Alternative methods for Thermal and Epithermal Flux Monitoring

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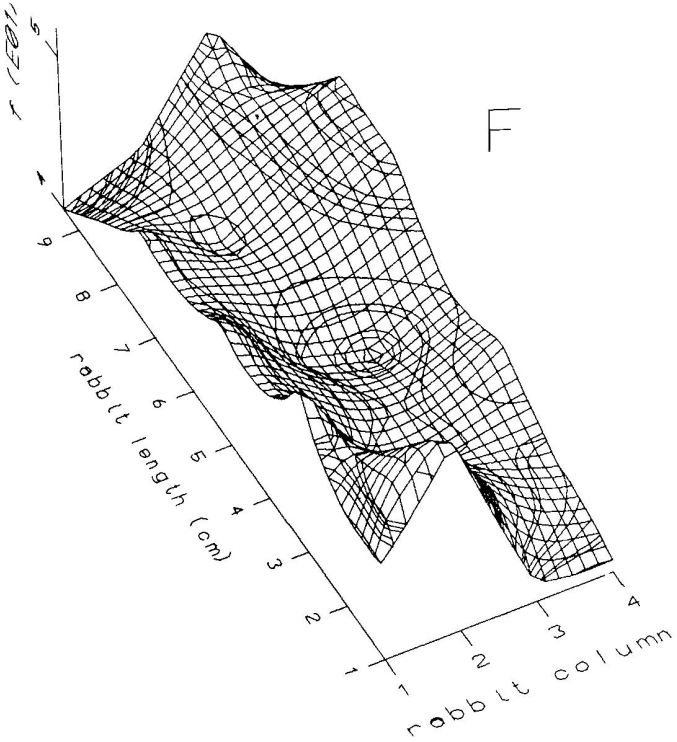
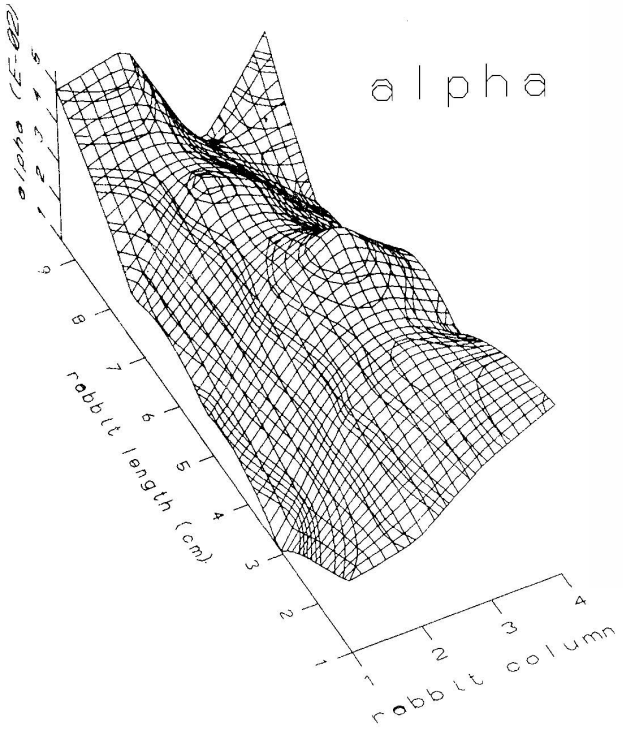
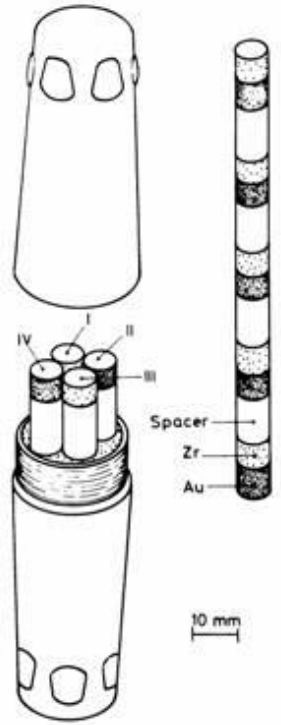
Thermal and Epithermal Flux Monitoring







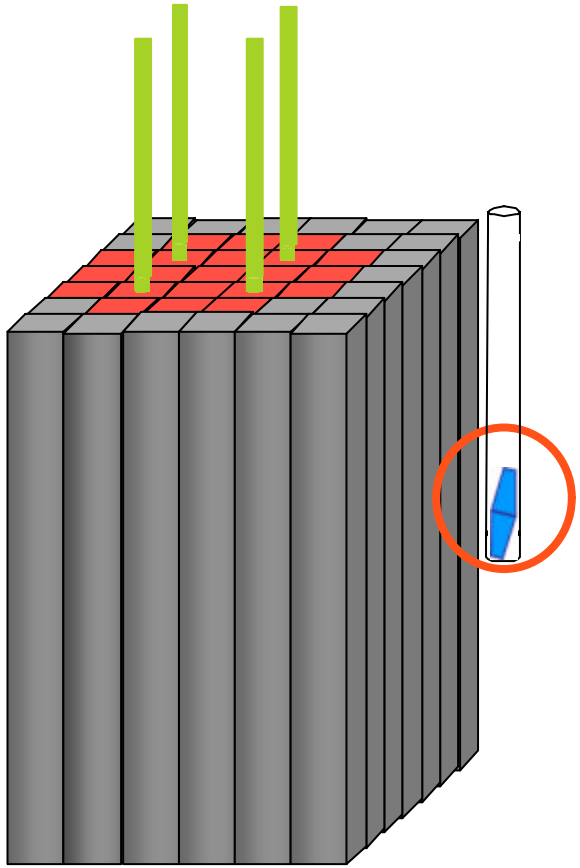
Thermal and Epithermal Flux Monitoring

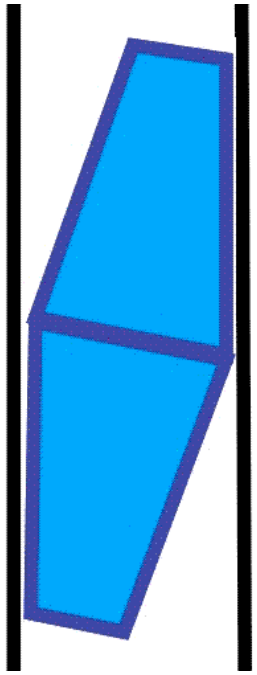
Poor reproducibility of *f* and α in consecutive irradiations under stable reactor conditions:

	1st series (n=5)	2nd series (n=5)
f	50 - 63	64 - 90
α	0,07 - 0,11	0,02 - 0,08

Temporarily solved at IRI by choosing α = 0.10 and calculating the corresponding *f* values

Thermal and Epithermal Flux Monitoring





Thermal and Epithermal Flux Monitoring

Conclusions:

- Metrology requires to determine spectrum parameters in every irradiation for every position inside the rabbit.

Thermal and Epithermal Flux Monitoring

Cd-covered Zr-Au method:

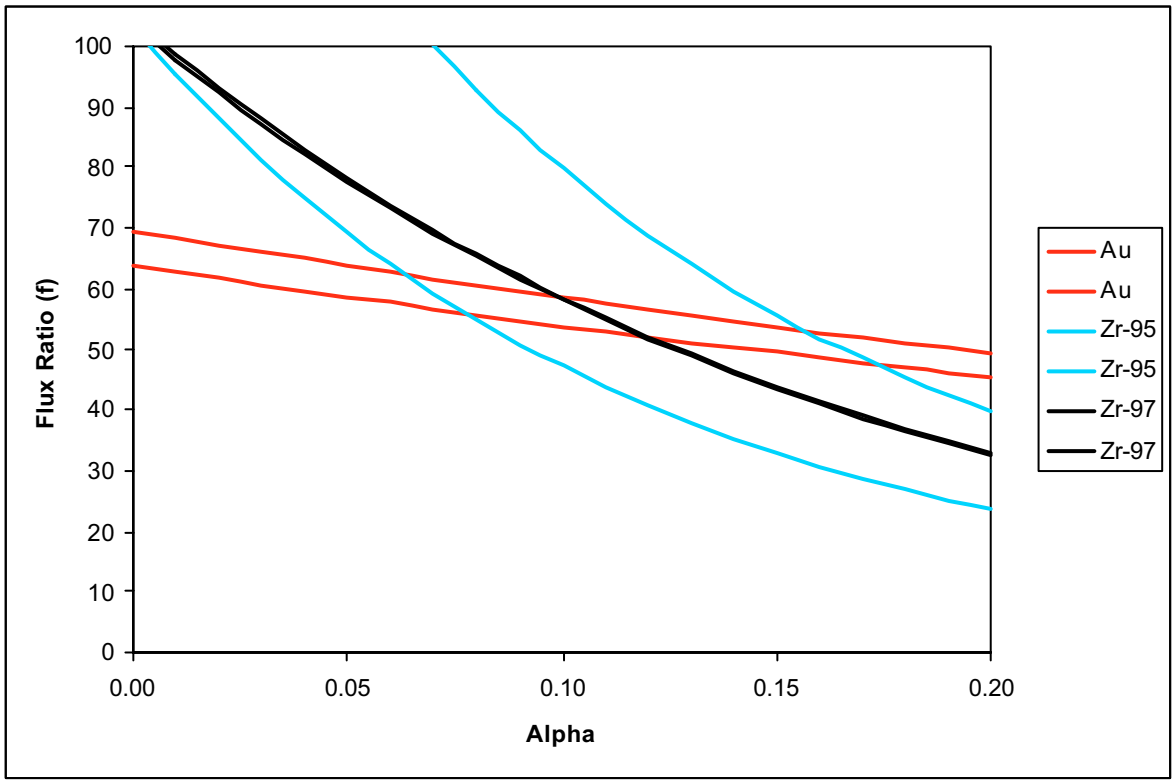
- Inapplicable due to thermal heating of Cd with a serious risk of damage to the plastic irradiation container.
- Inapplicable due to flux depressions in the real samples

Thermal and Epithermal Flux Monitoring

Bare triple method (Zr-Au):

- Poor counting statistics for ^{97}Zr under routine INAA conditions (t_{irr}: 1-4 h, t_d: 3-5 days, t_c: 1-4 h)
- Strong influence of counting statistics

Thermal and Epithermal Flux Monitoring



Thermal and Epithermal Flux Monitoring

Search for alternative pairs of flux and spectrum monitors

Needed:

- High Q_0, low E_r + High Q_0, high E_r
- High σ_0
- No spectral interferences; minimal coincidence summing
- Easy to prepare in large batches
- $t_{1/2}$ > 1 d

USP

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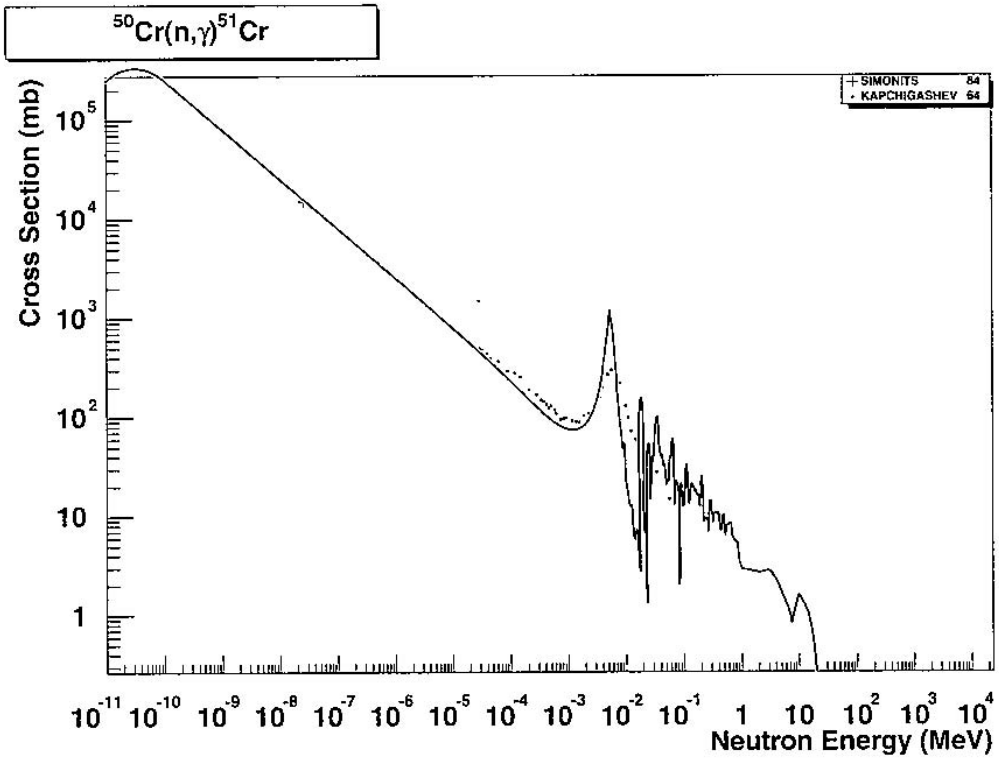
Thermal and Epithermal Flux Monitoring

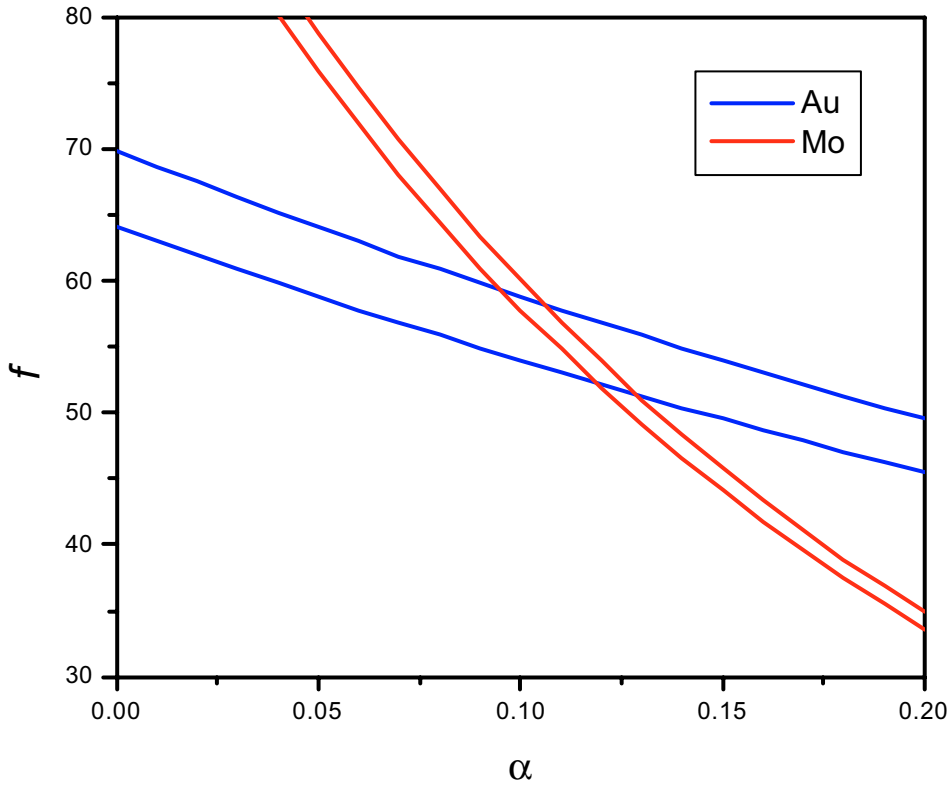
Epithermal flux can be neglected if f>50



Thermal and Epithermal Flux Monitoring

Alternative set of monitors:

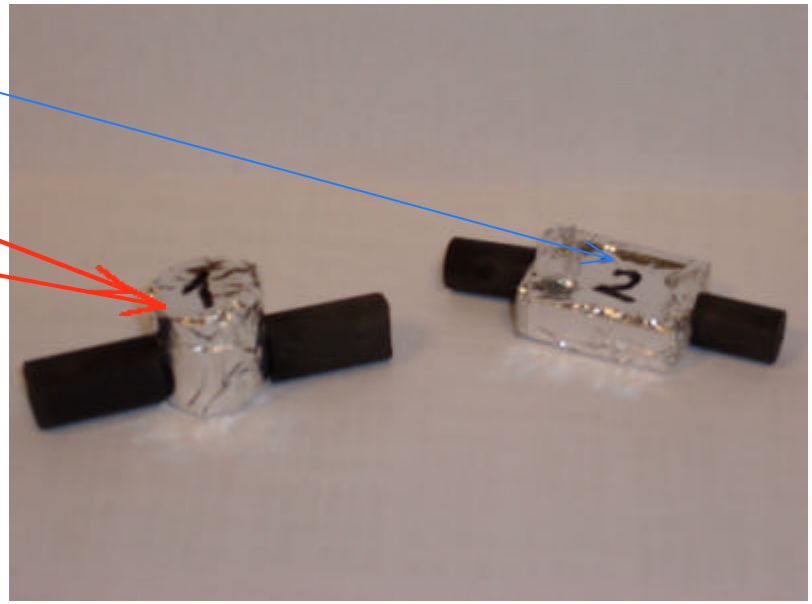
^{51}Cr, ^{99}Mo, ^{198}Au



Thermal and Epithermal Flux Monitoring

Verification in pool-side facility and Al-containers

- Cd-covered Zr-Au-monitor
- Cr, Mo, Au monitor
- Zr, Au-monitor



Irradiation time: 30 minutes
(2 separate irradiations)
Decay time: 4 days
Counting time: 2 hours
Detector: 35 % Ge-detector

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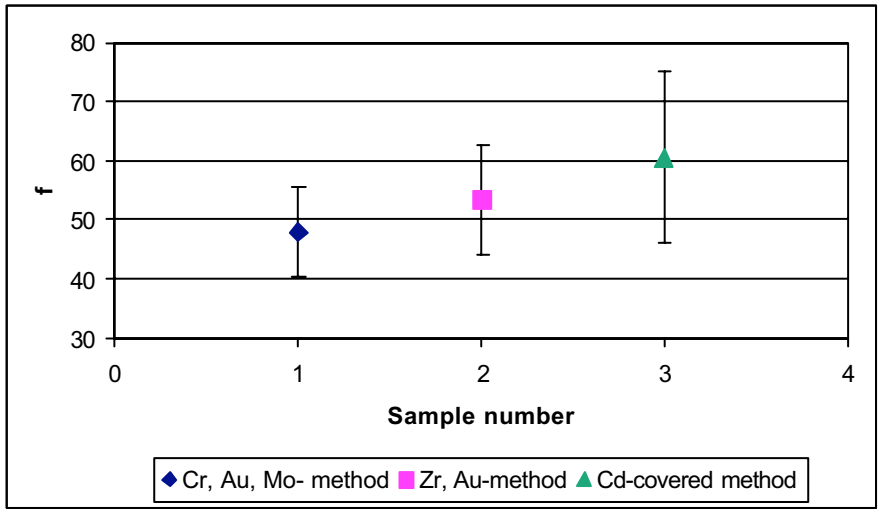
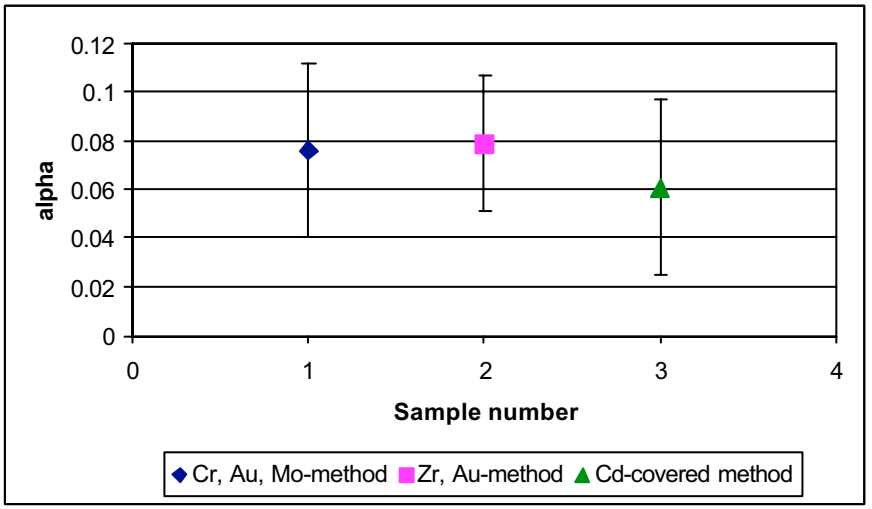
Thermal and Epithermal Flux Monitoring

f

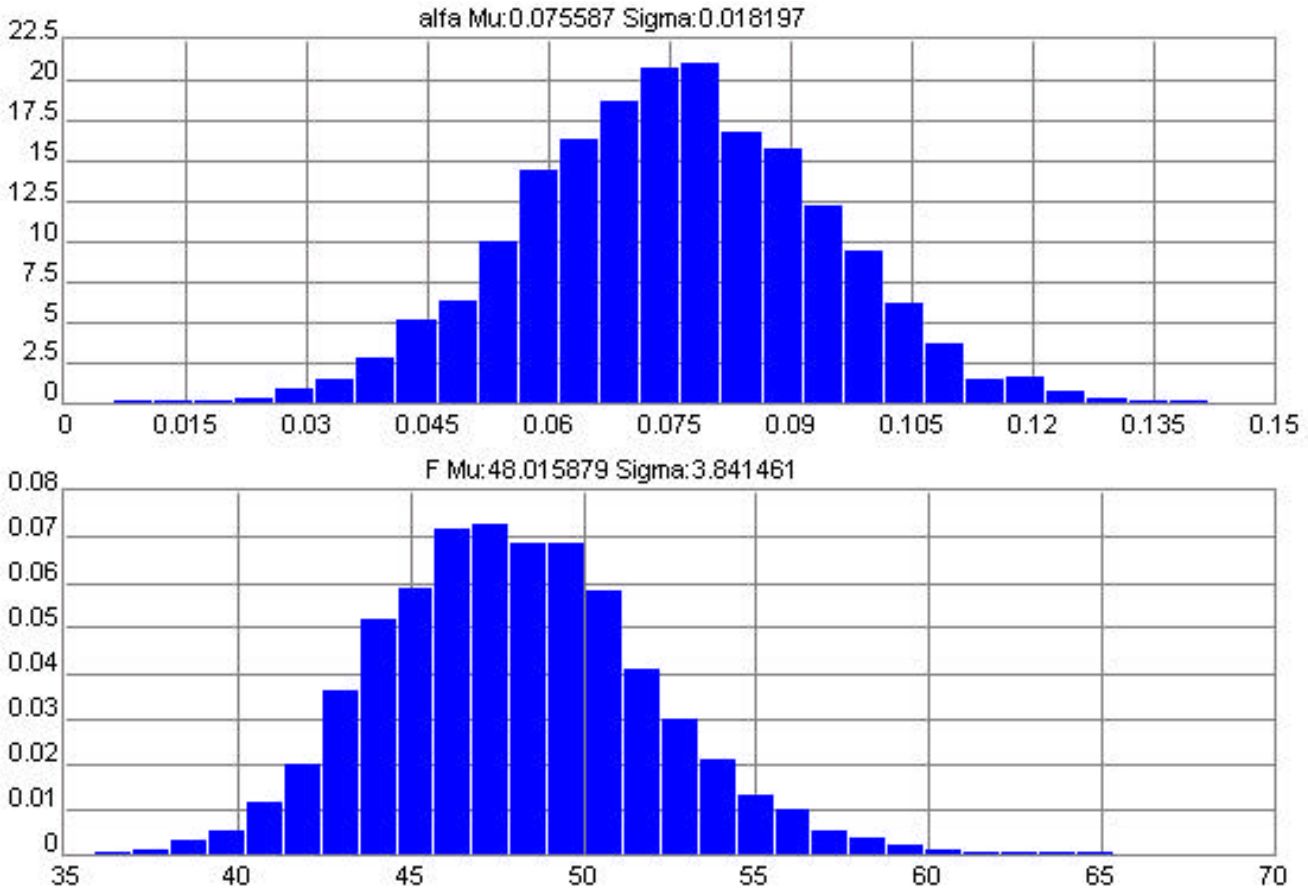


α

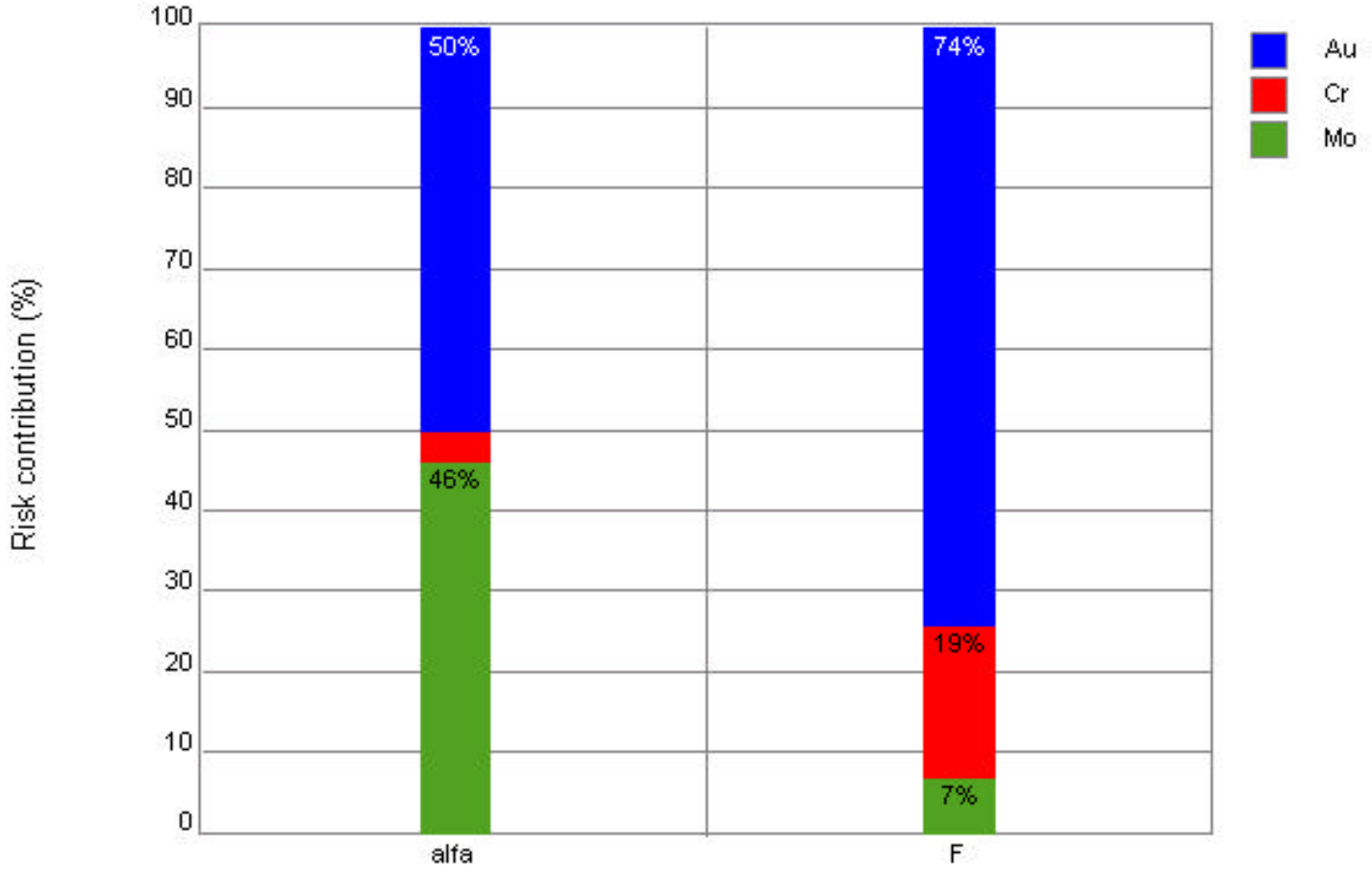


Thermal and Epithermal Flux Monitoring

	Activity uncertainty (%)
^{51}Cr	0.7
^{99}Mo	2.0
^{198}Au	1.1



Thermal and Epithermal Flux Monitoring



Thermal and Epithermal Flux Monitoring

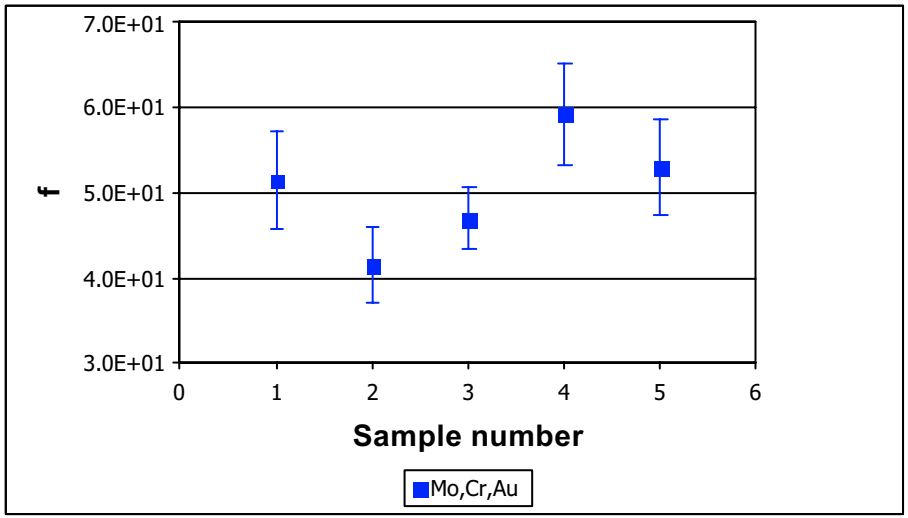
Characterization of pneumatic facility

5 Cr, Mo, Au-monitors

Irradiation time: 1 hour
Decay time: 4 days
Counting time: 1 hours
Detector: 35 % Ge-detector

Thermal and Epithermal Flux Monitoring

f



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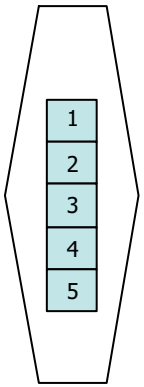

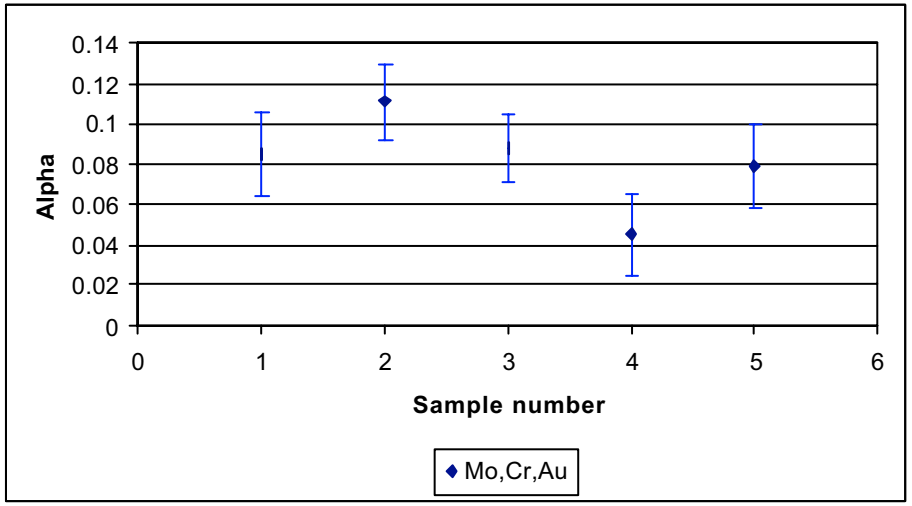

Thermal and Epithermal Flux Monitoring

Conclusions:

- The Mo, Au, Cr- monitor is the solution for spatial *f* and α monitoring
- The monitor is easy to prepare in large batches
- The monitor will be used in routine INAA