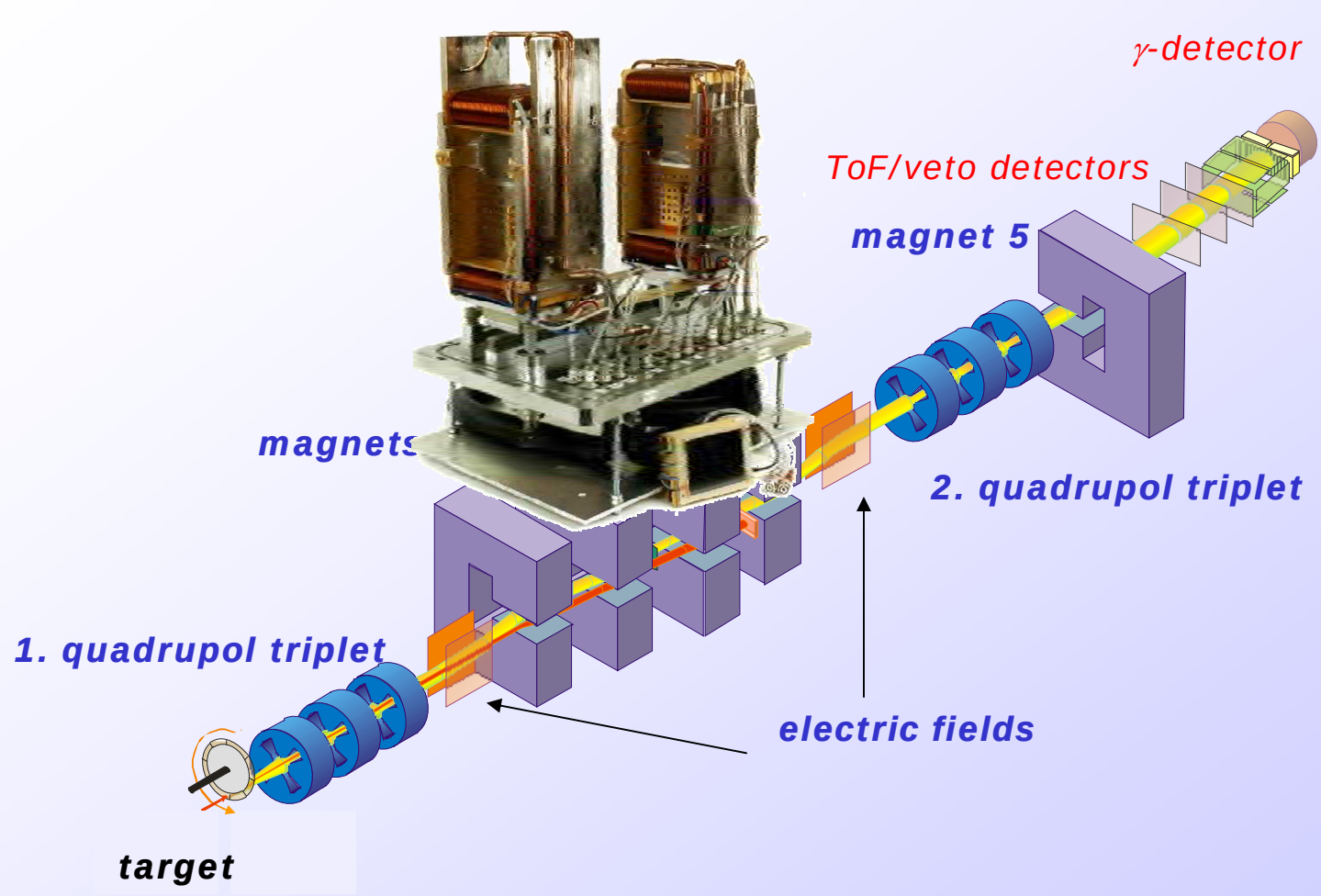
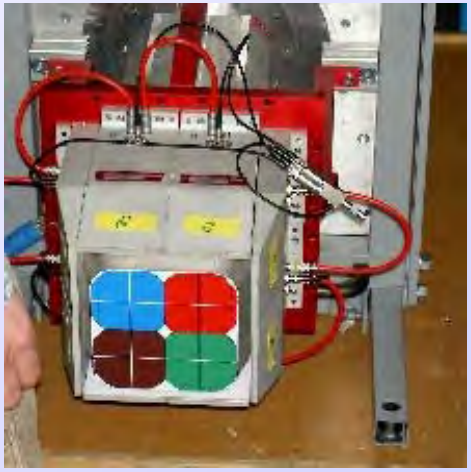
Detector and DAQ Electronics – Possible Solutions for TASCA

- SHIP detector setup
  - α-, γ-, (e^-) detectors
  - transmission detectors for veto and/or ToF
- SHIP DAQ system - a possible solution for TASCA
  - present "old" electronics
  - new DSP-based ADC-CPU interface
- the RITU focal plane – an example for another solution
  - GREAT
  - triggerless DAQ

The Ge-Clover detector



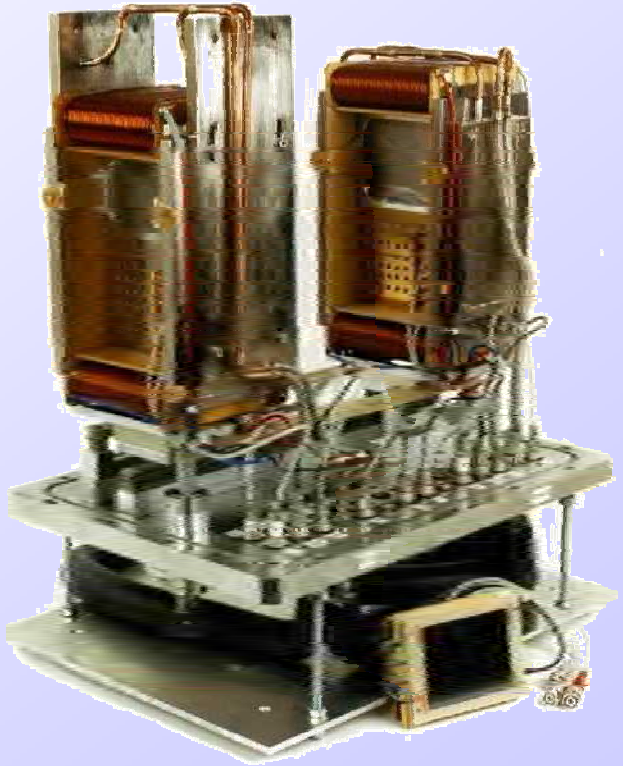


The Ge-Clover detector

- (80x35)mm² active area
- 16 strips - (5x35)mm² active area
- 300 µm thickness
- resistive layer
  - position resolution = 200 µm ⇒ total spatial resolution ≈ 1 mm²
- energy reslution ΔE = 18-20 keV @ E_α > 6 MeV
- 32 signals

The Ge-Clover detector

- 3 units
  - total efficiency > 99 %
- 2 C-foils
  - (55/74x100)mm²
  - entrance foil coated with MgO for more effecient e⁻emission
  - second foil for homogenious acceleration field
- magnetic deflection onto a pair of micro channelplates
- time resolution ≈ 500 ps



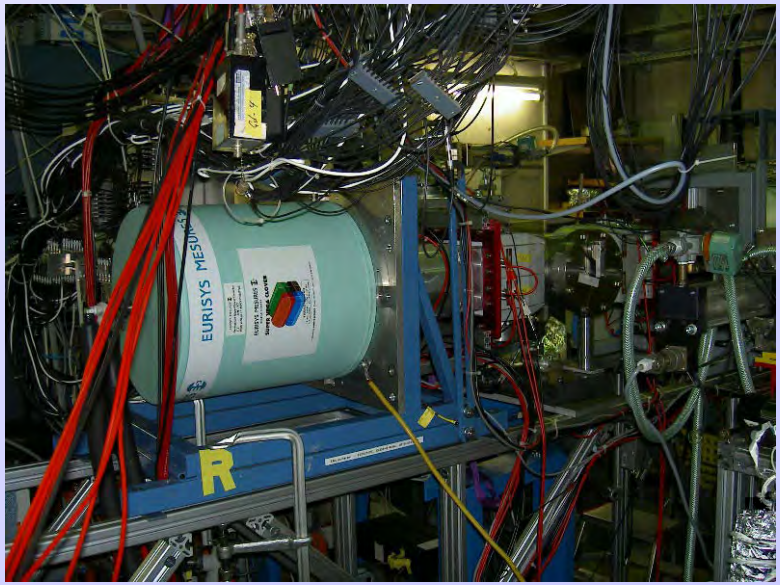
The Ge-Clover detector

- 4 crystals (70x90)mm²
- efficiency per crystal

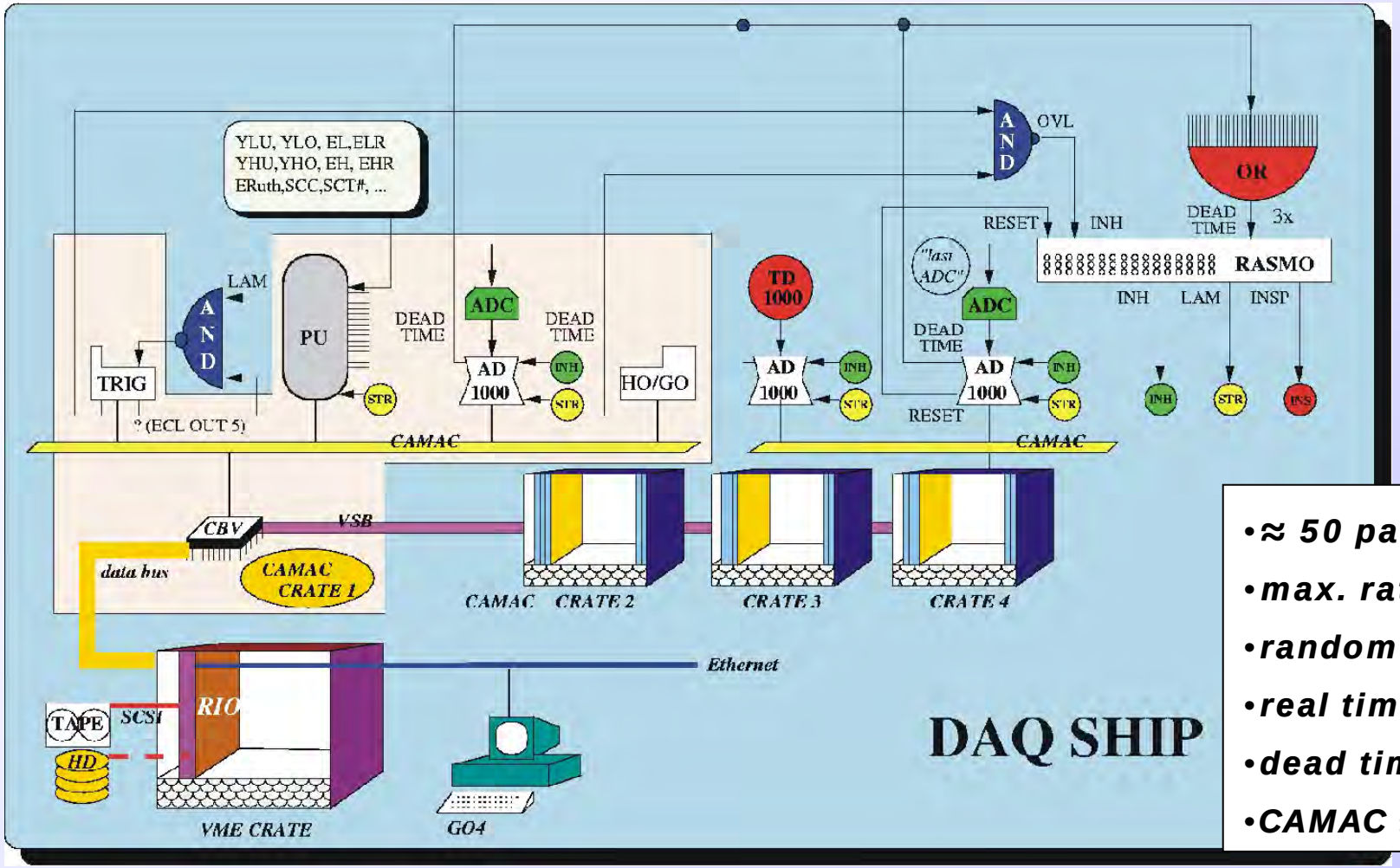
$$\varepsilon_\gamma = 23\%\ \text{at}\ 1.3\ \text{MeV}$$

- <2 cm behind STOP detector
- Al-window 0.5 mm thickness
- total efficiency from α-γ coincidences

$$\varepsilon_{exp} = 15\%\ \text{at}\ E_\gamma = 150\ \text{keV}$$

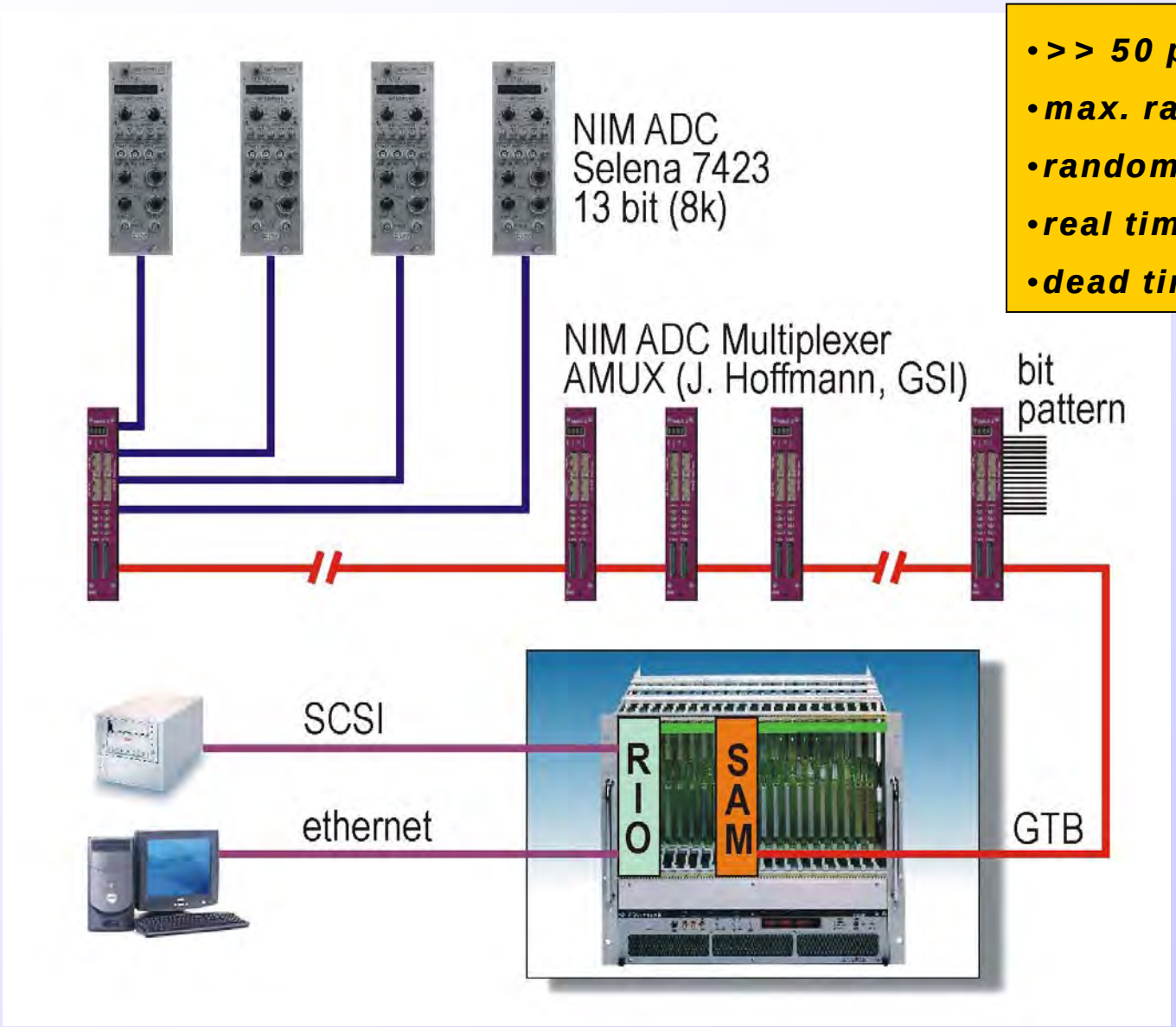


DAQ SHIP – Present Status



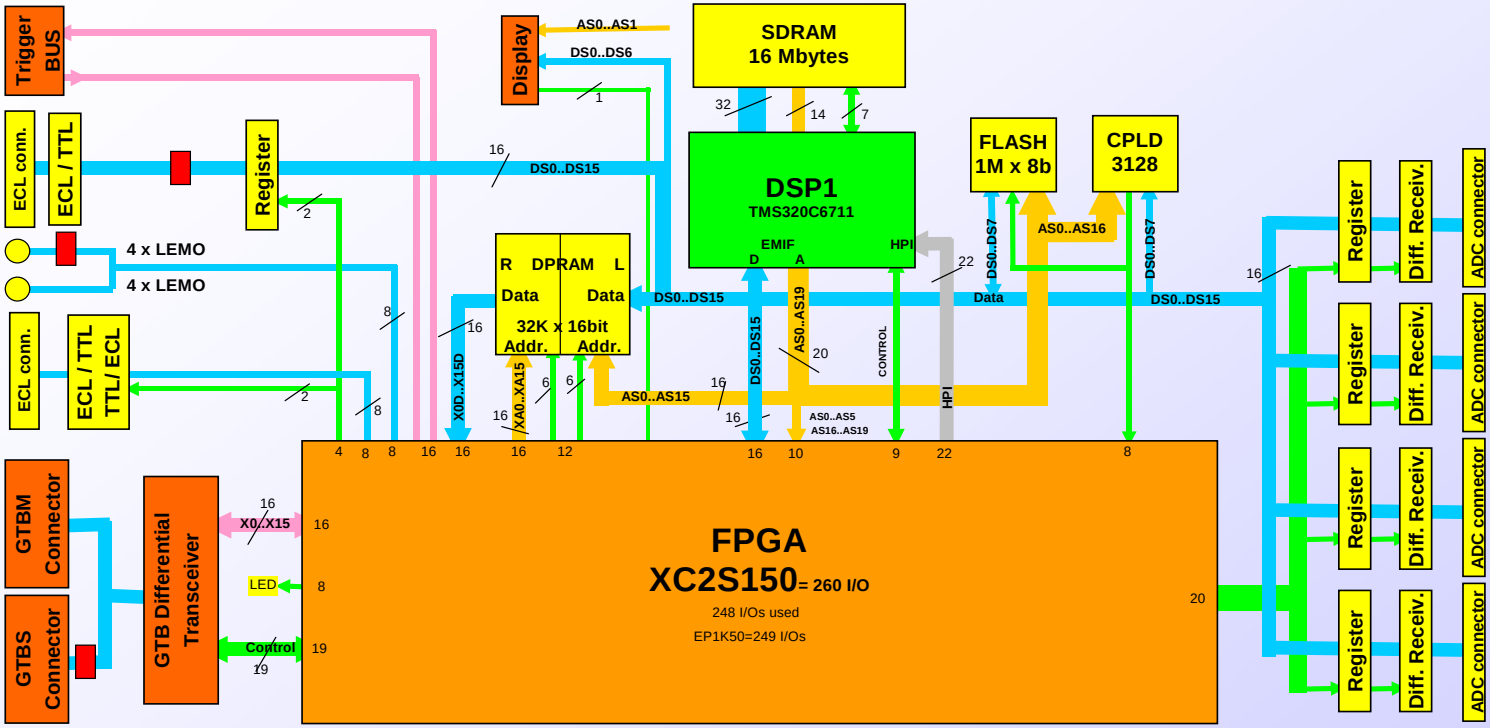
- ≈ 50 parameters
- max. rate ≈ 5 kHz
- random trigger
- real time clock (1µs)
- dead time 15 µs
- CAMAC ≈ 150µs

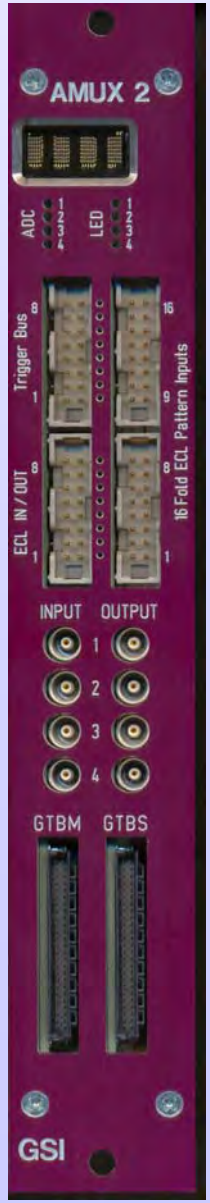
New DAQ SHIP



- >> 50 parameters
- max. rate ≈ 50 kHz
- random trigger
- real time clock
- dead time 10 µs

AMUX designed by Jan Hofmann, GSI





- *read and control 4 for 13 bit (8k) ADC's*
- *scaler function*
- *pattern unit function*
- *TDC function / real time clock*
- *macropuls / target wheel counter*
- *onboard histogramming possible*

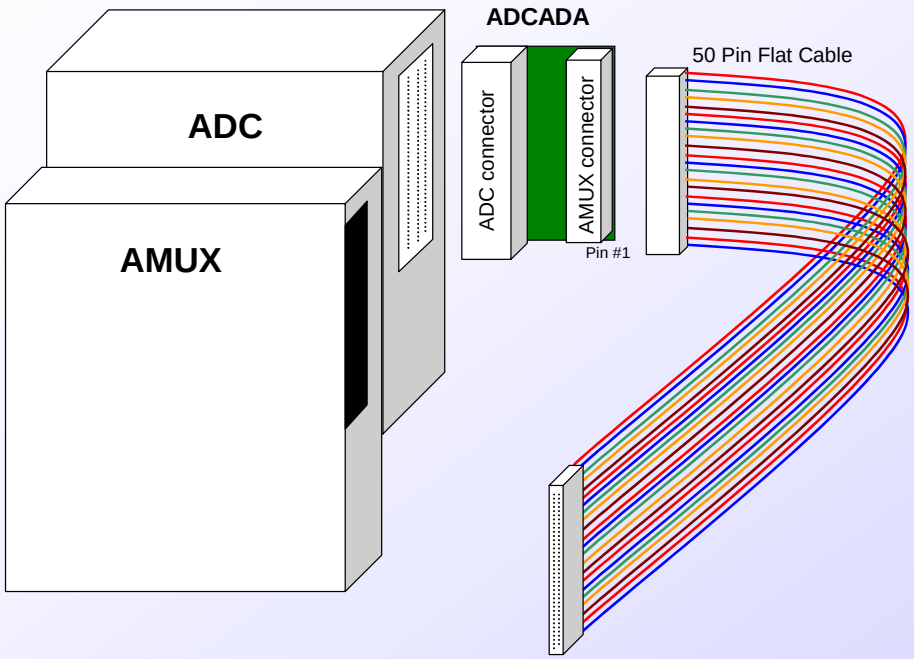
16Mb SDRAM (DSP)

max 10 MHz

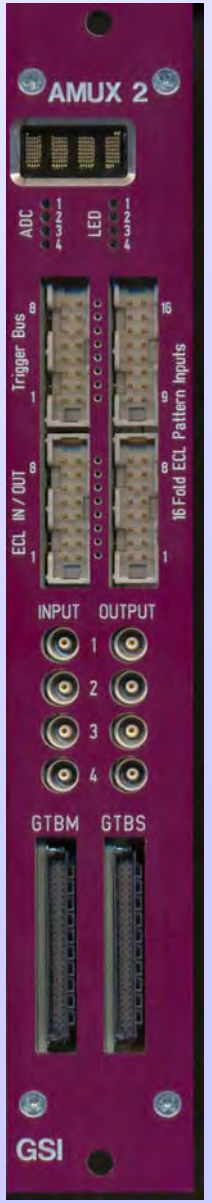
16 bits / channels

100 ns resolution

AMUX-ADC connection

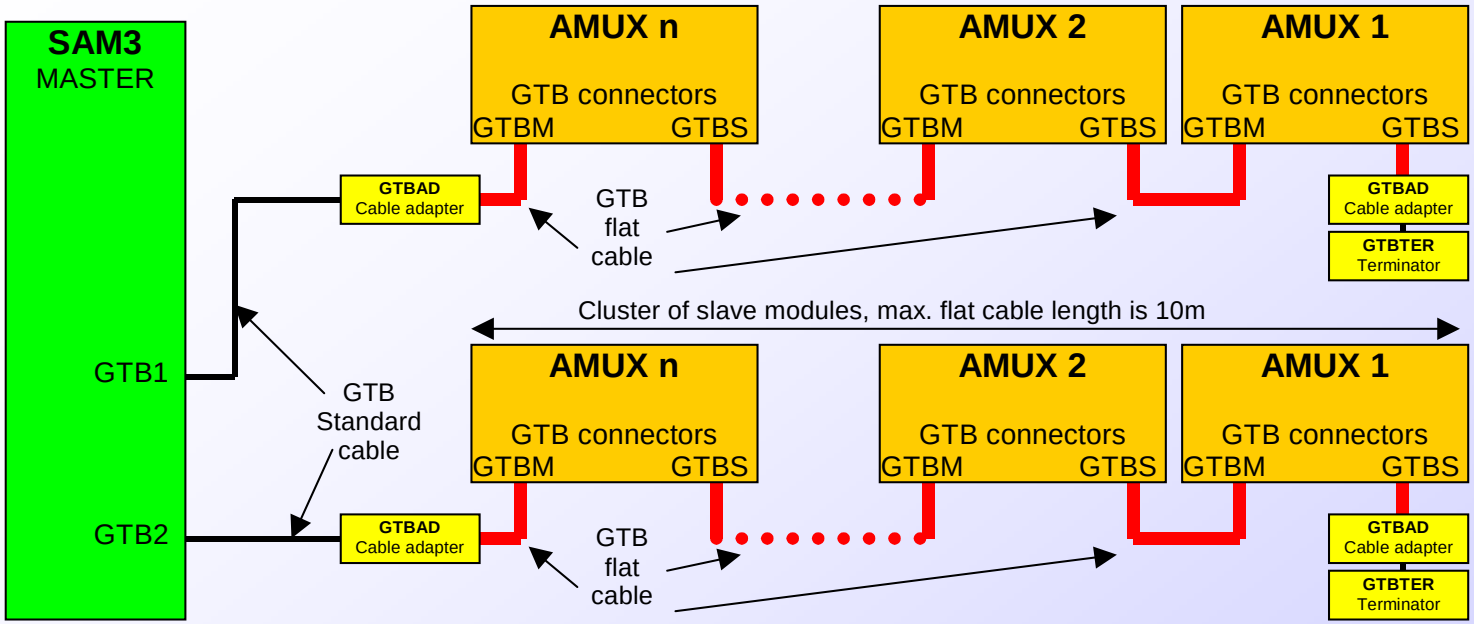


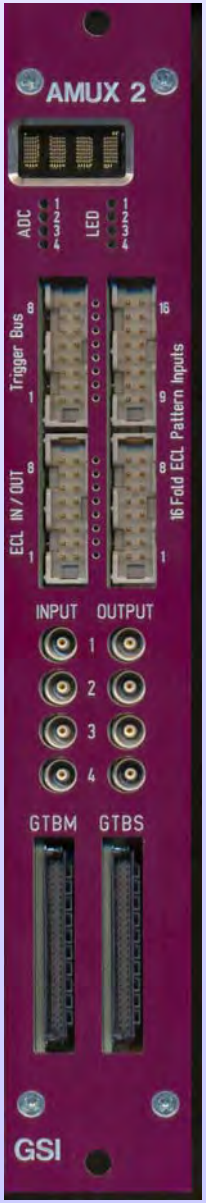
adaptor



- *4 ADC's per AMUX via special adaptor and 50 pin flat cable*

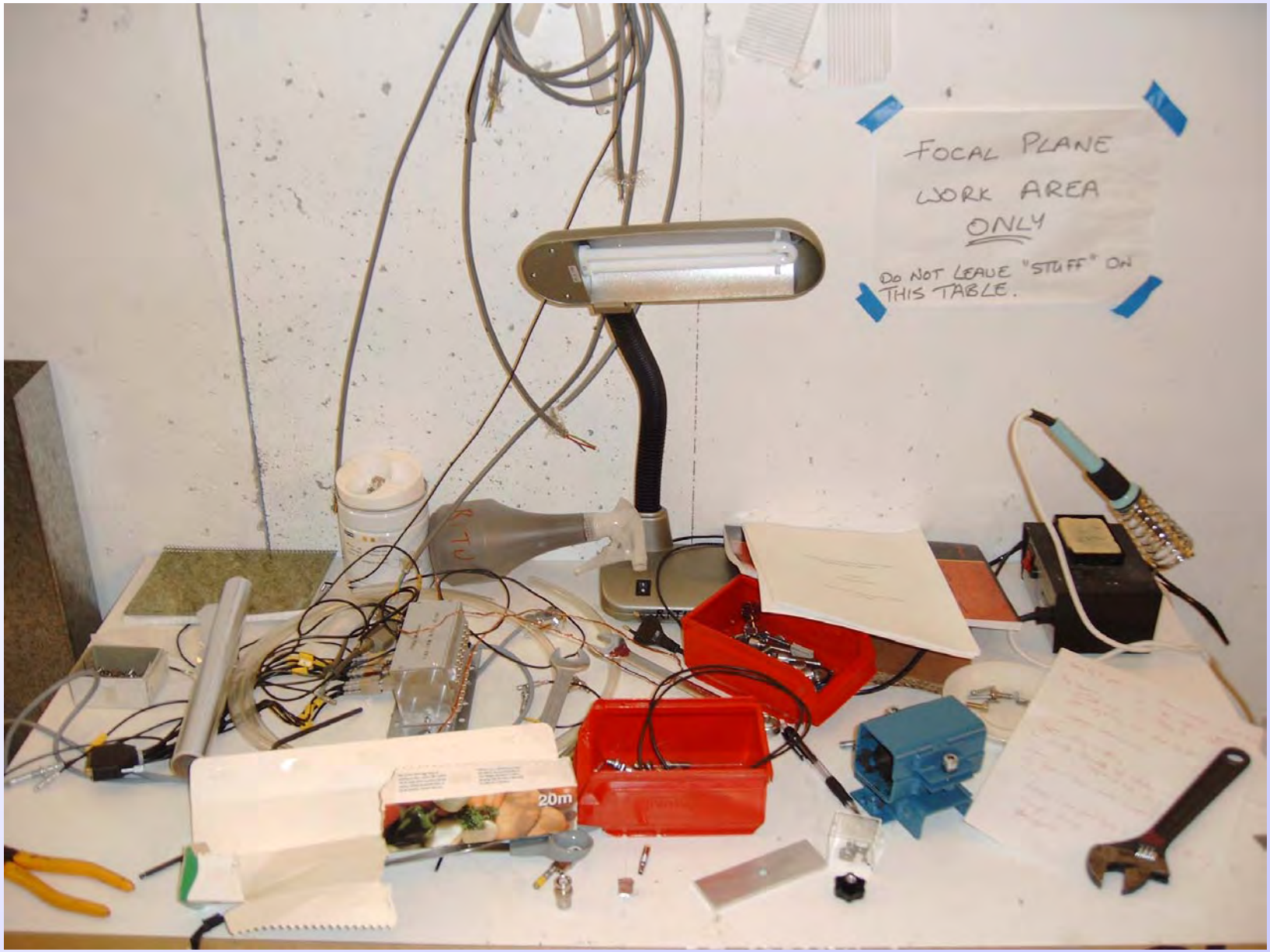
AMUX – GTB Interface



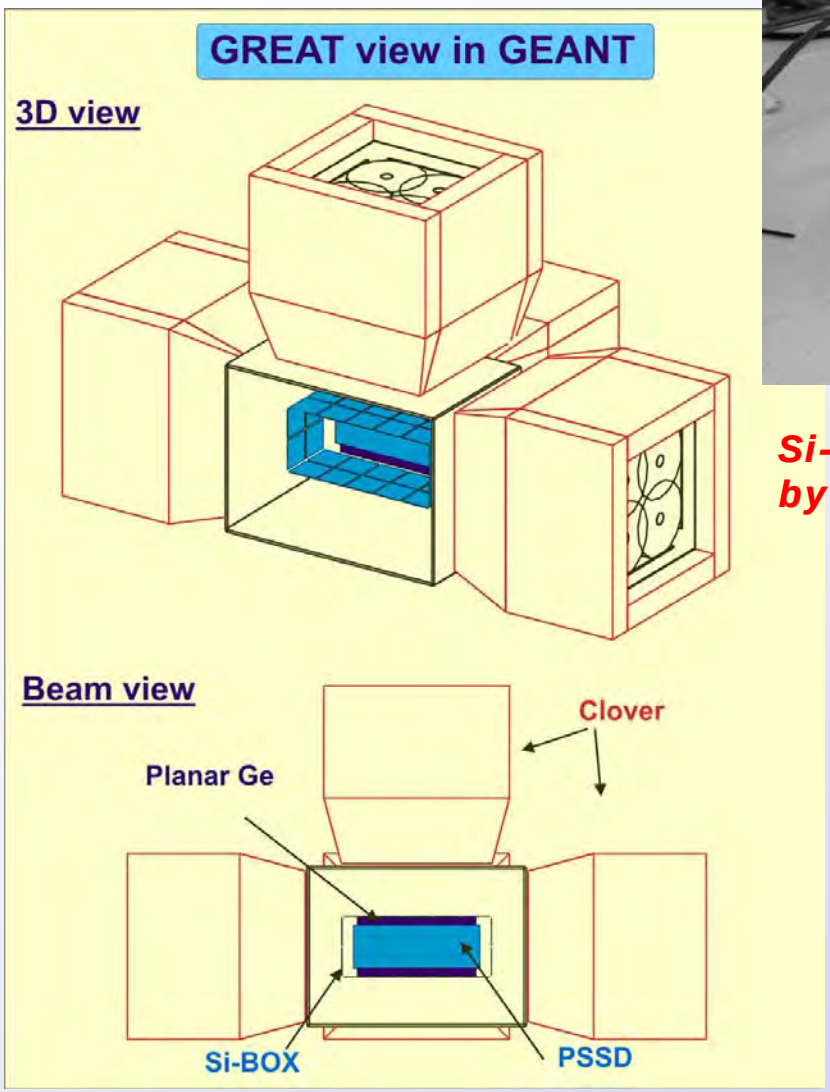


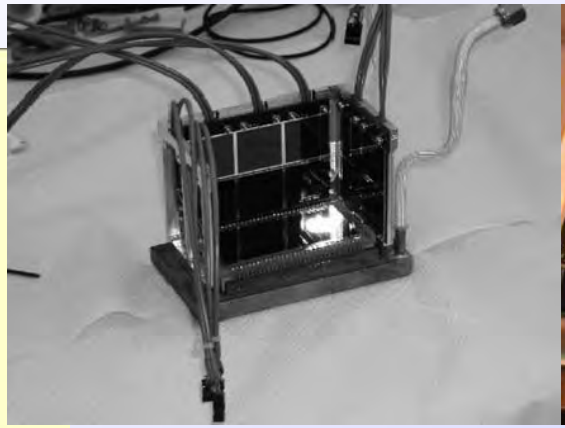
- ***daisy chain connection to SAM3 (up to 2x15 units) via GTB bus***
- ***event building and data transfer to DAQ-CPU by the readout processor SAM3***
- ***random trigger (first unit with data triggers readout)***
- ***max rate 50 kHz (tested in the lab)***
- ***high resolution real time clock***

RITU "Focal Plane Work Area"

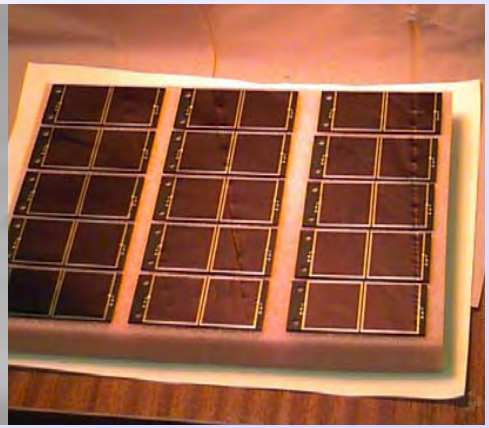


GREAT Detectors



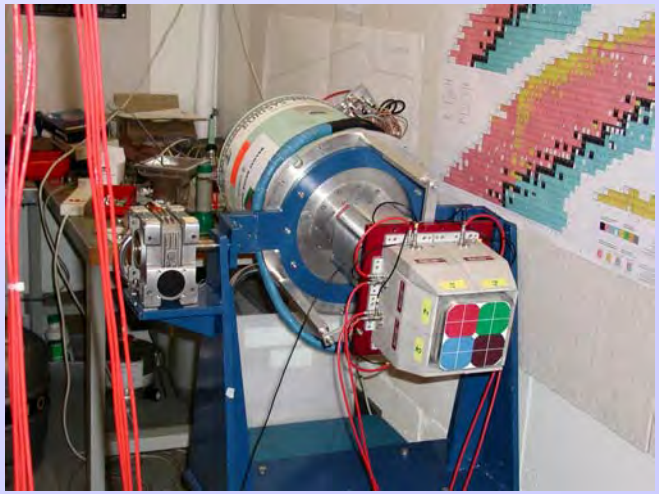


Si-detector, surrounded by the Si-PIN detectors



Si-PIN detector array

planar GE-detector

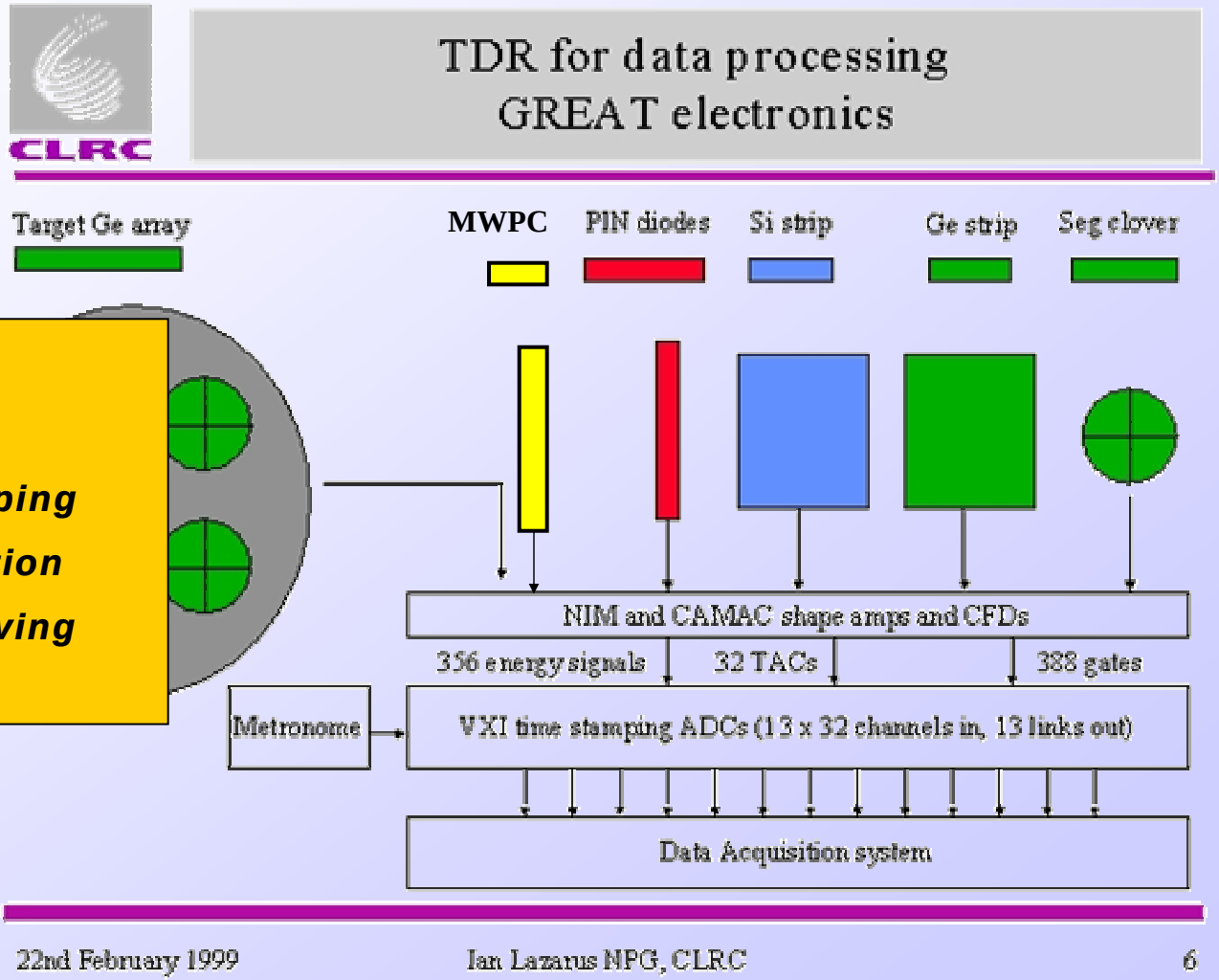


clover Ge-detector

http://nnsa.dl.ac.uk/GREAT/

GREAT – Triggerless Total Data Readout

- *14bit (16k) ADC's*
- *triggerless*
- *100 MHz clock for timestamping*
- *metronome for synchronisation*
- *DSP technology for data moving*
- *histogramming possible*

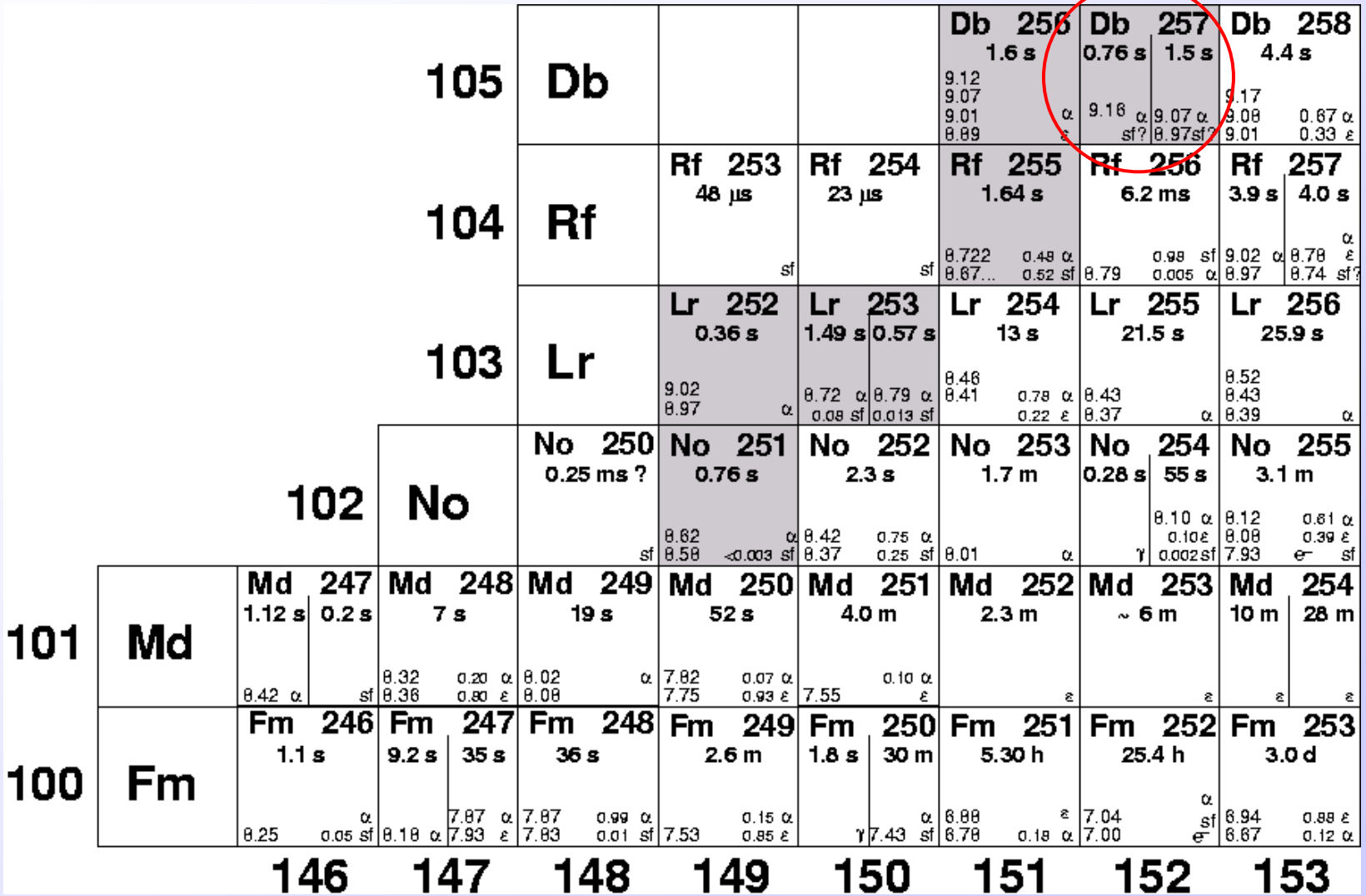


I. Lazarus, Feb. 1999, http://npg.dl.ac.uk/documents/edoc501/edoc501.html

Nuclear Structure of the Heaviest Nuclei:

ER-α-α Coincidences: ^{257}Db

F.P. Heßberger et al., Eur. Phys. J. A 12, 57-67 (2001)



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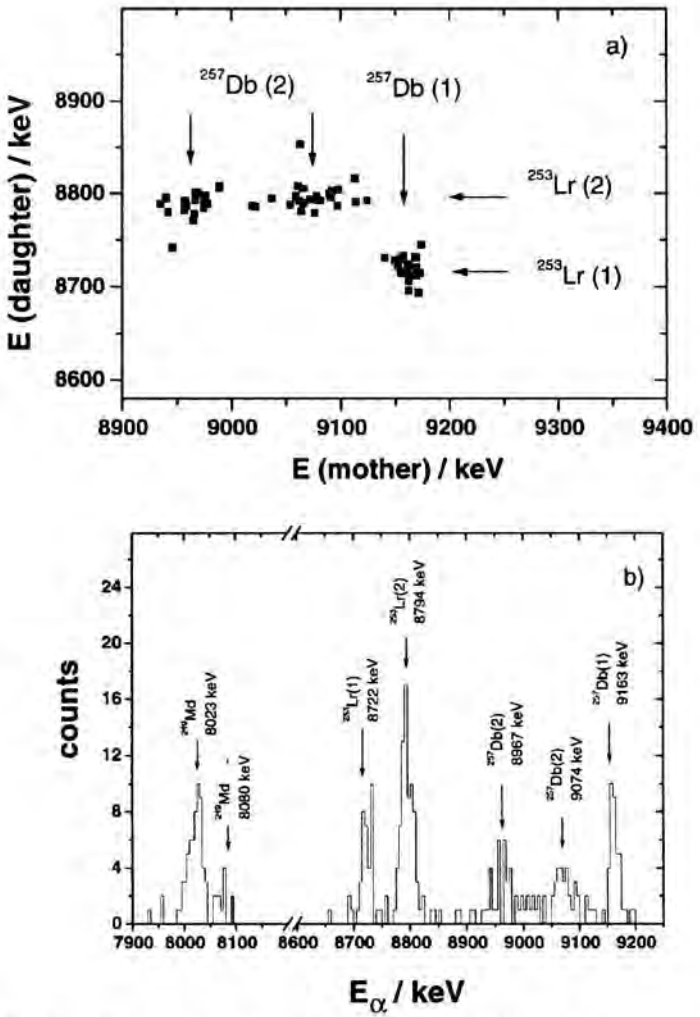

Fig. 3. a) α-α correlation plot for ^{257}Db $\rightarrow$ ^{253}Lr; b) spectrum of α-events attributed to ^{257}Db, ^{253}Lr and ^{249}Md.

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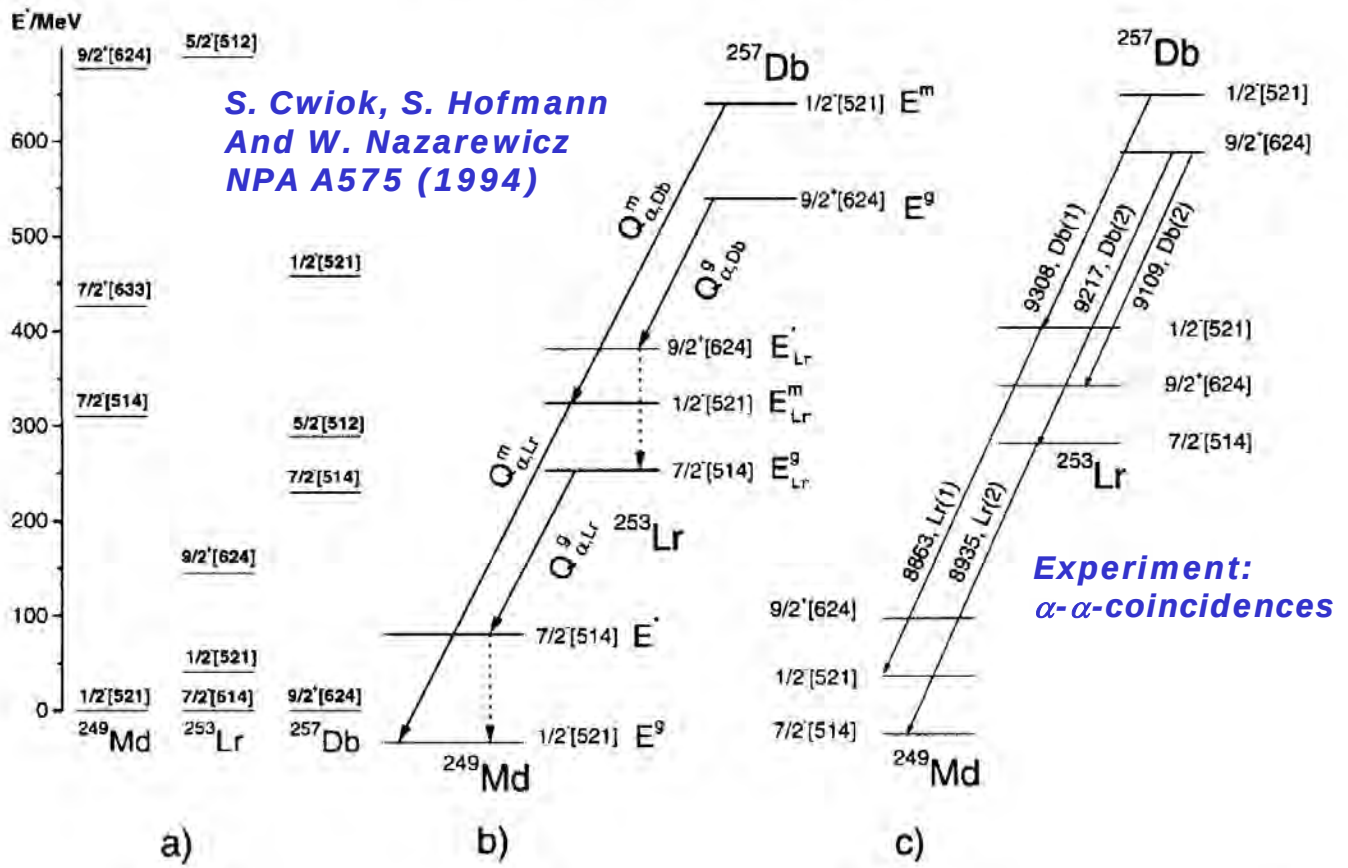

Fig. 4. a) Level schemes predicted for ^{249}Md, ^{253}Lr, ^{257}Db according to [3]; b) symbolic decay scheme for ^{257}Db using level sequences as predicted in ref. [3]; c) tentative decay scheme suggested for ^{257,257m}Db on the basis of the observed α-decay energies. The numbers denote the Q values.

Nuclear Structure of the Heaviest Nuclei:

ER-α-γ Coincidences: ^{255}Rf / ^{253}No

F.P. Heßberger, Symposium on Nuclear Clusters, Rauischholzhausen Germany, August 2002

		146	147	148	149	150	151	152	153
					105 Db		Db 256 1.6 s: 9.12 9.07 9.01 α 8.89 ε	Db 257 0.76 s: 9.16 α sf? / 1.5 s: 9.07 α 8.97 sf?	Db 258 4.4 s: 9.17 9.08 9.01 0.67 α 0.33 ε
					104 Rf	Rf 253 48 µs: sf	Rf 254 23 µs: sf	Rf 255 1.64 s: 8.722 0.48 α 8.67... 0.52 sf	Rf 256 6.2 ms: 8.79 0.98 sf 0.005 α	Rf 257 3.9 s: 9.02 α 8.97 / 4.0 s: α 8.78 ε 8.74 sf?
					103 Lr	Lr 252 0.36 s: 9.02 8.97 α	Lr 253 1.49 s: 8.72 α 0.08 sf / 0.57 s: 8.79 α 0.013 sf	Lr 254 13 s: 8.46 8.41 0.78 α 0.22 ε	Lr 255 21.5 s: 8.43 8.37 α	Lr 256 25.9 s: 8.52 8.43 8.39 α
				102 No		No 250 0.25 ms ?: sf	No 251 0.76 s: 8.62 8.58 α <0.003 sf	No 252 2.3 s: 8.42 0.75 α 8.37 0.25 sf	No 253 1.7 m: 8.01 α	No 254 0.28 s: γ / 55 s: 8.10 α 0.10 ε 0.002 sf	No 255 3.1 m: 8.12 8.08 0.61 α 0.39 ε 7.93 e⁻ sf
	101 Md	Md 247 1.12 s: 8.42 α / 0.2 s: sf	Md 248 7 s: 8.32 8.36 0.20 α 0.80 ε	Md 249 19 s: 8.02 8.08 α	Md 250 52 s: 7.82 7.75 0.07 α 0.93 ε	Md 251 4.0 m: 7.55 0.10 α ε	Md 252 2.3 m: ε	Md 253 ~ 6 m: ε	Md 254 10 m: ε / 28 m: ε
	100 Fm	Fm 246 1.1 s: 8.25 α 0.05 sf	Fm 247 9.2 s: 8.18 α / 35 s: 7.87 α 7.93 ε	Fm 248 36 s: 7.87 7.83 0.99 α 0.01 sf	Fm 249 2.6 m: 7.53 0.15 α 0.85 ε	Fm 250 1.8 s: γ / 30 m: 7.43 α sf	Fm 251 5.30 h: 6.88 6.78 ε 0.18 α	Fm 252 25.4 h: 7.04 7.00 α sf e⁻	Fm 253 3.0 d: 6.94 6.87 0.88 ε 0.12 α

Nuclear Structure of the Heaviest Nuclei:

ER-α-γ Coincidences: ^{255}Rf / ^{253}No

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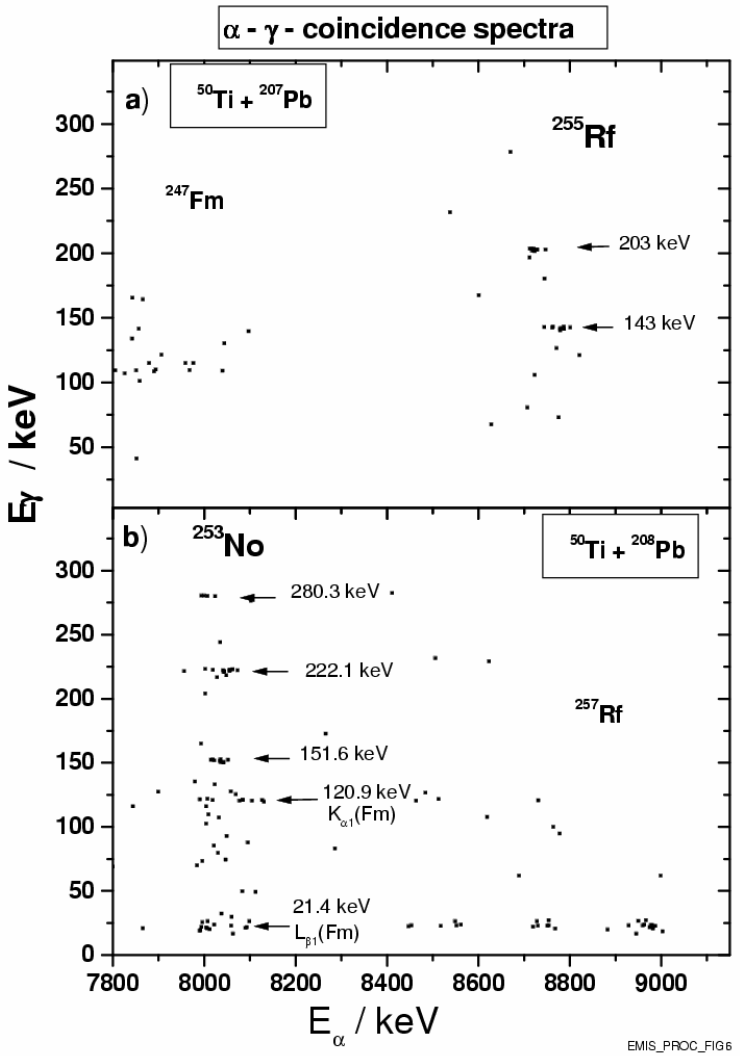

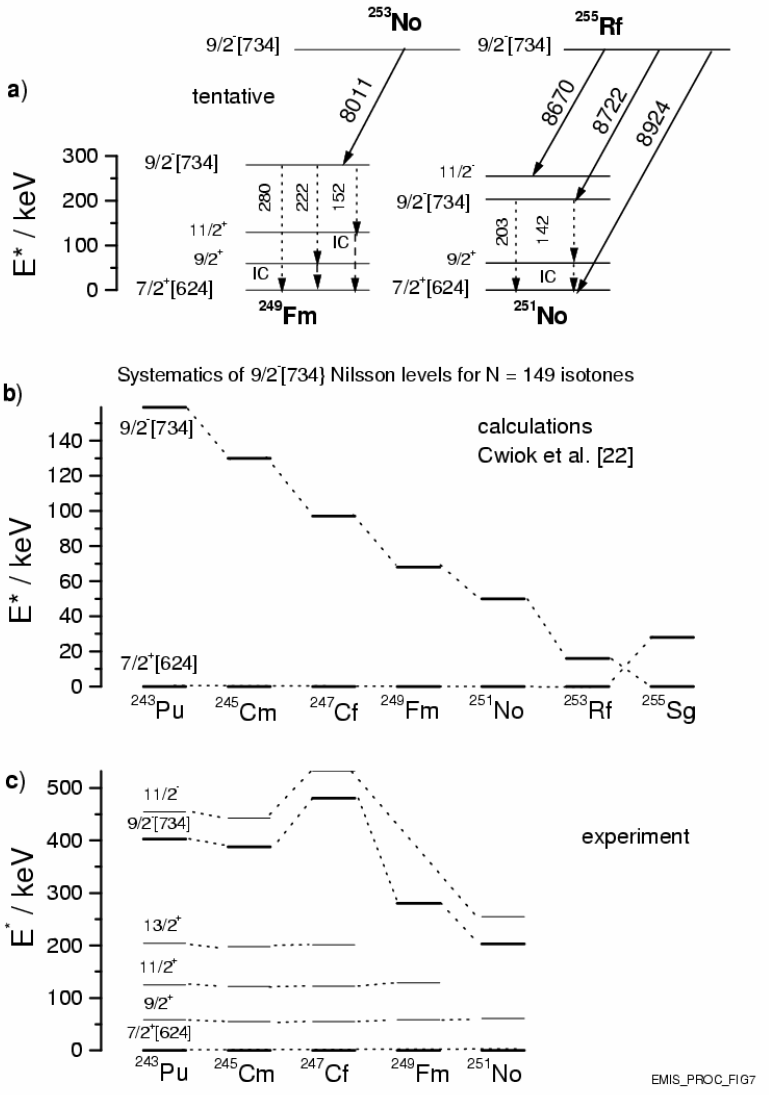

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