Exploring p-n pairing effects in the β-decay of T_z=-1 ^{62}Ge FRS-RISING Stopped Beam campaign

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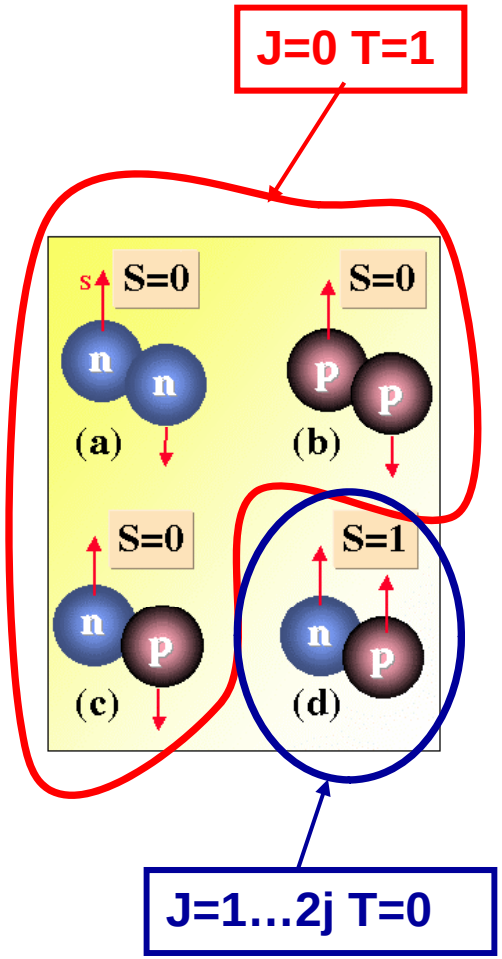
For the S326 RISING collaboration

Since long 62Ga is contemplated by nuclear structure theorist as a candidate for high spin phenomena related with T=0 pairing.

Through the 62Ge GT β-decay it is possible to explore also T=0 properties of low-lying 62Ga states.

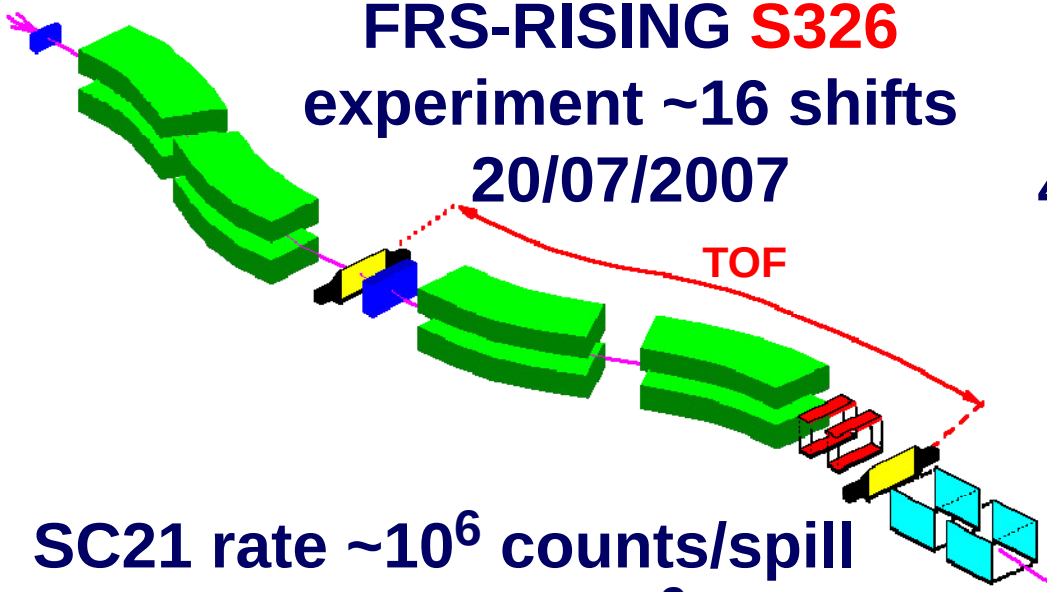
Single fermion GT transitions in medium mass nuclei are highly retarded *logft* > 4 (break of SU(4) symmetry). If p-n pairing survives small *logft* (large B(GT)) values are expected



FRS-RISING S326

experiment ~16 shifts

20/07/2007



$^{78}Kr^{34+}$ 750MeV/u

4.011g/cm2 Be + SEETRAM

6.5 g/cm2 Al S2 degrader

Extraction 9s

Implantation-decay

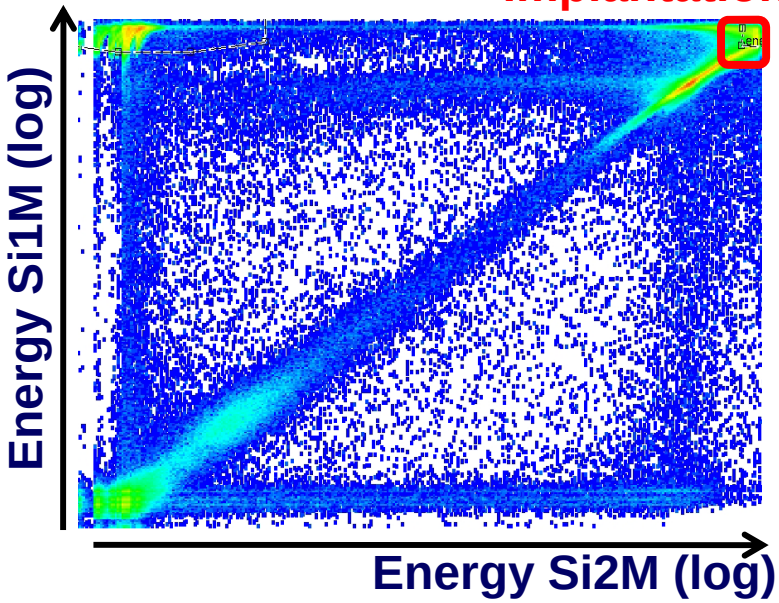
correlation efficiency ~40%

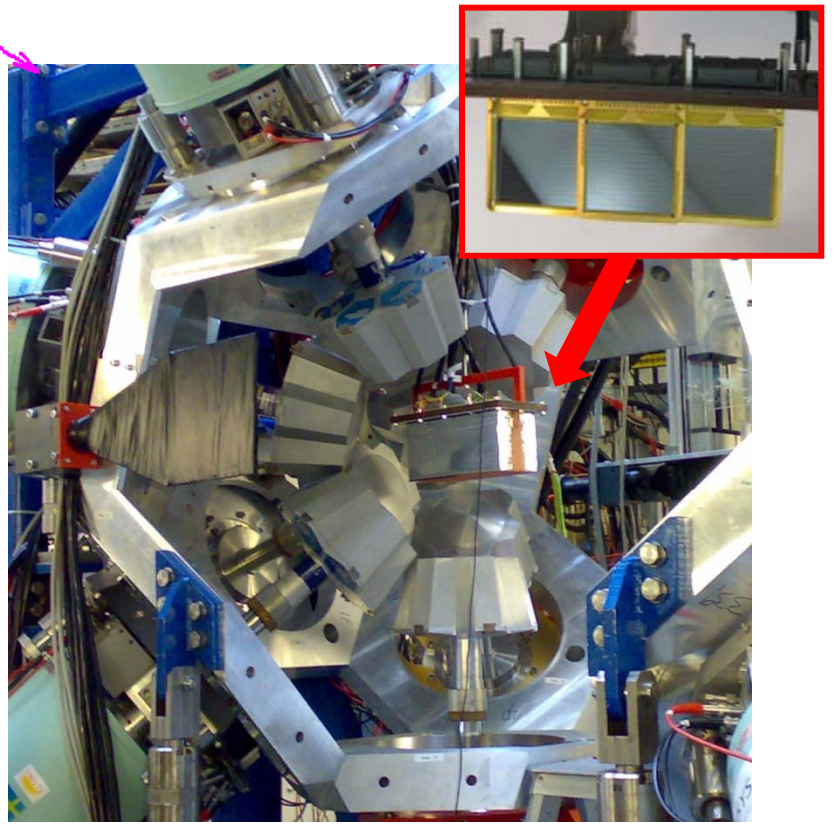
SC21 rate ~10^6 counts/spill

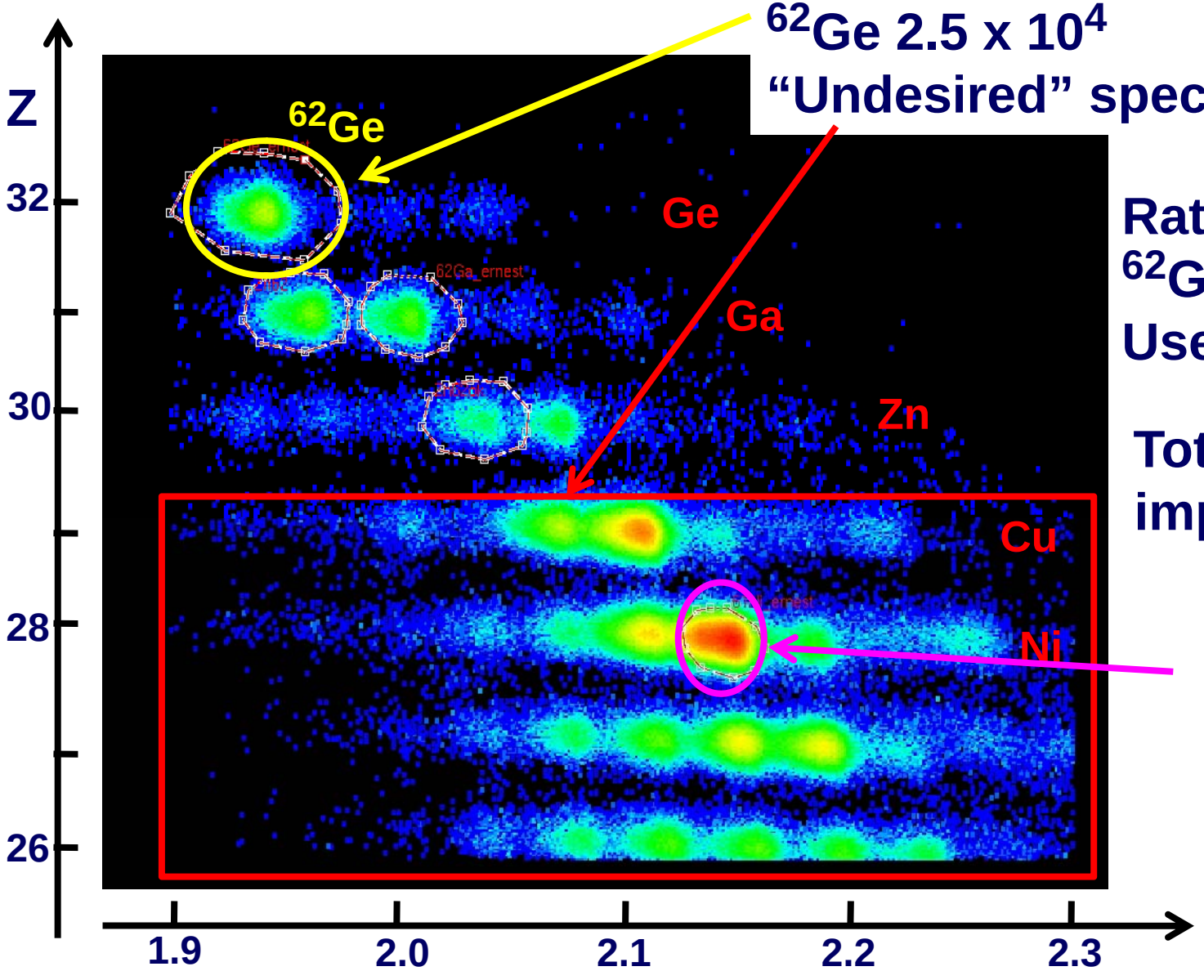
78Kr limited to ~$4x10^9$ / spill

Implantation Trigger 80 Hz

Implantation in S2M







FRS:

^{62}Ge 2.5 x 10^4

"Undesired" species: 1.7 x 10^6

Rates:

^{62}Ge:~0.5 pps

Useless:~40 pps

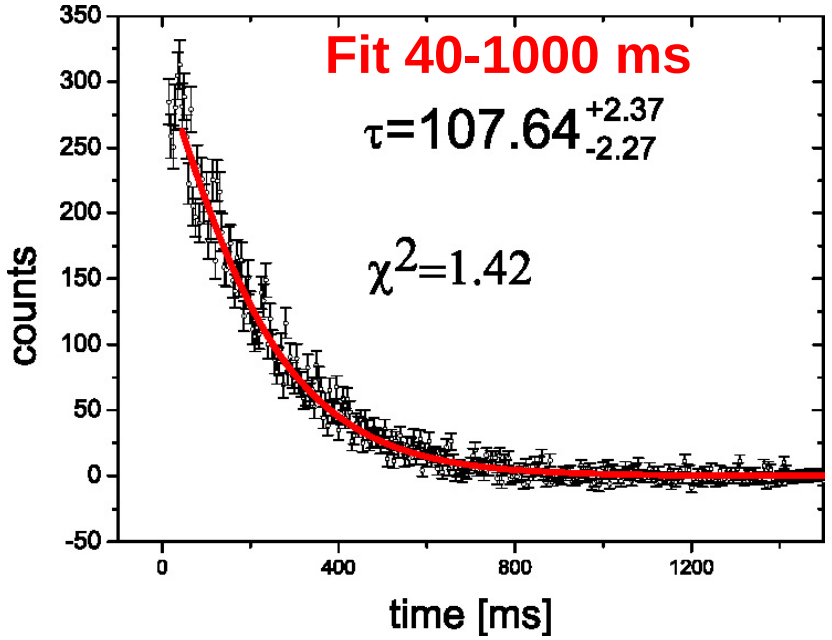
Total "correctly" implanted 62Ge: 1.9 x 10^4

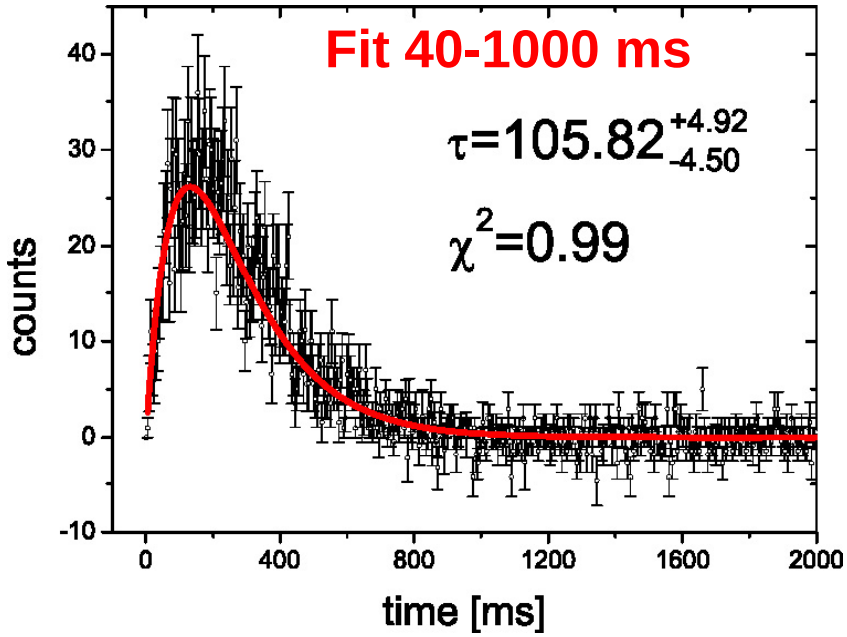
60Ni used to understand the possible random coincidence background

Sort by: E. Grodner INFN-LNL and HIL-Warsaw

J. Grebosz IFJ-PAN Cracow

^{62}Ge (T_z=−1) Lifetime Measurements





Gate on ^{62}Ge FRS+implantation Selected any decay after implantation i.e. decay time of ^{62}Ge + decay time of ^{62}Ga following the decay of ^{62}Ge

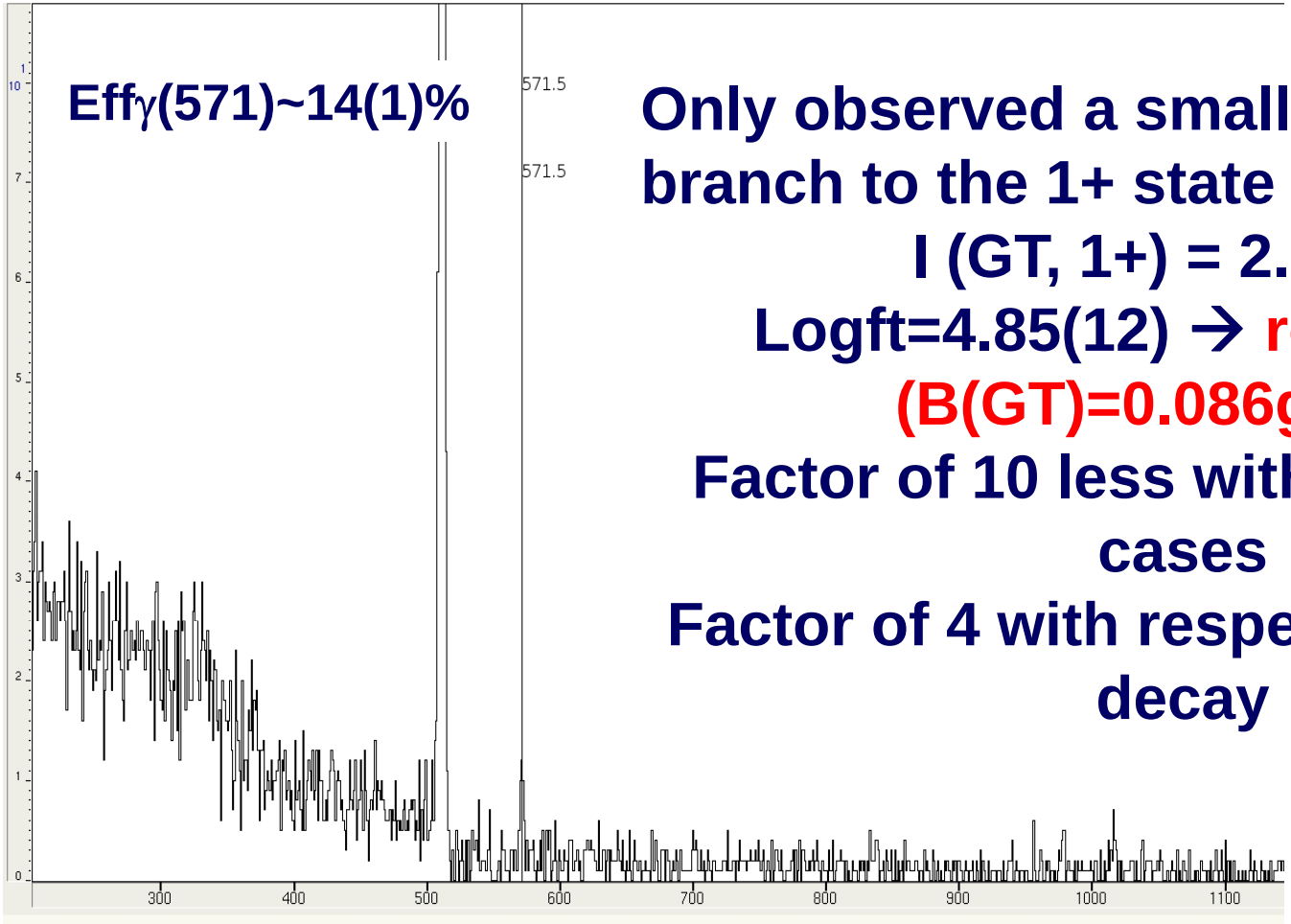
$T_{½}$ = 74.6 (16) ms (only statistical error)

Gate on ^{62}Ge FRS+implantation Selected two sequential decays after implantation i.e. decay time of ^{62}Ga following the decay of ^{62}Ge.

^{62}Ga $T_{½}$ = 116.121(21)ms from G.F.Grinyer et al., PRC77(08)015501

E. Grodner INFN-LNL and HIL-Warsaw

β-decay properties



Only observed a small GT decay branch to the 1+ state at 571 keV

I (GT, 1+) = 2.6(7)%

Logft=4.85(12) → retarded GT

($B(GT)=0.086 g_A^2/4\pi$)

Factor of 10 less with respect f7/2 cases

Factor of 4 with respect to the 58Zn decay

Conclusion: No evidence of p-n T=0 condensate in ^{62}Ga but highly diminish population of the low lying T=0 J=1+ state in the daughter nucleus

Agreement with Shell model Calculations

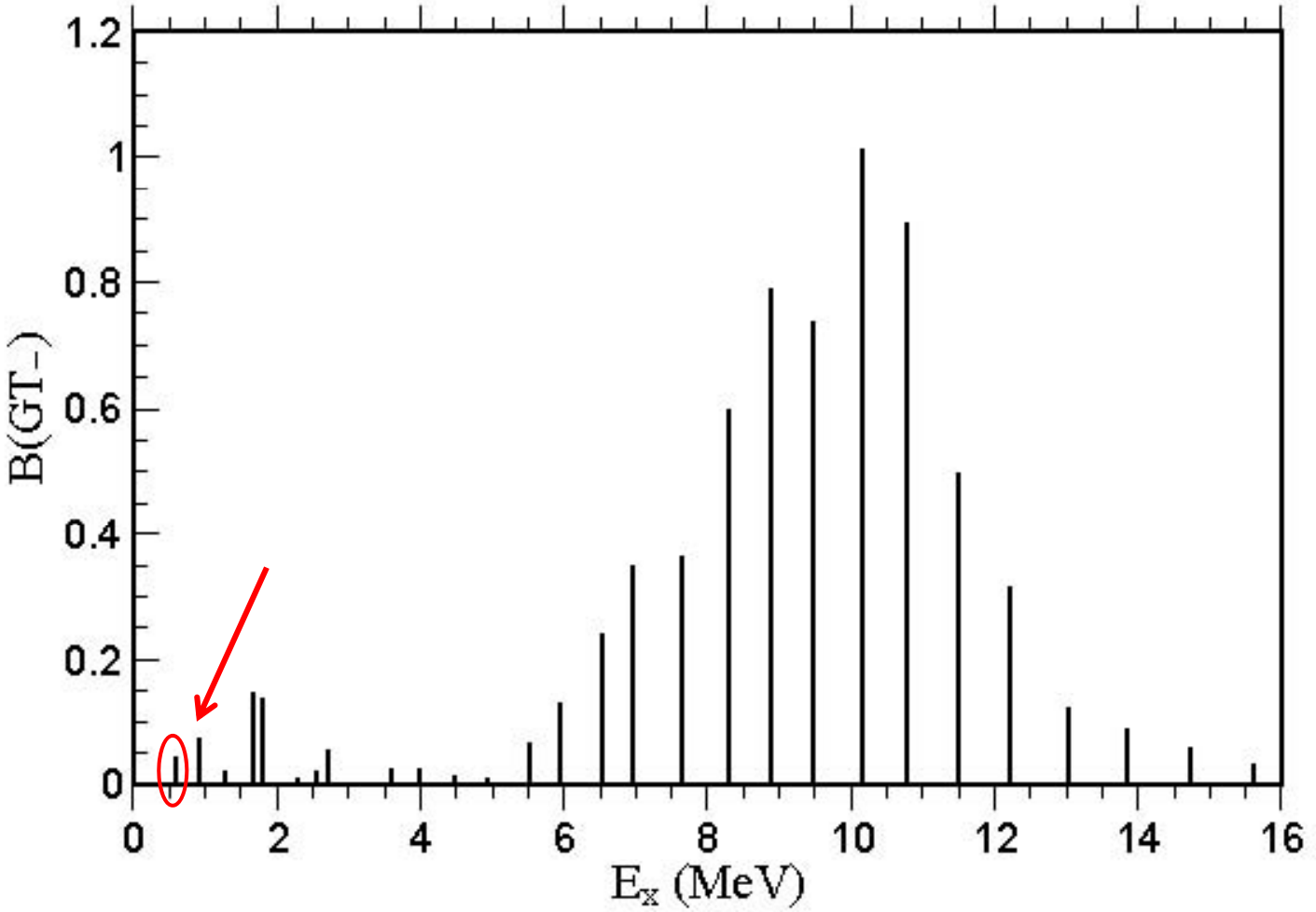


Fig. 7. Shell model GT_+ distribution for ^{62}Ge.

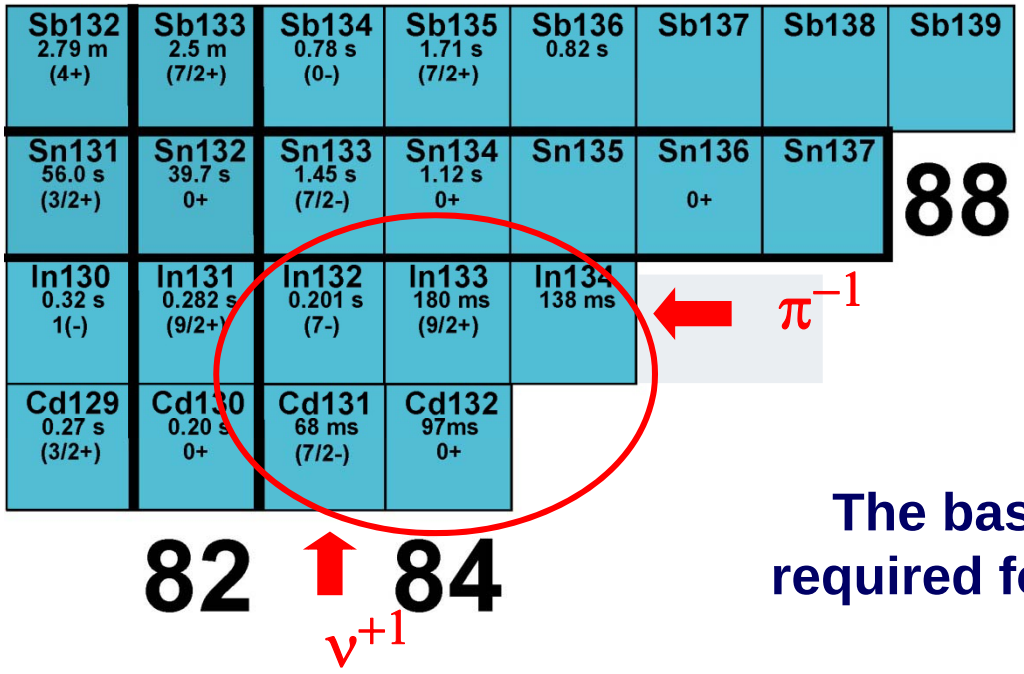
I.Petermann,G.Martínez-Pinedo,K.Langanke,E.Caurier
Eur.Phys.J.A34,319–324(2007)

Experimental Proposal S337

- Title "**Structure of ^{132}In populated in the β-decay of ^{132}Cd.**"
- Spokesperson: A.Gadea, IFIC-CSIC Valencia, Spain and INFN-LNL Legnaro, Italy
- GSI Contact Person: M.Górska, GSI-KPII
- Year of Approval:2007
- Shifts: 15 approved (main)
- 15 Shifts to be scheduled
- No parasitic beam assigned→ to be scheduled together with other 238U fission run
- Change of Rising Configuration to fast-beam mode on fall 2009

Experimental Proposal S337

The Southeast of the ^{132}Sn Region



No spectroscopic information available on nuclei with Z<50 N>83 (South-east) of the ^{132}Sn region.

The basic $\nu\pi^{-1}$ structure information required for the shell model calculations.

The most exotic species around ^{132}Sn: ^{132}In has a N/Z ratio ~1.69 to be compared with 1.68 for ^{134}Sn or 1.65 for ^{135}Sb (^{132}Cd N/Z~1.75).

The N=83 nuclei are the best candidates to observe the shell evolution at large isospin values, i.e. the evolution of the monopole interaction (tensor interaction between $\pi g_{9/2}$ and $\nu f_{7/2}$).

Experimental Proposal S337

Opportunity

- **Southeast of the ^{132}Sn: key region in the scientific program of the new generation radioactive beam facilities. The β-decay study of ^{132}Cd will contribute to make available fundamental information in the region.**
- **The GSI-FRS facility is the only one where is possible to get ^{132}Cd species identified even by event. Cadmium is difficult to extract from conventional ion sources.**
- **Rising has highest gamma efficiency in general, in particular for low energy gammas, for 500 keV it is ~15% and for 100 keV it's ~30% by far the highest efficiency one can get in the world in the near future.**
- **The Rising stopped setup with active stopper is prepared and running for the β-delayed gamma emission.**

FRS-RISING Setup

- **FRS focal planes equipment:**
  - **Standard FRS FP detectors MW/TPC & MUSIC**
  - **Standard Scintillator TOF between S2 and S4**
  - **Rising Active Stopper setup**
- **The Rising setup is ready, new active stopper DSSSD, for replacement/completion of the setup already purchased**
- **Standard equipment and DAQ required**
- **Primary ^{238}U beam 3x10^{9} pps (1 sec spill) posible by mid 2009**
- **15 shifts requested for 2009**

Experimental Proposal S337

Experimental details

- The ^{132}Cd production: induced fission of a ^{238}U beam at 750 MeV/u
- Production target 1g/cm^2 Be
- The extrapolated cross sections for ^{130}Cd ~1.8 10^{-6} barn and ^{132}Cd ~2.7 10^{-7} barn. Ratio (^{132}Cd/^{130}Cd) = 0.15
- The implantation rate of ^{130}Cd measured: 1 ion/min.
- With a beam intensity (SIS fast ramping mode) ~3x10^9 pps ^{132}Cd implantation rate of 0.3 ion/min = 400 ions/day
- The β-delayed P_n ~ 60%: i.e. ~40% with γ–transitions in ^{132}In.
- Rising array Efficiency > 15% at low energies, β-Efficiency ~40%.
- The setup with the active stopper to identify the sequential $T_{1/2}$=97(10) ms and $T_{1/2}$=207(6) ms two β-decays in the detector pixels.
- Beam time 5 days (15 shifts) for:
  - ~200 counts in each peak of the spectrum and
  - ~40 counts in the coincidence spectra

- β-delay spectroscopy of ^{130}Cd and ^{128}Cd will be also studied