WG3 Summary

"New Challenges in theory and Modelling"

Guideline

- Increasing brightness :
  - New Ideas
  - Emittance compensation schemes and optimization
  - Space charge at intermediate energy in ERL
  - CSR & CSR microbunching, compression
  - New acceleration schemes
- Radiation Sources
  - Multiple stages Cascades / Higher order harmonics
  - Code design
  - Quantum Fel Theory and Simulation

Three main categories

- Beam Dynamics
- Laser Plasma Sources
- FEL and Radiation Sources

Beam dynamics

- J. Rosenzweig, Optimum Beam Creation in Photoinjectors using Space-charge Expansion I: Theory and Simulation
- V. Litvinienko, Preservation of Beam Quality in ERLs
- M. Migliorati, Simulations of Coherent Synchrotron Radiation Effects on Beam Dynamics
- Torsten Limberg, CSRTrack Overview and Simulations
- Valeria Fusco, Wake Fields Effects in a high brightness photoinjector
- Massimo Ferrario, Beam Dynamics Around Transition in a High Brightness Linac for Short Wavelength SASE-FEL (16:50 – 17:10) (20 min)
- Cristina Vaccarezza, First Simulations Results on Laser Pulse Jitter Sensitivity and Microbunching Instability at SPARXINO (17:10 – 17:30) (20 min)

Laser Plasma Sources

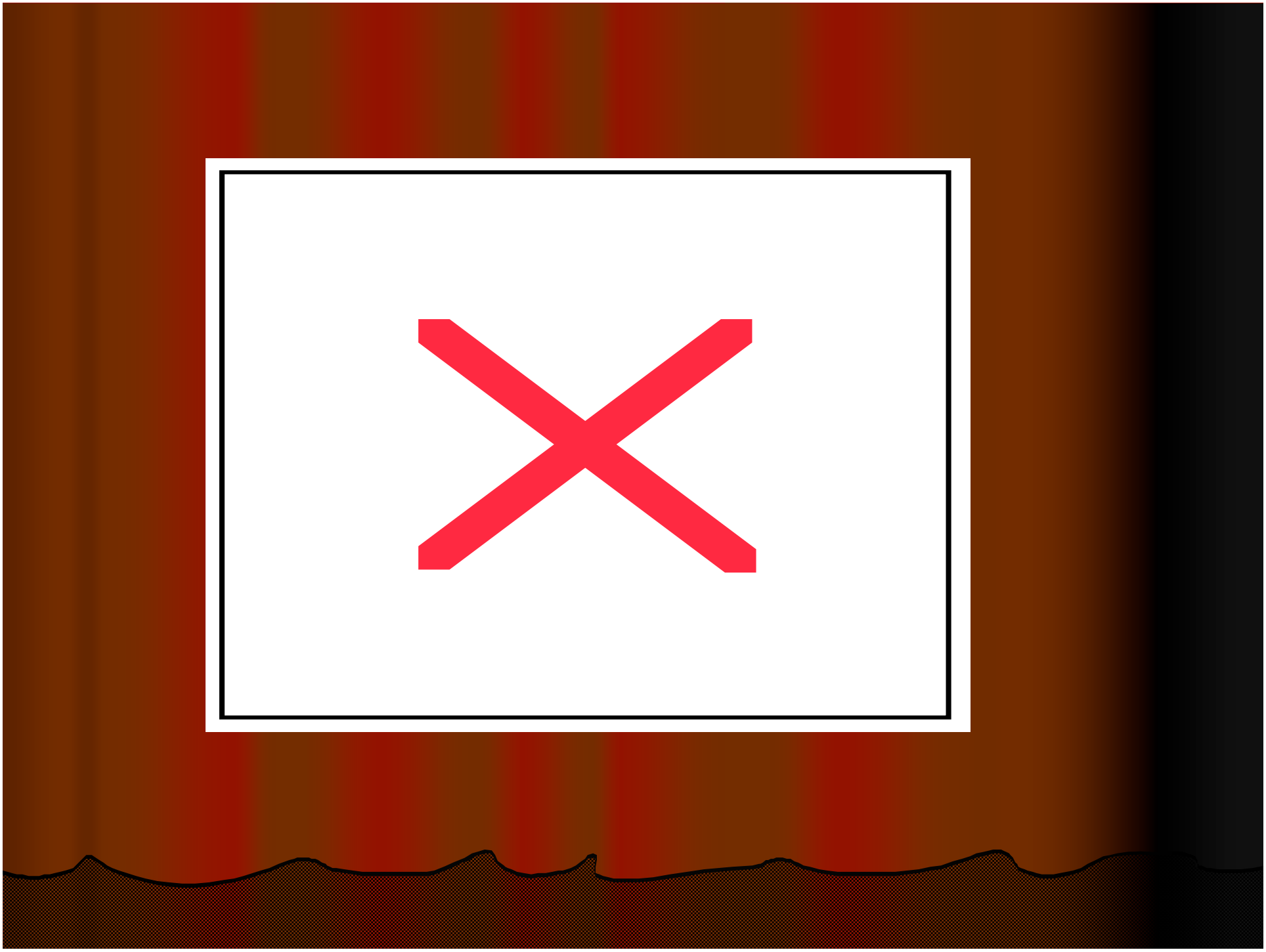
- Paolo Tomassini, Controlling the Compression of an Externally Injected Electron bunch in LWFA Accelerators via Background Density Shaping

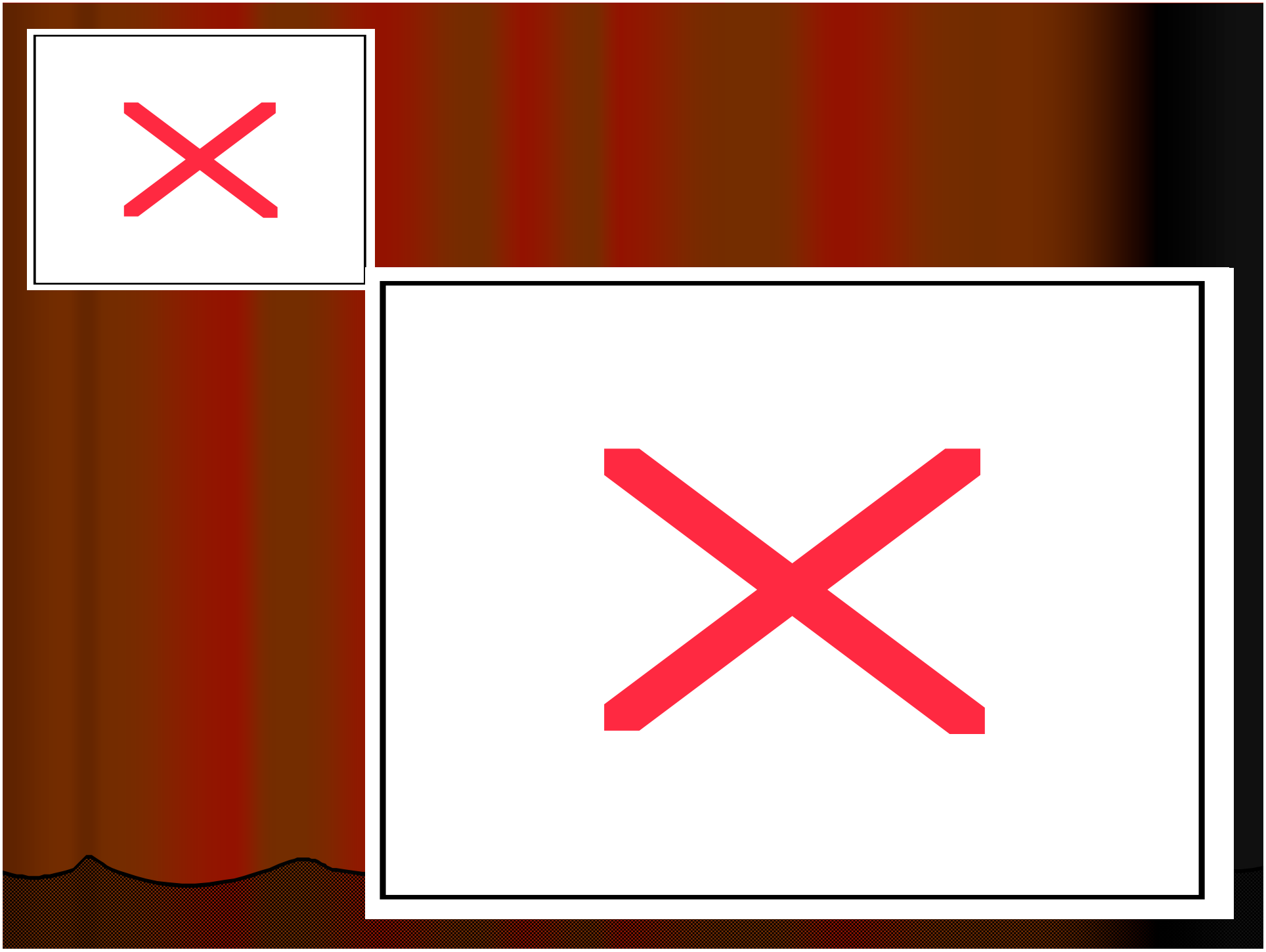
- Kenichi Kinoshita, Laser plasma cathode at University of Tokyo

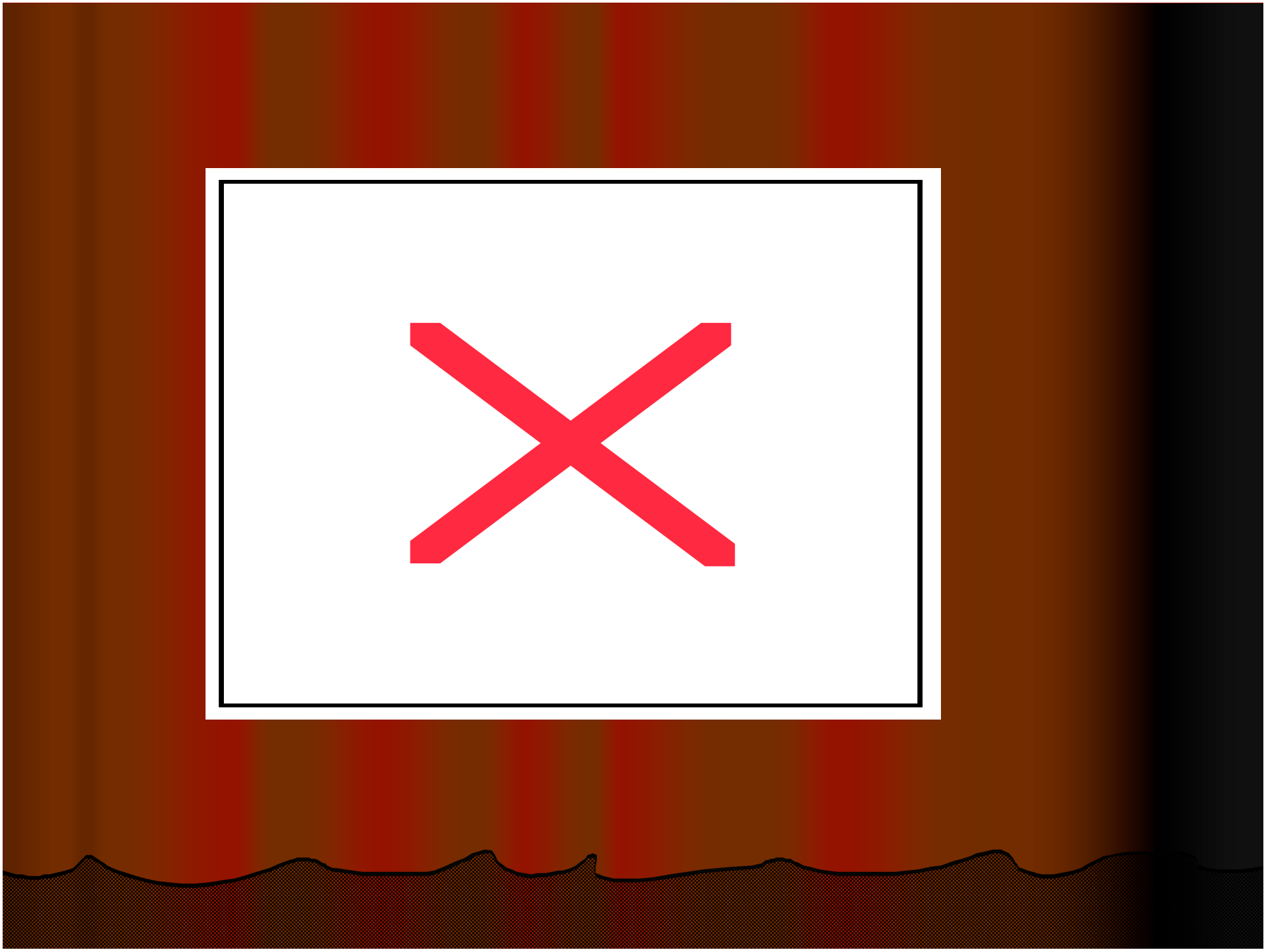
FEL and Radiation sources

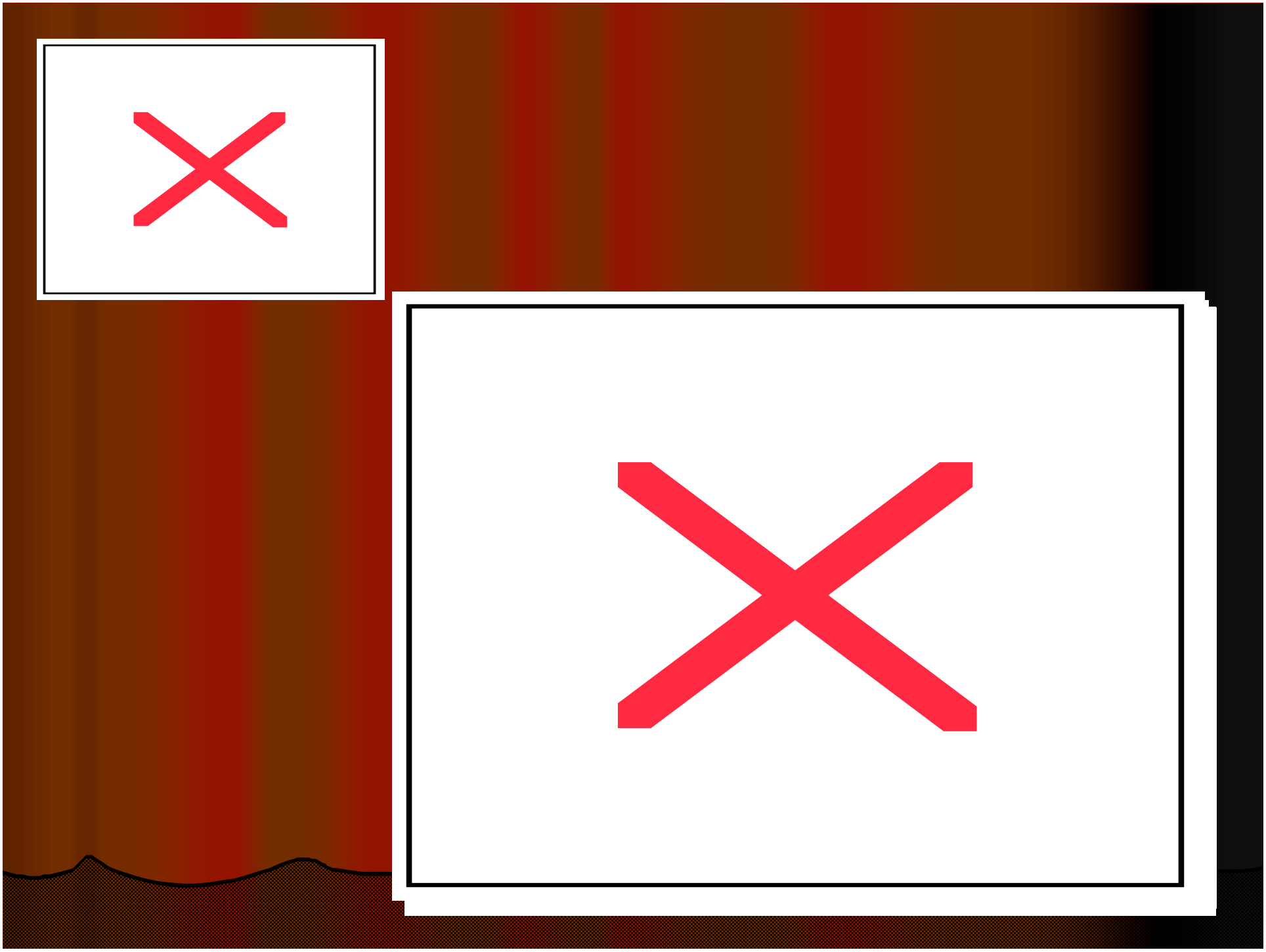
- Takahiro Watanabe, An experimental demonstration of superradiance in a single pass seeded FEL
- Sven Reiche, Numerical challenges for FEL
- Anatoliy Opanasenko, Wakefield Undulator Radiation
- Angelo Schiavi, Quantum FEL Numerical simulations
- K. J. Kim, Quantum effects in Gain and startup of Free Electron Laser-Wigner Function Approach
- Rodolfo Bonifacio, The Quantum FEL Experiment
- James Rosenzweig, Physical Limits on Narrow Band, inverse Compton Scattering X-ray Production: One Photon per Electron?

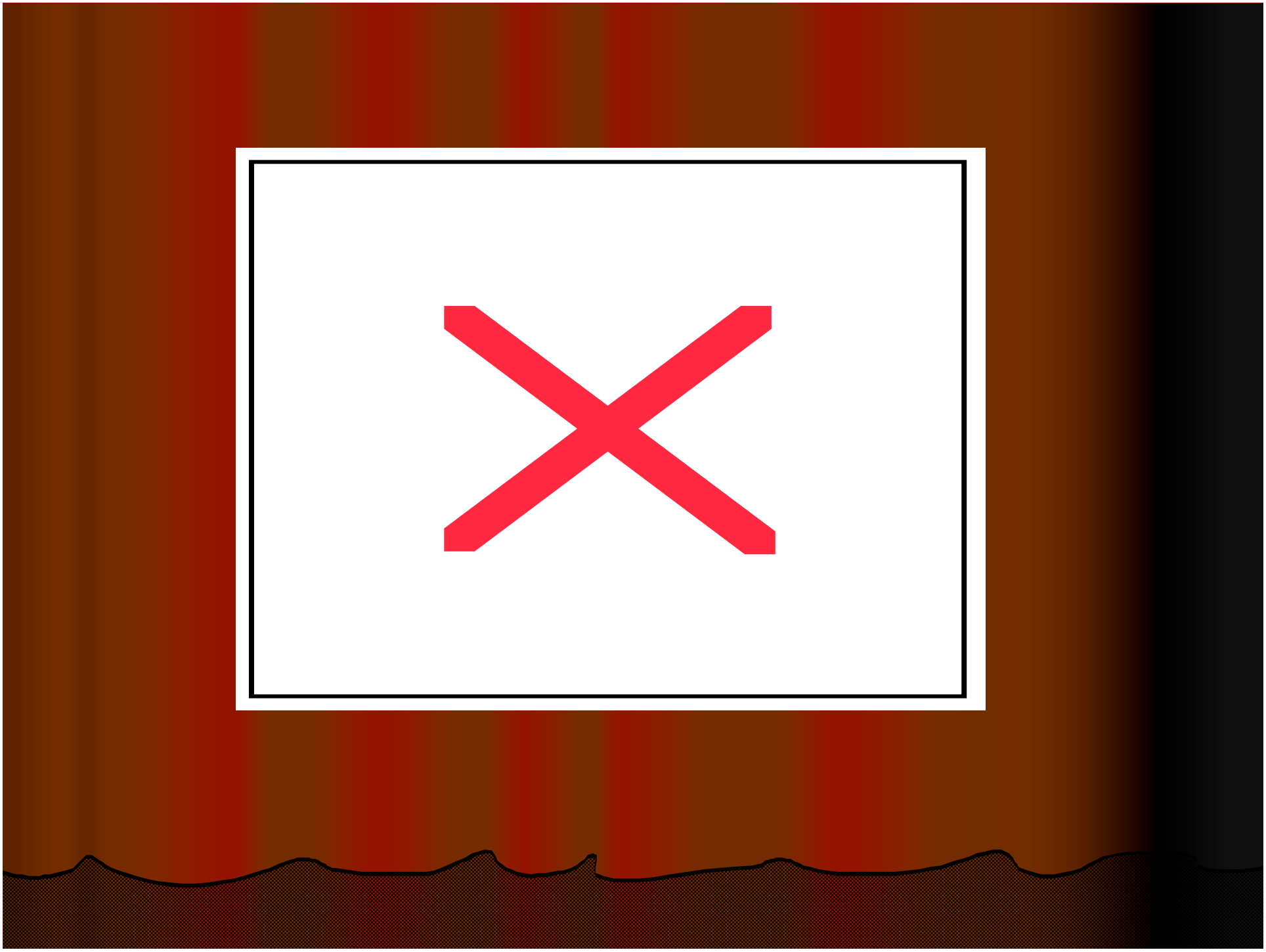
Beam Dynamics

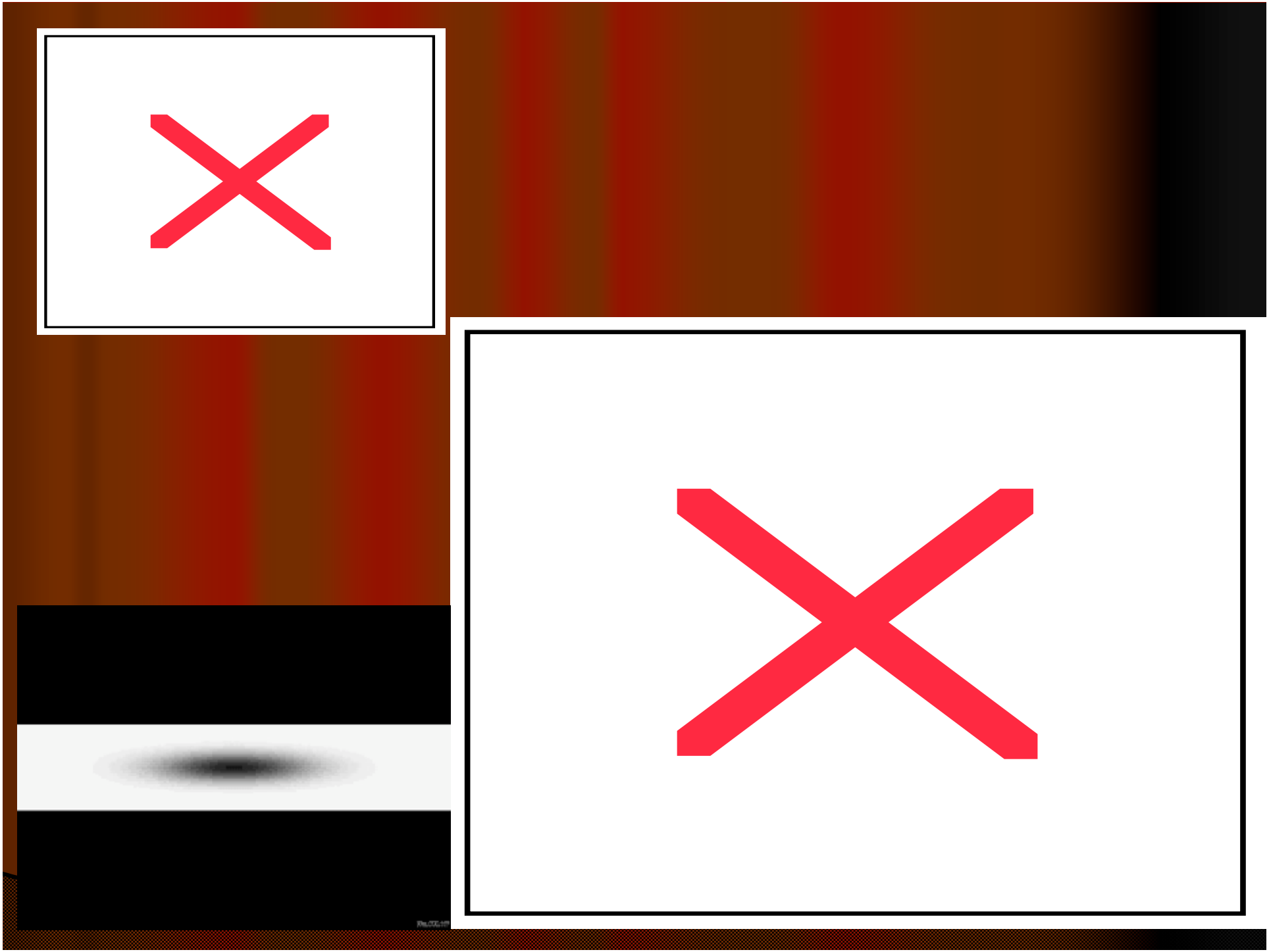


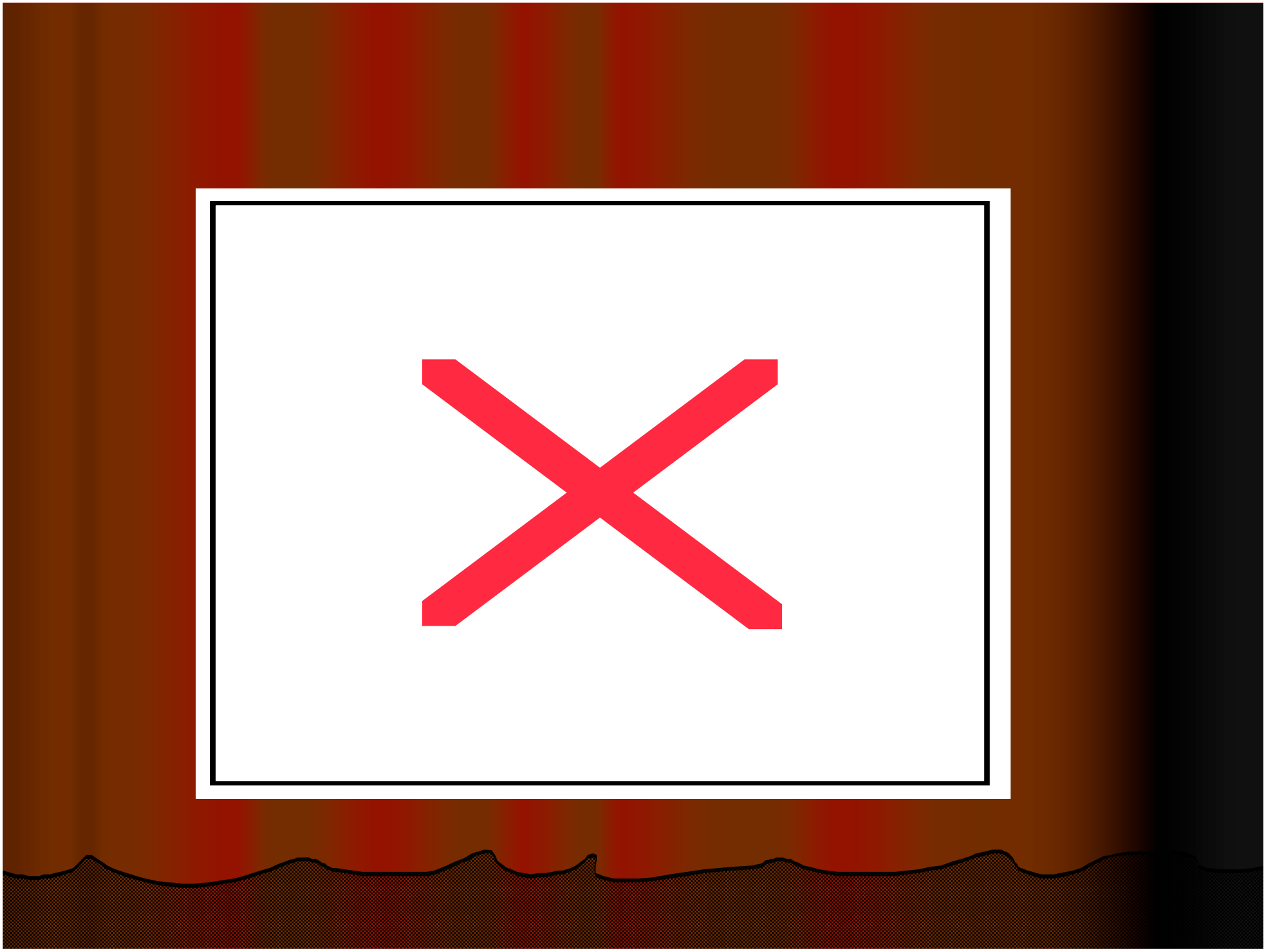


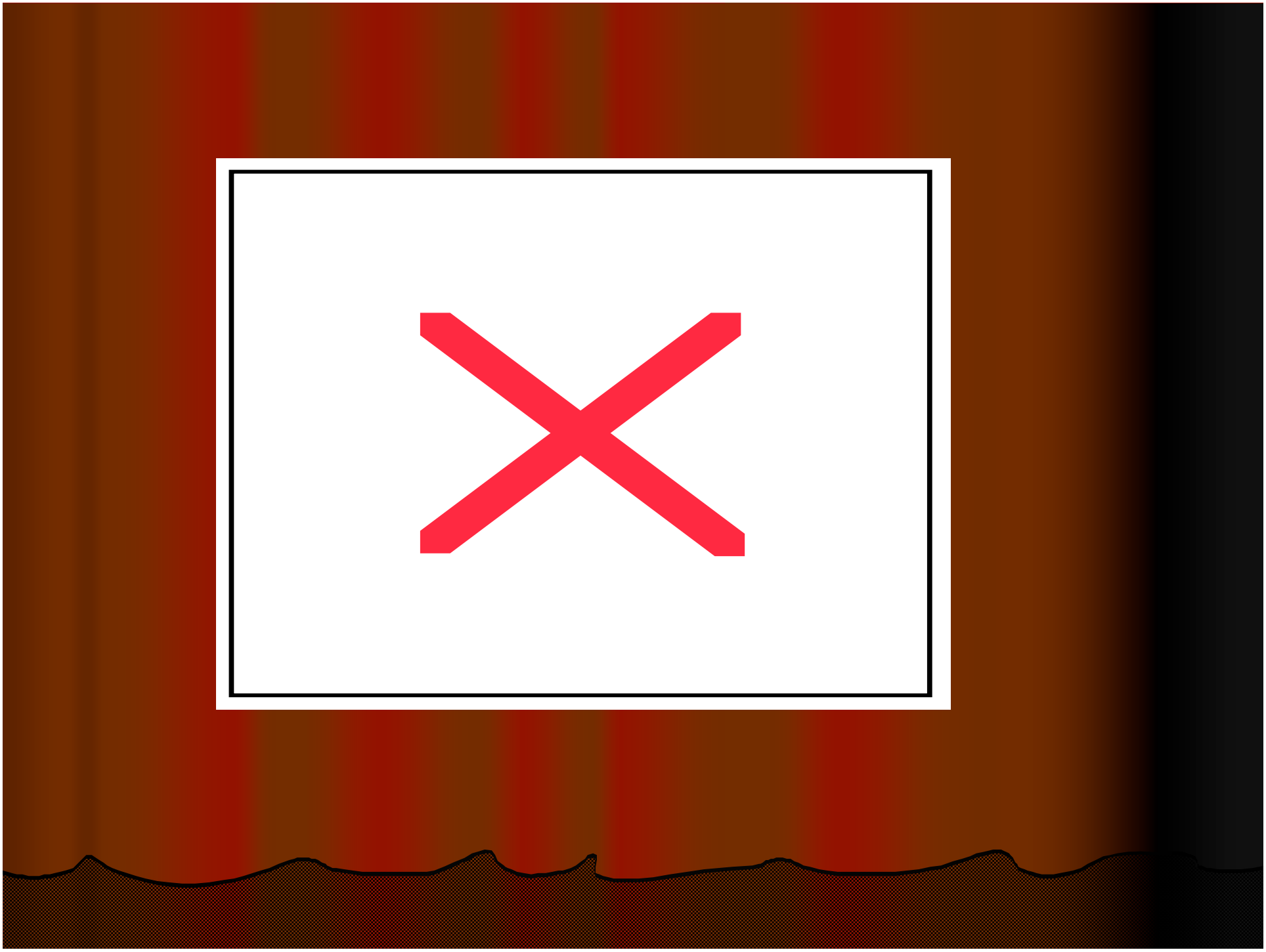


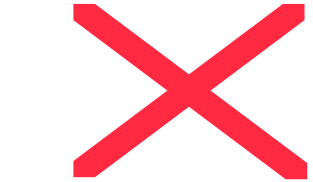


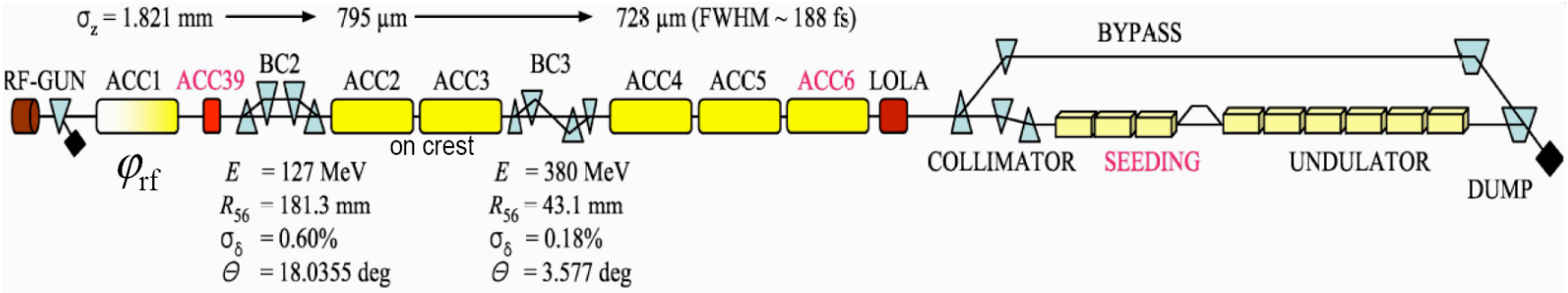


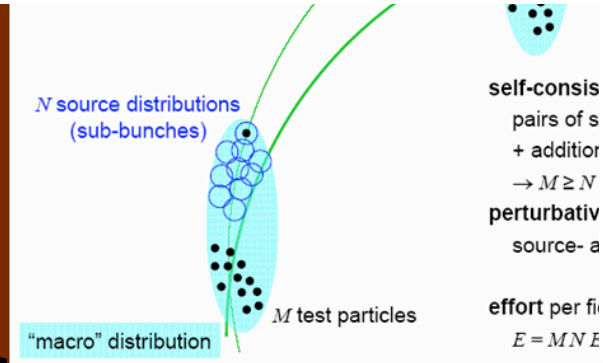












self-consis
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+ additior
→ M ≥ N
perturbativ
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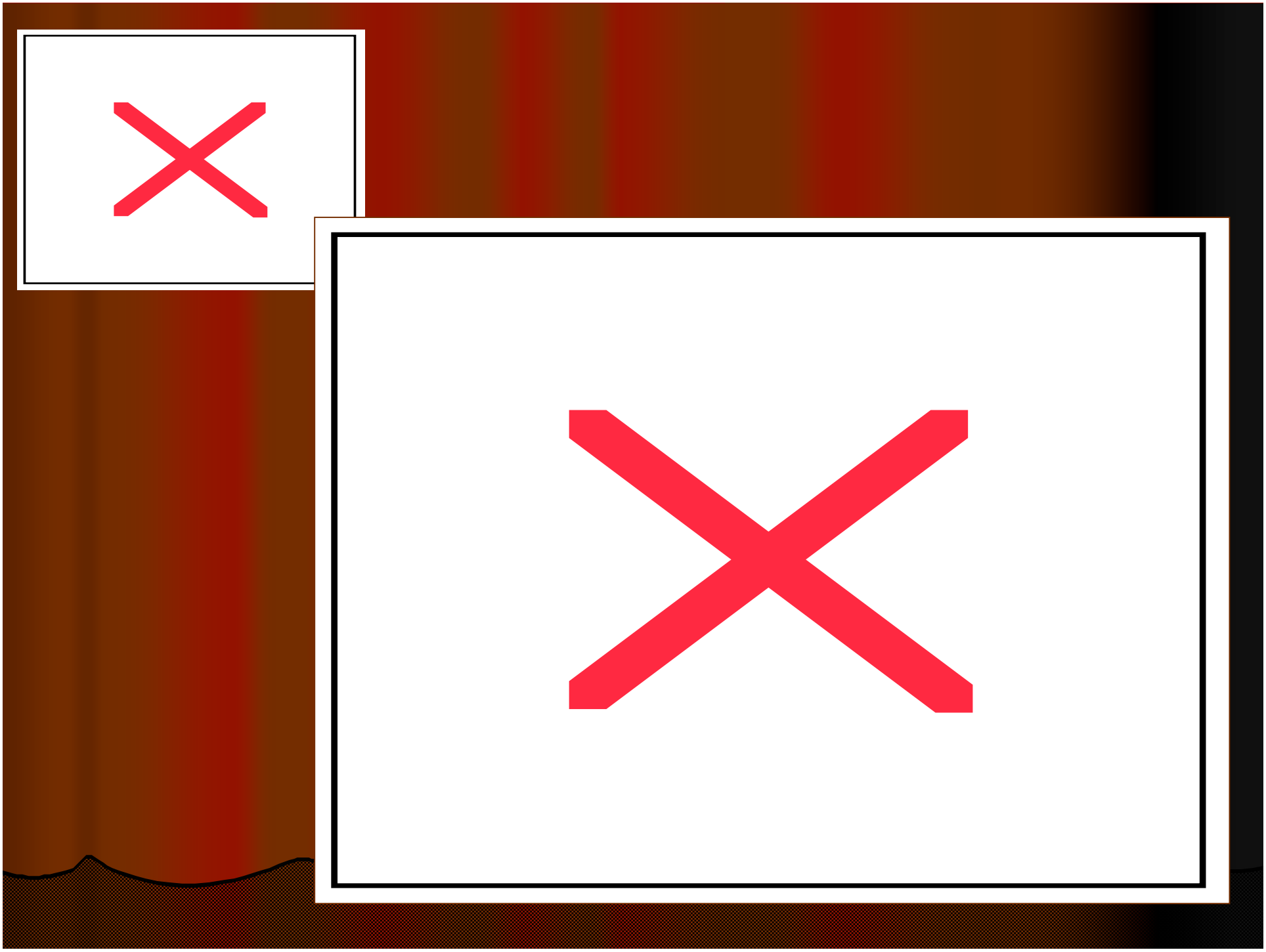
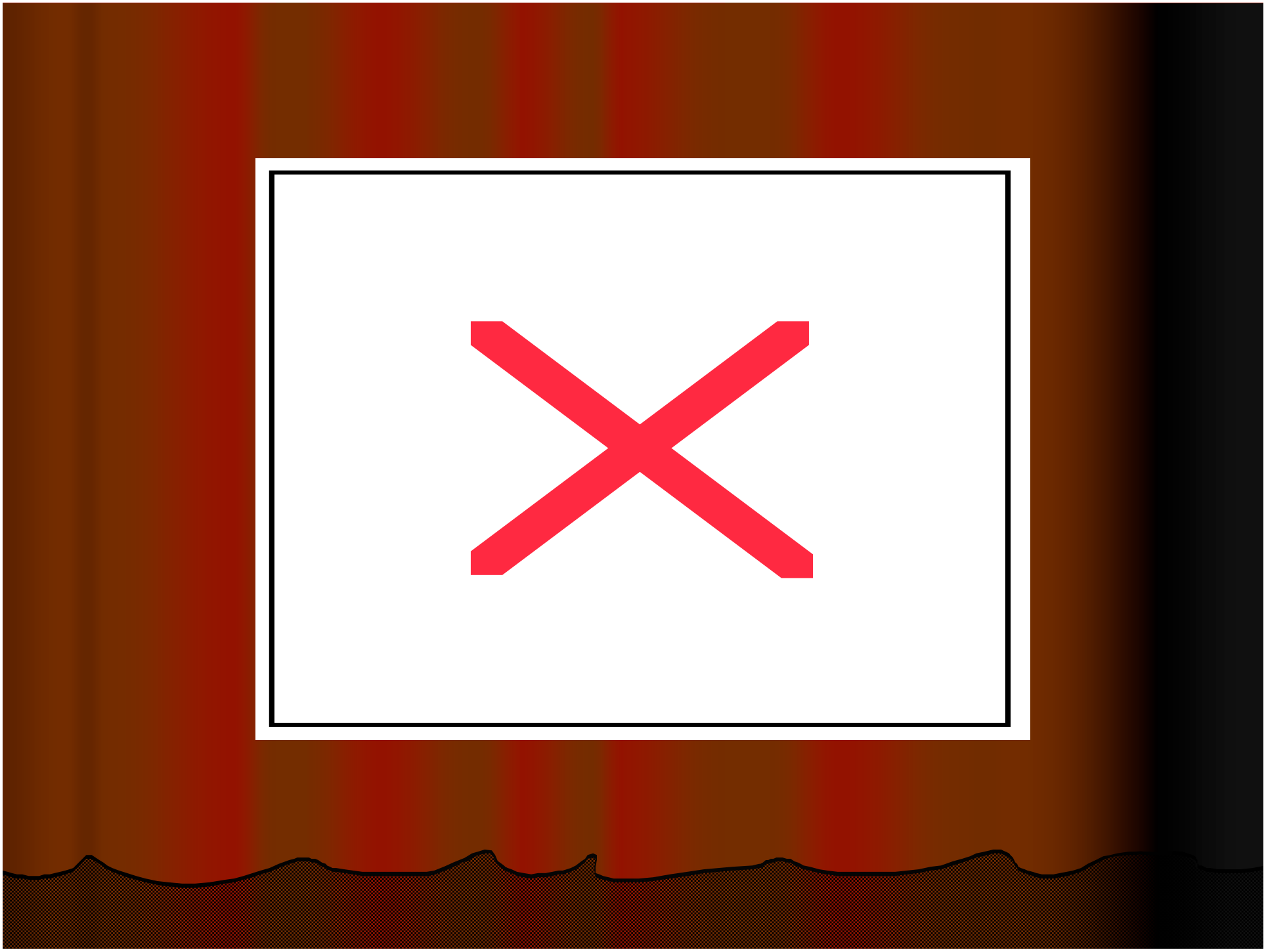
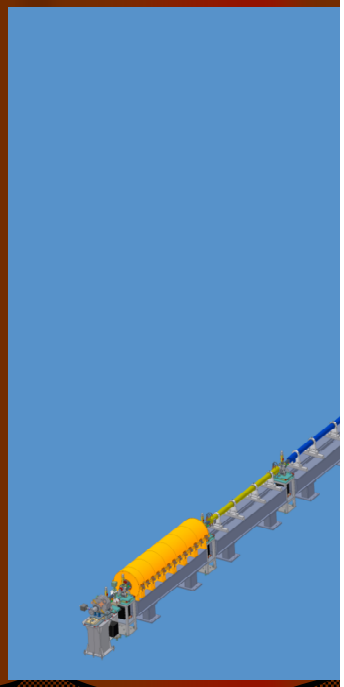
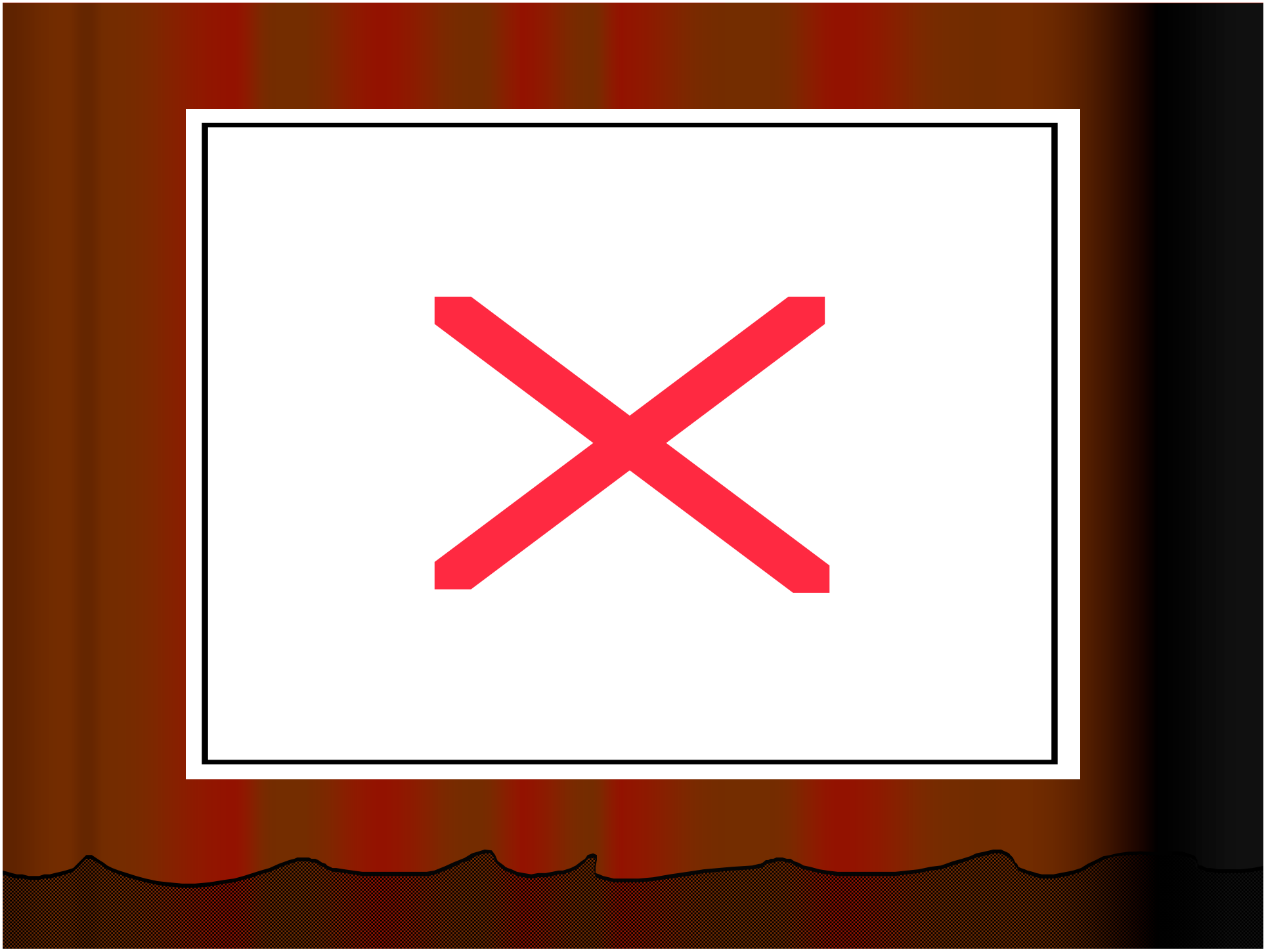
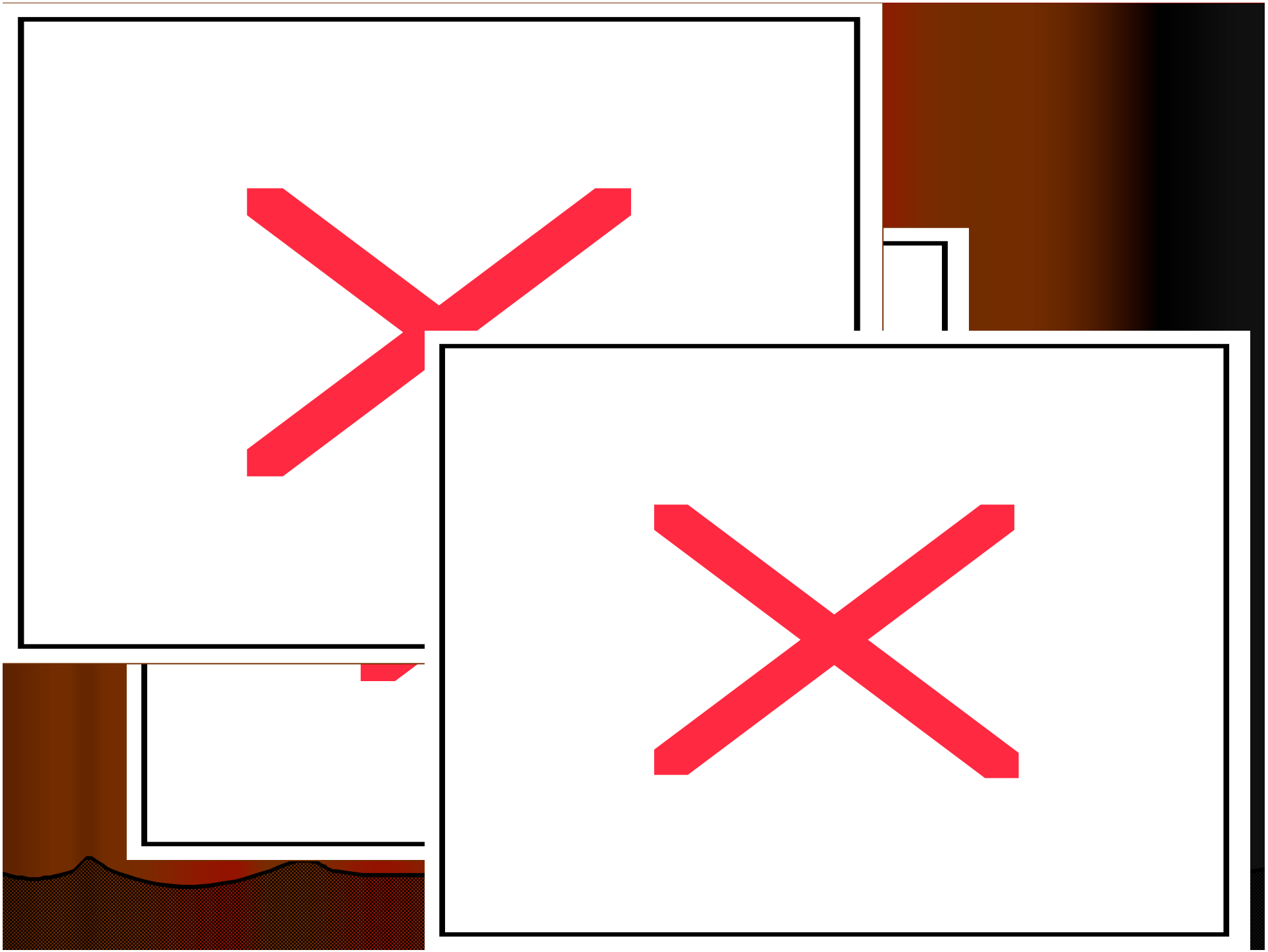
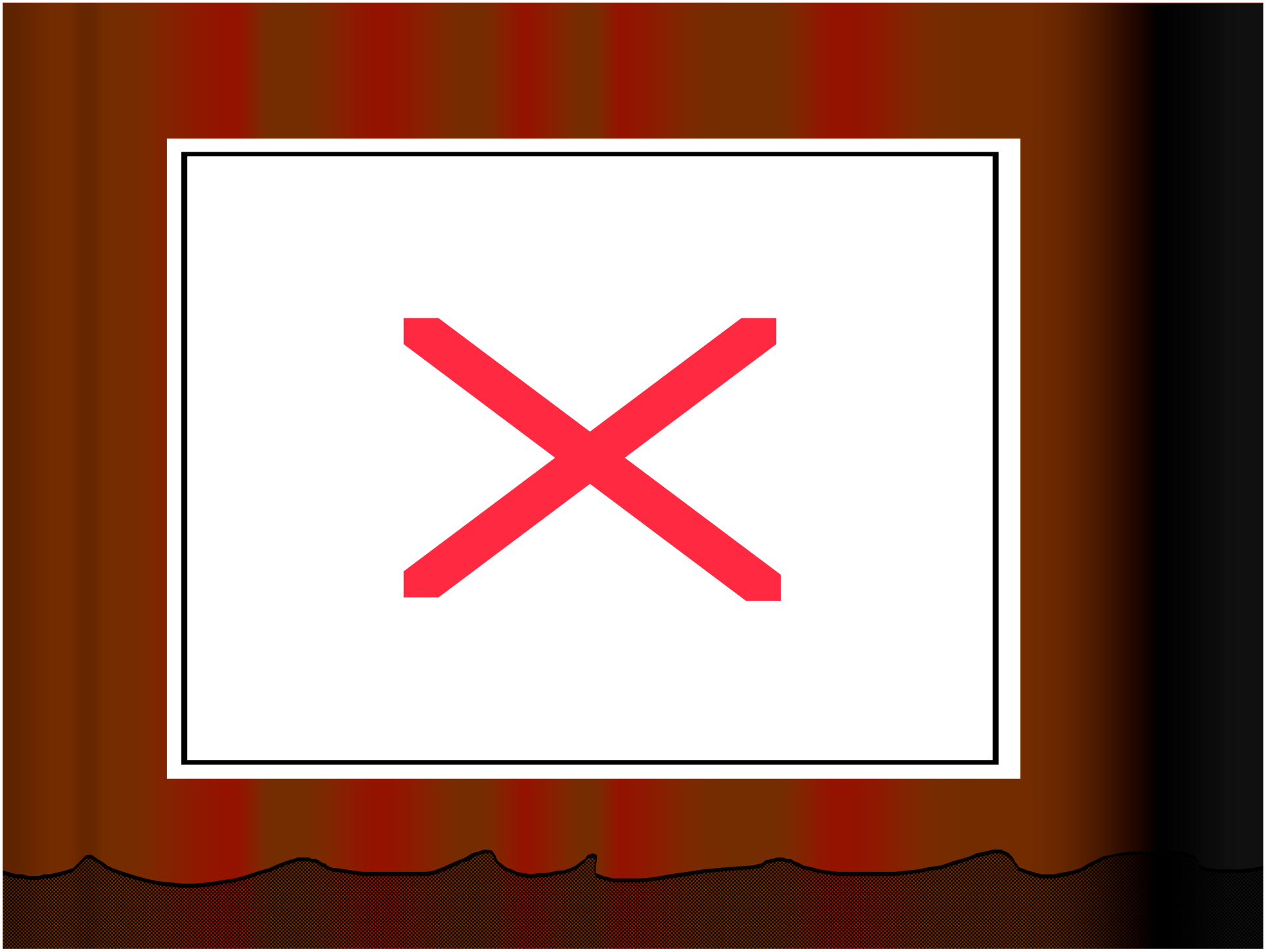


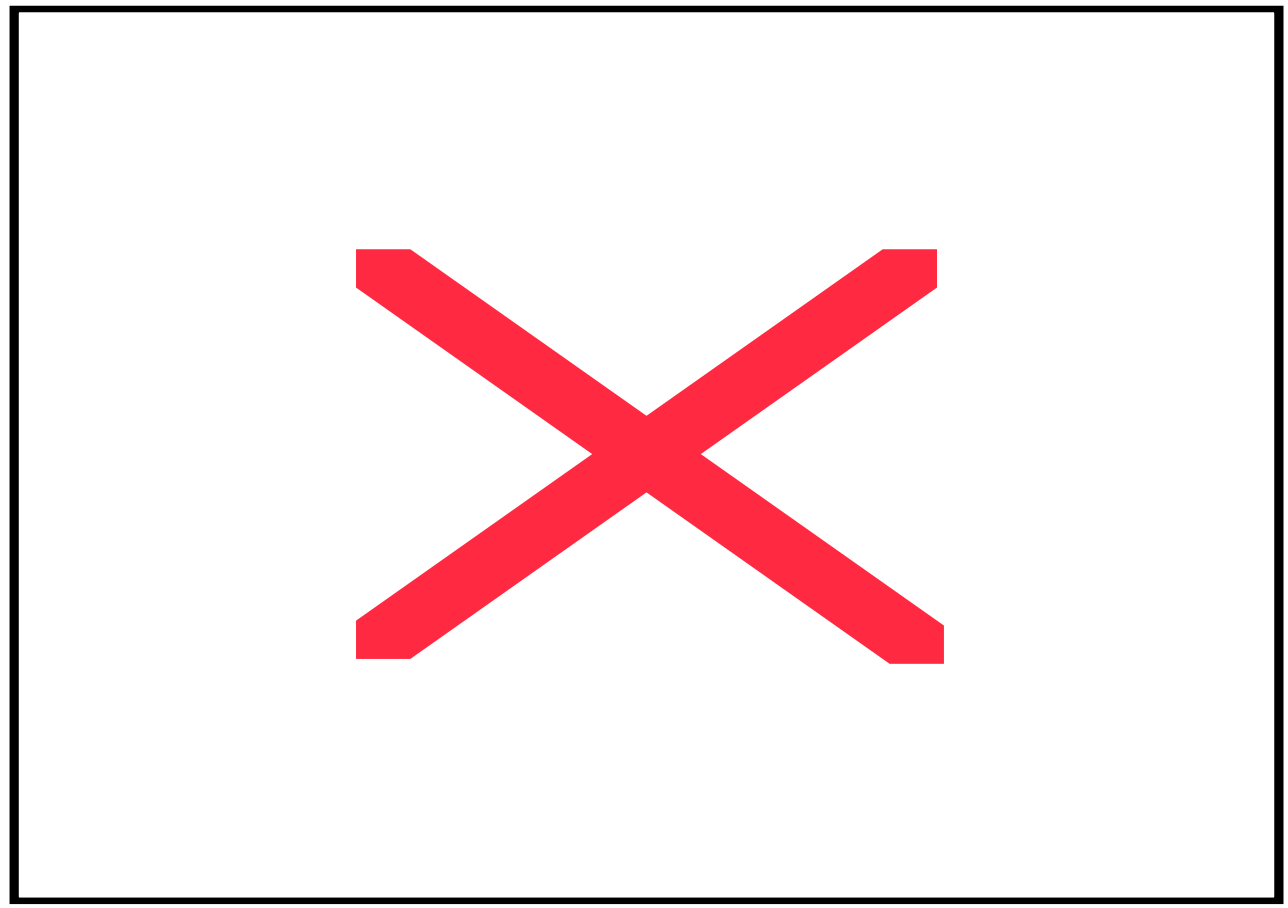






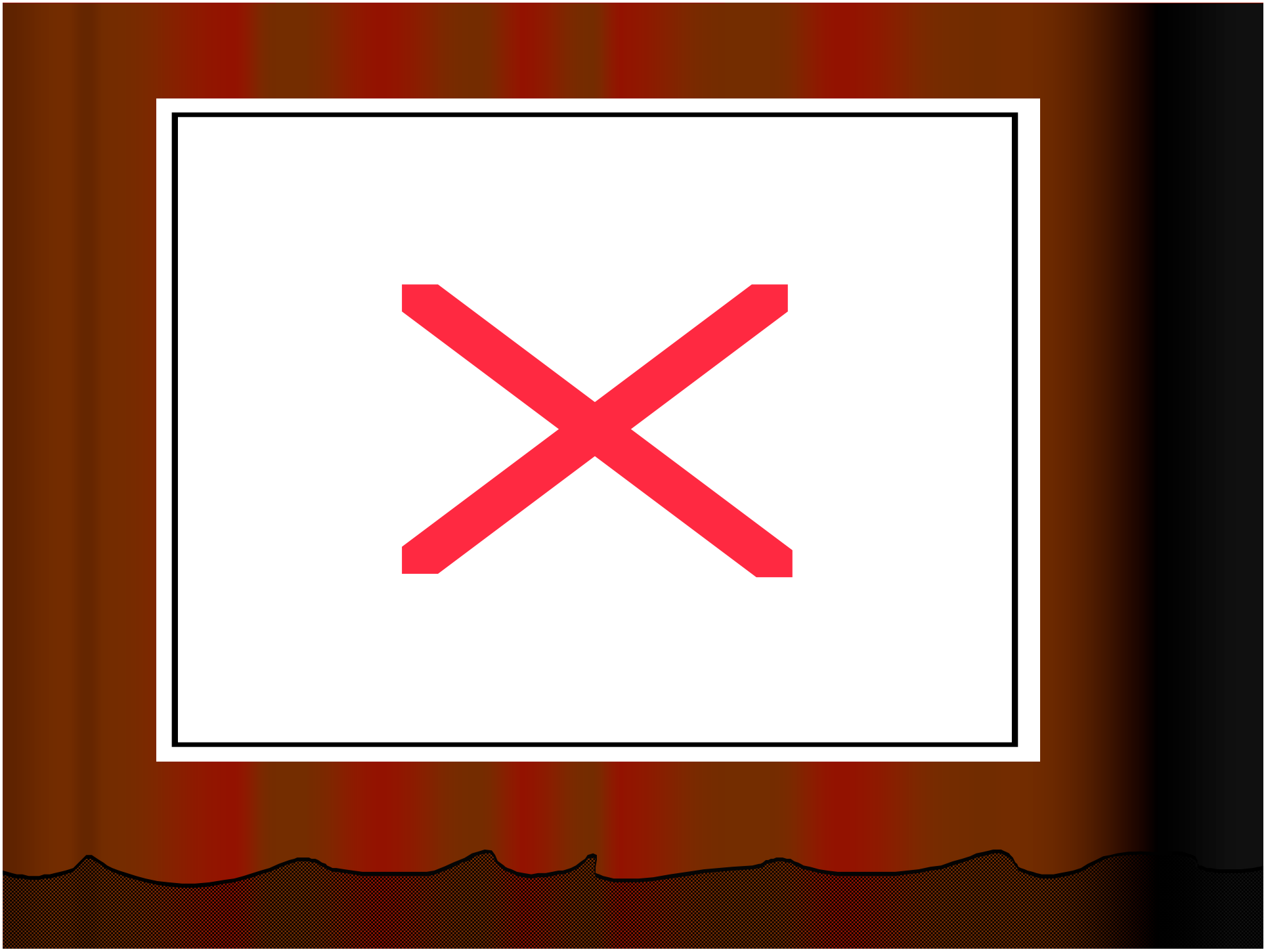


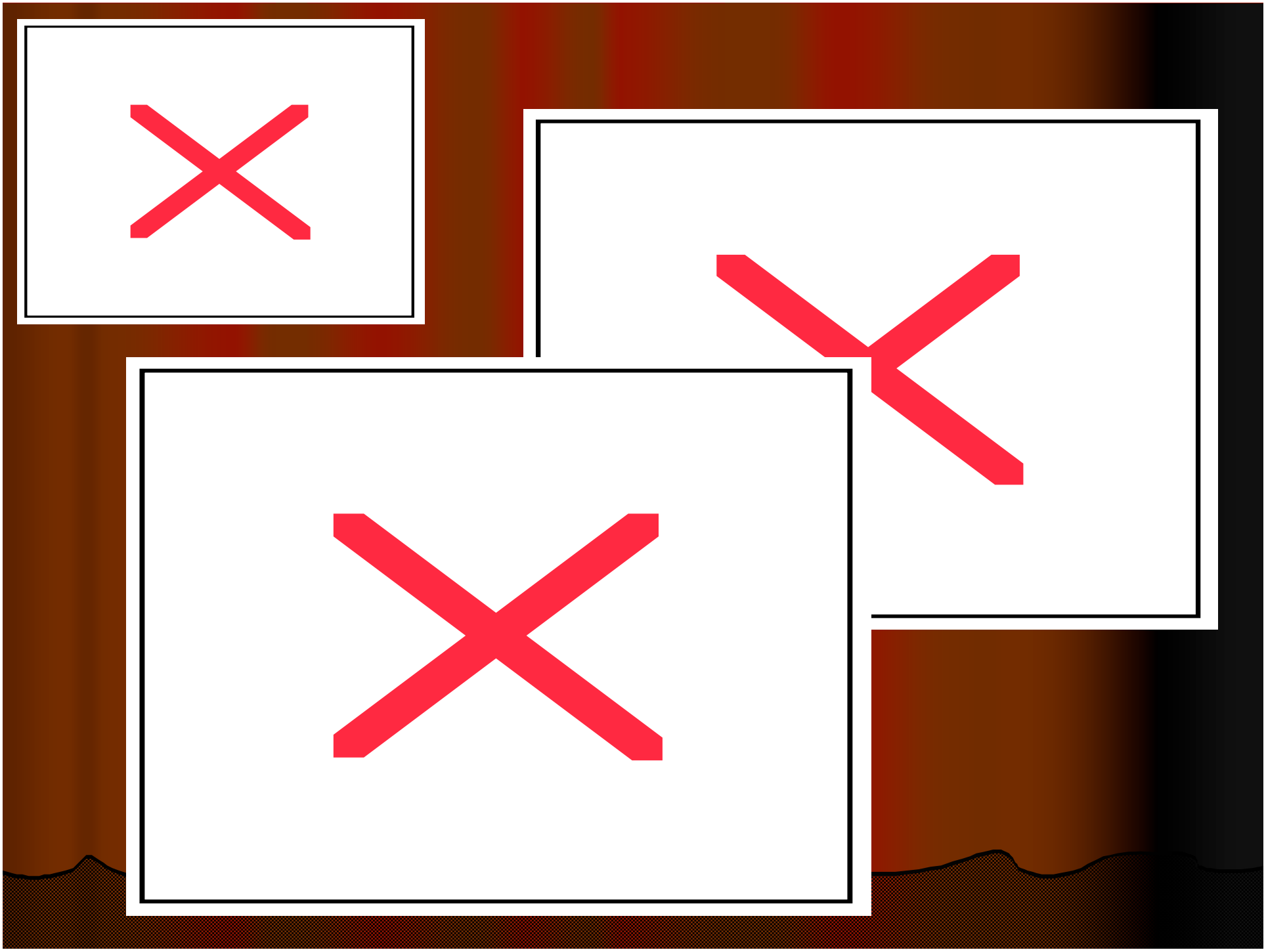


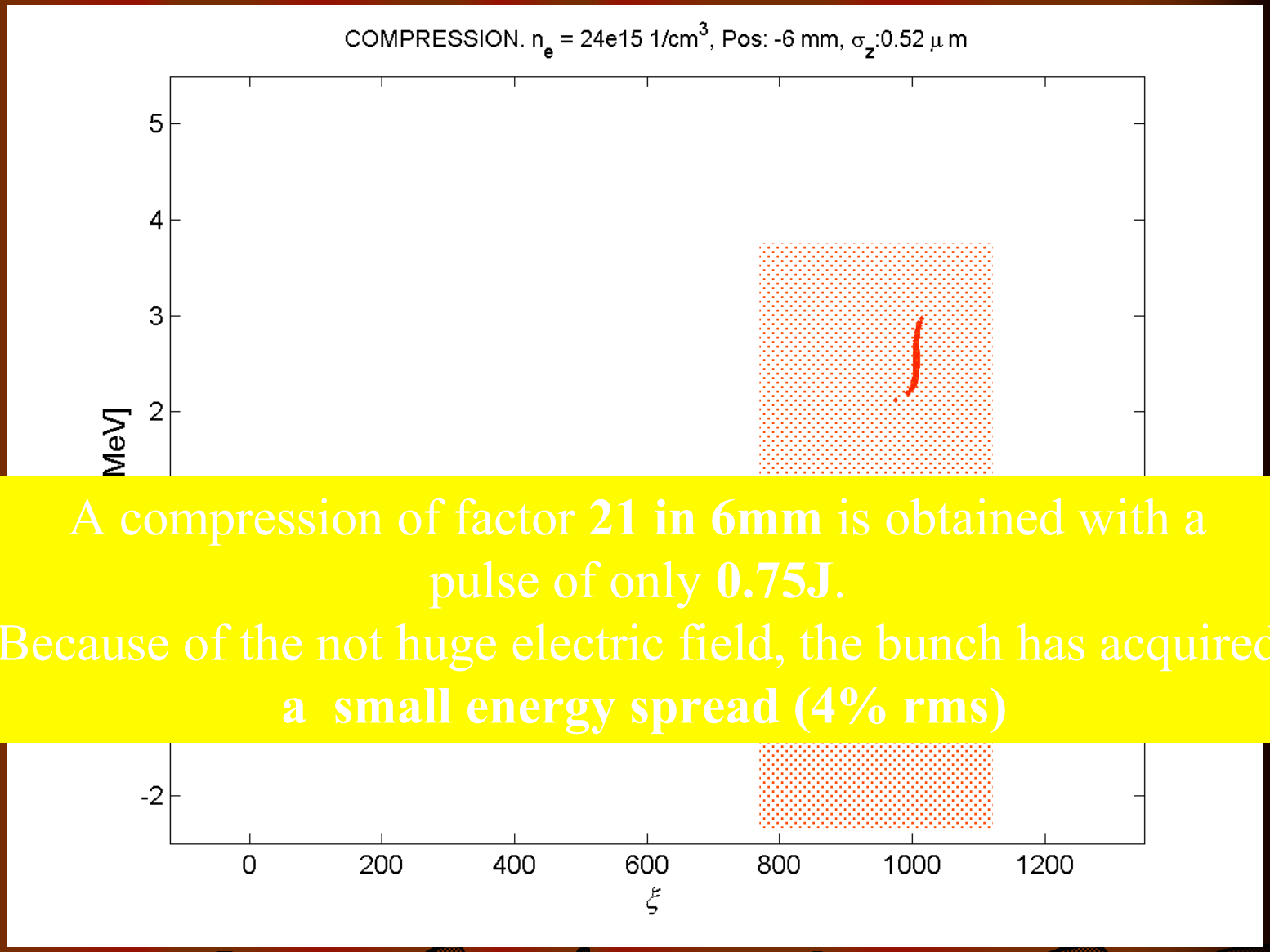


- Studies of CSR r
- Very preliminary
- We may need a

Laser Plasma Sources







A compression of factor **21 in 6mm** is obtained with a pulse of only **0.75J**.

Because of the not huge electric field, the bunch has acquired **a small energy spread (4% rms)**

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Mono-energetic Electron Generation and Plasma Diagnosis Experiments in a Laser Plasma Cathode

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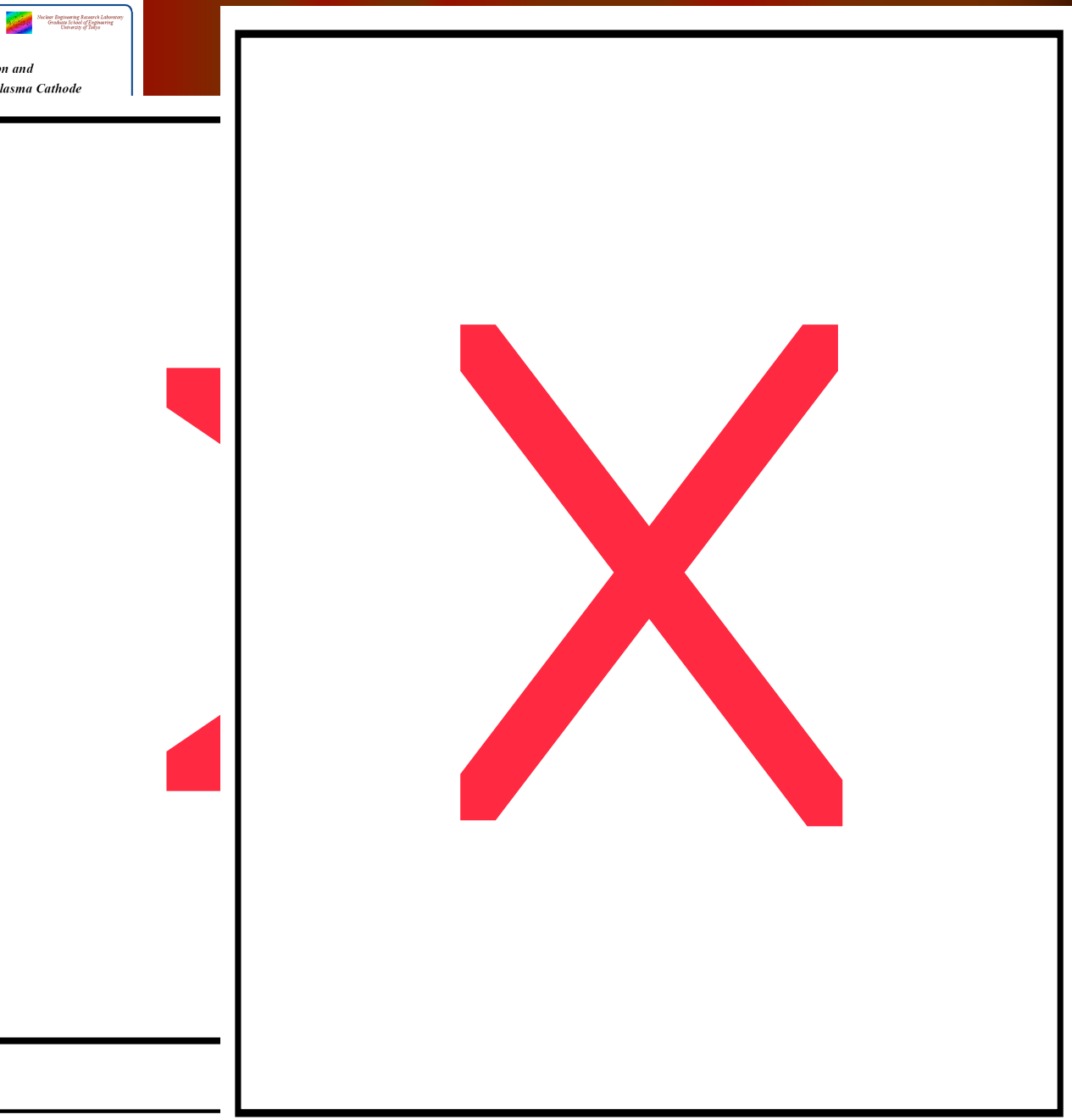
A. Yamazaki[2], H. Kotaki[2], M. Kando[2], K. Nakajima[2] and S. V. Bulanov[2]

[2]Advanced Photon Research Center, Japan Atomic Energy Research Institute Kansai

The physics and Applications of High Brightness Electron Beams, Erice (Italy), 10th-14th Oct. 2005.



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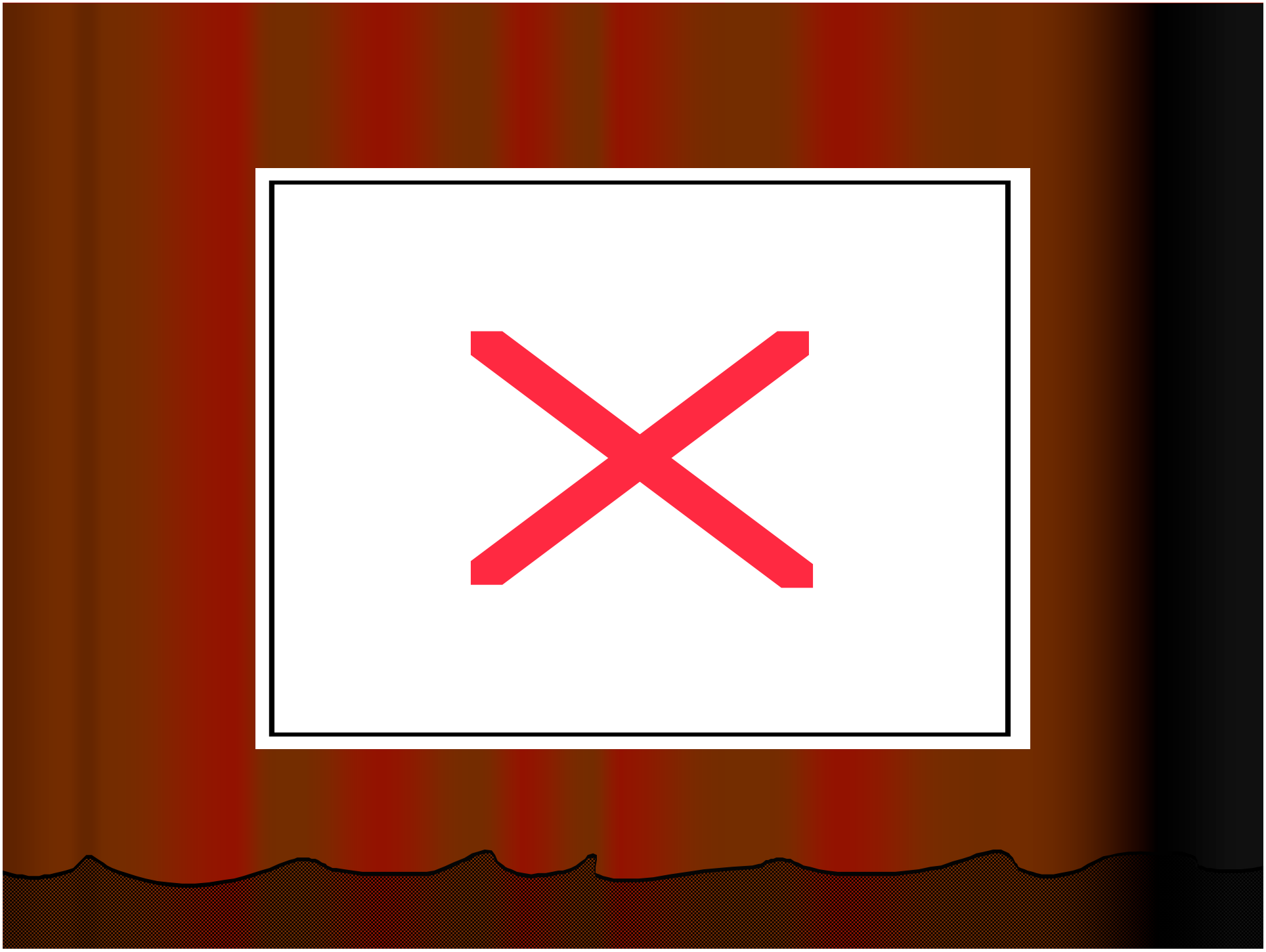
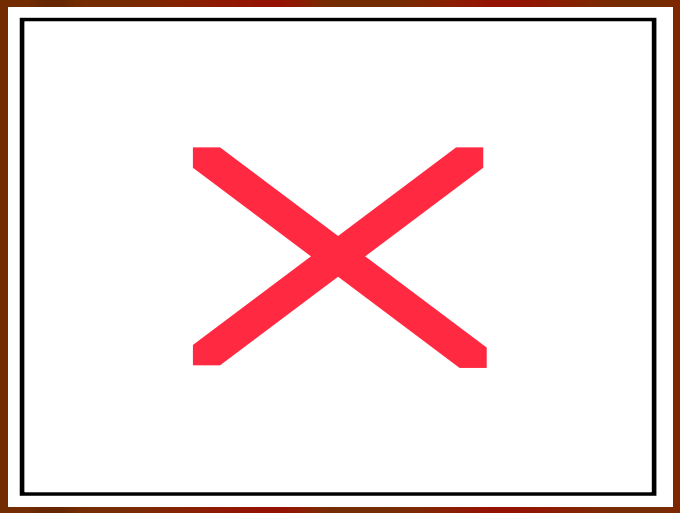
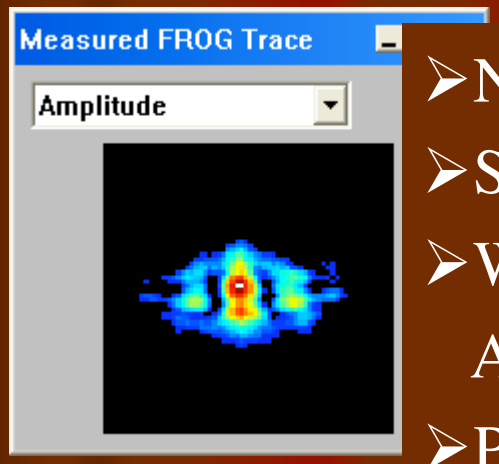
FEL and radiation sources

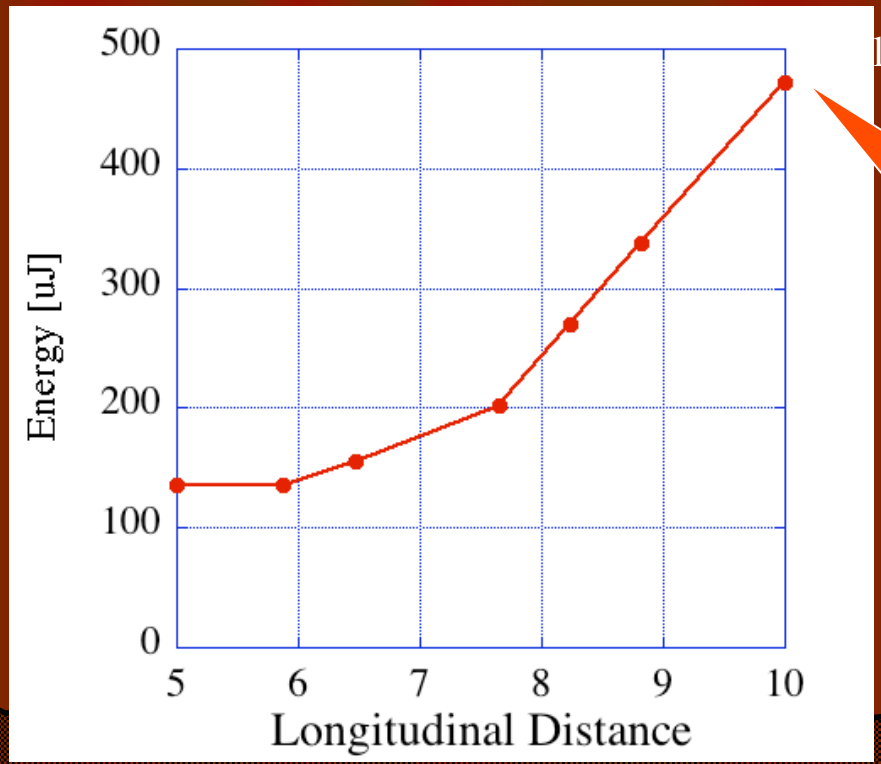






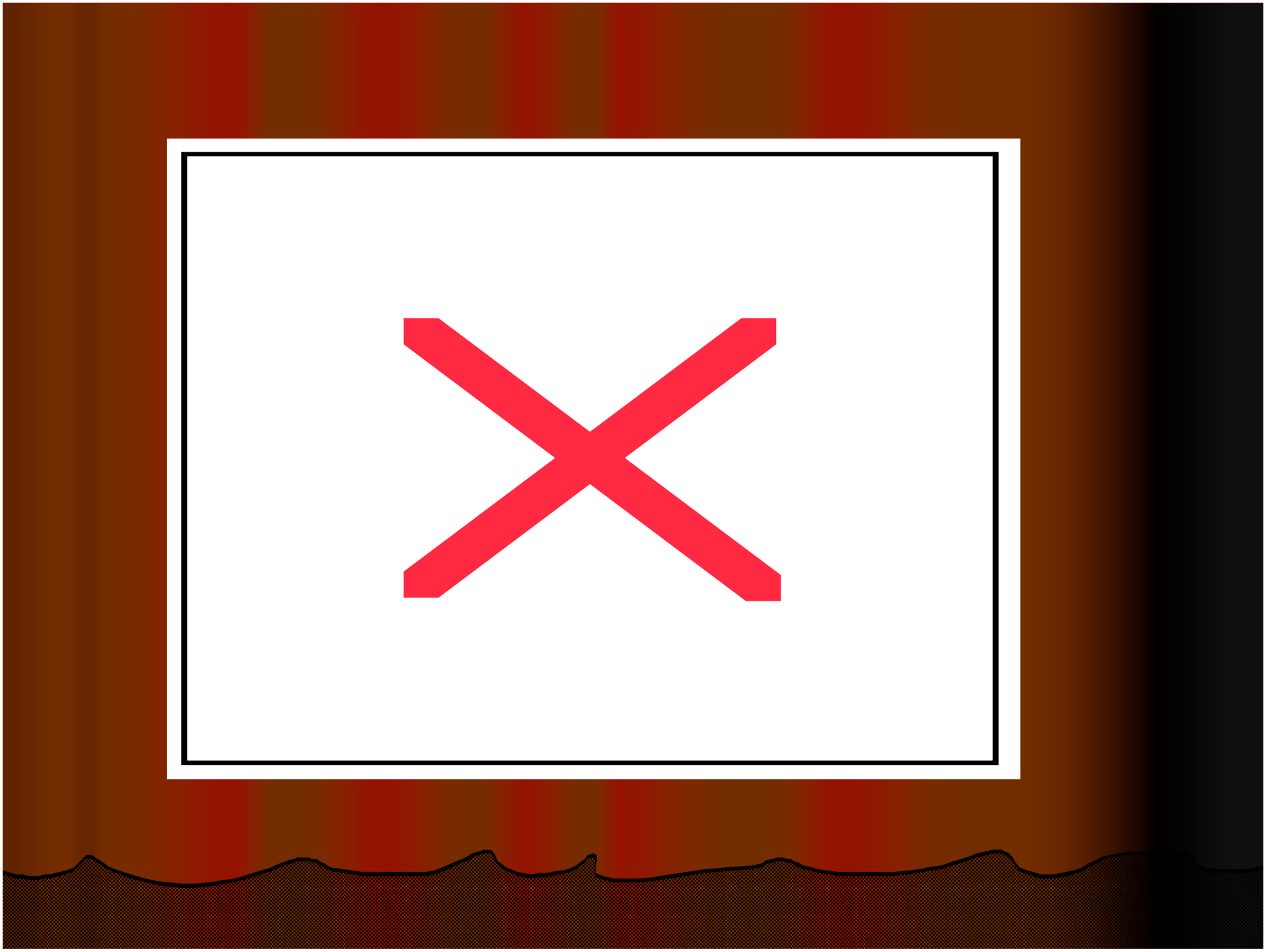
- Nonlinear gain after saturation observed.
- Spatial distributions of higher harmonics observed.
- Wide-band multi-peak FEL spectrum obtained. Agreed well with GENESIS calculation.
- Pulse shortening from 150 fs to 100 fs, and 130 fs to 80 fs observed.

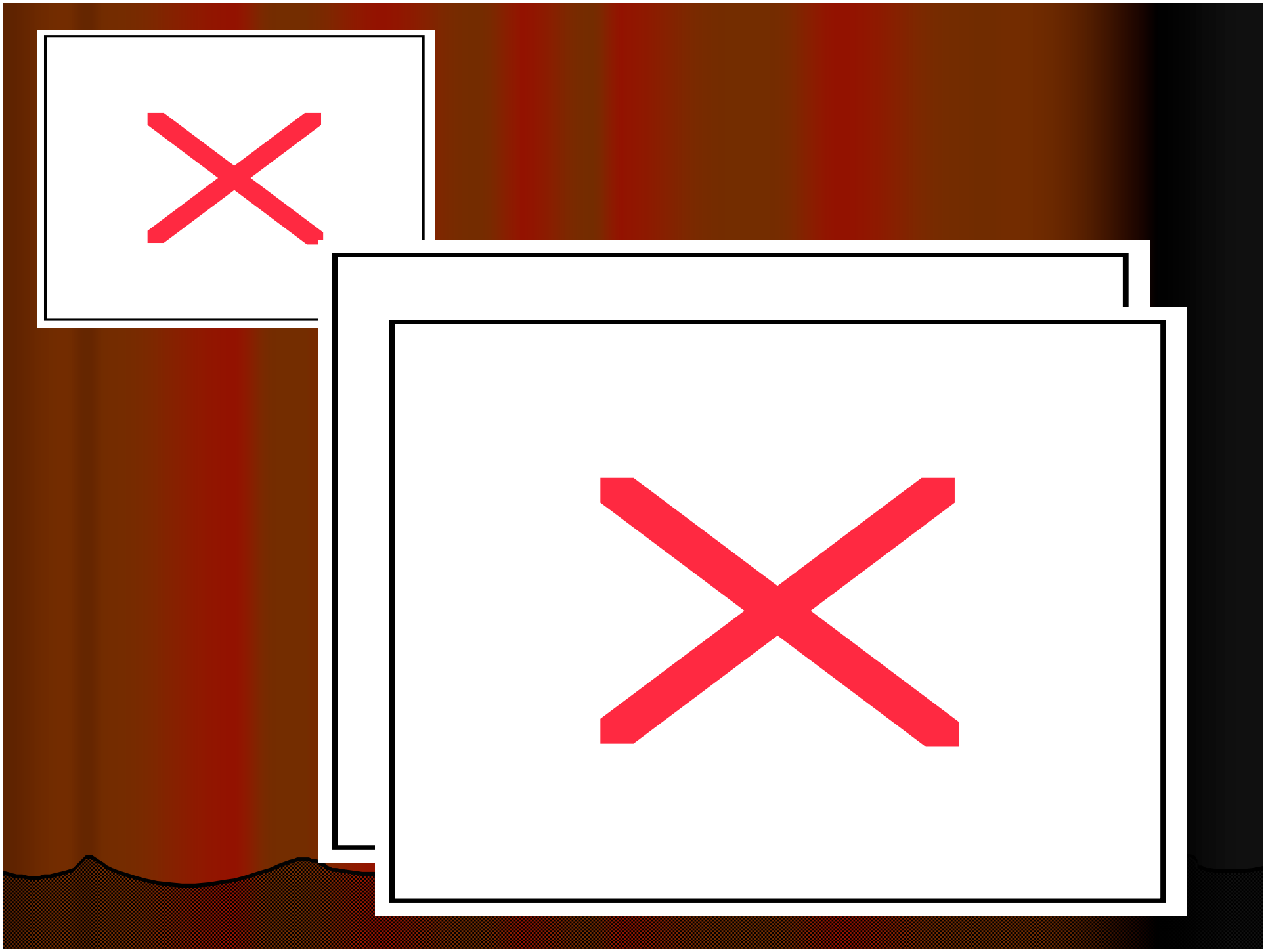
Gain Curve

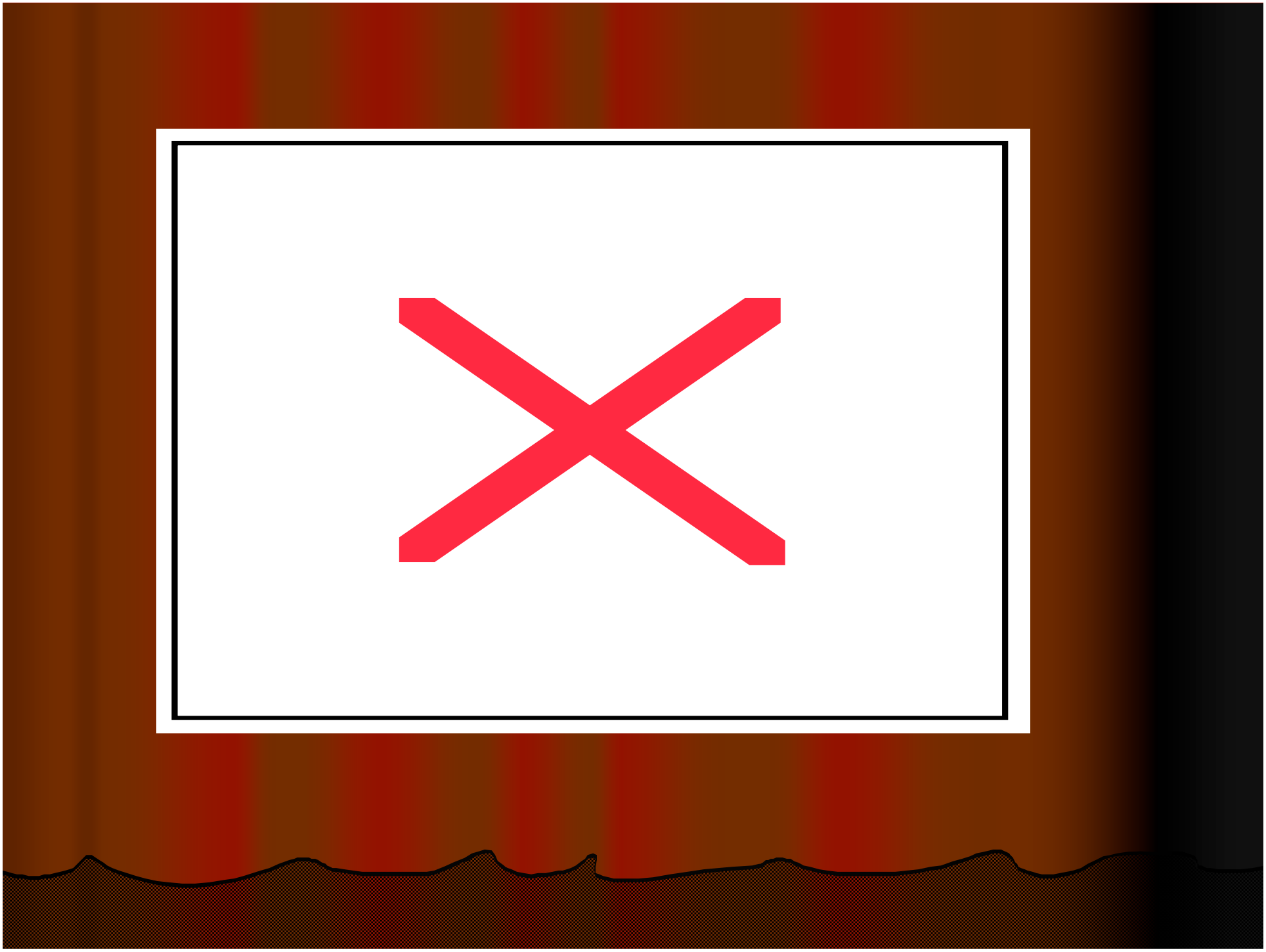


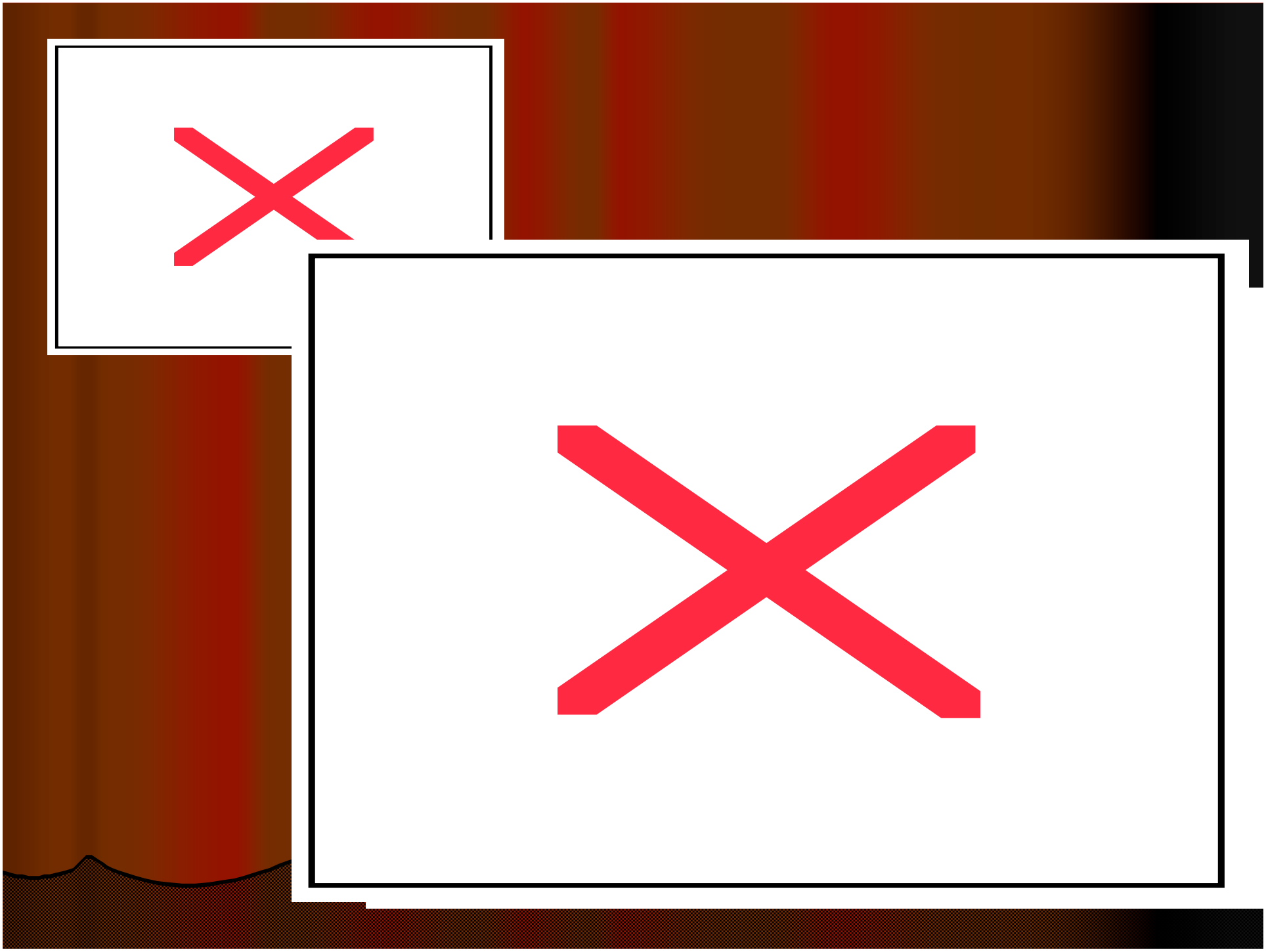
l be calibrated precisely.

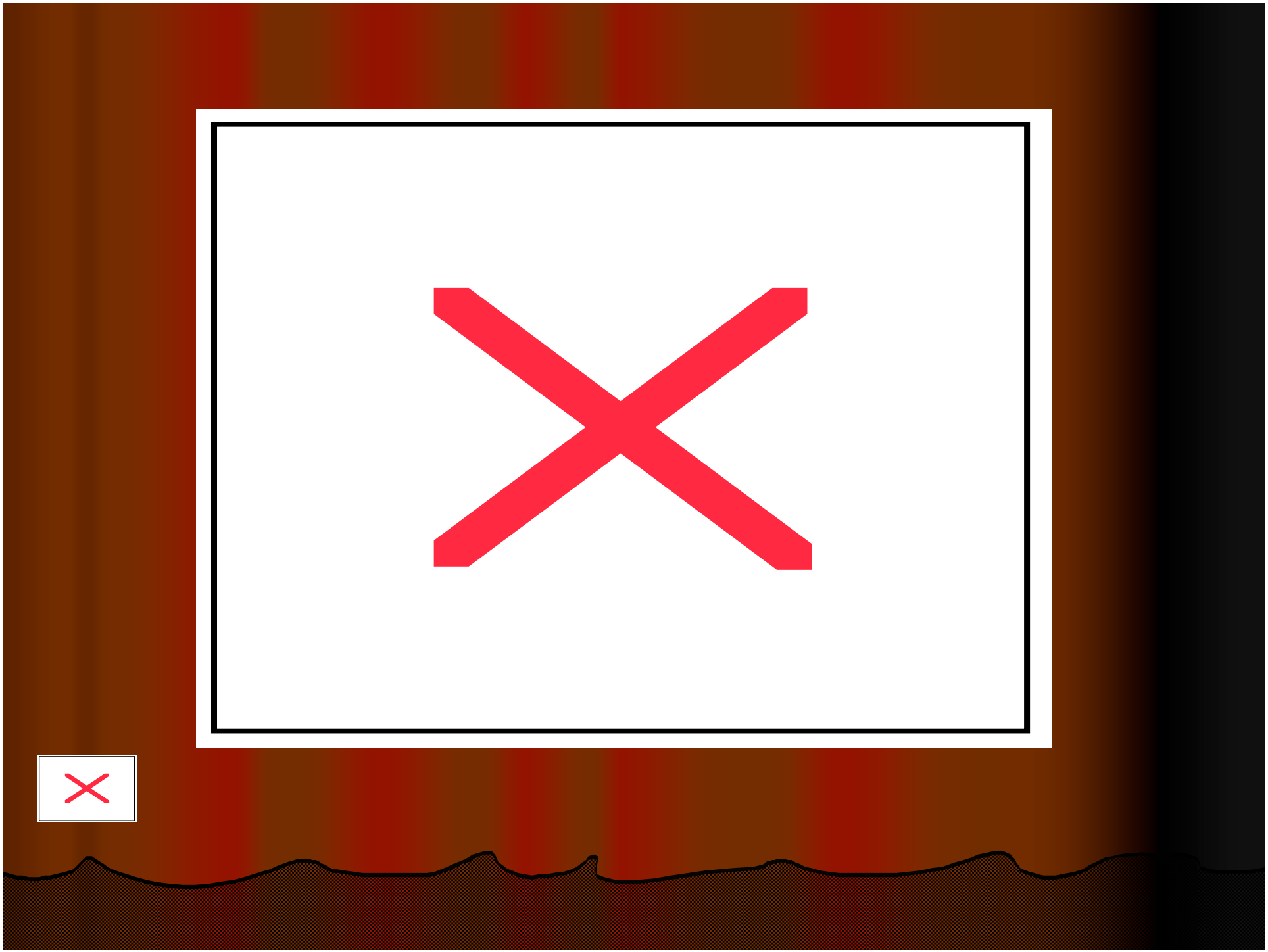
Peak power
~5 GW*

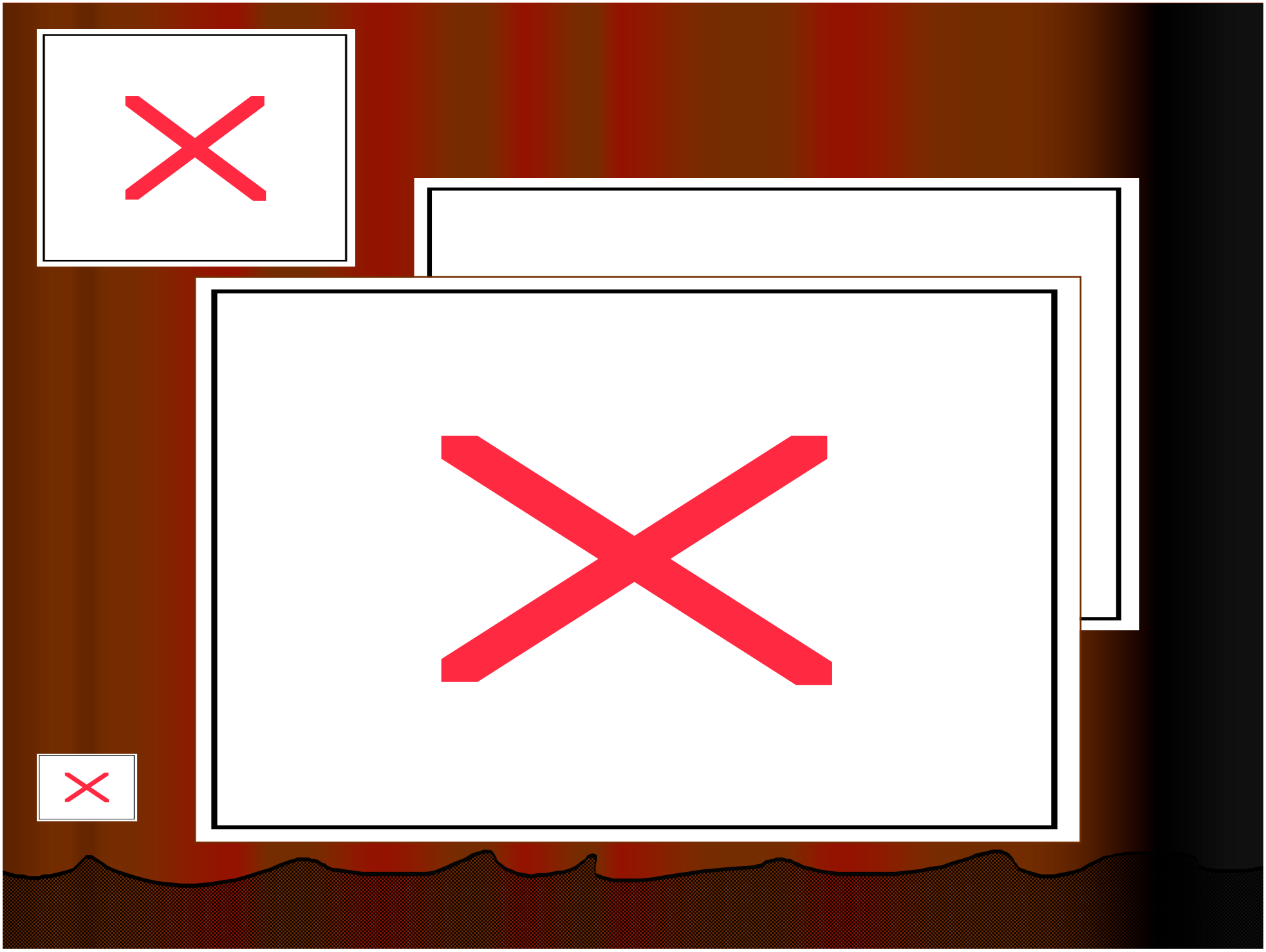


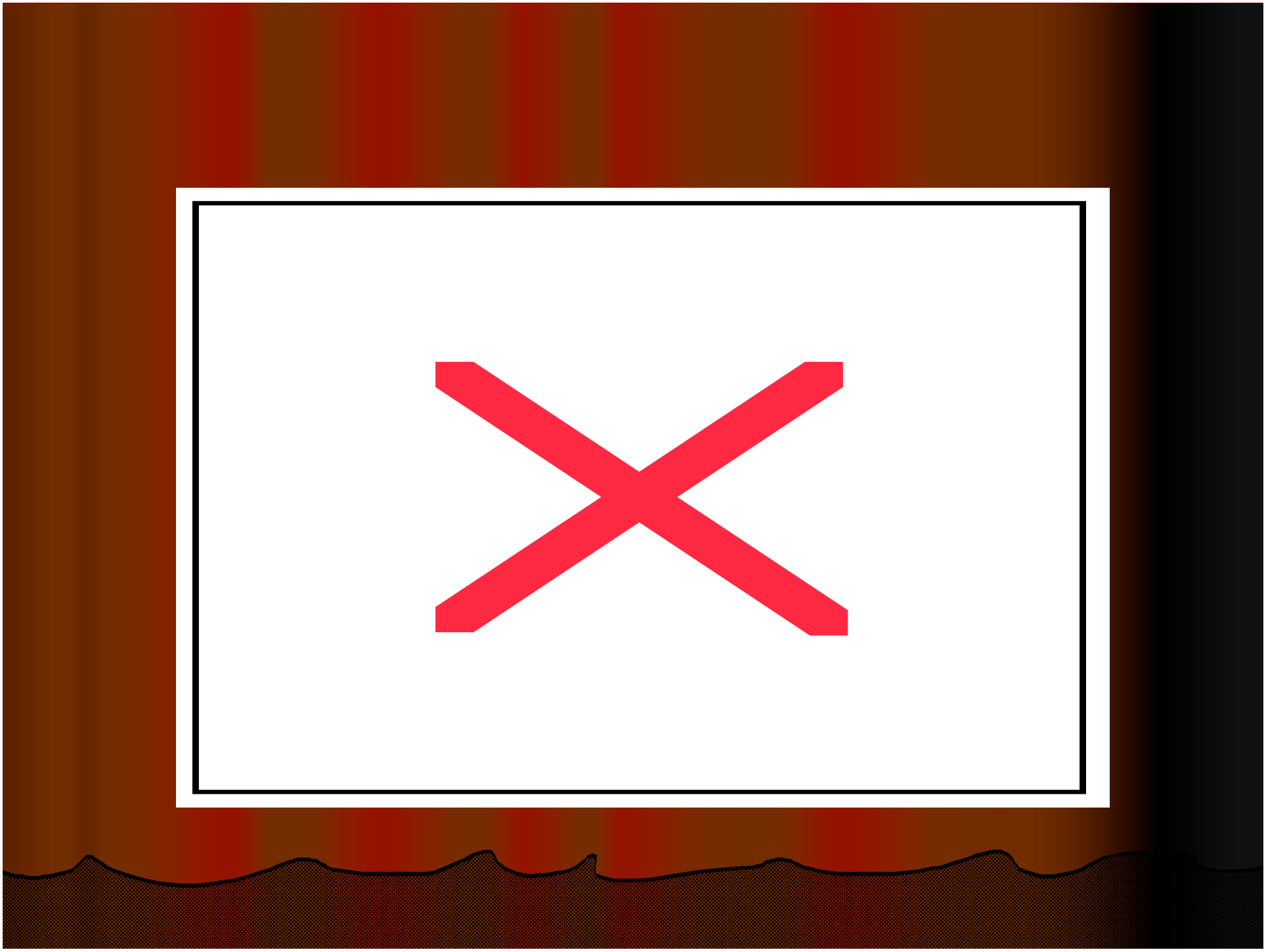


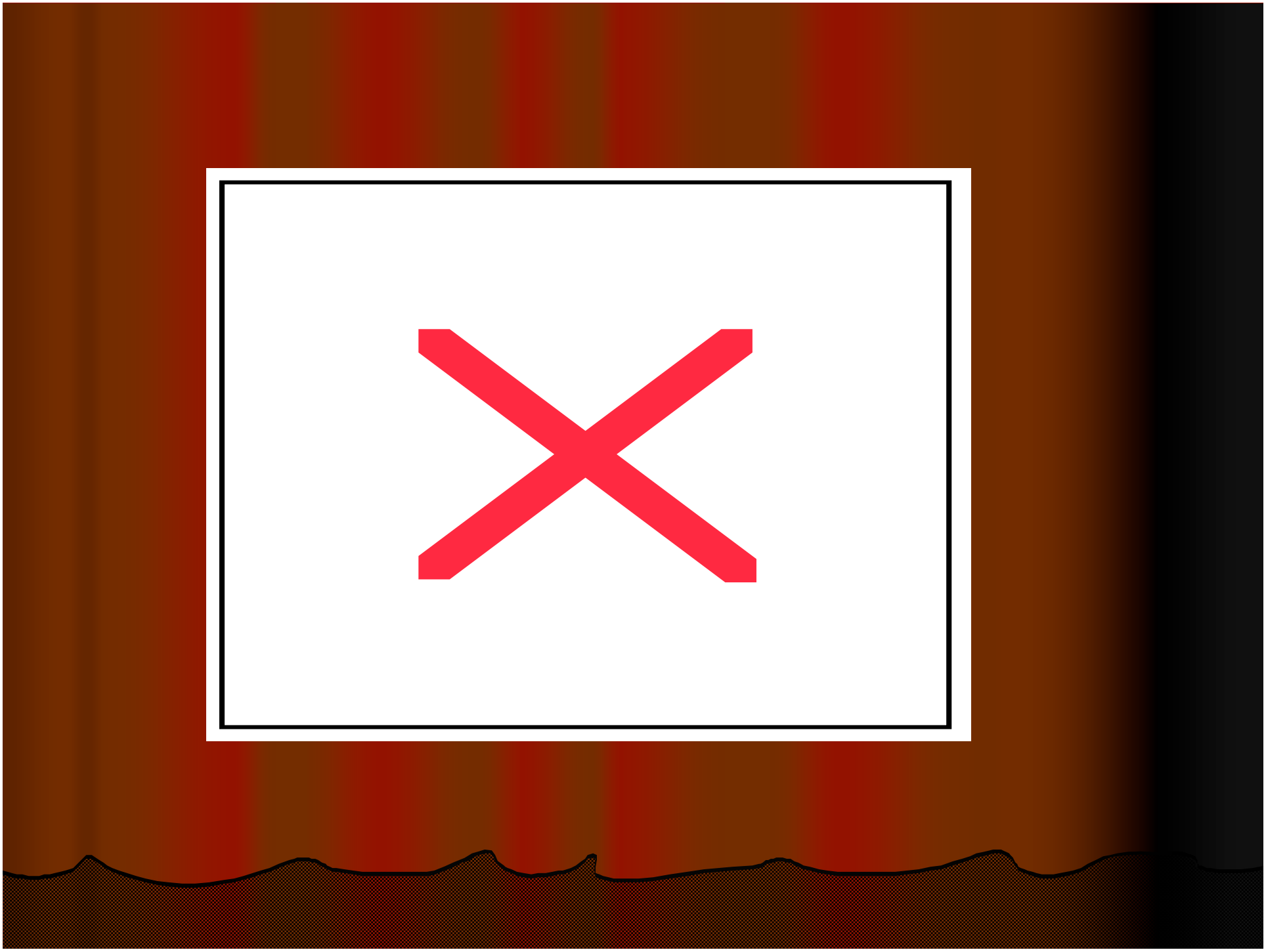


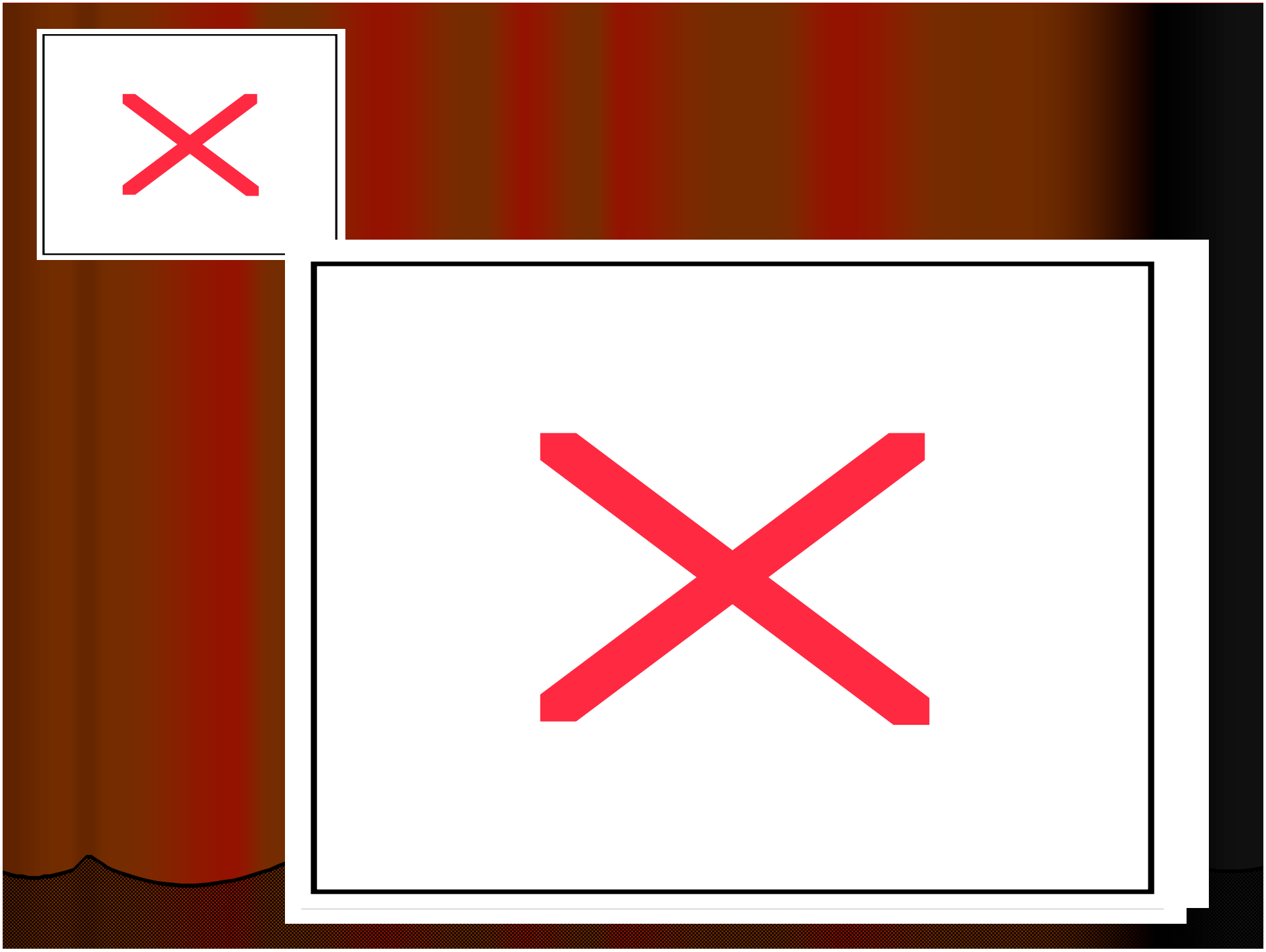


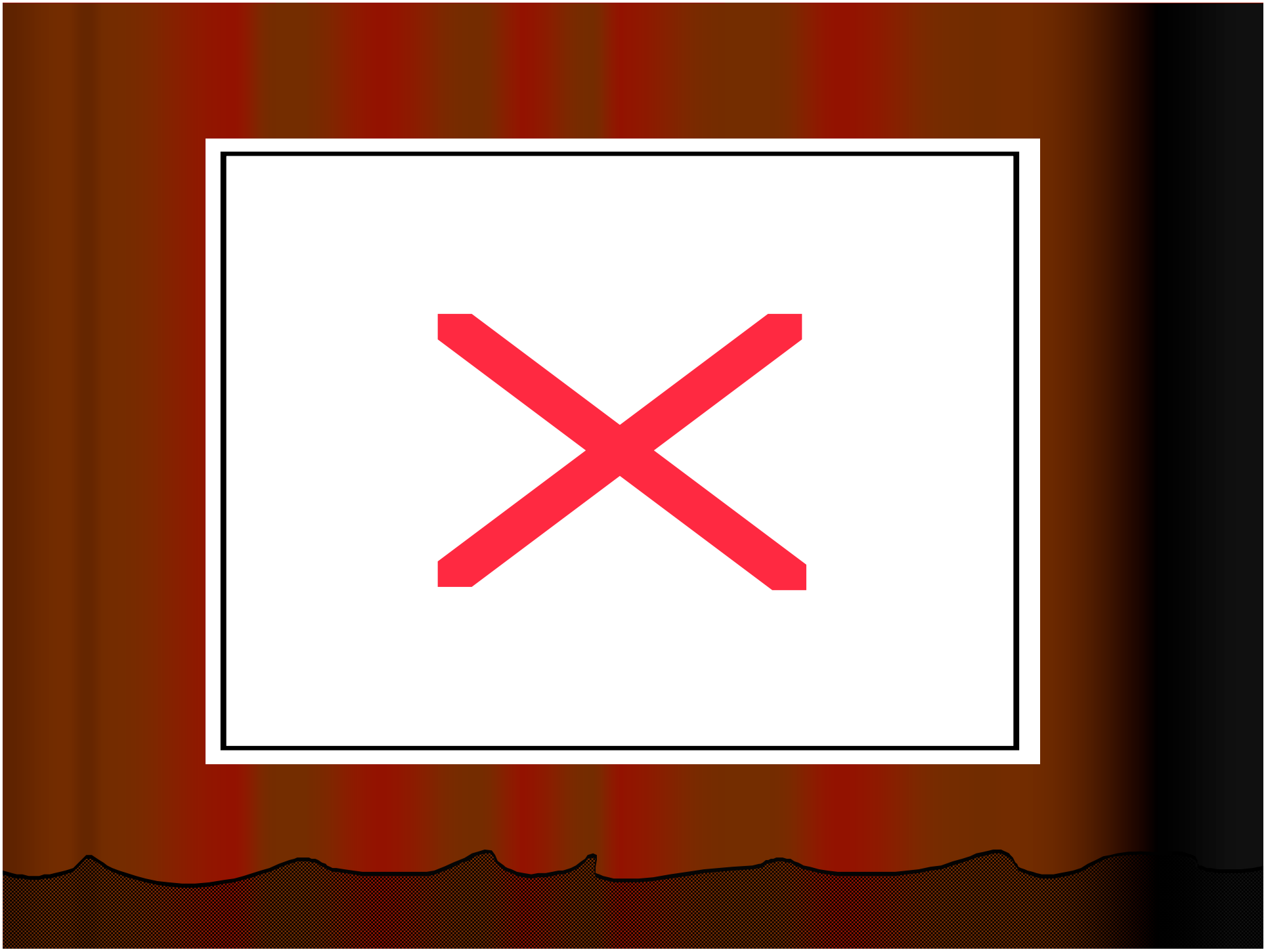


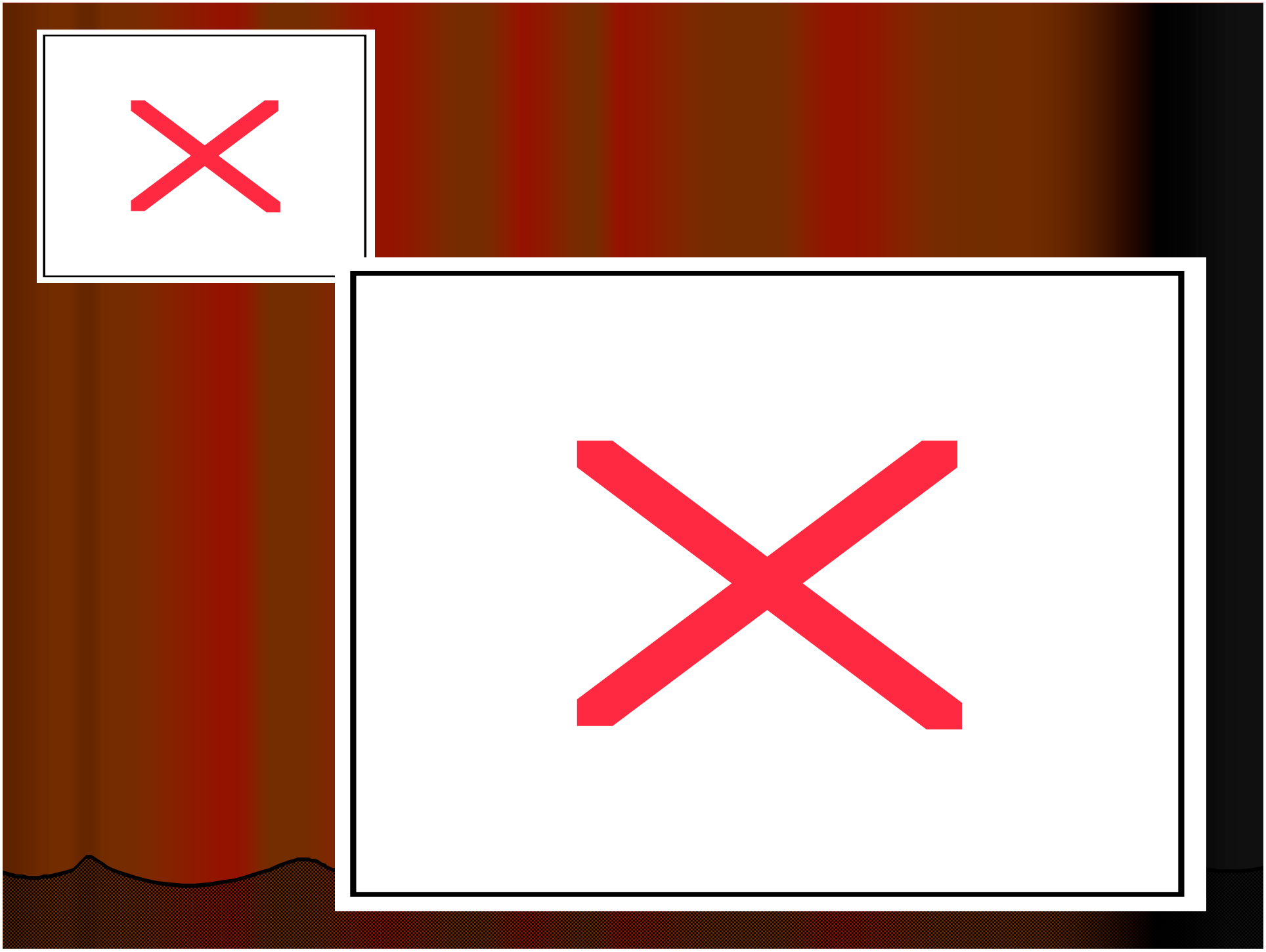


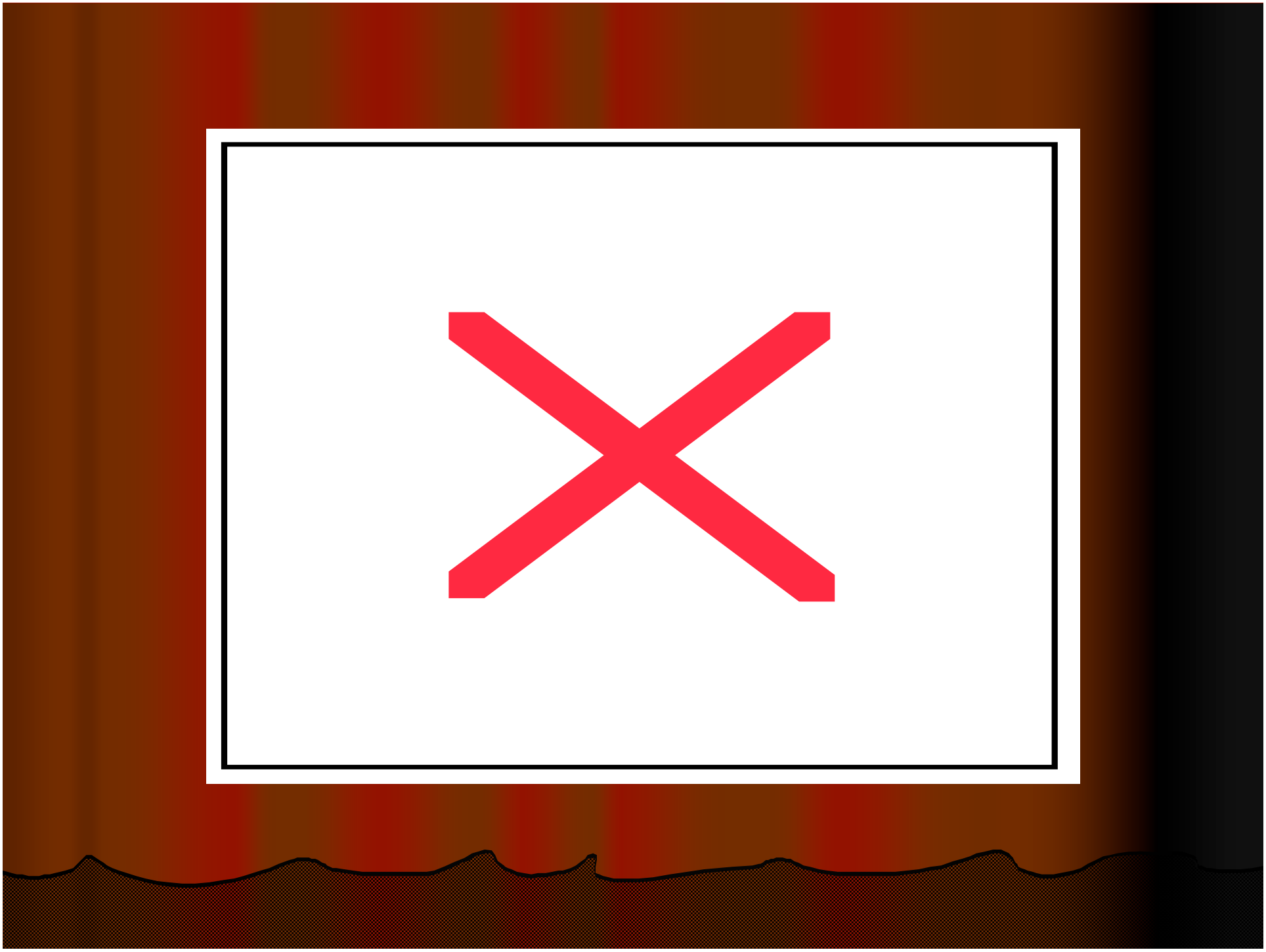


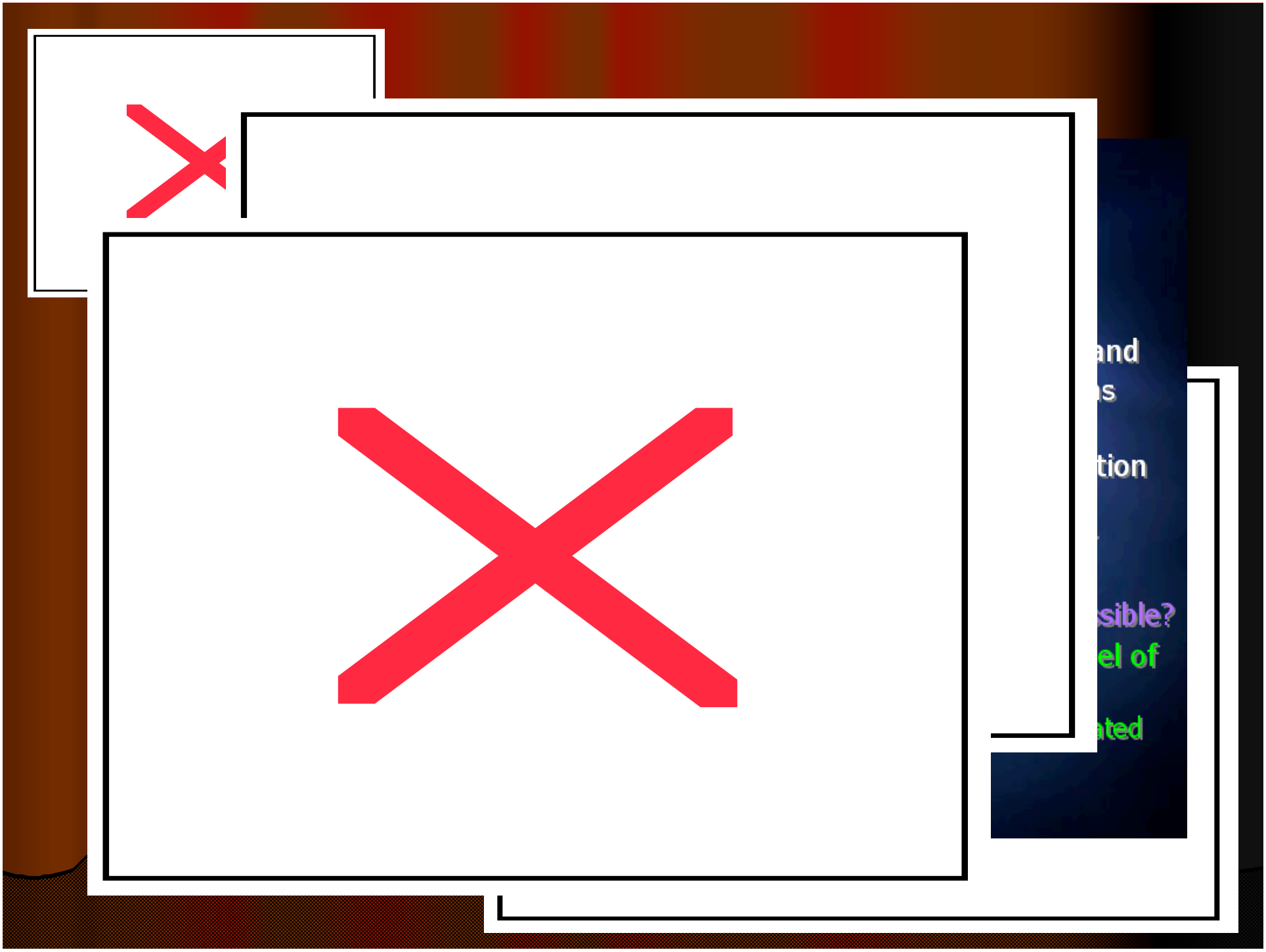












Summary

- Many new ideas coming in the field
- Older concepts are becoming more and more competitive
  - Laser plasma acceleration
  - Compton backscattering
- New demands for theory and modelling
  - Uniform Ellipsoidal bunch
  - ERL devices
  - FEL cascades
  - Quantum FEL
  - Advanced diagnostics