

# *Ultra Recording Simulator™*

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# Overview

- General-purpose, high-productivity, three-dimensional (3-D) micromagnetic recording design/analysis software.
- Software for new-generation recording technology
  - Heat-Assisted Magnetic Recording (*HAMR*); multilayer perpendicular and longitudinal recording; novel nano-scale recording etc.
- Microsoft Windows (*XP*<sup>™</sup>, *NT*<sup>™</sup> and *Vista*<sup>™</sup>) application.
- Comprehensive user documentation and web resources.



# Software Features at a Glance

- Comprehensive three-dimensional (3-D) modeling environment
  - Powerful analysis and field visualization tools
  - Friendly user interface (easy to use and intuitive)
  - Extremely short learning curve
- *New-design Assistant*
  - Start-up/new-design wizard for rapid creation of popular design concepts
- Reader *Shield Assistant*
  - For rapid setup of reader shield configuration
- Flexible simulation storage/playback facility
  - For creating a movie of a simulation and subsequent thorough analyses of computed states
- Easy access to MagOasis powerful productivity tools: **Cellider** (array-patterning), **Mag-O-Mat** (micro-property editor) and **MagJob** (job submission and monitoring).



# Simulation Types

- *Writing.* Moving energized **Writer** records on a storage media.
- *Reading.* A moving **Reader**, senses recorded media data
- *Media Test.* A media sample is subjected to externally applied vector fields to evaluate its magnetization behavior.
- *Writing Field Scan.* The fringing field produced by a write head is detected by a moving probe.
- *Media Field scan.* The fringing field produced by bits of a storage media is detected by a moving probe.
- *Write and Media Field scan.* The fringing field produced by a combination of a write head and storage media is detected by a moving probe.

# System Components

- *Writer. **Moveable** generic **single-pole, gapped** and **custom** heads. Possible **skewed** orientation and motion. Can be used in conjunction with thermal source.*
- *Reader. **Moveable** phenomenological (possibly shielded) magnetoresistive heads (**AMR & GMR**). Possible **skewed** orientation and motion.*
- *Thermal Source. **Moveable** media thermal source with user-specified **footprint**.*
- *Media. **Longitudinal, perpendicular** and other **composite anisotropy** media. User-specified anisotropies.*
- Components can be characterized independently.



# Physical Models

- Accurate, robust and efficient 3-D micromagnetics

*Dynamic* and *Quasi-static* solvers, *magnetostatic*, *Zeeman*, *exchange*, *anisotropy*

- Efficient phenomenological ***magnetoresistive*** read-head model (*AMR* & *GMR*).
- Thermal modeling of recording media including ***stochastic*** model.
- Three-dimensional magnetic shield model.

# Data Outputs

- Comprehensive data output repertoire
- Vector field viewer
  - Magnetization *maps*
  - Interaction-field *maps*
  - Vector field transformations
- Data Curve
  - Spectral analysis
  - Differentiation, integration etc.



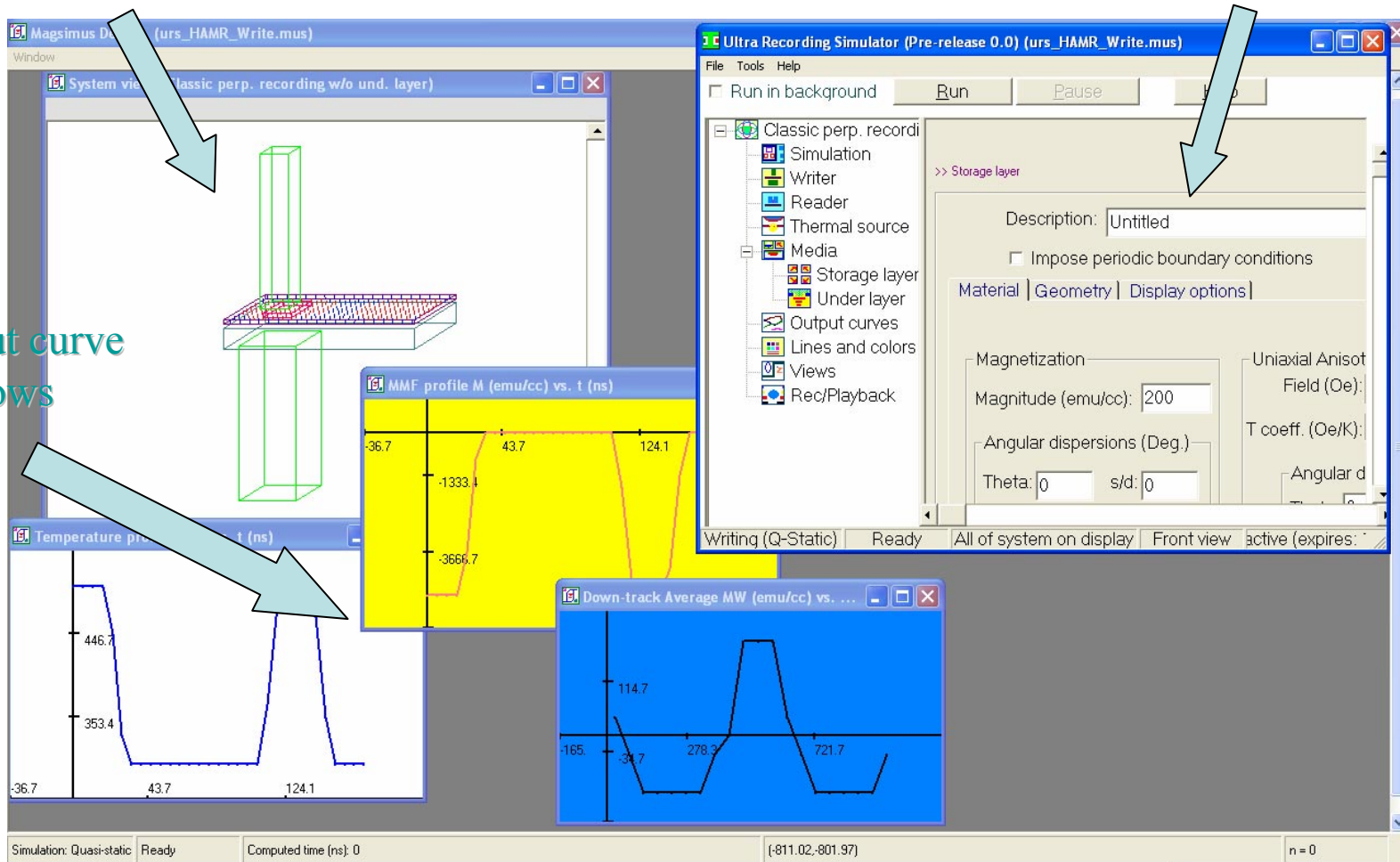
# HAMR Perpendicular Write Example

## Screenshot

System-View box

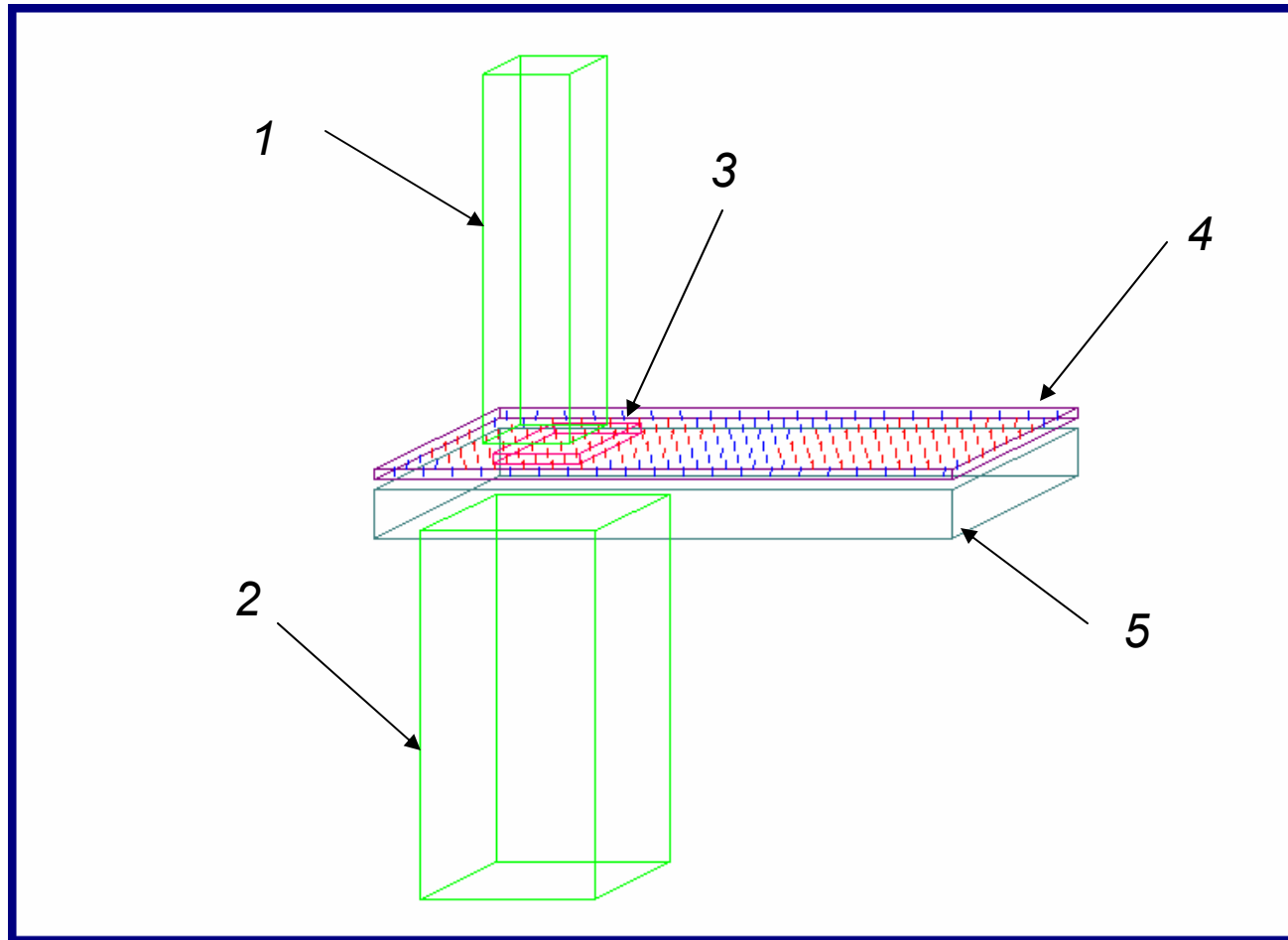
URS Control window

Output curve windows



# HAMR Perpendicular Write Example

## System Details 1

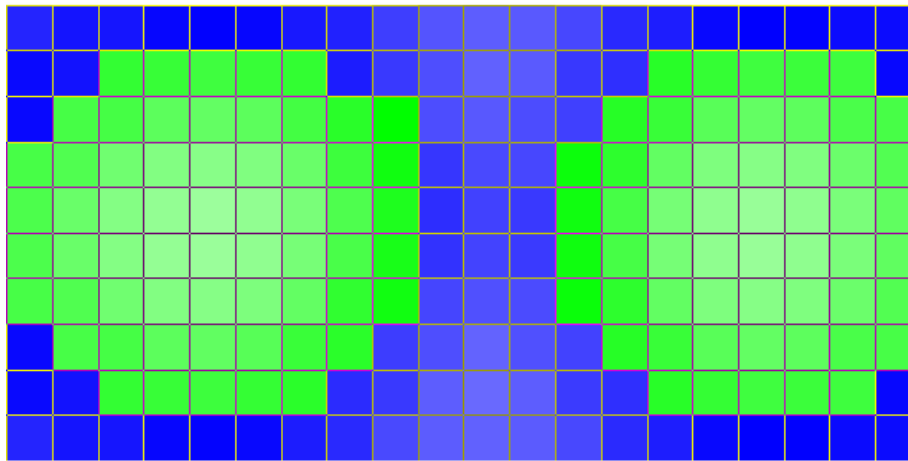


- 1 – P1 Pole
- 2 – P2 Pole
- 3 – Thermal *footprint* in media
- 4 – Media storage layer
- 5 – Media soft under layer

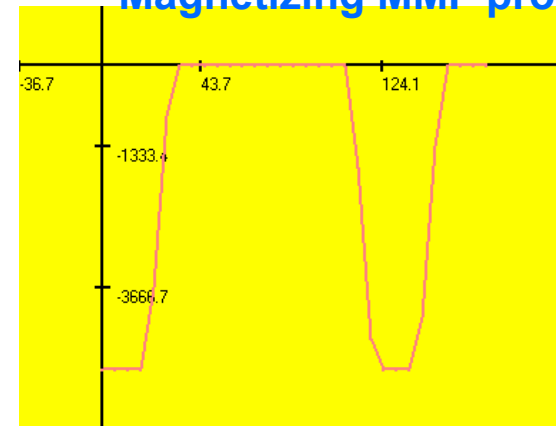
# HAMR Perpendicular Write Example

## System Details 2

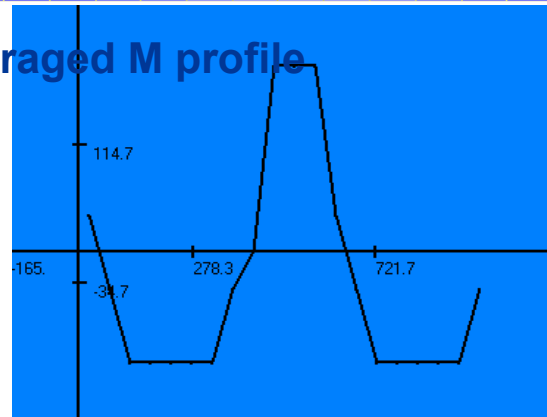
Induced top surface charge of media soft under layer



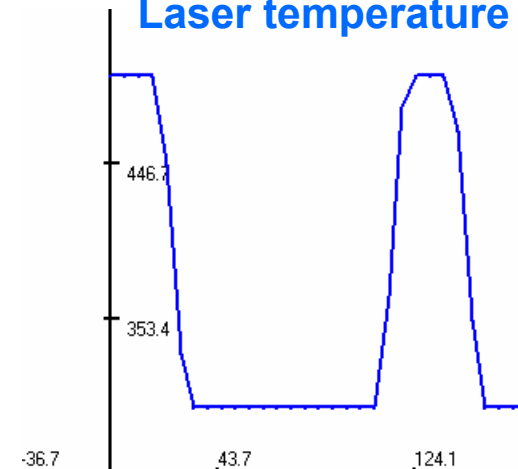
Magnetizing MMF profile



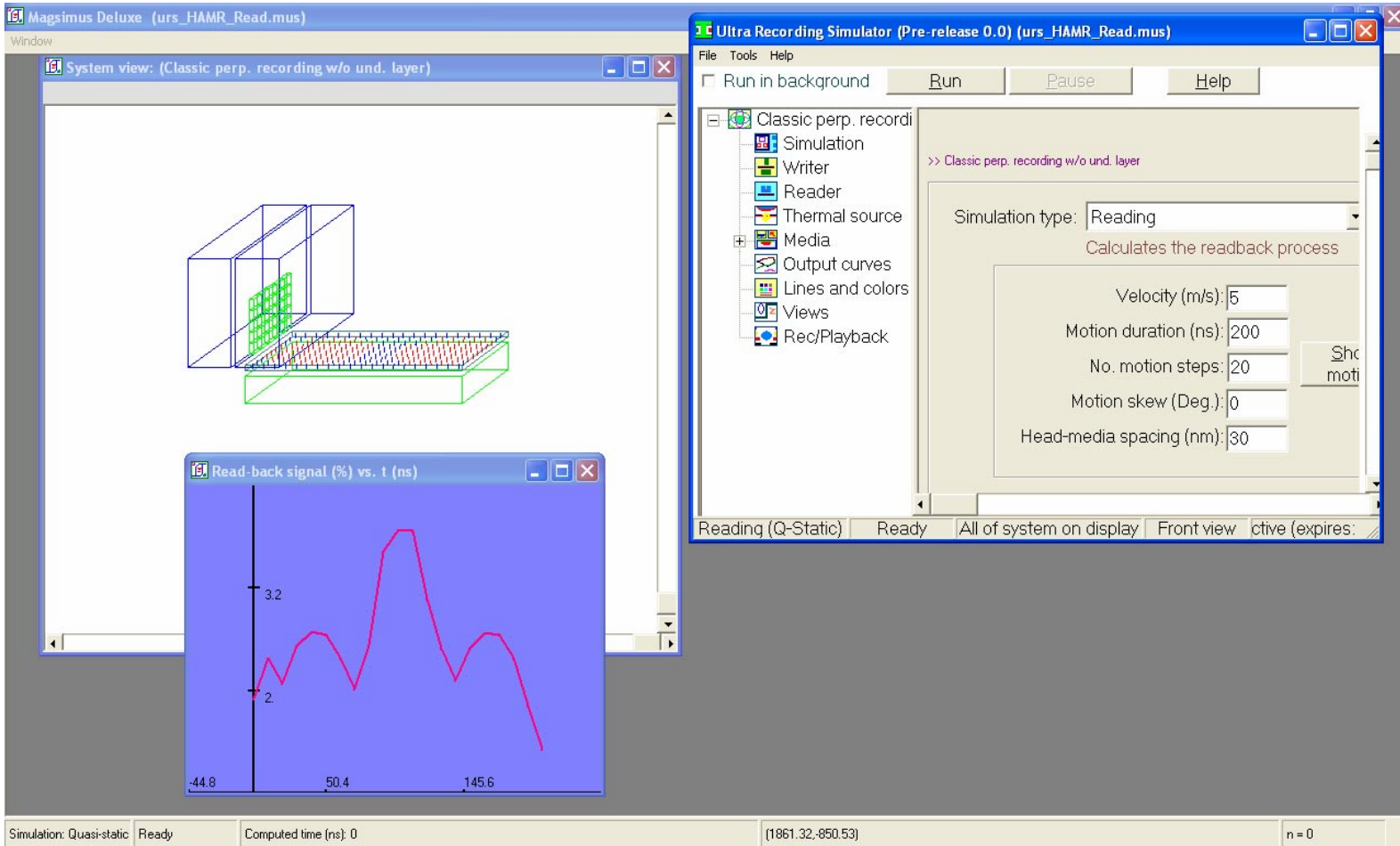
Cross-track averaged M profile



Laser temperature profile

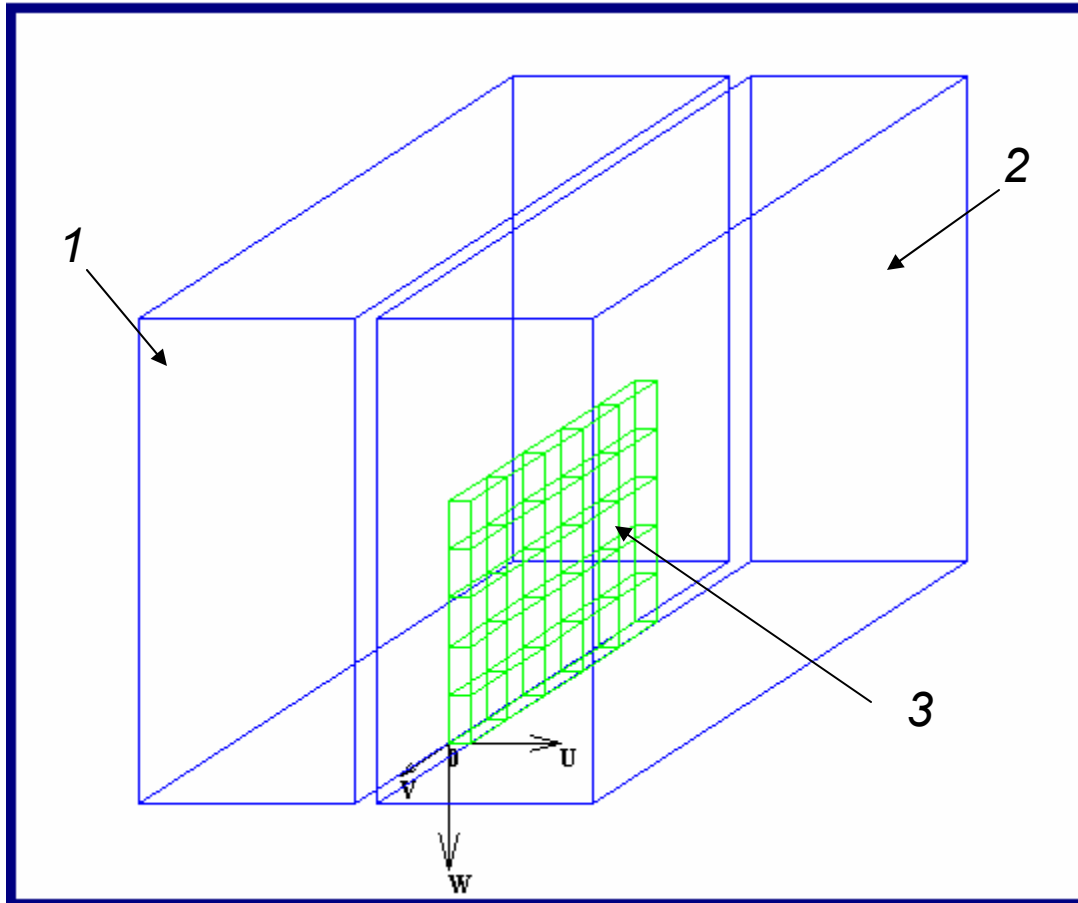


# HAMR Read Example Screenshot



# HAMR Read Example

## Reader Detail



- 1 – P1 Pole (shield)
- 2 – P2 Pole
- 3 – MR sensor

# URS Usage Hints

- Read tutorial in Chapter 2 of *User Booklet* (installed with software) during first run, to gain rapid proficiency in use of the program.
- Optimize as follows: First create all related designs and then use the *MagJob* utility to calculate the designs as batch background jobs.
- Use the *Cellider* utility to pattern the design components into different shapes.
- Use the *Mag-O-Mat* utility to specify novel initial magnetization states and magnetic anisotropy variations for media samples.
- Use the simulation *record/playback* feature for later in-depth analysis of all solution states of a calculation.



# Software distribution

- Web pages for software info, sign-up and downloads

*<http://www.magoasis.com/urs.htm>*

*[http://www.magoasis.com/MO\\_sw\\_signup.htm](http://www.magoasis.com/MO_sw_signup.htm)*

*<http://www.magoasis.com/Downloads.htm>*

