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**Cristian Pira**

# **ARIES WP 15.3 progress**

**ARIES 1st Annual Meeting, 22-25 May 2018, Riga**

# LNL Set-up and parameters

**L8 (tumbling), L16 (EP+SUBU)**

**L20 (SUBU LNL), L21 (EP)**

**C10 (SUBU CERN)**

*Initially planned*

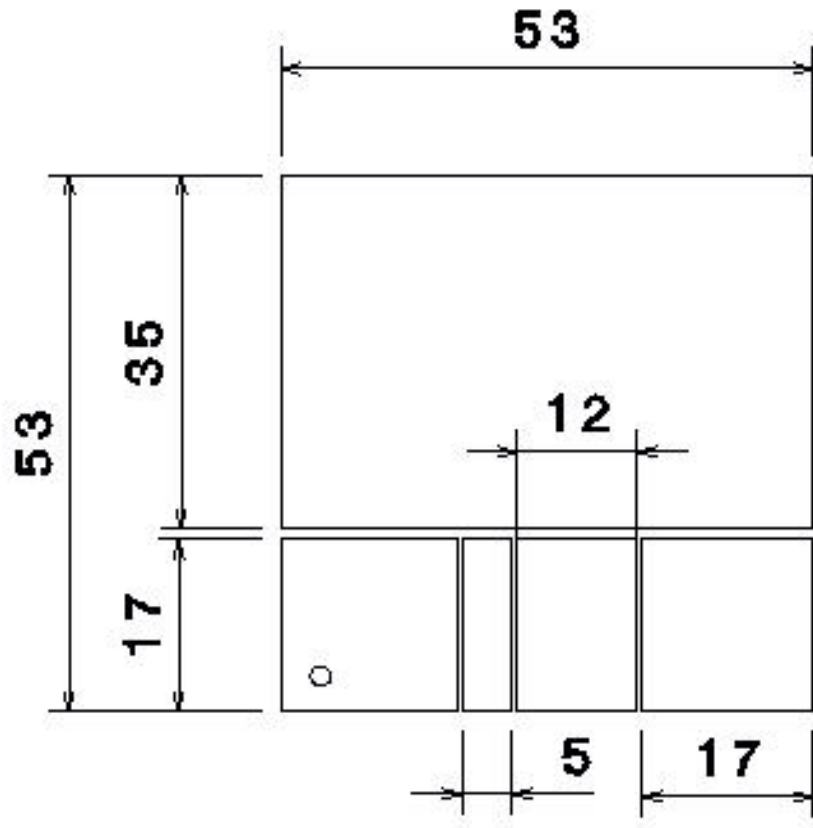
*Spare samples at LNL*

*Arrived from STFC on 19/04*

- Unpacking of Sample and directly installing it onto the sample holder.
- Chamber evacuation and baking at  $T_B = 650$  °C for more than 40 hours.
- Target conditioning for 5 minutes.
- Subsequent deposition without interruption of the process for 20 min.
- Cooldown for more than 15 hours.
- Opening the chamber and packing the sample into its original storage box.
- Cutting the samples
- Rinsing the pieces in ethanol and dry with nitrogen.
- Packing in PE bags and millipore boxes for shipping.



# Sample cutting set-up



# LNL Sputtering Log

- On 16/04 dispatched 2 samples to University of Siegen L9 (tumbling) and L23 (EP+SUBU)
- On 11/04 Sputtering of L8
- Problems with sample cutting: a mask is necessary to prevent bending
- On 16/04 Sputtering of L16
- On 21/04 Sputtering of C10 (After sputtering  $P = 8 \cdot 10^{-8}$  mbar : possible leak)
- On 04/05 L8, L16 and C10 cutted and dispatched to IEE, RTU and STFC for characterizations
- Series of breakages and unforeseen events: IR lamp, Gauge and Termocouple broken
- On 13/05 Sputtering of L20
- On 14/05 L20 cutted and dispatched to IEE, RTU and STFC for characterizations
- On 16/05 Sputtering of L21
- On 17/05 L21 cutted and dispatched to IEE, RTU and STFC for characterizations

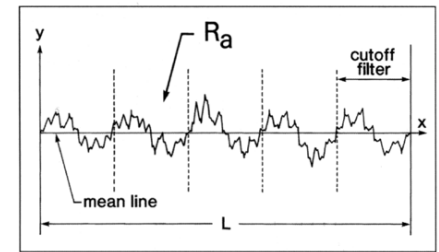
# Surface Characterization

On the five samples coated at INFN 4 different characterizations were done:

1. Roughness
2. SEM
3. EDS
4. XRD

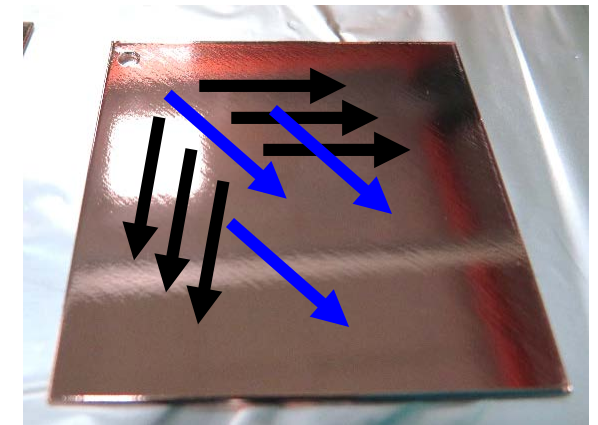
# Roughness

Sample	Ra	Ra diagonal
<b>SUBU5 CERN (C10)</b>	<b>126 ± 15 nm</b>	
<b>SUBU5 INFN (L20)</b>	<b>197 ± 98 nm</b>	
<b>EP (L21)</b>	<b>233 ± 66 nm</b>	<b>254 ± 50 nm</b>
<b>EP+SUBU5 (L16)</b>	<b>192 ± 64 nm</b>	<b>96 ± 18 nm</b>
<b>Tumbling (L8)</b>	<b>207 ± 53 nm</b>	



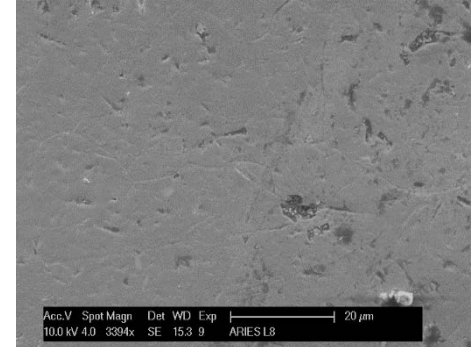
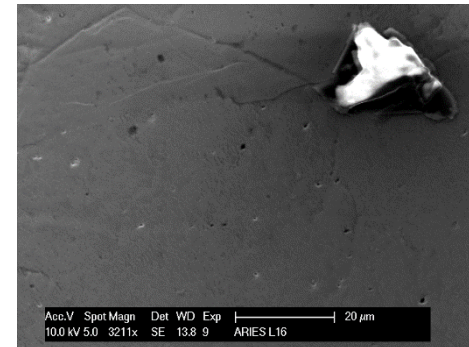
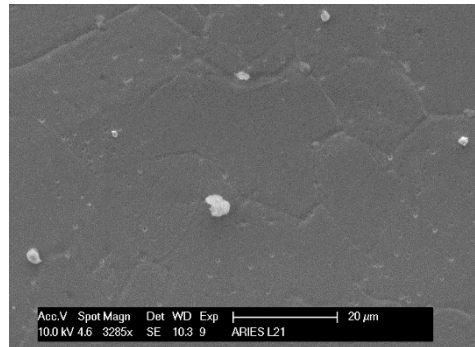
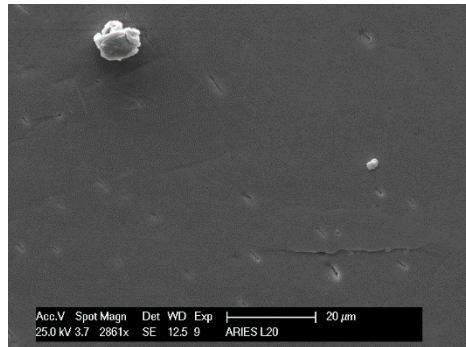
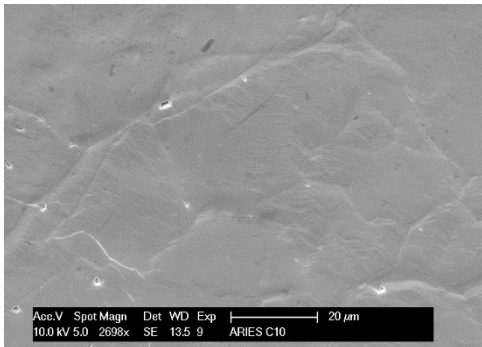
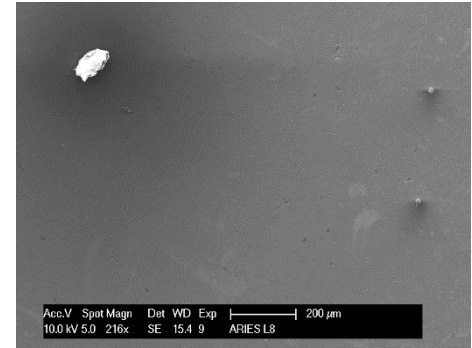
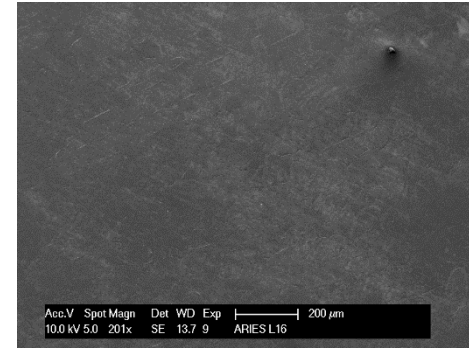
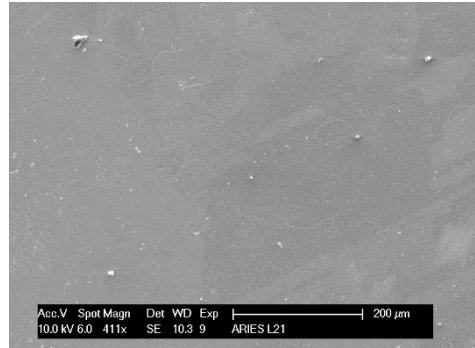
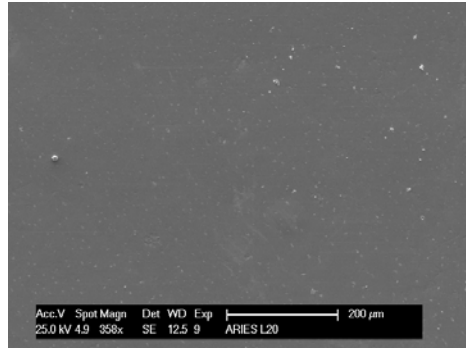
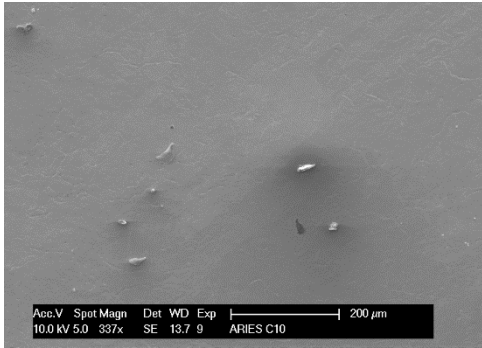
$R_a$  is the arithmetic average deviation from the mean line within the assessment length ( $L$ ).

$$R_a = \frac{1}{L} \int_{x=0}^{x=L} |y| dx$$



- Data dispersion is very high and all samples present similar roughness
- Probably, the roughness values are strongly influenced by the sample bending due to cutting

# SEM



**SUBU CERN**

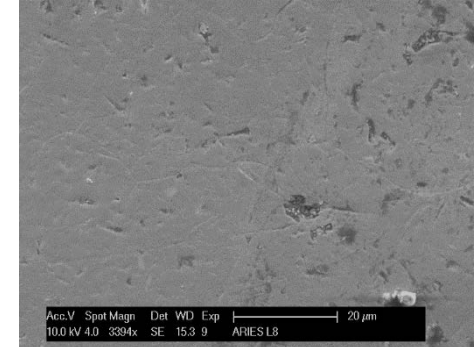
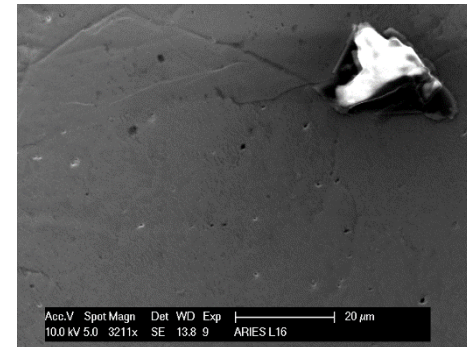
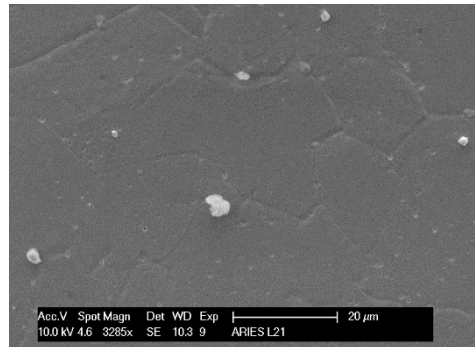
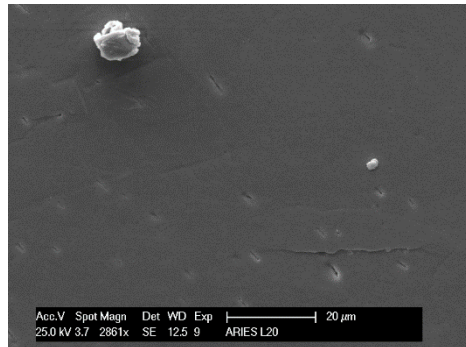
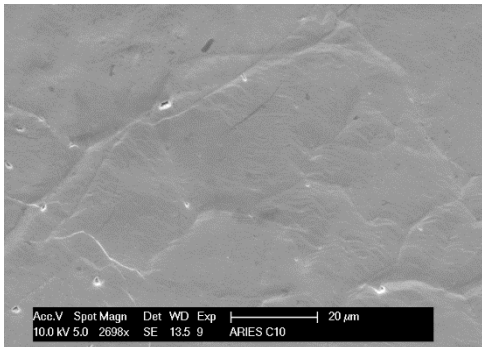
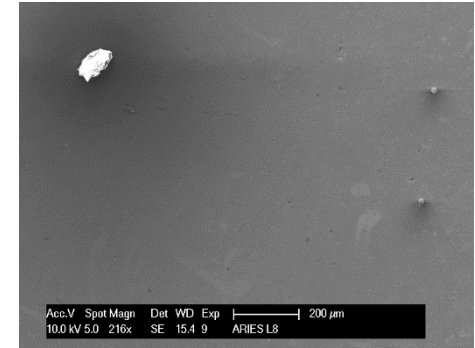
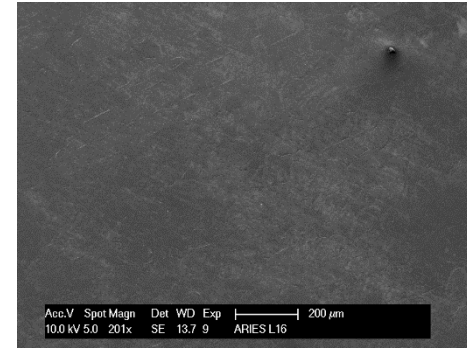
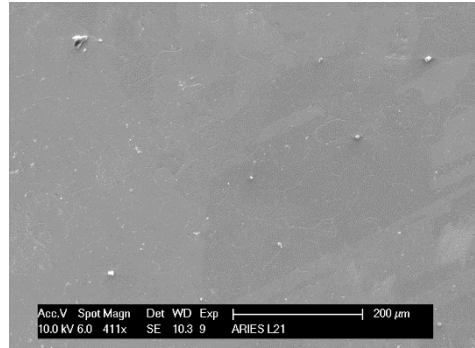
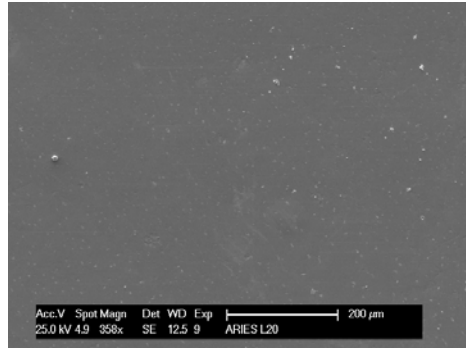
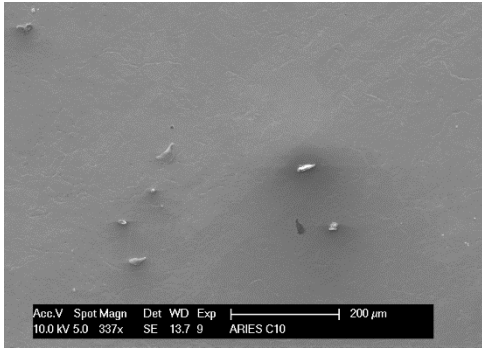
**SUBU INFN**

**EP**

**EP + SUBU**

**Tumbling**

# SEM



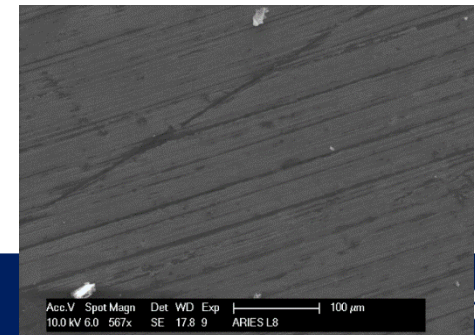
**SUBU CERN**

**SUBU INFN**

**EP**

**EP + SUBU**

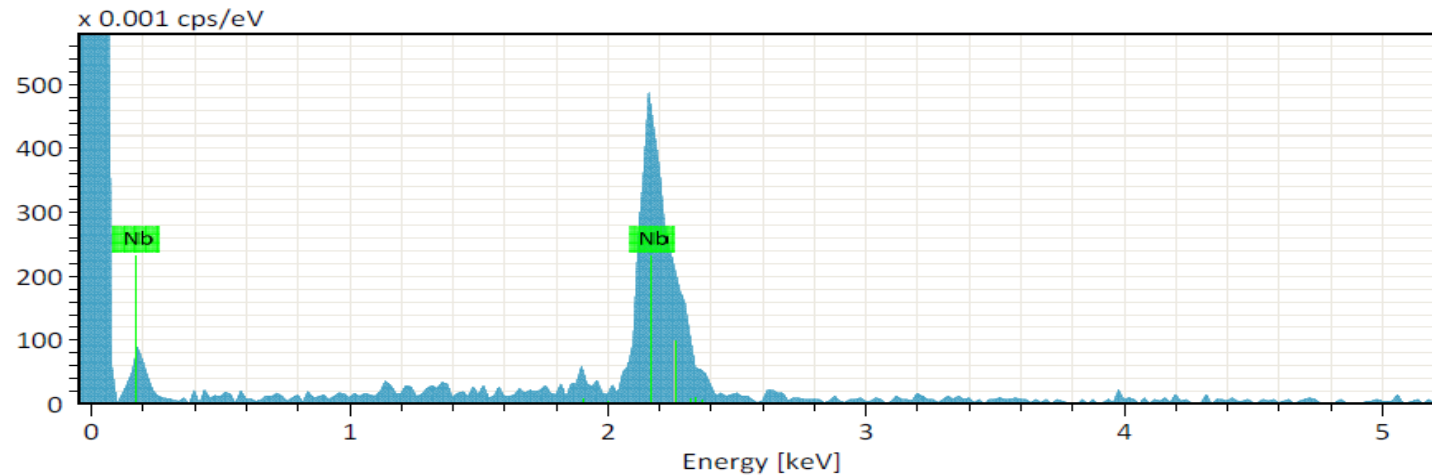
**Tumbling**





# EDS

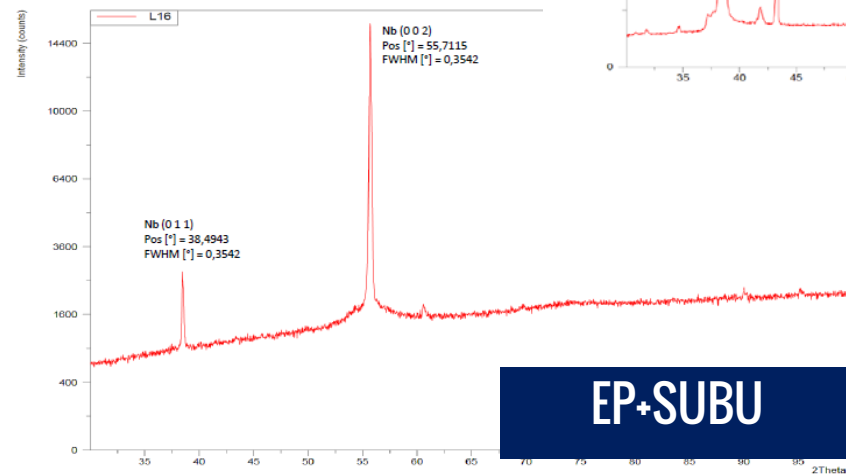
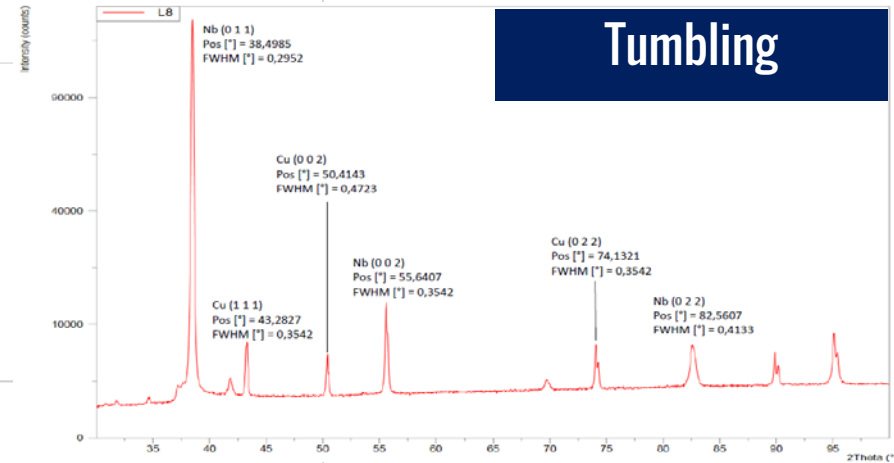
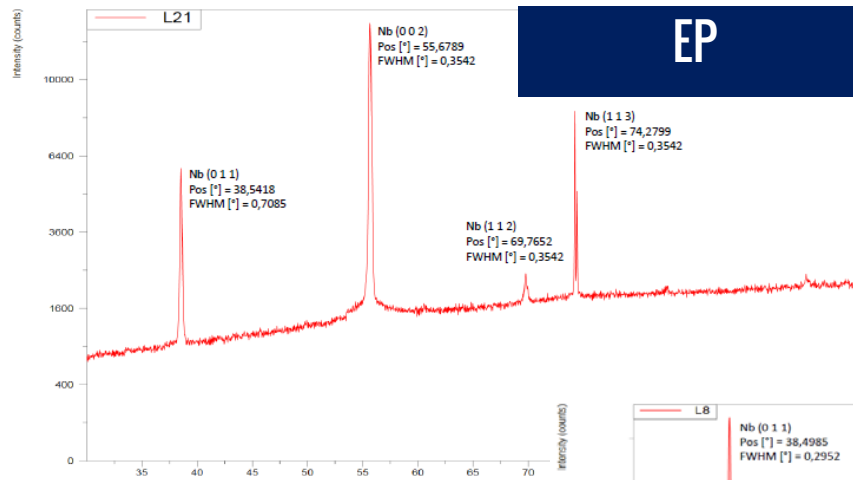
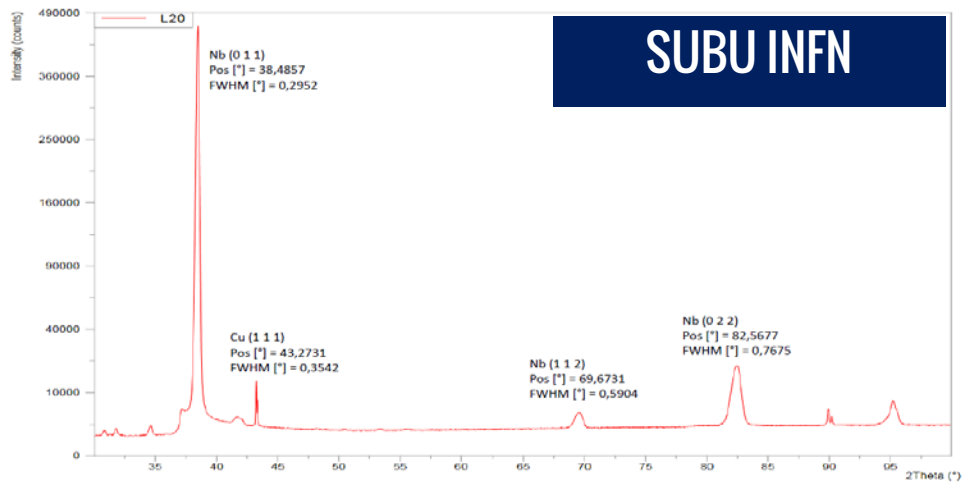
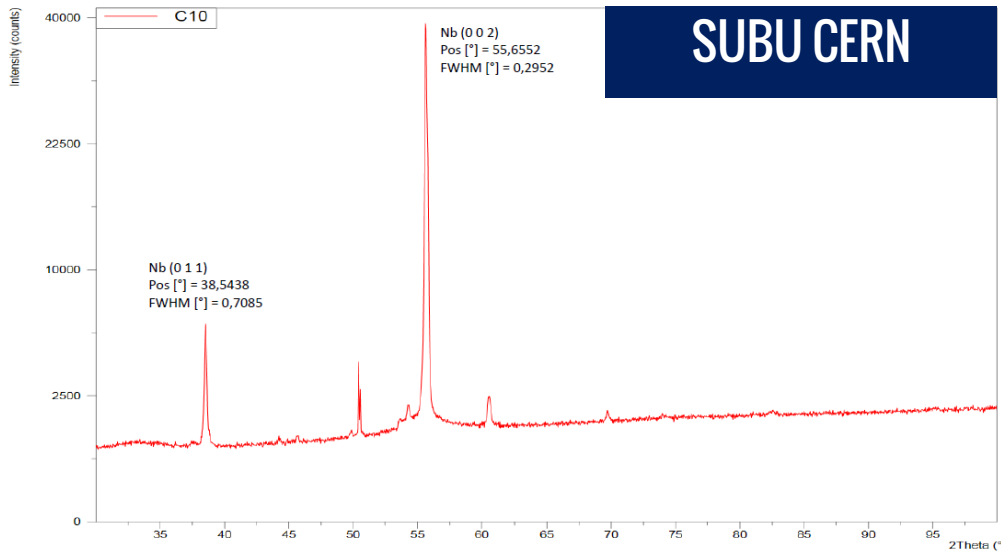
- EDS characterization was also done
- No visible contaminations appear in analysed samples



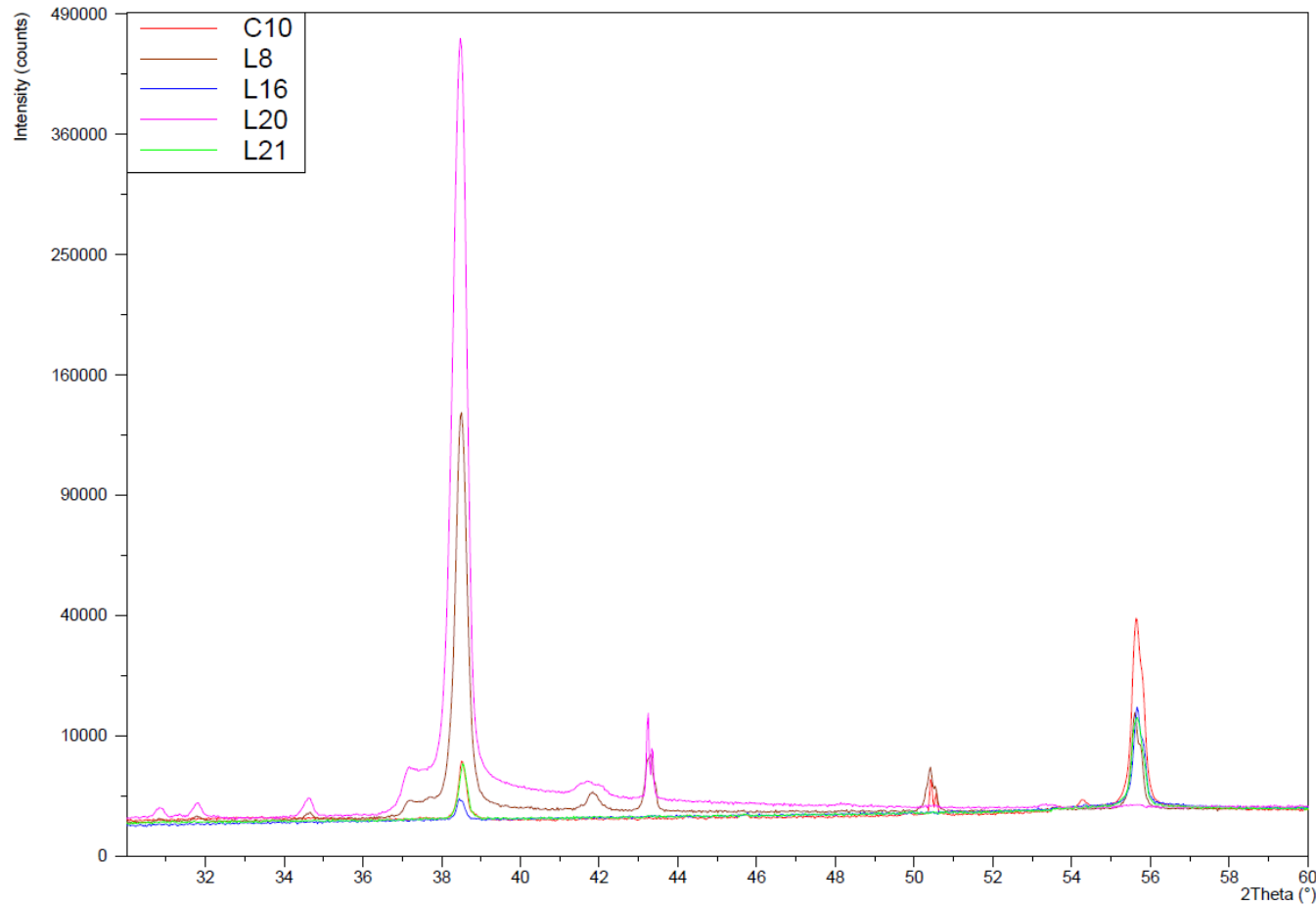
Name	Date	Time	HV [kV]	Real time [s]	Dead time [%]	Pulses [kcps]
point 967	5/9/2018	12:14:26 PM	10.0	20.527	0	0.135

Spectrum	Nb
point 967	100.00

# XRD



# XRD



Sample	Orientation	2 Theta (0 1 1)	Reticular parameter a
SUBU5 CERN (C10)	0 0 2	38,5438	3,303 Å
SUBU5 INFN (L20)	0 1 1	38,4857	3,308 Å
EP (L21)	0 0 2	38,5418	3,303 Å
EP+SUBU5 (L16)	0 0 2	38,4943	3,307 Å
Tumbling (L8)	0 1 1	38,4985	3,307 Å

- Reticular parameter Bulk Nb: 3,306 Å

$$n\lambda = 2d \sin \theta$$

$$a = \sqrt{h^2 + k^2 + l^2} \cdot d$$

# Conclusions

- All 5 samples coated, cutted and dispatched
- Probably roughness are strongly influenced by the sample bending due to cutting
- SEM confirm that morphology of Cu surface is replicated by the Nb film
- With EDS no visible contaminations appear in analysed sample
- XRD spectras are difficult to interpret. More statistics is needed