

DERIVING THE OBSIDIAN PLASMA INTERFACE

Mechanism-First Generative Design as a Technical Process

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Abstract

This note documents a generative design method for producing a visual language that had no stable reference class in existing model priors. The target was already known: a utility interface that appeared to emit from inside polished black glass, with plasma-like spectral behavior, CRT-like legibility, and no ordinary science-fiction console vocabulary. Direct aesthetic prompting failed because the model interpreted the request as flat graphics on a futuristic panel. The successful process replaced description with mechanism. A hypothetical but physically grounded display lineage was constructed from adjacent technologies - gas discharge displays, femtosecond laser volumetric graphics, laser writing in glass, liquid-crystal optical modulation, Chladni/cymatic modal fields, and physics-informed inverse design. The generated images then became experimental observations from which a transferable interface grammar was extracted.

Keywords: mechanism-first prompting; visual system design; generative AI; plasma display; dielectric bulk; fictional engineering; reference-class construction; aesthetic constraint synthesis

Executive Decision Summary

The exercise demonstrates that a missing visual reference class can be manufactured procedurally by constructing the physical mechanism that would make the desired appearance inevitable.

The display technology described here is not presented as a built device. It is a deliberately engineered causal scaffold. Its purpose was to force a generative model away from genre imagery and toward physically constrained visual behavior.

The final artifact was not the HTML page. The HTML page was the transfer test. The core output was the causal grammar: a set of visual rules that survived translation from photorealistic image generation into ordinary web primitives.

Finding	Implication
Direct style description was underconstrained.	The model filled the gap with familiar science-fiction display priors.
The desired result required medium causality.	Text had to appear as a luminous state inside matter, not graphics on a surface.
A staged fictional engineering lineage solved the prompt collapse.	Each generation added one physical constraint and removed one failure mode.
The final aesthetic became transferable.	The derived grammar could be implemented with normal HTML/CSS/SVG without retaining the fictional hardware.

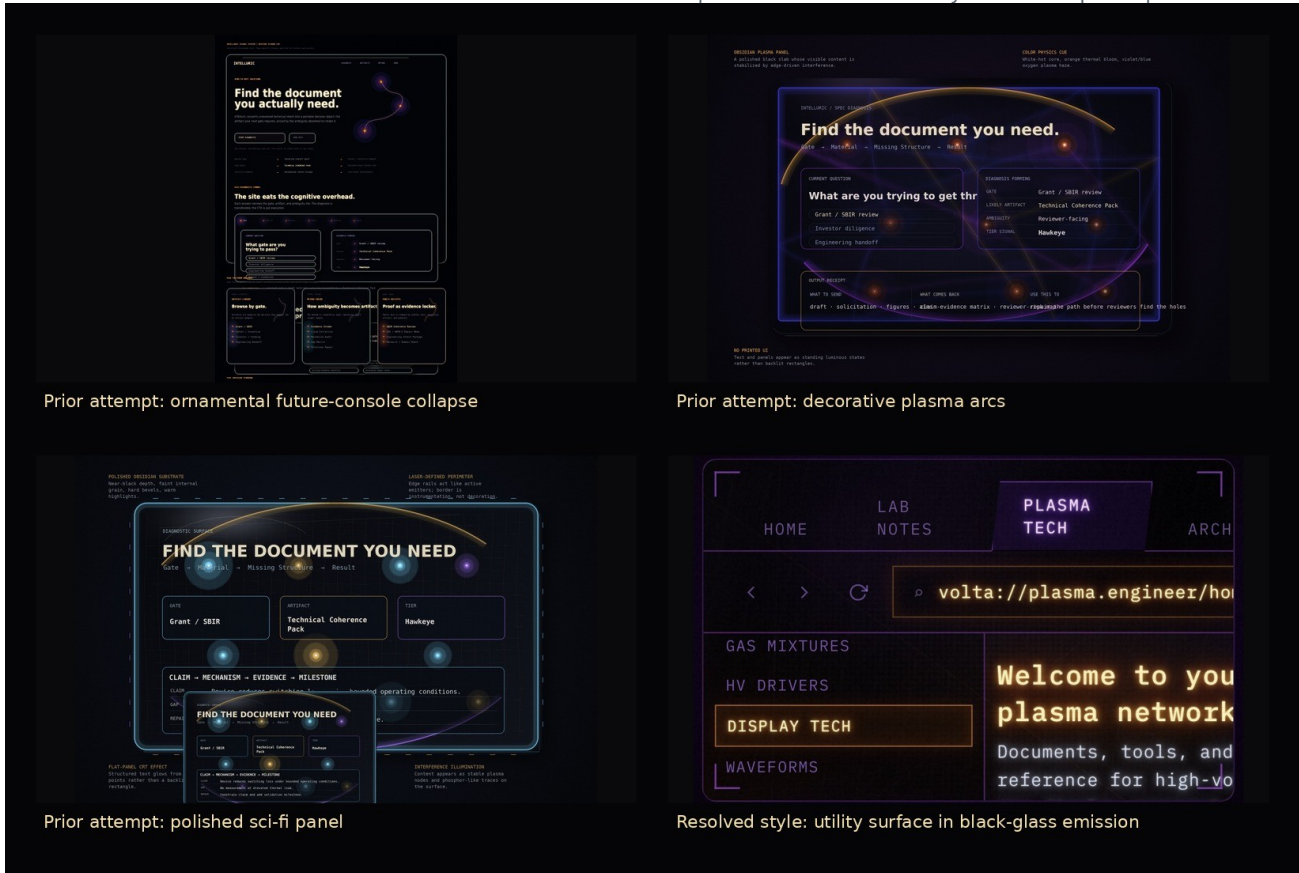


Figure 1. Prior attempts used established science-fiction console priors. The resolved style emerged only after the display medium acquired a causal mechanism.

1. Problem Definition: The Missing Industrial Lineage

The problem was not that the site lacked polish. The problem was that the intended visual system had no obvious industrial ancestor in the training prior. The target was not “futuristic UI.” It was a surface that looked as if it belonged to a real branch of display engineering that had developed differently from LCD, OLED, projector, hologram, and CRT lineages.

The required perceptual behavior was known before the mechanism existed: a black-glass utility surface; content visible as embedded emission; hard, readable strokes; limited spectral palette; depth without hologram theatrics; and a sense that the device would still function in a dark, dusty, smoke-filled engineering environment.

Describing those properties directly created a prior-collapse problem. The model could satisfy the words while still producing the wrong object: a Star Trek console, a cyberpunk HUD, a decorative hologram, or neon typography laid on a black panel. Those are not material systems. They are genre signals.

Coherence finding

Core diagnosis: the target visual language could not be reached by adding more adjectives. It required a causal substrate. The display had to be invented before the interface could be drawn.

2. Method: Mechanism-First Generative Design

Mechanism-first generative design is a prompt methodology for creating visual systems when the desired style has no stable reference class. Instead of asking the model to imitate a look, the operator defines a hypothetical physical system whose visible consequences are constrained enough that the look becomes inevitable.

The method treats image generation as a design loop. A prompt proposes a physical mechanism; the generated image becomes a visible hypothesis; failure modes are identified; the next prompt adds only the mechanism required to repair the failure. The process continues until the images stop looking like genre collage and start behaving like observations of a coherent artifact.

This is not the same as fictional worldbuilding. The invented mechanism must be constrained by adjacent real physics. The fiction exists only at the integration layer: the components are real or technically adjacent; the novel object is their engineered convergence.

Method stage	Operation	Output
Target inventory	State the required perceptual behavior without naming a genre.	A functional spec for the visual result.
Prior-collapse audit	Identify the imagery the model will default to and why that class is wrong.	A map of failure modes.
Mechanism selection	Choose physical primitives that force the target traits as consequences.	A hypothetical display architecture.
Staged prototyping	Render crude, then increasingly capable versions of the device.	A sequence of visible mechanism tests.
Invariant extraction	Extract visual laws that survive across generations.	A portable aesthetic grammar.
Implementation transfer	Translate the grammar to the target medium.	A conventional interface that preserves the effect.

3. Mechanism Selection Rationale

The selected mechanism was a black dielectric slab containing controllable plasma emission. It was not chosen because it sounded exotic. It was chosen because it solved the specific perceptual contradictions the desired interface had to satisfy.

The intended surface needed the ruggedness and optical suppression of black glass, the direct-emission behavior of gas discharge, the addressability of programmable optics, the volumetric depth of embedded light, and the sparse legibility of instrument-grade displays. No existing consumer display provides that combined grammar.

Design requirement	Mechanism chosen	Why it was necessary
Light must appear embedded in matter.	Polished obsidian-like dielectric bulk.	A near-black substrate suppresses inactive regions and makes emission read as internal, not overlaid.
Visible marks must be matter-energy events.	Localized plasma / gas discharge emission.	Gas discharge provides hard cores, halos, pinch points, and spectral limits absent from flat RGB UI.
The display must be programmable, not signage.	Edge excitation, waveguiding, and modulated field control.	Preserves neon/Nixie visual truth without fixed tube geometry.
Color must feel physical, not themed.	Limited plasma-standard palette: purple, amber/red, white.	Spectral constraint prevents generic rainbow sci-fi palettes.
The result must scale from text to imagery.	Layered optical modulation, then modal-field excitation.	Escalating mechanisms solve resolution and beam-addressing bottlenecks.
The system must feel real, not cinematic.	Prototype-lab staging before polished output.	Hardware clutter, exposure limits, uneven intensity, and repair history anchor the visual prior.

4. Real Adjacent Physics Used as Prompt Anchors

The mechanism was fictional as an integrated display technology, but each component was selected from real adjacent physical domains. These anchors were included because they constrain what the model can plausibly render. They also explain why the sequence improved: every stage replaced generic visual association with a more specific physical behavior.

Physical prior	Known basis	Prompt function
Laser-induced volumetric emission	Focused femtosecond lasers can generate visible plasma voxels in air and have been demonstrated for aerial/volumetric graphics [1].	Establishes that high-intensity optical excitation can produce luminous points in 3D space.
Laser modification of glass	Femtosecond laser writing can modify refractive index and form waveguides inside glass through nonlinear absorption and photoionization processes [2-4].	Makes embedded optical structure and bulk addressing visually plausible.
Plasma/gas discharge displays	Plasma displays and related gas discharge devices	Provides the visual lineage: Nixie/neon/plasma cells

	use voltage-driven ionization of sealed gas volumes to produce visible or UV-mediated emission [5-7].	without ordinary pixel backlighting.
Liquid-crystal optical modulation	LC spatial light modulators and beam-steering devices can control phase, polarization, and beam direction; LC polymer Bragg polarization gratings provide wavelength-scale polarization optics [8-10].	Supports the fictional columnar modulation stage and the idea of structured optical sheets.
Chladni/cymatic modal fields	Vibrating plates form frequency-dependent nodal structures; modern work extends modal and holographic field control to designed wave patterns [11-13].	Justifies replacing directional beam intersections with continuous modal interference.
Physics-informed inverse design	PINNs and related inverse-design methods solve or constrain wave and electromagnetic problems by embedding governing equations into the optimization process [14-16].	Gives the final controller a credible computational role: decompose images into waveform sets.

5. Iteration Sequence and Rationale

The sequence was deliberately incremental. Each prompt introduced one new physical capability because the previous generation exposed a bottleneck. This prevented the model from jumping directly to a polished fantasy object. The display had to earn its complexity.

The early prompts established the material and emission behavior. The middle prompts introduced addressability and resolution. The late prompts shifted from point addressing to field synthesis, then tested whether the visual grammar could support real utility interfaces.

Stage	Prompt mechanism	Rationale	Failure avoided
0	Direct “futuristic plasma/obsidian display” description.	Test whether the desired aesthetic existed in prior space.	Revealed collapse into flat sci-fi HUDs and decorative panels.
1	Real plasma reference images: filaments, sheets, glow in nearby volume.	Anchor emission to observed plasma topology.	Avoided soft generic neon haze.
2	Gas tube embedded in quartz.	Calibrate internal optical depth and trapped emission.	Avoided text pasted onto a surface.
3	Crude YouTube proof-of-concept: black glass, one color, uneven HELLO WORLD.	Prototype framing activates lab hardware priors, imperfect optics, brackets, cables, dust, exposure limits.	Avoided polished prop design.
4	Multi-edge laser array with three spectral layers.	Introduce color as depth/spectrum rather than theme.	Avoided arbitrary RGB UI.
5	Prism-expanded laser sheets with cholesteric LCP modulation.	Solve beam count and resolution bottleneck while preserving optical plausibility.	Avoided point-spark typography.
6	RF/cymatic modal-field excitation and inverse waveform synthesis.	Replace directional beam intersections with continuous field structure.	Allowed high-resolution vector/raster behavior without impossible laser quantization.
7	DOOM and browser benchmarks.	Force capability tests: imagery, perspective, UI hierarchy, dense text, and legibility.	Prevented beauty-only outputs that fail as instruments.

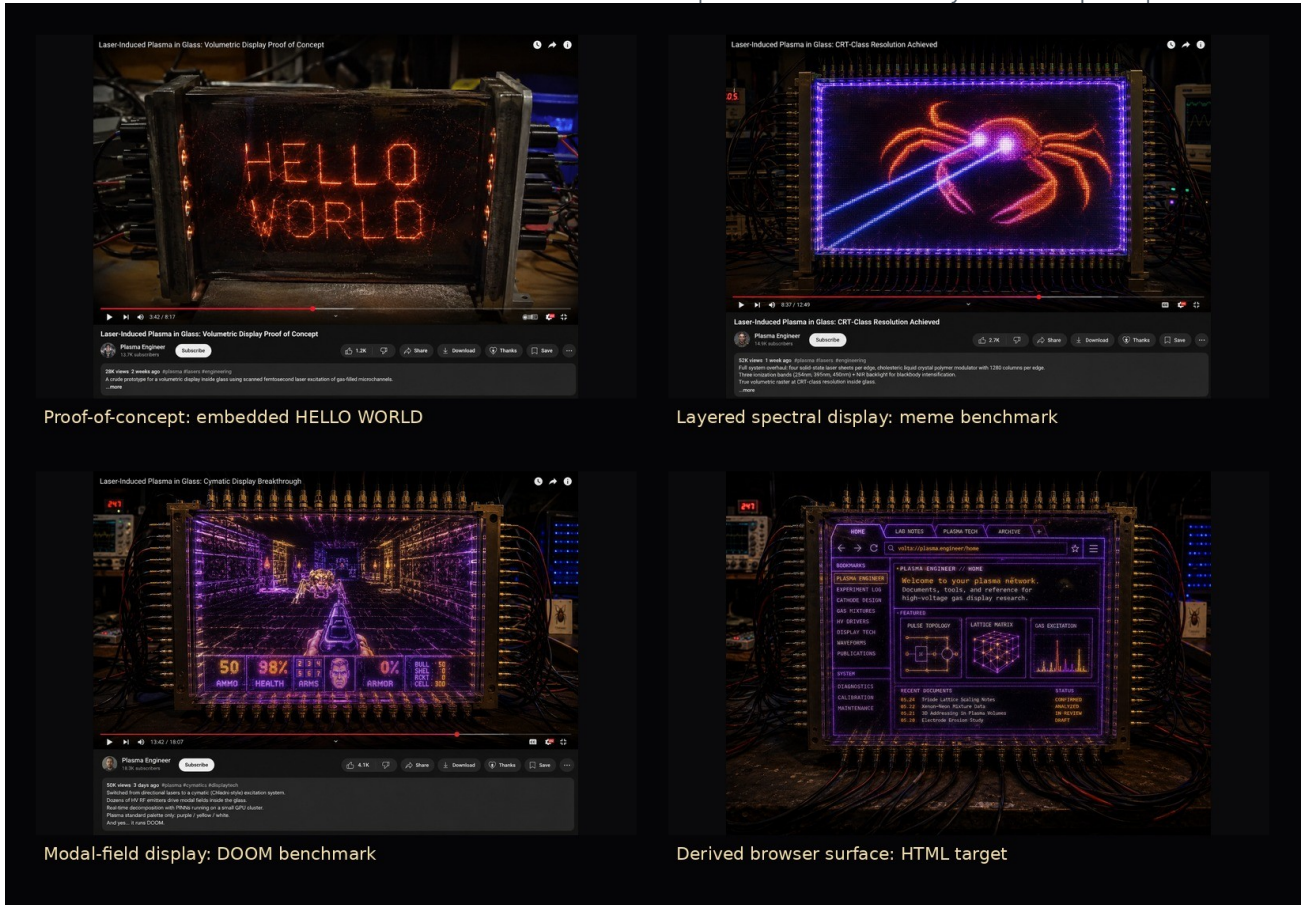


Figure 2. Prompted mechanism evolution. The display began as a proof-of-concept emission surface, escalated through layered spectral control, reached modal-field rendering, and finally produced a browser-oriented utility surface.

6. Why Mechanism Beat Description

A descriptive prompt can specify appearance, but it cannot force causality. “Futuristic,” “plasma,” “obsidian,” and “volumetric” are all words with multiple high-probability visual neighbors. In a generative model, that ambiguity is resolved by the nearest familiar image class.

The mechanism-first sequence changed the sampling problem. The model was no longer asked to render a style. It was asked to render a physical apparatus with constraints: edge emitters, black dielectric bulk, gas discharge, imperfect prototype hardware, spectral limits, optical scattering, and field-mode control. Those constraints made many genre solutions invalid before they could appear.

The key was maturity staging. A finished fictional technology tends to look like entertainment design. A crude prototype tends to inherit real-world camera, lab, wiring, exposure, and failure-mode priors. Once the crude object became believable, later generations could increase capability without losing the physical lineage.

Direct description failure	Mechanism-first repair
“Glowing futuristic interface” produces ornamental arcs, holograms, HUDs, and genre color palettes.	Define a display substrate and emission mechanism; let visual features follow from the mechanism.
“Plasma text” becomes neon typography or lightning effects.	Constrain emission to embedded channels, gas spectra, localized breakdown, and optical depth.
“Volumetric display” becomes hologram or floating screen.	Use a dielectric bulk whose active content exists inside the material.
“High-tech UI” produces decorative complexity.	Use a utility benchmark: readable text, status panels, navigation, tables, and diagnostic diagrams.
“Future style” has no failure modes.	Prototype staging creates flaws: uneven intensity, beam leakage, edge glow, dust, hardware limits.

7. Process-Structure-Property Map

The workflow can be summarized as a design analogue of a process-structure-property chain. The process was not code generation. The process was constrained prompt iteration. The structure was a hypothetical but mechanistically grounded display architecture. The property was the desired visual behavior: embedded, legible, non-cinematic, physically luminous interface grammar.

Process input	Structure imposed	Property observed	Design extraction
Plasma photos and glass calibration.	Filament/sheet emission, halos, internal scatter.	Light appears physical rather than graphical.	Bright core + small bloom; dark medium; directional glow.
Prototype demo framing.	Side-mounted emitters, cables, dirty slab, uneven lettering.	Object looks built, not staged.	Hardware context and imperfection are visual evidence.
Layered spectral display.	Separate depth/color planes.	Color reads as physics, not branding.	Palette limited to plasma-standard purple/amber/white.
Modal-field breakthrough.	Continuous interference basis instead of discrete beams.	High-resolution imagery without losing field behavior.	Use vector/raster density only after mechanism earns it.
Browser UI benchmark.	Tabs, address field, sidebars, cards, diagrams.	Aesthetic survives utility conditions.	Only stable invariants transfer into implementation.

8. Extracted Interface Grammar

The result is a set of constraints, not a moodboard. These rules define the obsidian plasma interface independently of any single generated image.

- Substrate rule: the background is a polished black mineral volume, not a flat black rectangle. It contains grain, scratch, shallow vein, and internal-scatter behavior.
- Emission rule: every visible mark has a hard luminous core and a physically limited halo. The glow is evidence of medium interaction; it is not the object.
- Palette rule: color is spectral and sparse. Purple/violet, amber/red, and white occupy distinct physical roles rather than theme slots.
- Geometry rule: use instrument geometry - frames, grids, axes, status markers, tabs, traces, and sparse diagrams. Avoid decorative arcs unless they encode a function.
- Legibility rule: the display must remain useful under poor ambient conditions. Utility outranks spectacle.
- Motion rule: animation is slow instability, breathing, or pulse drift. It is not glitch, cyberpunk flicker, or ornamental scan noise.
- Density rule: complexity is earned by mechanism. High resolution appears only after a plausible addressing model is established.

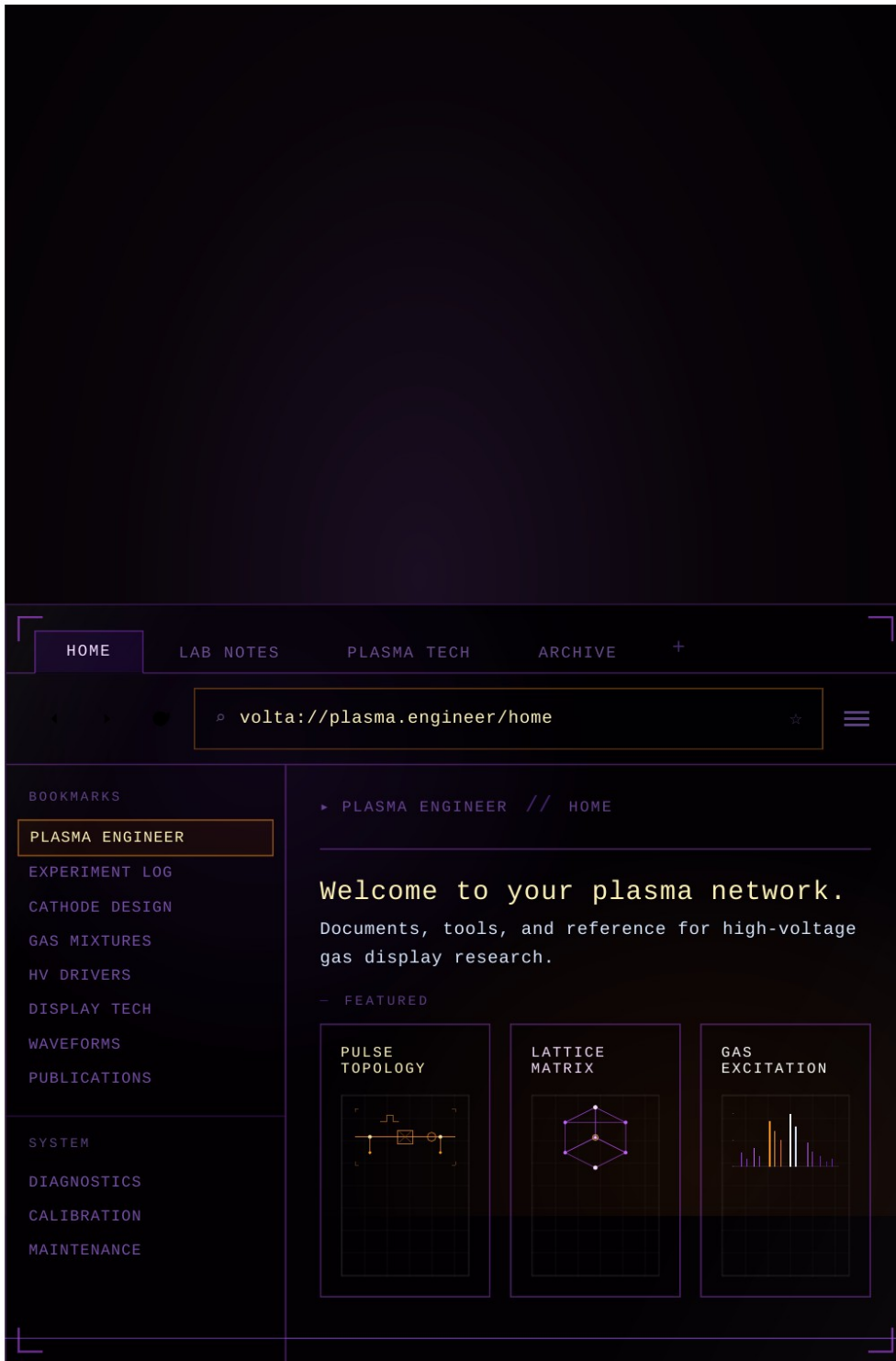


Figure 3. Implementation transfer. The browser surface is conventional HTML/CSS/SVG, but the visual behavior follows the extracted black-glass emission grammar rather than ordinary “neon UI.”

9. Validation Criteria

Because the display technology is hypothetical, validation does not mean demonstrating the hardware. Validation means demonstrating that the mechanism produces a reproducible visual grammar that solves the original design problem better than direct description. The process succeeds if the visual system remains coherent after translation to a different medium.

Criterion	Pass condition	Observed result
Embeddedness	Text and geometry appear inside the medium rather than projected onto it.	Achieved after gas-in-quartz and YouTube-prototype framing.
Reference-class resistance	Output no longer collapses into Star Trek, hologram, cyberpunk, or game HUD priors.	Achieved after mechanism and prototype history were specified.
Utility survival	Style supports dense text, navigation, status, tables, and diagrams.	Achieved in browser benchmark.
Transferability	Rules translate from generated imagery into conventional web primitives.	Achieved through substrate, emission, palette, and geometry rules.
Causal coherence	Every visible trait has an implied physical reason.	Achieved by tying appearance to substrate, excitation, spectra, and field control.

10. Generalizable Protocol

The procedure below is the reusable method. It applies when the desired aesthetic is known but cannot be reached reliably because existing visual priors point to the wrong reference class.

Step	Action	Purpose
1	State the required perceptual behavior.	Define what the artifact must do in the viewer's mind.
2	Inventory prior collapse modes.	Name the obvious genres and why they are wrong.
3	Choose real adjacent physical primitives.	Constrain the model with mechanisms, materials, manufacturing, and failure modes.
4	Invent the missing integration layer.	Create the fictional but coherent industrial lineage.
5	Stage maturity from crude to capable.	Prevent the output from becoming finished-prop fantasy.
6	Use capability benchmarks.	Force the system to render text, imagery, motion, utility, and hierarchy.
7	Extract invariants from successful generations.	Convert images into rules.
8	Translate to the implementation medium.	Prove that the method produced a design grammar, not a one-off render.

11. Discussion: Fictional Engineering as Constraint Layer

The methodological value of the exercise is not that the imagined display exists. The value is that a fictional engineering lineage can serve as a constraint layer when ordinary aesthetic vocabulary is too ambiguous. A model trained on existing images cannot directly render a missing industrial branch. It can, however, combine adjacent physical priors if the prompt sequence gives it a coherent mechanism, maturity curve, and failure history.

This matters because many design targets are not well served by named styles. “Futuristic” is usually a genre label, not a process. “Advanced” is usually decoration, not causality. The mechanism-first approach replaces visual taste with a causal audit: What medium would produce this? What constraints would it impose? What artifacts would early prototypes show? What failure modes would remain visible? What would disappear once the technology matured?

The prompt becomes an engineering specification for latent-space retrieval. The output becomes evidence. The final design is the invariant set extracted from that evidence.

12. Conclusion

The obsidian plasma interface did not emerge from a style prompt. It emerged from a mechanism selection process.

The selected mechanism was useful because it solved the core perceptual contradiction: the interface needed to look like a real future technology without borrowing the existing language of cinematic futurism. The repair was to invent the missing display lineage, ground each step in adjacent physical reality, test it through generative prototypes, and extract only the visual laws that survived the sequence.

The final lesson is simple: when the desired style has no adequate reference class, invent the mechanism that would have produced it. The mechanism does not have to exist yet. It has to be coherent enough to constrain the image model, strong enough to explain the visible result, and specific enough to survive translation into a working design surface.

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Appendix A. High-Level Prompting Pattern

The prompts used in the sequence followed a consistent structure. They did not ask for beauty first. They named a physical mechanism, a maturity state, a capability test, an environment, and a constraint to avoid known failure modes.

Prompt component	Role
Mechanism	What physical system produces the image.
Maturity state	Proof-of-concept, upgraded prototype, mature system, fielded utility surface.
Capability test	HELLO WORLD, meme image, DOOM, browser interface.
Environment	Workshop, abandoned utility room, dark lab, YouTube demo.
Constraint	No space-looking cruft, no hologram theatrics, no random branching, high legibility.
Failure repair	Add only the next physical mechanism needed to solve the observed failure.