Multi-Scale Investigation of Nucleate Boiling Phenomena in Microgravity

APPENDIX 3/3

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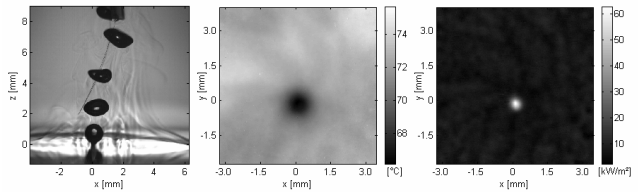
8.11. Data sets of sequence 77

General parameters of sequence 77:

- Electrical heating power $\dot{q}_{el} = 7773$ W/m²
- Bulk liquid temperature $t_{fluid} = 42.11$ °C
- Saturation temperature $t_{sat} = 42.4$ °C



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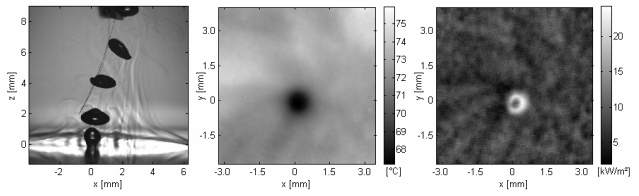

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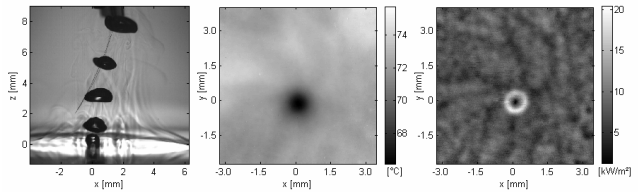

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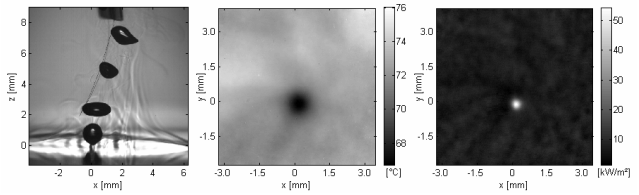

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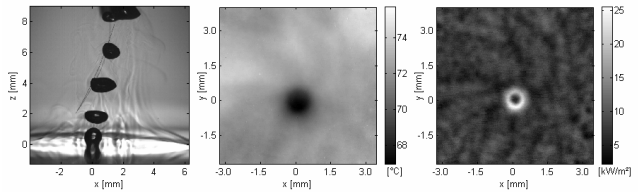

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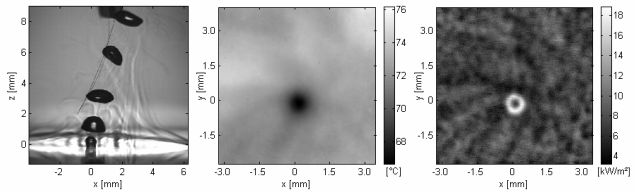

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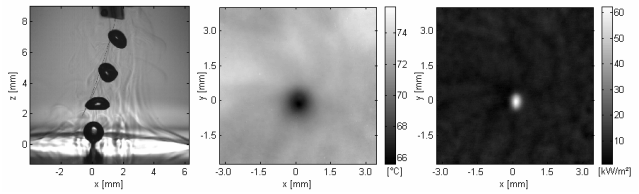

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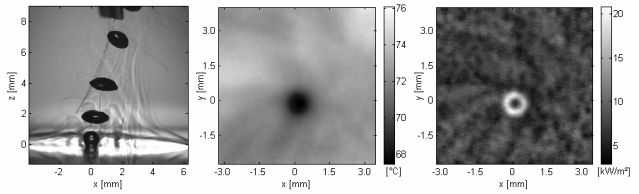

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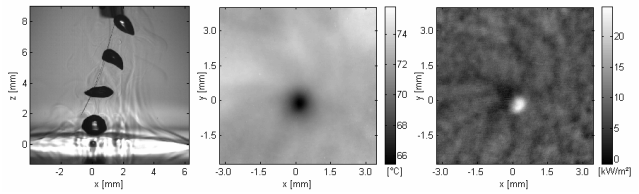

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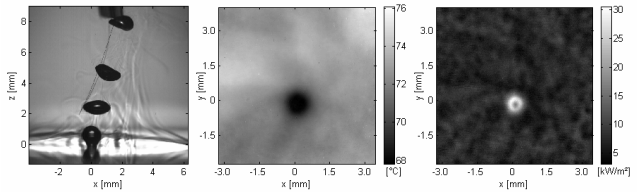

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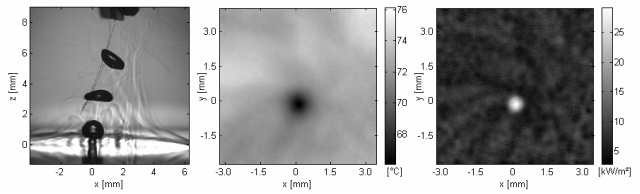

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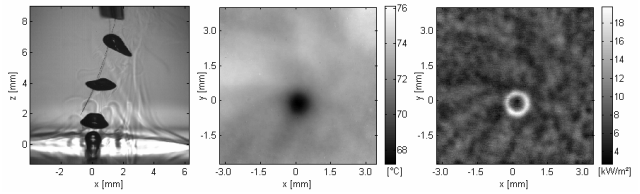

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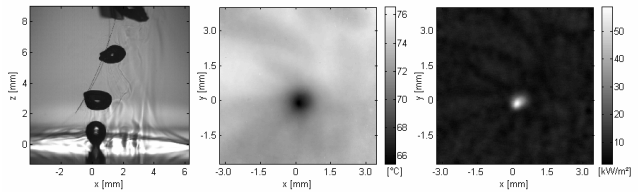

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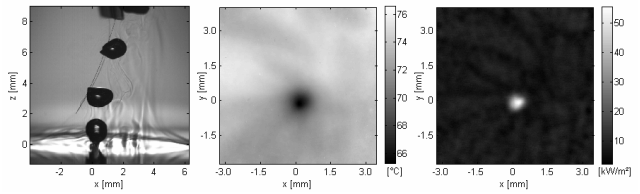

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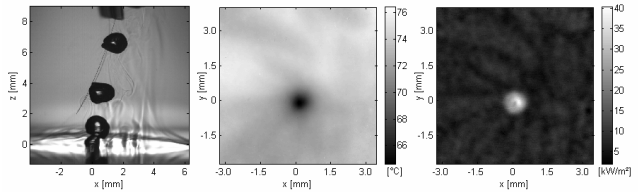

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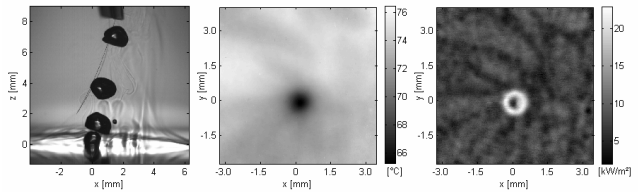

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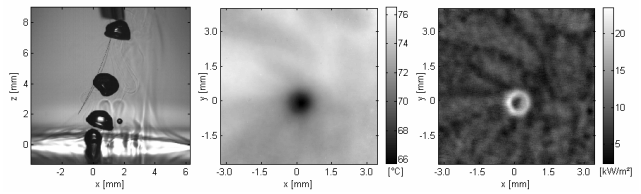

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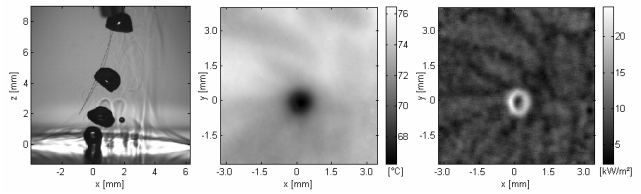

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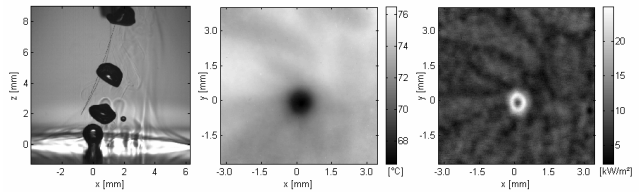

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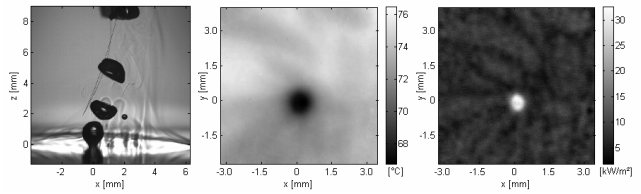

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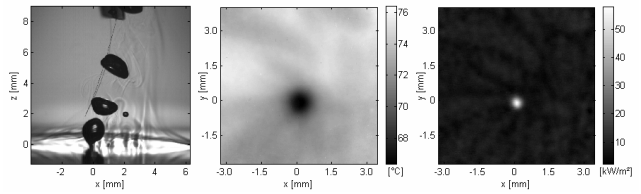

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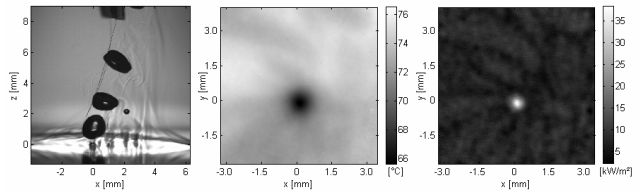

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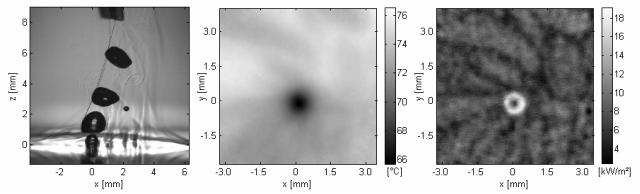

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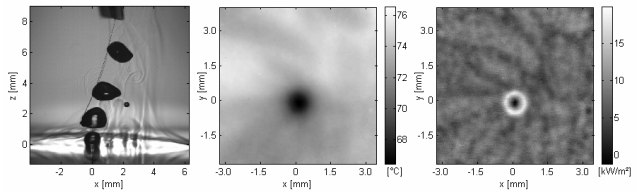

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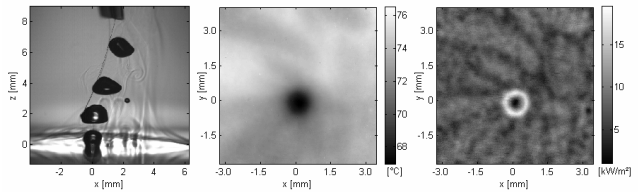

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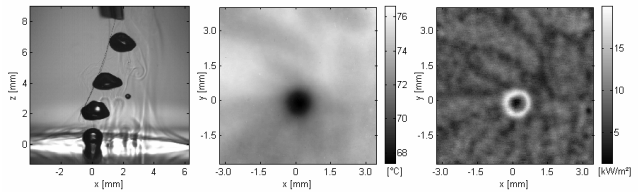

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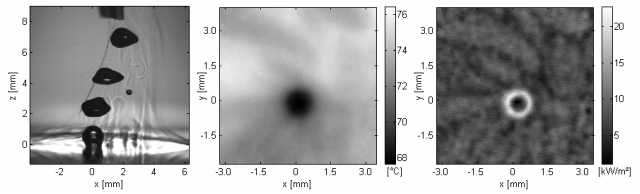

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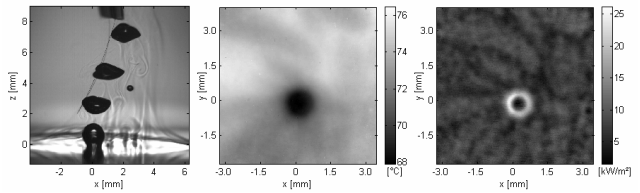

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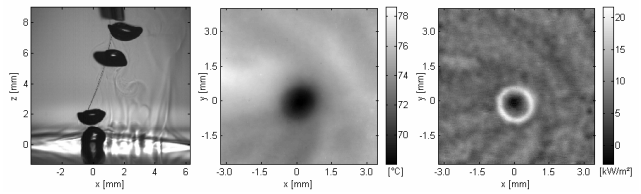

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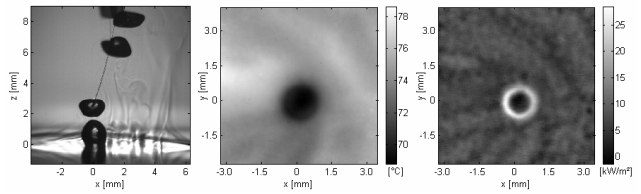

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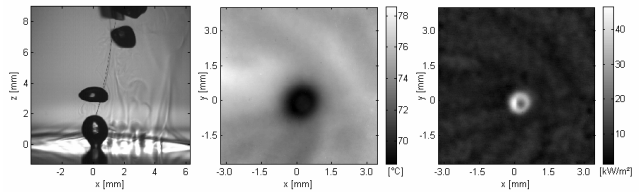

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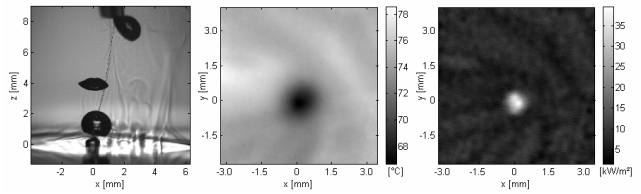

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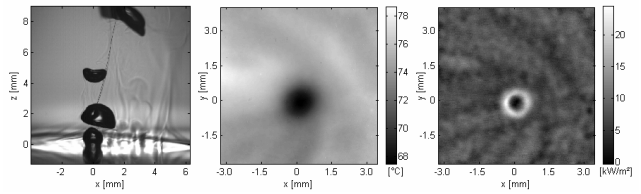

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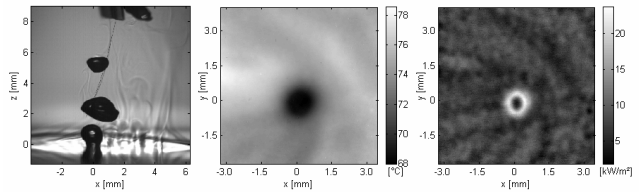

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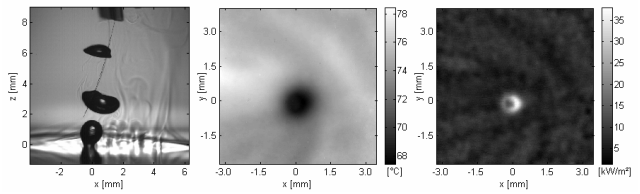

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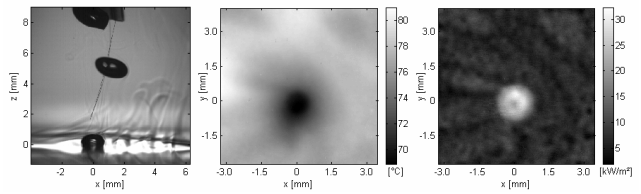

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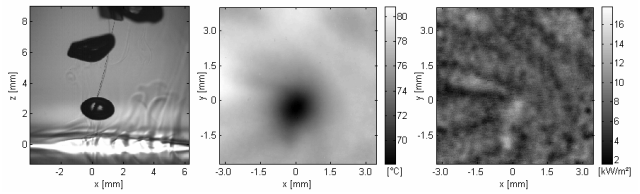

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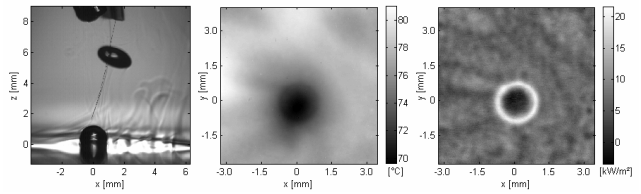

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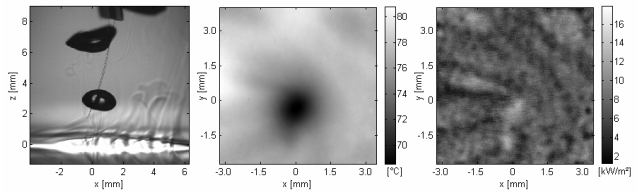

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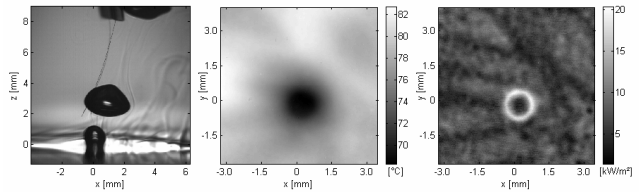

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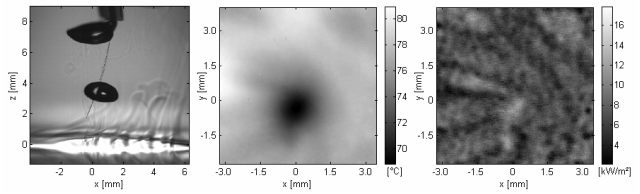

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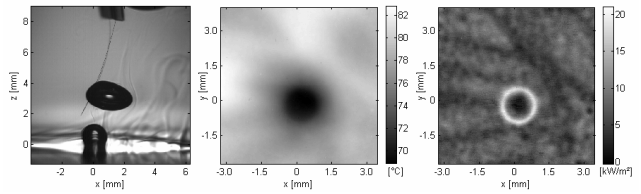
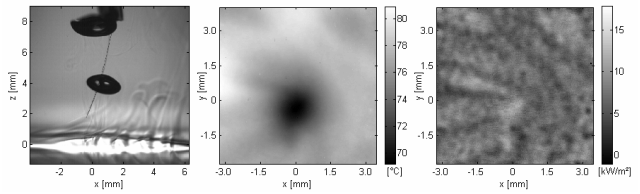
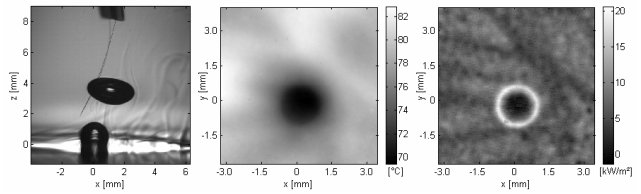


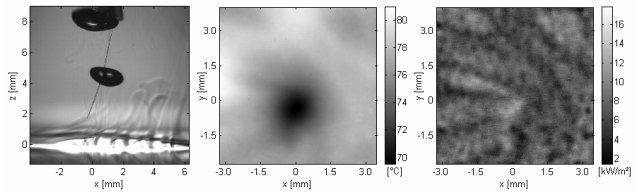
Seq: 77, time=1755ms, gravity=0.24g, q_mean=7123W/m², t_mean=78.3°C, q_max=21252W/m²



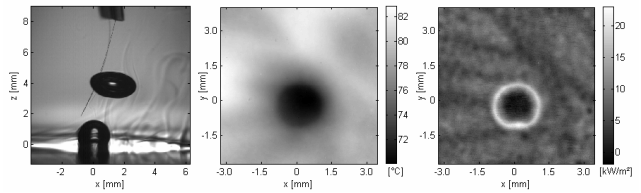
Seq: 77, time=1515ms, gravity=0.37g, q_mean=7047W/m², t_mean=76.86°C, q_max=12584W/m²



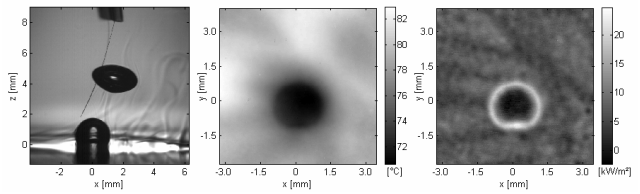
Seq: 77, time=1760ms, gravity=0.23g, q_mean=7168W/m², t_mean=78.34°C, q_max=20836W/m²



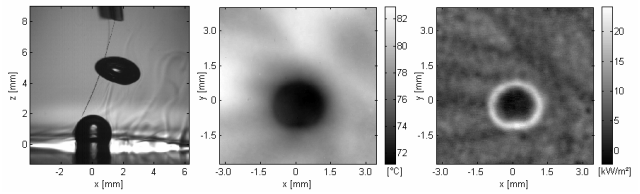
Seq: 77, time=1520ms, gravity=0.38g, q_mean=7106W/m², t_mean=76.91°C, q_max=12677W/m²



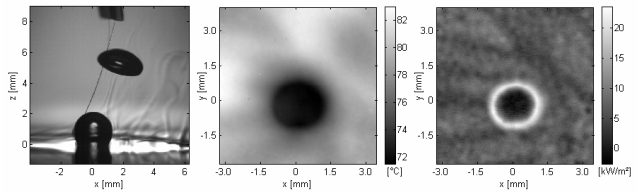
Seq: 77, time=1765ms, gravity=0.23g, q_mean=7262W/m², t_mean=78.38°C, q_max=23296W/m²



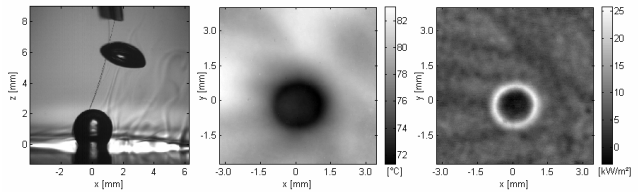
Seq: 77, time=1770ms, gravity=0.23g, q_mean=7207W/m², t_mean=78.42°C, q_max=24963W/m²



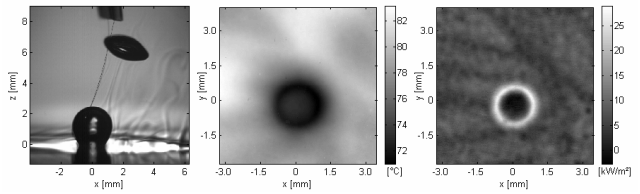
Seq: 77, time=1775ms, gravity=0.22g, q_mean=7133W/m², t_mean=78.46°C, q_max=24429W/m²



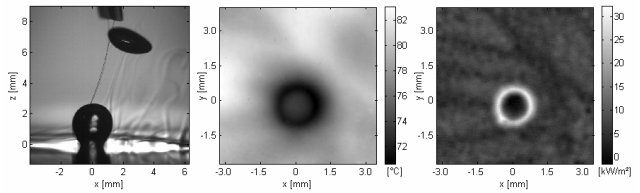
Seq: 77, time=1780ms, gravity=0.22g, q_mean=7181W/m², t_mean=78.5°C, q_max=23826W/m²



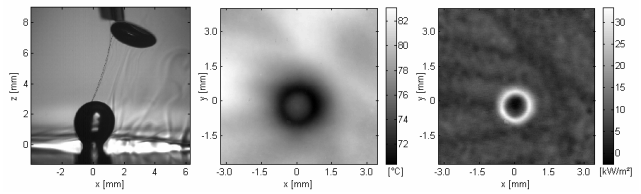
Seq: 77, time=1785ms, gravity=0.21g, q_mean=7245W/m², t_mean=78.54°C, q_max=26056W/m²



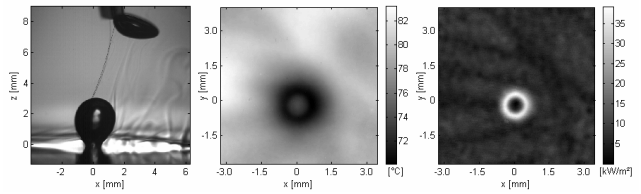
Seq: 77, time=1790ms, gravity=0.21g, q_mean=7335W/m², t_mean=78.57°C, q_max=29099W/m²



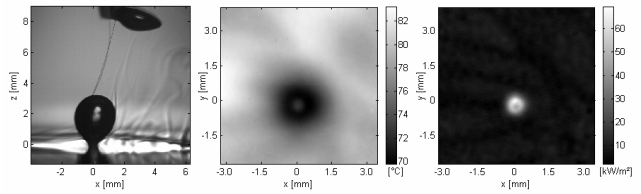
Seq: 77, time=1795ms, gravity=0.2g, q_mean=7468W/m², t_mean=78.6°C, q_max=32372W/m²



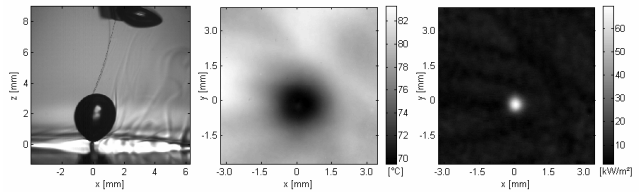
Seq: 77, time=1800ms, gravity=0.21g, q_mean=7447W/m², t_mean=78.62°C, q_max=33765W/m²



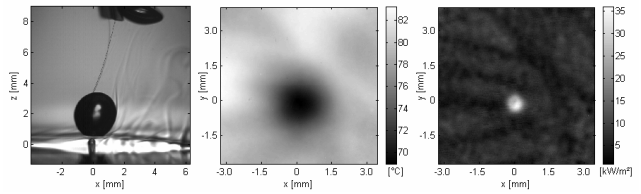
Seq: 77, time=1805ms, gravity=0.21g, q_mean=7402W/m², t_mean=78.64°C, q_max=39589W/m²



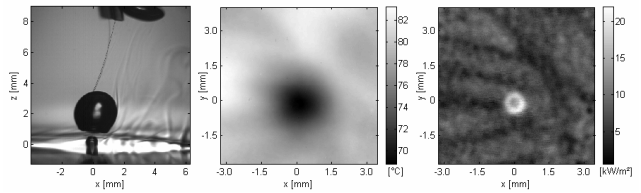
Seq: 77, time=1810ms, gravity=0.2g, q_mean=7316W/m², t_mean=78.67°C, q_max=70112W/m²



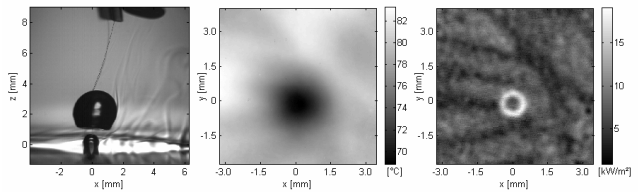
Seq: 77, time=1812ms, gravity=0.2g, q_mean=7071W/m², t_mean=78.68°C, q_max=70019W/m²



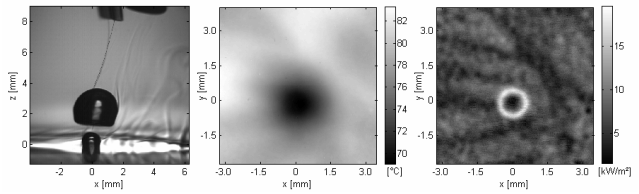
Seq: 77, time=1814ms, gravity=0.2g, q_mean=6886W/m², t_mean=78.7°C, q_max=36272W/m²



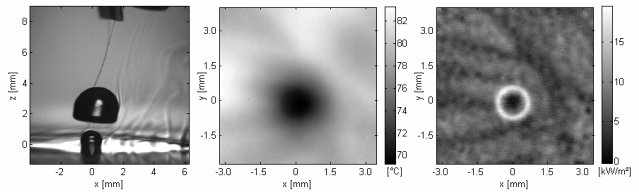
Seq: 77, time=1816ms, gravity=0.21g, q_mean=6882W/m², t_mean=78.73°C, q_max=22240W/m²



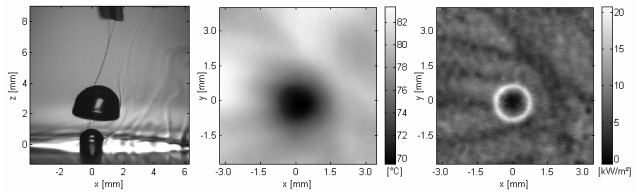
Seq: 77, time=1818ms, gravity=0.21g, q_mean=6891W/m², t_mean=78.75°C, q_max=19280W/m²



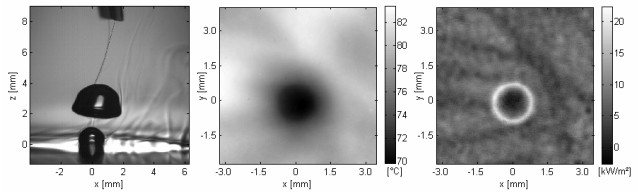
Seq: 77, time=1820ms, gravity=0.21g, q_mean=7021W/m², t_mean=78.77°C, q_max=19673W/m²



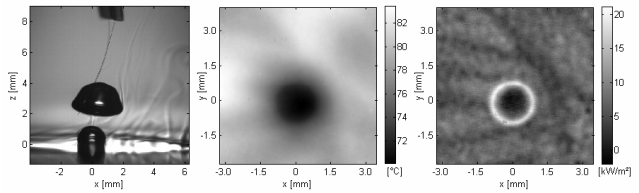
Seq: 77, time=1822ms, gravity=0.2g, q_mean=7050W/m², t_mean=78.79°C, q_max=19668W/m²



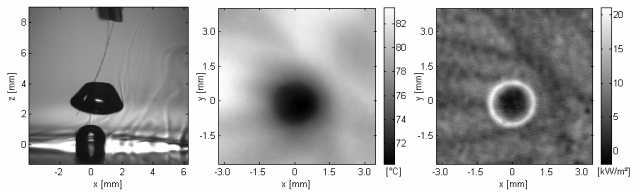
Seq: 77, time=1824ms, gravity=0.2g, q_mean=7029W/m², t_mean=78.81°C, q_max=20971W/m²



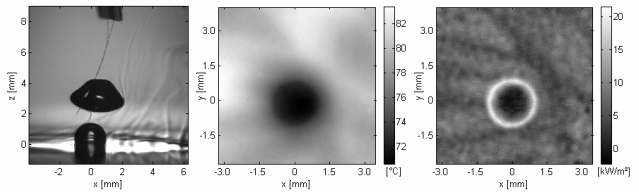
Seq: 77, time=1826ms, gravity=0.19g, q_mean=7086W/m², t_mean=78.83°C, q_max=22617W/m²



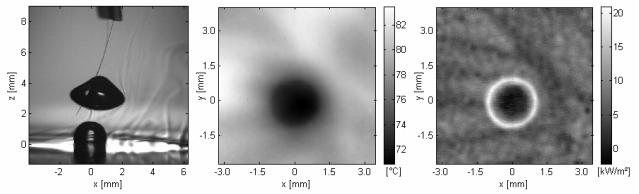
Seq: 77, time=1828ms, gravity=0.18g, q_mean=7104W/m², t_mean=78.85°C, q_max=21383W/m²



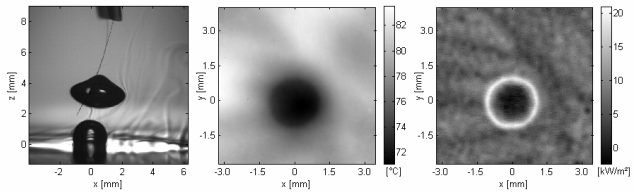
Seq: 77, time=1830ms, gravity=0.19g, q_mean=7136W/m², t_mean=78.87°C, q_max=21288W/m²



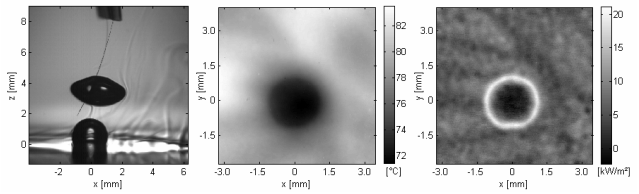
Seq: 77, time=1832ms, gravity=0.19g, q_mean=7158W/m², t_mean=78.88°C, q_max=21765W/m²



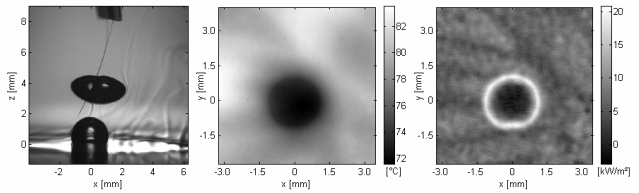
Seq: 77, time=1834ms, gravity=0.19g, q_mean=7154W/m², t_mean=78.9°C, q_max=21123W/m²



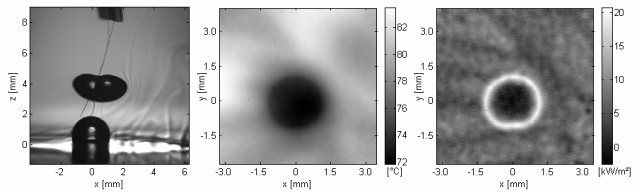
Seq: 77, time=1836ms, gravity=0.2g, q_mean=7158W/m², t_mean=78.91°C, q_max=21206W/m²



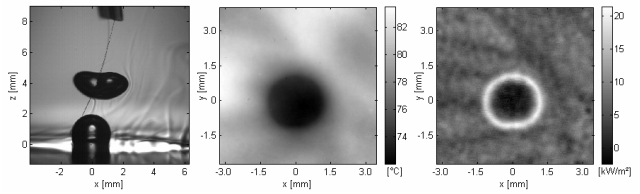
Seq: 77, time=1838ms, gravity=0.2g, q_mean=7124W/m², t_mean=78.93°C, q_max=21345W/m²



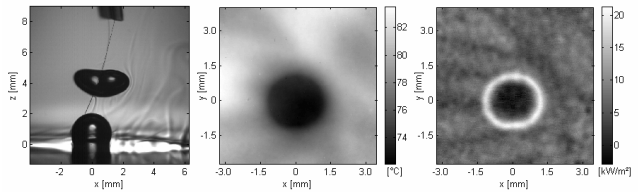
Seq: 77, time=1840ms, gravity=0.2g, q_mean=7114W/m², t_mean=78.95°C, q_max=20927W/m²



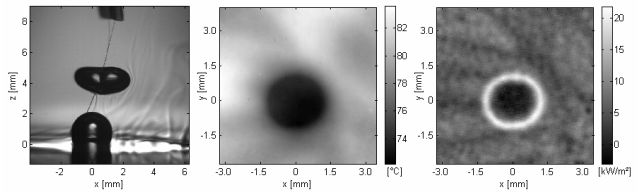
Seq: 77, time=1842ms, gravity=0.19g, q_mean=7074W/m², t_mean=78.97°C, q_max=20930W/m²



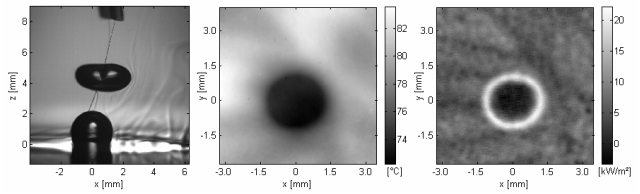
Seq: 77, time=1844ms, gravity=0.19g, q_mean=7103W/m², t_mean=78.98°C, q_max=21590W/m²



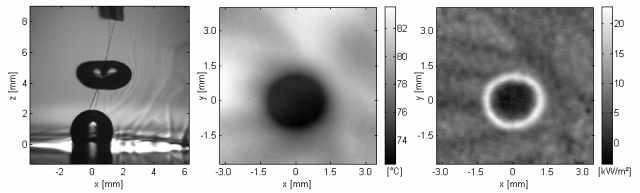
Seq: 77, time=1846ms, gravity=0.19g, q_mean=7055W/m², t_mean=79°C, q_max=21508W/m²



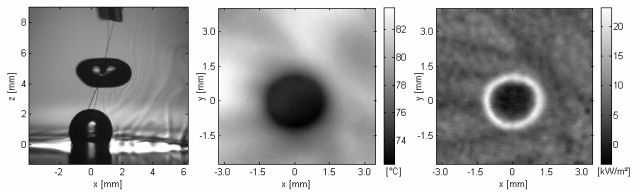
Seq: 77, time=1848ms, gravity=0.19g, q_mean=7056W/m², t_mean=79.02°C, q_max=22063W/m²



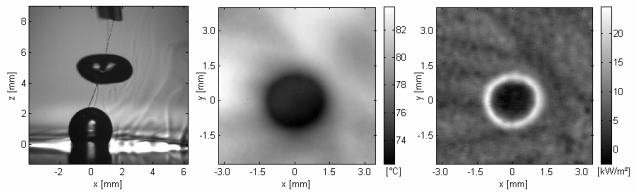
Seq: 77, time=1850ms, gravity=0.19g, q_mean=7011W/m², t_mean=79.04°C, q_max=22443W/m²



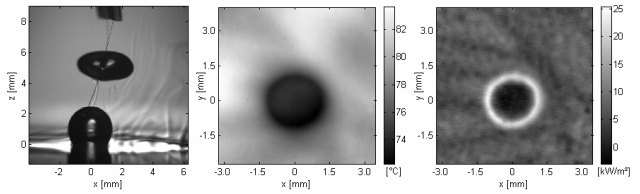
Seq: 77, time=1852ms, gravity=0.2g, q_mean=7077W/m², t_mean=79.06°C, q_max=23127W/m²



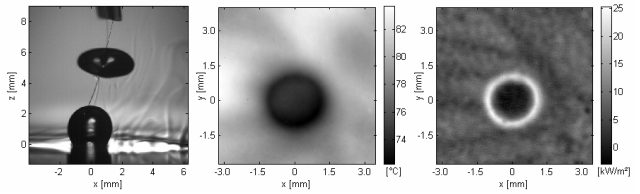
Seq: 77, time=1854ms, gravity=0.19g, q_mean=7134W/m², t_mean=79.08°C, q_max=23465W/m²



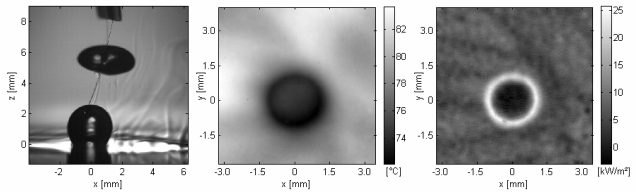
Seq: 77, time=1856ms, gravity=0.18g, q_mean=7210W/m², t_mean=79.1°C, q_max=24838W/m²



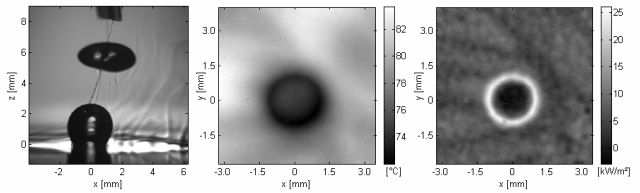
Seq: 77, time=1858ms, gravity=0.18g, q_mean=7249W/m², t_mean=79.11°C, q_max=25650W/m²



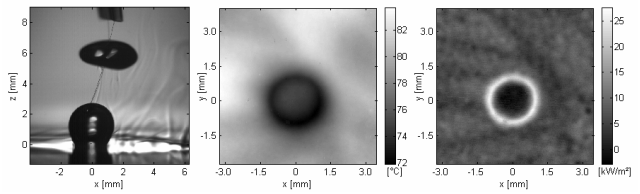
Seq: 77, time=1860ms, gravity=0.18g, q_mean=7205W/m², t_mean=79.12°C, q_max=25512W/m²



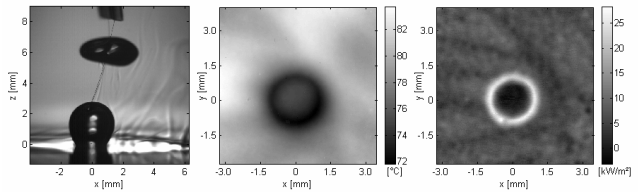
Seq: 77, time=1862ms, gravity=0.18g, q_mean=7270W/m², t_mean=79.14°C, q_max=25950W/m²



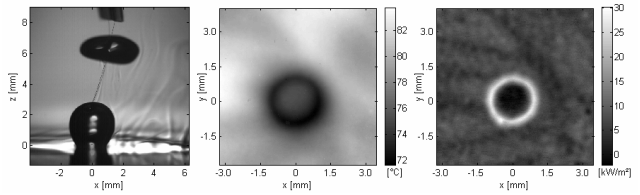
Seq: 77, time=1864ms, gravity=0.18g, q_mean=7335W/m², t_mean=79.15°C, q_max=26362W/m²



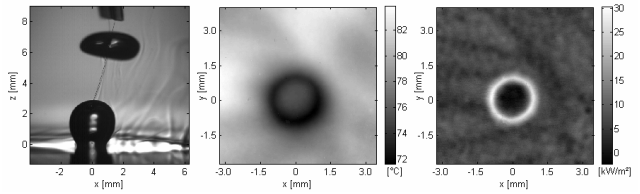
Seq: 77, time=1866ms, gravity=0.19g, q_mean=7305W/m², t_mean=79.16°C, q_max=27860W/m²



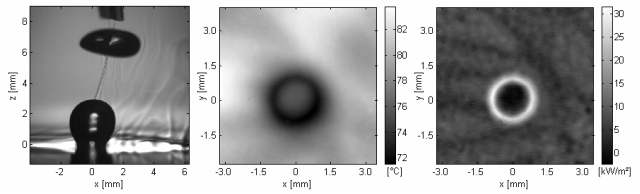
Seq: 77, time=1868ms, gravity=0.19g, q_mean=7331W/m², t_mean=79.17°C, q_max=28544W/m²



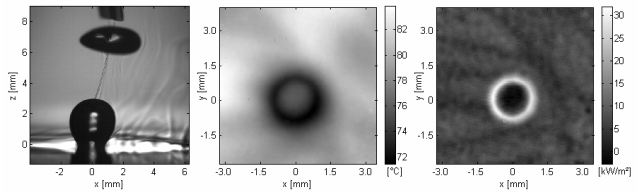
Seq: 77, time=1870ms, gravity=0.19g, q_mean=7422W/m², t_mean=79.19°C, q_max=30335W/m²



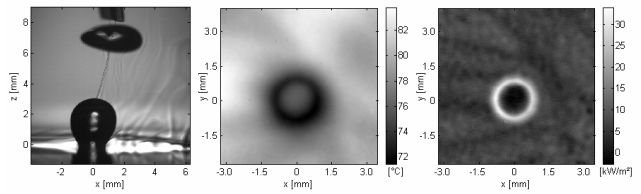
Seq: 77, time=1872ms, gravity=0.19g, q_mean=7373W/m², t_mean=79.2°C, q_max=30568W/m²



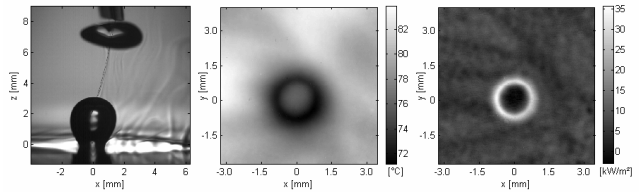
Seq: 77, time=1874ms, gravity=0.19g, q_mean=7369W/m², t_mean=79.21°C, q_max=31935W/m²



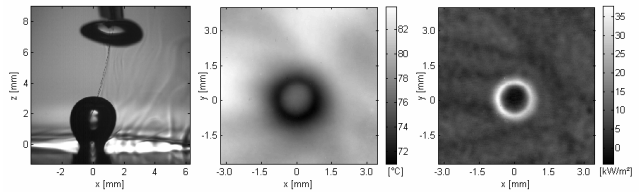
Seq: 77, time=1876ms, gravity=0.18g, q_mean=7346W/m², t_mean=79.22°C, q_max=32258W/m²



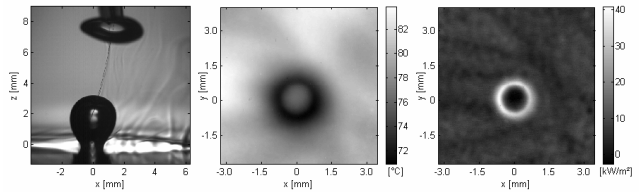
Seq: 77, time=1878ms, gravity=0.17g, q_mean=7349W/m², t_mean=79.23°C, q_max=34211W/m²



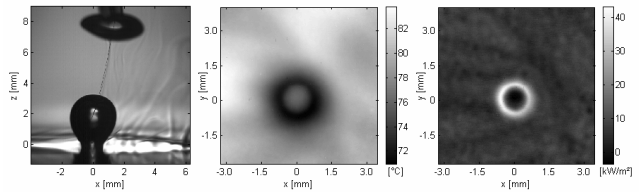
Seq: 77, time=1880ms, gravity=0.18g, q_mean=7359W/m², t_mean=79.24°C, q_max=35896W/m²



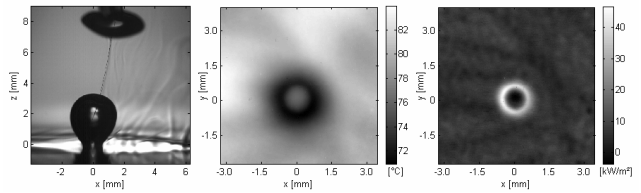
Seq: 77, time=1882ms, gravity=0.17g, q_mean=7397W/m², t_mean=79.25°C, q_max=38054W/m²



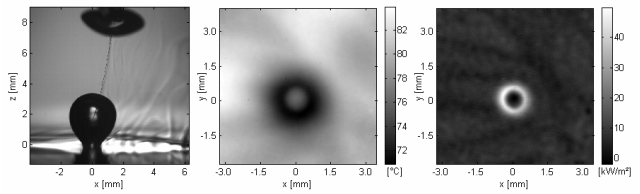
Seq: 77, time=1884ms, gravity=0.17g, q_mean=7452W/m², t_mean=79.26°C, q_max=41281W/m²



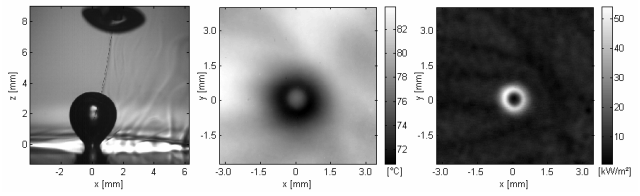
Seq: 77, time=1886ms, gravity=0.18g, q_mean=7569W/m², t_mean=79.27°C, q_max=43616W/m²



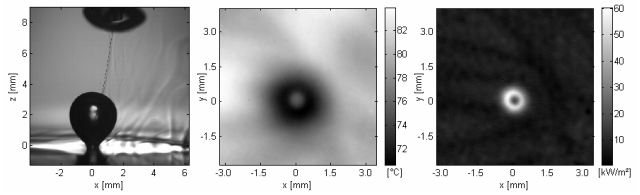
Seq: 77, time=1888ms, gravity=0.19g, q_mean=7527W/m², t_mean=79.28°C, q_max=47076W/m²



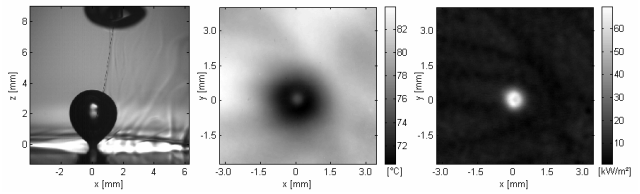
Seq: 77, time=1890ms, gravity=0.18g, q_mean=7536W/m², t_mean=79.28°C, q_max=50363W/m²



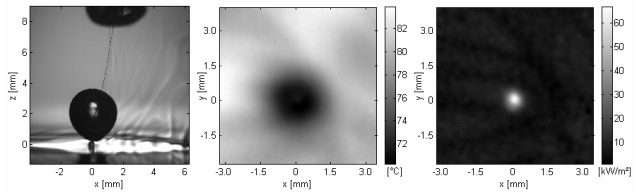
Seq: 77, time=1892ms, gravity=0.18g, q_mean=7526W/m², t_mean=79.29°C, q_max=54547W/m²



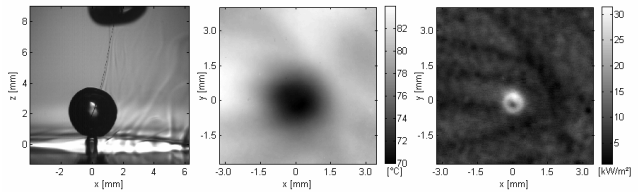
Seq: 77, time=1894ms, gravity=0.18g, q_mean=7582W/m², t_mean=79.29°C, q_max=60770W/m²



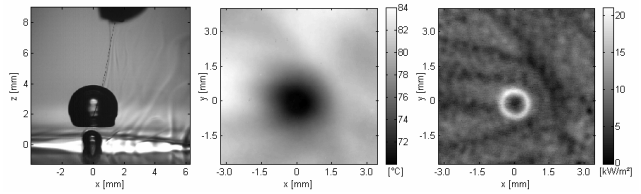
Seq: 77, time=1896ms, gravity=0.17g, q_mean=7516W/m², t_mean=79.3°C, q_max=70175W/m²



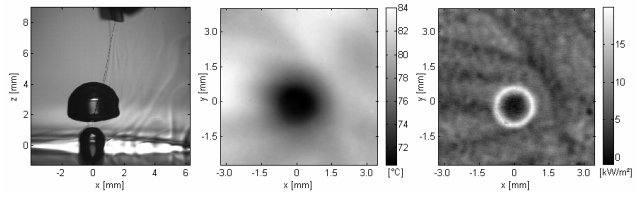
Seq: 77, time=1898ms, gravity=0.16g, q_mean=7184W/m², t_mean=79.31°C, q_max=67524W/m²



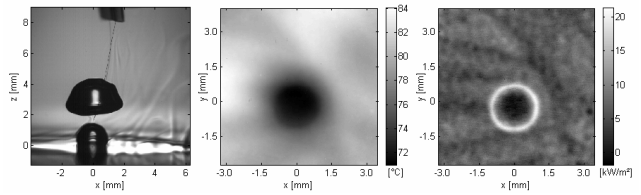
Seq: 77, time=1900ms, gravity=0.17g, q_mean=6975W/m², t_mean=79.33°C, q_max=31782W/m²



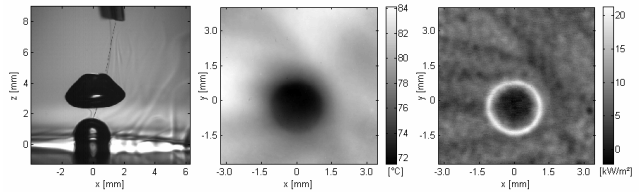
Seq: 77, time=1905ms, gravity=0.17g, q_mean=6950W/m², t_mean=79.38°C, q_max=21302W/m²



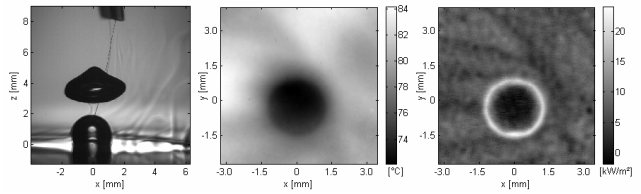
Seq: 77, time=1910ms, gravity=0.17g, q_mean=6917W/m², t_mean=79.43°C, q_max=20072W/m²



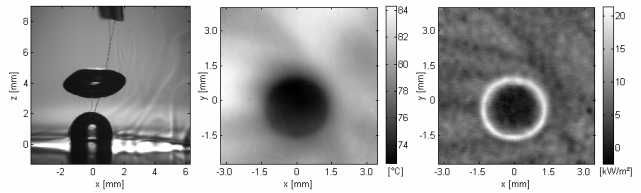
Seq: 77, time=1915ms, gravity=0.17g, q_mean=6974W/m², t_mean=79.49°C, q_max=21561W/m²



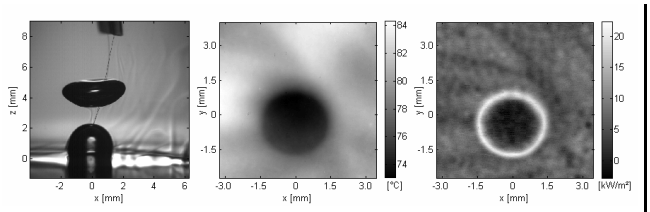
Seq: 77, time=1920ms, gravity=0.16g, q_mean=7009W/m², t_mean=79.54°C, q_max=21548W/m²



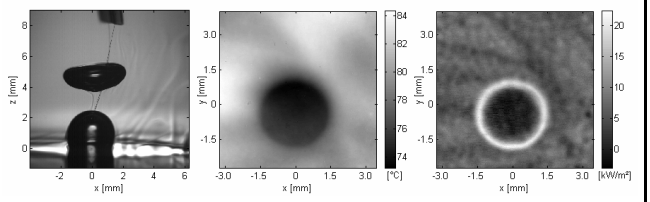
Seq: 77, time=1925ms, gravity=0.16g, q_mean=7024W/m², t_mean=79.59°C, q_max=24250W/m²



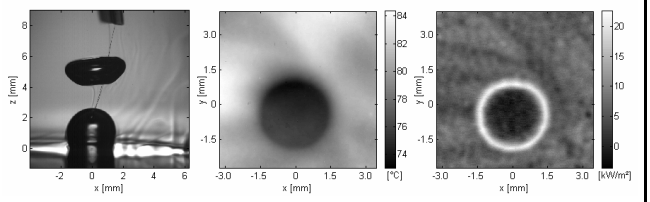
Seq: 77, time=1930ms, gravity=0.16g, q_mean=7067W/m², t_mean=79.64°C, q_max=21673W/m²



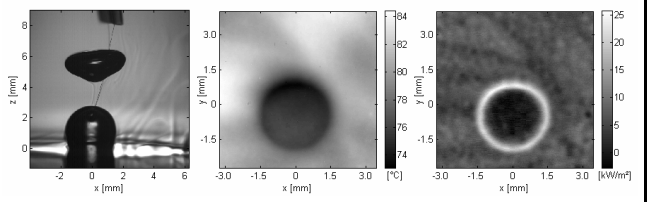
Seq: 77, time=1935ms, gravity=0.16g, q_mean=6995W/m², t_mean=79.69°C, q_max=22597W/m²



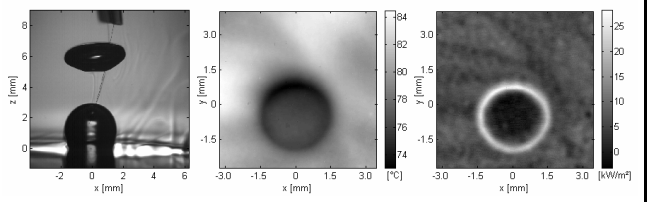
Seq: 77, time=1940ms, gravity=0.16g, q_mean=6969W/m², t_mean=79.74°C, q_max=22648W/m²



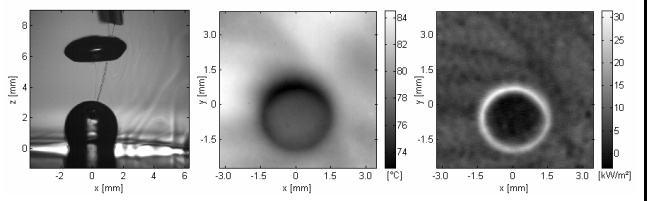
Seq: 77, time=1945ms, gravity=0.17g, q_mean=6923W/m², t_mean=79.79°C, q_max=22790W/m²



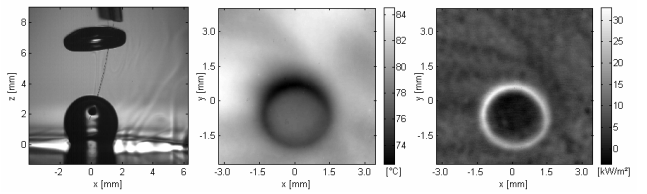
Seq: 77, time=1950ms, gravity=0.16g, q_mean=6981W/m², t_mean=79.85°C, q_max=26054W/m²



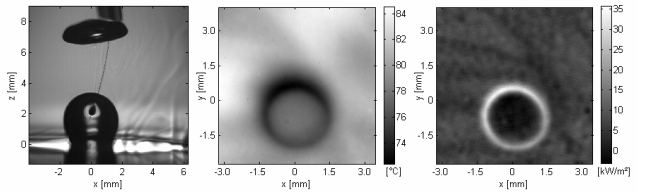
Seq: 77, time=1955ms, gravity=0.15g, q_mean=7066W/m², t_mean=79.9°C, q_max=28443W/m²



Seq: 77, time=1960ms, gravity=0.16g, q_mean=7097W/m², t_mean=79.94°C, q_max=31821W/m²



Seq: 77, time=1965ms, gravity=0.15g, q_mean=7231W/m², t_mean=79.98°C, q_max=33283W/m²

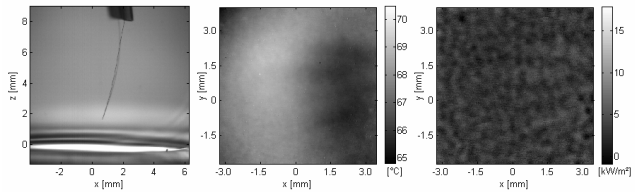


Seq: 77, time=1970ms, gravity=0.14g, q_mean=7243W/m², t_mean=80.02°C, q_max=35920W/m²

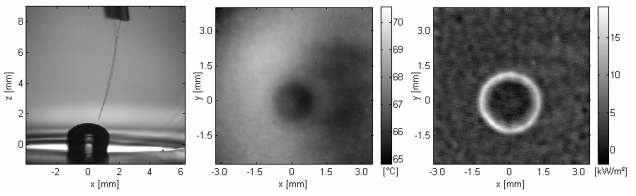
8.12. Data sets of sequence 86

General parameters of sequence 86:

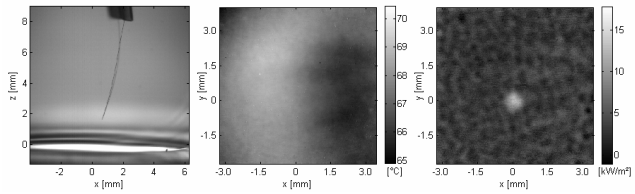
- Electrical heating power $\dot{q}_{el} = 3572$ W/m²
- Bulk liquid temperature $t_{fluid} = 42.12$°C
- Saturation temperature $t_{sat} = 42.34$ °C



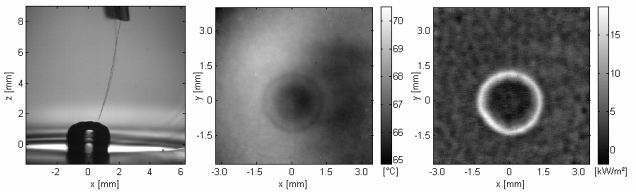
Seq: 86, time=1318ms, gravity=0.06g, q_mean=3195W/m², t_mean=67.31°C, q_max=7982W/m²



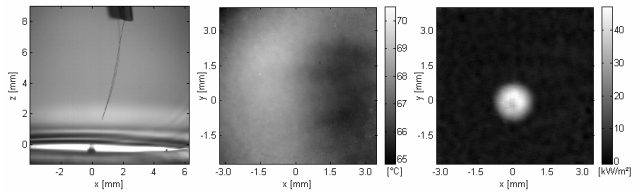
Seq: 86, time=1328ms, gravity=0.09g, q_mean=3724W/m², t_mean=67.23°C, q_max=19294W/m²



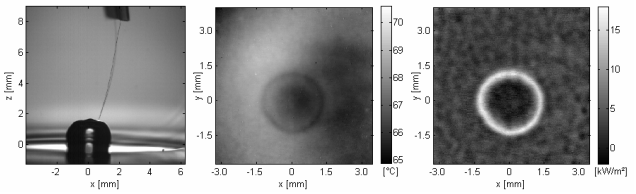
Seq: 86, time=1320ms, gravity=0.06g, q_mean=3305W/m², t_mean=67.32°C, q_max=13855W/m²



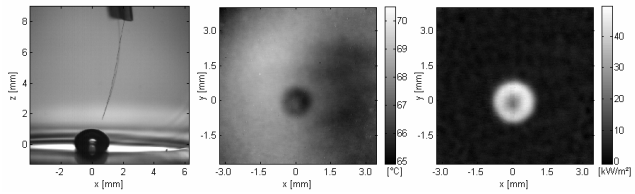
Seq: 86, time=1330ms, gravity=0.06g, q_mean=3735W/m², t_mean=67.23°C, q_max=18864W/m²



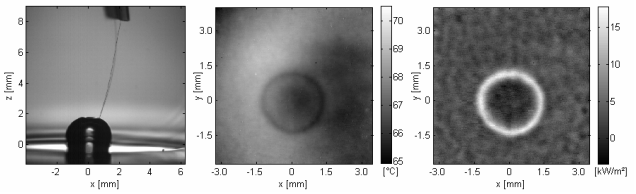
Seq: 86, time=1322ms, gravity=0.07g, q_mean=4595W/m², t_mean=67.32°C, q_max=47638W/m²



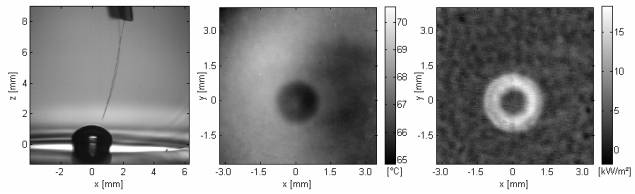
Seq: 86, time=1332ms, gravity=0.06g, q_mean=3697W/m², t_mean=67.22°C, q_max=18199W/m²



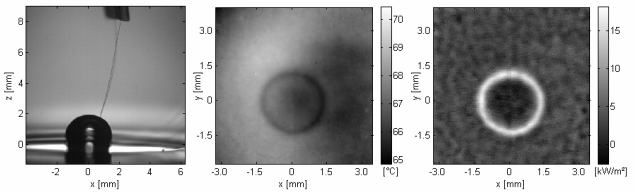
Seq: 86, time=1324ms, gravity=0.08g, q_mean=5350W/m², t_mean=67.28°C, q_max=49931W/m²



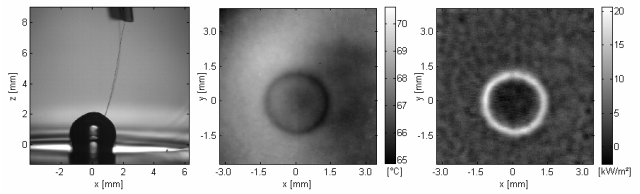
Seq: 86, time=1334ms, gravity=0.05g, q_mean=3724W/m², t_mean=67.22°C, q_max=17396W/m²



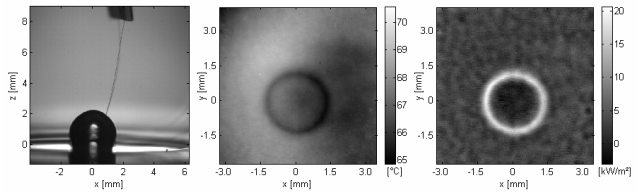
Seq: 86, time=1326ms, gravity=0.08g, q_mean=4134W/m², t_mean=67.23°C, q_max=18437W/m²



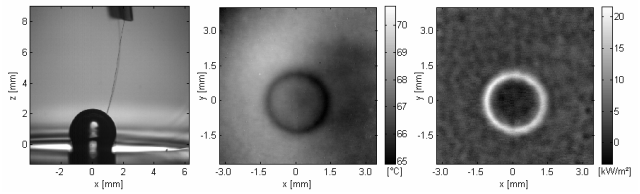
Seq: 86, time=1336ms, gravity=0.05g, q_mean=3741W/m², t_mean=67.21°C, q_max=18389W/m²



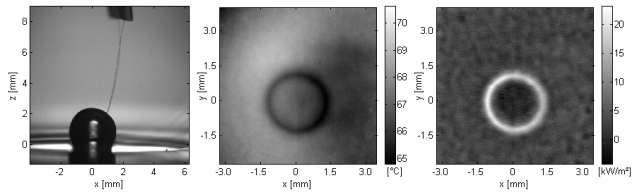
Seq: 86, time=1338ms, gravity=0.05g, q_mean=3783W/m², t_mean=67.21°C, q_max=20728W/m²



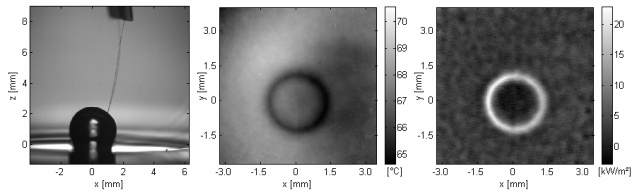
Seq: 86, time=1340ms, gravity=0.06g, q_mean=3789W/m², t_mean=67.2°C, q_max=20842W/m²



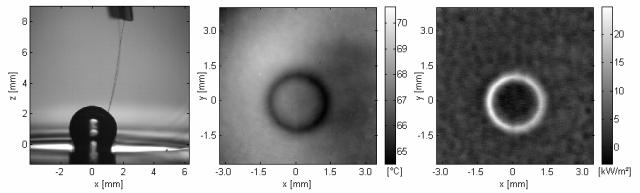
Seq: 86, time=1342ms, gravity=0.06g, q_mean=3828W/m², t_mean=67.19°C, q_max=21809W/m²



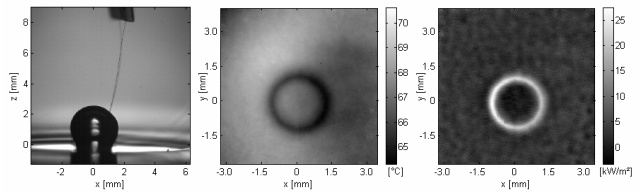
Seq: 86, time=1344ms, gravity=0.07g, q_mean=3809W/m², t_mean=67.19°C, q_max=23340W/m²



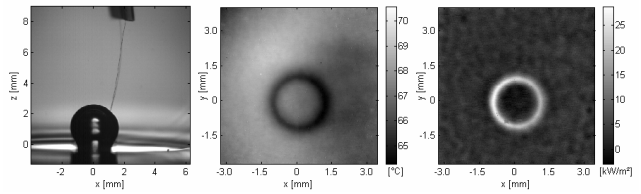
Seq: 86, time=1346ms, gravity=0.07g, q_mean=3756W/m², t_mean=67.18°C, q_max=23117W/m²



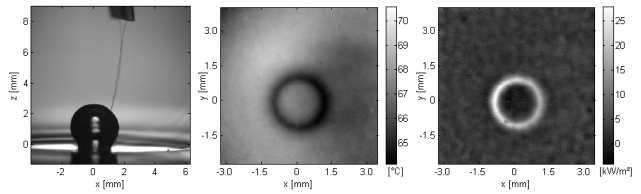
Seq: 86, time=1348ms, gravity=0.07g, q_mean=3848W/m², t_mean=67.17°C, q_max=25080W/m²



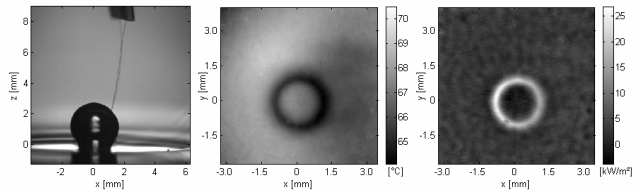
Seq: 86, time=1350ms, gravity=0.07g, q_mean=3865W/m², t_mean=67.16°C, q_max=27744W/m²



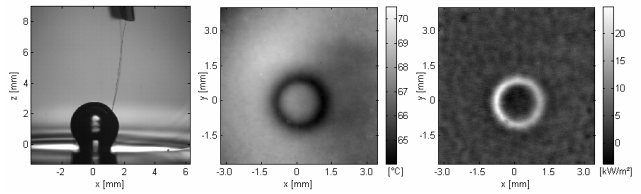
Seq: 86, time=1352ms, gravity=0.07g, q_mean=3864W/m², t_mean=67.16°C, q_max=29038W/m²



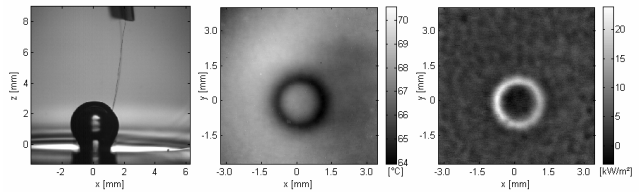
Seq: 86, time=1354ms, gravity=0.06g, q_mean=3793W/m², t_mean=67.15°C, q_max=28105W/m²



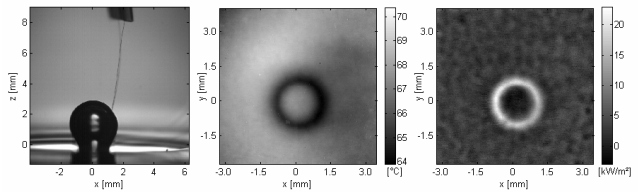
Seq: 86, time=1356ms, gravity=0.07g, q_mean=3765W/m², t_mean=67.14°C, q_max=27068W/m²



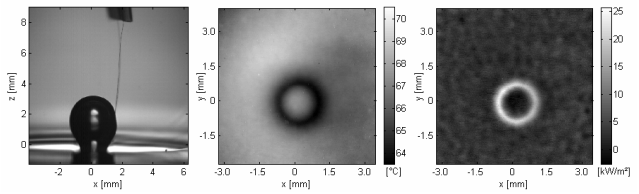
Seq: 86, time=1358ms, gravity=0.06g, q_mean=3737W/m², t_mean=67.14°C, q_max=25187W/m²



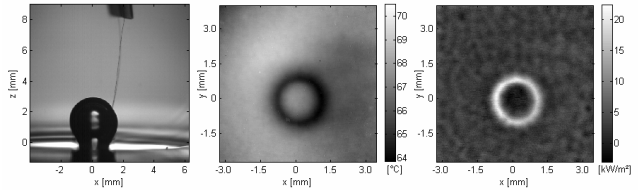
Seq: 86, time=1360ms, gravity=0.06g, q_mean=3738W/m², t_mean=67.13°C, q_max=24208W/m²



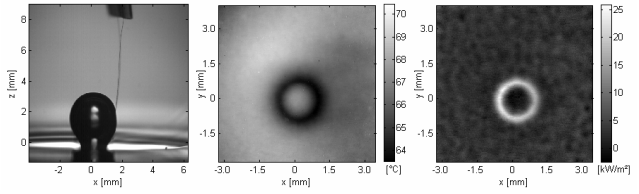
Seq: 86, time=1362ms, gravity=0.06g, q_mean=3709W/m², t_mean=67.13°C, q_max=23062W/m²



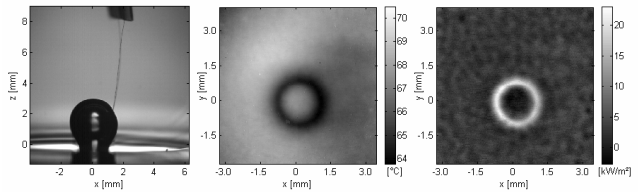
Seq: 86, time=1374ms, gravity=0.06g, q_mean=3679W/m², t_mean=67.1°C, q_max=25943W/m²



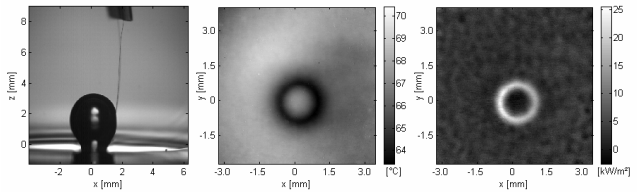
Seq: 86, time=1364ms, gravity=0.07g, q_mean=3630W/m², t_mean=67.12°C, q_max=22635W/m²



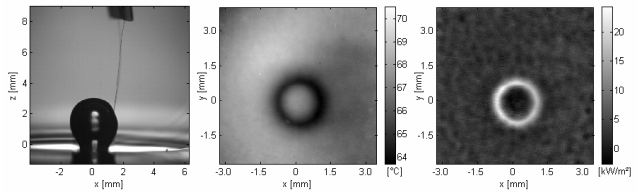
Seq: 86, time=1376ms, gravity=0.05g, q_mean=3714W/m², t_mean=67.1°C, q_max=26153W/m²



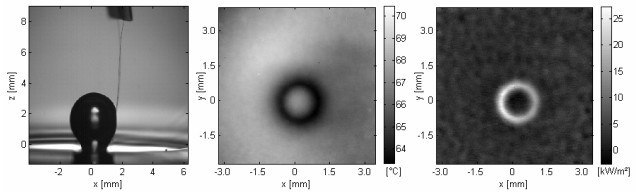
Seq: 86, time=1366ms, gravity=0.07g, q_mean=3734W/m², t_mean=67.12°C, q_max=23313W/m²



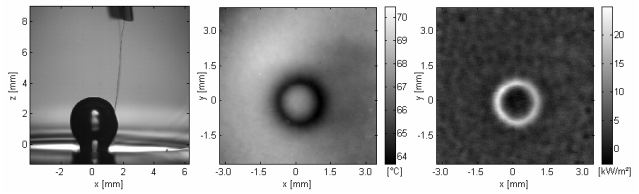
Seq: 86, time=1378ms, gravity=0.06g, q_mean=3689W/m², t_mean=67.1°C, q_max=25778W/m²



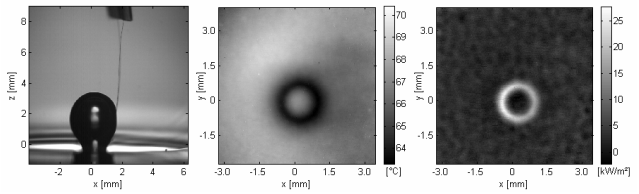
Seq: 86, time=1368ms, gravity=0.07g, q_mean=3736W/m², t_mean=67.12°C, q_max=24577W/m²



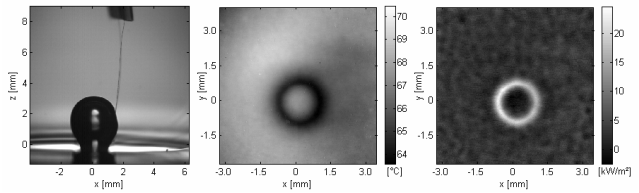
Seq: 86, time=1380ms, gravity=0.04g, q_mean=3648W/m², t_mean=67.09°C, q_max=27532W/m²



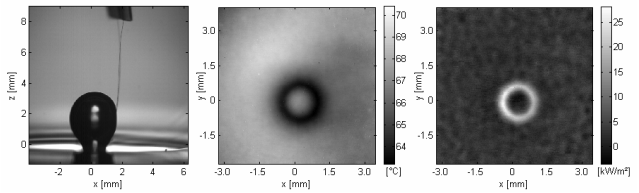
Seq: 86, time=1370ms, gravity=0.08g, q_mean=3688W/m², t_mean=67.11°C, q_max=25219W/m²



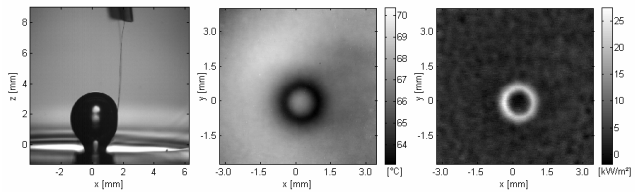
Seq: 86, time=1382ms, gravity=0.05g, q_mean=3653W/m², t_mean=67.09°C, q_max=28001W/m²



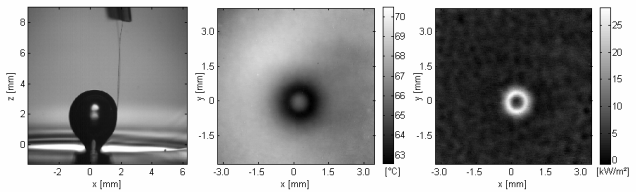
Seq: 86, time=1372ms, gravity=0.07g, q_mean=3641W/m², t_mean=67.11°C, q_max=24901W/m²



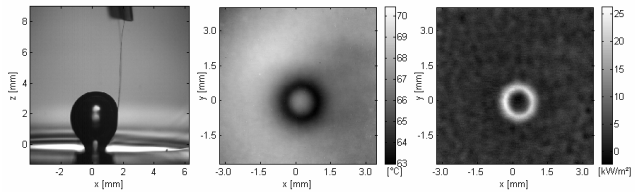
Seq: 86, time=1384ms, gravity=0.06g, q_mean=3626W/m², t_mean=67.09°C, q_max=28425W/m²



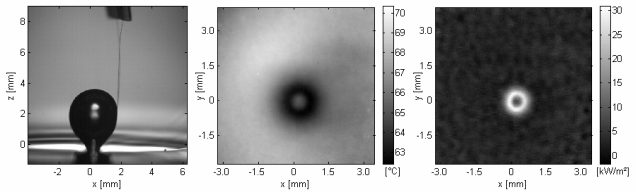
Seq: 86, time=1386ms, gravity=0.06g, q_mean=3608W/m², t_mean=67.09°C, q_max=27776W/m²



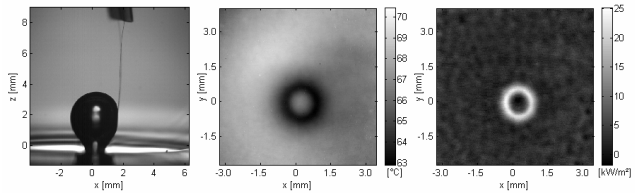
Seq: 86, time=1398ms, gravity=0.06g, q_mean=3539W/m², t_mean=67.08°C, q_max=28559W/m²



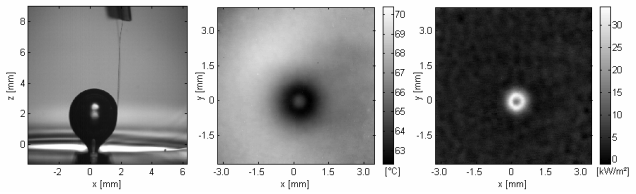
Seq: 86, time=1388ms, gravity=0.07g, q_mean=3640W/m², t_mean=67.08°C, q_max=26560W/m²



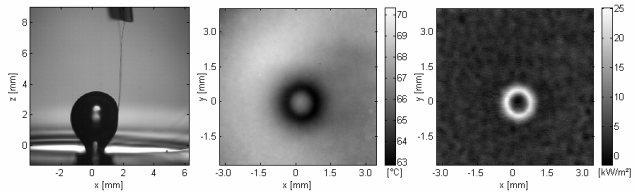
Seq: 86, time=1400ms, gravity=0.06g, q_mean=3586W/m², t_mean=67.08°C, q_max=31092W/m²



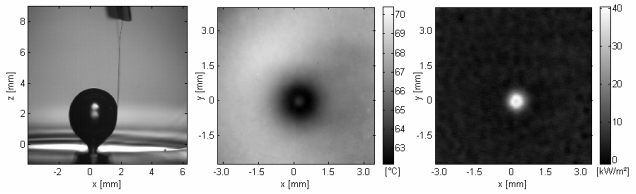
Seq: 86, time=1390ms, gravity=0.06g, q_mean=3589W/m², t_mean=67.08°C, q_max=25420W/m²



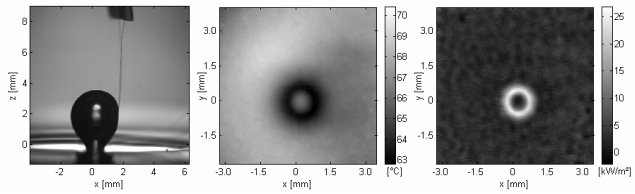
Seq: 86, time=1402ms, gravity=0.05g, q_mean=3522W/m², t_mean=67.08°C, q_max=34517W/m²



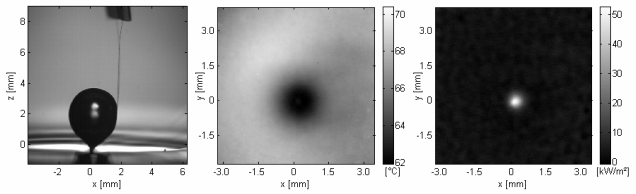
Seq: 86, time=1392ms, gravity=0.06g, q_mean=3593W/m², t_mean=67.08°C, q_max=25423W/m²



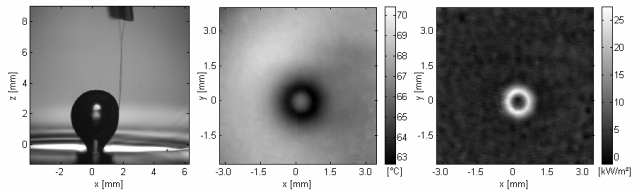
Seq: 86, time=1404ms, gravity=0.04g, q_mean=3403W/m², t_mean=67.08°C, q_max=40817W/m²



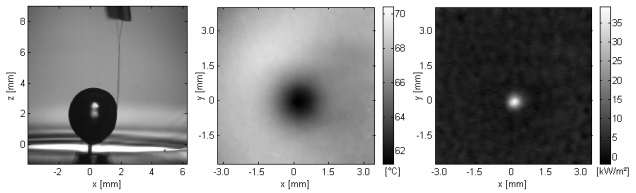
Seq: 86, time=1394ms, gravity=0.06g, q_mean=3583W/m², t_mean=67.08°C, q_max=27128W/m²



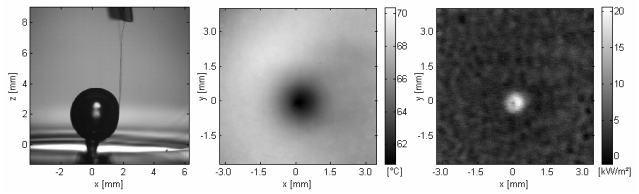
Seq: 86, time=1406ms, gravity=0.06g, q_mean=3326W/m², t_mean=67.08°C, q_max=53249W/m²



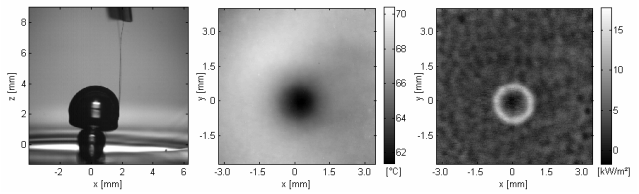
Seq: 86, time=1396ms, gravity=0.06g, q_mean=3556W/m², t_mean=67.08°C, q_max=27689W/m²



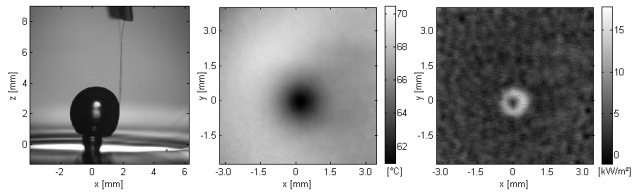
Seq: 86, time=1408ms, gravity=0.05g, q_mean=3212W/m², t_mean=67.09°C, q_max=39572W/m²



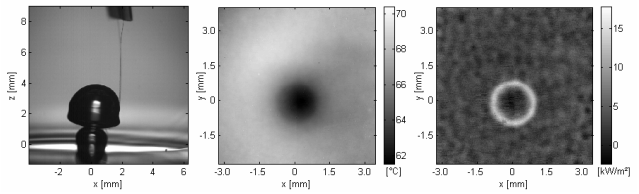
Seq: 86, time=1410ms, gravity=0.05g, q_mean=3203W/m², t_mean=67.1°C, q_max=20707W/m²



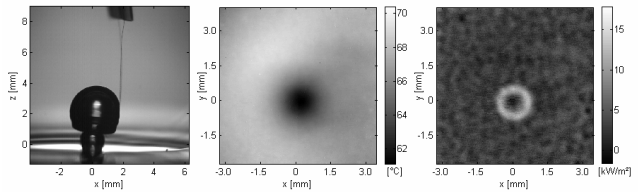
Seq: 86, time=1416ms, gravity=0.07g, q_mean=3400W/m², t_mean=67.12°C, q_max=14233W/m²



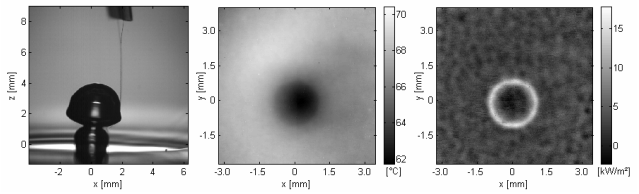
Seq: 86, time=1412ms, gravity=0.06g, q_mean=3225W/m², t_mean=67.1°C, q_max=14740W/m²



Seq: 86, time=1418ms, gravity=0.06g, q_mean=3425W/m², t_mean=67.12°C, q_max=14814W/m²



Seq: 86, time=1414ms, gravity=0.06g, q_mean=3328W/m², t_mean=67.11°C, q_max=13493W/m²



Seq: 86, time=1420ms, gravity=0.06g, q_mean=3472W/m², t_mean=67.12°C, q_max=16817W/m²

8.13. Array-description of bubble image evaluation

The structure array *bupi* (bubble in pictures) has been generated that contains all information about every bubble in a sequence. The first field number fn1 indicates the image number; the second field number fn2 the bubble number in the image. The structure array includes:

bupi{fn1}(fn2).bubble(1)	Number of the bubble as it appears in the sequence
bupi{fn1}(fn2).bubble(2)	Age of the bubble in milliseconds, also row indicator in the route array
bupi{fn1}(fn2).border	Array including the coordinates of the border pixel First column: z-coordinate (pixel row in image) Second column: x-coordinate of left border Third column: x-coordinate of right border
bupi{fn1}(fn2).coord	Coordinates of the bubble centre (x, z) in pixel
bupi{fn1}(fn2).pixvolume	Bubble volume in pixel³
bupi{fn1}(fn2).mm3volume	Bubble volume in mm³
bupi{fn1}(fn2).picnr	Image number (equal to fn1)
bupi{fn1}(fn2).route	Coordinates of the actual bubble in previous and next images First column: Image number Second column: x-coordinate of bubble centre Third column: z-coordinate of bubble centre
bupi{fn1}(fn2).attached	Attached (1) or detached (0) bubble

A second structure array named *bubbles* is created containing the trajectory and volume information about the bubbles in a sequence. The field number of the structure array is the number of the bubble as it appears in the sequence. The array includes:

- First column: Image number or sequence time in milliseconds
- Second column: Horizontal x-coordinate of the bubble centre in pixel
- Third column: Height of the bubble centre (z-coordinate) in pixel
- Fourth column: Bubble volume in pixel^3
- Fifth column: Attached (1) or detached (0)
- Sixth column: Bubble indicator in the corresponding image (programming reason)