

# WELCOME

**Kentaro Miuchi**  
**KOBE university**

supported by



Kobayashi-Maskawa Institute  
for the Origin of Particles and the Universe



# WELCOME to JAPAN



"manga" is one of the COOL stuff



NEWAGE-tan  
by Yuki Akimoto

weathercock



"WIMP wand"



daakumatan  
by Kiseki Nakamura



東大研究員が教える  
絵で見る素粒子物理学  
宇宙までまるわかり!  
素粒子の世界  
村山 資



cue

Miss CYGNUS  
by Kiseri

# WELCOME to TOYAMA

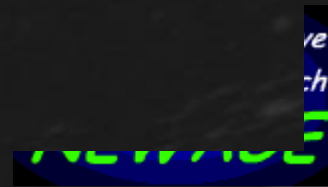
Entrance to Kamioka

420,000 residents

Shinkansen (bullet-train)  
from Tokyo coming in two years



beautiful CANAL in 5  
minutes' walk



# WELCOME to CYGNUS

## CYGNUS 2007

First Workshop on Directional Detection of Dark Matter

22-24 July 2007

Boulby Underground Laboratory, UK

ILIAS-N3 - advanced detectors meeting



## CYGNUS 2009

Directional Dark Matter

Detection

**Boston (USA, DM-TPC)**



CYGNUS 2011 : 3rd Workshop on directional detection of Dark Matter

7-10 June 2011  
Europe/Paris timezone

**Aussios  
(France, MIMAC)**

Direction Sensitive  
WIMP-search  
**WAGE**

# CYGNUS PUBLICATIONS

International Journal of Modern Physics A  
Vol. 25, No. 1 (2010) 1–51  
© World Scientific Publishing Company



WHITE PAPER from  
CYGNUS 2009  
112authors

THE CASE FOR A  
DIRECTIONAL DARK MATTER DETECTOR AND  
THE STATUS OF CURRENT EXPERIMENTAL EFFORTS

CYGNUS 2011  
proceedings

EAS Publications Series

New Content  
Alerts

Table of Contents - 2012 - Volume 53 , CYGNUS 2011: Third  
International Conference on Directional Detection of Dark Matter



# CYGNUS2013

4th Workshop on Directional Detection of  
10 June - 12 June 2013, Toyama, Japan



write down your  
name on the  
poster by the  
workshop photo

Kamioka tour June 12th  
PROCEEDINGS(Naka) June 13th  
+discussion on joint  
Dinner 10th  
workshop photo 11th

# CYGNUS2013

40 participants

~10 oversea

1/3 × Japanese

2/3 × Japanese

"CYGNUS"

from related fields

27 talks in

check the WEB for updates

10<sup>th</sup> morning- : status report

10<sup>th</sup> afternoon- : technical R&Ds

11<sup>th</sup> morning- : related activities

11<sup>th</sup> afternoon- : discussions



# CYGNUS WHERE ARE WE?

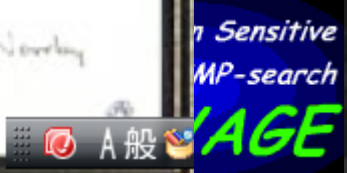
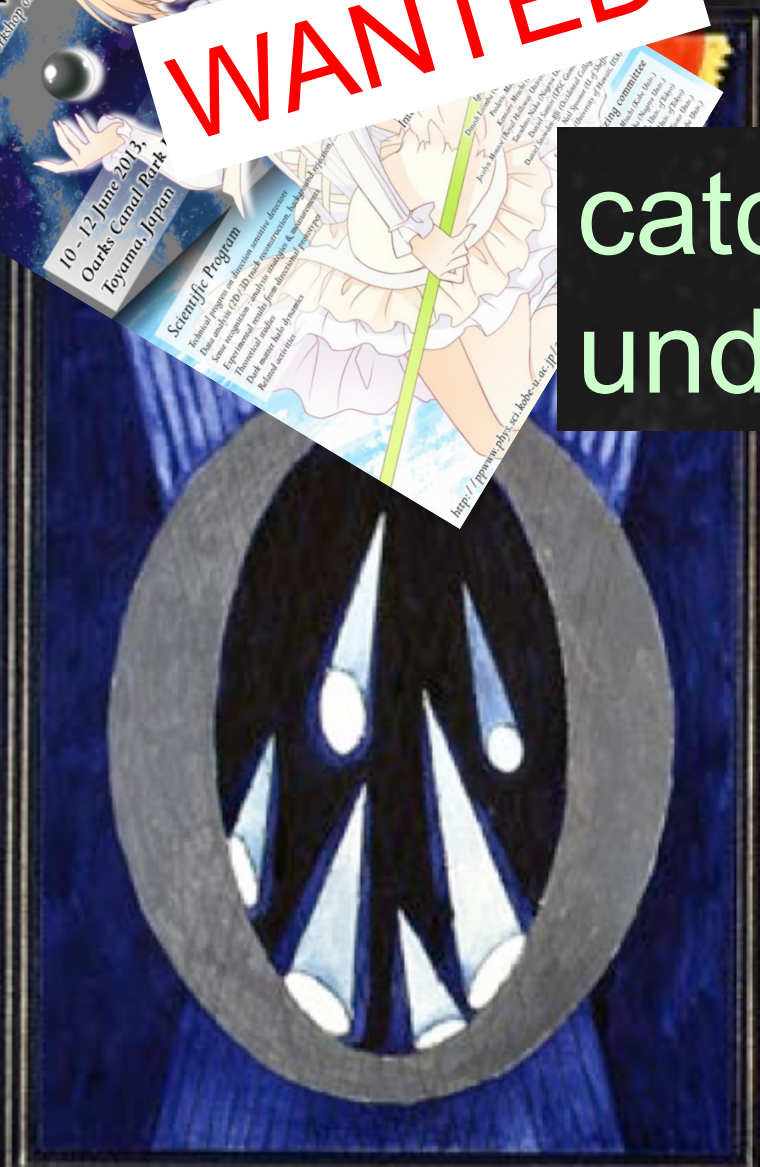




# GOAL

# WANTED

# catch & understand her



A 般

# The way to

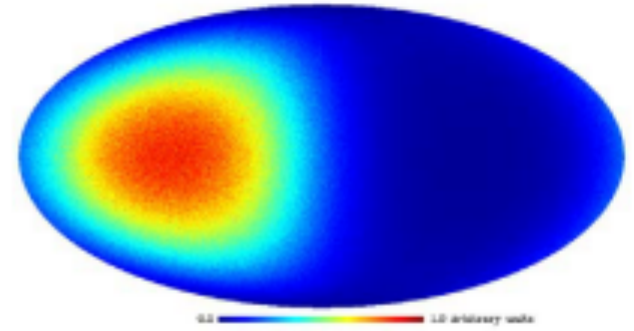
WIMP flux in a earth-based detector  
in galactic coordinates

Angular distribution of Fluorine recoils  
Energy range : [5;50] keV

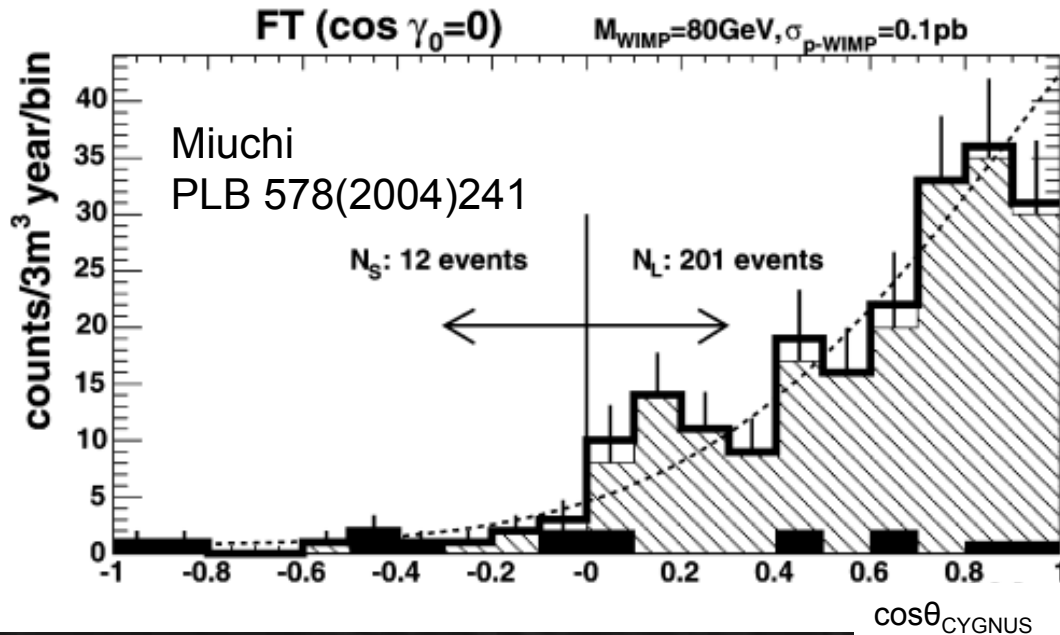
After scattering

100 GeV/c<sup>2</sup> WIMP

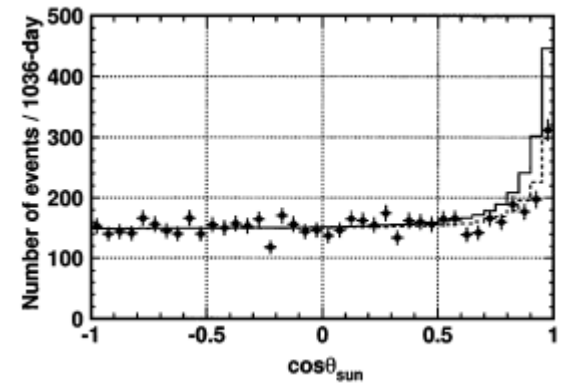
Mayet  
CYGNUS 2011



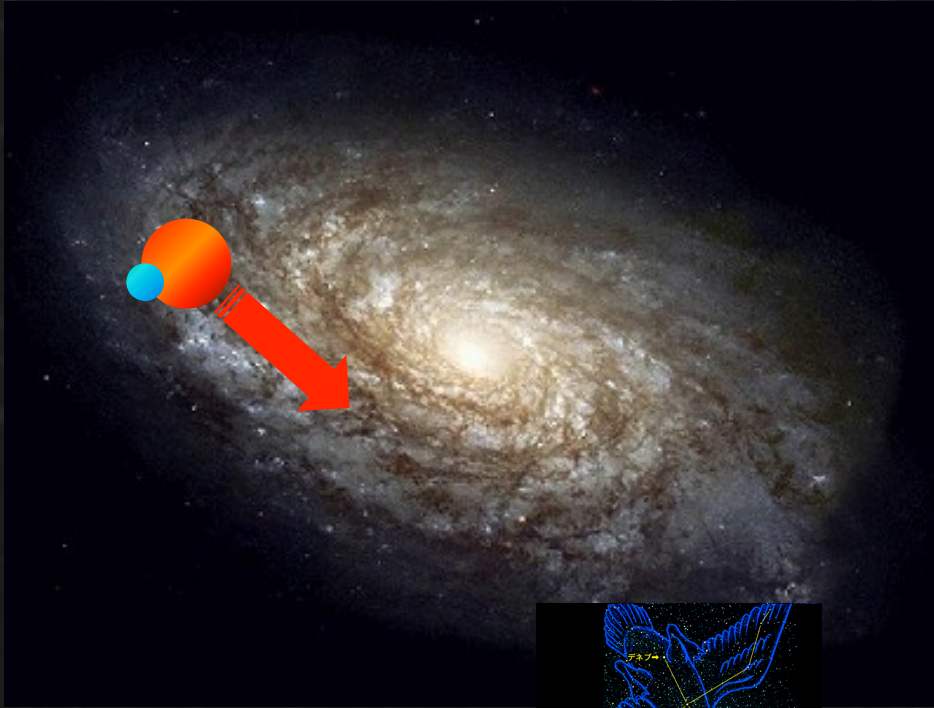
Expected WIMP-induced signal  
(recoil-map)



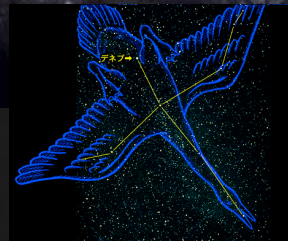
a. la.



# CYGNUS and us

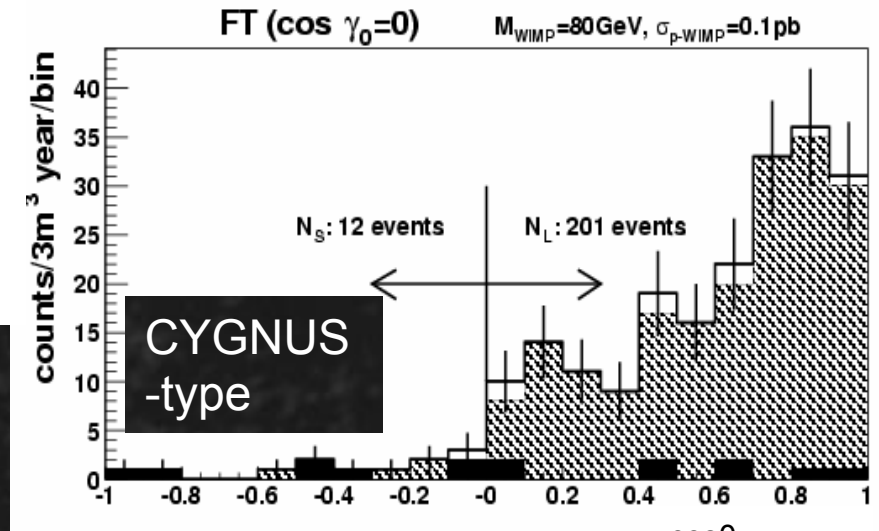
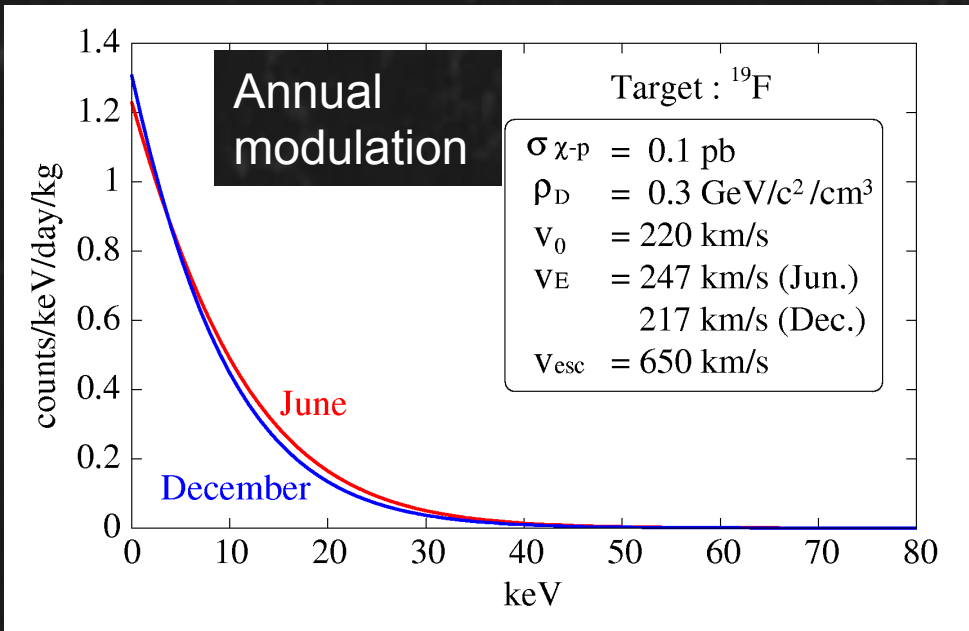
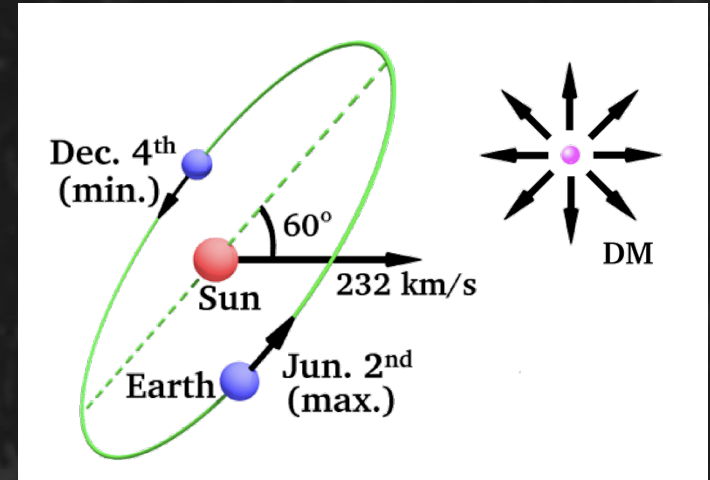


WIMP-wind is coming from  
CYGNUS direction



# HOW POWERFUL?

Annual modulation:  
not a smoking-gun signature, so far.

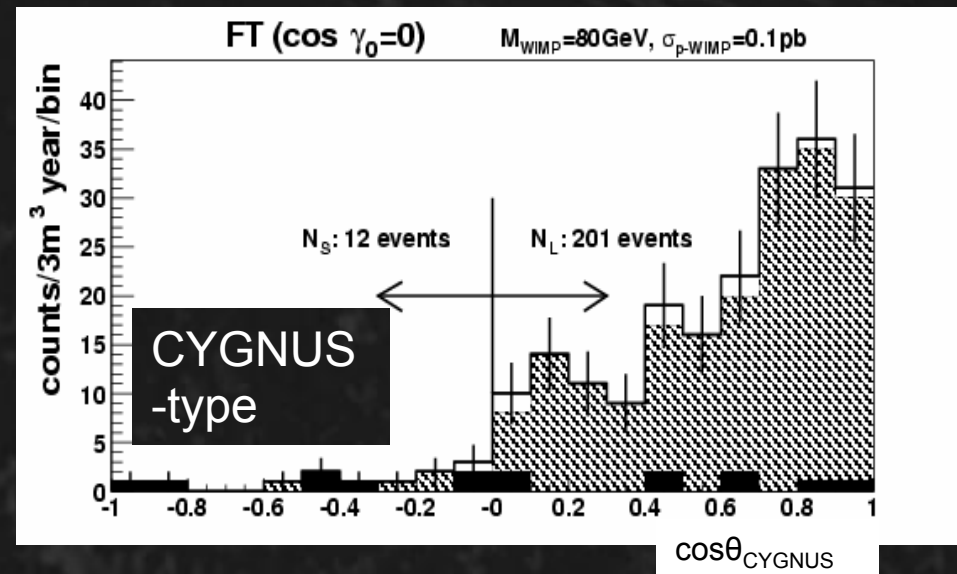


CYGNUS-type:  
large asymmetry

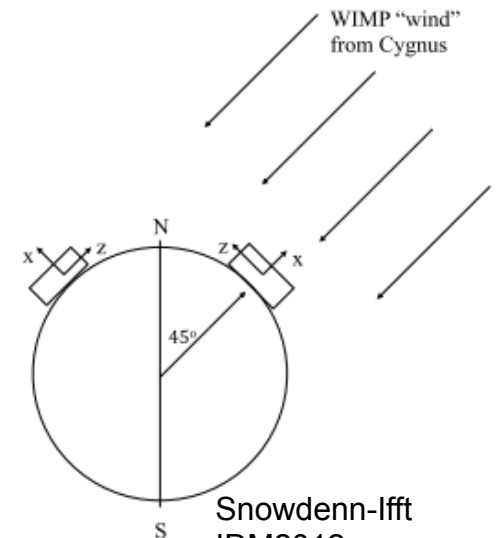
# Any other?

Large asymmetry  
Sidereal modulation  
BG (gamma) rejection

and... coming in this workshop



## A sidereal modulation

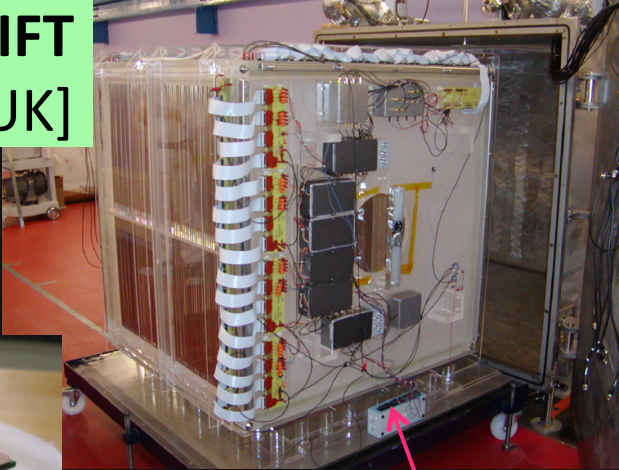


NEWAGE

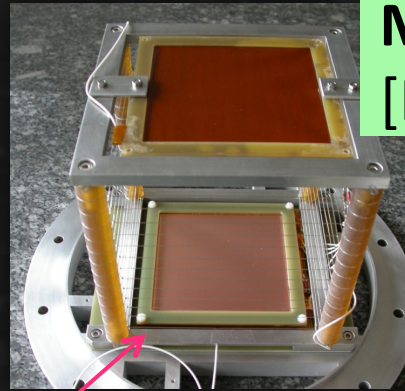


# CYGNUS, who are we?

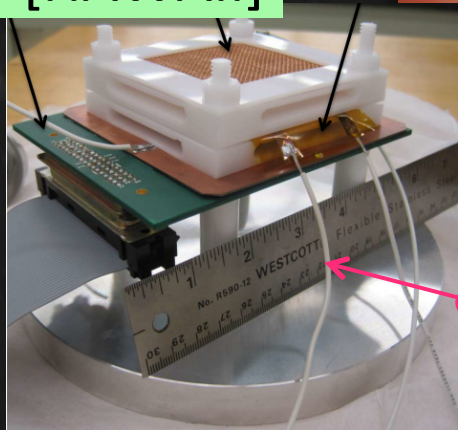
**DRIFT**  
[UK]



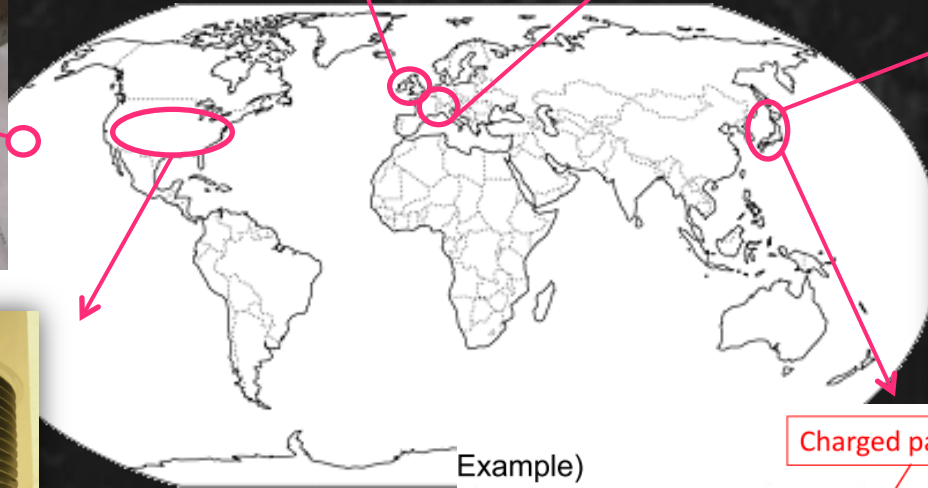
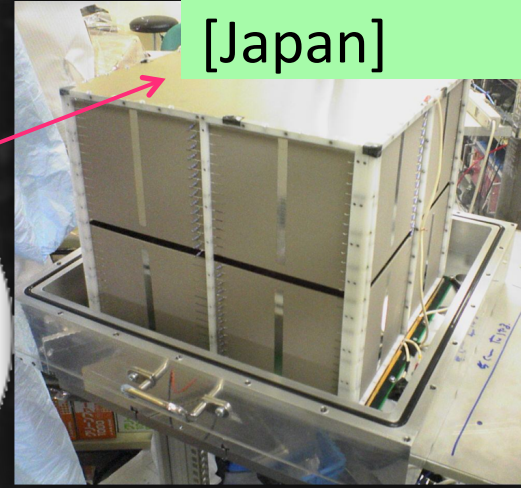
**MIMAC**  
[France]



**D3**  
[HAWAII]



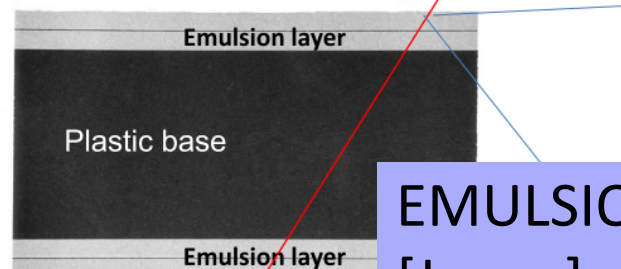
**NEWAGE**  
[Japan]



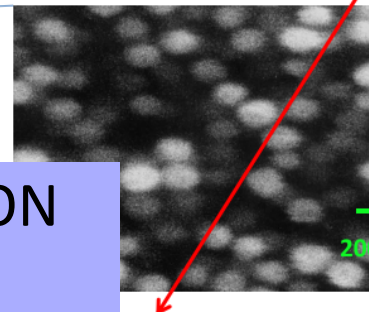
**DMTPC**  
[USA]

Charged particle

Example)



**EMULSION**  
[Japan]



# Challenges

**size**

diffusion

gas study

Radon

**BG**

quenching

z-position

gammas

stability

energy resolution

position resolution

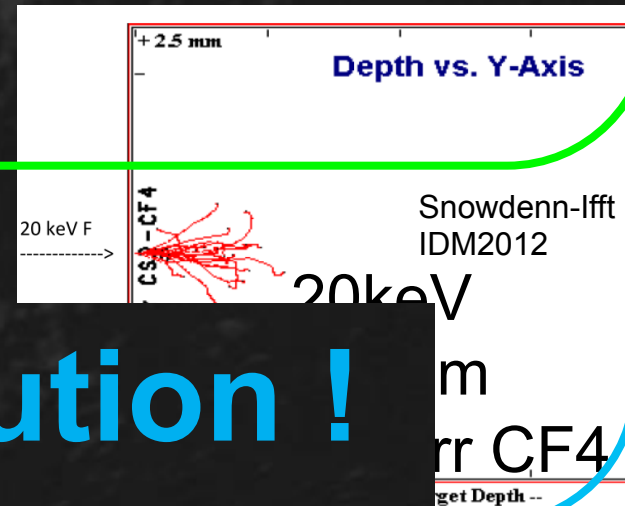
**DISCOVERY**

neutrons

energy threshold

exclusion limit

head-tail



**angular resolution !**



# CYGNUS, where are we?

as of CYGNUS 2011

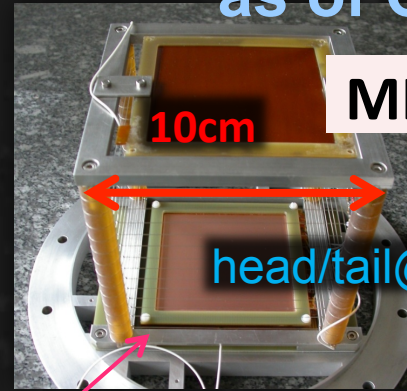
size, BG,  
angular resolution

**DRIFT**

underground  
RPR thin cathode film  
 $\gamma$  rejection  $3 \times 10^{-6}$

1m

head/tail@50keVnr



10cm

**MIMAC**

to underground

head/tail@10keVproton

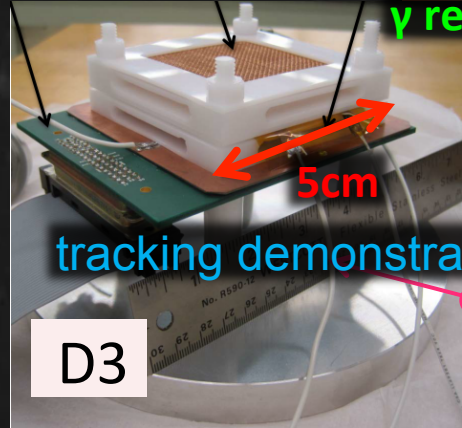
**NEWAGE**

underground  
gas circulation

$\gamma$  rejection  $8 \times 10^{-6}$

30cm

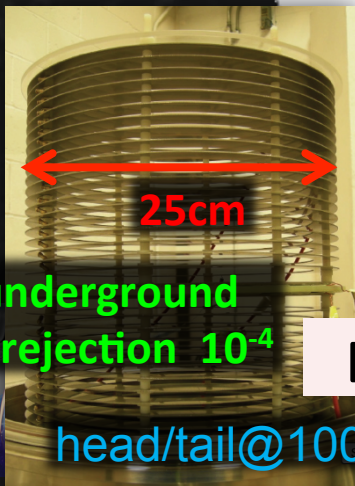
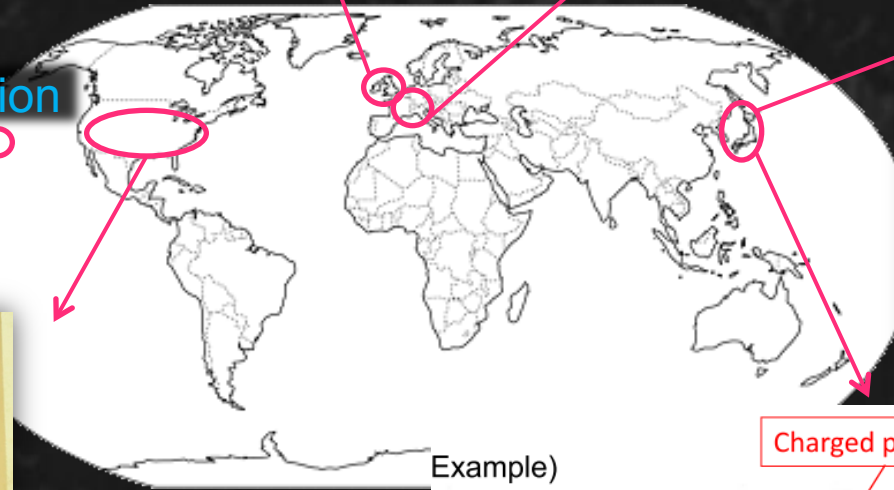
55°@100keVee



5cm

tracking demonstration

**D3**



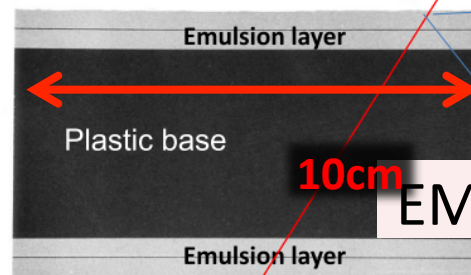
25cm

underground  
 $\gamma$  rejection  $10^{-4}$

**DMTPC**

head/tail@100keVee

Example)



Charged particle

17°@150nm

insensitive to  $\gamma$ s

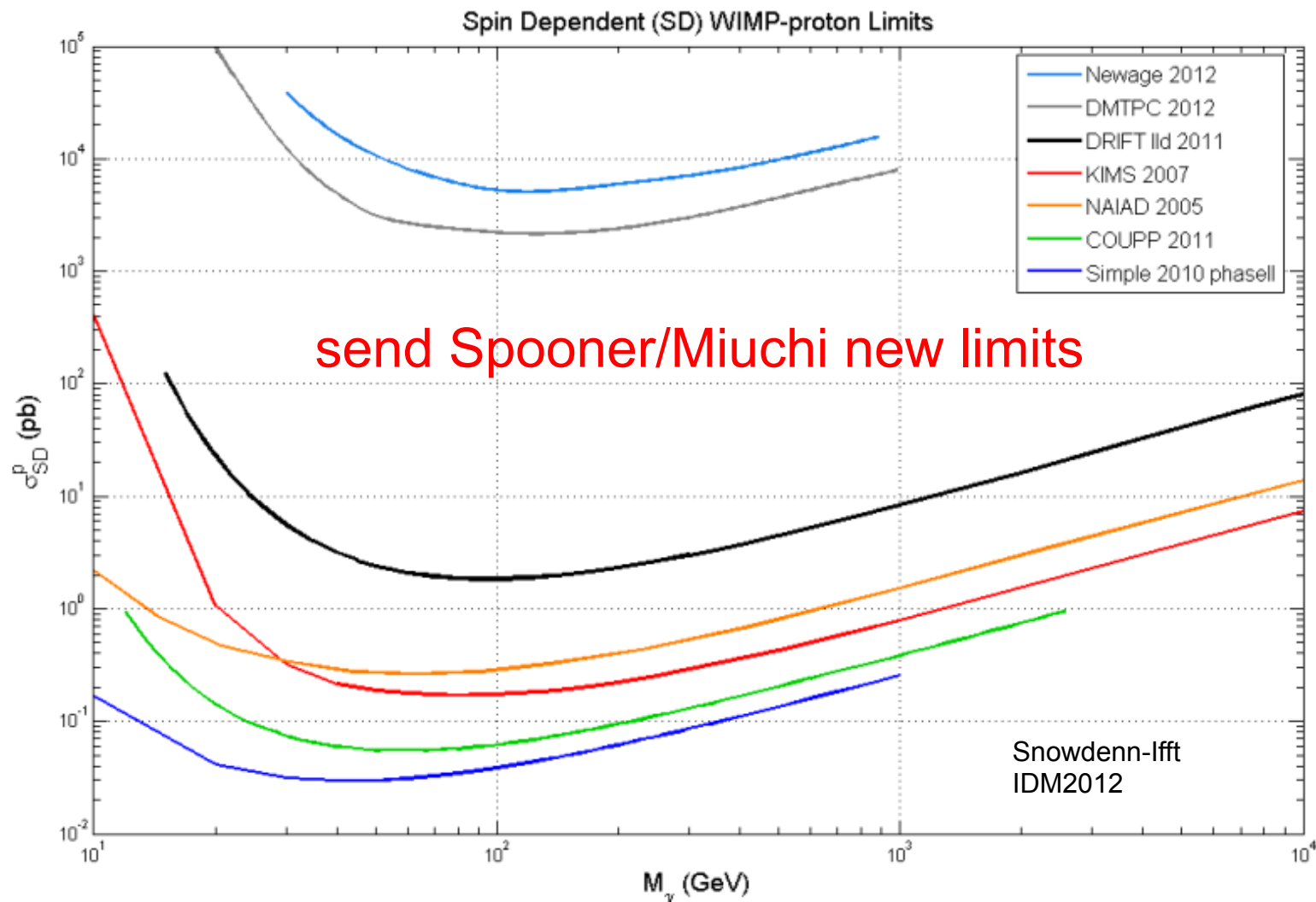
**EMULSION**

10cm





# Directional Progress - Limits



# CYGNUS, where are we?

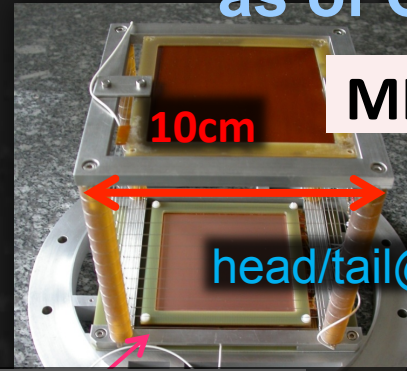
as of CYGNUS 2011

size, BG,  
angular resolution

**DRIFT**

underground  
RPR thin cathode film  
 $\gamma$  rejection  $3 \times 10^{-6}$

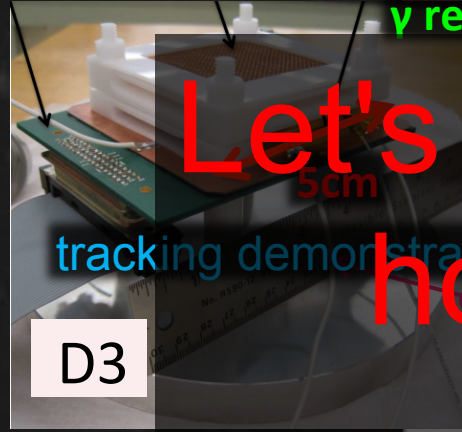
1m



**MIMAC**

head/tail@10keVproton

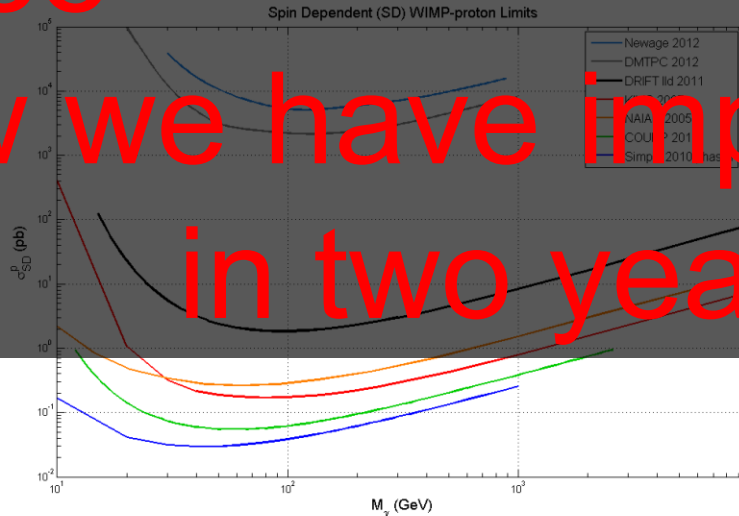
to underground



tracking demonstrator

D3

Directional Progress - Limits



**NEWAGE**

underground  
gas circulation  
 $\gamma$  rejection  $8 \times 10^{-6}$

30cm

55°@100keVee

article

17°@150nm

insensitive to  $\gamma$ s

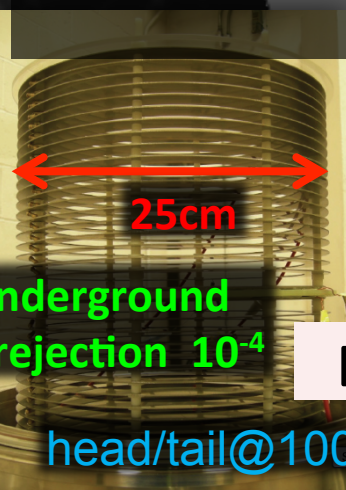
**EMULSION**

10cm

underground  
 $\gamma$  rejection  $10^{-4}$

**DMTPC**

head/tail@100keVee



25cm

