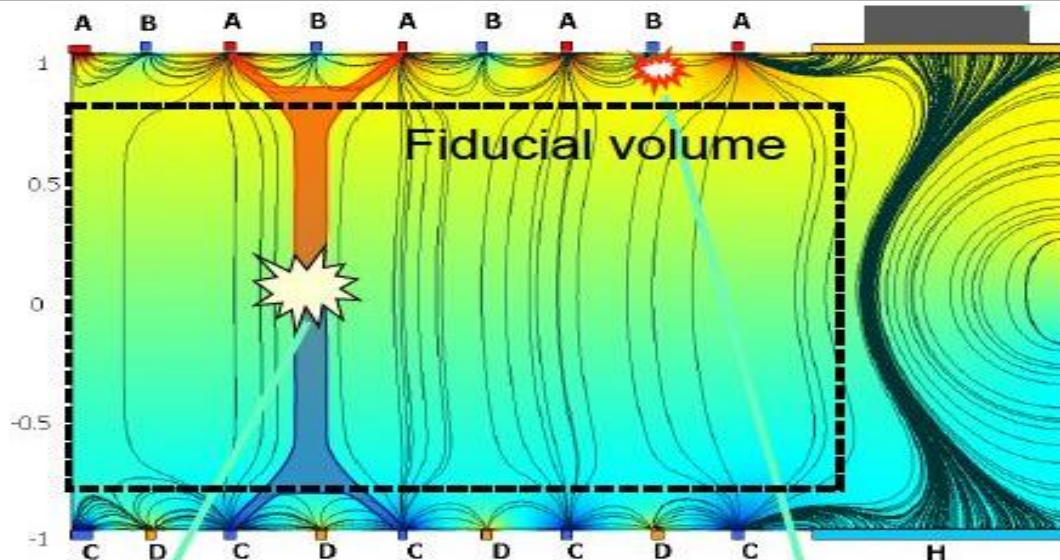


Searching for WIMPs at the EDELWEISS experiment by optimization of the background reduction

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Overview

- **Introduction**
- **The EDELWEISS Experiment**
- **Special methods of background reduction**
- **Results of phase II**

Introduction

■ Candidates for DM:

■ Barionic DM (MACHOS/RAMBOS)

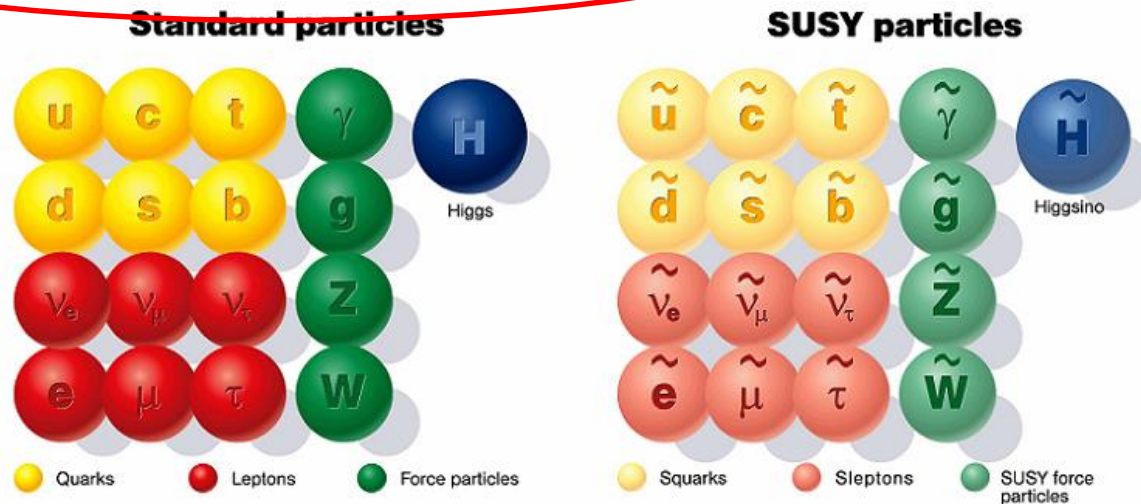
Problem: calculated part too small

■ Hot DM (Neutrinos)

Problem: no small scale structures possible

■ Cold DM (WIMPS)

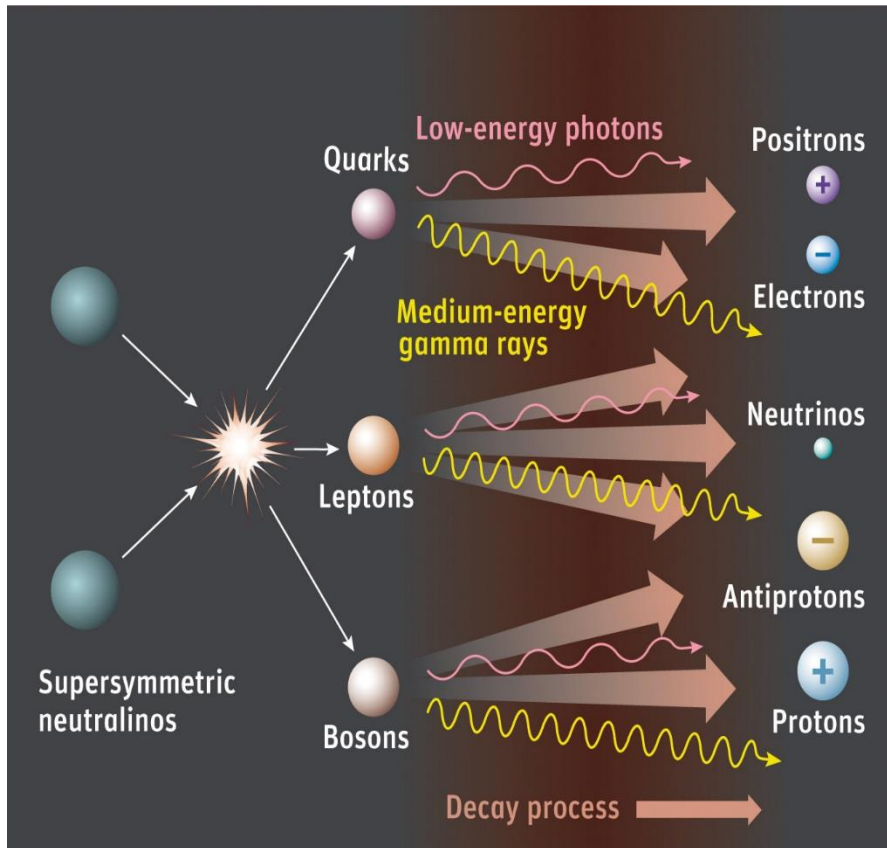
possible candidates: SUSY particles



http://www.physics.gla.ac.uk/ppt/images/susyparticles_sm.png

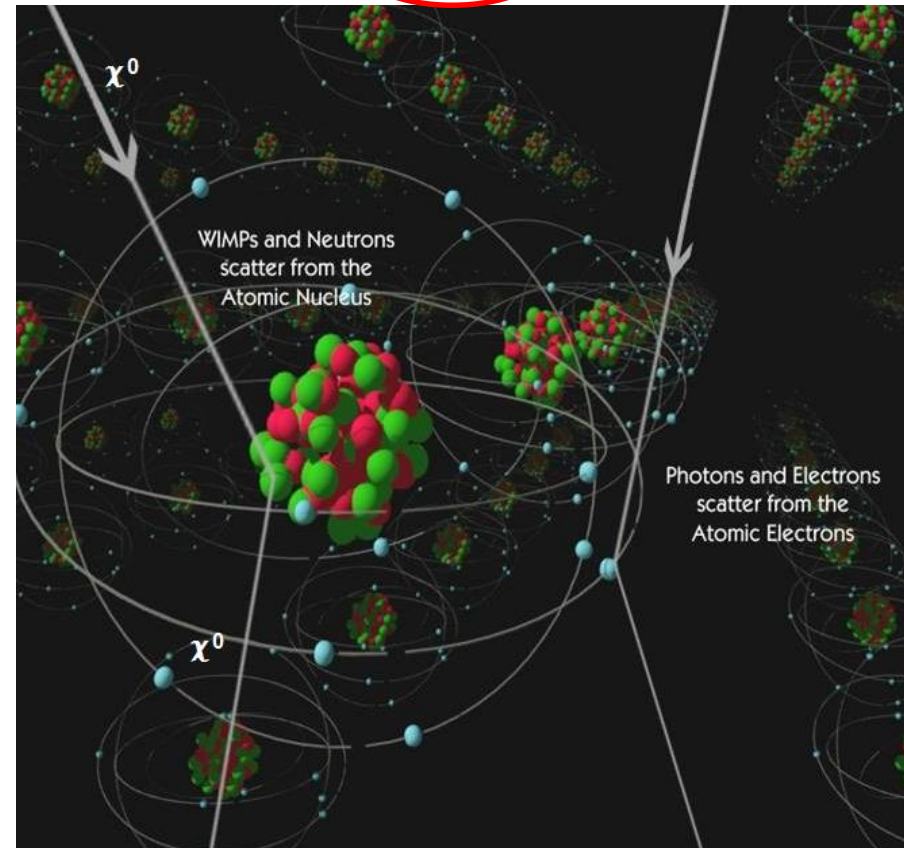
■ Possibilities to detect WIMPs

indirect

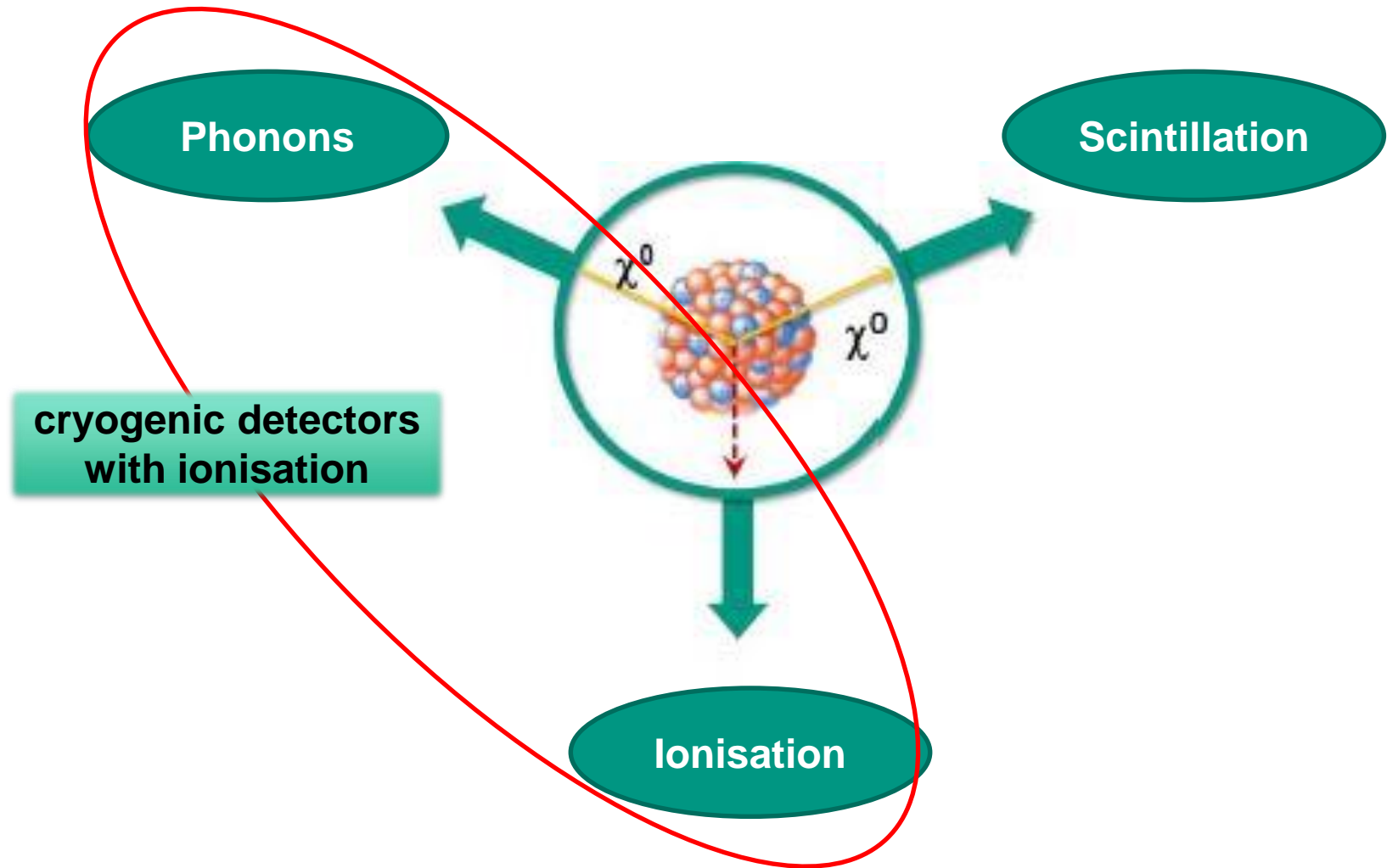


<http://cdn.zmescience.com/wp-content/uploads/2013/02/positron.jpg>

direct



<http://cdms.berkeley.edu/Education/DMpages/science/images/NucRecoilAtoms.jpg>



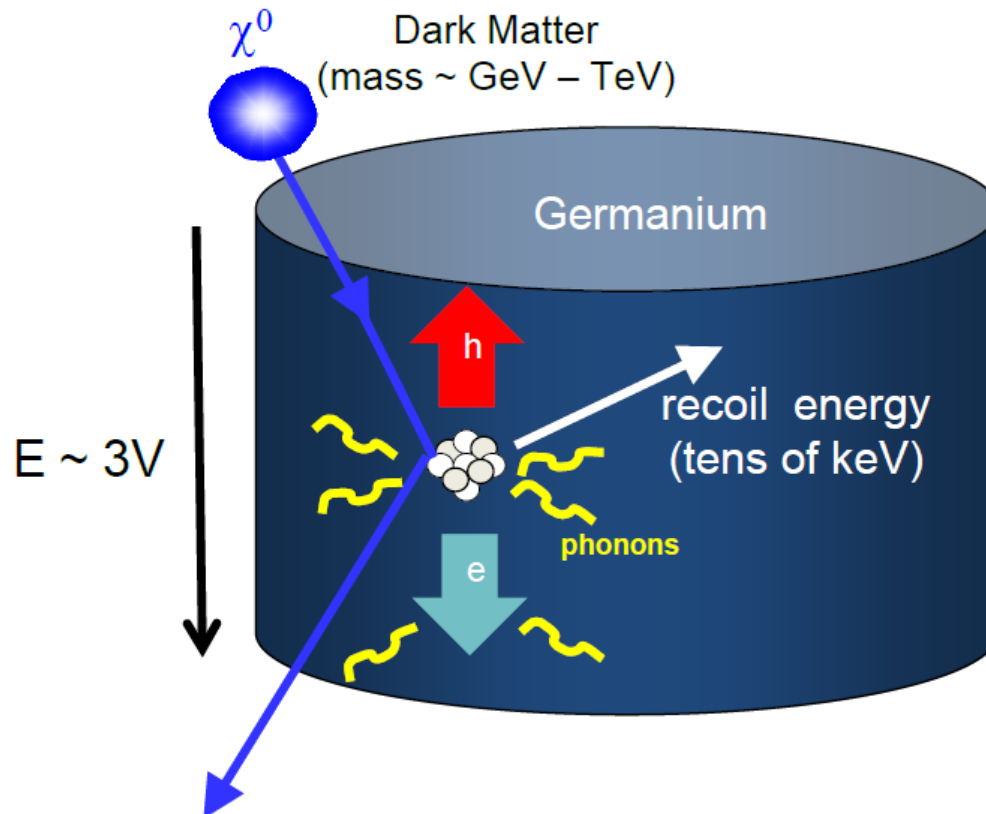
The EDELWEISS Experiment

- Place: Laboratoire Souterrain de Modane in the tunnel of Fréjus, 1800 m beneath the ground (\triangleq 4800 m water equivalent)



http://www-lsm.in2p3.fr/images/site/carte_modane04.gif

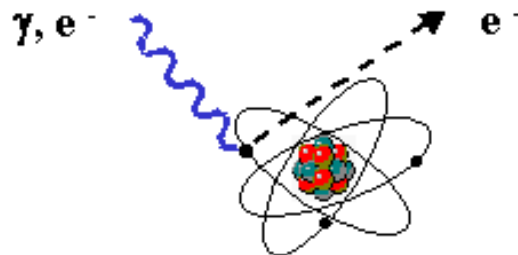
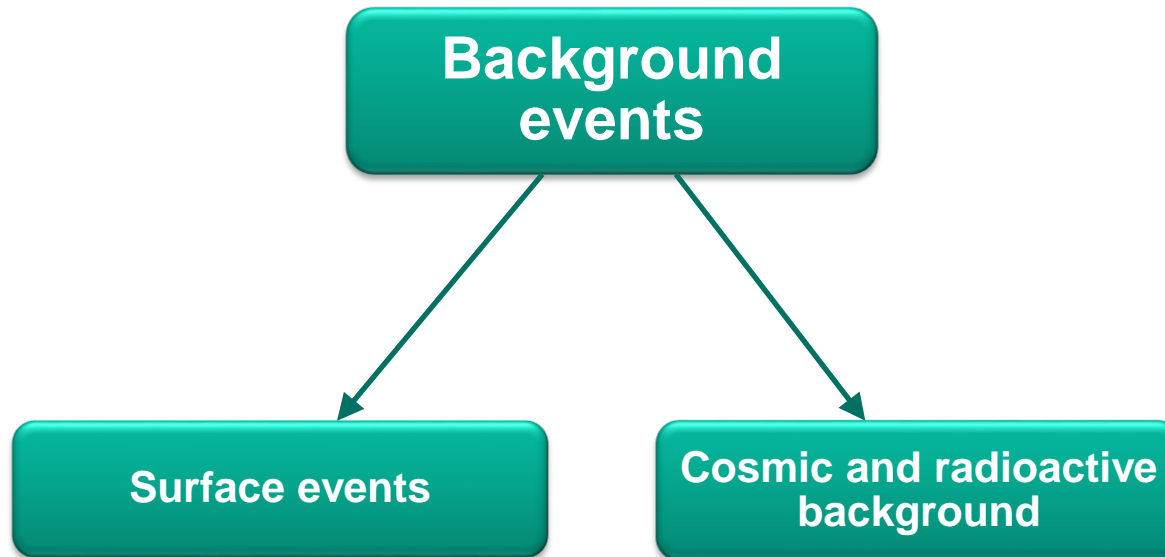
- **Place: Laboratoire Souterrain de Modane in the tunnel of Fréjus, 1800 m beneath the ground (\triangleq 4800 m water equivalent)**
- **Phases:**
 - **EDELWEISS I (2000-2004): 3 detectors with 320 g each**
 - **EDELWEISS II (2008-2010): 10 detectors with 400 g each**
 - **EDELWEISS III (2014-2017): 40 detectors with 800 g each**
- **Method: Detector array of Germanium low-temperature bolometers (~ 15mK)**



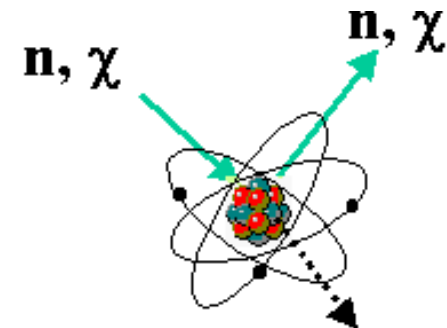
<http://kipac.stanford.edu/kipac/sites/default/files/images/project-images/DM.png>

- **Method: Detector array of Germanium low-temperature bolometers ($\sim 15mK$)**





electronic recoil : background

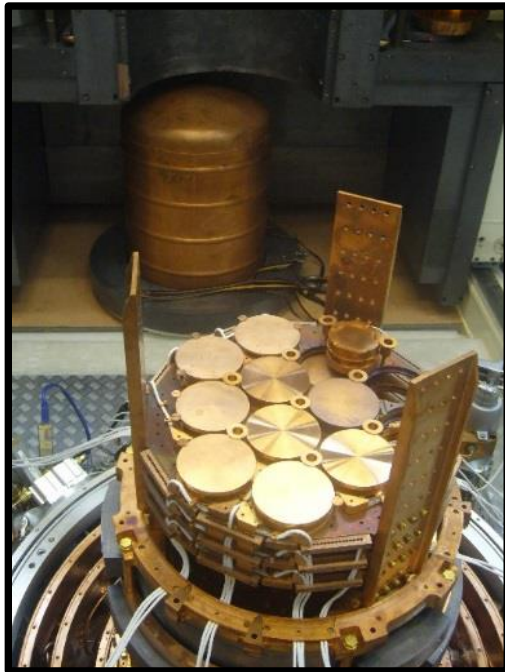


nuclear recoil : signal

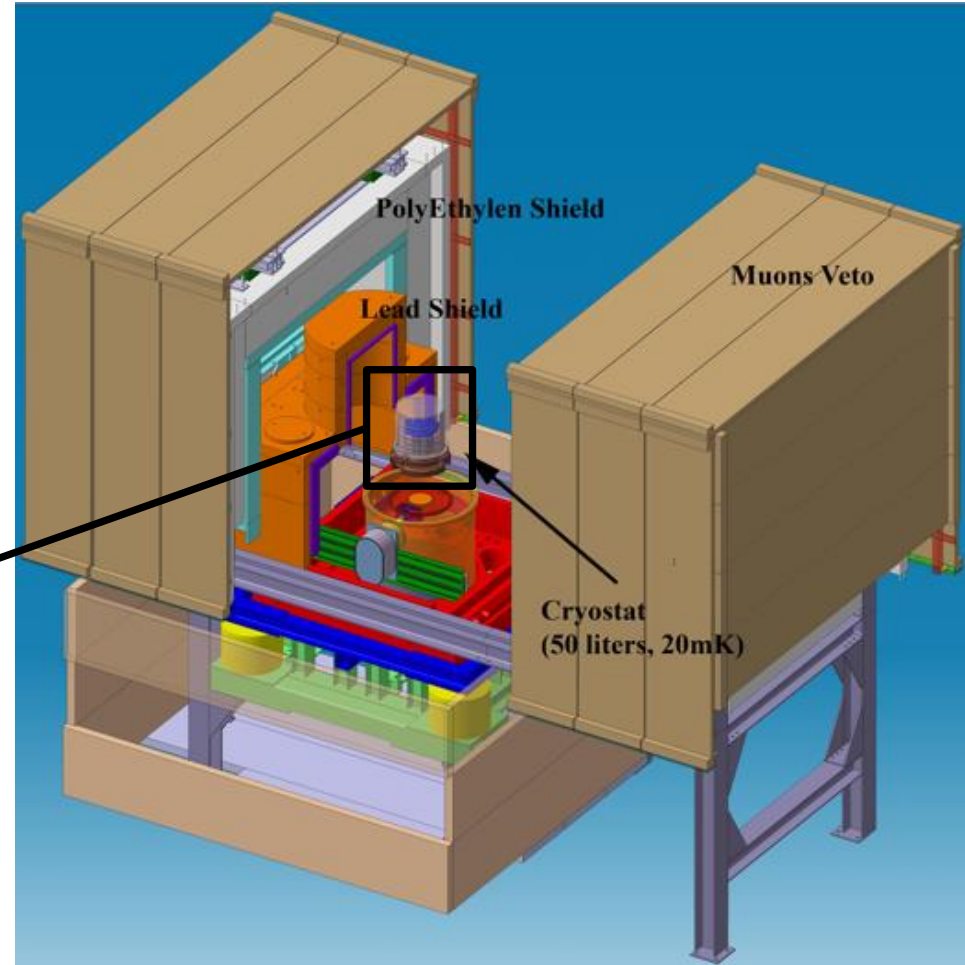
<http://edelweiss.in2p3.fr/Publications/Docs/IAUPOSTER.GIF>

Structure of the EDELWEISS Experiment

- Lead Shield (20 cm)
- PolyEthylen Shield (50 cm)
- Muons Veto



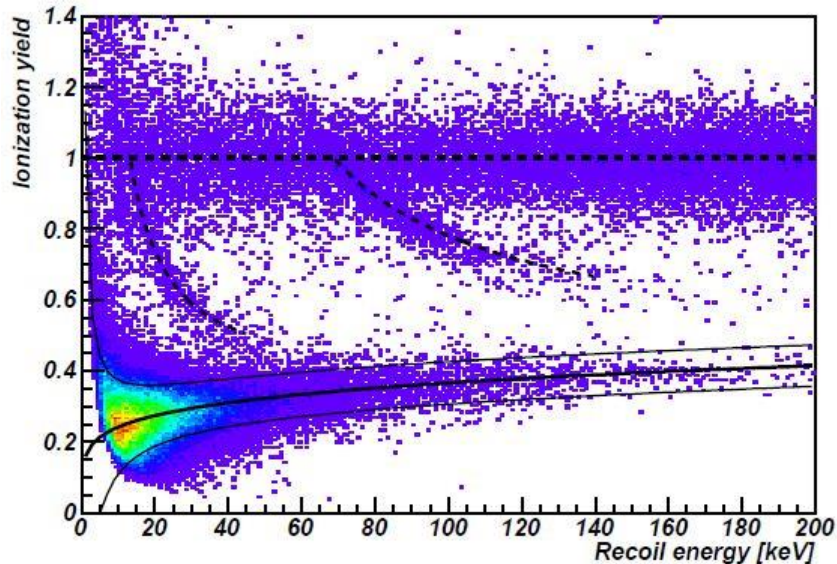
http://edelweiss.in2p3.fr/Presentation/Images/Images_EDW.zip



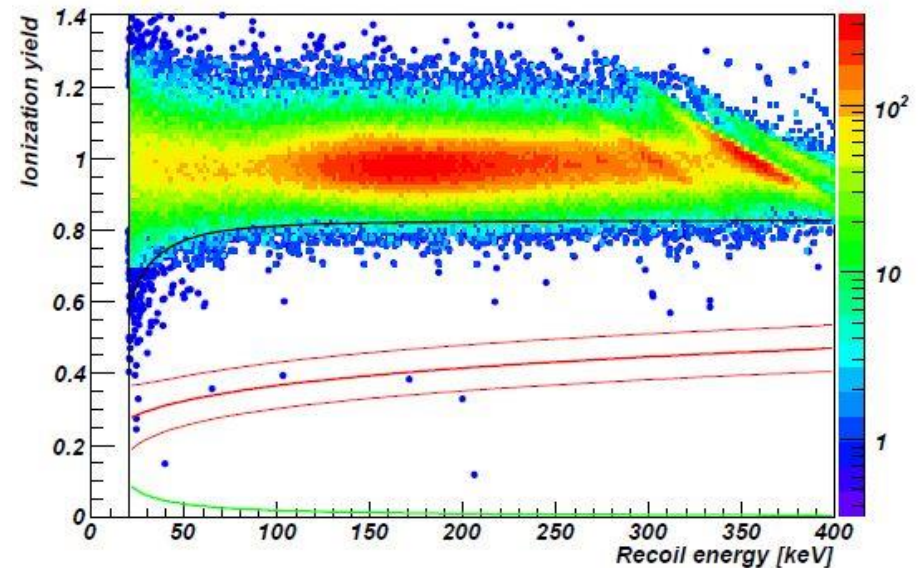
http://edelweiss.in2p3.fr/Presentation/Images/generalview_edw2.png

Special methods of background reduction

■ Calibration



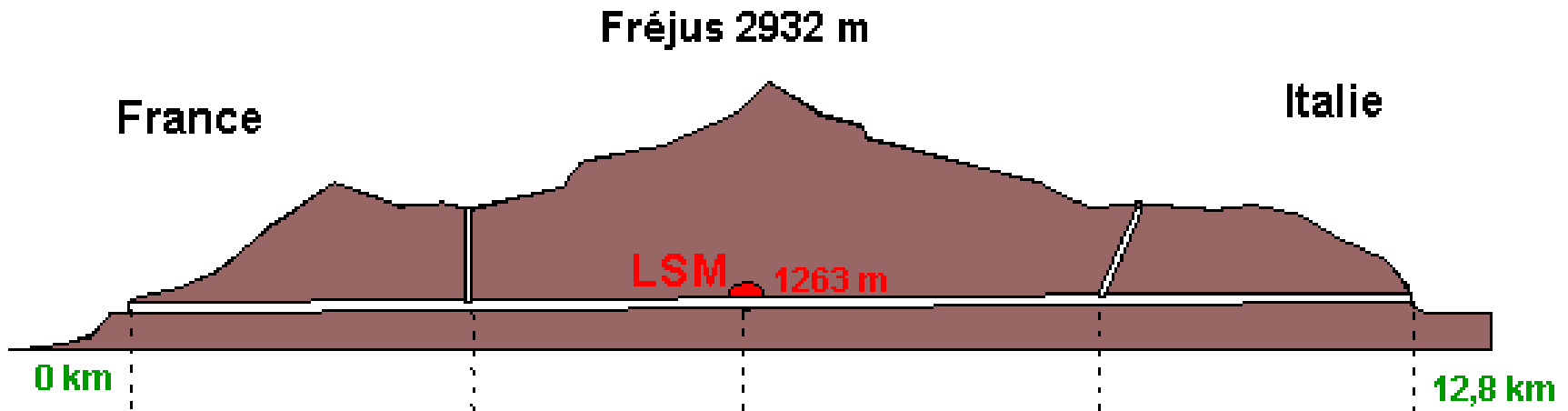
Neutron calibrations for all Ge-ID detectors



γ -ray calibrations for all Ge-ID detectors (¹³³Ba)

Armengaud et al.: Final results of the EDELWEISS-II WIMP search using a 4-kg array of cryogenic germanium detectors with interleaved electrodes (2011)

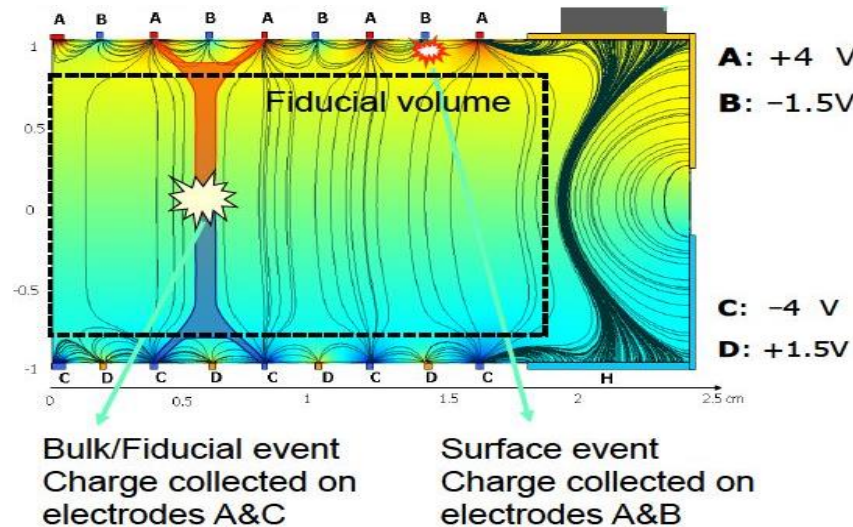
- **Cosmic and radioactive background**
 - **Shielding through rock and muons veto**



http://irfu.cea.fr/Images/astlmg/919_3.gif

- **Time distribution into hourly intervals**
- **Filtering of coincidence events**
- **GEANT4-Simulations based on the calibration**

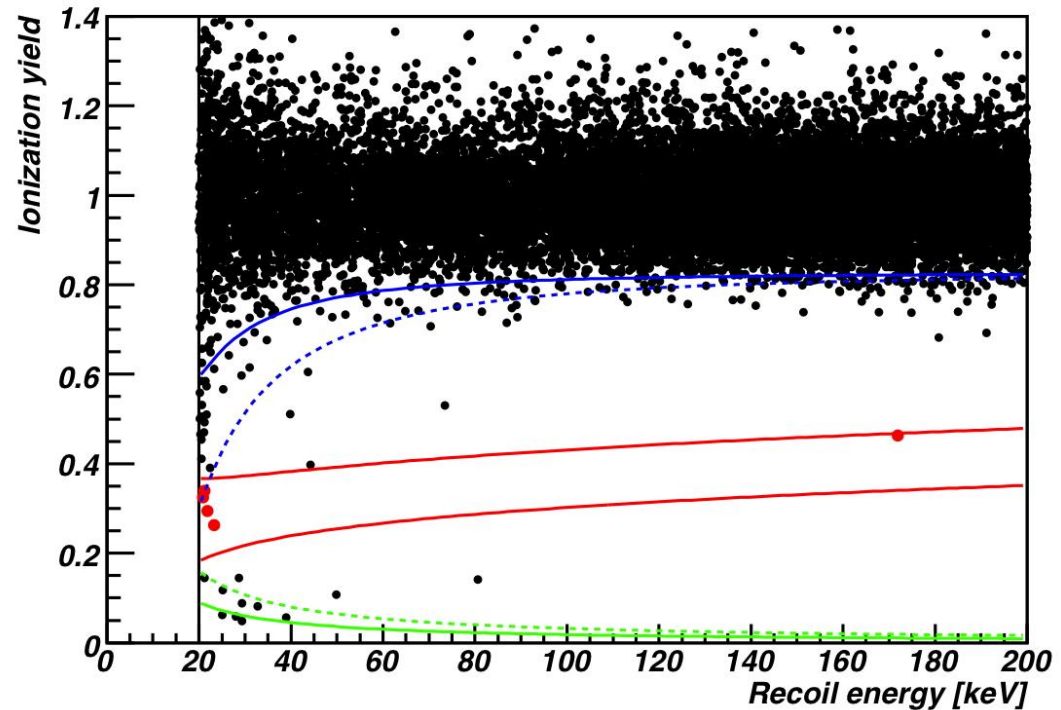
- **Surface events**
 - **Interleaved structure**
 - **Combination of the electrode signals**
 - **Combination of thermal sensors and electrodes**
 - **Interdigit sensors**



All in all this yields an estimated background of less than 3 events in 384 kg*d

Results of phase II

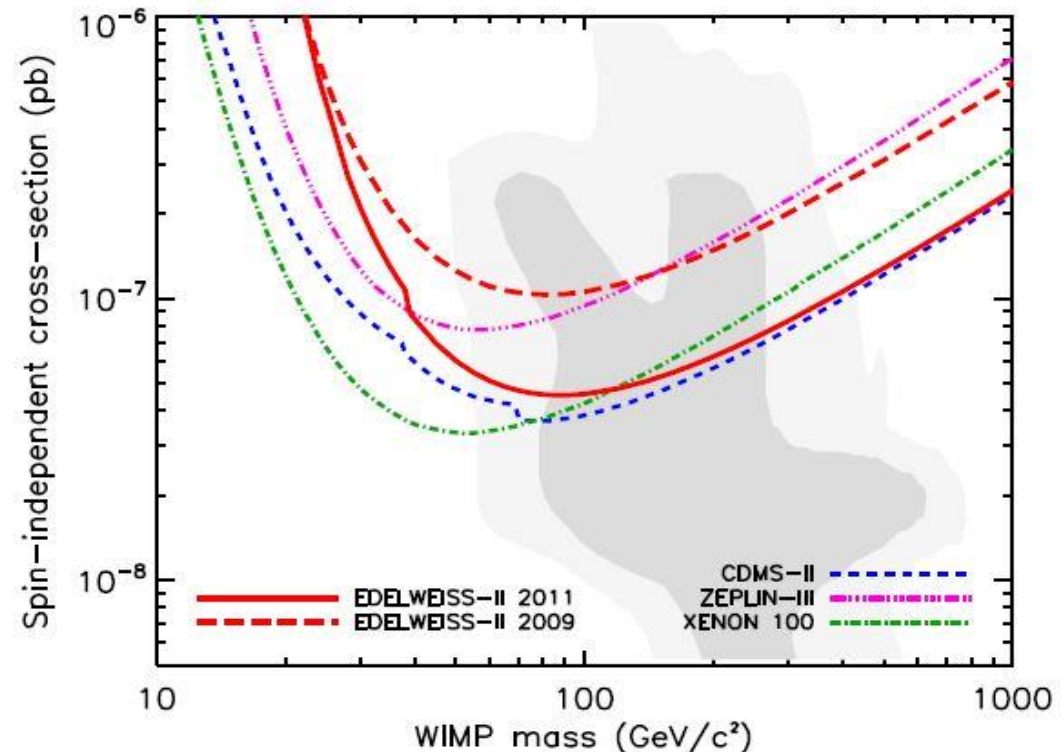
- Two runs with 384 kg*d (effective exposition)
- 5 possible WIMP events



Armengaud et al.: Final results of the EDELWEISS-II WIMP search using a 4-kg array of cryogenic germanium detectors with interleaved electrodes (2011)

Results of phase II

- Two runs with 384 kg*d (effective exposition)
- 5 possible WIMP events
- Cross-section limit at 90% CL: $4.4 \cdot 10^{-8}$ pb



Armengaud et al.: Final results of the EDELWEISS-II WIMP search using a 4-kg array of cryogenic germanium detectors with interleaved electrodes (2011)

Thanks for your attention!



Sources

- <http://edelweiss.in2p3.fr/index.php>
- Search for low-mass WIMPs with EDELWEISS-II heat-and-ionization detectors, *Phys. Rev. D*
- Final results of the EDELWEISS-II WIMP search using a 4-kg array of cryogenic germanium detectors with interleaved electrodes, *Physics Letters B*