics

Theoretical physics

Material chemistry

Organic chemistry  
and biochemistry

Physical chemistry

NMR

Molecular medicine

Molecular biology

Sea and  
environment

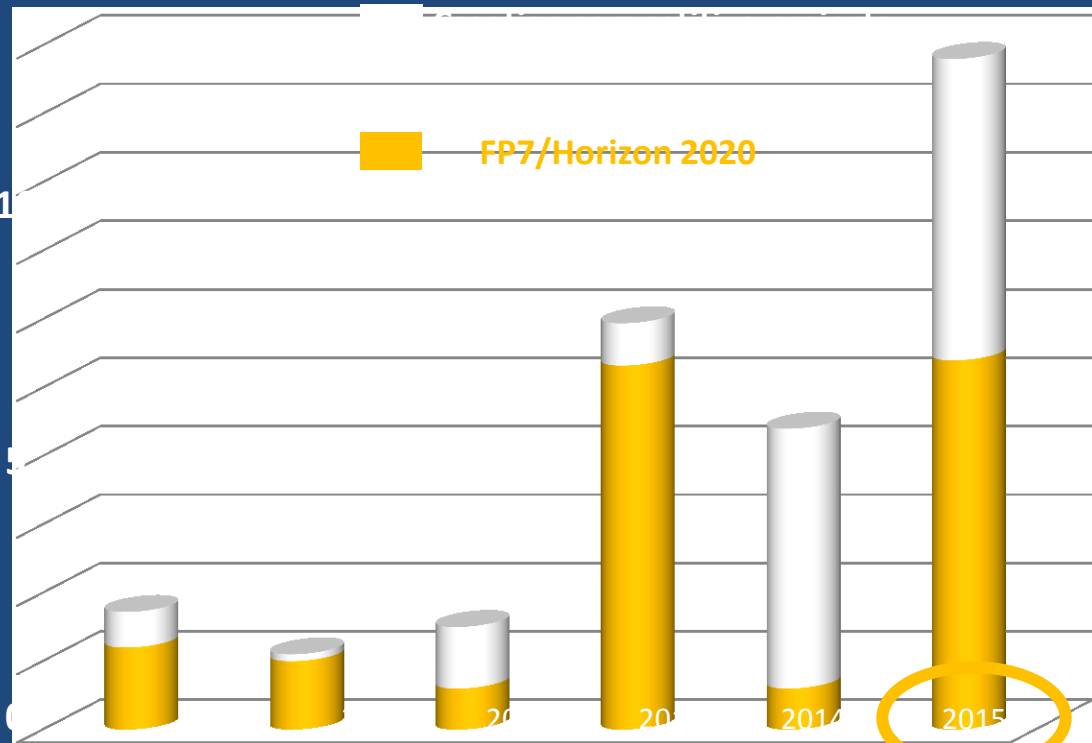
Center for sea  
research

Computer science

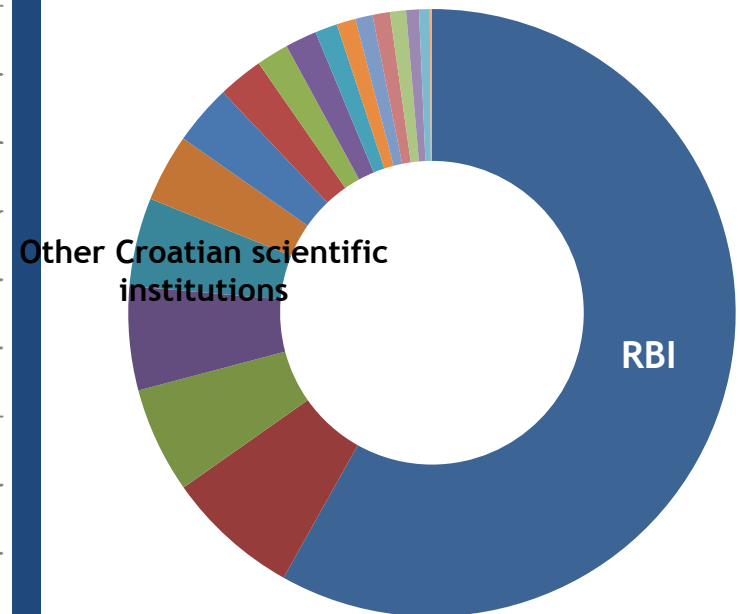
# RBI – leader in Croatia in all competitive projects

A significant additional funding from ESIF is expected by the end of 2017:

- Centres of excellence
- Centres of competence
- Horizon 2020 (ERA Chair, Twinning)



New projects, millions of Euros

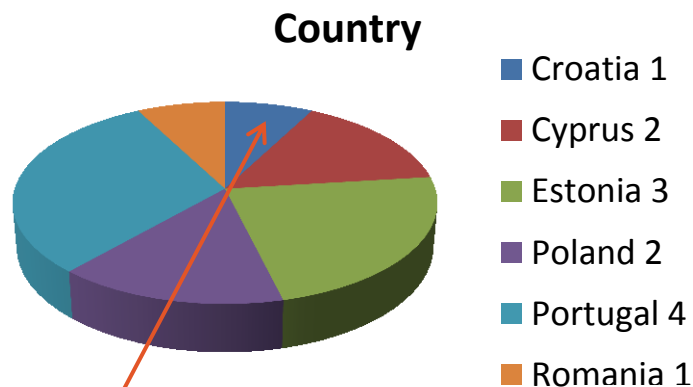


Percentage of Horizon2020 funding for all Croatian scientific institutions

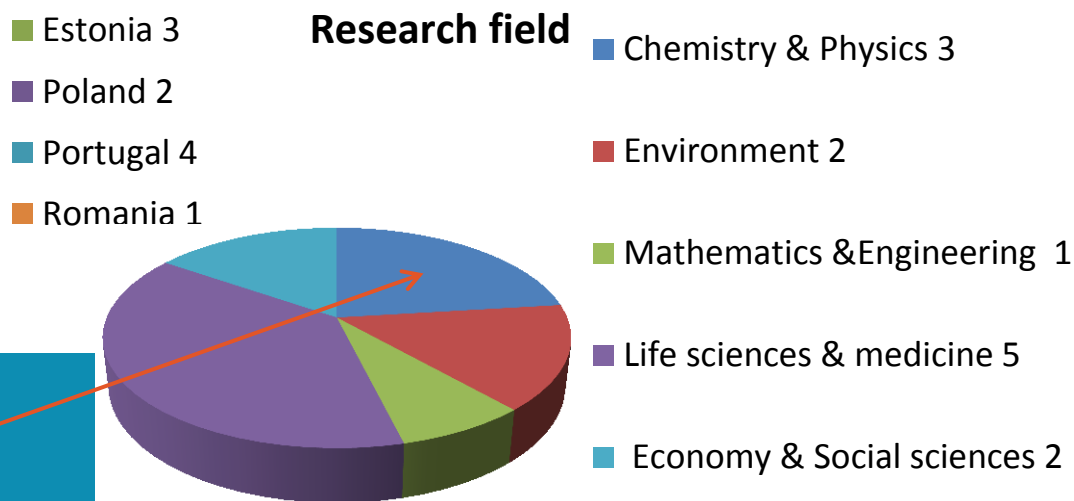
# H2020 ERA Chairs

*Results of the 1<sup>st</sup> Horizon 2020 ERA Chairs call*

88 submitted proposals, 41 above the threshold (10/15)  
13 projects funded – success rate 15%



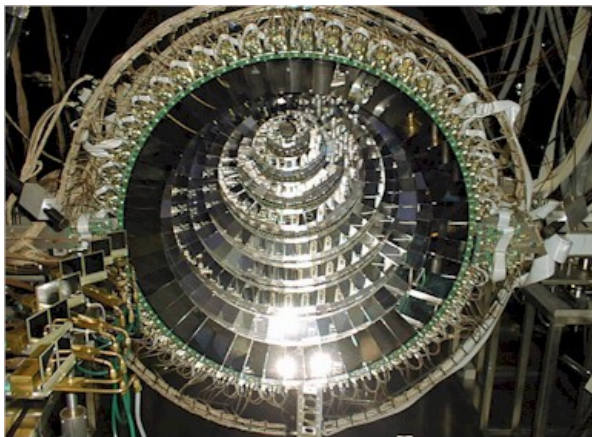
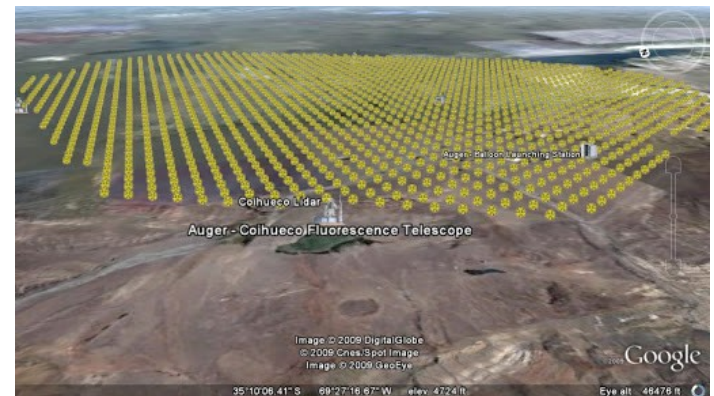
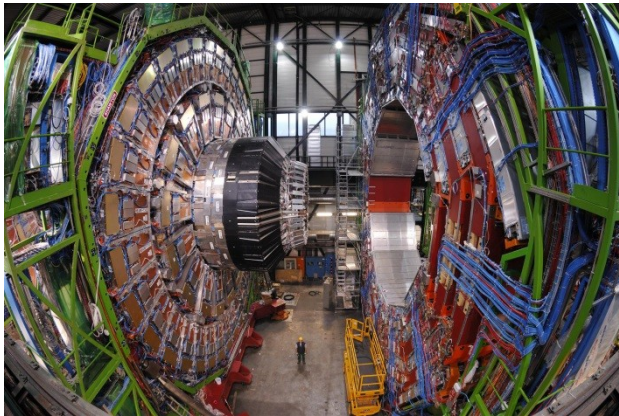
PaRaDeSEC: 13  
Excellence: 4.5  
Impact: 4.0  
Implementation: 4.5



# PaRaDeSEC

## *Expanding Potential in **P**article and **R**adiation **D**etectors, **S**ensors and **E**lectronics in **C**roatia*

Research in particle, astro-particle & nuclear physics, nuclear astrophysics and interdisciplinary research (ion beams, radiation)





# PaRaDeSEC

Large, complex and expensive scientific equipment

Large international collaborations – scientists, engineers, technicians – multidisciplinary approach

Institutions significantly contributing to development & construction of equipment have large impact & reputation

Large investment needed – returned by increased innovations, new technologies & knowledge transfer to economy

RBI researchers actively involved in international collaborations, their contribution recognized, but minor RBI contribution to development & construction of equipment

Strengthening RBI impact & reputation and increasing research quality ↔ development & construction of detectors, sensors & electronics – **Center for detectors, sensors & electronics - CDSE**  
- Contribution to international collaborations + strengthening local accelerator and other facilities



# PaRaDeSEC

Center: equipment, staff, knowledge & experience are needed

Large number of smaller international projects: IAEA, FP6, FP7

The most important FP7 REGPOT **project Particle detectors** - „Upgraded Facility for Development of Silicon and Diamond Particle Detector Systems“ funded by EC with 1.32 M€

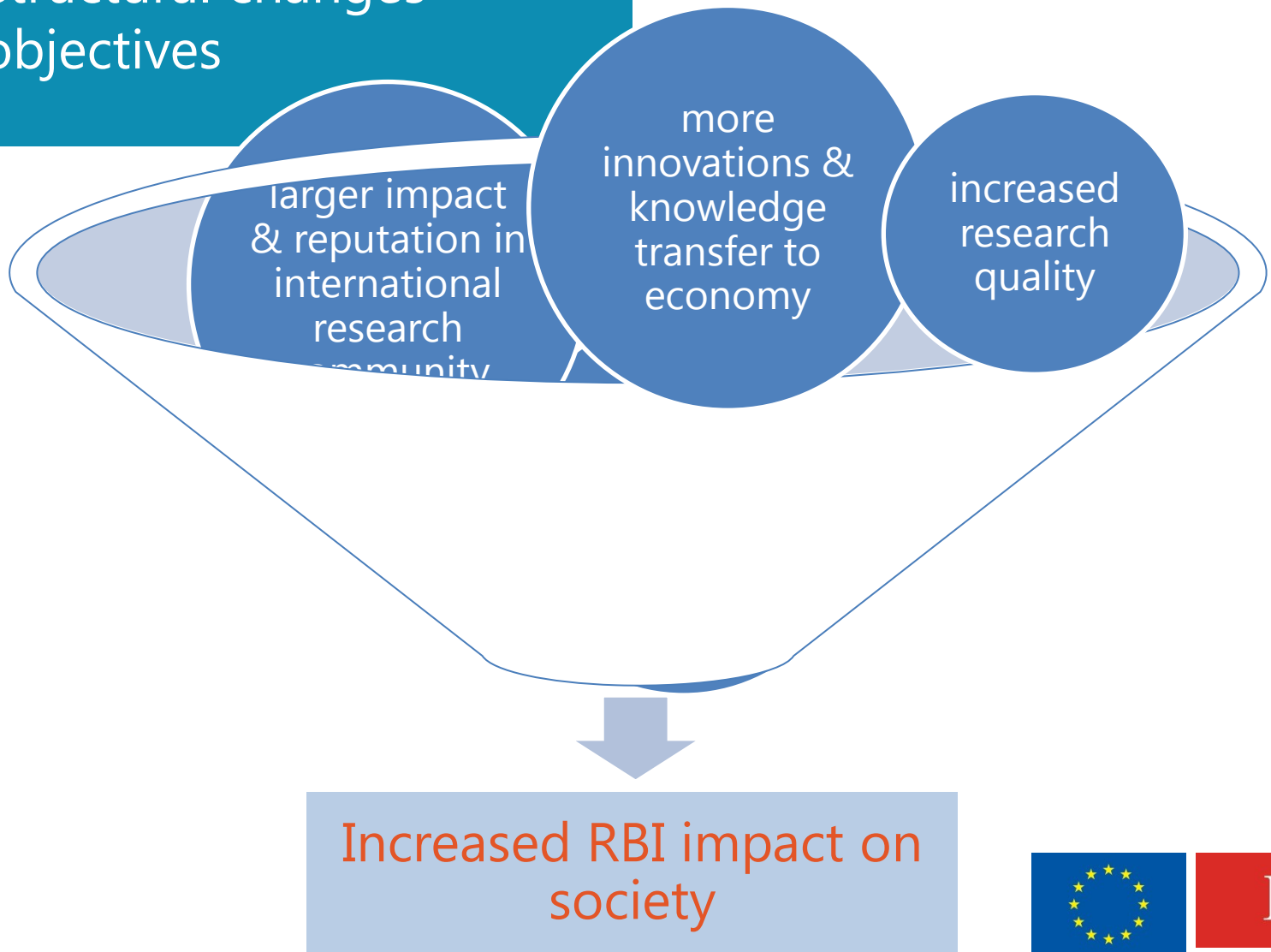
RBI is **multidisciplinary institution**: all required scientific fields for development & construction of these equipment for **fundamental & interdisciplinary research & applications**

RBI implements **significant structural changes** following practice and regulations of the best scientific institutions in Europe



# PaRaDeSEC

Structural changes  
objectives



# PaRaDeSEC

:

Employ at RBI excellent world expert  
in the research field as Center &  
project leader, 4 world experts for a  
core team

Strengthen RBI role  
in realization of  
national smart  
specialization  
strategy (O-ZIP) &  
speed up structural  
changes at RBI

Project  
objectives

Strengthen RBI  
position in  
international  
research community

Enlarge RBI capacities for multi- i inter-  
disciplinary applications & transfer of  
knowledge & experience to economy

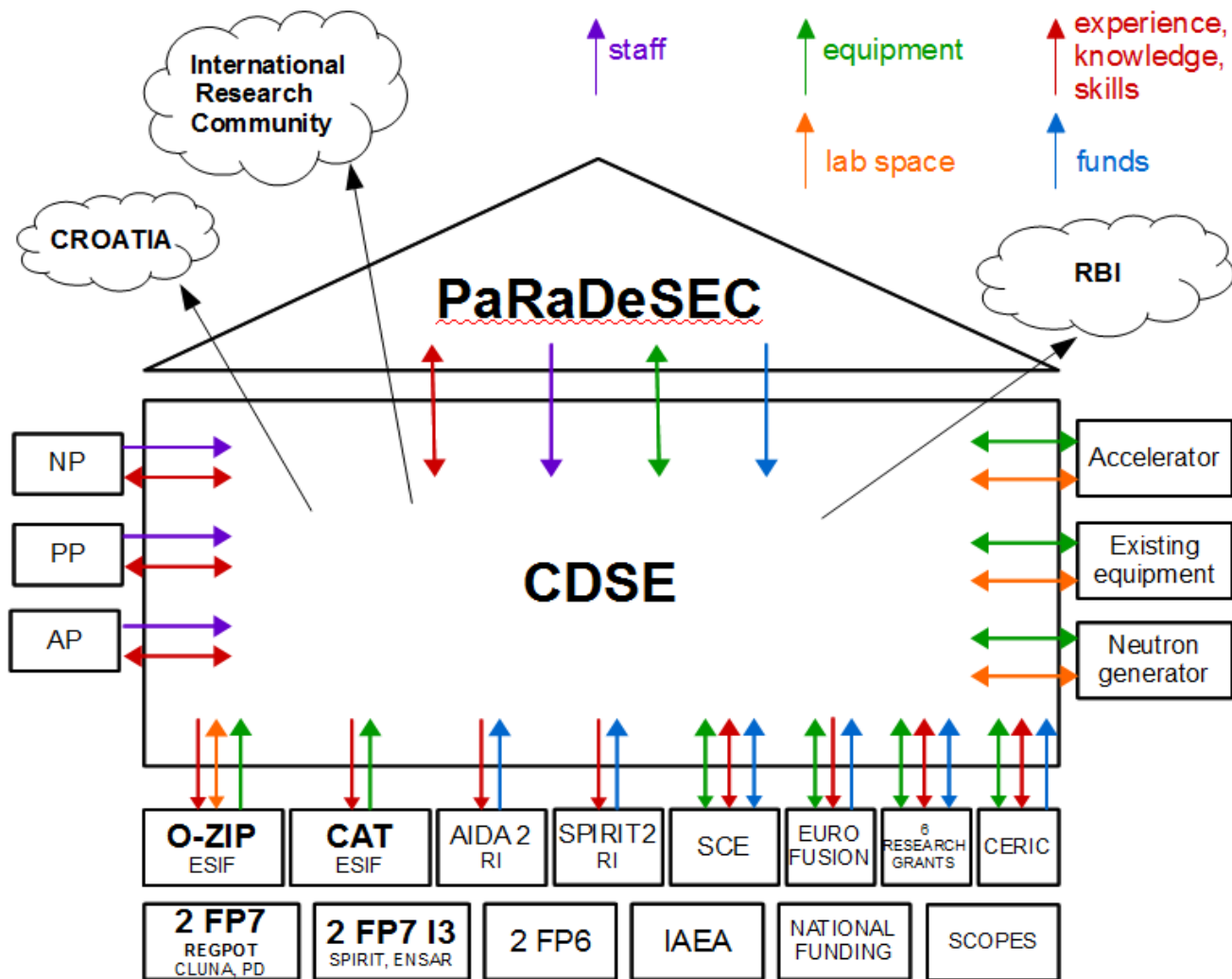


# PaRaDeSEC

Funding EC 2 434 500 €

Aim	Amount €
Staff	1 544 000
Equipment	200 000
Knowledge & experience transfer, education of young researchers, dissemination	296 000
Other expenses, dissemination, communication, science popularisation	124 000
Indirect expenses	541 000

# PaRaDeSEC



# PaRaDeSEC

## Related projects

RBI proposal for **EU structural funds O-ZIP**  
„Open scientific infrastructural platforms for innovative applications in economy and society” listed in **Operational program competitiveness & cohesion** (60 M€)

RBI+IF scientific **Center of excellence** for advanced detectors & sensors **CEMS** – structural funds (5 M€)

H2020 project **AIDA2** Advanced European Infrastructures for Detectors at Accelerators

H2020 project **EuroFusion** European Consortium for the Development of Fusion Energy

**CERIC** - Central European Research Infrastructure Consortium

At the moment eight national research projects (HrZZ)

H2020 **Twinning** projekt RBI-T-WINNING theoretical physics




# PaRaDeSEC

## Project impact

Formation of sustainable Center for detectors, sensors & electronics, independent RBI unit which will continue its work after the project end

Organisation and working environment at RBI similar to ones at the best scientific institutions in Europe



Improved research quality in particle, astroparticle, nuclear and applied physics

Improved research quality in multi- and inter-disciplinary research, knowledge & technology transfer to economy

Realisation of national smart specialization strategy



# CDSE - Center for detectors, sensors & electronics

Independent RBI unit  
collaborating with other  
organisational units

National center for  
development of particle &  
radiation detectors ,  
sensors for research &  
applications and associated  
electronics

CDSE will be open facility  
collaborating with all  
stakeholders in science,  
education, national & local  
administration & industry

Partners: PMF & FER UniZ,  
IF, all university units in  
related subjects, high-tech  
companies

**CDSE will enable larger and higher  
quality utilisation of EU funds from  
Horizon 2020 & ESIF**





# ***What was crucial for the success ?***

## **Excellence**

- Good international scientific relevance and reputation
- Well adjusted objectives
- Clear and concise SWOT analysis
- Credible and realistic action plan for structural changes

## **Impact**

- Well demonstrated enhancement of the RBI capabilities
- Well described positive impact on research level – both basic and applications
- Well described contributions to the objectives of national S3

## **Implementation**

- Large experience from previous FP projects
- Effective and properly presented work plan
- Coherence between SWOT analysis and work plan

## **European Structural Funds**

- Well explained relation with the O-ZIP project & national S3
- Success of the O-ZIP proposal
- Involvement in a number of other proposal for ESF

**PaRaDeSEC is not isolated project, it is an important part of the RBI strategy**



# PaRaDeSEC team

*Project start: 01. 07. 2015.*

*Era Chair employed: 01. 04. 2016.*

*Jaakko Härkönen (born 1972, PhD 2001.) silicon detector technology & applications of the semiconductor radiation detectors in various research fields, CMS silicon upgrade, around 100 publications in peer-reviewed journals on semiconductor processing, High Energy Physics instrumentation, semiconductor material characterization and radiation hardness of silicon detectors.*

*ERA Chair team: 4 researchers*

- *Aneliya Georgieva Karadzhinova – Ferrer (b. 1985, PhD 2016) empl. 01. 04. 2017., characterization and quality assurance methods for Si detectors and Gas Electron Multiplier foils*
- *Andrey Starodumov (b. 1962. PhD 1995) empl. 04. 2017., CMS Silicon pixel detector upgrade, test & calibration procedures development, quality control & assurance in CMS Phase 1 upgrade*
- *Valery Chmill (b. 1963, PhD 2006), empl. 05. 2017., R&D studies on new silicon based photo-detectors (SiPM)*
- *???*





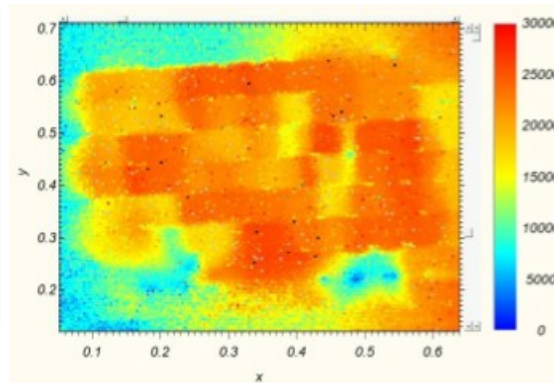
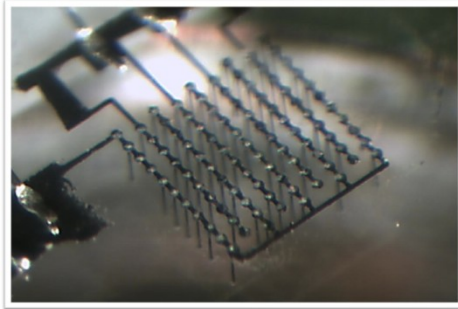
**CDSE**

Centar za detektore, senzore i elektroniku

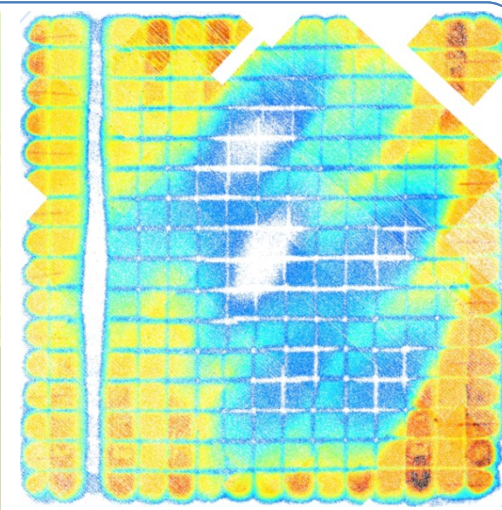
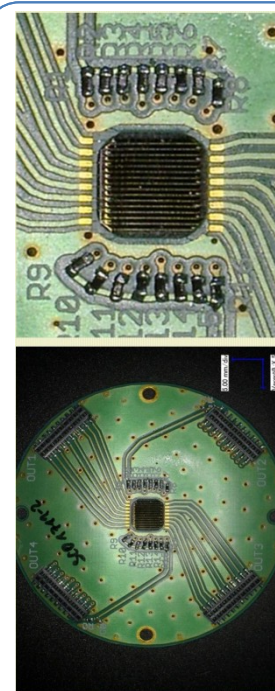
Former  
collabora  
tions



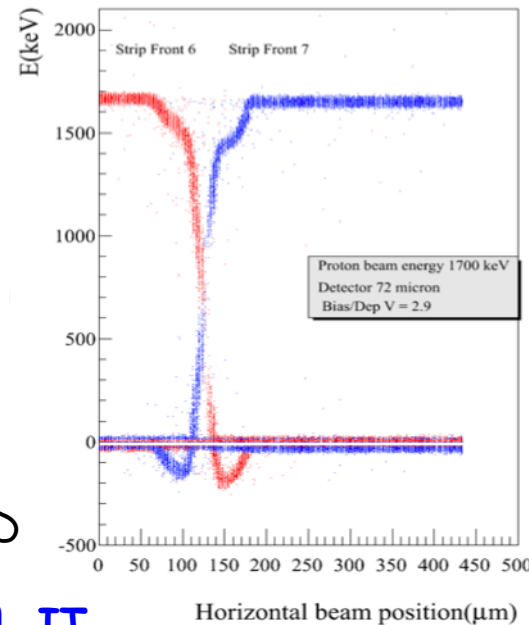
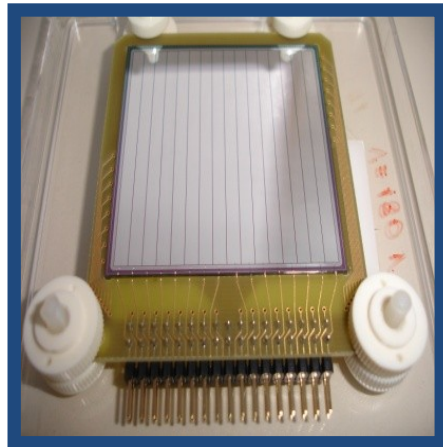
FP7 projects:  
Particle Detectors  
SPIRIT



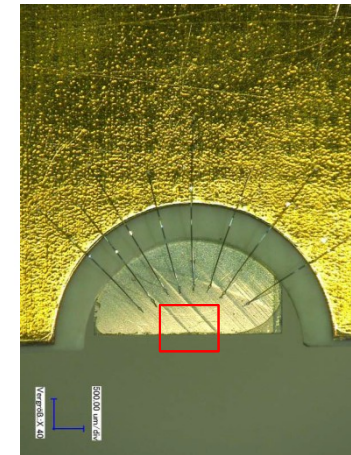
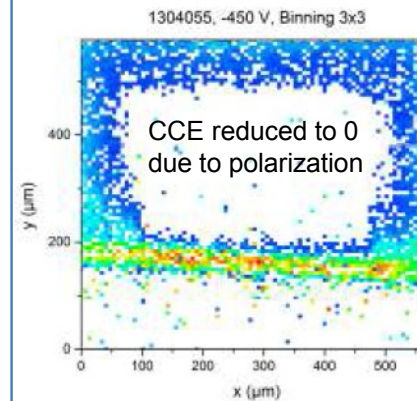
D diamond  
Efficiency and current transient structure in time  
with Alex Oh, **University of Manchester, UK**



HADES  
- radiation damage in  
start CVD diamond det.  
with J. Pietraszko **GSI**



Interstrip region - DSSSD  
Investigation of reverse  
polarity pulses with **INFN, IT**



DOI - diamond on iridium & polarization  
**University of Augsburg & GSI, D**  
with E. Berderman

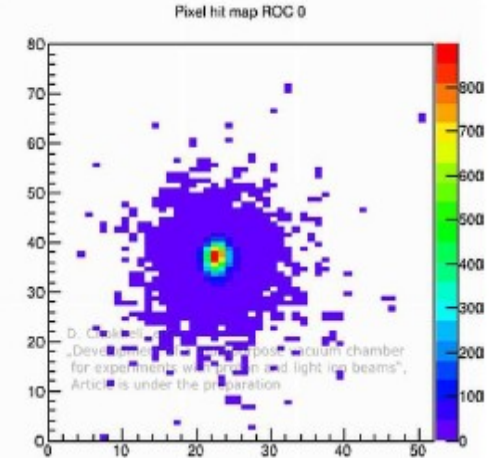
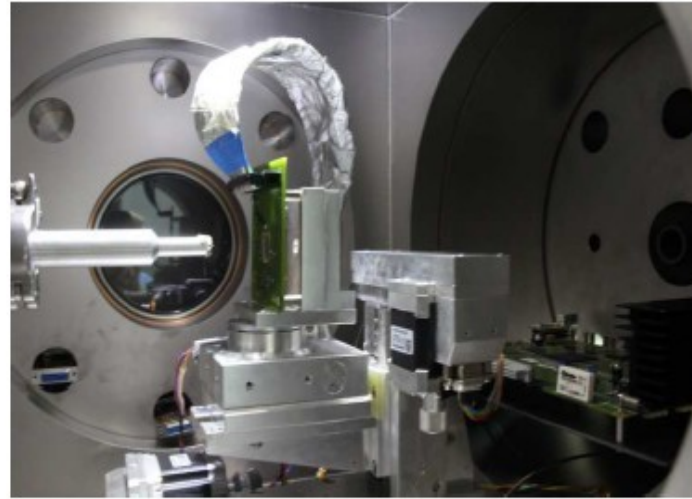


# Current collaborations



## FP7 projects: Particle Detectors SPIRIT

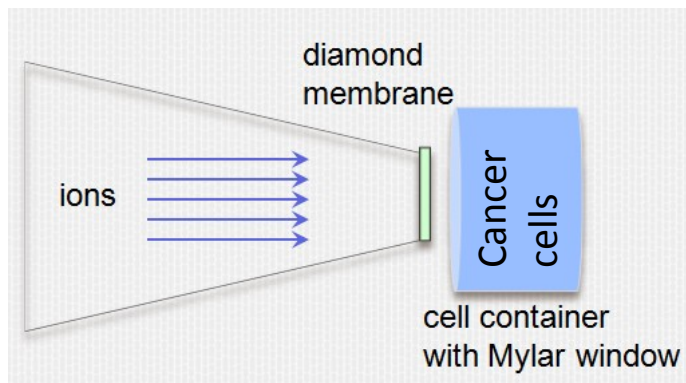
### Silicon Pixel detectors: PSI, Villingen



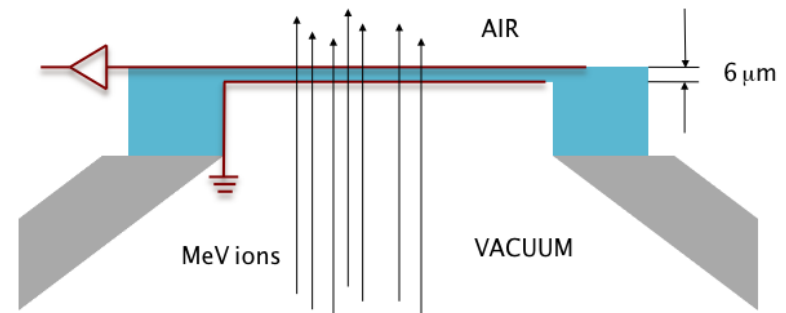
**Figure 7.** The ROC pixel detector is placed in front of the nozzle extracting the 2 MeV proton beam in air (left). Very first results collected by pixel detector using proton 2 MeV beam in air (right).

## Bilateral with Japan

### Diamond membranes: various applications, CEA (F), JAEA (Japan)



- dosimetry



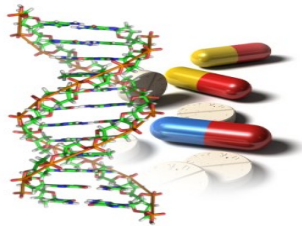
- thin transmission detector  
- battery

# Open Scientific Infrastructural Platform For Innovative Applications in The Economy And Society: O-ZIP

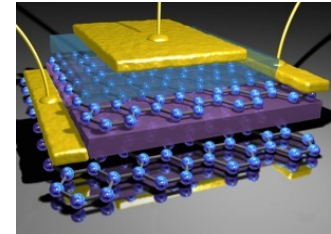
**60 million Euro project that will enable the Croatian industry to be based on science and innovation**

**Part of the Operational programme 2014 - 2020**

**BIOMEDICINE**



**ADVANCED MATERIALS**



**ENVIRONMENT AND SEA**



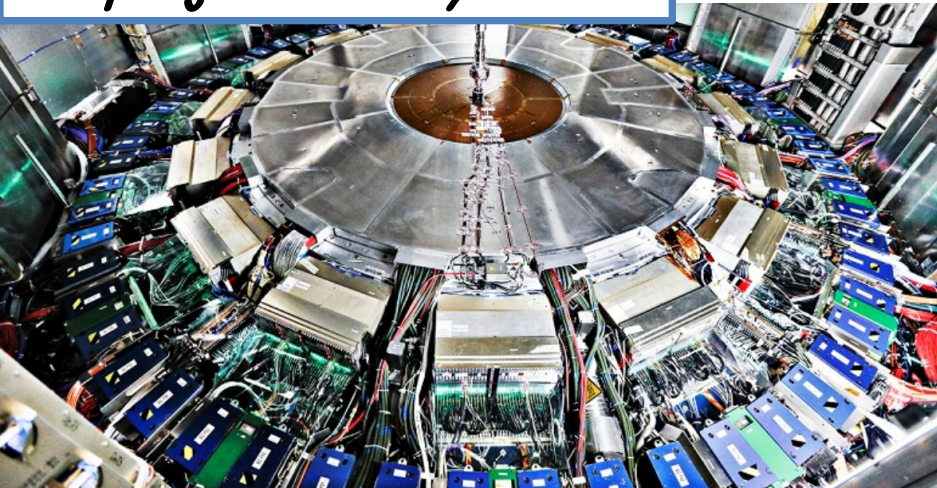
**ICT**



**Basis for a huge brain gain to RBI and all of Croatia**



*Detector development  
RI project led by **CERN***



Type of facility	Access provider	Infrastructure	Country
	CERN	PS&SPS	International Organisation
	DESY	DESY-II	Germany
	CERN	IRRAD	International Organisation
	CERN	GIF++	International Organisation
	JSI	TRIGA Reactor	Slovenia
	KIT	KAZ	Germany
	UCLouvain	CRC	Belgium
	UoB	MC40 Cyclotron	UK
Detector characterisation	RBI	RBI-AF	Croatia
	ITAINNOVA	EMClab	Spain





JET (Joint European Torus, UK)

The largest H2020 project ( $\approx 850$  M €)

RBI is the project partner ( $\approx 473$  K €)

Involved in work packages:

- WP PFC (Plasma facing components for ITER and DEMO)
- WP JET2 (Plasma facing components at JET tokamak)
- WP MAT (Fusion materials)
- WP EDU (Education)
- Fusion materials testing
- Research on plasma erosion of material
- Material resistance to fast neutrons
- Functional and other materials