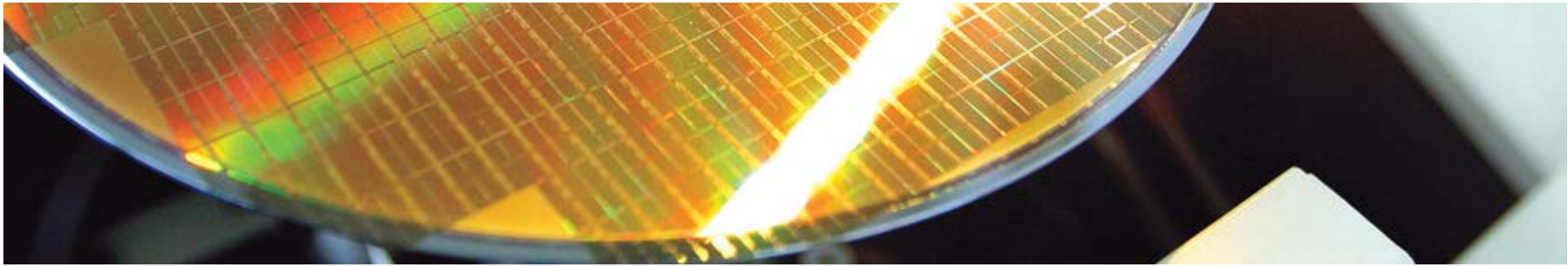
FFE300
Gencoa Ltd - 2015

semiconductor

products. process. support. **gencoa**

High performance components from Gencoa for Semiconductor Applications

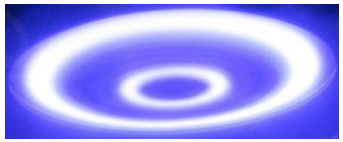
gencoa: perfect your process

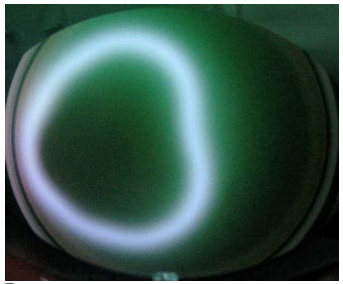


- New and retro-fit magnetrons and magnetics
- Reactive gas control & End Point Detection

Gencoa offer the following categories of products for ***static*** wafer coating

gencoa: perfect your process

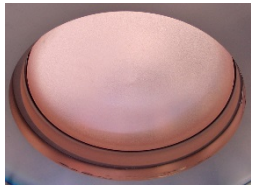


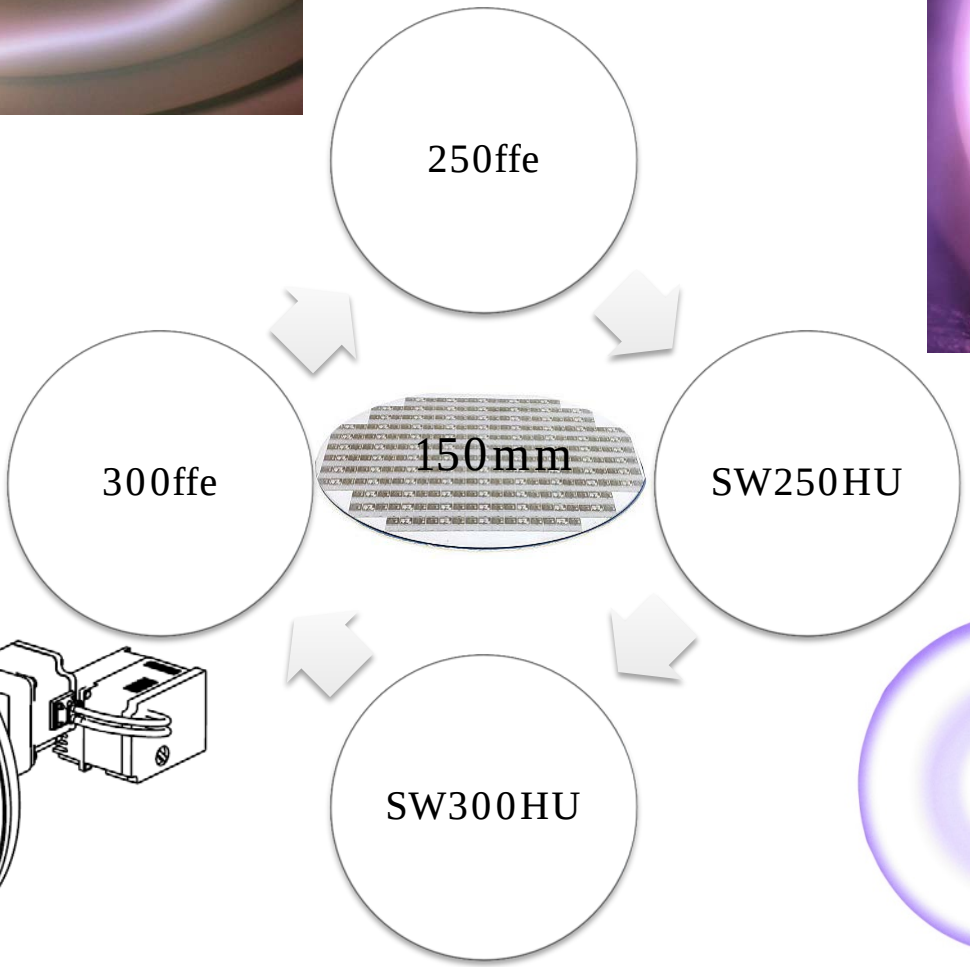


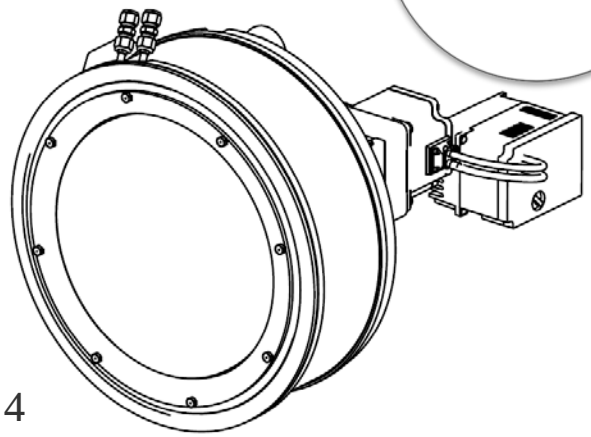
- 200mm
- 300mm
- Reactive Gas Control
- 150mm

150mm static wafer coating

gencoa: perfect your process

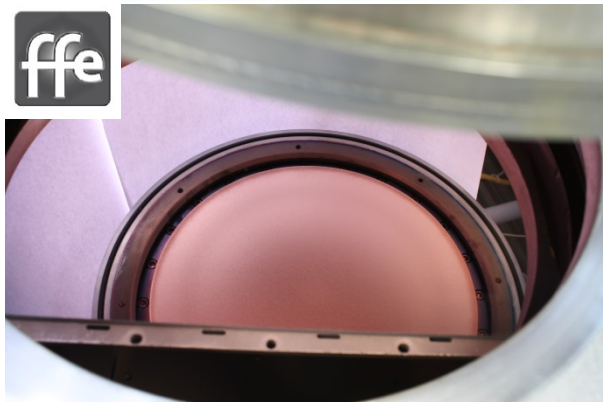


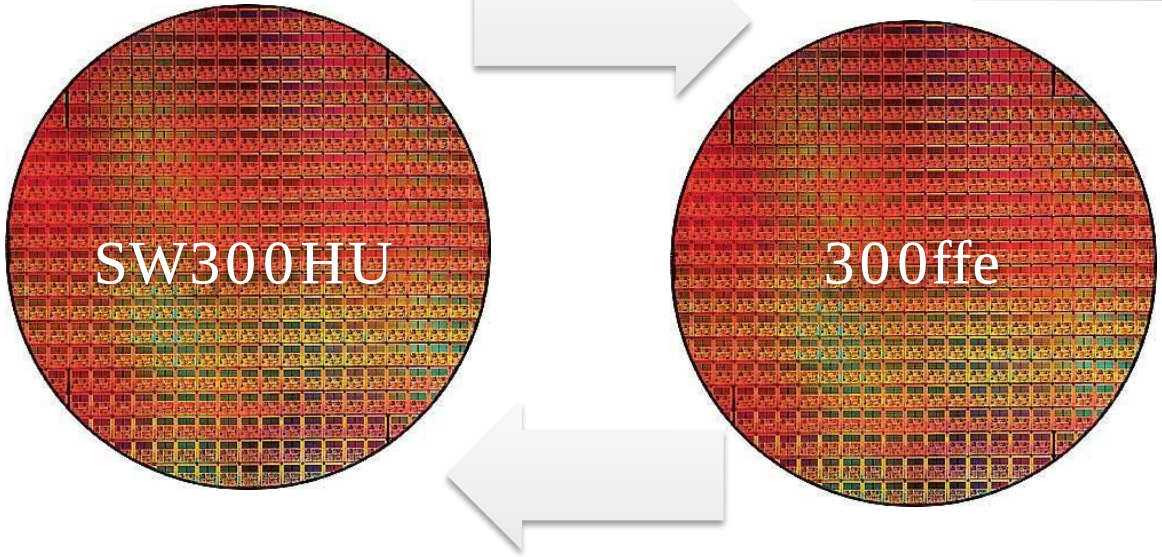




200mm static wafer coating

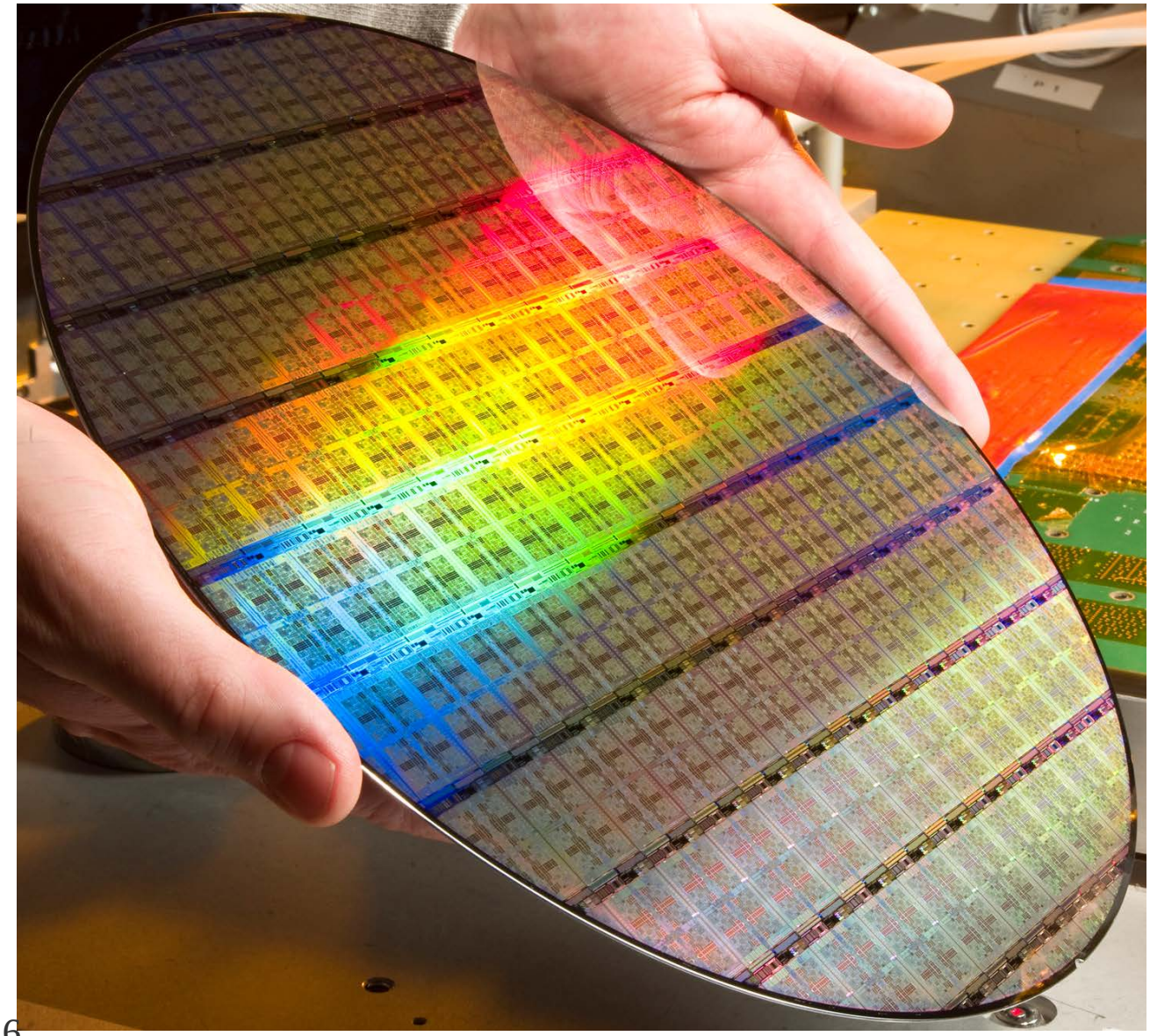
gencoa: perfect your process



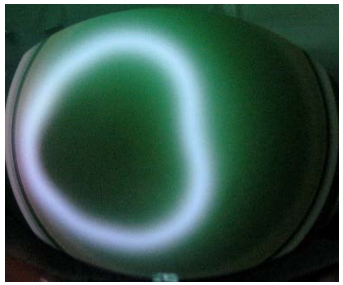


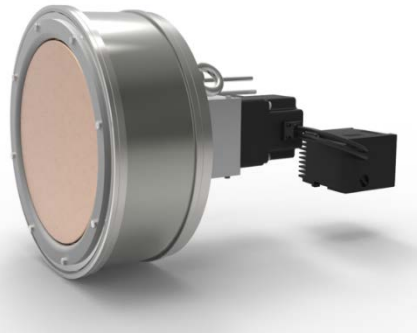
300mm static wafer coating

gencoa: perfect your process



400-450ffe



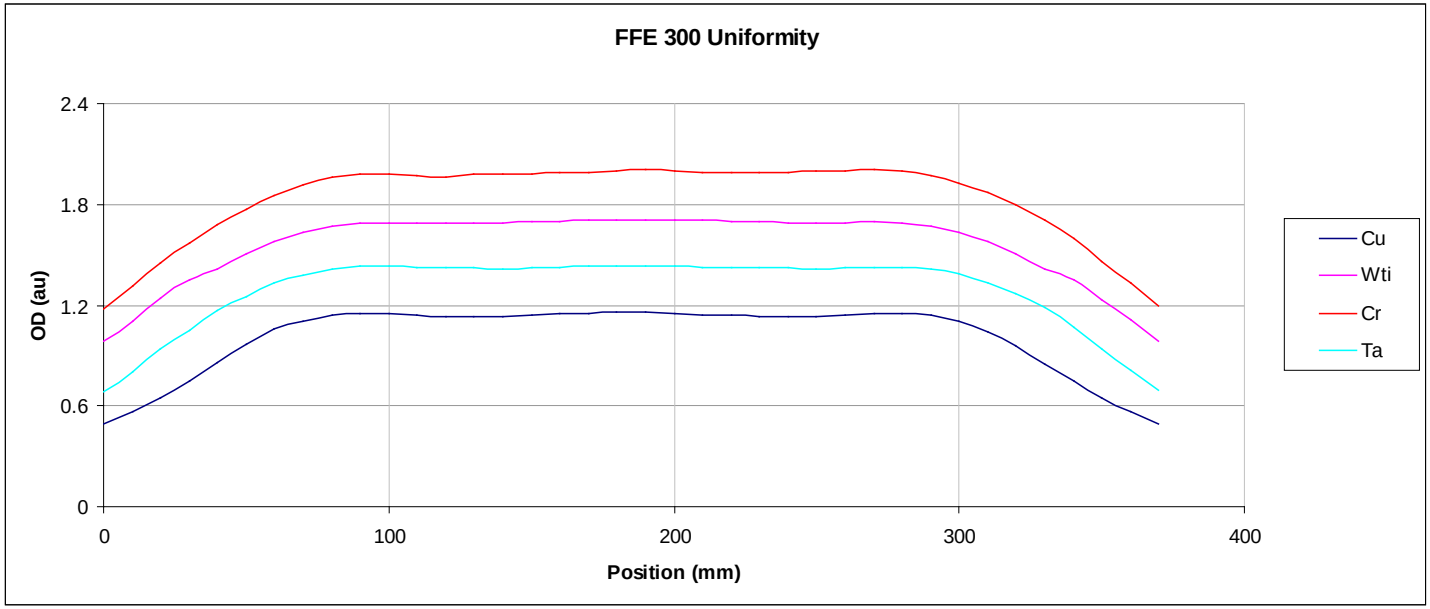


- No magnet pack in water – easily accessible
- Slow to Fast rotation of the magnets provides:
  - Uniformity tuning ability via speed control
  - Better arcs suppression – less time for charge-build-up at higher rotation speeds
  - Less layer defects from arc events
- Better than ±3% uniformity achievable for wafers upto 200mm(8”) diameter
- Same magnetic pack suitable for different materials (ferro-magnetic targets require different magnetics)
- Consistent coating uniformity throughout target life
- All vacuum and water seals are static – no rotation, hence no wear and leaking with time which maximizes up-time and minimizes maintenance costs
- High power capacity – high flow and directly cooled targets – optional indirectly cooled targets
- RF and Hipims power mode option

Gencoa FFE300

gencoa: perfect your process

One Magnetic pack for different material

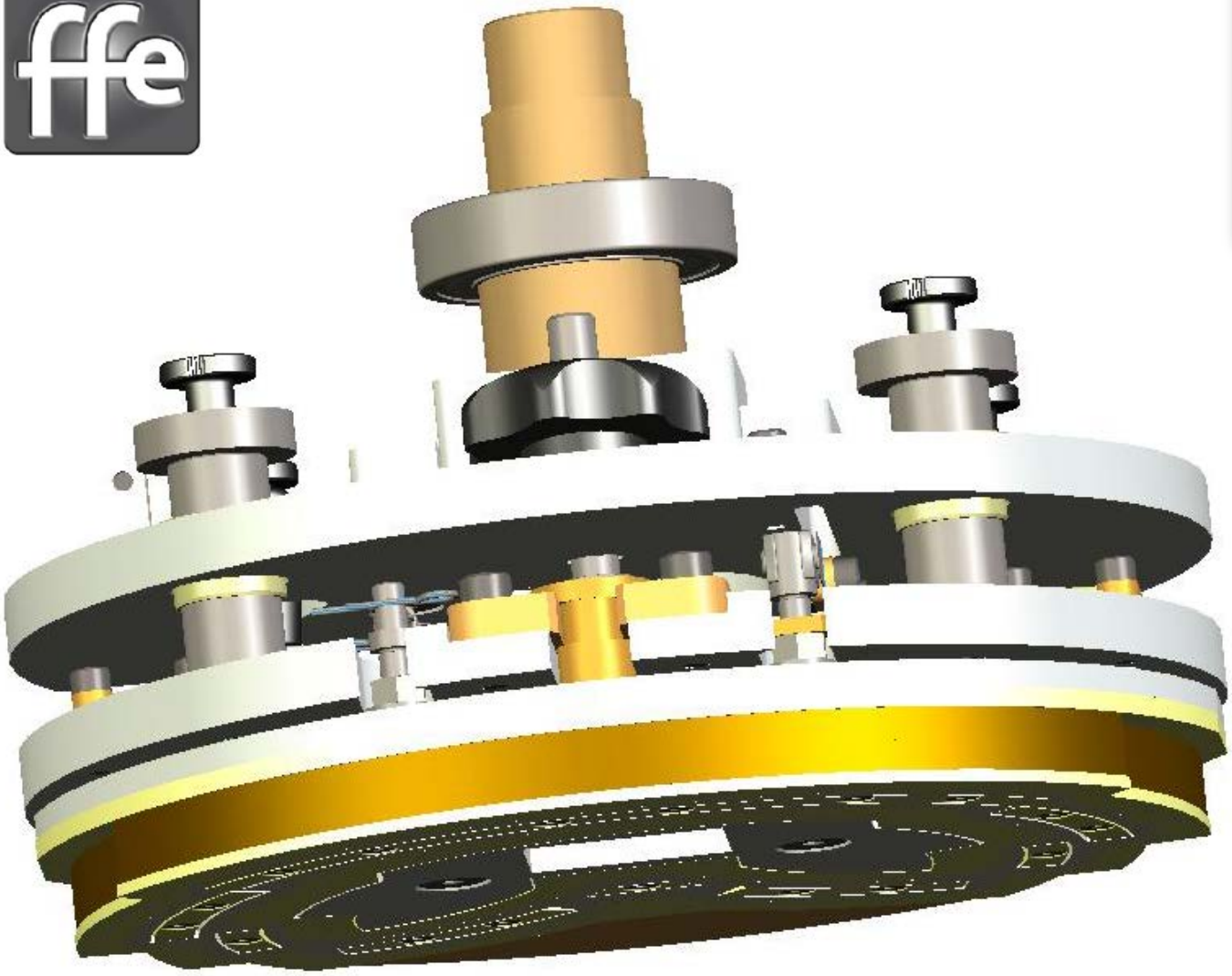


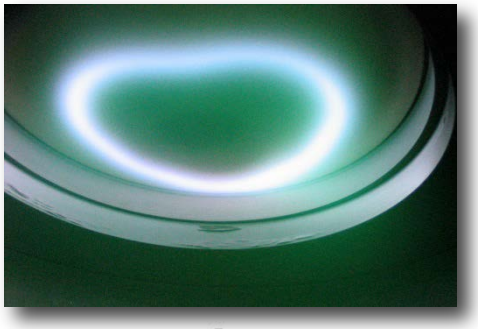
Uniformity over 200mm @150rpm

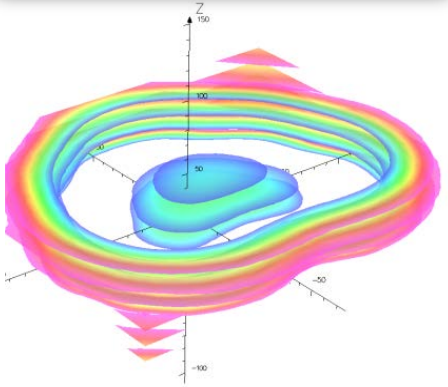
Cr	2.00%
WTi	1.90%
Ta	1.10%
Cu	1.60%

The SW300 FFE magnet packs create high uniformity with low defects at low target to substrate separations over static wafers

gencoa: perfect your process

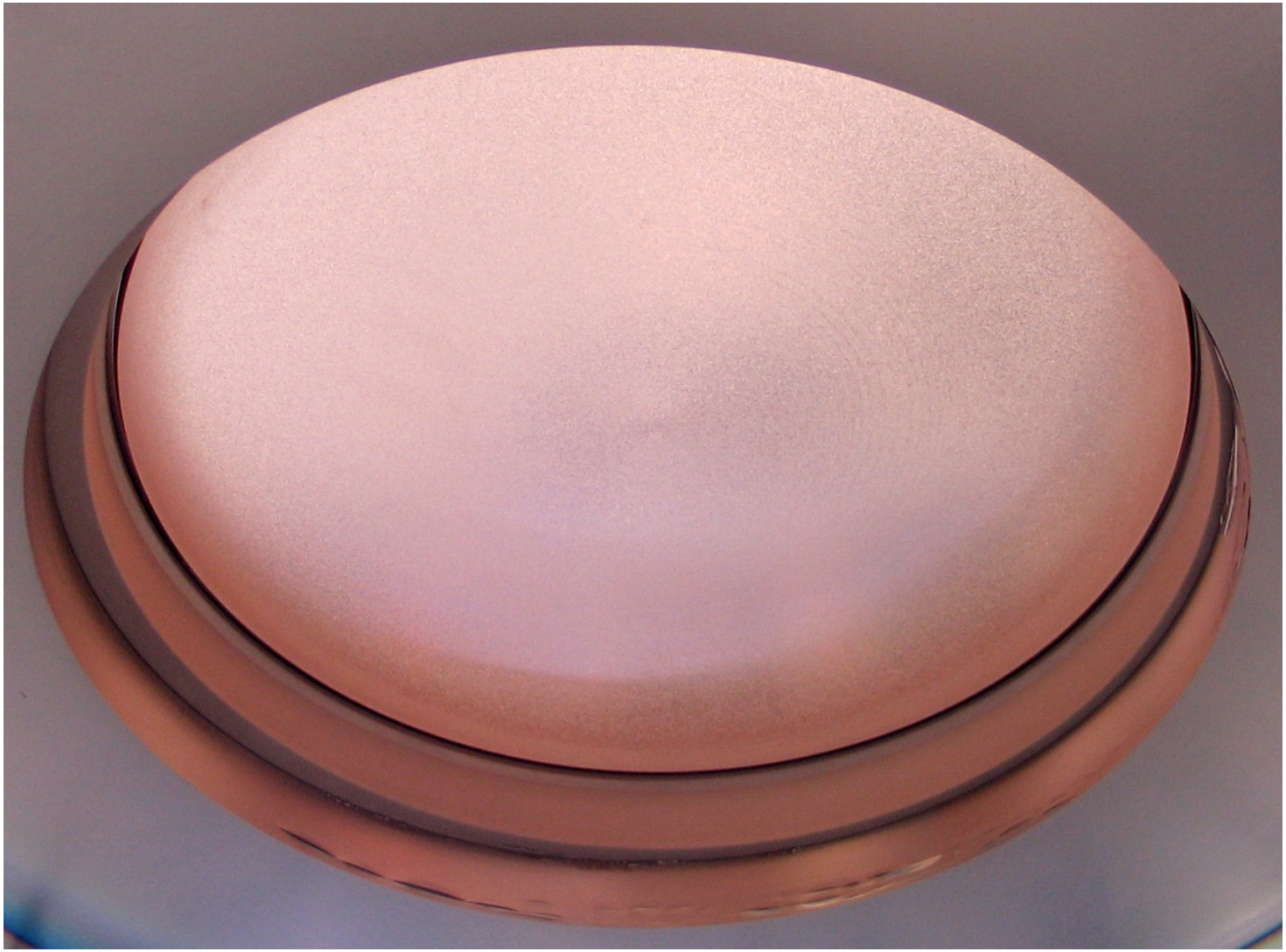






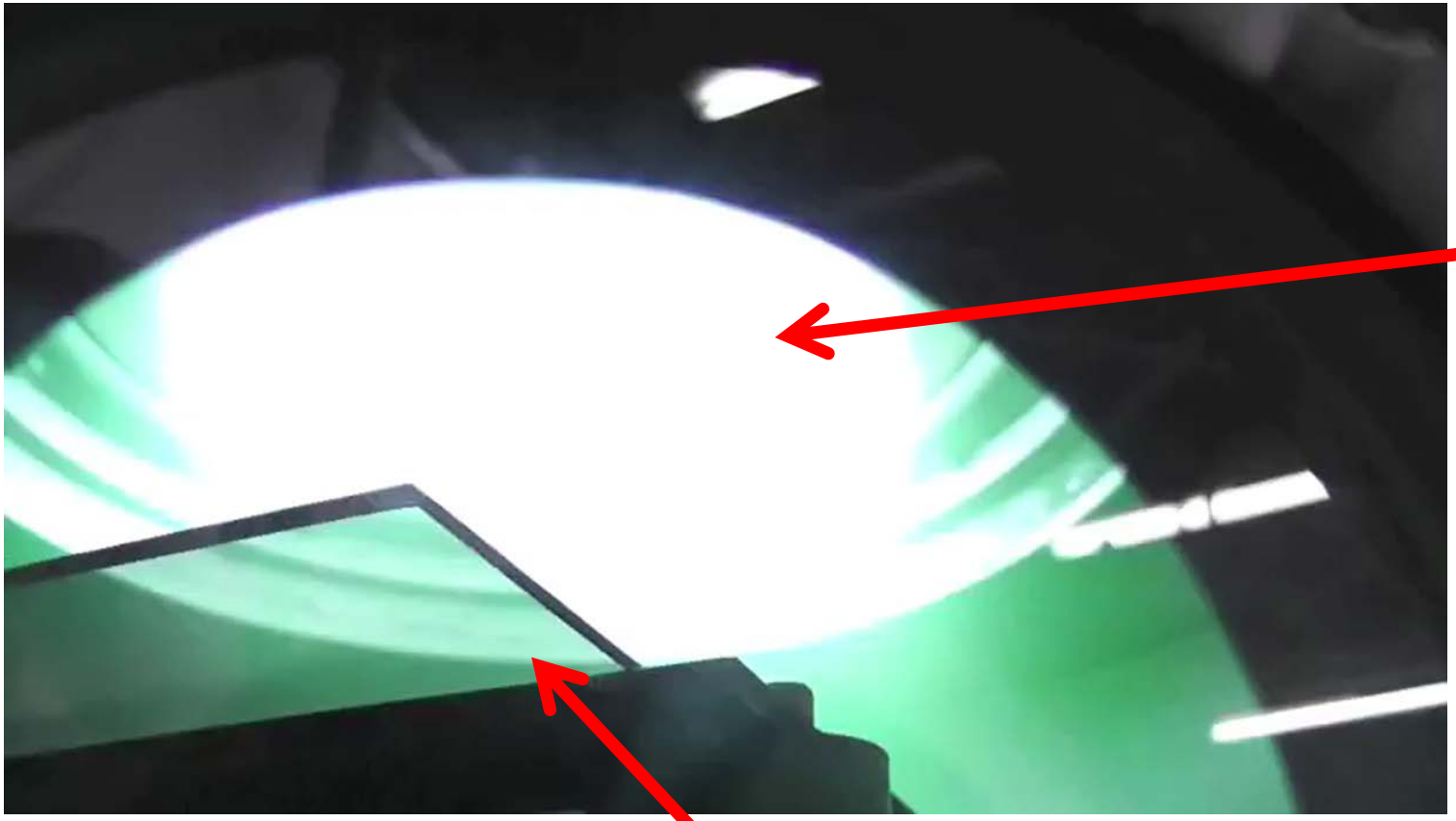
Target utilization can also be optimized via the magnetic design within the constraints of meeting the thickness uniformity spec.

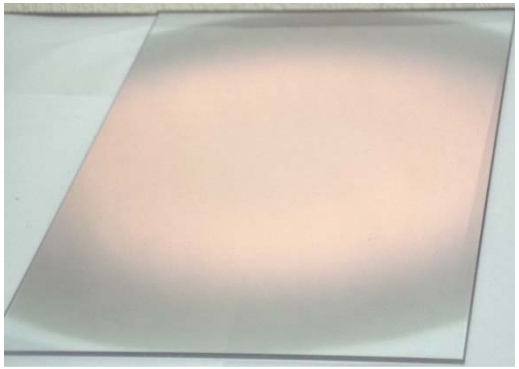
gencoa: perfect your process



FFE300 deposition tests

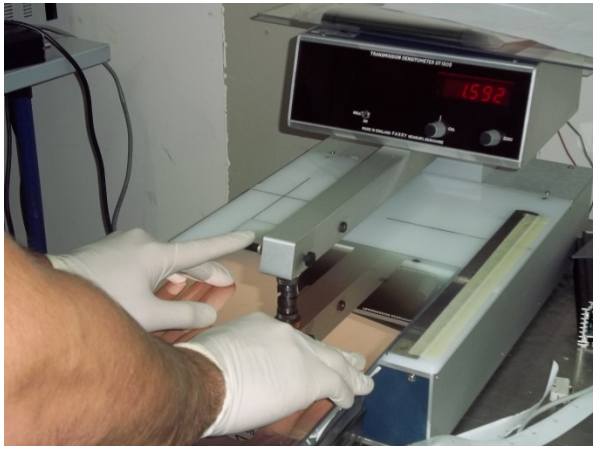
gencoa: perfect your process

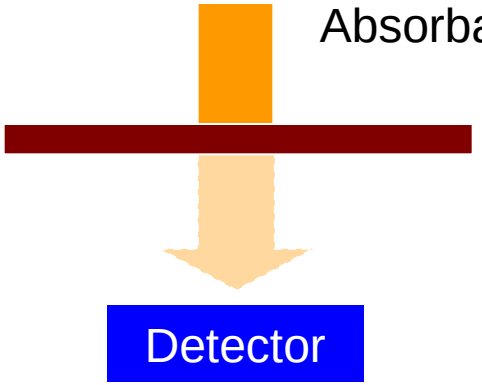




Optical density = Absorbance

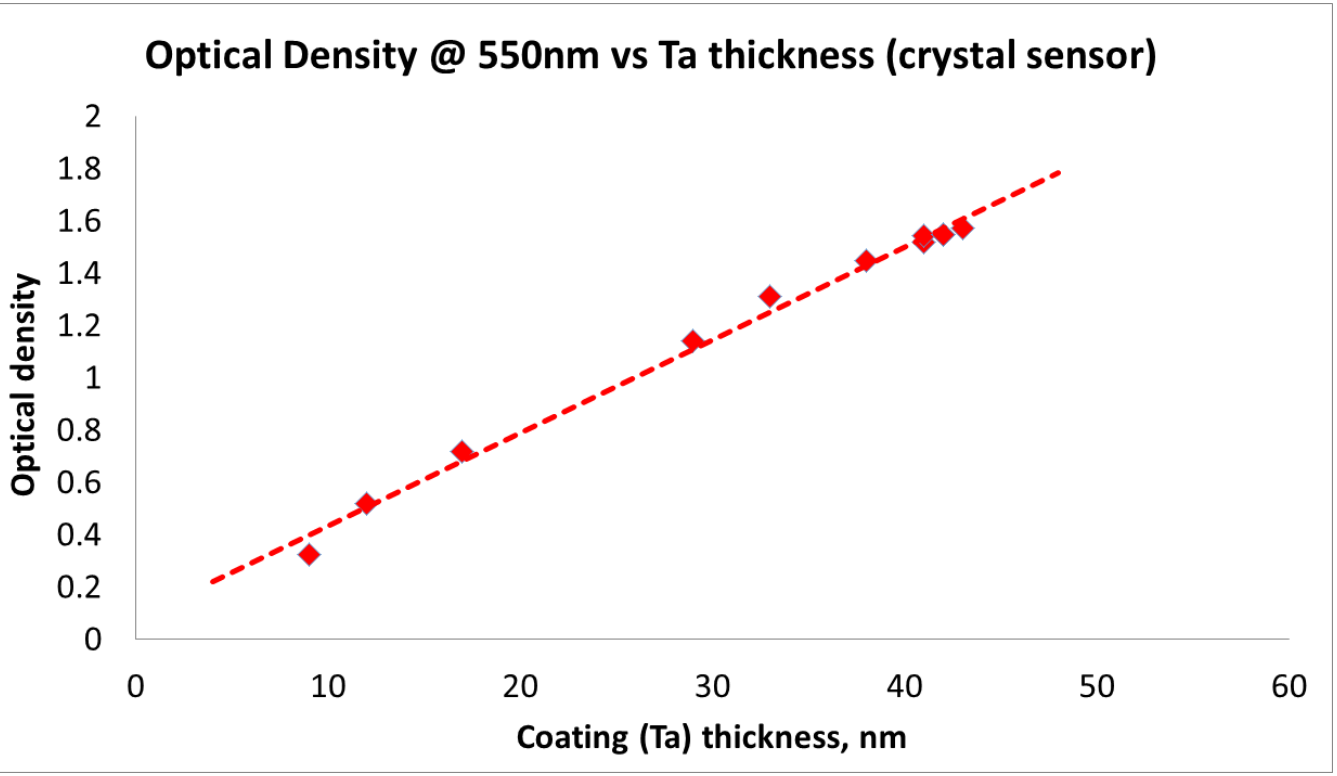
$$A_\lambda = \log_{10}(I_0/I) = -\log_{10}(T)$$





Optical Density Measurements

gencoa: perfect your process



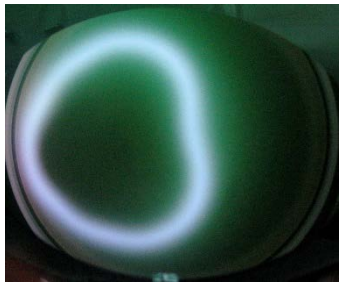
Example of FFE300 deposited Ta coating Optical density (@ 550nm) versus the ta thickness as measured by crystal sensors.

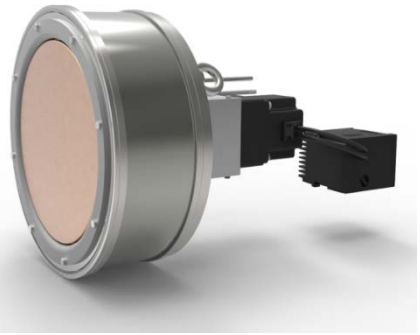
Because the light transmittance decreases exponentially as it travels through the material then the Optical density (OD) is proportional to thickness.
For accuracy we would like to be ~ 1 in OD(Transmittance >~ 10%)

Gencoa 300FFE

gencoa: perfect your process

Flexible uniformity control

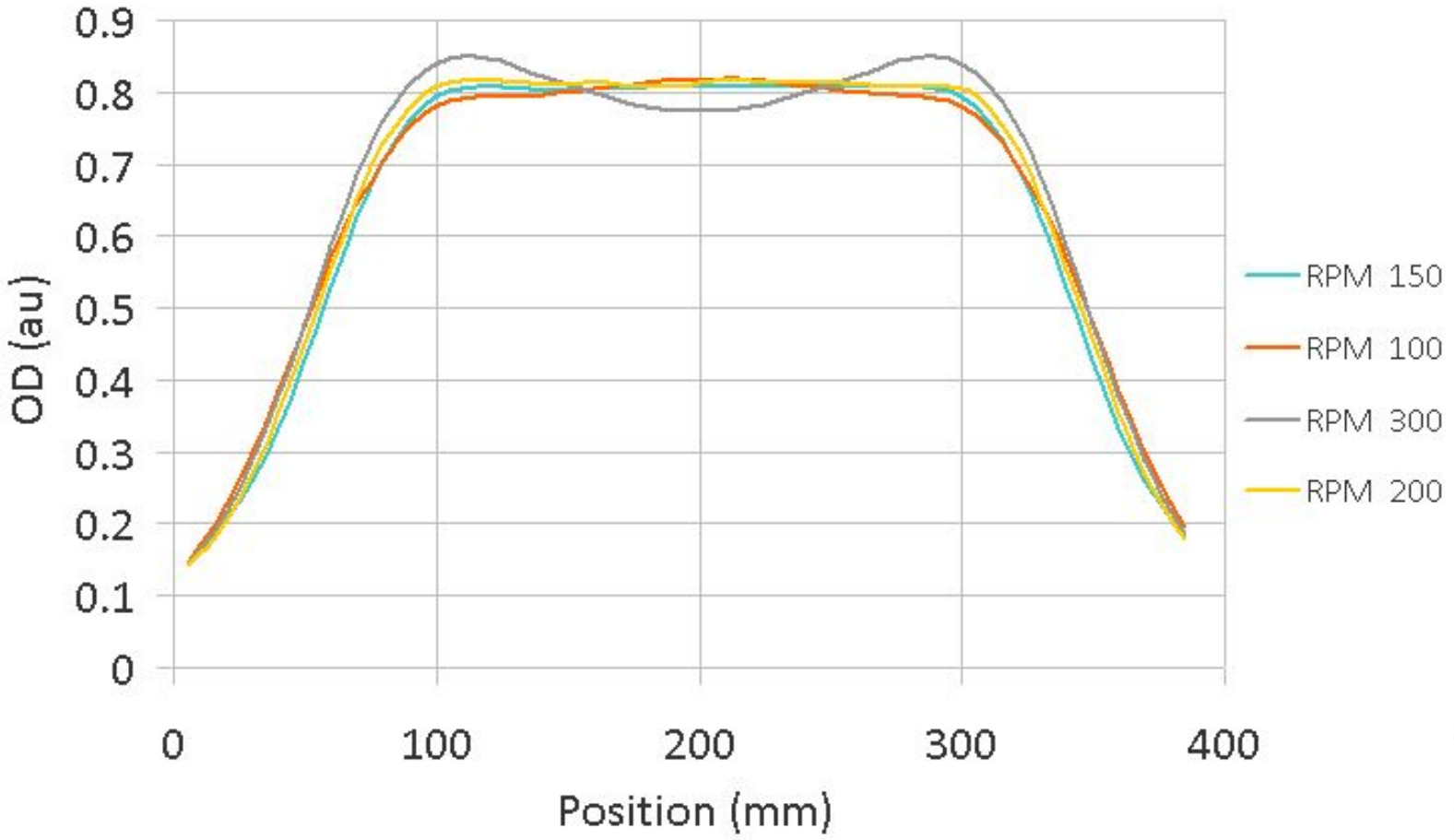




- Three different methods to adjust uniformity

1. Varying rotational speed of the array (50-450 rpm)
2. Adjusting position of the magnetic pack relative to the central axis of rotation – mechanical change
3. Use shunts to tune magnetics – mechanical change
4. Combination of methods 1,2 &3

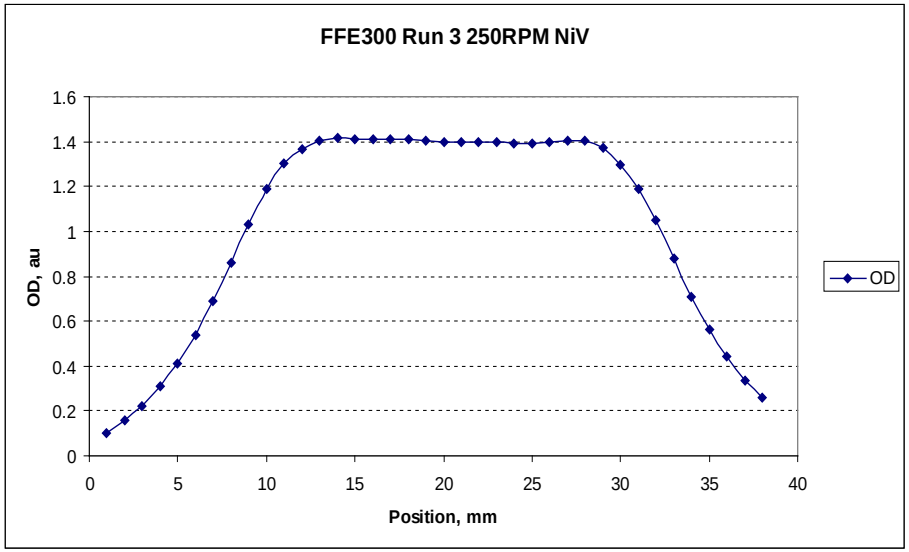
The ability to tune uniformity via speed variation is a powerful aid helping the adjustment of uniformity with target life

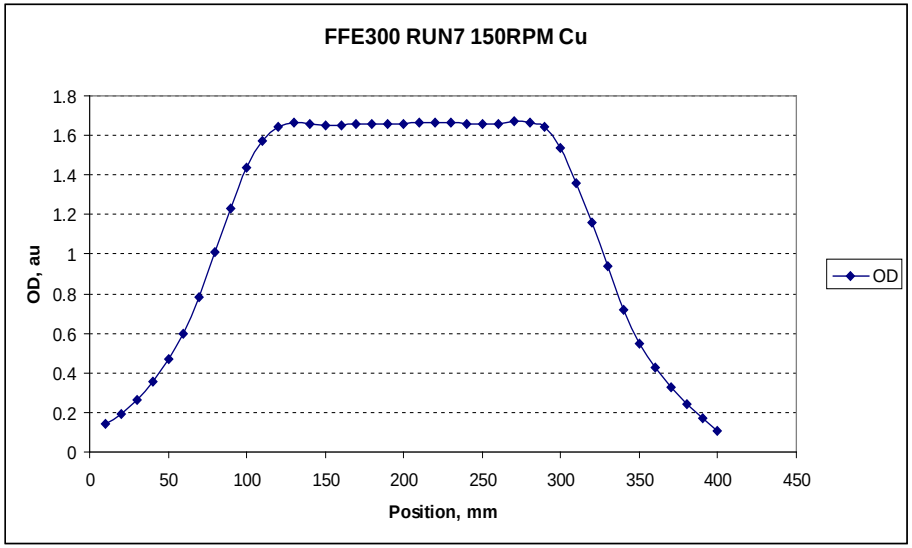


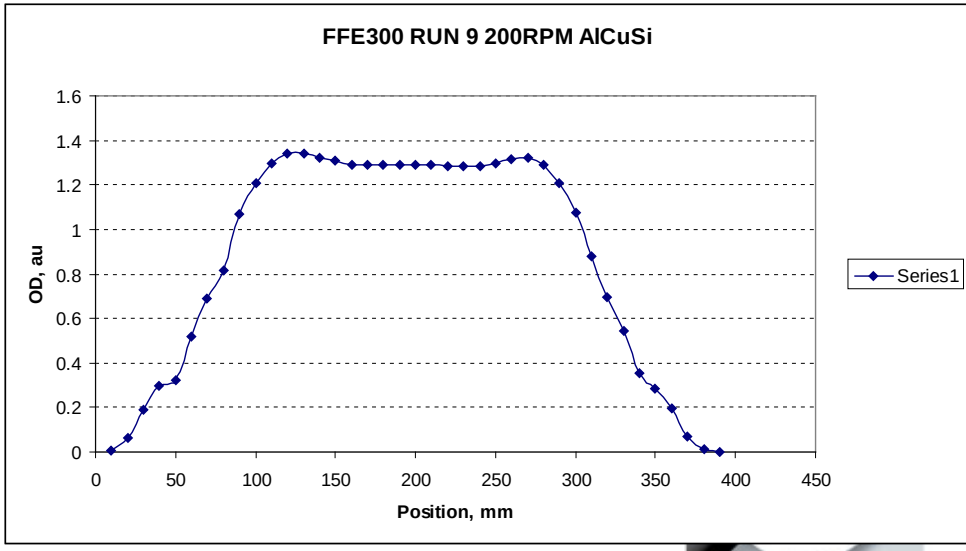
Examples of different speed settings for different materials to tune uniformity for

gencoa: perfect your process

NiV, Ti, Cu & AlCuSi to <±2%







Adjustments to tune uniformity

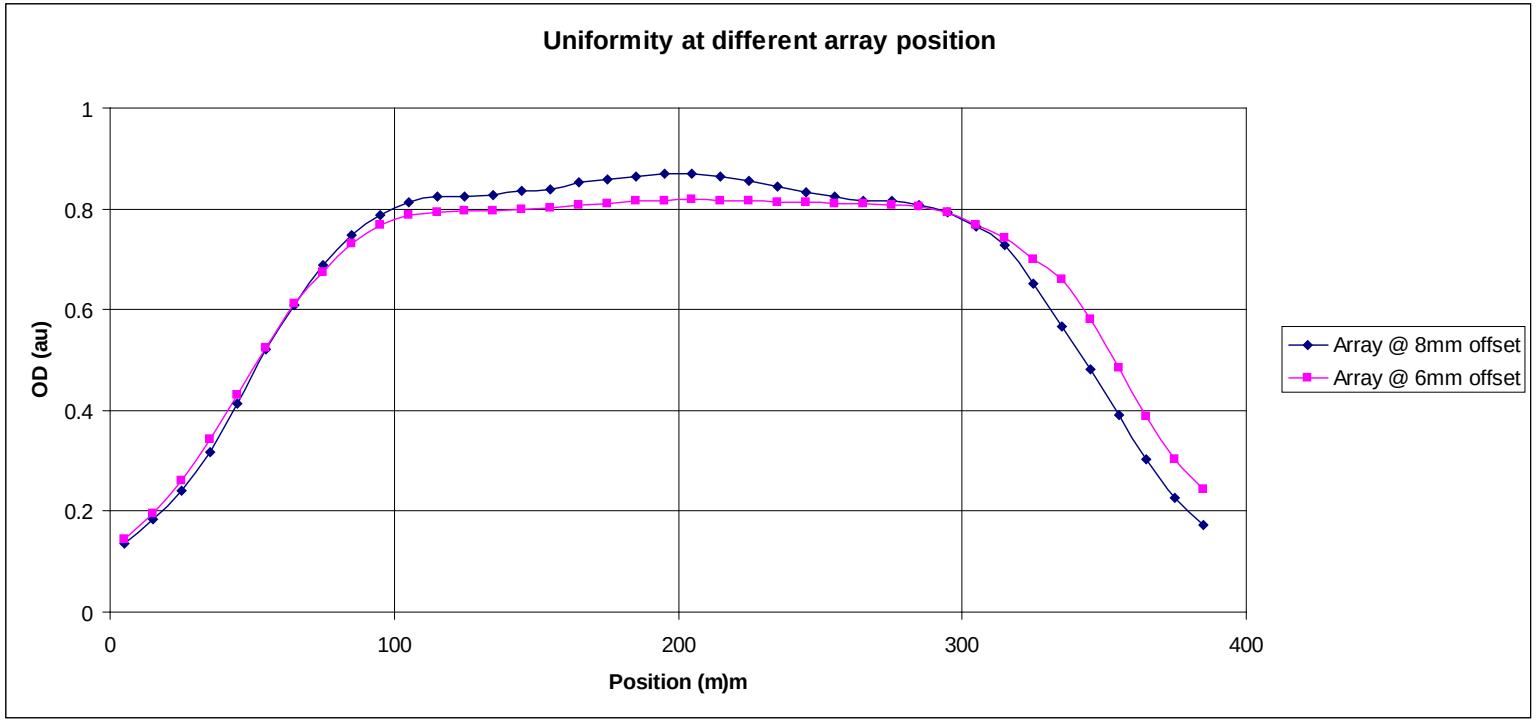
Varying the location of the magnetic pack.

- Lead screw adjustment can be used to vary the position of the magnetic pack relative to the central axis of rotation.
- Design allows easy accessibility to the lead screw .

Adjustments to tune uniformity

Varying the location of the magnetic pack.

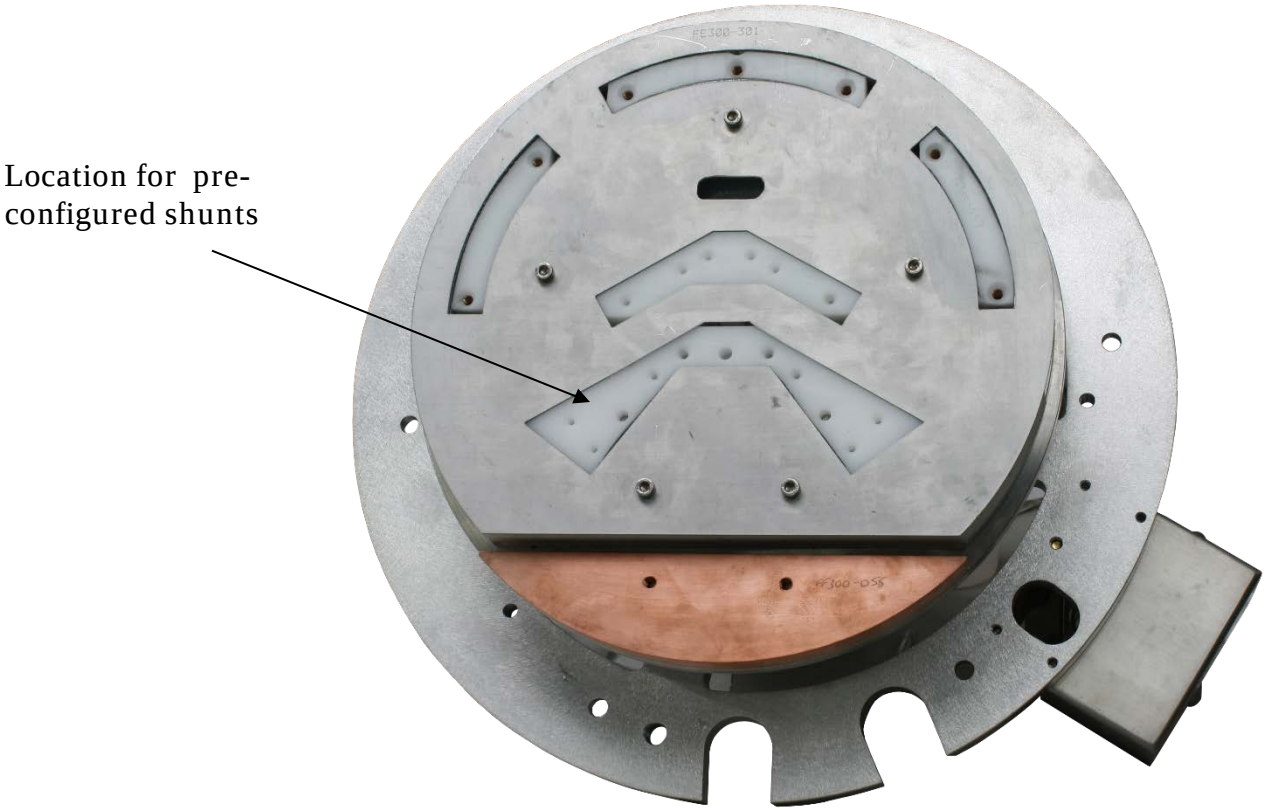
In-house testing has proved that by moving the array by 2mm, the uniformity measurement over 200mm changed by ±1.68%.



Uniformity over 200m at 8mm offset:-4.95%

Uniformity over 200m at 6mm offset:-3.27%

- In built design features to place pre-configured shunts for ultra fine tuning.
- Requires lifting of the magnetic pack from the source.



Typical deposition rate

Target	Deposition Rate (nm/min/kw)	T-S (mm)
Cr	85.71	60
Ti	57.14	66
NiV(10%)	107	60
Au	280	60
Ni	83.2	60

Target:	Cr
Run No.:	
Pressure	3.30E-03
RPM	100
Gas (Ar)	45%
Shunting	N/A
Power	2800W
Time	90 s
Array	Original
Array offset	0
T/S mm	60
S/N	S01533-FE-02

Crystal sensors
Quartz-gold

Average deposition rate= 240 nm/min

- Cr deposition rate is >200 nm/min at 2.8 kW

Target:	Ti
Run No.:	103
Pressure	4.3E-03 Torr
RPM	300
Gas (Ar)	65%
Shunting	none
Power	2800W
Time	150 s
Array	FE-03
Array offset	5
T/S mm	60
S/N	S0141-FE-03

Crystal sensors
Quartz-gold

Average deposition rate at 2.8 kW~ 160 nm/min

- Ti deposition rate is >140 nm/min at 2.8

FFE300 – Ni target

gencoa: perfect your process

Deposition rate test

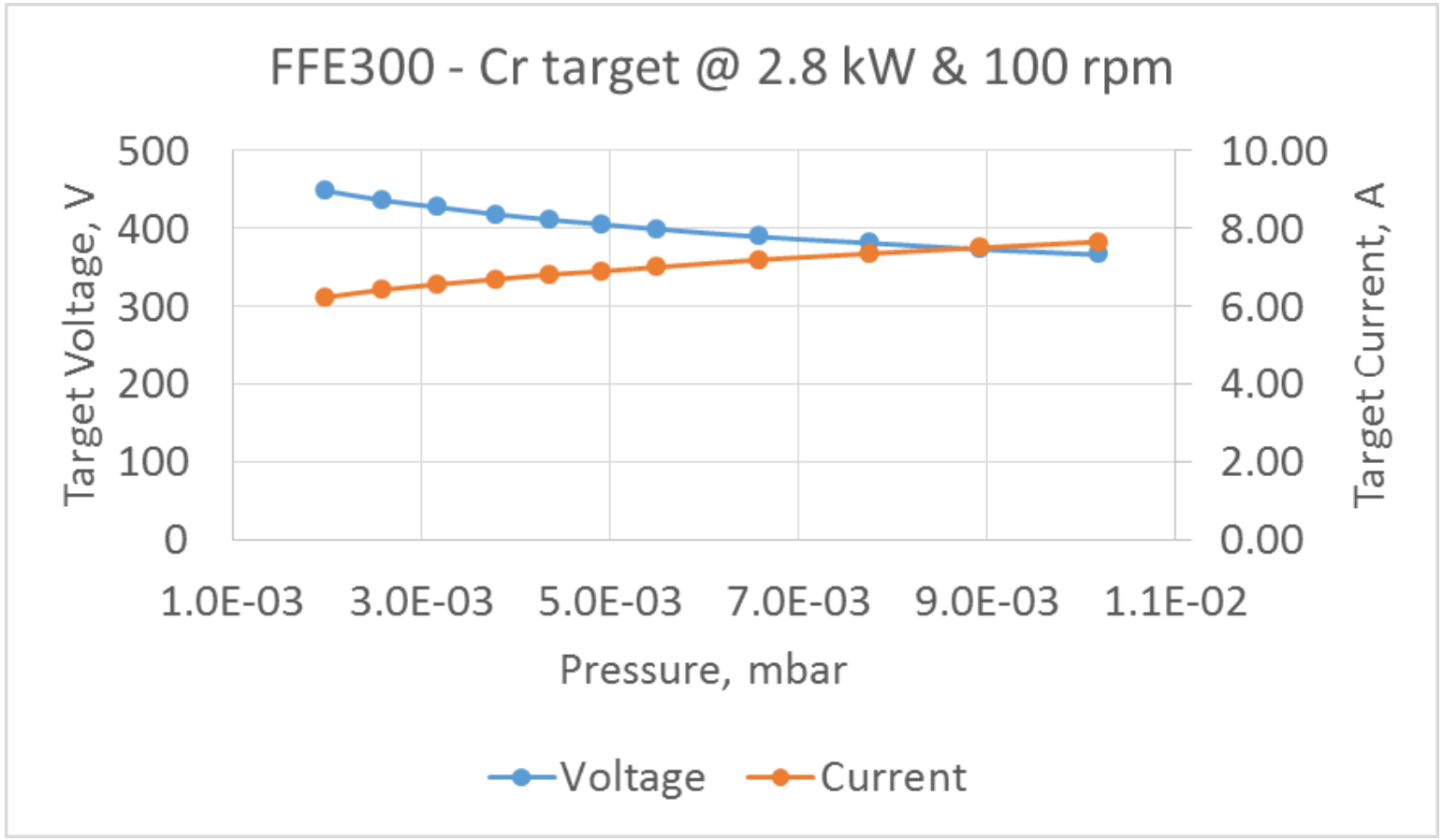
Target:	Ni
Run No.:	306
Pressure	6.0E-03 Torr
RPM	**60**
Gas (Ar)	30%
Shunting	N/A
Power	2800W
Time	150 s
Array	h202x1.5c-Hear
Array offset	5
T/S mm	60
S/N	S0141-FE-01

Crystal sensors
Quartz-gold

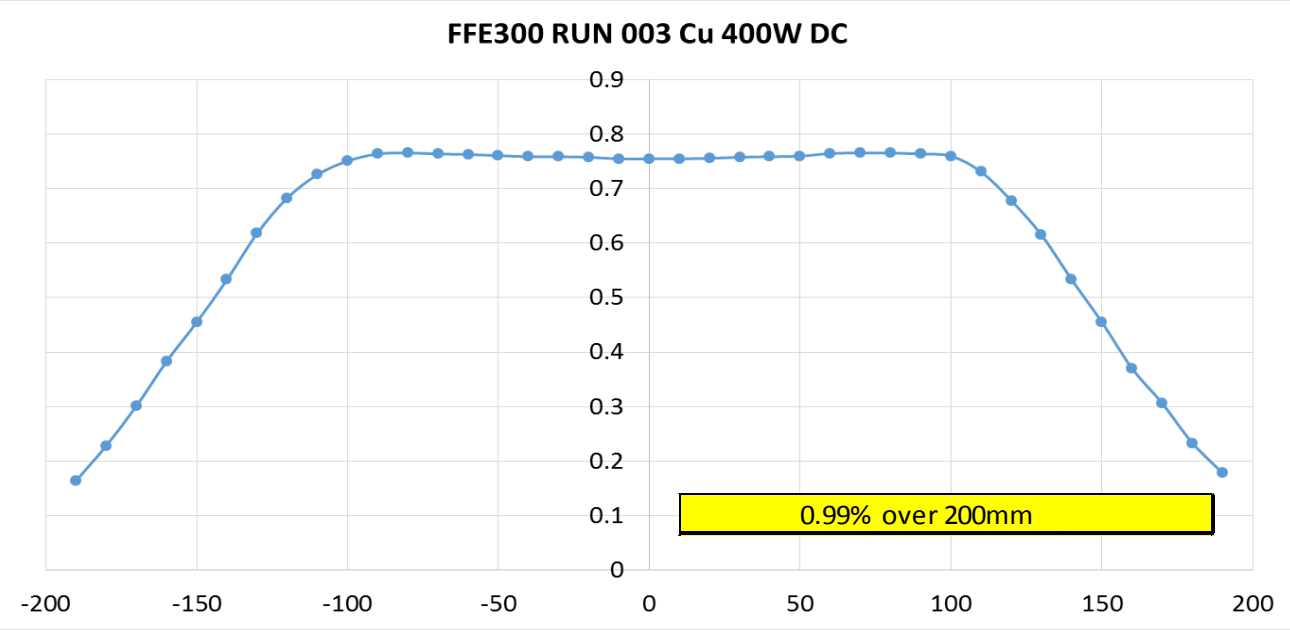
Average deposition rate at 2.8 kW~ 233 nm/min

- Ni deposition rate is >200 nm/min at 2.8 kW

- On/off tests @ 2.8 kW & 100 rpm were all on for the pressure range: 2E-3 mbar to 1.0E-2 mbar



Target:	Cu
Run No.:	002
Pressure	3E-03 Torr
RPM	200
Gas (Ar)	45%
Shunting	N/A
Power	400W
Time	31s
Array	FE-01
Array offset	0
T/S mm	60
S/N	S01533-FE-02



Position in mm vs Optical Density

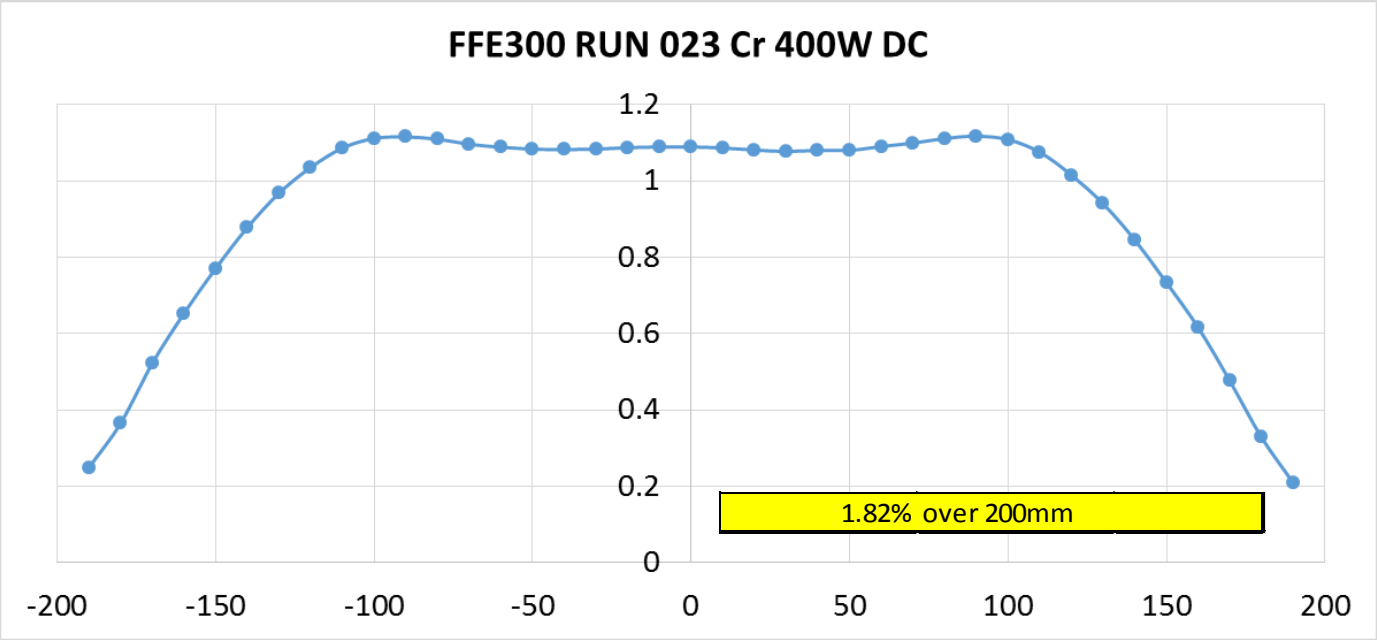
Initial tests typically carried out with a copper target.

FFE300 – Cr target

gencoa: perfect your process

Uniformity test

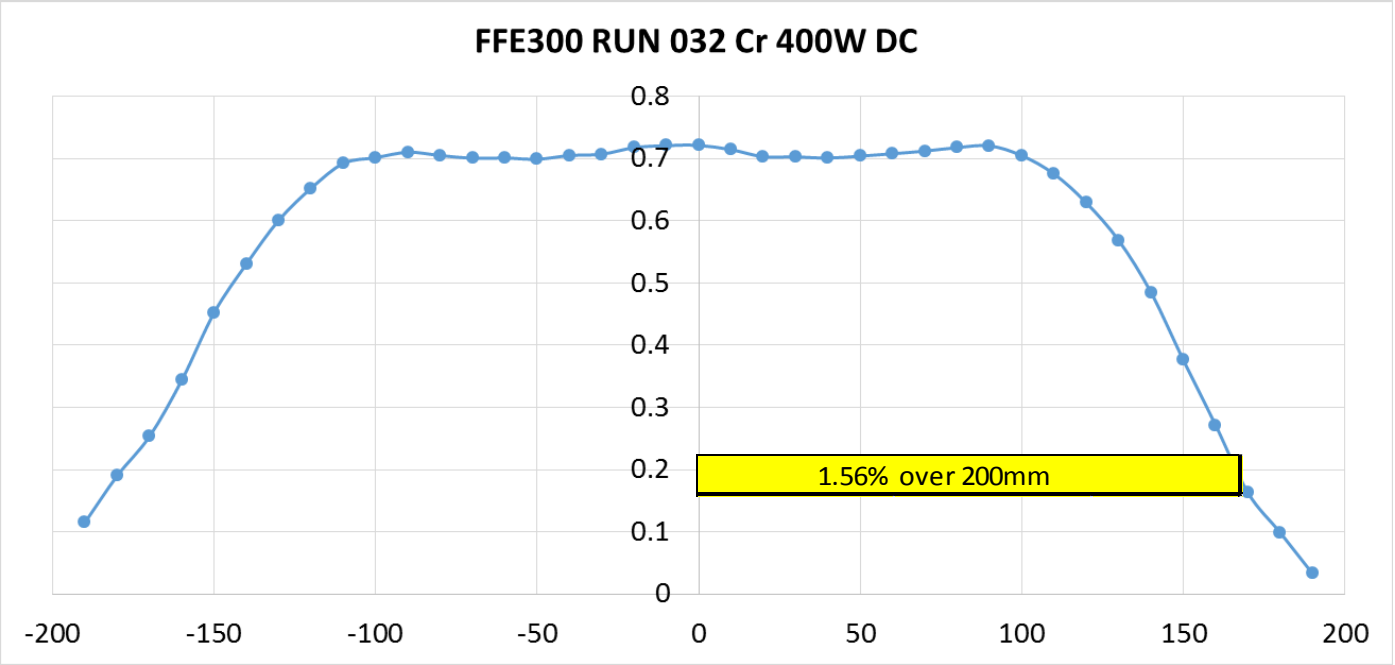
Target:	Cr
Run No.:	023
Pressure	3.30E-03
RPM	100
Gas (Ar)	45%
Shunting	N/A
Power	400W
Time	35s
Array	FE-01
Array offset	0
T/S mm	60
S/N	S01533-FE-02



Position in mm vs Optical Density

- Cr uniformity at the beginning of target life is <= +/- 3%

Target:	Cr
Run No.:	032
Pressure	2.9E-03
RPM	150
Gas (Ar)	45%
Shunting	
Power	400W
Time	35S
Array	FE-01b
Array offset	5
T/S mm	60
S/N	S01533-FE-02

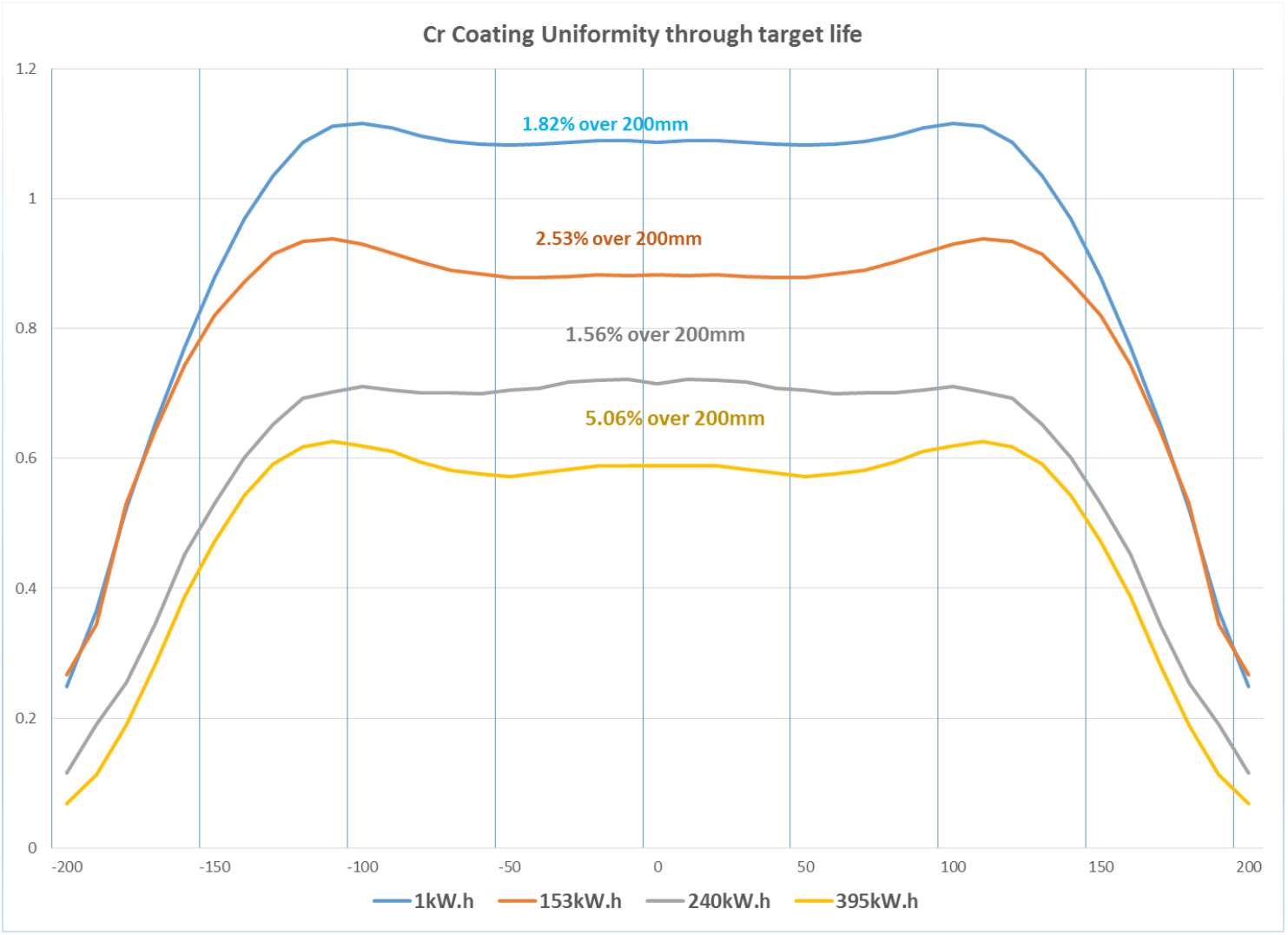


Position in mm vs Optical Density

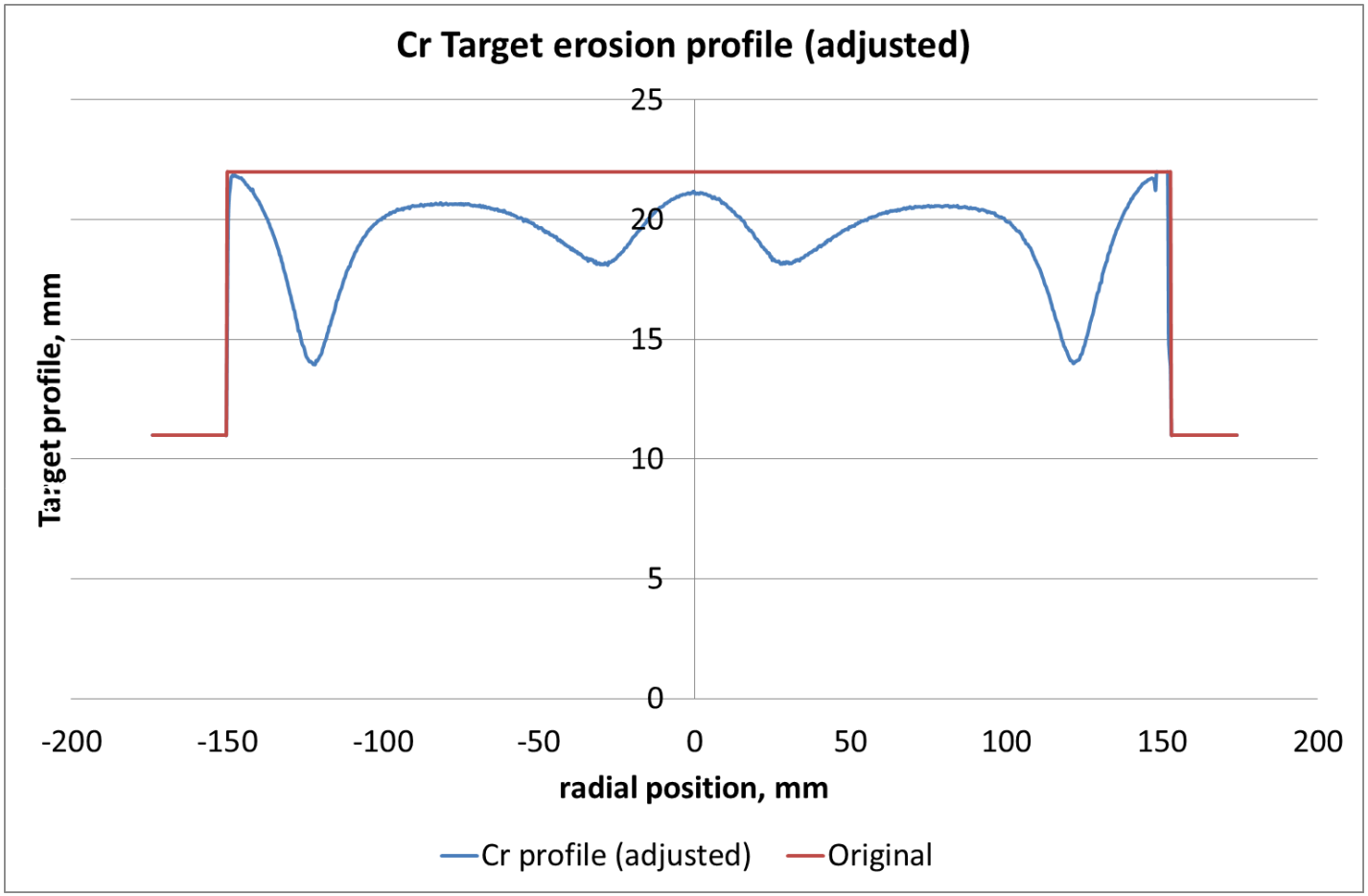
- Cr uniformity out at 240 kW.h +/- 1.6%

gencoa: perfect your process

Cr Uniformity over full target life



Final target Profile



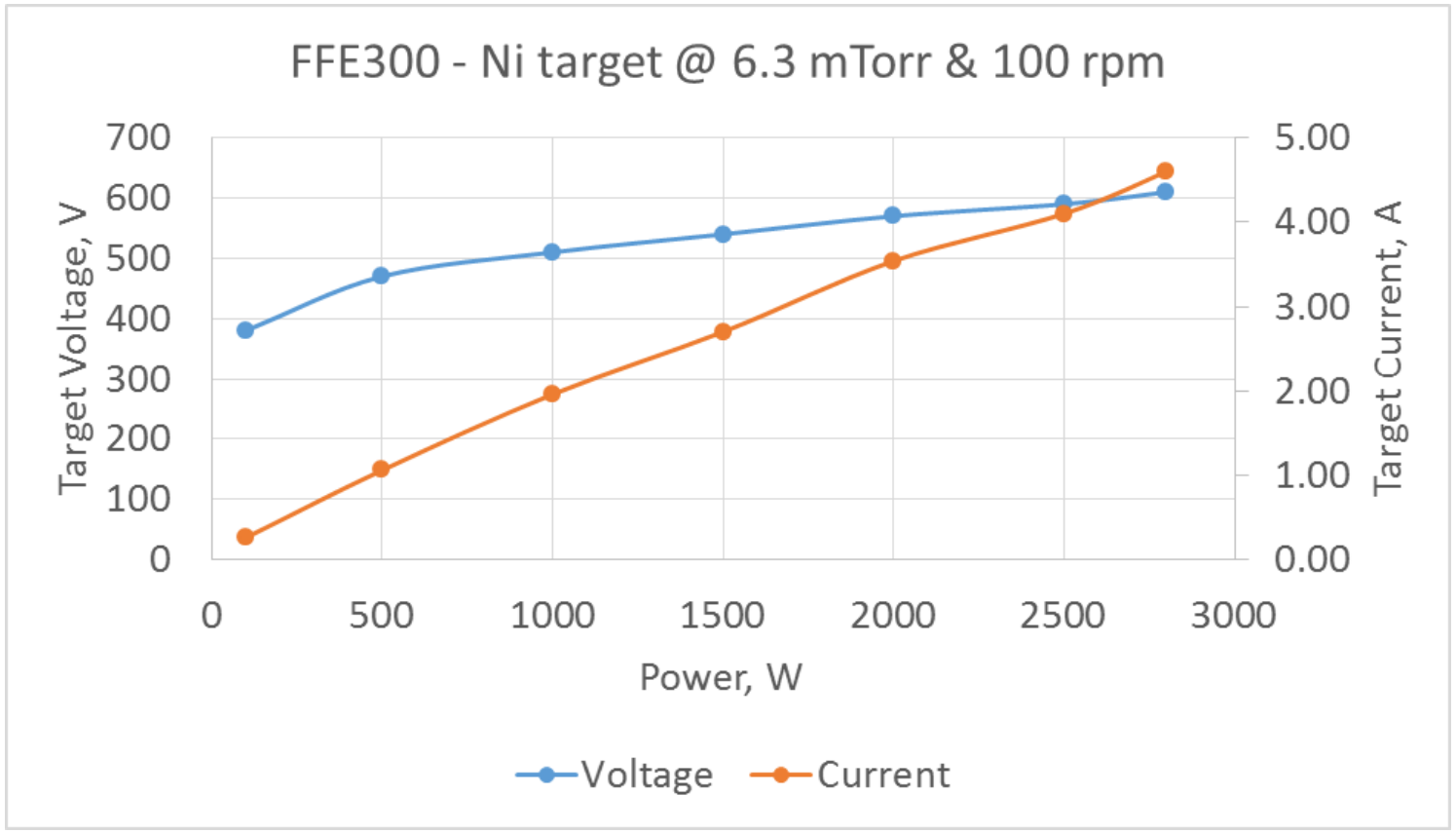
- Cr target utilisation (from profile): 38%
- Maximum depth from original: 7.5 mm

DATA ADJUSTED FROM LASER SCANNING MEASUREMENTS

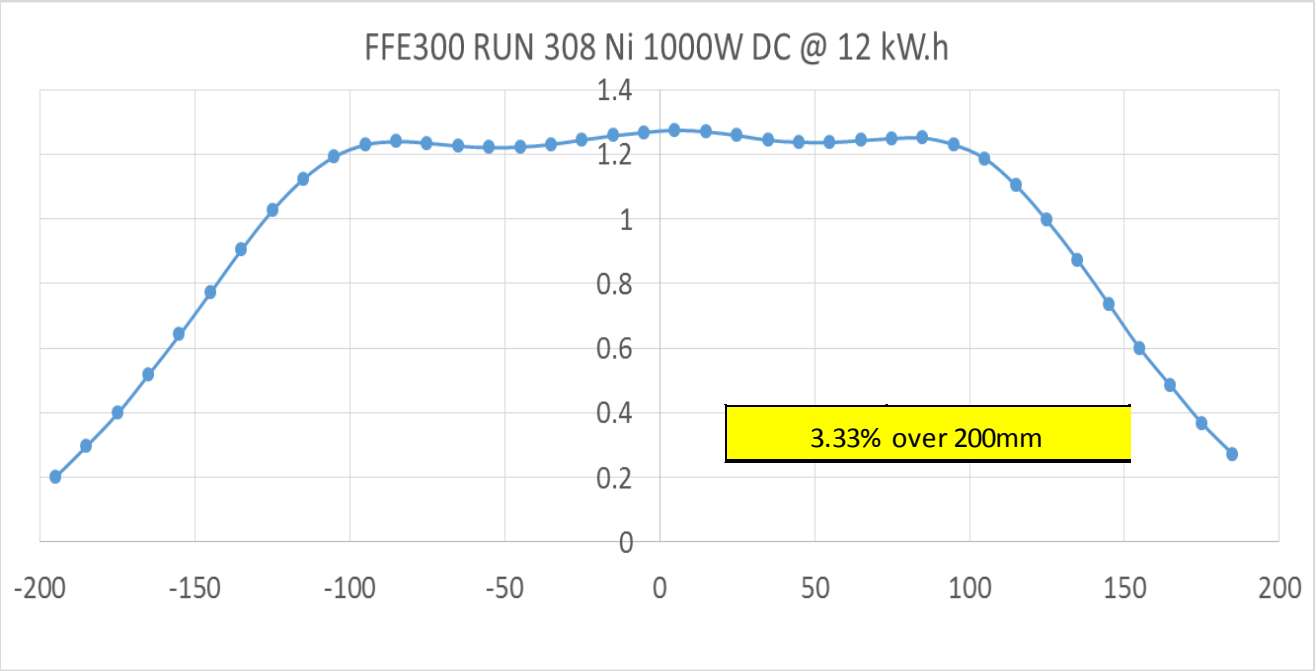
FFE300 – Ni target

gencoa: perfect your process

V / I curves



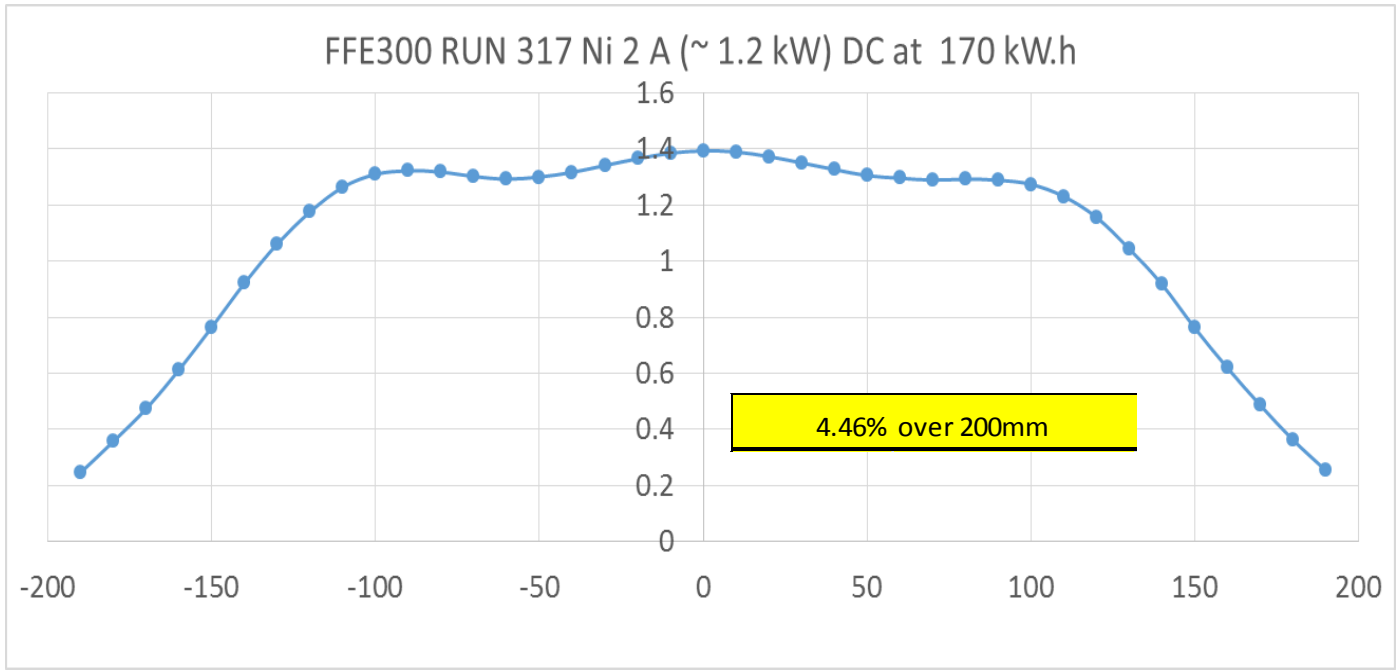
Target:	Ni
Run No.:	308
Pressure	6.0E-03 Torr
RPM	**30**
Gas (Ar)	30%
Shunting	N/A
Power	1000W
Time	22 s
Array	h202x1.5c-Hea
Array offset	5
T/S mm	60
S/N	S0141-FE-01



Position in mm vs Optical Density

As the target erodes the outer contribution increases, as this is the area of higher erosion depth

Target:	Ni
Run No.:	317
Pressure	6.0E-03 Torr
RPM	60
Gas (Ar)	30%
Shunting	N/A
Power	2 A (~1.2 kW)
Time	26 s
Array	h202x1.5c-Hear
Array offset	12.5
T/S mm	60
S/N	S0141-FE-01

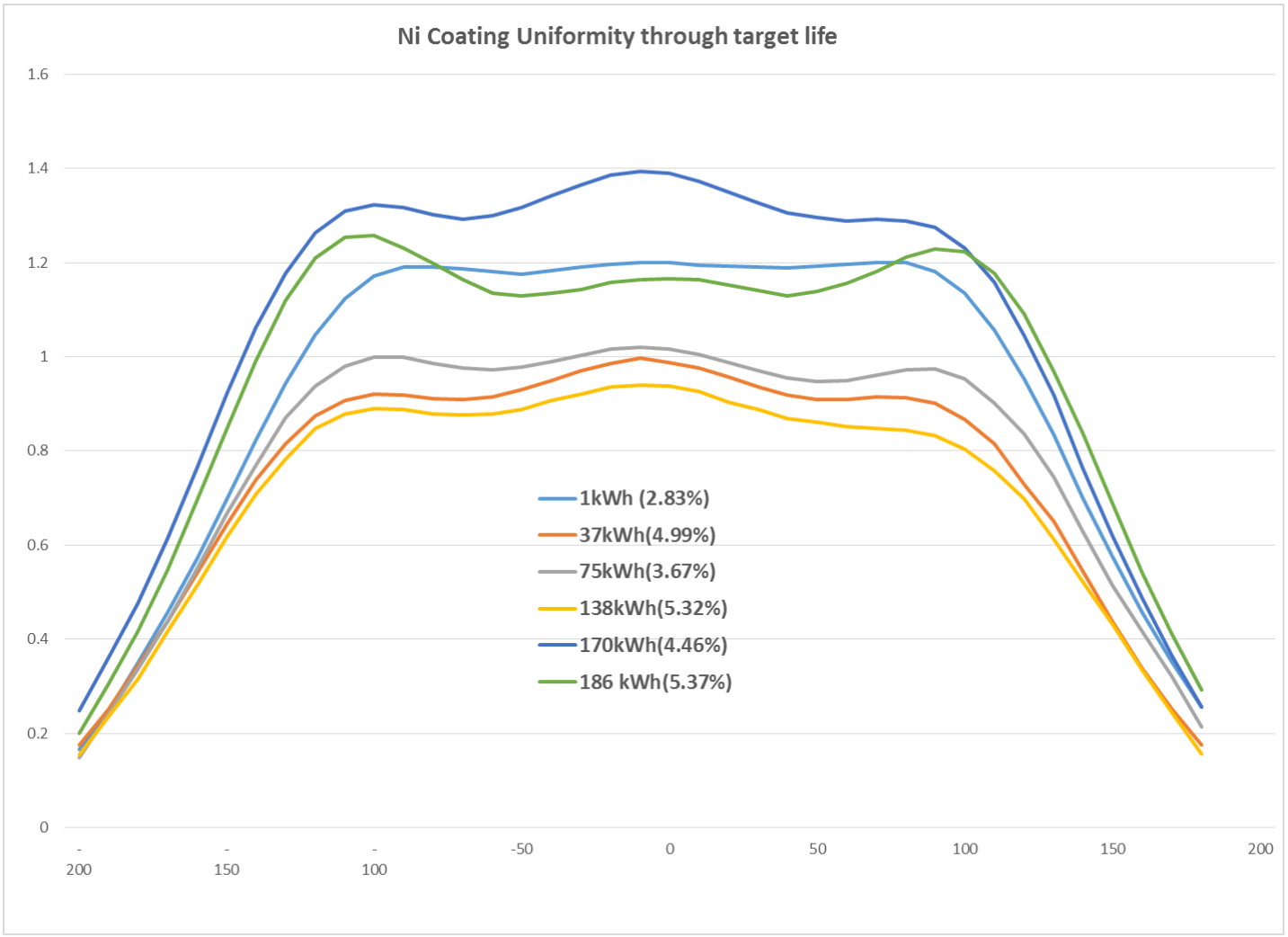


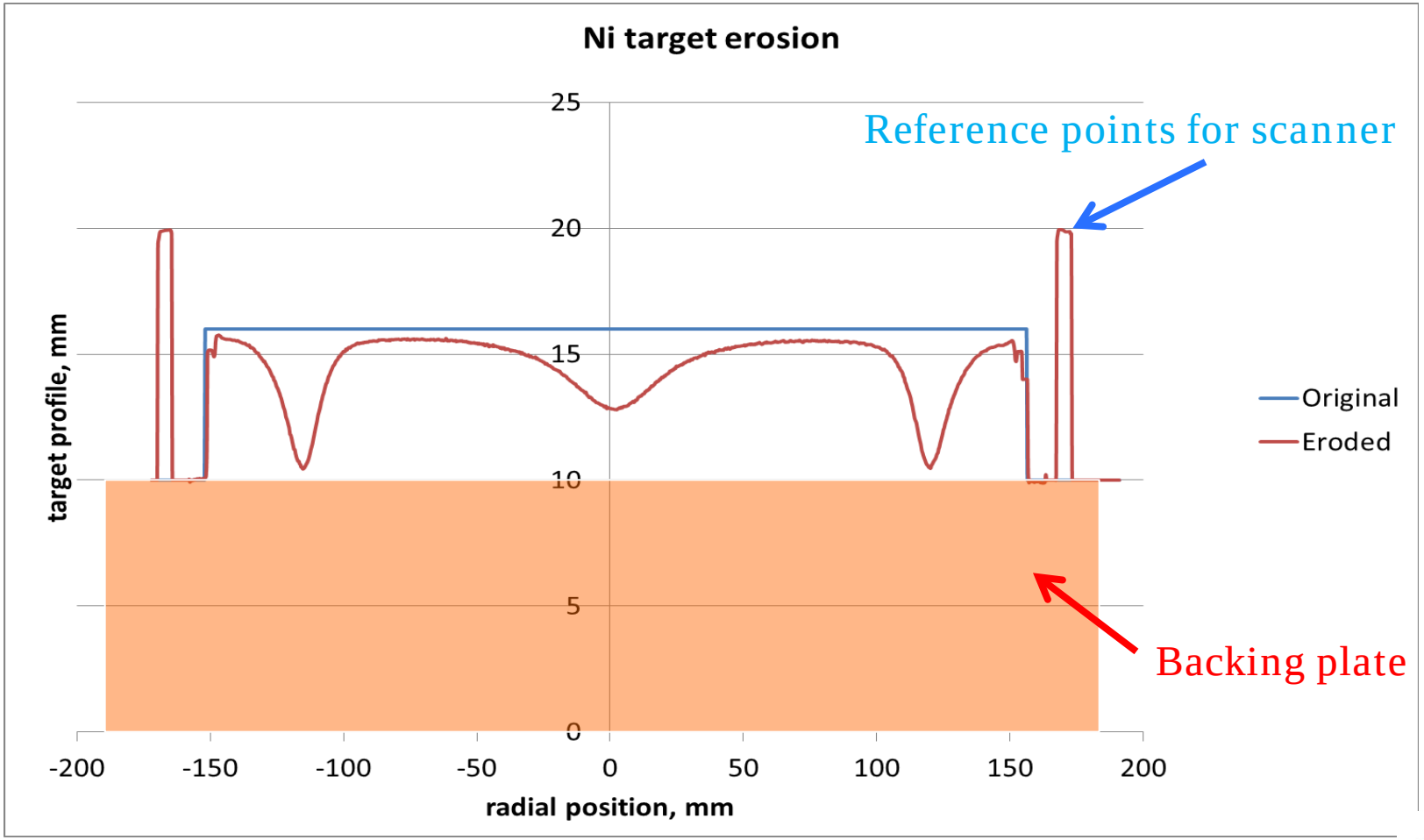
Position in mm vs Optical Density

Bringing uniformity within spec.

With constant current was possible to balance the side to side uniformity.

Ni Uniformity over full target life



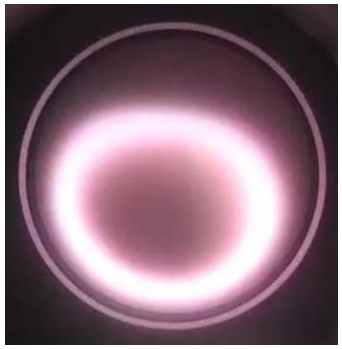


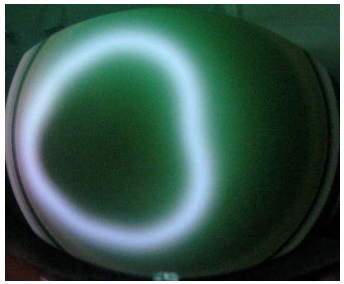
Ni target profile after erosion:

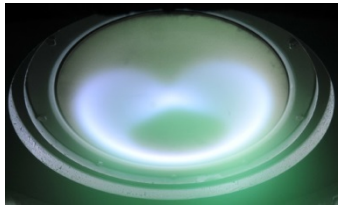
23.4% target use – 0.6 mm remaining from original 6 mm

The FFE300 is the most advanced sputter source for static wafer coating on the market

gencoa: perfect your process







- Flexible
- Unrivalled performance
- Standard cathode design usually in-stock
- Backed by Gencoa's process support
- Pre-delivery acceptance for specific processes (subject to a charge)
- OEM volume annual supply contracts available
- Gencoa ffe magnetrons are available from 75mm to 600mm target diameters