Controlling Water in Nitrogen Management

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Presentation will be available at: http://ucanr.edu/schwankl

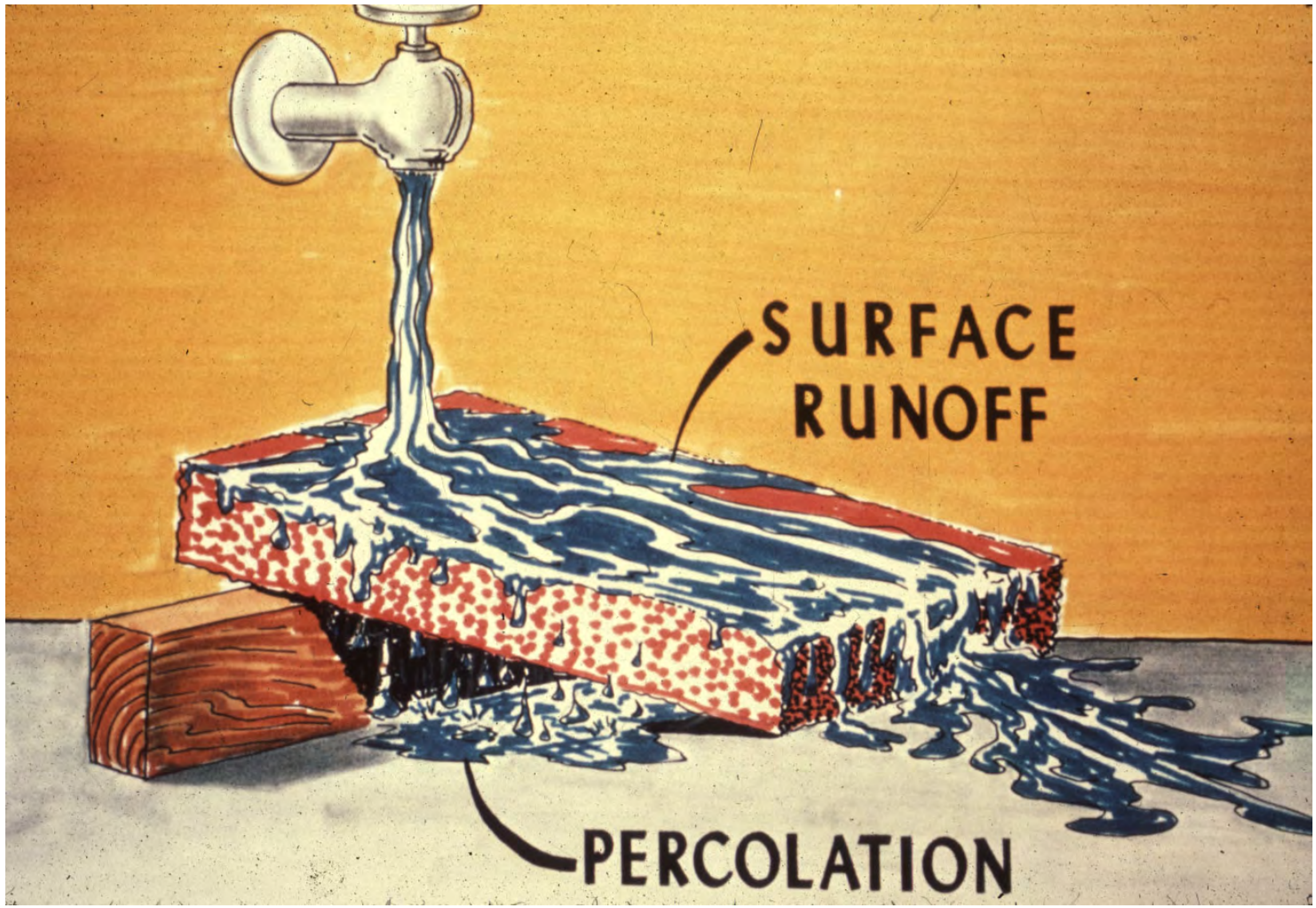
Irrigation Management

- Why is irrigation a big deal when we're dealing with nutrient management?

Nutrient management in CA

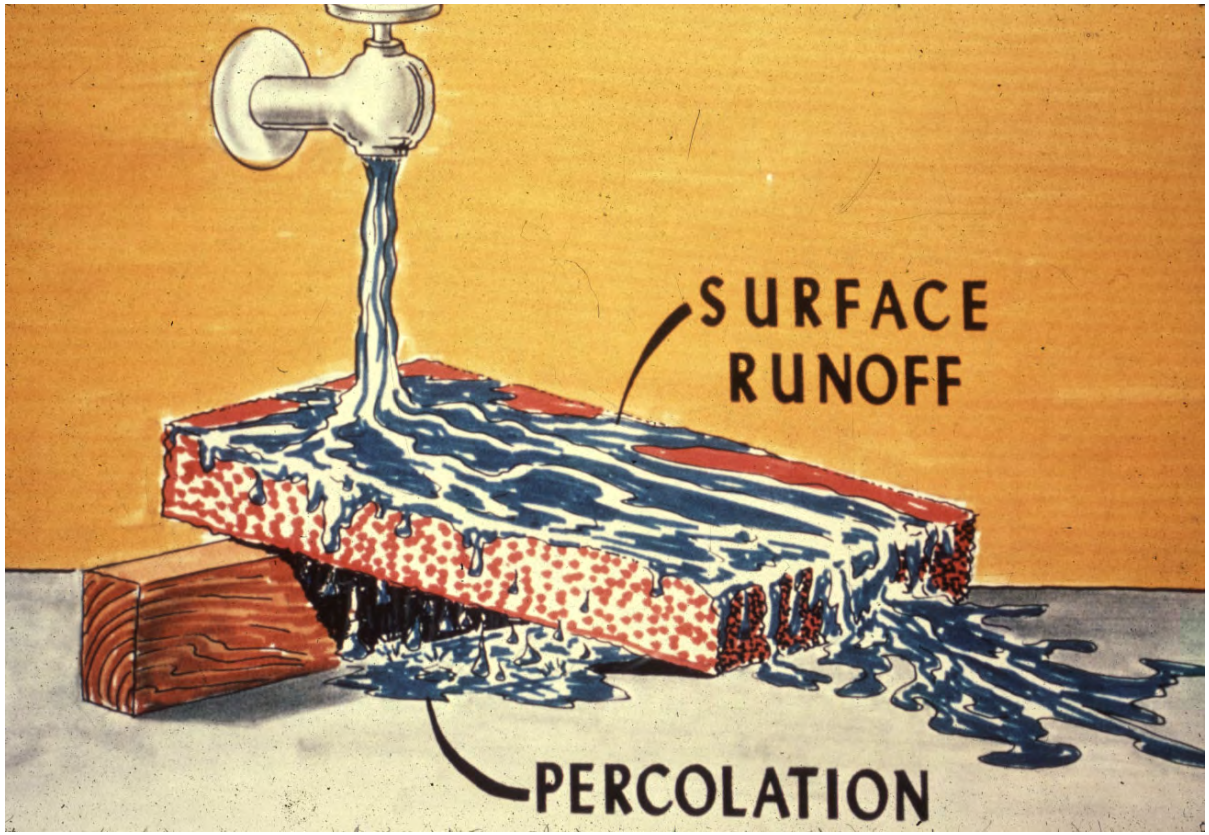
- Issue of major concern currently is nitrogen leaching.

What is leaching?



What is leaching?

- Nitrogen will not be leached unless there is water to move it.

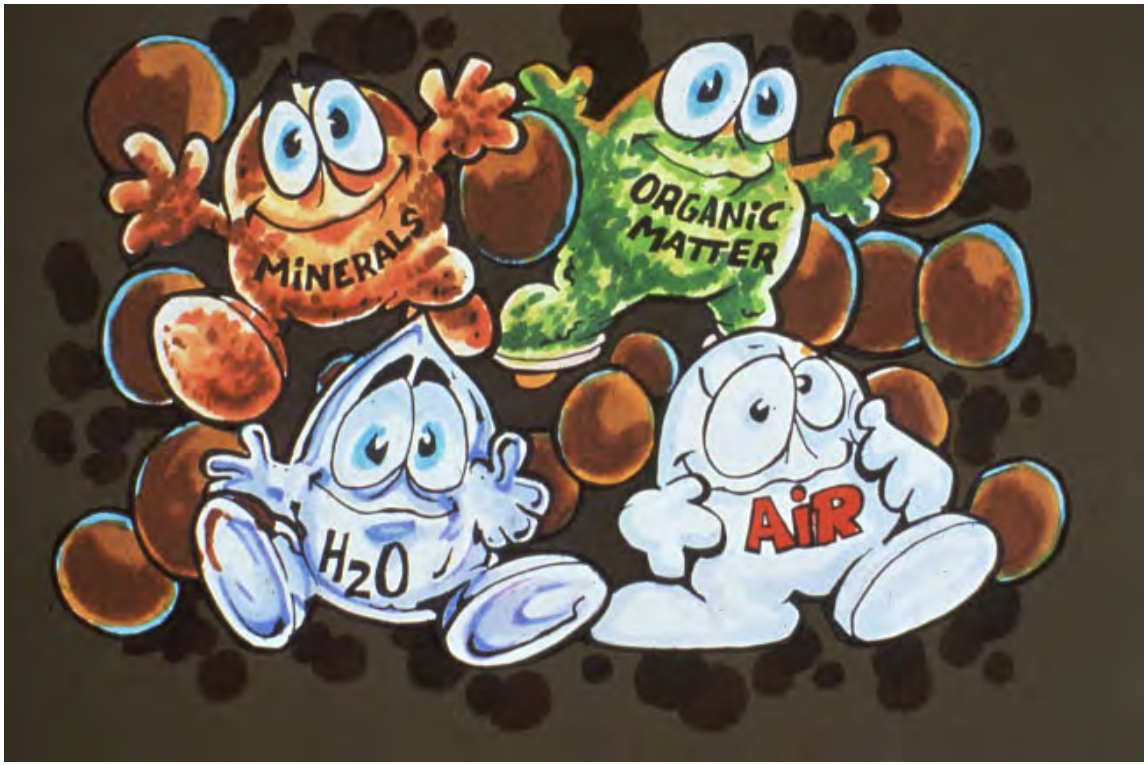


What is leaching?

- Nitrogen will not be leached unless there is water to move it.
  - Water can be irrigation water or it can be rainfall.

Nitrogen and leaching

- Nitrate is the form of nitrogen which moves with the water and is the major concern of leaching and groundwater contamination.



Nitrogen and leaching

- Nitrate is the form of nitrogen which moves with the water and is the major concern of leaching and groundwater contamination.
- Nitrogen can also be present in the soil in the organic and ammonium forms.
  - These forms do not readily leach.
  - Plants can take up nitrogen in the nitrate or ammonium forms.

Nitrate and leaching

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- Mineralization: The organic form of nitrogen is converted by soil microorganisms into ammonium. Other microorganisms then convert the ammonium into nitrate.

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- Mineralization: The organic form is converted by soil microorganisms into ammonium. Other microorganisms then convert the ammonium into nitrate.
- The rate of mineralization is dependent on the soil temp., oxygen supply, and moisture level.
    - The time of conversion can range from days to much longer (months or even years).

Nitrate and leaching

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- Nitrogen can also be present in the soil in the organic and ammonium forms.
- Mineralization: The organic form is converted by soil microorganisms into ammonium. Other microorganisms then convert the ammonium into nitrate.
- The rate of mineralization is dependent on the soil temp., oxygen supply, and moisture level.
- Whatever form of N you apply, if it is not taken up by the crop, it is eventually going to be converted to nitrate. If there is water moving thought the soil (irrigation or rainfall), it can pick up the nitrate and transport it.

Nitrate and leaching

- So, water is the transport vehicle for the nitrates.

- If we can minimize the excess water applied to the crop (only apply the water that the crop needs), we minimize the nitrate moving below the crop's root zone.
  - The crop water requirements = evapotranspiration (ET)

Surface Irrigation

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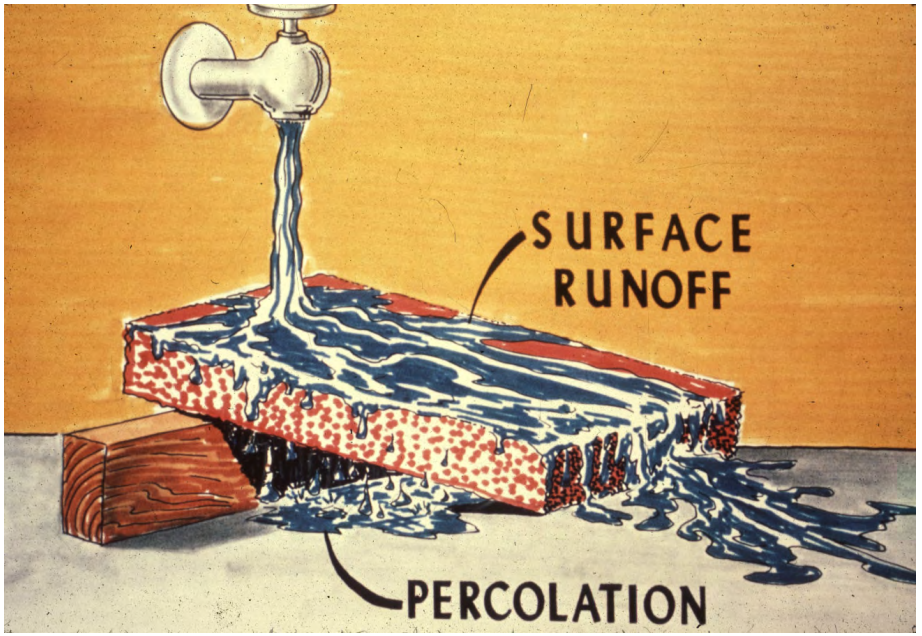
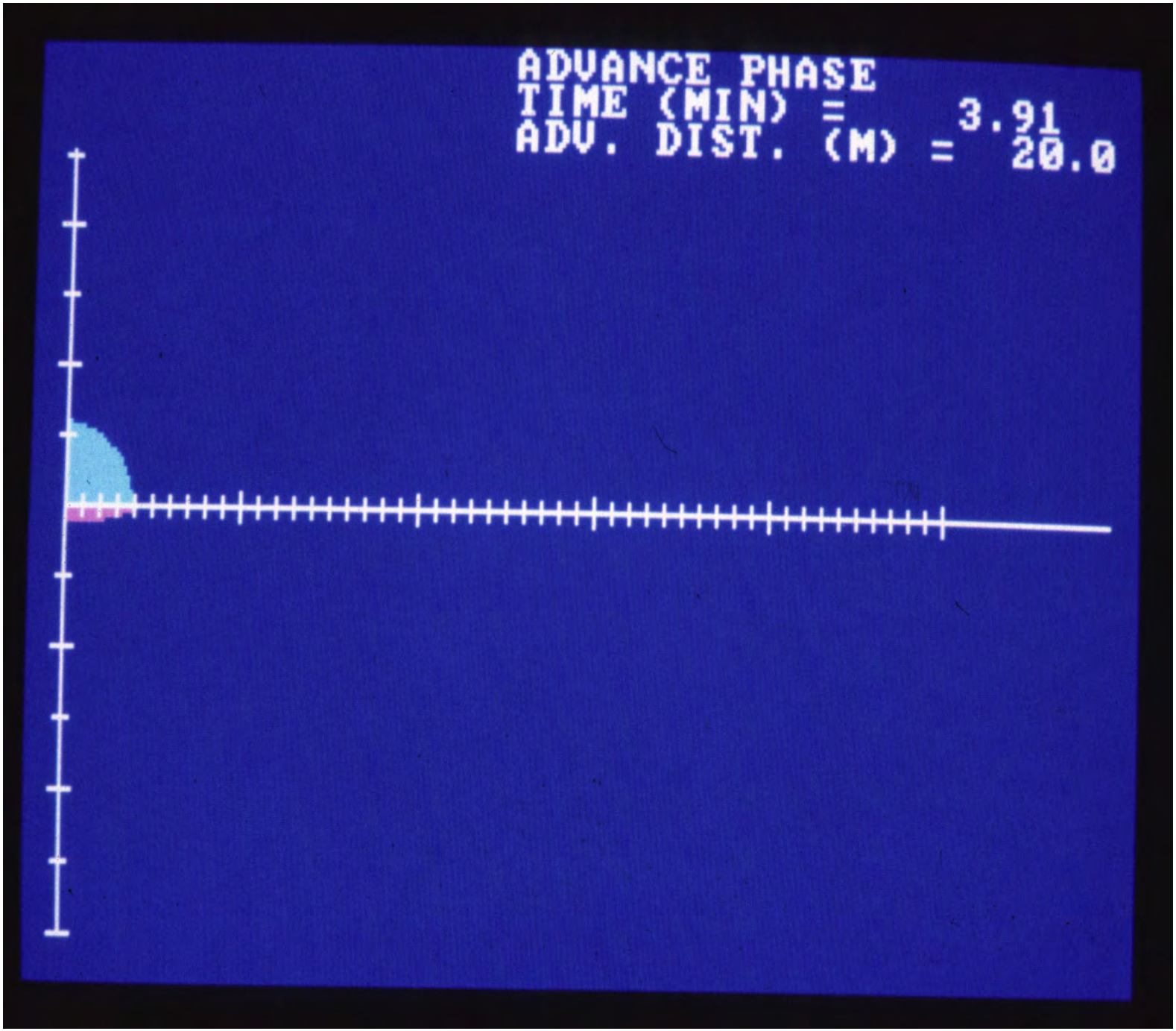
- Losses can be from deep percolation and tailwater runoff.
  - Minimize runoff losses by Tailwater Return Systems.
  - Deep percolation losses are a challenge for surface irrigation systems.

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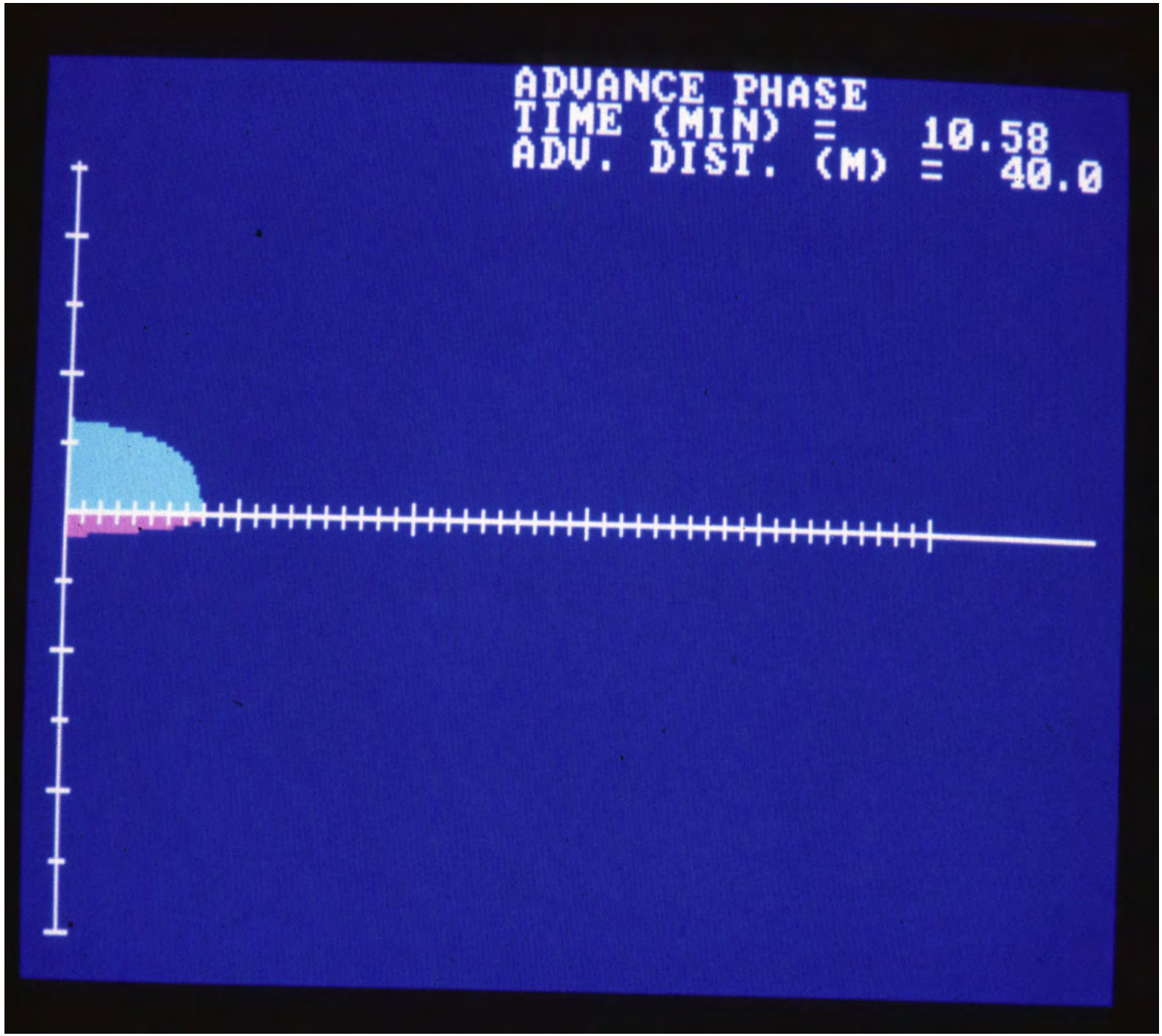
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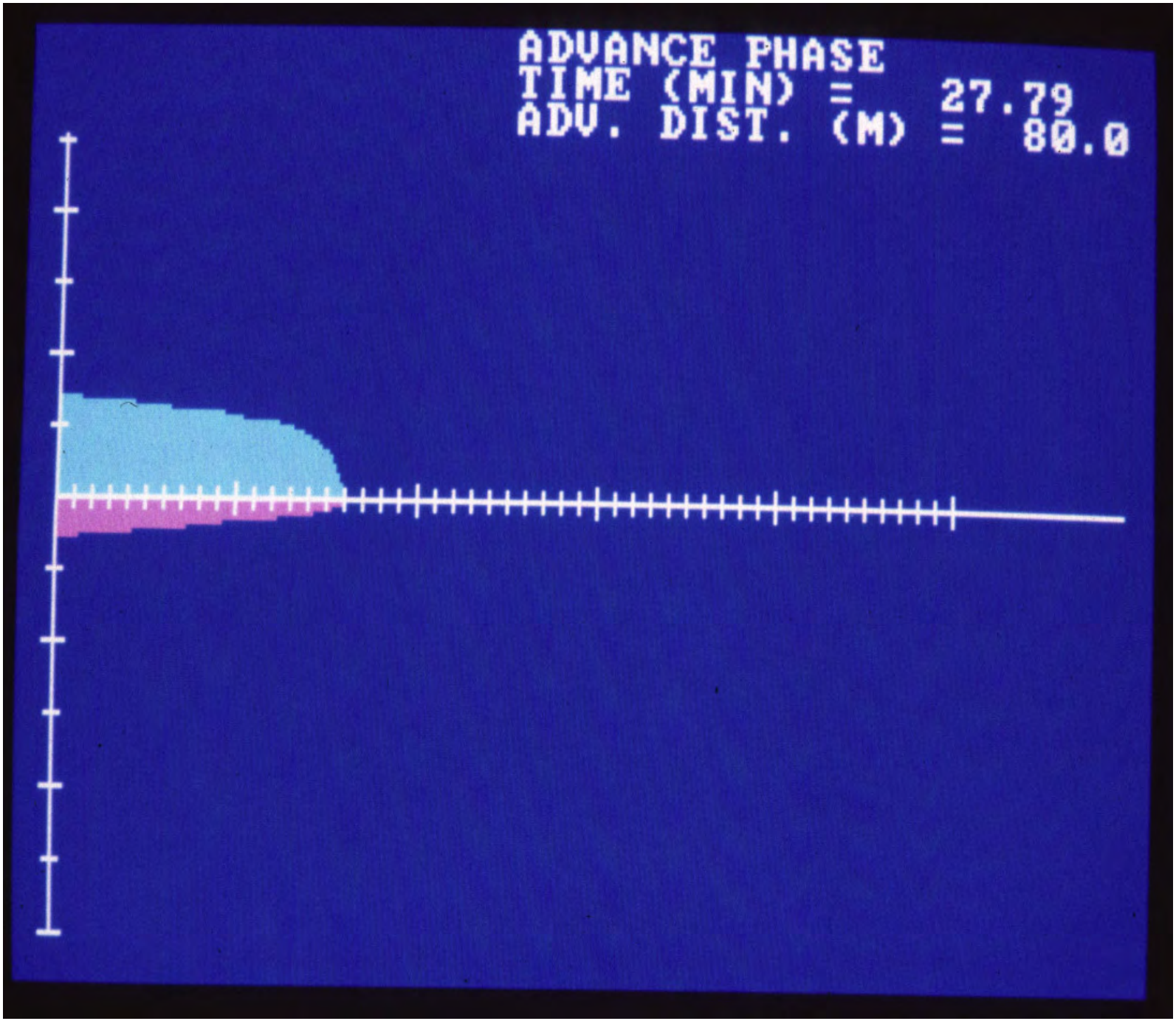
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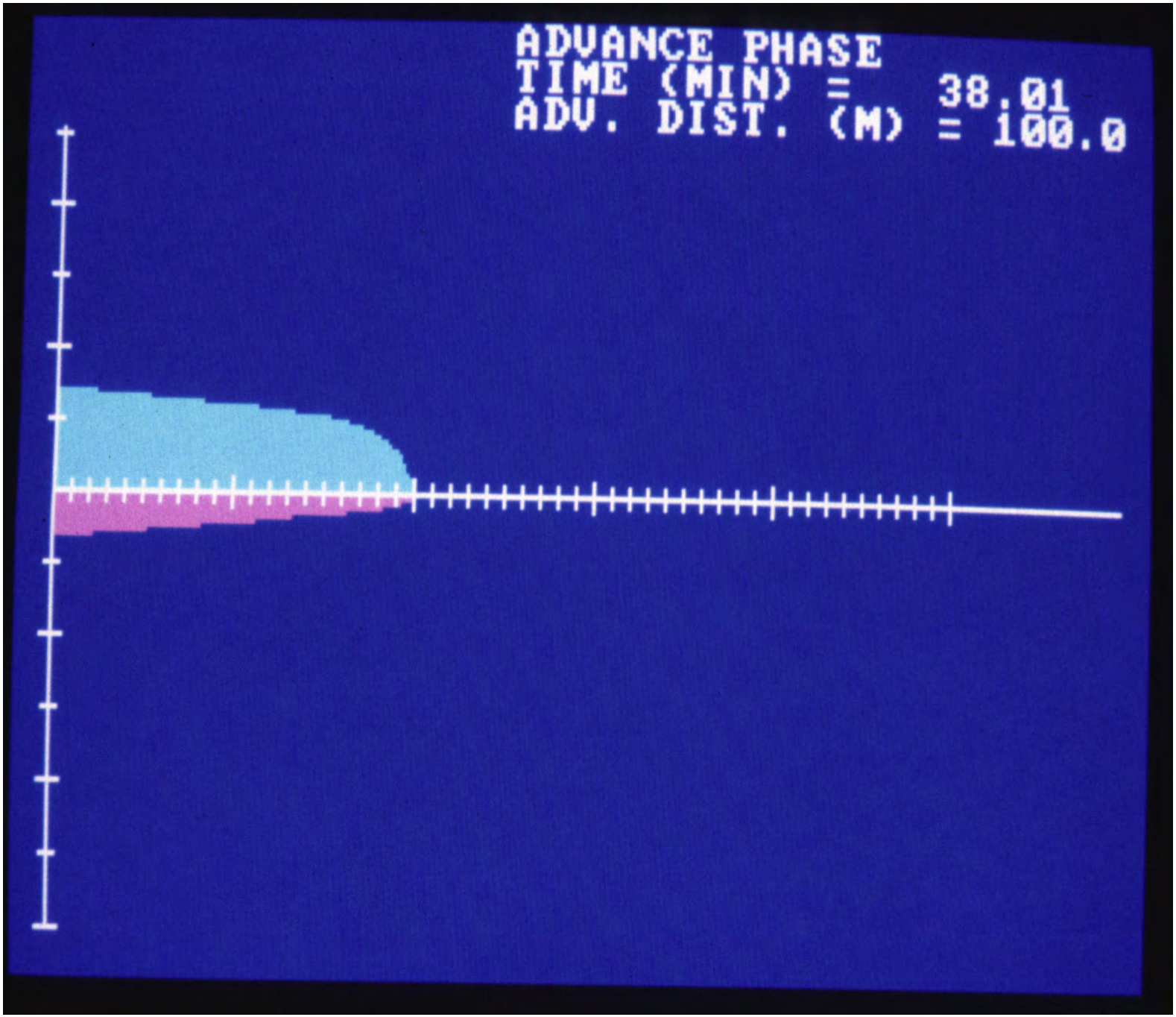
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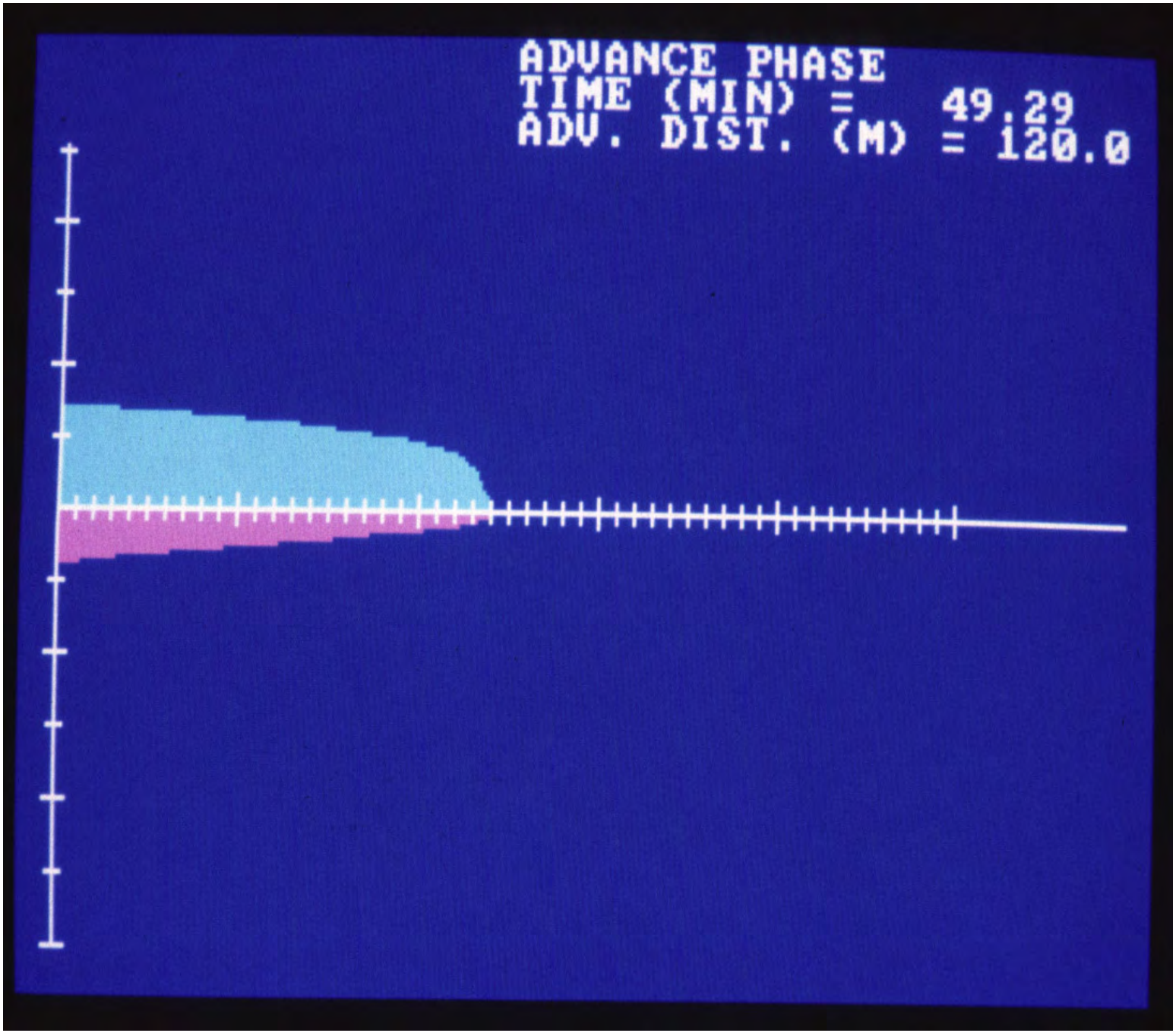
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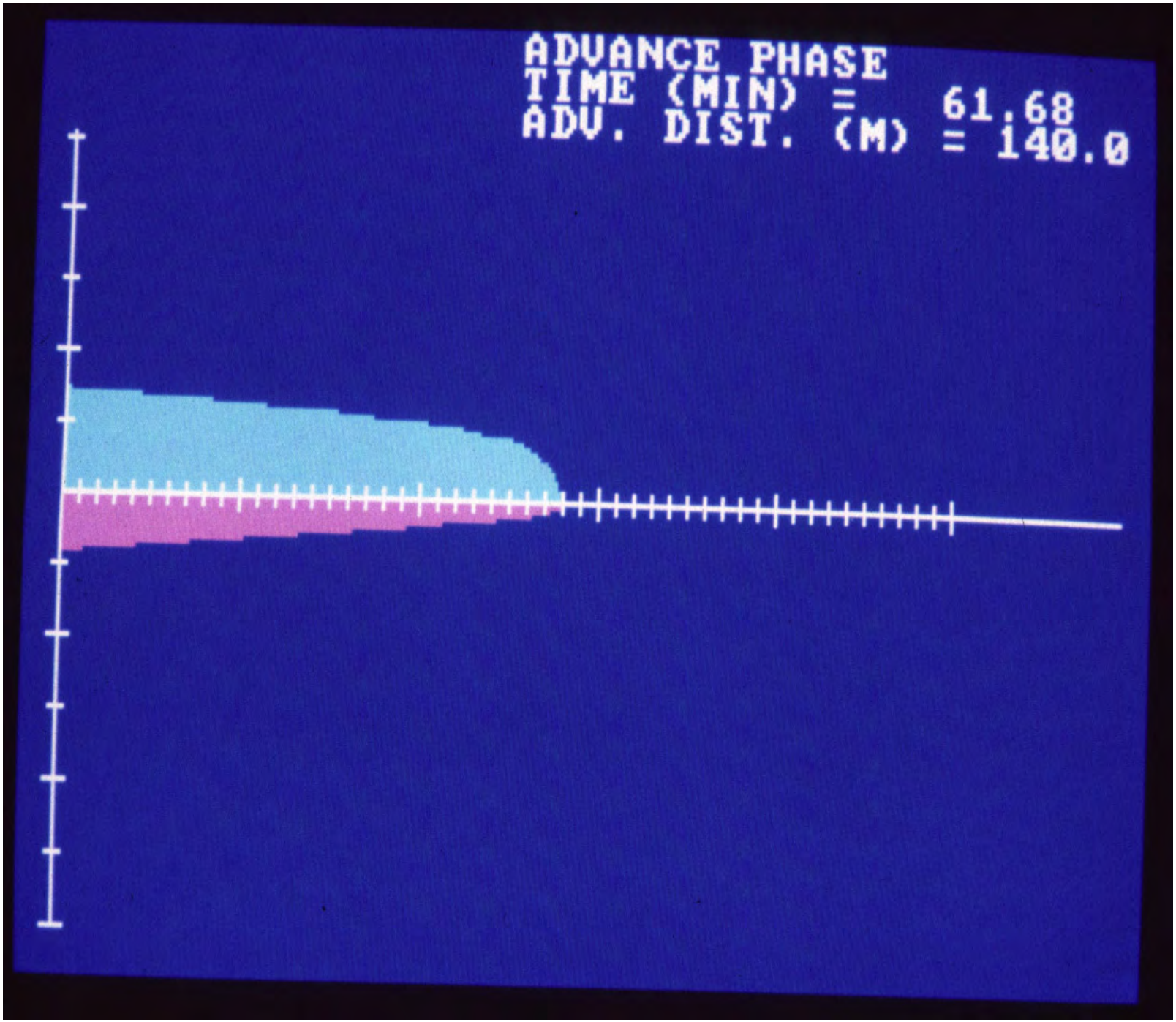
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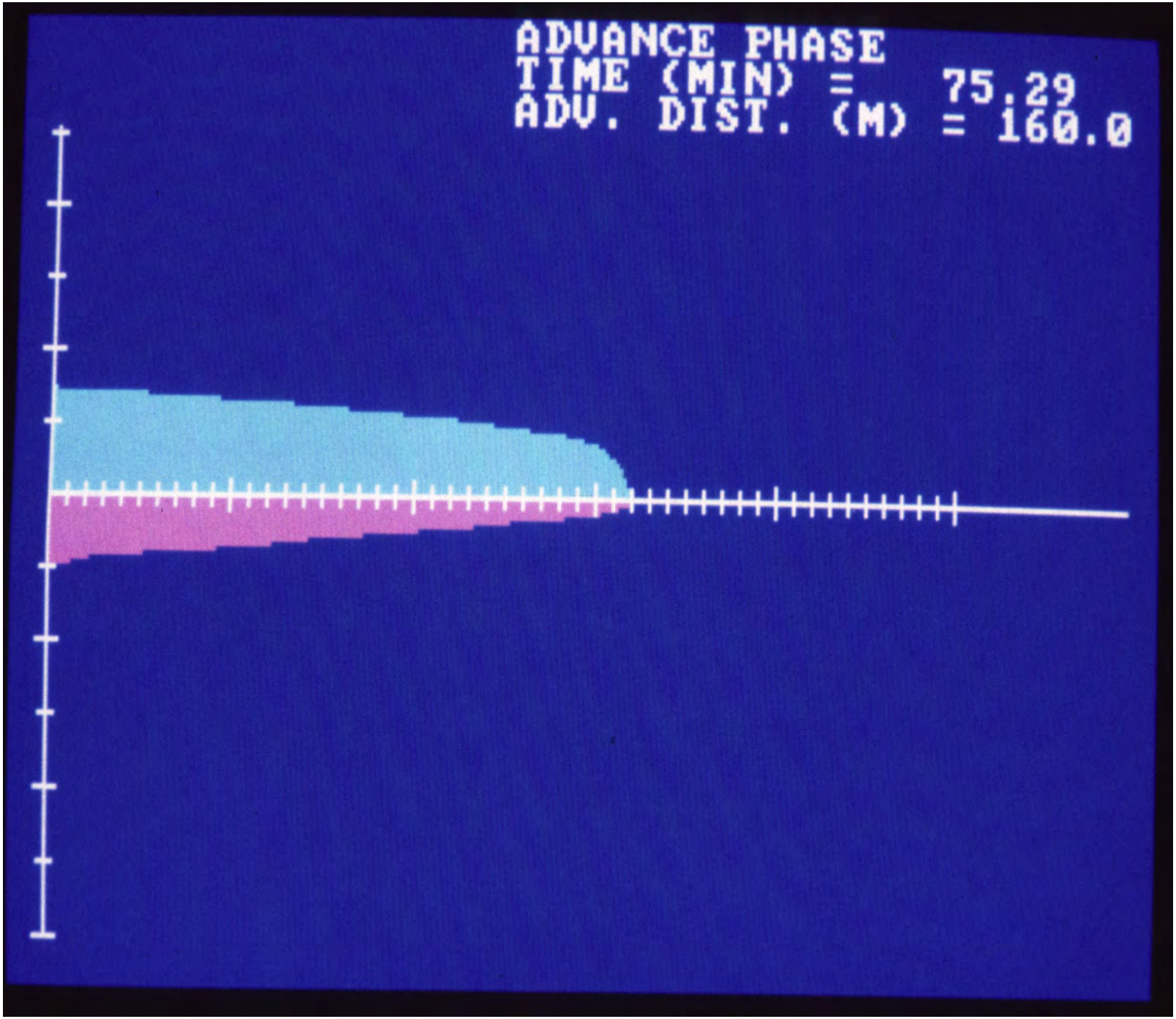
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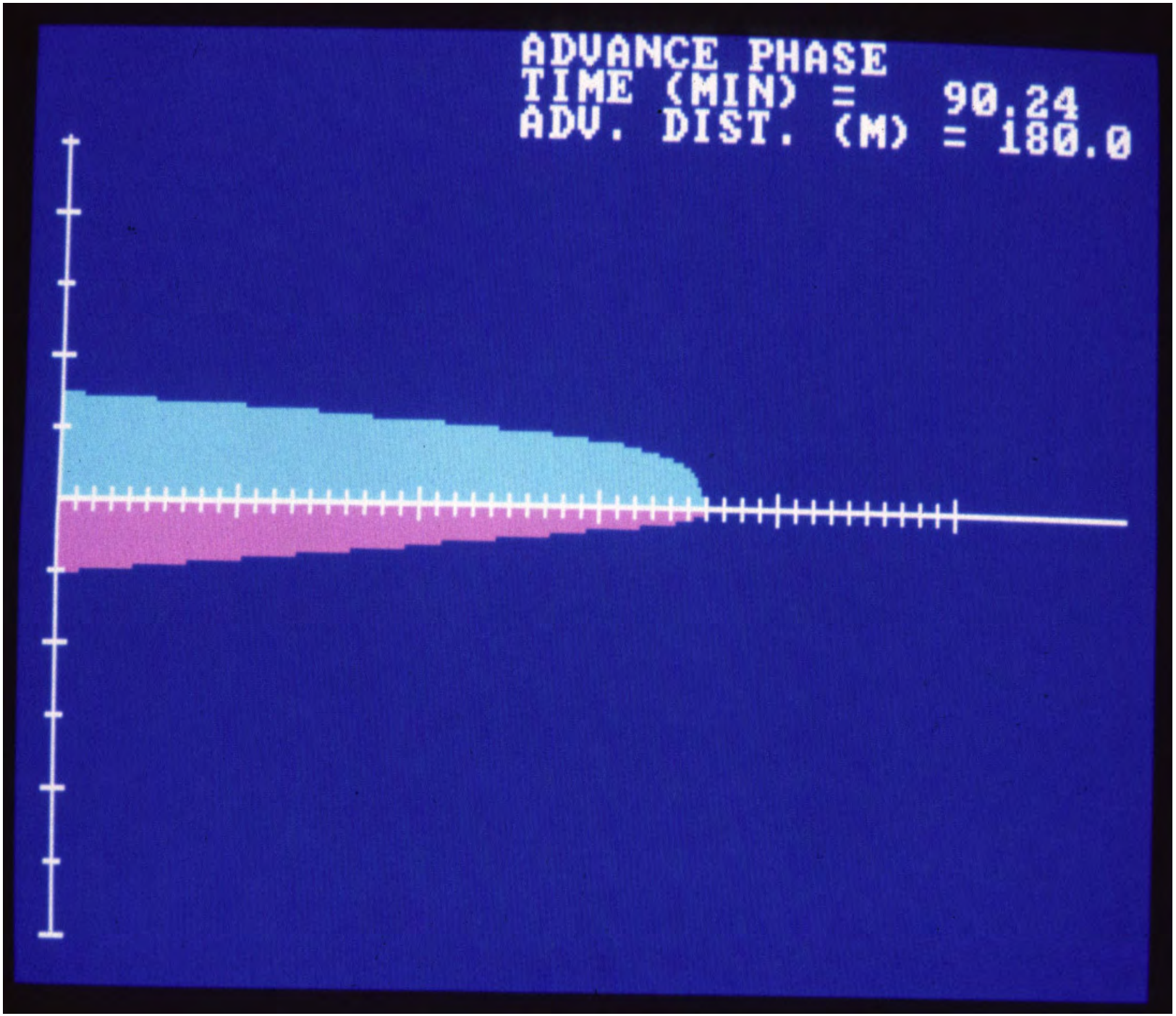
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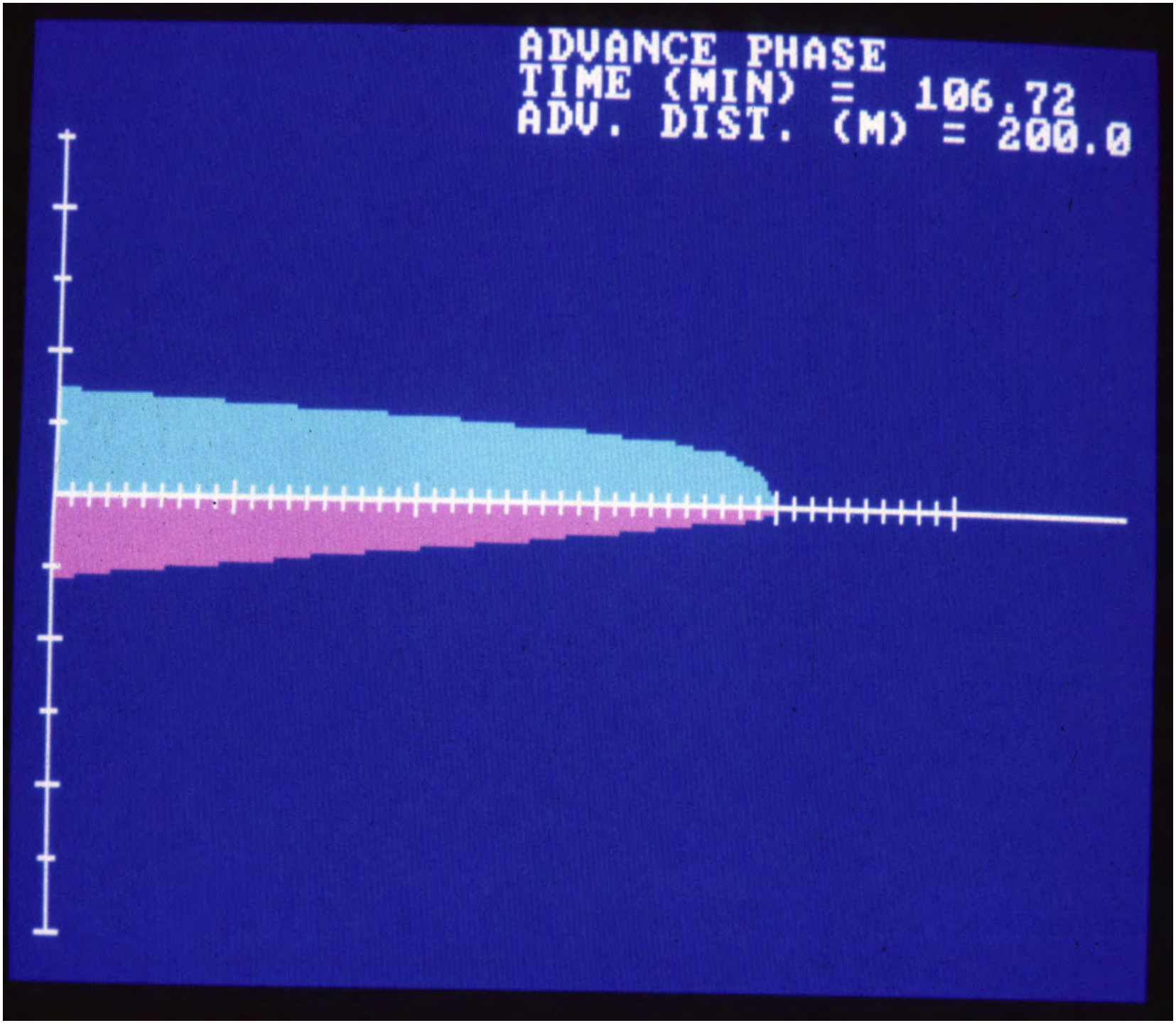
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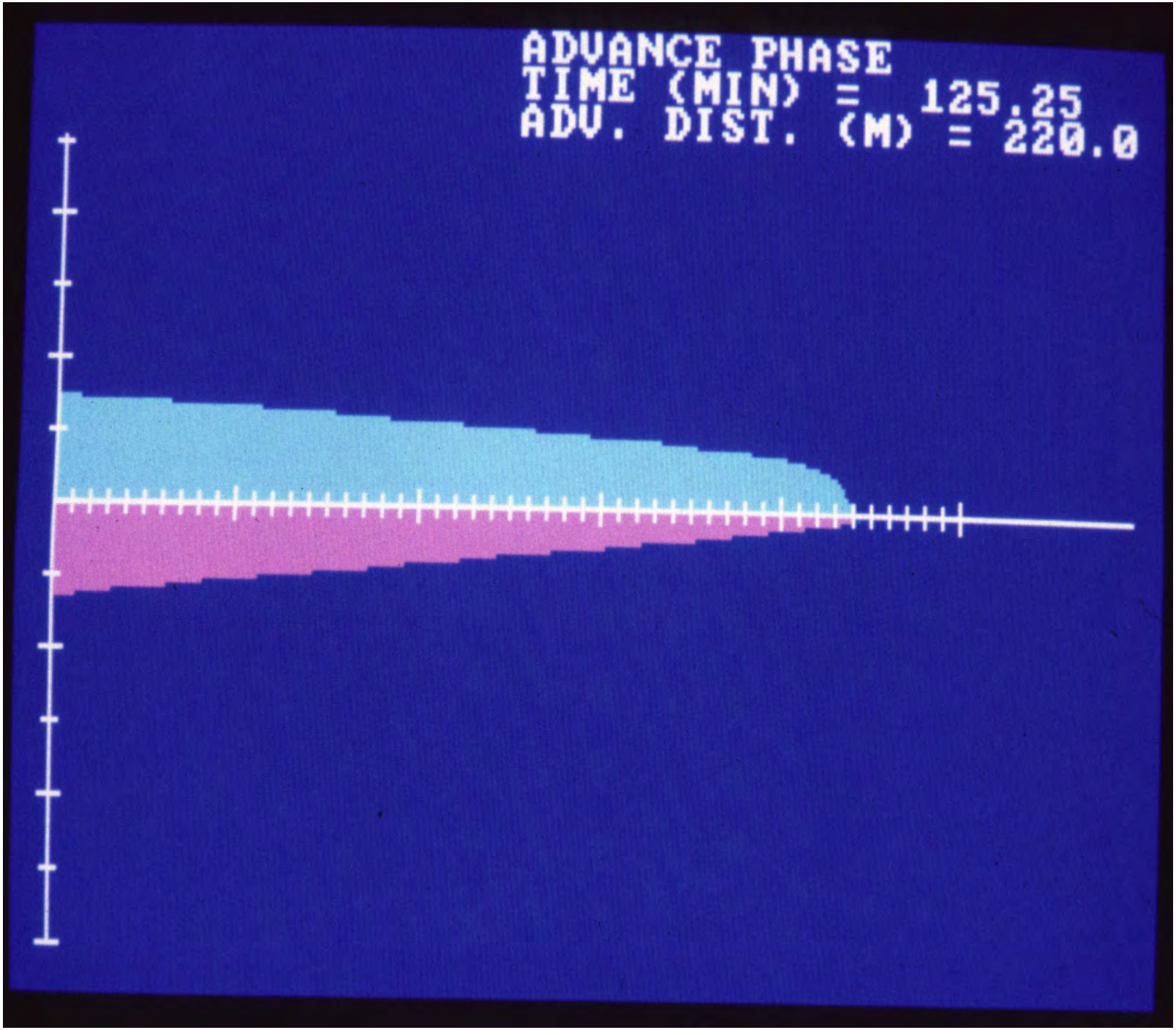
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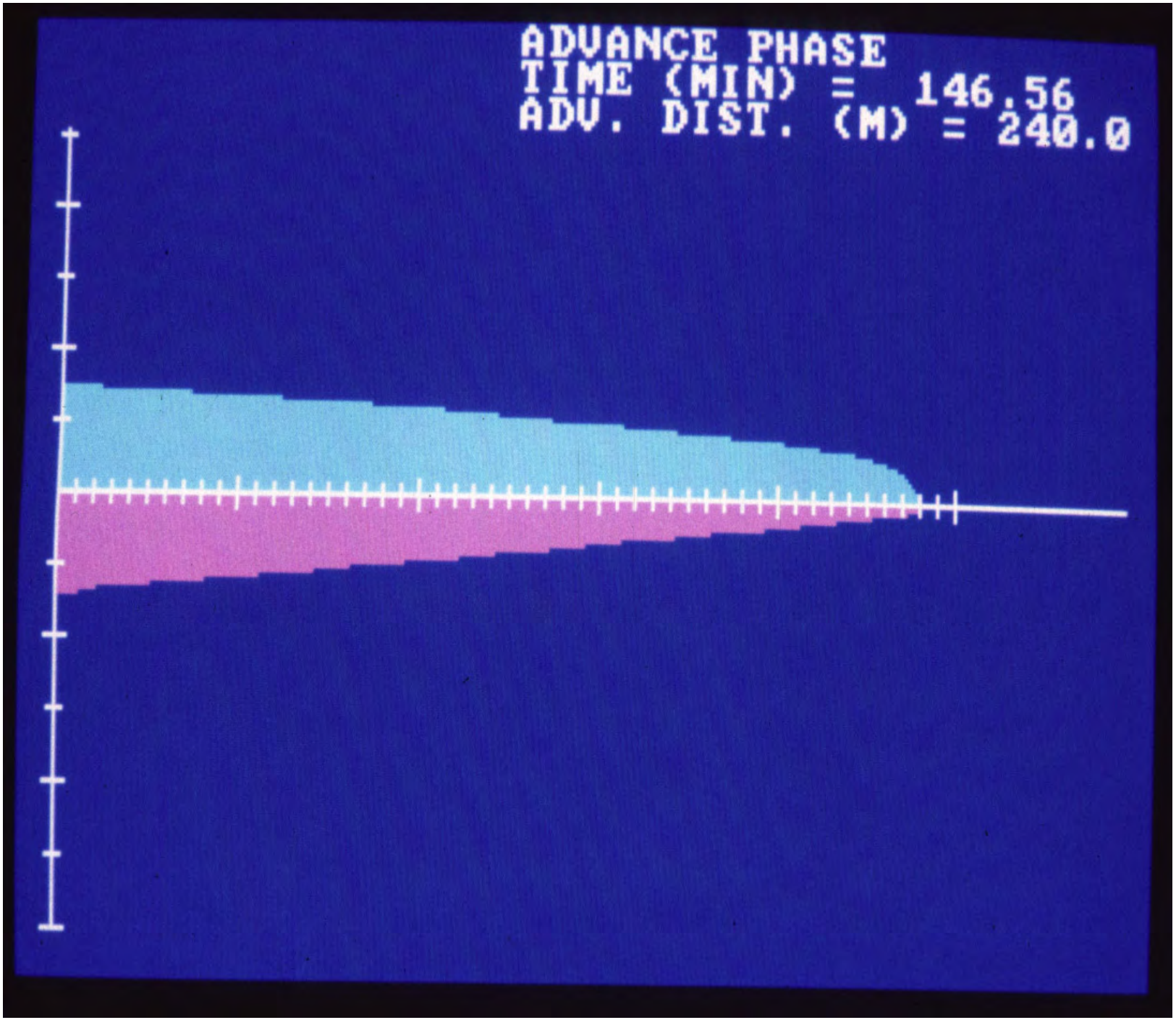
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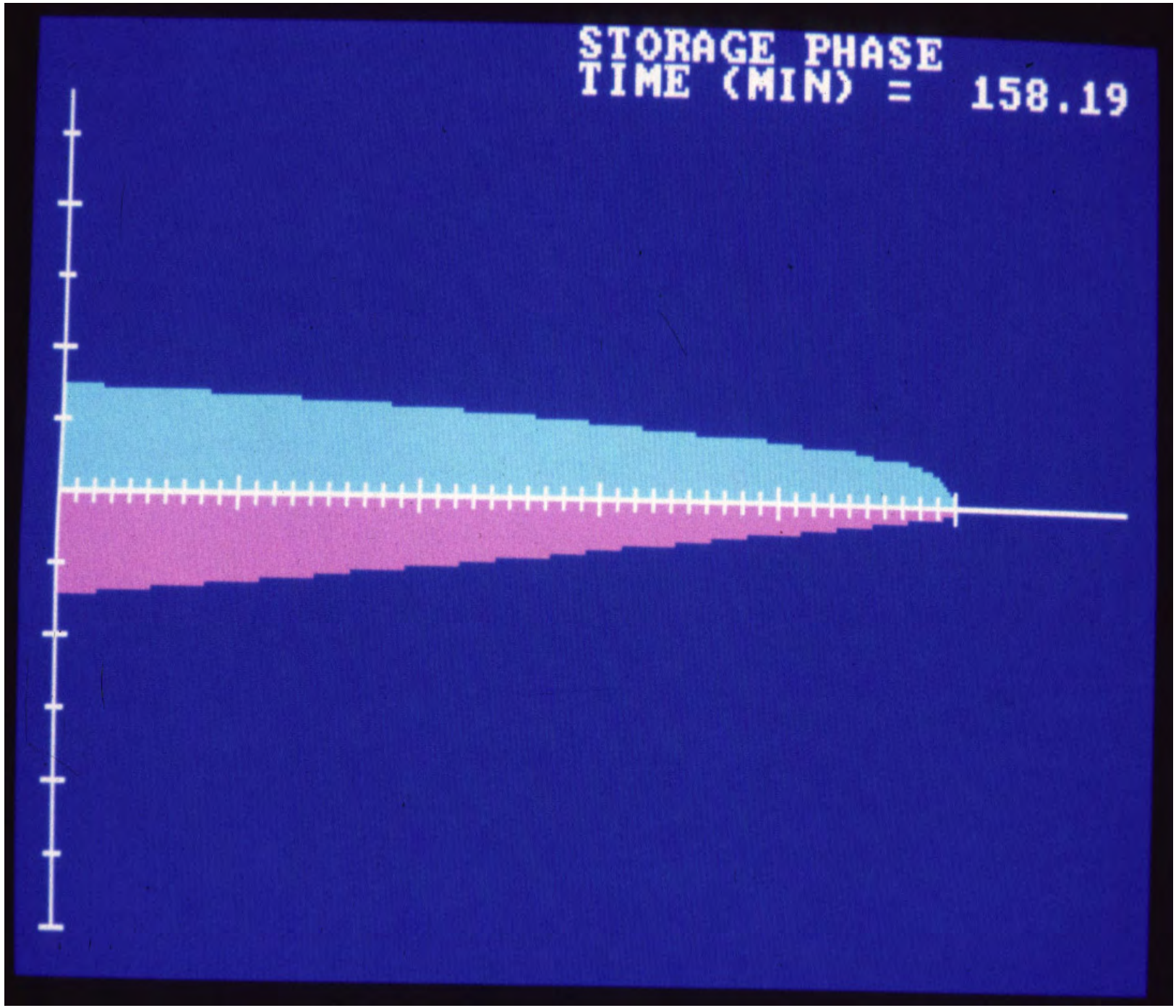
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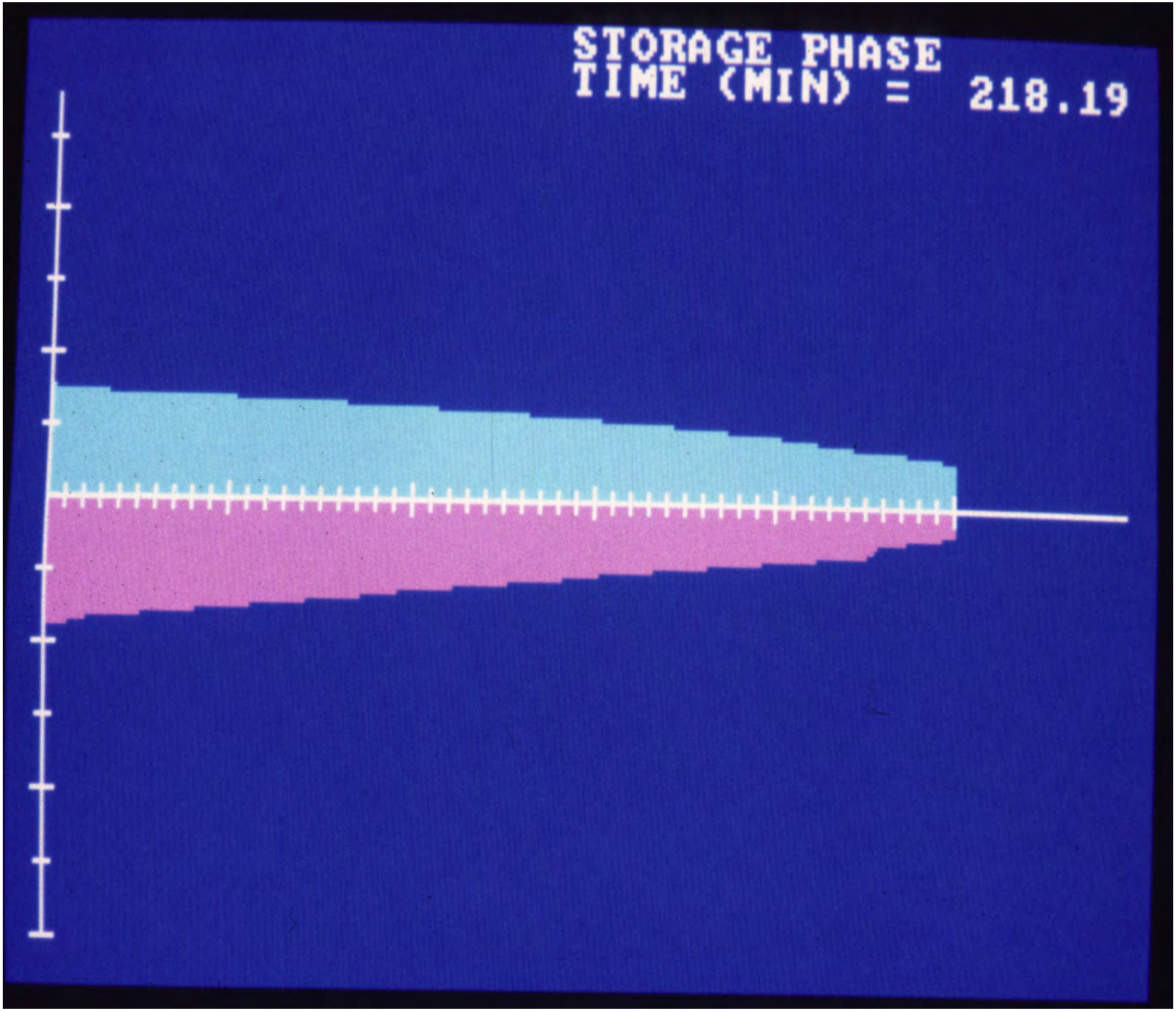
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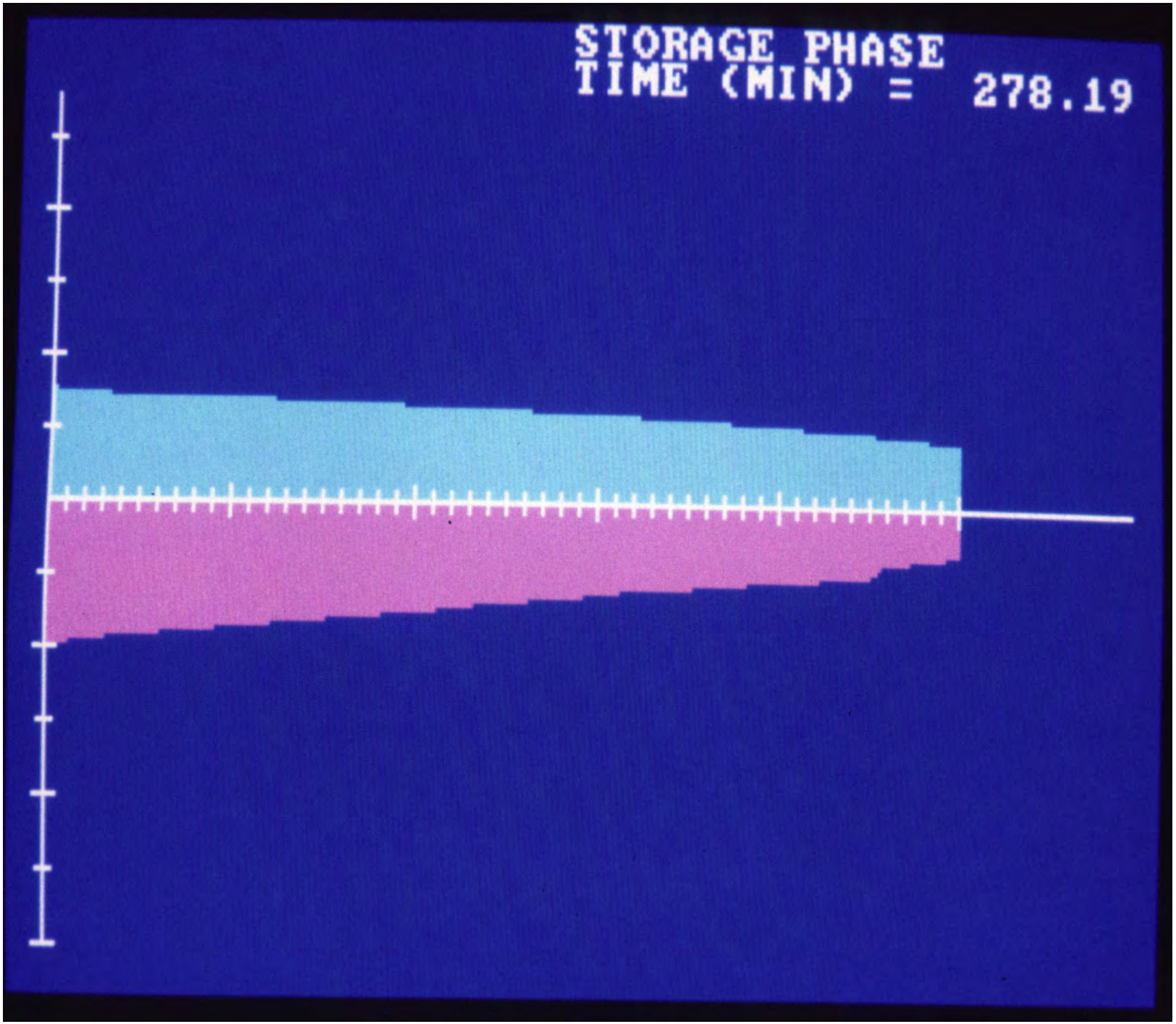
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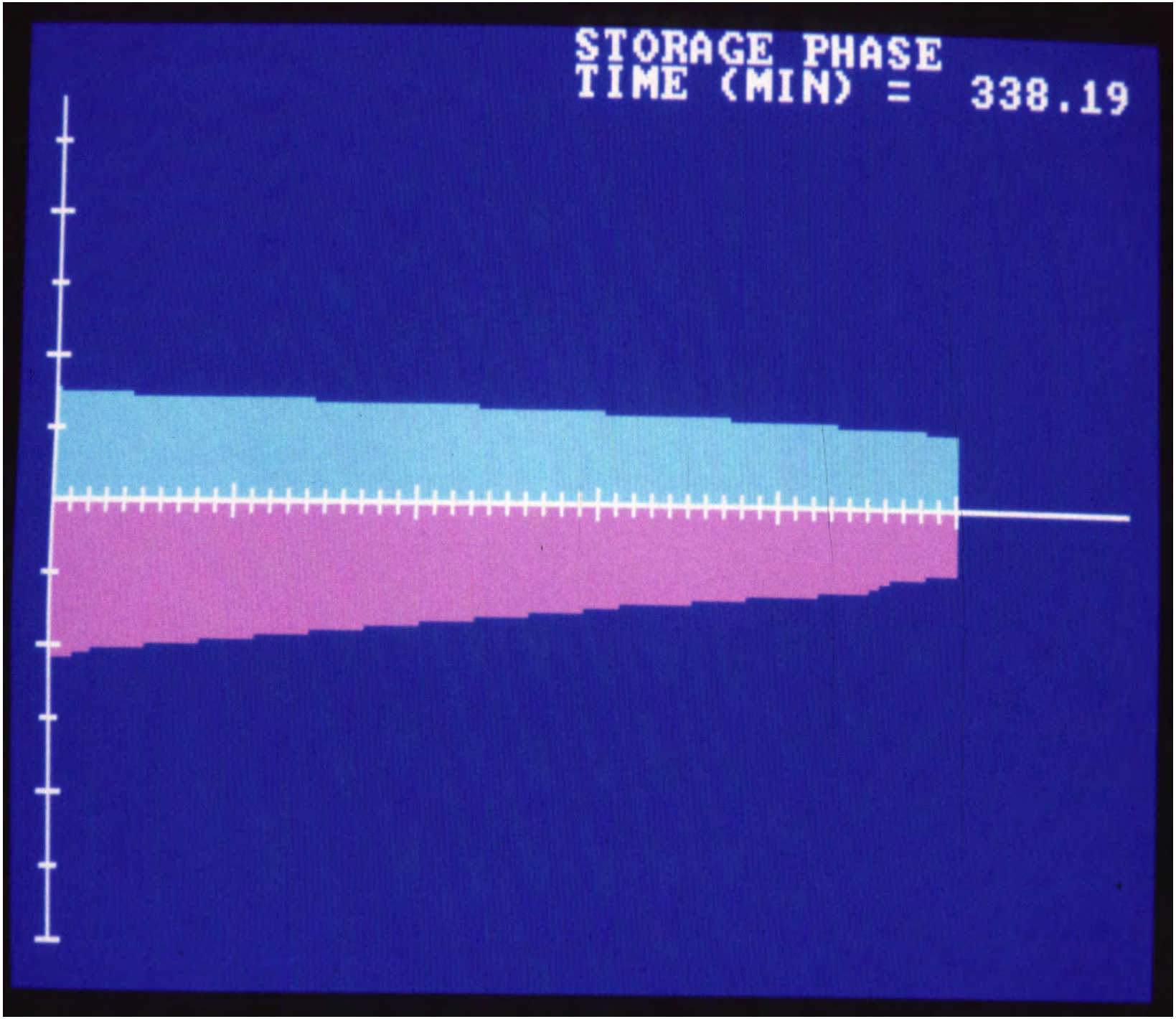
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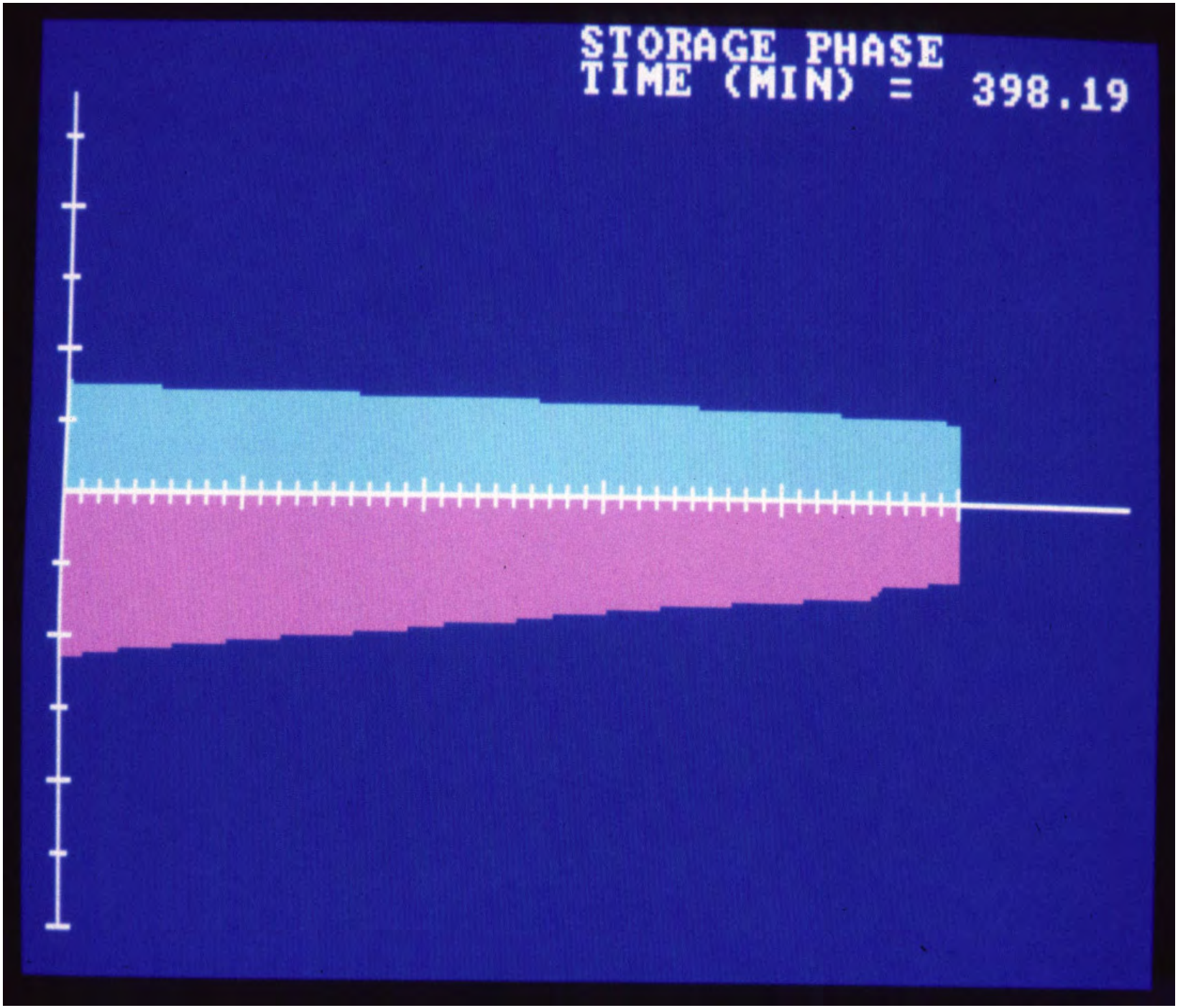
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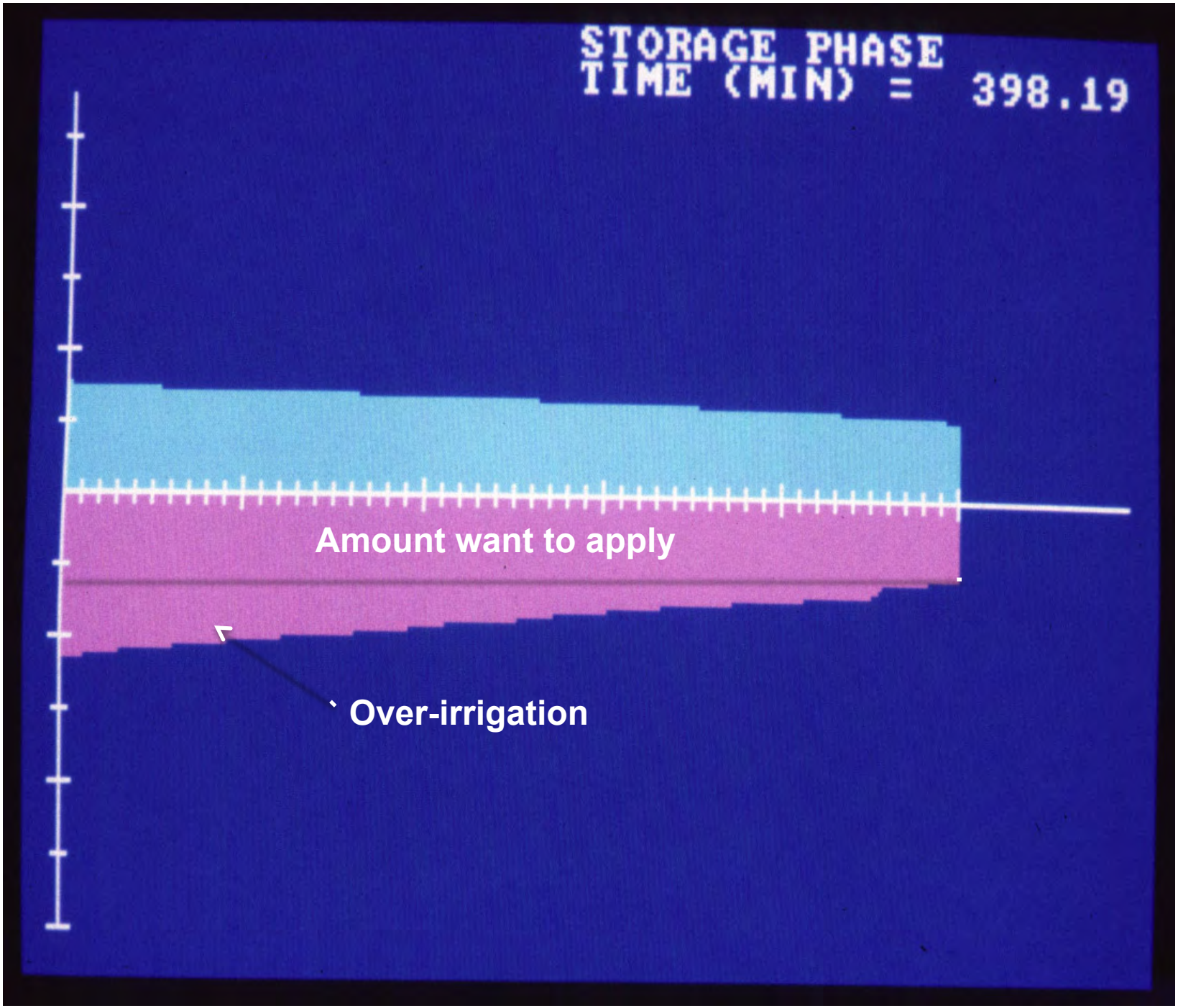
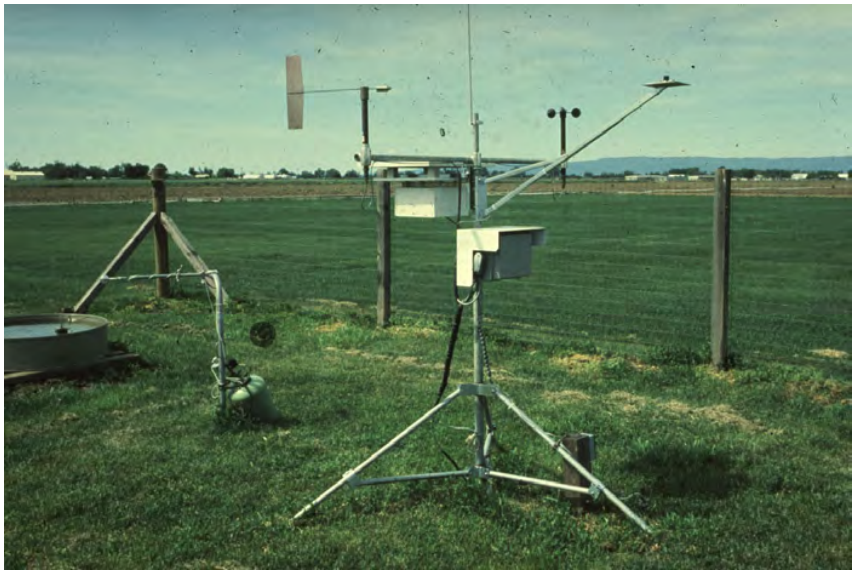

STORAGE PHASE
TIME (MIN) = 398.19
Amount want to apply
Over-irrigation

Surface Irrigation

- Losses can be from deep percolation and tailwater runoff.
  - Minimize runoff losses by Tailwater Return Systems.
  - Deep percolation losses can be reduced by;
    - Irrigating the right amount at the right time (irrigation scheduling)



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  - Minimize runoff losses by Tailwater Return Systems.
  - Deep percolation losses can be reduced by;
    - Irrigating the right amount at the right time (irrigation scheduling)
    - Having a well designed system (right length field, right flow rate, etc.). Can then have good uniformity.

Irrigation Application Uniformity

- A measure of how evenly water is applied to the field. Applies to surface, sprinkler, and microirrigation.

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- If the irrigation system is non-uniform, you have to apply additional water (to the entire field) to make sure the areas of the field receiving the least water gets adequately irrigated.

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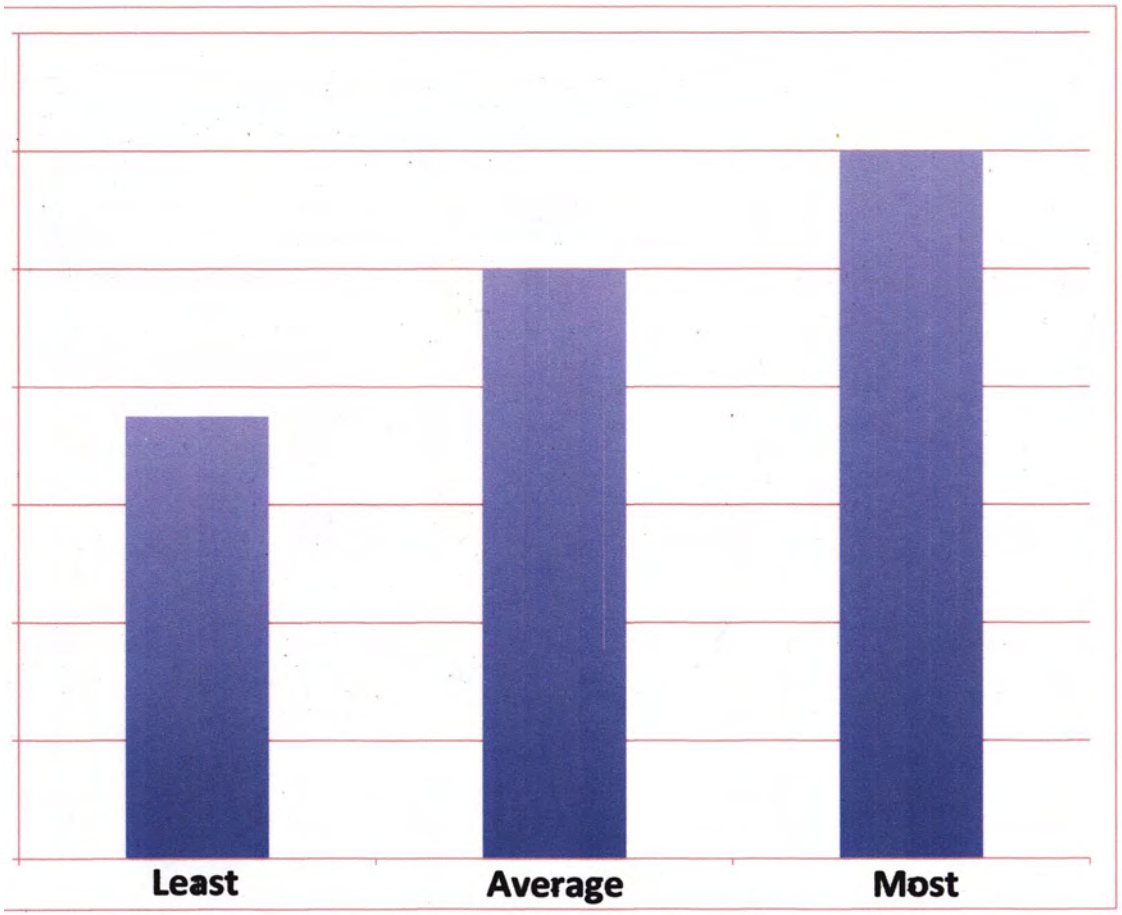

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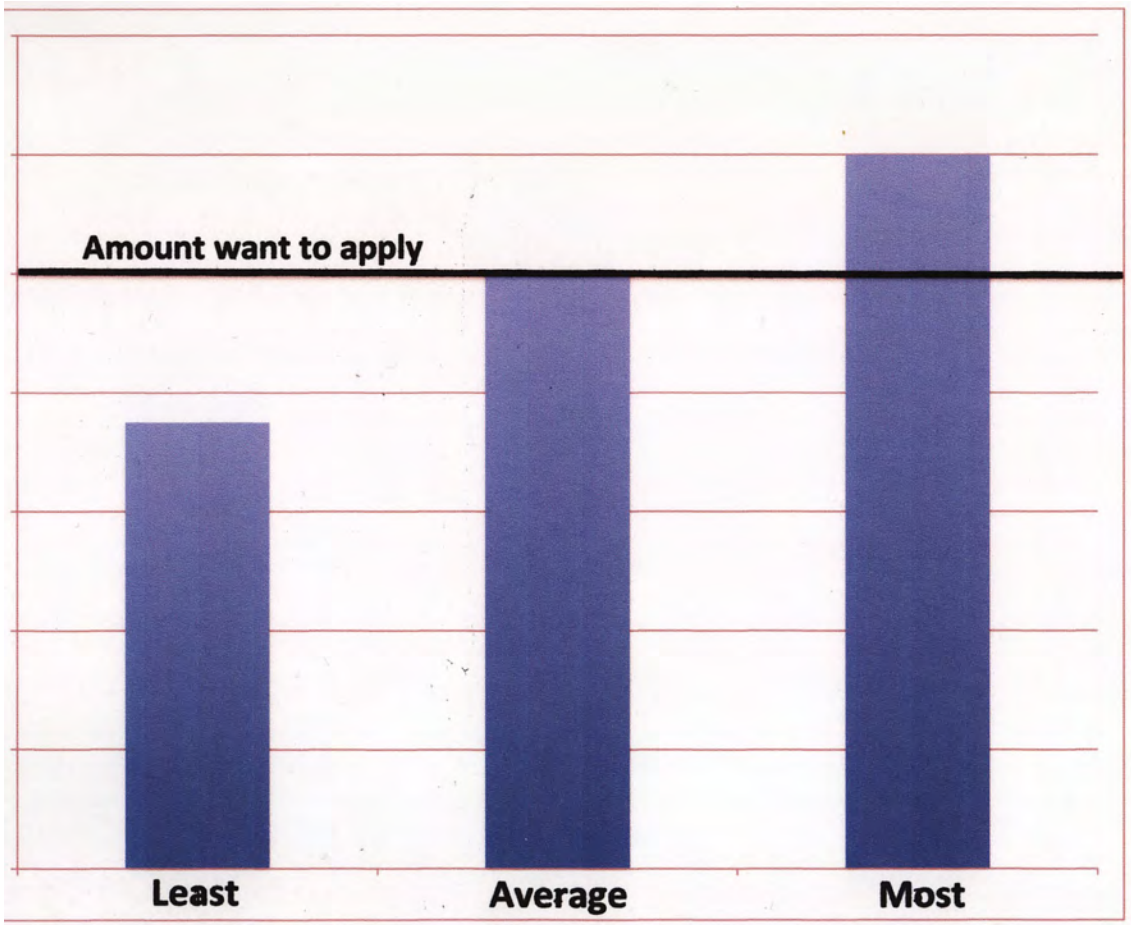

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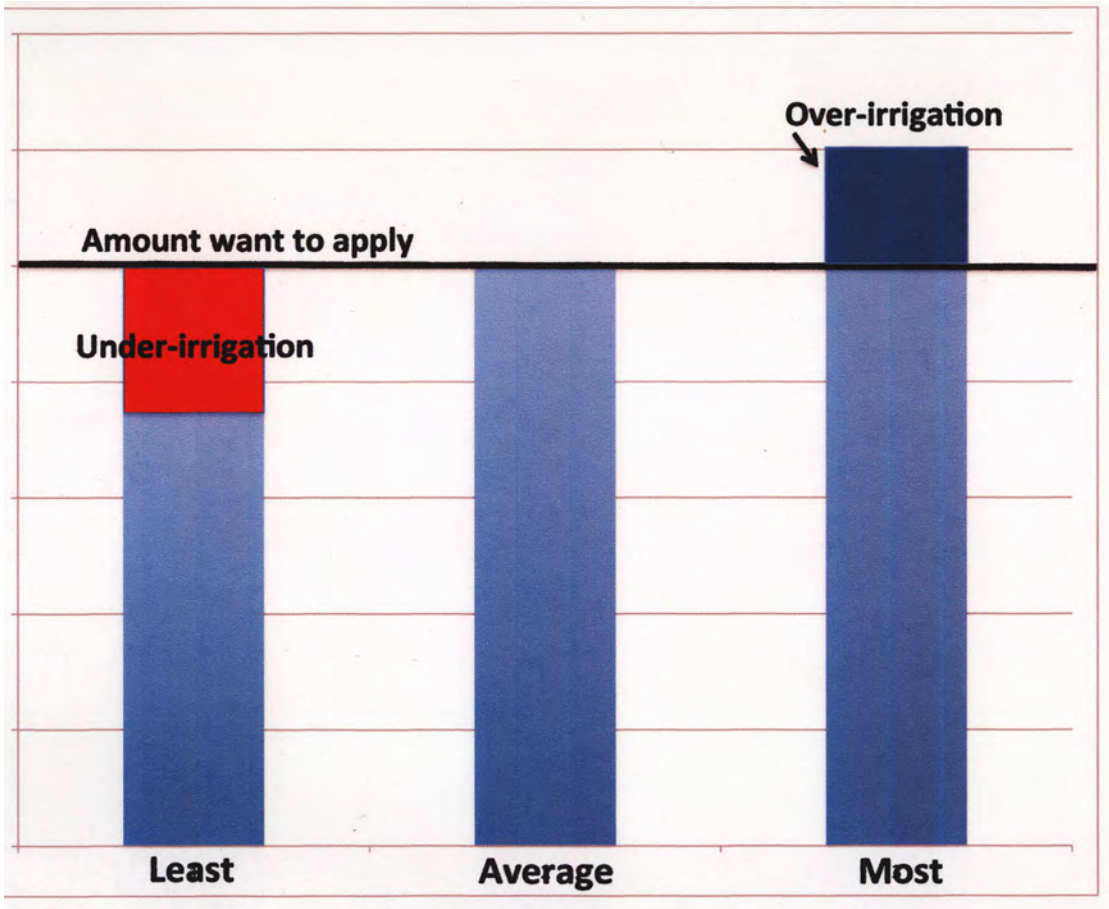

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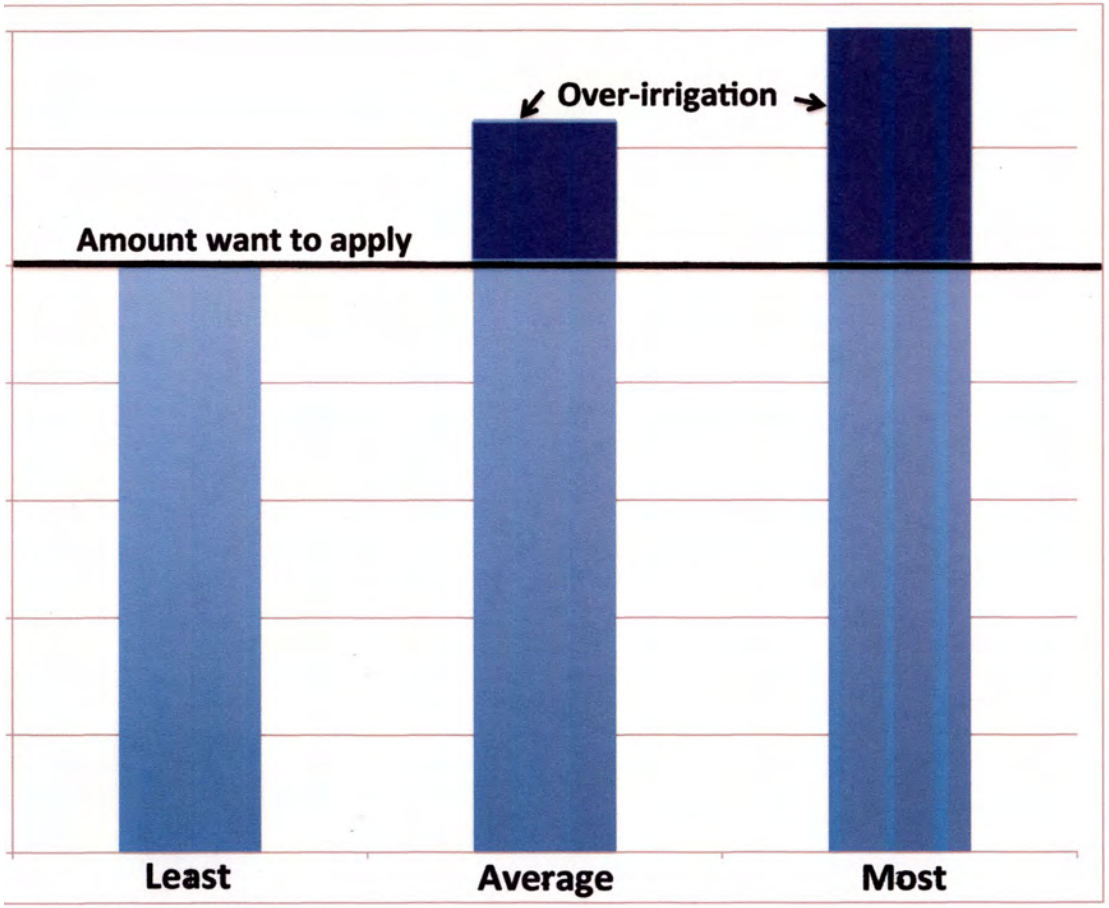

Surface Irrigation

- Losses can be from deep percolation and tailwater runoff.
- Good management needed when adding nutrients to irrigation water.
  - Know how much water and nutrient is being applied!

Sprinkler Irrigation

- Should be minimal runoff losses if designed correctly.

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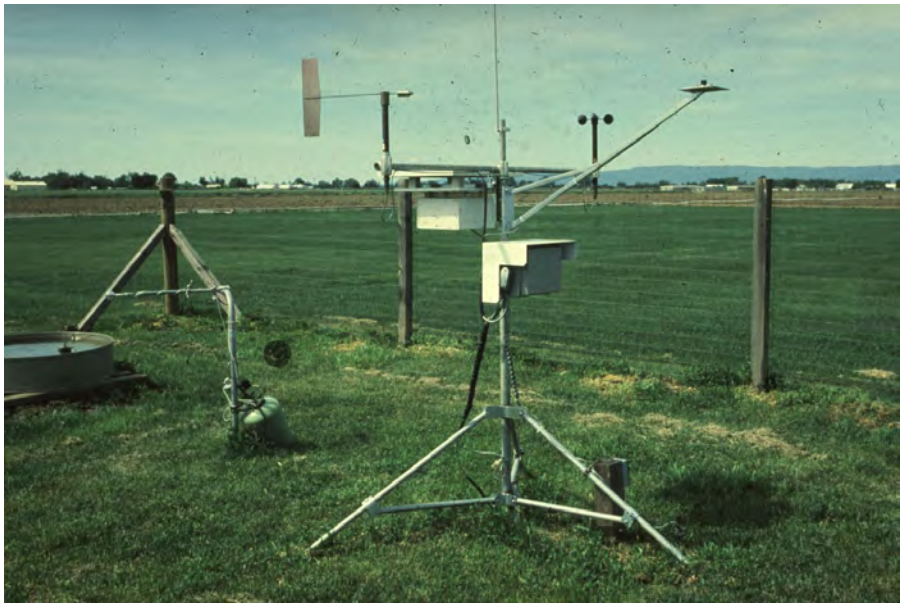
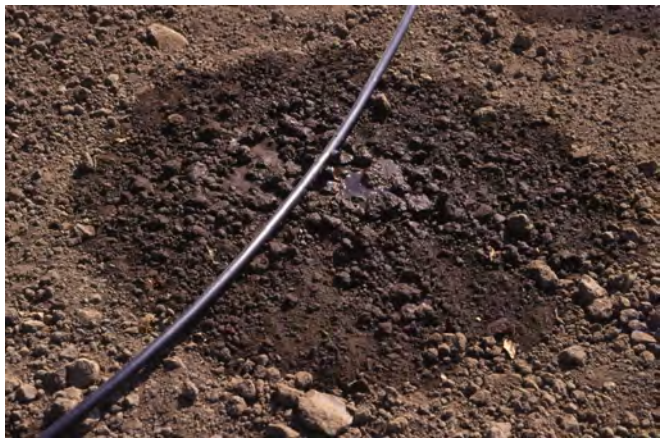
- Deep percolation losses can be minimized by good irrigation scheduling. Hardware gives better control.



Microirrigation Irrigation

- Minimal runoff.



Microirrigation Irrigation

- Minimal runoff.
- Deep percolation losses can be minimized with good irrigation scheduling. Again, hardware provides better control.

Nitrate and leaching

- Good irrigation water management goes a long ways toward achieving good nutrient management.
  - Is it true that "because we use microirrigation, we don't cause any leaching?"

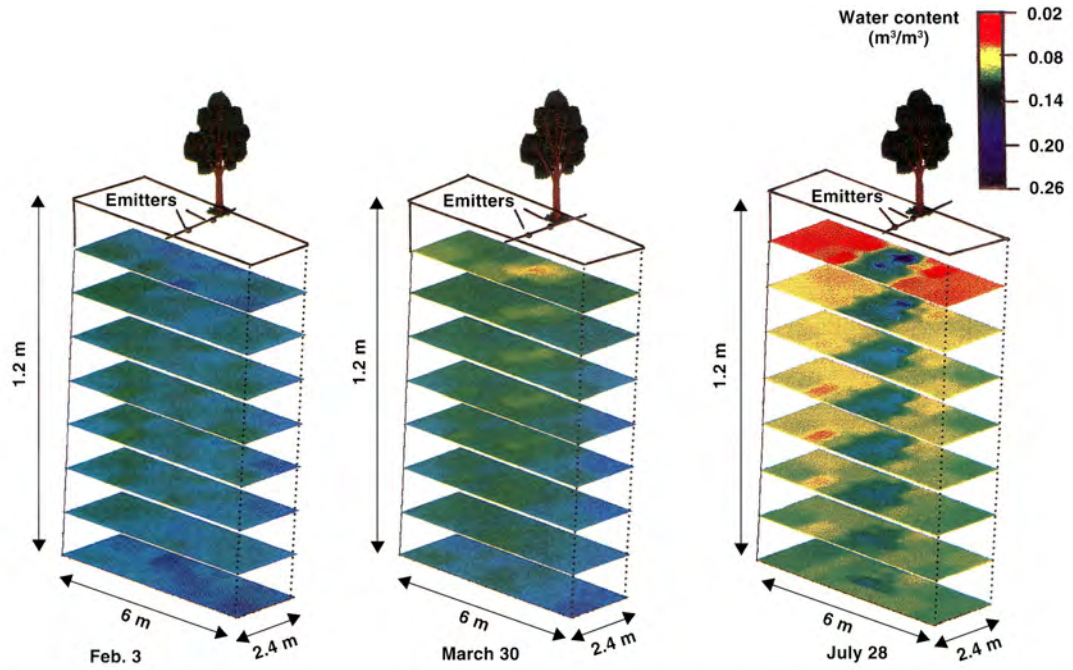


Fig. 1. Soil moisture distribution around an almond tree for 3 days in 1995: Feb. 3, soil moisture profile refilled by winter rains; March 30, soil moisture profile just before beginning irrigations; and July 28, soil moisture profile typical of that under surface drip irrigation during the growing season.

Summary - What are the challenges?

- Determine the crop water needs so you can apply the correct amount of water at the correct time

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- Determine the crop water needs so you can apply the correct amount of water at the correct time.
- Operate the irrigation system the correct amount of time to replace the desired amount of soil water.
  - Application rate of the irrigation system.
  - Uniformity of the the irrigation system.

Summary - What are the challenges?

- Determine the crop water needs so you can apply the correct amount of water at the correct time.
- Operate the irrigation system the correct amount of time to replace the desired amount of soil water.
- Apply the N at the correct amount and at the correct time.

Summary - What are the challenges?

- Determine the tree water needs so you can apply the correct amount of water at the correct time.
- Operate the irrigation system the correct amount of time to replace the soil water used since the last irrigation.
- Apply the N at the correct amount and at the correct time.
- Don't want excess nitrate in the soil going into the winter rain period since it could be leached by rainfall.

Questions?

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For Powerpoint presentation go to:

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