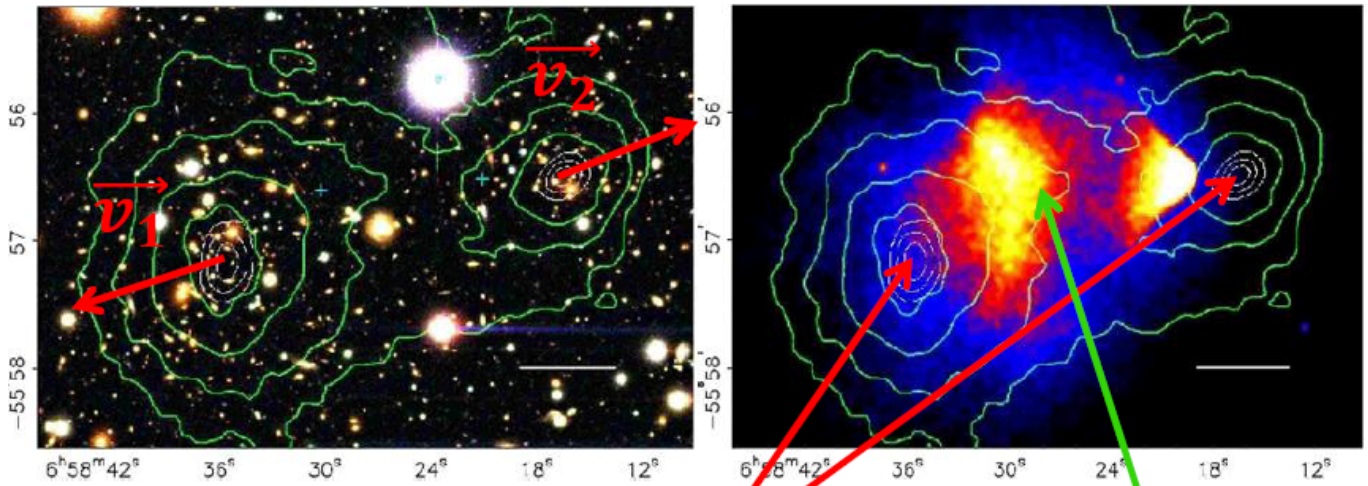
Introduction aux prospectives LPSC 2015-2020 sur la

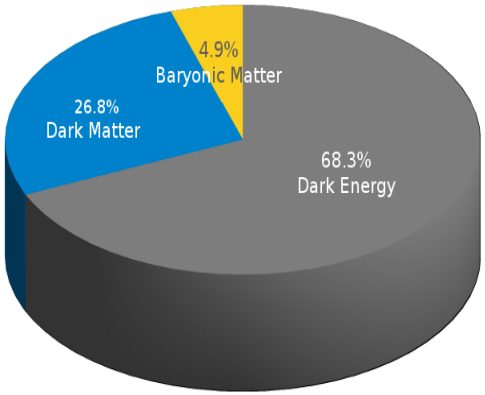
MATIERE SOMBRE (NOIRE)



Collision de l'amas de la balle
D. Clowe et al 2006

Masse

Matière baryonique

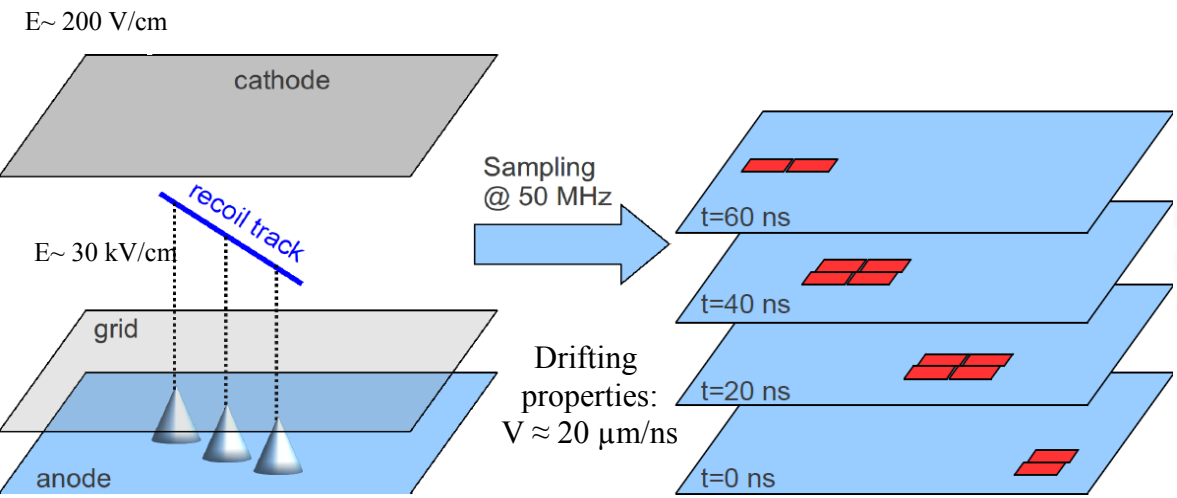


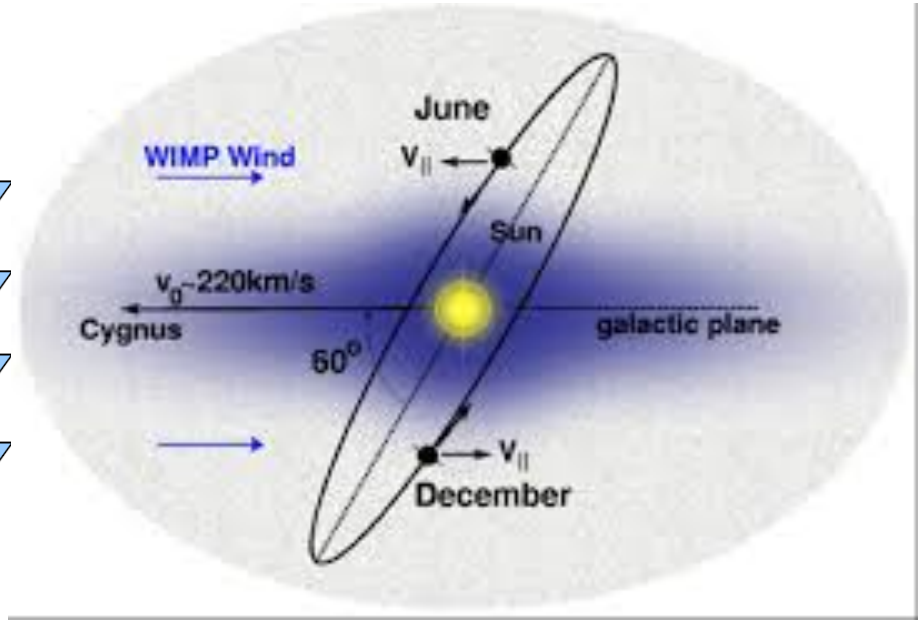
26,8% de la masse de l'Univers = MATIERE SOMBRE

1/ MIMAC : Micro-tpc Matrix of Chambers

Laboratoire Souterrain de Modane, CPPM, IRFU, LPSC

- Détection DIRECTIONNELLE





Module test en opération au LSM depuis 2012

Collaboration MIMAC- FRANCE

- LPSC (Grenoble) : D. Santos, Q. Riffard (Ph.D), F.Naraghi, C. Couturier (PostDoc ENIGMASS)
- Coordination Technique : O. Guillaudin
- - Electronique : G. Bosson, J. Bouvier, J.L. Bouly,
- L.Gallin-Martel, F. Rarbi
- - Data Acquisition: T. Descombes
- - Mechanical Structure : Ch. Fourel, J. Giraud
- - COMIMAC (quenching) : J-F. Muraz
- Valorisation : N. Sauzet (IR ENIGMASS)

- IRFU (Saclay): P. Colas, E. Ferrer-Ribas, I. Giomataris
- Rui de Oliveira (Cern)
- CCPM (Marseille): J. Busto, D. Fouchez, C. Tao (Tsinghua (China))

Letter of Intent to CJPL about space for MIMAC dark matter directional detection experiment

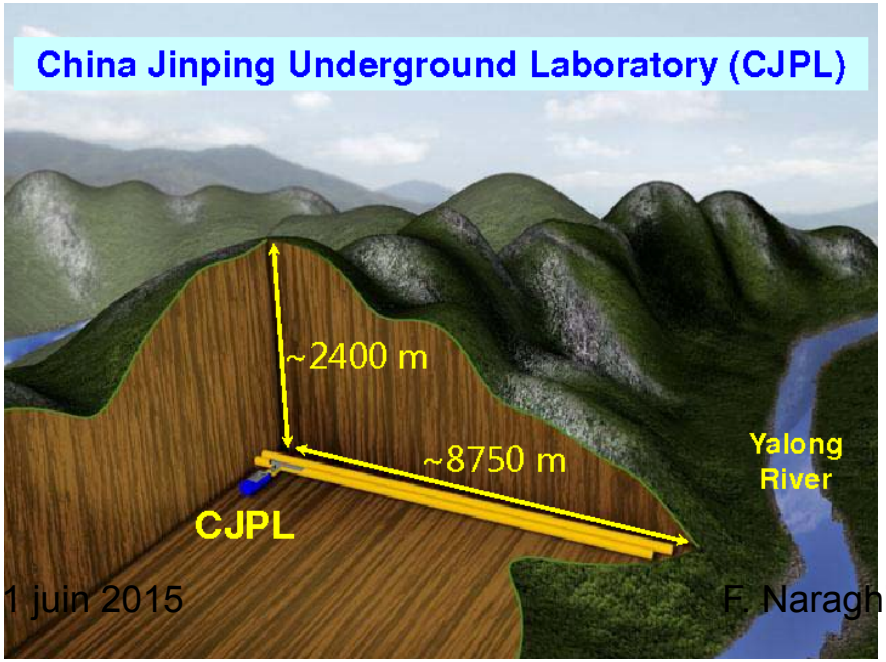
LPSC, CPPM, IRFU,

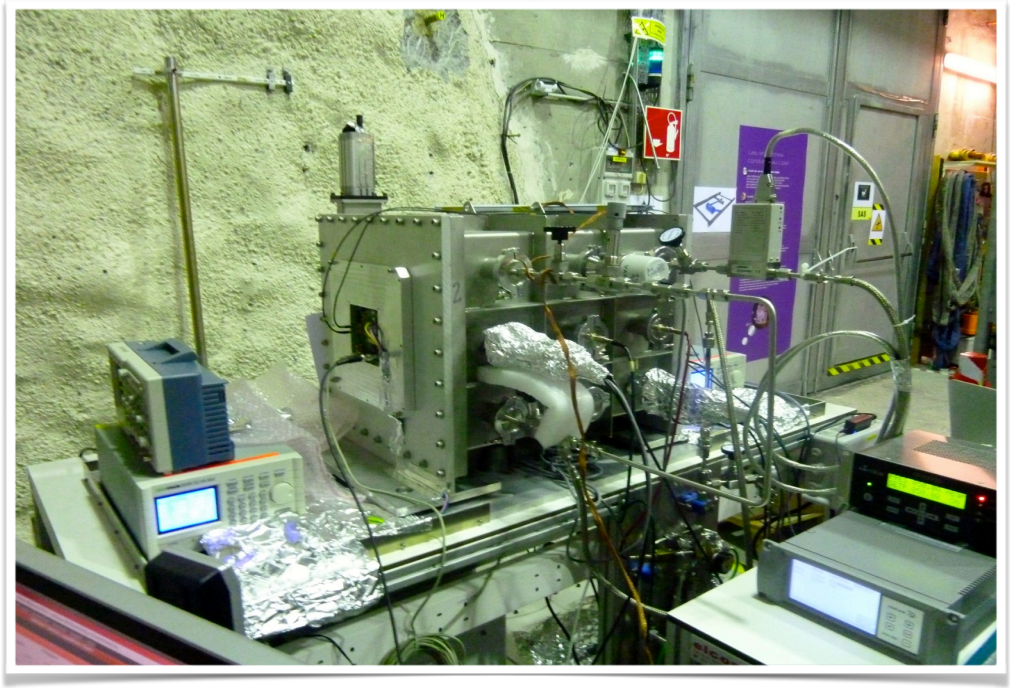
Tsinghua U. (Pekin), IHEP (Pekin), SJTU (Shanghai), USTC (Hefei) ≈12 personnes

May 21, 2015

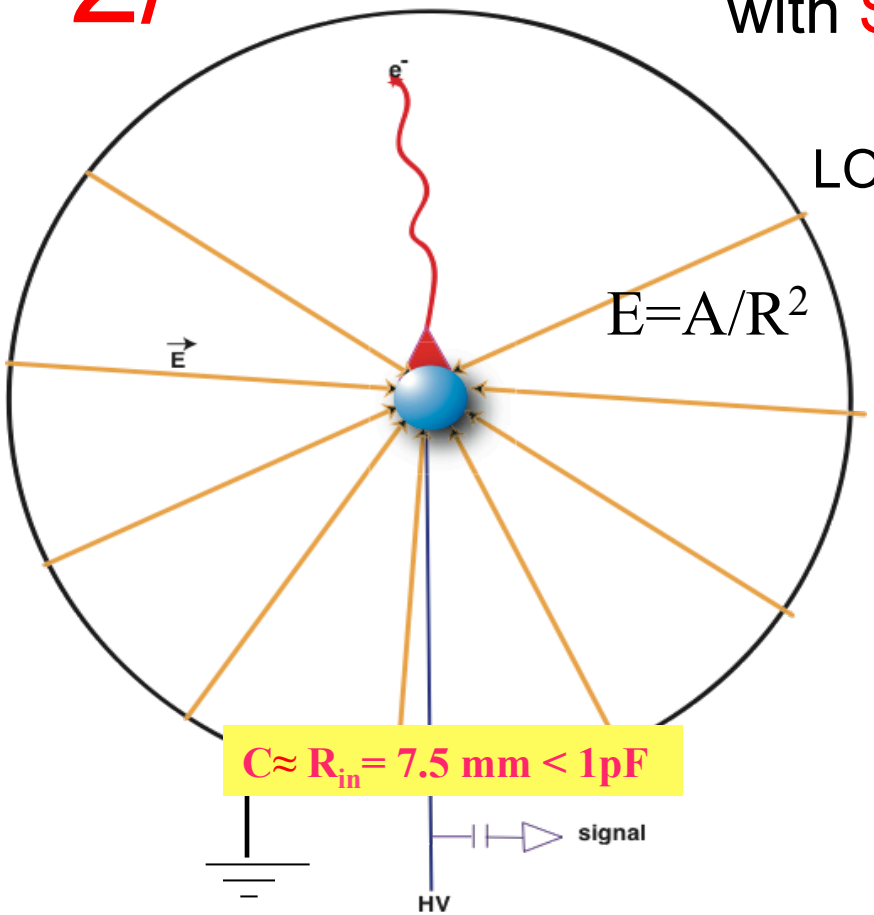
… … … **install a MIMAC R&D project and a MIMAC directional search experiment (5 m^3 initial and upgradable to 50 m^3) in CJPL**.

+ Construction, installation et opération du détecteur 1m^3 au LSM (Modane)





2/ NEWS : New Experiment for Wimps detection with Sphere



LOI approuvé par le comité de SNOLAB

- Queen's University – Canada
- LPSC
- IRFU
- LSM

- **Simple et bon marché**
- **Grand Volume: 2m de diam.**
- **Un seul canal de sortie**

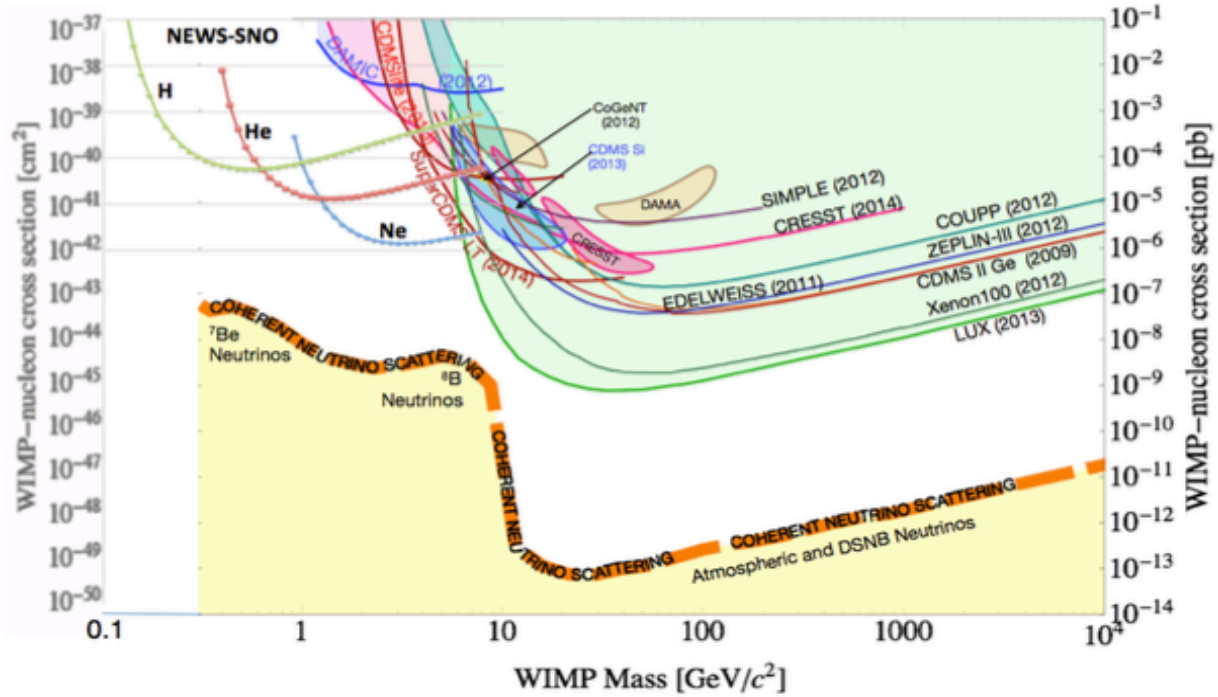
A Novel large-volume Spherical Detector with Proportional Amplification read-out, I. Giomataris *et al.*, JINST 3:P09007,2008

NEWS complémentaire à MIMAC

Détection directe de Matière sombre non-directionnel

BUT : EXPLORER LA ZONE DE MASSES FAIBLES

- Seuil en énergie du detecteur < keV
- Possibilité de plusieurs noyaux cibles (H, He, Ne)



Introduction aux Prospectives LPSC 2015-2020

MIMAC :

- Installation du module actuel au CJPL
- Installation et test du module bi-chambre 35 x35 x 26 cm au LSM
- Construction, test et opération du détecteur 1m^3 au LSM
- Construction et test du détecteur 5m^3 au CJPL

NEWS :

- Calibration +Mesure du facteur de Quenching + système de circulation du gaz (LPSC)
- Construction, installation et prise de données à SNOLAB


45°
Lake Balkhash
Burqin
Karamay
Yining
Urumqi
Mongolia
Hailar
Qiqihar
Harbin
Changchun
Shenyang
North Korea
Kashi
China
Hohhot
Beijing
Tianjin
Dalian
Yumen
Huang R.
Shijiazhuang
Yantai
South Korea
Pak.
Yinchuan
Taiyuan
Qingdao
Jinan
Golmud
Xining
Lanzhou
Lianyungang
Indus R.
Zhengzhou
Shiquanhe
Xi'an
Yellow Sea
Nanjing
30°
Hefei
Shanghai
Yangtze R.
Hangzhou
Brahmaputra R.
Wuhan
Chengdu
Lhasa
East China Sea
Nepal
Chongqing
Nanchang
Changsha
Bhutan
Fuzhou
Formosa Strait
Ganges R.
Guiyang
Xiamen
Taiwan
Bangladesh
Kunming
Xun R.
Guangzhou
Kao hsiung
India
Irrawaddy R.
Nanning
Hong Kong
Macau
Thanlwin R.
Vietnam
Zhanjiang
Laos
Philippines
Bay of

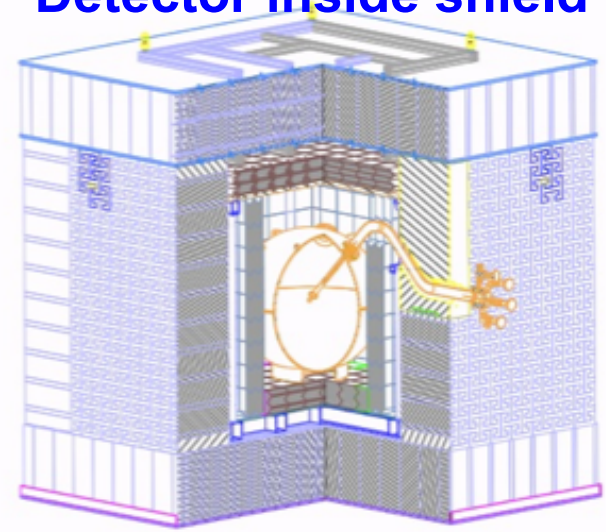

Alaska
(États-Unis d'Amérique)
Cercle Polaire Arctique
Mer de Beaufort
Île Banks
Île Melville
Île Devon
Resolute (Qausuittuq)
Île Prince of Wales
Île Victoria
Baie de Baffin
Détroit de Davis
Île de Baffin
Cercle Polaire
Inuvik
Dawson
Grand Lac de l'Ours
Territoire du Yukon
Whitehorse
Territoires du Nord-Ouest
Yellowknife
Grand Lac de l'Esclave
Nunavut
Baker Lake (Qamanittuaq)
Bassin Foxe
Iqaluit
Île Southampton
Détroit d'Hudson
Mer du Labrador
Terre-Neuve-et-Labrador
Baie d'Ungava
Nain
Kuujjuaq
Océan Pacifique
Fort Nelson
Colombie-Britannique
Détroit d'Hécate
Prince George
Île de Vancouver
Vancouver
Victoria
Kamloops
Fort McMurray
Alberta
Edmonton
Calgary
Lac Athabasca
Saskatchewan
Saskatoon
Regina
Churchill
Lac du Caribou (Reindeer Lake)
Manitoba
Lac Winnipeg
Winnipeg
Baie d'Hudson
Sandy Lake
Lac Nipigon
Thunder Bay
Ontario
Baie James
Réservoir Smallwood
Churchill Falls
Lac Caniapiscau
Réservoir La Grande 2
Sept-Îles
Québec
Golfe du Saint-Laurent
Terre-Neuve
Charlottetown
Île-du-Prince
Fredericton
Halifax
Nouvelle-Écosse
Québec
Montréal
Ottawa
SNOLAB
Toronto
Nouveau-Brunswick
Lac Supérieur
Lac Michigan
Lac Huron
Lac Ontario
Lac Érié
ÉTATS-UNIS D'AMÉRIQUE
CANADA – Politique
Frontière internationale
Frontière internationale (contestée)
Limite de la Zone Économique Exclusive (ZEE) à 370 km
Frontière provinciale et/ou territoriale
Alberta Province/Territoire
Ottawa Capitale nationale
Regina Capitale provinciale ou territoriale
Échelle
0 250 500 750 1 000 km

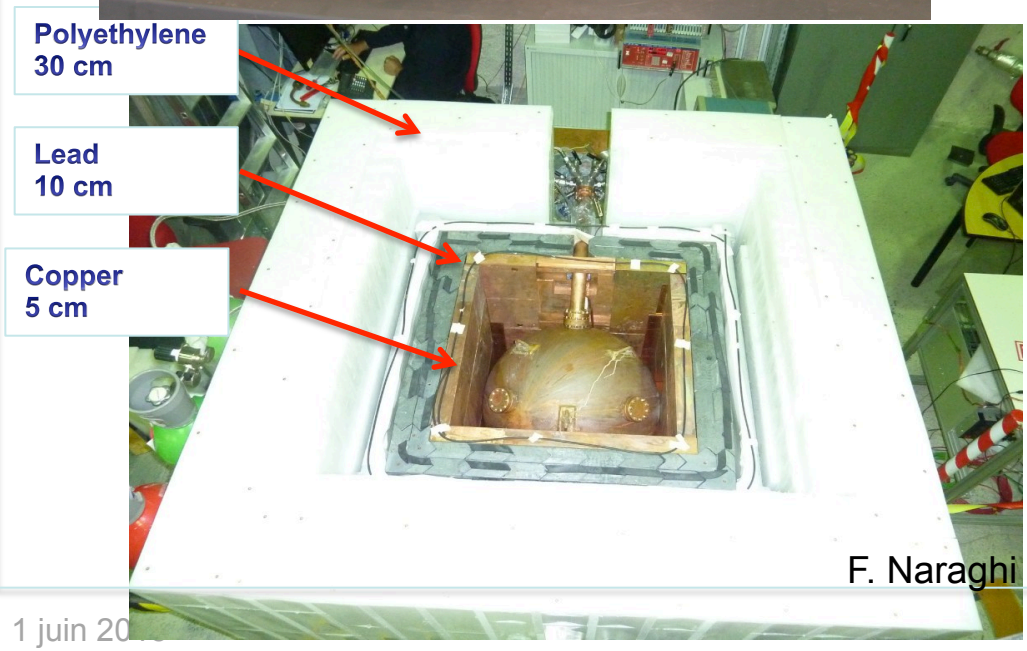
Search for light dark matter

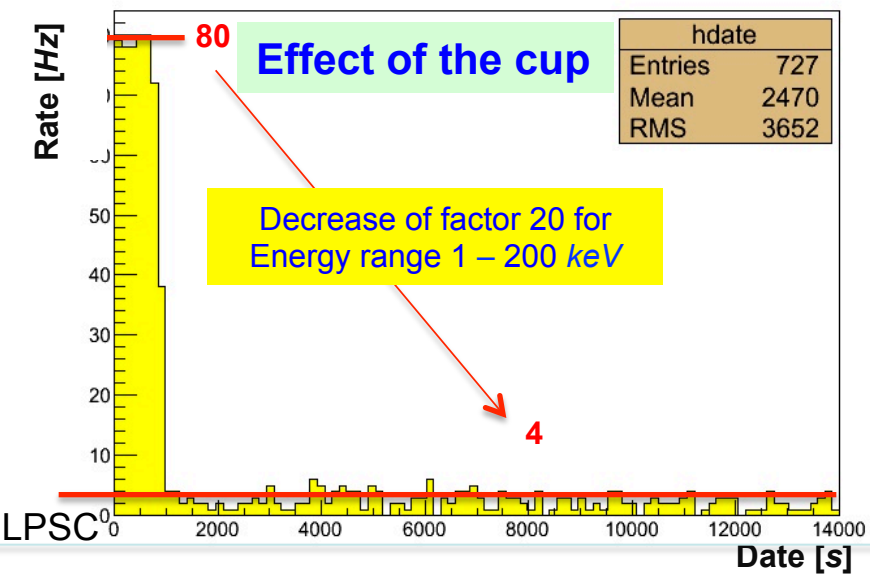
Detector installed at LSM end 2012: 60 cm, Pressure = up to 10 bar

Gas targets: Ar, Ne, He, CH4

Detector inside shield







Internal contamination cleaning

Goal: remove Po-210, Pb-210

1st chemical cleaning of sphere

Conditions :

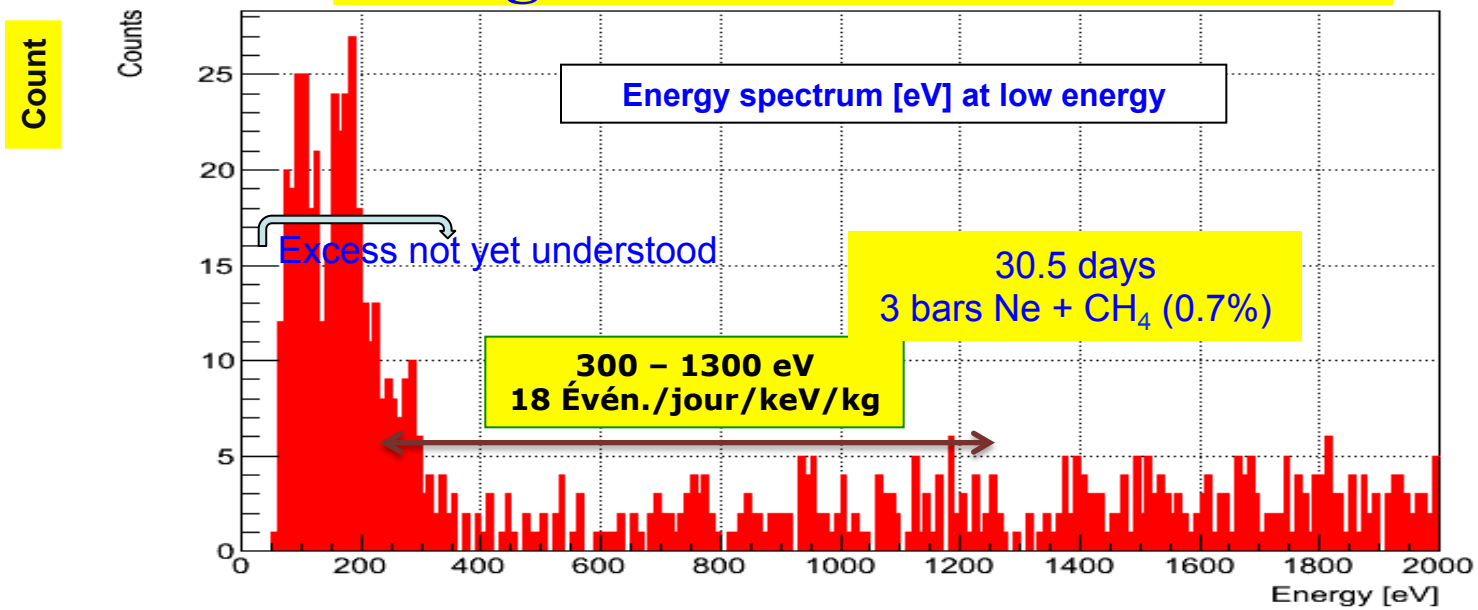
- Nitric acid (17 %)
- Temperature 10° *C*
- Cleaning by filling the spherical cavity
- Washing by pure water
- Drying by hot nitrogen

2nd chemical cleaning of sphere

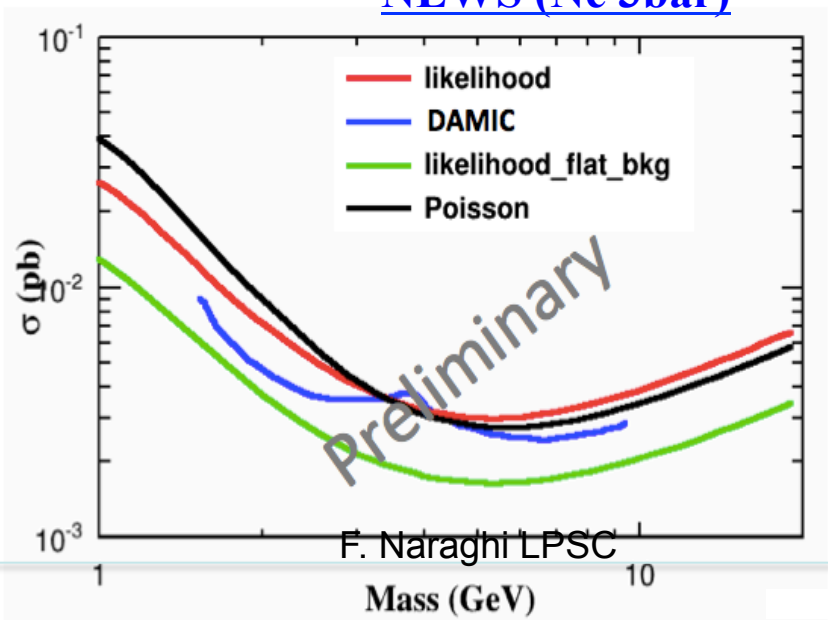
Conditions :

- Nitric acid (30 %)
- Temperature 30° *C*
- Cleaning by spray
- Washing by pure water
- Drying by hot nitrogen

Light WIMP search results



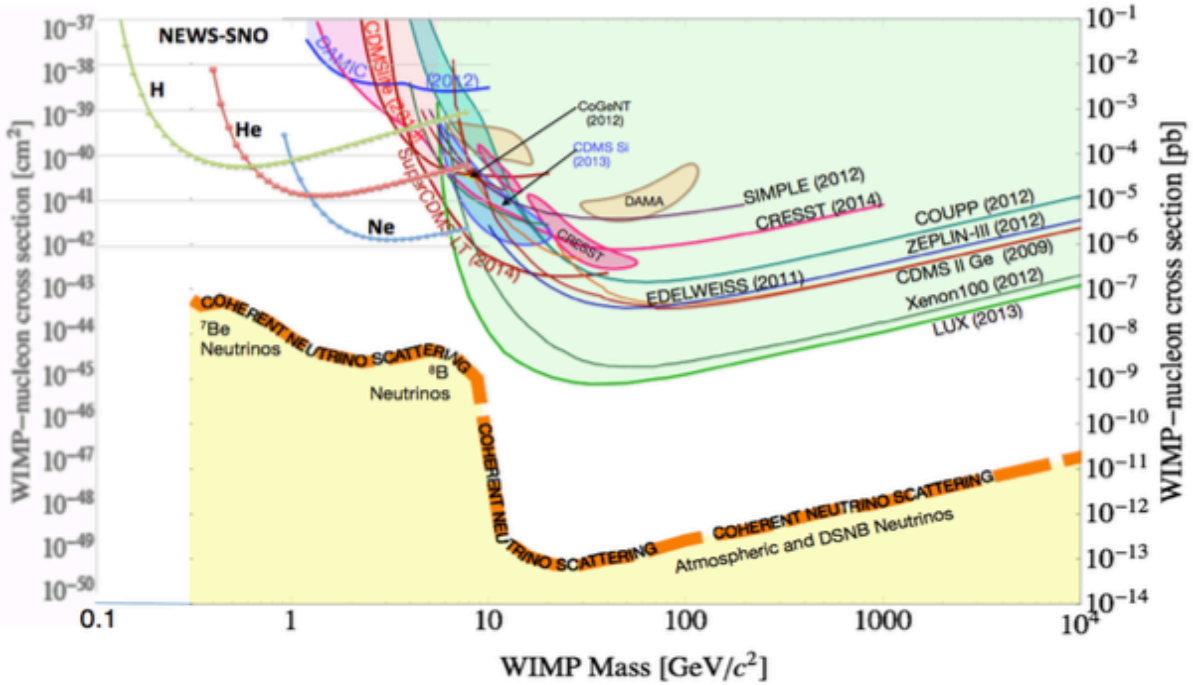
NEWS (Ne 3bar)



F. Naraghi LPSC

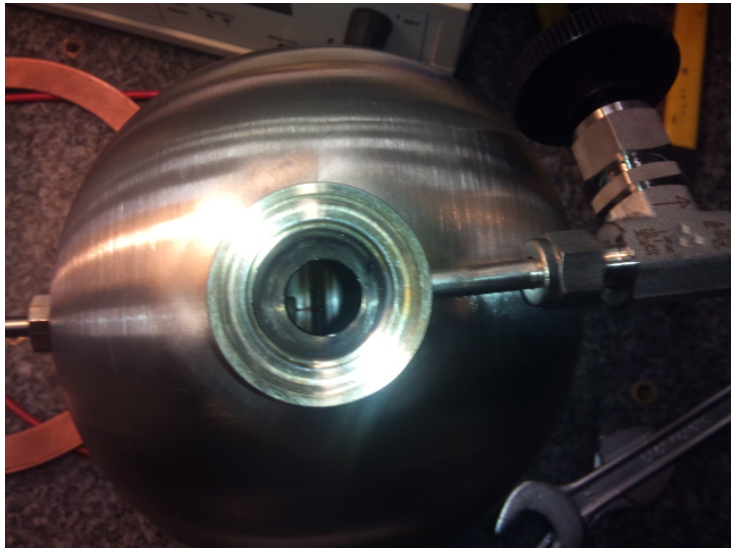
NEWS-SNOLAB project

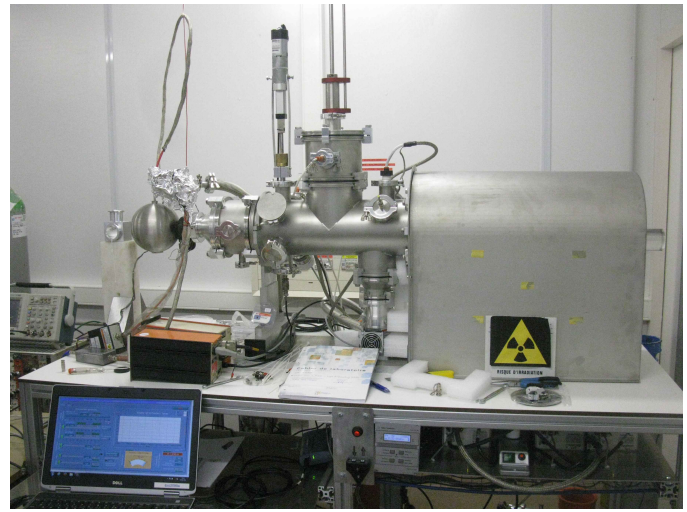
Kingston, Saclay, Grenoble, LSM, Thessaloniki…..
2 m detector at 10 bar
Pure water shield
Funded by Canadian grant of excellence
LOI recently approved by SNOLAB committee



Quenching factor measurements

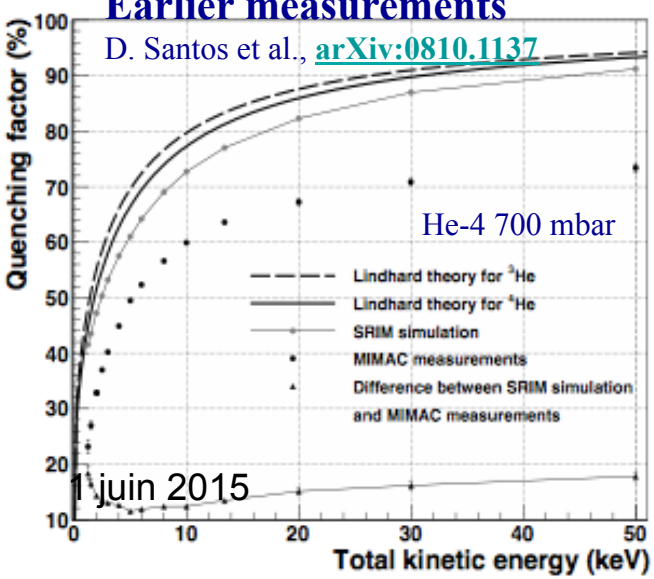
Goal: measure QF down to 500 eV ion energy using the Grenoble MIMAC facility for H, He, Ne, CF4, Ar, Xe at various pressures





Earlier measurements

D. Santos et al., arXiv:0810.1137



Recent investigations with a 15 cm sphere show the capability to measure 500 eV He-4 ions with an estimated QF of about 25%

Saclay, Grenoble, Thessaloniki, Queen's-Kingston