INTRODUCTION TO

V-Grade 5S Series Software

V-Grade 5S

V-Grade 5S Plus

V-Grade 5S Pro

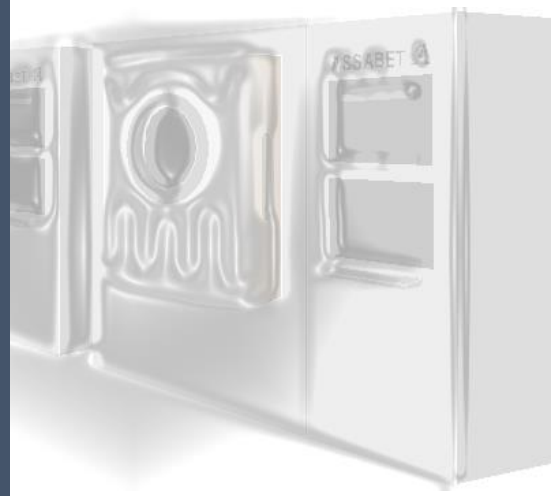
V-Grade 5S Products: Tools for PVD Engineering

FACT Few PVD Processes Are Optimized

3 FUNDAMENTAL MEASURES OF A PVD PROCESS

- Deposition rate
  – it often determines the throughput
- Vapor capture
  – percentage of material vapor captured by the workpiece carrier, a measure of efficient use of source materials
- Thickness distribution
  – it determines if specs are met, and therefore yield

*Emphasis may be different from one job to another



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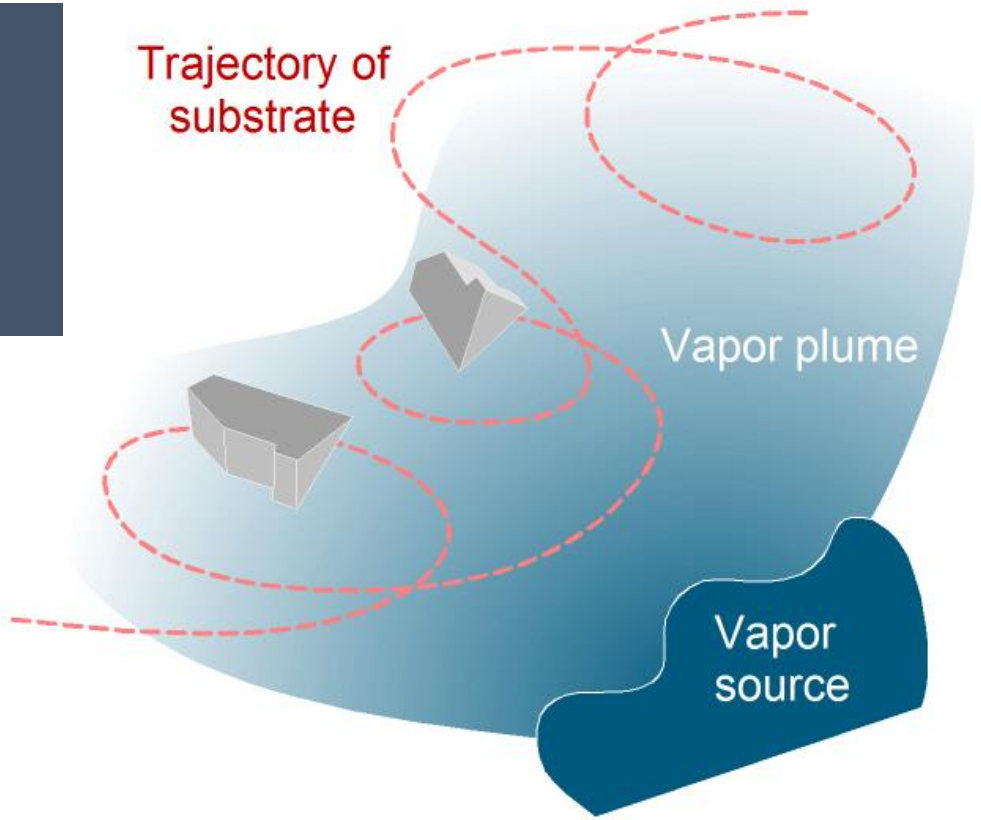
FACT PVD Processes Are Convoluted

Realistic numerical simulation is essential to achieving a desired outcome.

V-Grade 5S series software was conceived to fulfil the needs.



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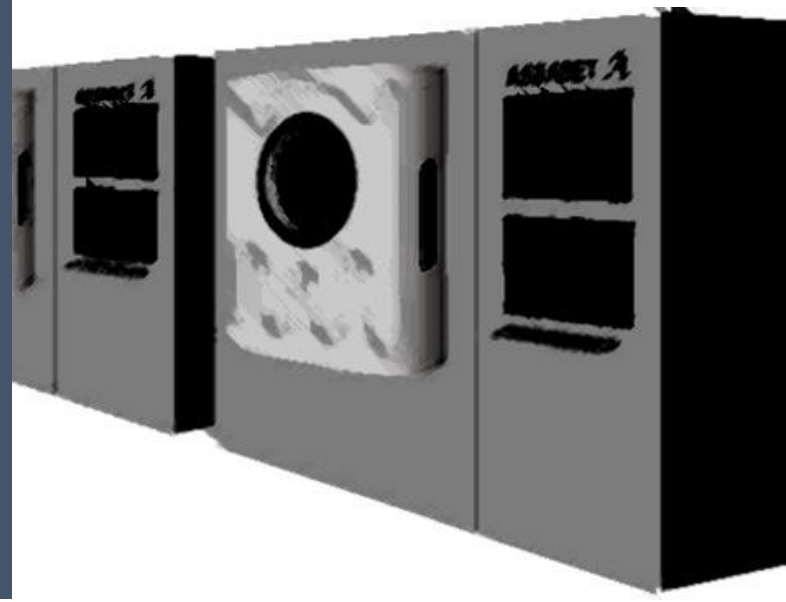
V-GRADE 5S SERIES SOFTWARE IS BUILT TO ADDRESS CRITICAL NEEDS IN

- Design of PVD equipment
- Optimize and debug PVD processes
- Feasibility studies
- Specification development
- Production planning
- Cost analysis (material & power consumptions)



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(cont') WHERE YOU MAY ENCOUNTER

- Common or specialty source types
- Source re-position and re-orientation
- Vapor obstruction (masks, baffles, chimneys, dividers and collimators)
- Novel substrate motion
- Multiple-source deposition
- Power-modulated transits
- Complex-surface substrates
- Plasma enhanced processes, such as HiPIMS

>>> and a lot more

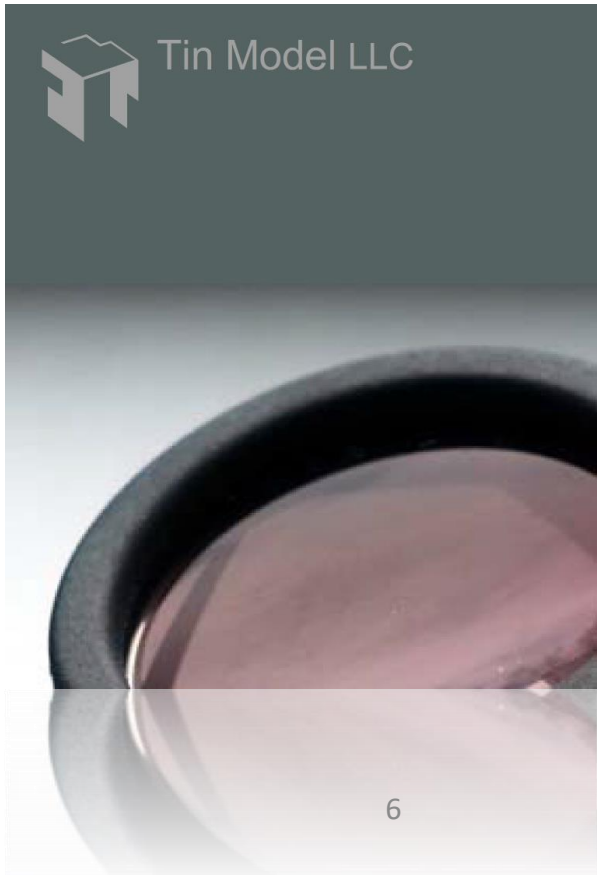
"NO PROCESS IS TOO DIFFICULT OR TOO COMPLEX"

V-Grade 5S Products: Tools for PVD Engineering

DESIGN PRINCIPLE OF V-GRADE 5S SOFTWARE

Power and Ease-of-Use

- Rich in features yet intuitive
- Graphic user interface
- Libraries of common sources and substrates
- Enablement of unconventional processes
- Example configurations for quick starts
- Spreadsheet compatibility (imports and exports)
- Standardized file handling



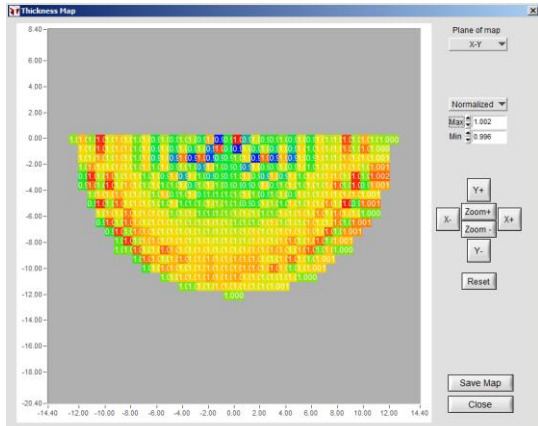
V-Grade 5S Products: Tools for PVD Engineering

V-GRADE 5S COMPUTATION ENGINE

Accurate, Reliable and Fast

Our clients have employed *V-Grade 5S* series software to design and build some of the most complicated and mission-critical PVD processes.

With *V-Grade 5S*, novel solutions have been discovered, tested and verified.



Tin Model LLC

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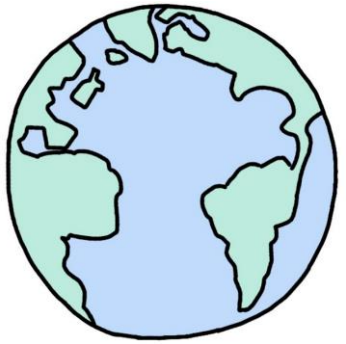
V-GRADE 5S SERIES SOFTWARE ENABLES

PVD Engineering for Sustainability

Not all PVD processes are equal in their impact to the environment and consumption of natural resources. V-Grade 5S makes it easy to maximize a figure of merit :

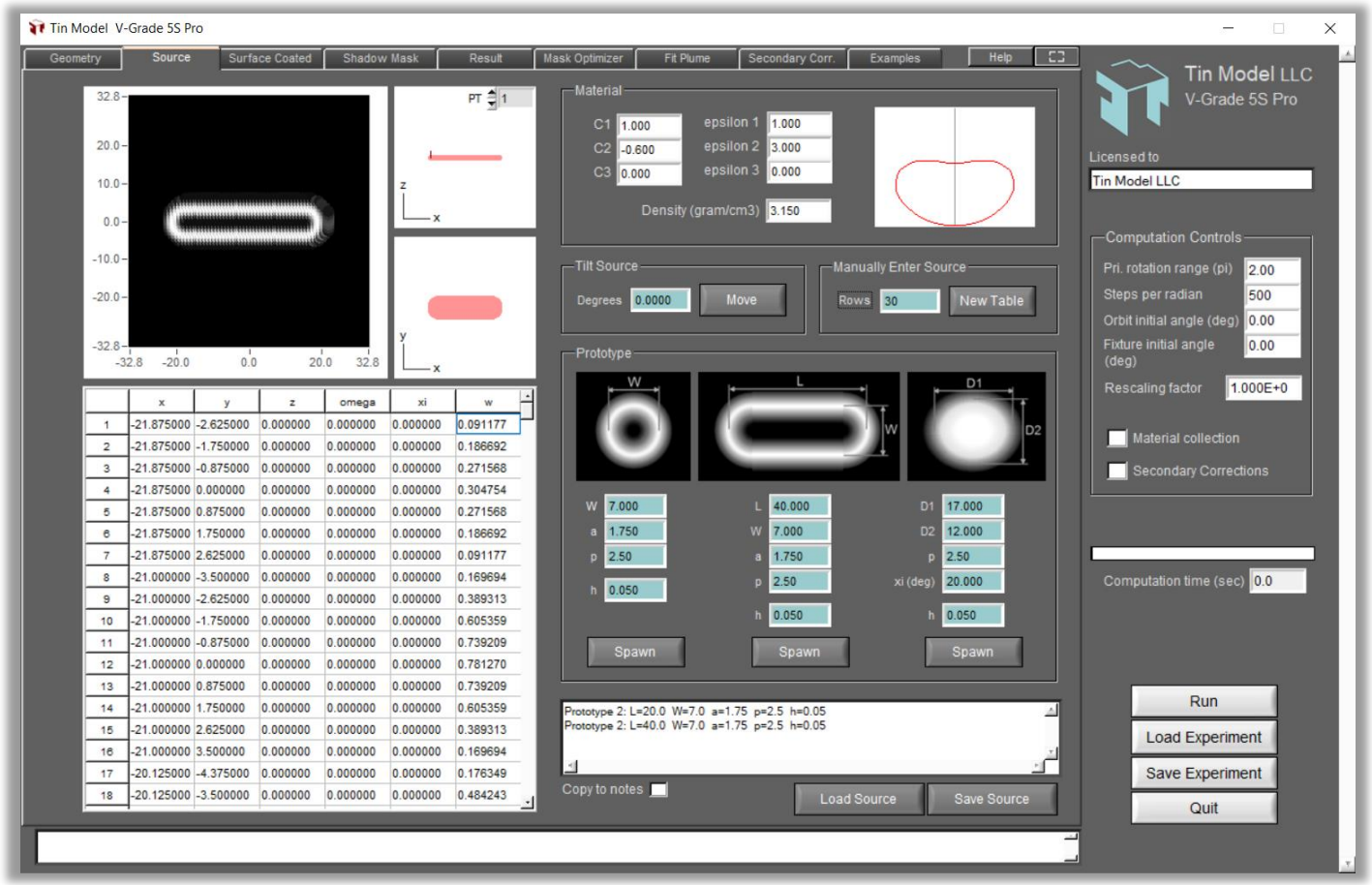
$$M = R \cdot V \cdot (1\text{-}NU) / W$$

where R is deposition rate, V vapor capture, W power applied to the source, and NU non-uniformity, all of which are quantifiable within V-Grade 5S. The higher the M the better a process conserves raw materials and energy, thus more environmentally plausible.



Tin Model LLC

V-Grade 5S series features: SOURCE



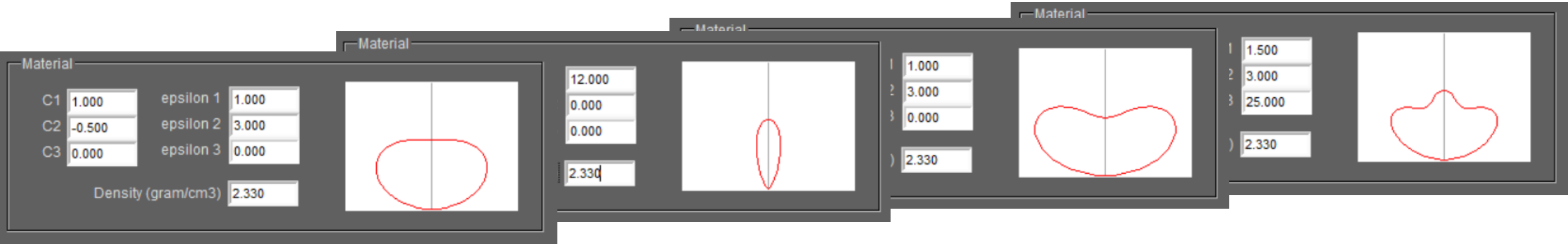
Source types

- Evaporation
- Magnetron sputtering
- Ion-beam sputtering
- Uncommon-geometry sources
- Laser ablation
- Cylindrical magnetron
- User-defined arbitrary

Source positioning

- Tiltable 360 degrees

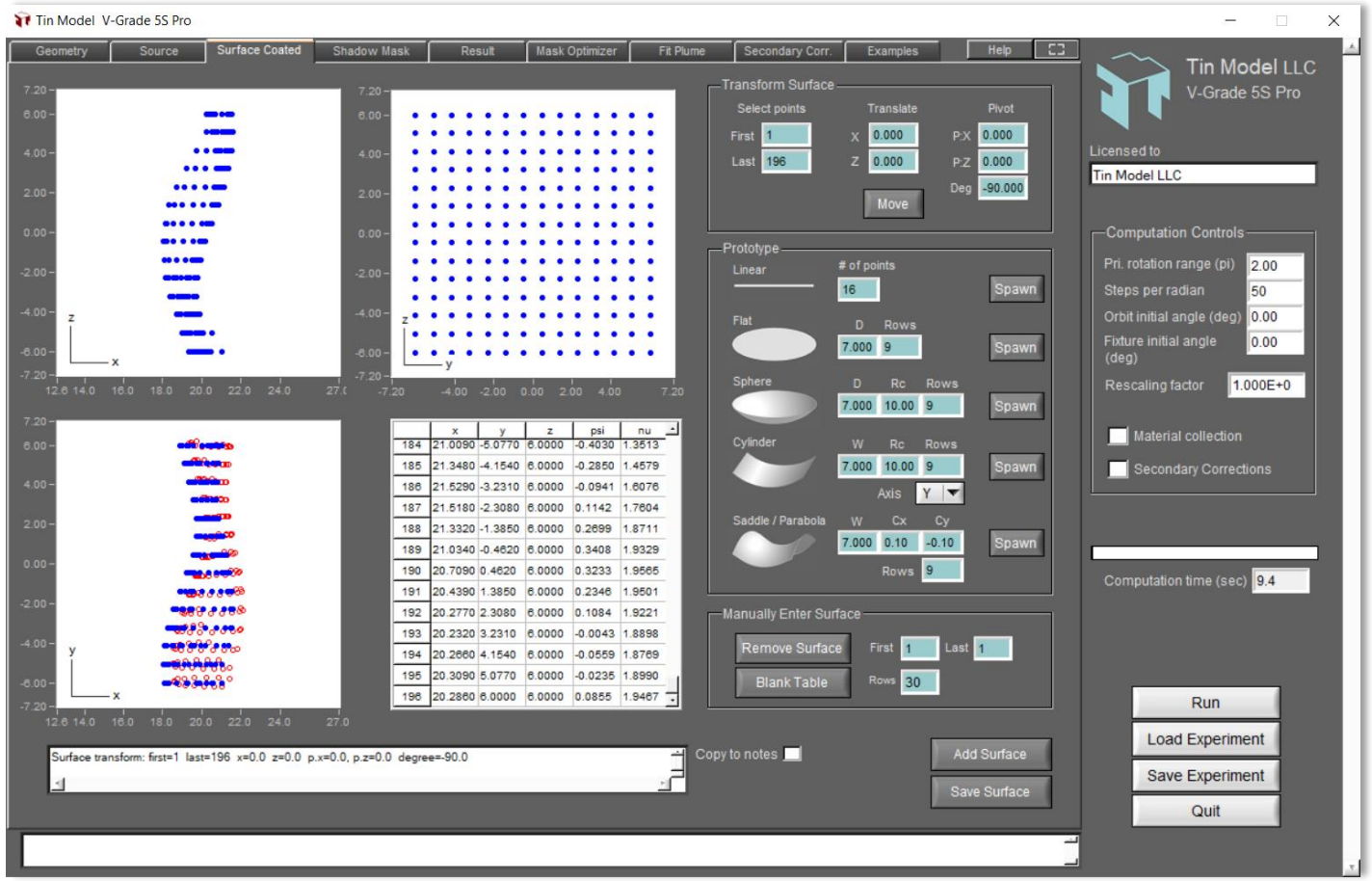
V-Grade 5S series features: VAPOR PLUME



Vapor plume handling: definable with a 3-term expression that encompasses

- Evaporation
- Sputtering
- Plume evolution due to target erosion
- Tilt axis (ion-beam sputtering)
- Fit to experimental data (via an automated routine)

V-Grade 5S series features: SUBSTRATE



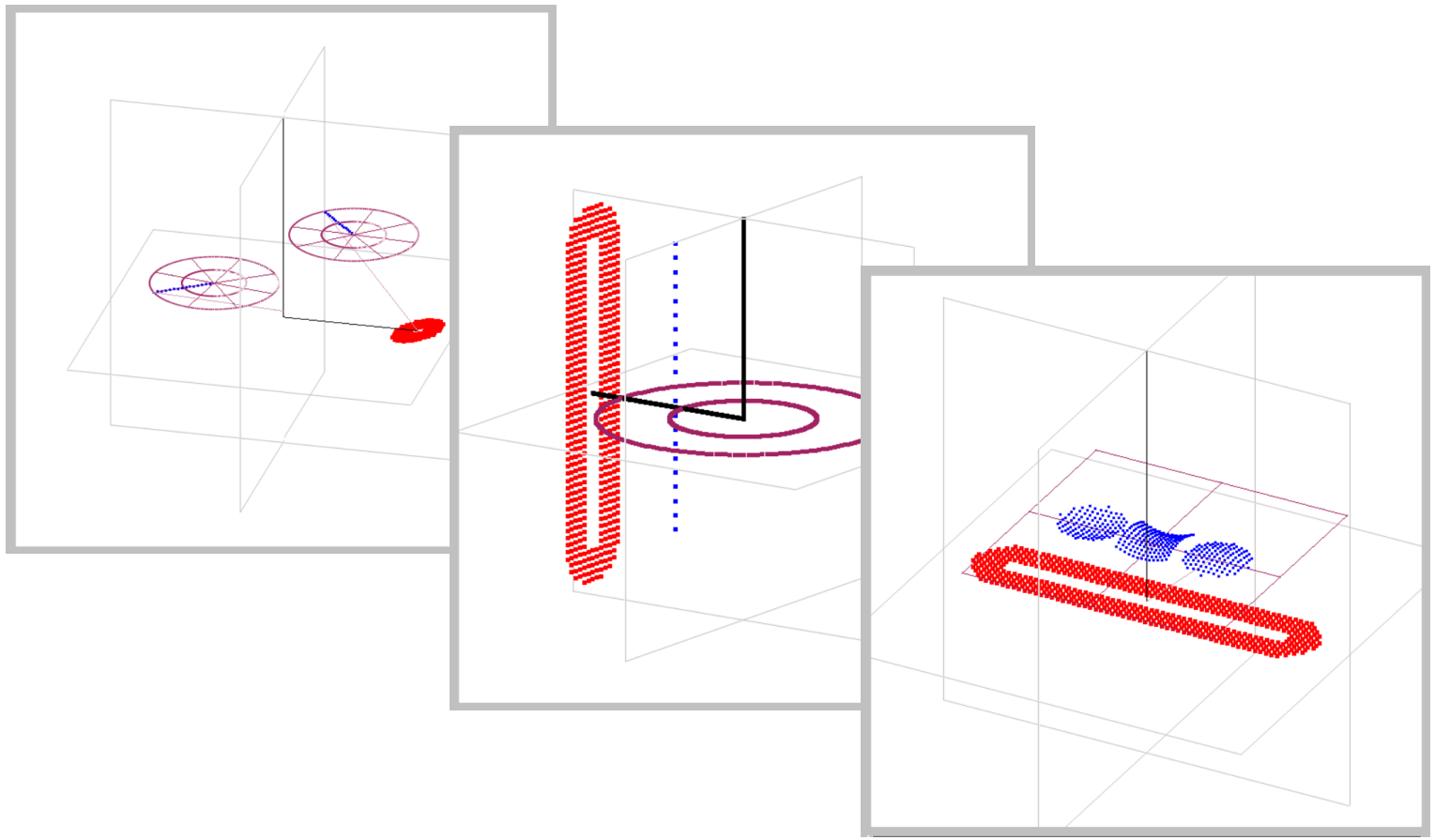
Substrate types

- Flat
- Spherical
- Aspherical
- Parabolic
- Cylindrical
- Saddle
- User-defined arbitrary

Substrate repositioning

- Translate & tilt

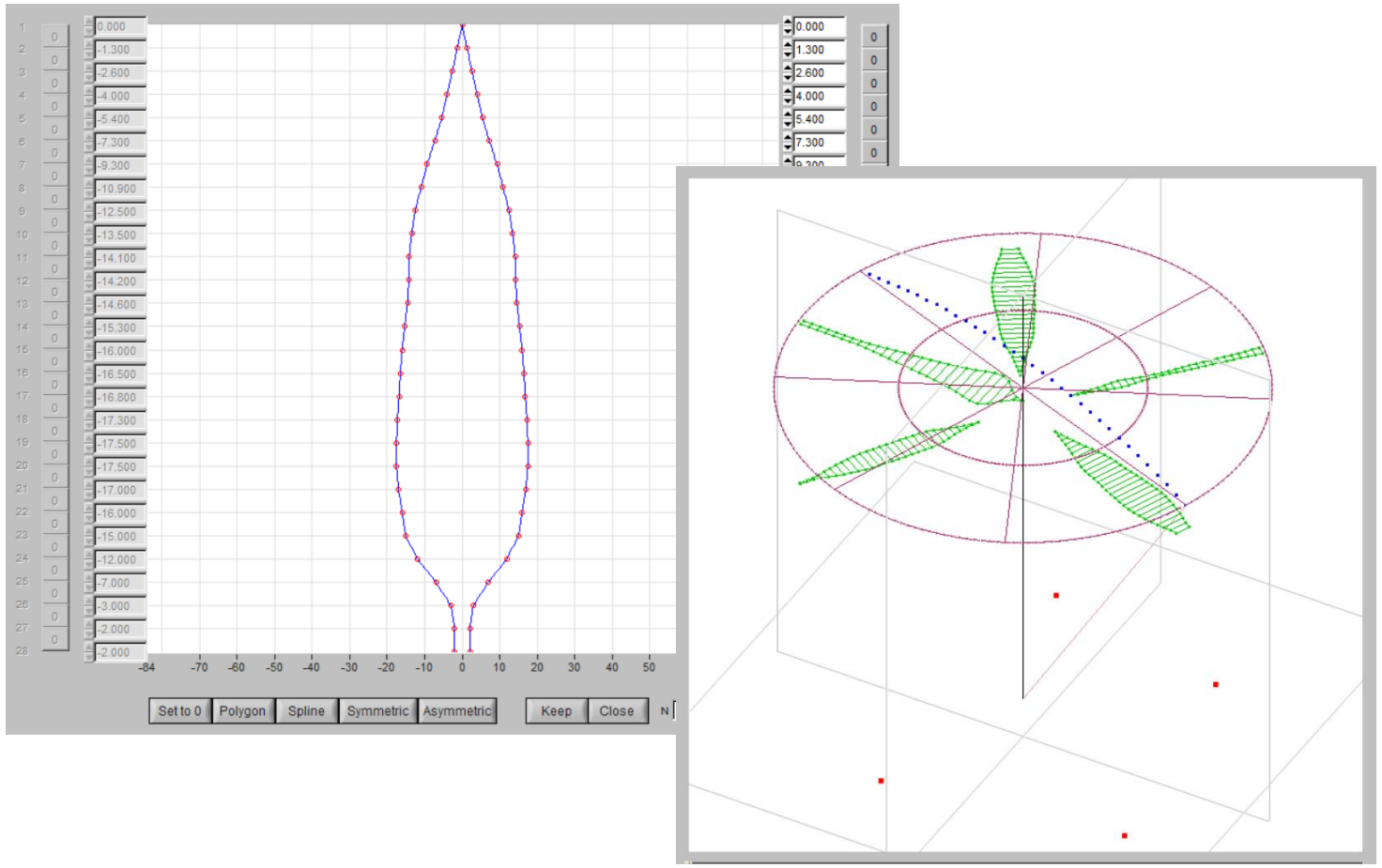
V-Grade 5S series features: SUBSTRATE MOTION



Motion types

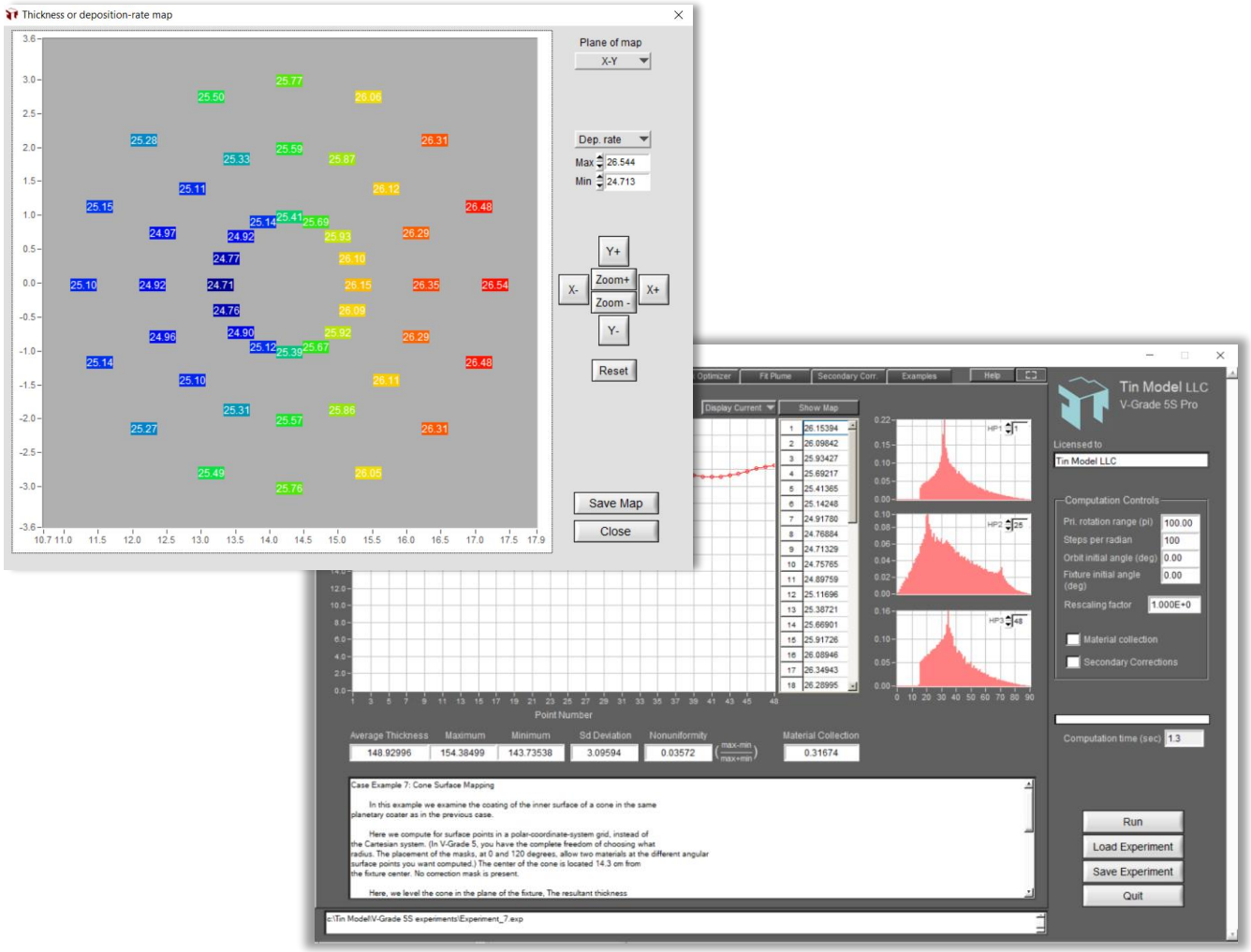
- 1-axis rotation
- 2-axis rotation (planetary)
- 3-axis rotation
- Linear translation
- Roll-to-roll
- User-defined arbitrary

V-Grade 5S series features: VAPOR OBSTRUCTION



- Shadow masks
  - Symmetrical
  - Asymmetrical
  - Arbitrary shapes
  - Mounting provisions
  - Positive & negative
  - Static & rotational
  - Tiltable
  - Automatic optimization
- Baffles
- Dividers
- Collimators

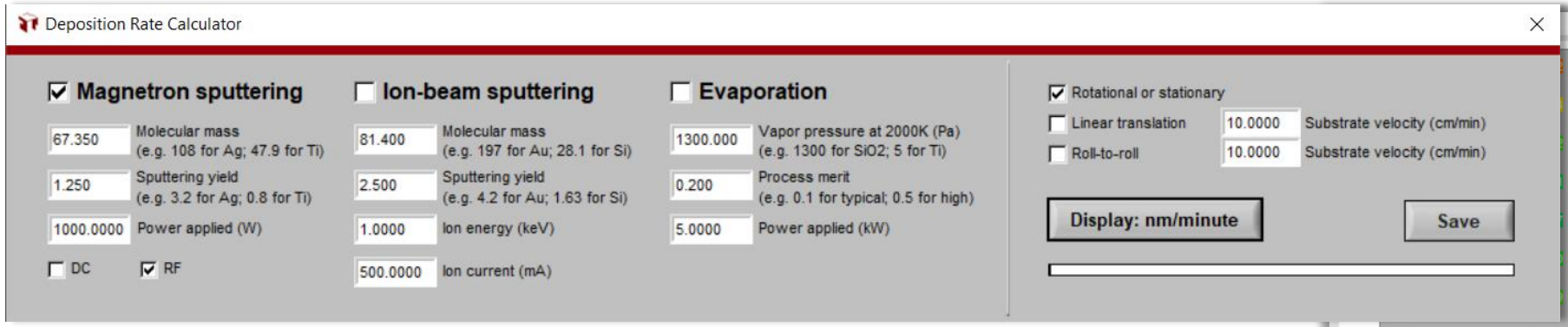
V-Grade 5S series features: RESULT

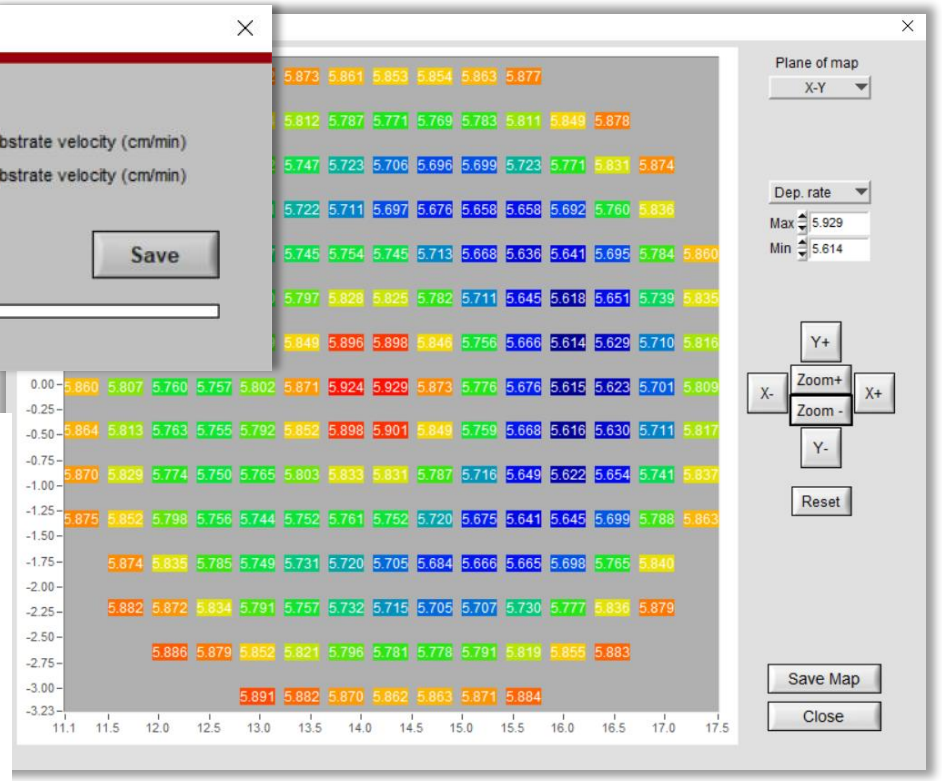


Output

- Thickness plot & maps
- Deposition-rate plot & maps
- Power requirement for given deposition rates
- Vapor capture %
- Vapor-striking-angle statistics
- Optimized masks
- Mask manufacturing files
- Vapor plume functions
- Dynamic 3D representation

V-Grade 5S series features: DEPOSITION RATE



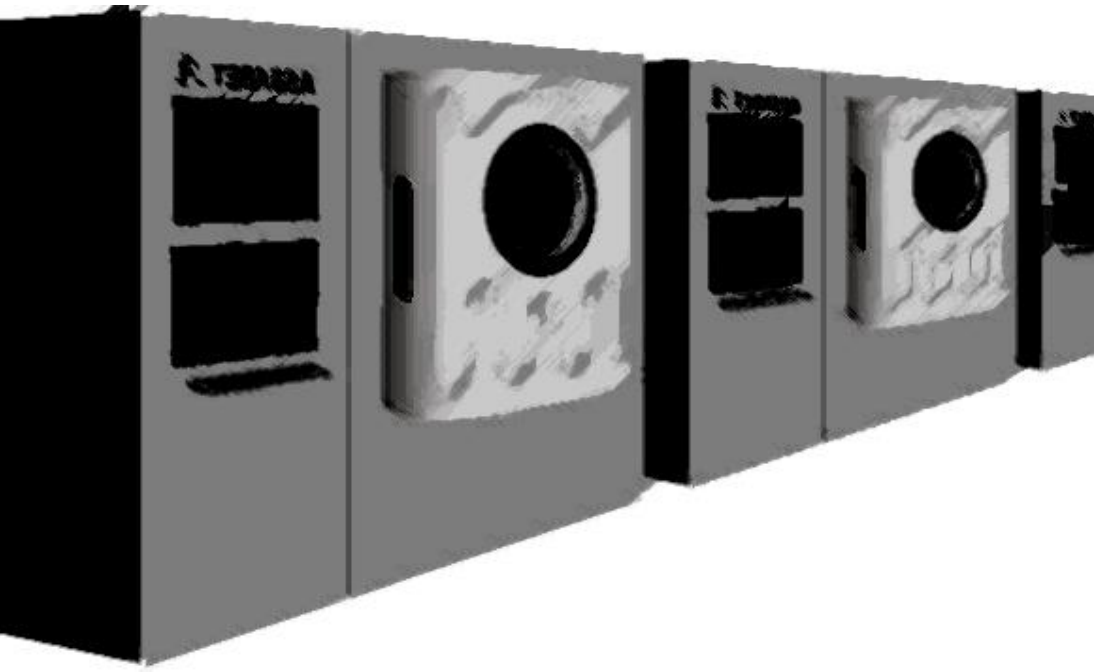


Deposition-rate map

Deposition Rate Calculator available for

- Magnetron sputtering
- Ion-beam sputtering
- Evaporation
- Any geometric configuration
- Final thickness in the case of linear-translation or roll-to-roll coating

V-Grade 5S series features: SECURE OPERATIONS



V-Grade 5S series software treats your data security as a priority. At no time your data are exposed to external risks.

- 100% self-contained programs operate off-line
- Installs off-line
- Your IP and sensitive information are unexposed to risks

V-Grade 5S Products: Tools for PVD Engineering

With *V-Grade 5S* series software, you can solve problems from the mundane to the most challenging:

NO PROCESS IS TOO DIFFICULT OR TOO COMPLEX

"TURN YOUR IDEAS INTO PRACTICAL AND WINNING PVD PROCESSES"

NOT ALL PVD PROCESSES ARE EQUAL: CHOOSE SUSTAINABILITY !

FOR FURTHER INFORMATION CONTACT US

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