Title: Physics of Innovation, & The Power of Ideas (2 Presentations)

Date: Oct 22, 2010 03:00 PM

URL: http://www.pirsa.org/10100103

Abstract:

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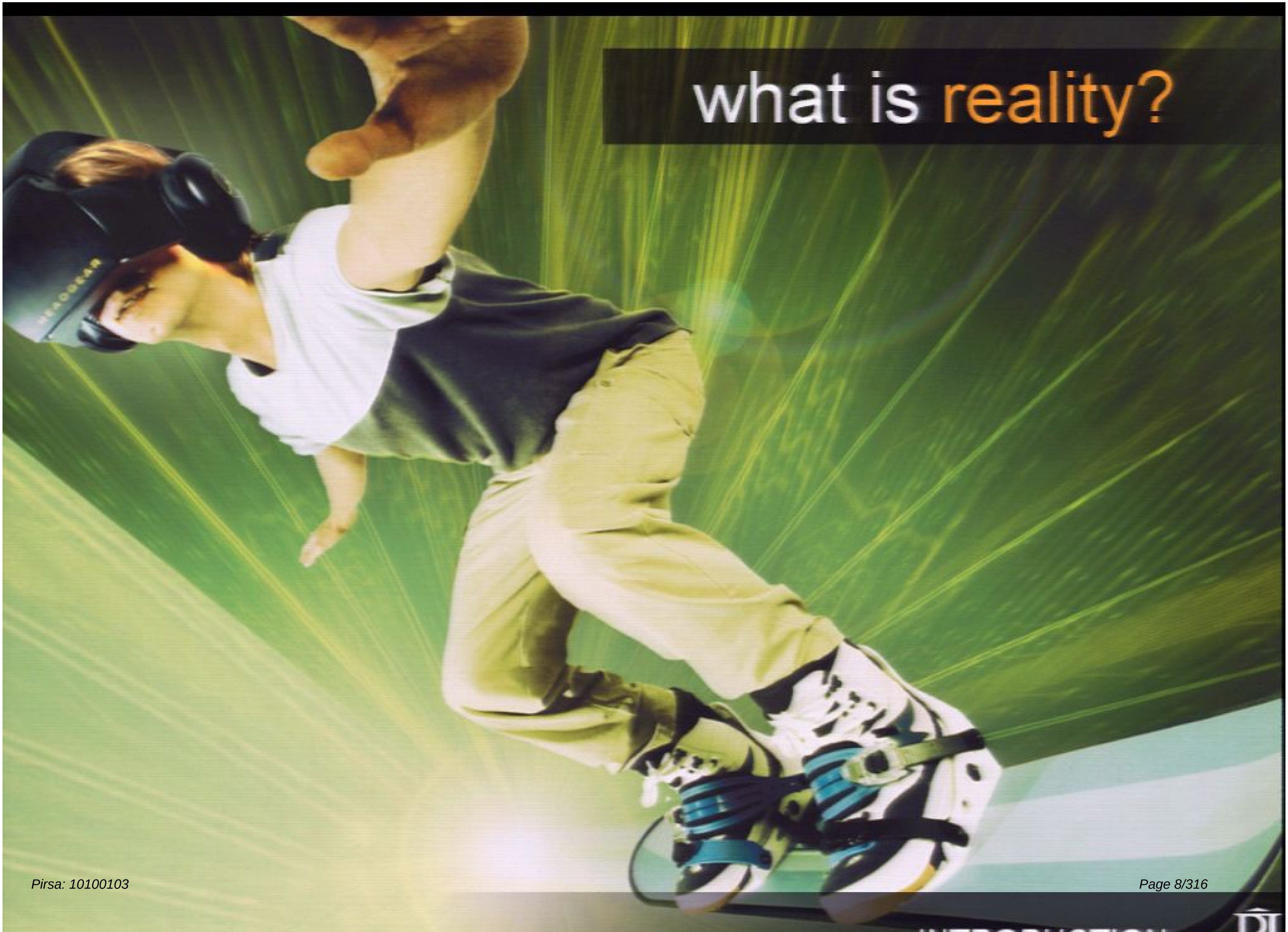
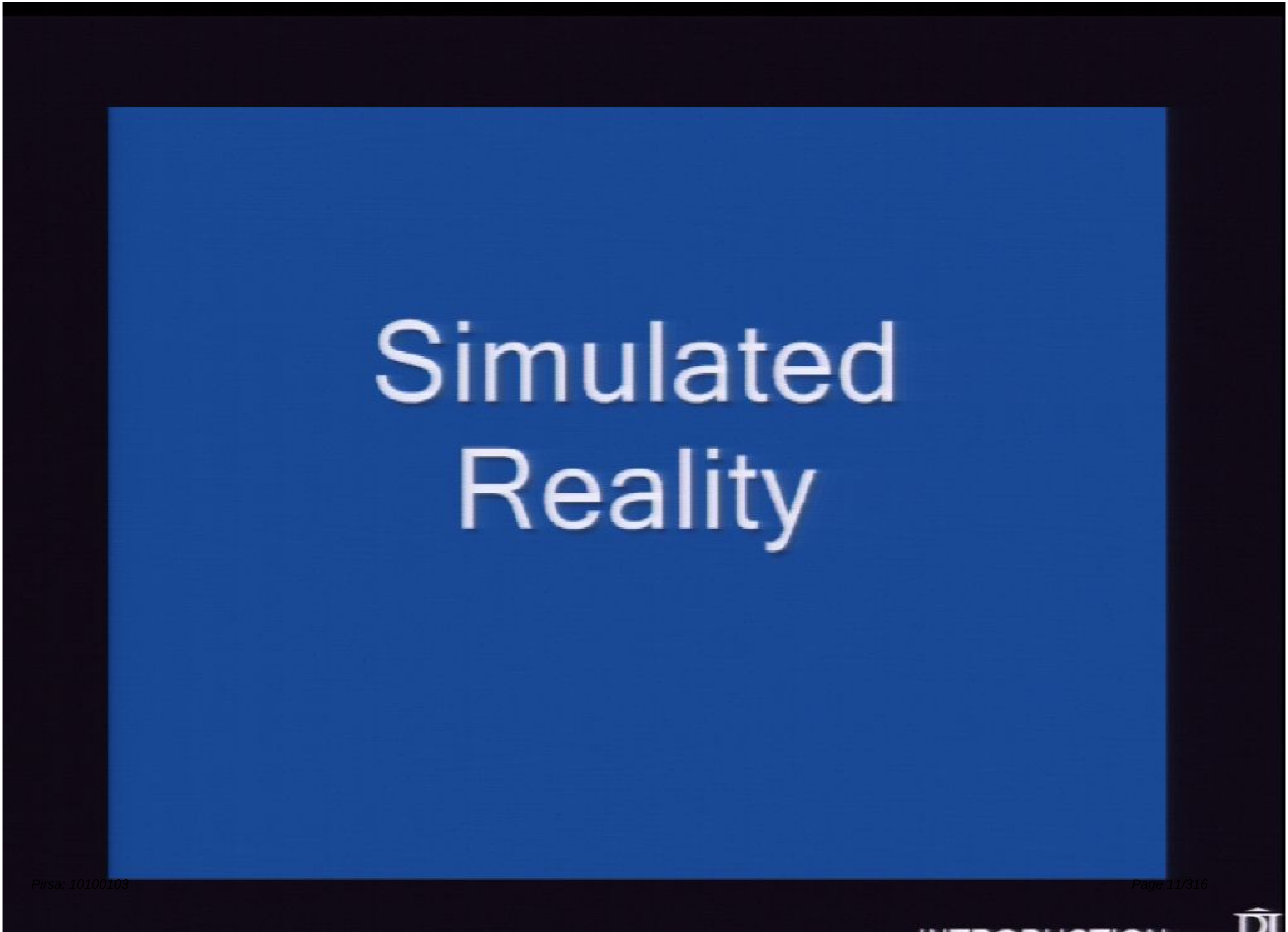
Physica Phantastica
THE PHYSICS OF INNOVATION
explore
understand
bu


THE PHYSICS OF INNOVATION INTRODUCTION


what is reality?


HEADGEAR


what is reality?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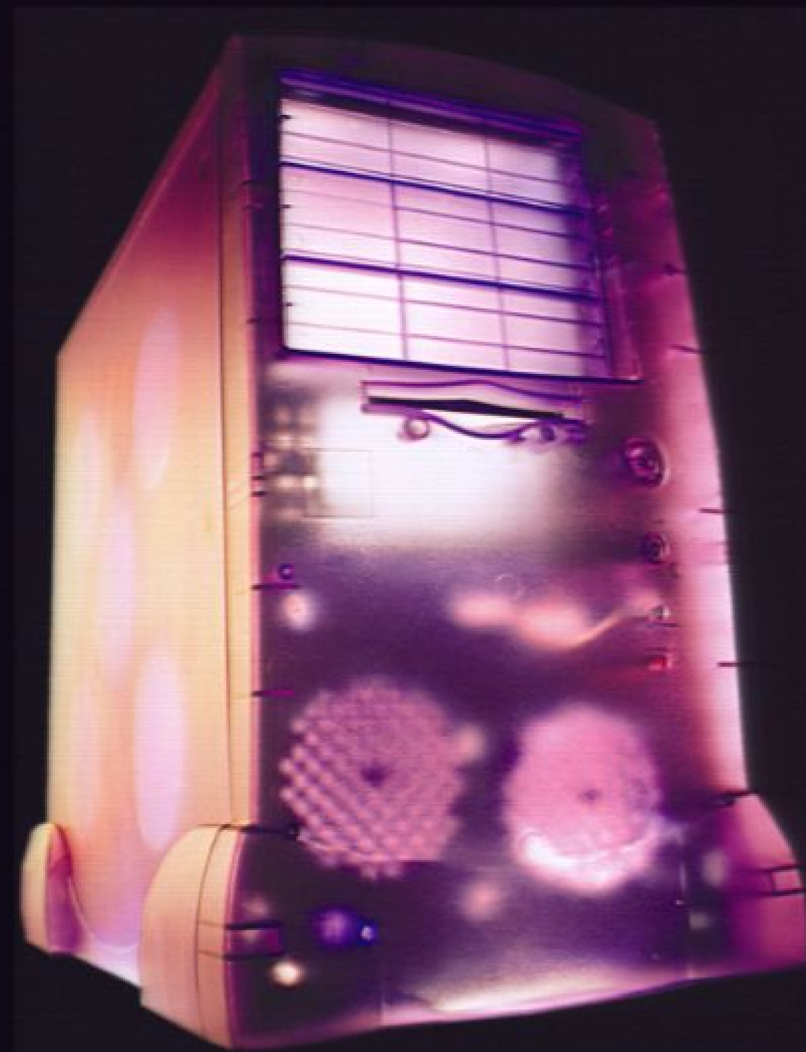
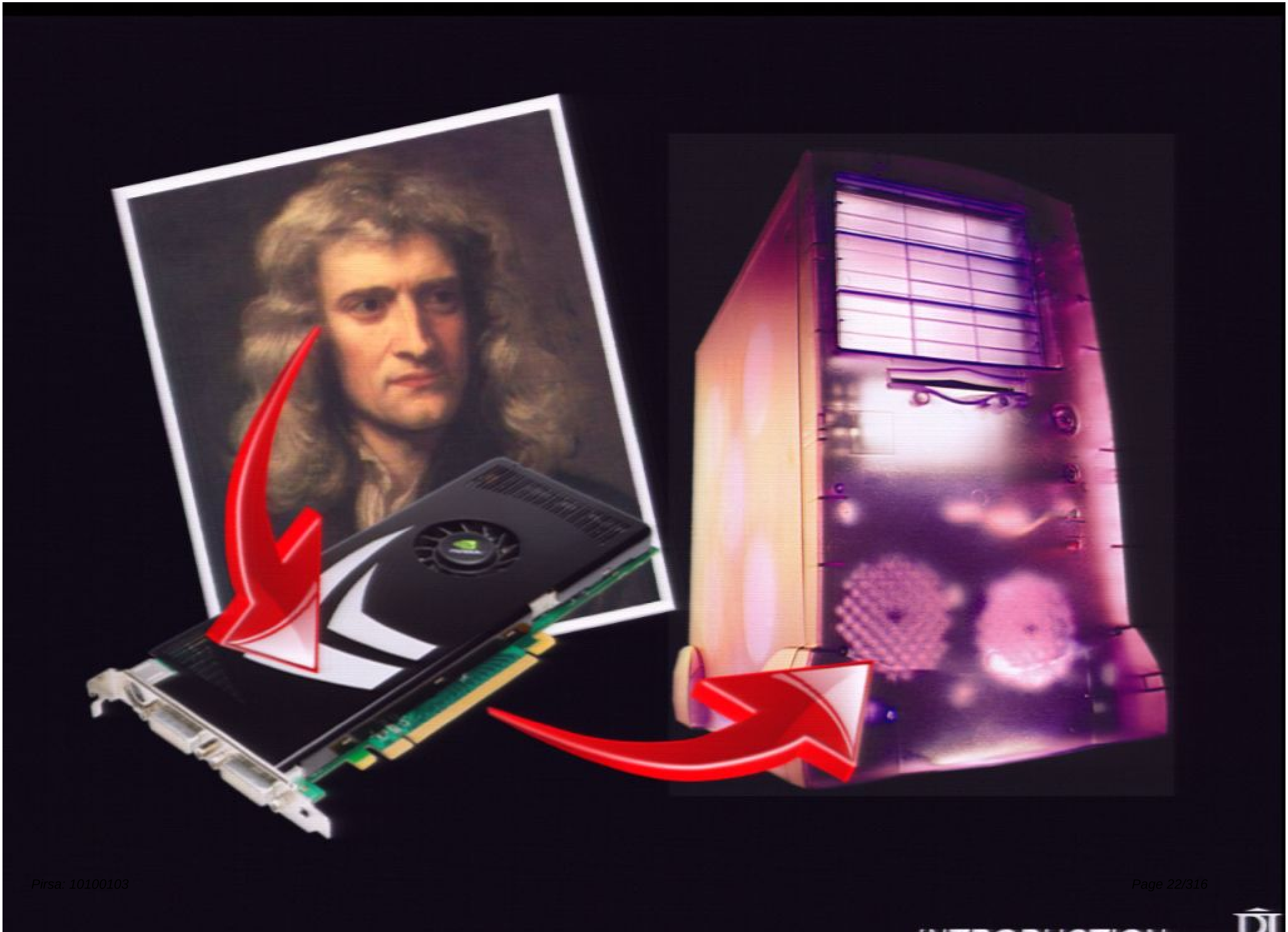
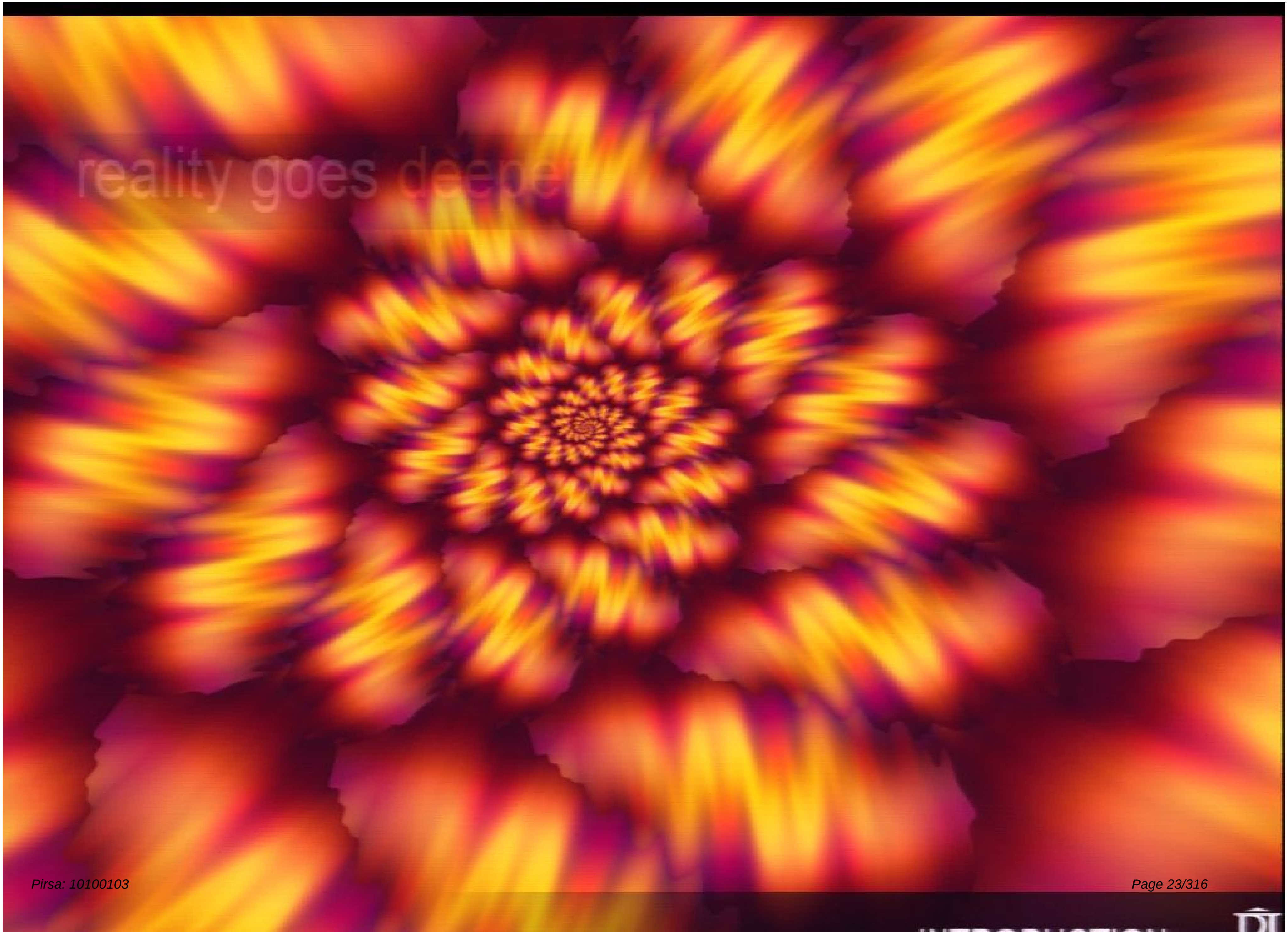
Reality



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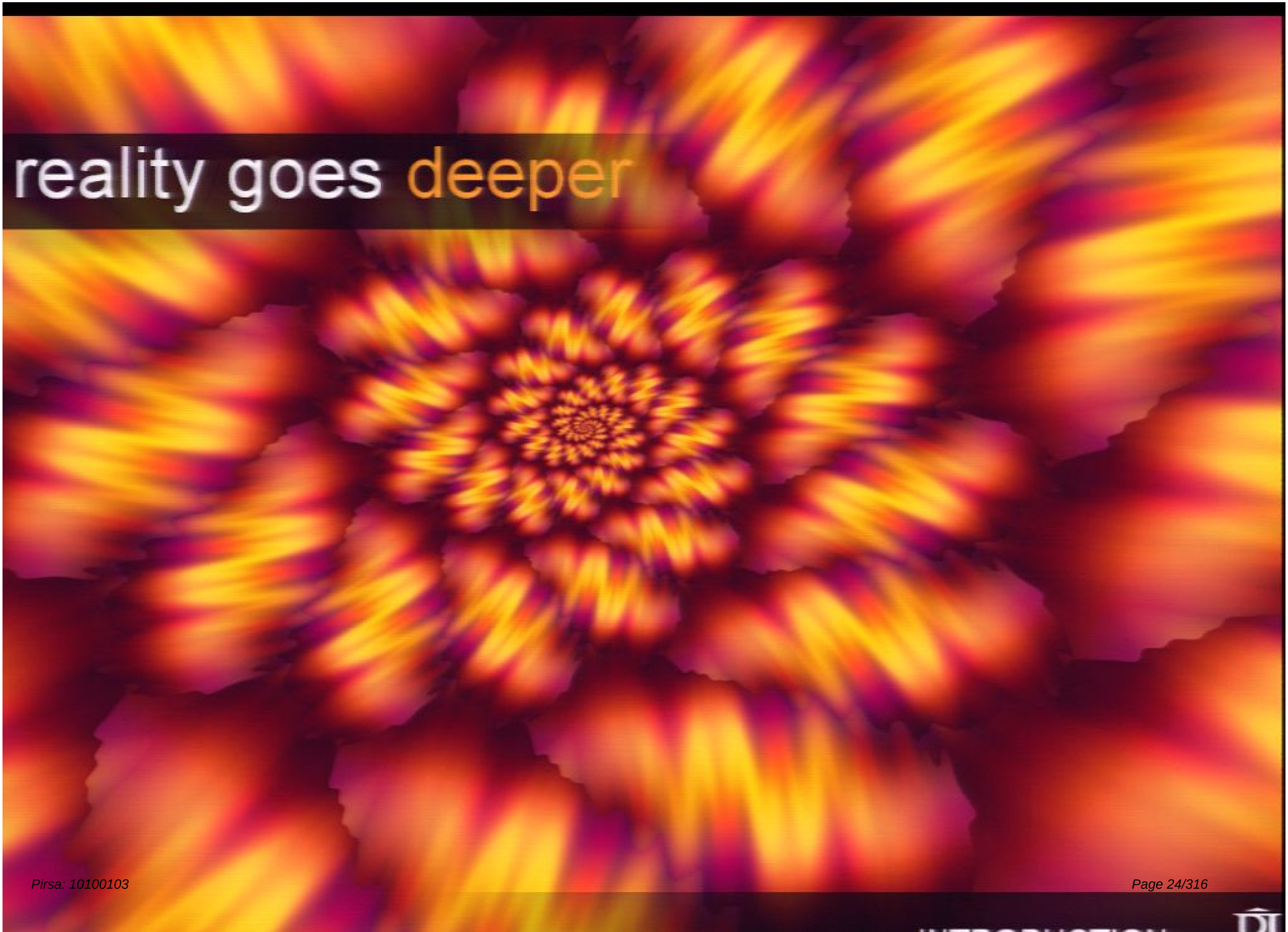
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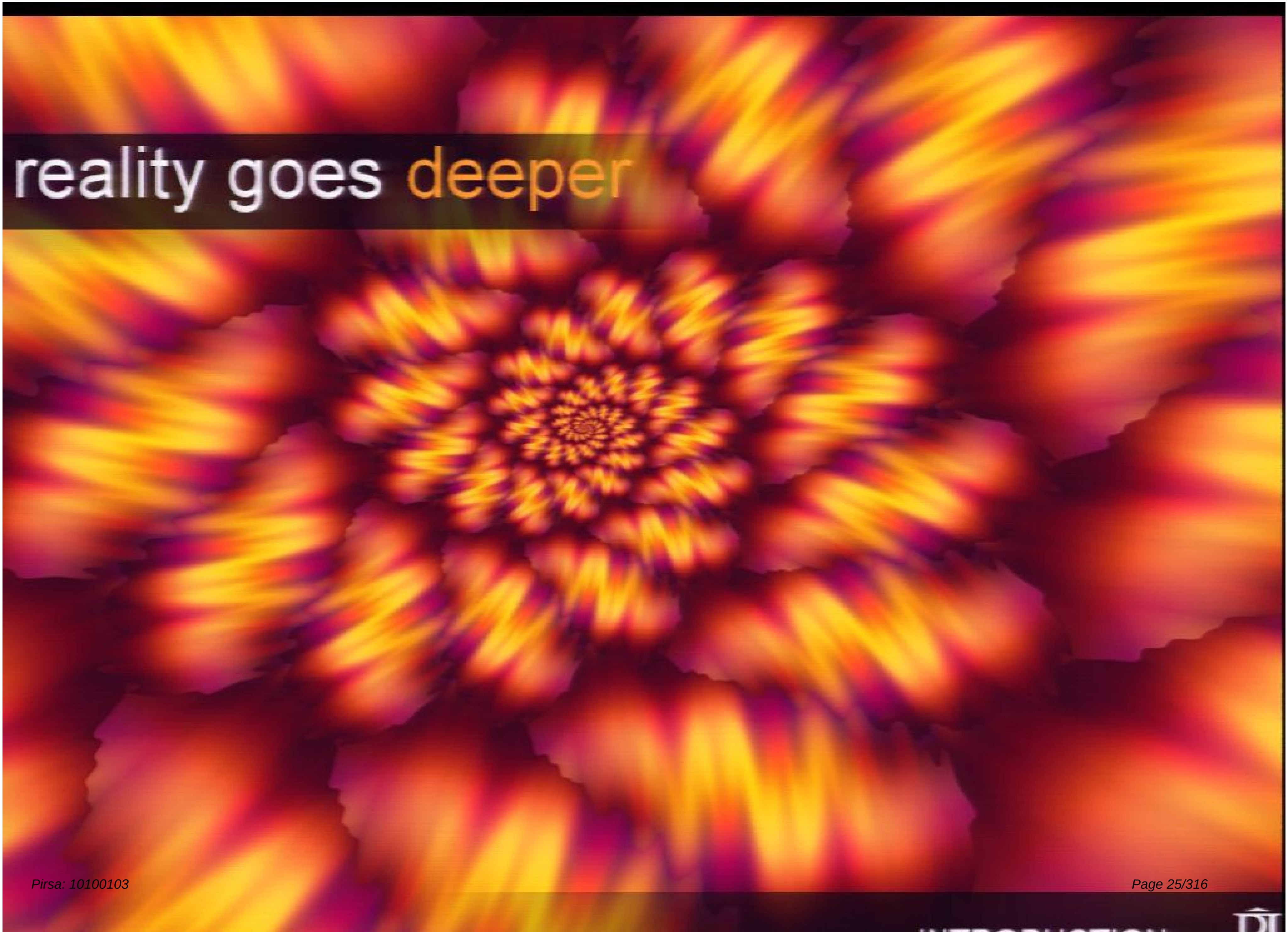
reality goes deeper


example of
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example of
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understanding
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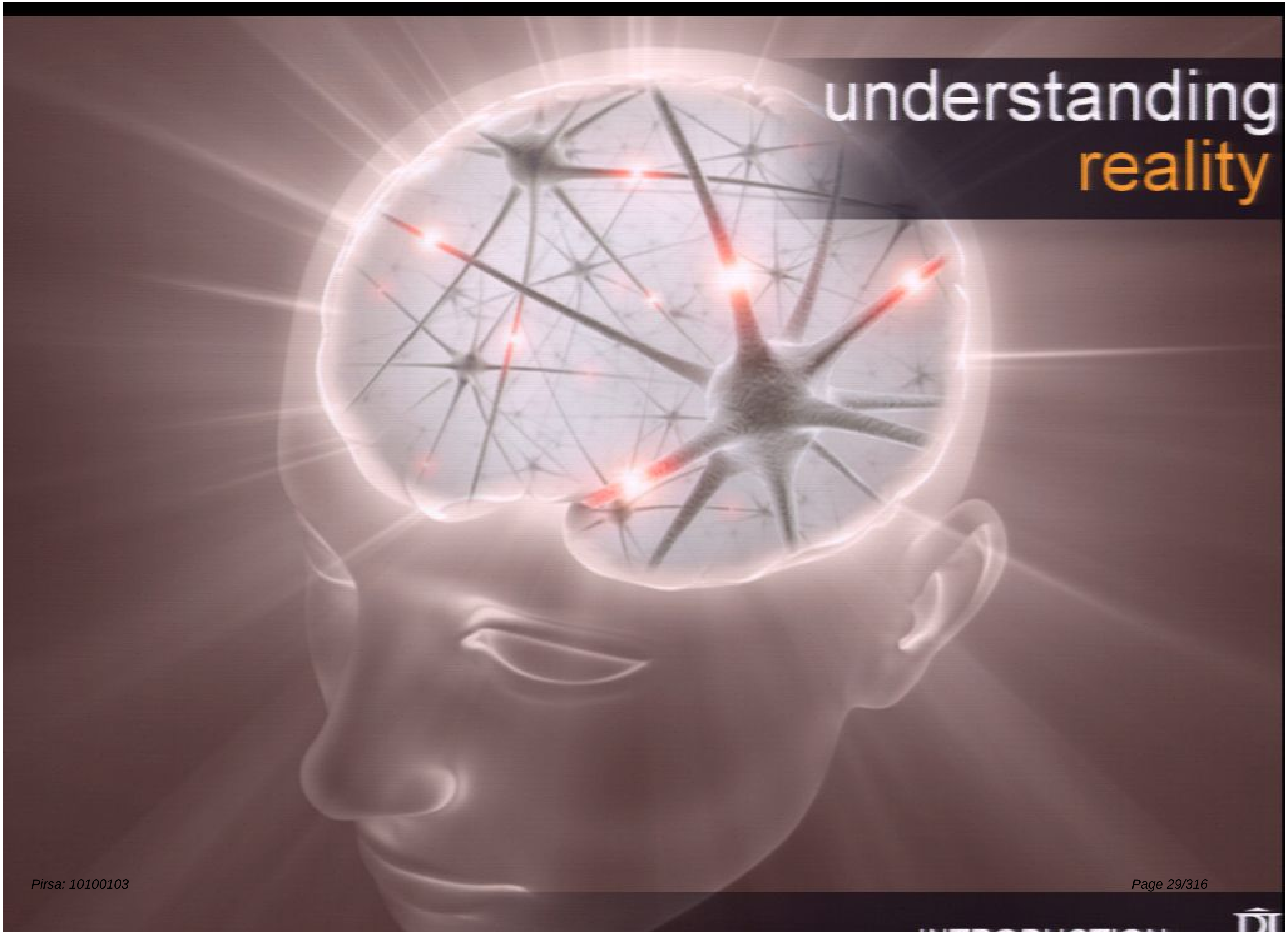
understanding
reality


empowers us to
innovate

the physics of innovation:

the physics of innovation:

explore mystery

the physics of innovation:

explore mystery

understand reality

the physics of innovation:

explore mystery

understand reality

build cool stuff

the physics of innovation:

explore mystery

understand reality

build cool stuff

4 ideas that changed the world

electromagnetism

special relativity

general relativity

quantum

[redacted]

4 ideas that changed the world

electromagnetism

special relativity

general relativity

quantum

4 ideas that changed the world

electromagnetism

special relativity

general relativity

quantum


General Relativity
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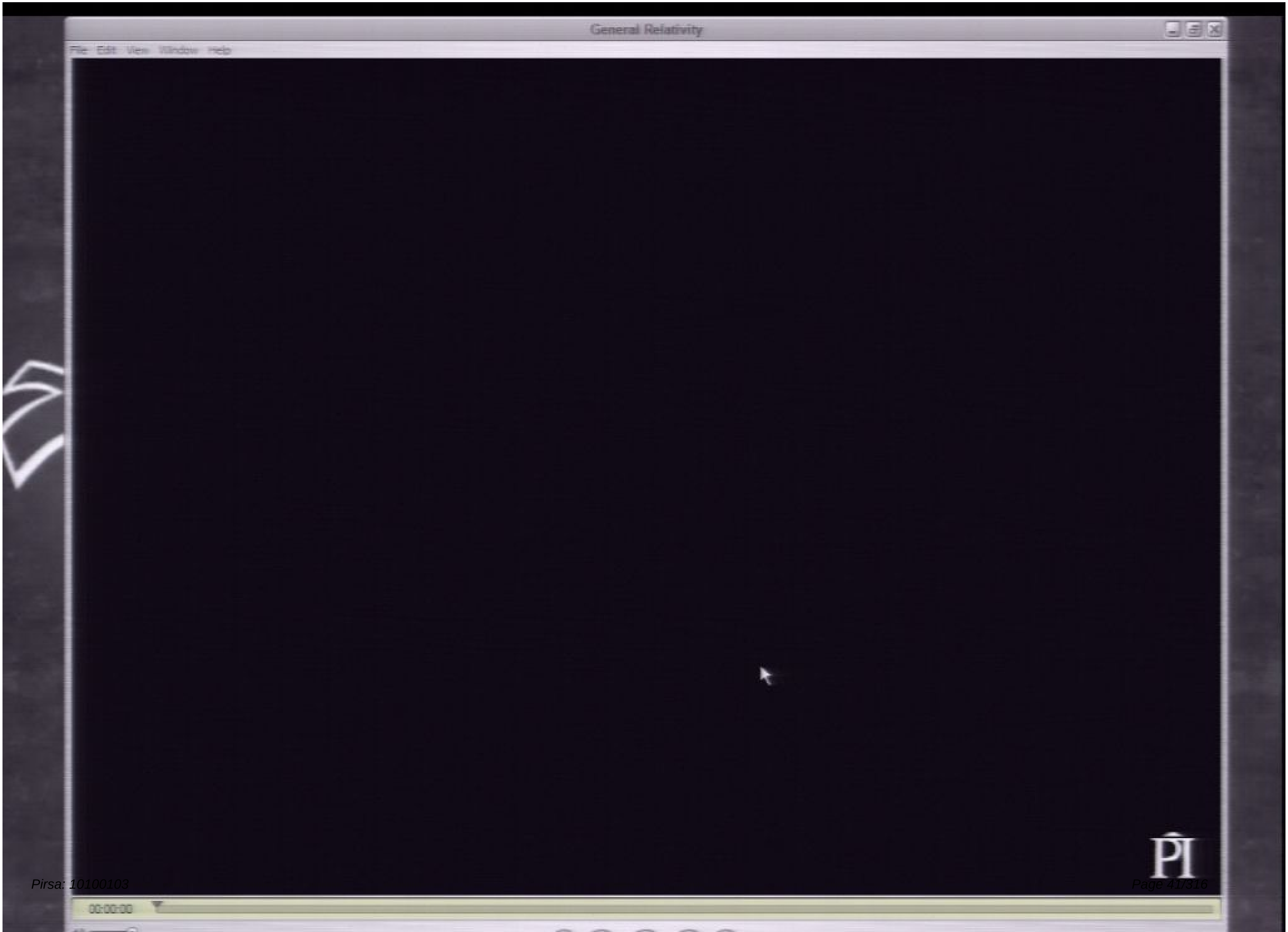
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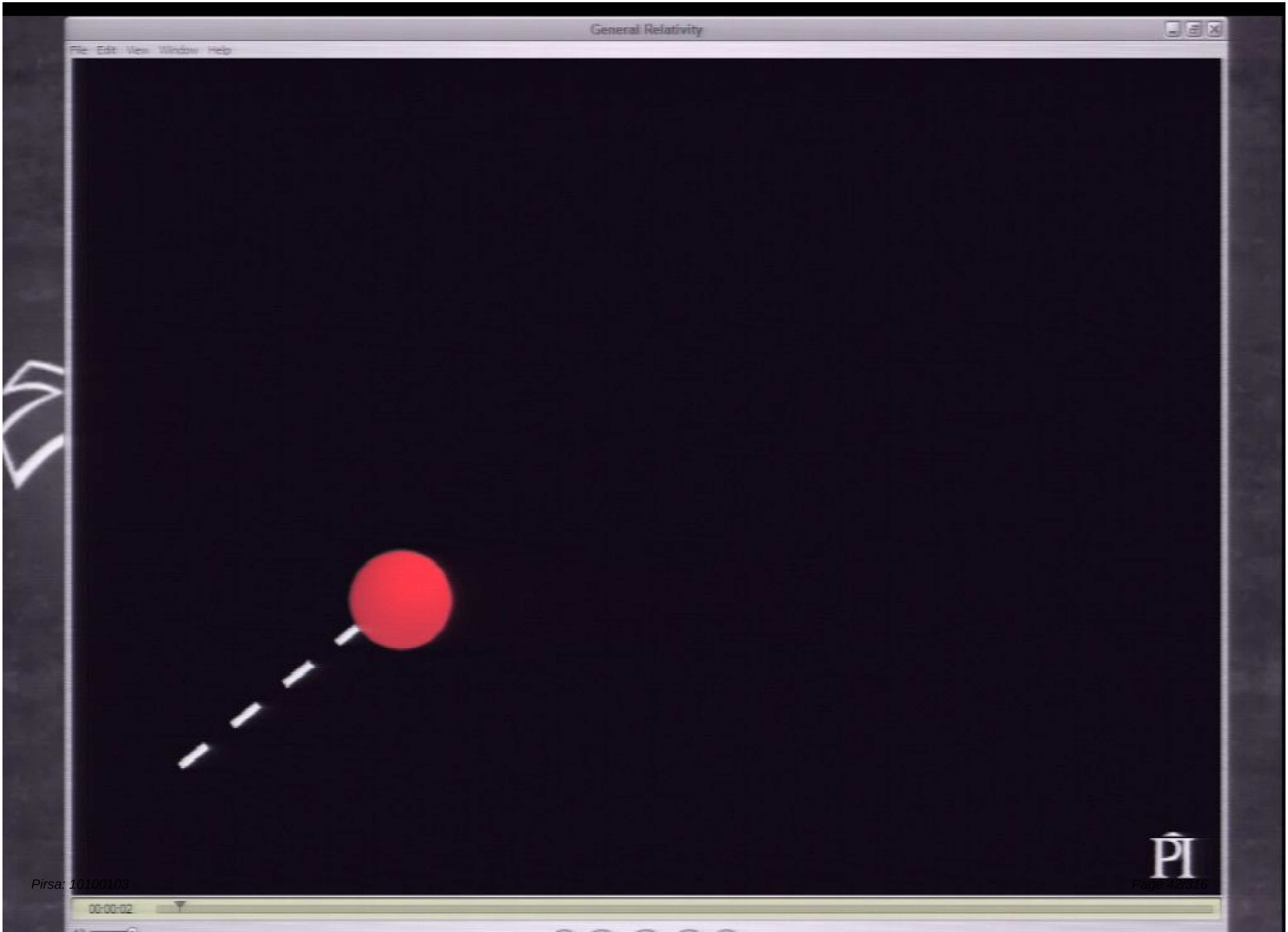
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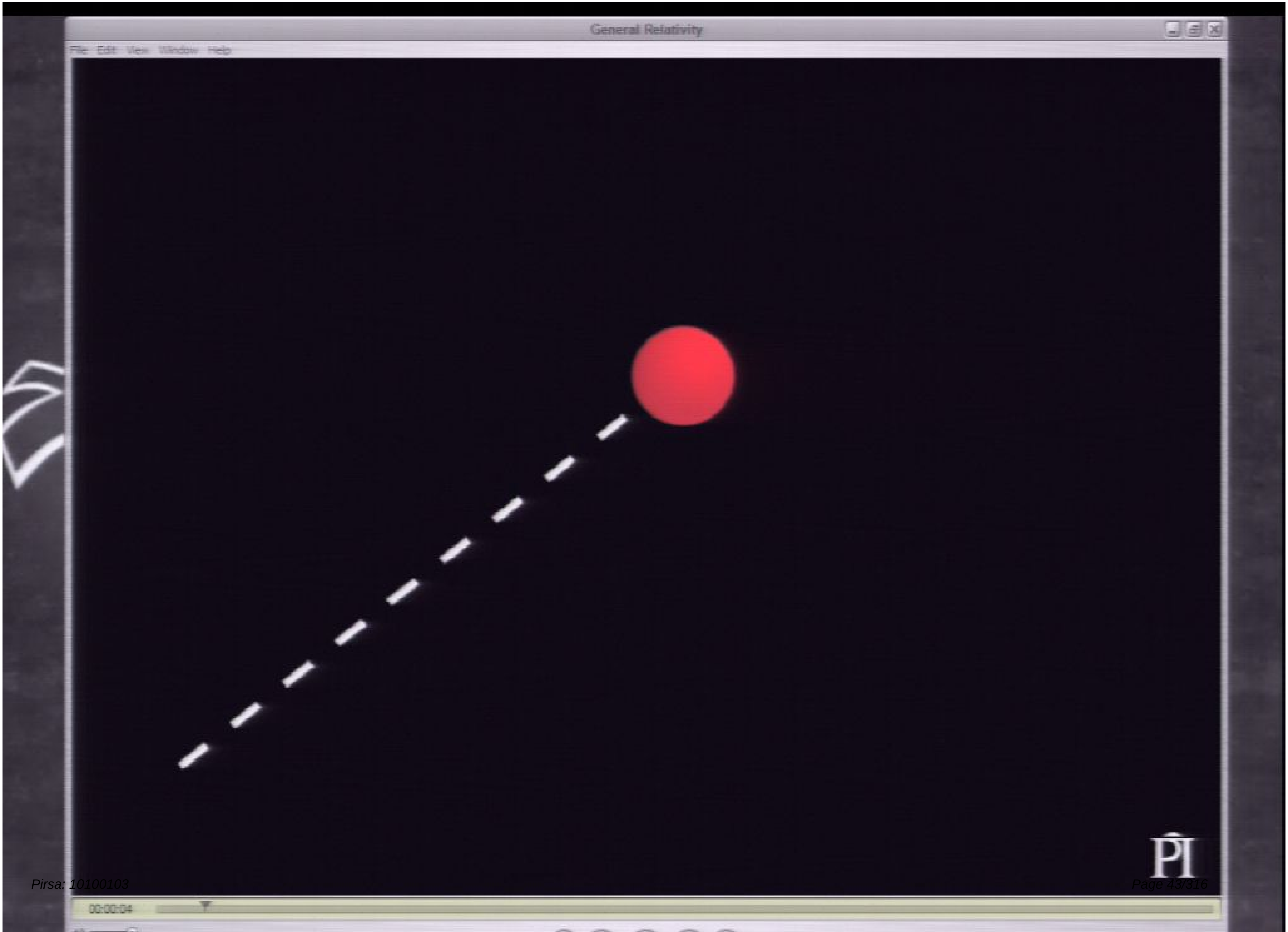
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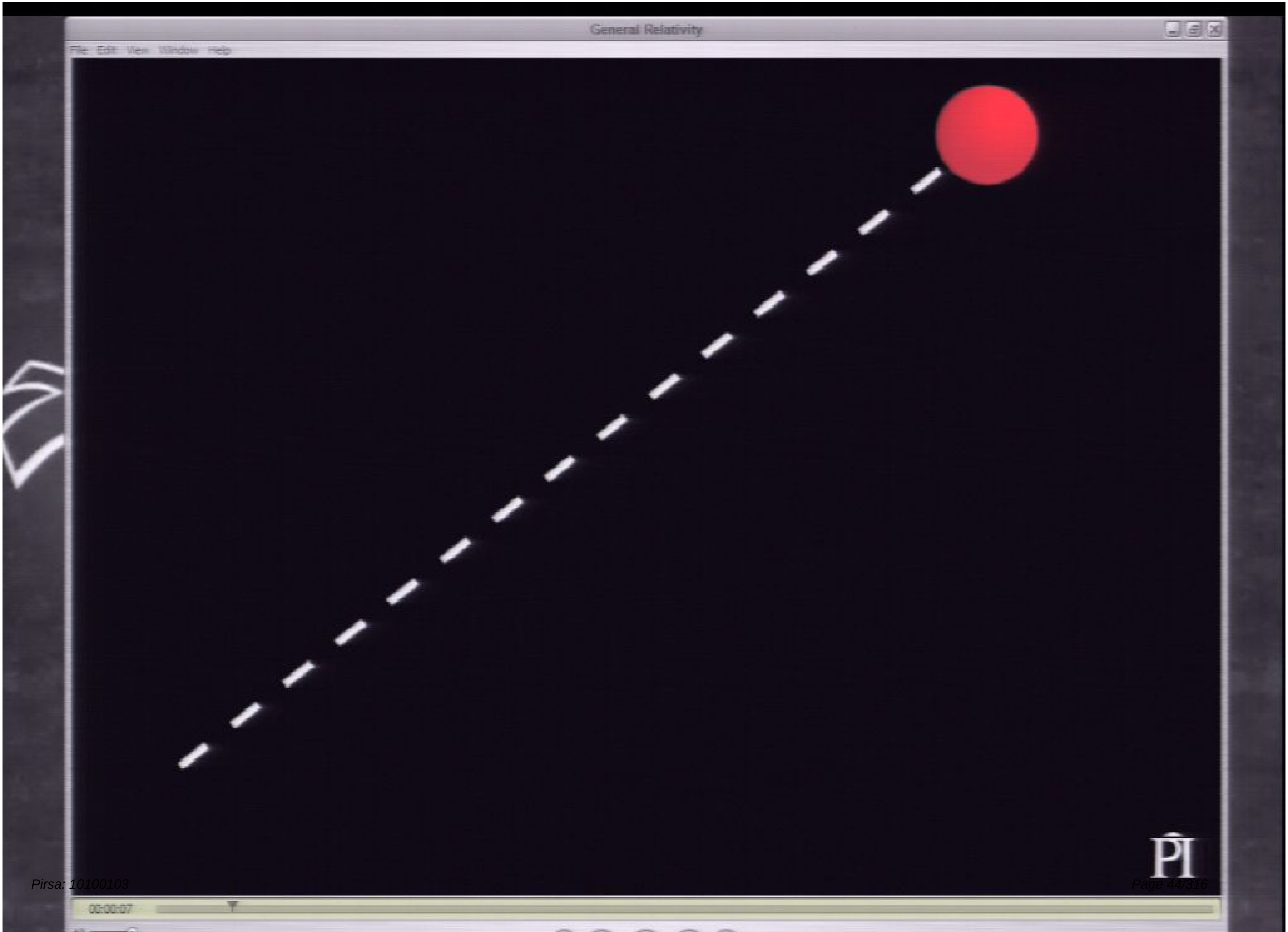
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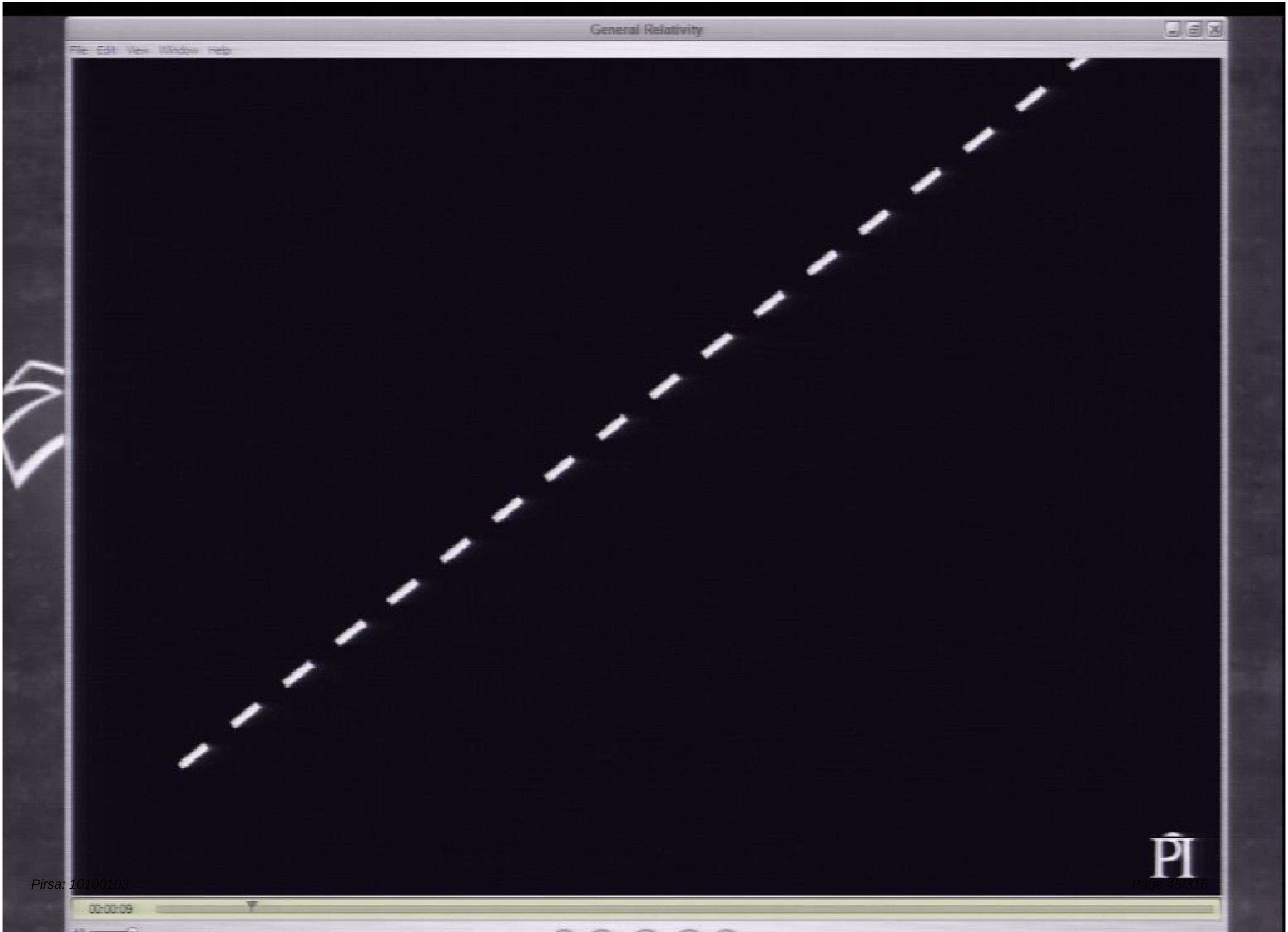
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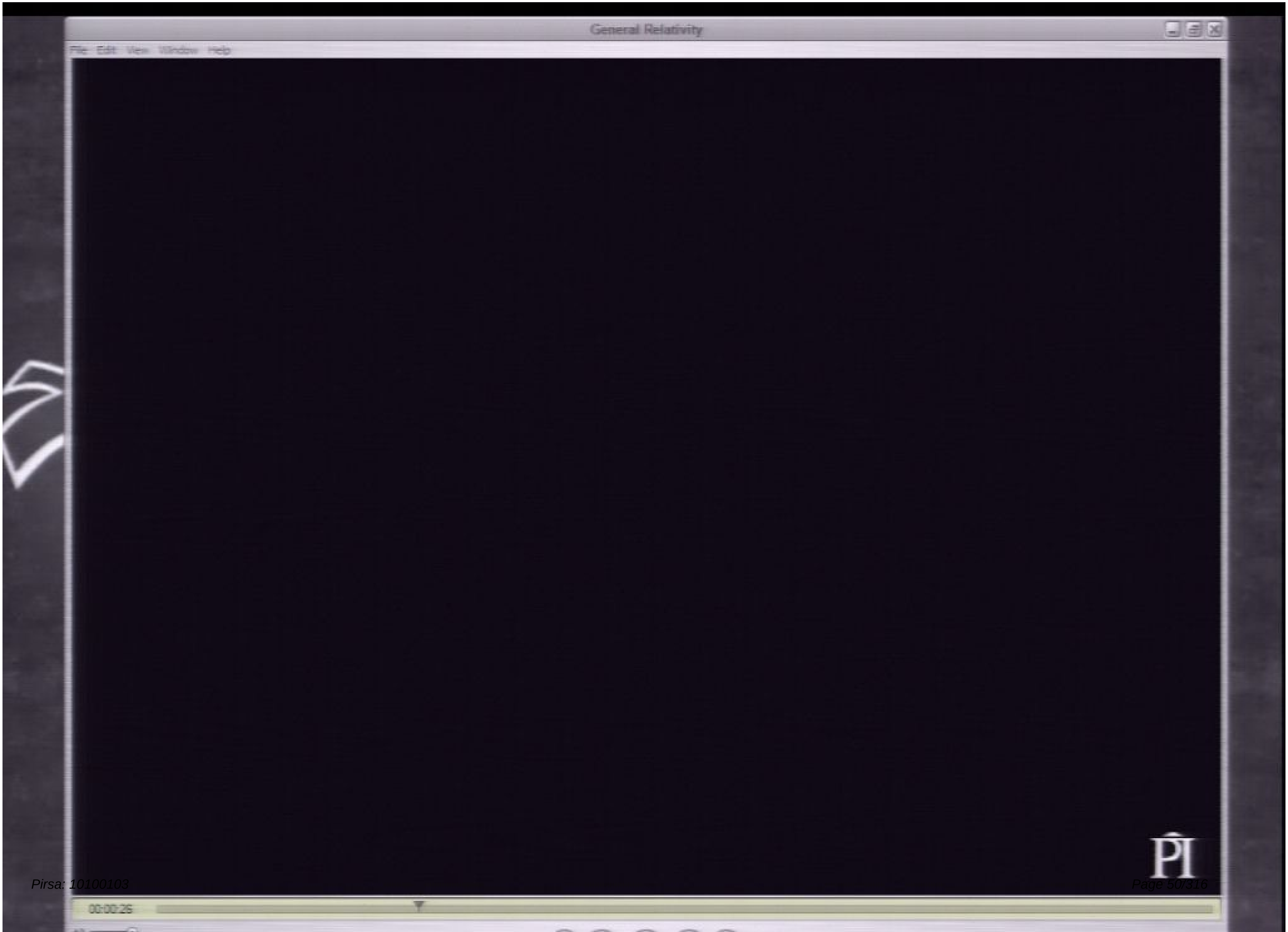
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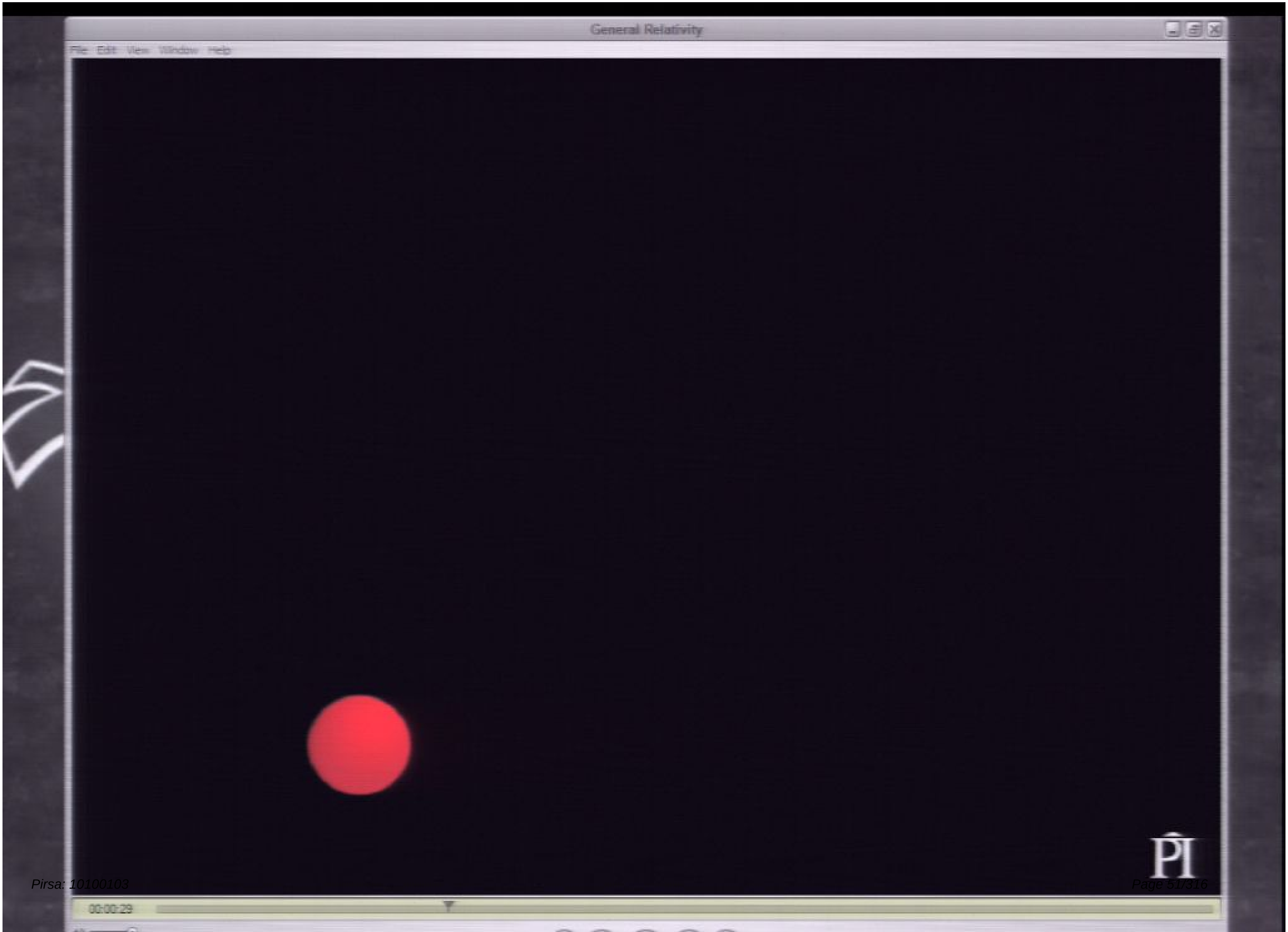
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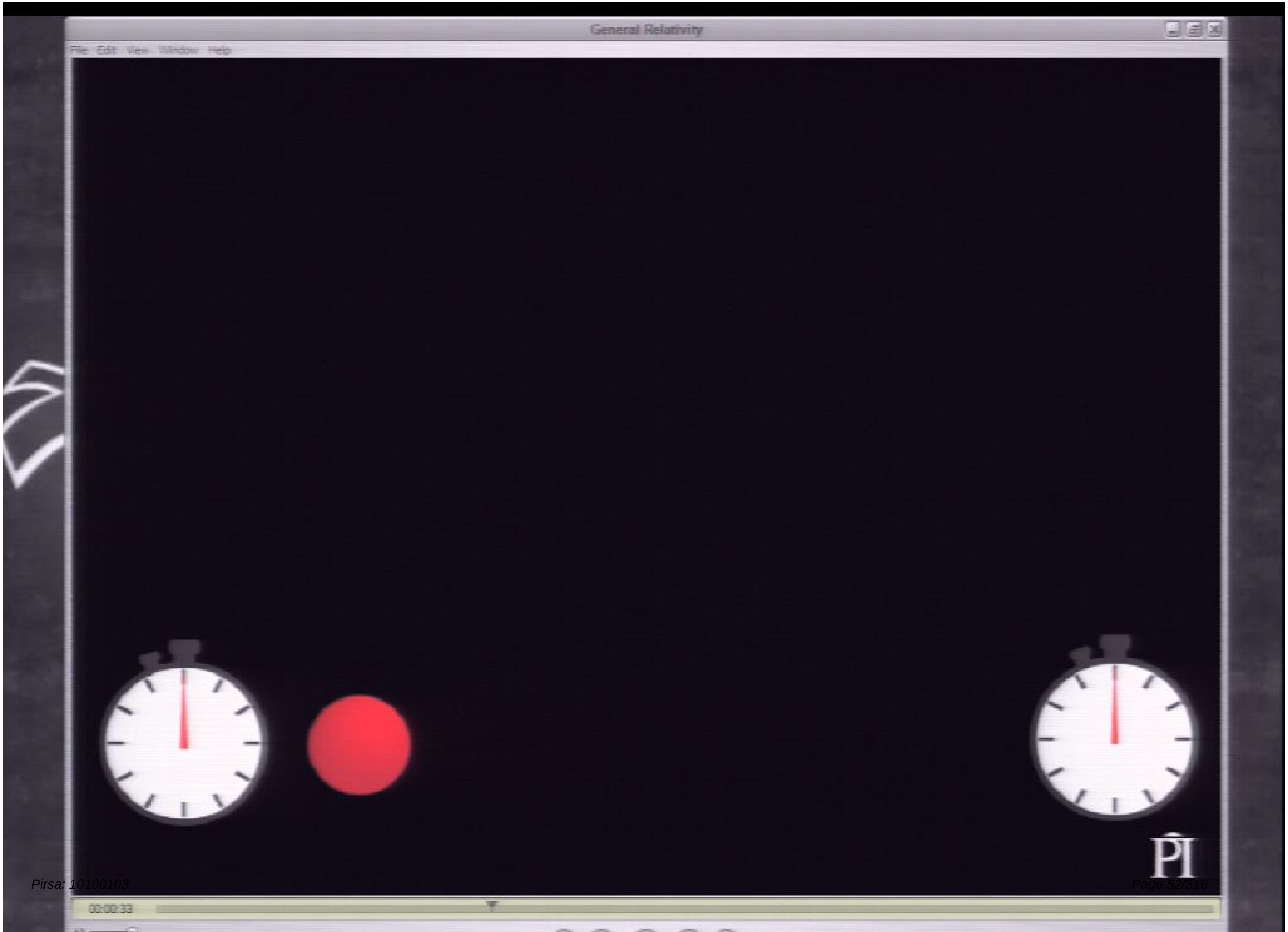
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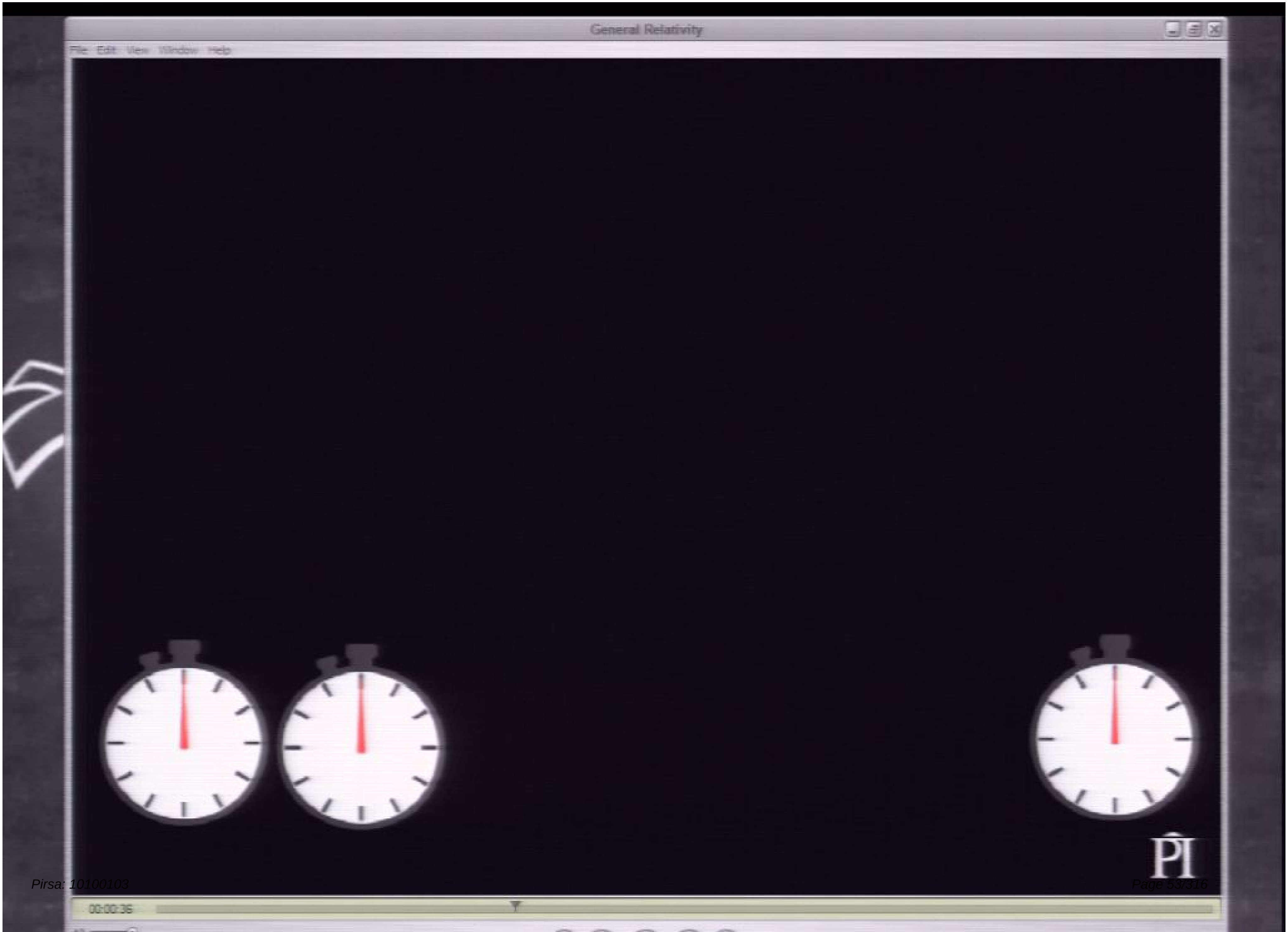
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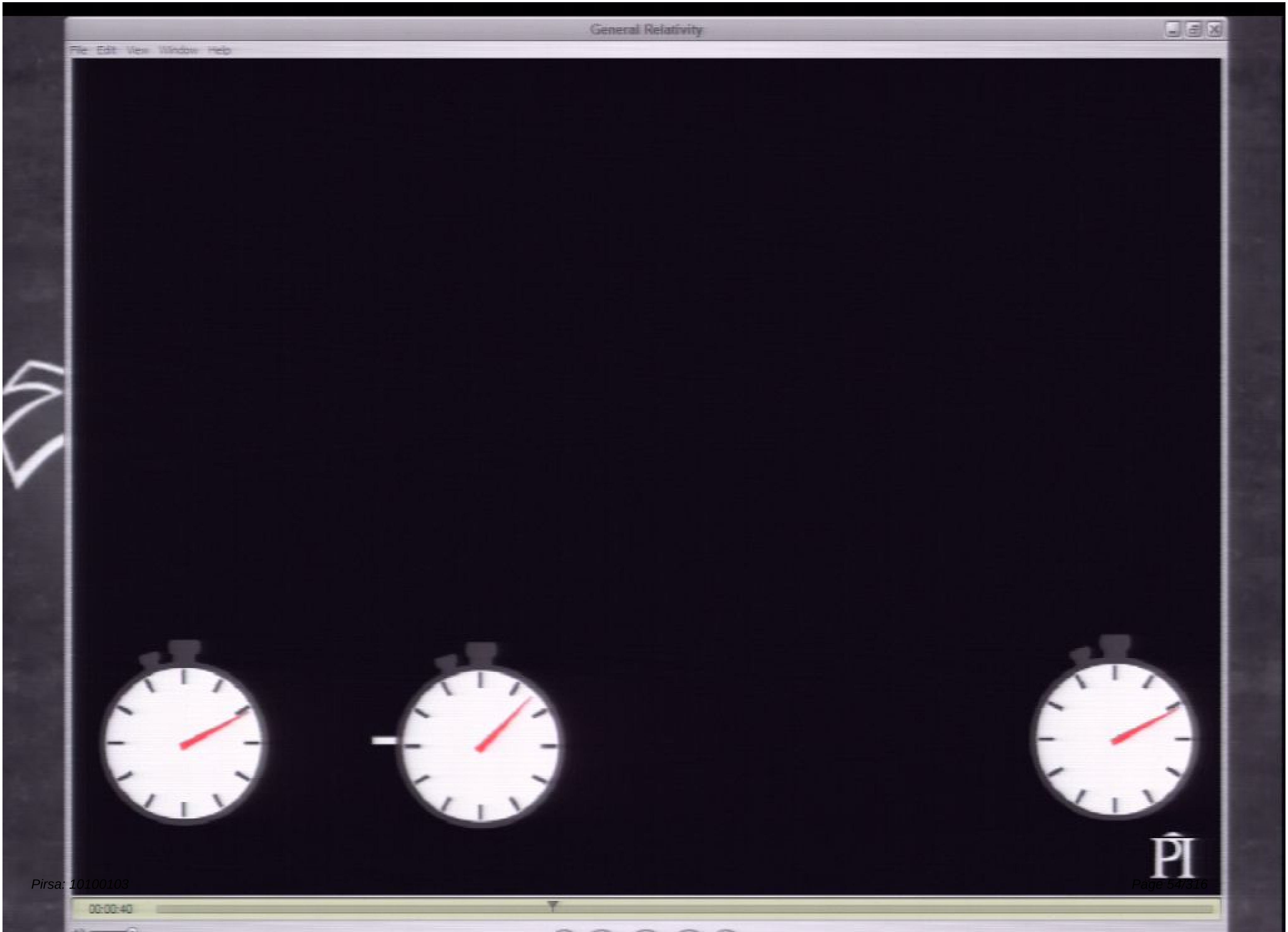
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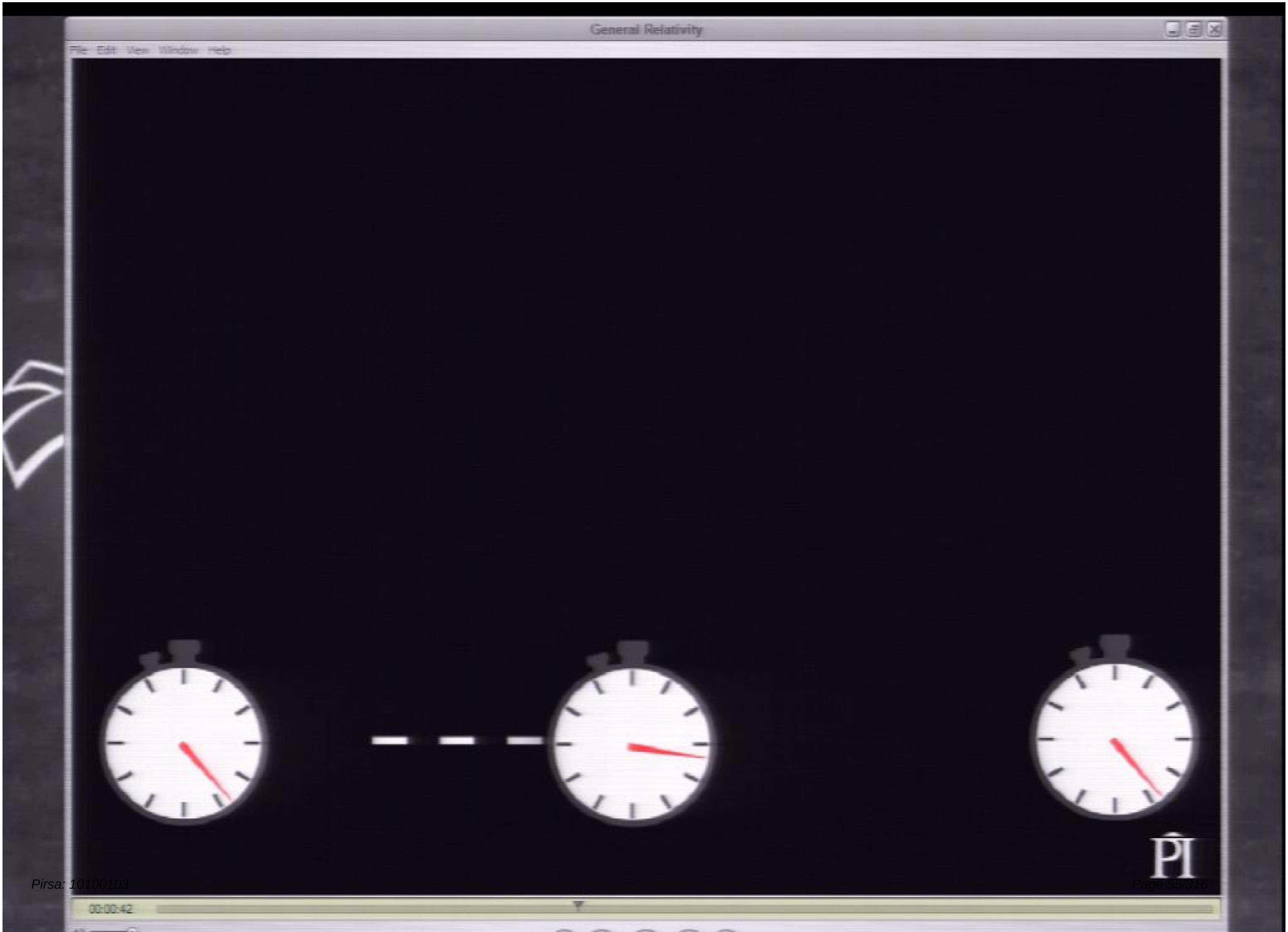
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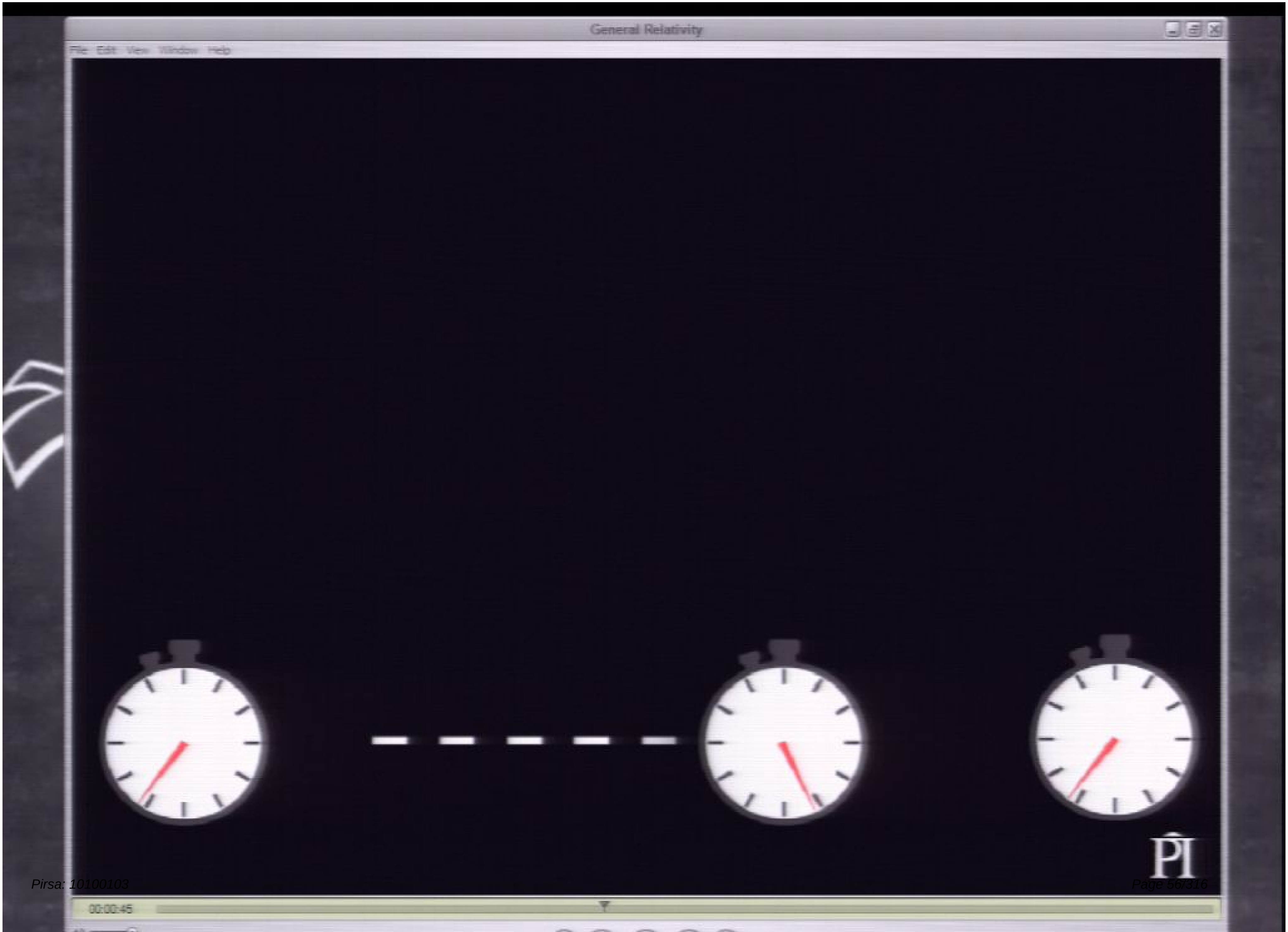
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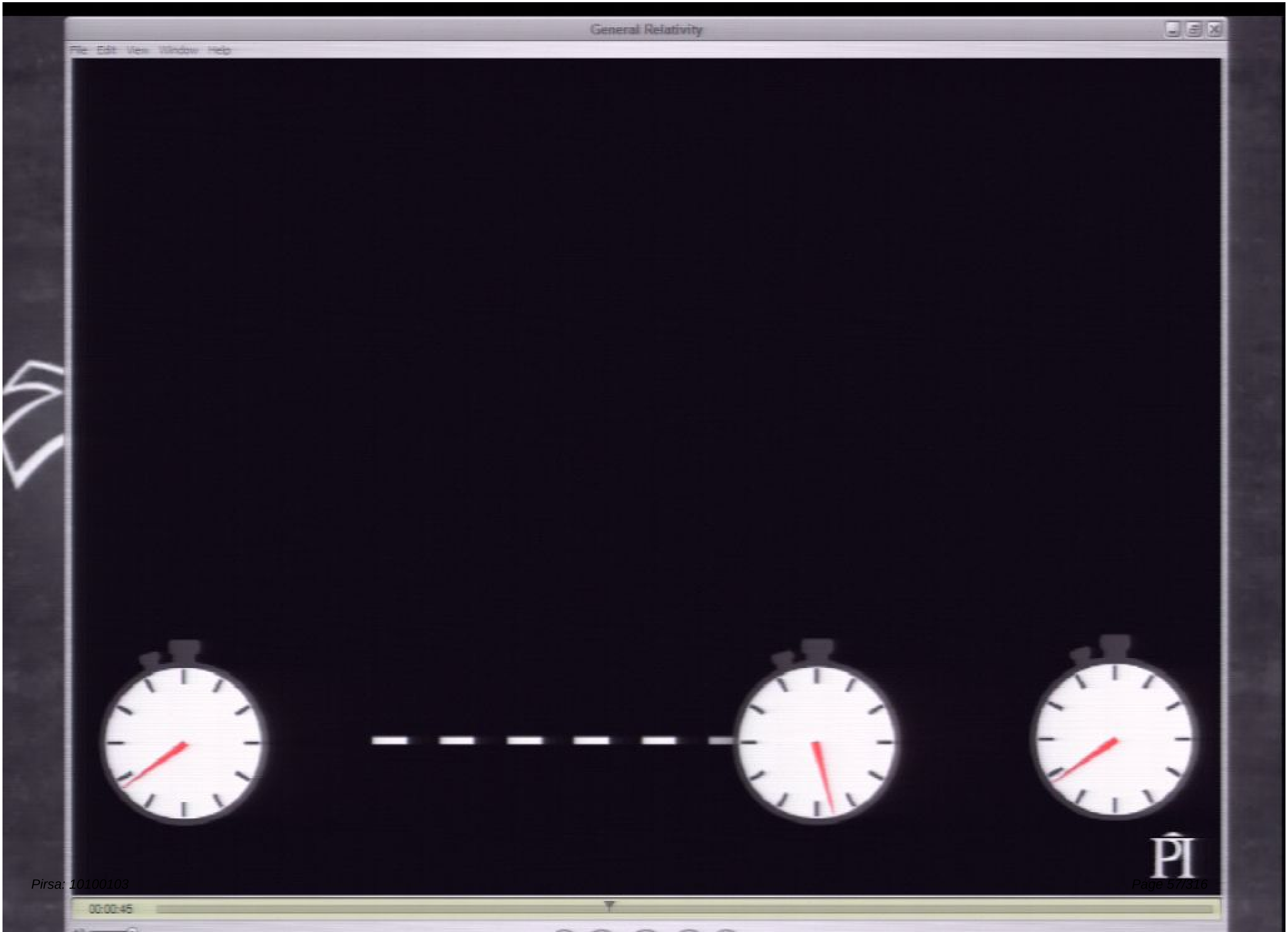
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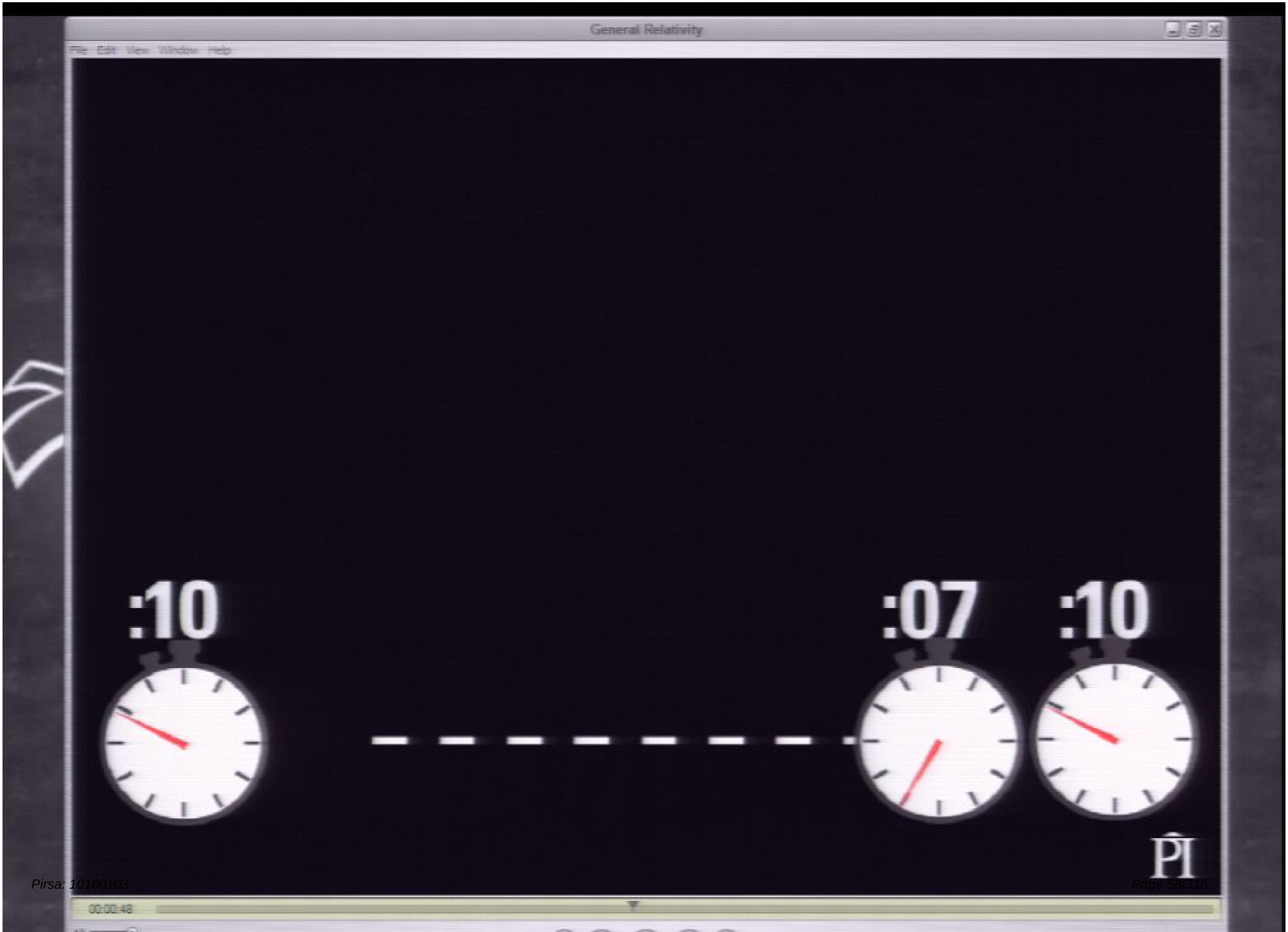
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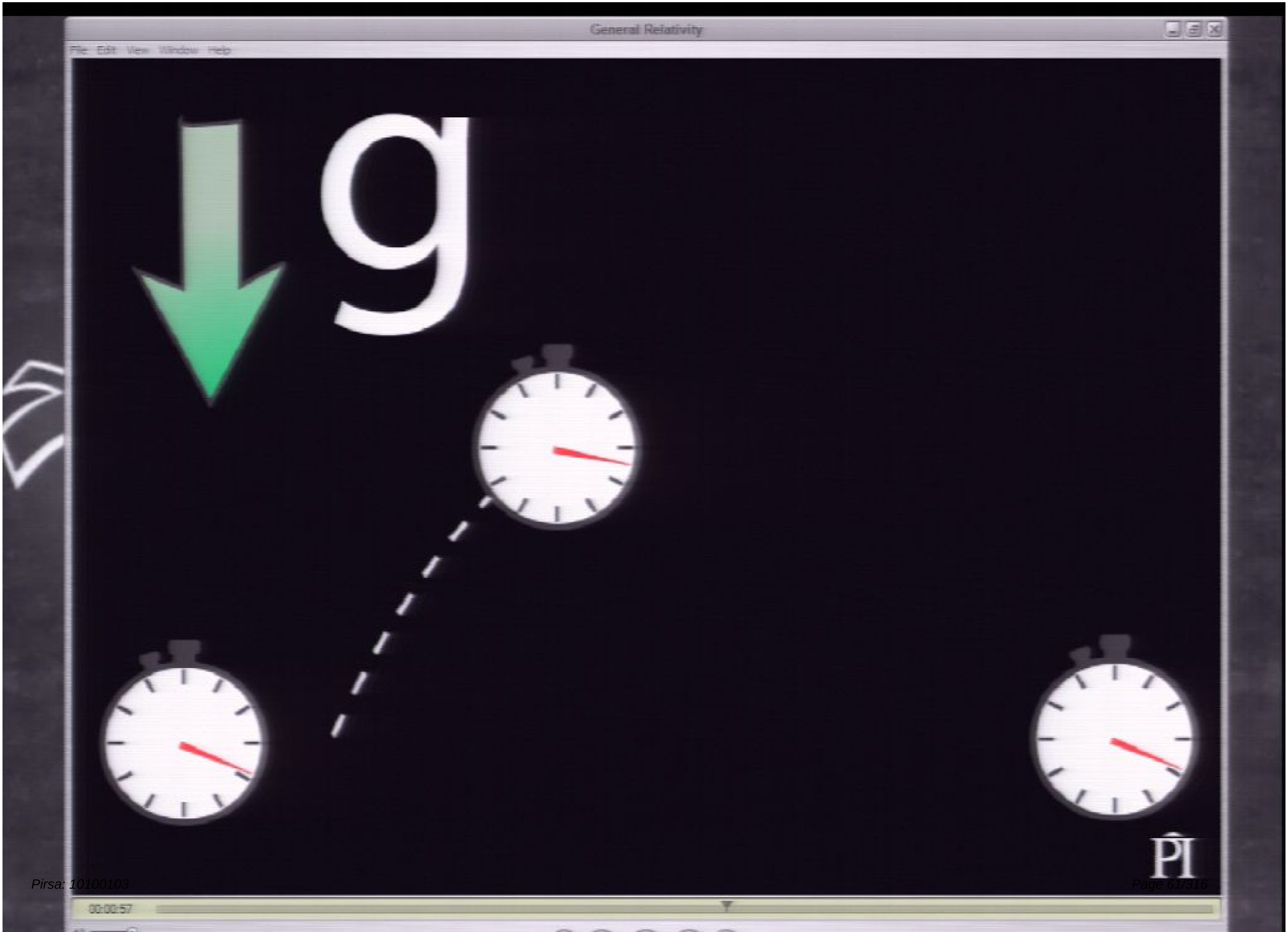
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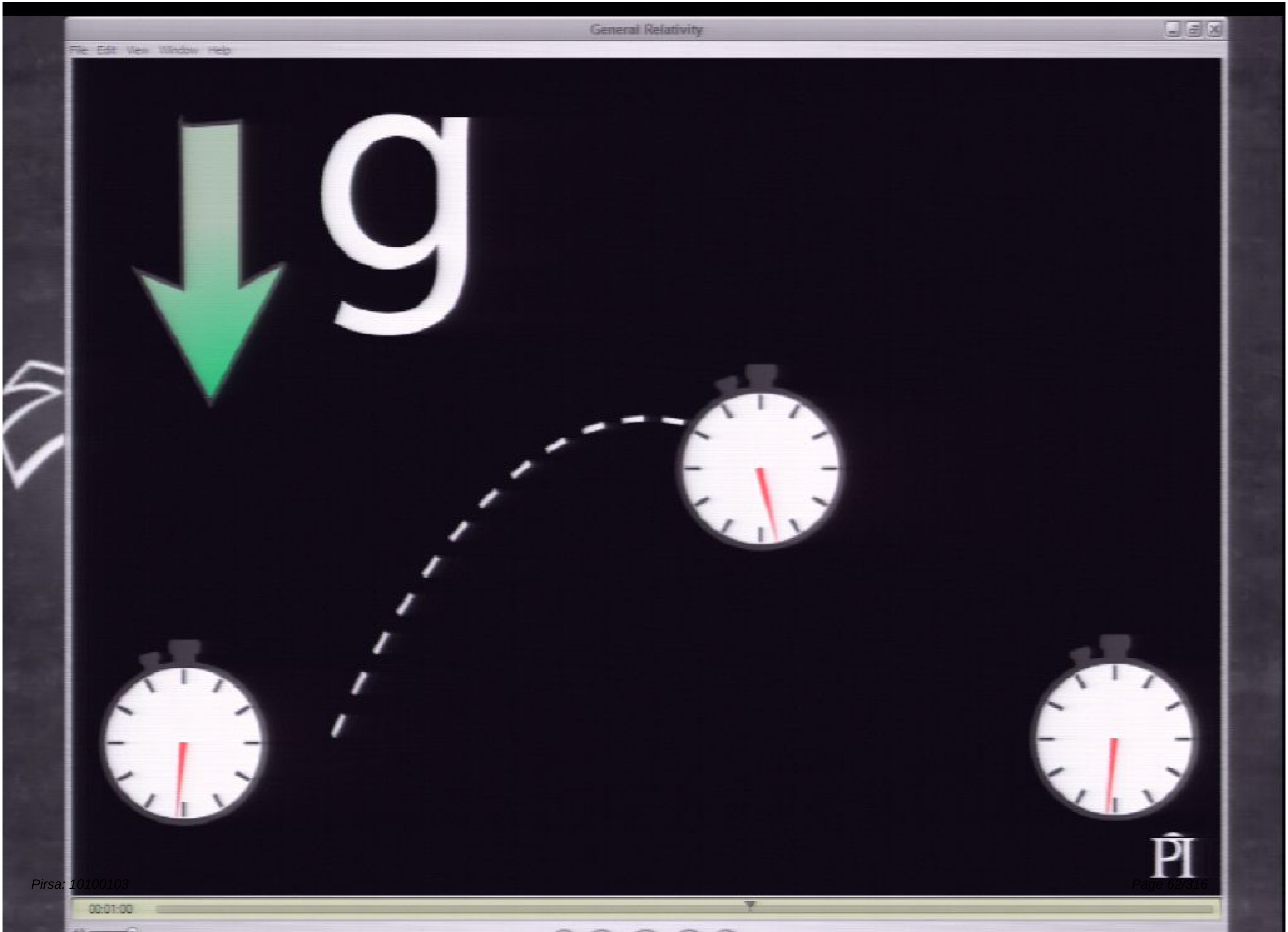
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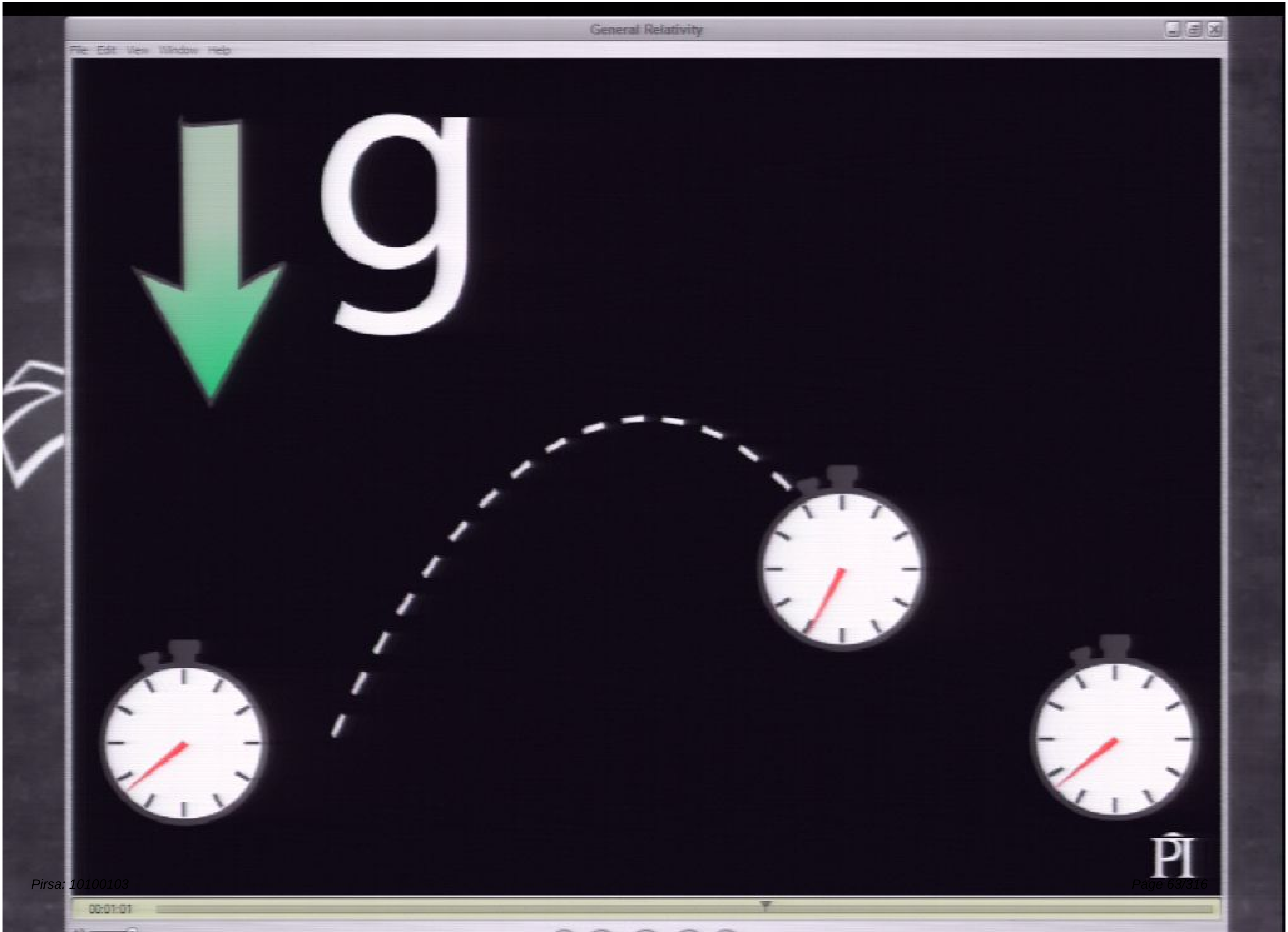
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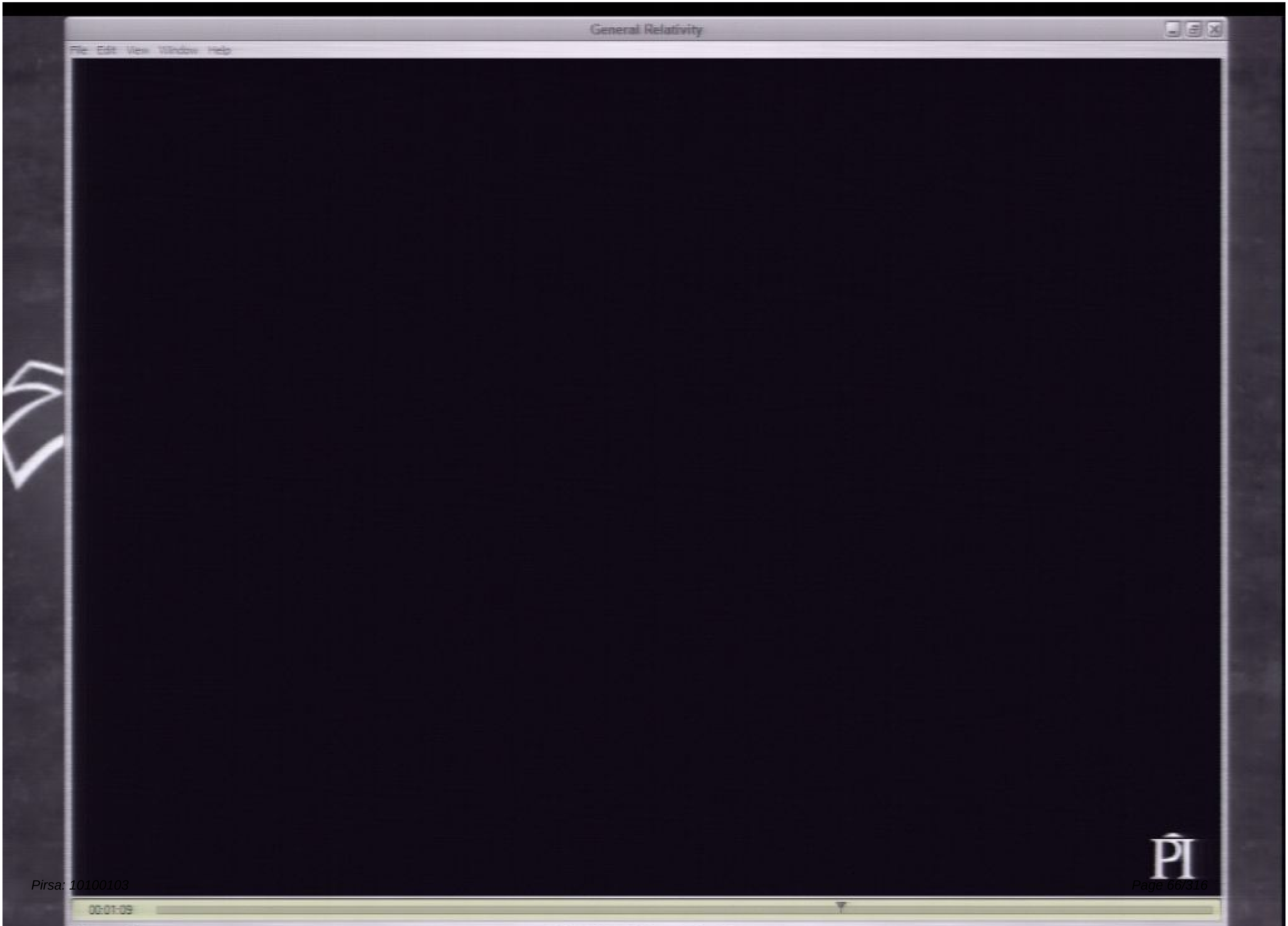
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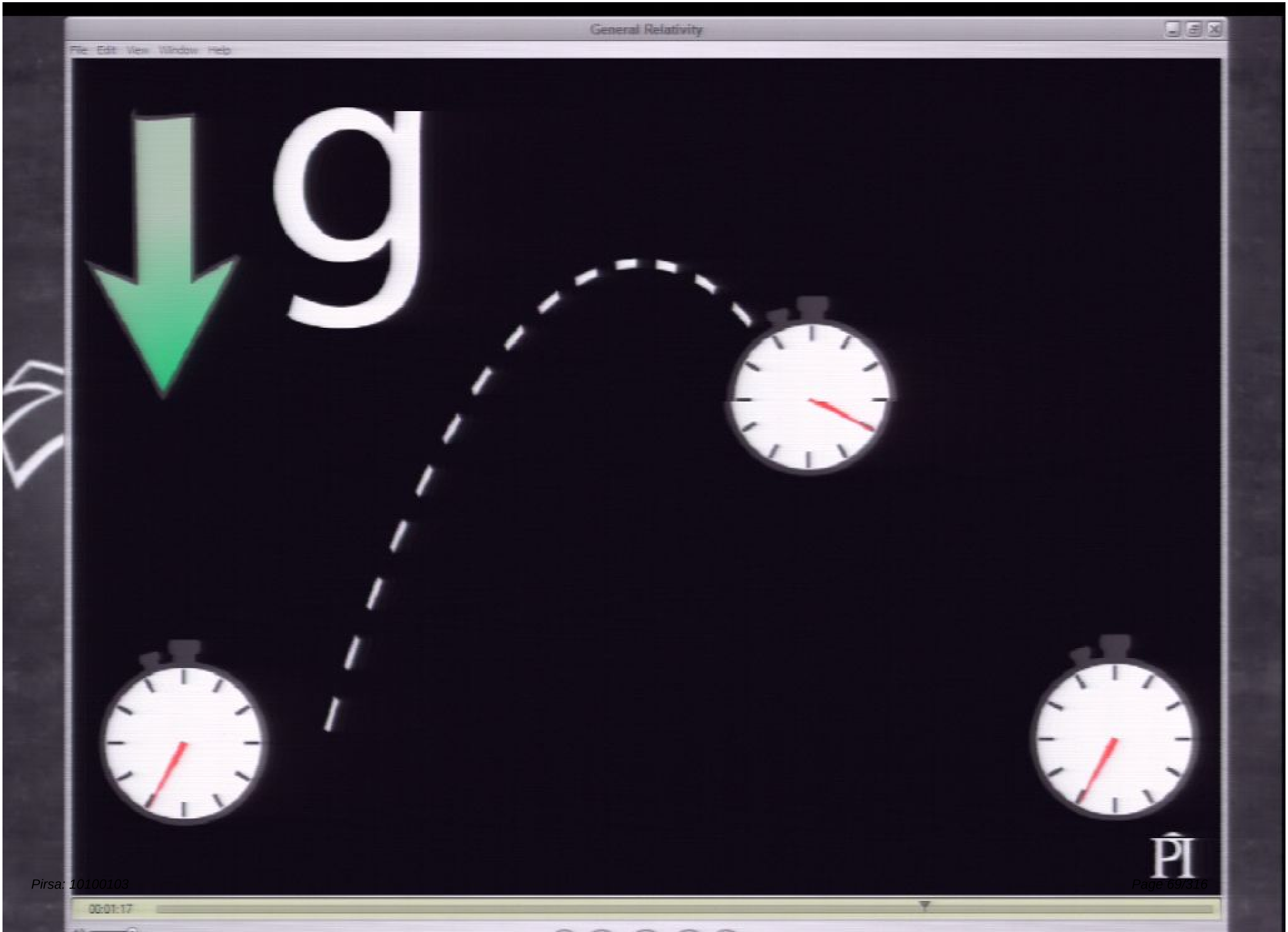
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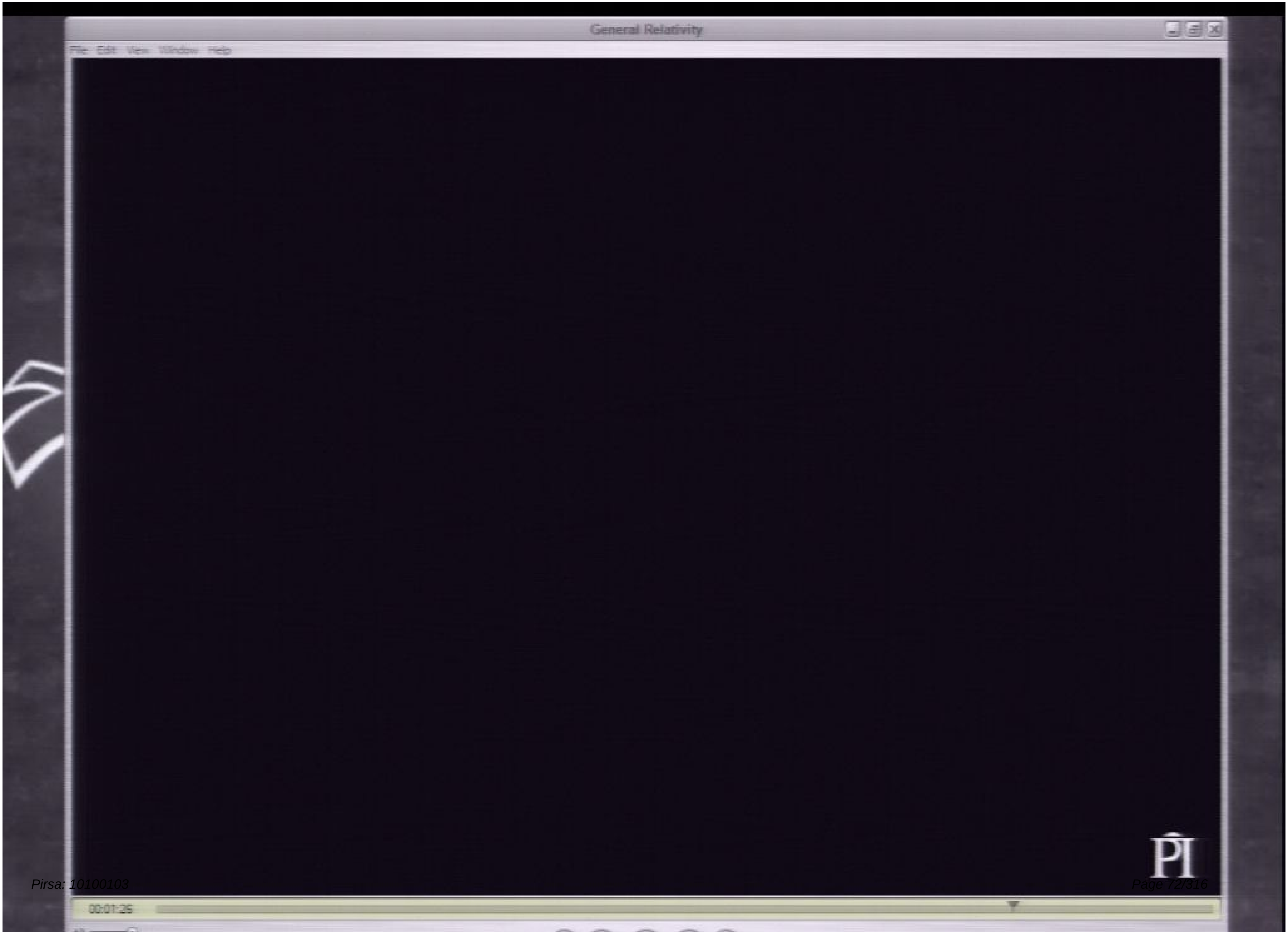
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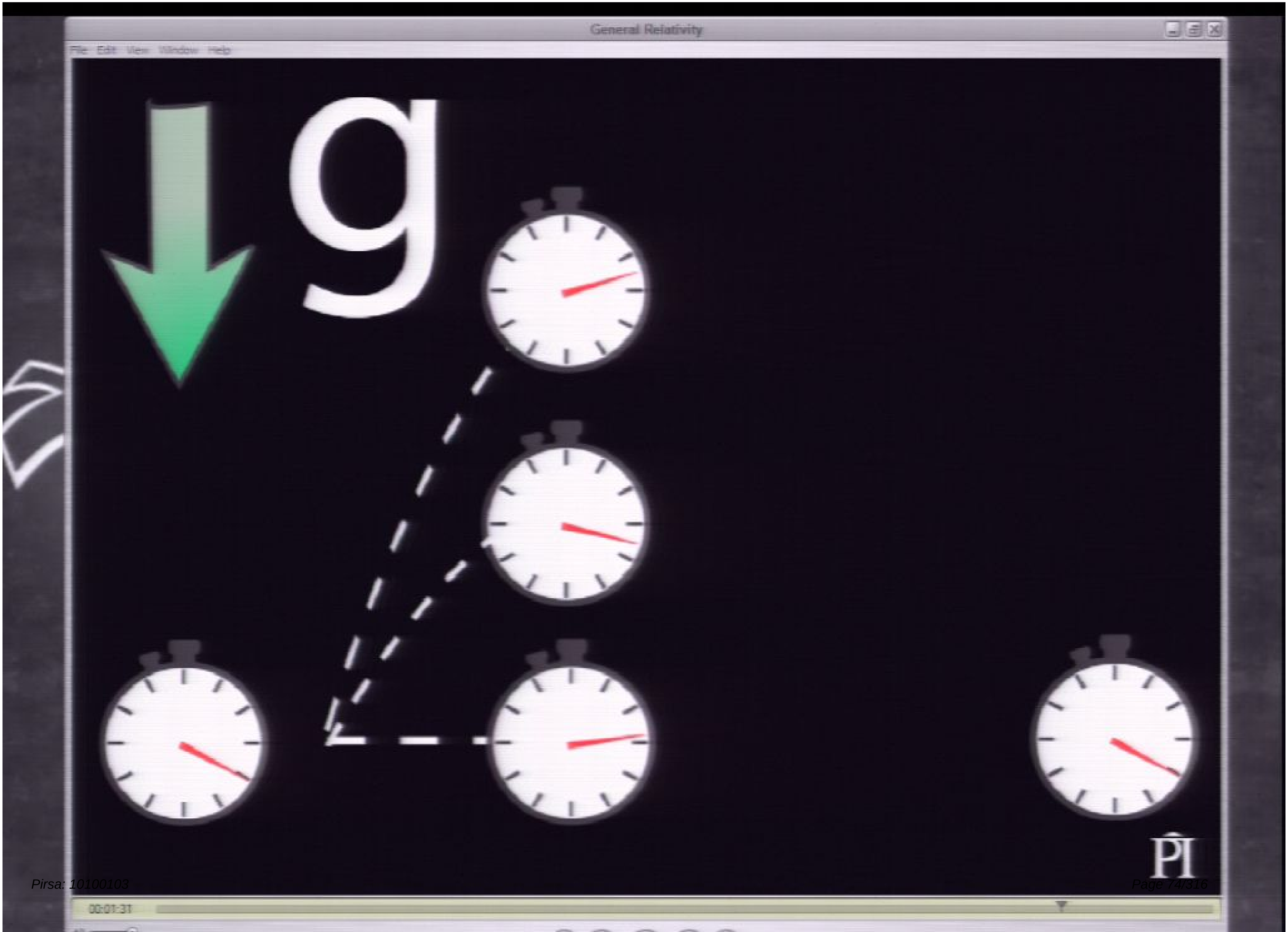
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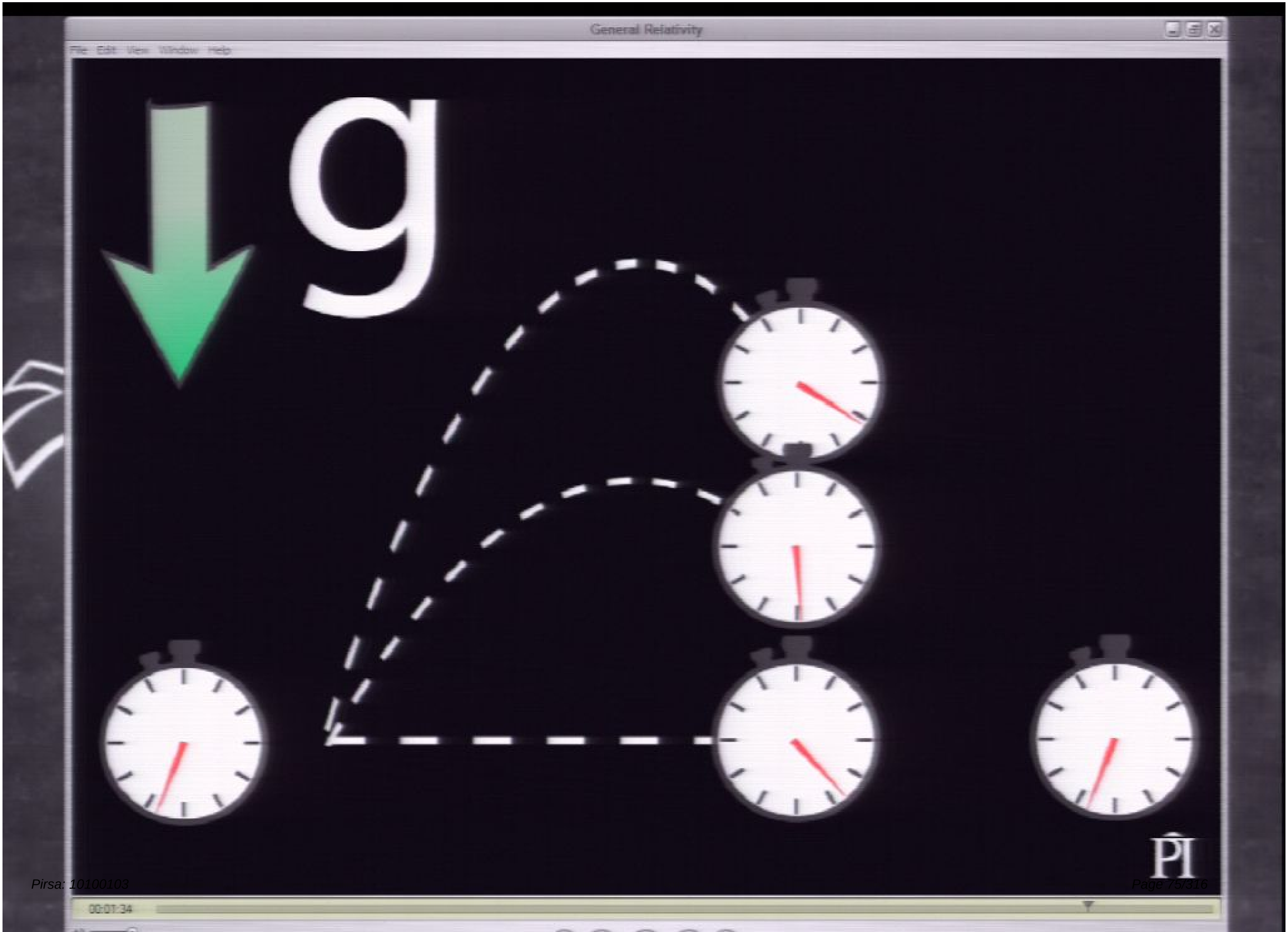
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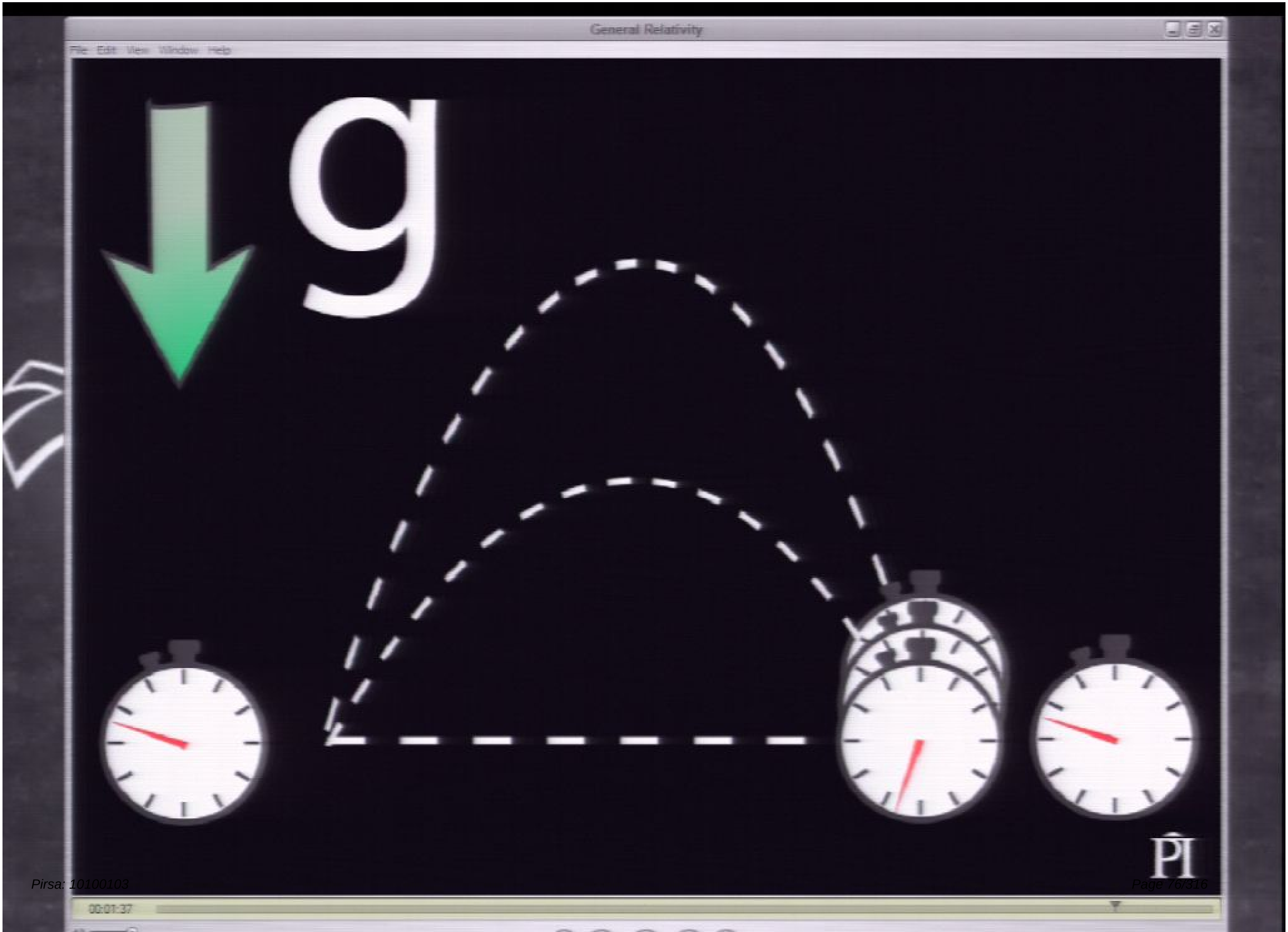
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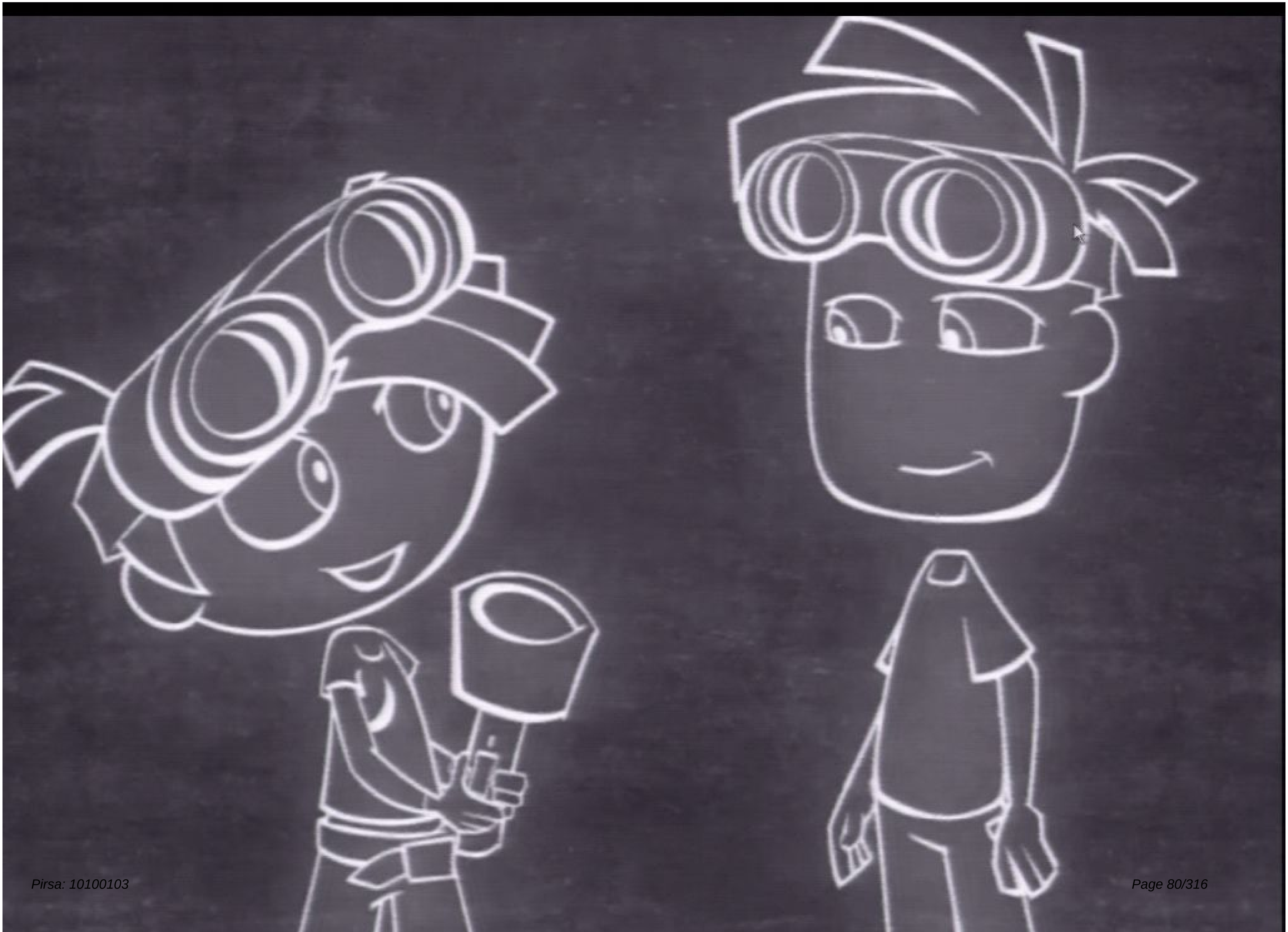

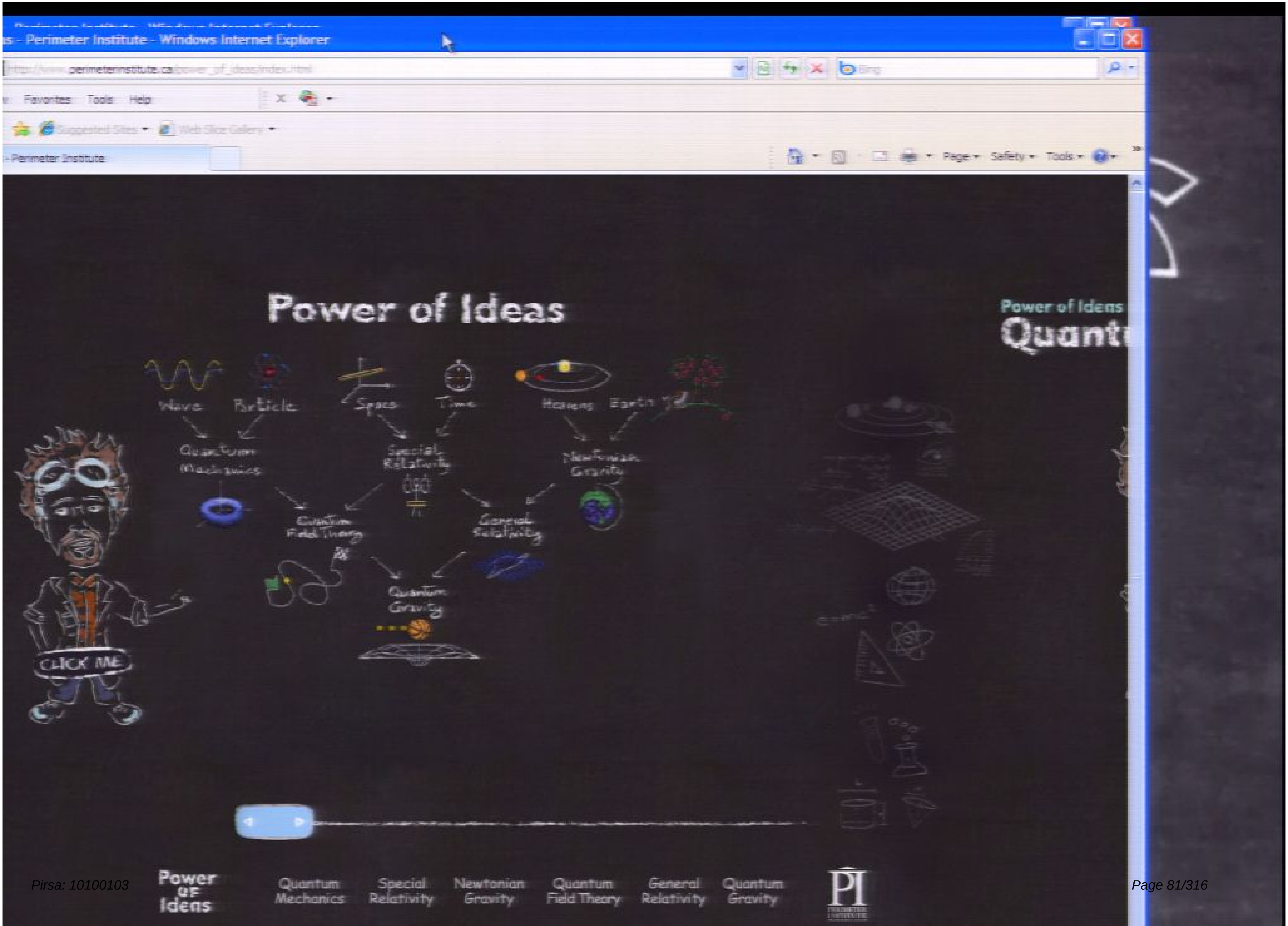

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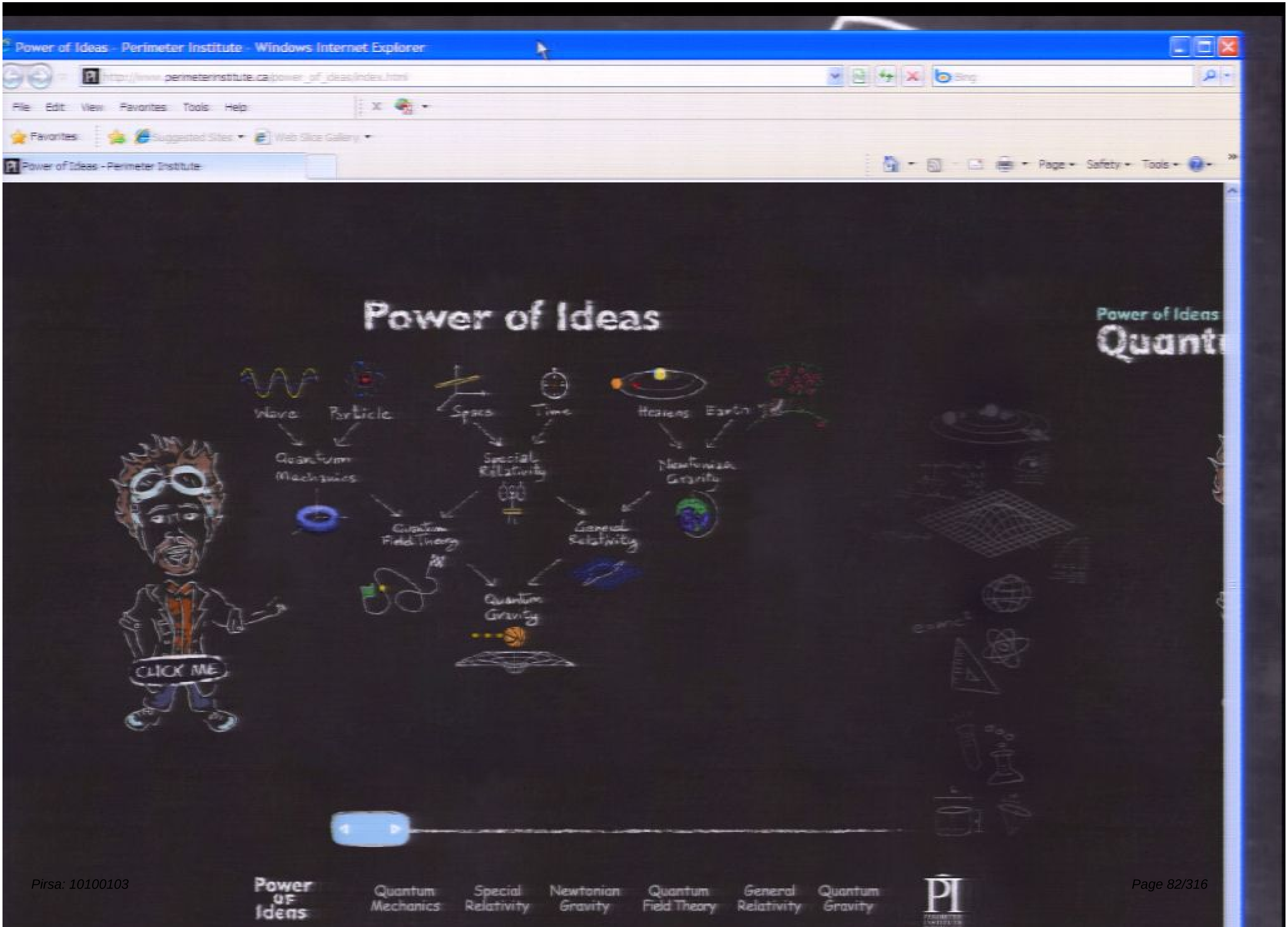
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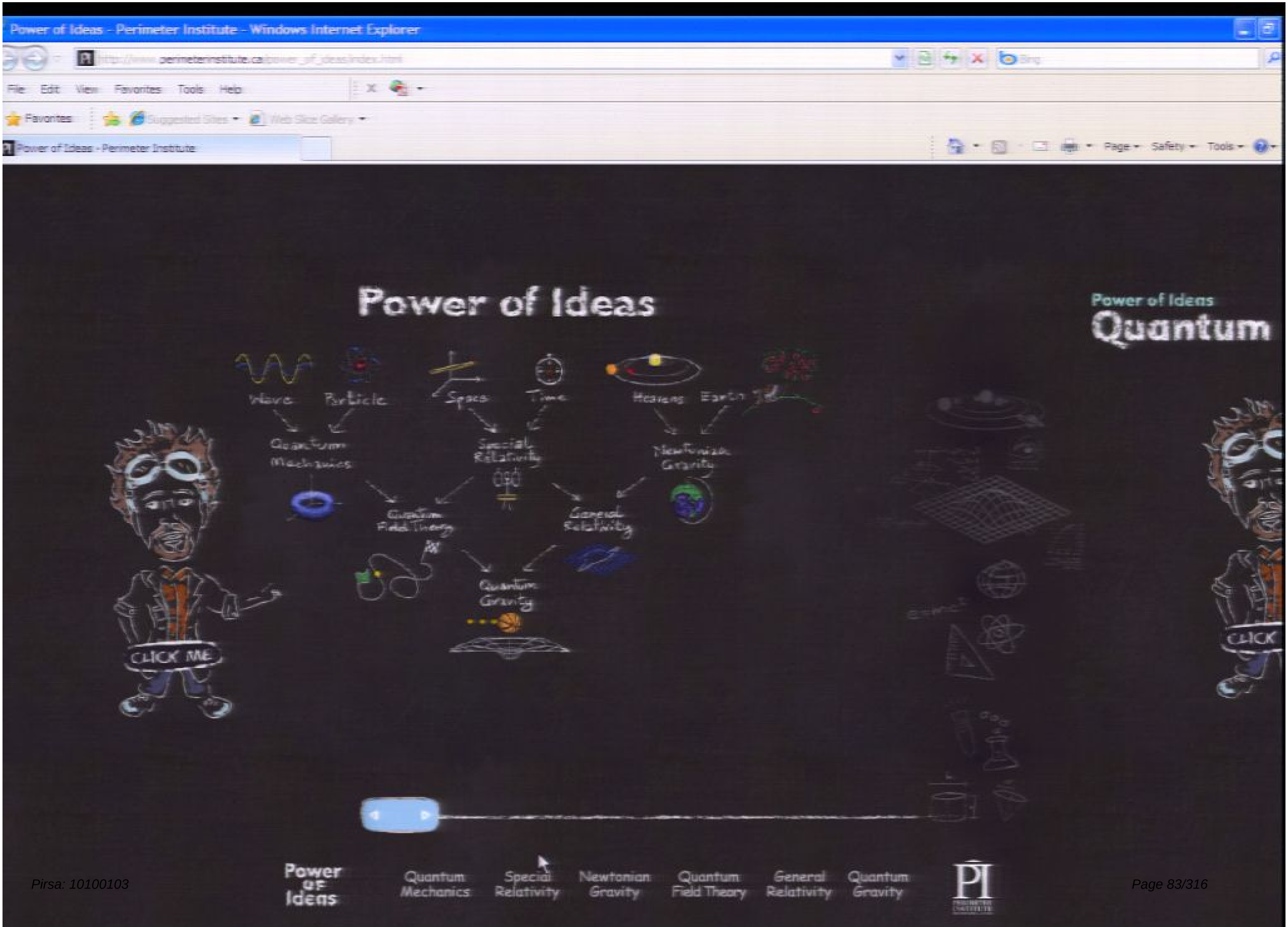
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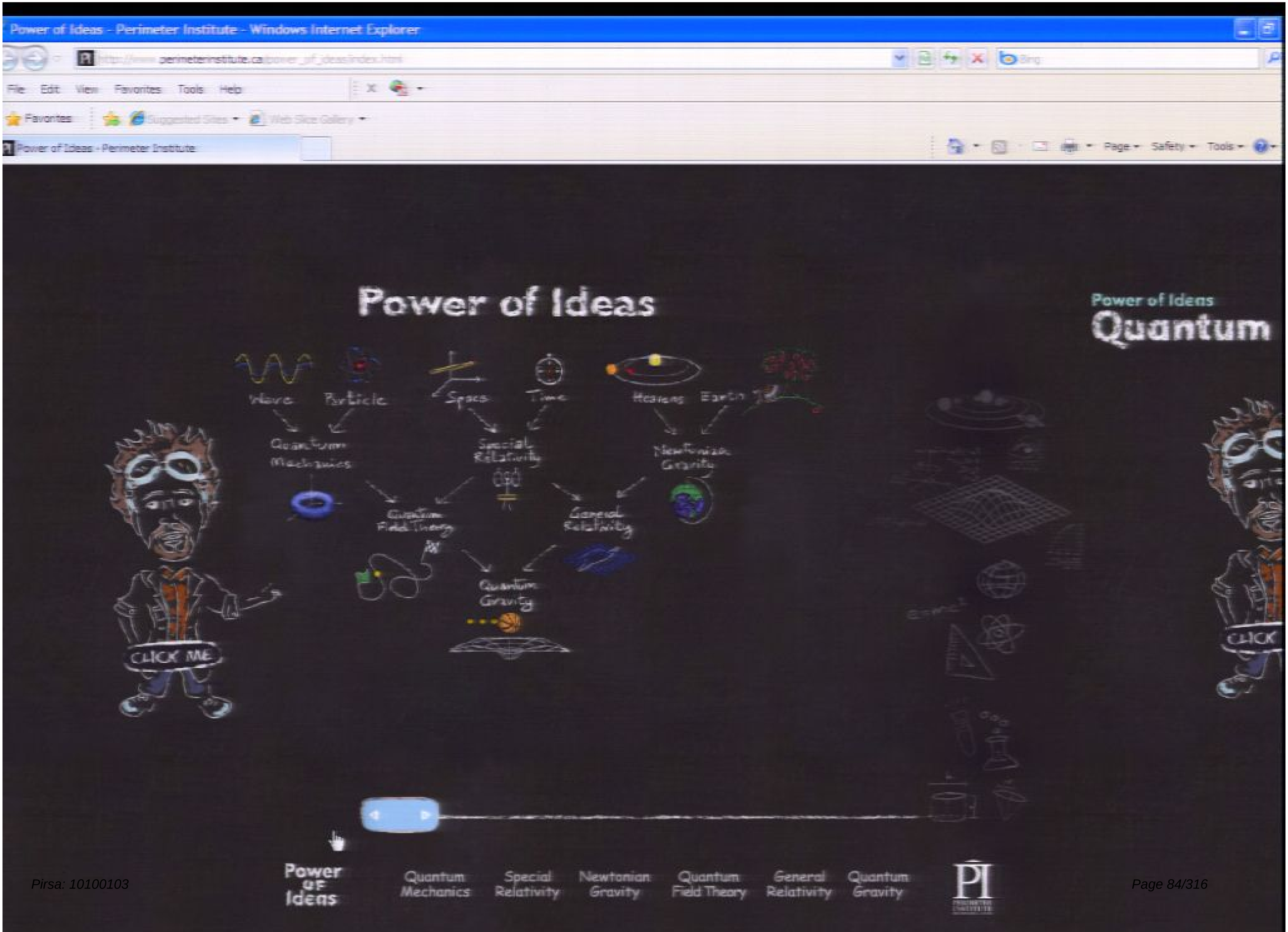

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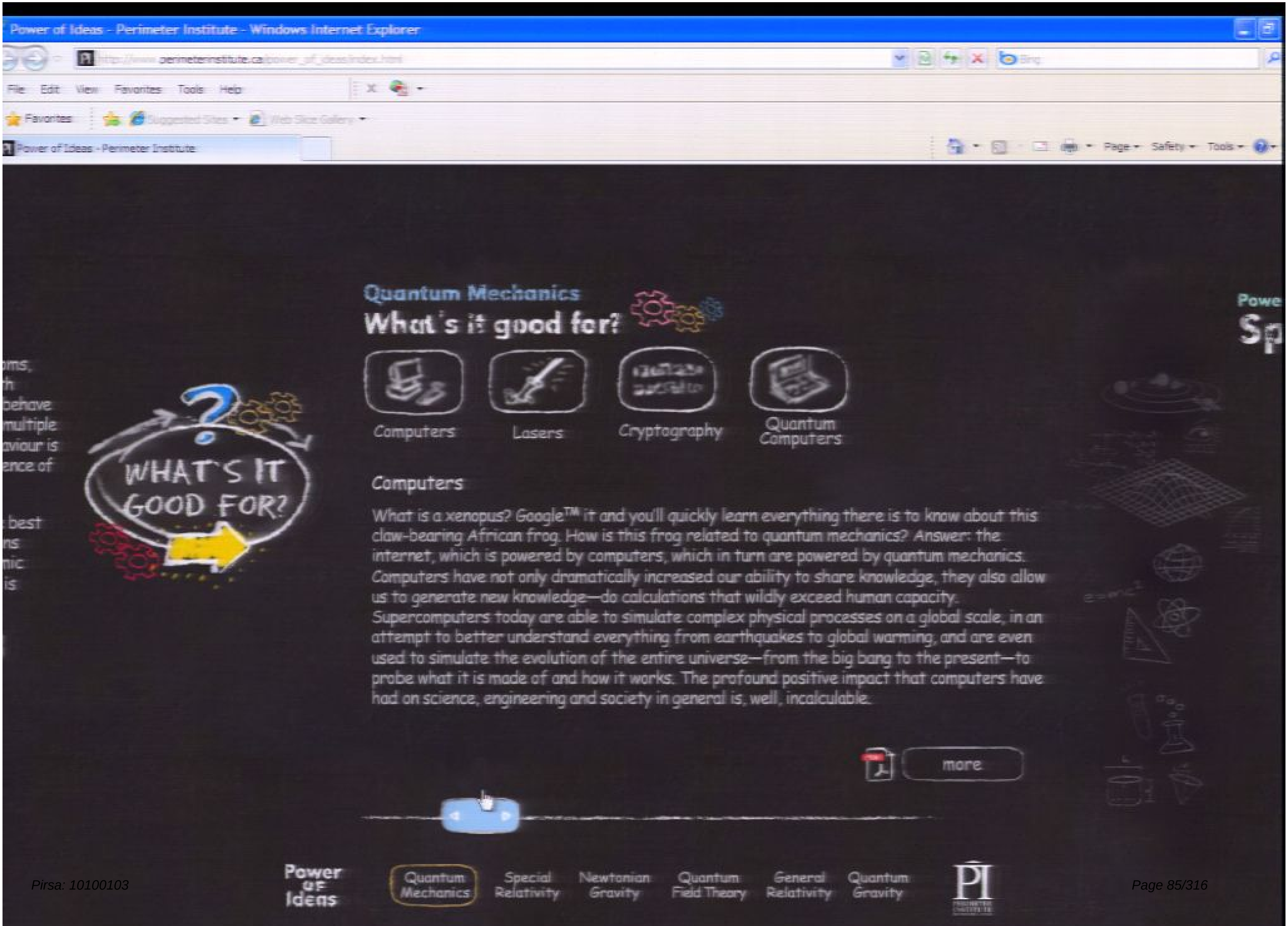
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Quantum Mechanics
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Quantum Computers
Computers
What is a xenopus? Google™ it and you'll quickly learn everything there is to know about this claw-bearing African frog. How is this frog related to quantum mechanics? Answer: the internet, which is powered by computers, which in turn are powered by quantum mechanics. Computers have not only dramatically increased our ability to share knowledge, they also allow us to generate new knowledge—do calculations that wildly exceed human capacity. Supercomputers today are able to simulate complex physical processes on a global scale, in an attempt to better understand everything from earthquakes to global warming, and are even used to simulate the evolution of the entire universe—from the big bang to the present—to probe what it is made of and how it works. The profound positive impact that computers have had on science, engineering and society in general is, well, incalculable.
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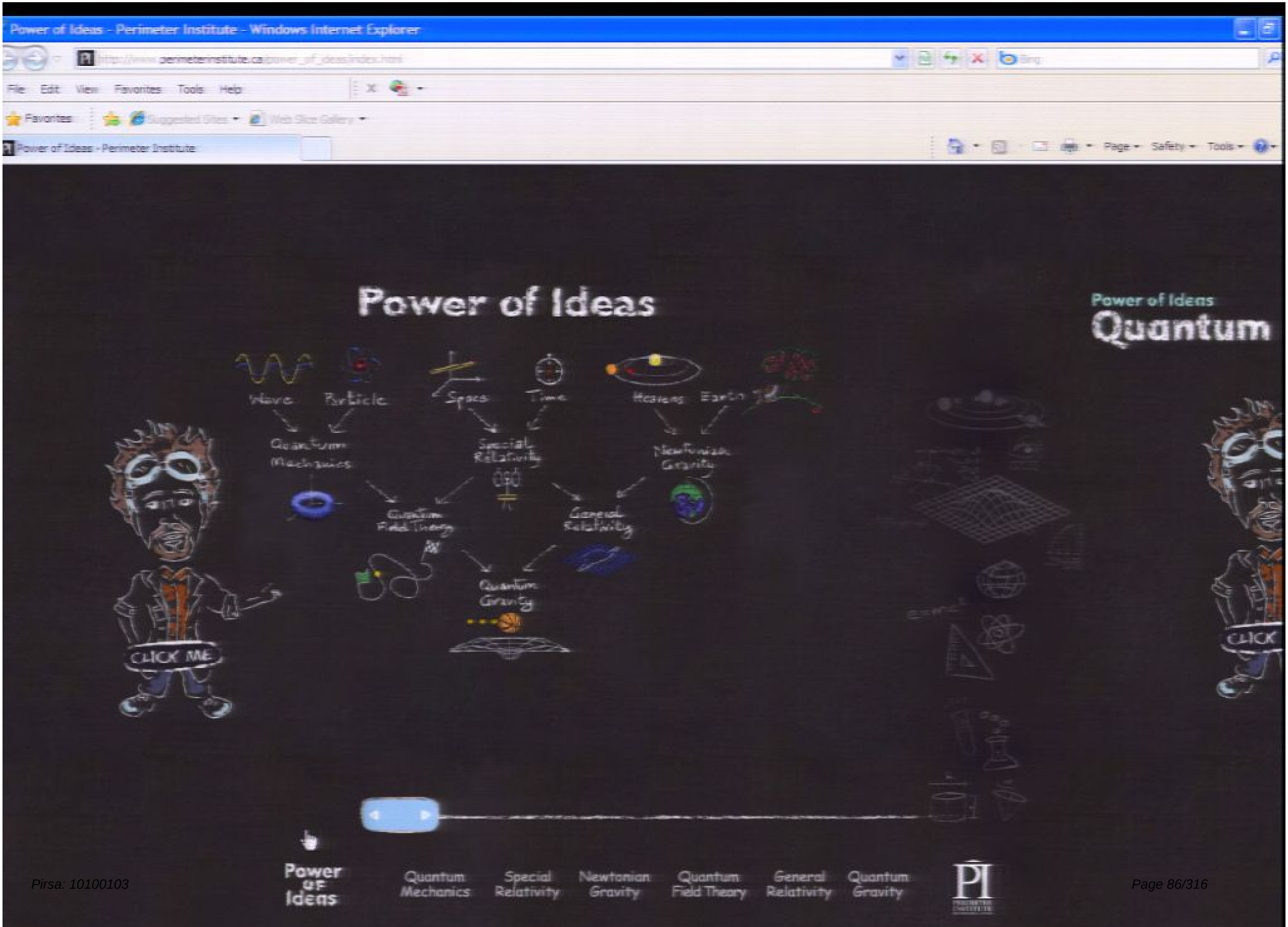
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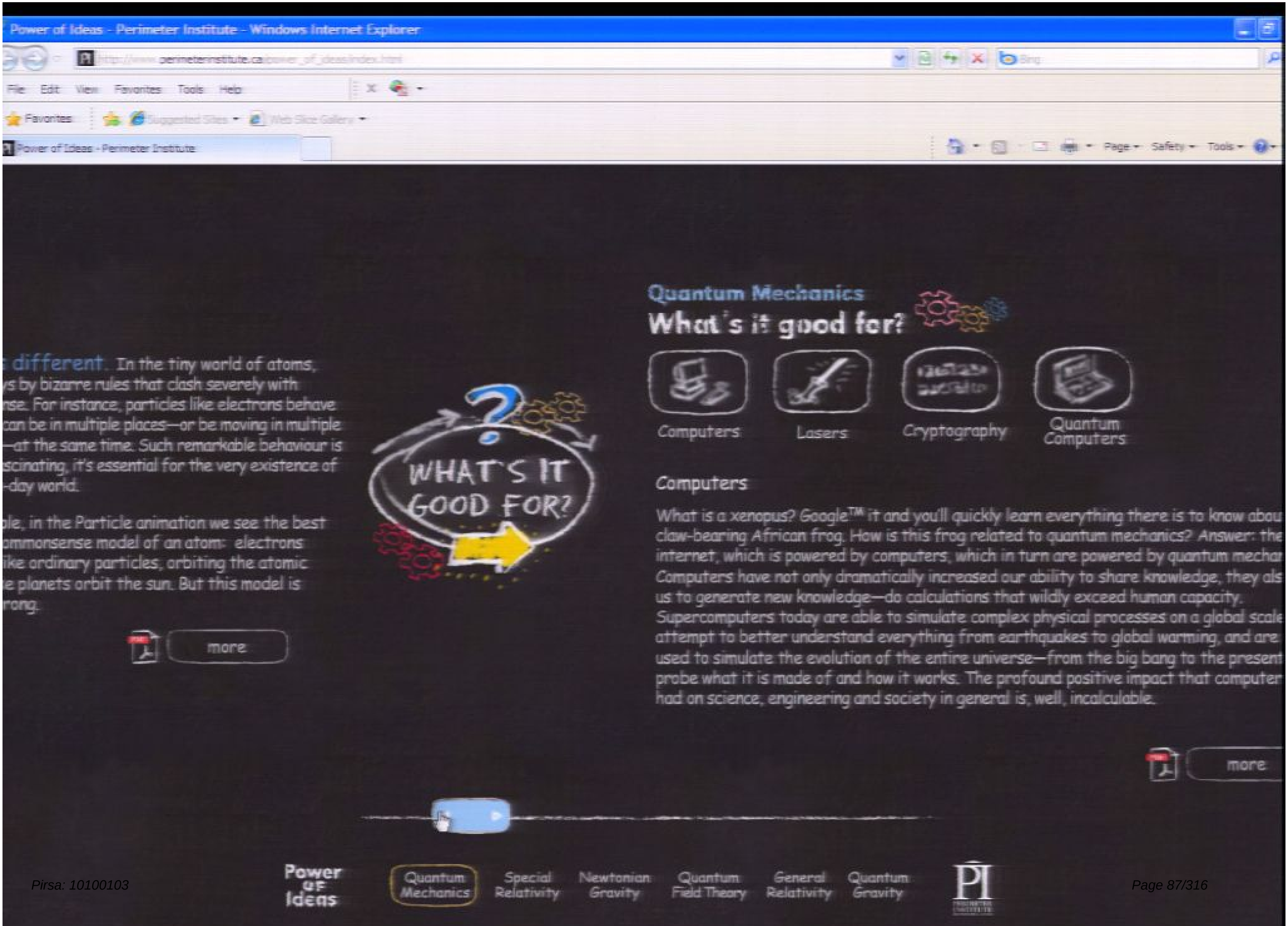
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different. In the tiny world of atoms,
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can be in multiple places—or be moving in multiple
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le, in the Particle animation we see the best
ommonsense model of an atom: electrons
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e planets orbit the sun. But this model is
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Computers have not only dramatically increased our ability to share knowledge, they als
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Supercomputers today are able to simulate complex physical processes on a global scale
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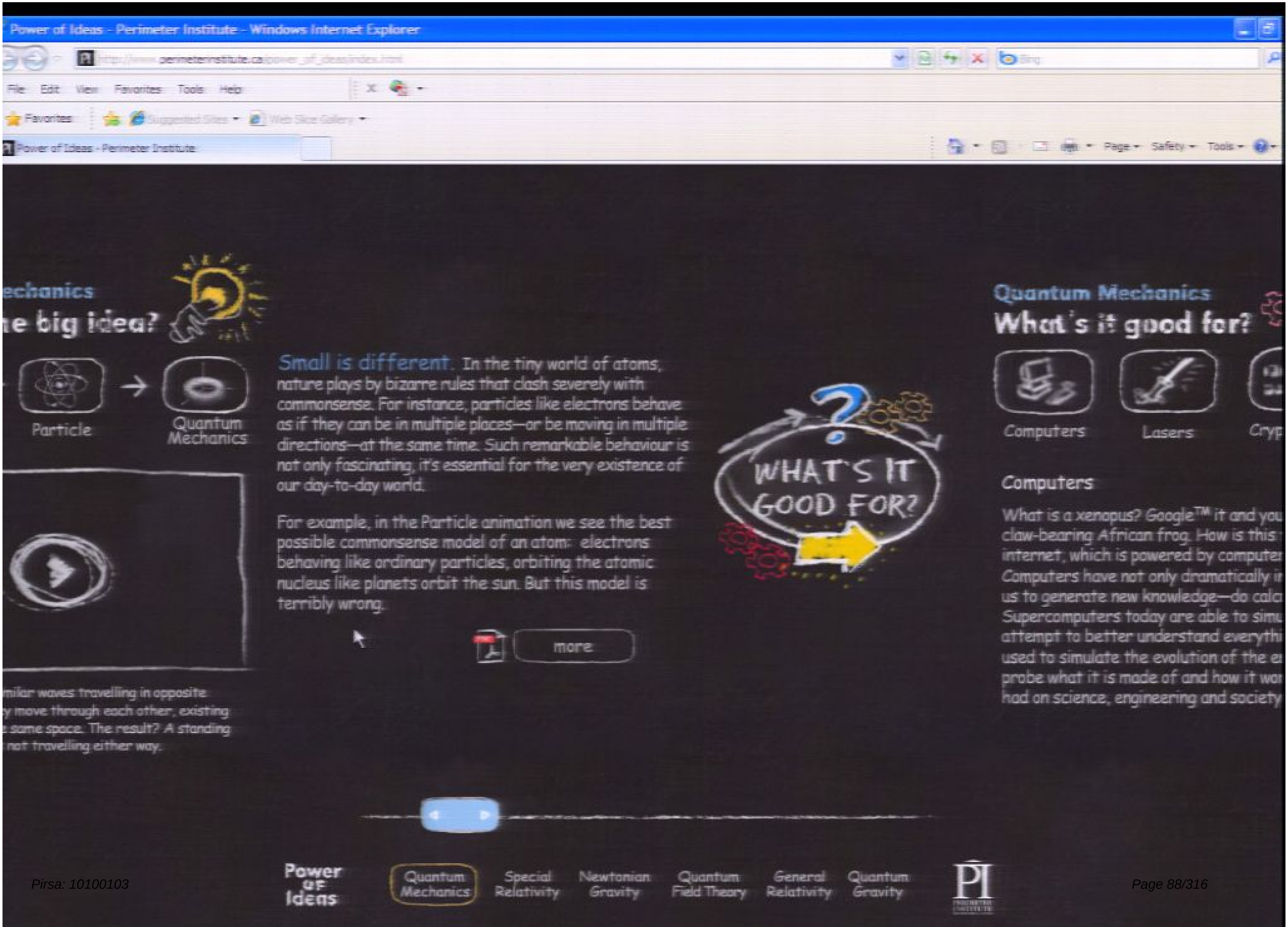
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echanics
e big idea?
Particle
Quantum Mechanics
Small is different. In the tiny world of atoms, nature plays by bizarre rules that clash severely with commonsense. For instance, particles like electrons behave as if they can be in multiple places—or be moving in multiple directions—at the same time. Such remarkable behaviour is not only fascinating, it's essential for the very existence of our day-to-day world.
For example, in the Particle animation we see the best possible commonsense model of an atom: electrons behaving like ordinary particles, orbiting the atomic nucleus like planets orbit the sun. But this model is terribly wrong.
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milar waves travelling in opposite
y move through each other, existing
e same space. The result? A standing
not travelling either way.
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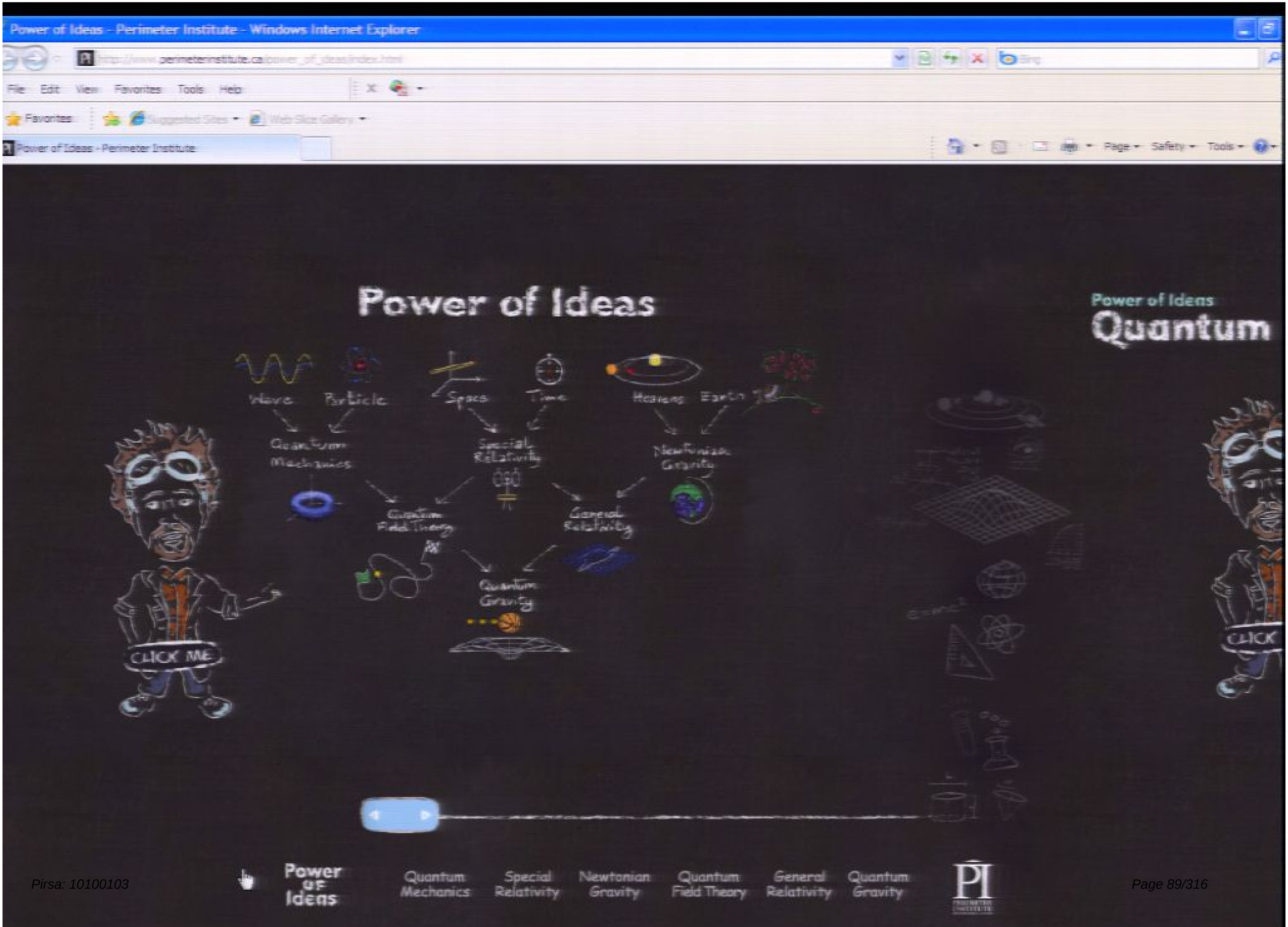
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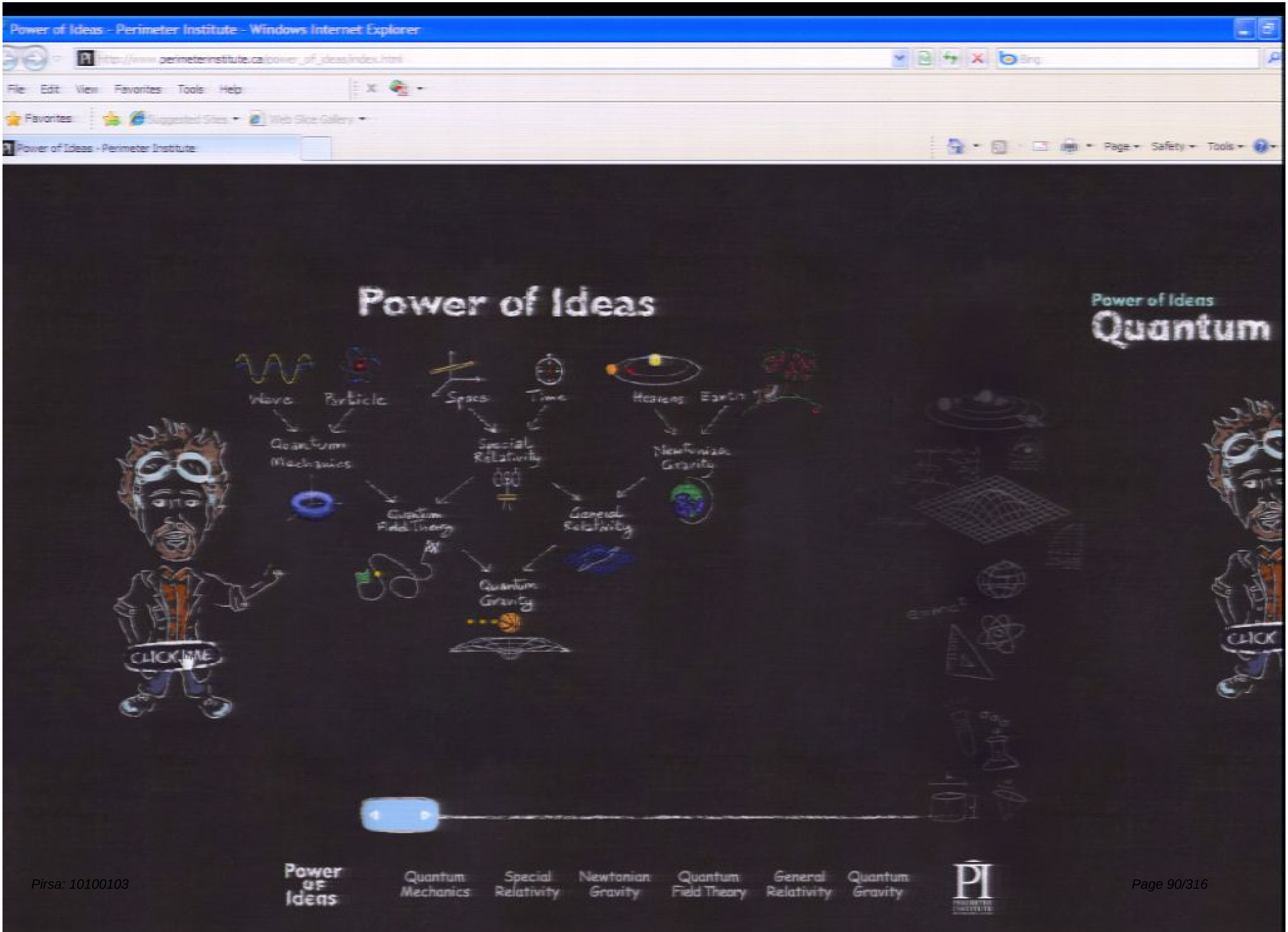

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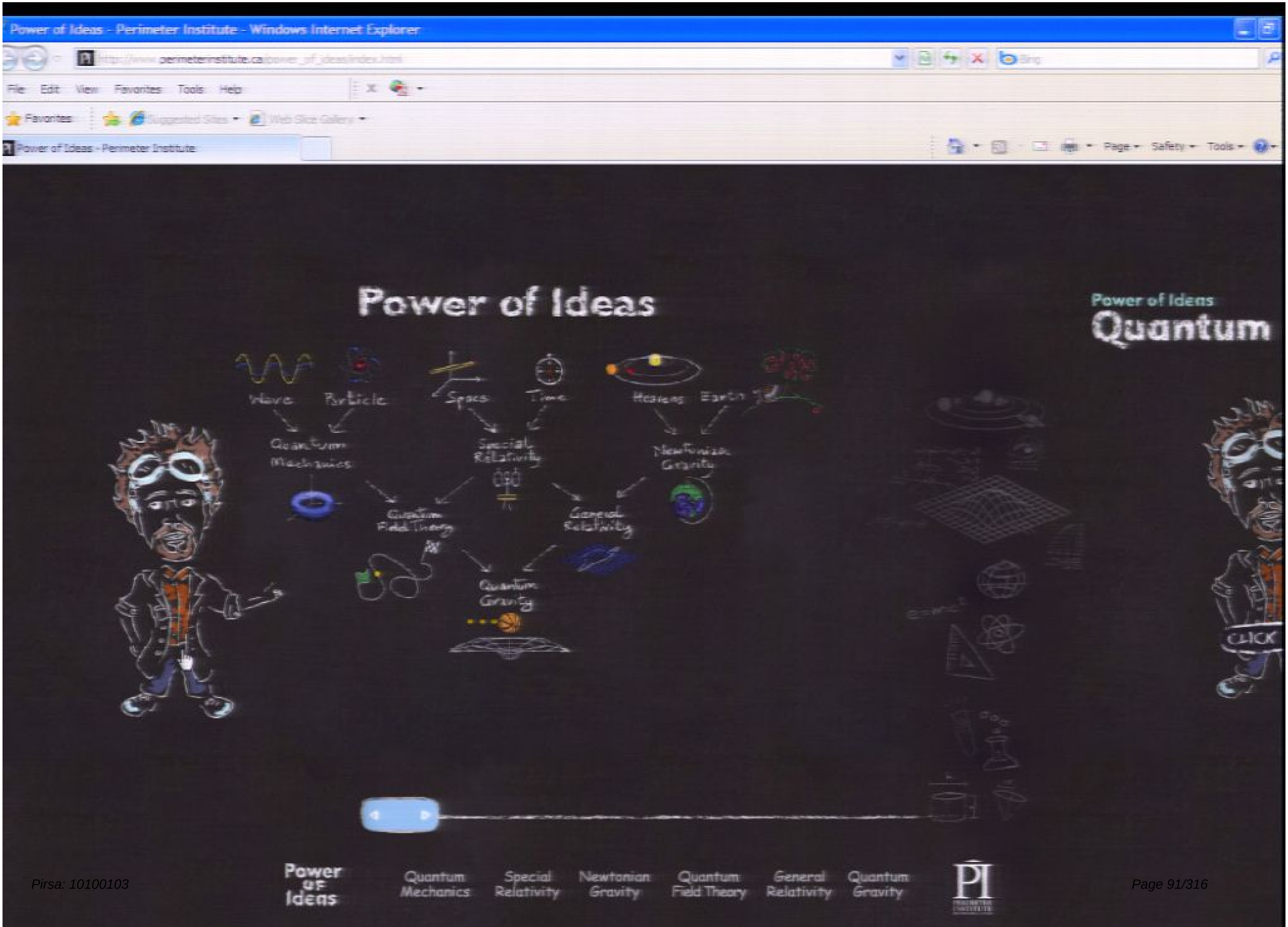
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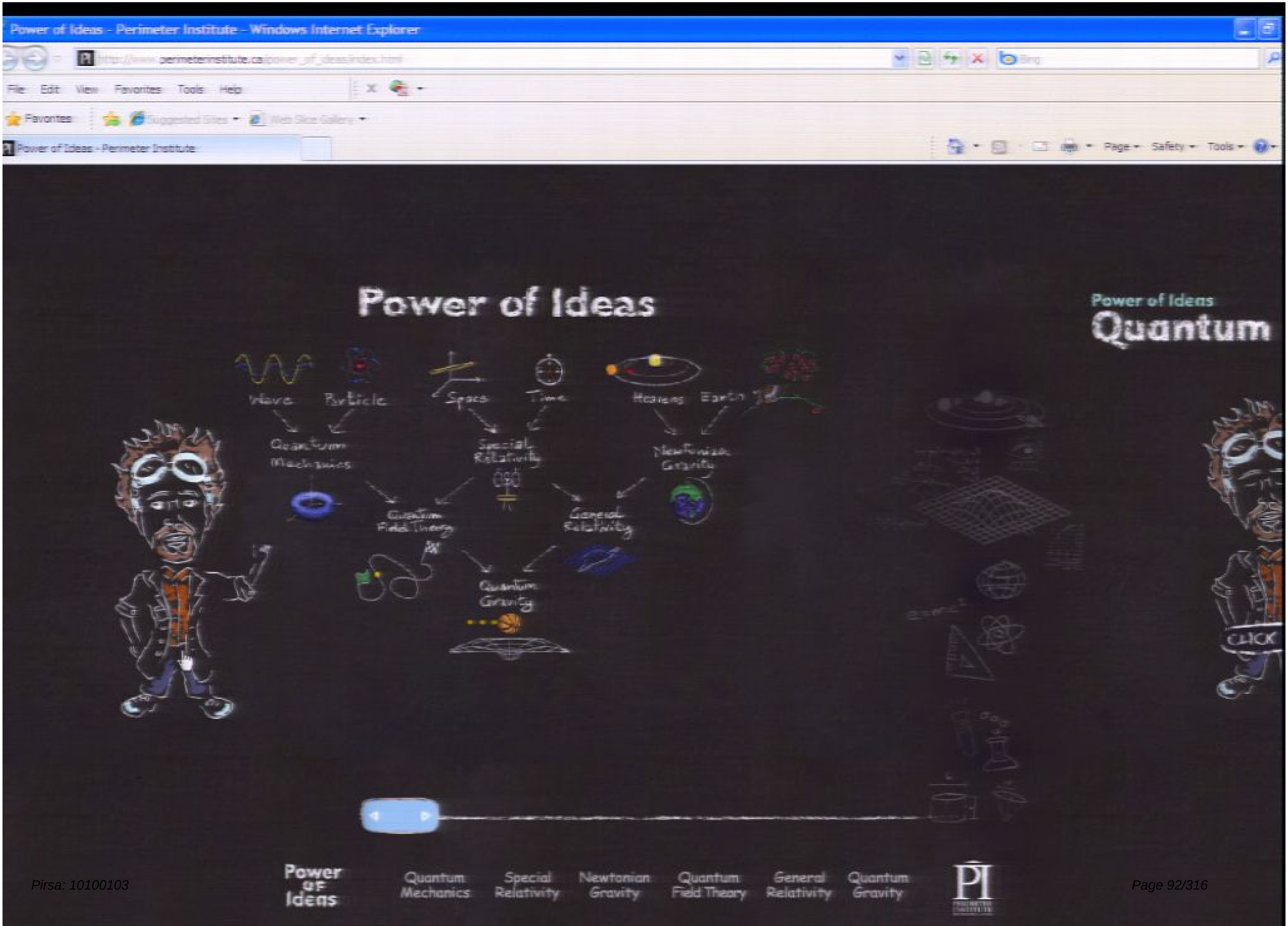
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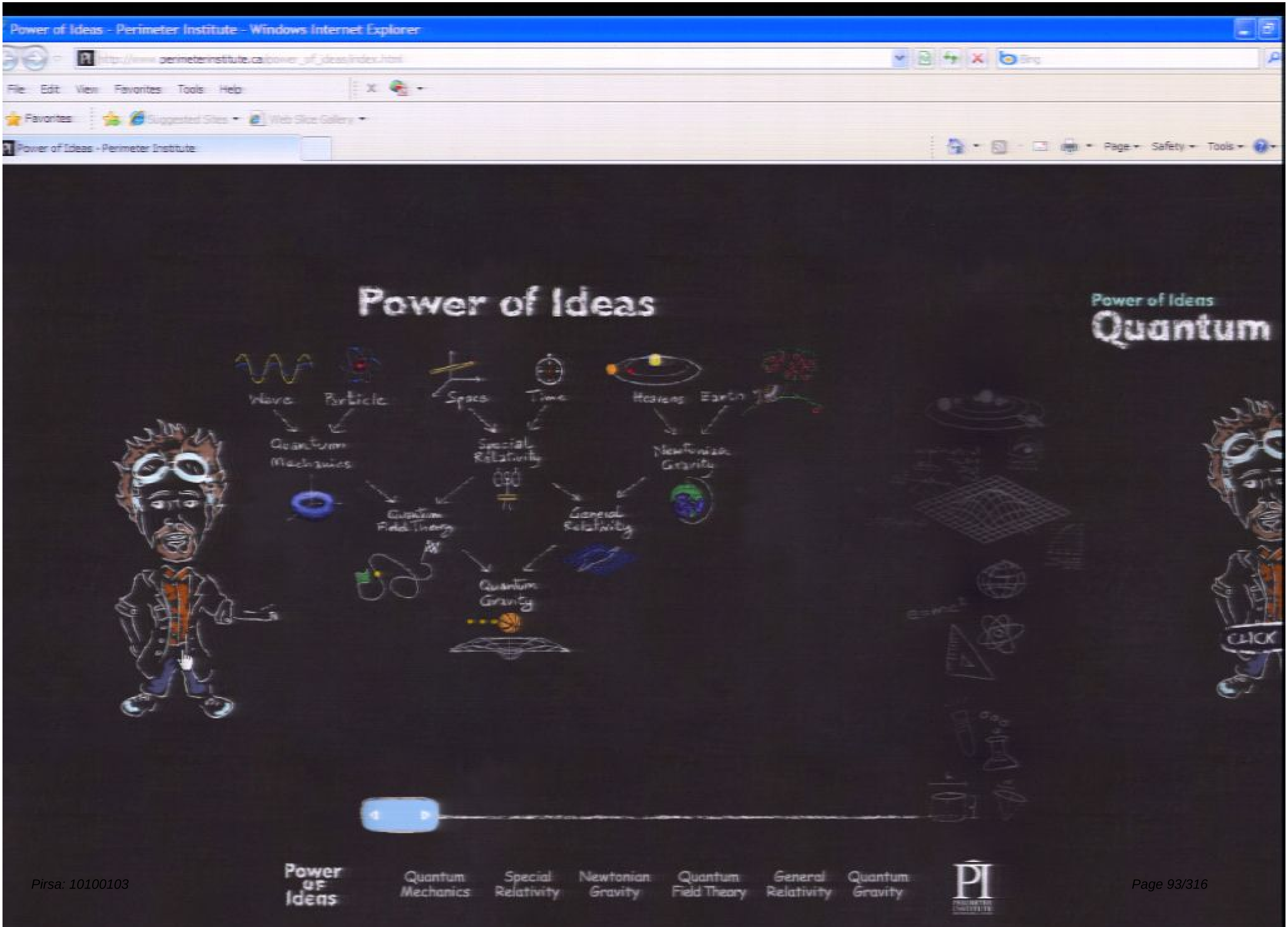
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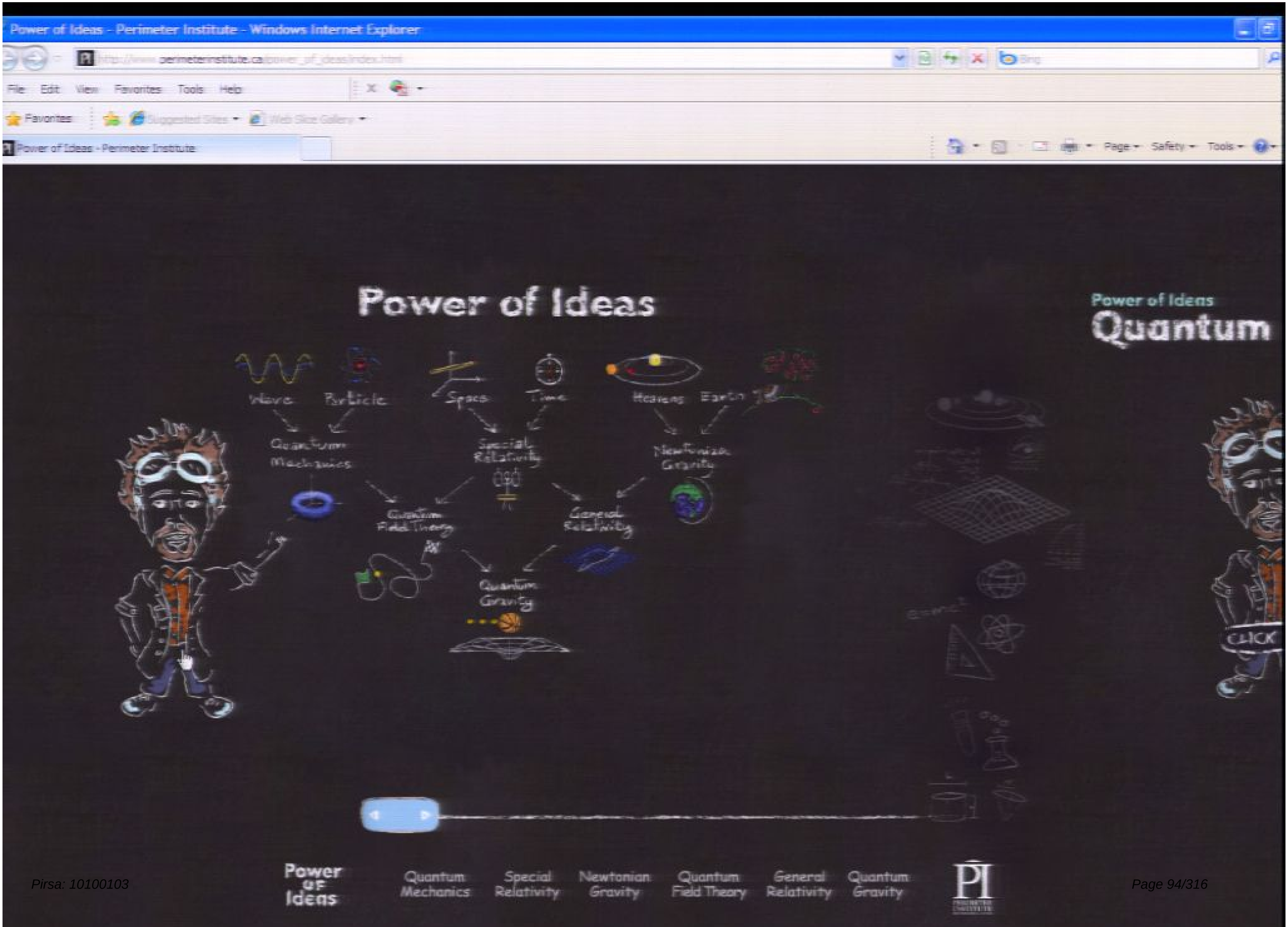
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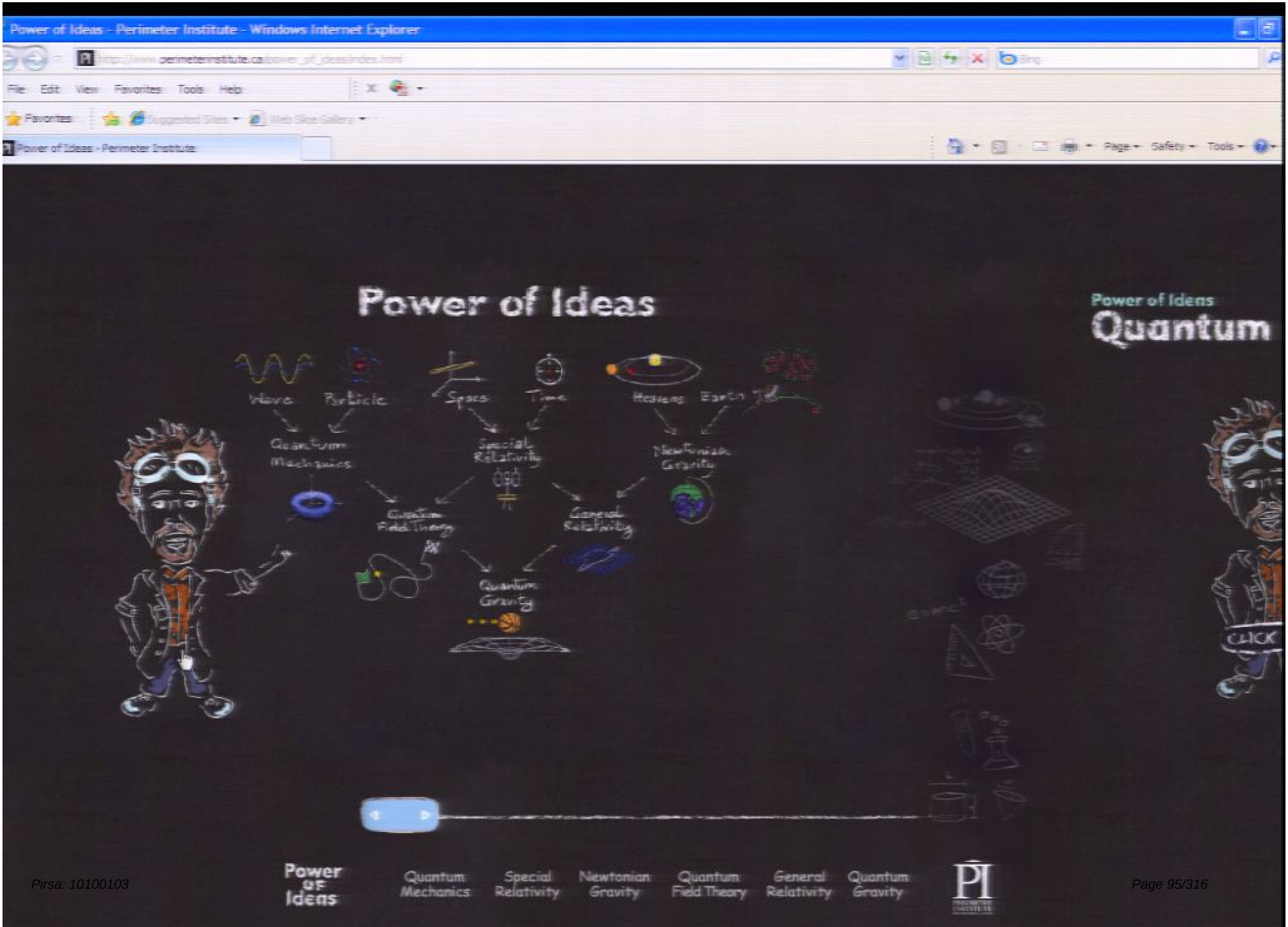

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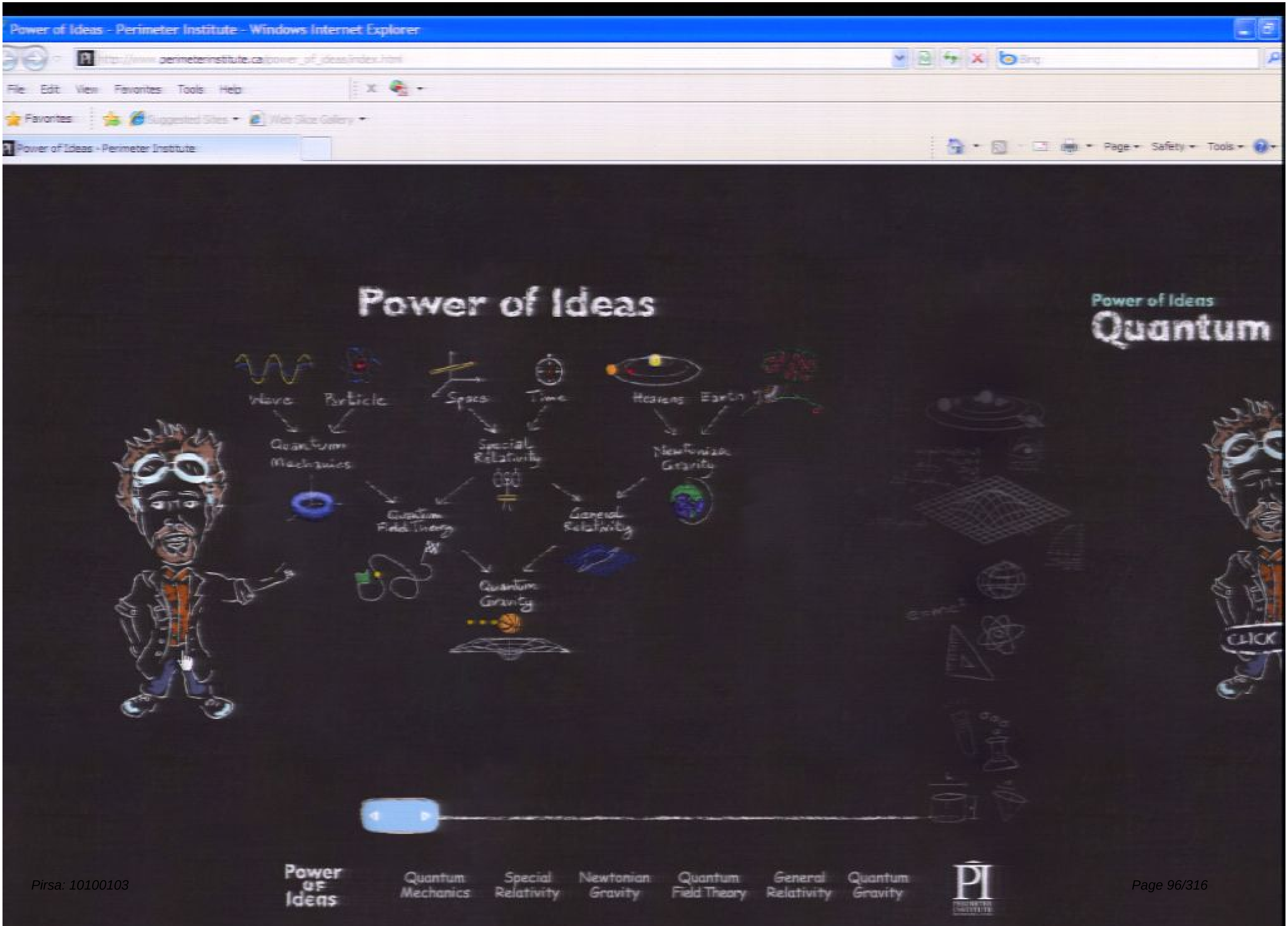
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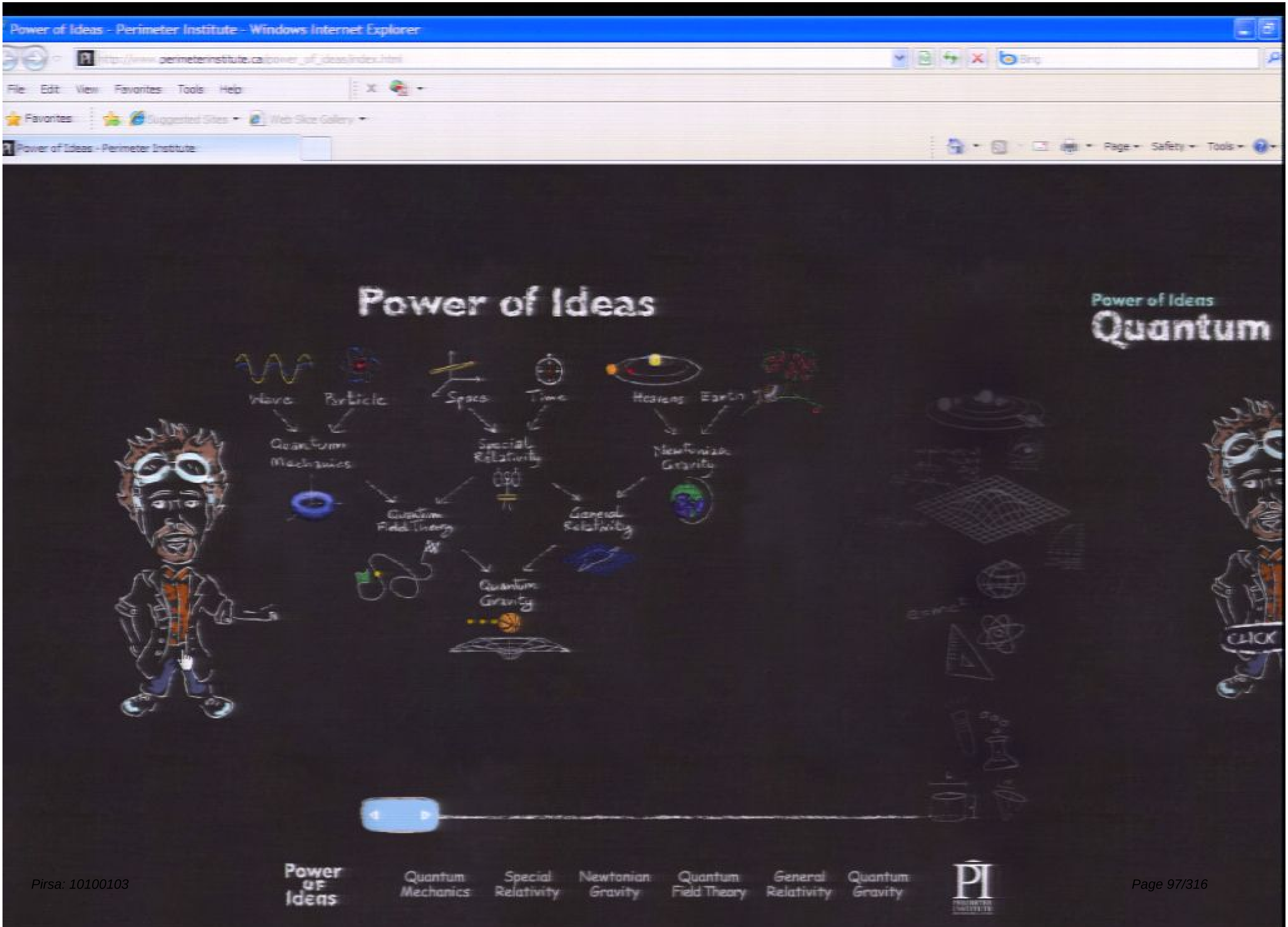
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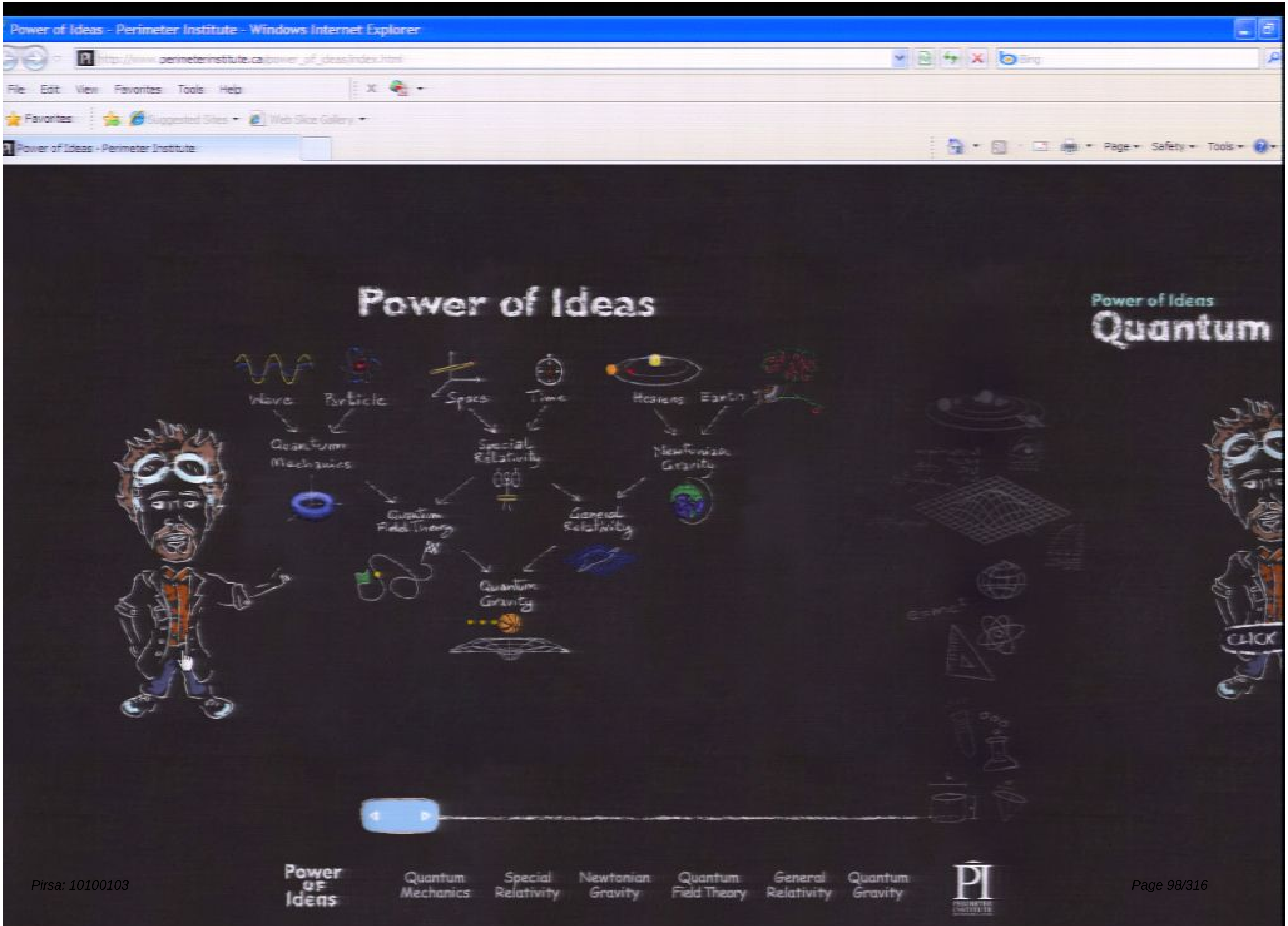
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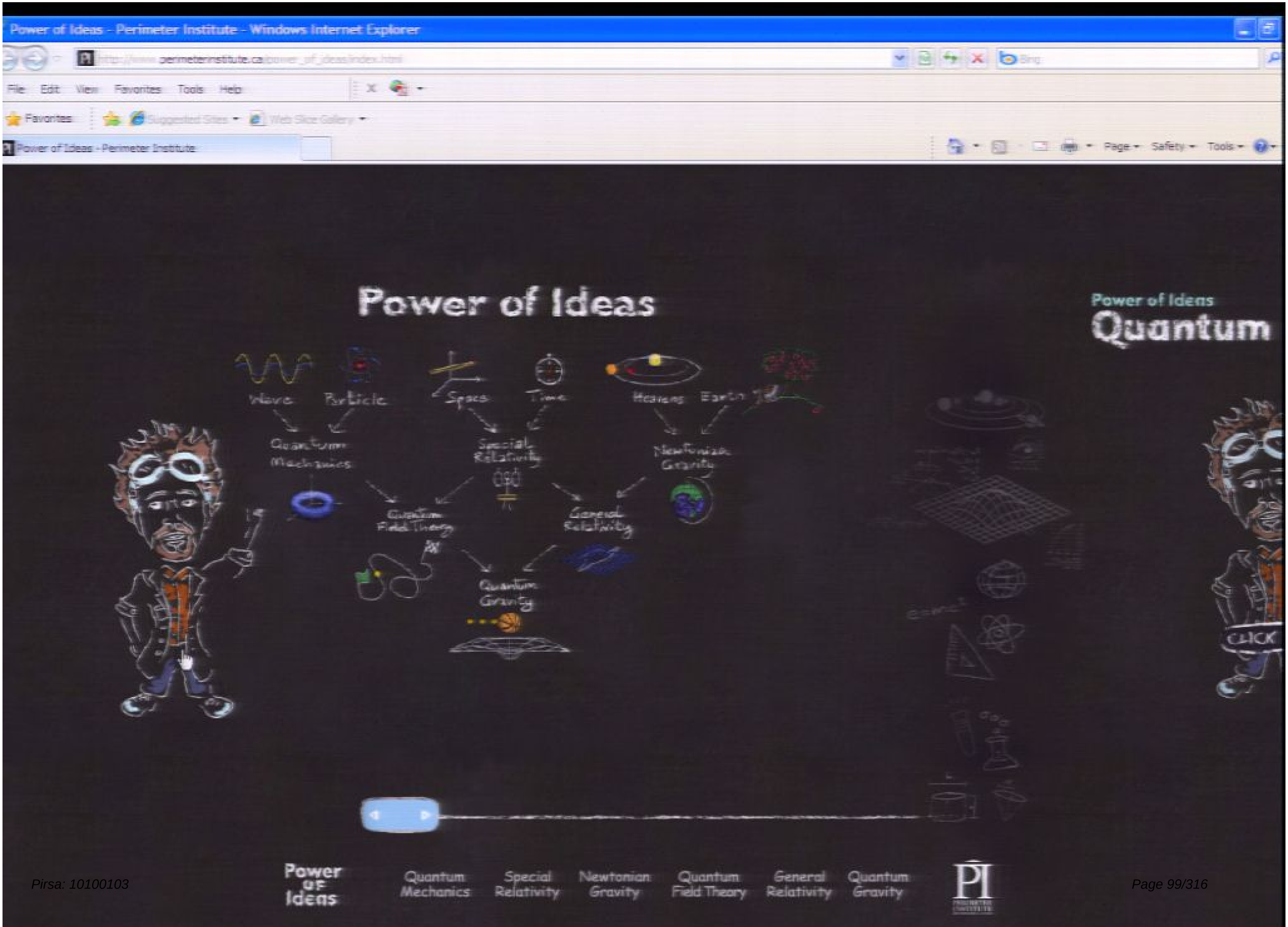
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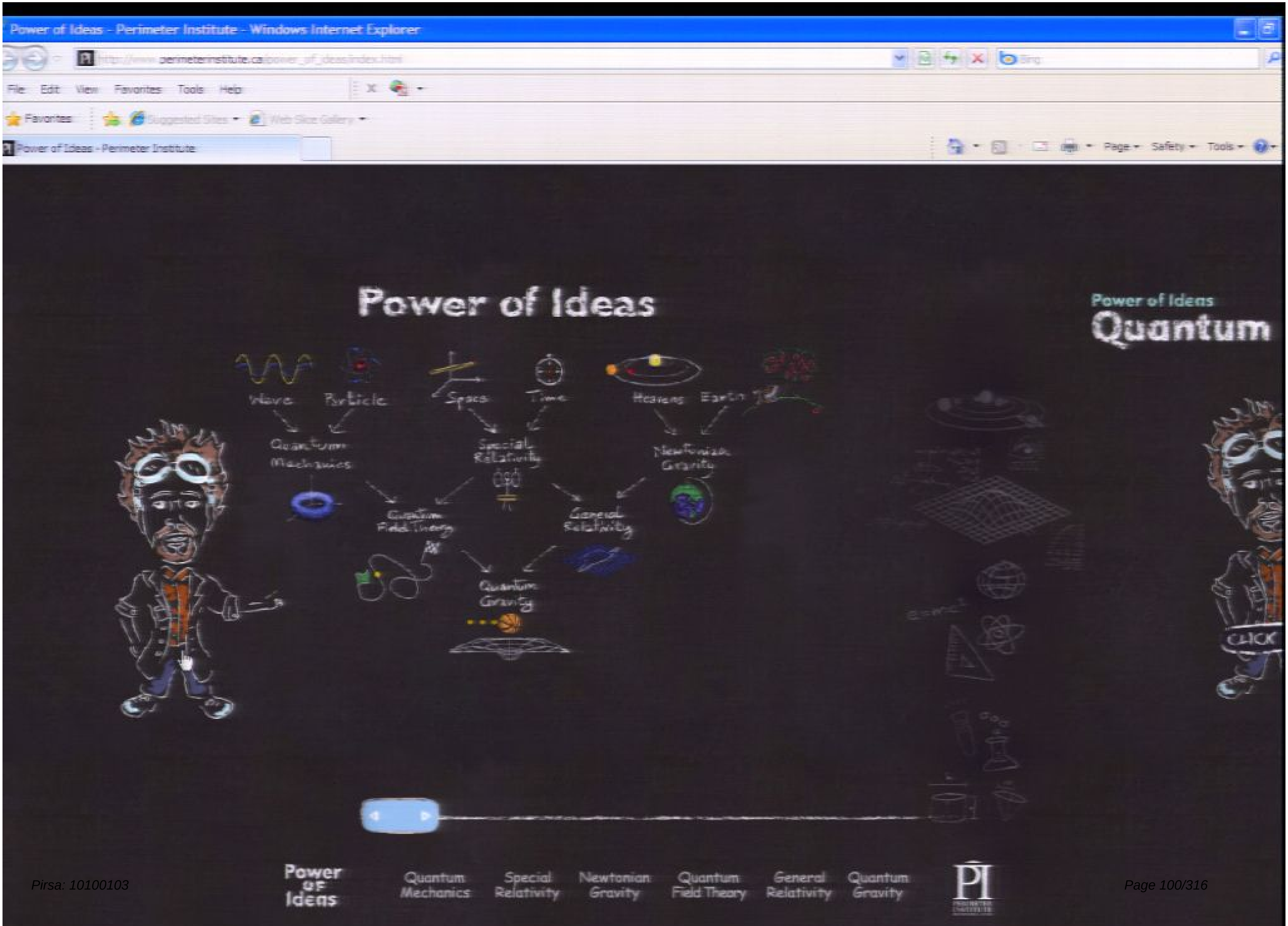
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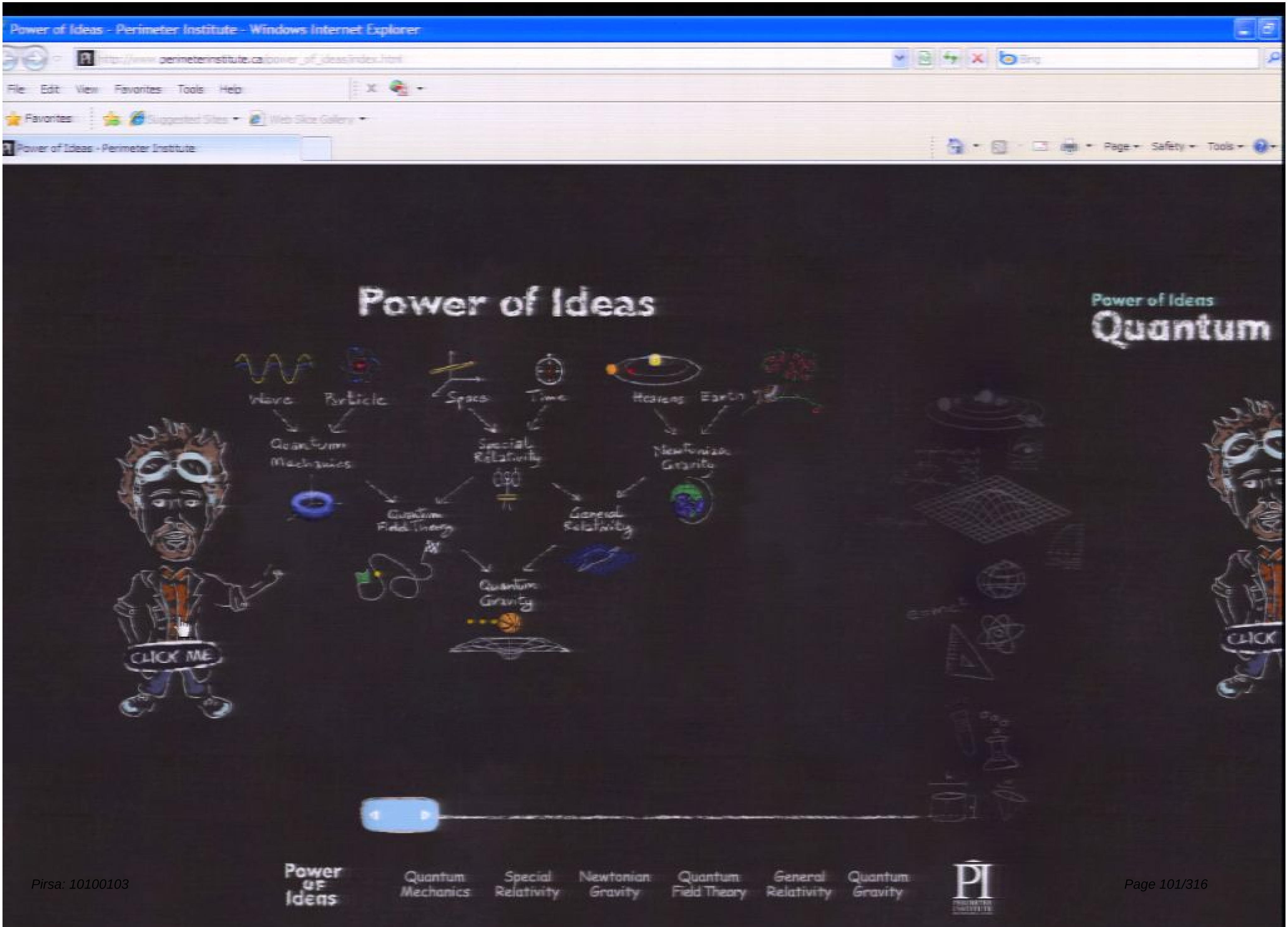
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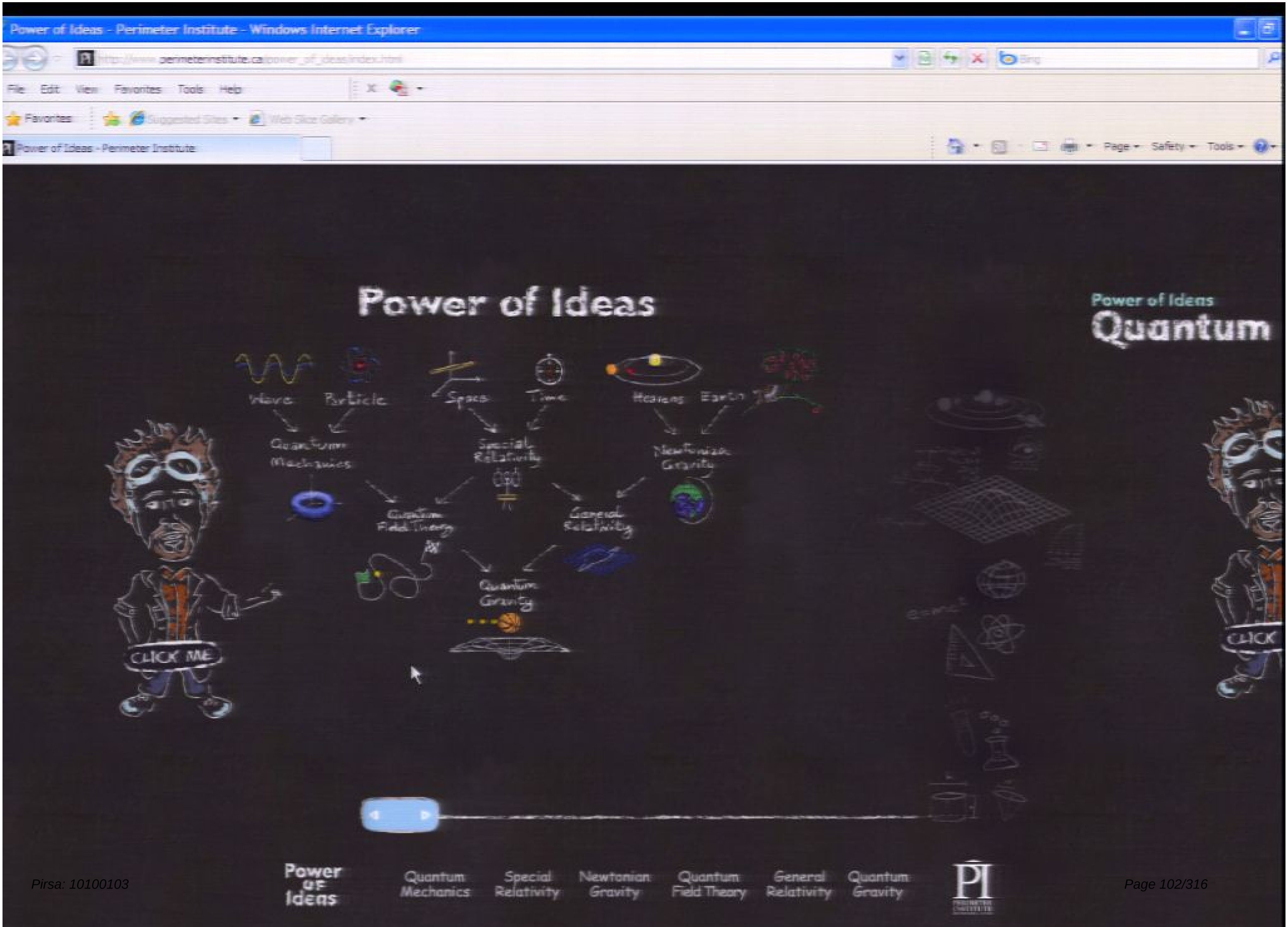
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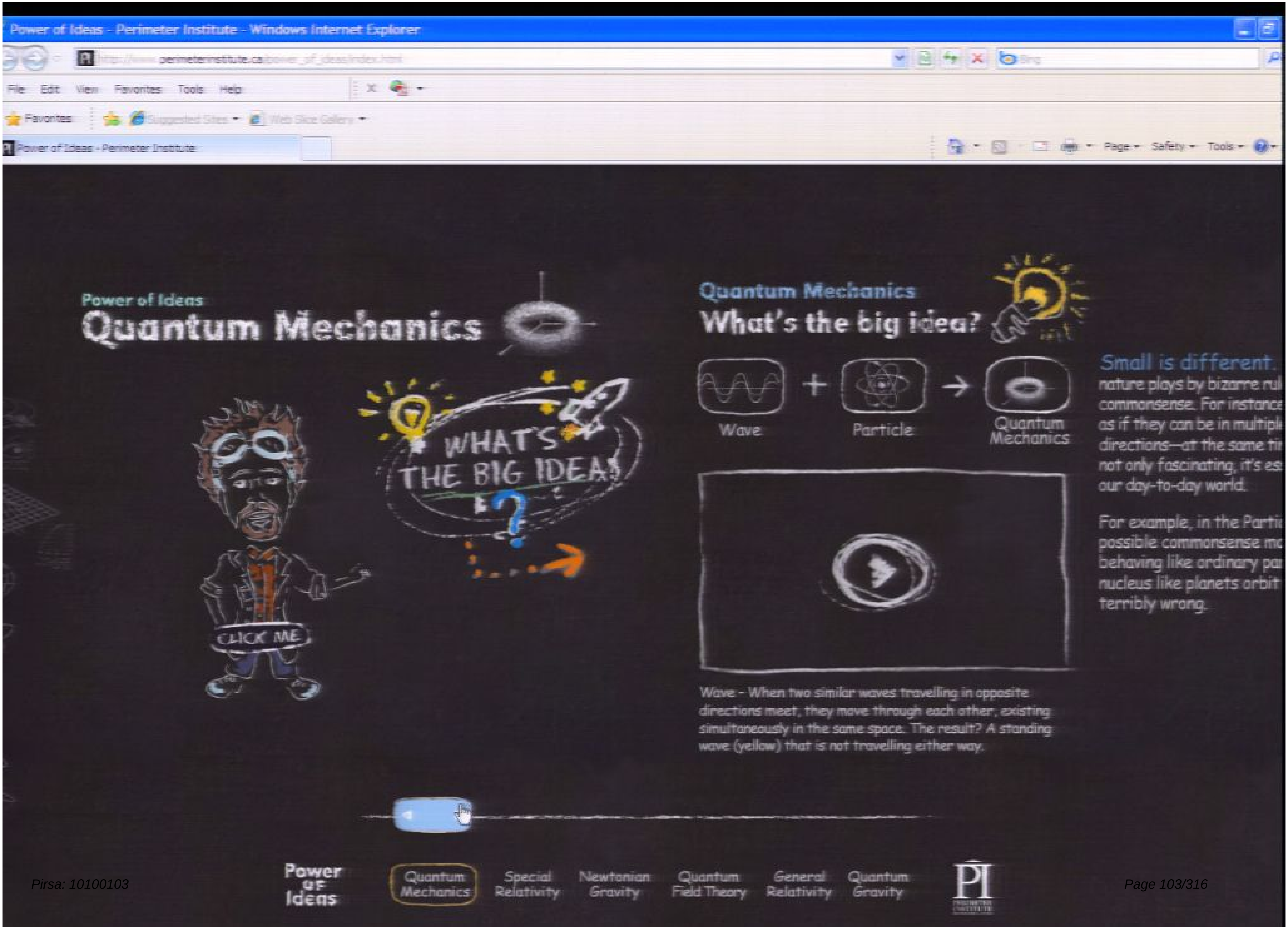
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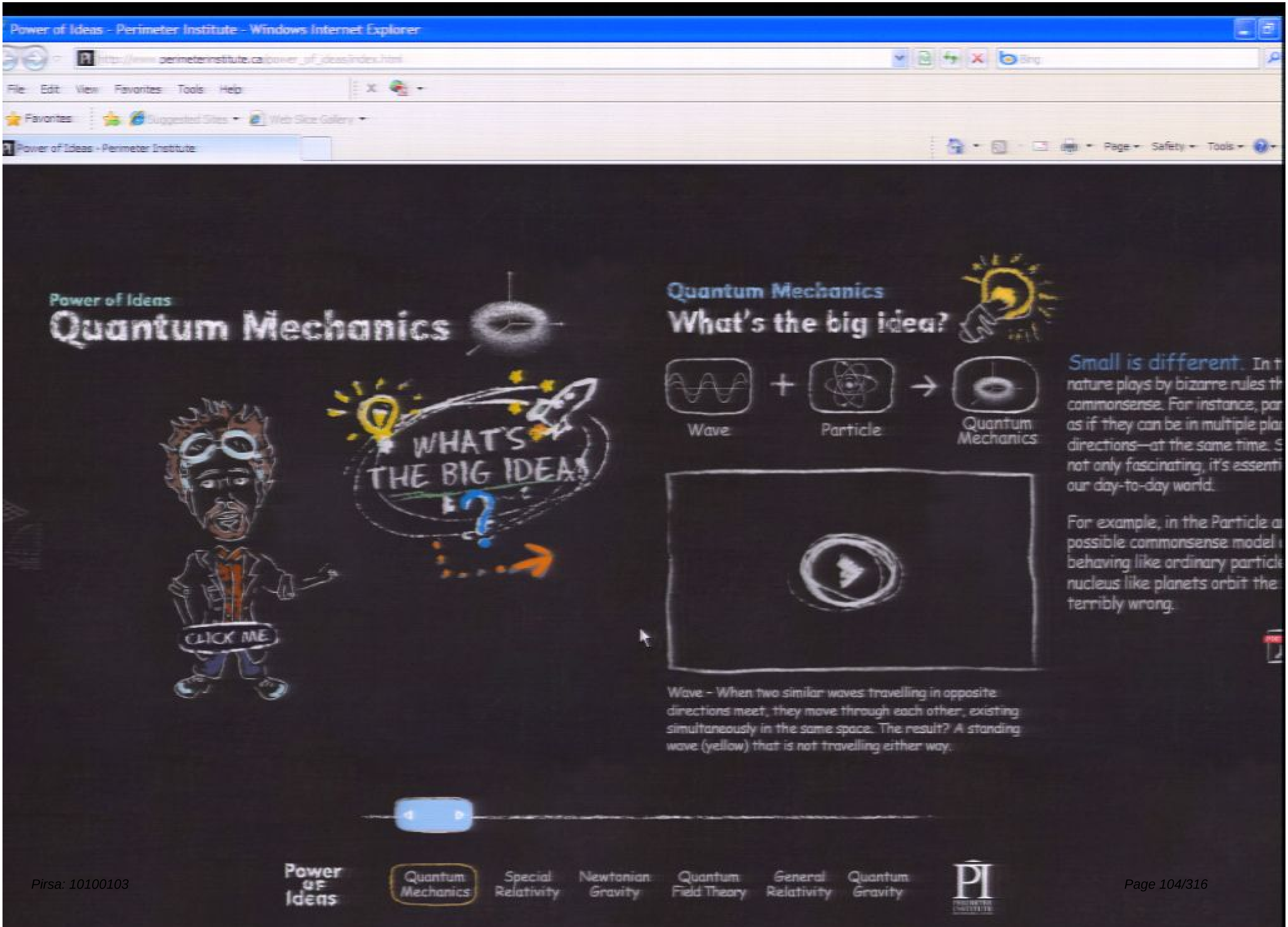
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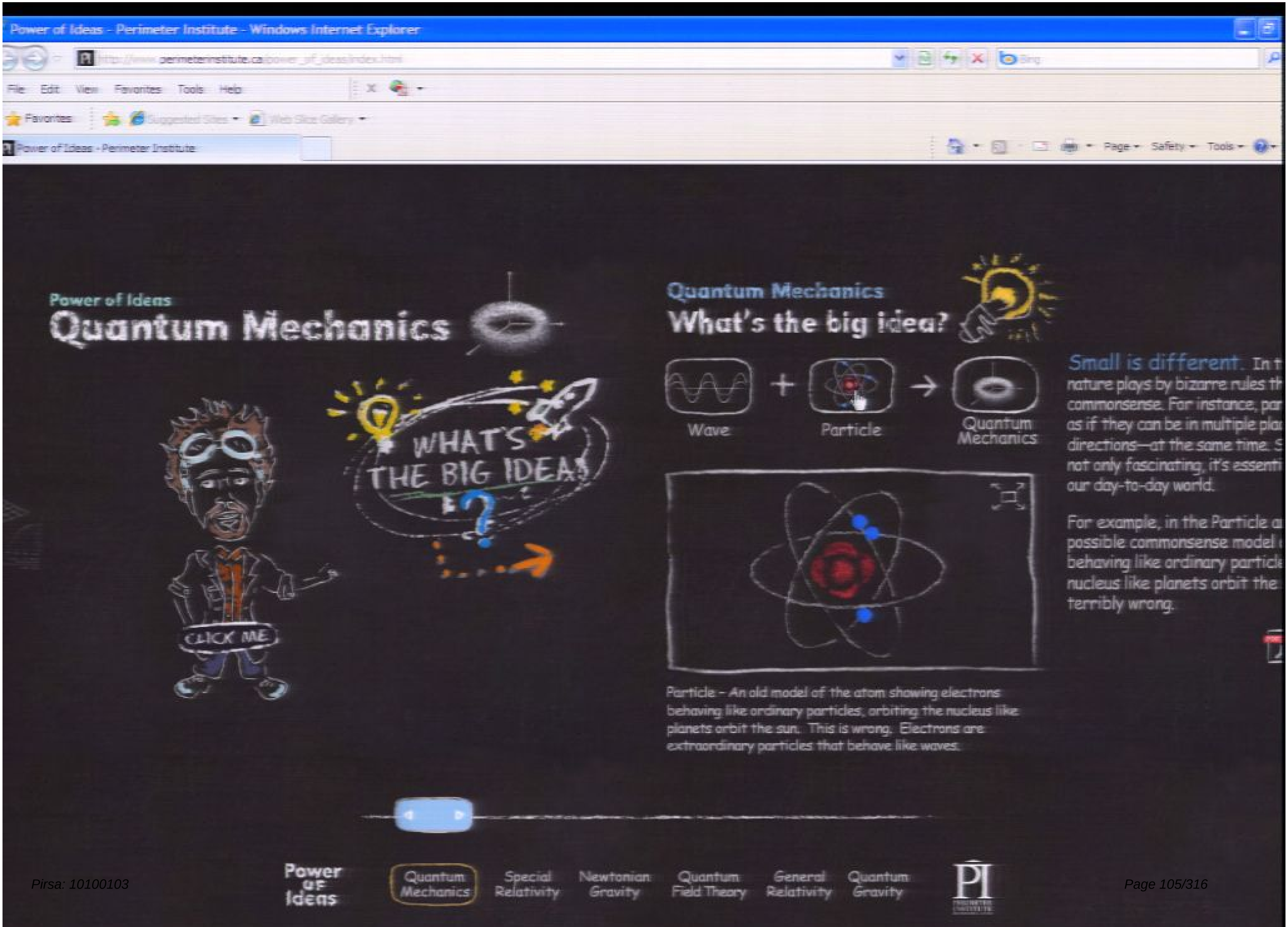

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Particle – An old model of the atom showing electrons behaving like ordinary particles, orbiting the nucleus like planets orbit the sun. This is wrong. Electrons are extraordinary particles that behave like waves.
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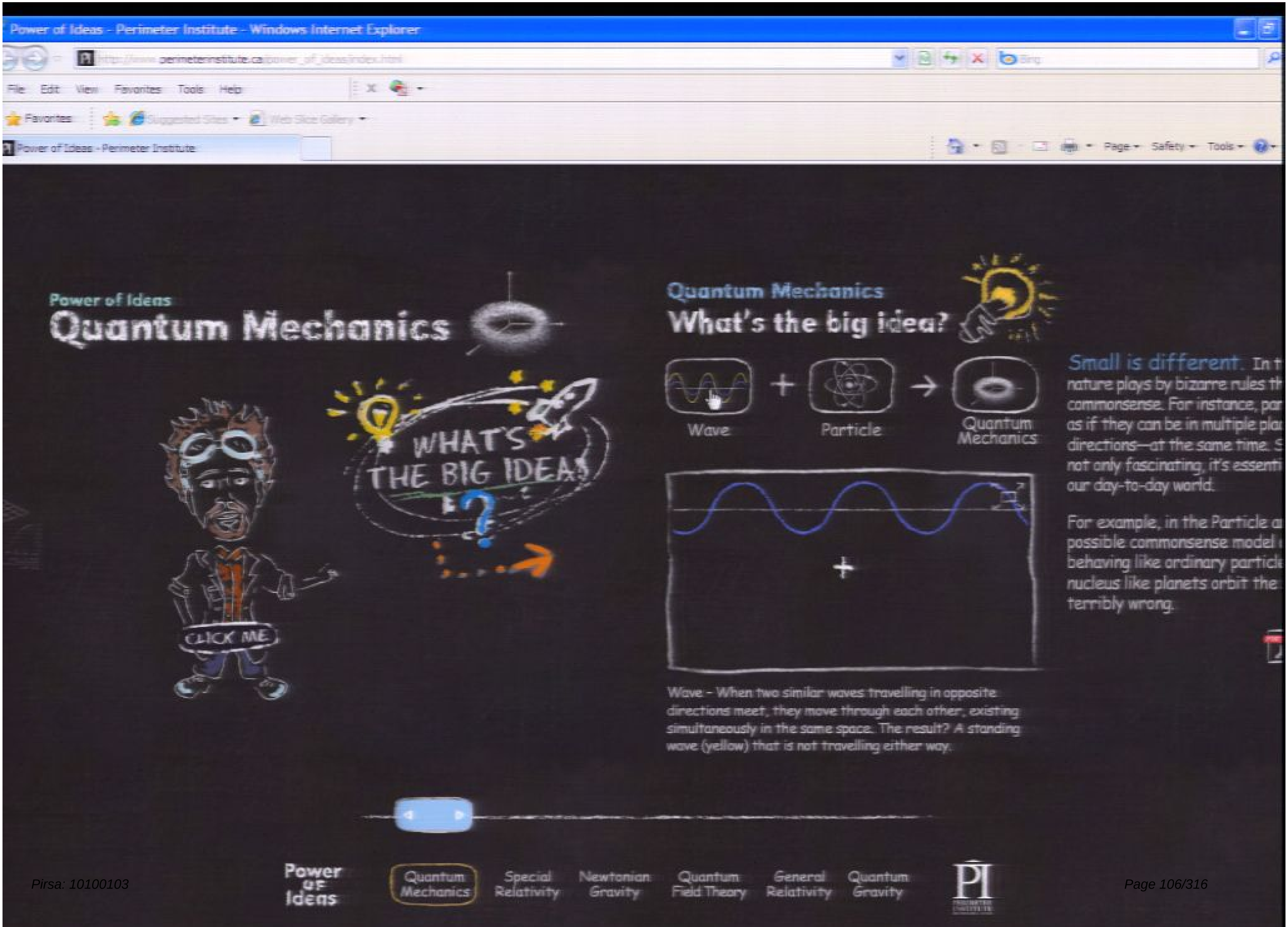
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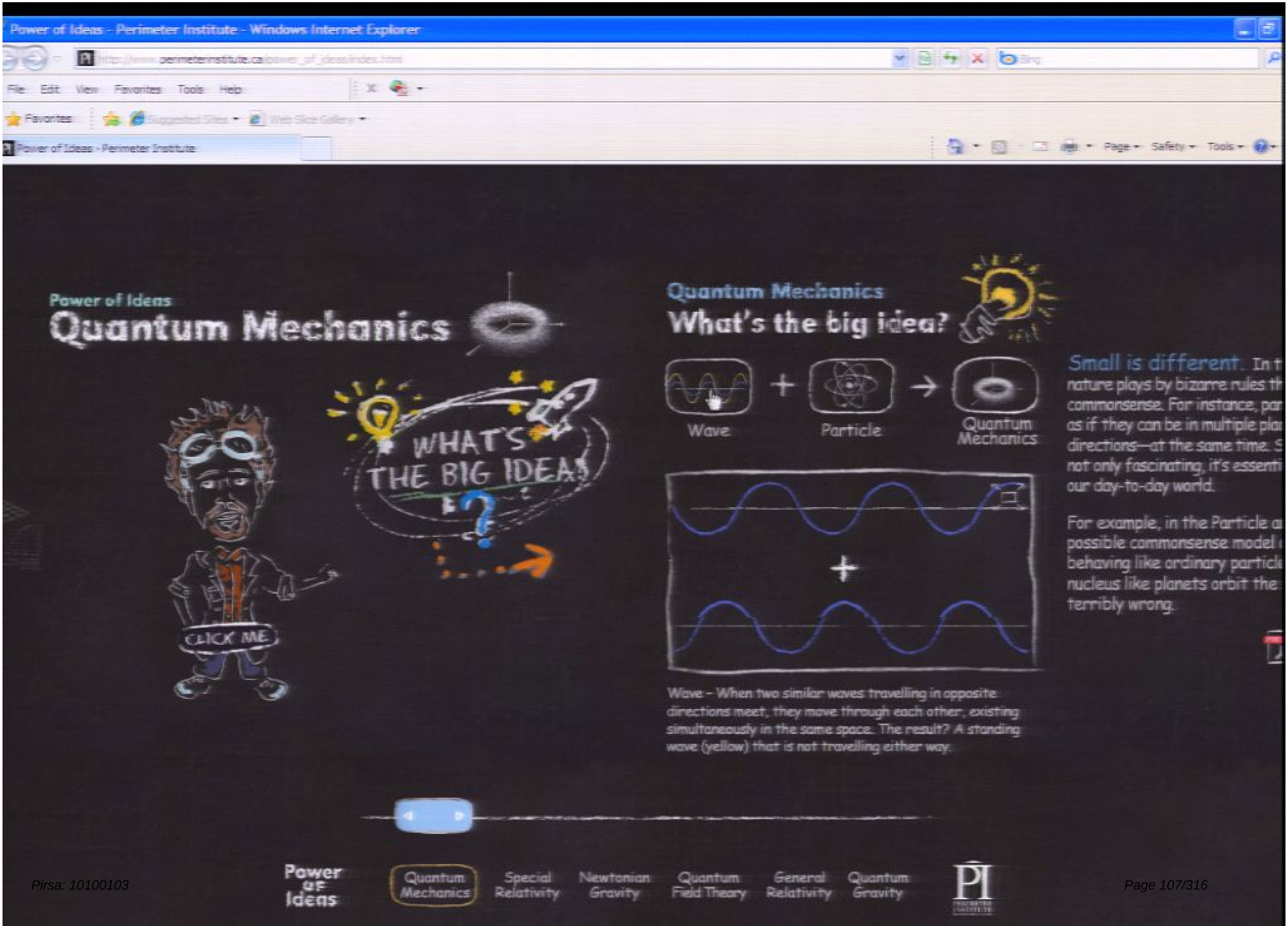

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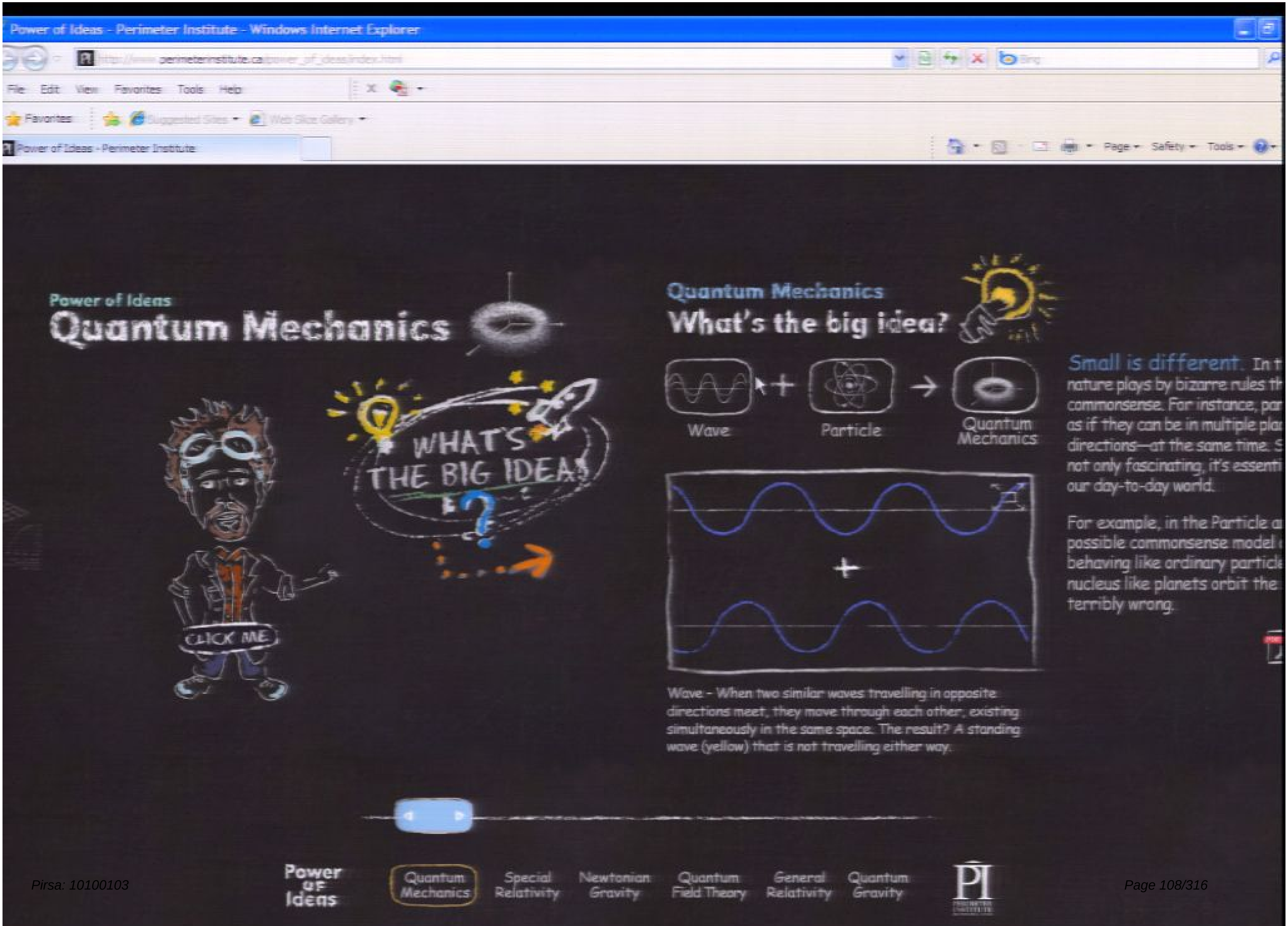
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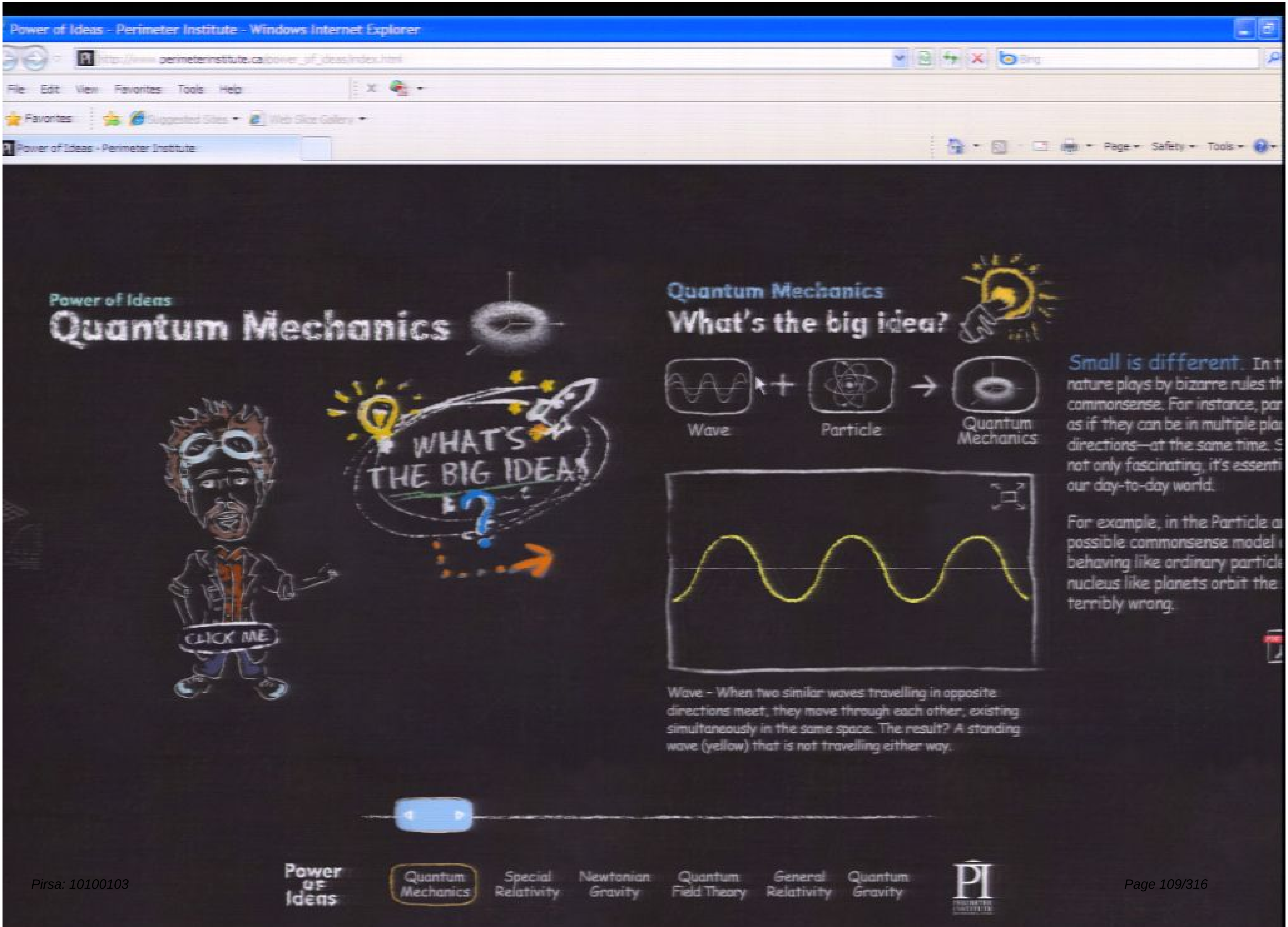
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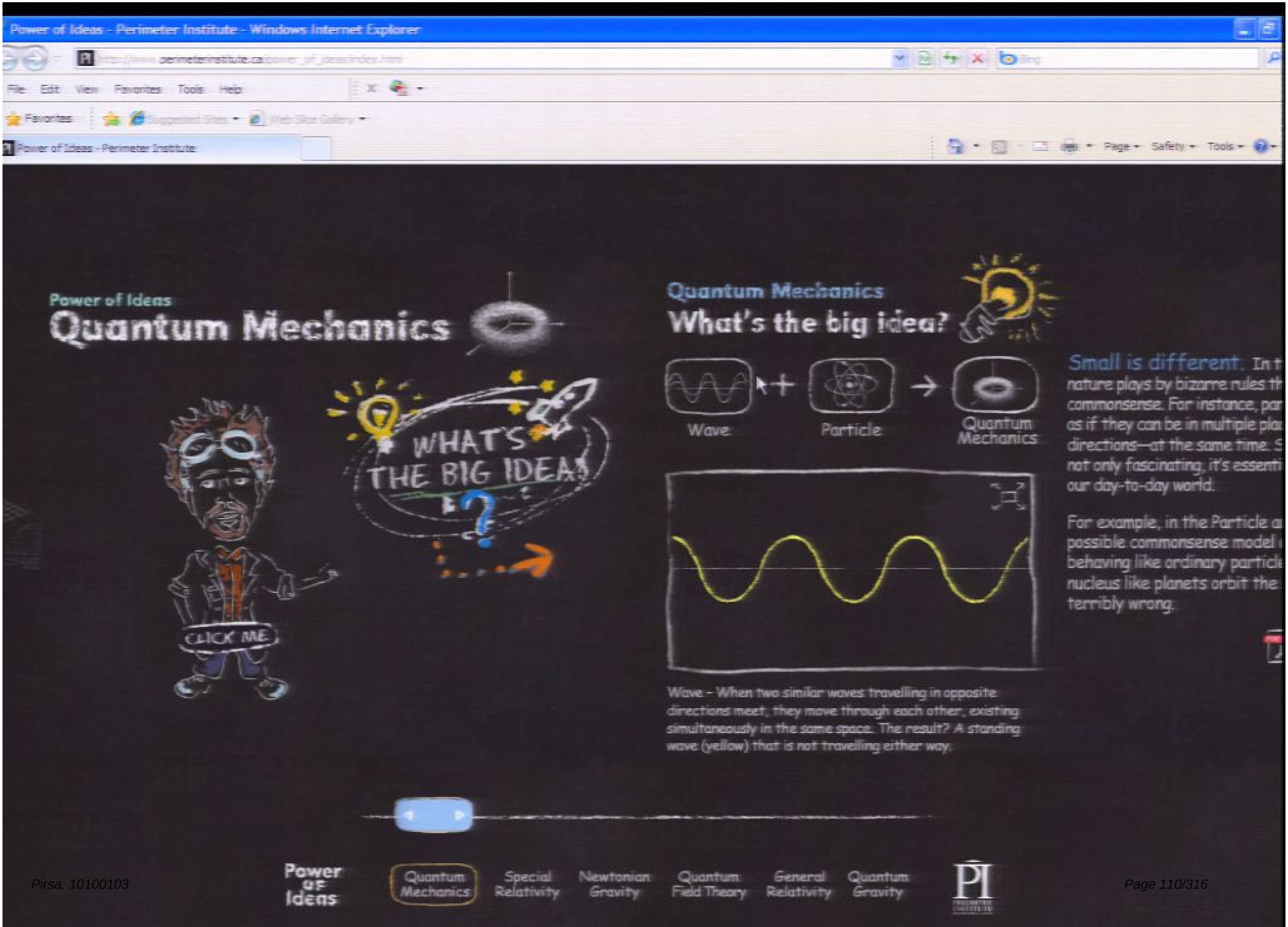
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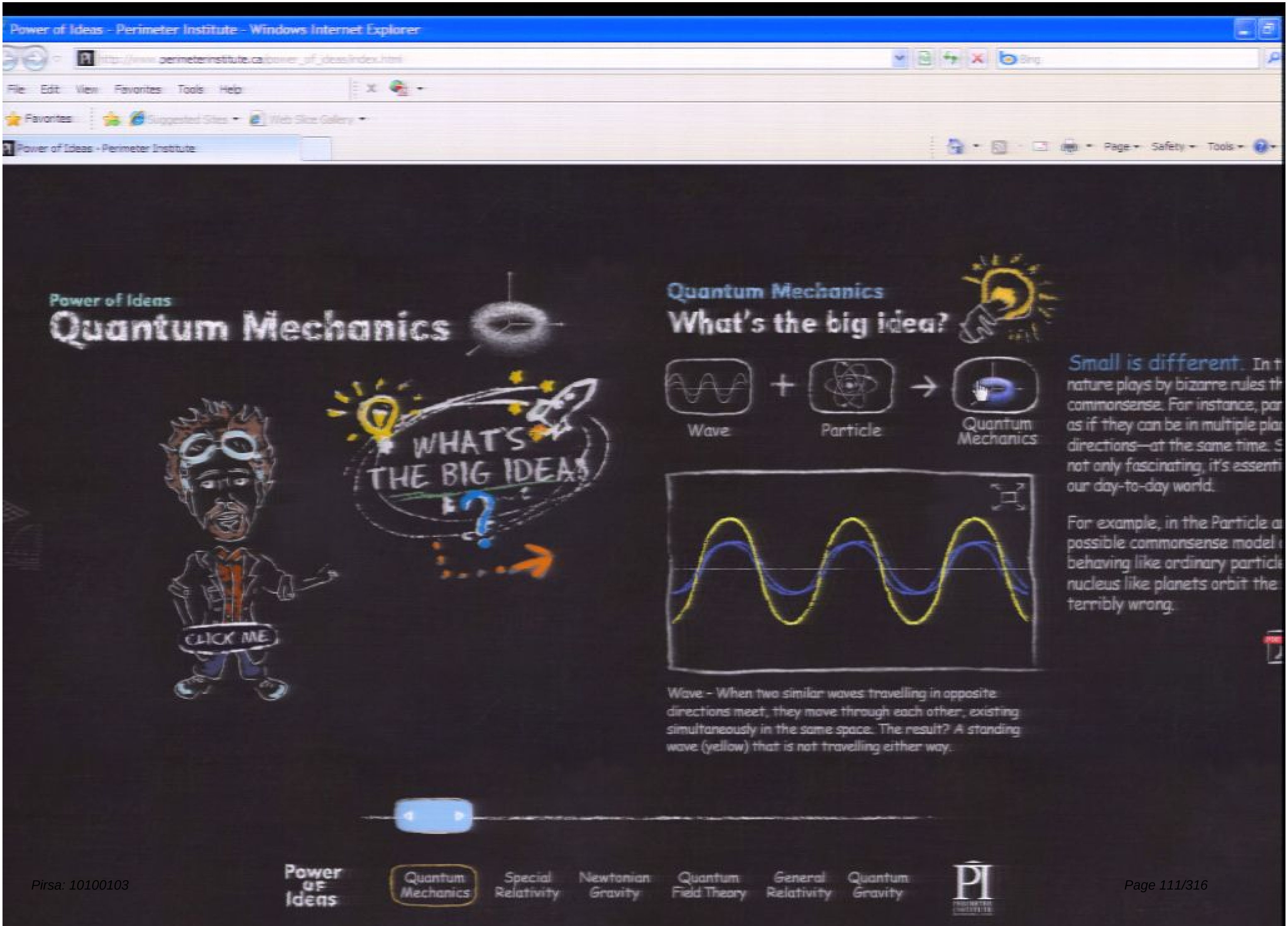

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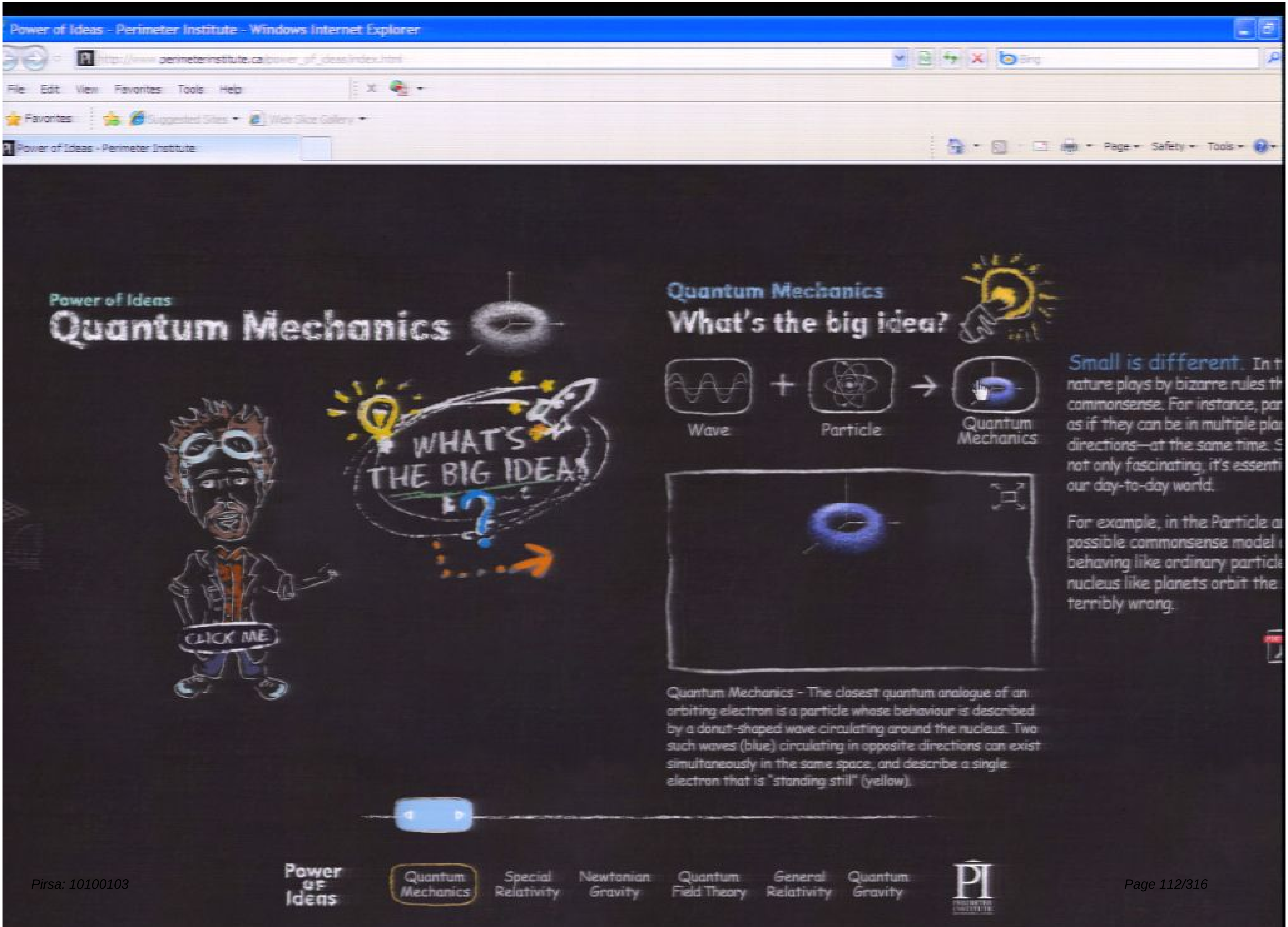
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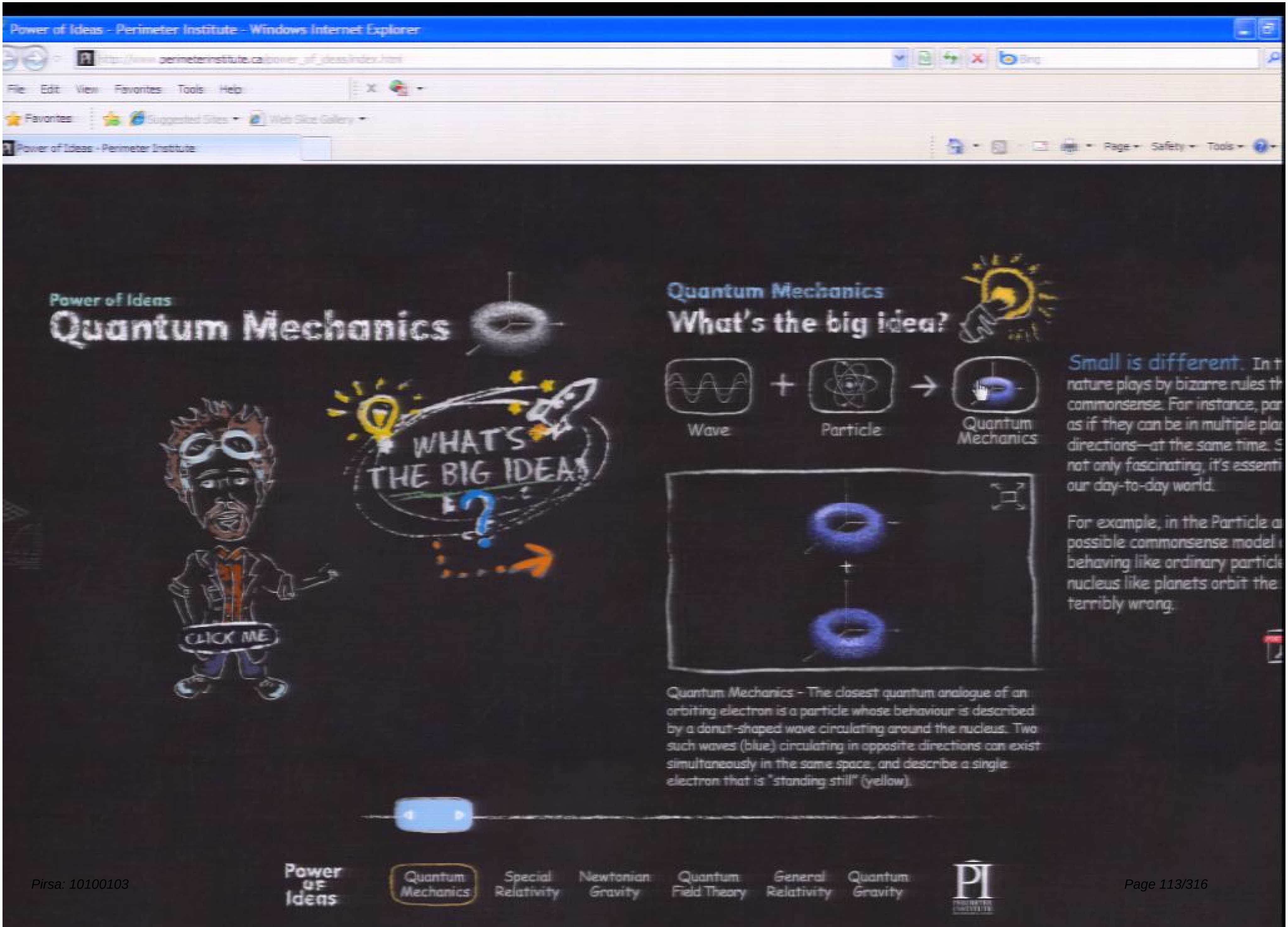
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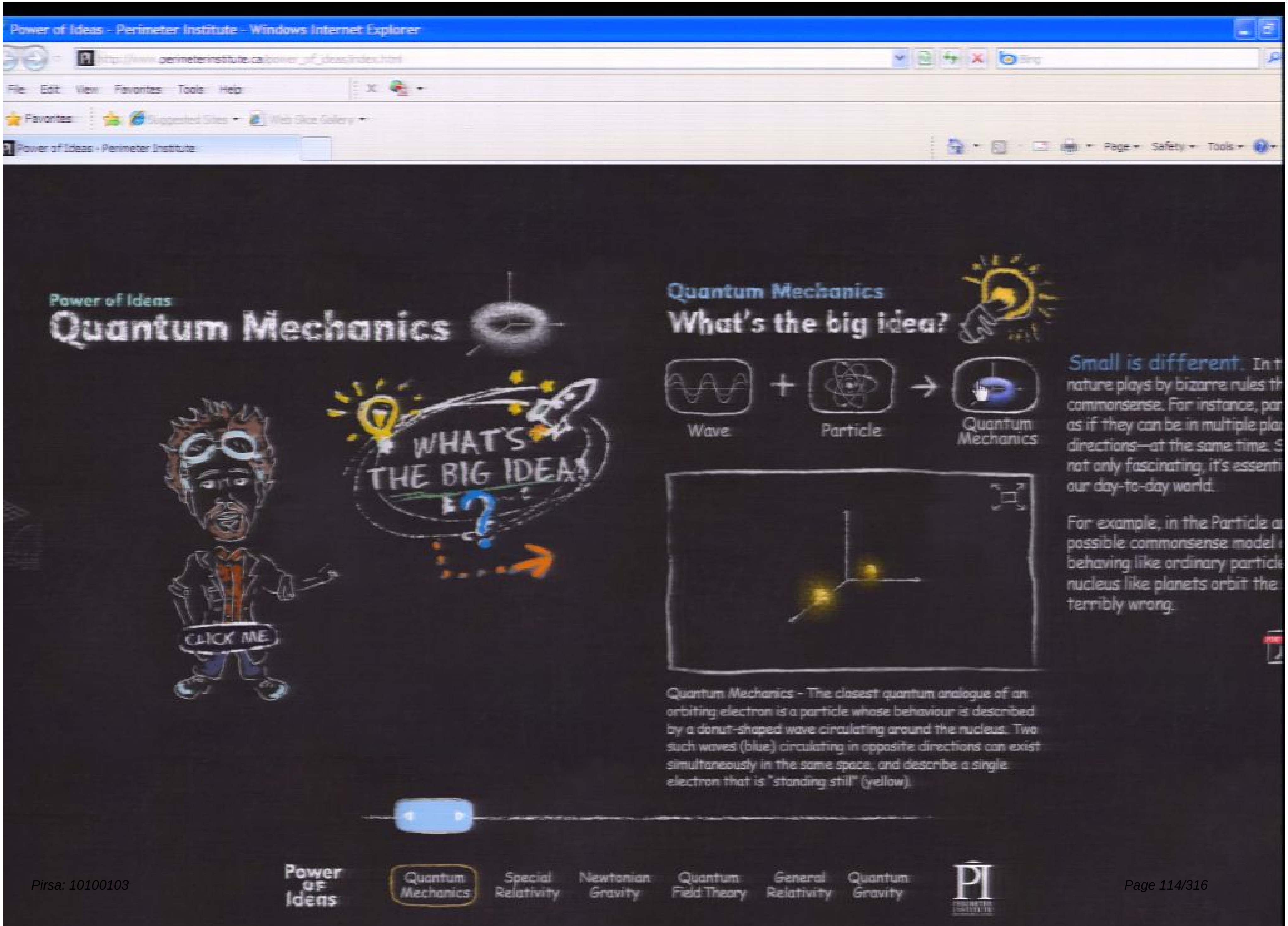
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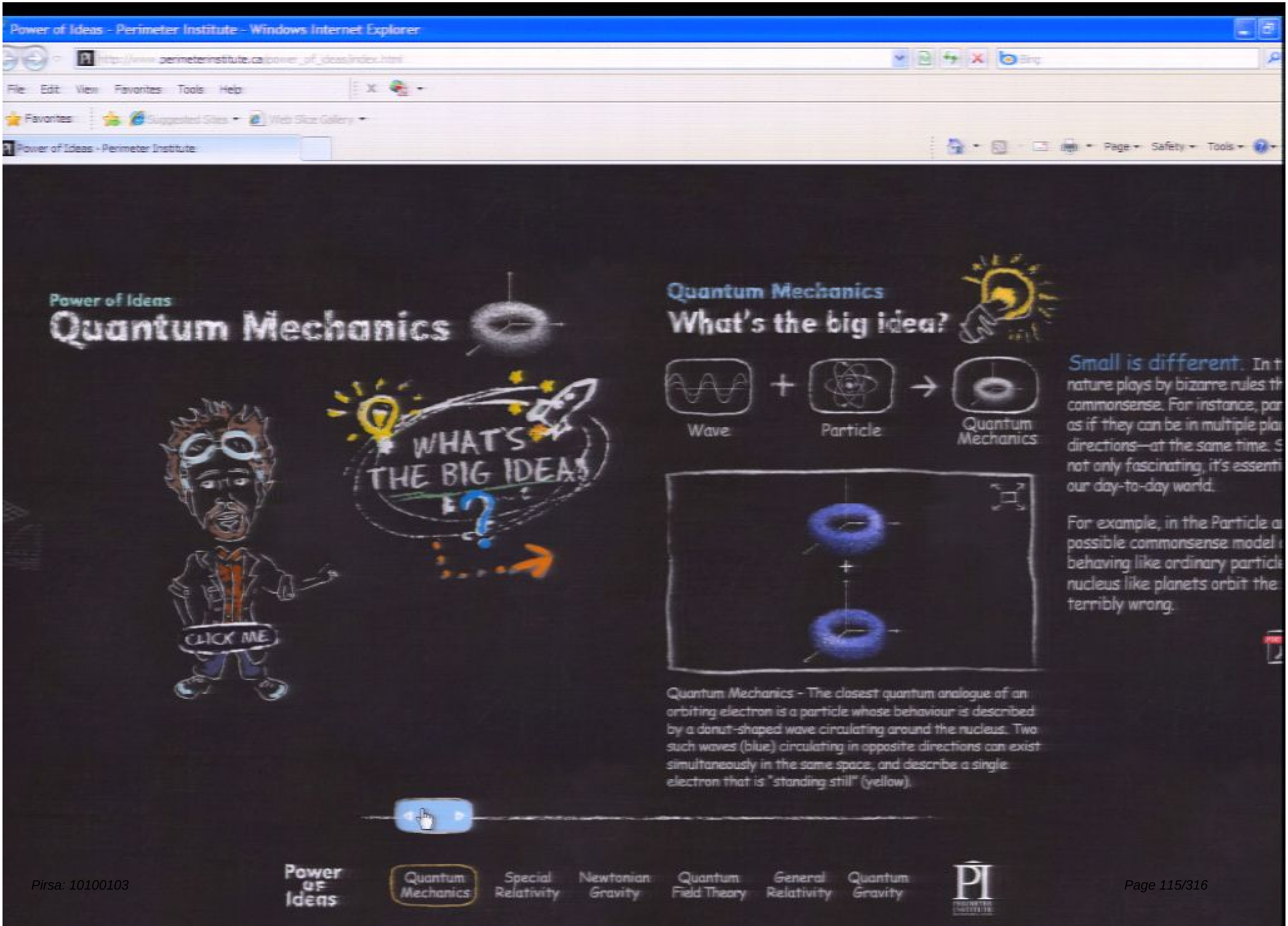
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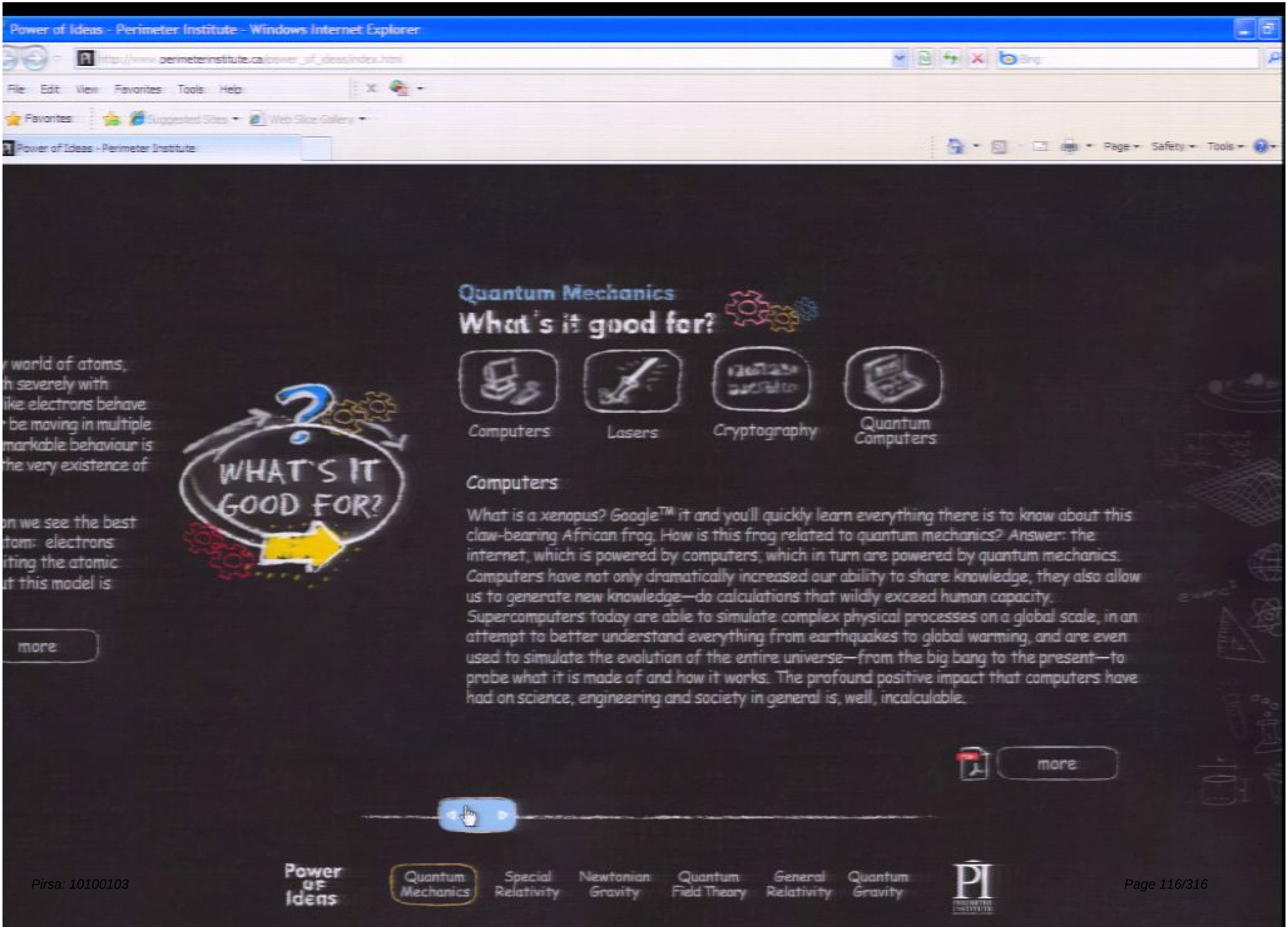

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Quantum Mechanics
What's it good for?
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Quantum Computers
Computers
What is a xenopus? Google™ it and you'll quickly learn everything there is to know about this claw-bearing African frog. How is this frog related to quantum mechanics? Answer: the internet, which is powered by computers, which in turn are powered by quantum mechanics. Computers have not only dramatically increased our ability to share knowledge, they also allow us to generate new knowledge—do calculations that wildly exceed human capacity. Supercomputers today are able to simulate complex physical processes on a global scale, in an attempt to better understand everything from earthquakes to global warming, and are even used to simulate the evolution of the entire universe—from the big bang to the present—to probe what it is made of and how it works. The profound positive impact that computers have had on science, engineering and society in general is, well, incalculable.
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Quantum Mechanics

What's it good for?

Computers | Lasers | Cryptography | Quantum Computers

WHAT'S IT GOOD FOR?

Computers

What is a xenopus? Google™ it and you'll quickly learn everything there is to know about this claw-bearing African frog. How is this frog related to quantum mechanics? Answer: the internet, which is powered by computers, which in turn are powered by quantum mechanics. Computers have not only dramatically increased our ability to share knowledge, they also allow us to generate new knowledge—do calculations that wildly exceed human capacity. Supercomputers today are able to simulate complex physical processes on a global scale, in an attempt to better understand everything from earthquakes to global warming, and are even used to simulate the evolution of the entire universe—from the big bang to the present—to probe what it is made of and how it works. The profound positive impact that computers have had on science, engineering and society in general is, well, incalculable.

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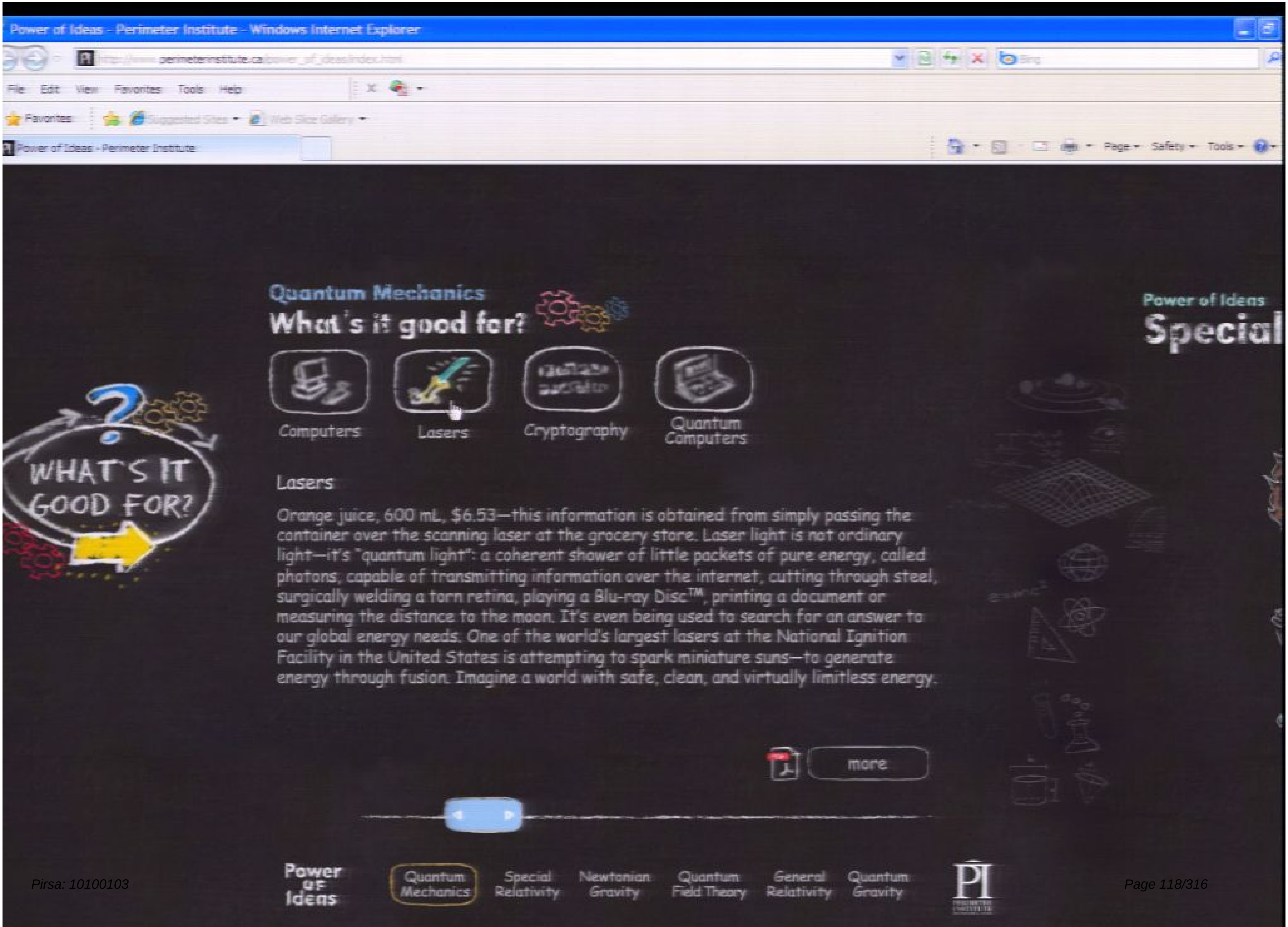
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Quantum Mechanics
What's it good for?
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Quantum Computers
WHAT'S IT GOOD FOR?
Lasers
Orange juice, 600 mL, $6.53—this information is obtained from simply passing the container over the scanning laser at the grocery store. Laser light is not ordinary light—it's "quantum light": a coherent shower of little packets of pure energy, called photons, capable of transmitting information over the internet, cutting through steel, surgically welding a torn retina, playing a Blu-ray Disc™, printing a document or measuring the distance to the moon. It's even being used to search for an answer to our global energy needs. One of the world's largest lasers at the National Ignition Facility in the United States is attempting to spark miniature suns—to generate energy through fusion. Imagine a world with safe, clean, and virtually limitless energy.
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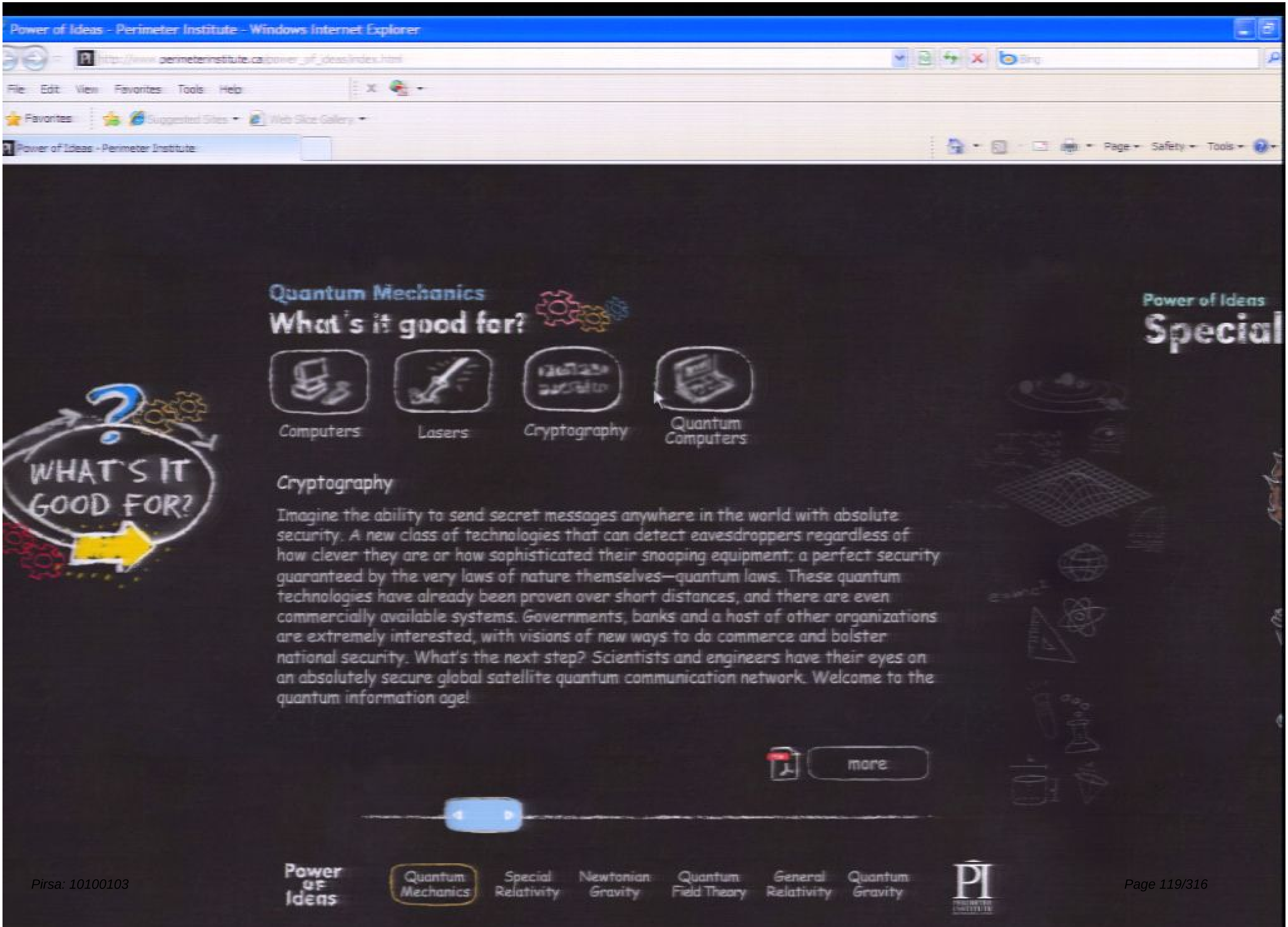
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Cryptography
Imagine the ability to send secret messages anywhere in the world with absolute security. A new class of technologies that can detect eavesdroppers regardless of how clever they are or how sophisticated their snooping equipment; a perfect security guaranteed by the very laws of nature themselves—quantum laws. These quantum technologies have already been proven over short distances, and there are even commercially available systems. Governments, banks and a host of other organizations are extremely interested, with visions of new ways to do commerce and bolster national security. What's the next step? Scientists and engineers have their eyes on an absolutely secure global satellite quantum communication network. Welcome to the quantum information age!
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Quantum Mechanics

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WHAT'S IT GOOD FOR?

Quantum Computers

Quantum superposition, entanglement, and teleportation—three ingredients needed for a quantum computer. What's a quantum computer? A new breed of computer that might make today's supercomputers look like mere hand calculators. Instead of processing bits of information (binary digits; 0 or 1) they would process qubits of quantum information: quantum superpositions of both 0 and 1—simultaneously; a new kind of "quantum parallel" computer. Using quantum entanglement—one of the weirdest aspects of quantum mechanics—this quantum information would be quantum teleported between different parts of the computer. Scientists have already built small prototypes, and know of a few kinds of problems quantum computers can solve—like quantum database searching, or breaking the encryption codes we use today for secure communications. A huge, worldwide effort is currently underway attempting to scale up these prototypes and find new kinds of problems these amazing machines could solve. If successful, we may be in for a second computer revolution, possibly even more profound than the first.

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Quantum Mechanics

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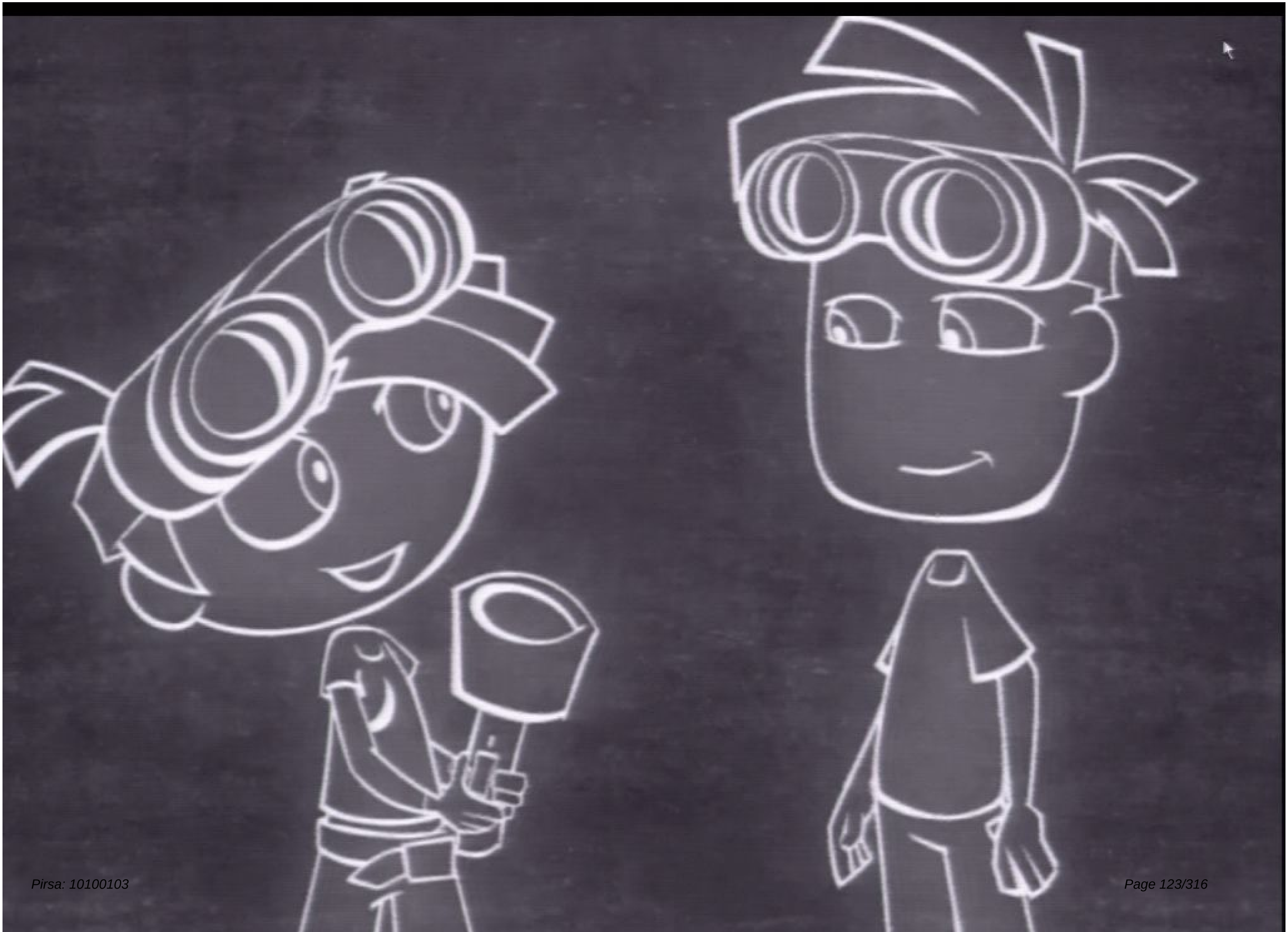

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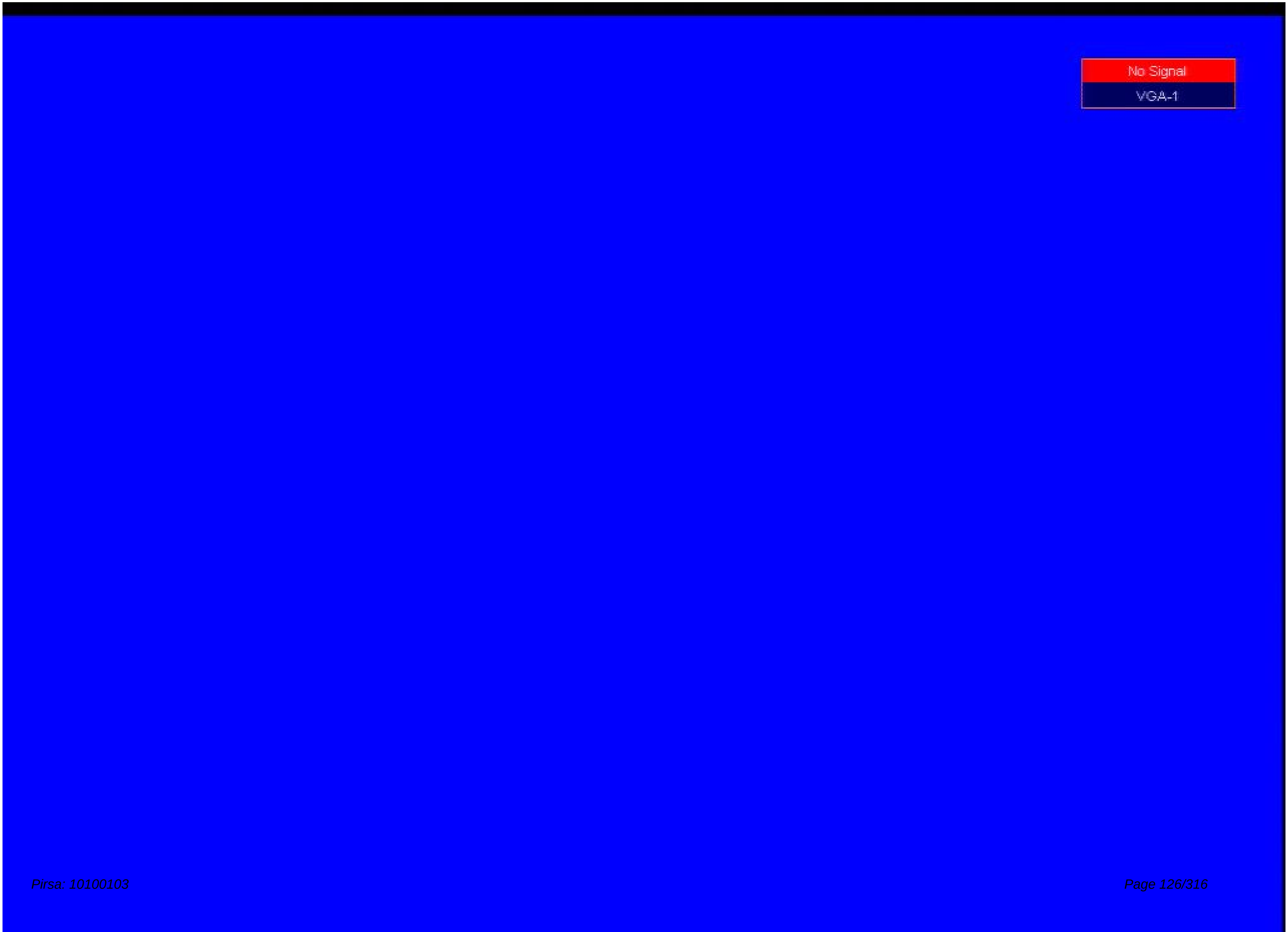
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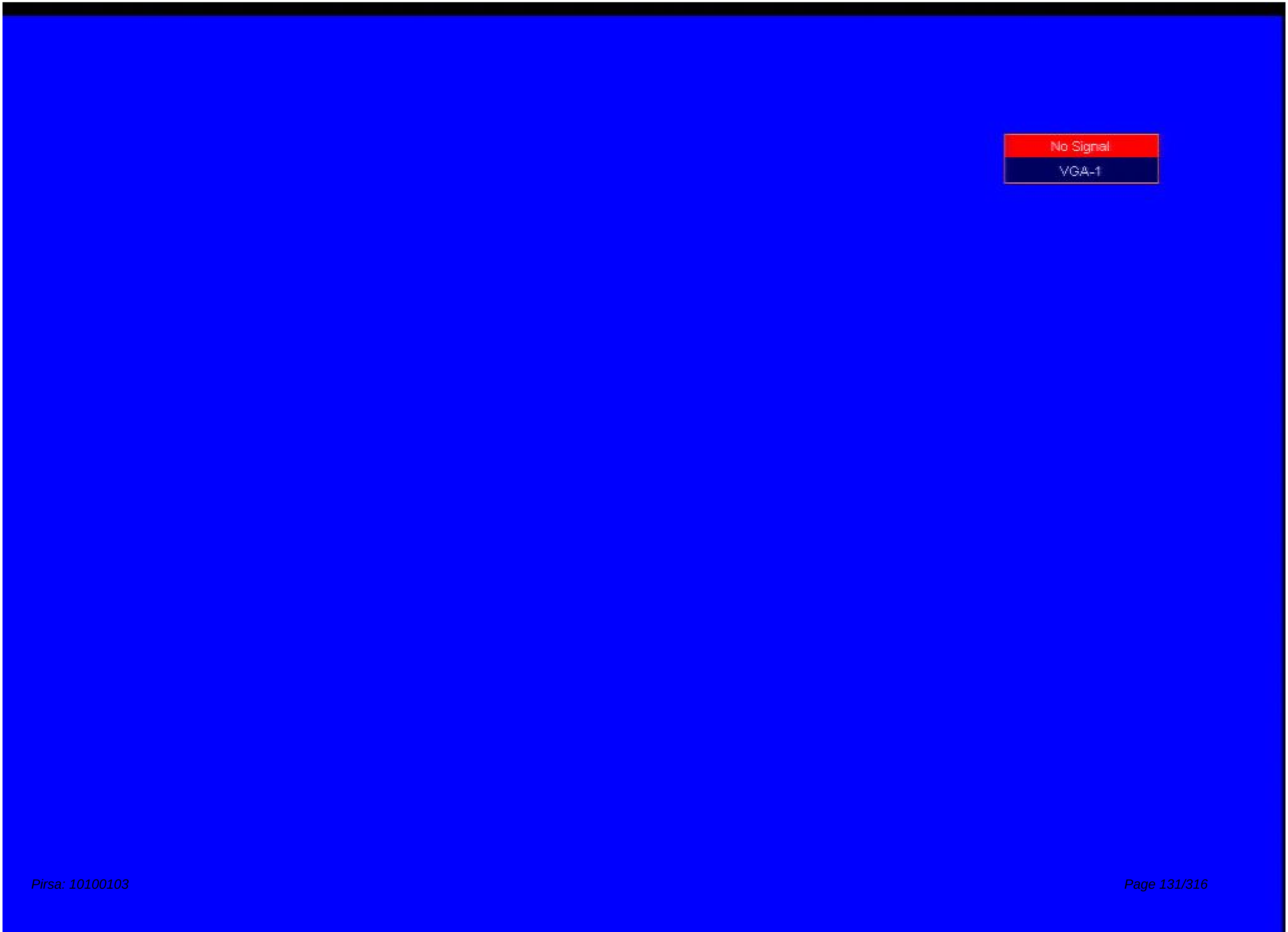
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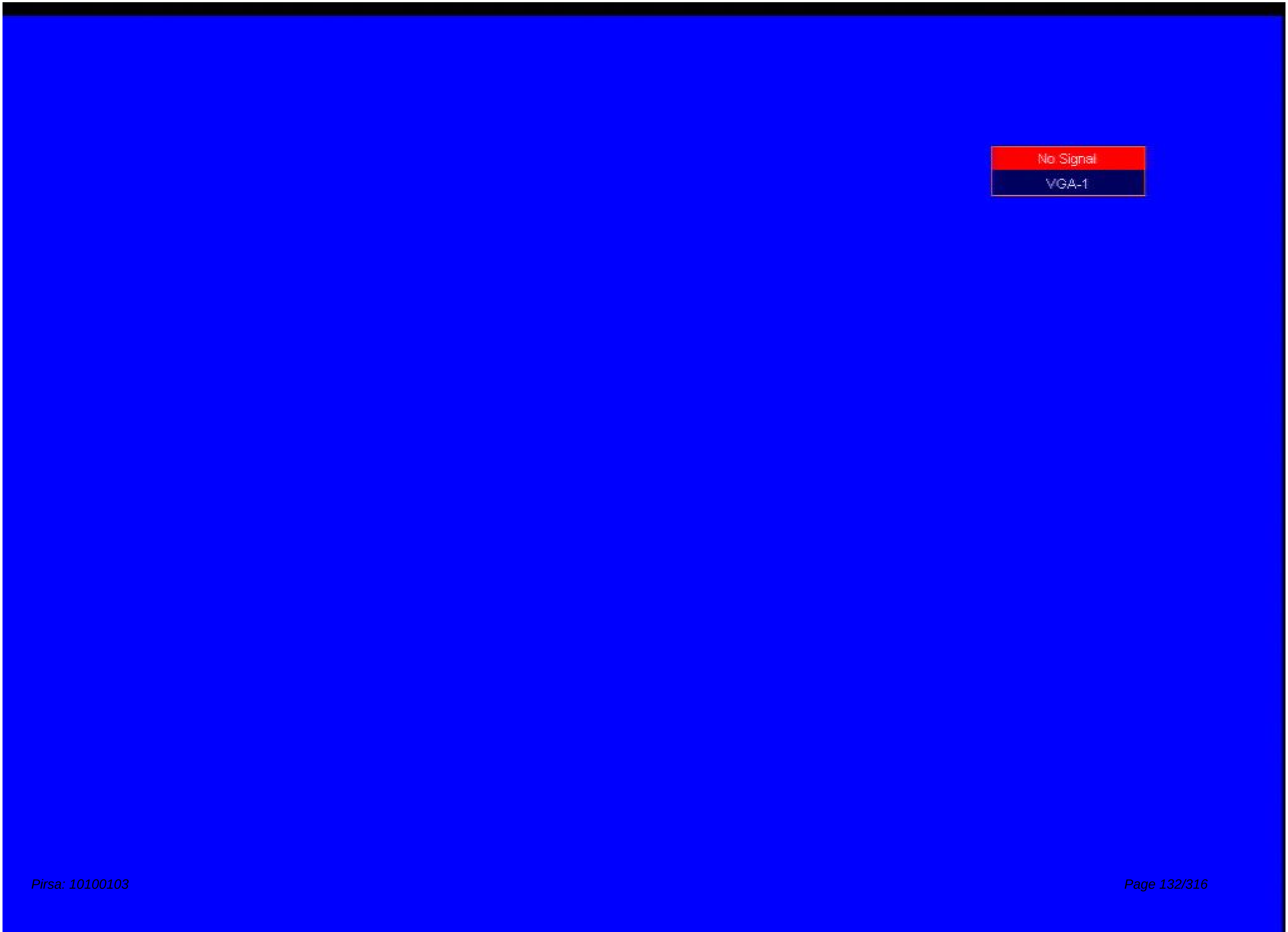
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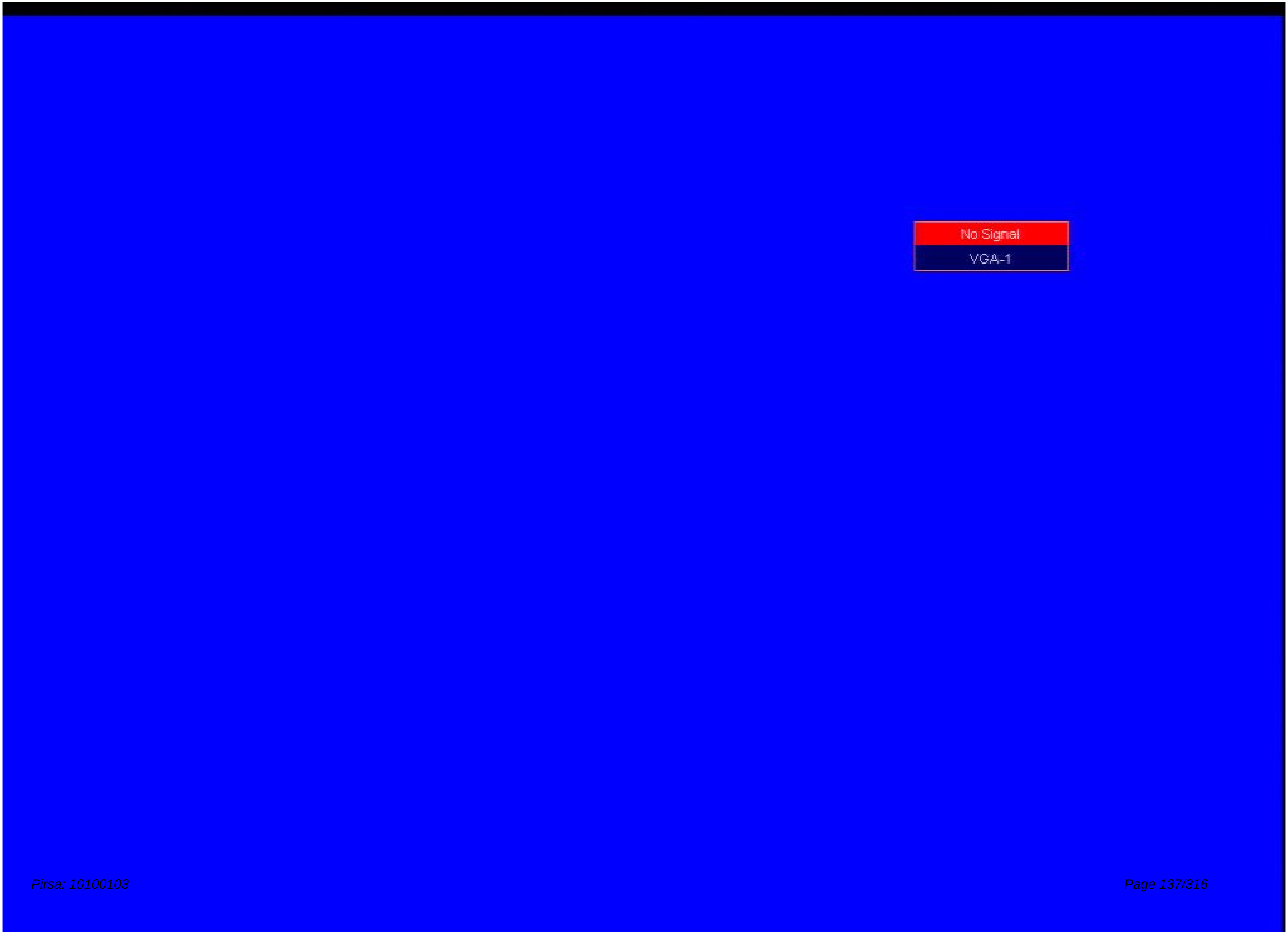
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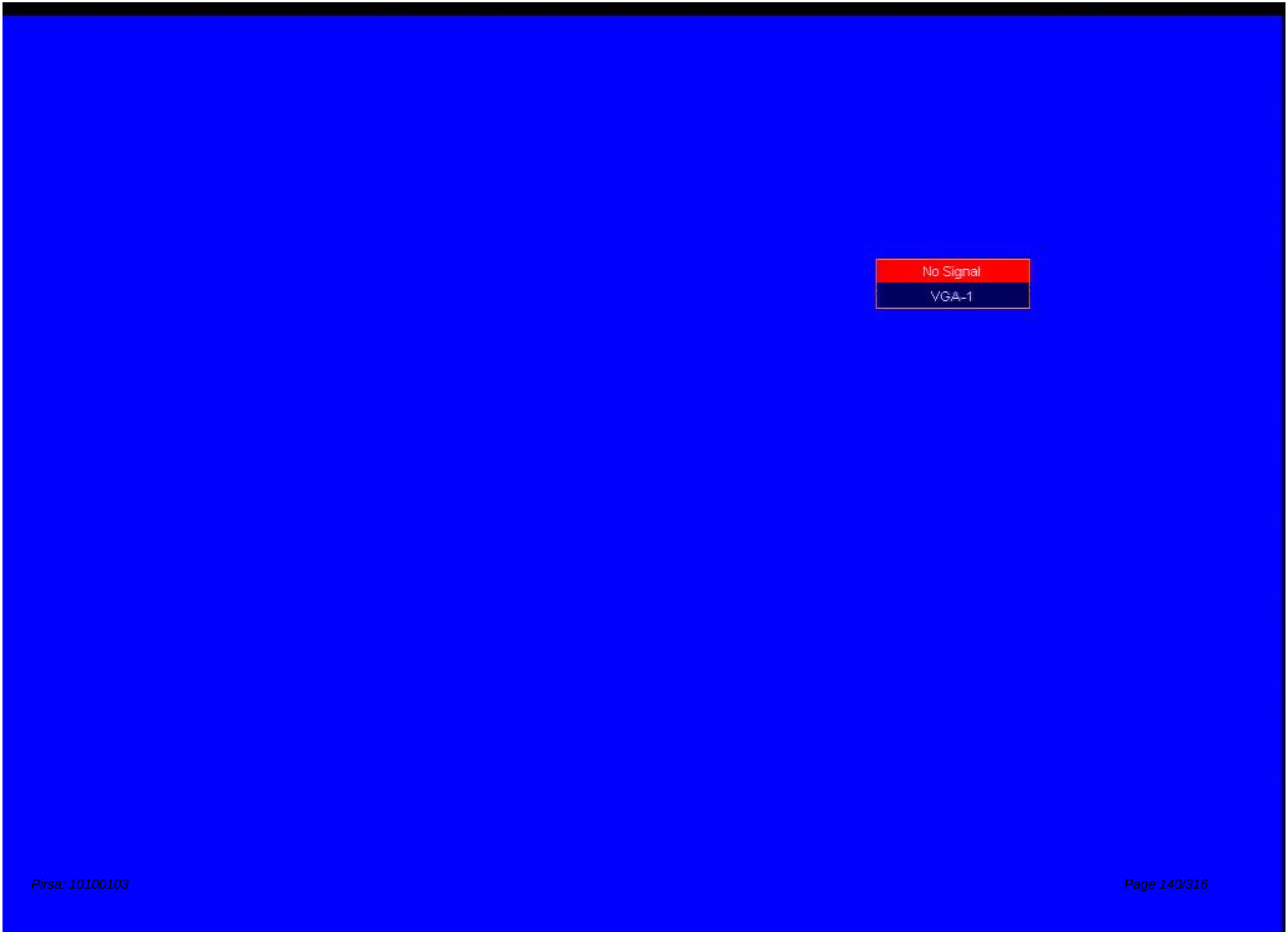
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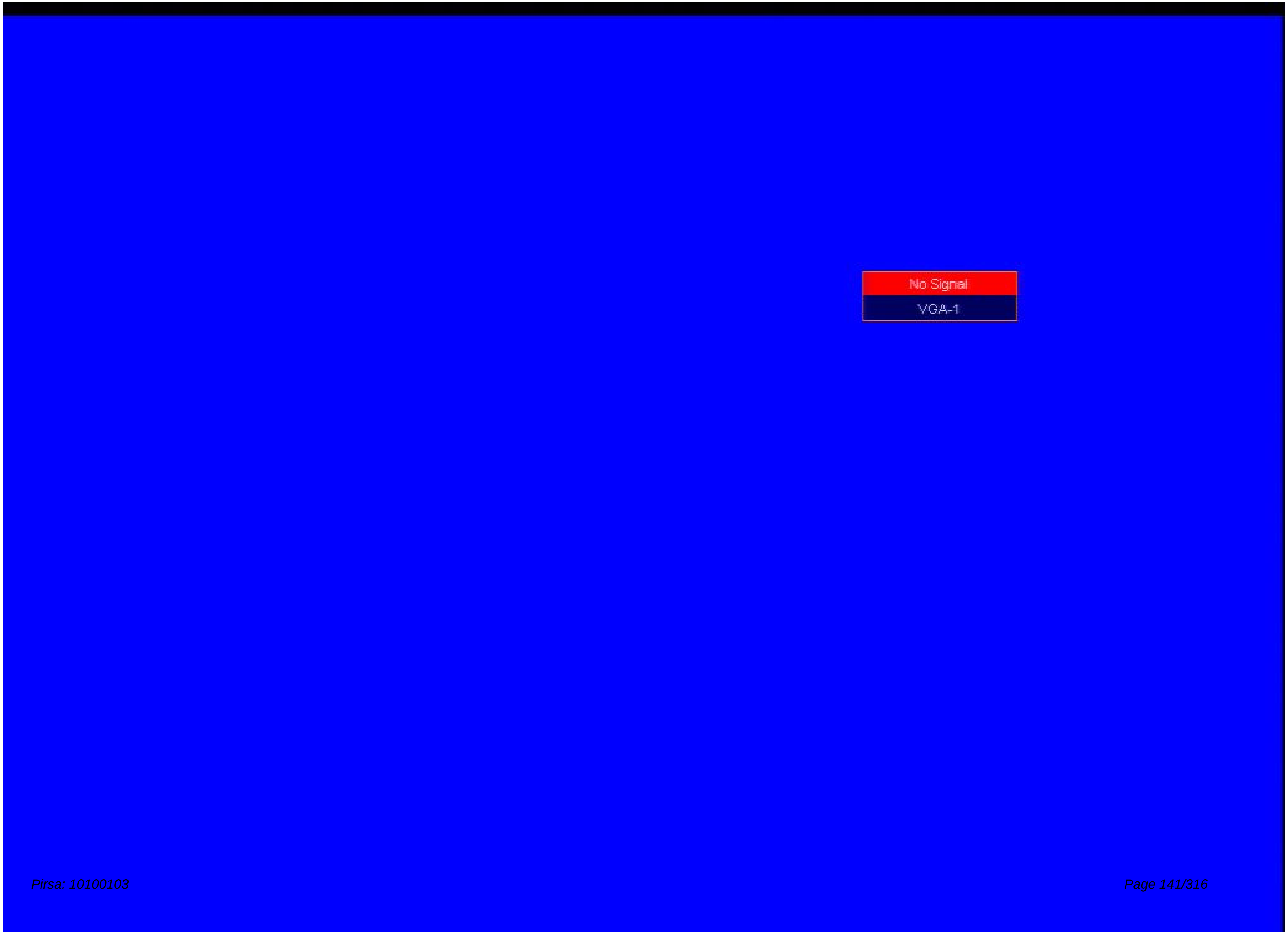
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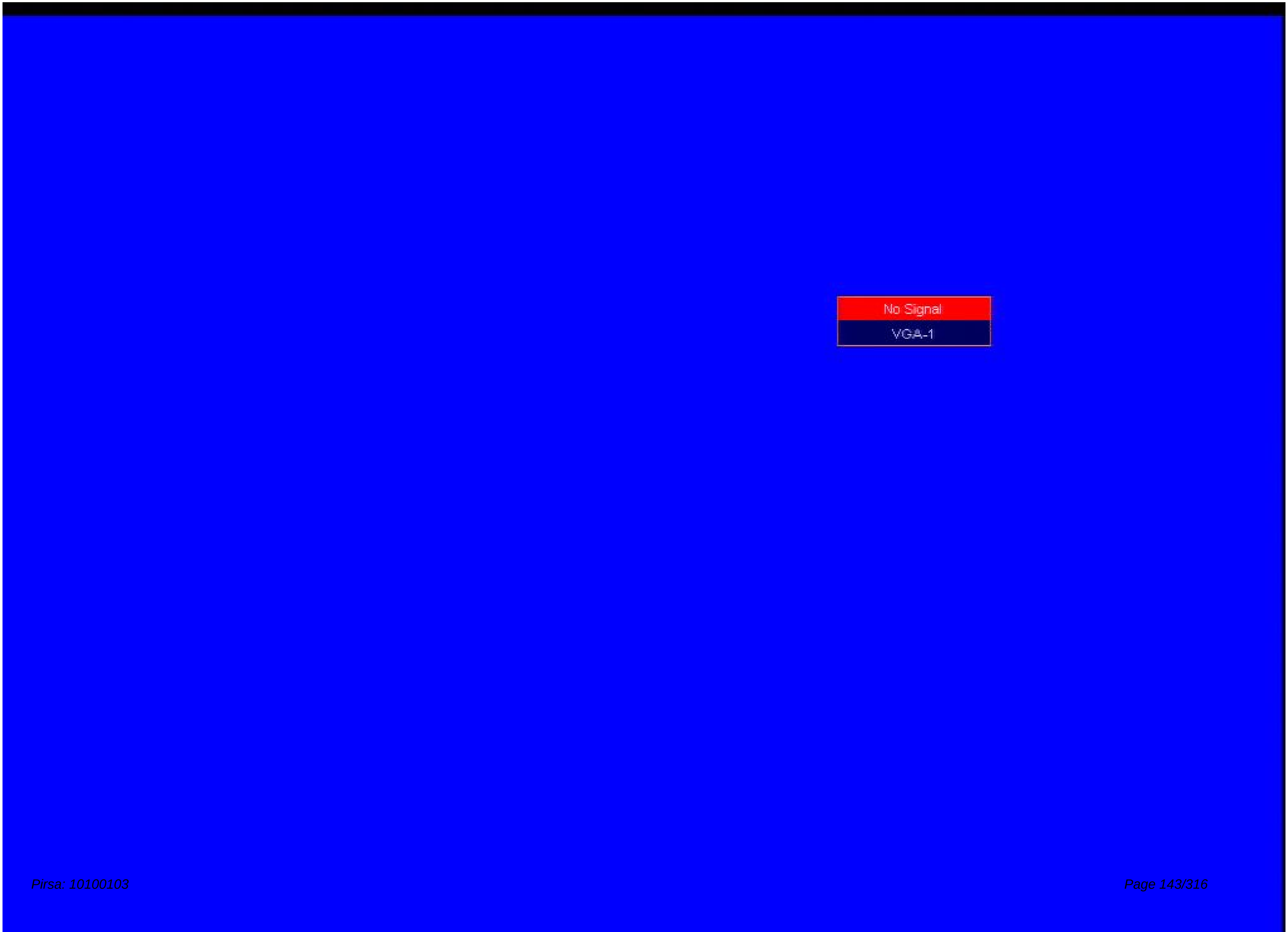
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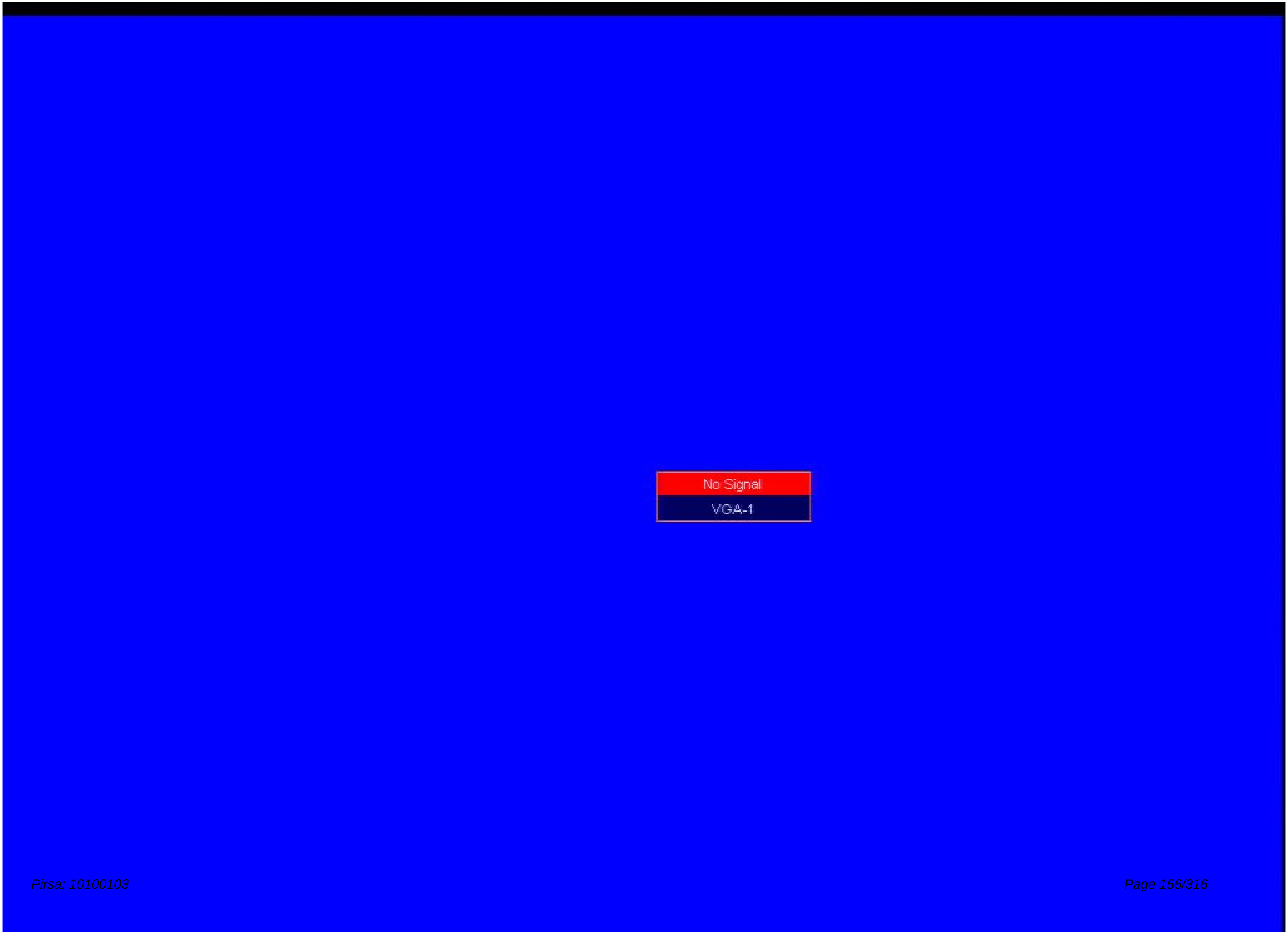
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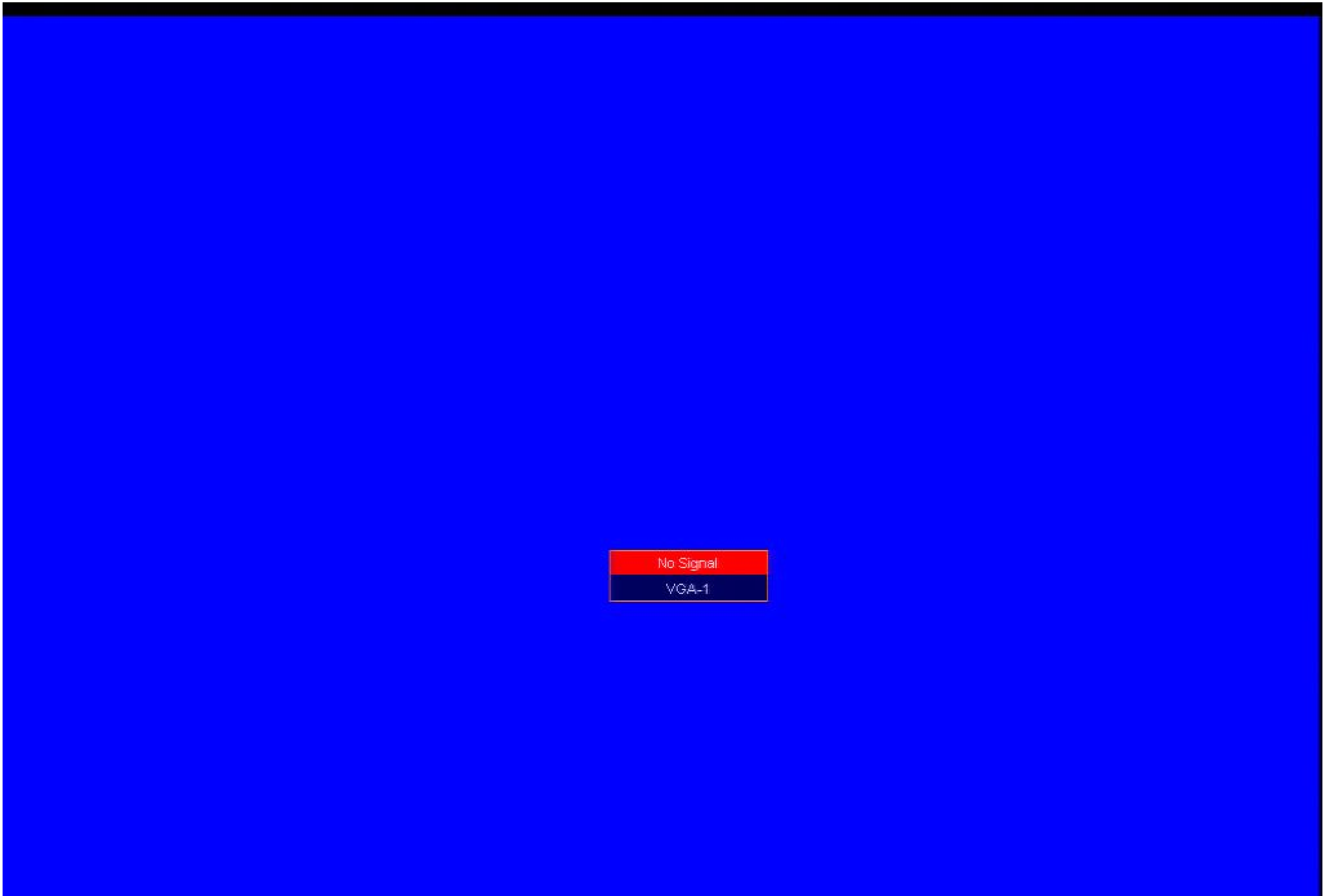
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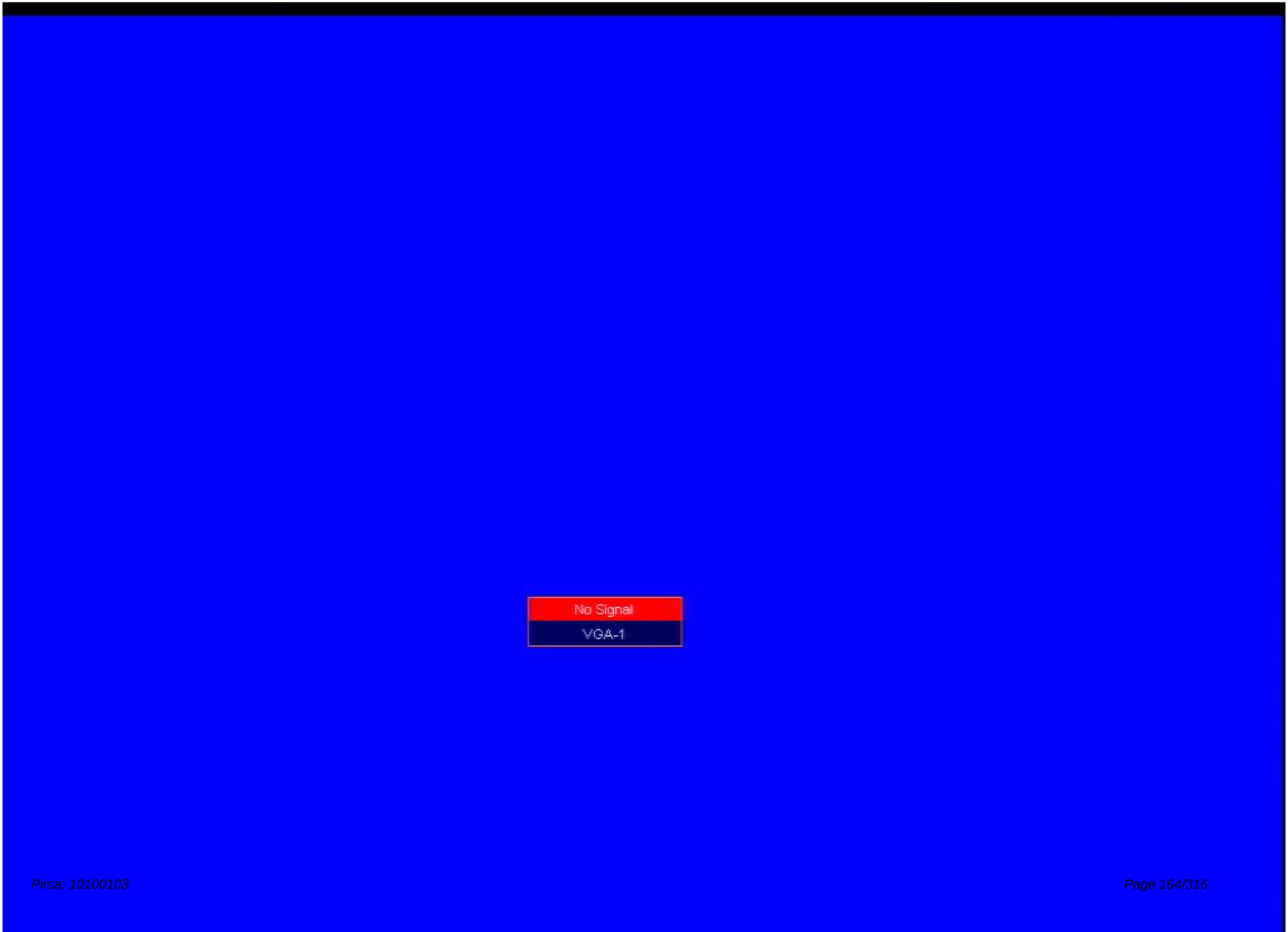
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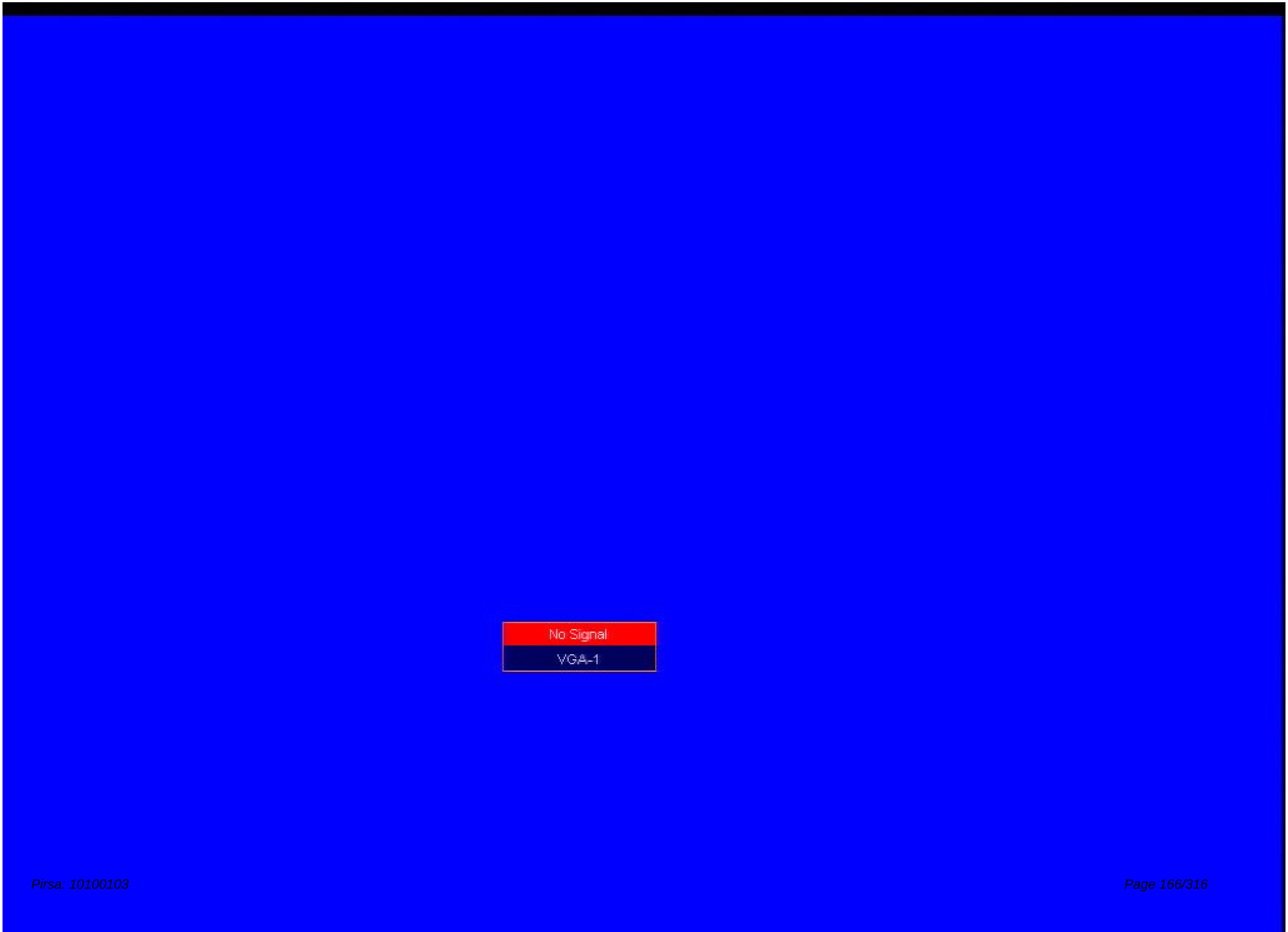
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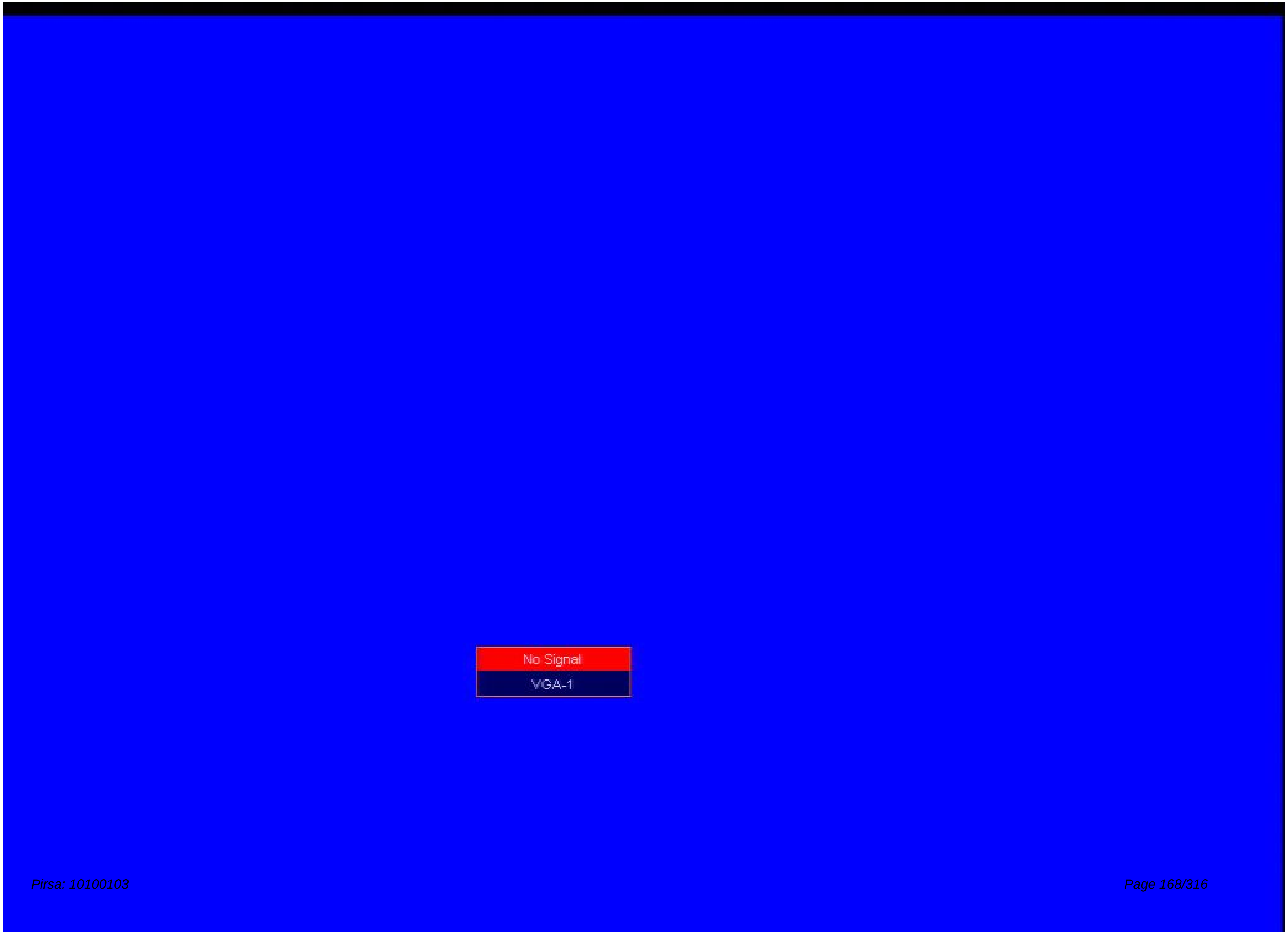
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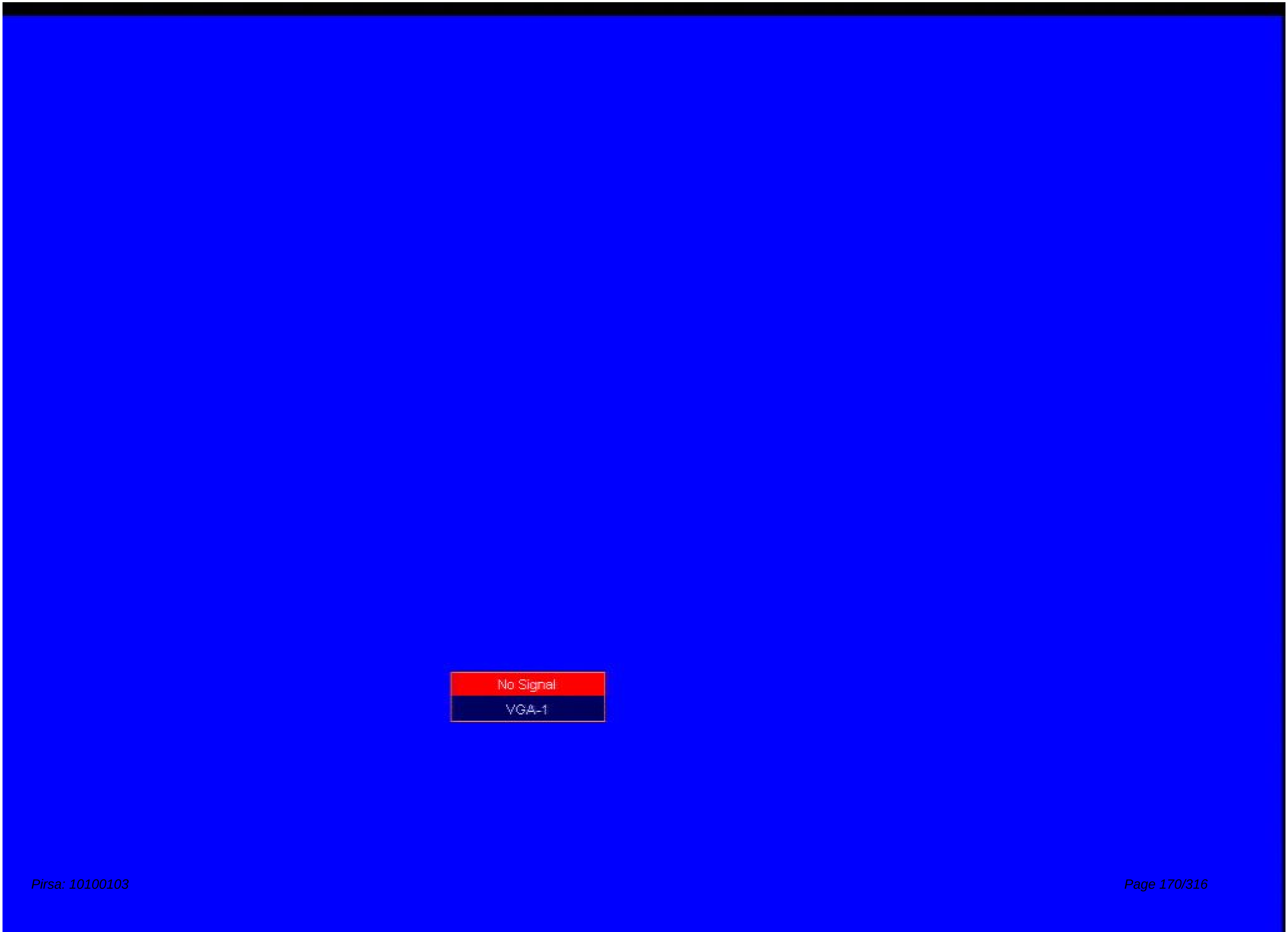
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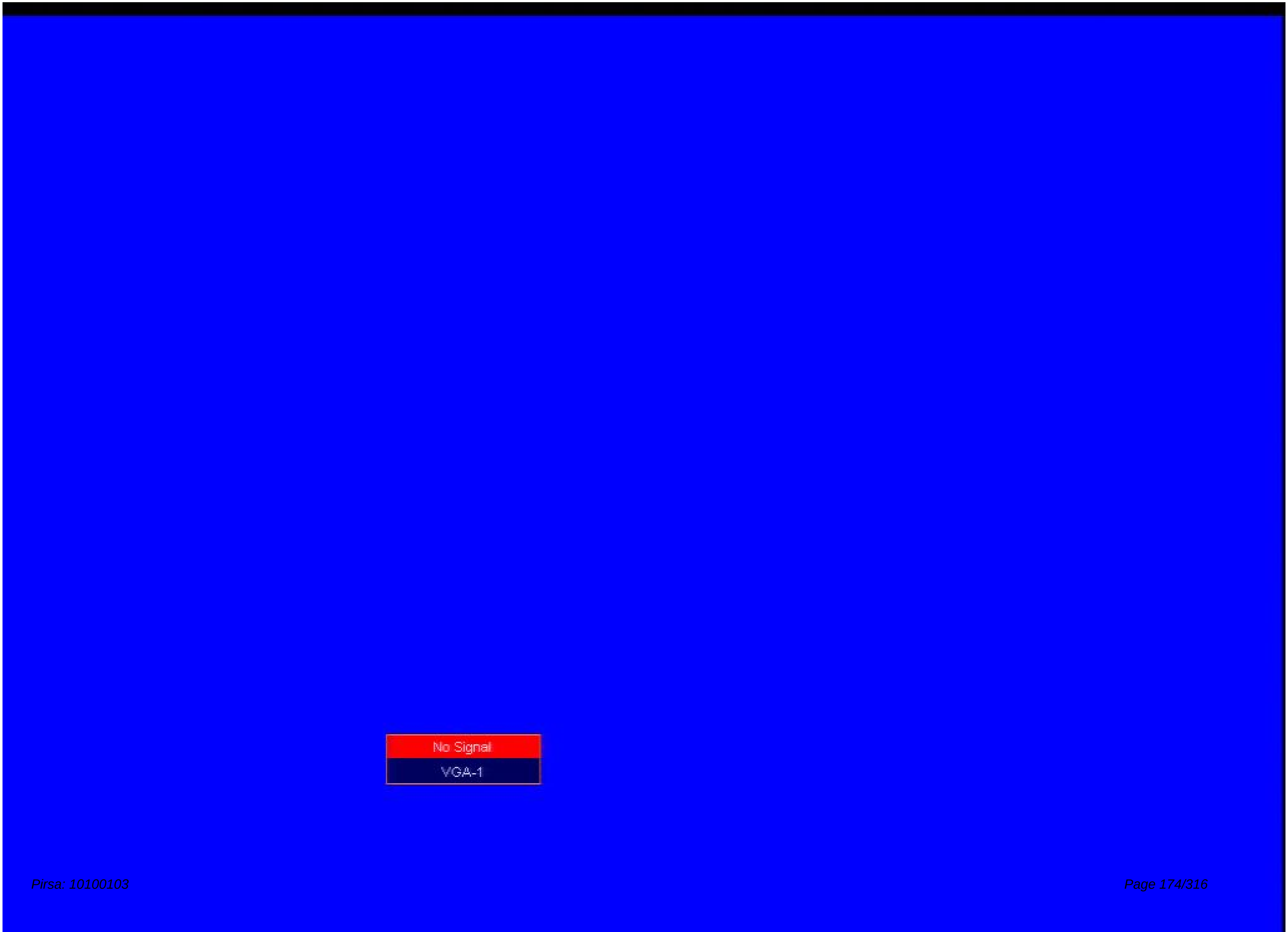
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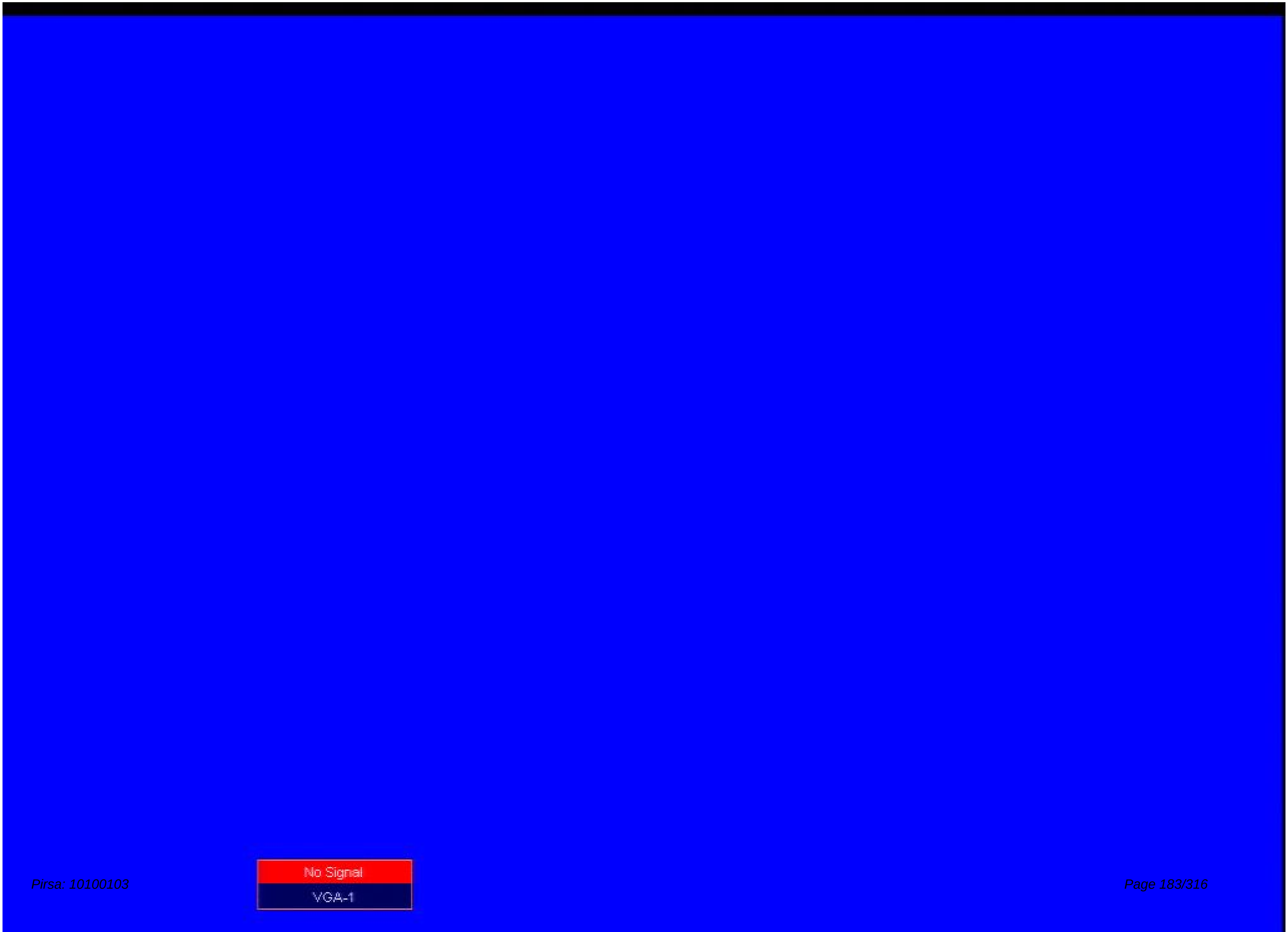
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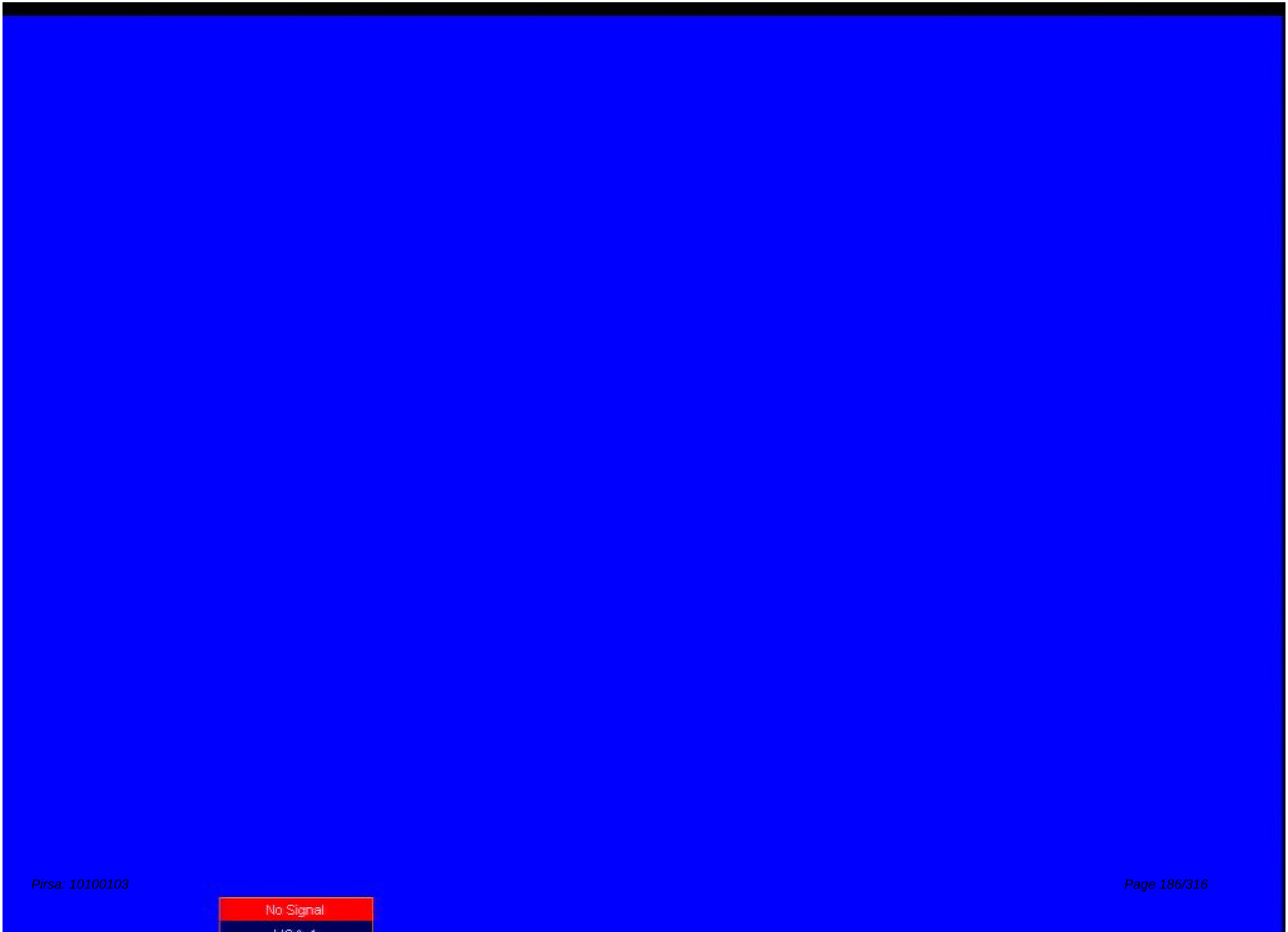
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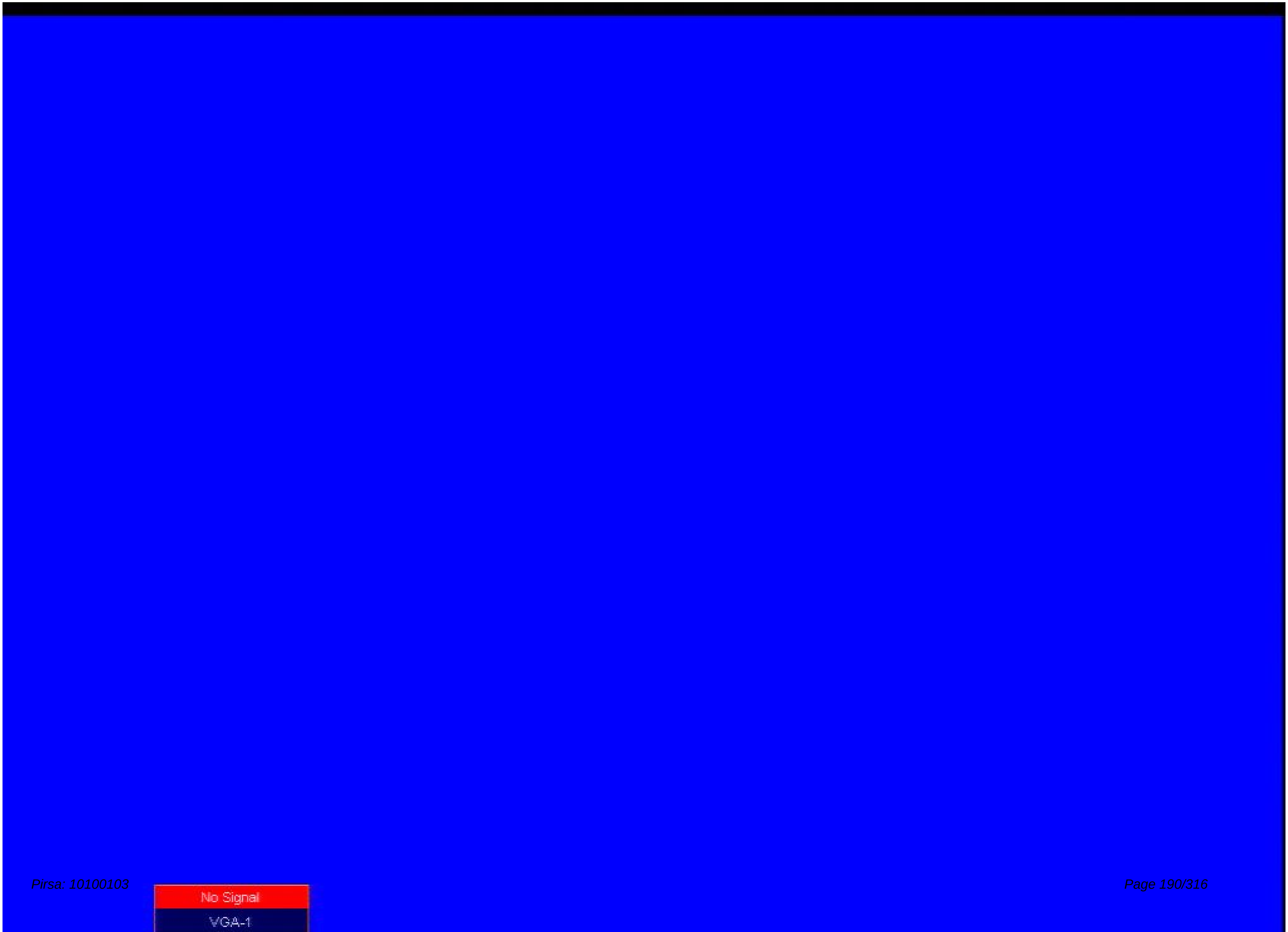
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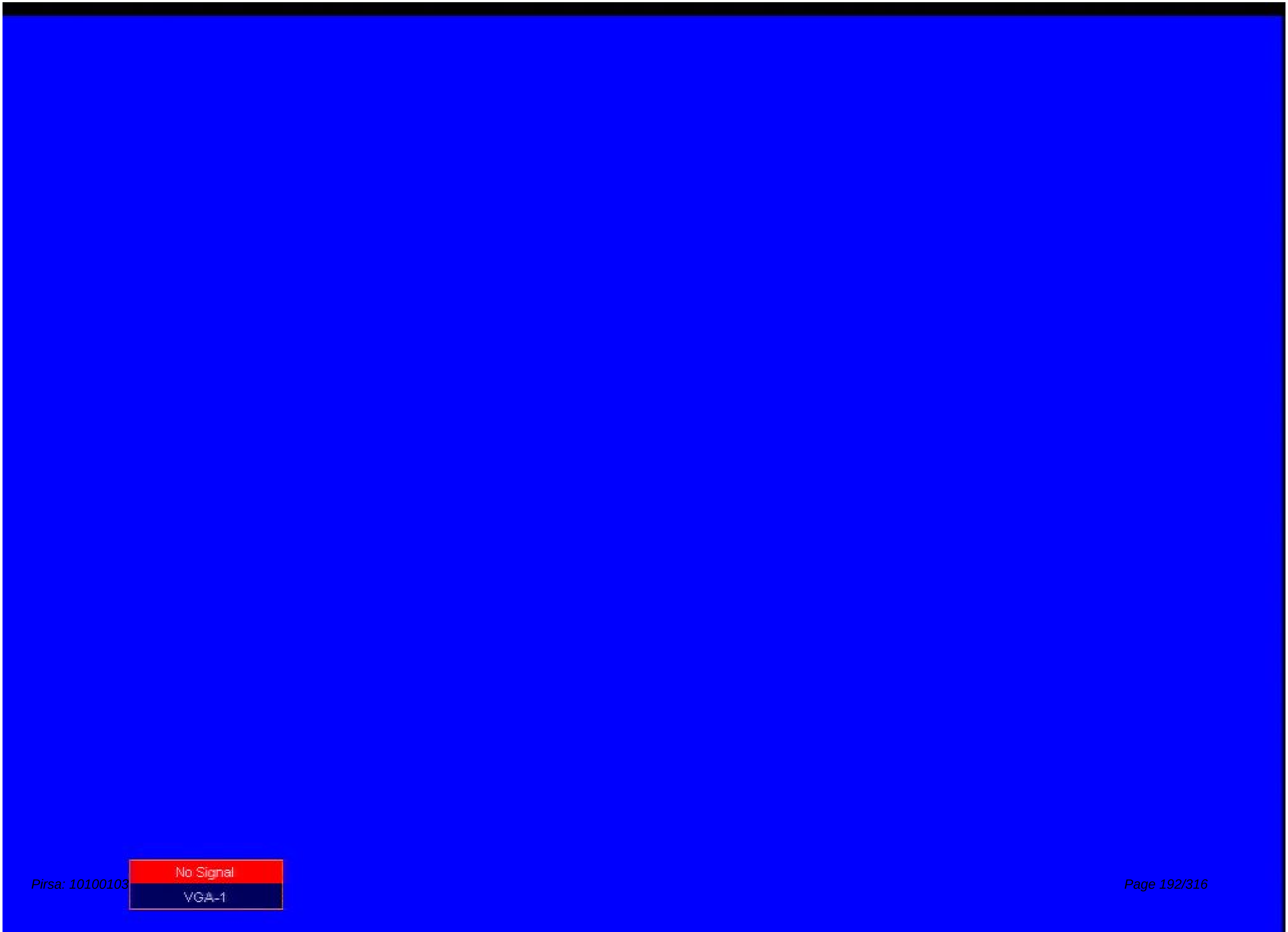
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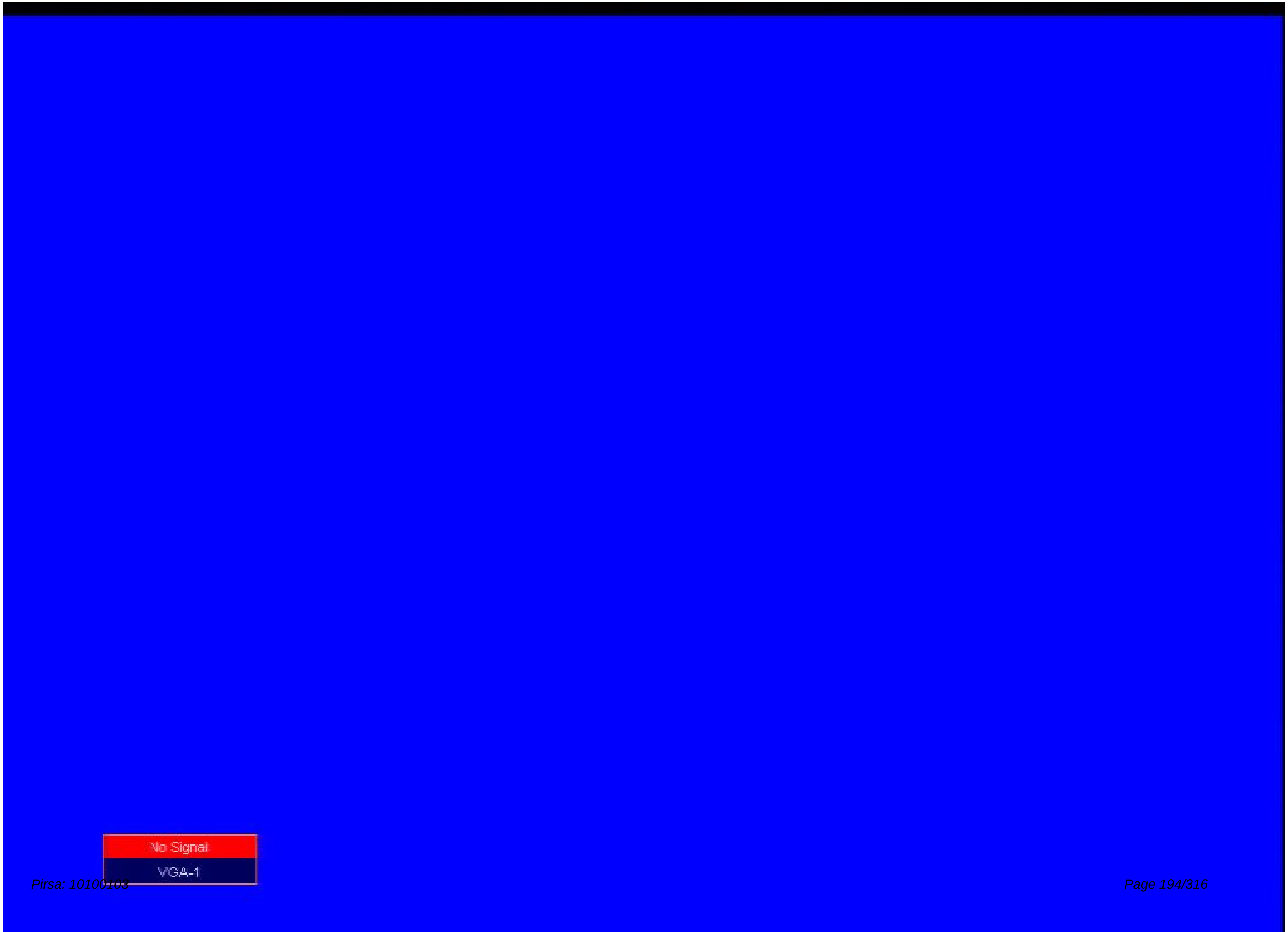
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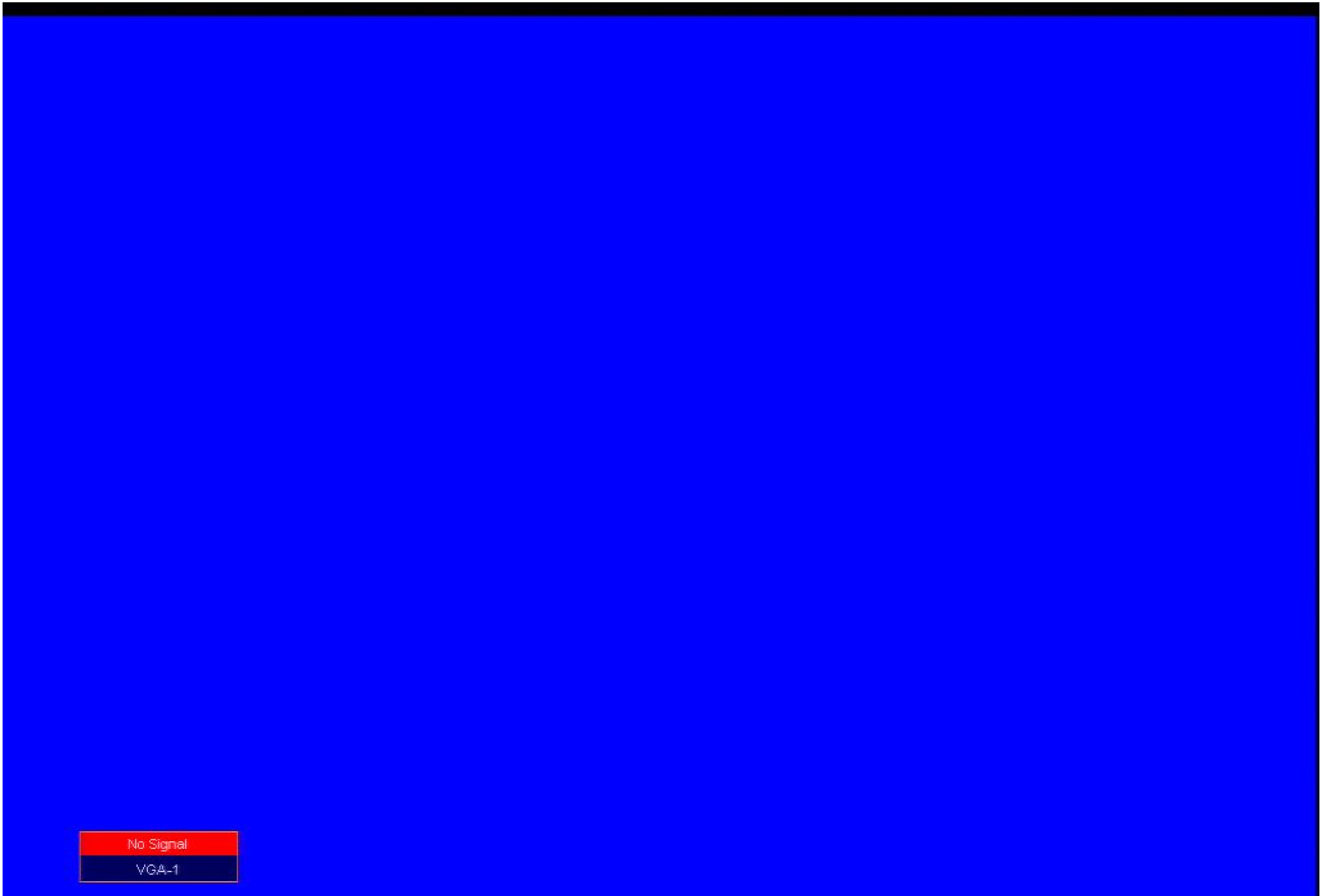
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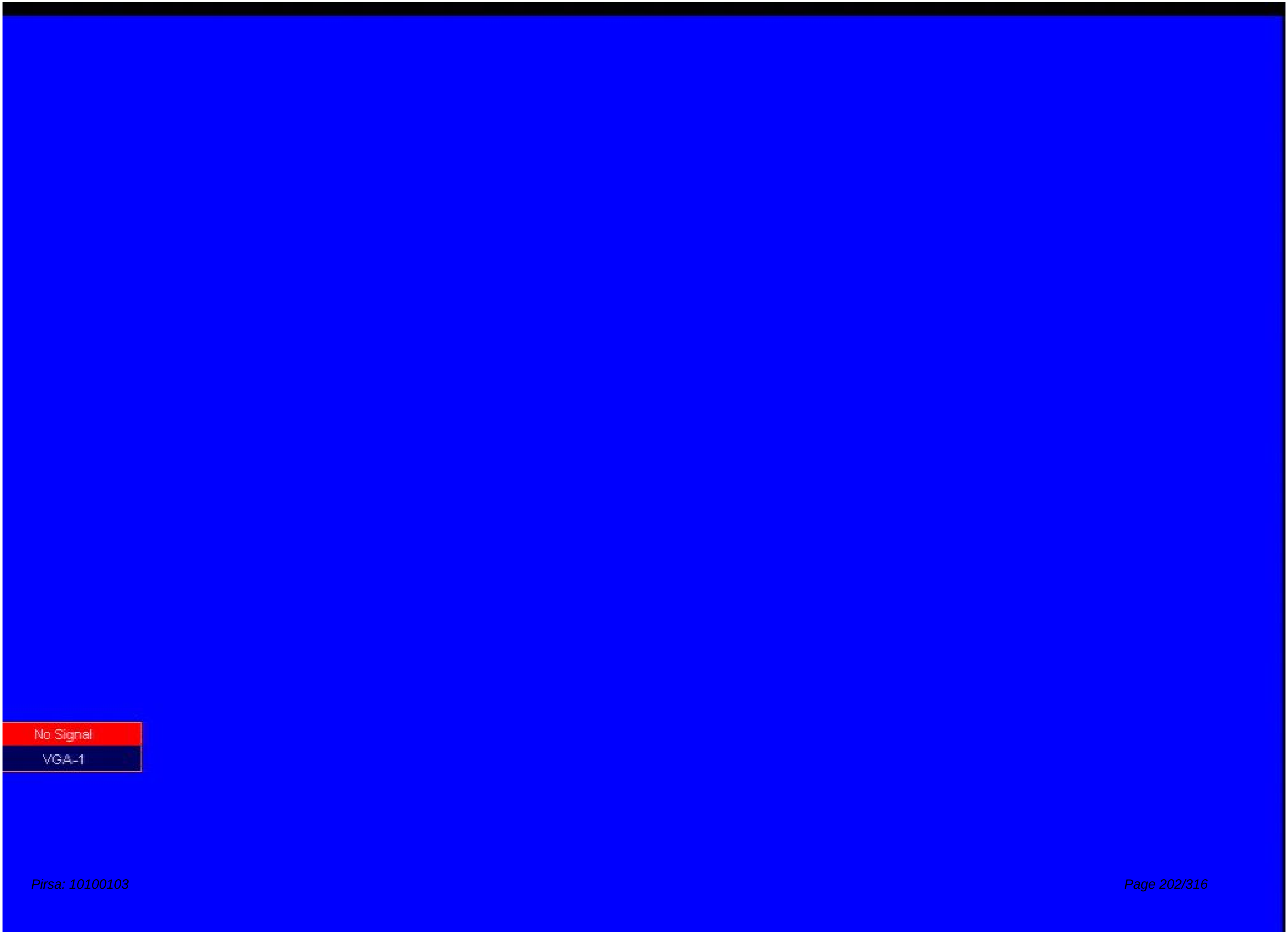
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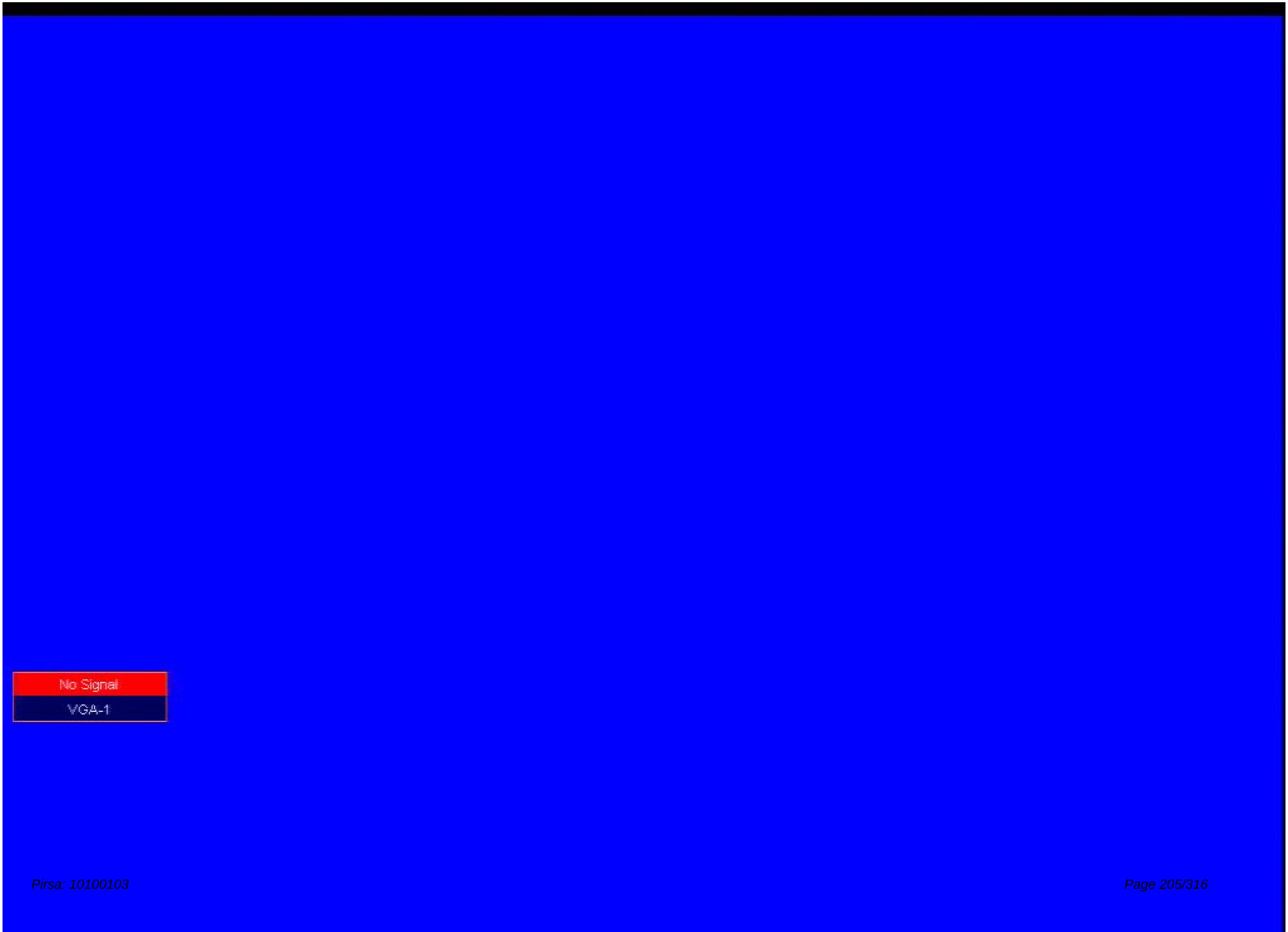
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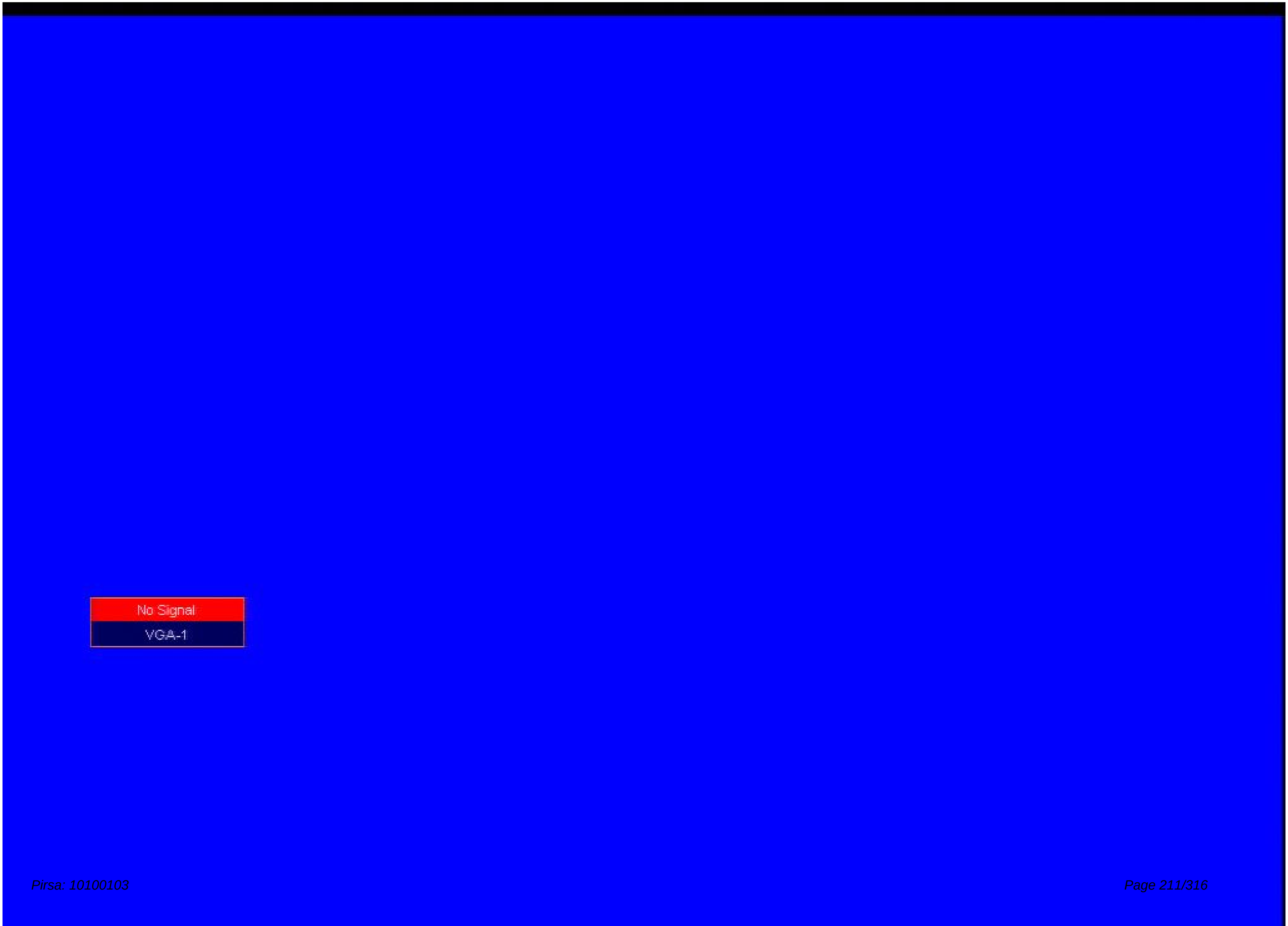
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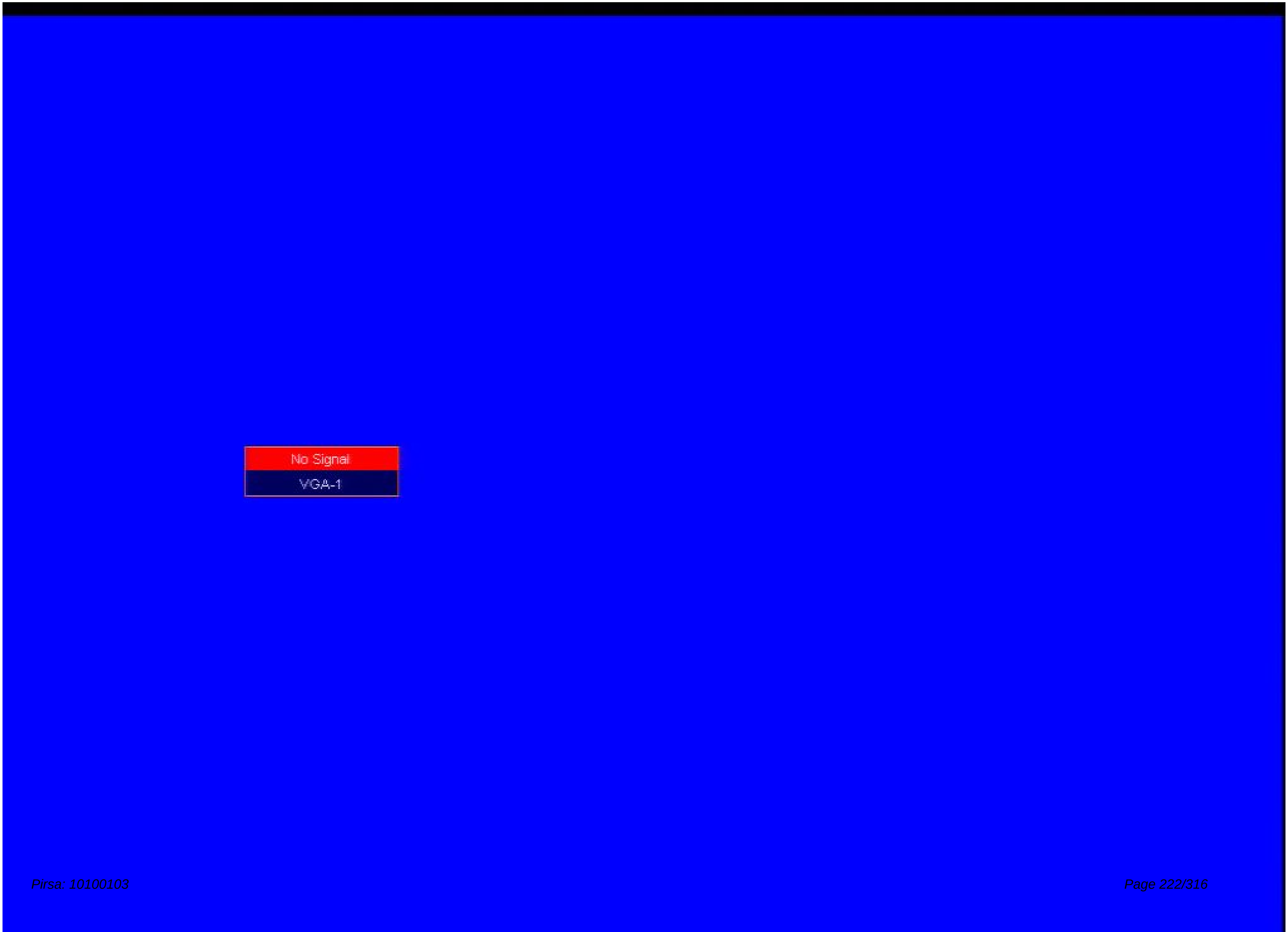
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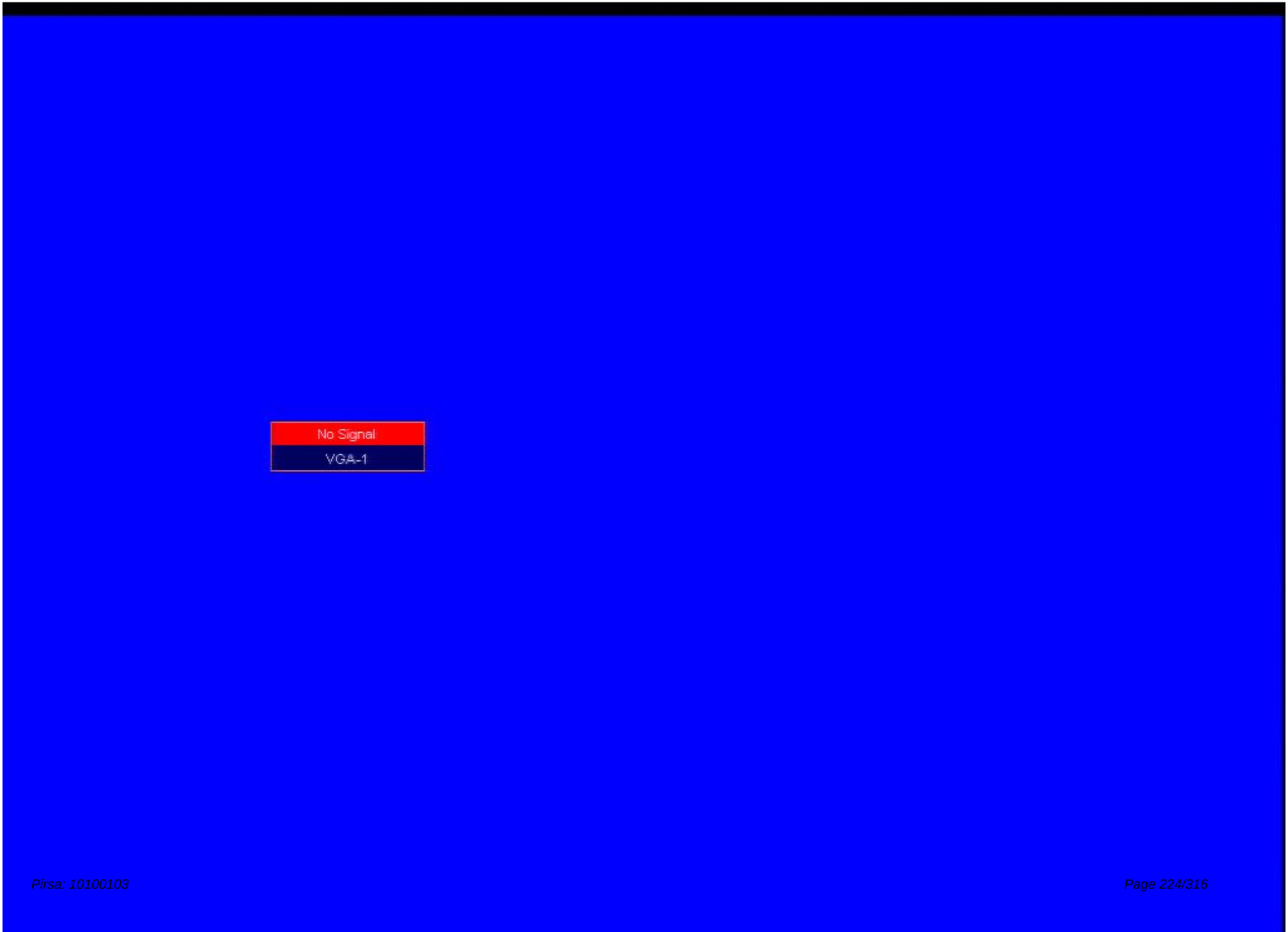
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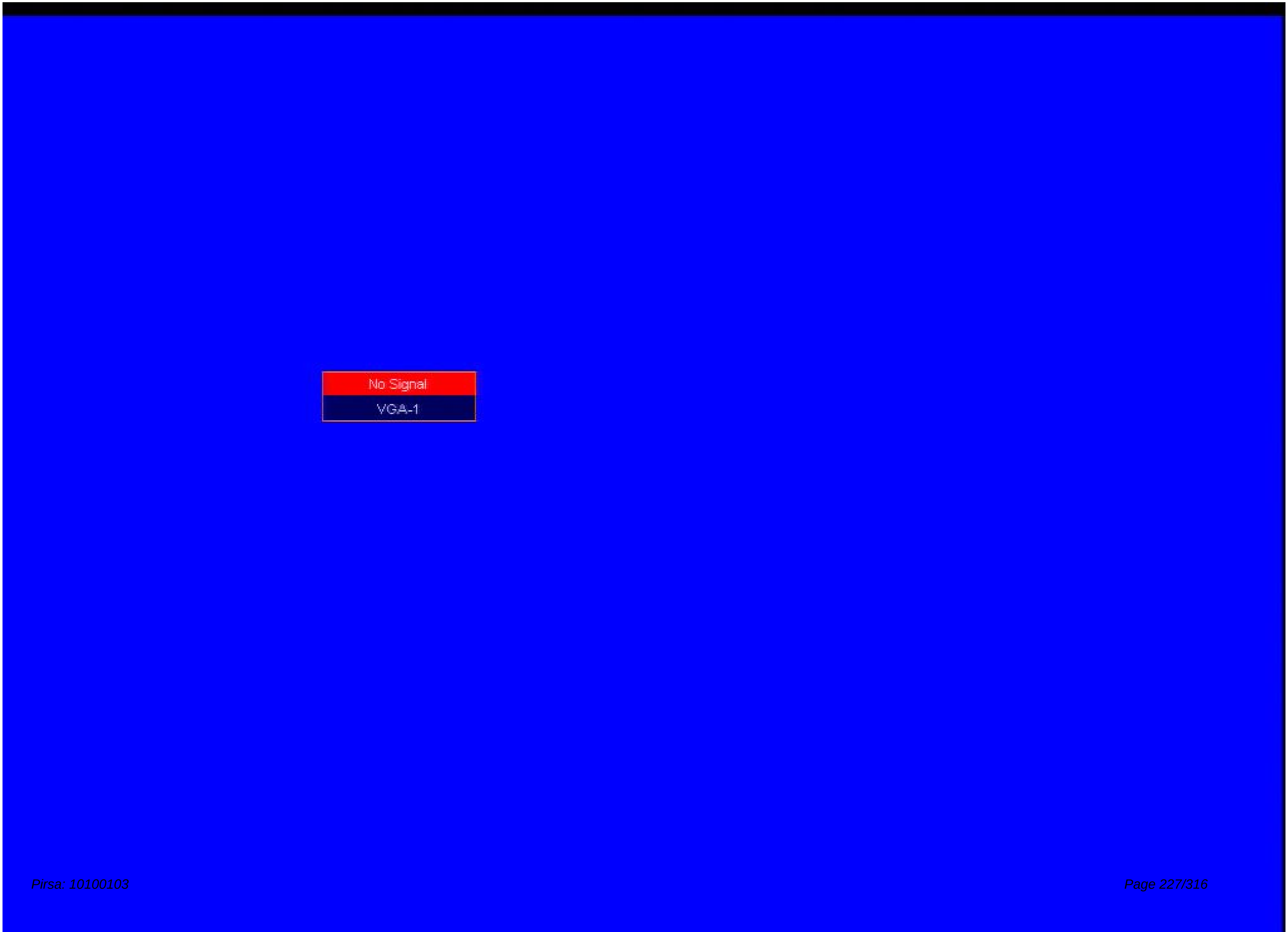
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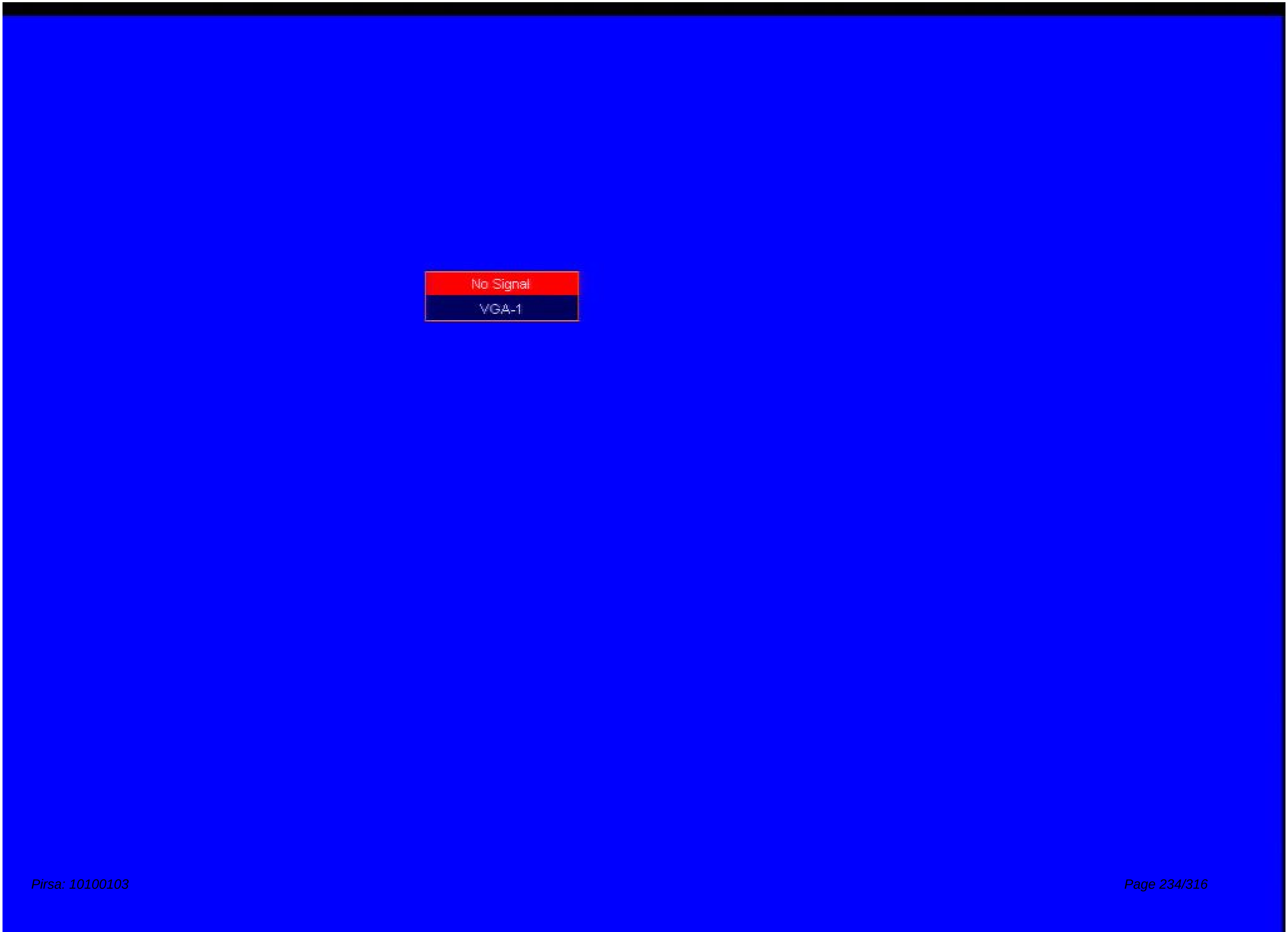
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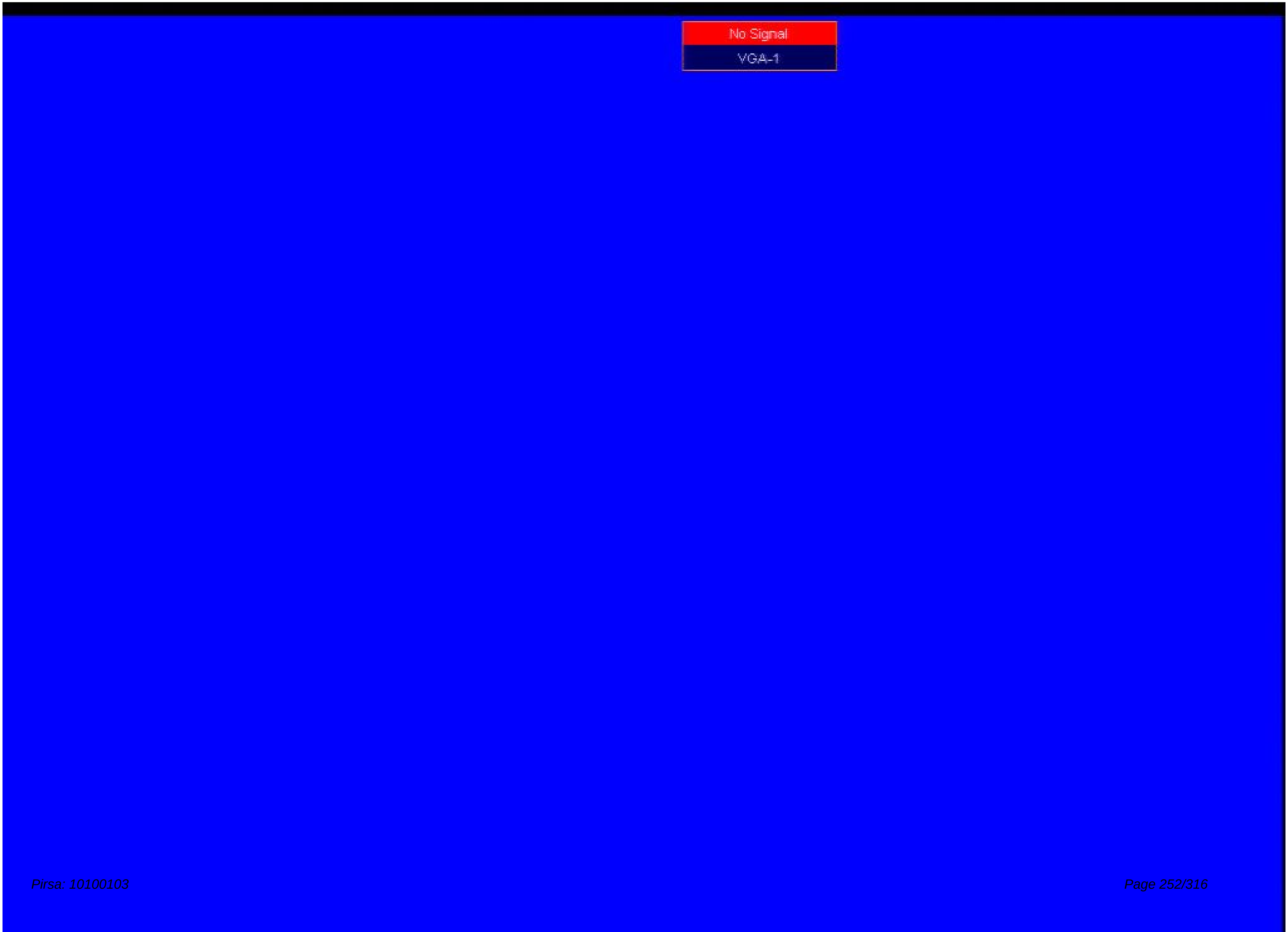
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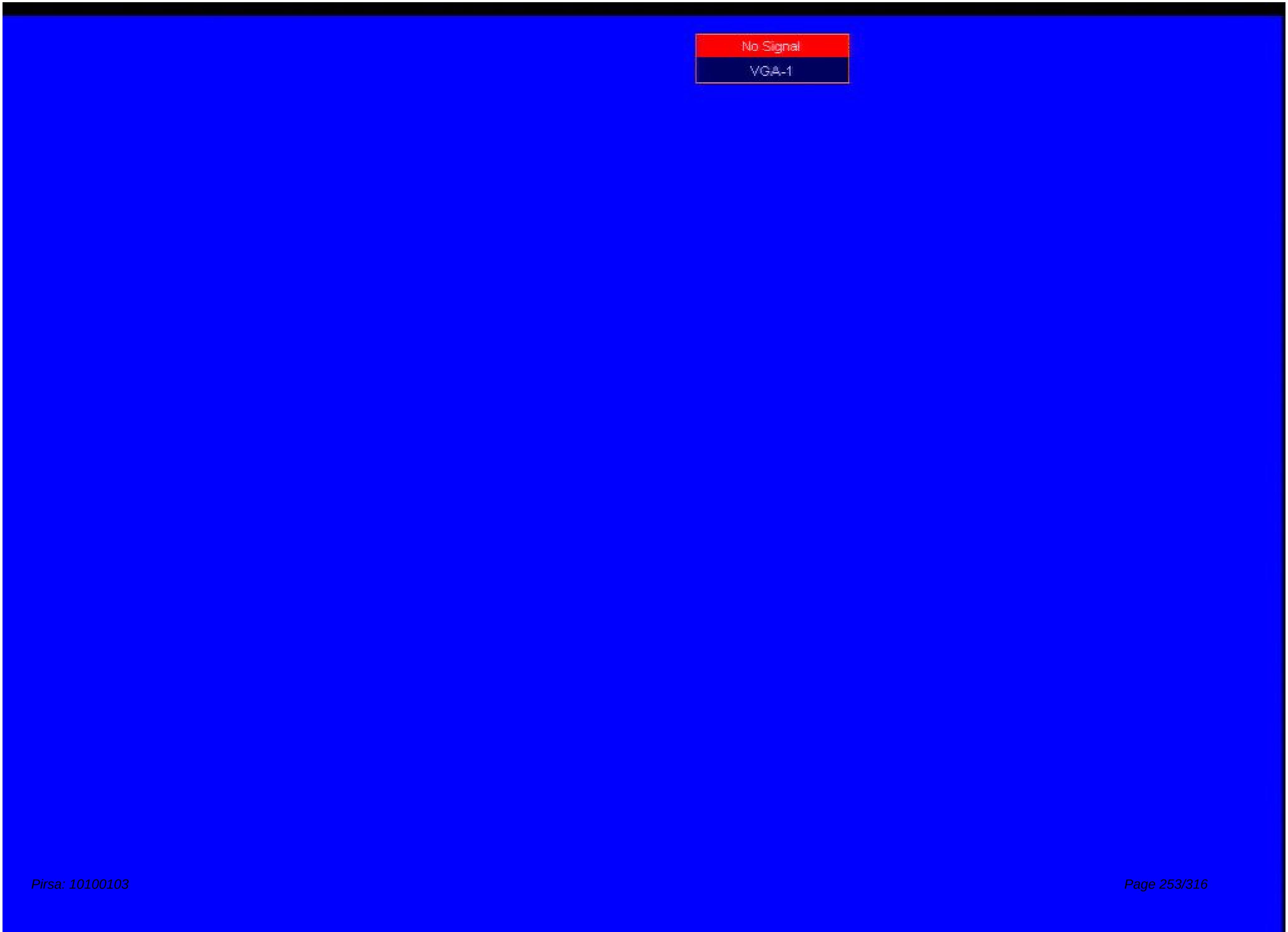
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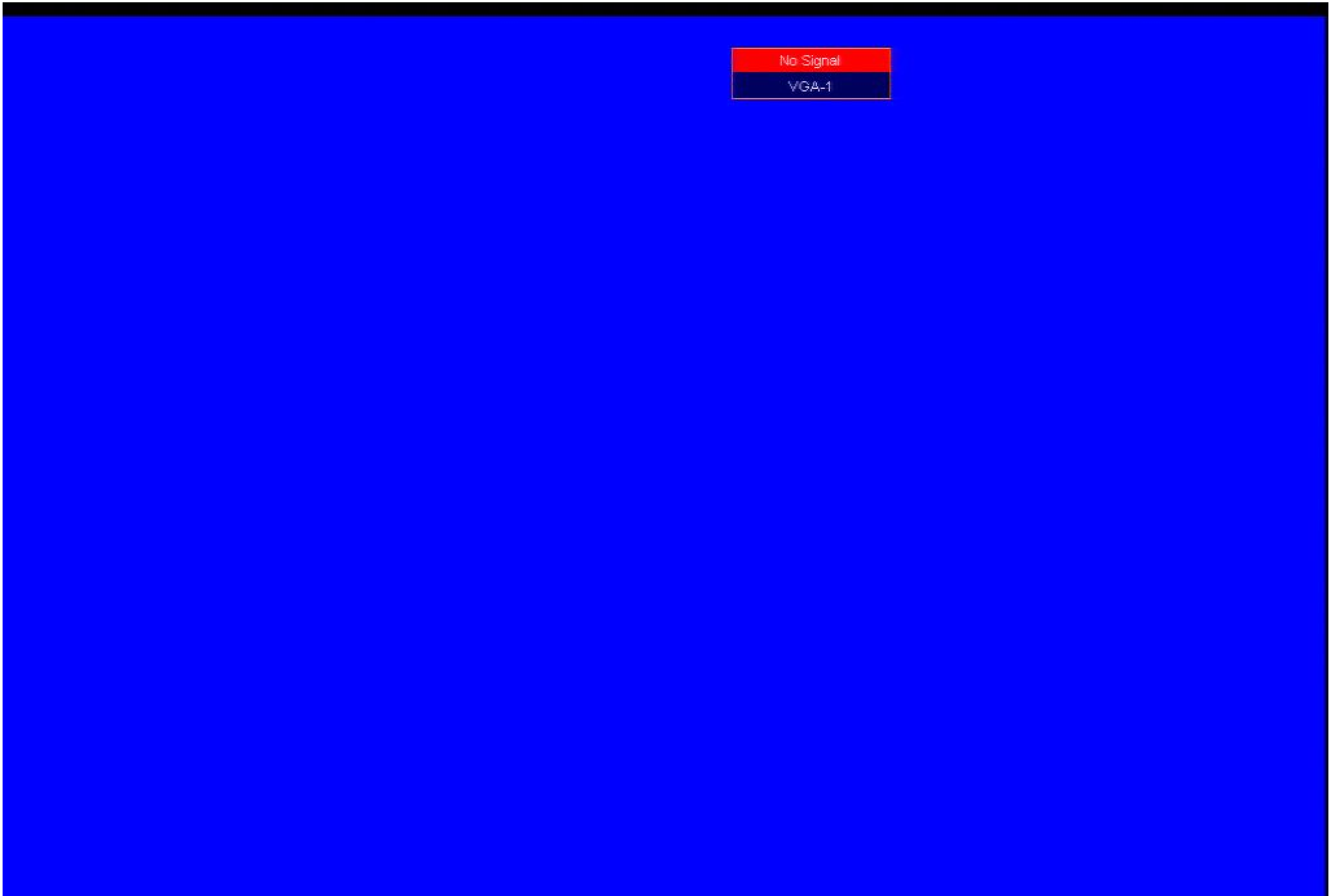
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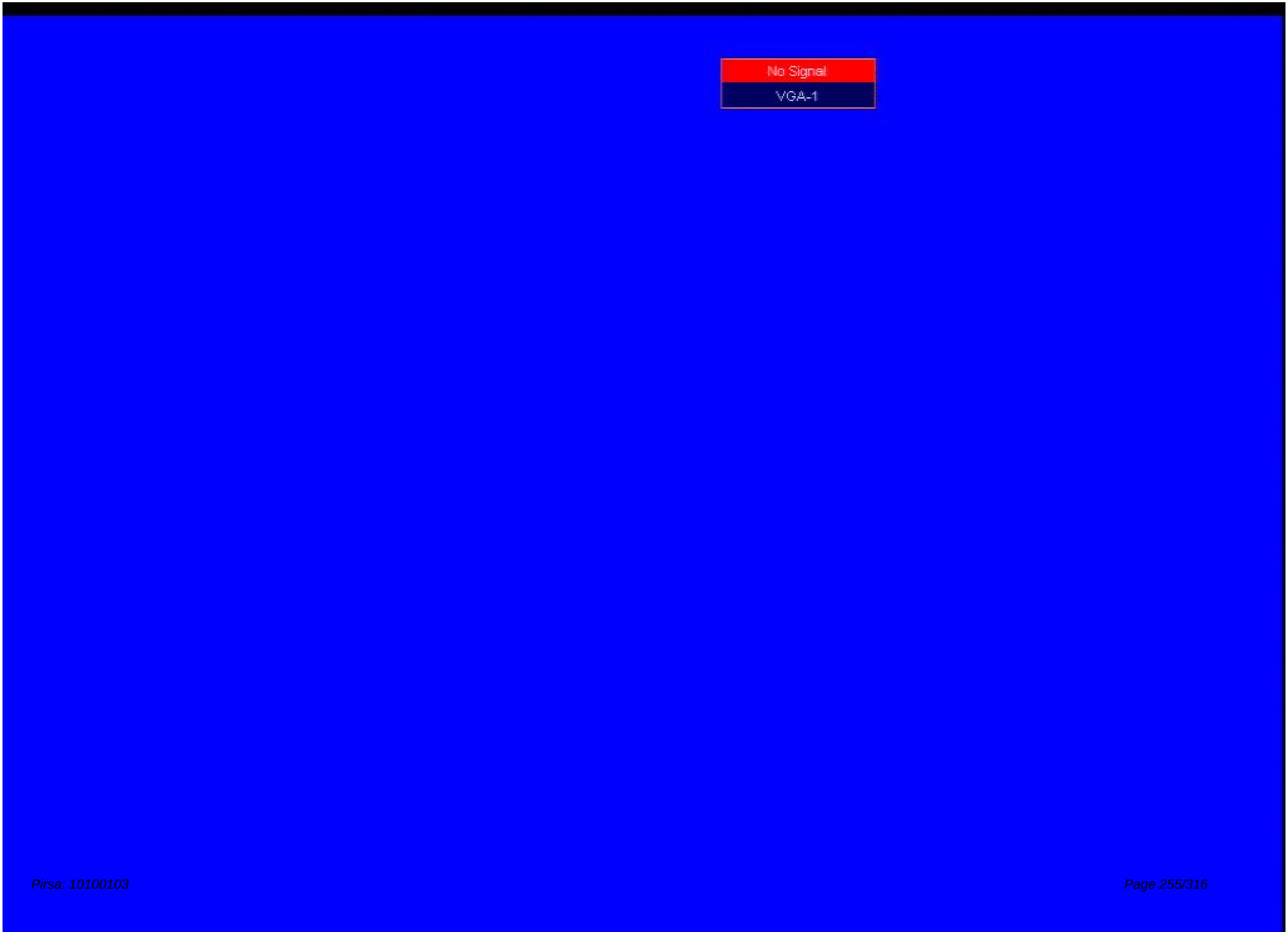
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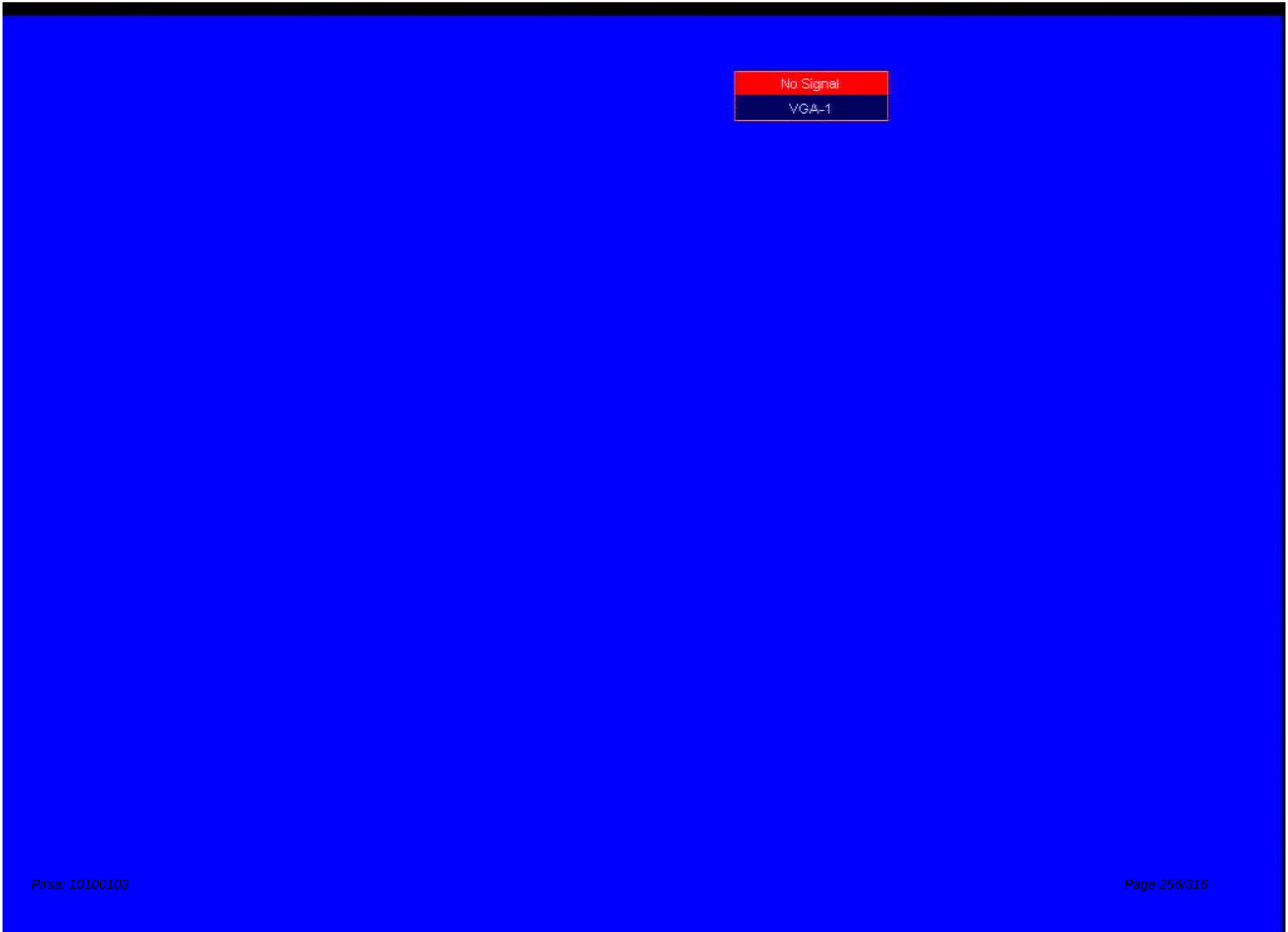
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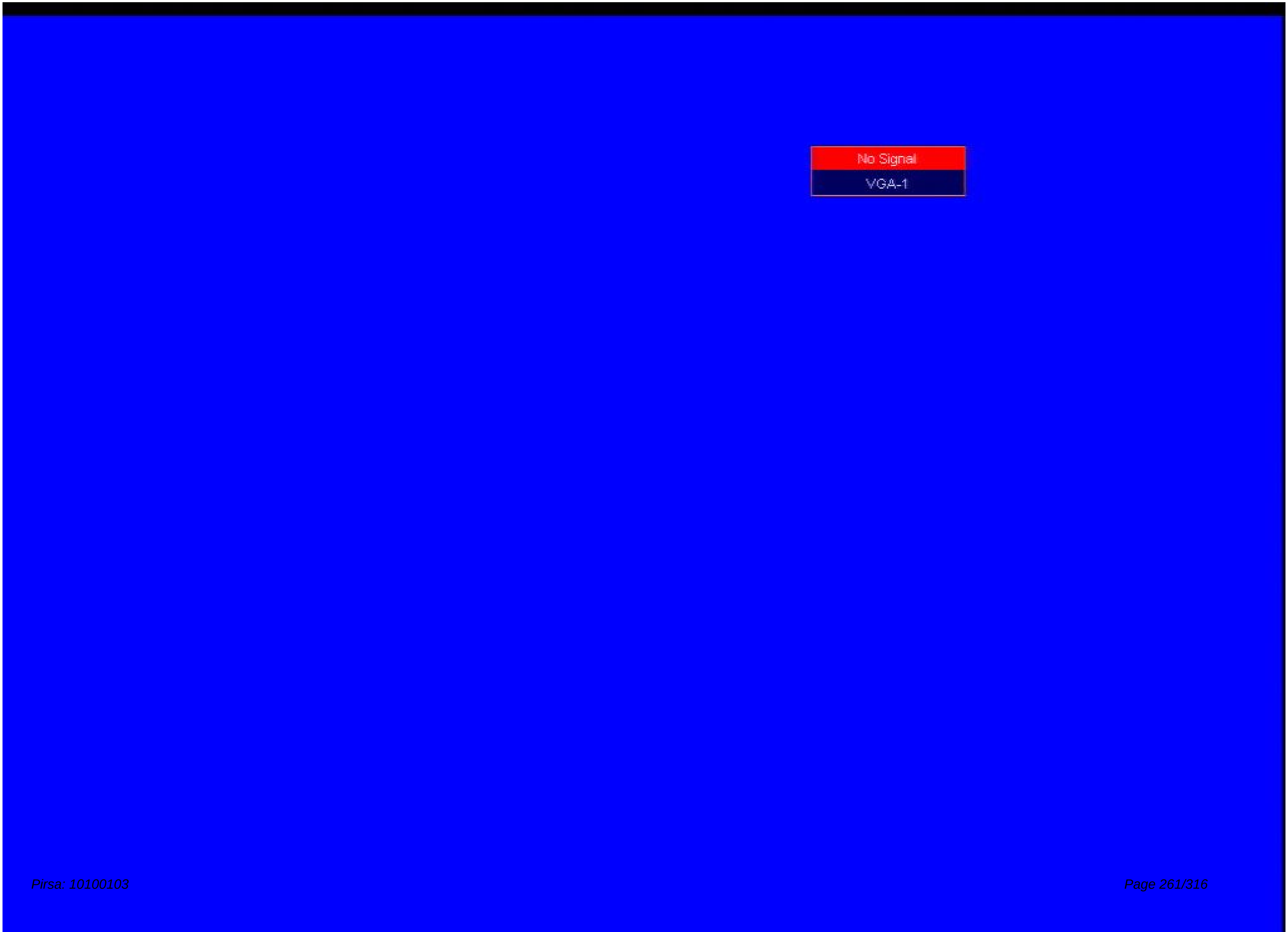
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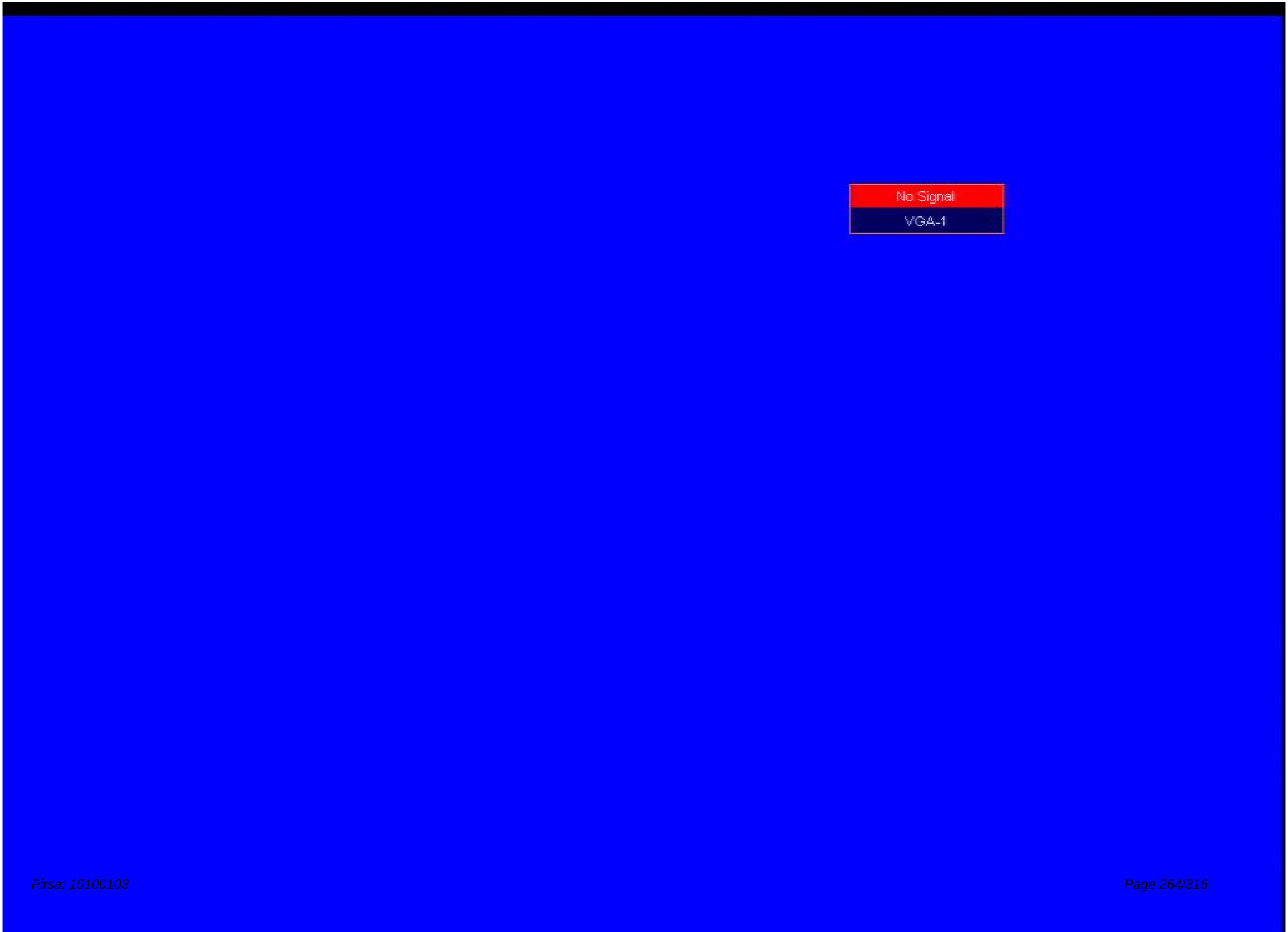
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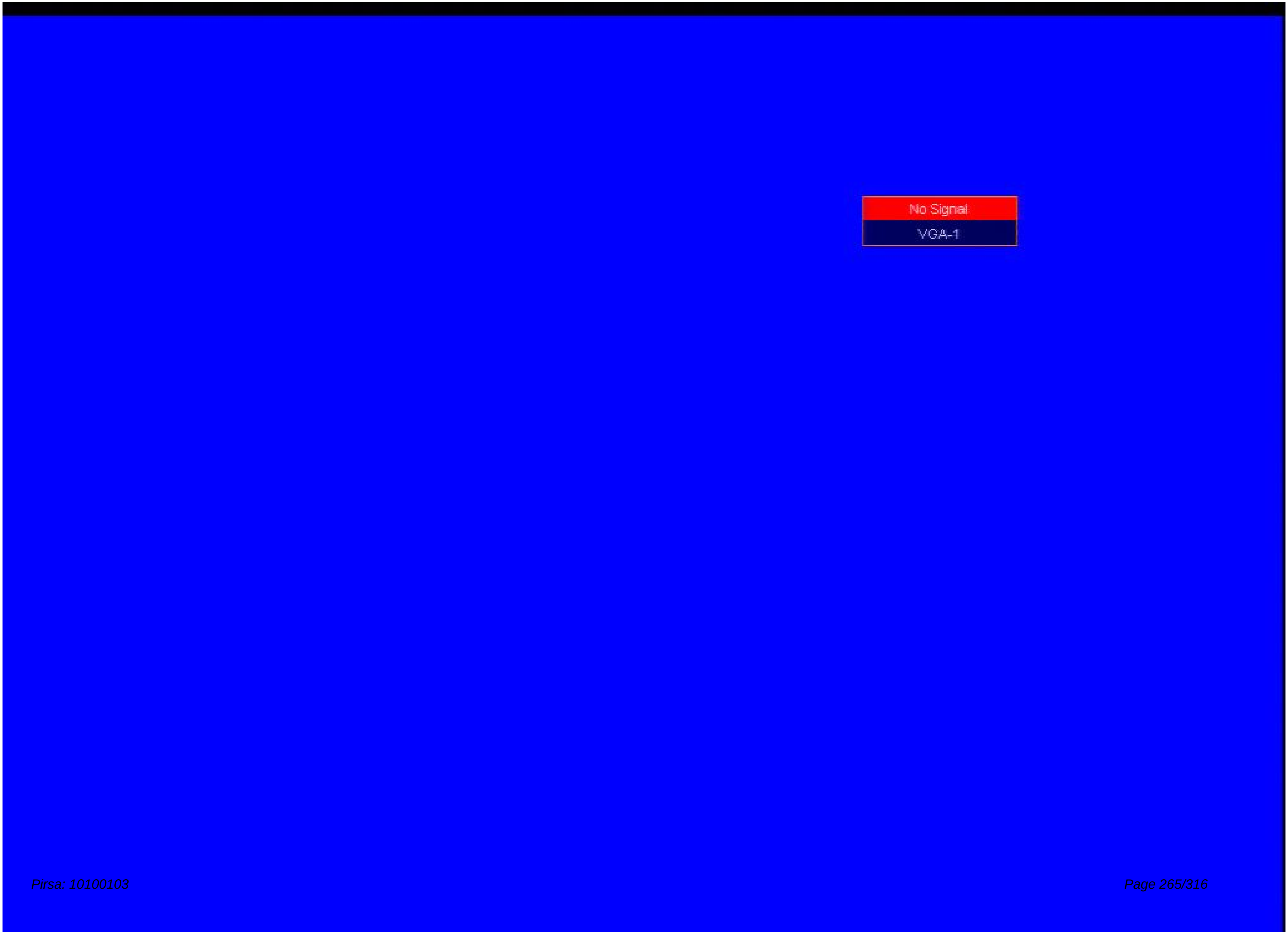
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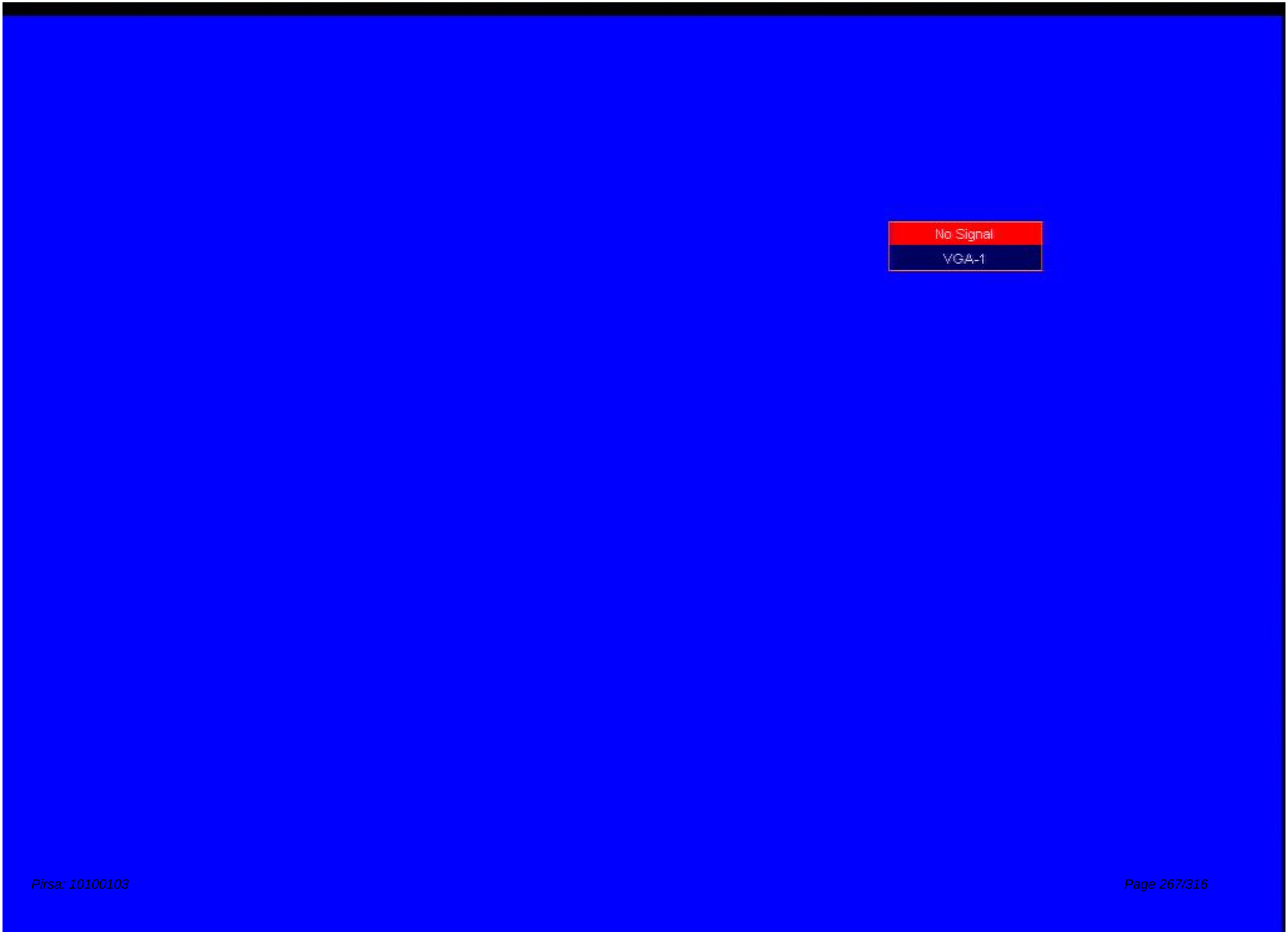
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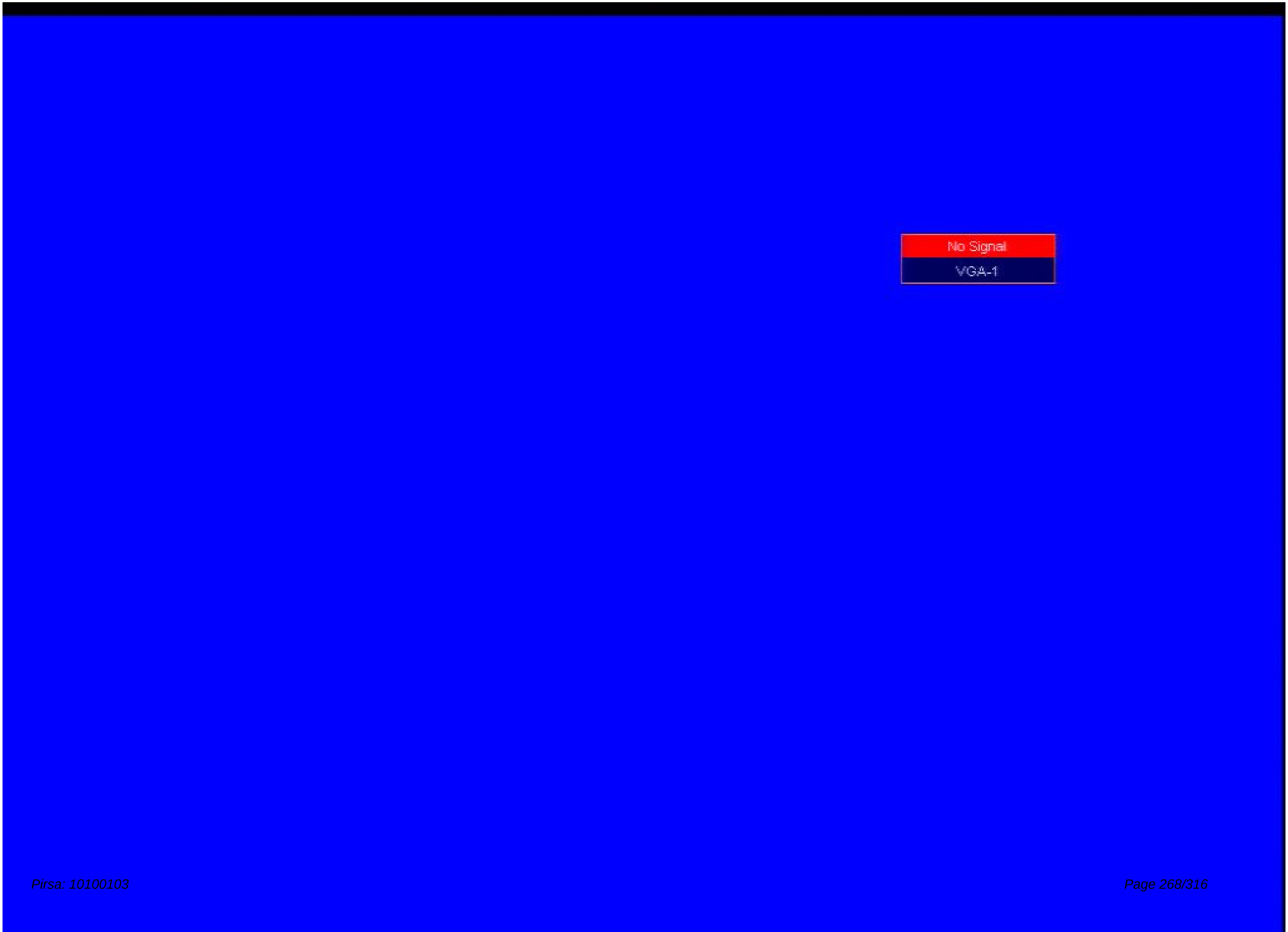
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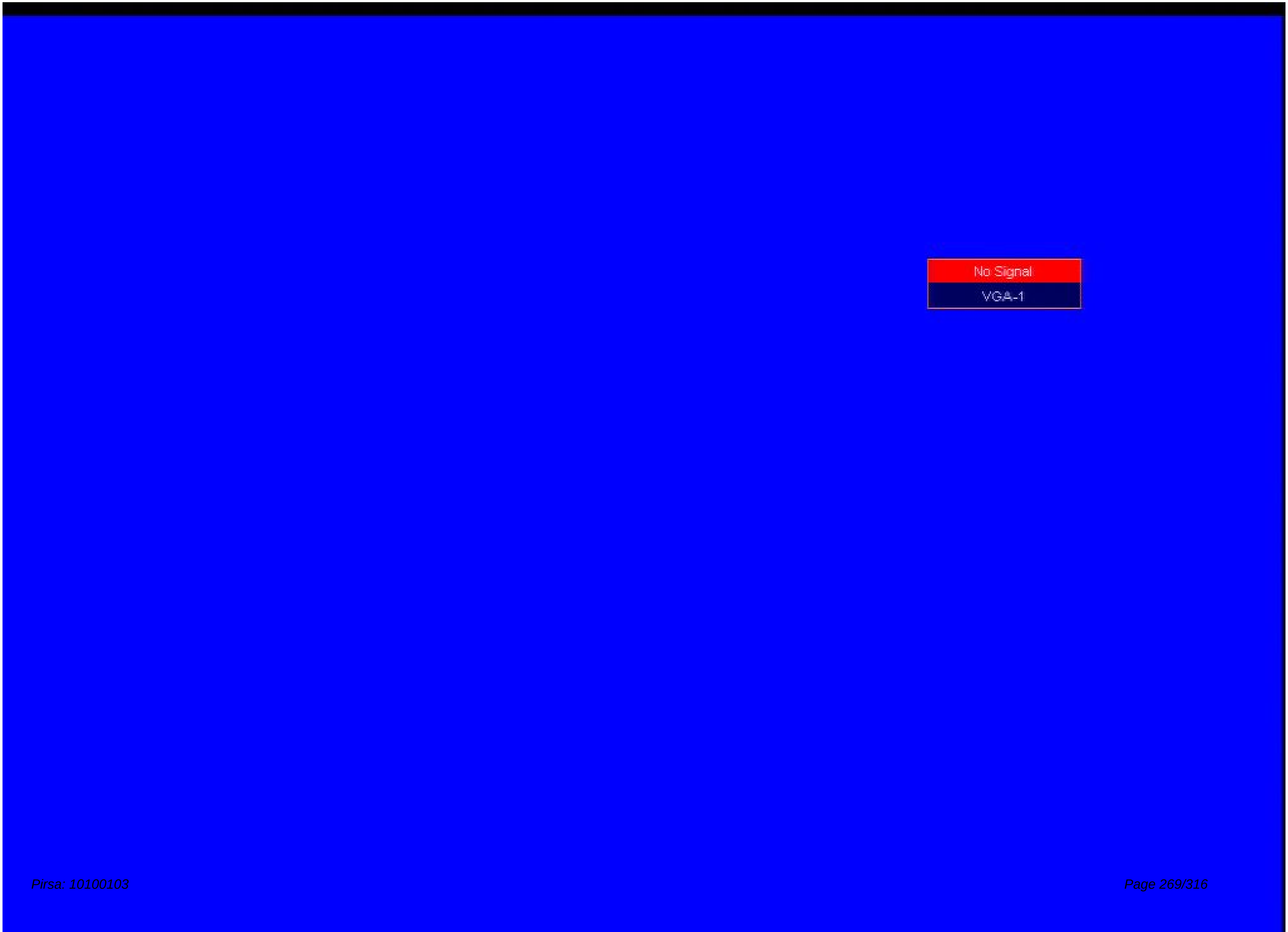
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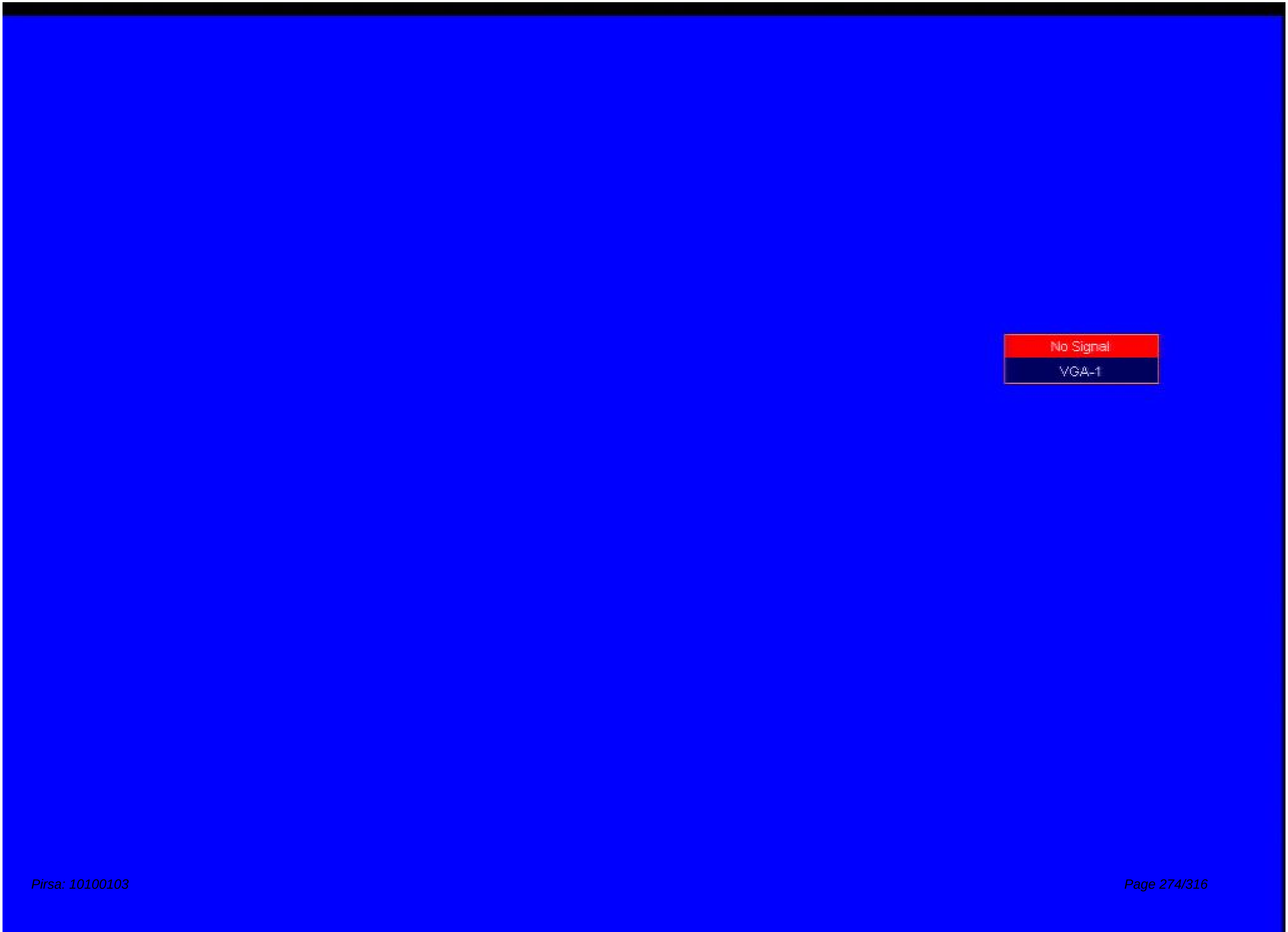
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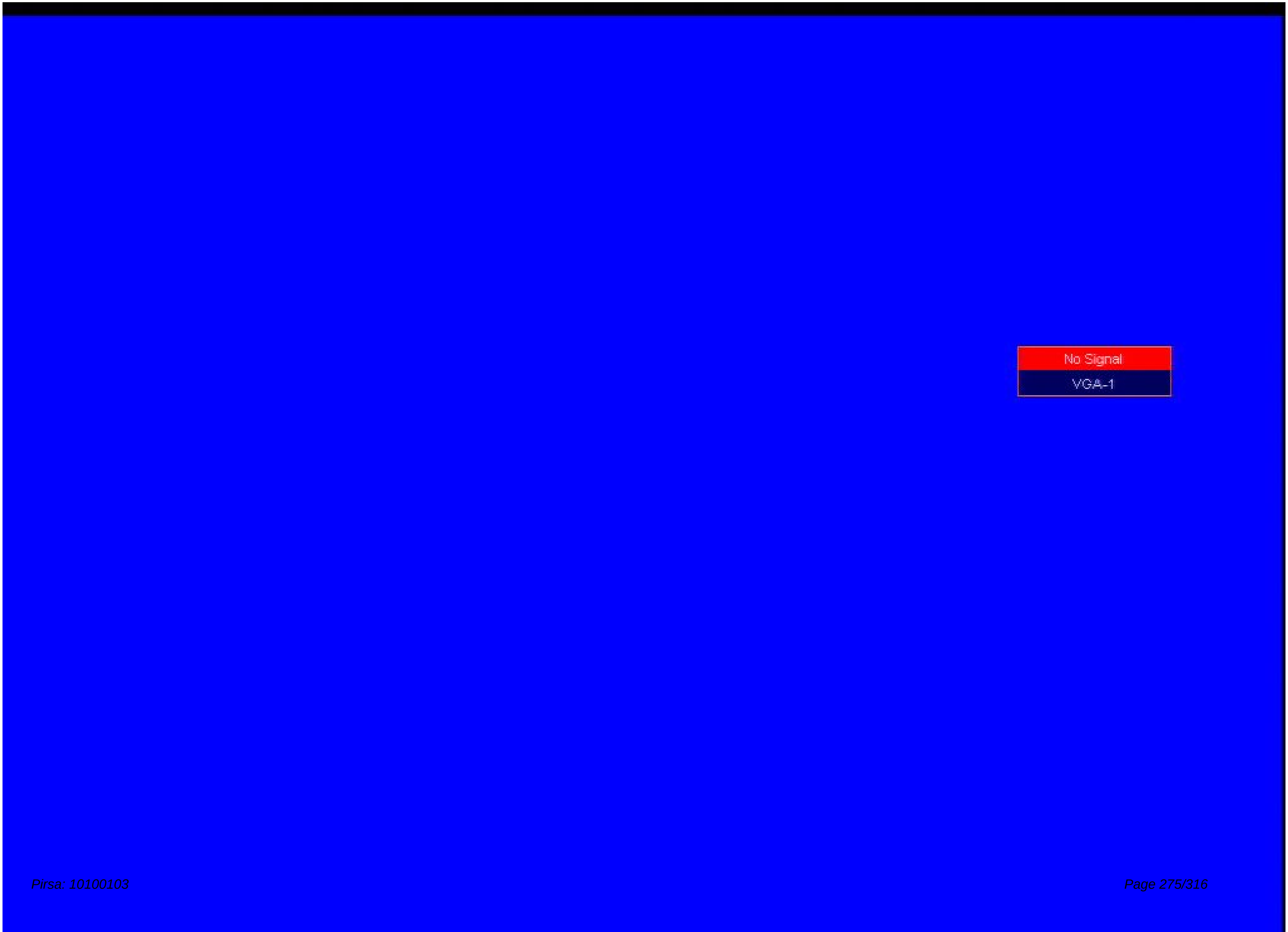
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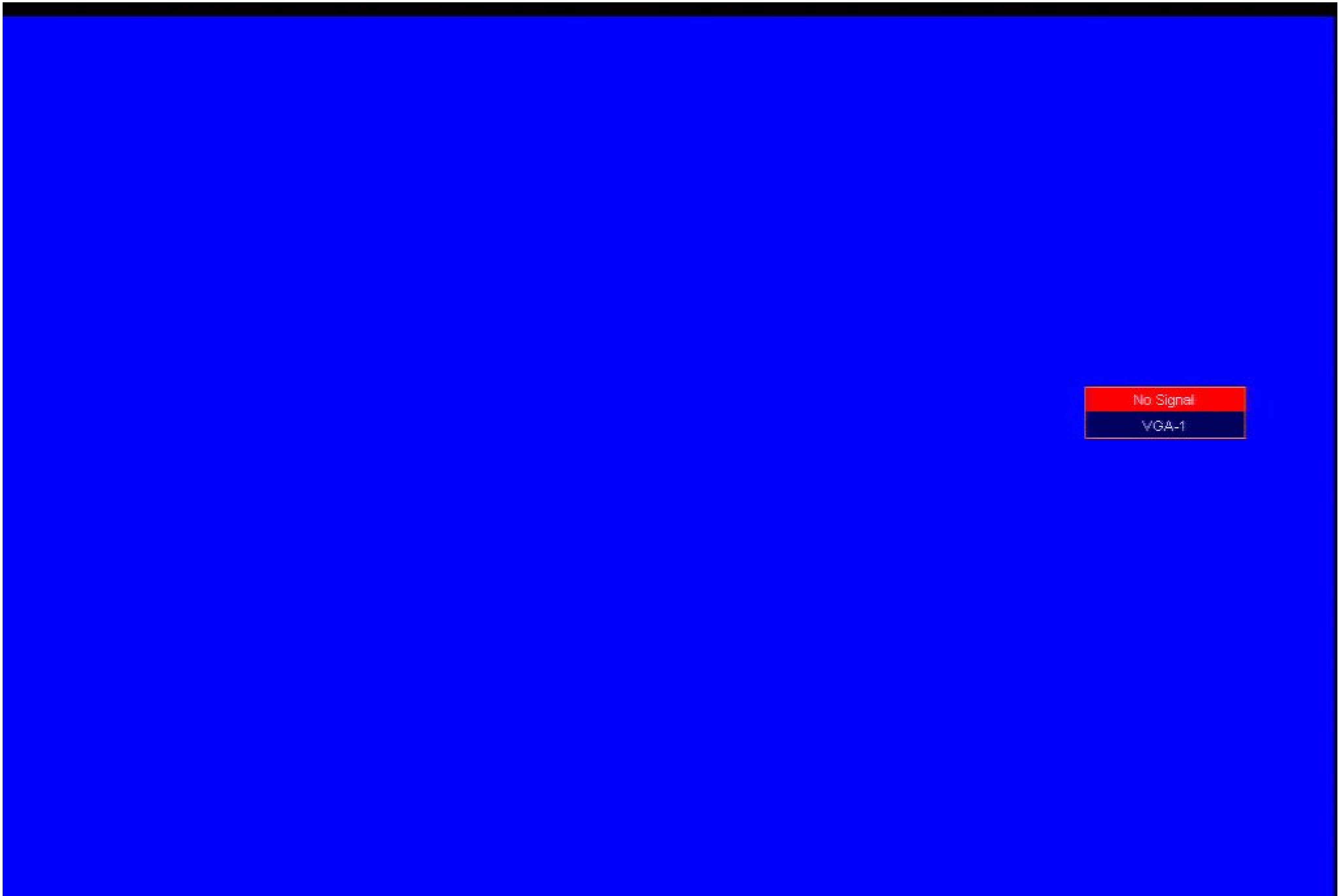
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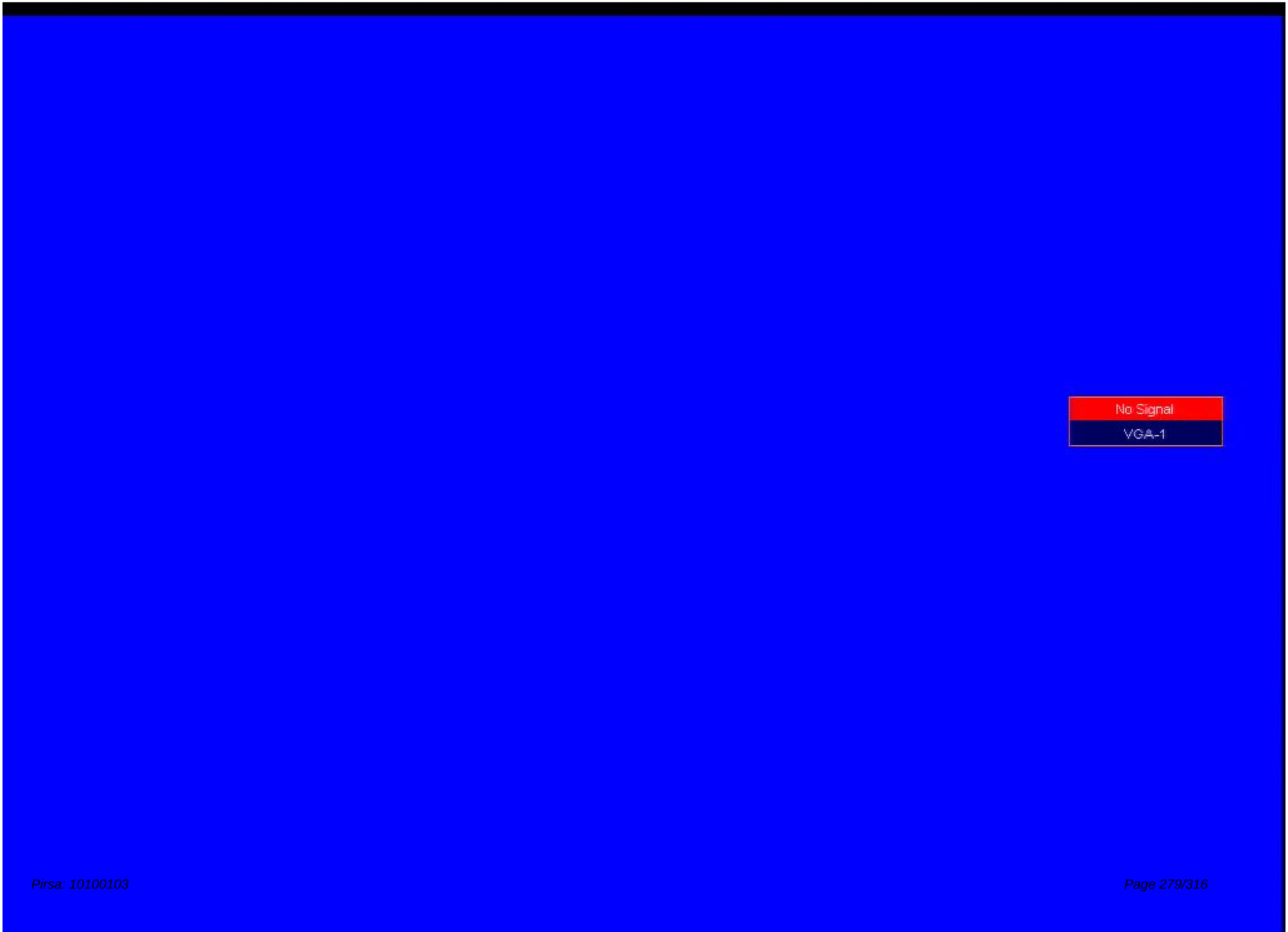
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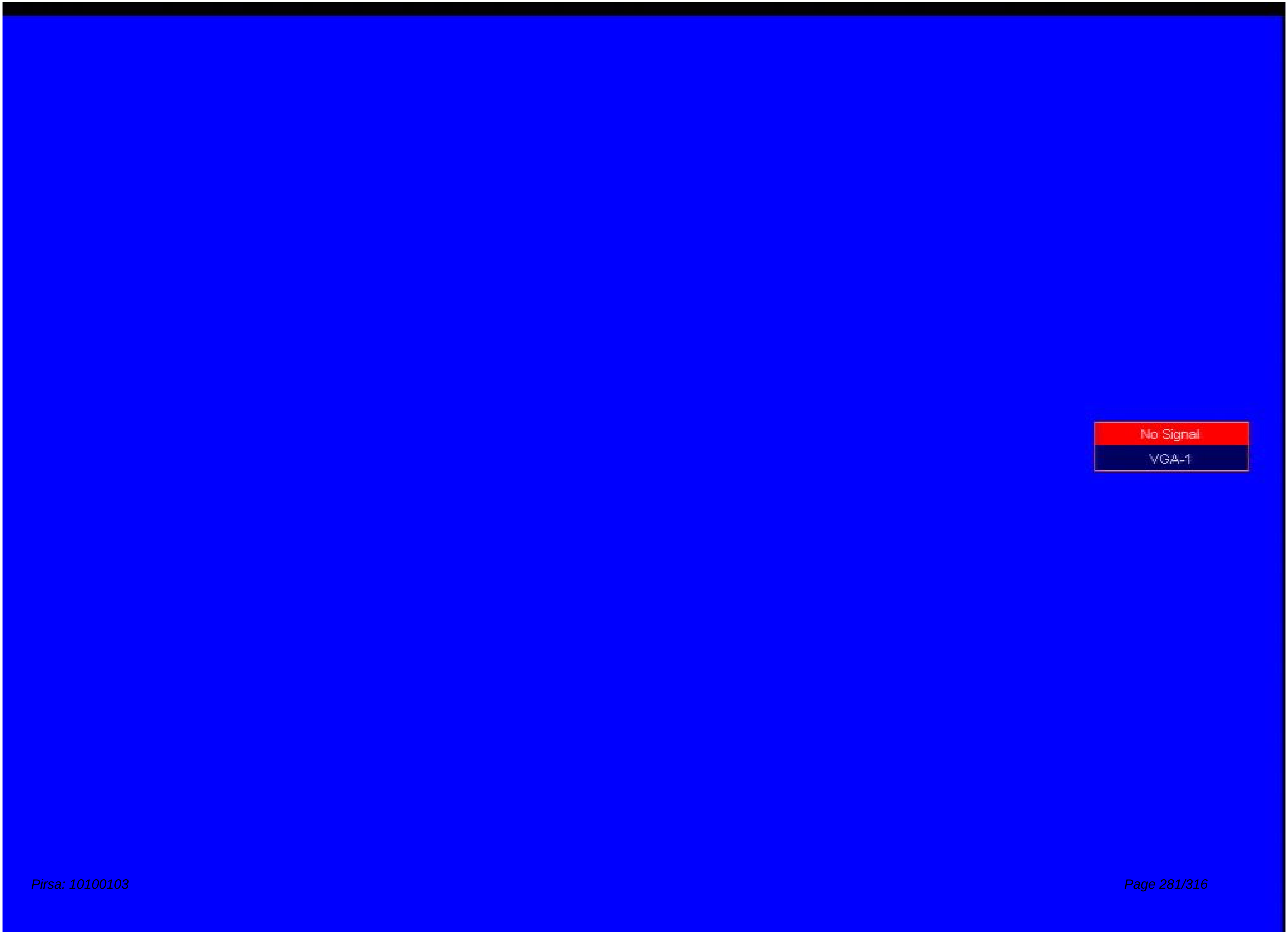
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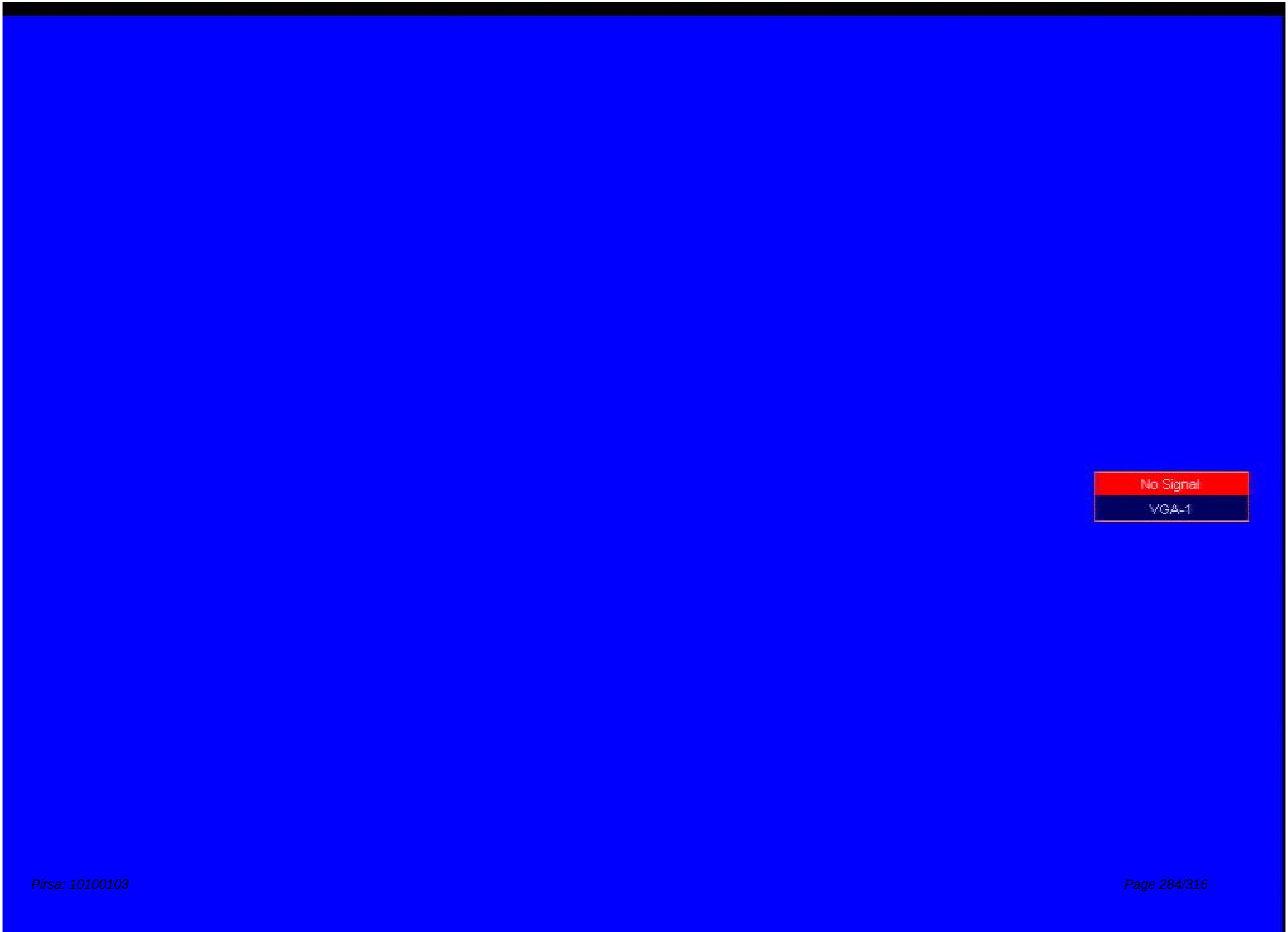
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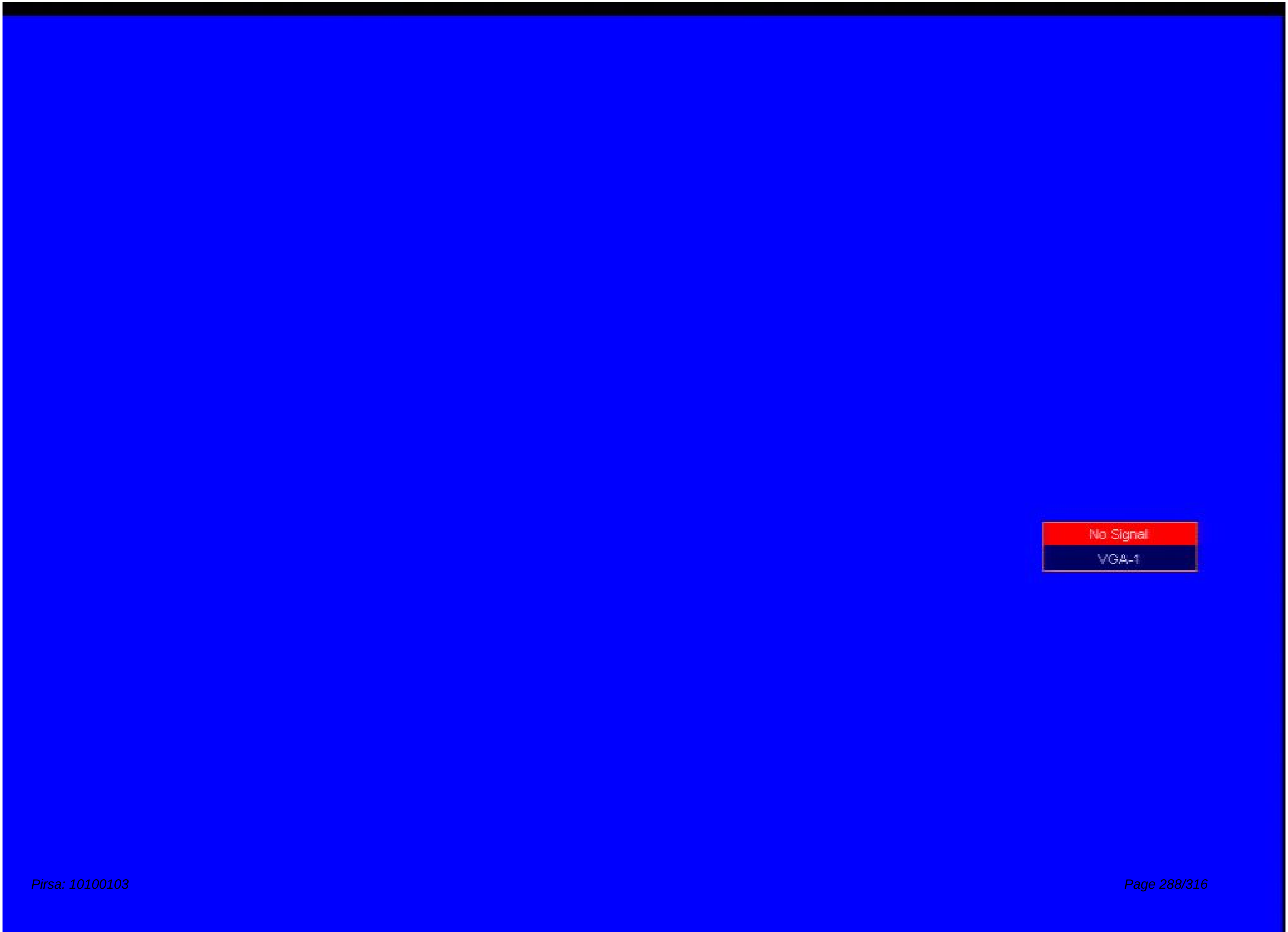
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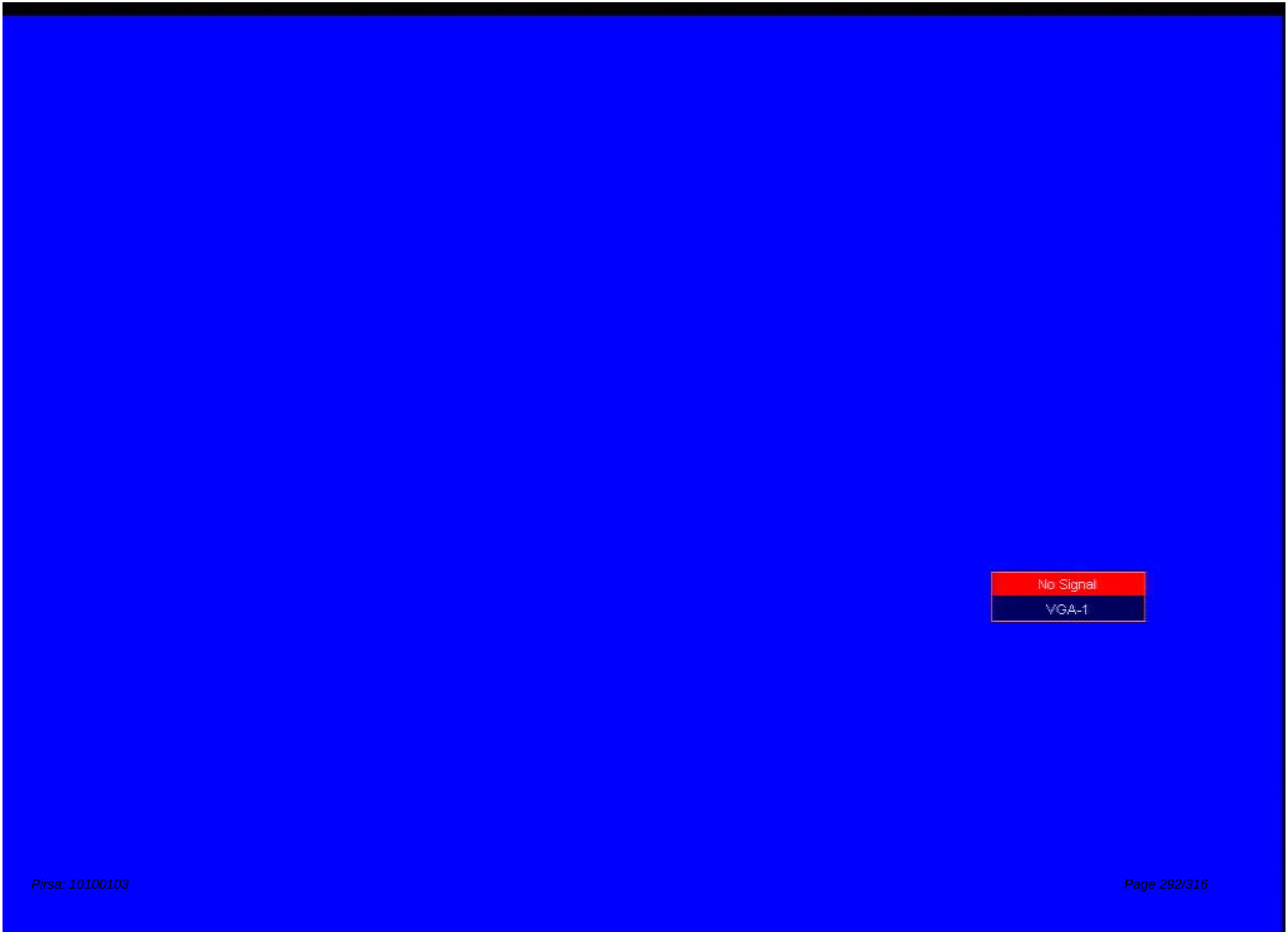
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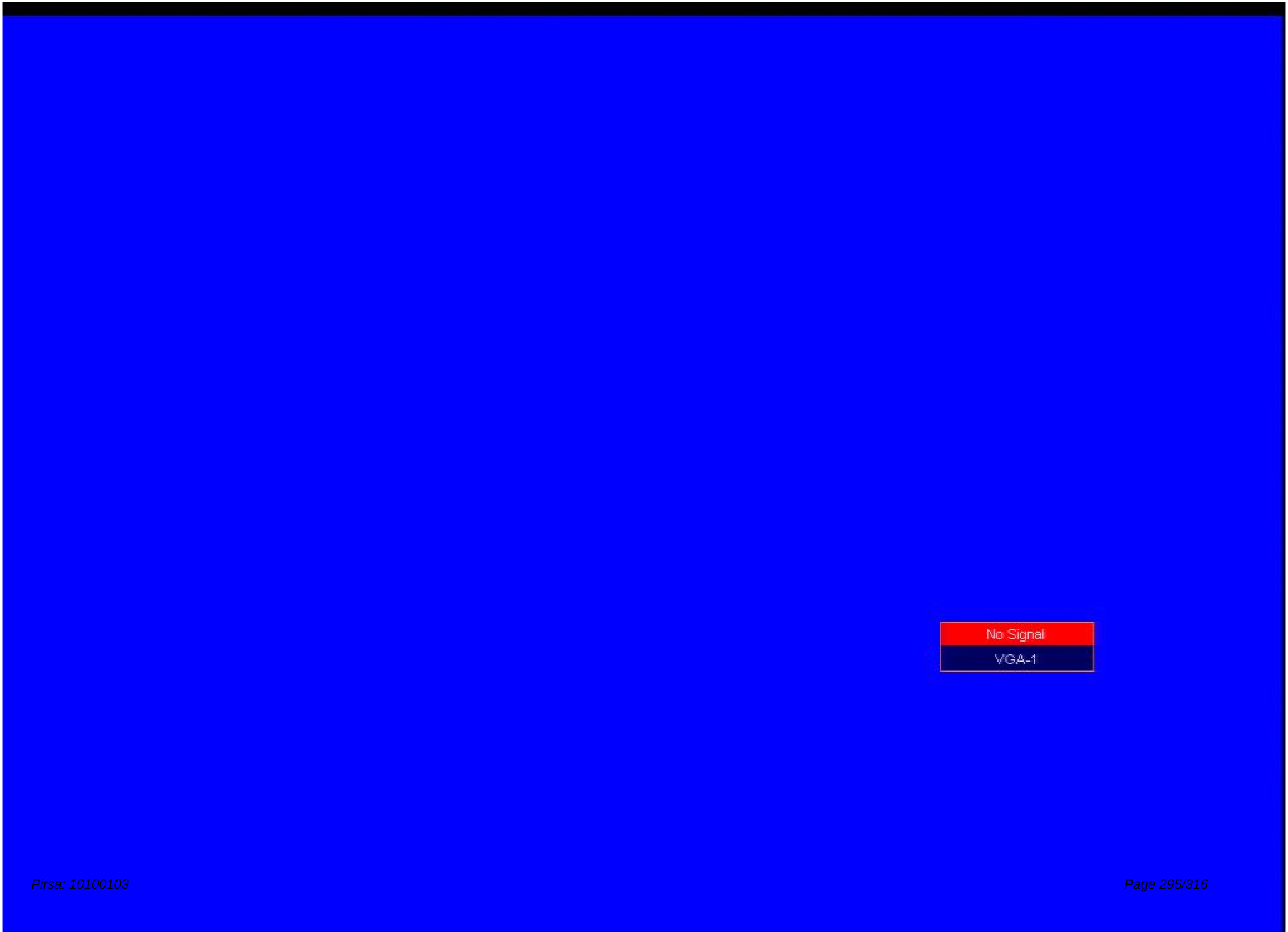
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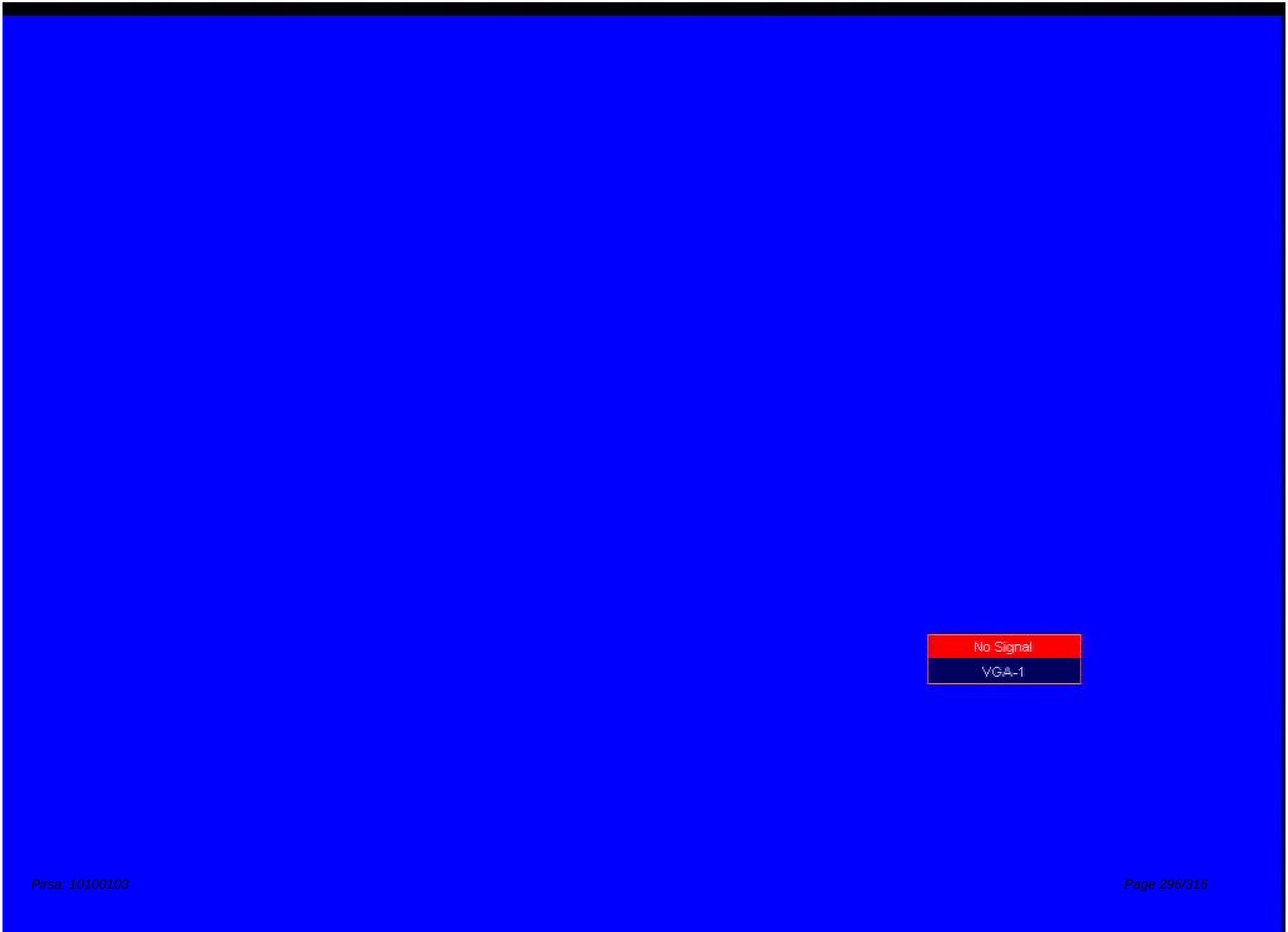
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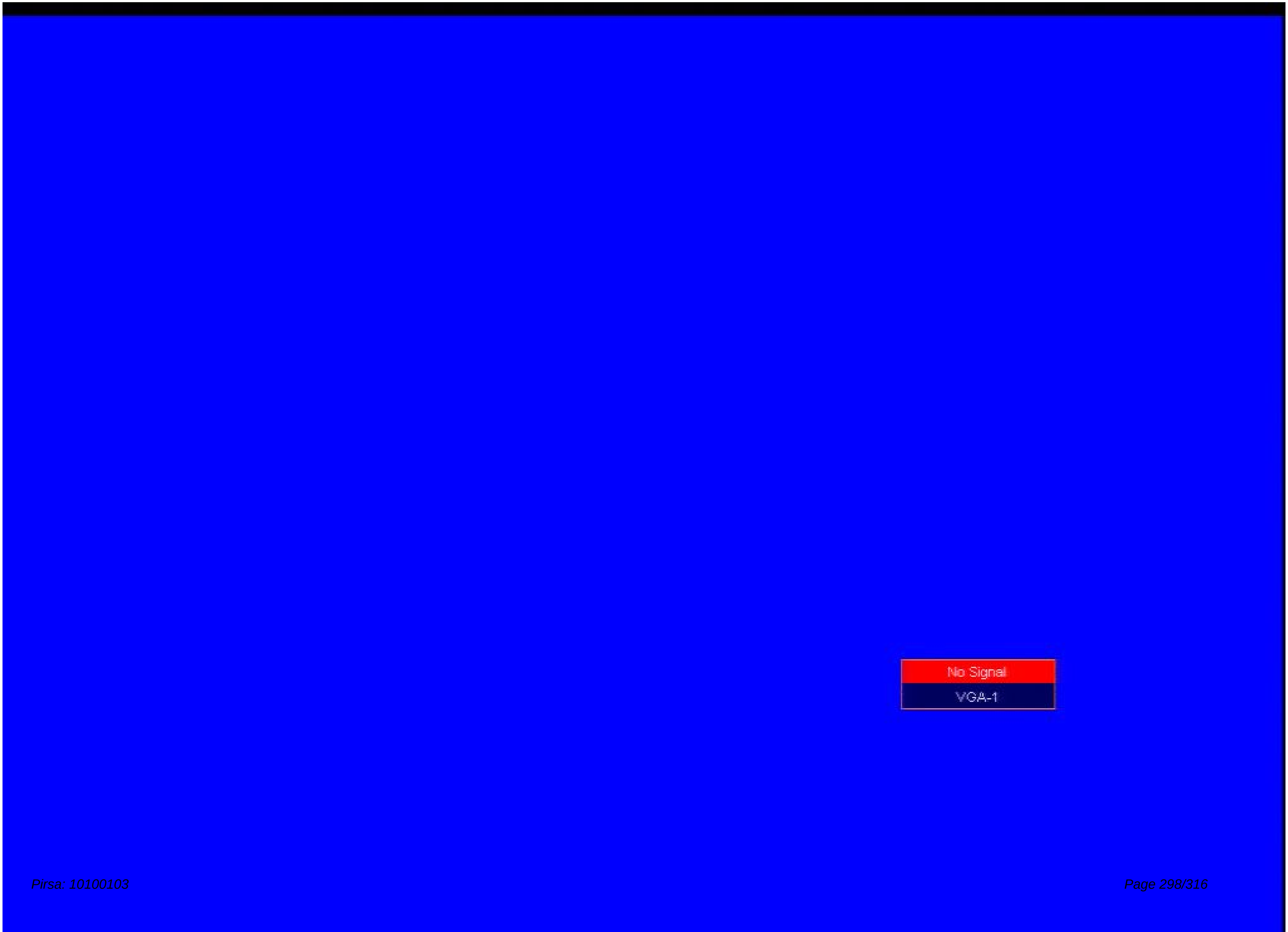
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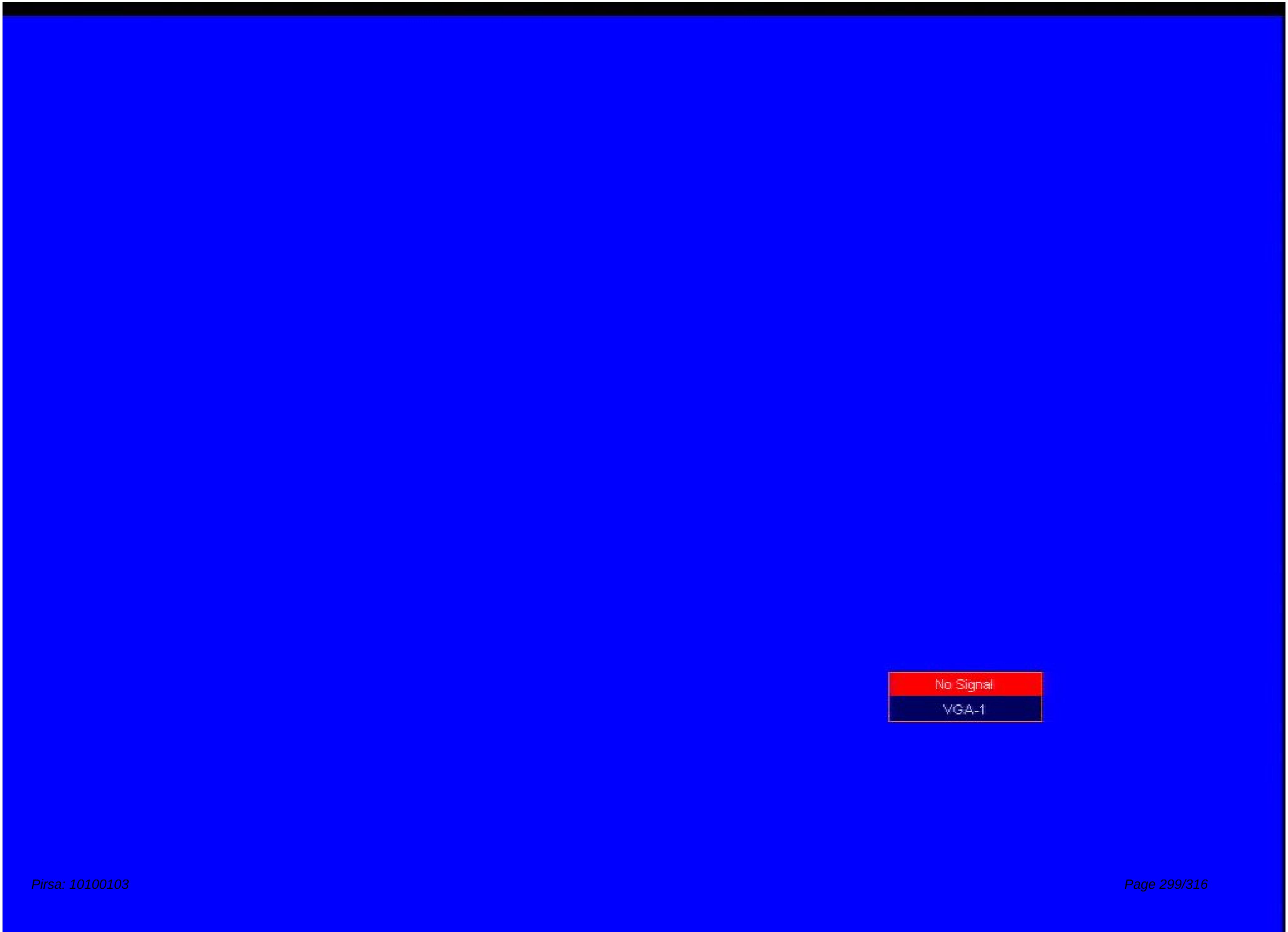
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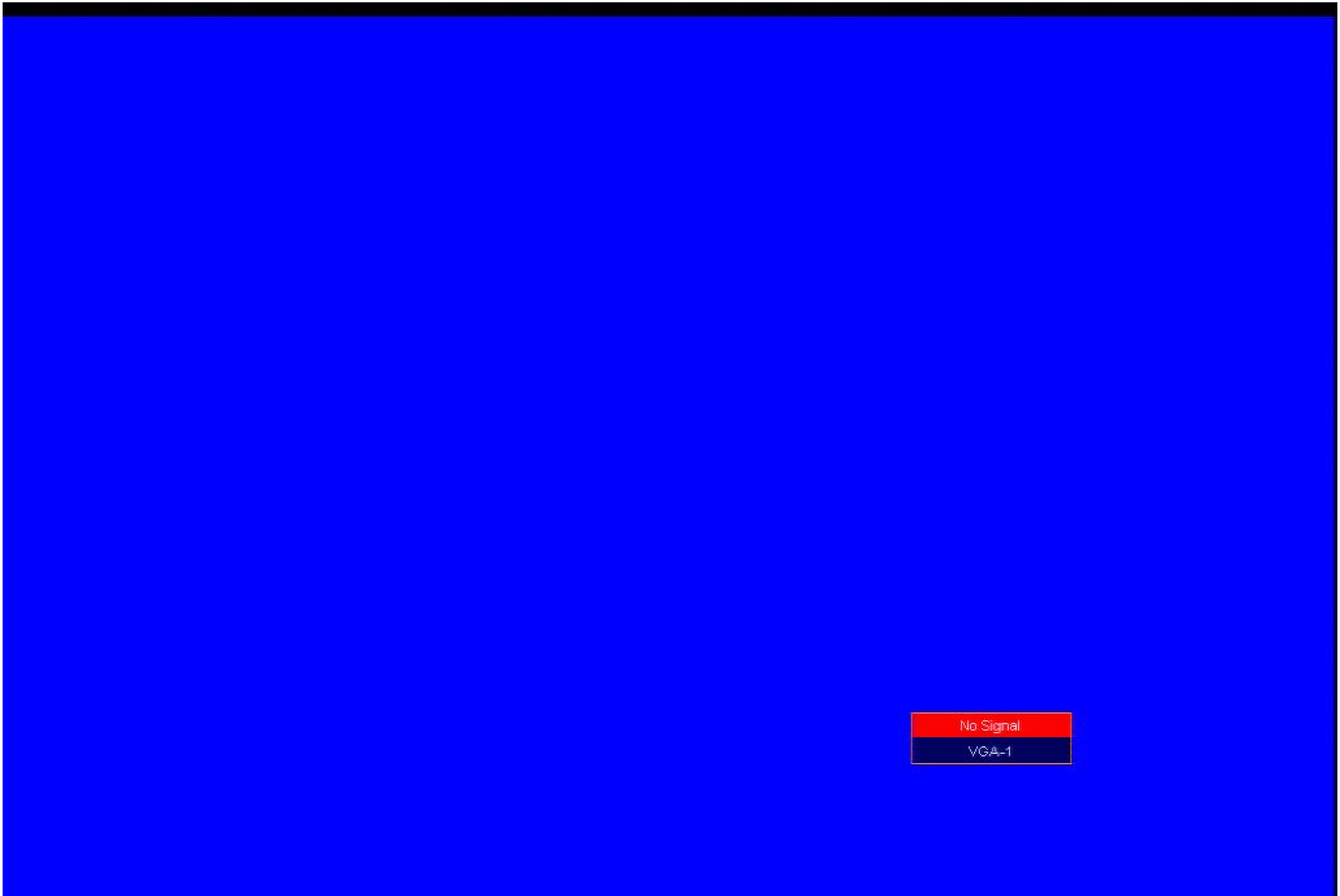
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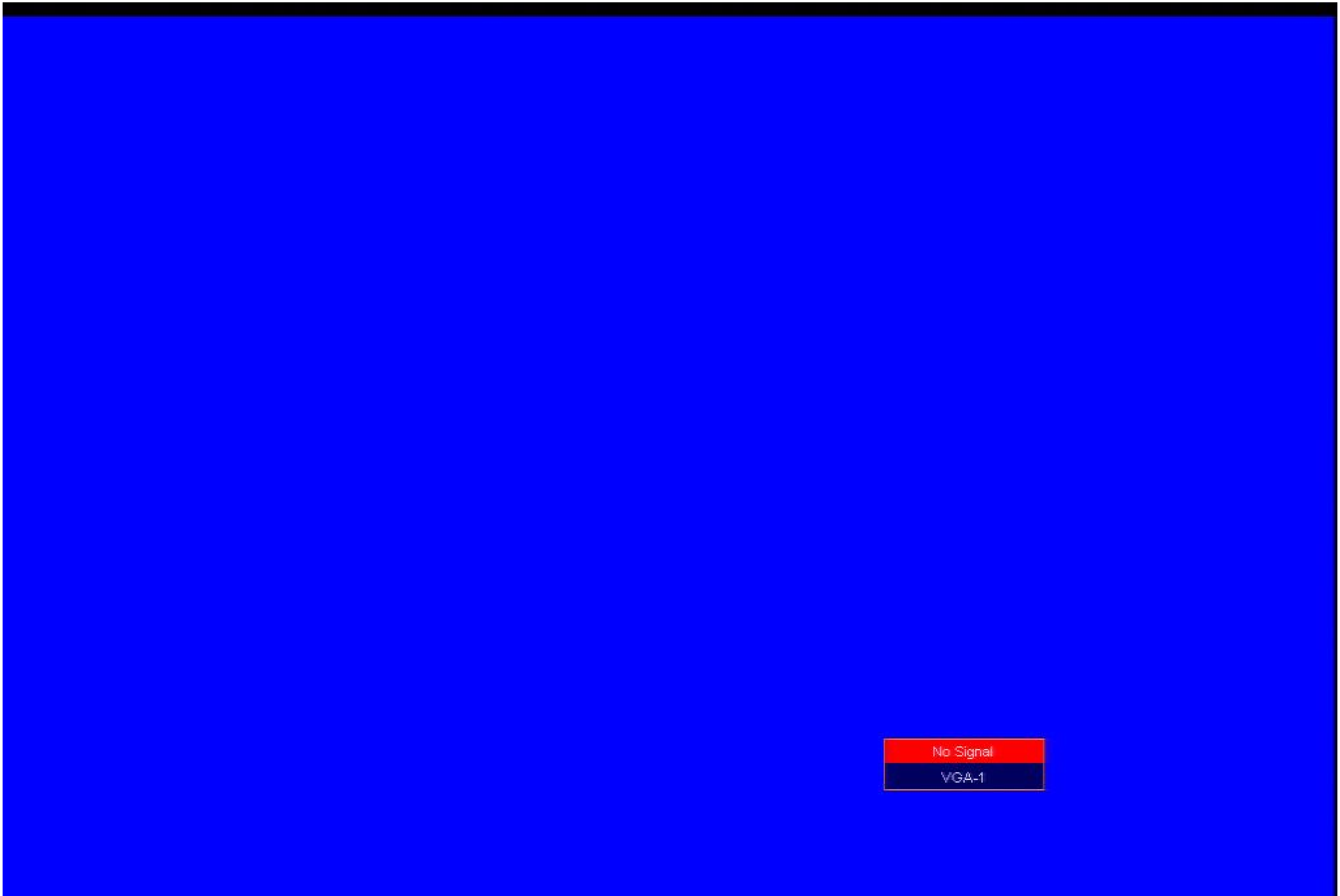
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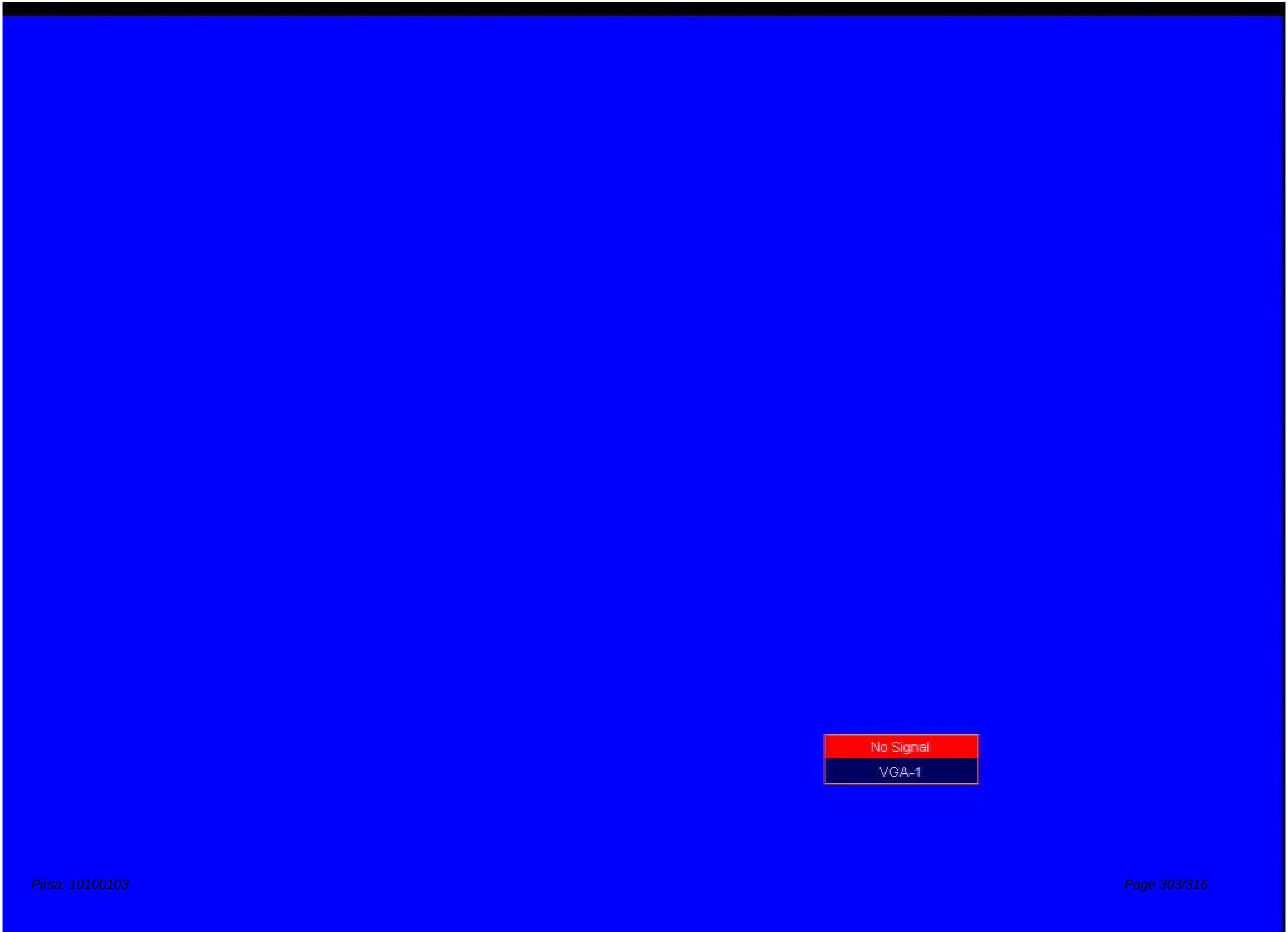
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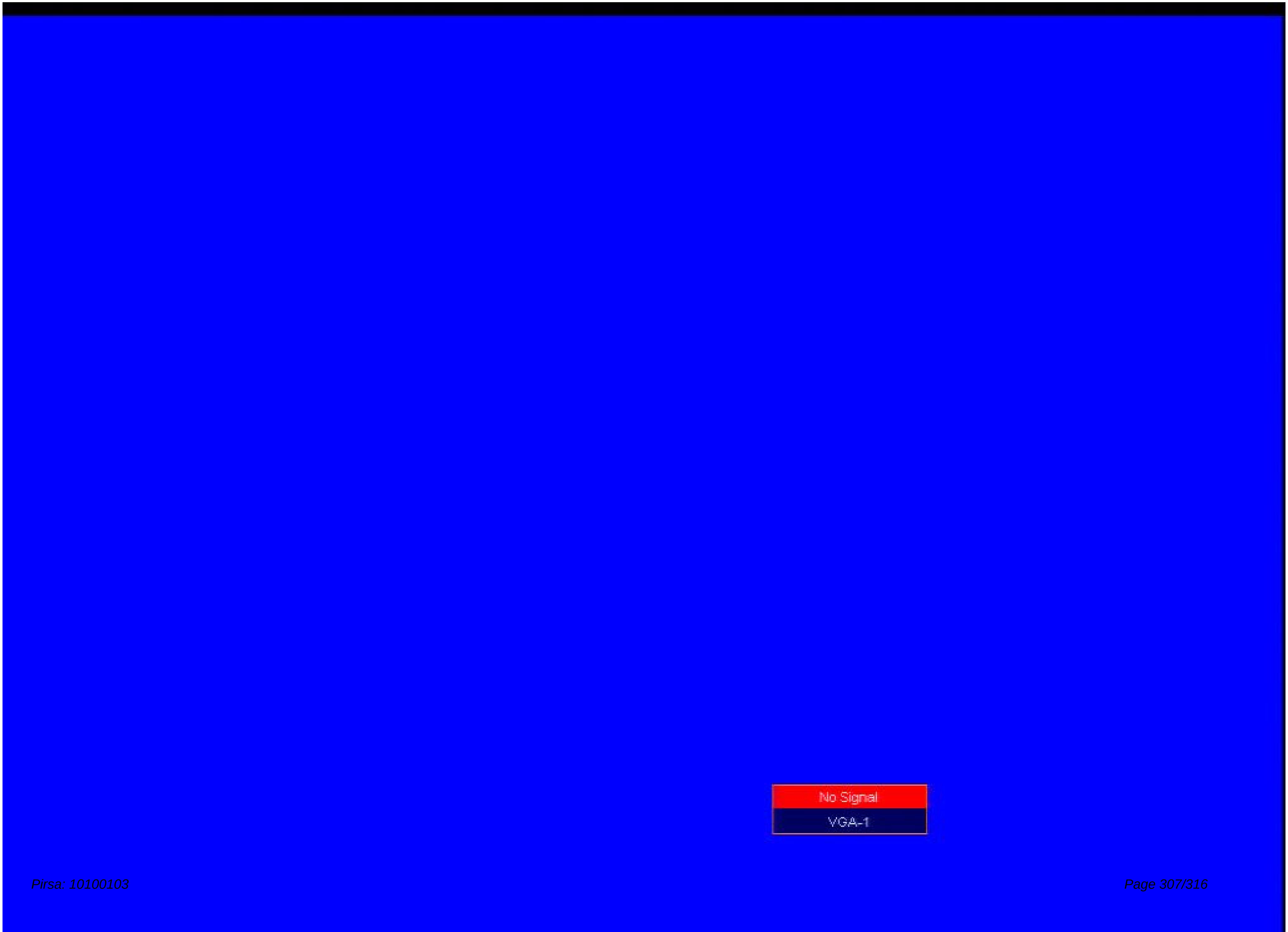
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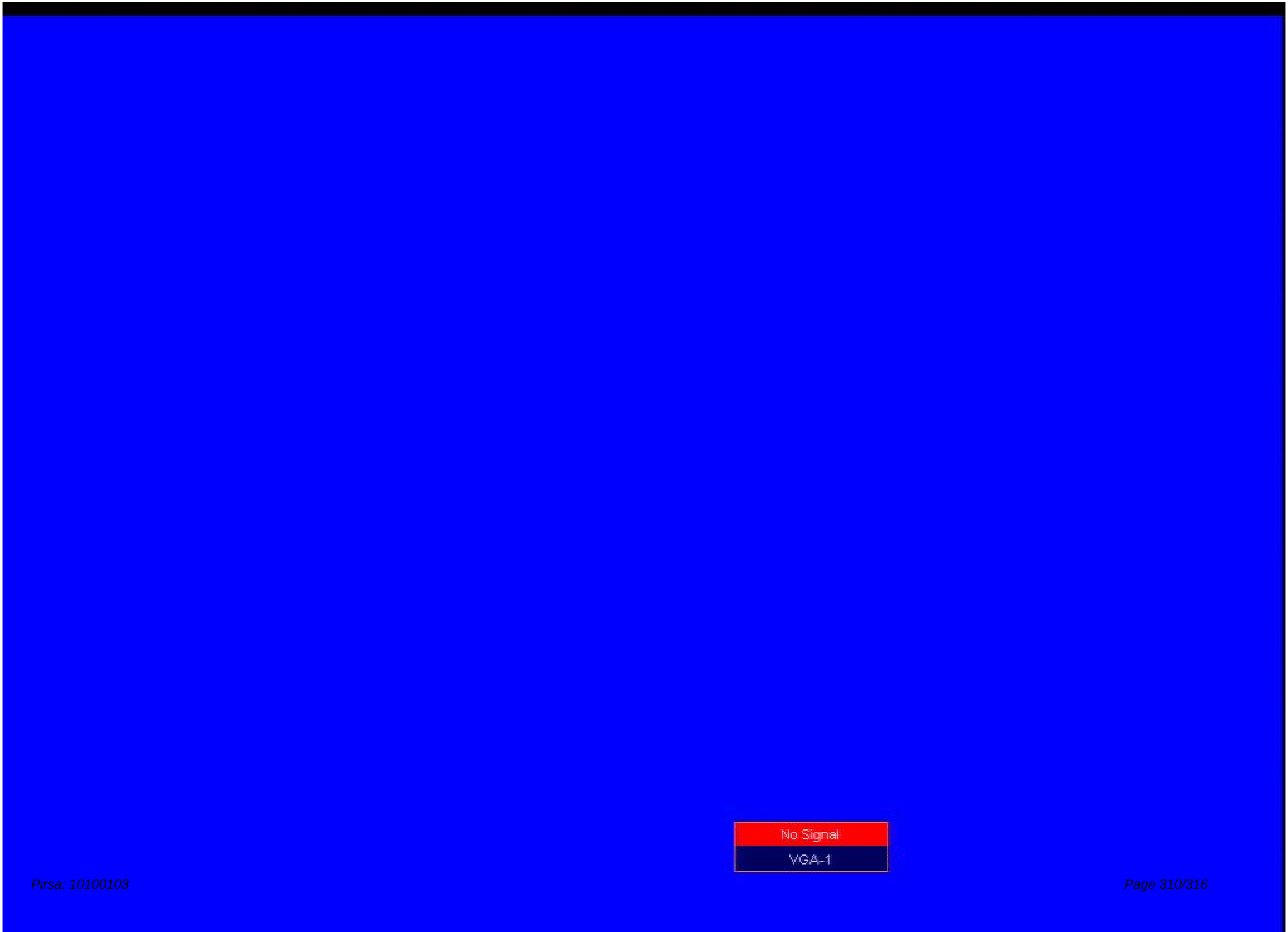
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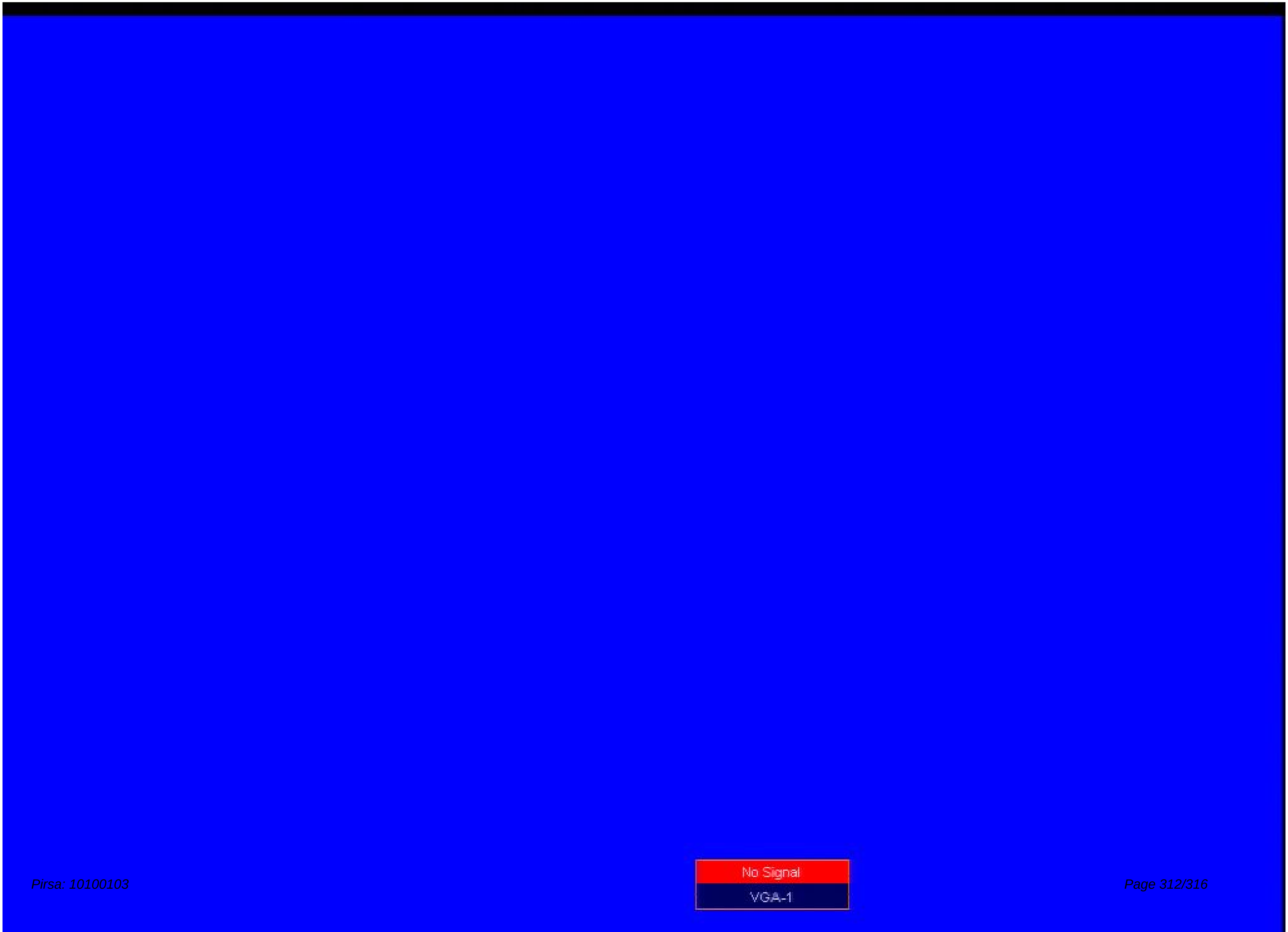
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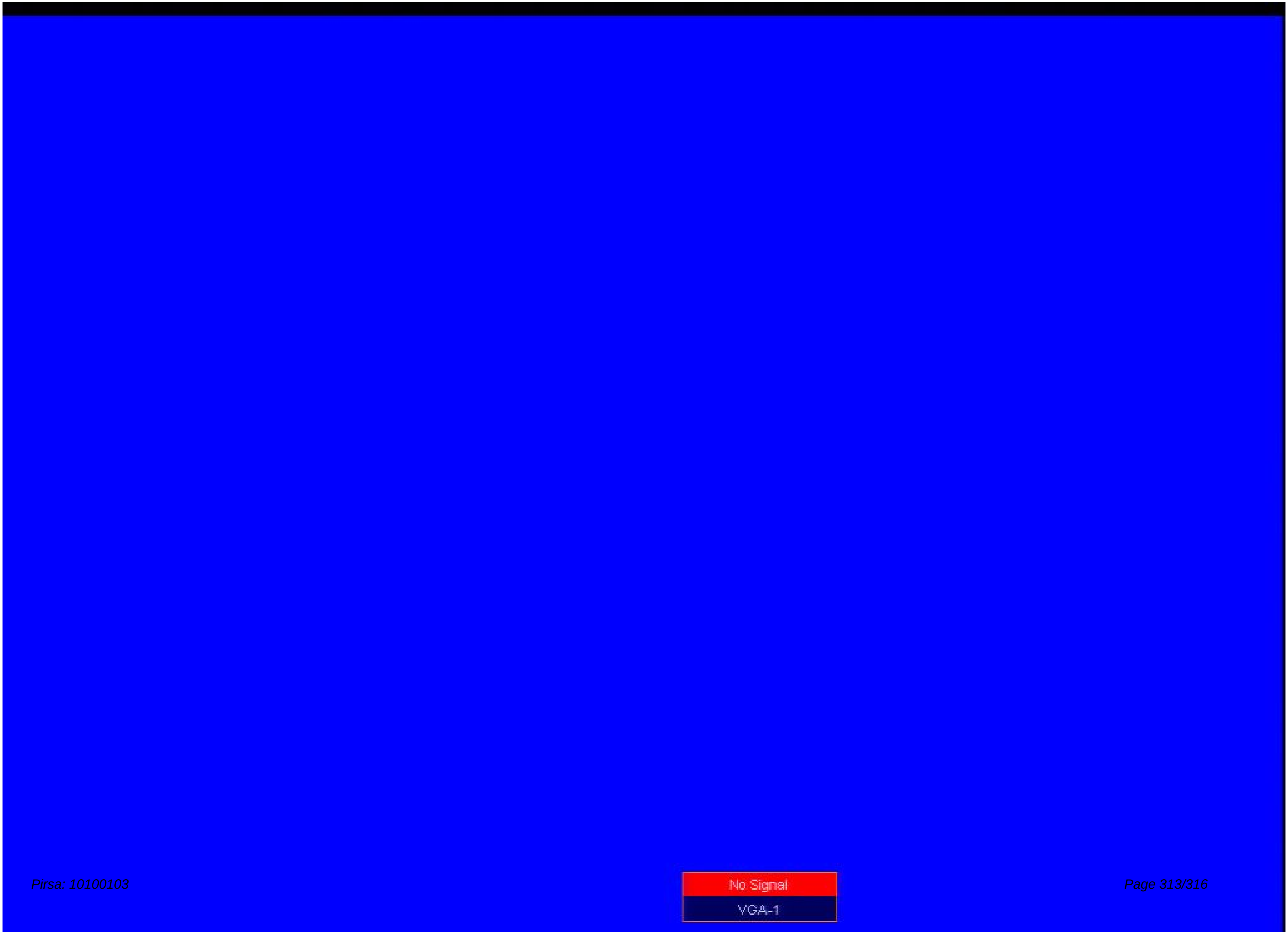
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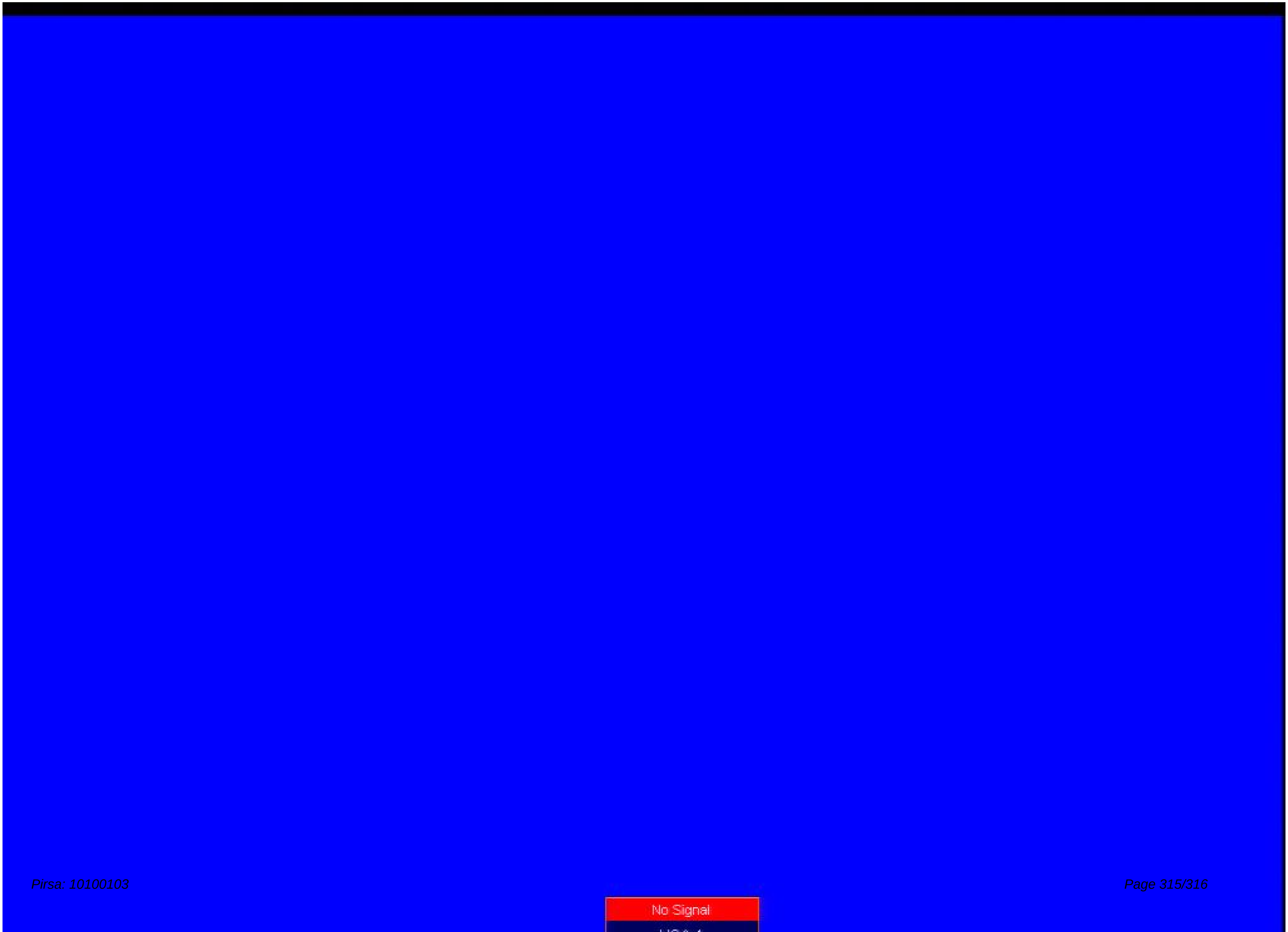
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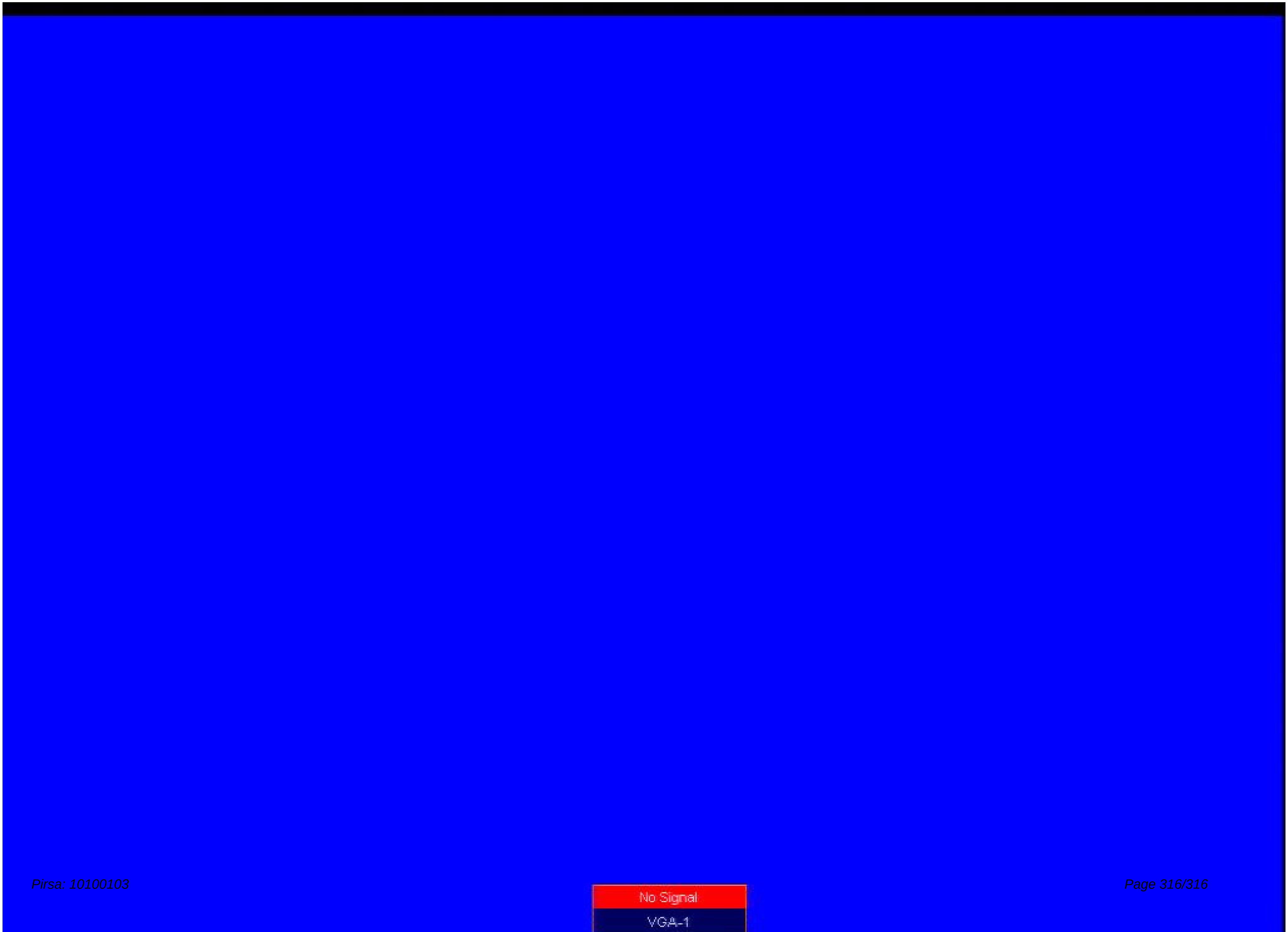
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