Lock Picking and Physical Security

Tyler Nighswander

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Introduction

- Who I am:
  - PPP member (specializes in crypto and hardware interested in everything!)
  - CMU student in Computer Science and Physics

Before I Start...

- Some of the things I'll talk about are complicated
- I don't speak any Korean so it is hard for me to explain things to you
- If something I say is not clear, **stop me and ask!**

- After I'm done talking, a few people at a time can try picking some locks I have brought. I will also be happy to answer any other questions!

Why Lockpicking

- Picking locks is a good lesson in how not to do security!

  (important to learn common mistakes so you don't do them)

- A system is only as strong as the weakest link

  (breaking into a physical server room is a great way to get access)

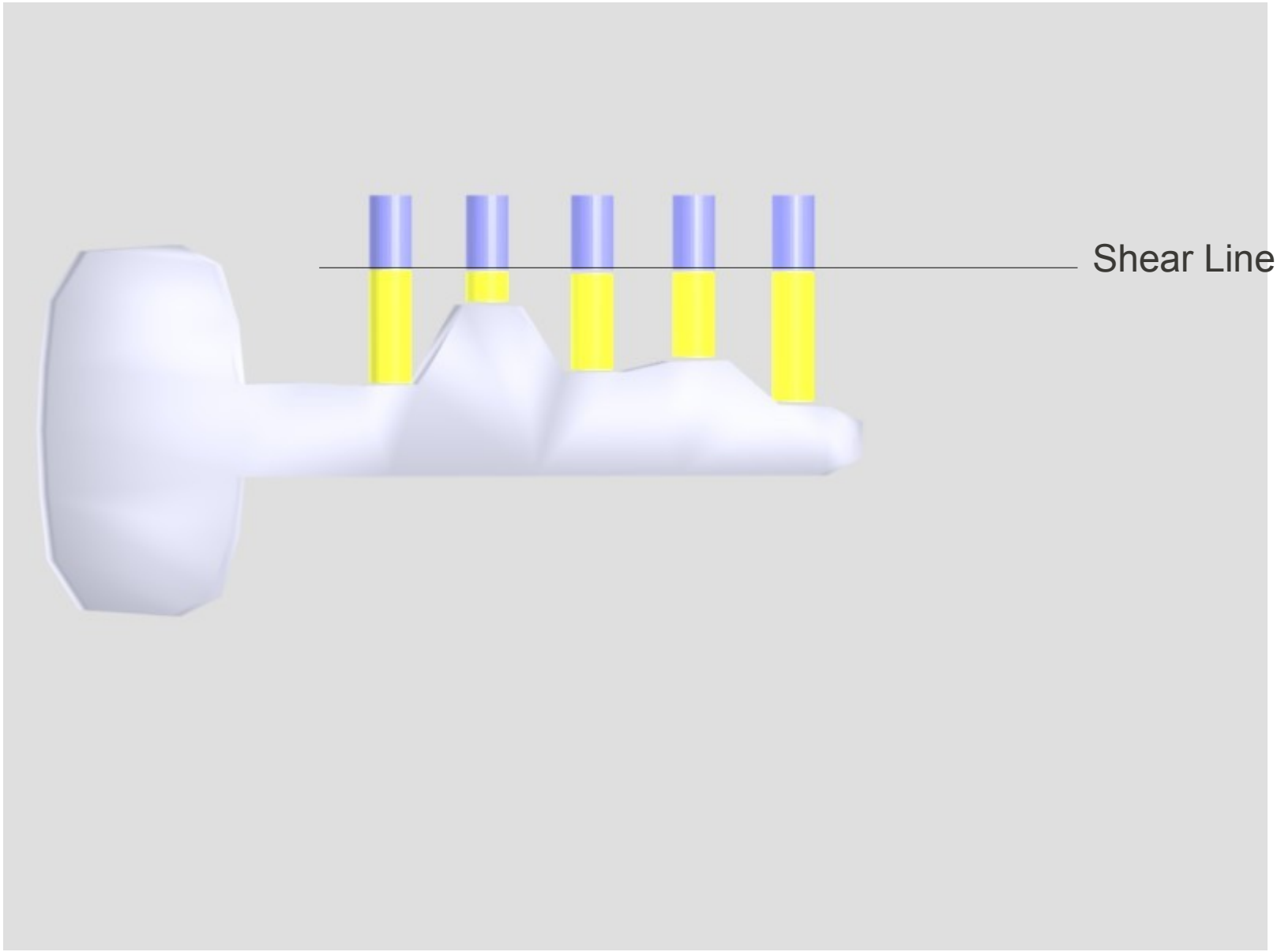
- Many relations to software security

  (especially cryptography, which I will talk about here)

Disclaimer

- Breaking into places is illegal!
- In some areas, having lockpicks is illegal!
- Please be very careful and don't do anything you shouldn't!

How locks work
(Pin and Tumbler)



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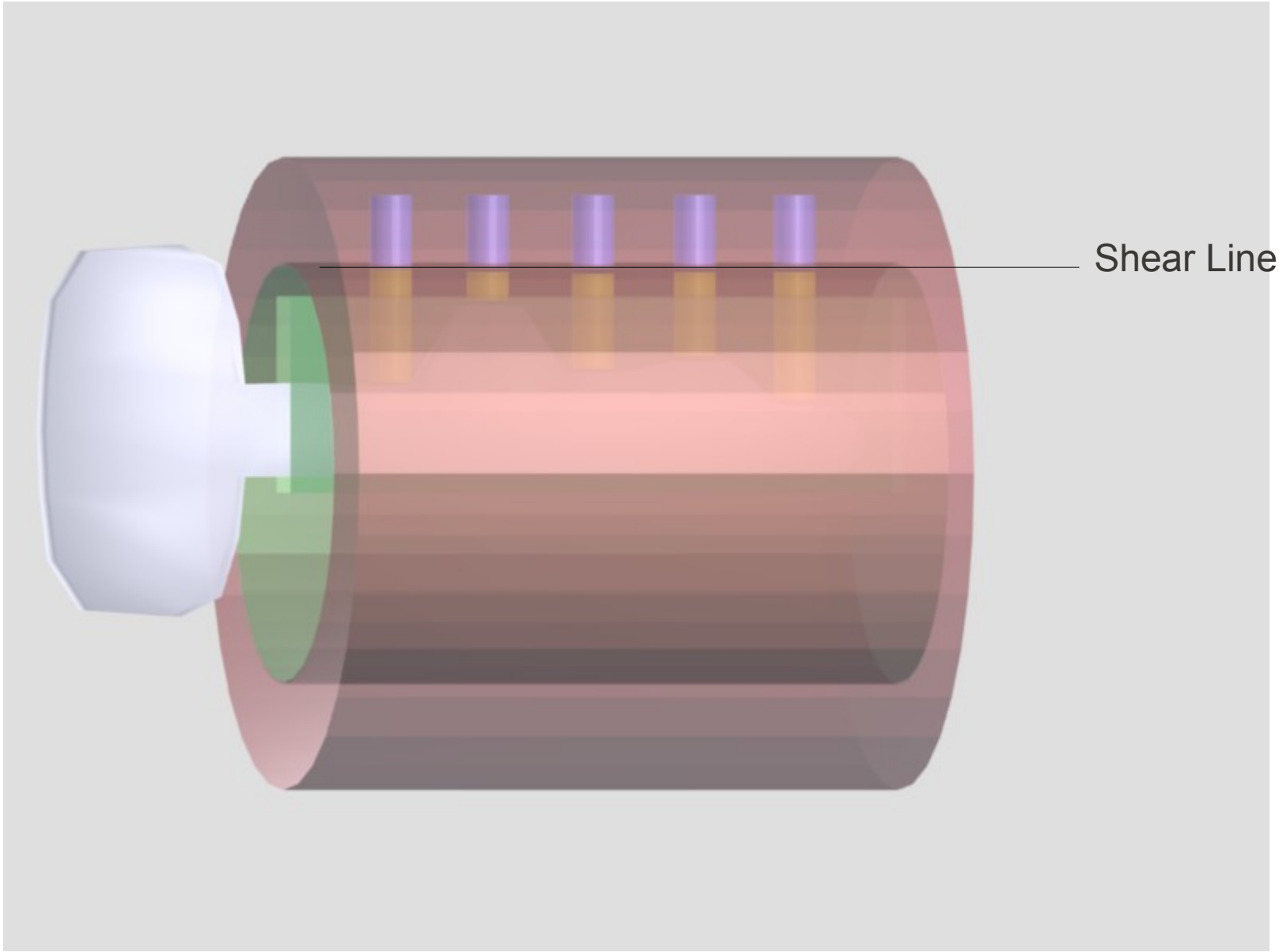

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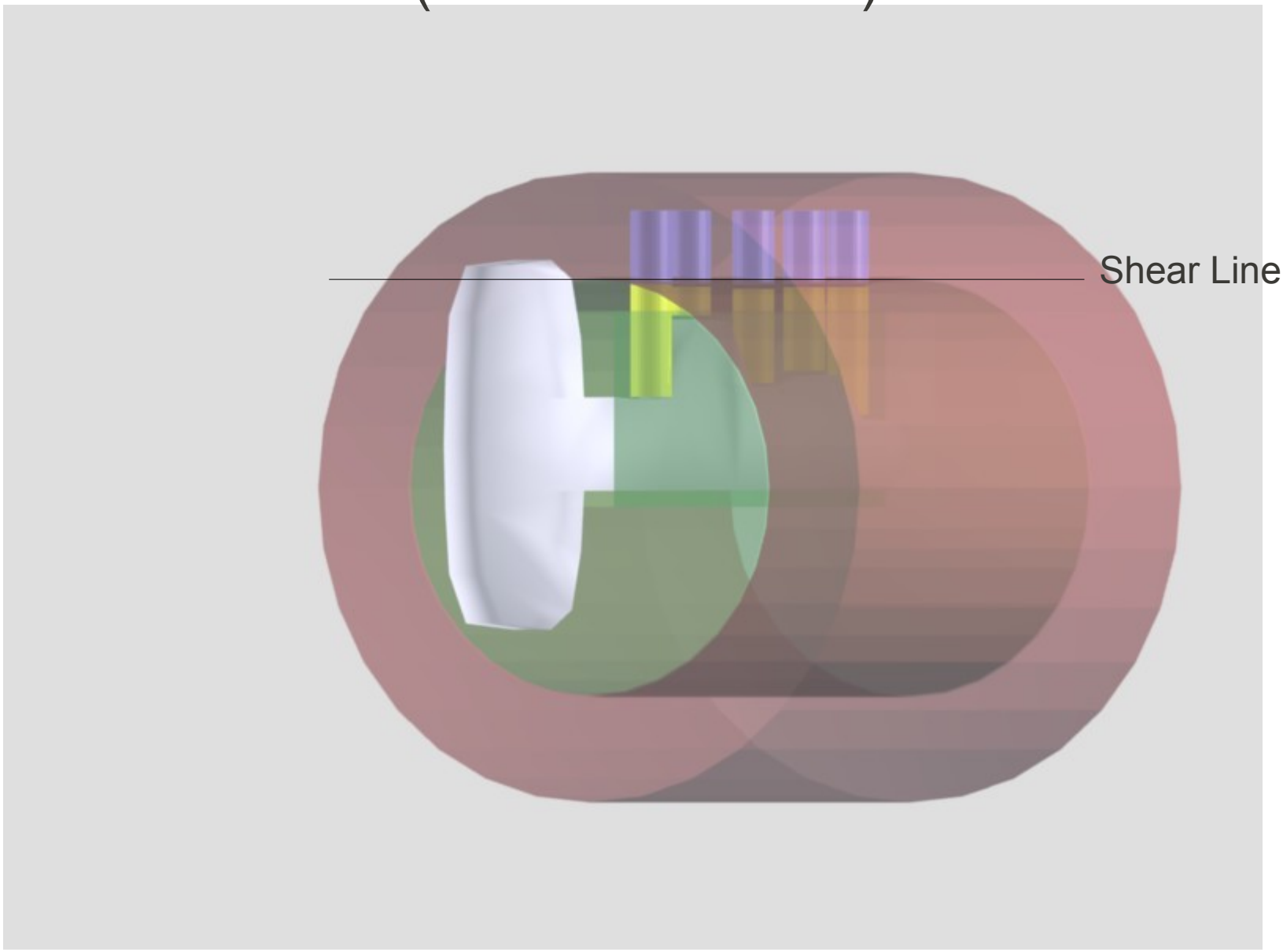

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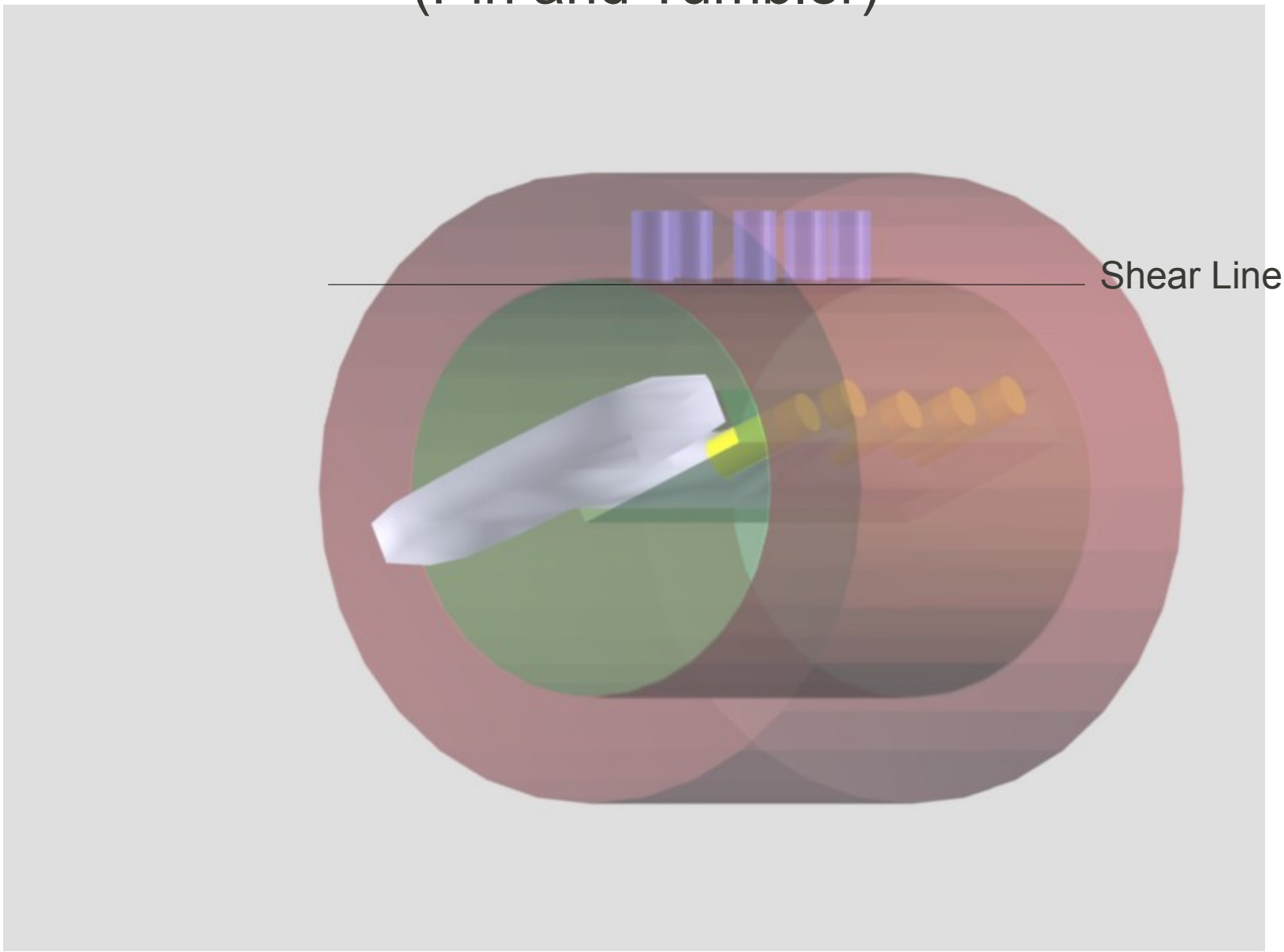

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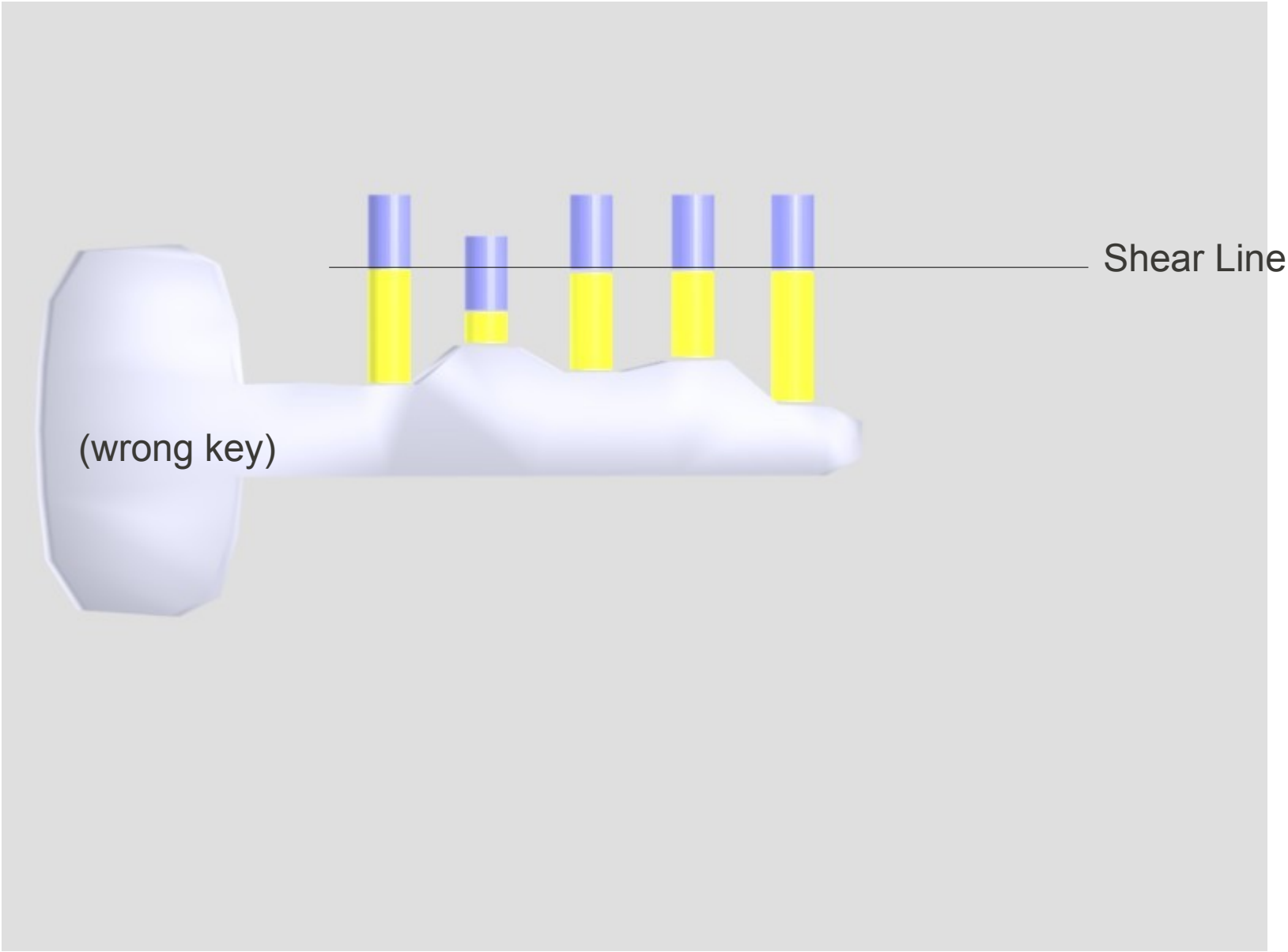

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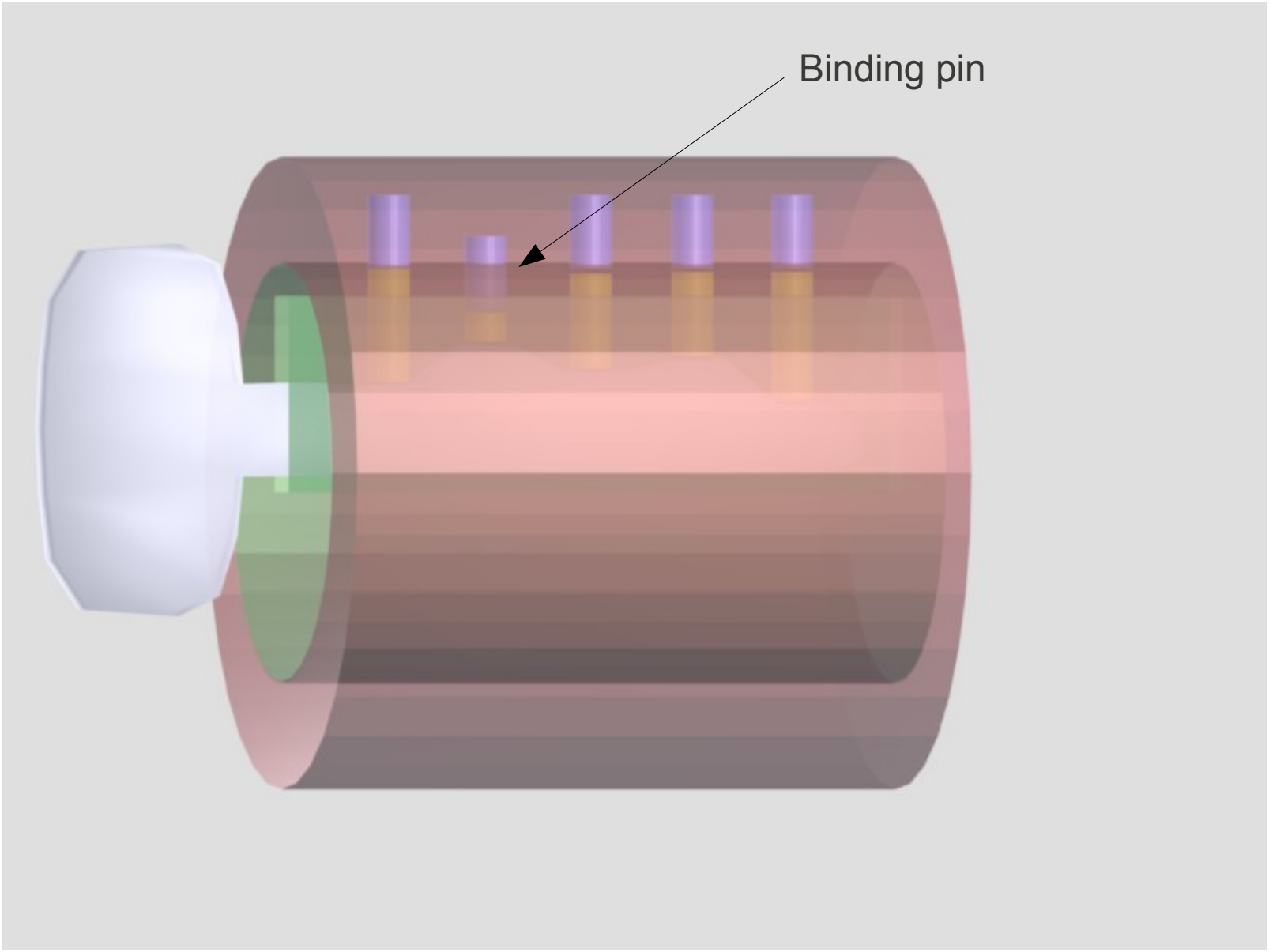

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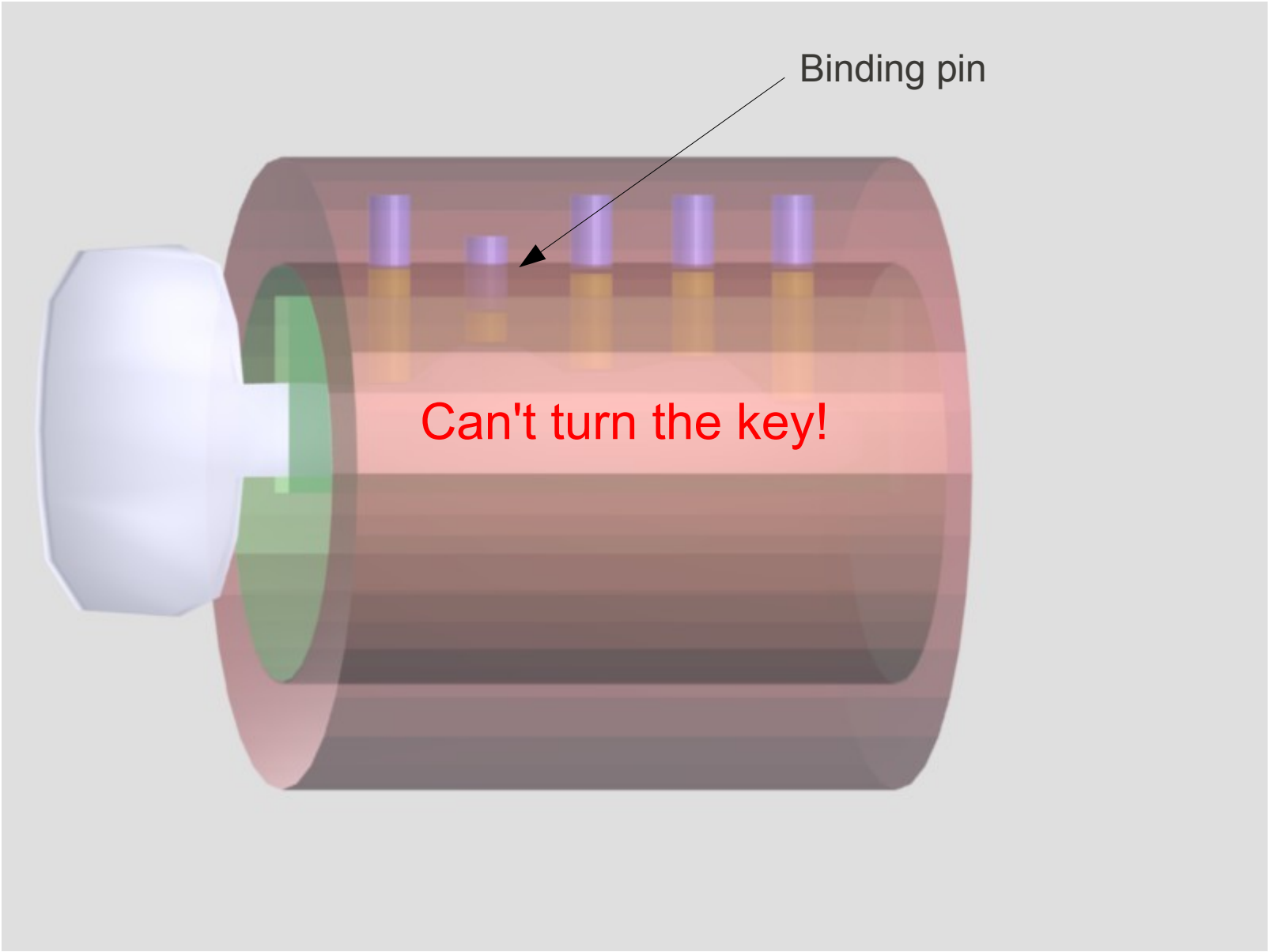
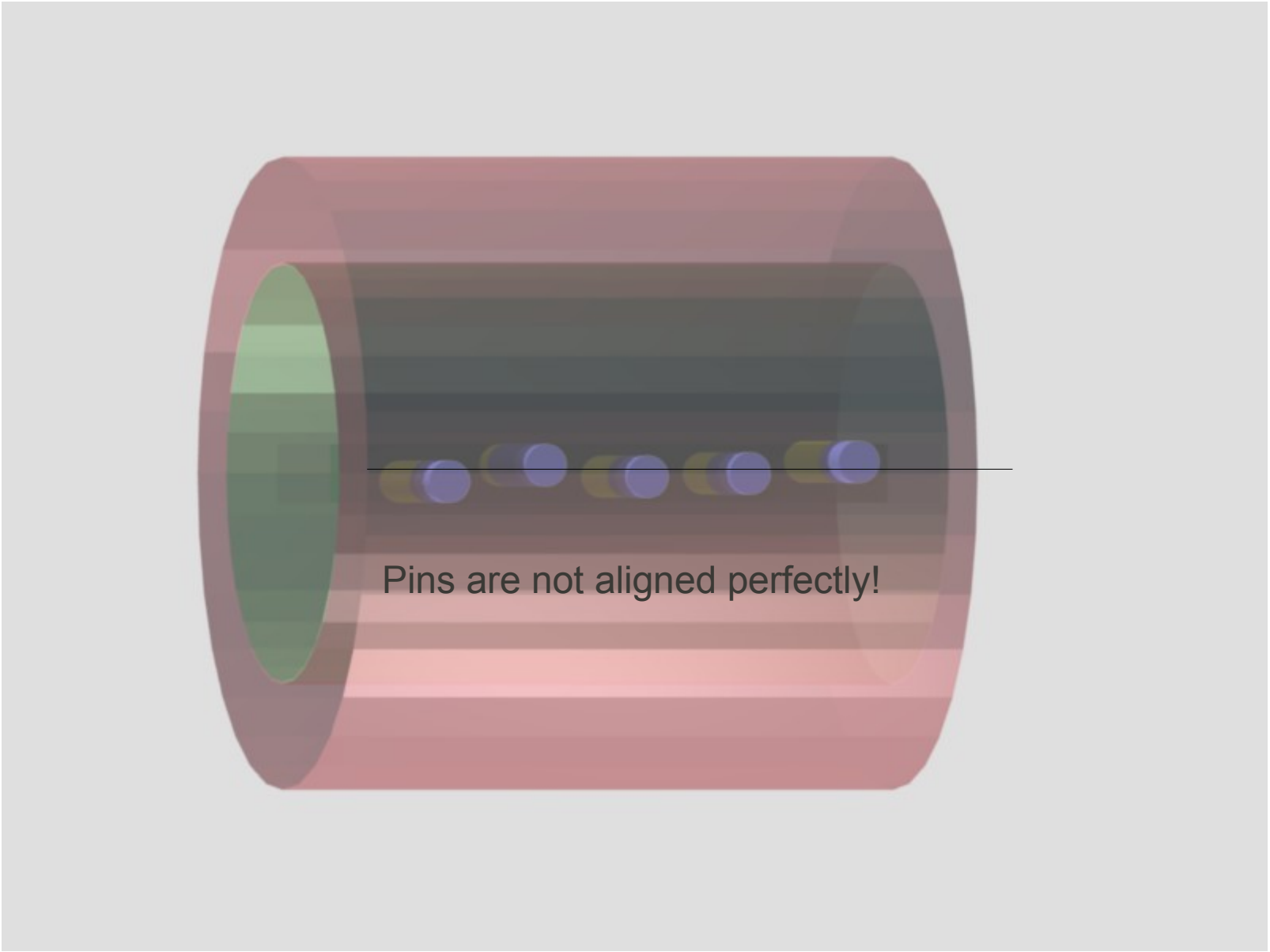
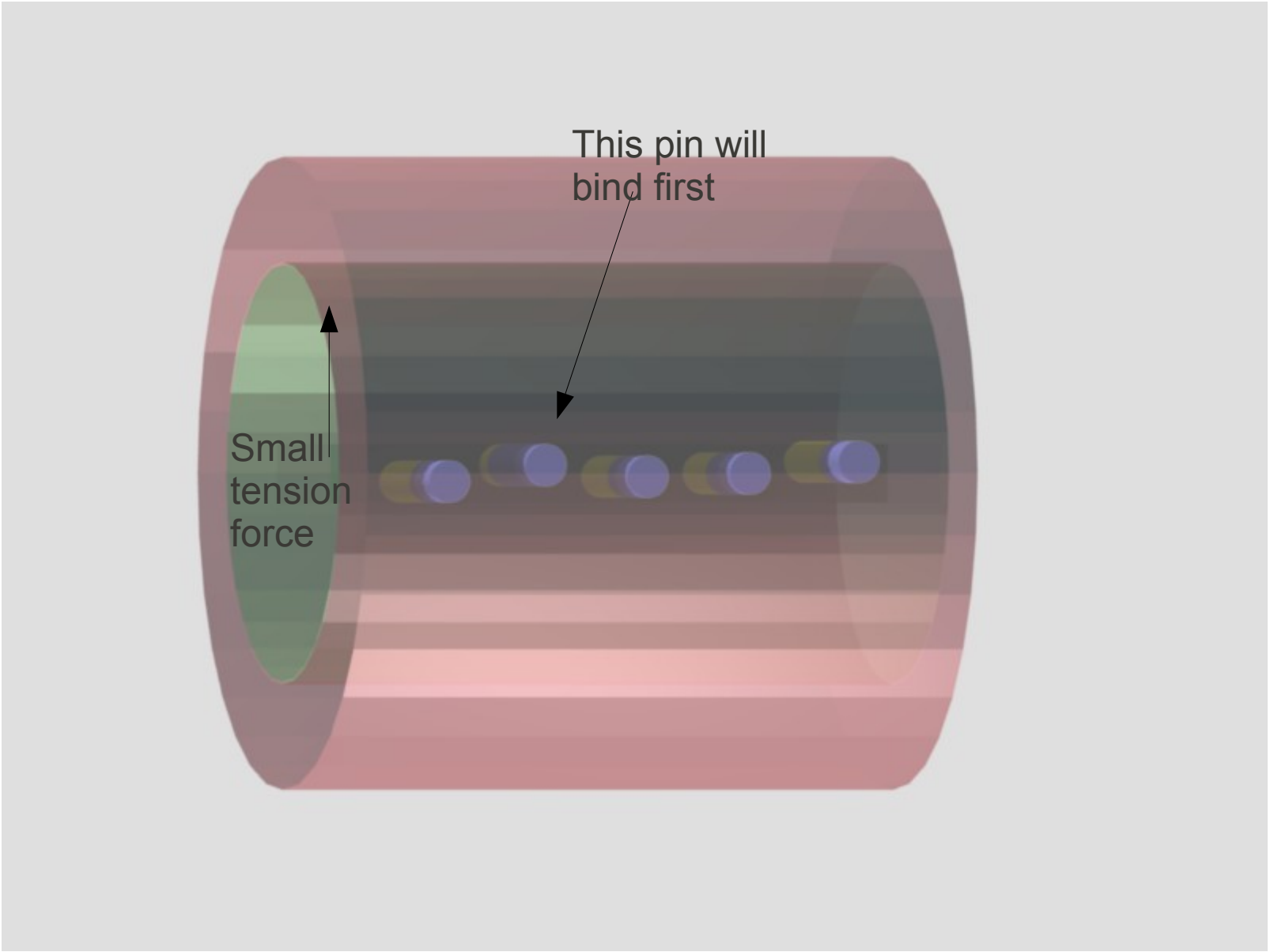


Questions so far?

Lockpicking

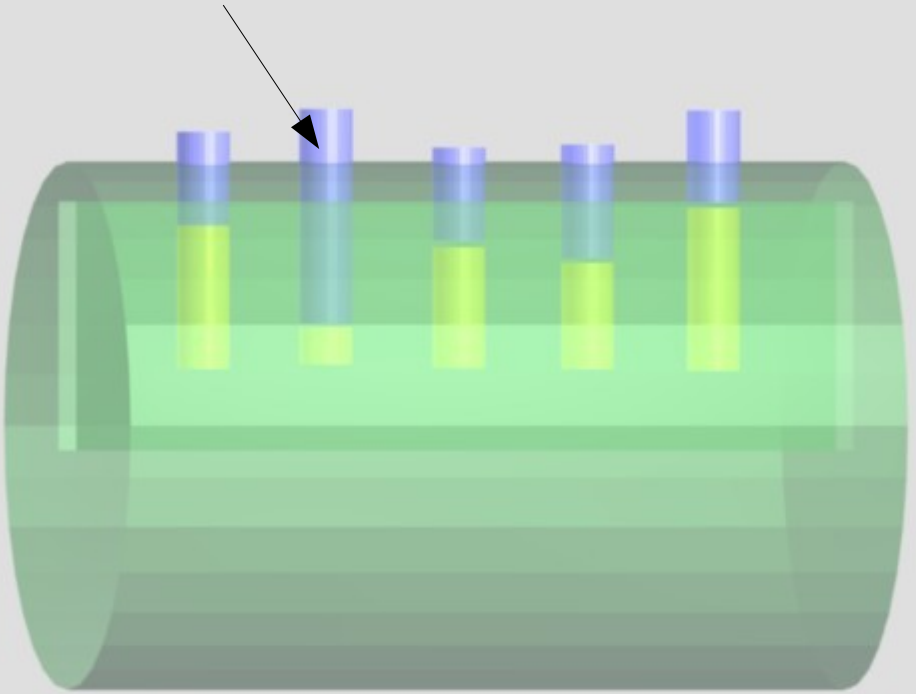


Lockpicking

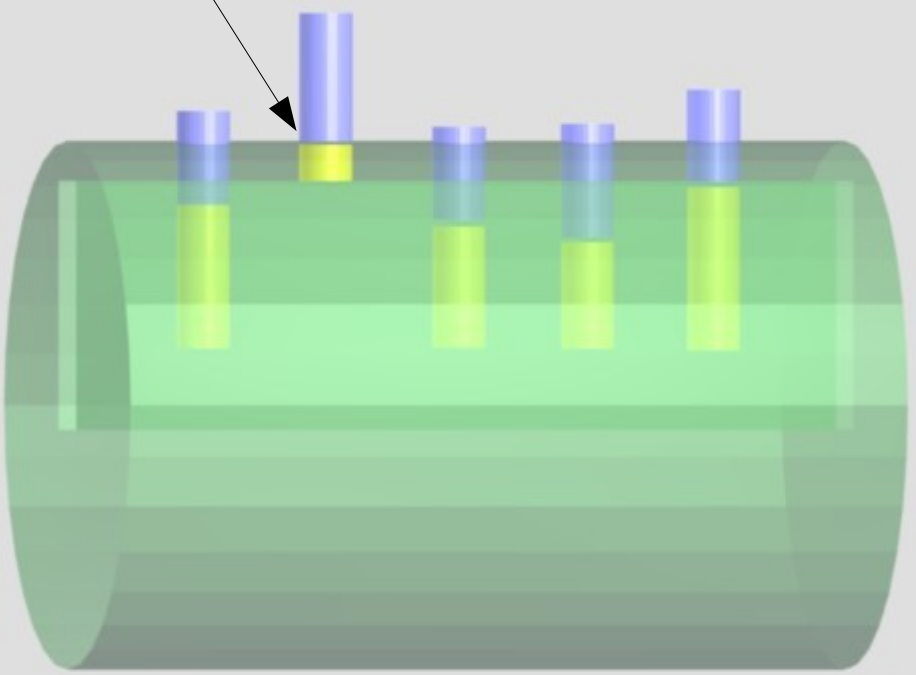


Lockpicking

Still putting tension on the cylinder, push up on that pin

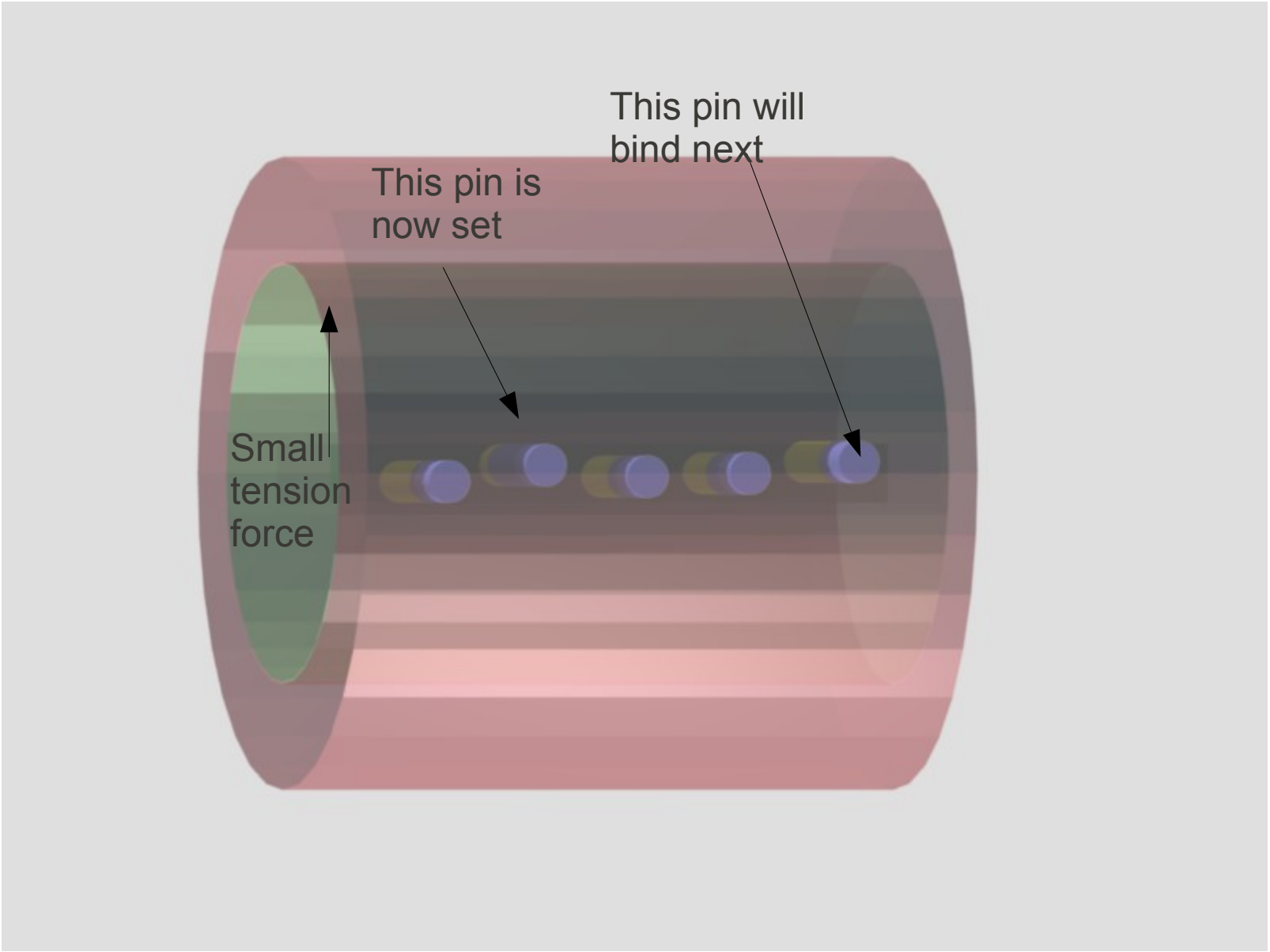


Lockpicking



When this happens, the cylinder should turn a tiny bit,
and you will hear a small click

Lockpicking



Lockpicking

L shaped tool is called “tension wrench”, this provides the turning force on the cylinder

Other tool is called the pick, use this to set the pins in the lock

Cryptography

- Just like in cryptography, only the “key” should be secret
  - Thief may possess the lock
  - Hacker may possess an encrypted file

Cryptography

- Just like in cryptography, only the “key” should be secret
  - Thief may possess the lock
  - Hacker may possess an encrypted file
- *Unlike* cryptography, finding “key” can usually be done in $O(n)$ tries vs $O(2^n)$
  - Makes physical locks much less secure than digital ones!

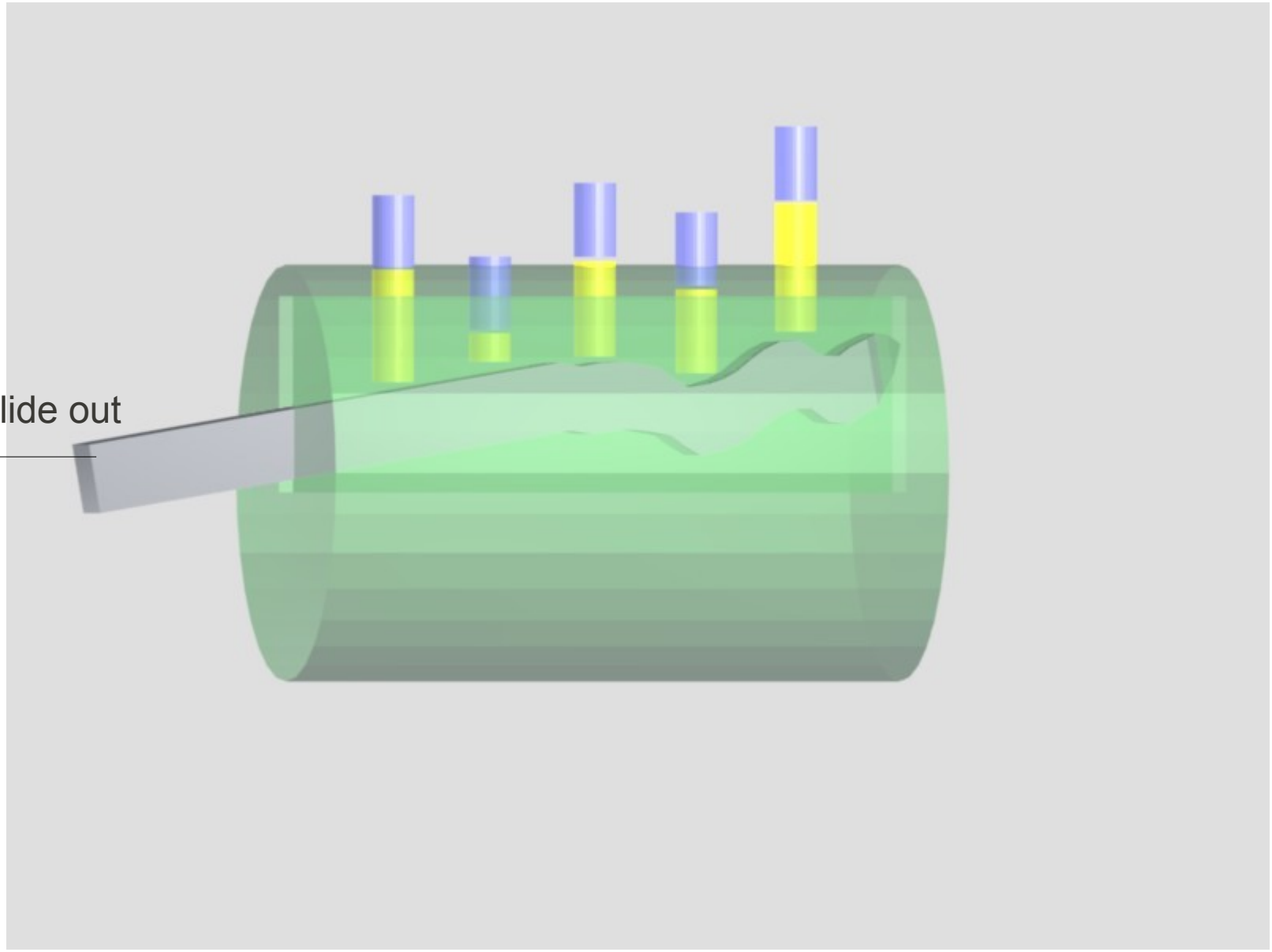
That sounds too easy!

It can be even easier!

Raking

- Quickly slide across the pins while applying a small amount of tension
- All the pins will lift up, and as the pins fall back into place, they should get set one by one
- Takes practice to master, doesn't always work
- Usually one will make a few passes raking, and then proceed to set the pins that are left

Raking



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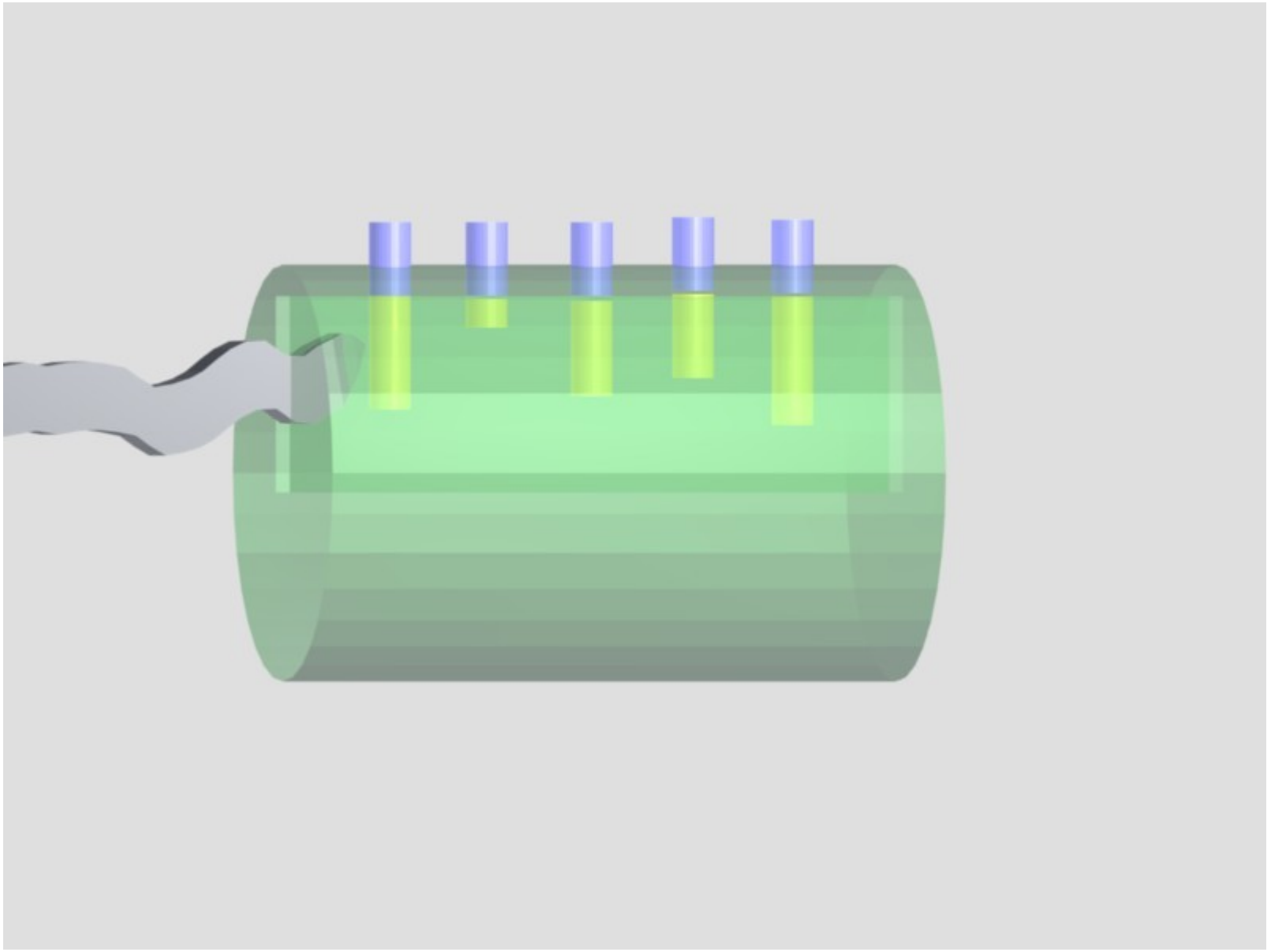


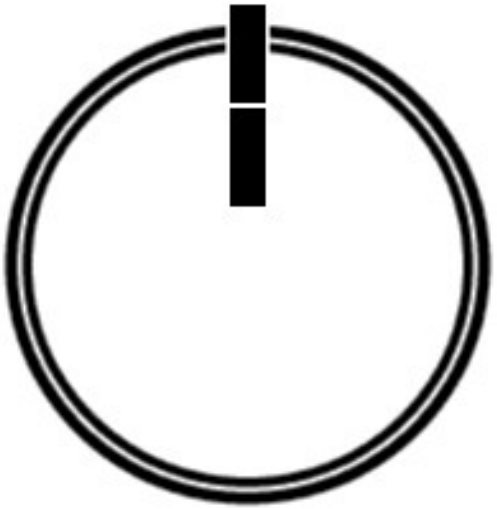
High security measures

(And countermeasures)

High Security

- “High security pins” (spool, mushroom, serrated)
  - Why are they hard to pick?
  - How can you tell if a lock is using them?
  - How can we defeat them?

High Security



Normal pins will not let cylinder turn

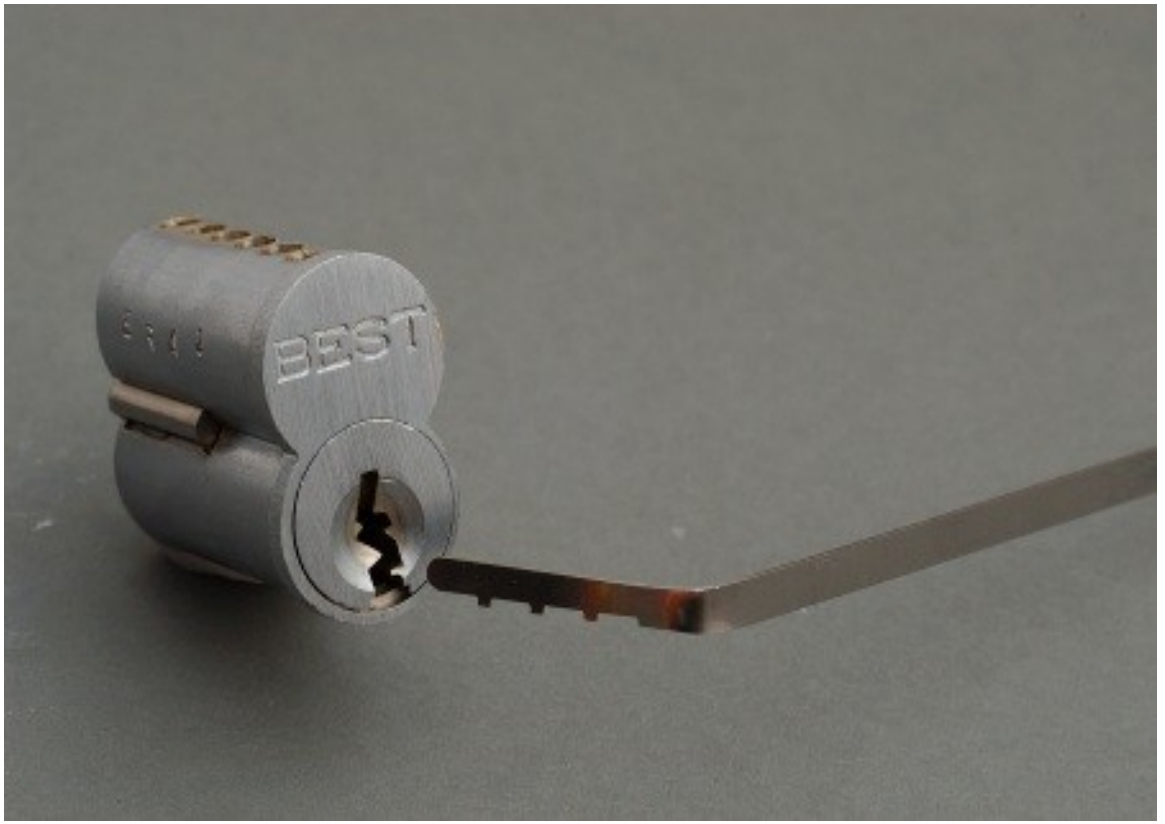
High security pins will let the cylinder turn, but will be set incorrectly!

High Security

- “Best” locks have two shear lines
  - One is for “control keys”, the other is for normal keys
  - Can't tell which is being set while picking the lock!

High Security

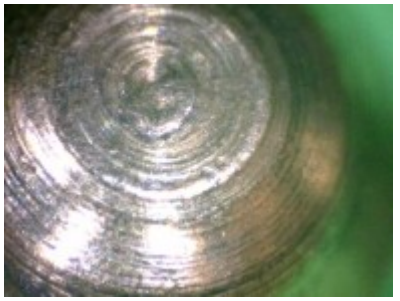
- Special torque wrench spins only one core

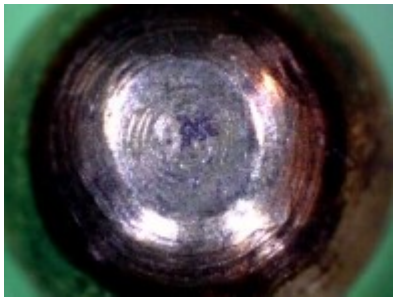


High Security

- In general “high security” just means you need a special tool to break it!

Forensics

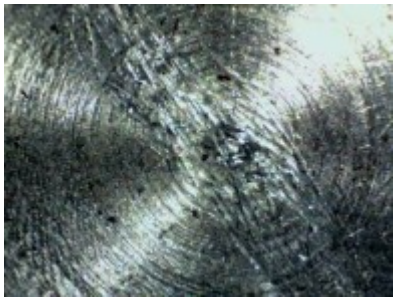





Normal usage

Attempted picking


Attempted raking



Forensics

- Physical evidence in lock is like digital evidence for computers
  - Brute forcing leads to evidence left behind
  - Careful checking leads to evidence of break-ins, or attempted break ins

Other bypass techniques

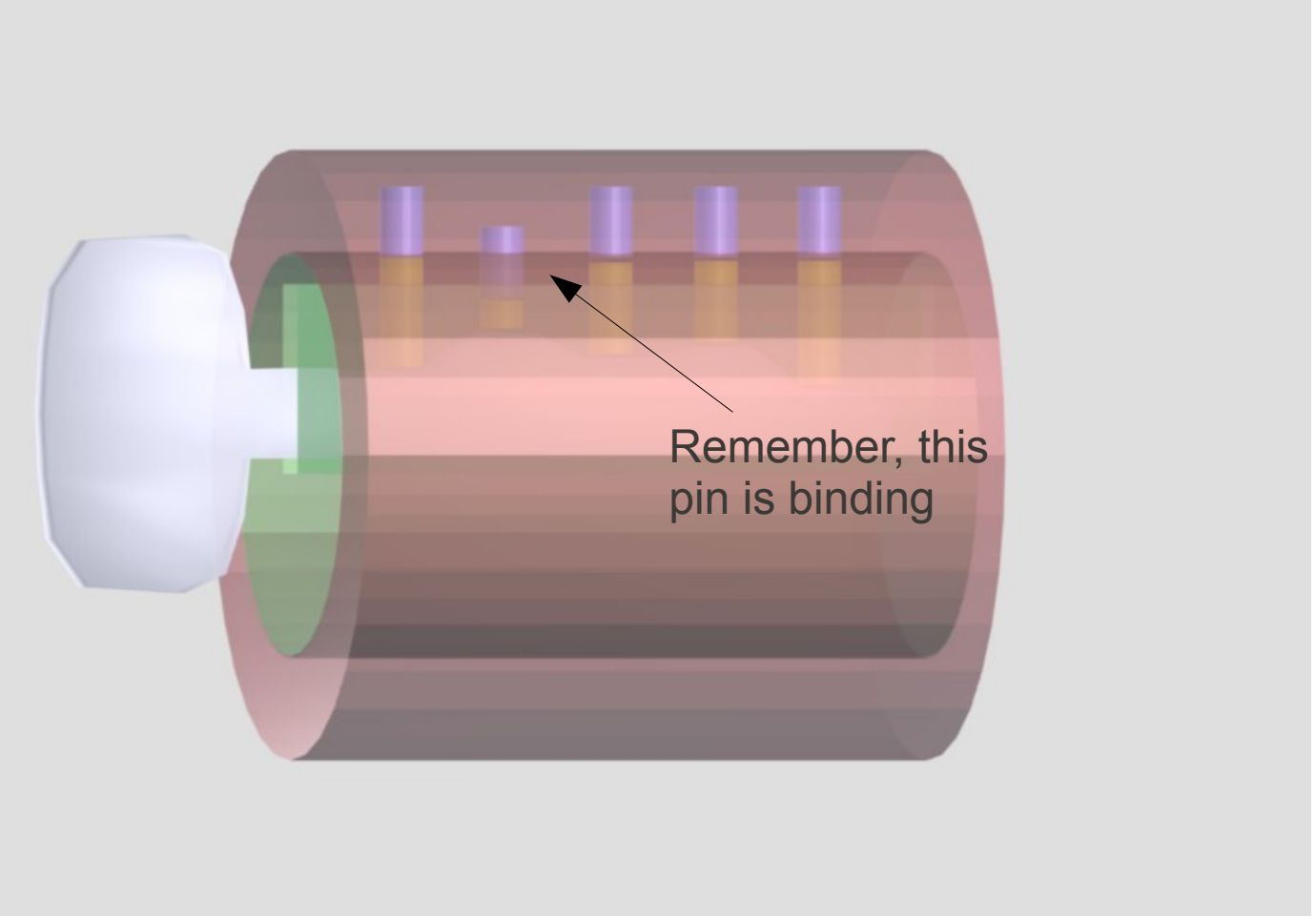
- “Pick style” techniques
  - Bump keys
  - Pick guns
  - Impressioning
- Other style
  - Shimming
  - Destructive entry

Bump keys and Pick guns

- Very similar to the raking technique!
- Hit the pins up very quickly
- Try turning the cylinder at the same time
- Hopefully the pins will settle correctly

Impressioning

- Not only do you open the lock, but you actually get a key for the lock



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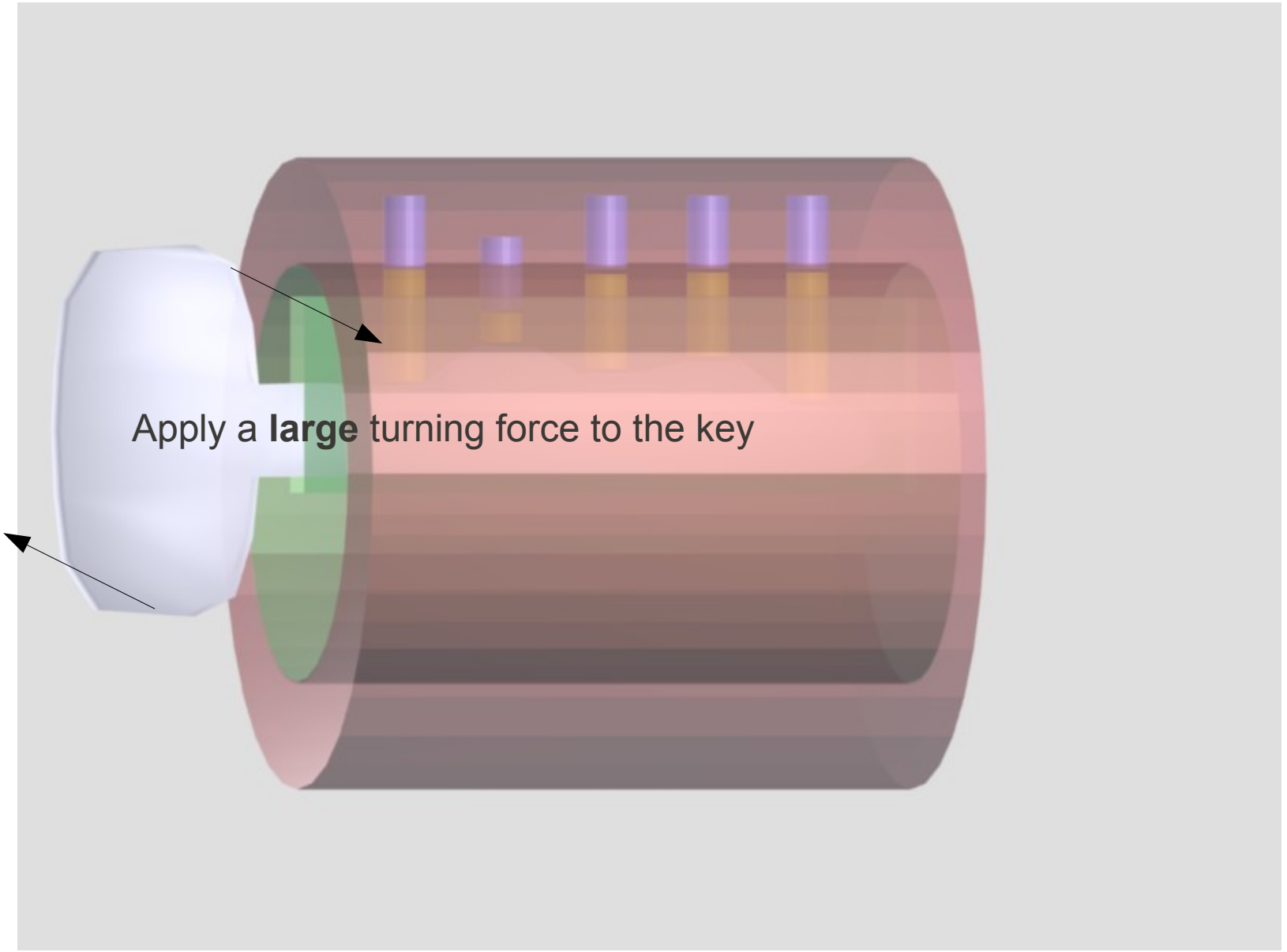

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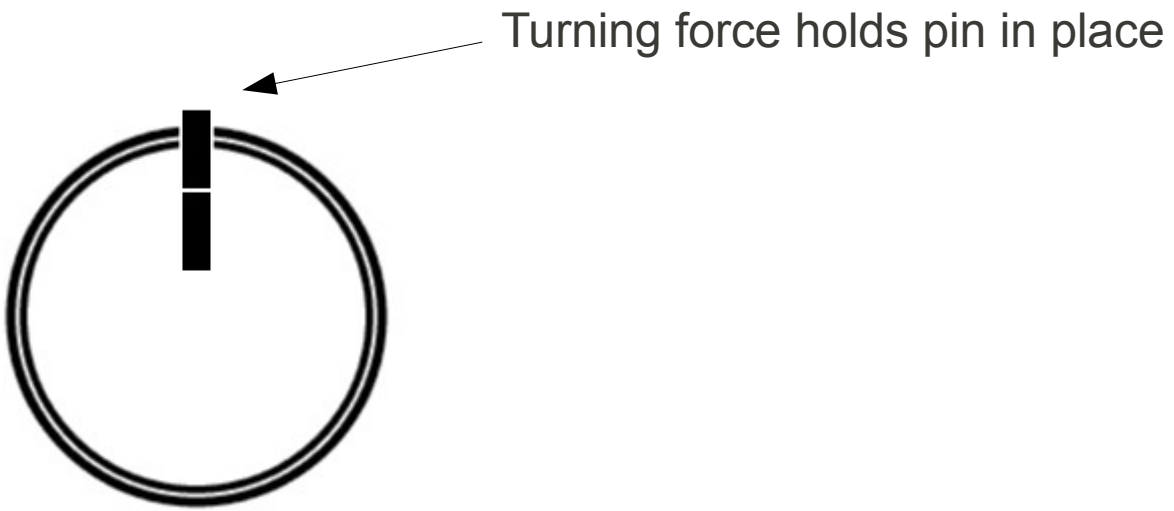

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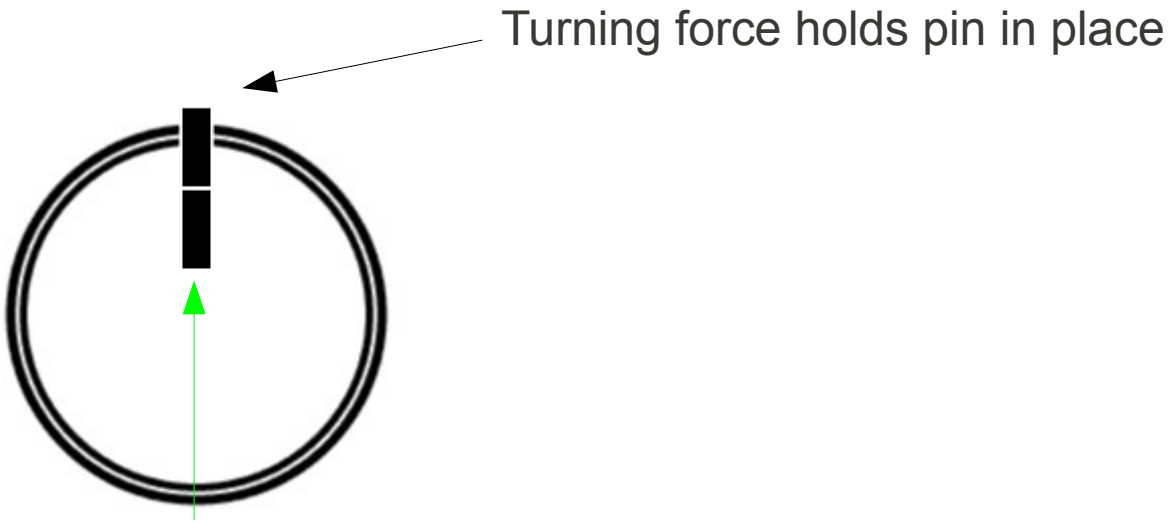
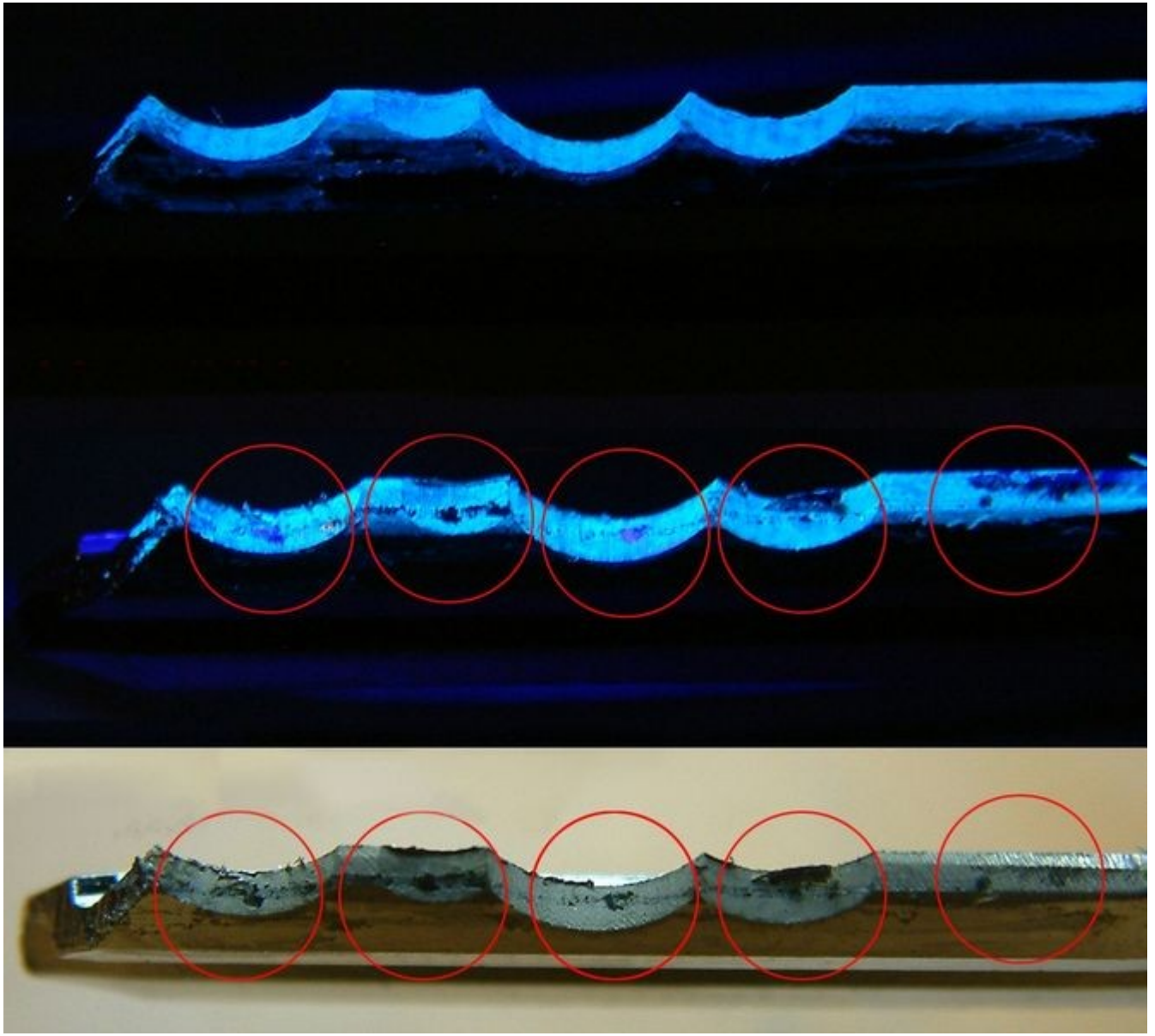


Push the key up against the pin and wiggle the key: it will scratch the key's surface because the pin cannot move!

Impressioning



Wherever a mark appears, that means that part of the key should be filed down

Impressioning

- Eventually no more scratches will appear on the key
- When that happens, the key should open the lock!

Cryptography

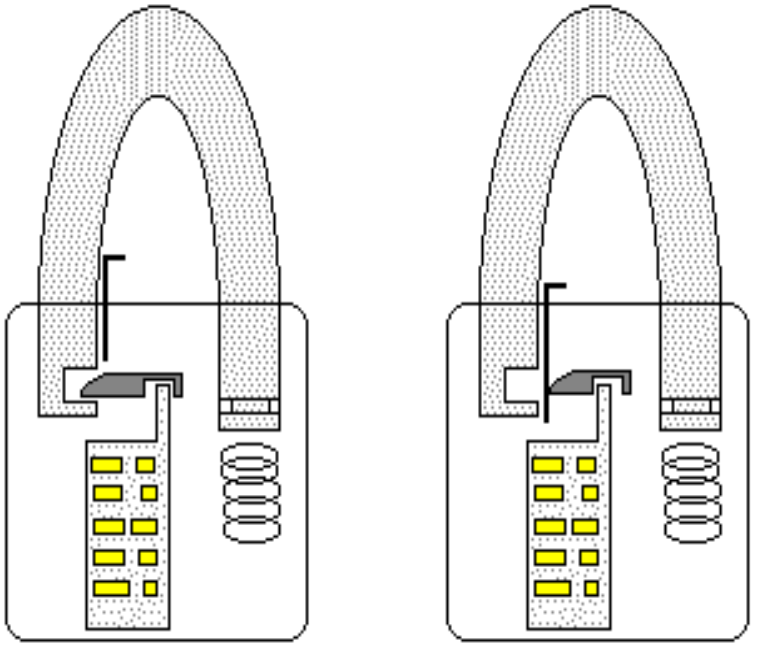
- Impressioning uses the lock as an “Oracle”
- Given a key and a lock, you can find out which pins are set and which are not
- This is like a computer which tells you which letters are wrong in a password!
- Oracles are a common way to reason about some cryptographic systems
  - Padding oracles tell whether or not an encrypted string has proper encoding
  - With a padding oracle, some crypto systems can be broken in linear time!

Other bypass techniques

- "Pick style" techniques
  - Bump keys
  - Pick guns
  - Impressioning
- Other style
  - Shimming
  - Destructive entry

Other techniques

- Shimming



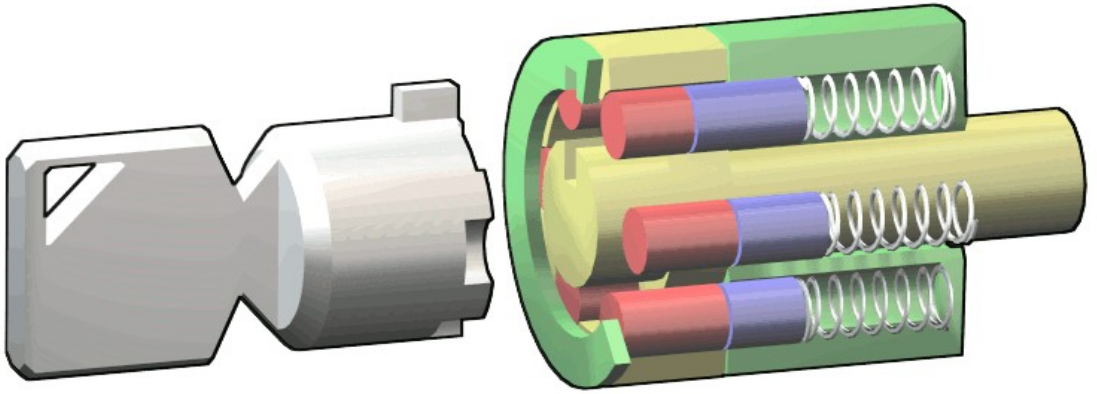
- Destructive entry
  - Just break the lock/door/window!

Cryptography

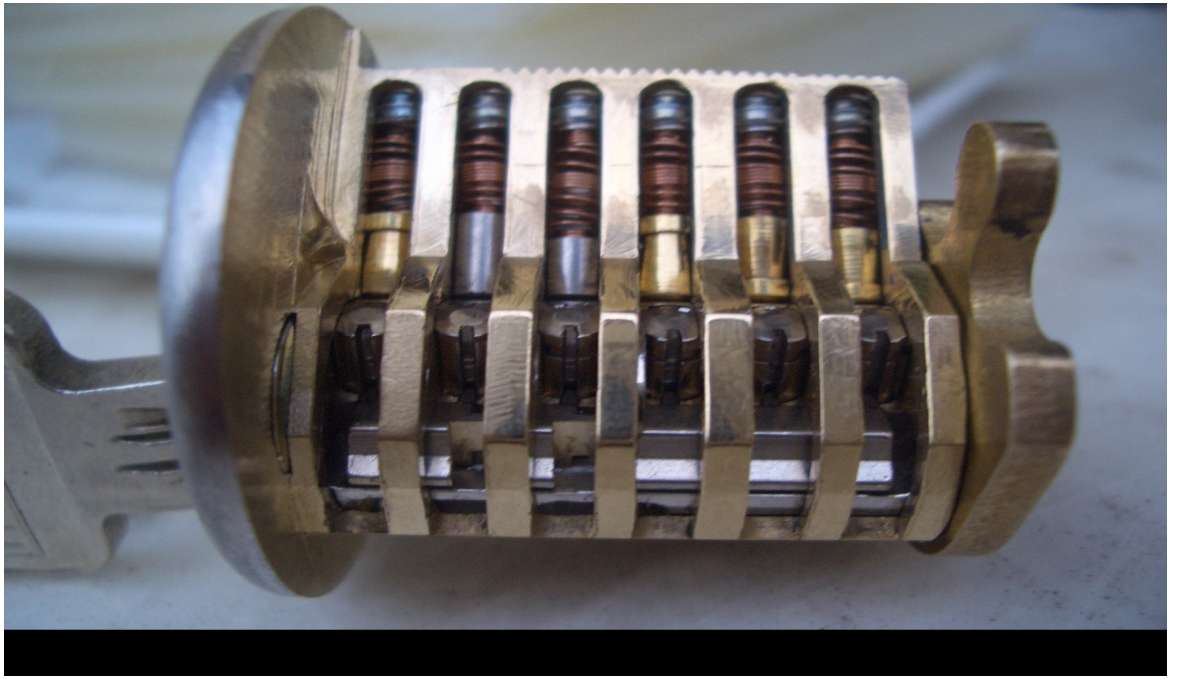
- The “other techniques” are really “side channel” attacks
  - In cryptography, this means attacking something other than the cryptographic algorithm itself (for example timing attacks or TEMPEST)
  - In lock picking this usually means “ignoring” the lock (for example, breaking down a door)
  - Many times these “side channel” attacks are the easiest to exploit, and the hardest to prevent

Other locks

- Tubular locks



- Medeco locks



Other locks

- Dimple pins

Your turn!

- I have some locks and picks, you can try opening some of the locks up here!

- If you have any questions, please ask them!