ESRF	**Experiment title:** Preliminary Study of Microtomography on Plasma-Sprayed Tungsten (first part of MA-890)	**Experiment number**: MA-890
Beamline:	**Date of experiment**: from: 27.07.09 to: 27.07.09	**Date of report**: 28.08.09
Shifts: 3	**Local contact(s):** Dr. Timm Weitkamp, ID19	*Received at ESRF:*

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Report *(This report refers to the first part of MA-890)*

Main Goal: demonstrate feasibility of high resolution microtomography on porous tungsten.
Goal Status: successfully achieved.

The Experiment MA-890 has been split into a preliminary part and a subsequent measurement campaign, in order to first check feasibility of the measurement (due to the challinging task to penetrate tungsten) and find out the best dimensions of the samples. Successful measurements has been carried out at ID19 with 52keV beam energy on conoidal samples (Fig.1). Up to 0.6 mm thick Vacuum Plasma Sprayed - Tungsten (25% porous) has been successfully reconstructed.

Sample Geometry

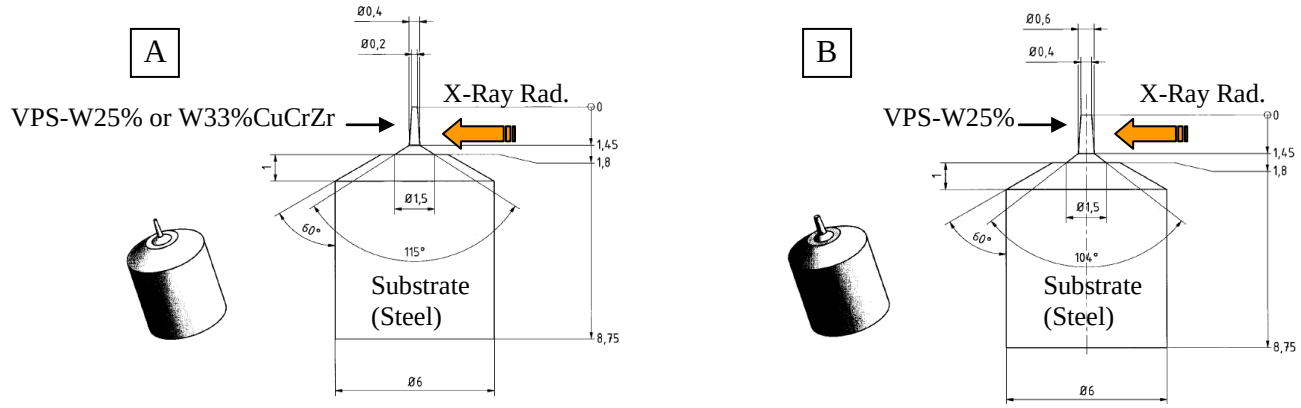


Fig. 1 Sample geometry used during the preliminary study. Conoidal shape has been required in order to test different sample thicknesses. A: diameter range from 0.28 to 0.4 mm. B: diameter from 0.4 to 0.6 mm

All the samples (except one W33%CuCrZr sample) were directly cut from a 10 cm*5 cm tile coated with 2 mm VPS-W 25% porous. The samples include a large cylindrical base made of steel (substrate), the thin conoidal spike of VPS-W (coating) and a W-Steel junction region (between coating and substrate).

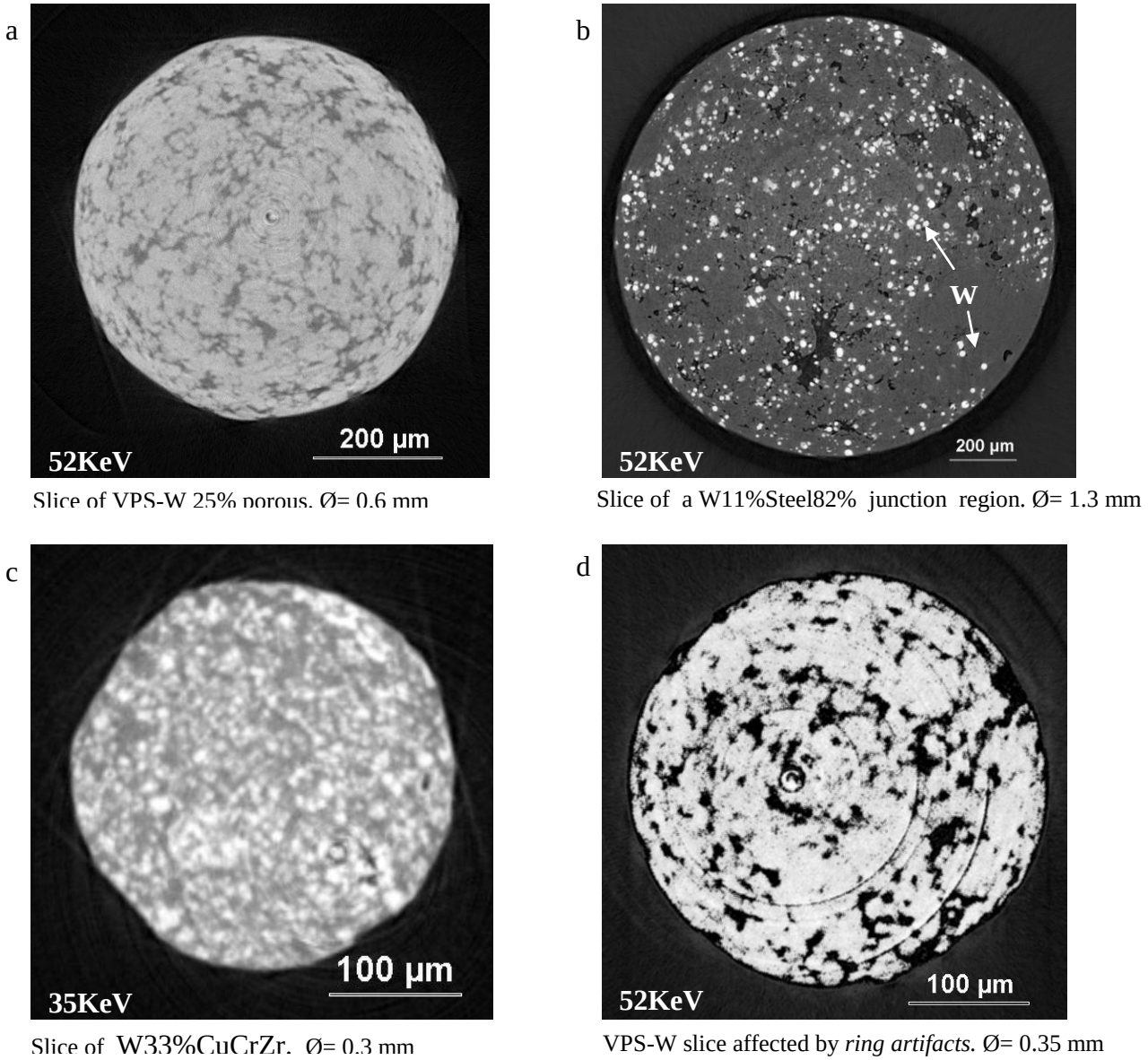
Sample ID	Material	Top Ø [mm]	Bottom Ø [mm]
2	VPS-W25%	0.4	0.6
4	VPS-W25%	0.25	0.4
5	VPS-W25%	0.25	0.4
8	W33%CuCrZr	0.25	0.4

Table 1: samples tested during the MA-890 preliminary campaign.

Measurement Details

All the 17 tomographic scans except 3 have been performed at 52 keV, with a single scan time ranging from 0.5 to 2 hours. Five parameters, which affect the quality of the reconstruction, have been identified and adjusted for VPS-W25%. We tried to optimize the reconstruction quality keeping the time per scan on reasonable values. The best tomographic quality has been achieved with a 73 min long scan and 1.4 μm/px resolution. Lower beam energy (35 keV) has been attempted on less dense W30%CuCrZr composite (Fig. 2c), in the hope to further improve the reconstruction quality. However no improvement has been noticed.

Results



Slice of VPS-W 25% porous. Ø= 0.6 mm

Slice of a W11%Steel82% junction region. Ø= 1.3 mm

Slice of W33%CuCrZr. Ø= 0.3 mm

VPS-W slice affected by *ring artifacts*. Ø= 0.35 mm

Fig. 2 Tomographic slices of different materials in scope for MA-890

Fig. 2a demostrates feasibility of microtomography on a 0.6 mm thick region of a 25% porous tungsten.
Fig. 2b demonstates feasibility of microtomography on a 1.3 mm thick junction region of W11%Steel82% (7% voids have been also observed in the steel substrate).
During every reconstruction (from projections) we faced the problem of ***ring artifacts*** formation in the 2D slices (fig.2d). The problem has been solved with special filtering algorithms applied to the projections before slice reconstruction took place.