CERN — European Organization for Nuclear Research

EN-MME/MM

EN Engineering Department

Section de Matériaux et Métrologie/ *Materials and Metrology section*

Rapport expérimental / *Investigation report*

Domaine / Field:	***Date:***	***N° EDMS / EDMS Nr.:***
SPS	2-02-2012	1183817
Requérant / Customer:	***Liste de distribution / Distribution list:***	
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SEM examination of a fractured carbon wire (2 pieces) after lead ion beam radiation in SPS

1. Résumé / Abstract:

The goal of this study is to analyze the influence of lead ion beam on carbon wires used for beam profile measurements (Beam Wire Scanner) in SPS. The carbon wire was removed after one year of exposition to ion beam. The wire ruptured while it was dismounted. Two pieces were brought for SEM examination of the carbon wire.

The results were compared with similar observations of carbon wires subjected to proton radiation:

1. EDMS report No. 1110058
2. EDMS report No. 696266
3. BE technical note CERN-BE-2009-028 (http://cdsweb.cern.ch/record/1183415/files/CERN-BE-2009-028.pdf))

2. Données expérimentales / Experimental data:

Sample : 2 pieces of a carbon wire after expositon to Pb ion radiation in SPS

Observations: SEM Leo 430i Leica, Leo software.

3. Résultats / Results (click on blue text to go to images):

Annex 1: SEM image of normal area (unaffected by ion beam exposition) with diameter of approx. 33.5 µm
Annex 2: SEM image of reduced section of piece 1 with diameter of approx. 4.9 µm
Annex 3: SEM image of reduced section of piece 1 showing artificial fracture
Annex 4: SEM image of reduced section of piece 2 showing brittle mechanical fracture with diameter of approx 7.7 µm
Annex 5: EDS spectrum of reduced area of piece 2 (carbon and sulfur)

4. Discussion et conclusions / Discussion and conclusion:

The investigation showed that ion beam caused around 95 – 97 % sublimation of the material which is comparable with the same analysis of carbon wire subjected to proton beam in SPS (ref. 3.). The wire showed brittle mechanical fracture due to dismounting. EDS analysis showed very small content of sulfur on the carbon wire.

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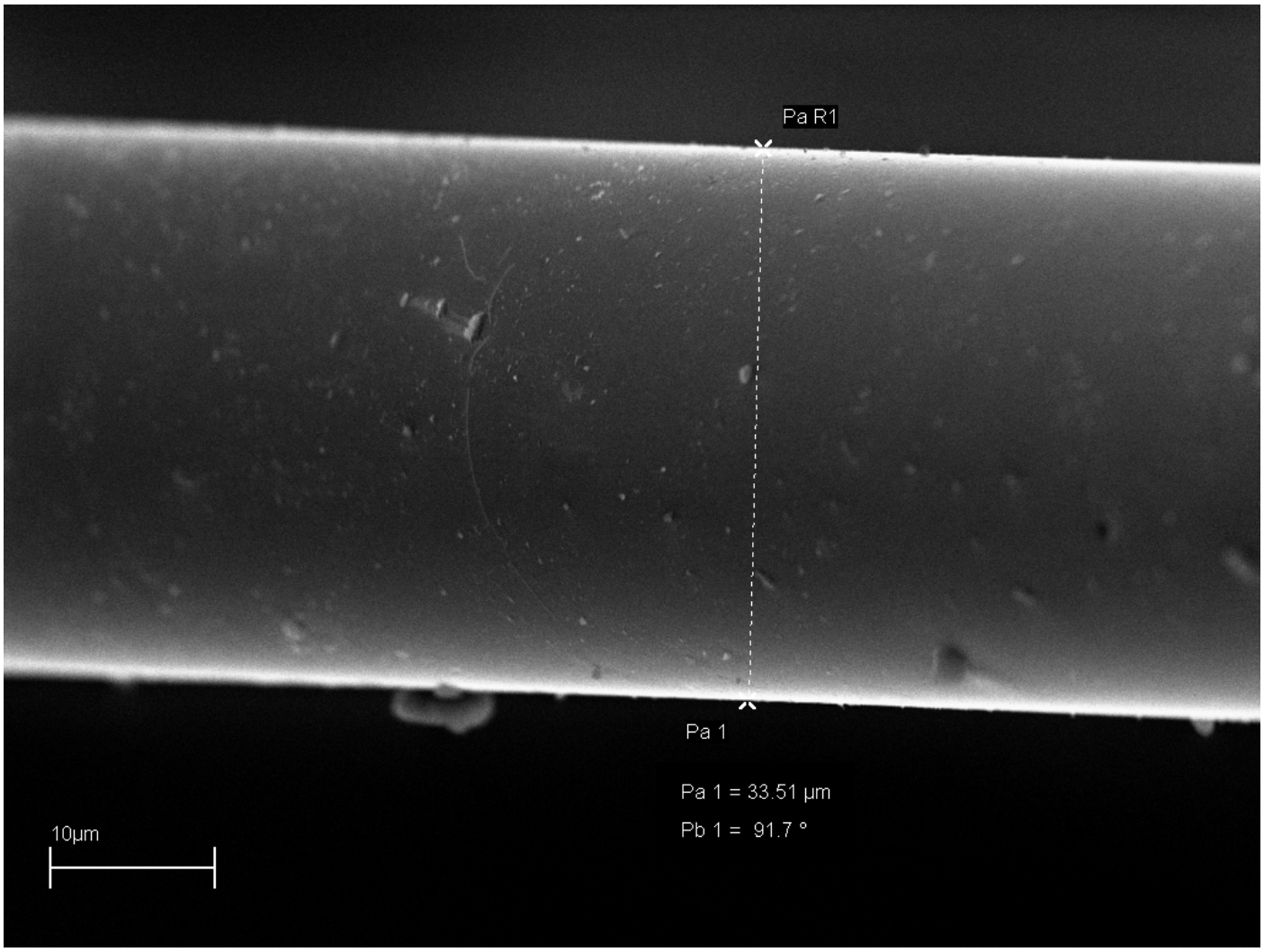

Figure 1. Carbon wire – normal area (unaffected by ion beam)

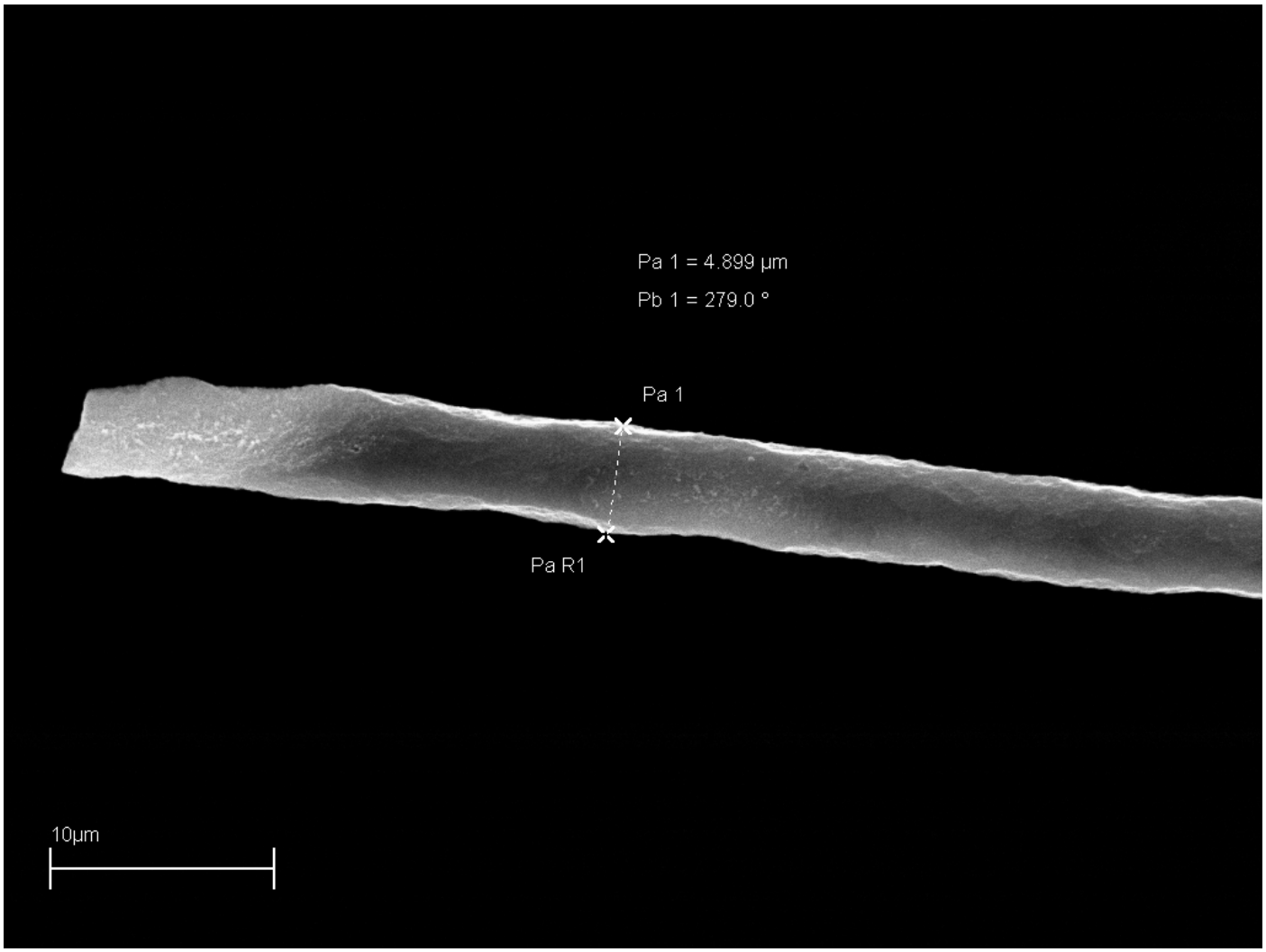

Figure 2. Reduced area of piece 1

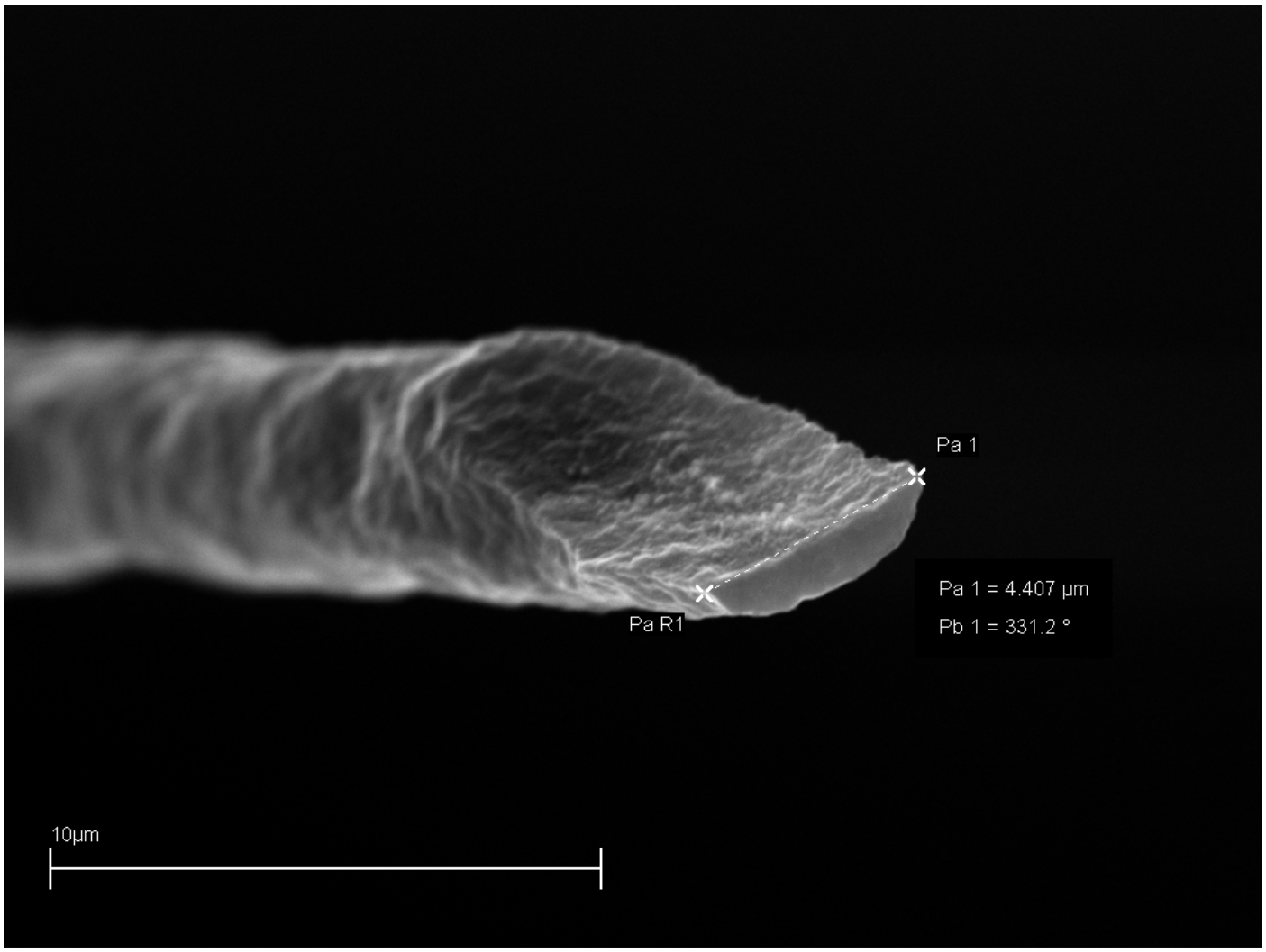

Figure 3. Reduced area of piece 1

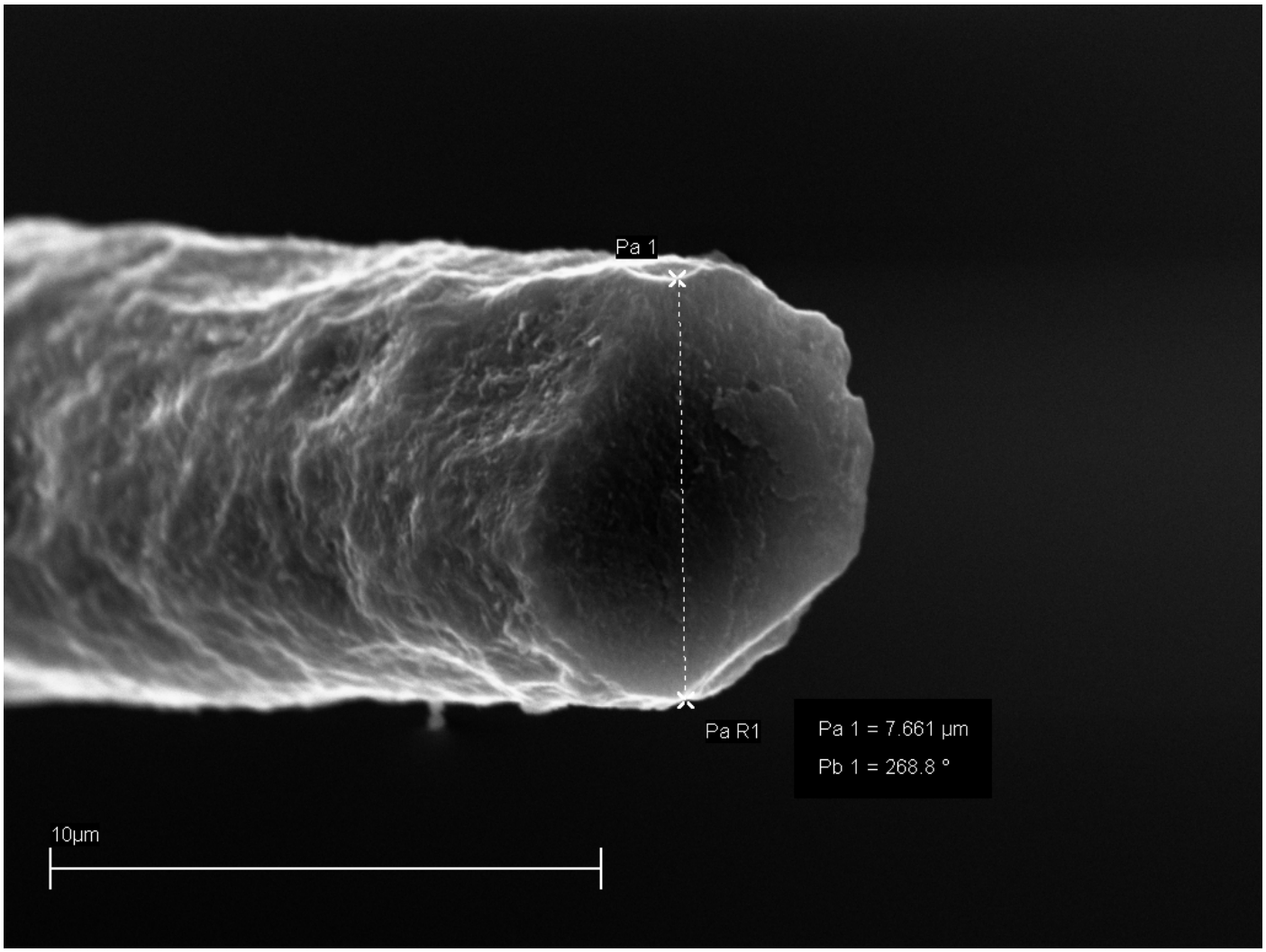

Figure 4. Reduced area of piece 2

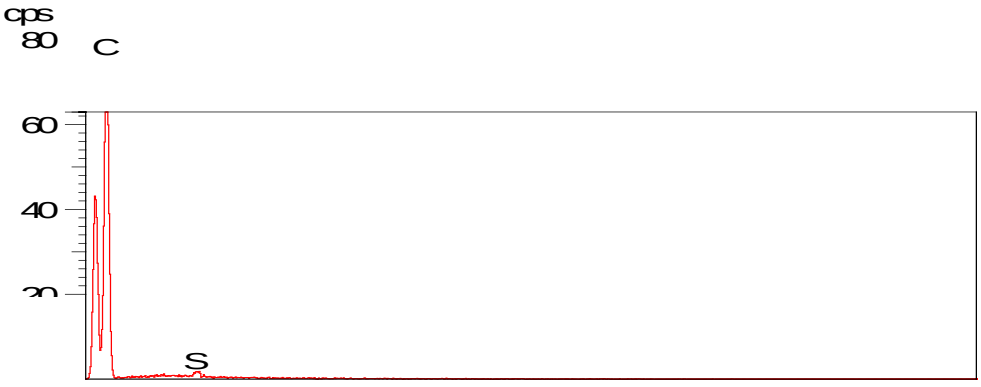

Figure 5. EDX spectrum of fractured carbon wire