

# Comparison study on low-level Sr-90 measurements for the Dutch food monitoring program

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# Introduction RIKILT

- Institute for Food Safety
- About 200 employees
- Part of Wageningen University & Research





Our Mission

Safe and reliable food  
for everyone



WAGENINGEN  
UNIVERSITY & RESEARCH

# Our activities



Reference institute



Method development



Measuring and detecting substances



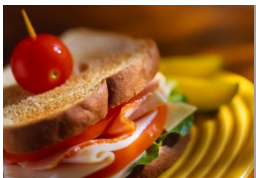
Safe food production



Effects of substances on humans and animals



Training and consultancy



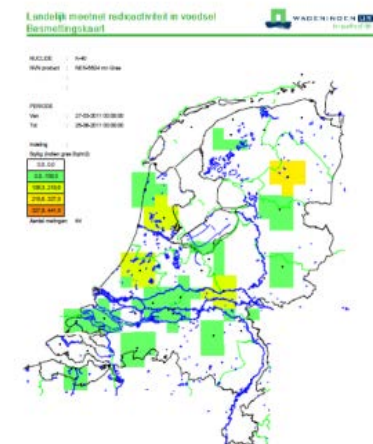
Food fraud and composition



24/7

# Activities on radiation monitoring (1)

- Incident monitoring network
  - 50 measuring stations
  - Automatic data collection to Wageningen
  - Providing information on contamination levels and advices on indirect measures



# Activities on radiation monitoring (2)

## ■ Regular monitoring program

- About 2500 analyses a year
  - 2000  $\gamma$ -measurements
  - 400  $\alpha/\beta$ -measurements



## ■ Focus on right discrimination between $\text{Sr}^{89}$ and $\text{Sr}^{90}$

- $\text{Sr}^{89}$  for early phase after incidents
- $\text{Sr}^{90}$  for obligations from Euratom 2000/473



# Experimental set-up

## ■ Available instruments:

- Canberra Packard Tricarb 2300
- Quantulus 1220
- Hidex LSC 300

## ■ Measuring strategy:

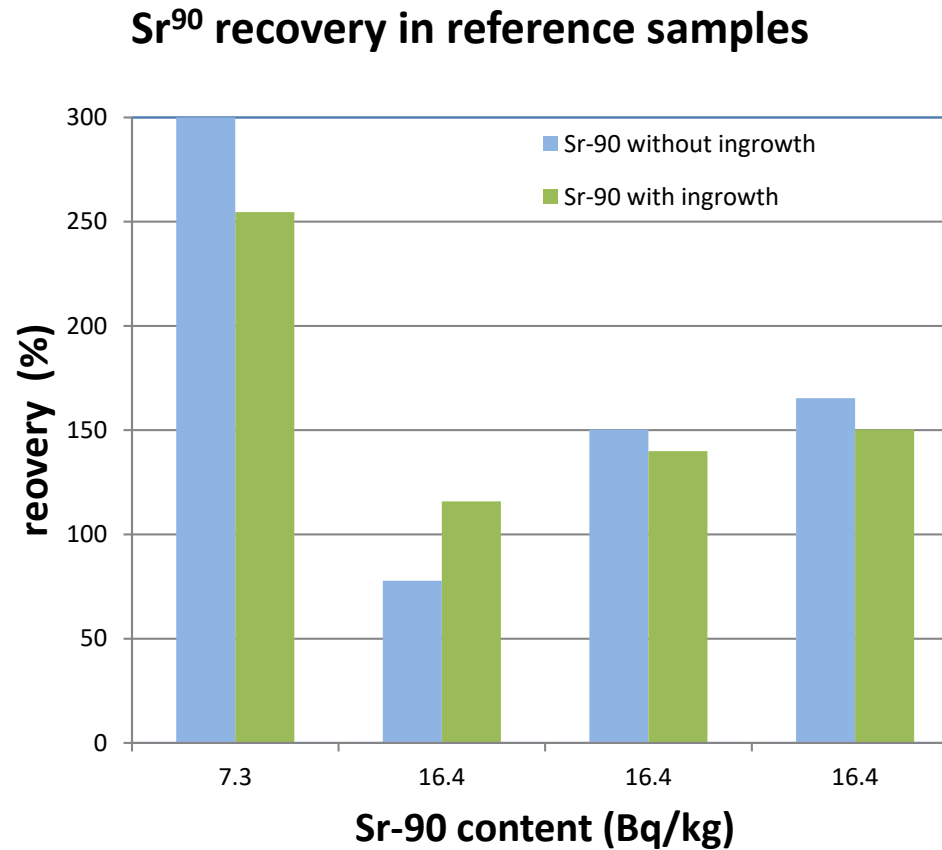
- Determine calibration lines for  $^{89}\text{Sr}$  and  $^{90}\text{Sr}$
- Tests of reference samples (different  $\text{Sr}^{89}/\text{Sr}^{90}$  ratios)
- Concentrations as low as possible (0.1 – 10 Bq)

# Samples with variable Sr<sup>89</sup>/Sr<sup>90</sup> ratios

Sample nr	Sr-89 (Bq/vial)	Sr-90 (Bq/vial)	Sr-89/Sr-90 ratio
1 (blanco)	-	-	N/A
2	1.1	-	N/A
3	-	0.7	N/A
4	5.82	0.7	8.3
5	5.82	0.35	17
6	12	0.35	34
7	0.58	0.07	8.3
8	1.1	3.68	0.30
9	0.54	3.51	0.15
10	0.53	7.12	0.07
11	0.11	0.35	0.31

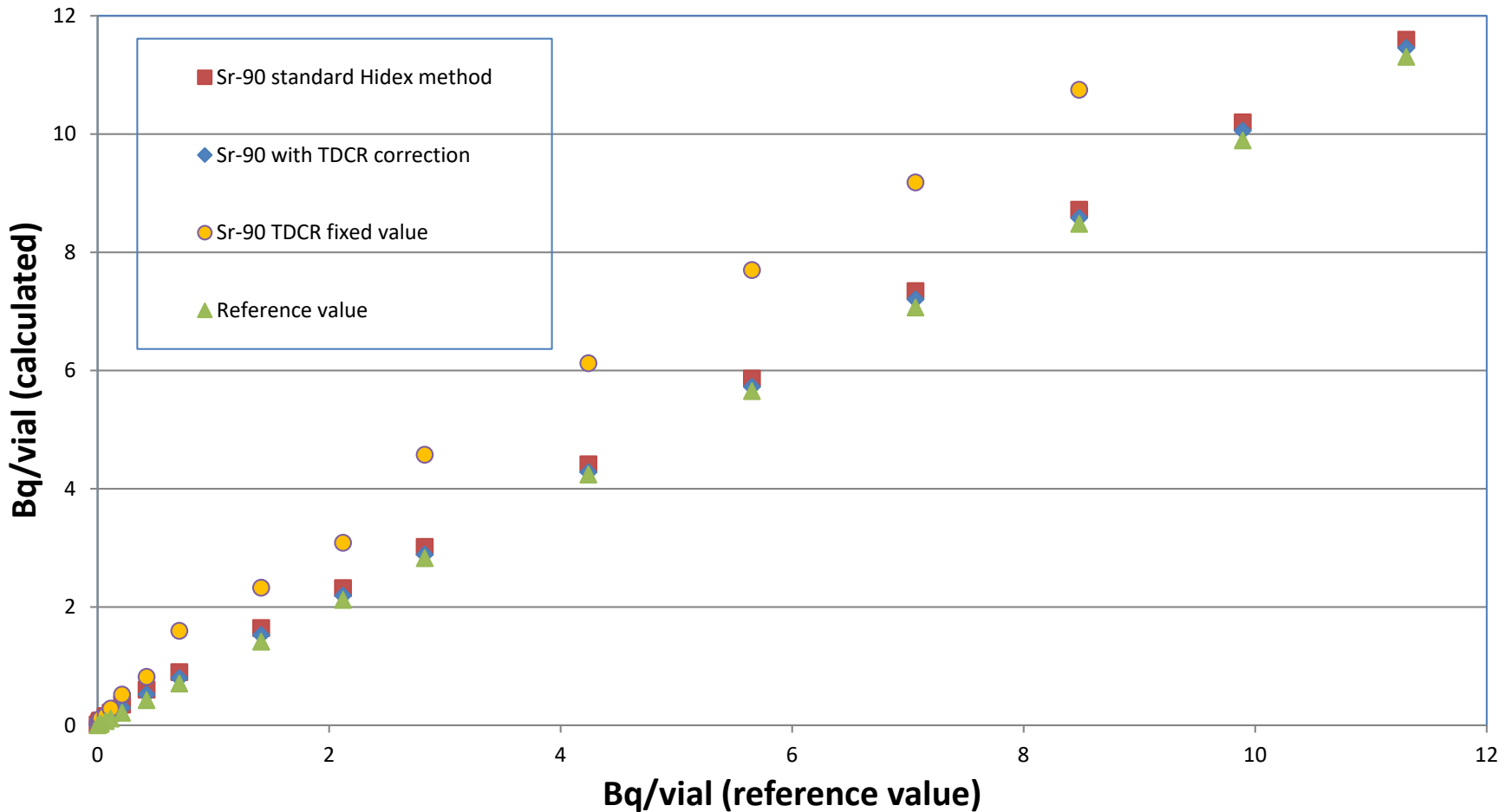


# First results in Sr<sup>90</sup> reference samples



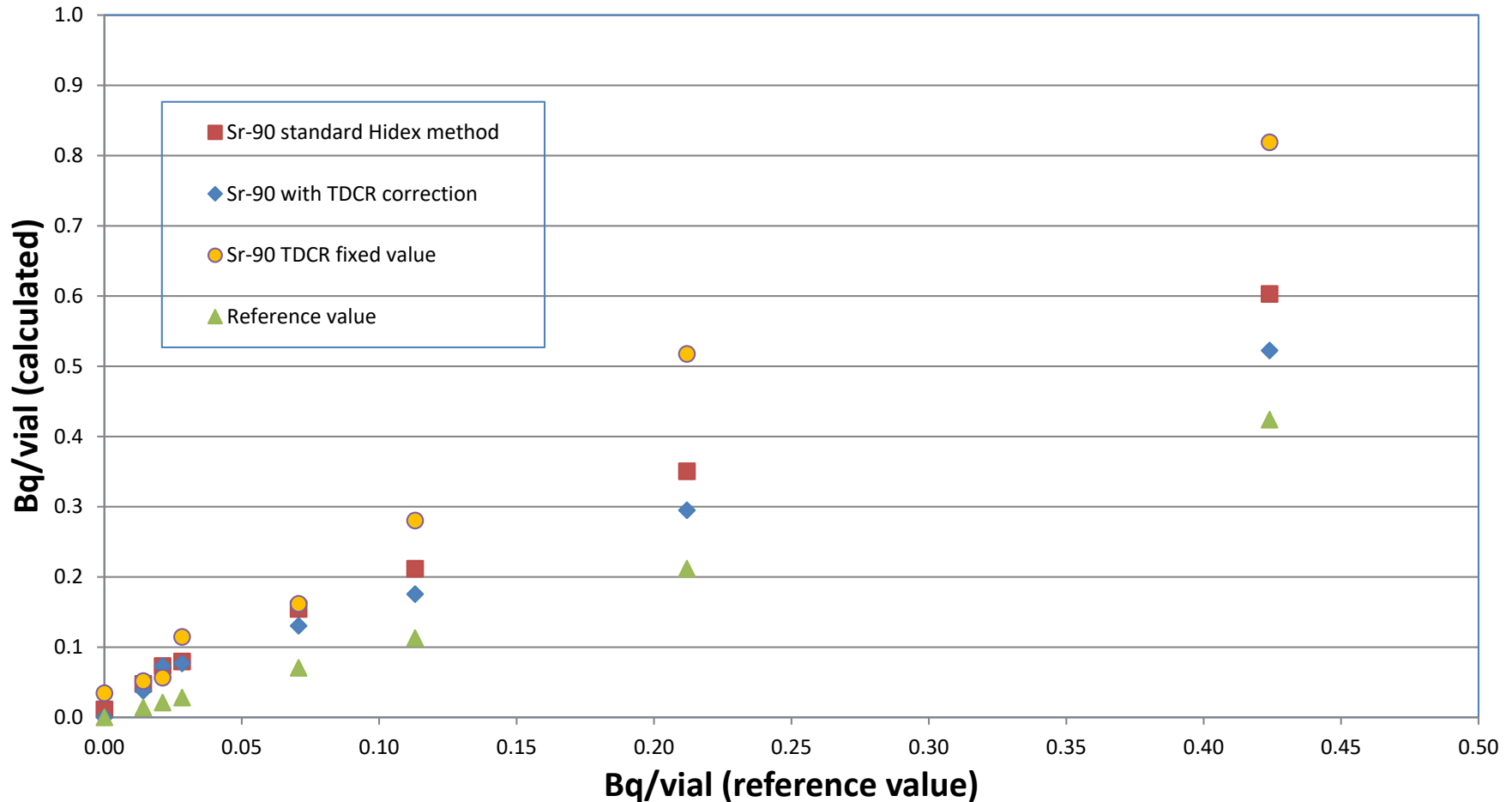
# Extended Sr<sup>90</sup> calibration line

Extended Sr-90 calibration line (in equilibrium with Y-90)



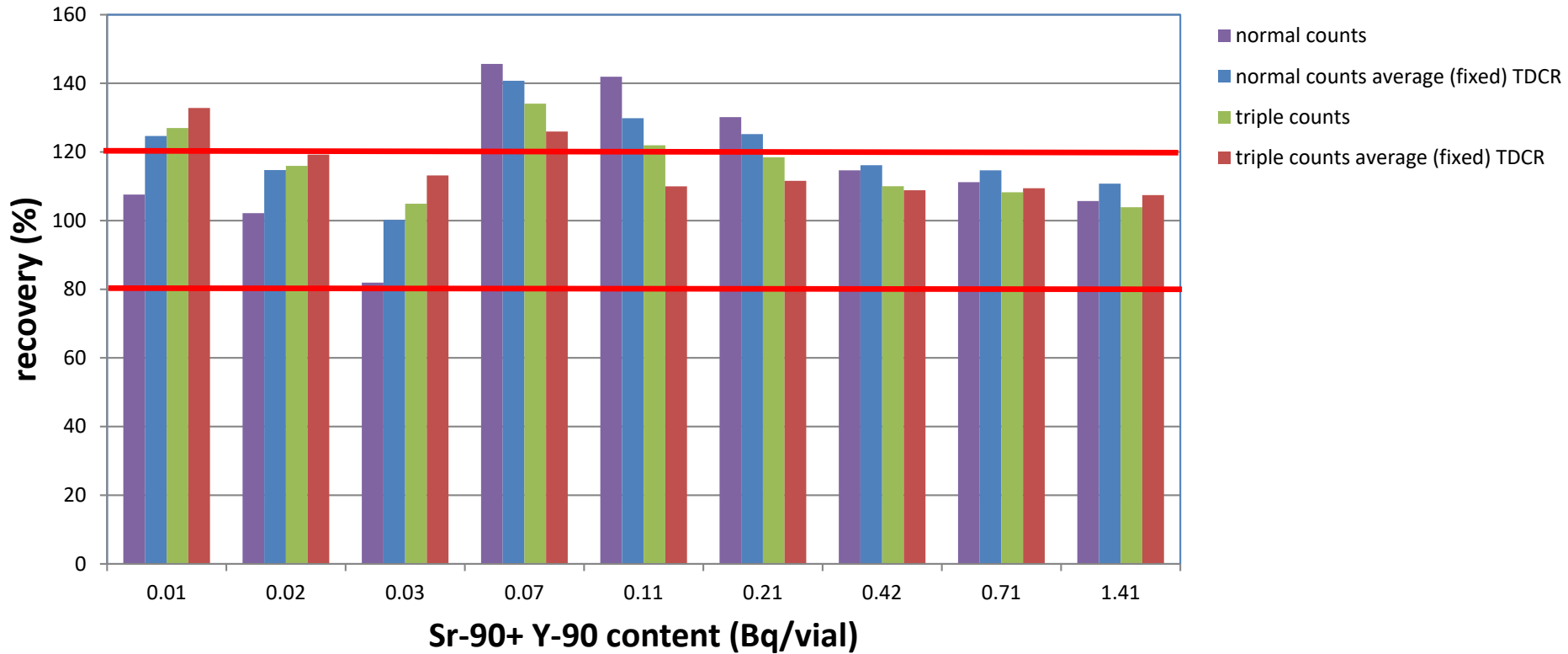
# Detailed view low level Sr<sup>90</sup> calibration line

Low level area of Sr-90 calibration line (in equilibrium with Y-90)



# New software installed

## Sr-90 + Y-90 recovery with new parameter settings





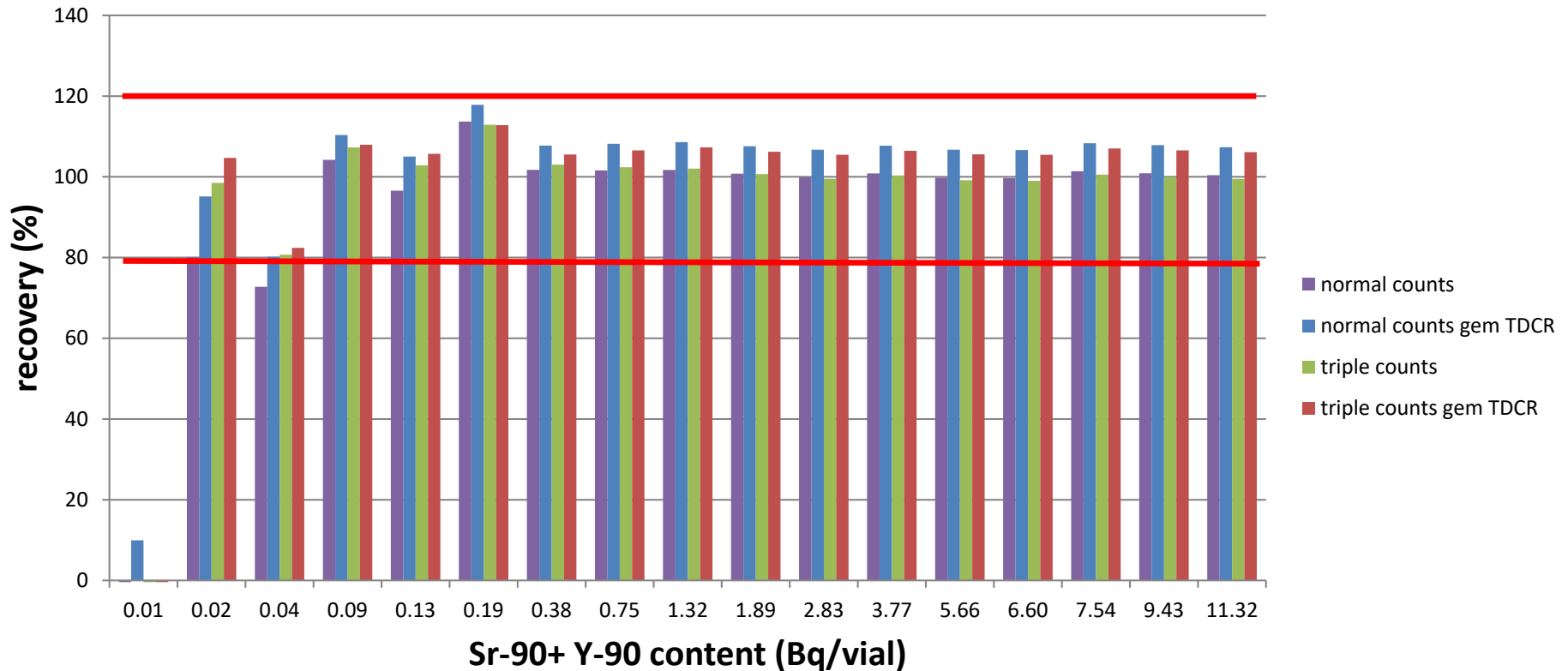
# Diagnosis of problems

- Number of chemiluminescence counts not stable ( $> 1$ )
- Number of luminescence counts increases considerably

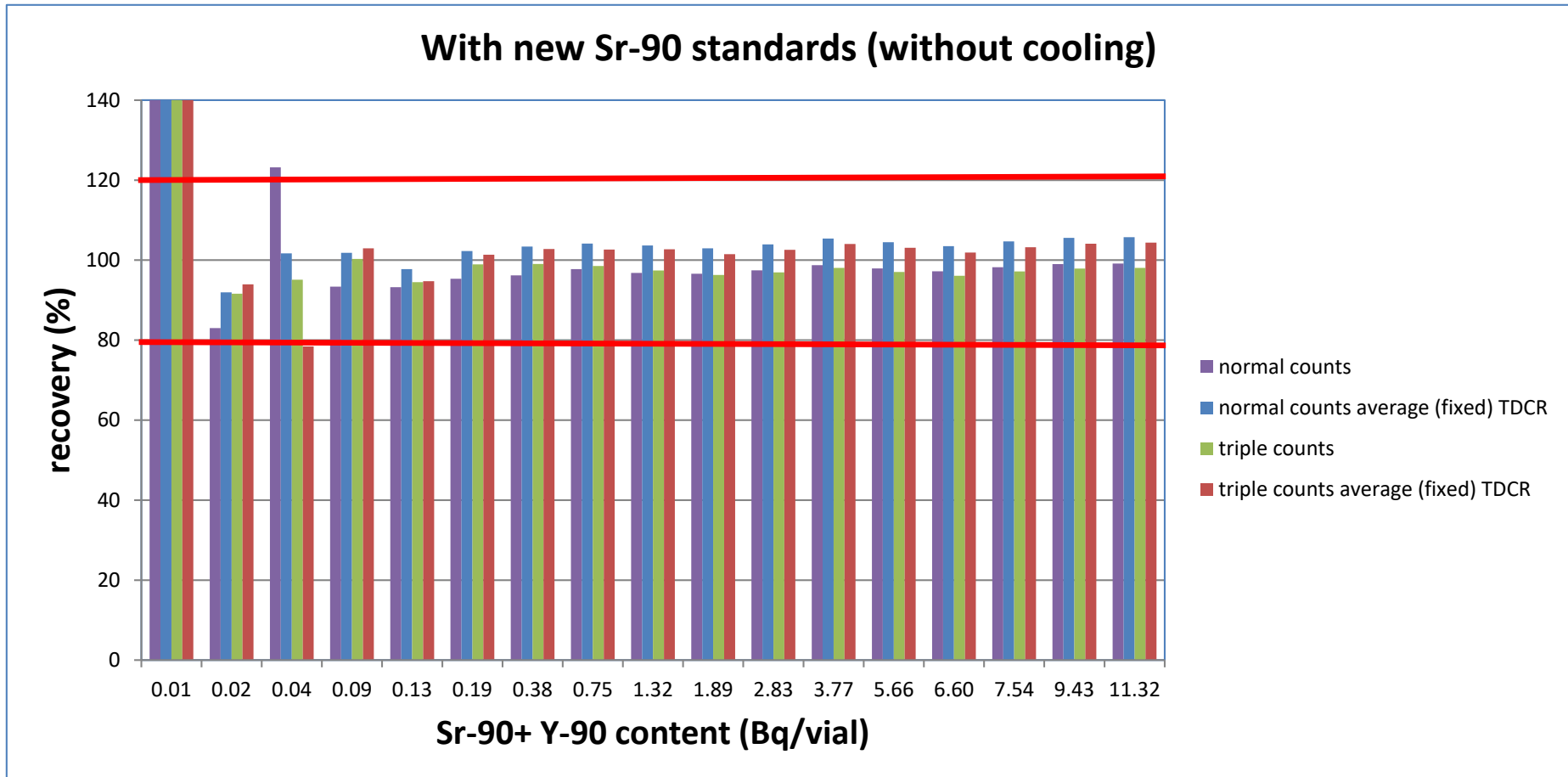
normal counts	TDCR	Triple counts	Chemi	Lumi CPS
8927	0.729	6509	0.14	324
9279	0.742	6884	0.19	371
9413	0.745	7014	0.23	411
9493	0.753	7148	0.32	480
9404	0.745	7010	0.58	647
9596	0.734	7043	0.9	805
10914	0.759	8287	1.37	992
11860	0.758	8993	2.04	1210
14230	0.789	11236	2.41	1313
18764	0.838	15728	2.34	1294
25116	0.874	21958	2.33	1292
40207	0.916	36839	2.36	1300
9928	0.693	6883	2.73	1396

# With new Sr-90 calibration standards

Repeated experiments with new Sr-90 standards (including cooling)



# Measurements without cooling



# Experimental results





Idea: multicriteria function ?

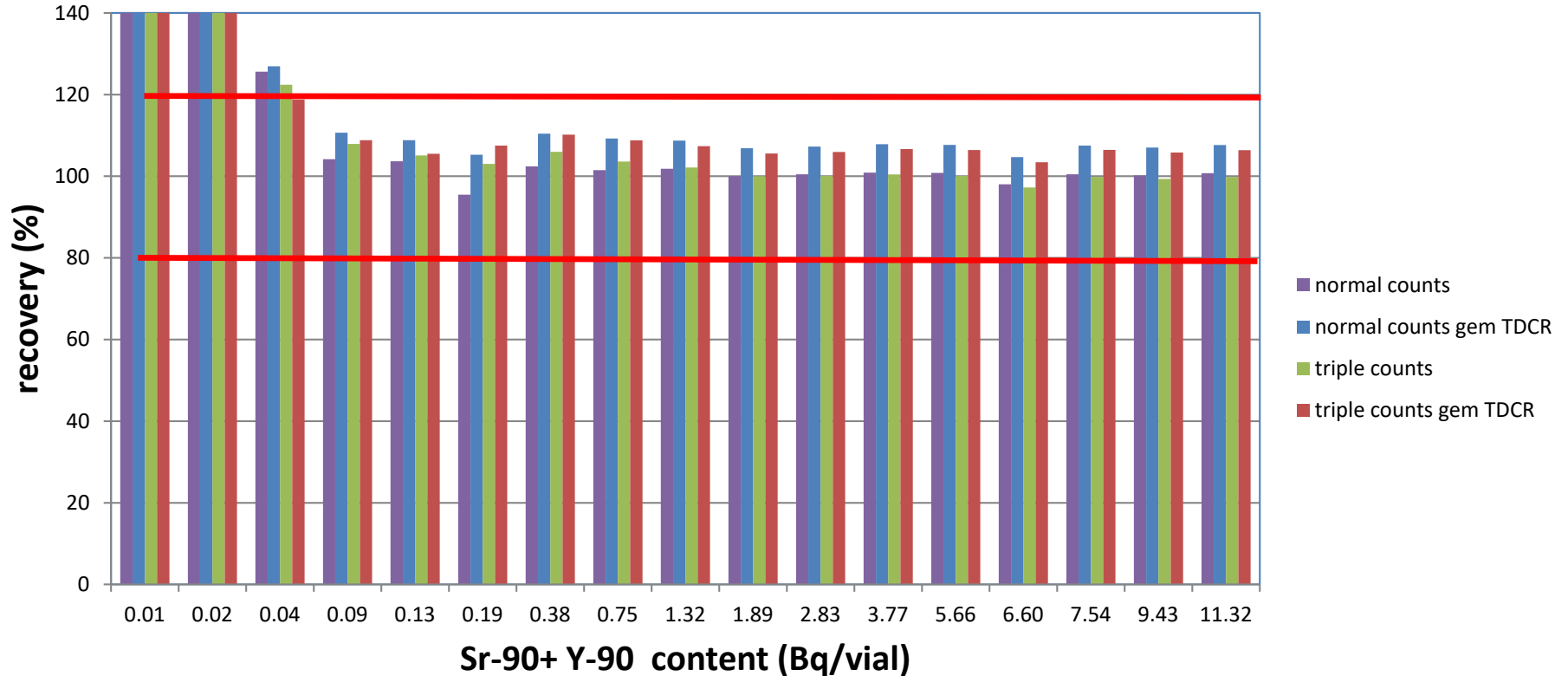


# Contact with Hidex

- Evaluation of problems with measurements at low Bq/kg levels ( $< 0.1$  Bq/sample)
- Sometimes unexpected much counts in double and triple counts channels during one measurement series
- Acknowledgement of problem by Hidex
- Cause: condense on detector cables results in additional pulses in the double count channels !
- Solution: isolation of the cables of the PMT-detector to the electronic processors

# After repair/update

After fix condens issue (including cooling)

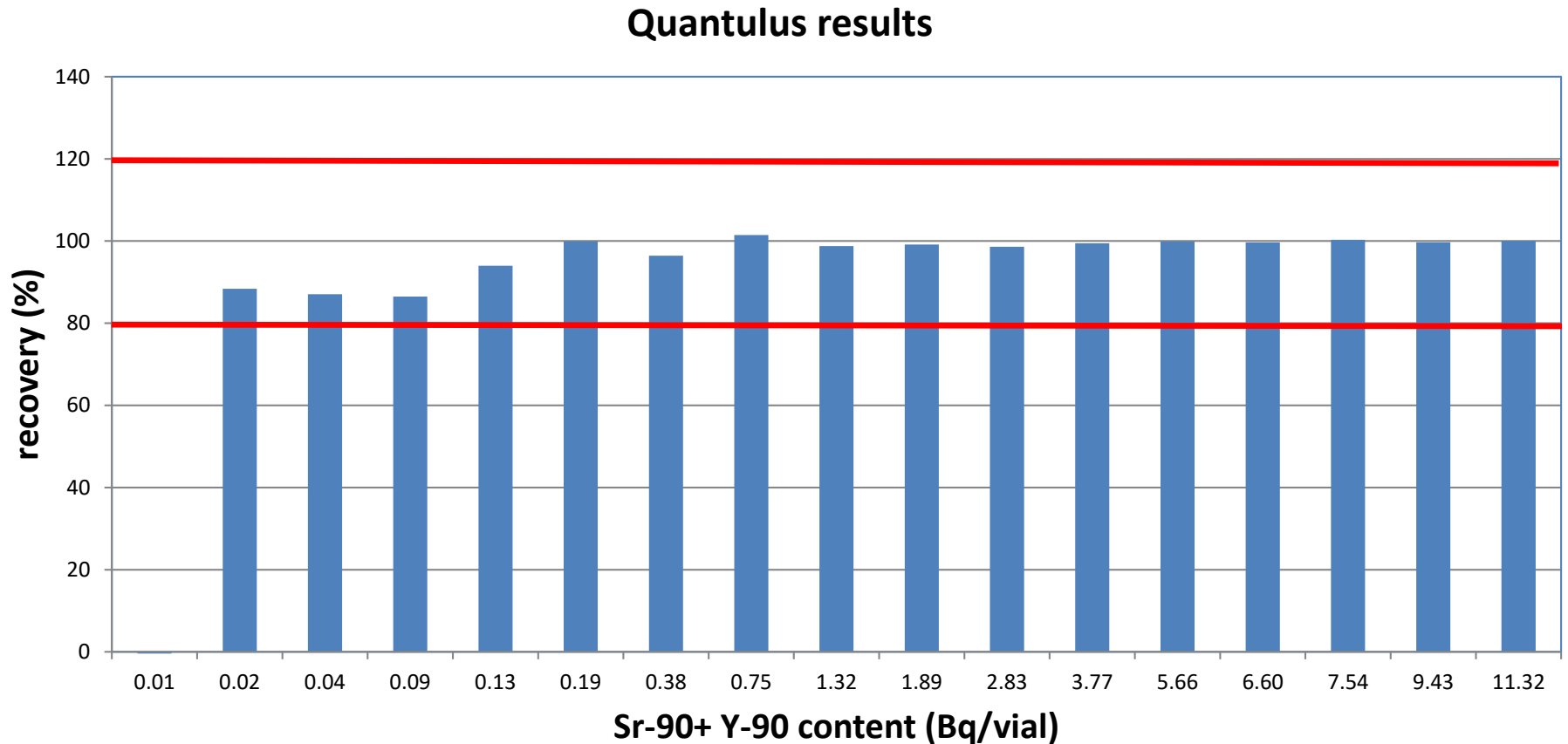


# Improved luminescence parameters

normal counts	TDCR	Triple counts	Chemi	Lumi CPS
6284	0.739	4645	0.23	409
6542	0.739	4836	0.21	389
6685	0.754	5042	0.2	381
6920	0.757	5240	0.2	386
7670	0.783	6008	0.25	430
8192	0.793	6495	0.19	371
8921	0.822	7338	0.14	324
11817	0.86	10165	0.11	284
17229	0.902	15546	0.1	270
25348	0.926	23469	0.18	366
33054	0.941	31088	0.15	335
46588	0.954	44454	0.12	301
60316	0.963	58083	0.1	280
87188	0.97	84612	0.1	275
98077	0.972	95331	0.13	313
114012	0.976	111305	0.11	288
140353	0.977	137179	0.14	321
168042	0.979	164561	0.21	387

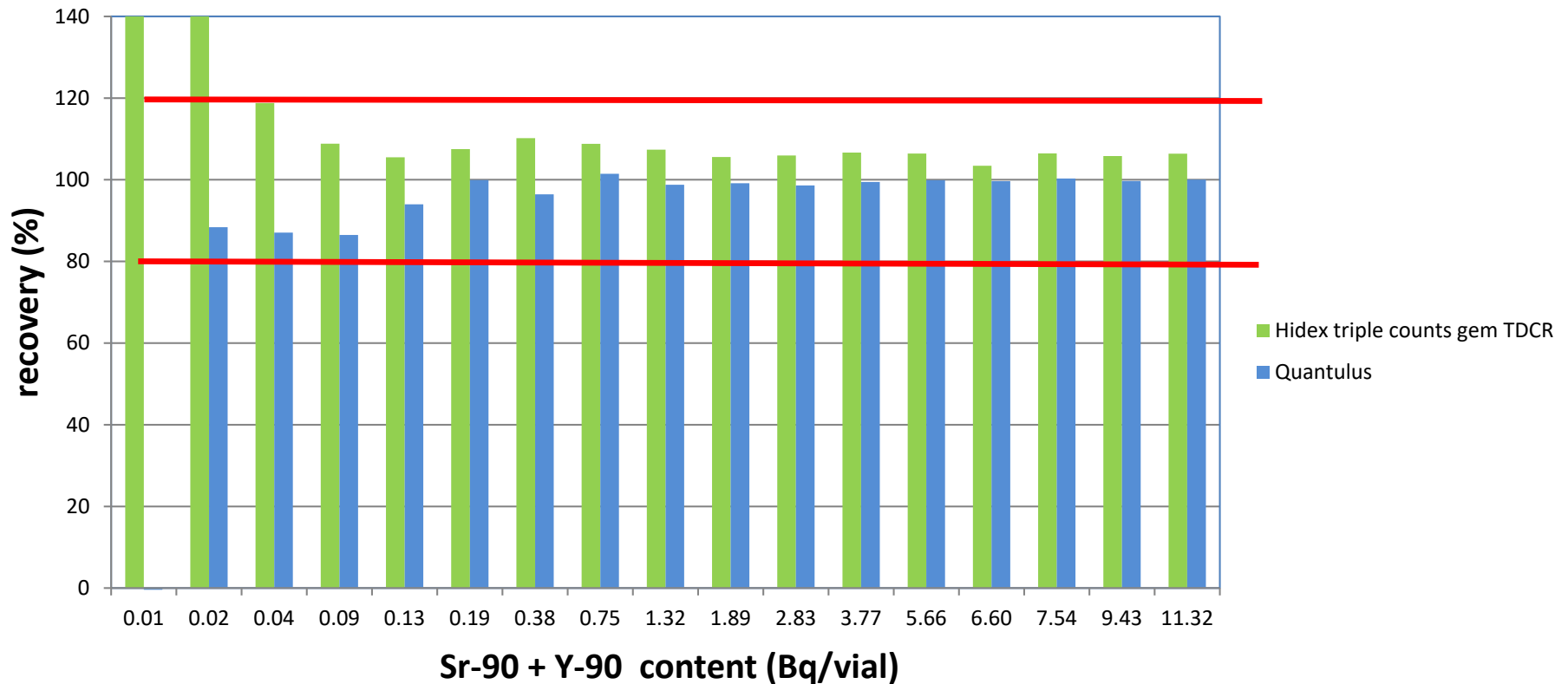


# Results Quantulus Sr-90 measurements



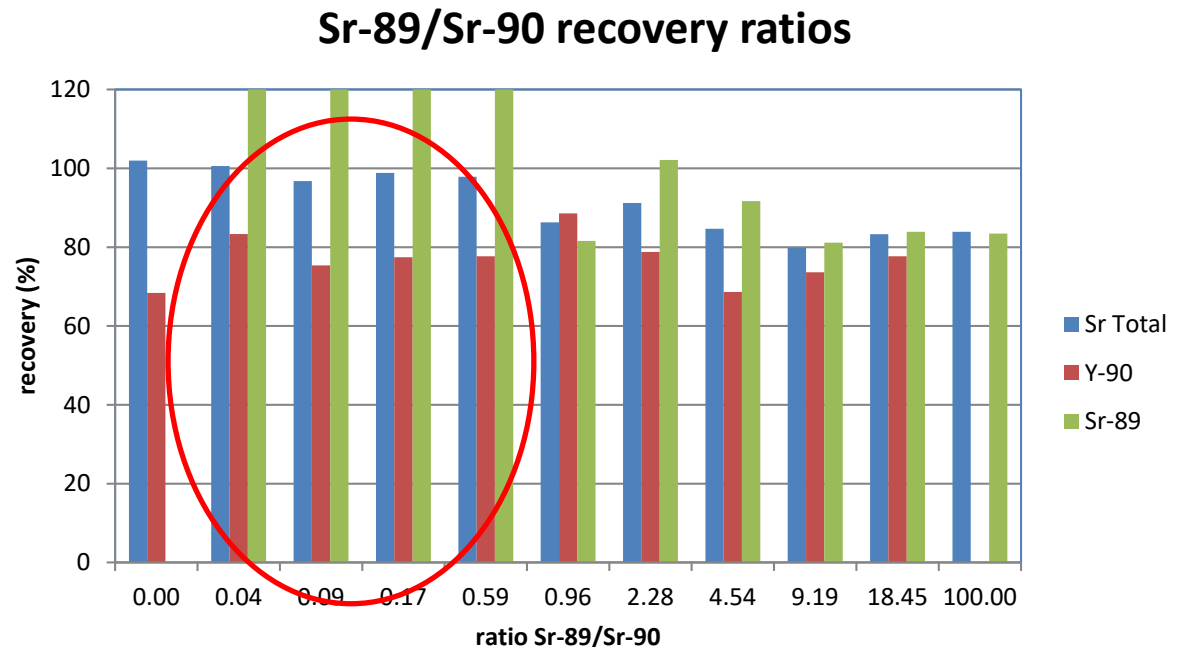
# Intercomparison of Sr-90 results

## Comparison of Hidex and Quantulus







# Future work

- Measuring  $^{90}\text{Sr}$  activities up to 0.02 Bq/vial in milk samples
- Extending measuring to 6 hours for final validation
- Repeating the measurement of  $^{89}\text{Sr}/^{90}\text{Sr}$  ratio's at low levels



# Conclusions

- As requested we are able to measure low-level  $^{90}\text{Sr}$  activity concentrations in food samples ( $< 0.1$  Bq/vial) for both the Hidex and Quantulus 
- At the moment we are not able to reproduce the calculated measuring times for the Hidex for these low concentrations 
- When taking the average value of the triple counts TDCR values the best results are obtained within this validation study 
- When extending the measurement time to 6 hours we expect to reach the requested specifications 



# Call for participation !

- CEN WG 327/6
  - European normalisation committee
  - Determination of the radionuclides I-131, Cs-134 Cs-137 in animal feed
  - Project is performed by JRC Geel
  - Several matrices (e.g hay, maize)
  - Intercomparison to be held at the end of 2017
  - Not enough participating institutes yet to obtain the requested amount of measurements for PT's
- So please help me with names of organisations who can participate !

# More info ?



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