

# *Peak area determination proficiency test for the "Reference Database for Neutron Activation Analysis" CRP of the IAEA*

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# Overview

- Introduction
- How it was done in 1995
- How it was done in 2006/7
- Results
- Discussion / conclusions

# Introduction

- Peak area determination is at the root of all INAA: No good INAA can be done without good peak areas
- INAA has the special ability to estimate its own reproducibility from a single measurement –to do this properly means to determine good peak areas as well as good uncertainties
- Both aspects were therefore tested in the proficiency test

# How it was done in 1995

- $^{226}\text{Ra}$  spectrum acquired many, many times
- Individual spectra inspected
- 20 spectra added to create reference spectrum
- Other spectra shifted and added to create spectra with well known doublet area ratios
- Two independent analysis runs performed on reference spectrum, to get reference peak areas
- Software written to match tested software output to reference list of peaks, and calculate u-scores of various kinds

# How it was done in 2006/2007

- $^{152}\text{Eu}$  spectrum acquired twice (14 minutes, 280 minutes)
- Individual spectra inspected
- Two not-so independent analysis runs performed on reference spectrum, to get reference peak areas
- 1995 Software reused to match tested software output to reference list of peaks, and calculate u-scores of various kinds

# Results / preliminary info

Program	Participant	Name	Remarks by participant(s)
GAMANAL	María Arribére	arri	
Hypermet PC 5.01	Alessandro Borella	bor1	DT unknown
Hypermet PC 5.01	Borella and Blaauw	bor2	E-cal improved, DT unknown
Hyperlab 2002.3	Frans De Corte	corte1	
Hypermet PC 5.0	Frans De Corte	corte2	
k0-IAEA	Radojko Jacimovic	jacko1	
Hyperlab 2002.3	Radojko Jacimovic	jacko2	
Unknown	Sunday Jonah	Jonah	No DT correction
Hypermet PC	Zsolt Revay	revay	DT applied
k0-IAEA	Petra Rogan	rogan	

# Results / example output

APPENDIX III - sample output

This report was generated by CMPSPEC (version Apr 20 2007, 15:02:47)

40 peaks in ARRI.TXT

168 peaks in COMBIREF.TXT

367.77 and 366.50 matched 366.81 so were merged

Ratio to multiply all measured peak areas with: 1.0854 +/- 0.434 %

'TRUE' DATA COMBIREF.TXT					MEASURED DATA ARRI.TXT					Z-scores	
E		A		E		A		Z-scores		rep	ref
val	unc	val	unc	val	unc	val	unc	rep	ref		
*	37.6	0.5	291	54	37.6	0.5	0	261			0.0
*	43.2	0.1	359	50	43.2	0.1	0	244			0.0
*	44.1	0.5	480	57	44.1	0.5	0	276			0.0
*	44.7	0.2	86	26	44.7	0.2	0	127			0.0
*	55.5	0.0	31	15	55.5	0.0	0	71			0.0
*	65.2	0.0	4160	227	65.2	0.0	0	1100			0.0
*	67.1	0.0	8032	377	67.1	0.0	0	1827			0.0
*	76.3	0.0	3686	115	76.3	0.0	0	560			0.0
*	78.6	0.0	1035	50	78.6	0.0	0	242			0.0
*	96.8	0.1	36	19	96.8	0.1	0	93			0.0
	120.6	0.0	34597	179	120.8	0.7	34986	557	0.7		0.5
*	129.9	0.0	13	20	129.9	0.0	0	97			0.0
*	136.5	0.0	53	16	136.5	0.0	0	77			0.0

# Results / example output

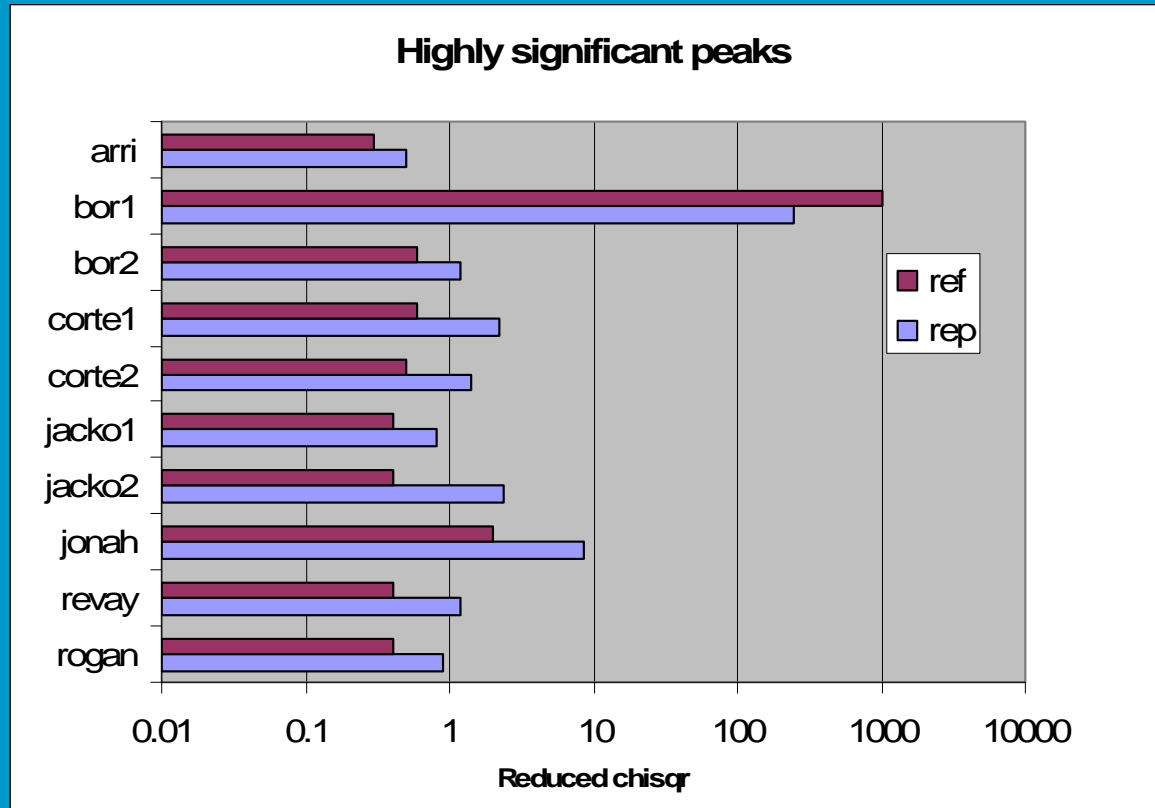
'TRUE' DATA COMBIREF.TXT				MEASURED DATA ARRI.TXT				Z-scores	
E		A		E		A		rep	ref
val	unc	val	unc	val	unc	val	unc		
1407.6	5.4	21996	55	1407.7	0.6	21985	250	-0.0	-0.0
1434.0	0.0	979	52	1434.0	0.0	0	255		-4.1
1457.7	0.0	1089	55	1457.7	0.0	0	265		-4.4
1476.0	3.1	587	16	1476.0	3.1	0	76		-8.2
* 1486.0	0.1	190	22	1486.0	0.1	0	106		0.0
* 1488.4	0.3	41	10	1488.4	0.3	0	49		0.0
1528.8	6.2	3747	45	1528.8	6.2	0	220		-18.0
* 1549.8	0.0	10	8	1549.8	0.0	0	40		0.0
* 1558.0	0.0	15	8	1558.0	0.0	0	39		0.0
1579.6	0.1	163	33	1579.6	0.1	0	160		-1.1
1596.6	0.3	53	60	1596.6	0.3	0	293		-0.2
1643.6	0.0	712	31	1643.6	0.0	0	149		-5.1
1649.9	0.1	124	16	1649.9	0.1	0	77		-1.7
* 1682.9	0.0	0	7	1682.9	0.0	0	35		0.0
* 1686.6	0.0	9	7	1686.6	0.0	0	34		0.0
1719.5	0.4	35	35	1719.5	0.4	0	168		-0.2
1785.9	7.9	16623	61	1785.9	7.9	0	294		-59.8
* 1853.6	0.2	104	19	1853.6	0.2	0	91		0.0



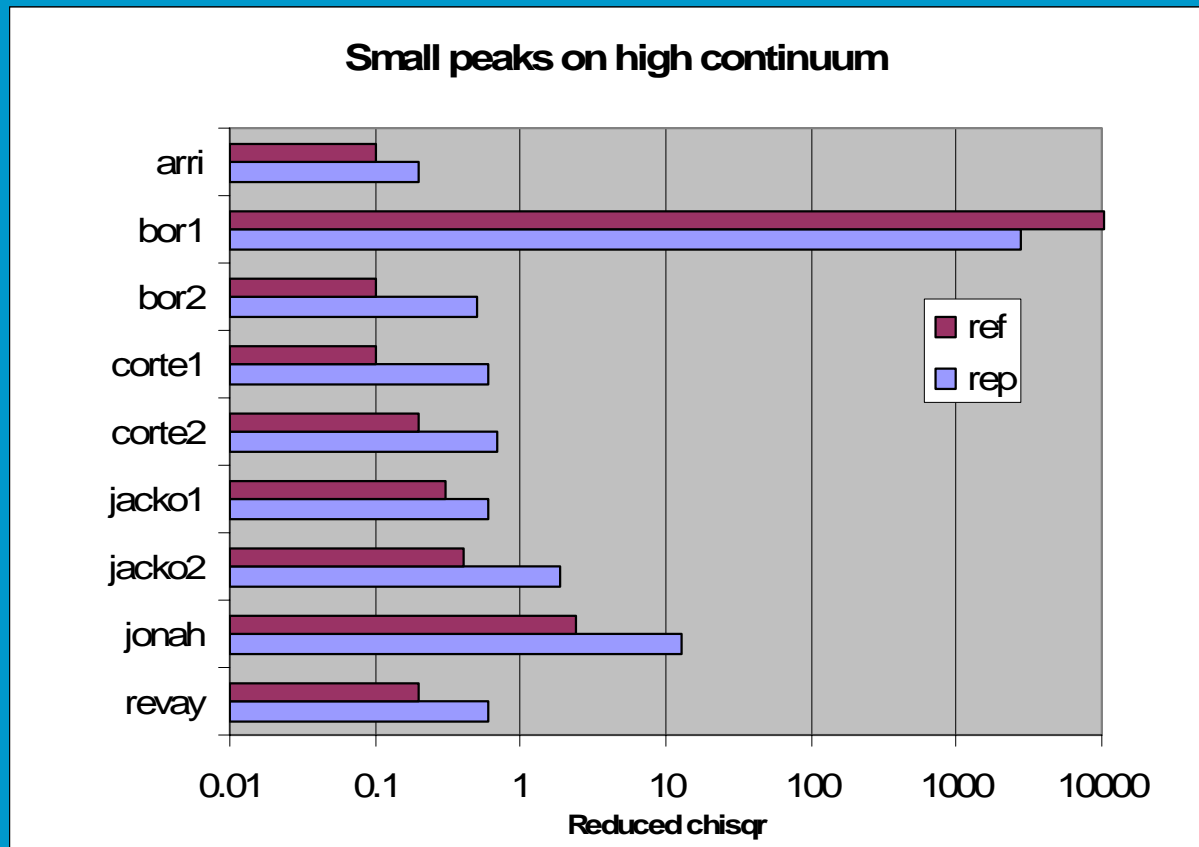
# Results / example output

```
COMPARISON RESULTS FOR COMBIREF.TXT AND ARRI.TXT
TRUE MATCHES
  Number of matches for high peaks: 12
    related chisqr for areas and reported uncertainty: 0.5 *
    and for reported areas with reference uncertainty: 0.3 *
  Number of matches for small peaks on high continuum: 22
    related chisqr for areas and reported uncertainty: 0.2 *
    and for reported areas with reference uncertainty: 0.1 *
  Number of matches for small peaks on low continuum: 0
  Number of non-511 matches all together: 34
    related chisqr for areas and reported uncertainty: 0.3 *
    and for reported areas with reference uncertainty: 0.2 *
    and the chisqr for their positions: 0.1 *
FITTING THE 511 keV PEAK
  Number of peaks found there: 1
    related chisqr: 0.7
MISSES AND FALSE HITS
  Number of misses: 44
    related chisqr: 101.1 *
  Number of false hits: 0
TOTALS
  Number of considered peaks (ex 511): 78
    related chisqr for areas: 57.9 *
CONSTANTS USED:
  Second spectrum was counted 20.0 times shorter than the first.
  Threshold energy: 100.00 keV.
  Criteria for energy matching:
     $E1 - E2 < 2 * \sqrt{\text{sqr}(dE1) + \text{sqr}(dE2)}$  or
     $< 0.5 * \text{FWHM}(E1)$ .
  Criterion for high significance:  $A/\text{ref\_err} > 10$ .
  Criterion for high continuum:  $3.0 * \text{net} < \text{gross}$ .
  Criterion for annihilaton peak:  $|E - 511| < 3.0$ .
```

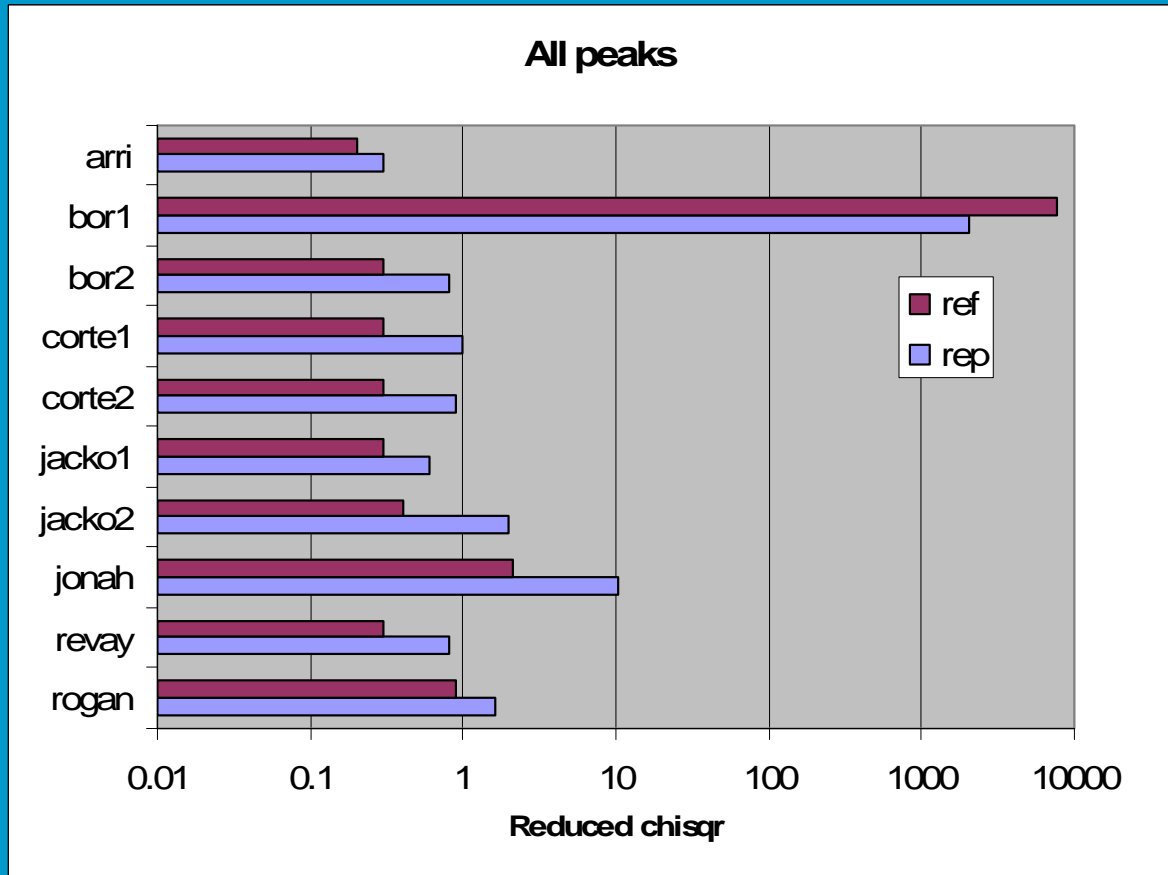
# Results



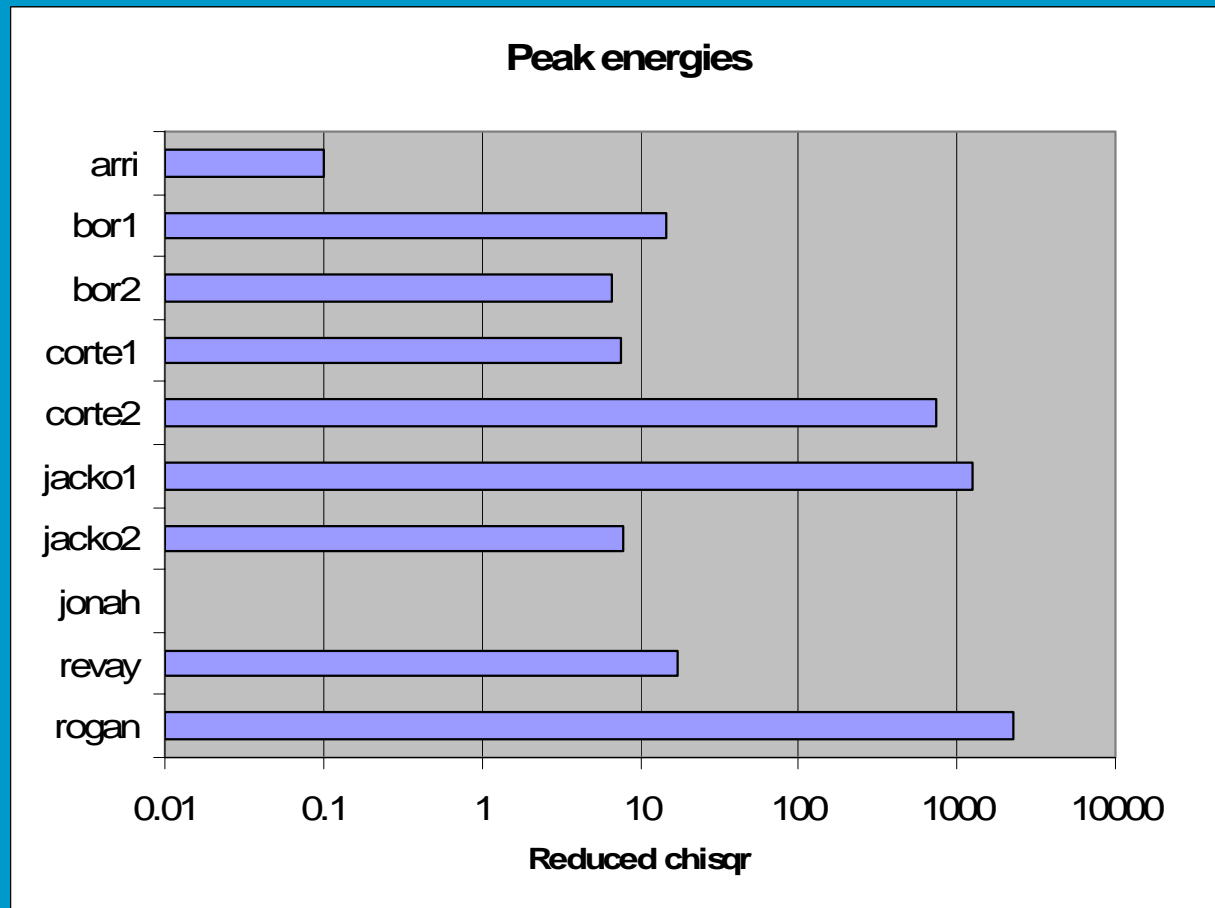
# Results



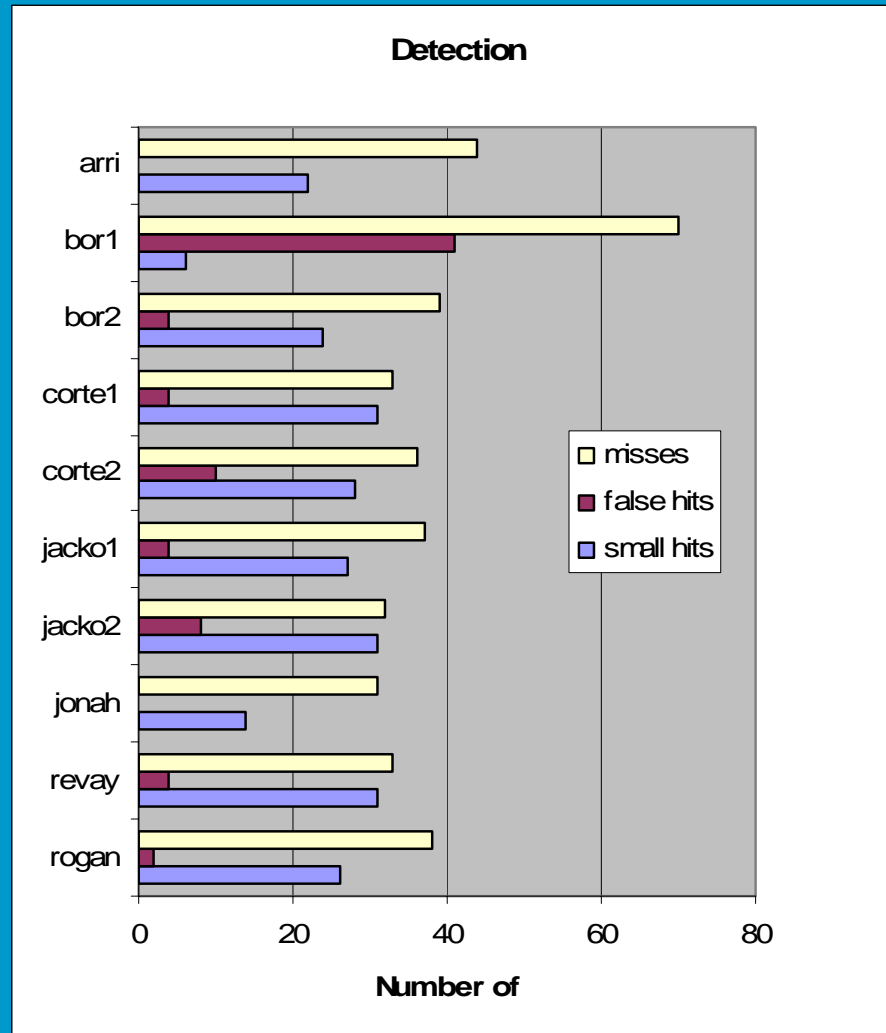
# Results



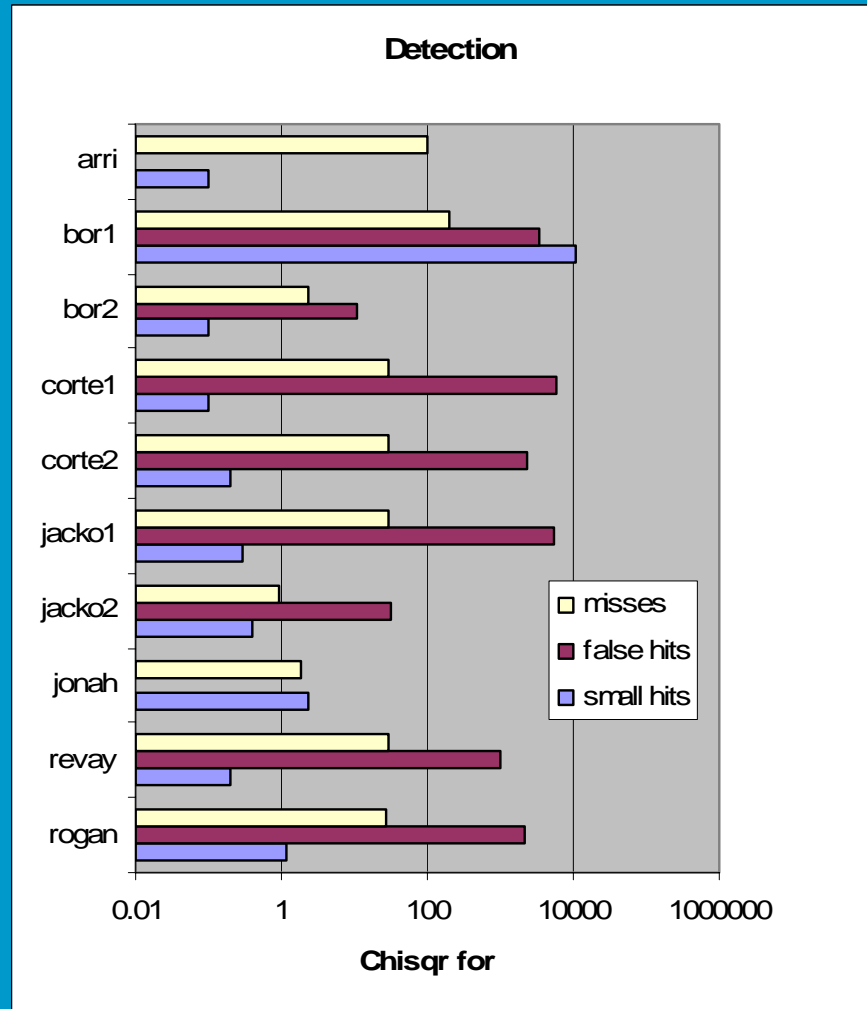
# Results



# Results



# Results



# Discussion / conclusions

- Up to you!