Decay spectroscopy around ^{68}Ni with the EURICA setup

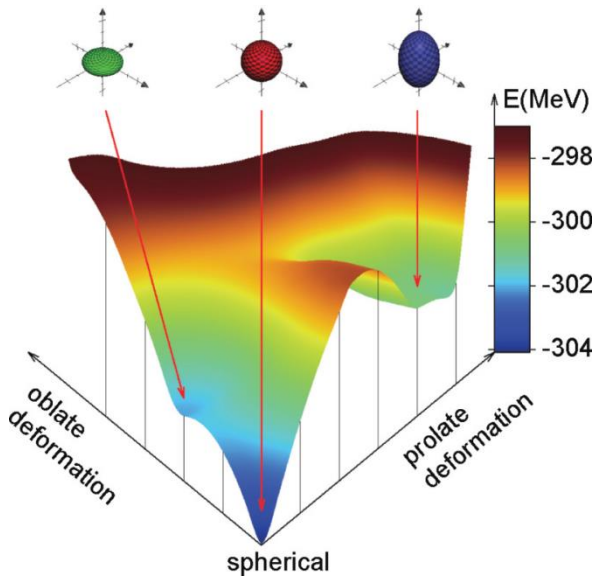
G.Benzoni
INFN sezione di Milano, Italy

Outline:

- Motivations
- Exp. Details
- First results

* Monte Carlo shell-model calculations give a coherent description of the experimental results and suggest that spherical, oblate, and prolate shapes appear within the energy range of 3 MeV in ^{68}Ni.

*Discussion in the conference about ^{68}Ni
Topical talks
+ POSTERS PS2-1037 Tsunoda
PS2-A039 Suchyta



Suchyta et al., PRC89 (2014) 021301(R)

Y.Tsunoda et al.,Phys.Rev. C 89 (2014) 031301

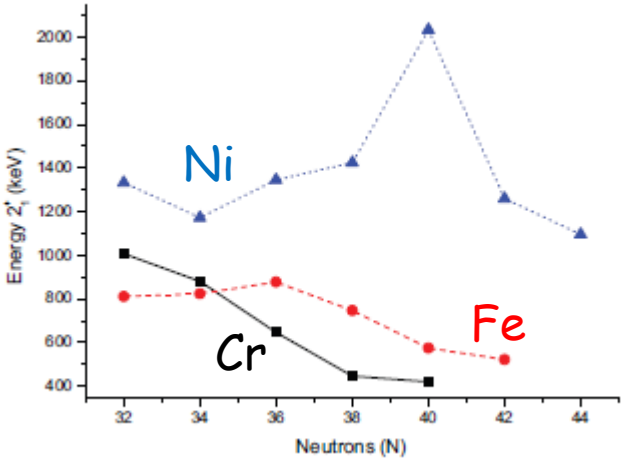
Physics around ^{68}Ni

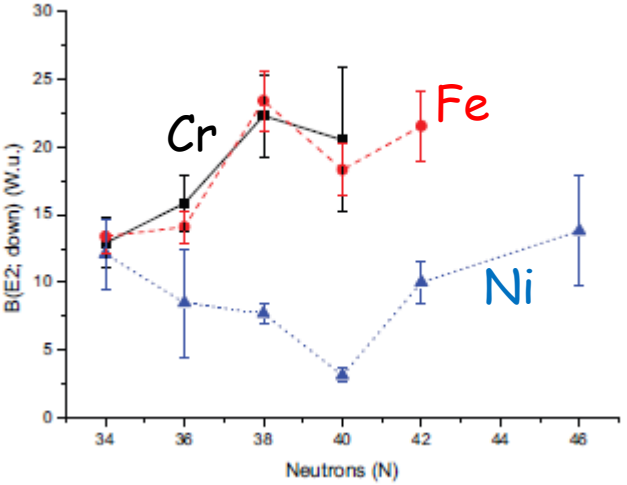
^{68}Ni is not a closed core
* rapid drop of 2^+ energy in Fe and Cr chains
* B(E2) indicate an increase in collectivity

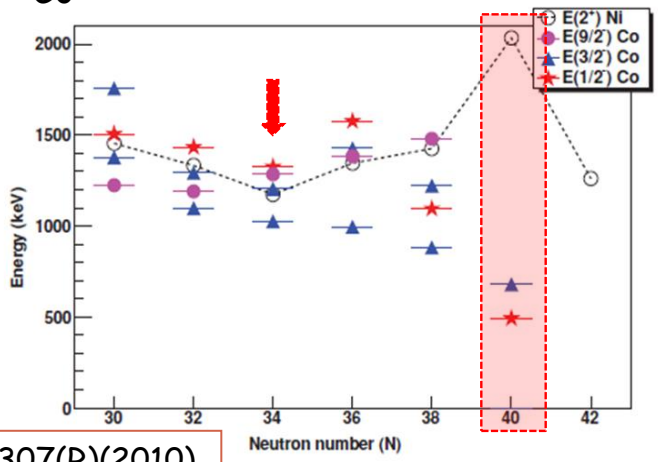
Onset of collectivity as protons are removed from f7/2 along the N=40 isotonic chain

➔ Removal of 2 protons from 68Ni to 66Fe results in an inversion of the normal configuration

The presence of intruder levels have been observed in the odd-*A* ^{65,67}Co isotopes where proton excitations across the *Z* = 28 shell have been suggested to account for the anomalous low-energy 1/2− states in both ^{65,67}Co







Pauwels et al. PRC78, 041307(R)(2010)

A. Macchiavelli, Acta Phys. Pol. B **44**, 359 (2013).
B. Pritychenko et al.At. Data Nucl. Data Tables **98**, 798 (2012).
T. Baugher et al, Phys. Rev. C **86**, 011305 (2012).
B.Olaizola et al, PRC88(2013) 044306

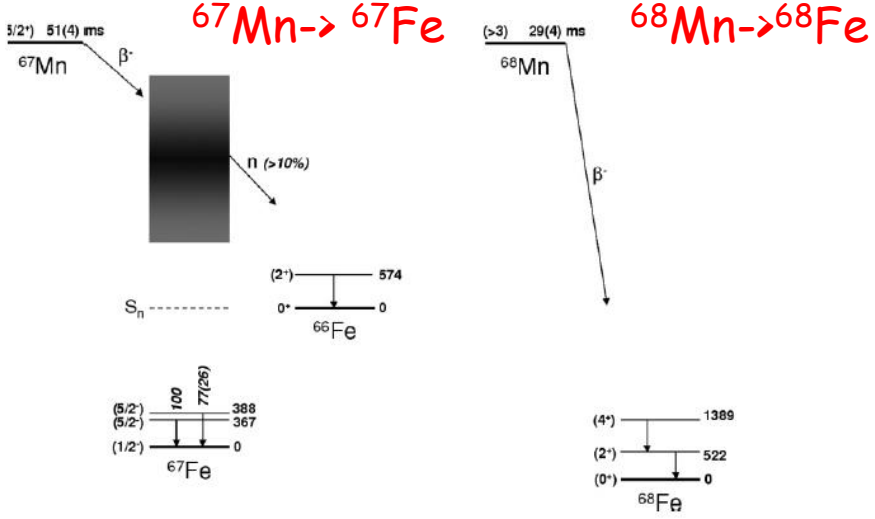
Fe isotopes: up-to-date experimental information

Region has been attached by many exp. lately (MSU-CERN)

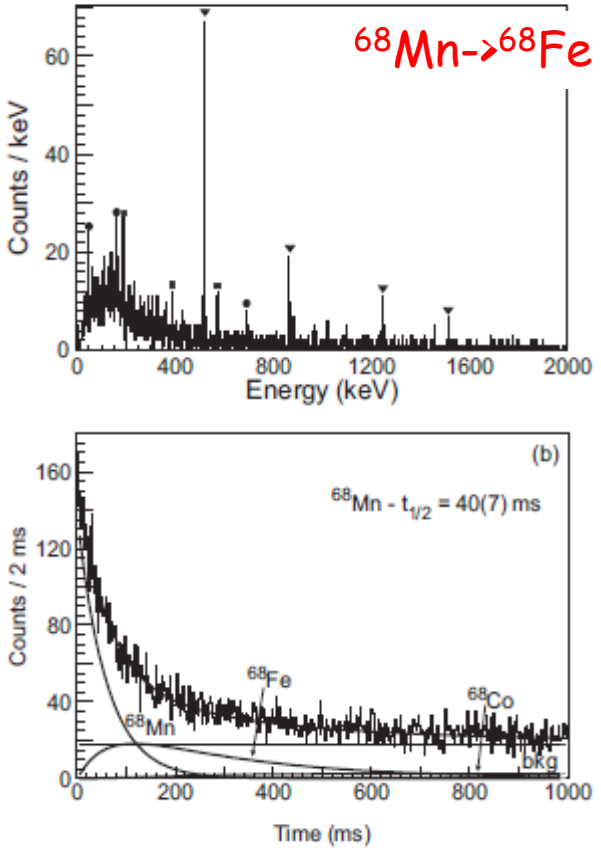
- Fast timing measurements ^{63}Mn->^{63}Fe
  ^{65}Mn->^{65}Fe
  ^{66}Mn->^{66}Fe

POSTERS: PS1-A011
PS1-A012

B.Olaizola et al, PRC88(2013) 044306



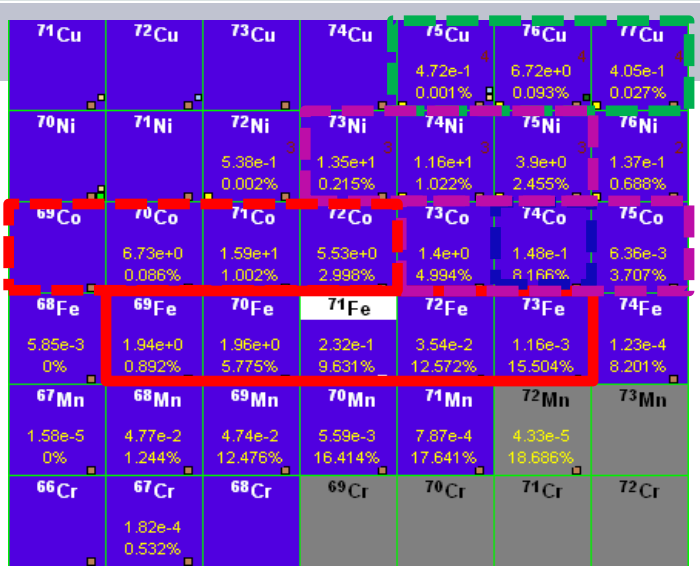
J.M.Daugas et al., PRC 83, 054312 (2011).



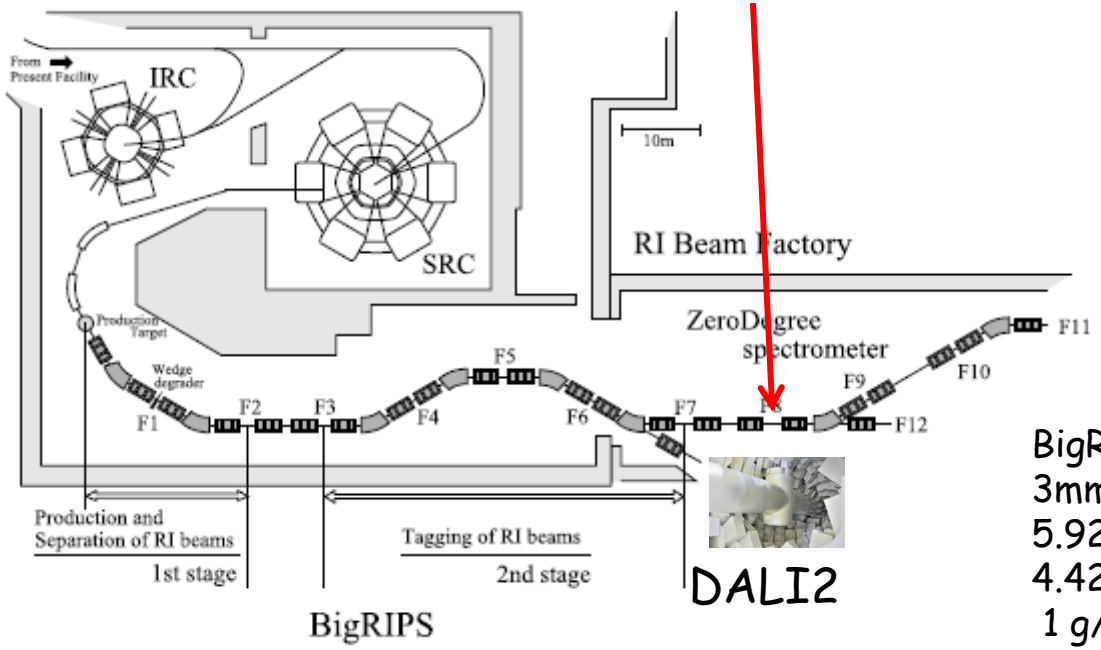
S.N.Liddick et al., PRC 87, 014325 (2013).

RIBF80+RIBF49 experiment at RIKEN

3 days of beamtime
^{238}U @ 345MeV/u
I_{beam}~ 10 pnA
BigRIPS setting focused on ^{71}Fe
Decay +In-Beam studies

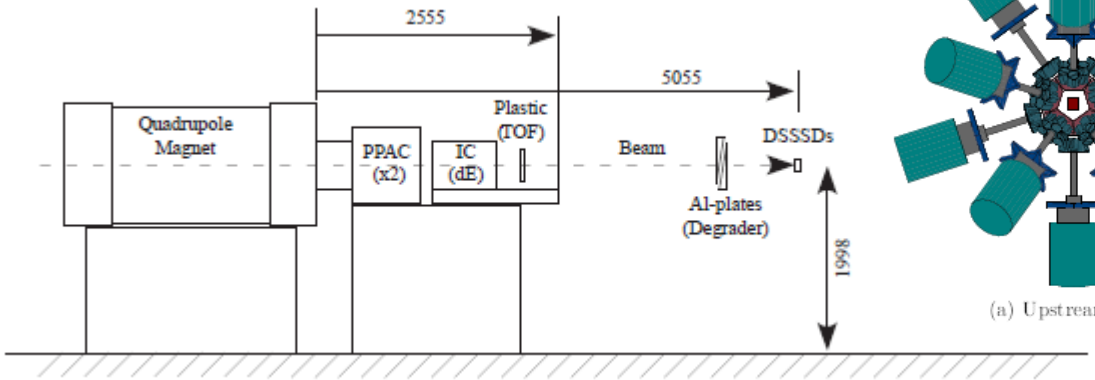


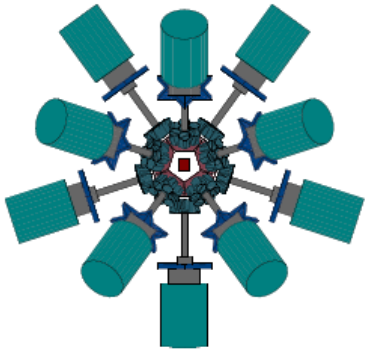
In-beam
Coulex $^{73-75}Ni$



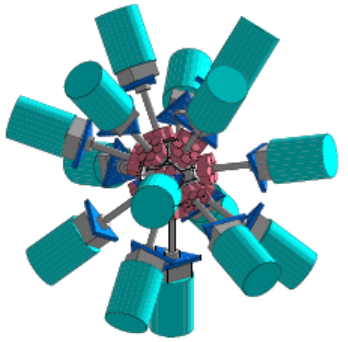
BigRIPS setting:
3mm Be target
5.92 mm Al F1 degrader
4.42 mm Al F5 degrader
1 g/cm2 Pb secondary target

EURICA setup

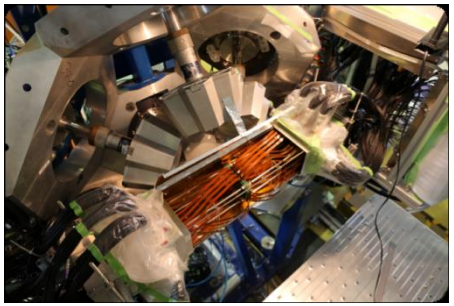




(a) Upstream view

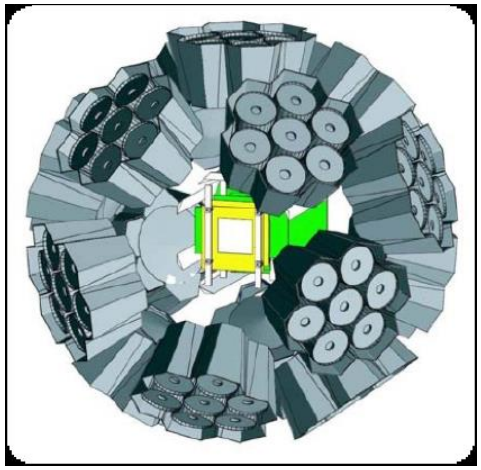


(b) View from 120 degrees



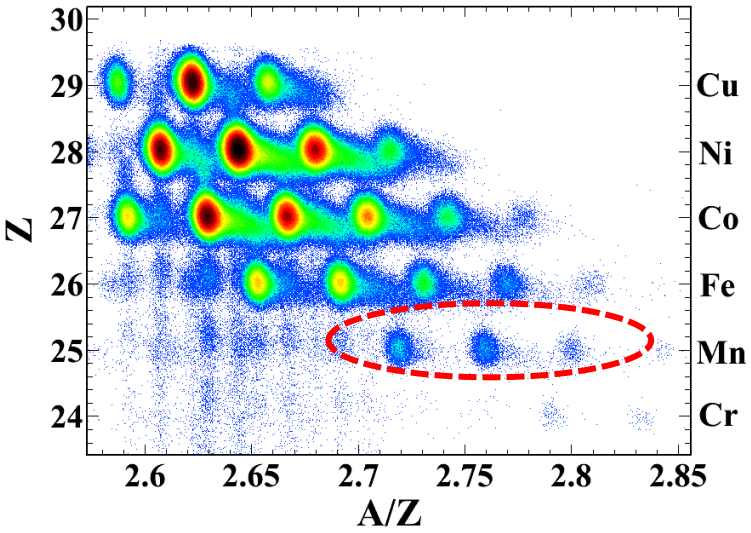
5 DSSSD - WAS3ABI
(64X40 strips)
Ion-beta correlations

12 HPGe Clusters
β–γ correlations



18 $LaBr_3(Ce)$ (1.5"x 2")
2 BC-418 Plastic 2mm thick
Fast-timing measurements

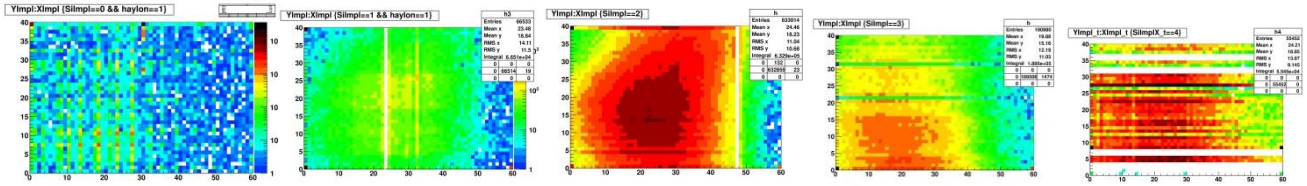
Experimental spectra

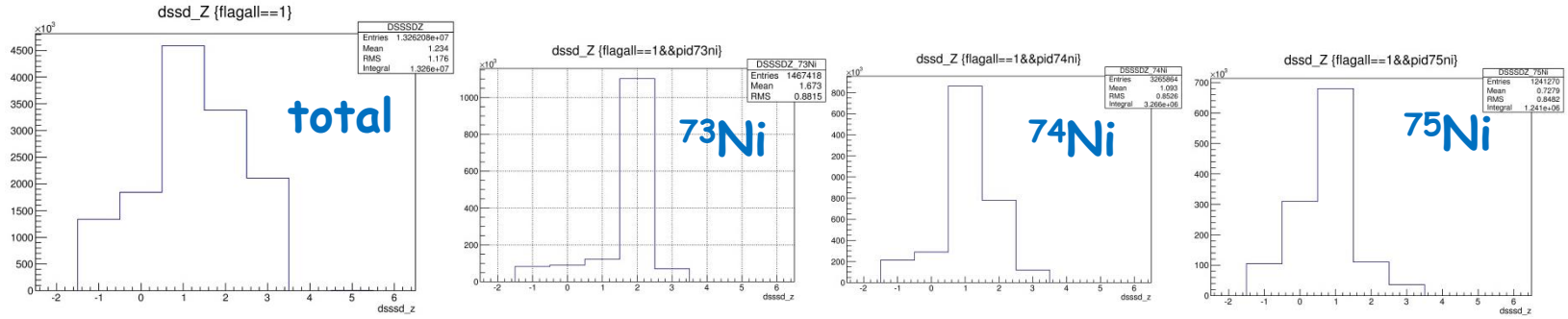


Research mainly focusing in:

- Isomer search
- New half-lives
- Delayed spectroscopy:
  - Transitions measured for first time
  - Extension of level schemes

Example of implantation profiles for ^{72}Co

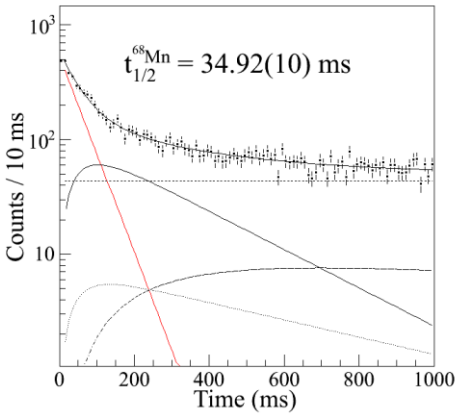




Lifetime measurement

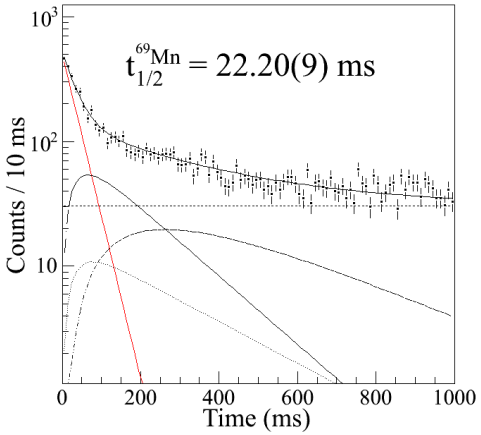
Parent	N_{ions}	ε_β	T1/2 [ms]
^{70}Co	$1.5 \cdot 10^5$	32	112.3(2.6)
^{71}Co	$1.6 \cdot 10^6$	48	86.5(0.3)
^{72}Co	10^6	54	53.6(0.2)
^{73}Co	$3 \cdot 10^5$	52	41.9(0.2)
^{74}Co	$3 \cdot 10^4$	52	33.5(0.5)
^{75}Co	10^4	56	25.9(2.1)
^{69}Fe	$2 \cdot 10^5$	34	107.4(1)
^{70}Fe	$1.8 \cdot 10^5$	51	65.9(0.5)
^{71}Fe	$3 \cdot 10^4$	48	31.9(0.6)
^{72}Fe	$5.4 \cdot 10^3$	53	14.7(0.9)
^{73}Fe	300	53	13.3(1.6)
^{68}Mn	**$7.7 \cdot 10^3$**	**46**	**34.92(10)**
^{69}Mn	**$5 \cdot 10^3$**	**43**	**22.20(9)**
^{70}Mn	**500**	**57**	**12.4(4)**

Ref	FRDM [3]
40(7) [1]	12.8
18(4) [2]	12.9
	9



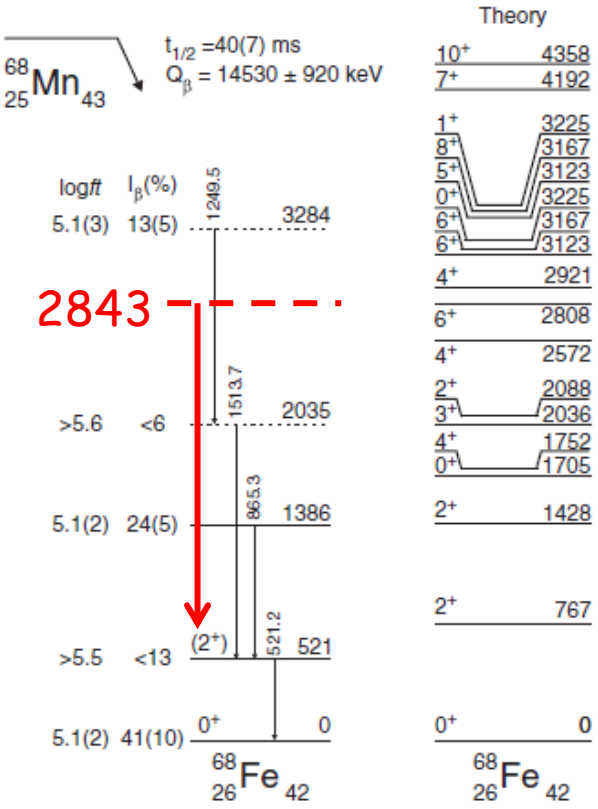
^{68}Mn-> ^{68}Fe

^{69}Mn-> ^{69}Fe

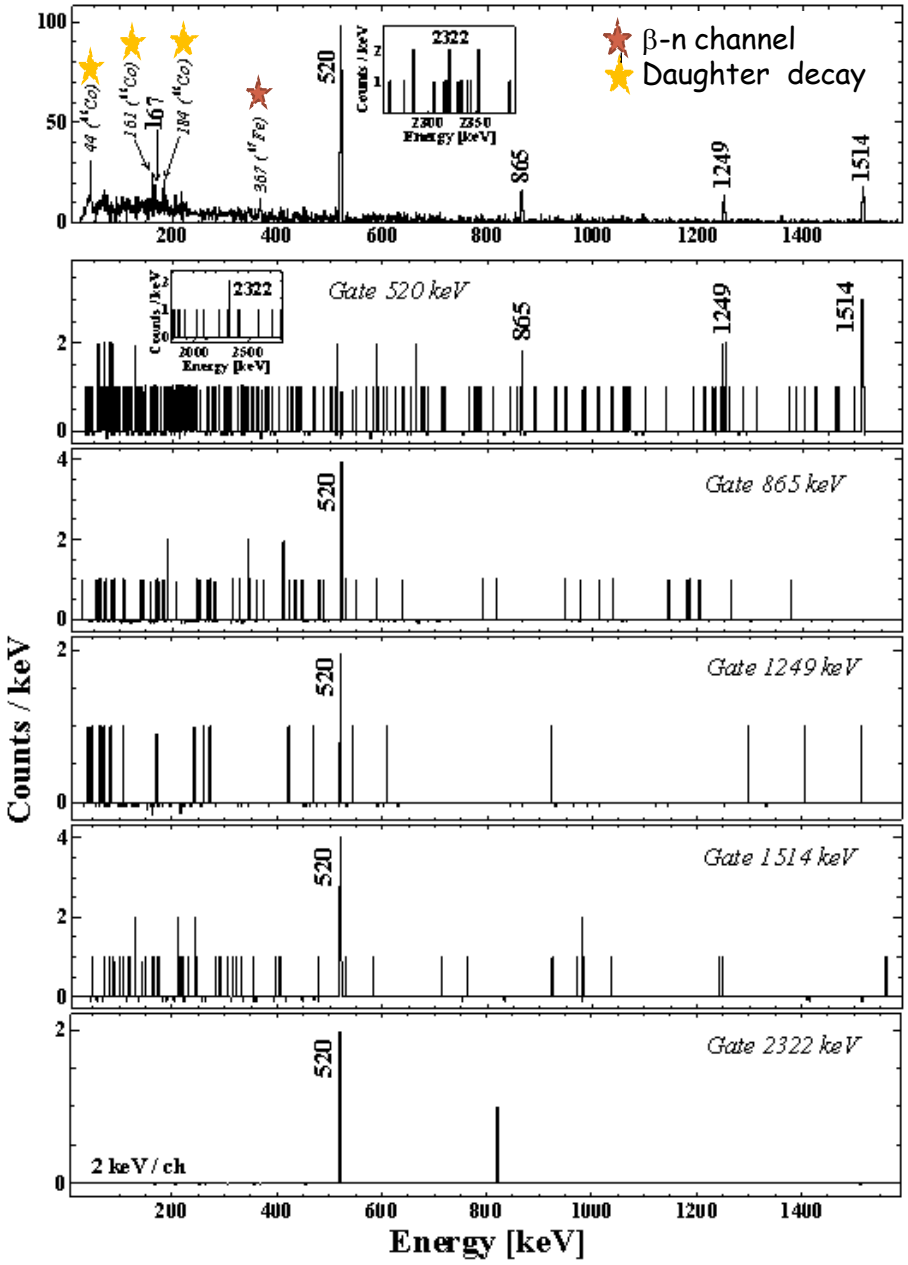


[1] S.N.Liddick et al., PRC 87, 014325 (2013).
[2] J.M.Daugas et al., PRC 83, 054312 (2011)
[3] P.Moller, B.Pfeiffer and K.-L. Kratz,Phys.Rev. C 67, 055802 (2003)

^{68}Mn-> ^{68}Fe



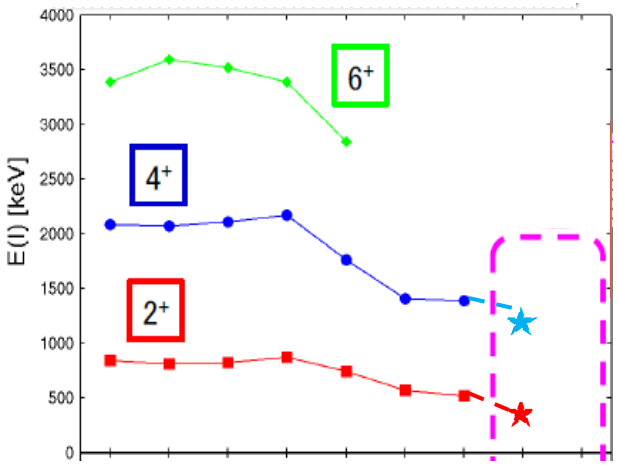
S.N.Liddick et al., PRC 87, 014325 (2013).

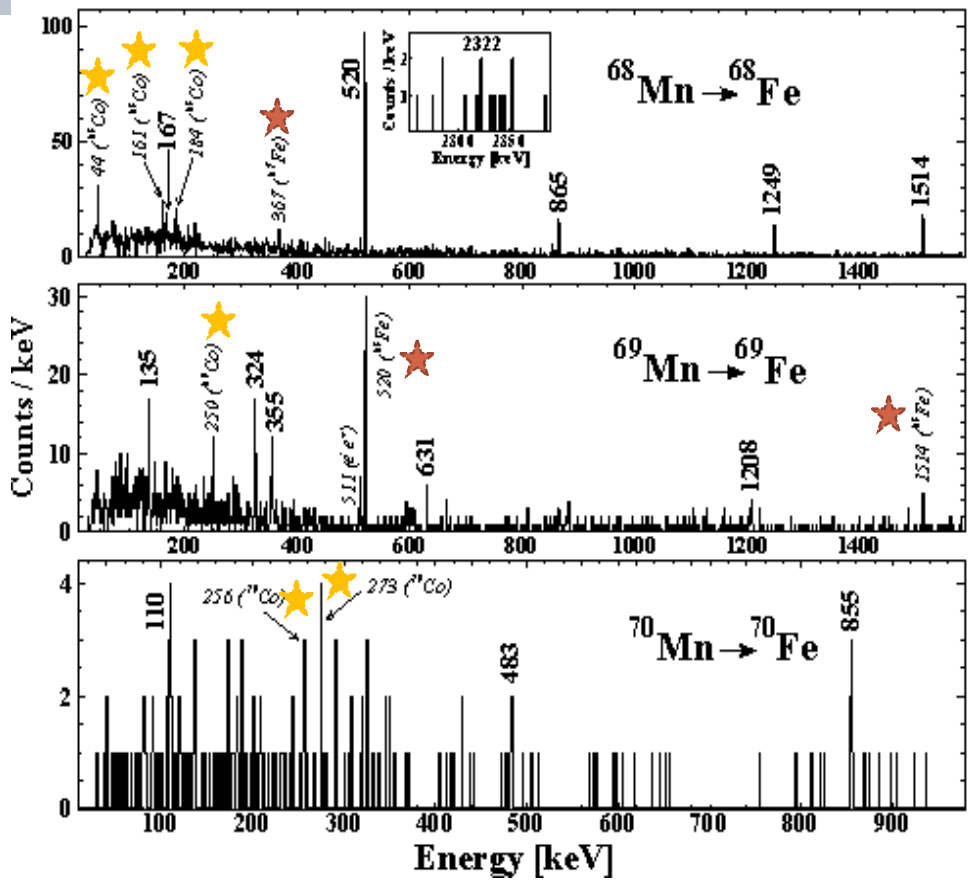


Agreement with latest results
Additional state at 2.8 MeV decaying to 2^+

^{69}Mn-> ^{69}Fe and ^{70}Mn-> ^{70}Fe

- β-n channel
- daughter decay





Decay spectra of $^{69\text{-}70}$Fe

- Definition of the level scheme
- P_n evaluation
- Comparison with SM calculations (S.Lenzi)

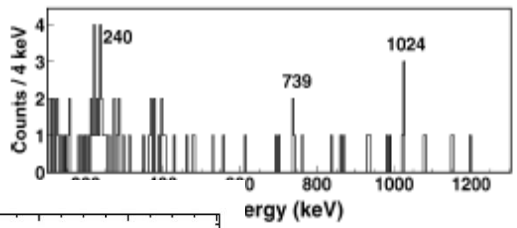
Conclusions:

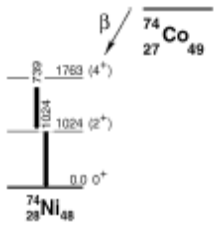
- Region around ^{68}Ni studied at RIKEN
- Relativistic fission of 238U beam
- BigRIPS+ZeroDegree + EURICA setup

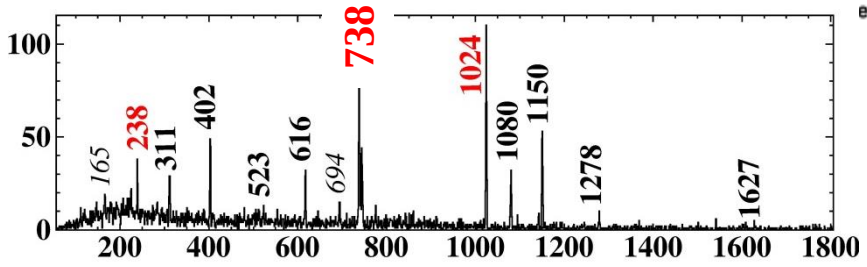
* 3 days of beamtime
* Populated wanted region with sufficient statistics
* Results still VERY preliminary

➔ Measurement of new half-lives
➔ Transitions in $^{69\text{-}70}$Mn measured for first time
➔ Evaluation of other populated nuclei (Co-Ni)

^{74}Co->^{74}Ni







C.Mazzocchi et al. PLB622

Collaboration

Ana Isabel Morales Lopez INFN-MILANO
Hiroshi WATANABE Beihang Univ

NISHIMURA Shunji RIKEN
LORUSSO Giuseppe RIKEN
SUMIKAMA Toshiyuki Tohoku Univ.
DOORNENBAL Pieter RIKENMelon Barbara
XU Zhengyu Univ. of Tokyo/RIKEN
ISOBE Tada-aki RIKEN
SöDERSTRöM P.A. RIKEN
BROWNE Frank Brighton Univ./IPA
WU Jin Peking Univ./RIKEN
YAGI Ayumi Osaka Univ.
BABA Hidetada RIKEN
PATEL Zena Surrey Univ./IPA
RICE Simon Surrey Univ./IPA
SINCLAIR Laura York Univ./IPA

DOMBRADI Zsolt ATOMKI
SOHLER Dora ATOMKI
VAJTA Zsolt ATOMKI
KUTI Istvan ATOMKI
INFN-Firenze
Valiente Dobon Jose Javier INFN-LNL
Mengoni Daniele Universita' di Padova
Modamio Hoybjor Victor INFN-LNL
Napoli Daniel INFN-LNL
Yalcinkaya Mehtap University of Istanbul
Sahin Eda Univ. of Oslo
Sakurai Hiroyoshi Univ. of Tokyo
Taniuchi Ryo Univ. of Tokyo/RIKEN
Matsui Keishi Univ. of Tokyo
Miyazaki Takuya Univ. of Tokyo
Momiyama Satoru Univ. of Tokyo
Orlandi Riccardo Instituut voor Kern- en StralingsFysica/K.U. Leuven
Delattre Marie-Coralie IPNO Orasy

Crespi Fabio C.L. INFN-Milano
Blasi Nives INFN-Milano
Ceruti Simone INFN-Milano
Avigo Riccardo INFN-Milano
YOKOYAMA Rin CNS
DAIDO Rie Osaka Univ.
FANG Yifan Osaka Univ.
NIIKURA Megumi Univ. of Tokyo
WIELAND Oliver INFN-Milano
TAPROGGE Jan Consejo Superior de Investigaciones Cientificas
BELLO GARROTE Frank L. Univ. of Oslo
DE ANGELIS Giacomo INFN-LNL
GOTTARDO Andrea INFN-LNL