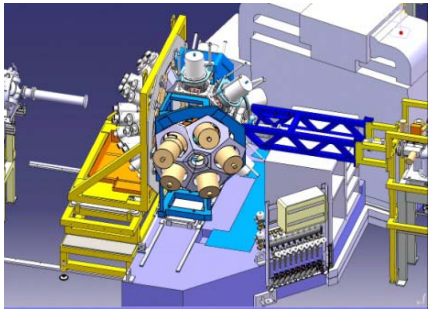
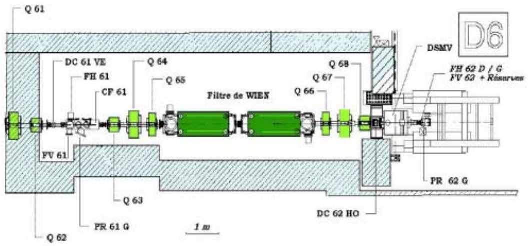
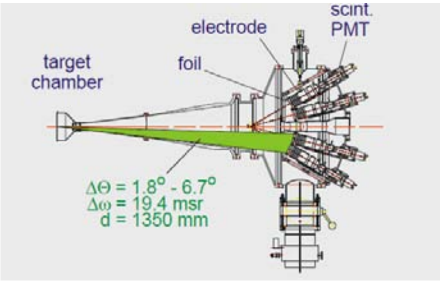
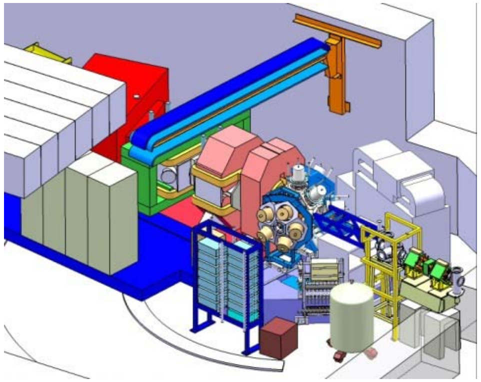
Which set-up for fusion evaporation at GANIL/SPIRAL2 ?









B.Jacquot : E. Clément

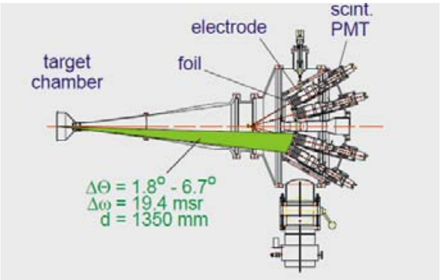
The use of DIAMANT, NWALL or the RFD

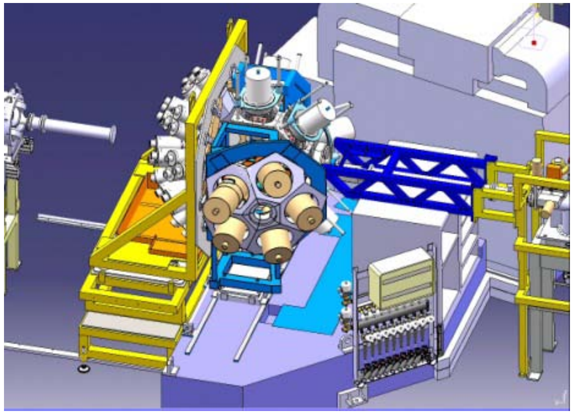
Great success with stable beam at GANIL I=10^{11} pps

(High intense stable beam → S3)

Radioactive beam I=10^{8}pps

→ Improve selectivity (I beam & γ background for RIB)





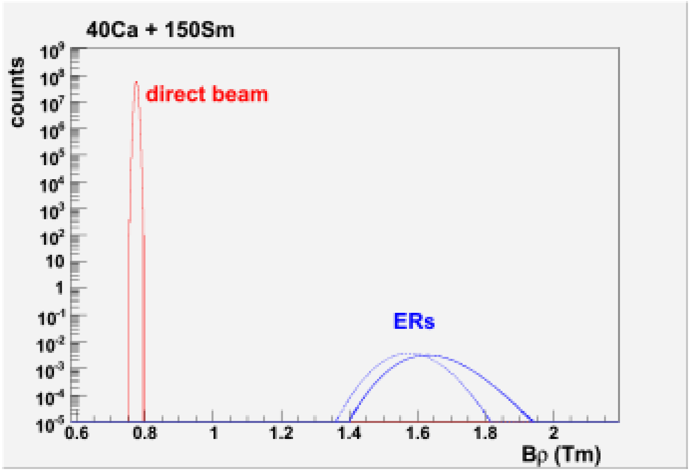
Exogam + Neutron array+DIAMANT

Exogam + Recoil Filter Detector

Interesting channels involve proton channel with n-rich beam (veto neutron)

Compatible with the γ background induced by a RIB@10^{8}pps ?

The use of a separator



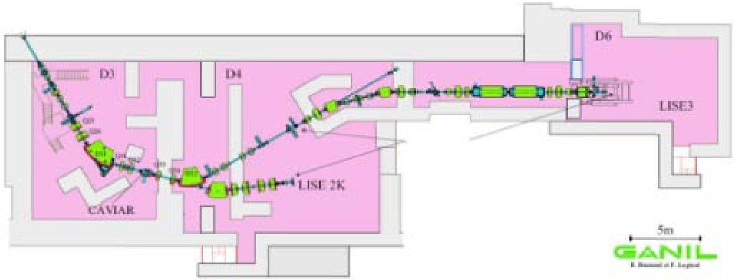
•VAMOS : Gaz filled mode

C. Schmitt NIM A 621 (2010) 558

Beam rejection : 10^{10}

•VAMOS : Mode « QQ Wien filter » =>

Only for very asymetric kinematics « Ne+Pb » ,
low rejection (10^7) & low dispersion



•Lise Wien Filters : rejection ~10^{12}

→Cannot fit in the cave

•Modification of « VAMOS_Wien filter » in G2 : QQ+ Wien filter

Accept~ 10-15 mSr
Beam rejection 10^7
Reasonnable cost

The use of the VAMOS Wien filter

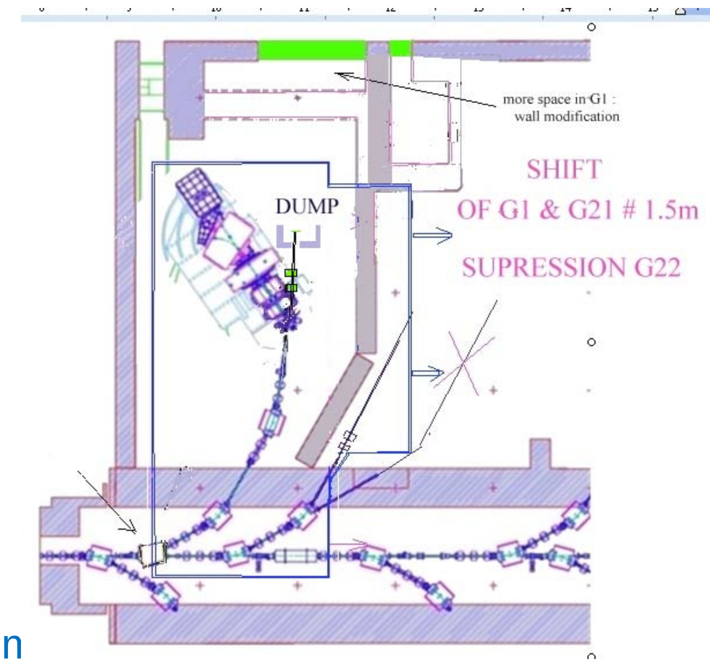
- ## Vamos Wien filter in G1:

Electric field too low : Electric gap 100 cm

Beam rejection 10^7 for very asymetric reaction

Operation : 2 tests in the last 5 years

The G1 cave modification to allow a rotation beyond 45 degrees is under discussion



- ## Vamos Wien filter in G2:

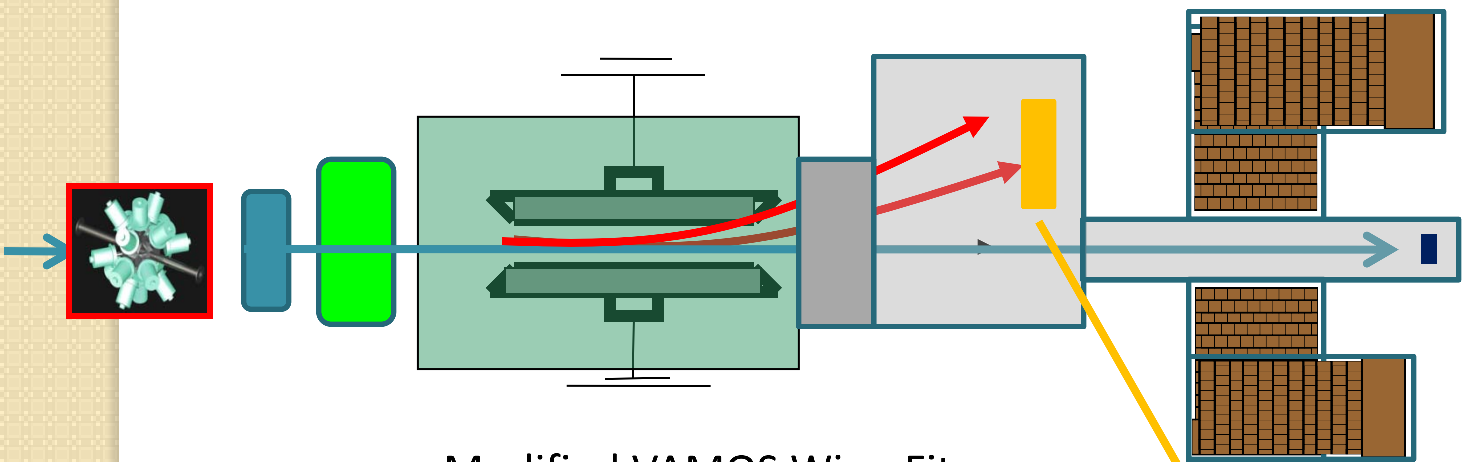
Modification of the electrodes: Electric gap 14-15 cn

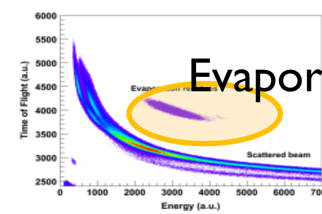
Very competitive acceptance ~ 10-15 mSr

Beam Rejection ~ 10^7 for Abeam=50 +Atarget=130

~ 10^5 for Symmetric Kinematic

The use of the (new) Wien filter





With TKE, X,Y pos, TOF
Get Mass

Large array for detection → higher counting rate

The gas filled mode is more efficient

All experiments will run at VAMOS

- Change of setup frequent
- gaz ←→ vaccum

Only one cave → « Dead Time », radioactive decay …

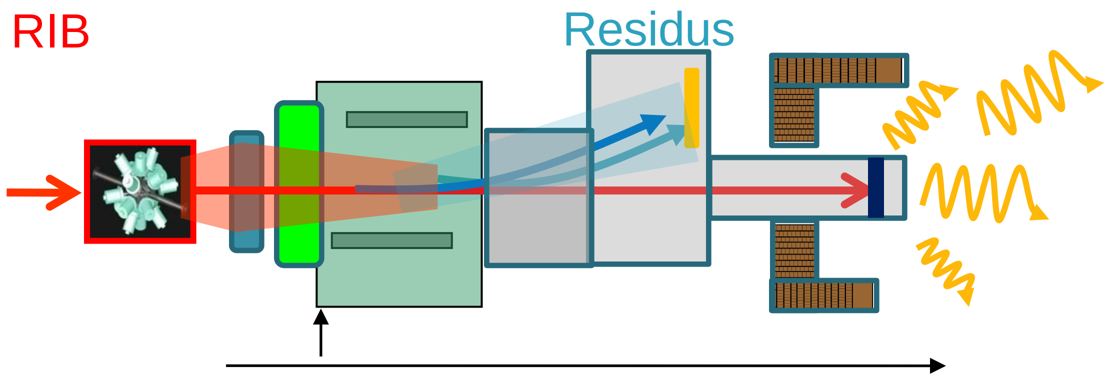
A second cave equiped for fusion-evaporation makes sense

The use of the (new) Wien filter

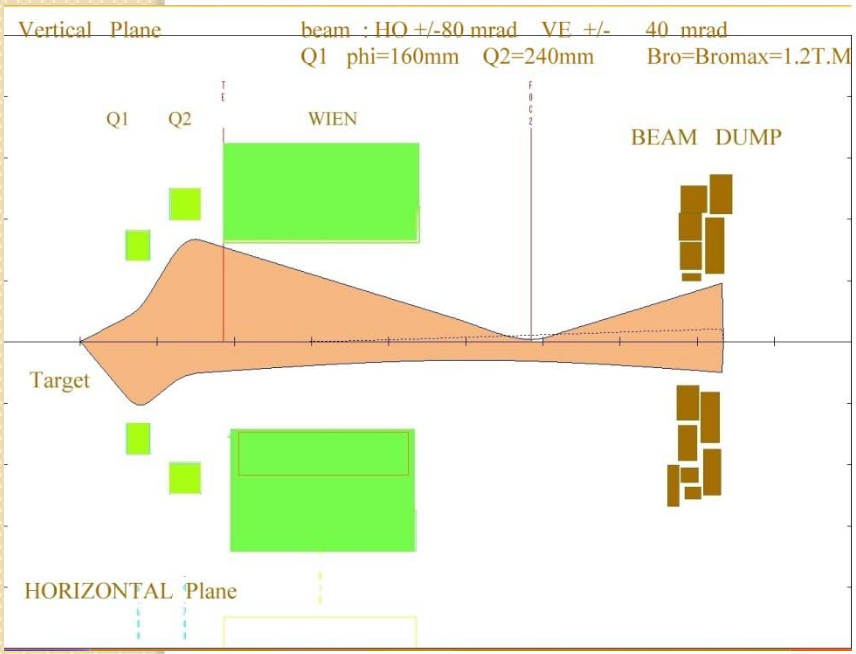
- ❑ The modification has a cost (time, money, human …)
- ❑ If the decision is taken this year : technical studies 2011-2013, construction 2014…
- ❑ The budget has to be found and not only at GANIL
- ❑ The project will be considered only if there are scientific interest

→LOI SPIRAL2 phase 2 Day 1

The gas filled mode of VAMOS is not yet optimised (no differential pumping) and deserves more work but we need physics proposal to proceed



Beam Dump
+ Shielding



Velocity separation in Horizontal
Residus : Bro ± 4% in 90mm*40mm

Mass reconstruction ~ Energy . (TOF**2)

RDT : possible (alpha emitters)

Transport of the beam after target

Fusion-evap channels at GANIL /SPIRAL2

$^{142}Xe^{*}+^{70}Zn \Rightarrow {}^{210}Pb + 2p$
$^{94}Kr^{*}+ {}^{26}Mg \Rightarrow {}^{114}Cd$
$^{94}Kr^{*}+^{48}Ca \Rightarrow {}^{142}Ba$
$^{132}Sn + {}^{48}Ca \rightarrow {}^{180}Yb^{*}$

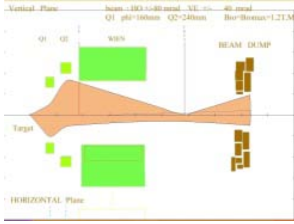
$^{15}C^{*}$+ Pb,…

$^{94}Kr + {}^{48}Ca \rightarrow {}^{134}Ba + 6n$
$^{56}Ni + {}^{50}Cr \rightarrow {}^{101}Sn + \alpha n$

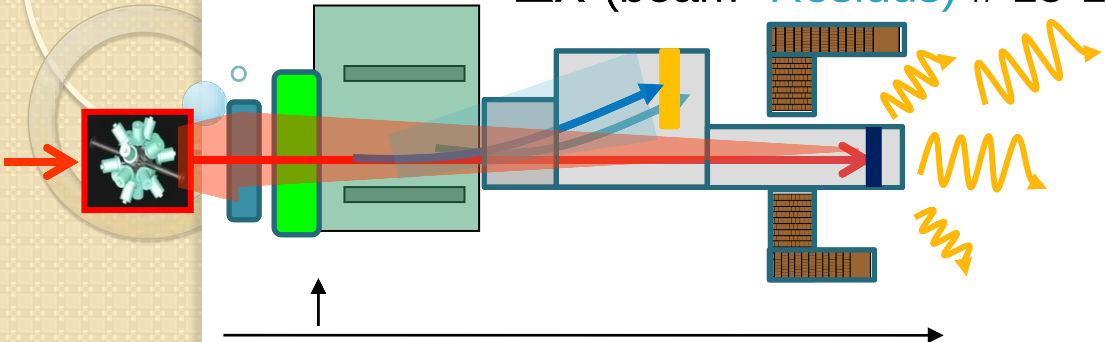
$^{24}Mg + {}^{18}Ne \rightarrow {}^{37}Ca$
$^{46}Ti + {}^{58}Cu \rightarrow {}^{99}In$
$^{50}Cr + {}^{56}Ni \rightarrow {}^{101}Sn$
$^{92}Kr + {}^{164}Dy \rightarrow {}^{256}No$

Rarely assymetric

Annex: Beam optics (III)



Δx (beam- Residus) # 15-18 cm



Wien filter tuning (beam transmitted at 0°, target 0.5 mg/cm2, beam E=5.0 AMeV)
Wien# 1m + Drift#1m(detection) Egap=15cm

Abeam=94 + Atarget=124 → A= 218 Ewien=0.7MV/m Bwien=230 Gauss T16#0.3 cm/%
(±60kV) Δx#17 cm

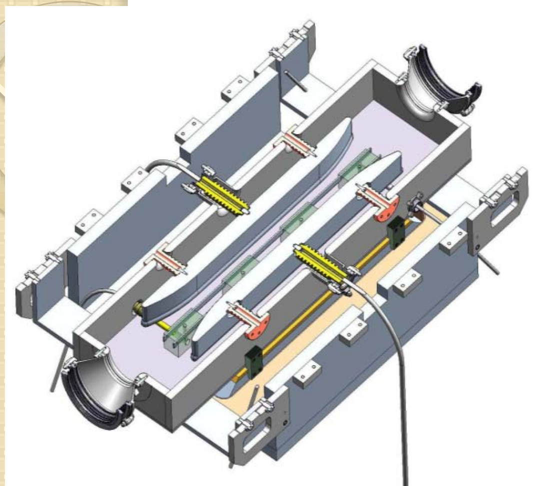
Abeam=40 + Atarget=40 → Ar=80 Ewien=0.8MV/m Bwien=250 Gauss T16# 0.35cm/%
(± 65kV) Δx#18 cm

Abeam=94 + Atarget=40→ Ar=134 Ewien=1.2MV/m Bwien=362 Gauss T16#0.5cm/%
(V± 90kV) Δx#15cm

Abeam=94 + Atarget=24 → Ar=114 Ewien=1.6MV/m Bwien=490 Gauss T16#0.65 cm/%
(V± 120 kV) Δx#12 cm

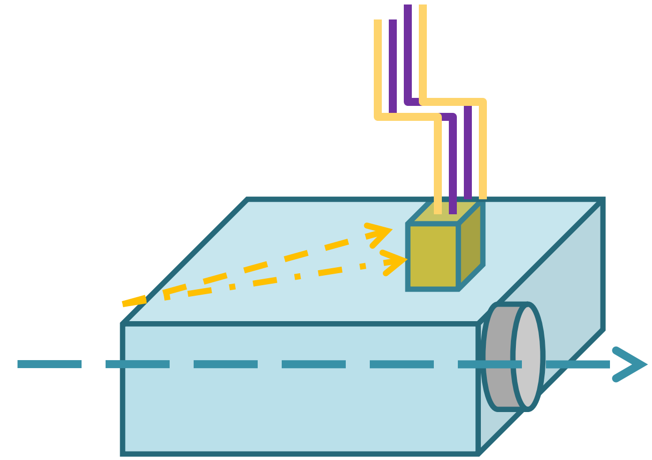
Rejection = 10**4-10**3 ???

TECHNICAL issues for « VAMOS Wien FILTER » IN G2

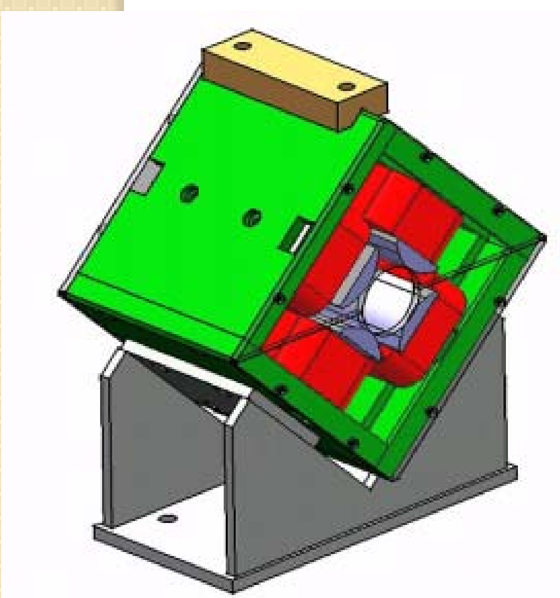


Design of a new
Electrodes box

Vmax#+/-150 kV
Egap# 15 cm
LE -eff= LB-eff= 108 cm



Chamber +
Detection ?:
-Plastic
- Ionisation Chamber+Si
-Bragg Chamber
- Musett for RDT



Design of quad doublet
Quad N°1 f=180mm
G = 7.5 T/m; L#0.3m

Quad N°2 f=240mm
G = 5.7 T/m; L#0.4m

Needed for
beam dump acceptance

B.JACQUOT : 06/2010