



Status of OBLA Measurements



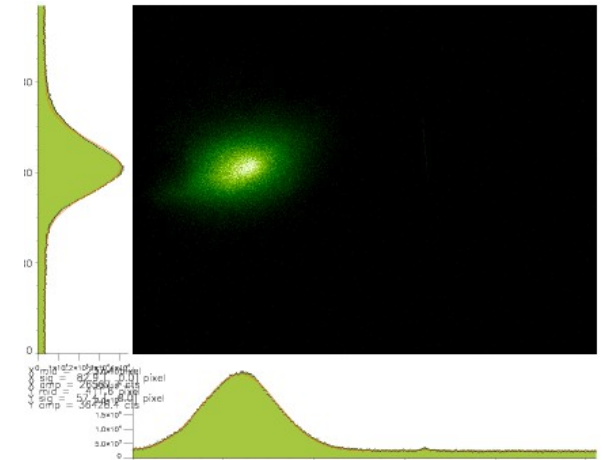
Thomas Schietinger

FELSI Meeting, 29 January 2008

Measurement campaign so far



- Before Christmas: first beam observed, but parts of the diagnostics not yet working, large timing jitter.
- First two weeks of January mainly devoted to hardware fixes (timing problem, diagnostics)
- Observe (?) charge-up of UHV mirror
 - go from 2.5 mm to 5 mm distance from beam
- Solenoids have strong effect on beam position
 - Realignment requested (done last Friday)
- First attempt to estimate emittance: solenoid scan on 24 Jan., using first solenoid (MSL10=SP1, bolted to pulser, has counter coil)



Emittance monitor;
200 kV / 12 mm gap

Solenoid Scan with MSL10



- MSL10 has counter coil. Exact field map depends on ratio main/counter coil!
 - MSL10 not very well suited for solenoid scan
- To cancel B field on cathode at 12 mm gap, counter coil current must be -2.37% of main coil
 - This value is different for each gap!
- For main coil current around 30–40 A, no current on counter coil:
 - field integral $\int (B/I)^2 dz = 28.182 \text{ kT}^2\text{m/A}^2$,
 - effective length $l_{\text{eff}} = \int (B/B_{\text{max}})^2 dz = 33.70 \text{ mm}$
- Use these values for preliminary emittance evaluation

Solenoid Scan, 24 Jan. 2008

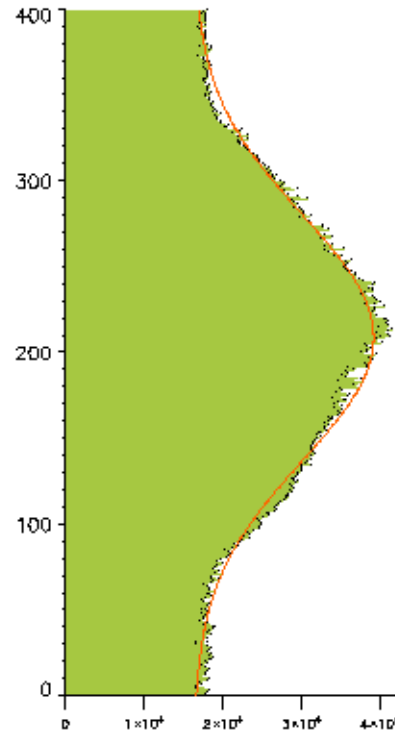


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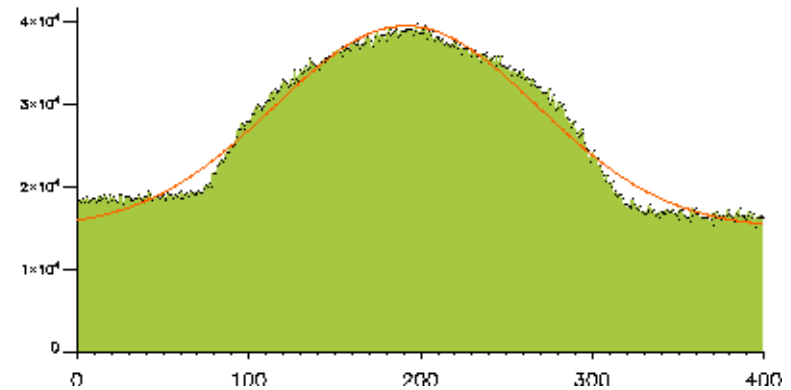
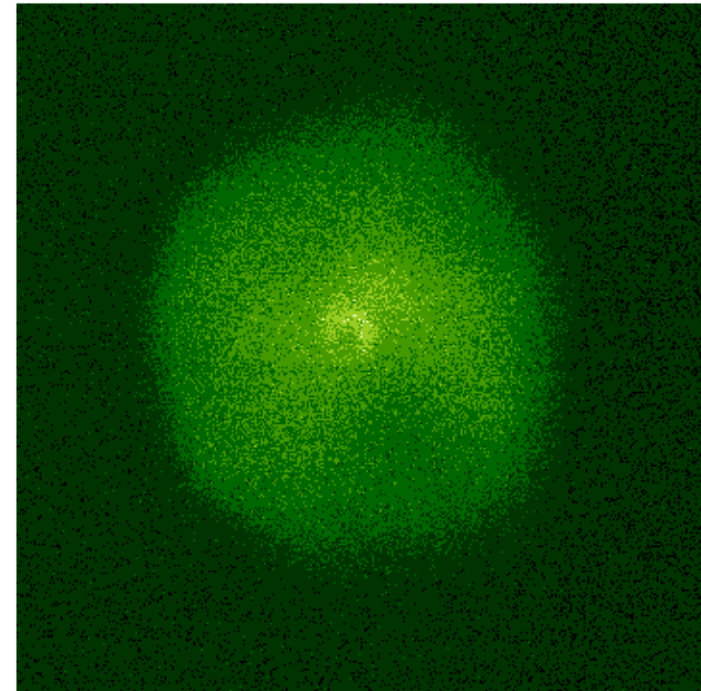
- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

I(main coil): 31 A

I(counter coil): 2 A



X mid = 192.1 pixel
X sig = 74.3 [2.7] pixel
X amp = 24671.0 cts
Y mid = 209.2 pixel
Y sig = 71.3 [2.2] pixel
Y amp = 22911.3 cts



Solenoid Scan, 24 Jan. 2008

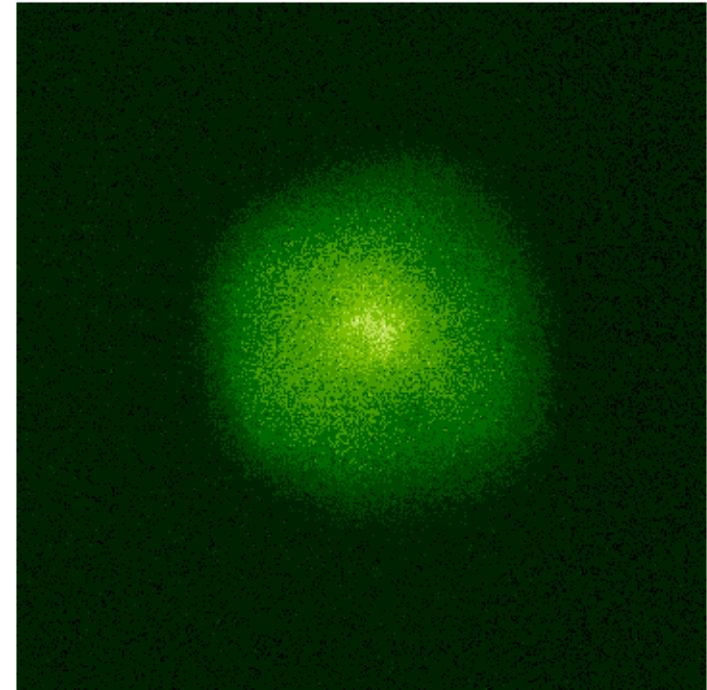
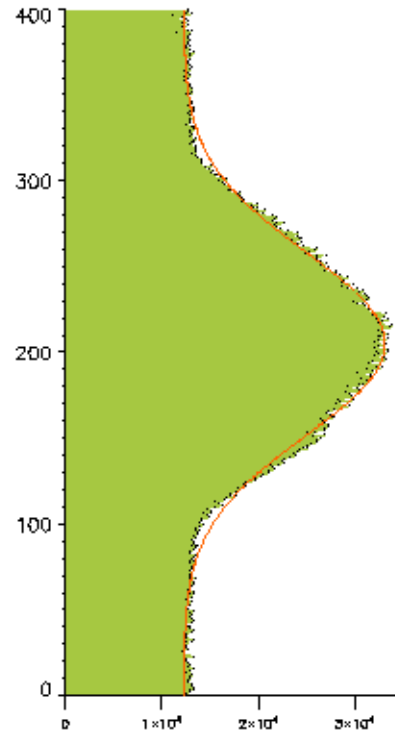


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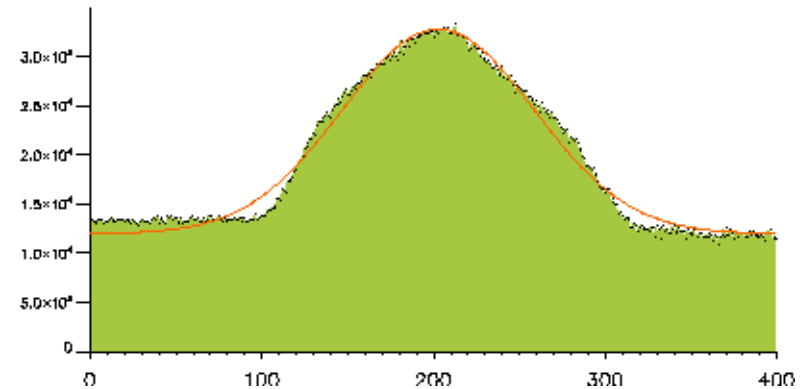
- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

I(main coil): 32 A

I(counter coil): 2 A



X mid = 203.3 pixel
X sig = 54.7 [2.0] pixel
X amp = 20870.1 cts
Y mid = 205.6 pixel
Y sig = 53.1 [1.9] pixel
Y amp = 20952.6 cts



Solenoid Scan, 24 Jan. 2008

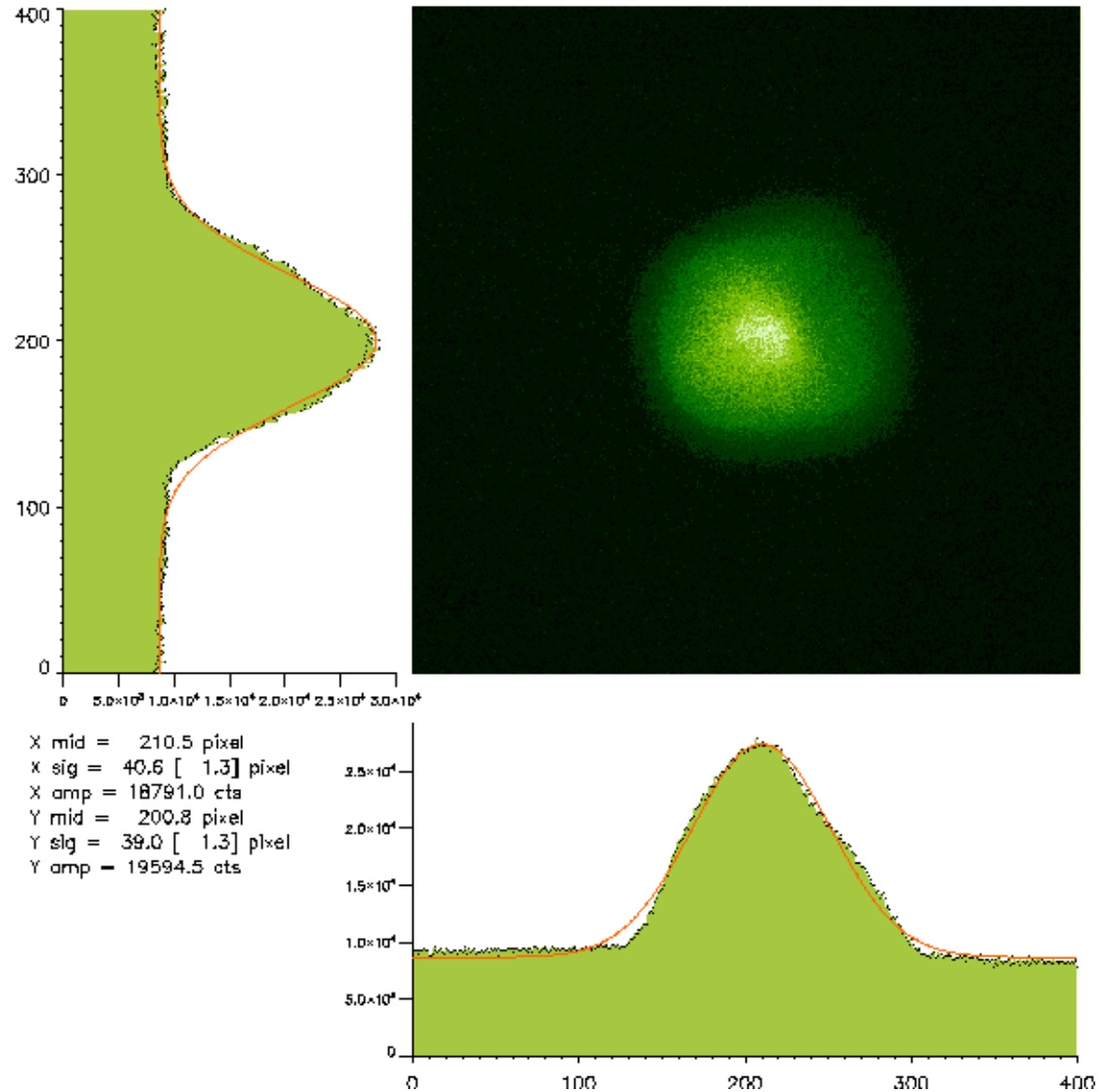


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- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

I(main coil): 33 A

I(counter coil): 2 A



Solenoid Scan, 24 Jan. 2008

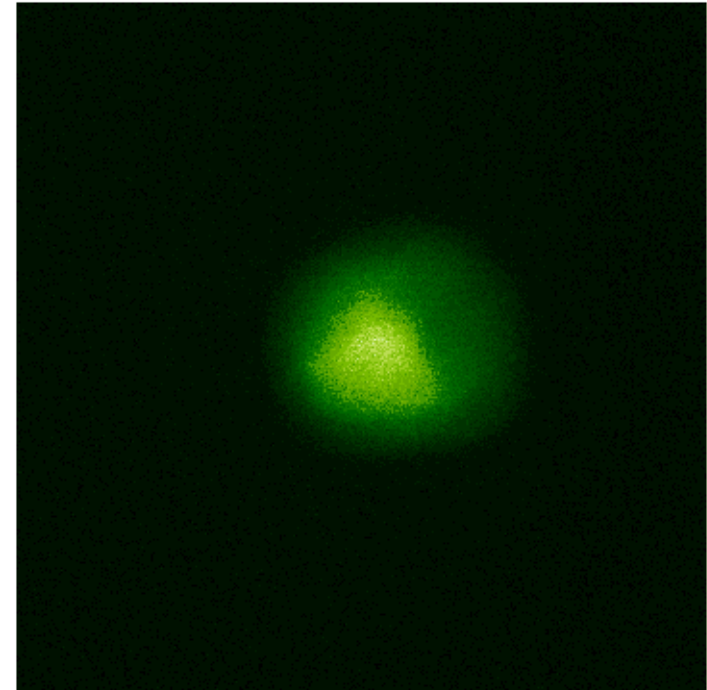
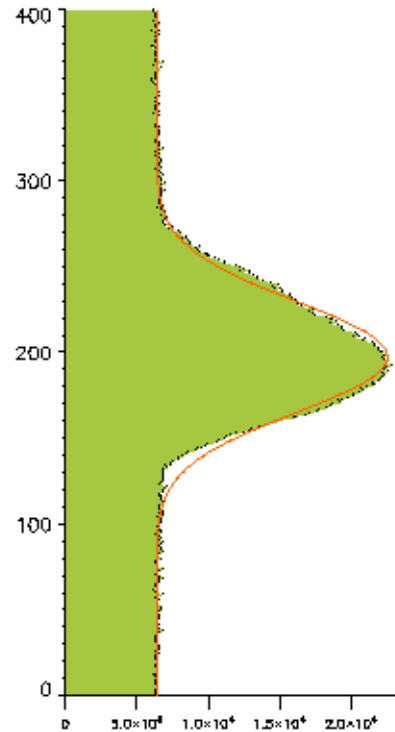


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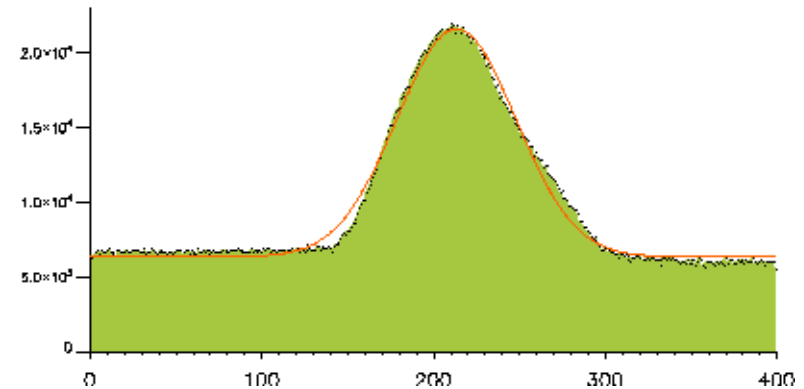
- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

I(main coil): 33.5 A

I(counter coil): 2 A



X mid = 213.9 pixel
X sig = 34.1 [1.2] pixel
X amp = 15253.1 cts
Y mid = 198.0 pixel
Y sig = 32.2 [1.2] pixel
Y amp = 18227.7 cts



Solenoid Scan, 24 Jan. 2008

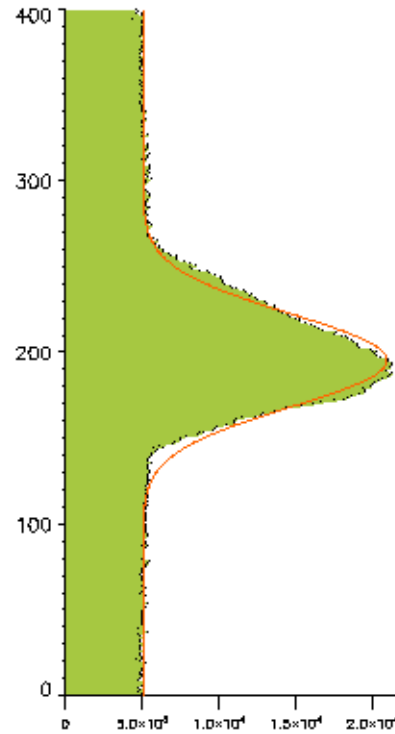


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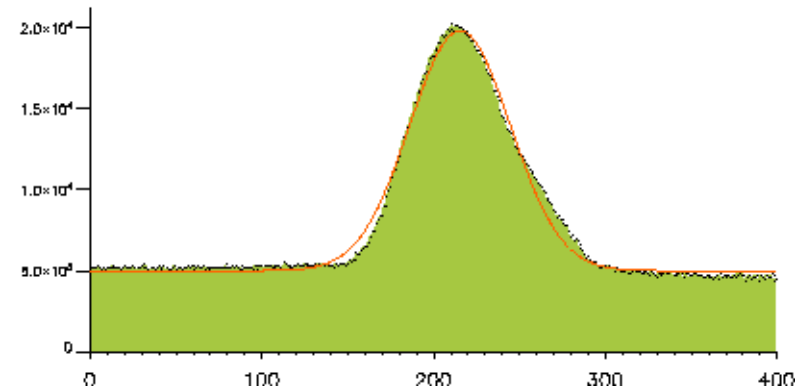
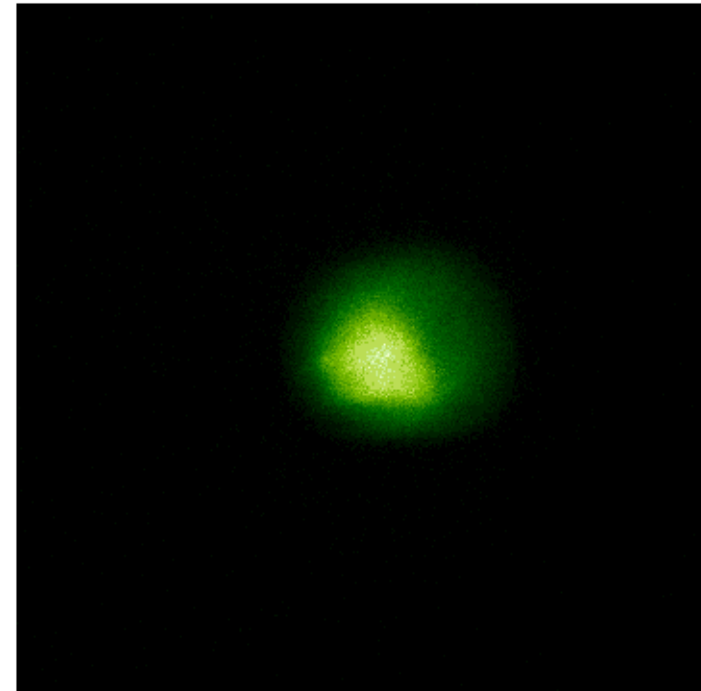
- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

I(main coil): 34 A

I(counter coil): 2 A



X mid = 218.1 pixel
X sig = 29.5 [1.0] pixel
X amp = 14846.3 cts
Y mid = 195.9 pixel
Y sig = 27.2 [1.1] pixel
Y amp = 15894.8 cts



Solenoid Scan, 24 Jan. 2008

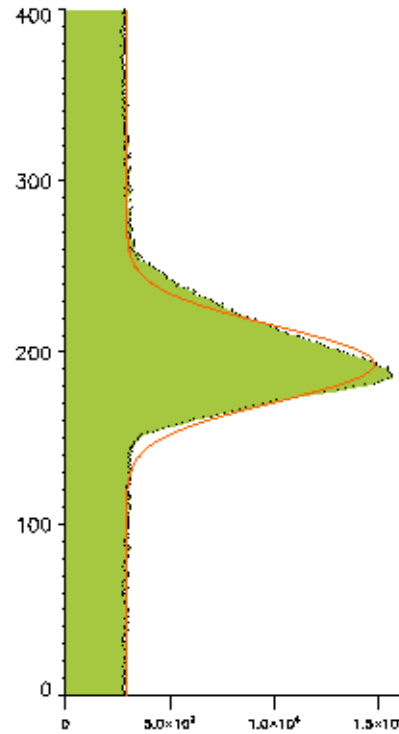


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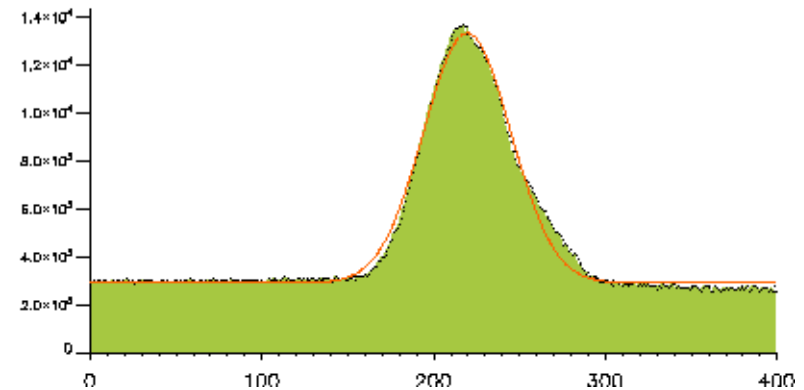
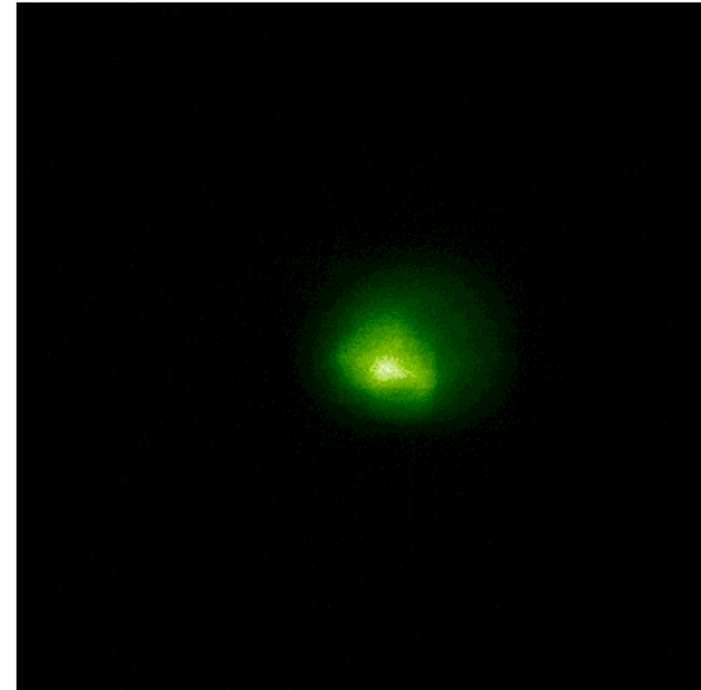
- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

I(main coil): 34.5 A

I(counter coil): 2 A



X mid = 220.2 pixel
X sig = 24.7 [0.8] pixel
X amp = 10431.0 cts
Y mid = 193.8 pixel
Y sig = 21.4 [0.9] pixel
Y amp = 11892.4 cts



Solenoid Scan, 24 Jan. 2008

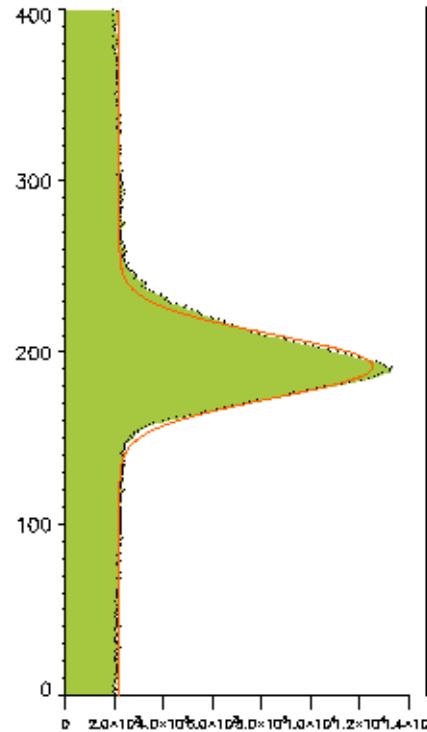


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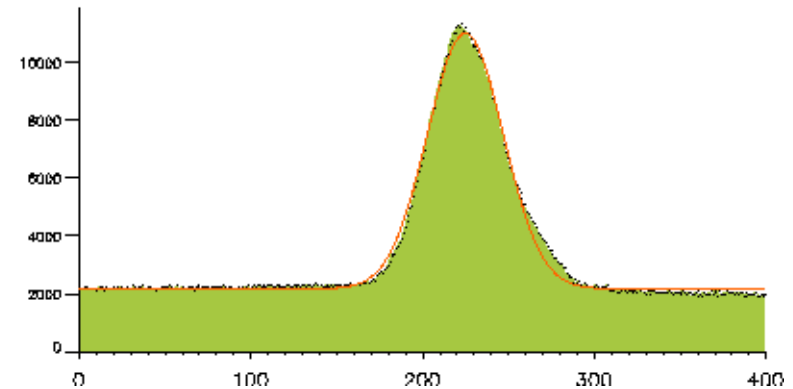
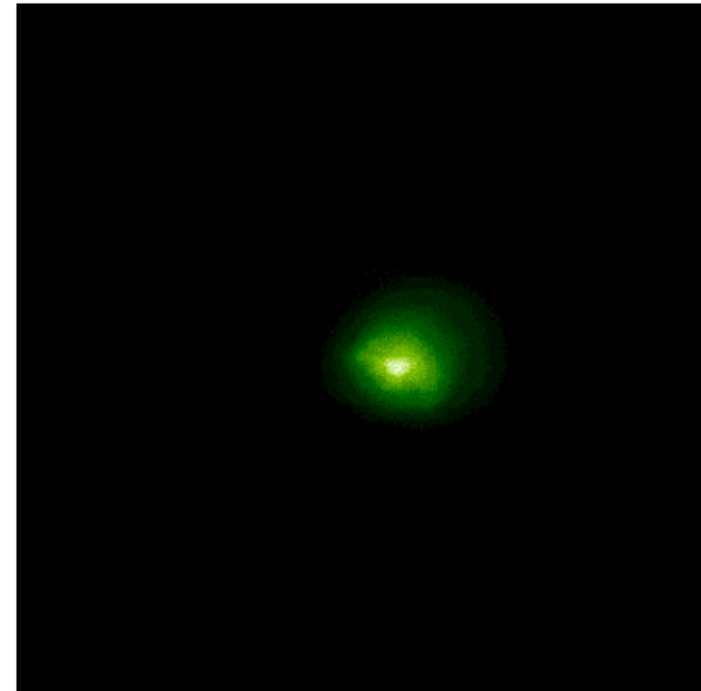
- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

I(main coil): 35 A

I(counter coil): 2 A



X mid = 225.6 pixel
X sig = 22.1 [0.5] pixel
X amp = 8639.6 cts
Y mid = 192.4 pixel
Y sig = 18.1 [0.6] pixel
Y amp = 10370.4 cts



Solenoid Scan, 24 Jan. 2008

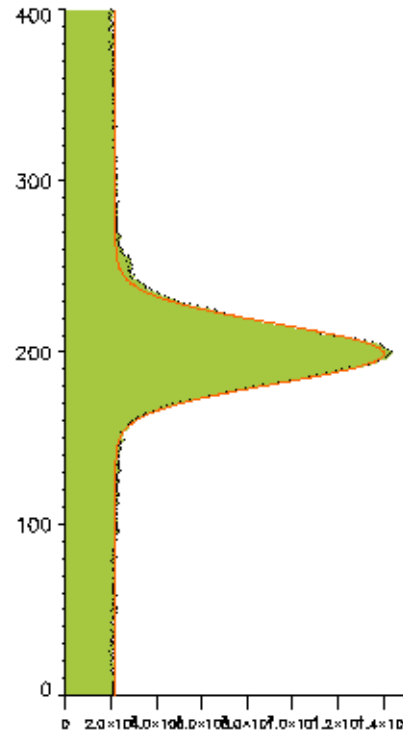


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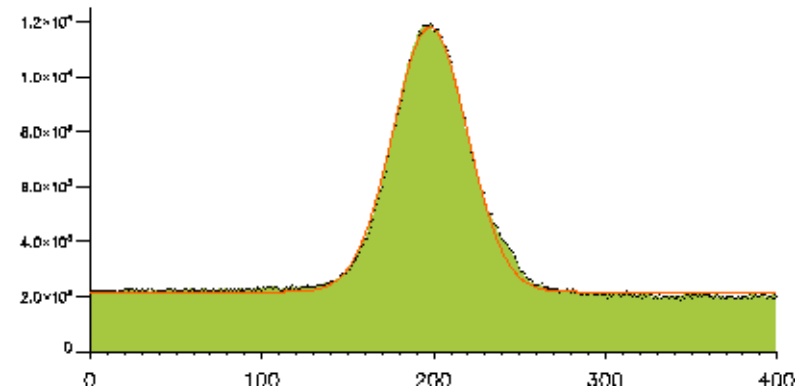
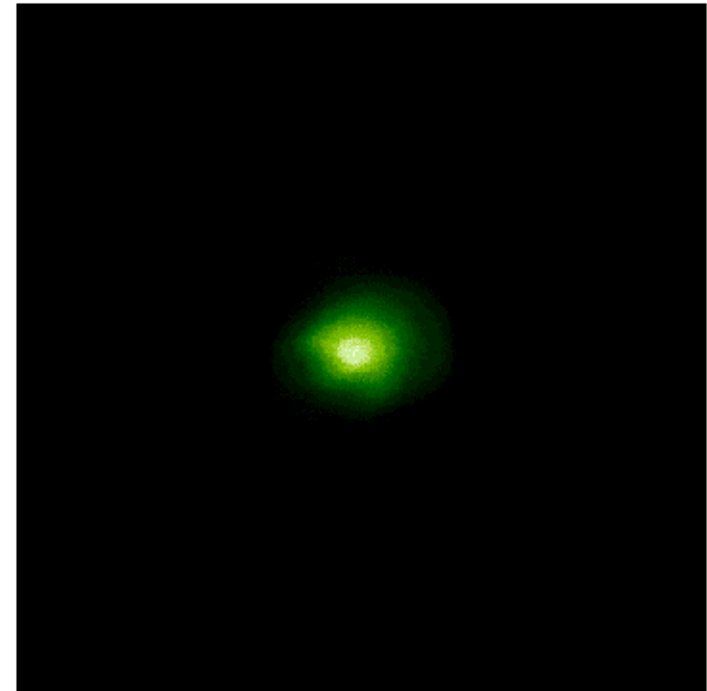
- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

I(main coil): 35.5 A

I(counter coil): 2 A



X mid = 198.6 pixel
X sig = 21.3 [0.3] pixel
X amp = 9624.6 cts
Y mid = 199.8 pixel
Y sig = 17.3 [0.2] pixel
Y amp = 11833.0 cts



Solenoid Scan, 24 Jan. 2008

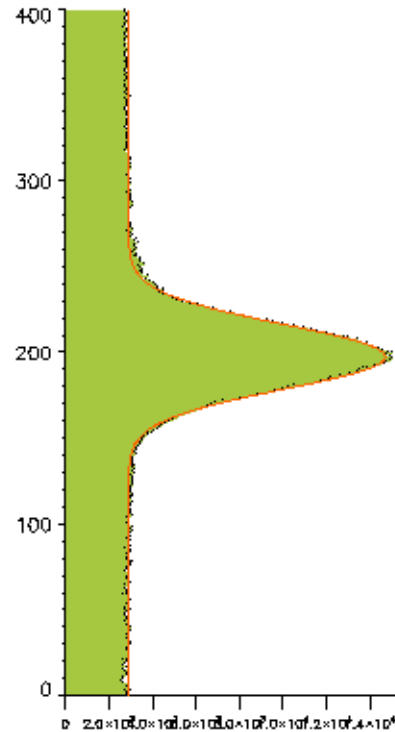


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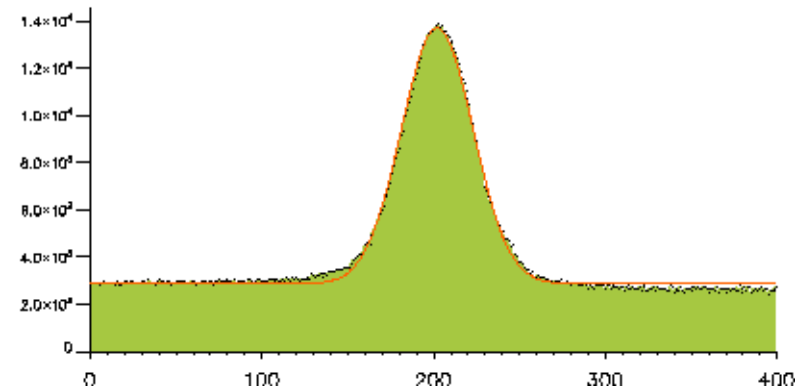
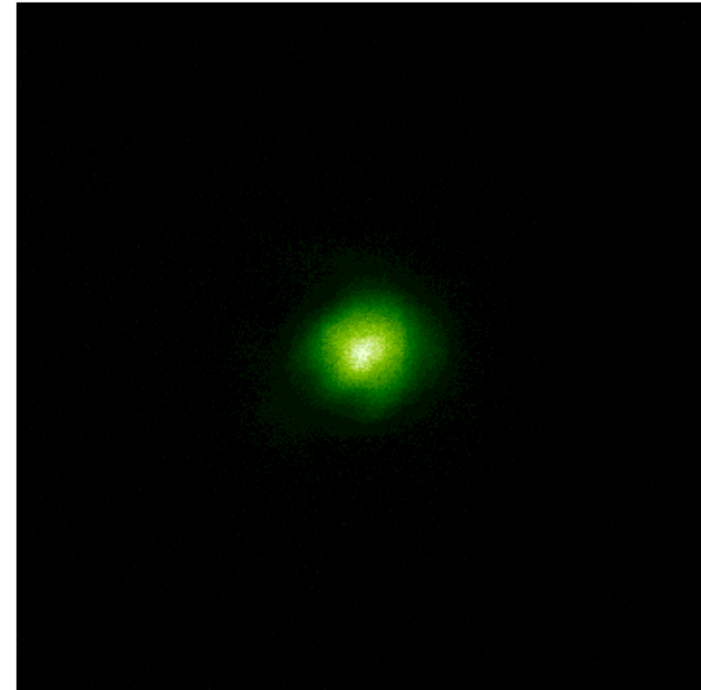
- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

I(main coil): 36 A

I(counter coil): 2 A



X mid = 202.7 pixel
X sig = 22.0 [0.7] pixel
X amp = 10846.7 cts
Y mid = 198.0 pixel
Y sig = 19.2 [0.8] pixel
Y amp = 11820.3 cts



Solenoid Scan, 24 Jan. 2008

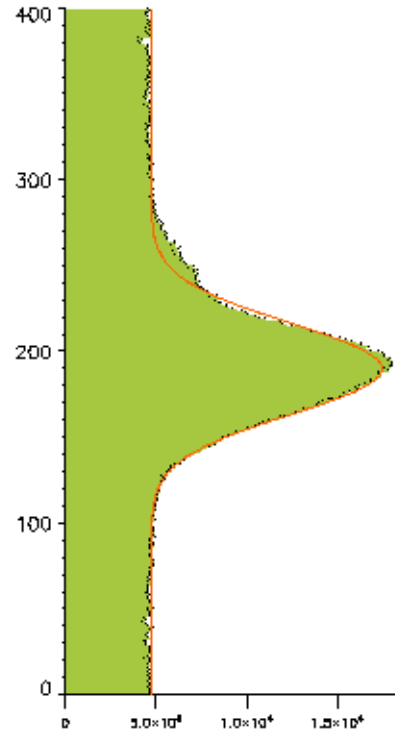


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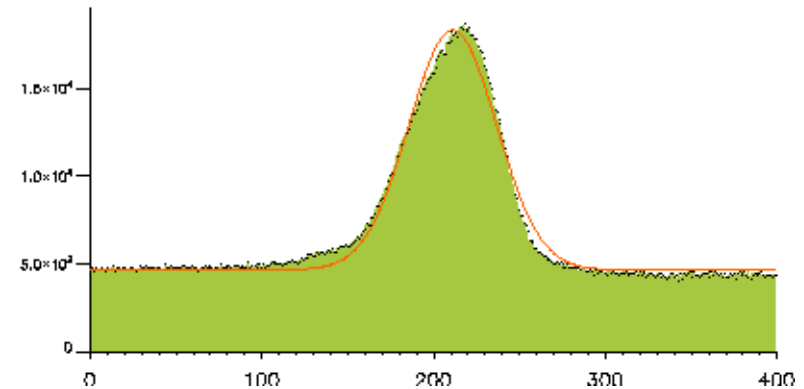
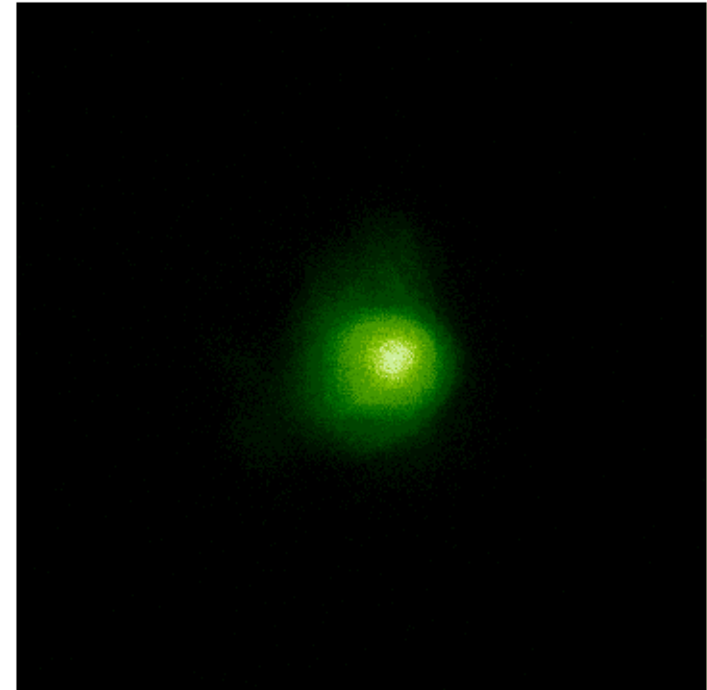
- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

I(main coil): 36.5 A

I(counter coil): 2 A



X mid = 211.6 pixel
X sig = 25.3 [0.8] pixel
X amp = 13653.3 cts
Y mid = 190.4 pixel
Y sig = 25.0 [1.3] pixel
Y amp = 12757.6 cts



Solenoid Scan, 24 Jan. 2008

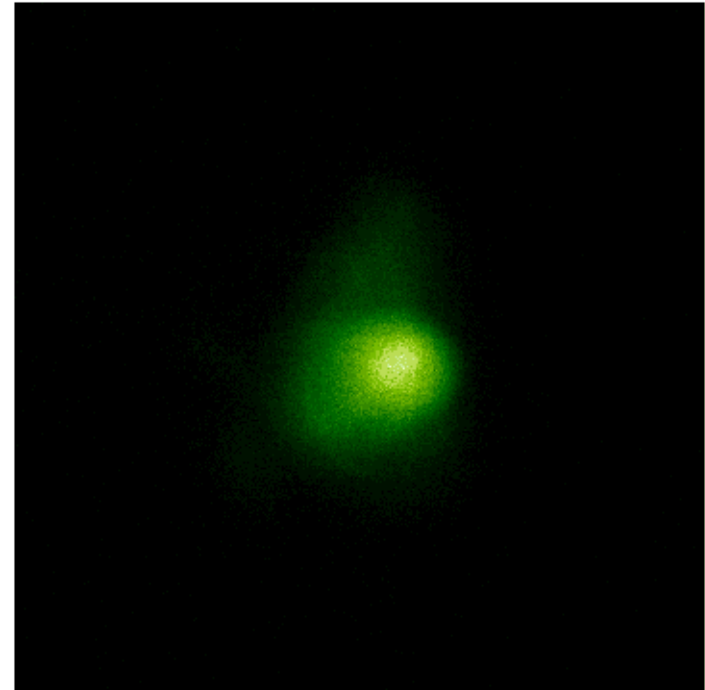
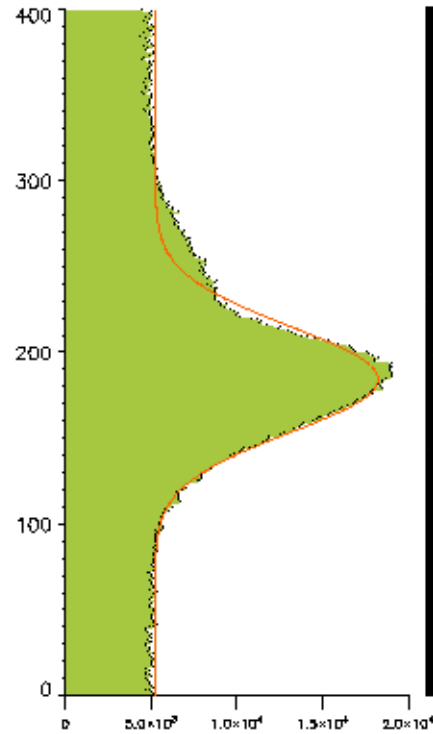


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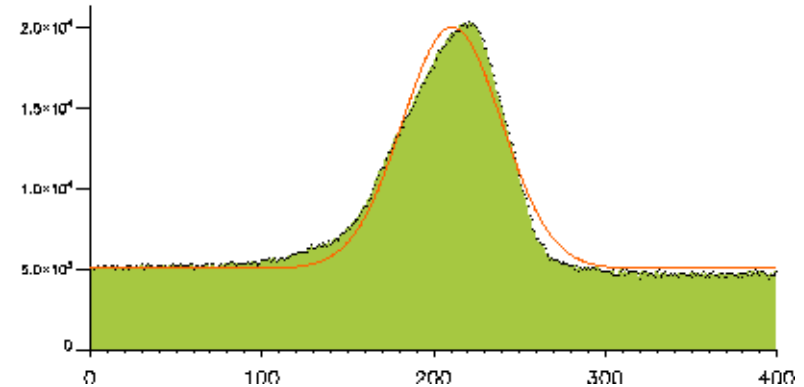
- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

I(main coil): 37 A

I(counter coil): 2 A



X mid = 211.4 pixel
X sig = 28.8 [1.0] pixel
X amp = 15008.3 cts
Y mid = 184.8 pixel
Y sig = 31.1 [1.4] pixel
Y amp = 13032.3 cts



Solenoid Scan, 24 Jan. 2008

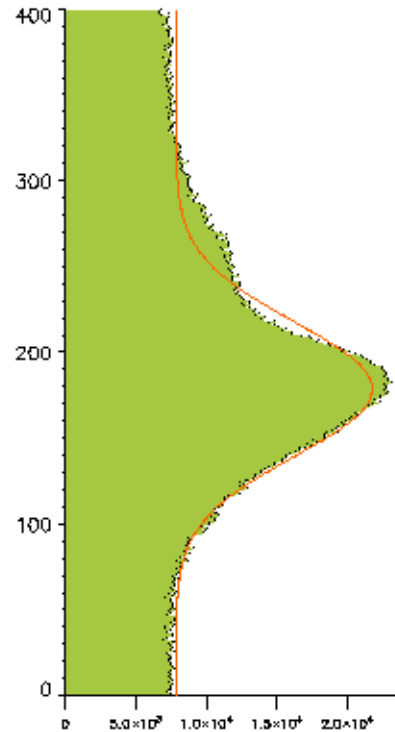


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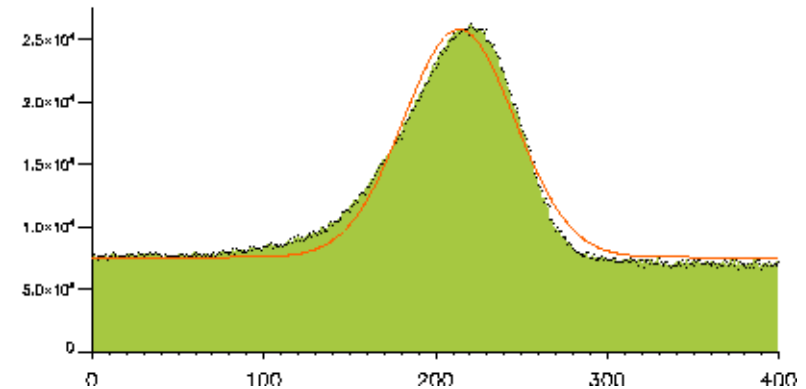
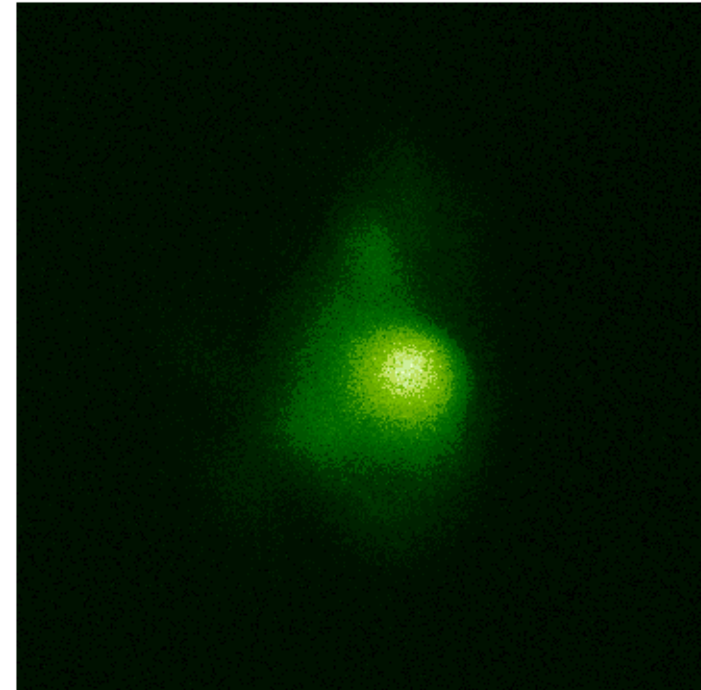
- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

I(main coil): 37.5 A

I(counter coil): 2 A



X mid = 214.4 pixel
X sig = 31.8 [0.7] pixel
X amp = 18266.8 cts
Y mid = 179.1 pixel
Y sig = 36.7 [1.4] pixel
Y amp = 13973.3 cts



Solenoid Scan, 24 Jan. 2008

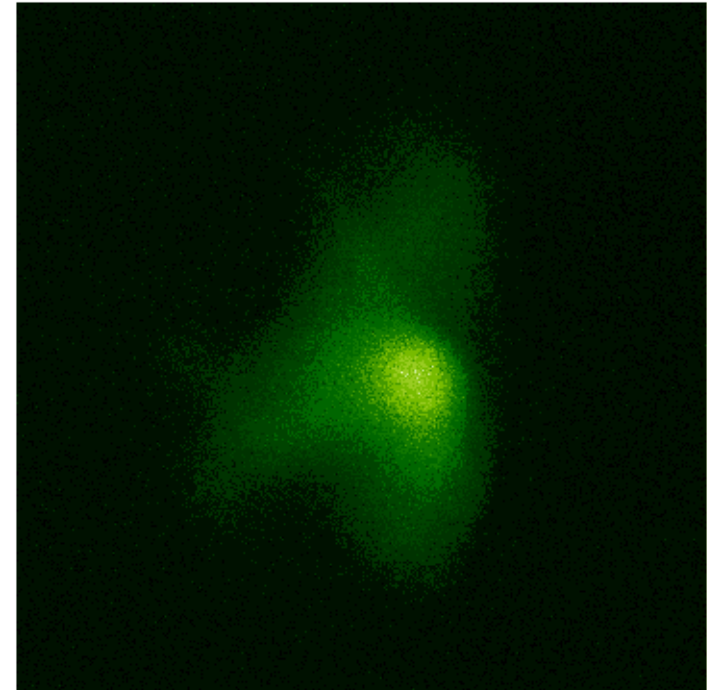
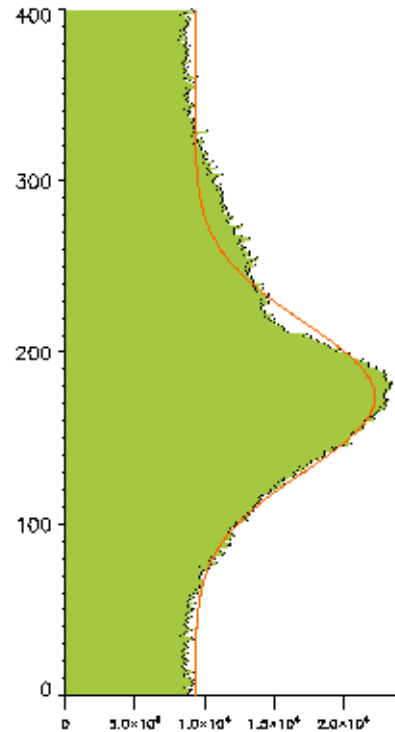


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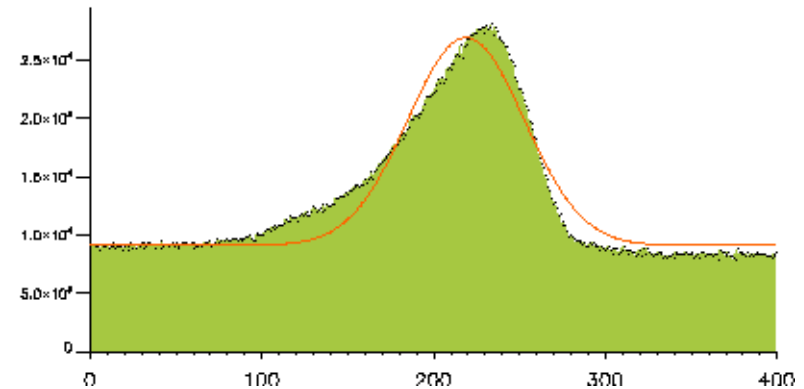
- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

I(main coil): 38 A

I(counter coil): 2 A



X mid = 219.6 pixel
X sig = 34.6 [1.4] pixel
X amp = 17839.0 cts
Y mid = 174.5 pixel
Y sig = 42.9 [2.9] pixel
Y amp = 12975.8 cts



Solenoid Scan, 24 Jan. 2008

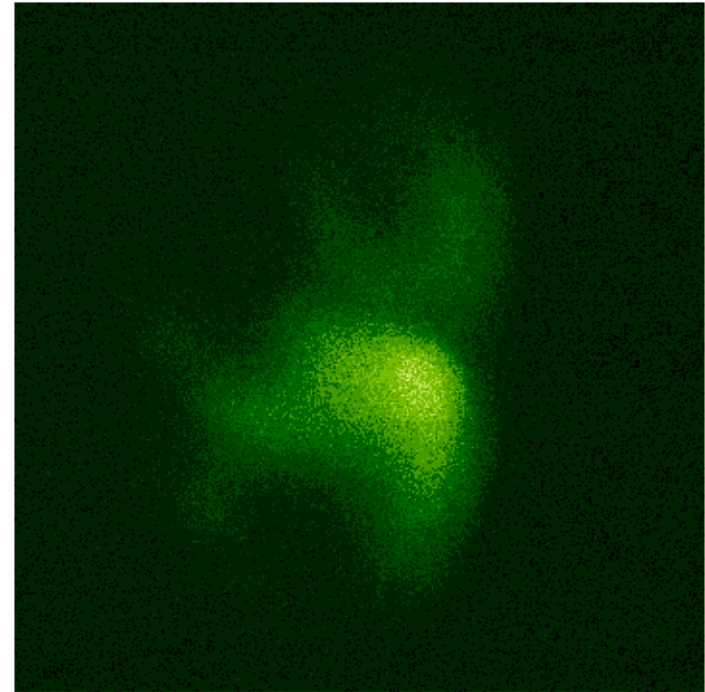
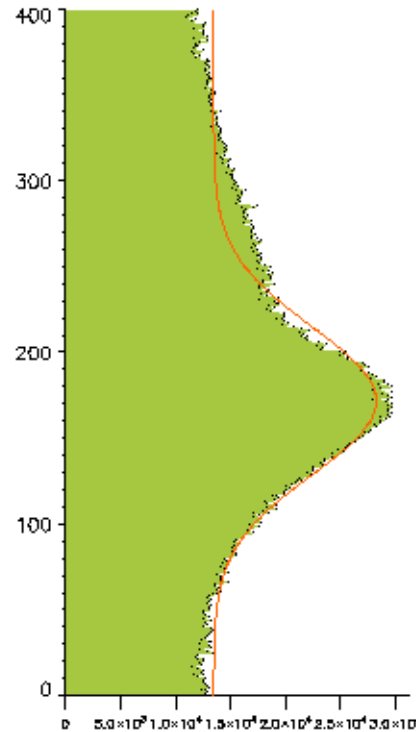


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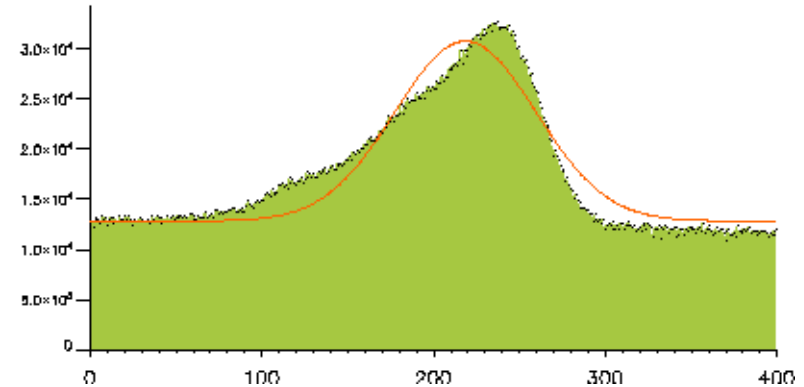
- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

I(main coil): 38.5 A

I(counter coil): 2 A



X mid = 219.2 pixel
X sig = 41.1 [2.1] pixel
X amp = 17998.2 cts
Y mid = 172.3 pixel
Y sig = 48.1 [3.6] pixel
Y amp = 14808.0 cts



Solenoid Scan, 24 Jan. 2008

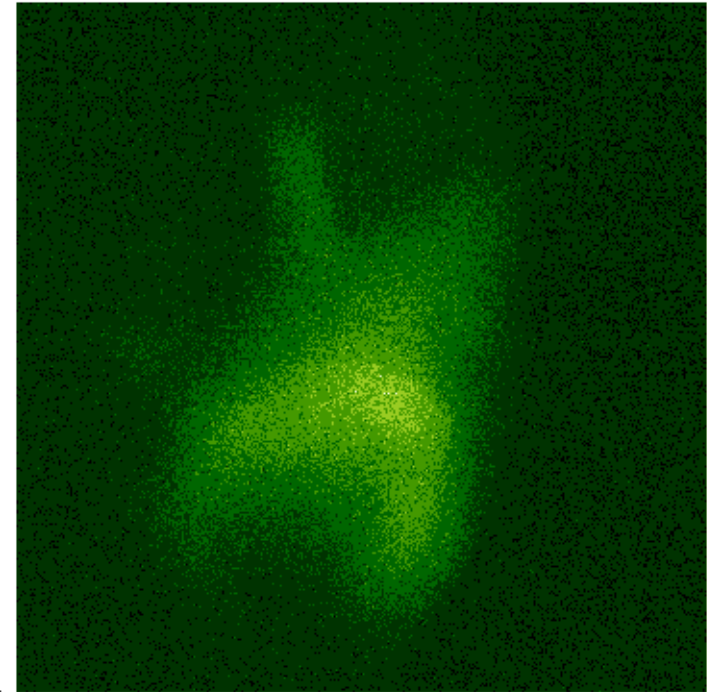
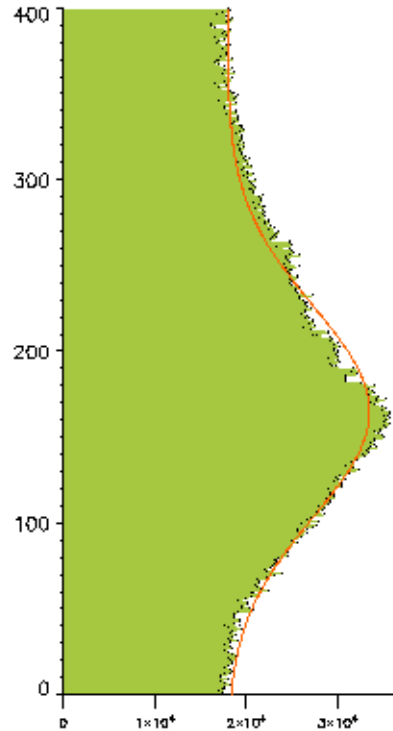


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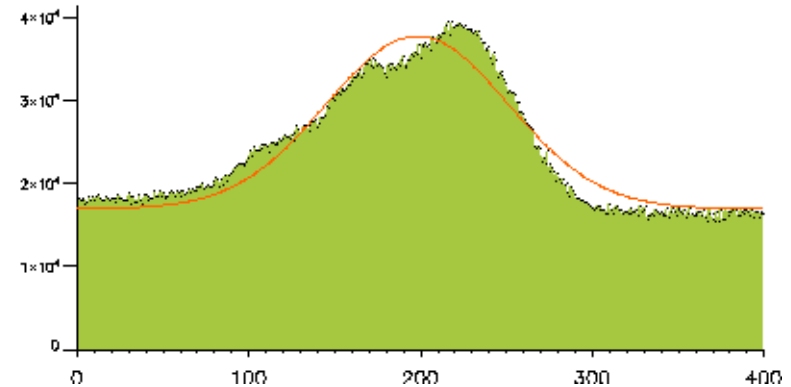
- Cathode-anode gap: 12 mm
- Pulser voltage: ~315 kV
- Laser $\sigma_{x,y}$: 130 μm
- Laser σ_t : 16.5 ps
- Pixel size: 25.8 μm
- Distance solenoid-screen: 429.5 mm

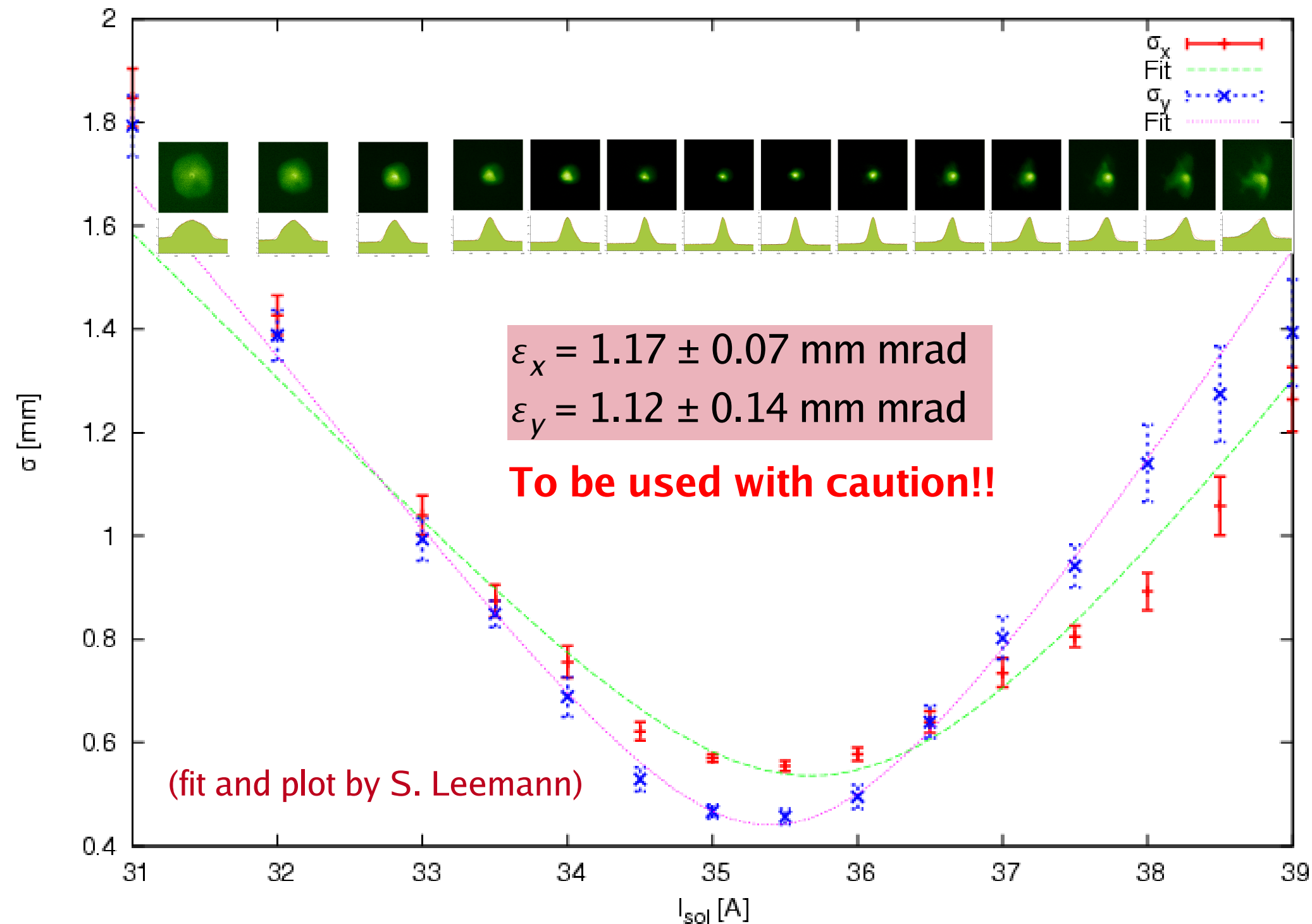
I(main coil): 39 A

I(counter coil): 2 A



X mid = 198.7 pixel
X sig = 48.8 [3.5] pixel
X amp = 20864.5 cts
Y mid = 165.4 pixel
Y sig = 54.1 [5.3] pixel
Y amp = 15593.4 cts

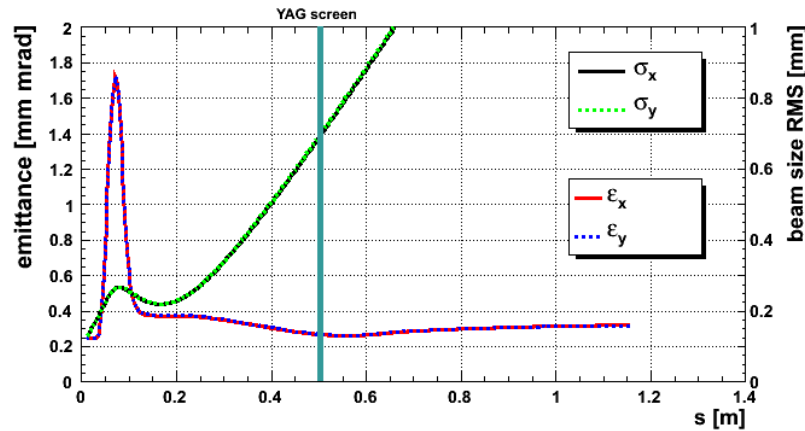




Charge: 7.6 pC
 mesh: 32 × 32 × 32
 macroparticles: 100k
 time step: 0.1 ps (gun),
 1 ps (after)
 σ_t : 16.5 ps; $r_{x,y}$: 225 μ m

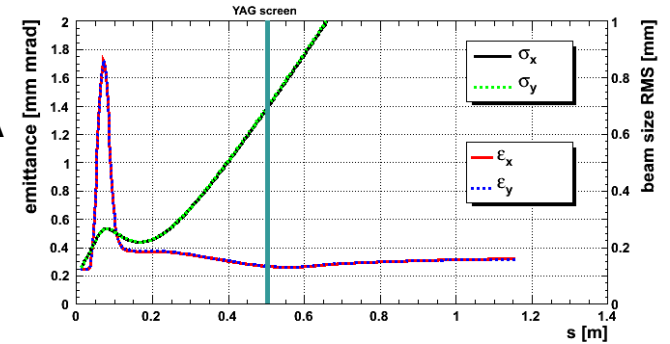
Simulation (Impact-t)

OBLA, phase-I, 12 mm gap, 315 kV

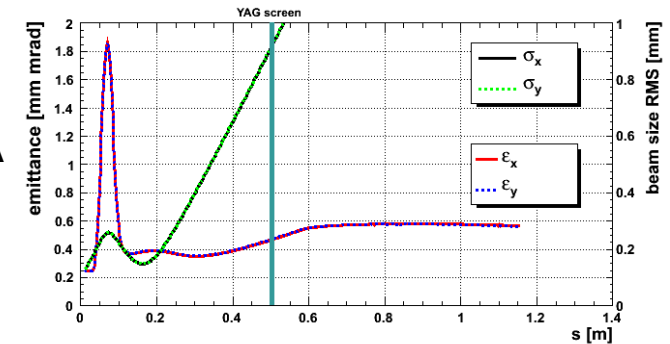


$I_{\text{tot}} = 31 \text{ A}$

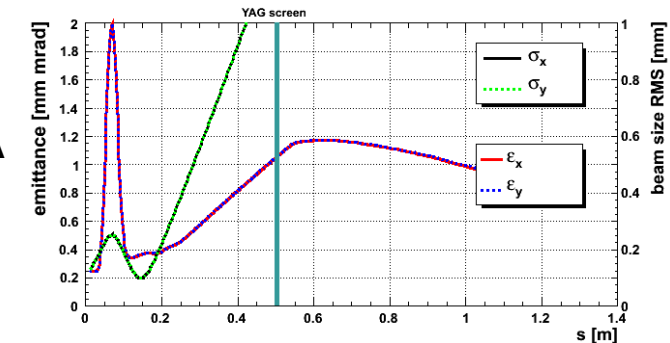
OBLA, phase-I, 12 mm gap, 315 kV



$I_{\text{tot}} = 35 \text{ A}$

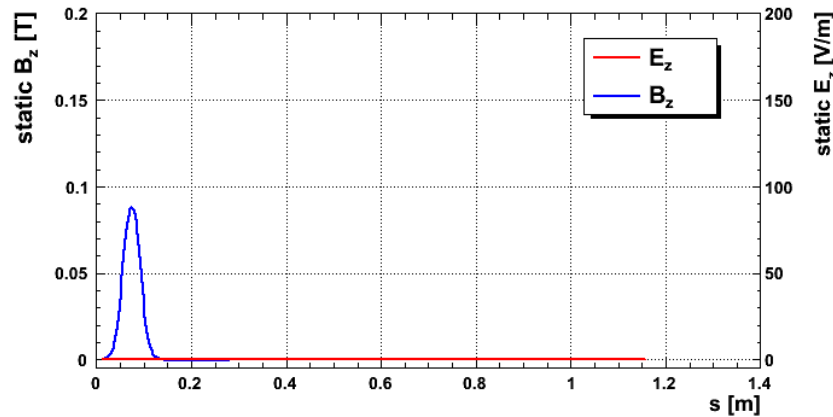


$I_{\text{tot}} = 39 \text{ A}$



$I_{\text{tot}} = 31 \text{ A}$

SP1: 87.74 mT (31 A)



IMPACT-T

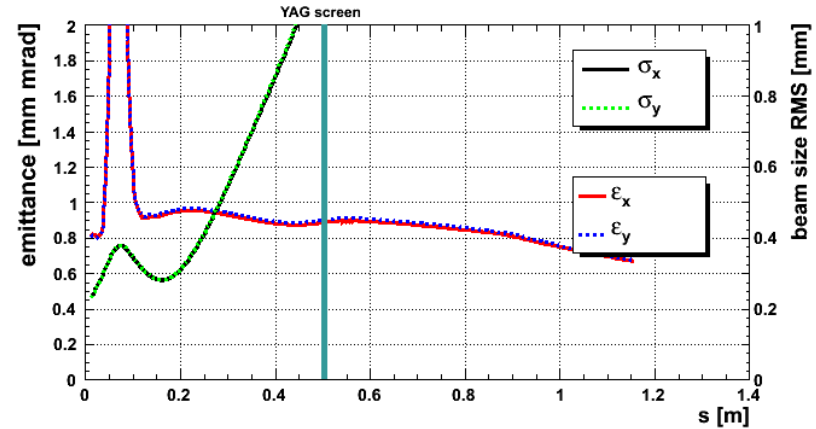
Tue Jan 29 13:05:05 2008



Charge: 7.6 pC
 mesh: 32 × 32 × 32
 macroparticles: 100k
 time step: 0.1 ps (gun),
 1 ps (after)
 σ_t : 16.5 ps; $r_{x,y}$: 450 μm

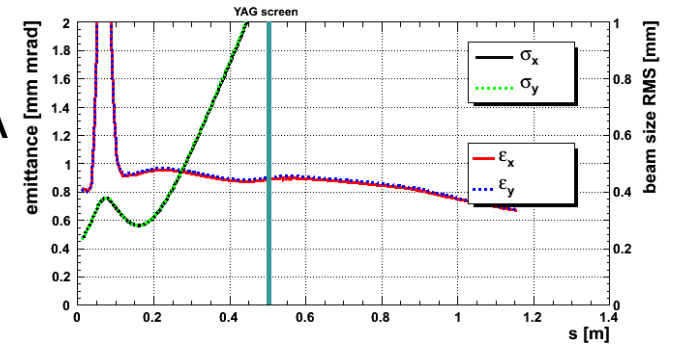
Simulation (Impact-t)

OBLA, phase-I, 12 mm gap, 315 kV



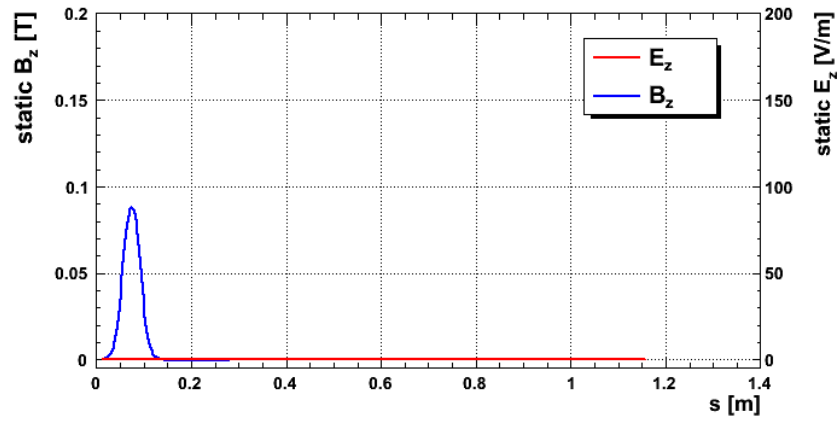
$I_{\text{tot}} = 31 \text{ A}$

OBLA, phase-I, 12 mm gap, 315 kV

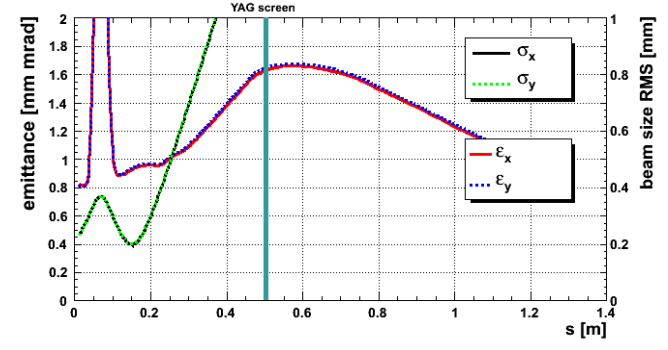


$I_{\text{tot}} = 31 \text{ A}$

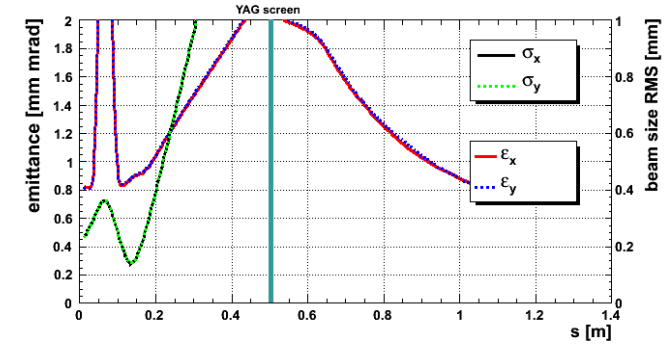
SP1: 87.74 mT (31 A)



$I_{\text{tot}} = 35 \text{ A}$



$I_{\text{tot}} = 39 \text{ A}$



IMPACT-T

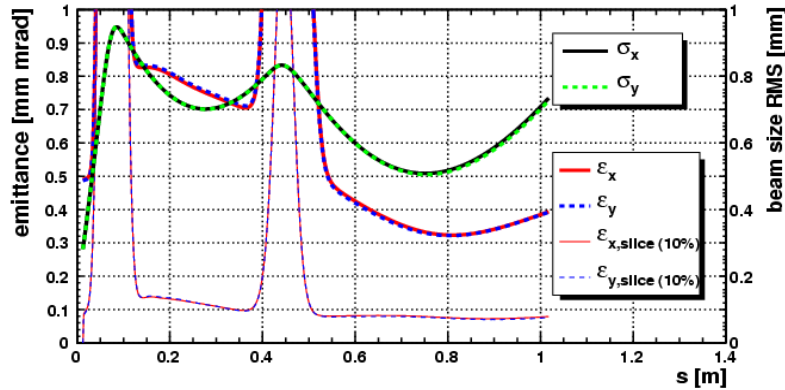
Tue Jan 29 13:18:12 2008



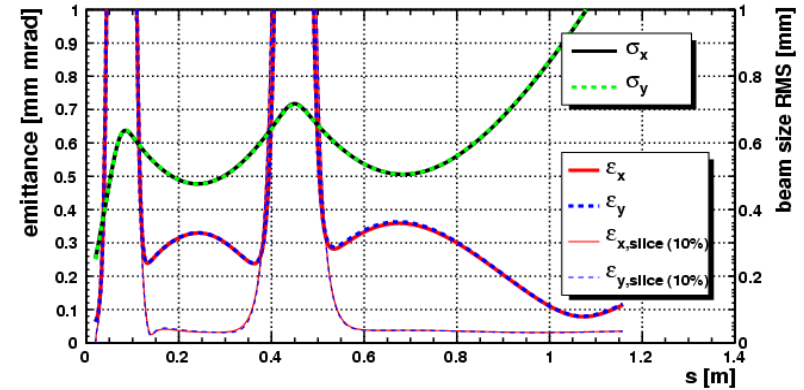
Charge: 6 pC
 mesh: $32 \times 32 \times 32$
 macroparticles: 100k
 time step: 0.1 ps (gun),
 1 ps (after)
 σ_t : 6.5 ps; $r_{x,y}$: 300 μm

Older simulations (Impact-t)

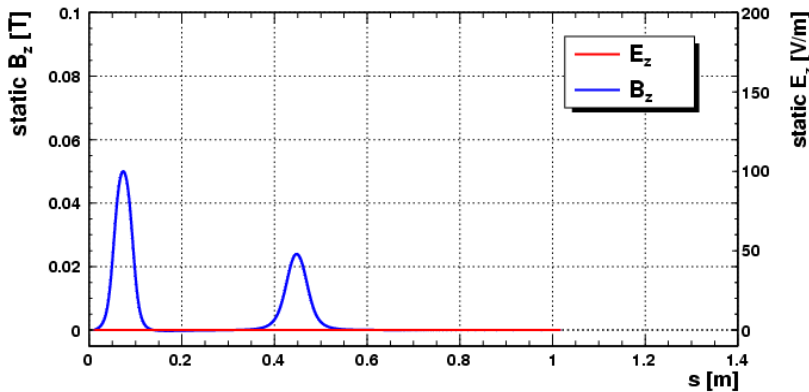
OBLA, phase-I, 12 mm gap, 100 kV



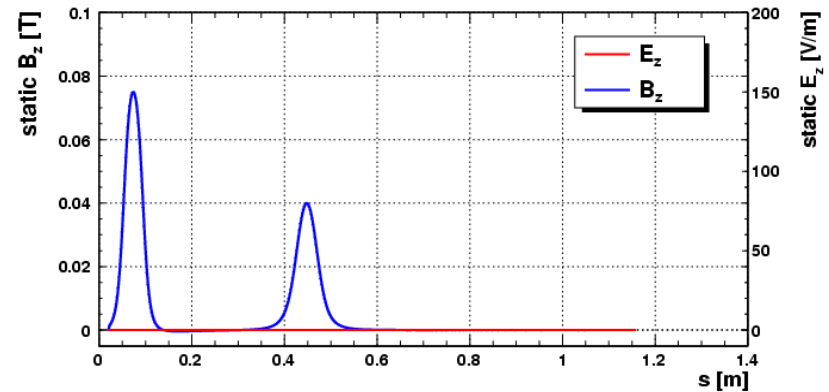
OBLA, phase-I, 12 mm gap, 200 kV



SP1: 50 mT, SP4: 24 mT



SP1: 75 mT, SP4: 40 mT



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Tue Dec 18 16:02:01 2007

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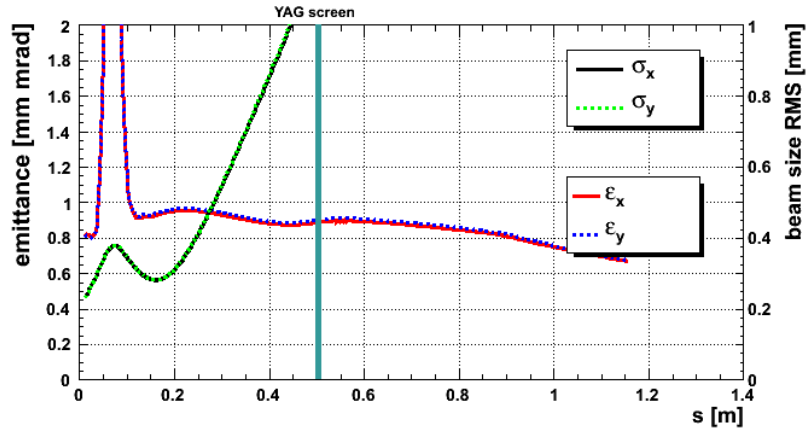
Wed Dec 19 08:54:33 2007



Charge: 7.6 pC
 mesh: 32 × 32 × 32
 macroparticles: 100k
 time step: 0.1 ps (gun),
 1 ps (after)
 σ_t : 16.5 ps
 $r_{x,y}$: 450 μm

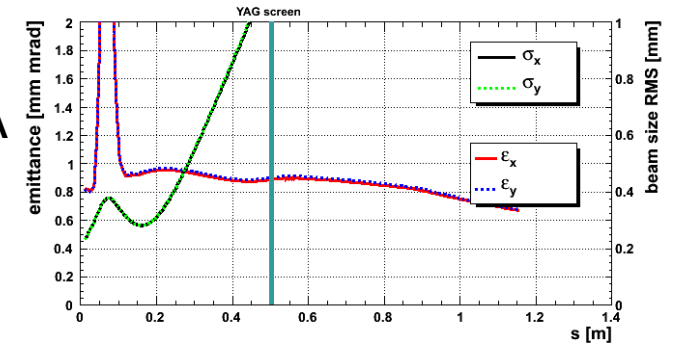
Simulation (Impact-t)

OBLA, phase-I, 12 mm gap, 315 kV



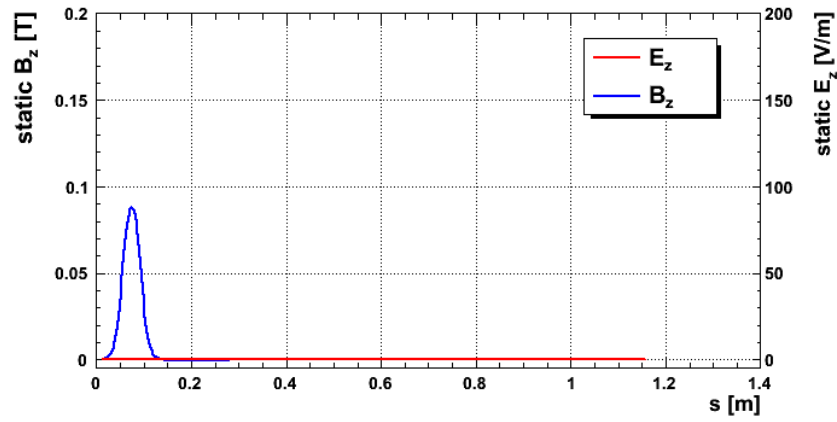
$I_{\text{tot}} = 31 \text{ A}$

OBLA, phase-I, 12 mm gap, 315 kV

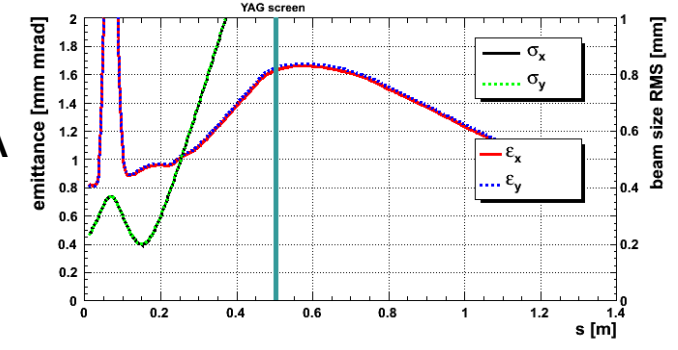


$I_{\text{tot}} = 31 \text{ A}$

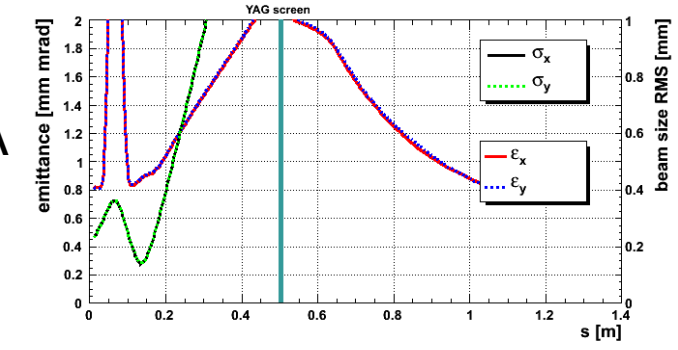
SP1: 87.74 mT (31 A)



$I_{\text{tot}} = 35 \text{ A}$



$I_{\text{tot}} = 39 \text{ A}$



IMPACT-T

Tue Jan 29 13:18:12 2008

