

Copper cleaning

# Cleaning Procedure

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- The CUPID/COSINUS collaboration uses:
- Ultrasonic bath with 1% acid soap (Elma clean 60, or other soaps acidic.....) for at least 20 minutes.
- Washing with 10%  $\text{HNO}_3$  and 1%  $\text{H}_2\text{O}_2$  solution for 1 hour (takes off about 7/10  $\mu\text{m}$ ). To shorten the time we can increase  $\text{H}_2\text{O}_2$
- The use **nitric acid**, because citric acid needs the addition of a lot of  $\text{H}_2\text{O}_2$  to make it work;
- Washing with 1% citric acid solution and 0.5%  $\text{H}_2\text{O}_2$  for 15 seconds;
- Bath with demineralized water for 15 seconds.
- Washing under running (demineralized) water to remove the remaining traces of acid.
- Drying with clean room cloth
- Further drying with clean chamber cloth and nitrogen flow under laminar flow hood

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- A similar protocol was used to clean the copper before the ICPMS measurements

## Sample list

- Cu piece CSN CARL SCHREIBER

Sample "Cu L"	Weight [g]	Sample treatment	Cu dissolved [g]	Note
Starting	14.10			
After Etching n 1	11.05	6 mL H <sub>2</sub> O + 10 mL HNO <sub>3</sub>	3.05	Waste
After Etching n 2	8.13	6 mL H <sub>2</sub> O + 10 mL HNO <sub>3</sub>	2.92	Measured
After Etching n 3	5.20	6 mL H <sub>2</sub> O + 10 mL HNO <sub>3</sub>	2.93	Measured
After Etching n 4	2.13	6 mL H <sub>2</sub> O + 10 mL HNO <sub>3</sub>	3.07	Spiked 100 ppt

Tab.1 Sample etching with HNO<sub>3</sub>

## Rinse and description

Cu sample was rinsed with 5% of acid soap "Decon" in ultra-sonic bath, nitric acid and citric acid, this procedure was performed by Roberto Cerroni together with samples cleaning for gamma-ray spectroscopy.

- I think we should foresee a similar procedure to treat copper before the final assembly;
- It should be cost-affordable, but requires a small facility to be setup, chemical handling

# Copper analysis with ICPMS

- They used the described procedure to clean it and measured the U and Th content

	<b>Etching 2</b>	<b>Etching 3</b>
	[pg * g <sup>-1</sup> ]	[pg * g <sup>-1</sup> ]
Th	9 ± 3	7 ± 2
U	5 ± 2	2 ± 1

- These were the Matthias results

## radionuclide concentrations:

Th-232: < 0.38 mBq/kg <=> < 9.3 E-11 g/g  
 Ra-228: < 0.20 mBq/kg <=> < 4.9 E-11 g/g  
 Th-228: < 0.20 mBq/kg <=> < 4.9 E-11 g/g

U-238: < 0.44 mBq/kg <=> < 3.5 E-11 g/g  
 Ra-226 < 17 mBq/kg <=> < 9.3 E-10 g/g  
 Th-234 < 11 mBq/kg <=> < 6.5 E-10 g/g  
 Pa-234m < 11 mBq/kg <=> < 6.5 E-10 g/g

U-235: < 0.37 mBq/kg <=> < 6.5 E-10 g/g

K-40: < 3.2 mBq/kg <=> < 1.0 E-7 g/g

Cs-137: < 0.14 mBq/kg

Co-60: < 0.12 mBq/kg @ start of measurement: 07-OCT-2022

Co-58: (0.8 +- 0.1) mBq/kg @ start of measurement: 07-OCT-2022

Mn-54: (0.12 +- 0.05) mBq/kg @ start of measurement: 07-OCT-2022

<sup>58</sup>Co has an half life of 70 days

<sup>54</sup>Mn has an half life of 1 year

- Upper limits on U and Th, 10 times larger than actual values