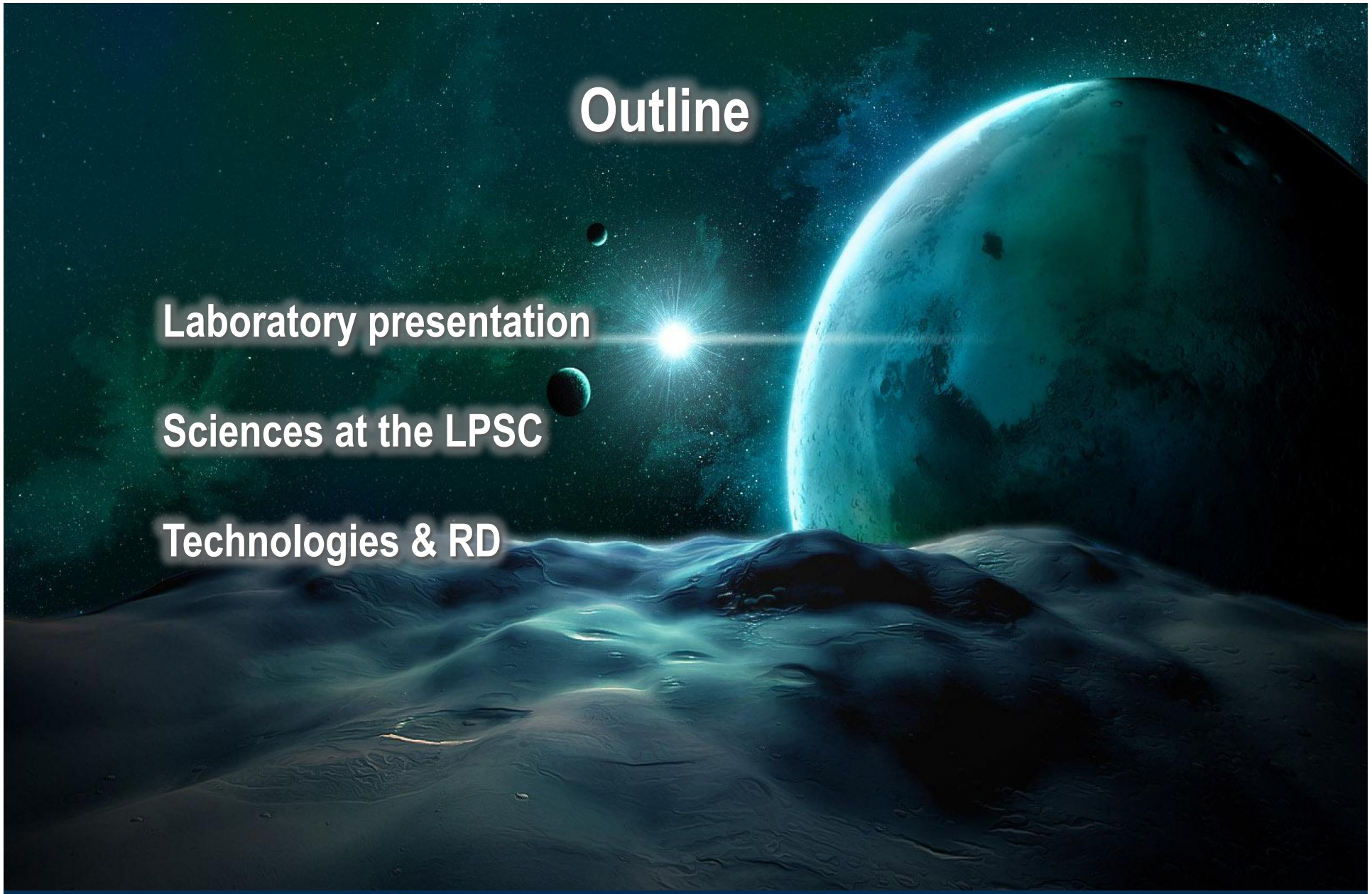
cnrs

LPSC Grenoble

Grenoble INP

UNIVERSITÉ Grenoble Alpes



cnrs LPSC Grenoble Grenoble INP UNIVERSITÉ Grenoble Alpes


Outline
Laboratory presentation
…Personnel and infrastructures
... Research Organization
Sciences at the LPSC
Technologies

LPSC : scientific and academic context

LPSC : Organization

Funding Agencies

Mixed Unit of Research from CNRS, University Grenoble Alpes and Grenoble-INP

CNRS : National Institute For Nuclear and Particle Physics (IN2P3)
Grenoble-Alpes University (UGA)
Engineering School Grenoble-INP (G-INP)

Organization

Research Activities

68 Permanent staff physicists (39 CNRS researchers, 29 university staff)
30 Phd Students and about 10 post-docs
→ **Regrouped in *10 research teams*, each team being involved in 1 to 3 projects**

Technical support Activities

87 permanent staff Engineers, Technicians and Administrative in 5 technical Departments
→ Common support services dedicated to ALL research activities in project

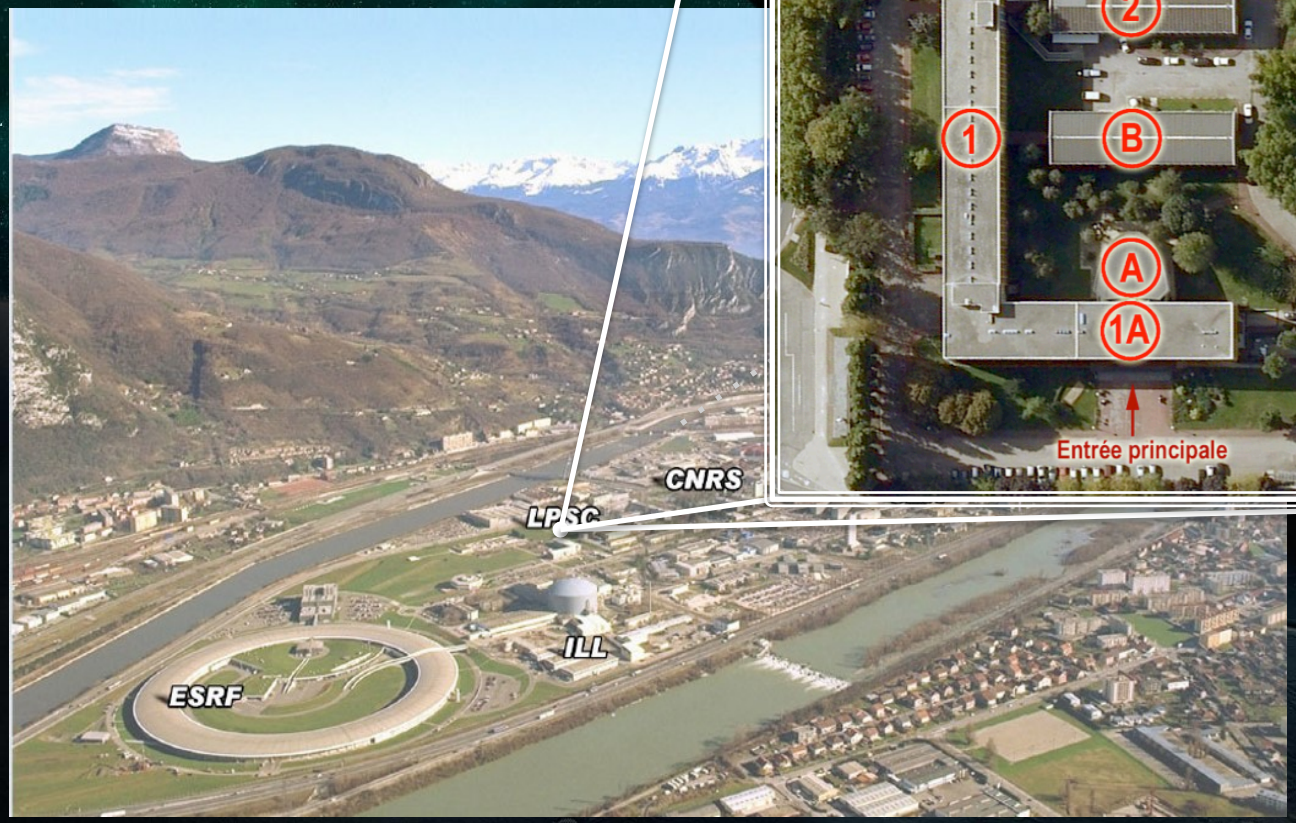
Technical Departments (5)

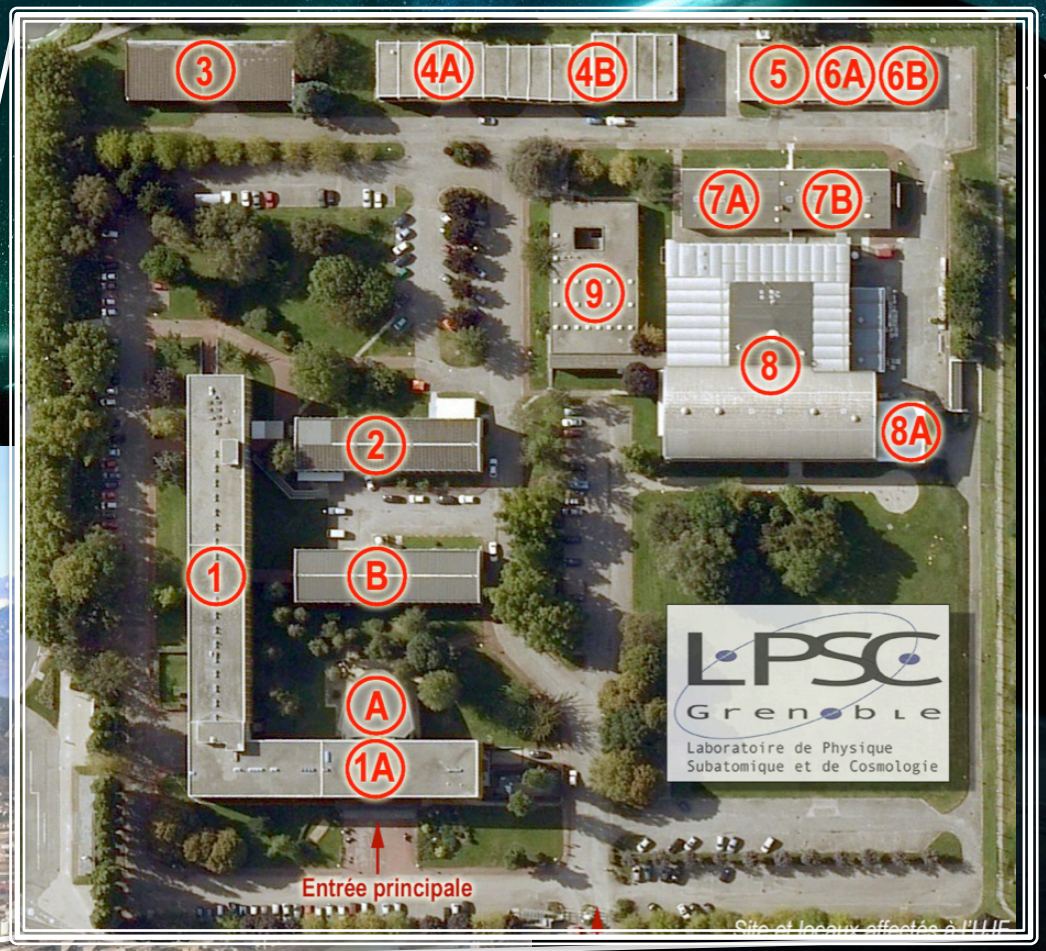
Mechanics – Electronics – Computing - Instrumentation - *Accelerator & Ion sources*

Technological Platforms (4)

GENESIS – Neutron Source for rapid neutrons (nuclear data, irradiation for insutrials)
FEST – Fluids Experiments and Simulations in Temperature (reactor physics activities)
PLASMA – Platform of micro-wave plasma reactor (materials, procedees)
Computing Grid – Tier2 (initially) for LHC and (now) beyond experiments

LPSC : facilities and infrastructures





LPSC : facilities and infrastructures

Plasma Reactor Facility

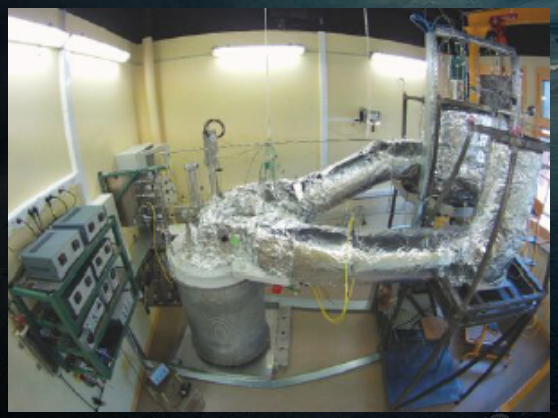
Research team

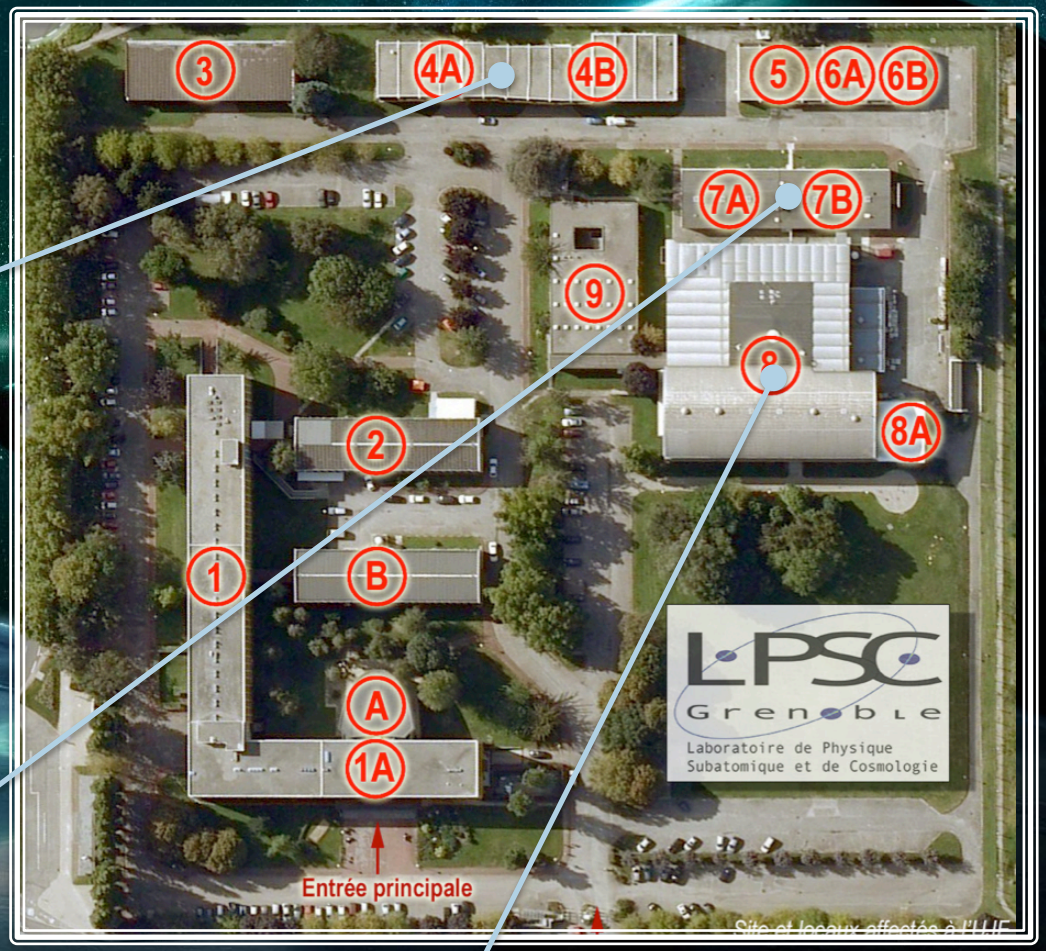
Plasma Reactor Hall

Chemistry Experimental Hall

Forced Fluorid Flux Liquid

Molten Salt Reactor Install.





Accelerator Experimental facility

Accelerator Beam Lines

Ion Sources installation

Neutron Source Platform GENESIS

→ research and irradiations

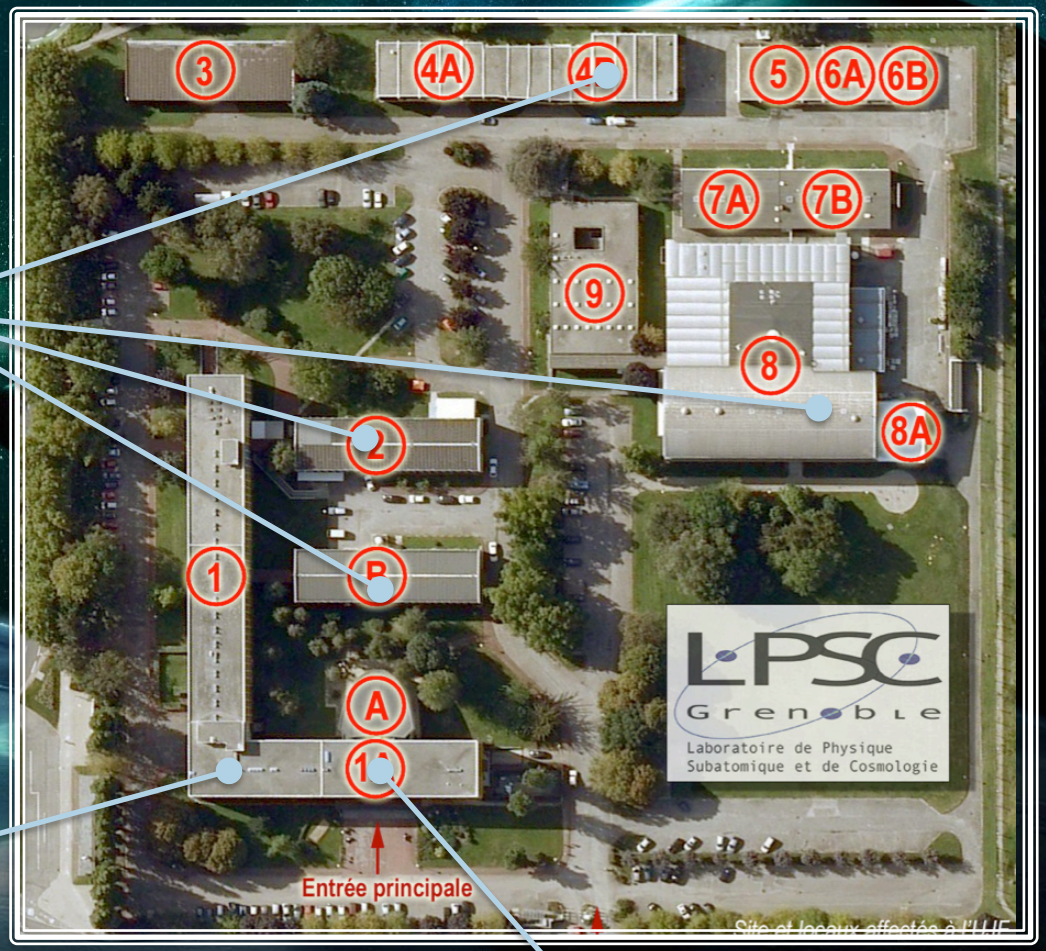
LPSC : facilities and infrastructures

Assembling Mounting Hall

Assembling & Mounting
Testing, integrating

Computing Center

Tier2 for LHC experiments
CPU : 83 servers,1200 cores,
Storage : 16 servers, 2 Po

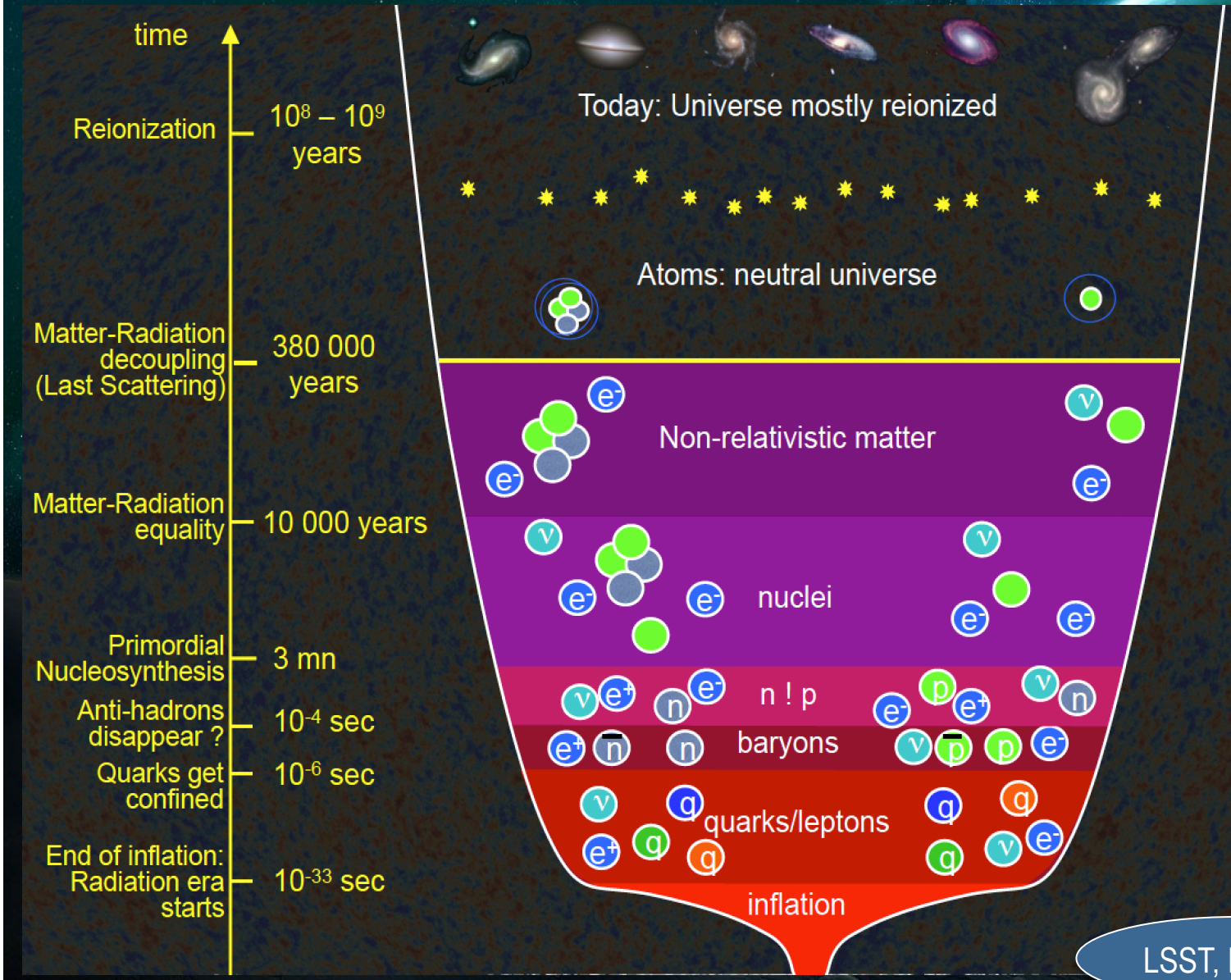


Academic Training Plateform

University, Eng. School, CNRS
Subatomic Physics & detection
400 student / year L-Master
Simulation of REP reactors


Outline
Laboratory presentation
Sciences at the LPSC
…Particle Physics & Hadronic Physics
…Astroparticle & Cosmology
…Accelerator, ion sources, plasma
…Nuclear for Reactor Physics & Medical Application
Technologies
cnrs
LPSC
Grenoble
Grenoble INP
UNIVERSITÉ
Grenoble
Alpes

I. Sciences at the LPSC



AMS/ CREAM

AUGER

NEWS

MIMAC

PLANCK

ALICE (LHC)

ATLAS (LHC)

LSST, EUCLID

I. Particle Physics

ATLAS team

Research fields : Higgs boson physics, Top quark physics, New Physics search (YY, Y-jet, DM)

ALICE team

Research fields : γ−Jet, γ−hadron correlations, b-flavoured jet reconstruction

Theoretical Particle Physics team

Research fields : Higgs boson Physics, New Physics search, QCD lattice, nuclear PDF

Ultra-Cold Neutron team

Project n(2)EDM : Search for neutron electrical dipolar momentum

STEREO Team

Research field : Sterile neutrinos search

ILC Project

Research field : prepraration for the next linear e+e- collider; higgs physics; calorimetry,

I. Particle Physics

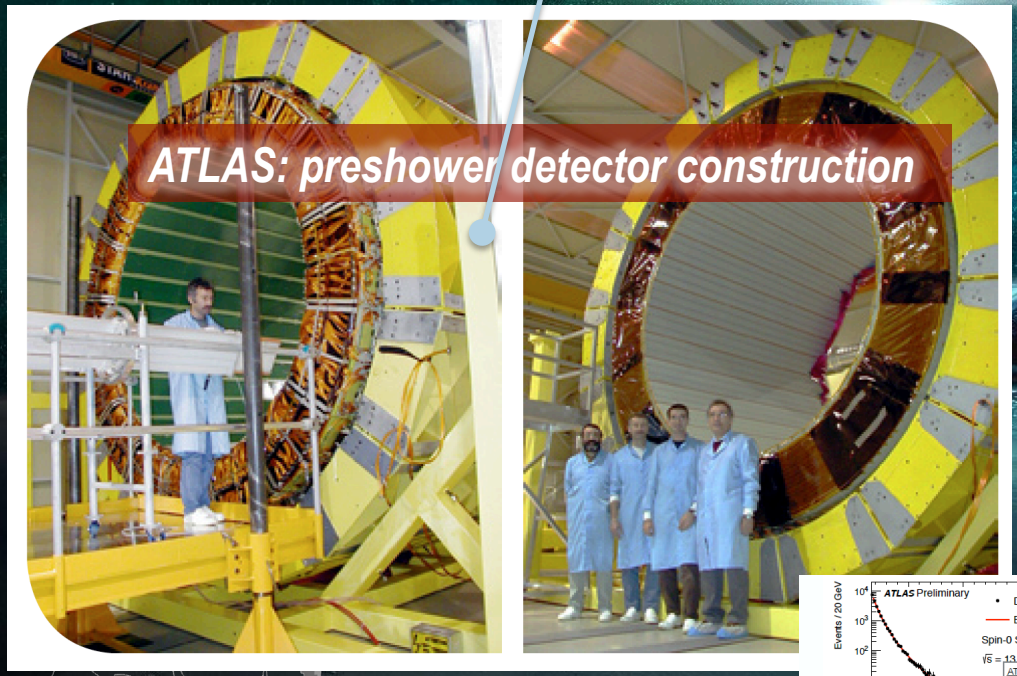
LHC experiment

ATLAS team …since 1983

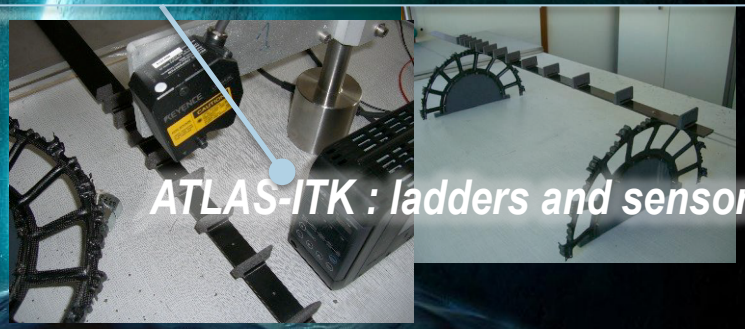
Research fields : Higgs boson physics, Top quark physics, Beyond SM search (top, γγ, γ+MET)

Main contributions : Preshower construction, calorimeter cryogeny, γ/e/jet reconstruction

Future Project : Internal Tracker / alpine config. sensors, module loading, validation

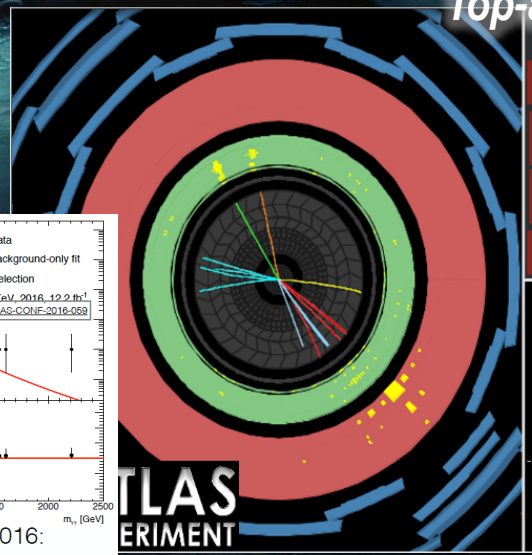


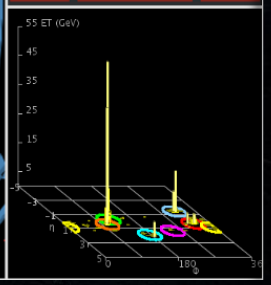
ATLAS: preshower detector construction

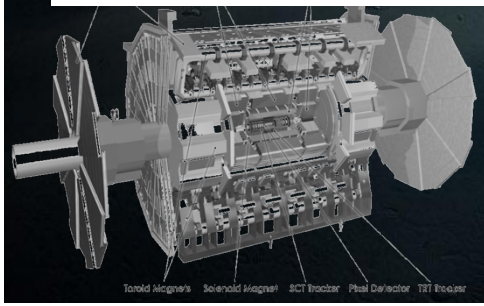


ATLAS-ITK : ladders and sensors

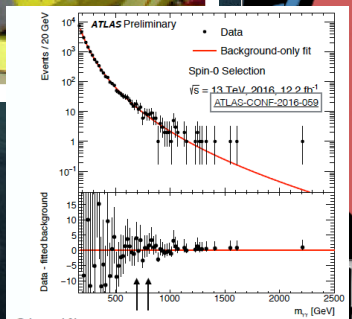
Top-antitop event







γγ-resonance search



Significance 2015+2016:
m=710 GeV (10% width)
2.3σ(local)/<1σ (global)

I. Particle Physics

LHC experiment

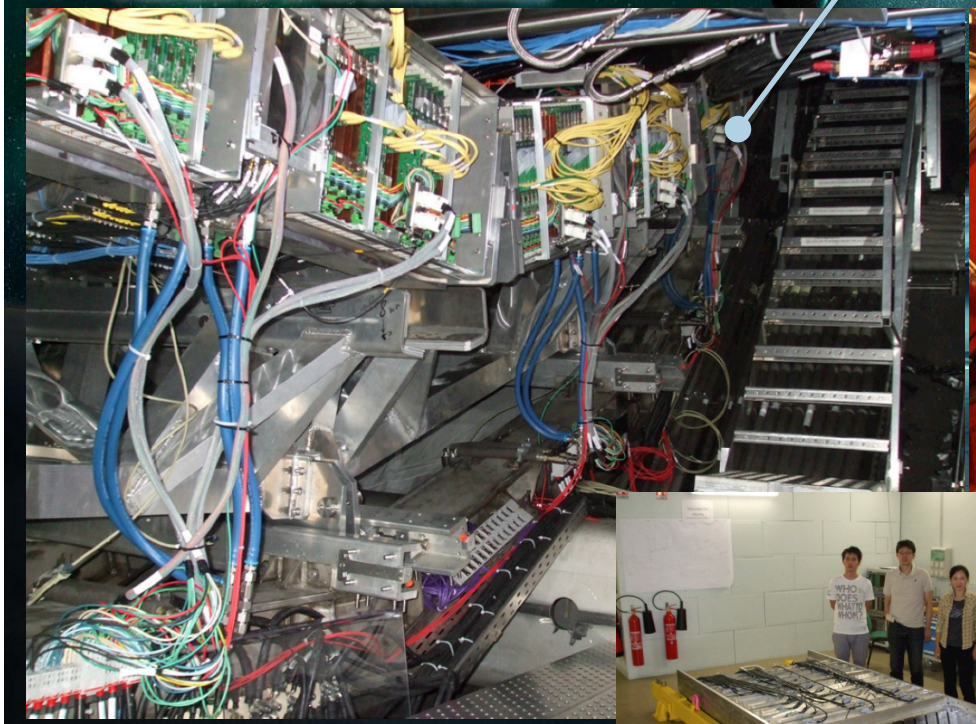
ALICE team **…since 2007**

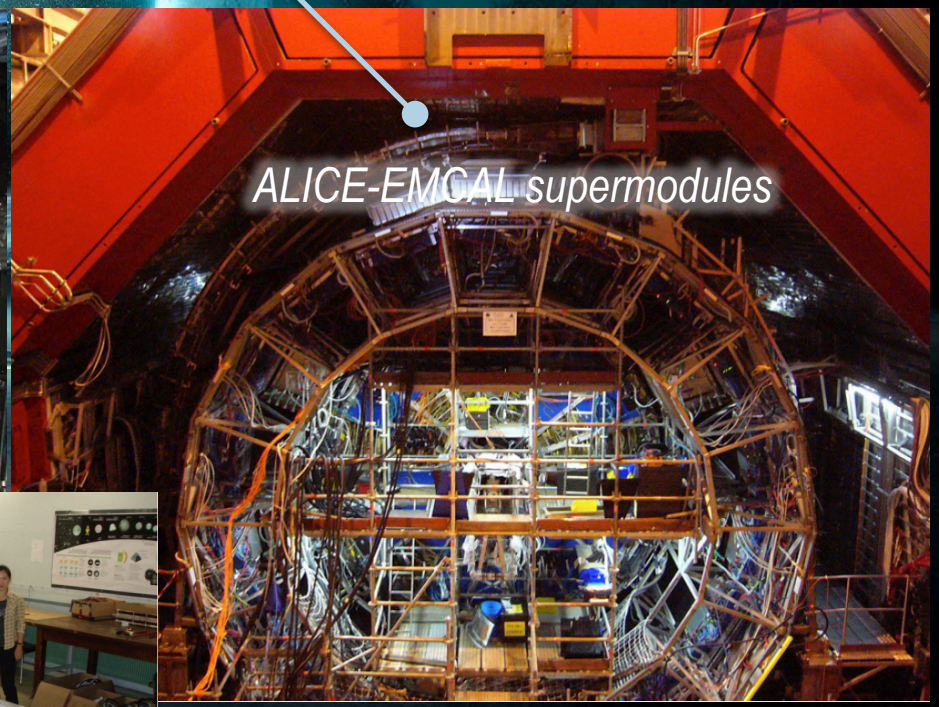
Research fields : γ−Jet, γ−hadron correlations, b-flavoured jet reconstruction

Main contributions : EMCal and Dcal assembling & mounting; Triggering & RO electronics ;

Future project : ALICE-O2 upgrade

ALICE-DCAL electronics





ALICE-EMCAL supermodules

ALICE-DCAL supermodules

I. Particle Physics

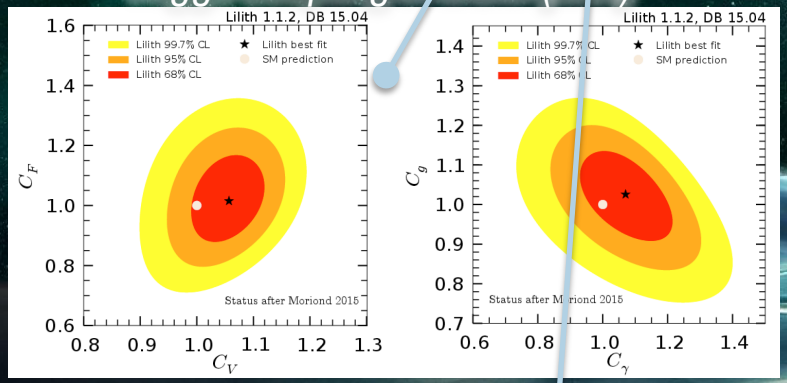
LHC experiment

Theoretical Particle Physics

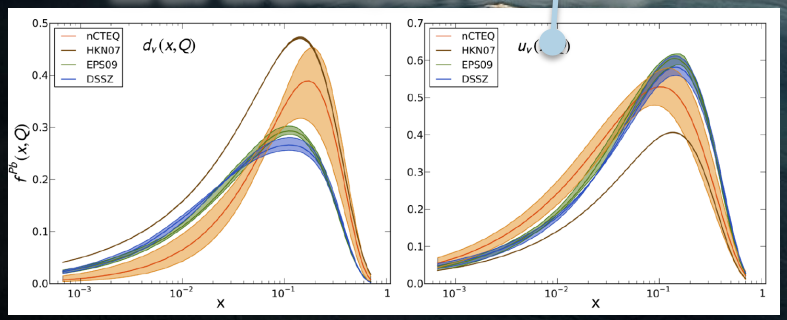
Research fields : Higgs boson Physics, 2HDM (effective theory approach), SUSY, GUT
nuclear PDF, QCD lattice, QCD precision measurement, DM search (EFT)

Main projects : iLHCTools, nCTEQ, SModelS, LiLith, DM-tools, QCD-lattice

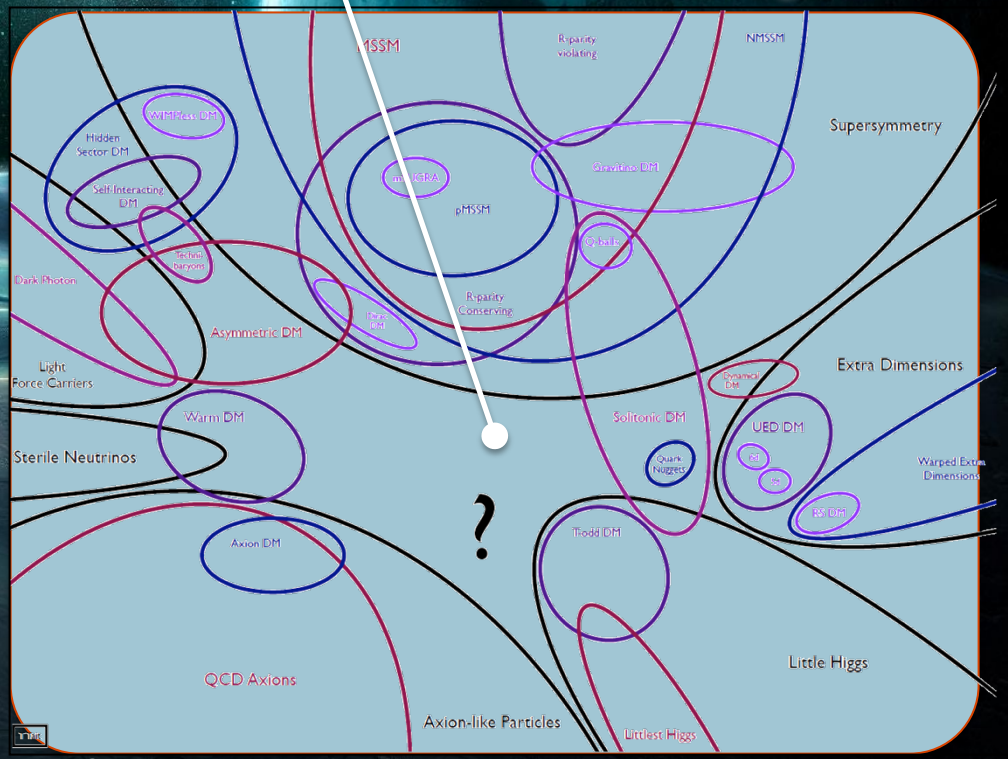
Higgs coupling in BSM (lilith)



nPDF in CTEQ for Pb nucleus



The DM puzzle…



Courtesy T. Tait

I. Particle Physics

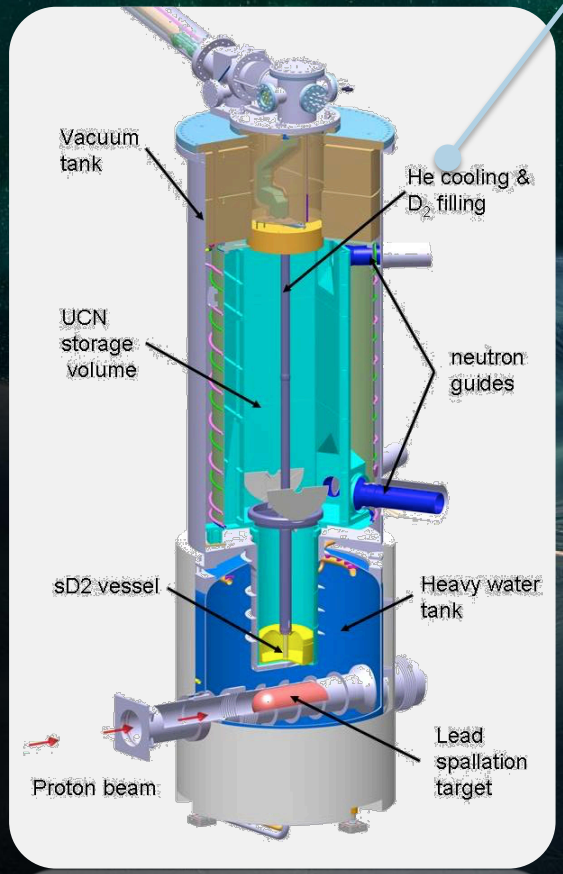
PSI / ILL

Ultra-Cold Neutron team

Research field : BSM physics, CP-violation, EDM as probe to EW baryogenesis / leptogenesis

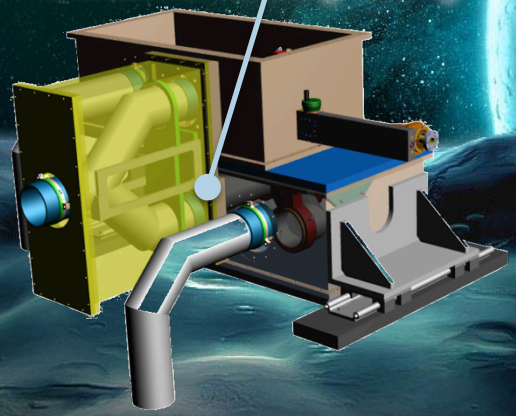
Experiment nEDM : Best limit on electrical dipolar momentum (<10^{-26} e.cm); syst on B-field;

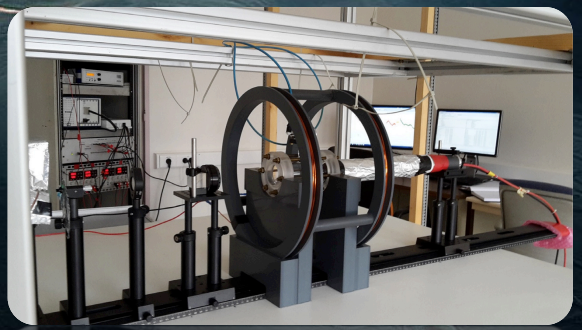
Project n2EDM : New UCN source; UCN switch, Hq polarisation chamber; Current source



UCN source (nEDM)

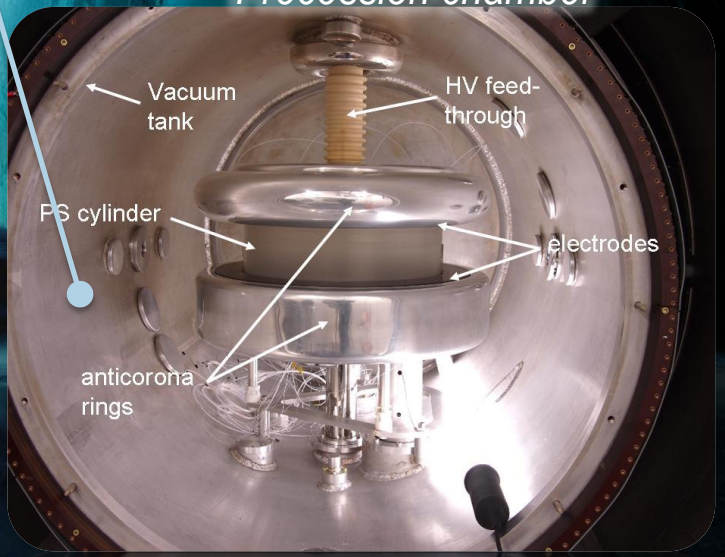
Switch for UCN (nEDM)





Co-magnetometry test bench

Precession chamber



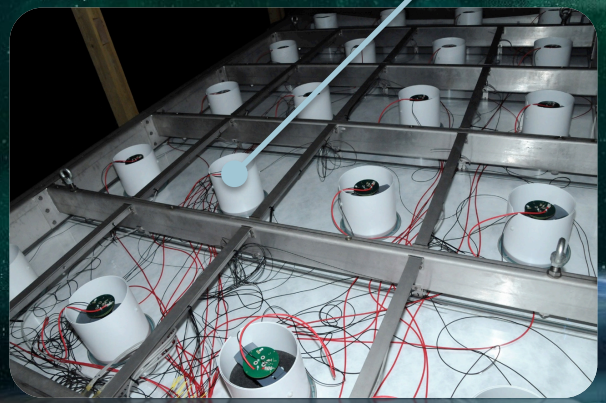
I. Particle Physics

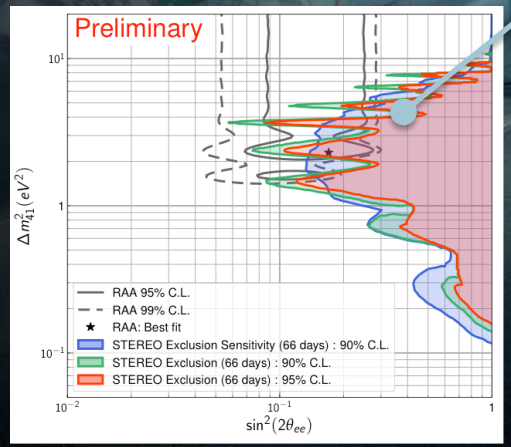
ILL

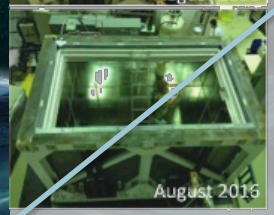
STEREO Team

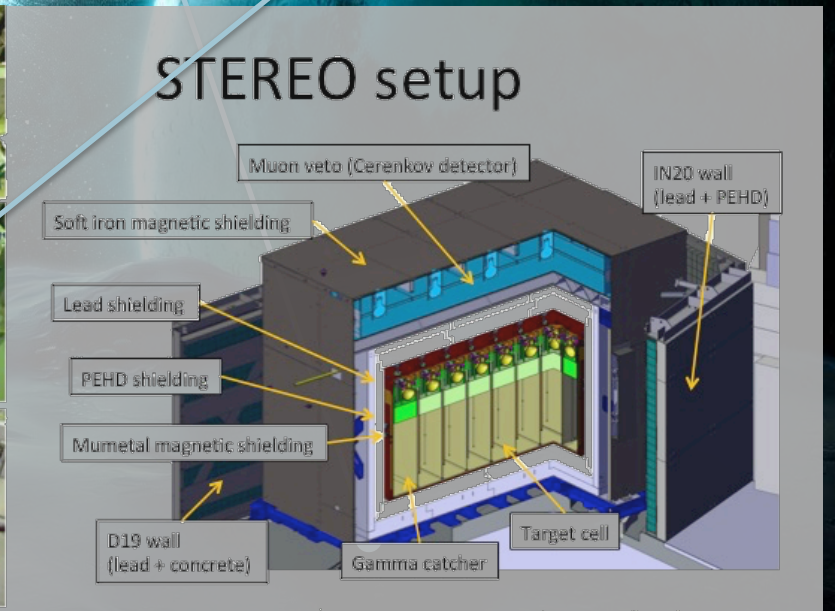
Research field : Sterile neutrinos search by measurement of reactor anti-ve flux

Main contributions : Muon veto construction ; assembling, mounting/commissioning of the detector; triggers and electronics; first exclusion limits ;









2. Astroparticle and Cosmology

AUGER team
Research field : UHE cosmic rays, Search for UHE photons, nature of CR (primary)

AMS-02 project
Research field : Search for antimatter in CR, nature of CR (primary)

PLANCK team
Research field : CMB as a probe to cosmology; use galaxy clusters as probe to cosmology;

NIKA team
Research field : Cosmology using galaxy clusters; KIDs development

LSST project
Research field : Dark matter, dark energy; cosmological constraints; BAO;

EUCLID project
Research field : Dark matter; cosmological constraint via galaxy cluster study;

MIMAC Dark Matter Projects
Research field : Dark Matter Direct Detection; low mass and high mass; directional;

2. Astroparticle and Cosmology

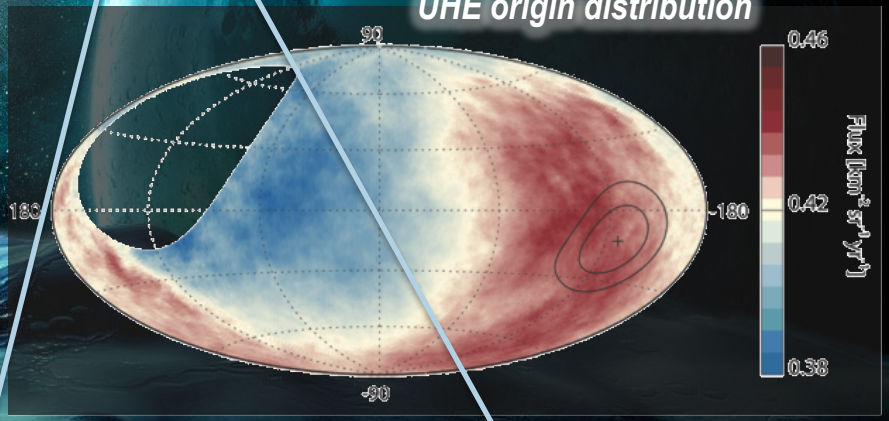
Cosmic Rays on ground

AUGER team

Research field : UHE (>10^{18}eV) cosmic rays origin & propagation; Search for UHE γ

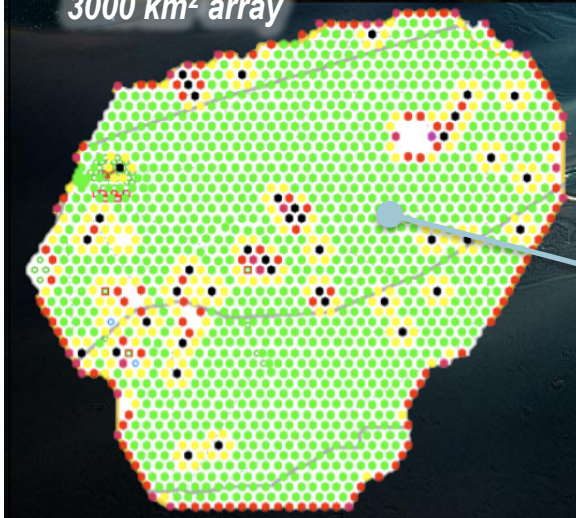
AUGER contributions : UHE CR distribution: Radio detection of showers;

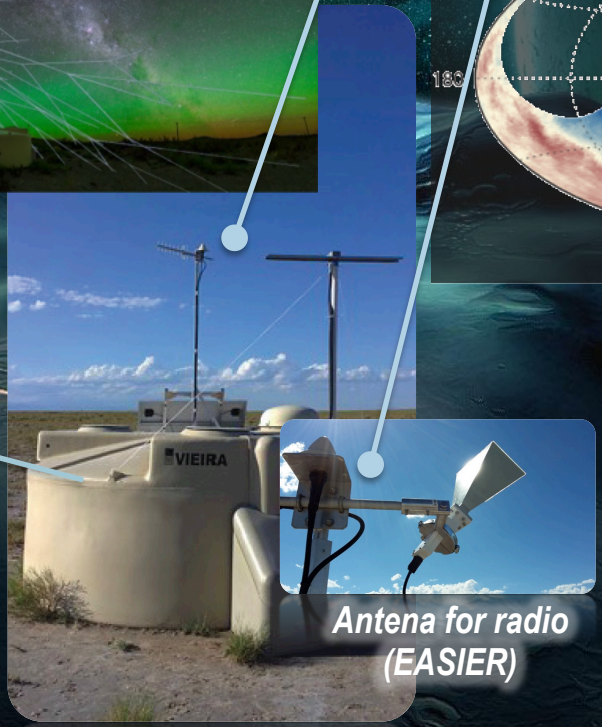
AUGER-PRIME : Construction of scintillator modules + FE electronics; nation. coordination



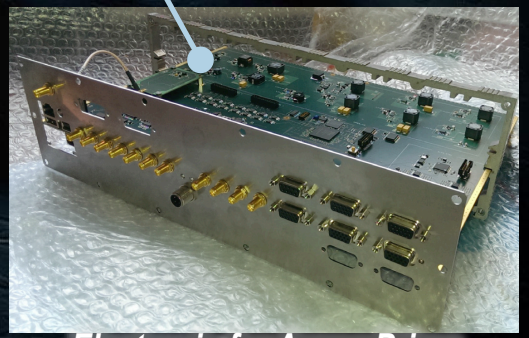
UHE origin distribution

3000 km^2 array





Antena for radio (EASIER)



Electronic for Auger-Prime Surface Detectors

2. Astroparticle and Cosmology

Cosmic Rays in space

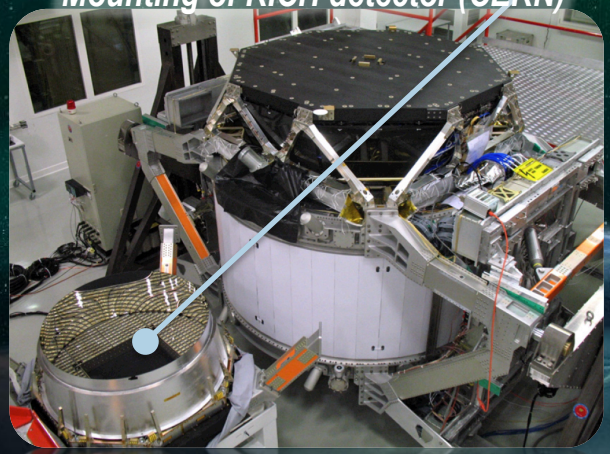
AMS team …since 1997

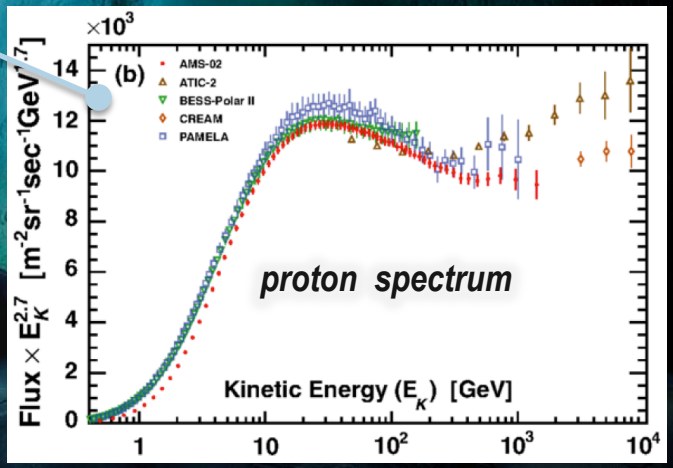
Research field : Search for antimatter in Gev-TeV CR, CR propagation

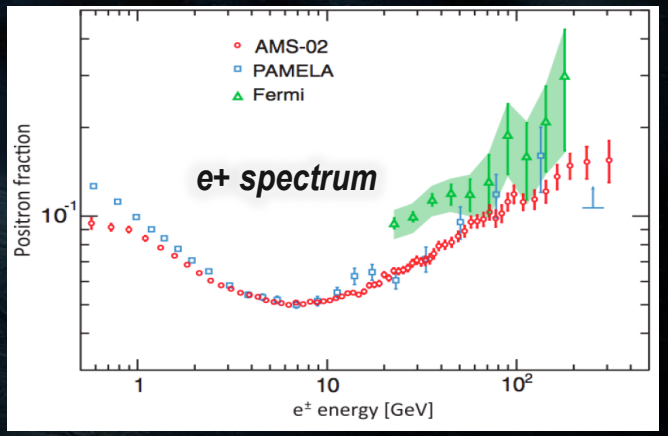
Instrumental contributions: Construction of Cerenkov detector & FE electronics in AMS-02

Scientific contributions : e+, p/H/C/O in primary CR, Li/Be/B in secondary, solar modulation

Mounting of RICH detector (CERN)







2. Astroparticle and Cosmology

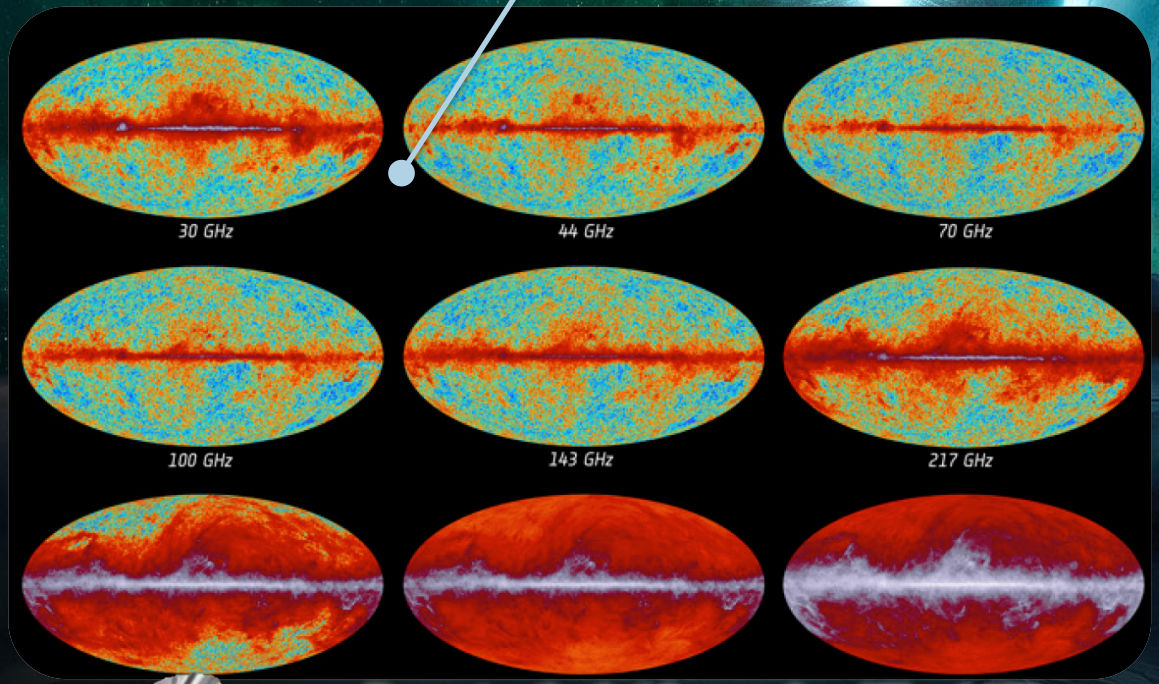
CMB Planck Satellite

PLANCK project

Research field : CMB as a probe to cosmology; use galaxy clusters as probe to cosmology;

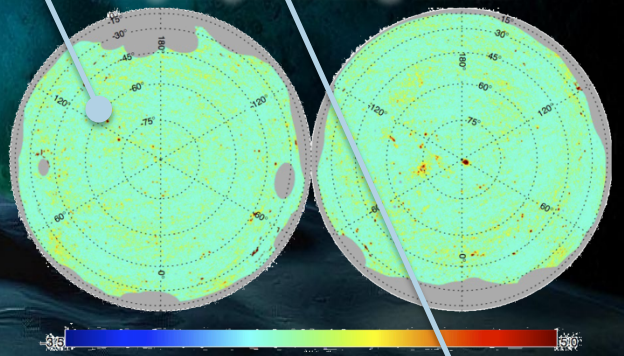
Main contributions : HFI data processing; HFI cooler electronics

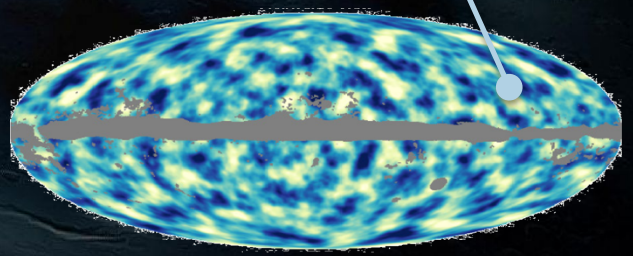
Scientific contributions : polar systematics; thermal SZ effects, CMB lensing B-mode analyse



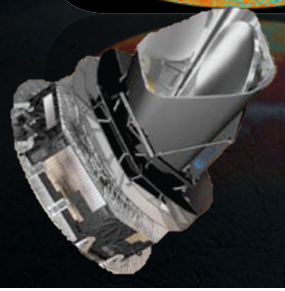
Reconstruction in 6 frequencies of Planck HFI

Compton parameter y via tSZ





Gravitational potential determined using gravitational lensing effects



2. Astroparticle and Cosmology

30m-IRAM telescope, Néel

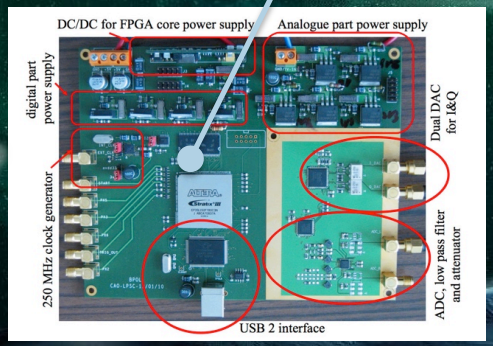
NIKA team

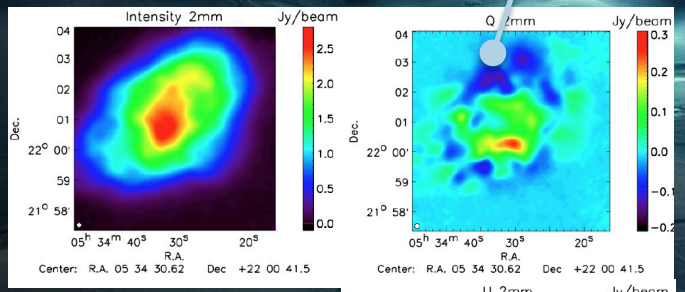
Research field : Cosmology using galaxy clusters;

Main contributions : Electronics for mm-wave polarised KIDs camera; processing pipeline;

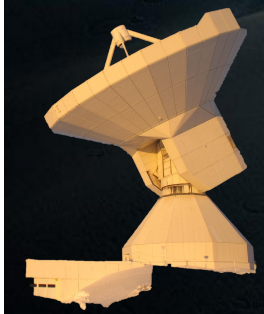
Scientific contributions : first polarization measurement; galaxy cluster analysis using tSZ

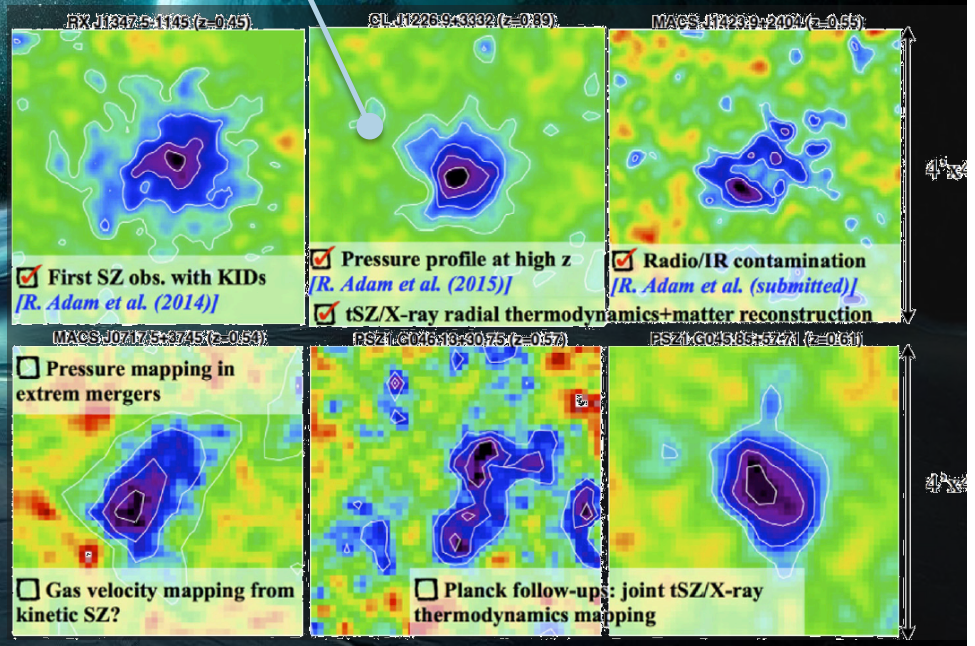
Electronics for KIDs RO





Reconstruction of Stokes parameters Using KIDs





Radial profils fpr galaxy cluster pression, density and mass

See Juan's talk later on…

2. Astroparticle and Cosmology

3 gigapixels camera Telescope

LSST project

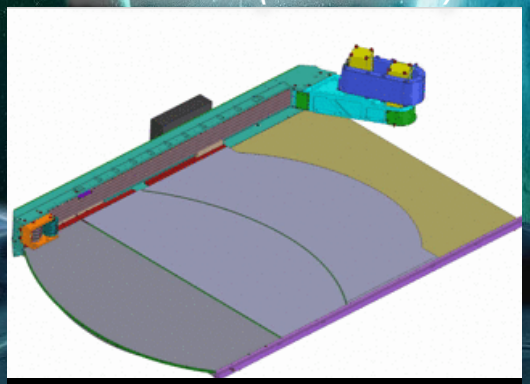
Research field : Dark matter, dark energy; gravitational lensing;

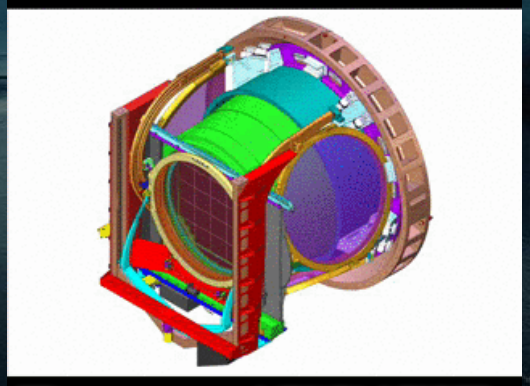
Instrumental contribution : Filter loader; Camera Calibration Optical Test Bench;

Scientific contribution : photometric-redshift reconstruction; simulation of BAO on photo-z;

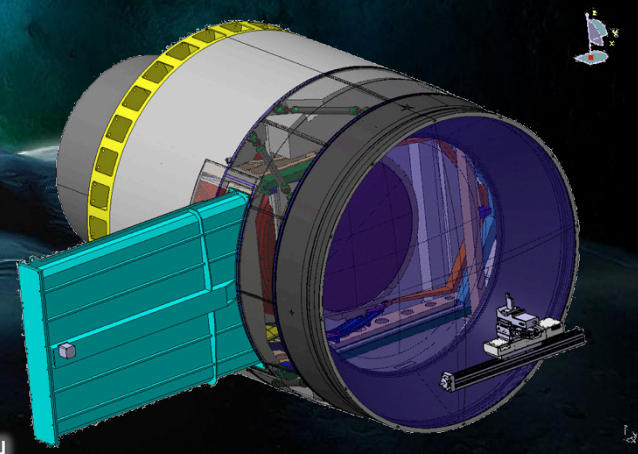
Filter loader

Filter loader (IN2P3-LPSC)





Filter carroussel (IN2P3-LPNHE)



Credit : LSST-DOE

LSST Camera Test Bench (CCOB)
(3.2 gigapixels, 2.8 t)

2. Astroparticle and Cosmology

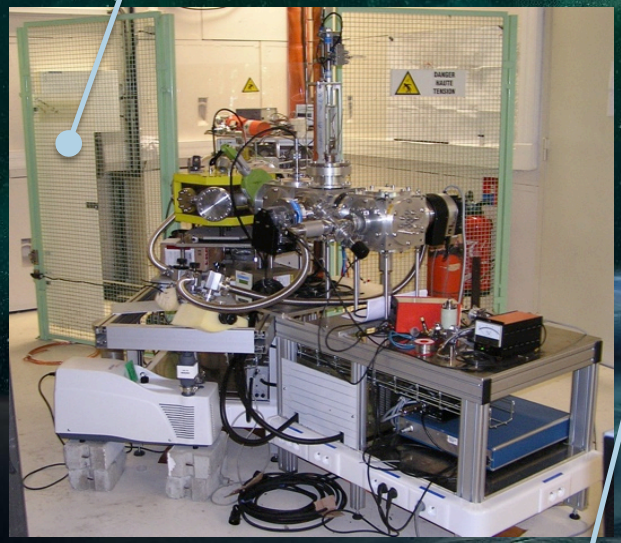
Underground laboratory LSM

MIMAC project

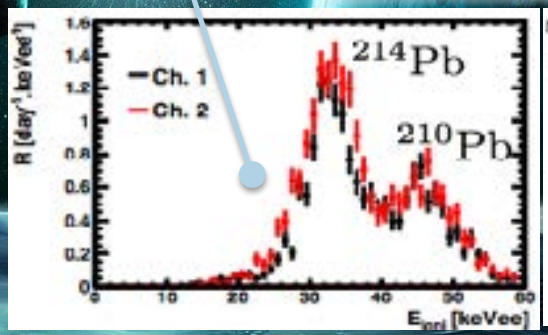
Research field : Directional Direct detection of Dark matter, for neutron vs WIMP separation

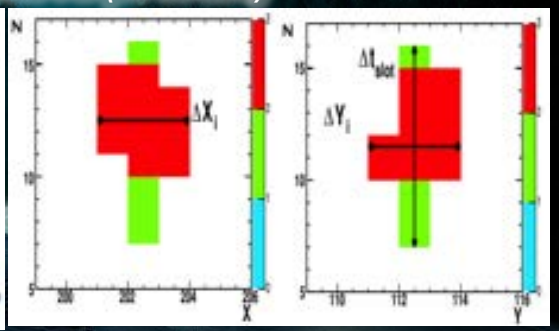
Original R&D : Development of pixelised MicroMegas Matrix track chamber; Anode RO w/ time

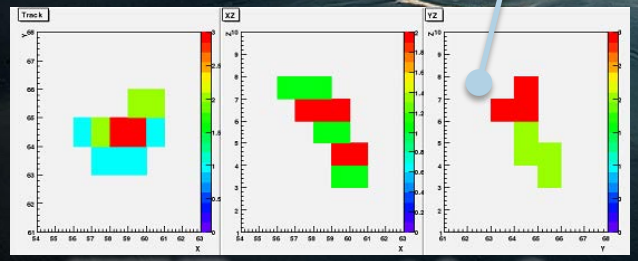
Achievements : 3D-Measurement of nuclear recoil energy (ionisation) & direction (few 10 keV)



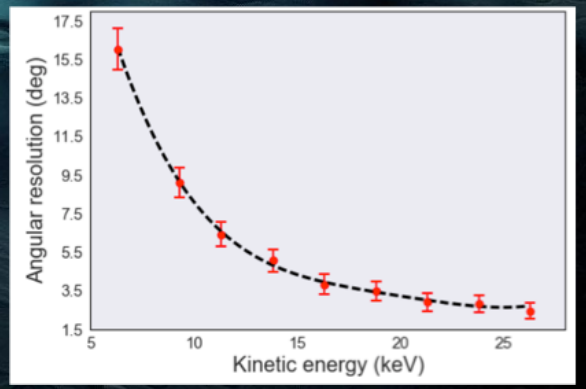
Nuclear recoil for Pb (30-50 keV)







XY, XZ, YZ mesurement of recoil From a neutron of 8 keV



Angular resolution on tracks as f(E)

3. Nuclear for Energy and Health

Nuclear Reactor team

Interdisciplinary Mission framework of CNRS (CEA, IRSN EDF, …)

Medical Application team

Regional synergies with hospital, ESRF, ILL and national coll (ARONAX, GANIL)

3. Nuclear for Energy and Health

Nuclear Reactor team

European program FP7, Interdisciplinary Mission framework (CEA, CNRS, IRSN,EDF)

Transmutation : Accelerator Driven System, Guinevere

→ Contributions to Myrrha program

Solid state fuel, Thorium cycle:

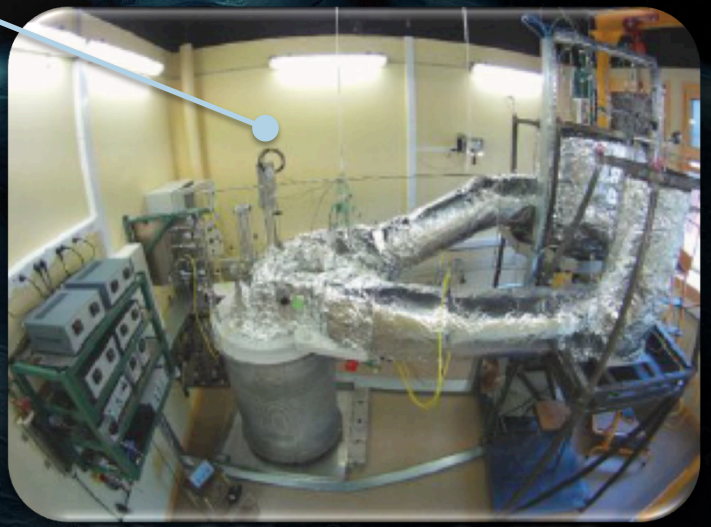
→ Scenarios, Thorium fuel cycle

Reactors of 4th generation" :

→ Molten salts, Thorium, design by safety

Experimental activities : nuclear data, FFFER for molten salt research (ILL, GANIL, etc.)

Original Design of the Molten Salt Fast Reactor
And associated thermic-neutron thermic studies



Molten Salt loop operated at 600° C

3. Nuclear for Energy and Health

Medical Application team

Local synergies with hospital, ESRF, ILL and national coll (ARONAX, GANIL)

Beam Profiler : collaboration with Hospital Center CHU-Grenoble and ESRF

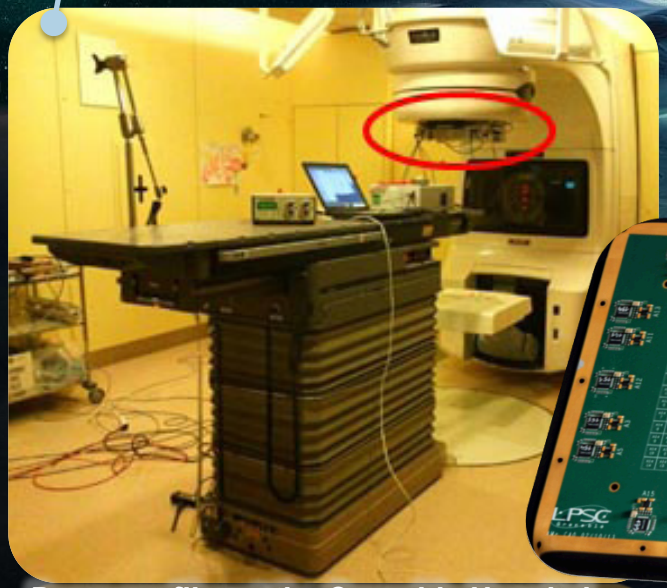
→ Main dévelopments in Grenoble : IN2P3 & MI2B, INSERM, ILL

Beam Monitoring for hadron-therapy

→ Developments around diamond detectors & its electronics

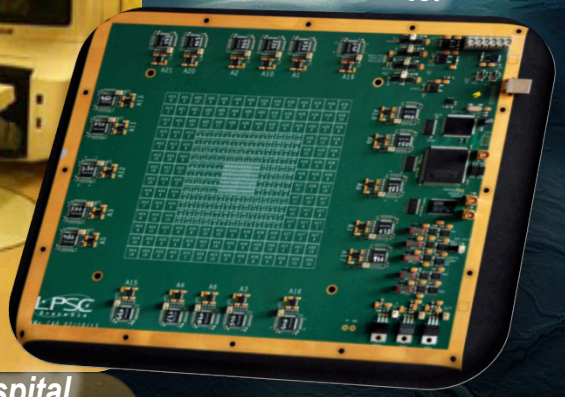
ABnCT as innovative therapy

→ Developments around high-intensity flux neutron Source

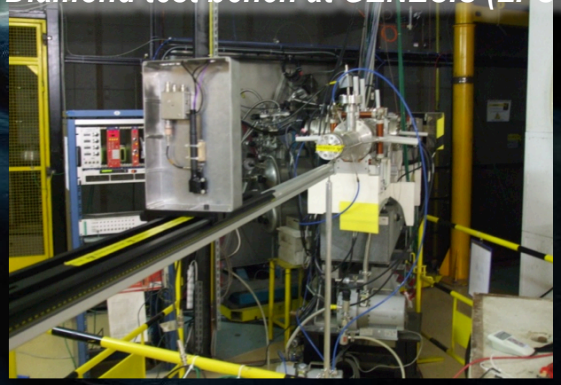


Beam profiler at the Grenoble Hospital

TraDeRa detector



Diamond test bench at GENESIS (LPSC)



4. Accelerator, ion sources and Plasma

Accelerator and ion sources team

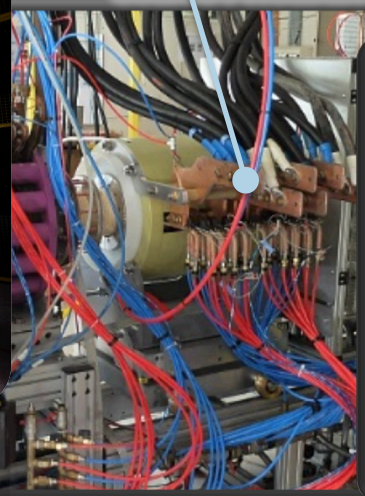
Accelerator in European FP7-H2020 framework and national program context

- Low Energy Beam Transport line for ADS project (MYRRHA, Mol in Beligum)
- Source of pulsed neutrons beam for irradiation and nuclear data : GENESIS platform
- Power Coupling devices for Spiral-2 (GANIL program)

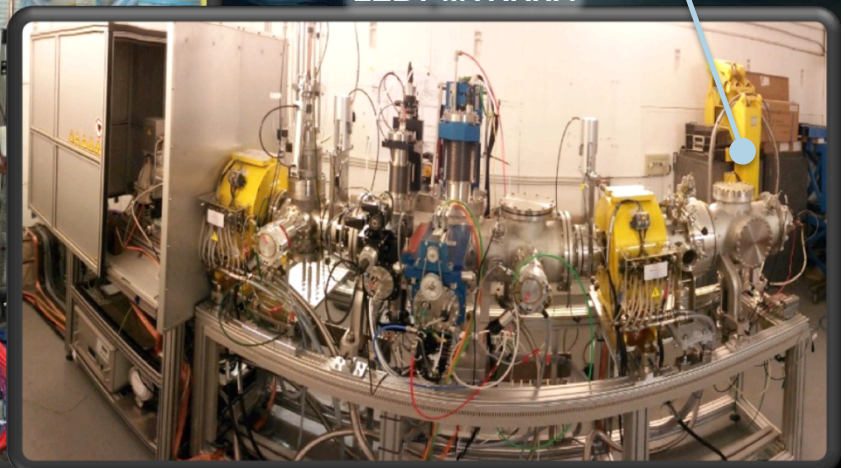
Ion sources, ECR, boosters

- Ion sources for Spiral2 at GANIL : PHOENIX V2 and V3
- Charge Booster 1+n+
- High frequency ECR ion sources (5.8 GHz, 60 GHz)

GENESIS platform



Source PHOENIX V3



LEBT MYRRHA


Outline
Laboratory presentation
Sciences at the LPSC
Technologies
…Present and future Research & Technologie

3. Technologies : present and future at the LPSC

Neutron Detectors … from Darka Matter experiments

MIMAC –Fast N : Neutron spectrometry (incident energy & location of neutrons)
(patents 2017) Detection range : incident neutron in 10 keV – 200 MeV
COMIMAC : Modular Measurement of quenching factor

Kinetic Inductance Detectors… from astrophysics projects

Cryogenic millimetric detectors for astrophysics & beyond – Collaboration Néel, IPAG, IRAM
Instrumental contribution : Readout electronics (NIKA, NIKA2, etc..)
→ SEE Juan Macias 's Talk for details !!

Diamond based detector for beam monitoring in hadron therapy

Alternative to scintillating fiber hodosope at a few MHz with <100 ps resolution
Diamond detectors : polycristal vs monocristals bench;
Instrumental contribution : Metalization of thin electrods by PCVD; (5x5 to 20x20 mm) surface
Readout electronics; measts of resolution (40 ps) on ESRF;

R&D on high intensity (epi)thermal neutron flux production …from new neutron therapy

Alternative to reactor facility for neutron Capture Therapy
At stake: Design of Li, Be targets on proton (deuton) beam

“I don't know the future.

I didn't come here to tell you how this is going to end. I came here to tell how it's going to begin.”

a late XXe american philosopher