



Status of W7-X samples availability in 2022 and plans for analyses in different labs

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W7-X samples analysis after OP1.2B

IBA

- ^{13}C analysis of W7X TDU units after OP1.2B
- using $^{13}\text{C}(\text{D},\text{p})^{14}\text{C}$ reaction
- focus on tiles near the injection location

Laser-based diagnostics

Analysis of the distribution of ^{13}C , O, B on various TDU by means of:

LIBS: Laser-Induced Breakdown Spectroscopy

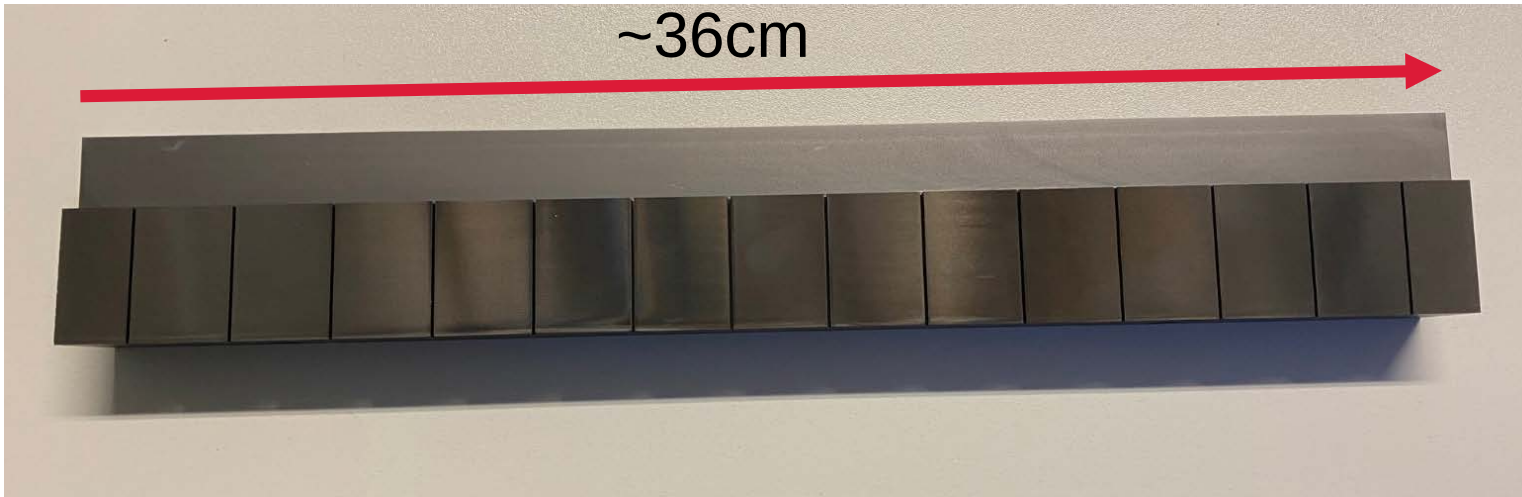
DP-LIBS: Double-pulse LIBS

LAMIS: Laser ablation molecular isotopic spectrometry

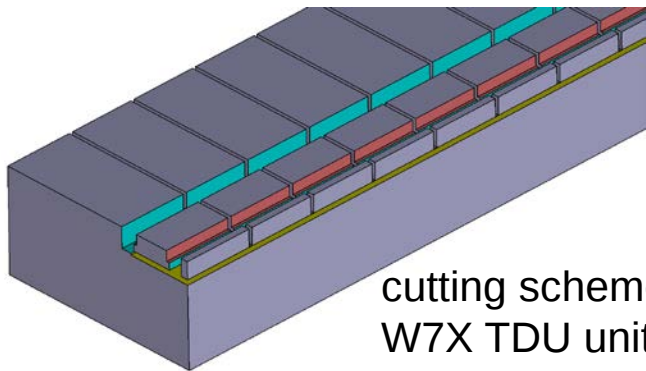
Surface morphology

- Detailed investigation (SEM, FIB, EDX, TEM) of deposited layers on various W7X TDU after OP1.2B including study of the thickness and composition (O, B)

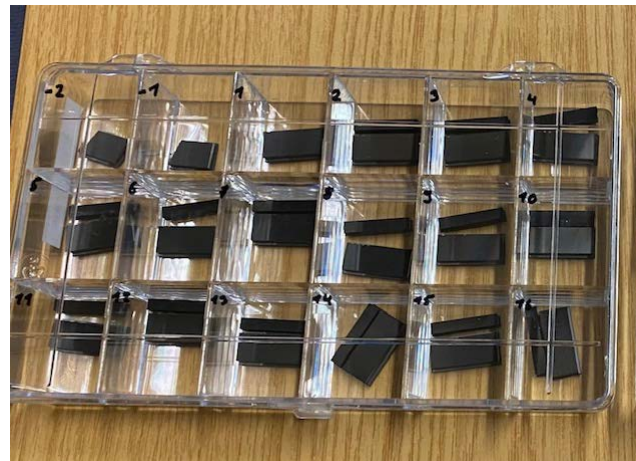
Processing of the samples



Target element with a line of samples cut out



cutting scheme
W7X TDU units



Cut and sorted samples



Samples on the holder before the analysis

Update W7-X divertor samples

- 16 of 20 Elements (TE) cut and measured
- RBS/NRA with 1MeV D+ done
 - Aiming for: absolute ^{13}C deposition and its localization in W7-X
 - Already done: relative distribution of ^{13}C on each element calculated
 - Next step: Calculating the ^{13}C amount and receiving W7-X mapping data

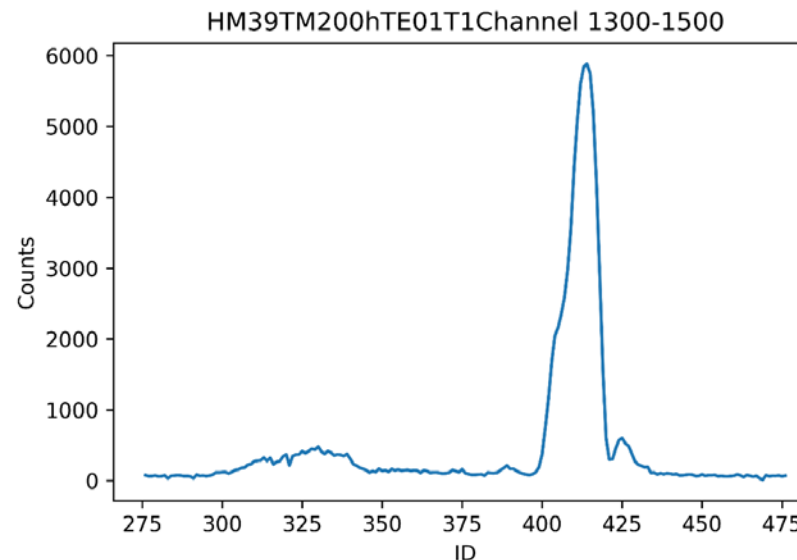
Graphic:

X = ID of TE samples

Y = number of ^{13}C Counts

Distance of 2 IDs: ~2,5mm

Results for adjacent elements are quite similar, so no large errors in the measurement methods are expected



Samples measured:

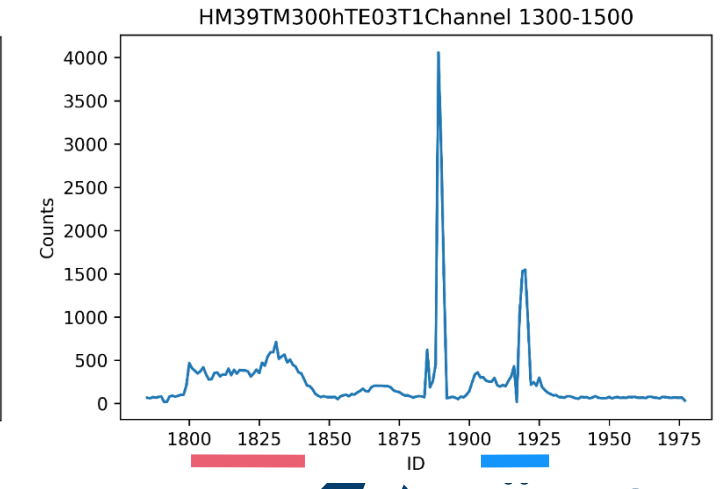
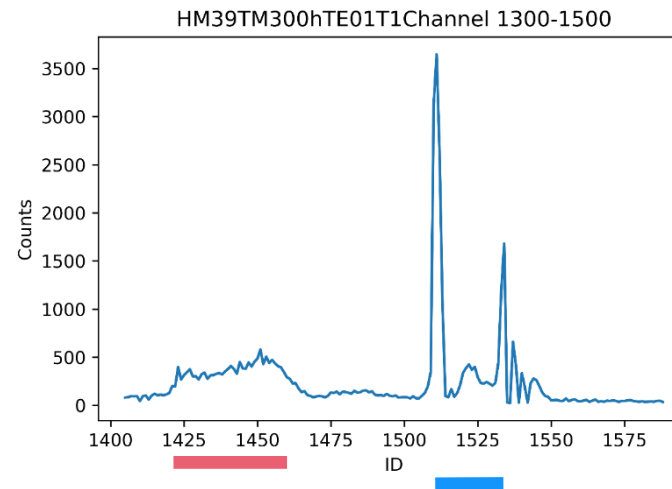
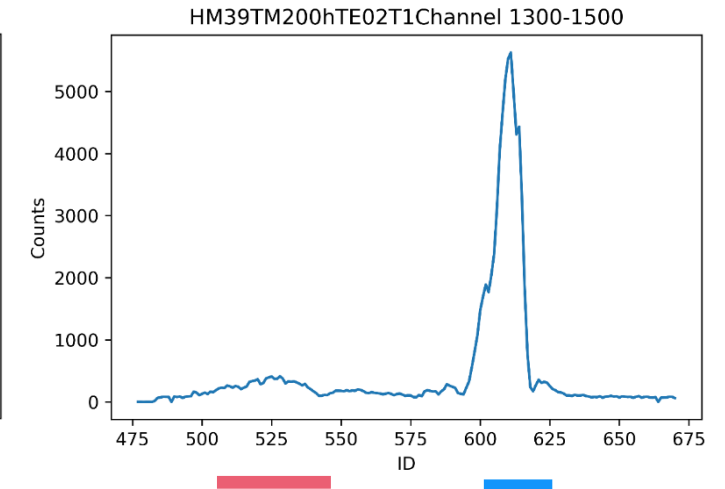
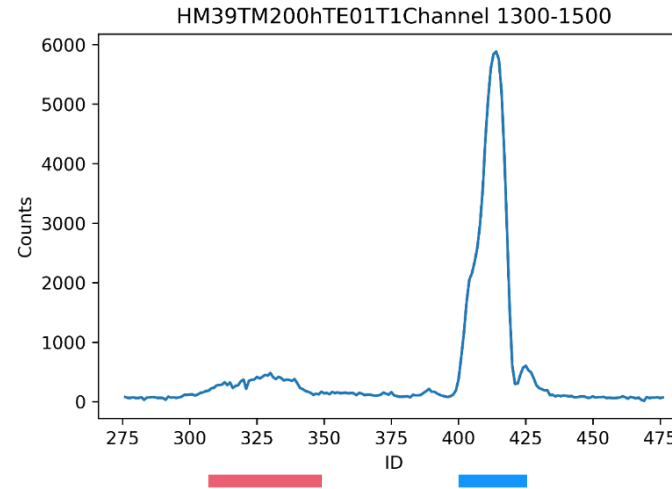
- HM39TM100vTE8T1
- HM39TM100vTE9T1
- HM39TM200vTE5T1
- HM58TM100vTE10T1
- HM58TM200hTE05T1
- HM58TM200hTE07T1
- HM39TM300hTE01T1
- HM58TM300hTE02T1
- HM58TM200vTE05T1
- HM39TM200vTE01T1
- HM39TM200vTE02T1
- HM39TM200hTE01T1
- HM39TM200hTE02T1
- HM39TM200vTE03T1
- HM39TM200vTE04T1
- HM39TM300hTE02T1
- HM39TM300hTE03T1

Relative deposition of ^{13}C close to intake target elements

horizontal

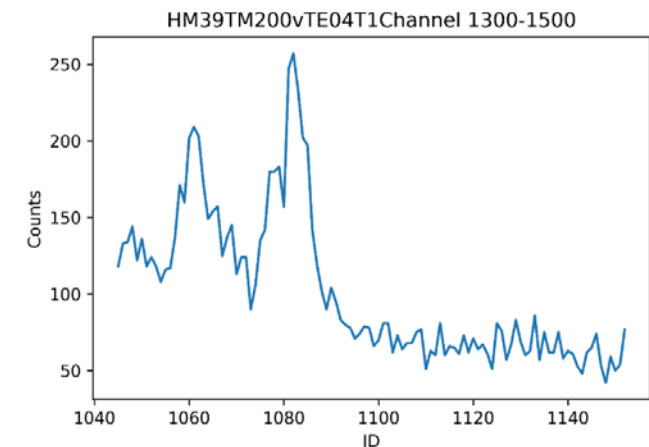
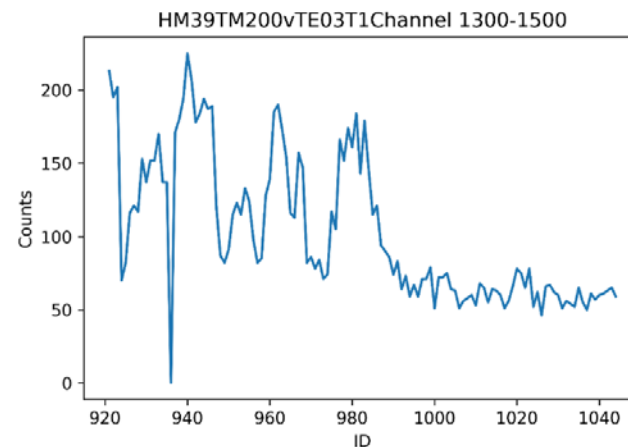
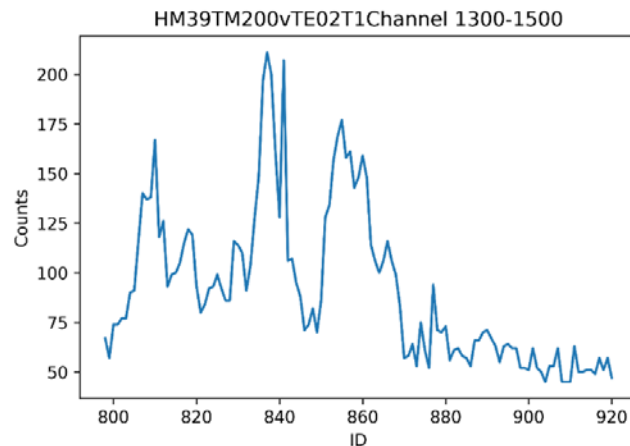
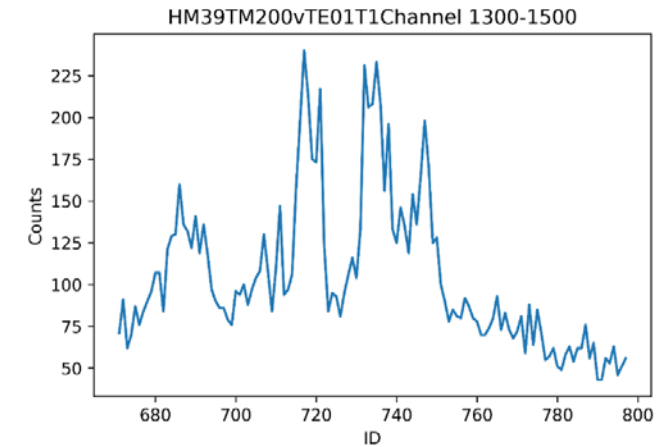
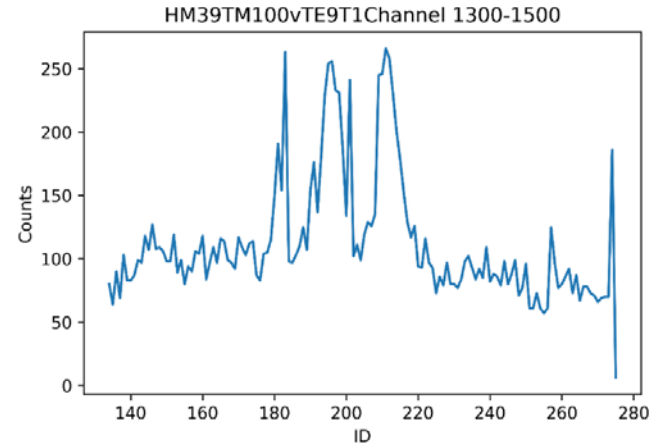
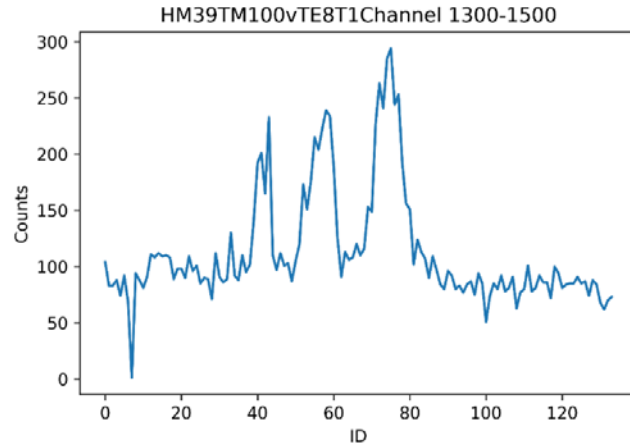
- Highest deposition on these elements
- High toroidal deposition near the intake
- Slight deposition across the strike line

Peak clarity and height decreases for further distances
(up to down, left to right)

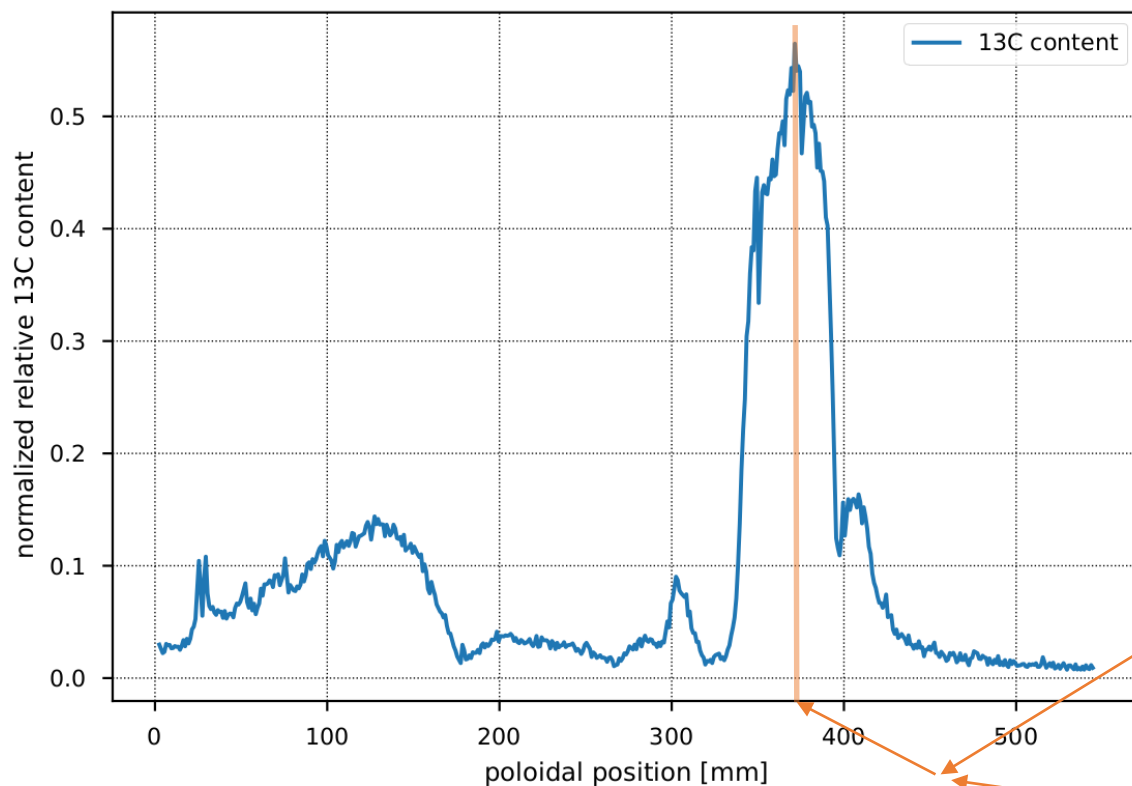


Relative deposition of ^{13}C across vertical targets

- Low deposition detected
- 3 slight peaks visible but only low count rates



LIBS on HM39TM200hTE1

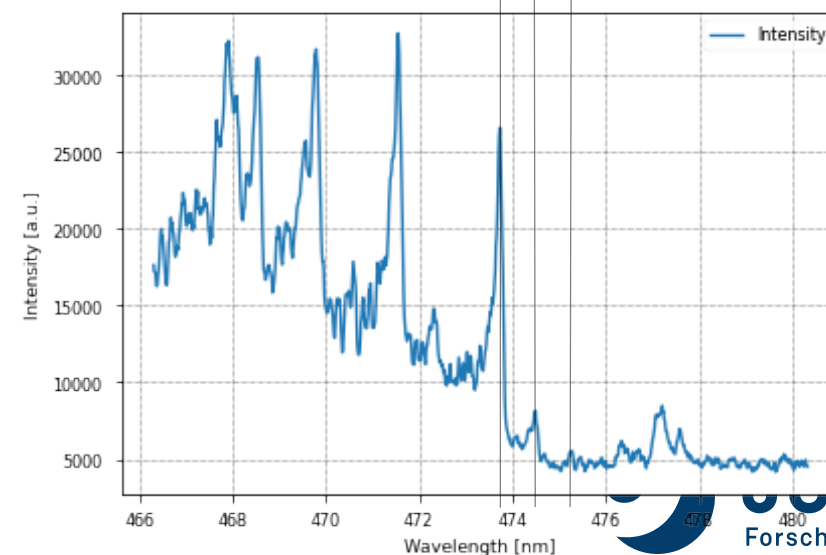
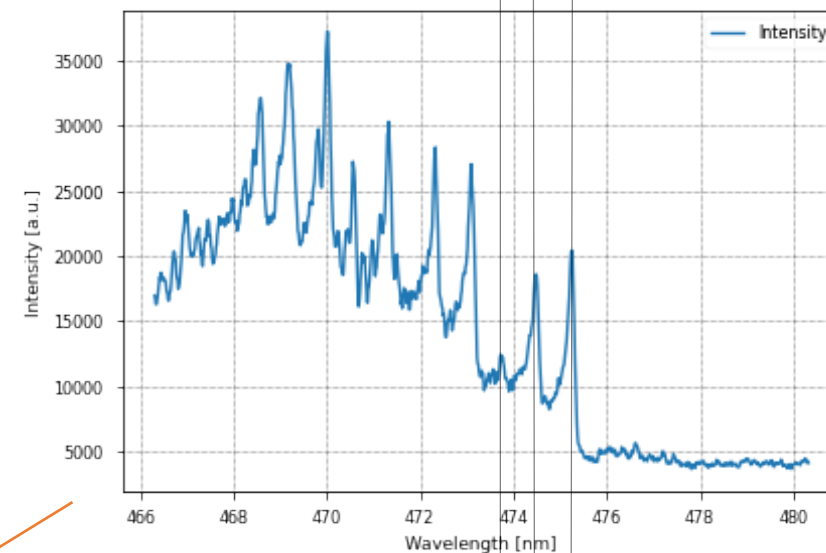


Sample spectra location of highest ^{13}C

$^{13}\text{C}^{12}\text{C}$
 $^{12}\text{C}_2$ $^{13}\text{C}_2$

1st

2nd



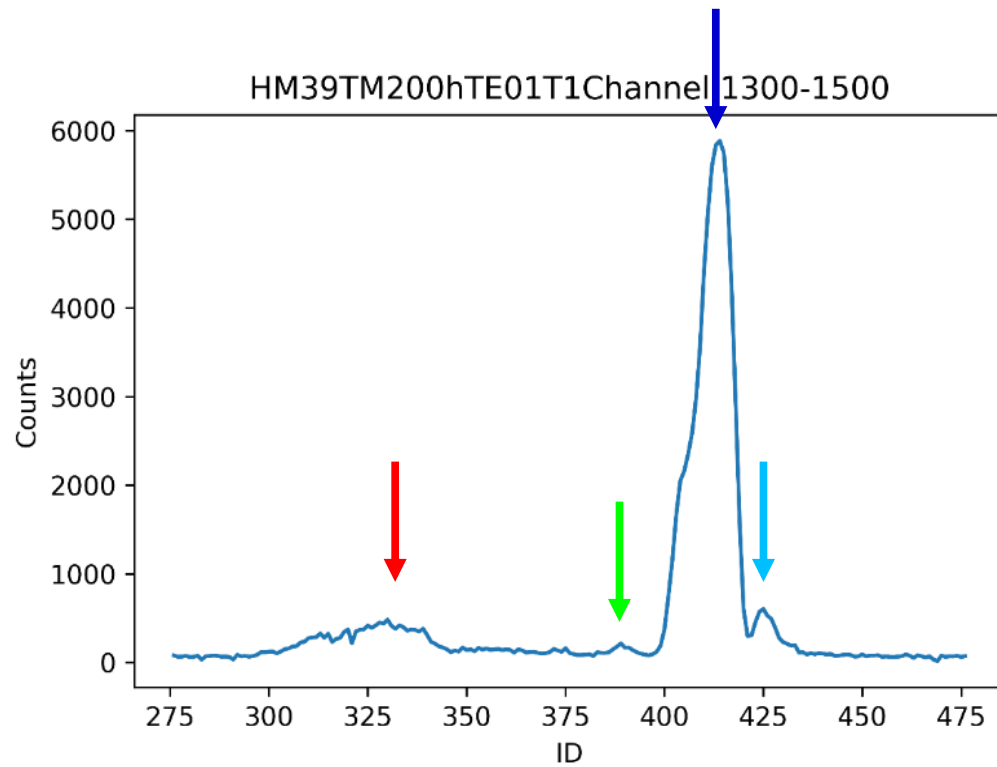
^{13}C content in first 400 nm (2 laser pulses) under sample surface

Pressure in chamber $p=1,9$ mbar

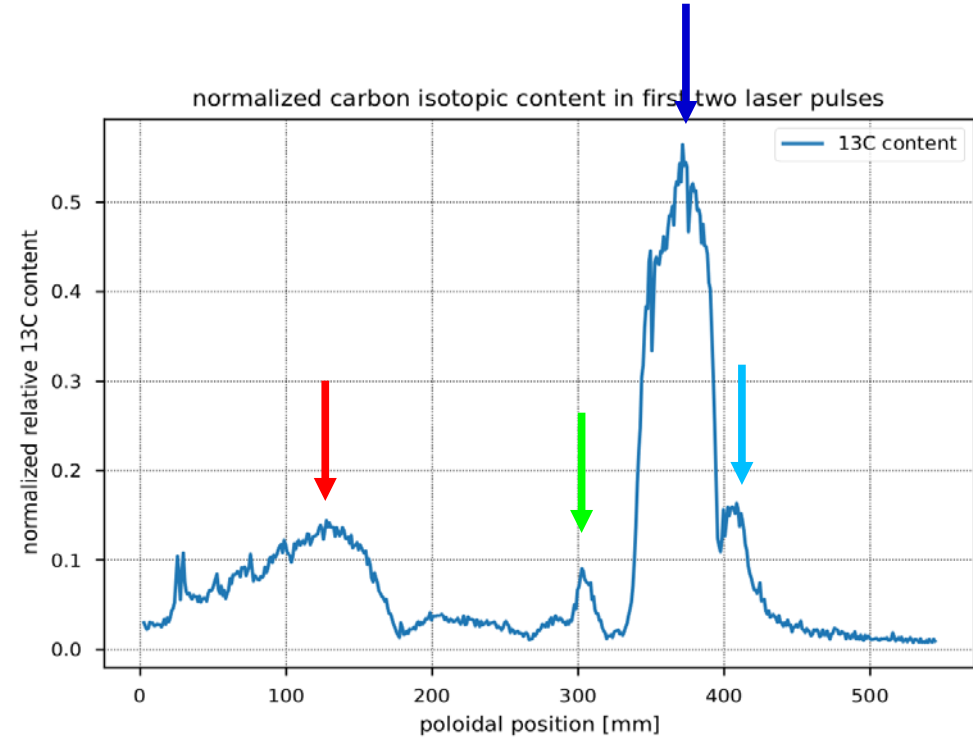
Pulse energies: $E_{\text{first}, 355} = 19$ mJ, $E_{\text{second}, 1064} = 30$ mJ

First “comparision” of NRA and LIBS

- Very similar features
- Relative peak heights different, but both methods in early stage of analysis cycle



NRA



LIBS

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Measurements finished
Analysis ongoing

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Measurements ongoing

Surface morphology

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Measurements to start soon

After the analysis samples could be available for other labs.