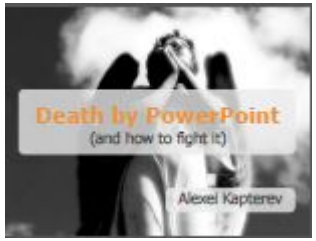
Communicating in Science—Celia's Tips for Science Talks



There are 300 million PowerPoint users in the world*

*estimate

They do 30 million presentations each day*

*estimate

About a million presentations are going on right now*

*estimate

50% of them are unbearable*

*conservative estimate

"Death by PowerPoint"
Alexei Kapterev
http://www.slideshare.net/thecroaker/death-by-powerpoint/

Celia M. Elliott
Department of Physics
University of Illinois at Urbana-Champaign

ILLINOIS

Step 1: PLAN what you're going to say

Distill your message to one sentence that you could write on a PostIt™ note (main point)

What do you have to explain so the audience understands that message? (subpoints)

Use images instead of text to illustrate your points as much as possible

Overarching message the audience should walk away with

What must I explain?

1.
2.
3.

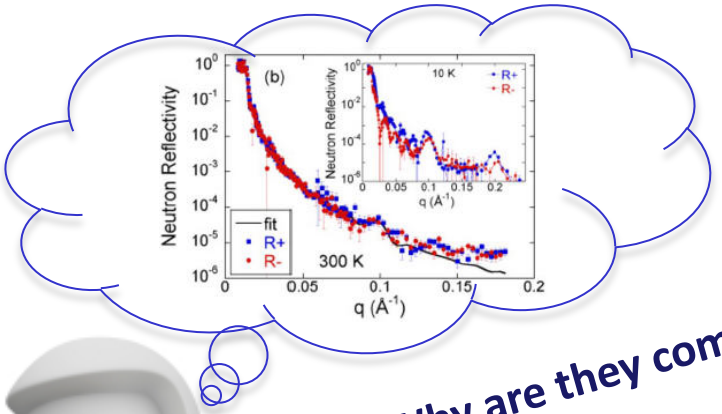
How can I best illustrate these points?

Before you start the first slide, decide what your ultimate goal is

- Disseminate a new result
- Provide an overview of
- Reinterpret existi
- Propose a n
- Explai method
- Stim laborations
- Educat udience on a specific concept
- Get a job

Overarching goal: Tell a memorable story & teach the audience something interesting

Next step—analyze your audience



What words will they understand?

What do I have to explain?

What do they believe?

What is their level of expertise?

Why are they coming to my talk?

What do they already know?

What will confuse them?

What do they think is important?

You

Your audience

Your biggest constraint: How much material can you cover in the time allotted for your talk?

Elliott equation:

$$p = \frac{t}{8}, \qquad [1]$$

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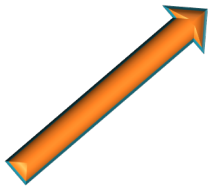
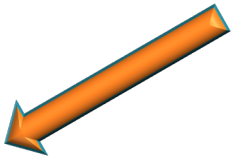


The number of main points you can make in an oral presentation

Your biggest constraint: How much material can you cover in the time allotted for your talk?

Elliott equation:

The time allotted in minutes



$$p = \frac{t}{8}, \qquad [1]$$

Tip: It takes at least 6 to 8 min to adequately introduce, explain, illustrate, give examples of, and summarize a major point in an oral talk

Don’t try to tell “the whole story”*

*Your objective is
to get the audience
interested enough
to remember your name
and ***read the paper***

Distill your talk to a few key points (q.v. Eq. 1)

Present only enough data to

- Illustrate your main points
- Support your conclusions
- Demonstrate the originality of your work

More presentation math:

$$S = \frac{t}{2}, \qquad [2]$$

where *S* is the number of slides that can be presented, and *t* is the time allotted in minutes

A good "rule of thumb" is to allow about 2 minutes per slide

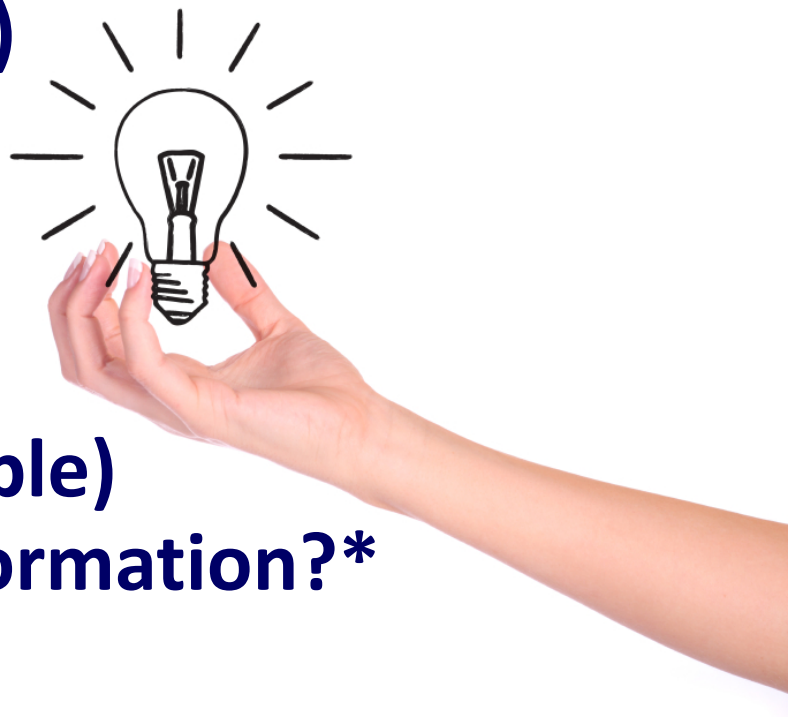
Allow more time for equations, complex plots, complicated figures, tabular data

Tip: You cannot show 44 slides in a 15-min presentation, *no matter how fast you talk*

How do you start?—with the ideas!

What are the (2 or 3, at most) main ideas that I want to convey to the audience?

What is the best (easiest to understand, most memorable) way to show them that information?*

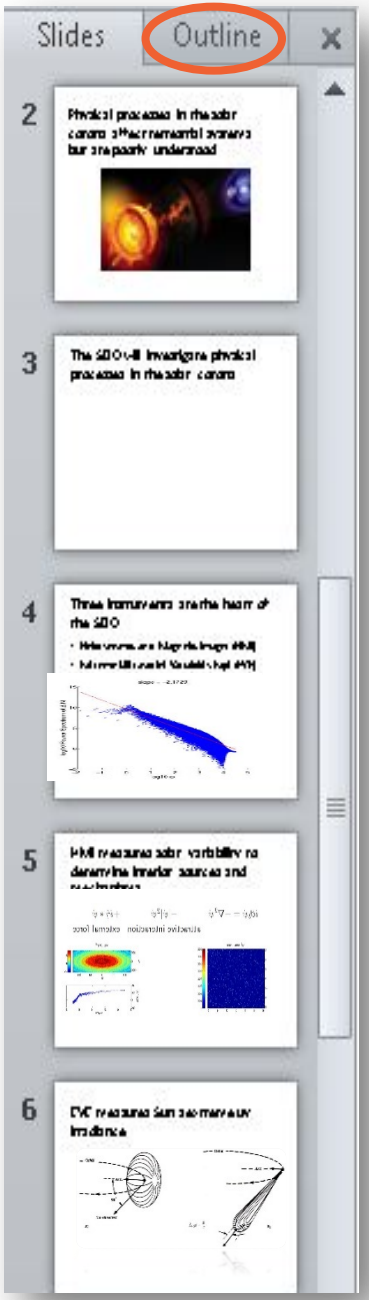


***Hint: It's probably not by written words that you read off the screen**

Write out main ideas in full sentences

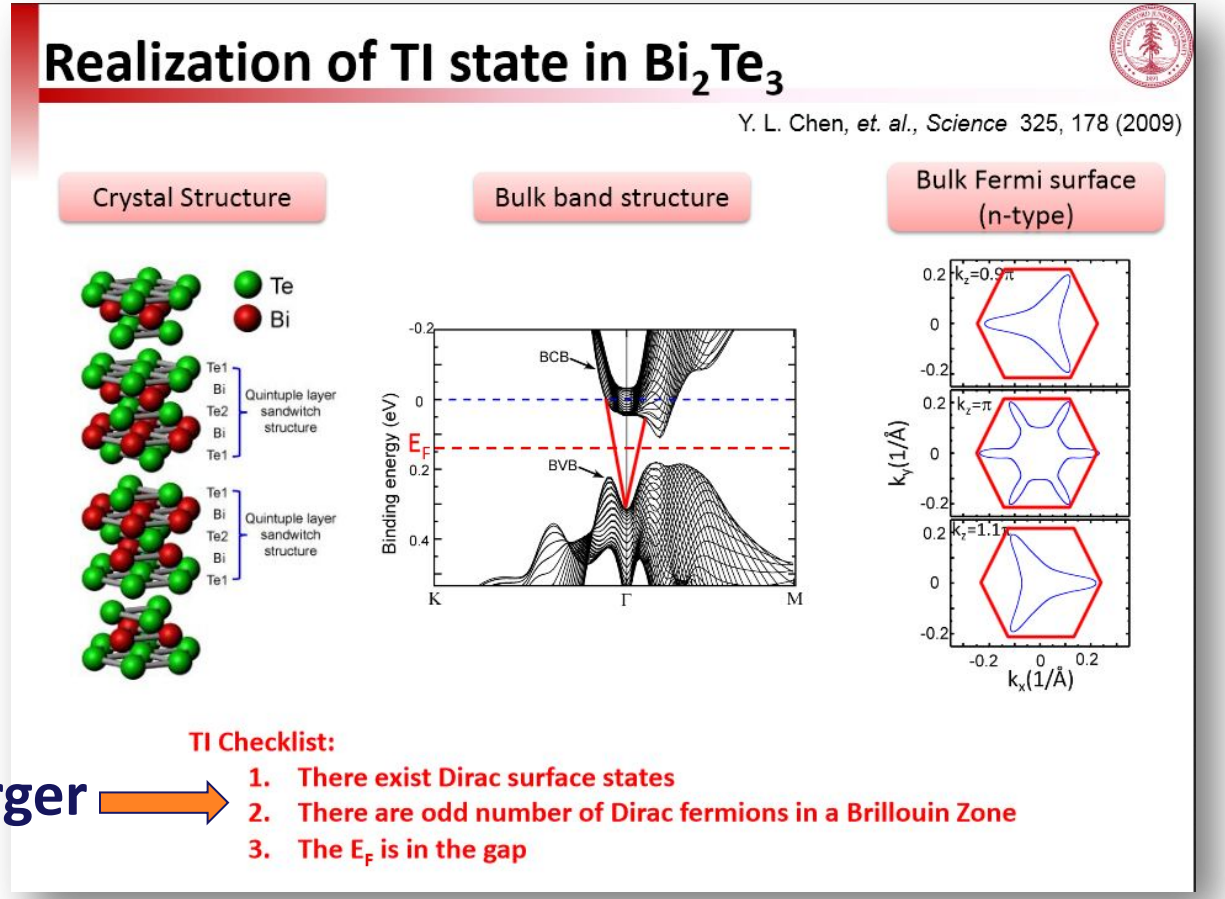
The sentences become slide titles —one main idea per slide

Use the rest of the slide to explain and support the statement at the top of the slide



Tip: Read the sentences one after the other. Do they form a logical narrative? In "outline" view, moving slides around to ensure a logical story is easy!

Every other element that you put on the slide should explain or amplify the motivating statement



Should be larger →

Yulin Chen, "Direct Probing the Electronic Structures of Topological Insulators," Tutorial on topological insulators, APS March meeting, 2011 http://www.stanford.edu/~chenyl/APS_Tutorial_2011_YulinChen.pdf

Step 2: MAKE effective slides

Think of each slide as a paragraph in a paper

"Topic sentence" goes at the top of the slide

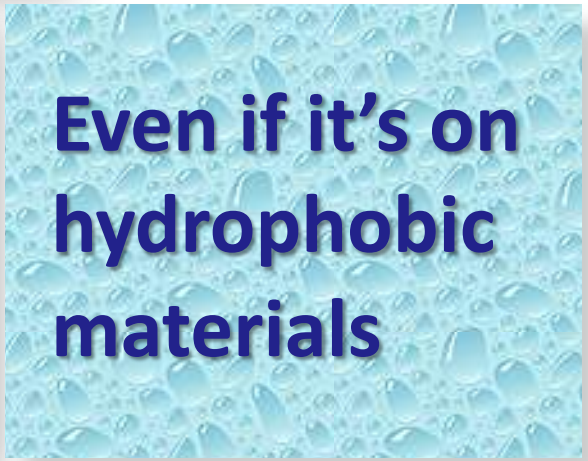
Everything else on the slide

1. Explains
2. Expands on
3. Gives evidence for that statement

First, the "don't"s …

Don't use photographic or "fill" backgrounds

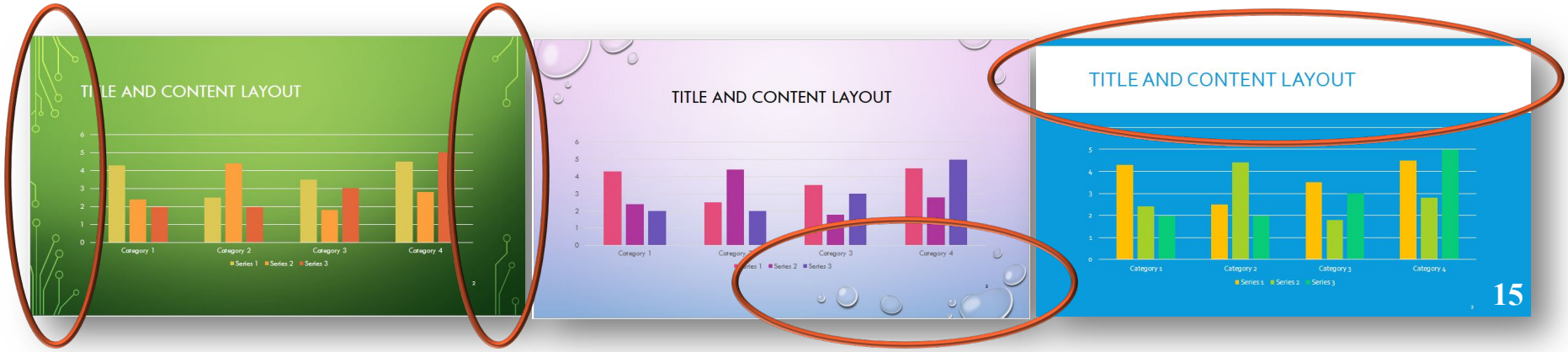
- They're distracting
- They make your text too hard to read
- They get boring after the first two or three



Just don't do it!

Don't use one of the PPT templates

- They take up too much real estate with meaningless graphics
- They force you to devote 25% of the slide to the "title"
- They trivialize your message by promoting style over substance
- Many are just hideous



Don't use  unless you are presenting an actual list

Status of Projects

HEP at ANL

Theory

- Connection with UC through Carlos Wagner (
  appt) has brought two thesis students to
- New Assistant level theorist (Tim Ta
- 7 international workshops orga
  - *Broad participation by sta*
- Active work on organi
  workshops held el
- Physics highli

Accelerator R

- Ba wakefield
  -beam configurations,
  major developments of the

REJECTED

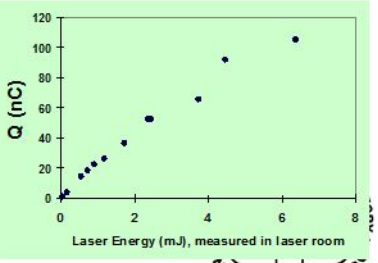
ation of acceleration to 100 MeV in 1m

s required a major upgrade of their facility, especially
electron gun and laser system

- *h power tests of externally powered dielectric loaded waveguides in collaboration with Naval Research Laboratory*

- 2 new physics processes affecting electron acceleration discovered (and published)

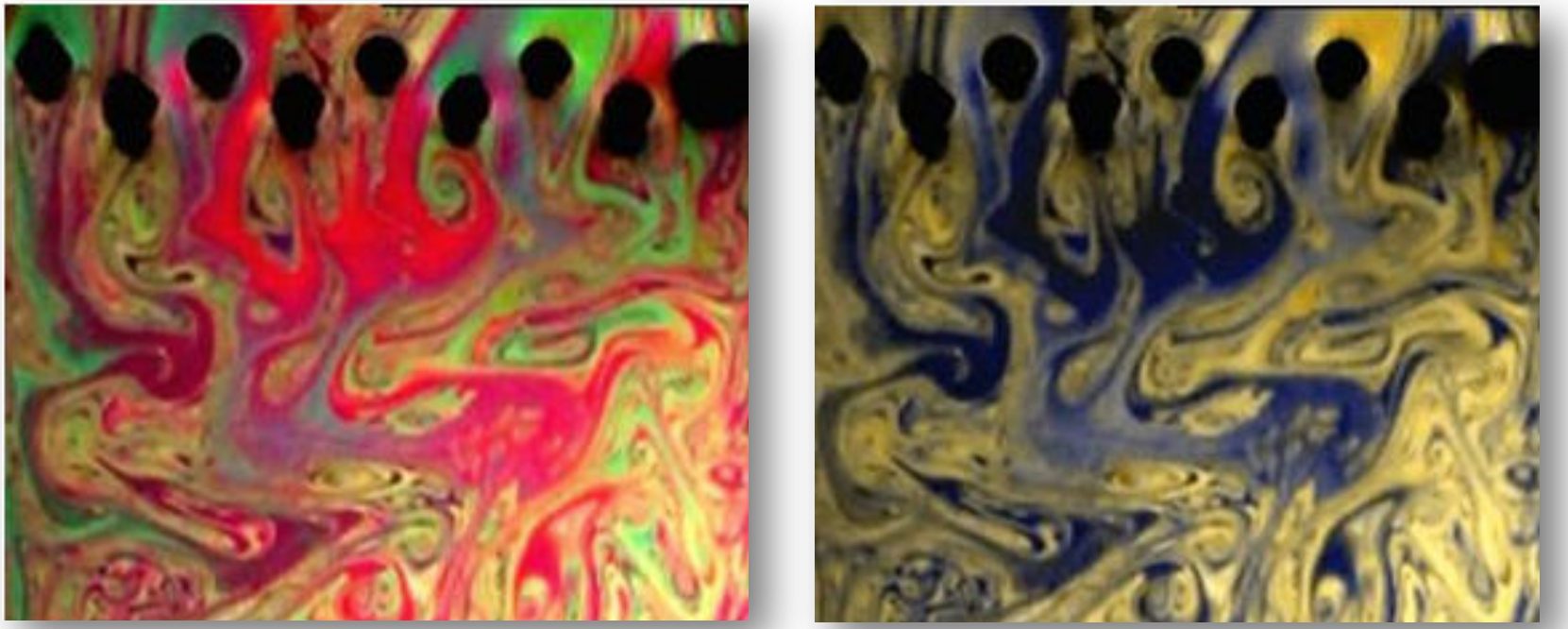
Charge generated from the new gun



NIVERSITY OF CHICAGO

24

Don't use red or green to convey important information*

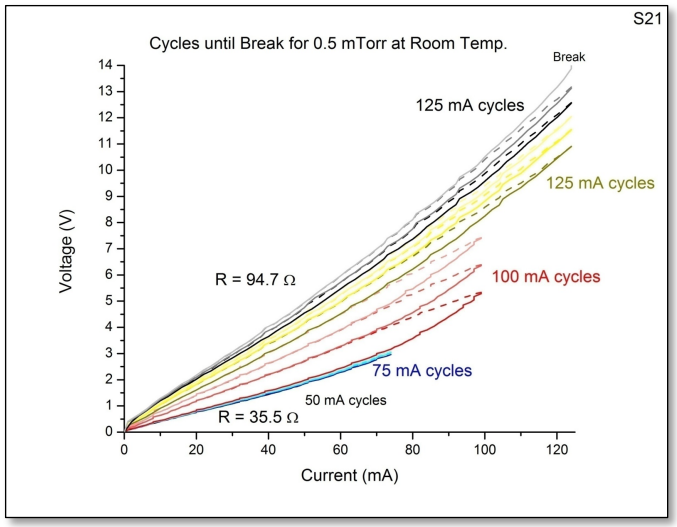


Development of turbulence in a soap film as its surface is raked by a wire comb. *Courtesy Nigel D. Goldenfeld*

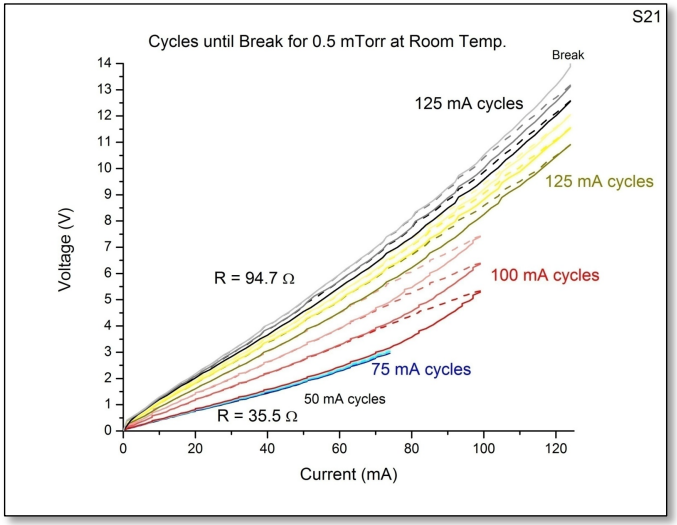
***Between 8 and 12 percent of white males are red-green colorblind—who's your audience?**

DO replace the content-less PPT "title" with a meaningful motivating statement

Results



***IV* curves showed an increase in resistance with Joule heating**

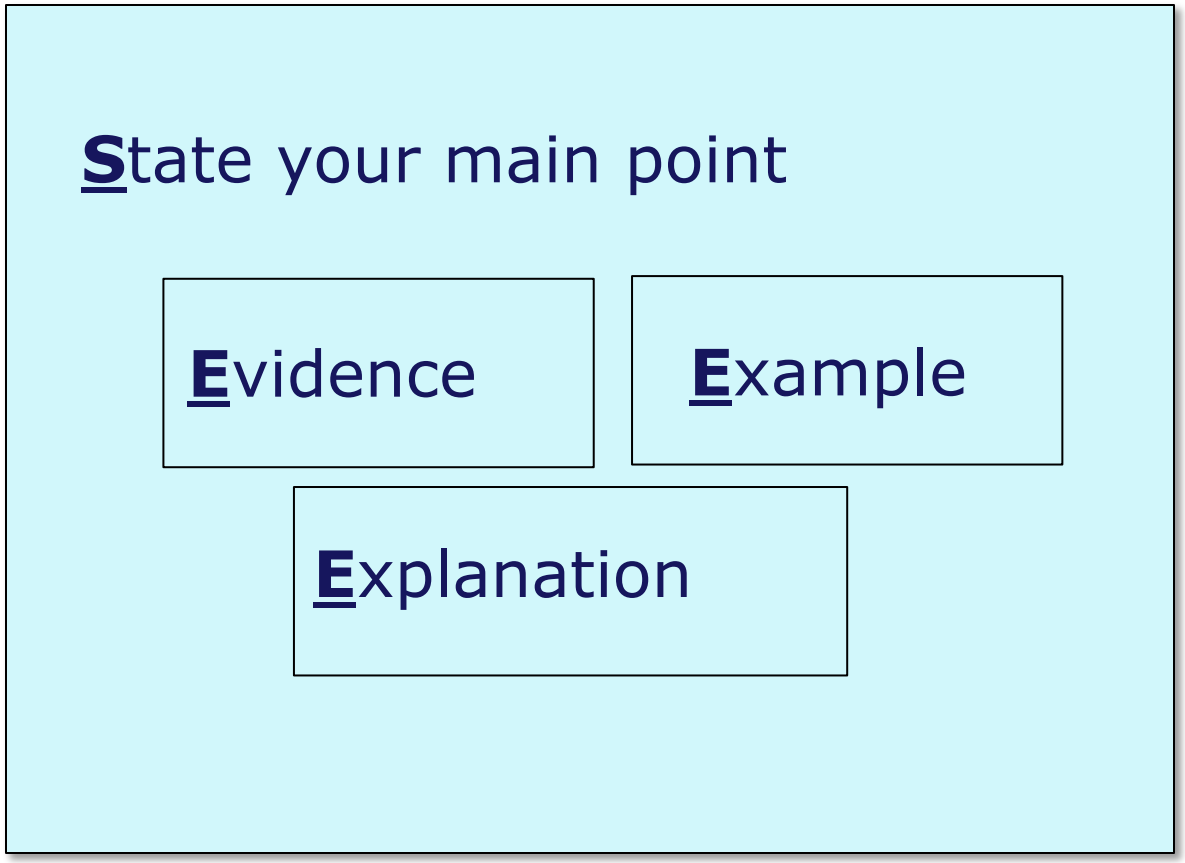


Plot courtesy Thomas Hymel

Tip 1: Write the statement as a sentence and left-justify it

Tip 2: Turn off the "auto-correct" feature in PPT that reduces the font size if you exceed the number of characters MS thinks you should have on a line

DO use the SEEE method to present your ideas effectively



DO use the SEEE method to present your ideas effectively

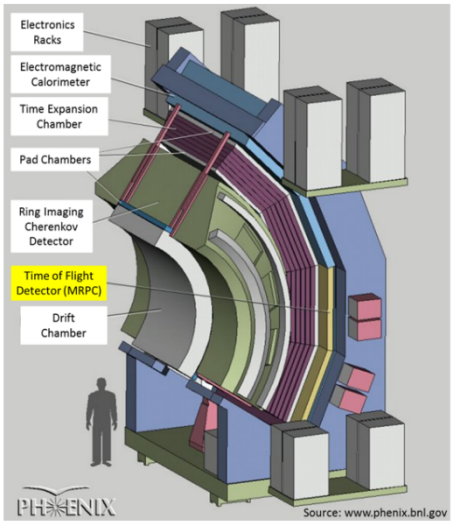
State your main point

Evidence

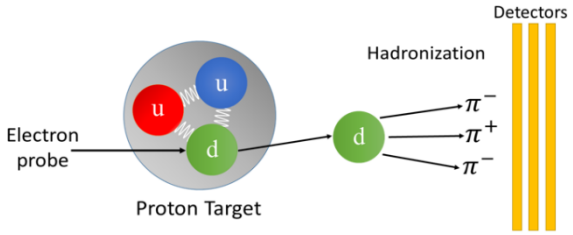
Ex

Explanatio

Study of nucleon spin structure requires high-timing-resolution detector



PHENIX center arm detector



$$p = \gamma m_0 \beta c$$

$$\sigma\left(m^2\right) = 2E^2\frac{\sigma_\tau}{\tau}$$

High timing resolution → high mass resolution
→ better particle identification

Goal: To develop a cost effective multigap resistive plate chamber (MRPC) having high timing resolution.

Courtesy Jun Hui See Toh

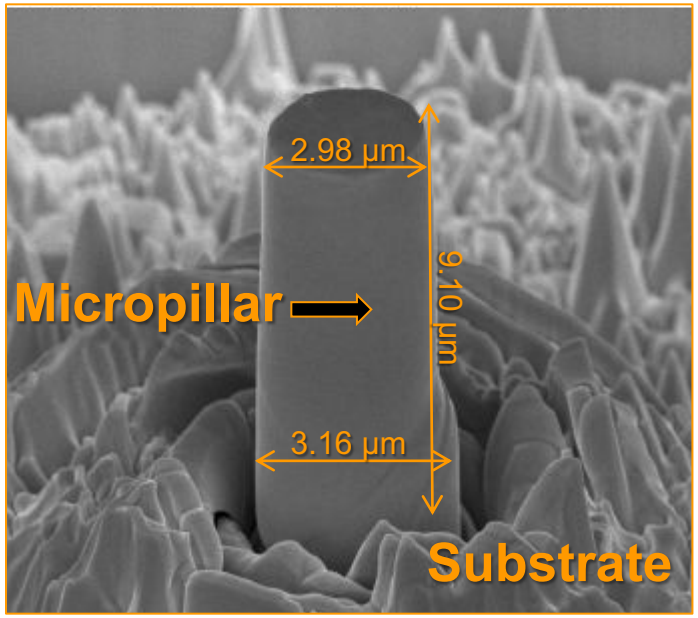
DO label all elements in a figure

Point out important features

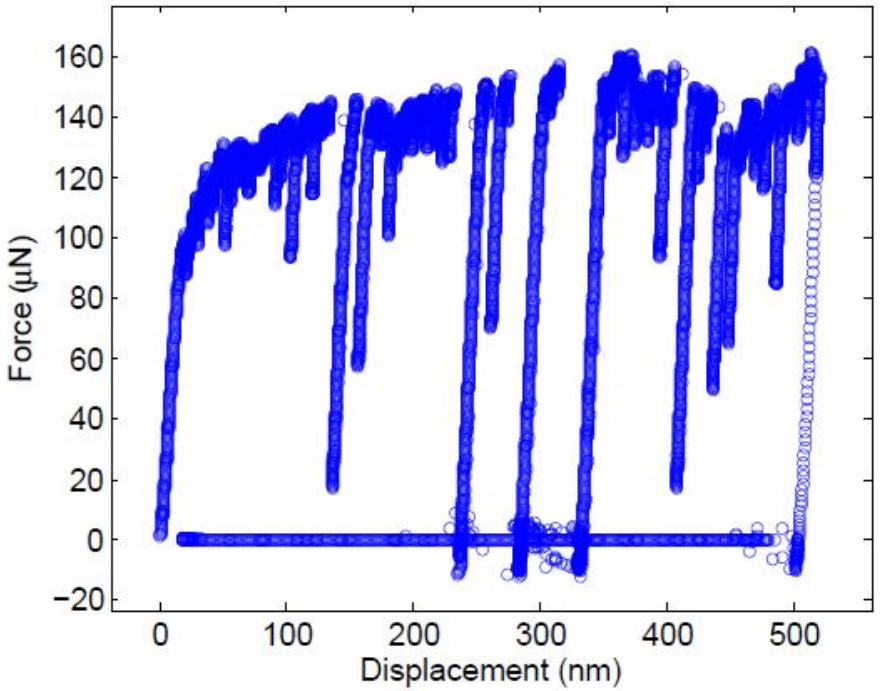
Provide a scale

Label both axes of graphs and show units

Give credit



SEM image of gold micropillars
(*Courtesy M. Wraith*)



Displacement controlled compression of the micropillars
(*Courtesy M. Wraith*)

DO number your slides

"viz." (*videlicet*) means "namely"*

Use to introduce specifically the items comprised by a previously expressed whole

"The noble gases, viz., helium, neon, argon, krypton, xenon, and radon, are a group of six gaseous chemical elements constituting Group 18 of the periodic table."

*Few writers use viz. nowadays, but know what it means

DO use a simple sans serif font

- Serif fonts don't project as well because the narrow parts tend to fade
- Eschew weird *fonts* (in*)
- Use one main fo most, one contr for emphasis
- Use o d, at most, one cont ont for emphasis
- Use mixed upper and lower case for text—WRITING IN ALL CAPS LOOKS LIKE YOU'RE SHOUTING (and it's much harder to read—and proofread!)

*or risk professional ridicule

Sans serif fonts are easier to read when projected

Two main families of font styles

Sans serif—all the lines of the letters are the same thickness

Calibri	Tahoma
Helvetica	Univers
Arial	Verdana

Serif—some lines are thinner and extra thin strokes are added at the base & ends of letters

Times	Aptos Serif
Georgia	Palatino Linotype
Century	MingLiu

DO use equations only if absolutely necessary to convey your message

DARK ENERGY SURVEY

Photon Fluctuations

- After PSF and normalization, must simulate photon fluctuations
- Convert each pixel ADC count to number of photons by gain of each pixel
- Apply Poisson distribution errors to each pixel
- Convert number of photons back to ADC counts

$$\text{New ADC value} = \frac{\text{Poisson}(\text{Gain} * \text{Old ADC Value})}{\text{Gain}}$$

- Finally, superimpose SN onto image

Slide Courtesy Nick Langellier

Replace math with words

Slow down; talk through step by step
Define all symbols
Explain relevance
Make them large enough to be easily read

DO "embed" special fonts in PPT to avoid embarrassing surprises at the conference

your computer

The Strickler–Berg relation opens the door for comparing measured spectral quantities

$$1/\tau_{FM} = 2.88\text{x}10^{-9}\frac{n_f^3}{n_a}\left\langle \bar{\nu}_f^3 \right\rangle_{av}^{-1}\int\frac{\varepsilon d\bar{\nu}}{\bar{\nu}}$$

Different computer—Voilà! Pencils!

conference computer

The Strickler–Berg relatio opens the door for comparing measured spectral quantities

$$\frac{1}{\blacklozenge} = (2.88 \bullet 10^{12}) * (n^2) * [\bullet^3]^{-1} * \int_0 \Pi_e(\bullet)\, d\bullet$$

DO choose a neutral background and a high-contrast color for the text

Use a light-colored background with dark text

Use a dark background with light text

This isn't high-enough contrast

Neither is this

Don't ever put red on blue

Or blue on red

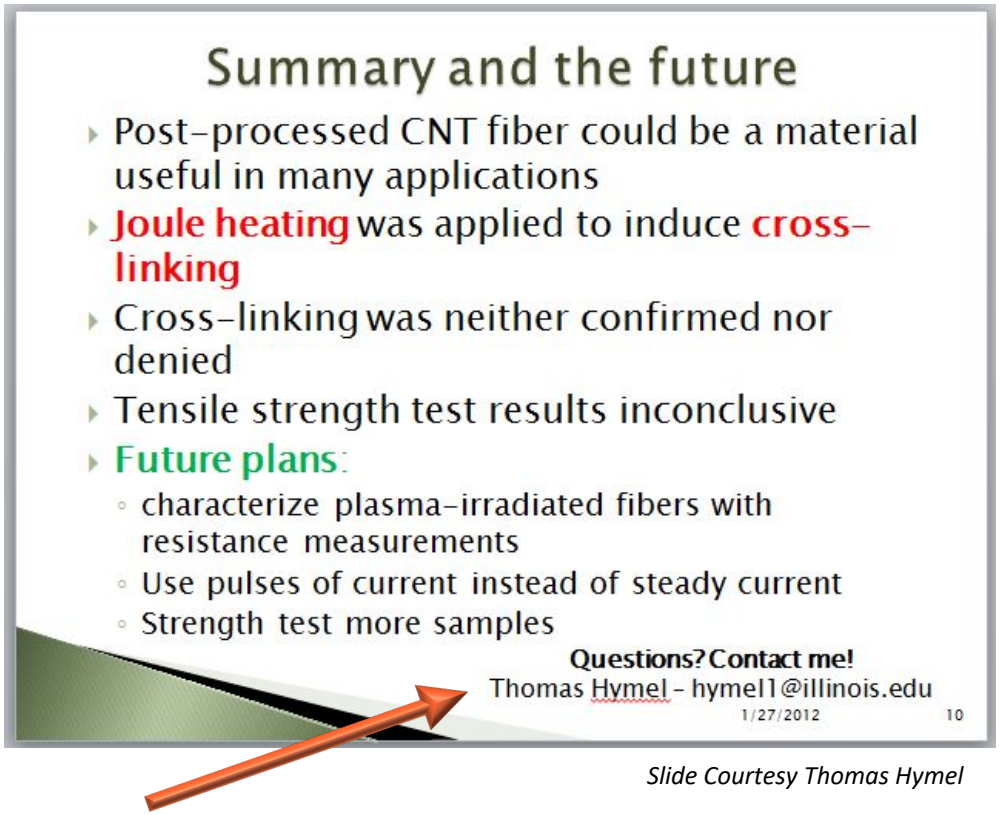
And avoid using gradient fills, too

DO provide a "summary" slide and make it count!

Recap key results

Reiterate principal conclusions

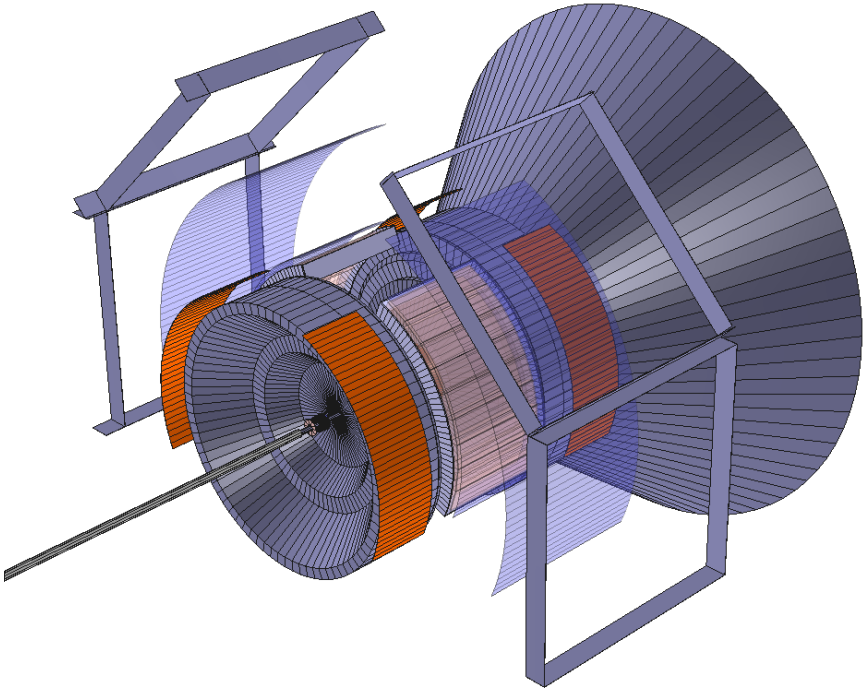
Repeat your contact information



Slide Courtesy Thomas Hymel

Tip: Your last slide will probably get the longest exposure, and it will be the first thing people see when they wake up

Most people will remember your images better than your words…



Figures promote audience interest, provide supporting evidence, help explain complex ideas and relationships quickly, and give the audience something to remember

…and they'll look at the figures first, too

Who can tell me the four reasons to include figures in your talk?

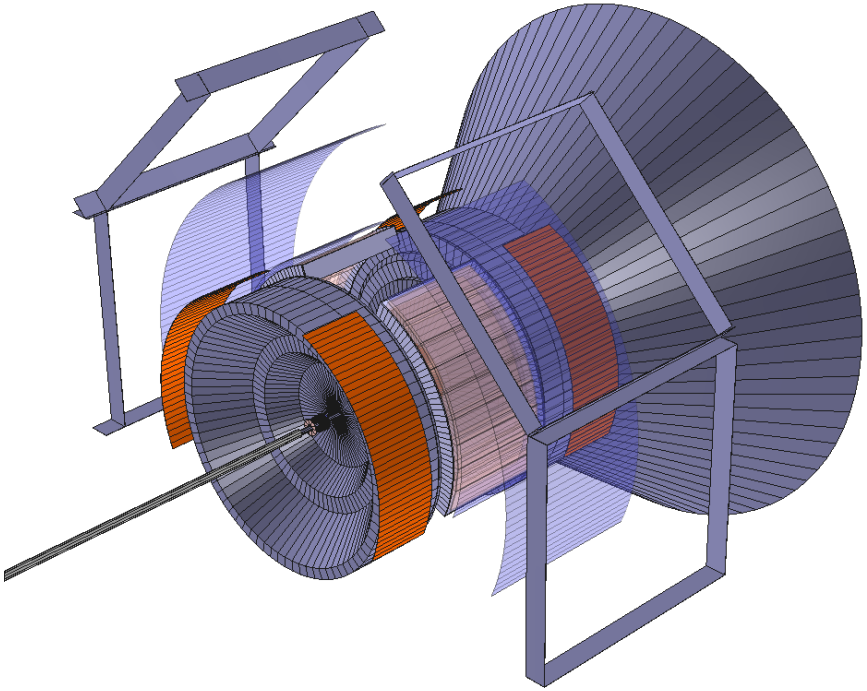
Three reasons?

Two reasons?

Who remembers the image shown on the previous slide?

I rest my case…

Most people will remember your images better than your words…

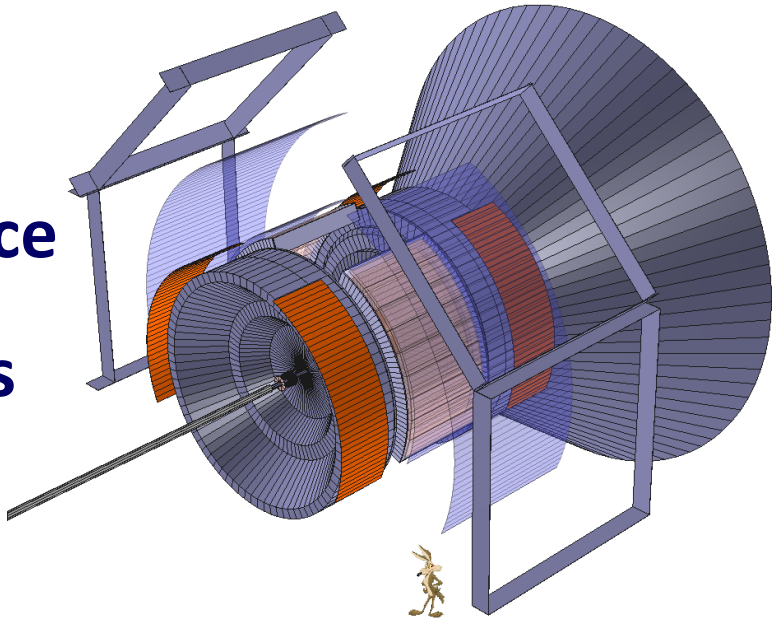


Figures promote audience interest, provide supporting evidence, help explain complex ideas and relationships quickly, and give the audience something to remember.

…and they'll look at the figures first, too

Figures serve four purposes in talks

1. Engage the audience and capture their interest
2. Provide supporting evidence
3. Help explain complex ideas and relationships quickly
4. Give the audience a visual, memorable "hook" to hang your key ideas on



PHENIX detector at the Relativistic Heavy Ion Collider
Courtesy M. Grosse Perdekamp

Tip: Add a brief caption to orient the audience immediately—they're going to look at the figure before you explain it—and always add a scale

Visual images should inform, explain, or persuade, not merely decorate

Improving the Cooling of Blades and Vanes in Gas Turbine Engines

- To increase efficiency, gas turbine engines have to run at higher power
- Better cooling schemes can dramatically affect the life of blades and vanes in gas turbines

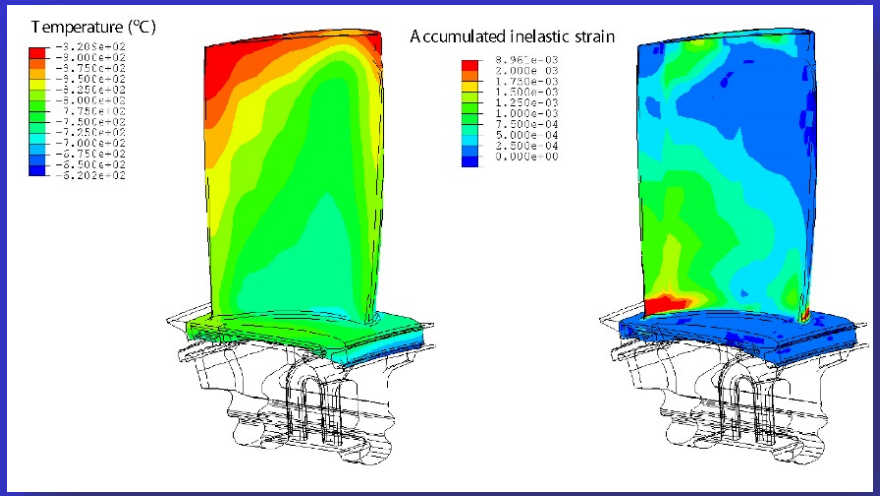
Here's how I'd change this slide:

Improved cooling increases operating lifetimes of blades and vanes in gas turbine engines

Higher power =
increased efficiency

Higher power =
more heat produced

Better cooling schemes =
increased lifetimes of blades and vanes



Add a motivating statement to replace the bland "title"

Turn off the bullets for more room

Write short phrases instead of full narrative sentences

Increase the interline spacing for improved readability

Show some data!

Improving the Cooling of Blades and Vanes in Gas Turbine Engines

- To increase efficiency, gas turbine engines have to run at higher power
- Better cooling schemes can dramatically affect the life of blades and vanes in gas turbines

Before

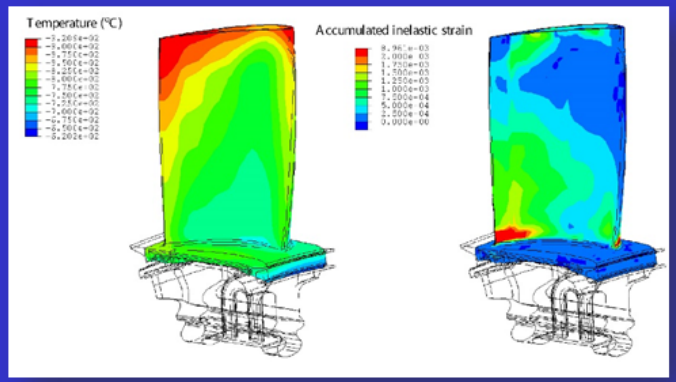
After

Improved cooling increases operating lifetimes of blades and vans in gas turbine engines

Higher power = increased efficiency

Higher power = more heat produced

Better cooling schemes = increased lifetimes of blades and vanes



Use manual line breaks so that the text is not interrupted in awkward places

- SPring-8: electron storage ring for synchrotron radiation, 8 GeV
- LEPS = Laser Electron Photon beam @ SPring-8
- Compton back scatter 351 nm Ar (UV) laser photons off electrons
- produces 1.5-2.4 GeV photon beam

Avoid big empty spaces, too

Here's how to do a slide make-over

- SPring-8: electron storage ring for synchrotron radiation, 8 GeV
- LEPS = Laser Electron Photon beam @ SPring-8
- Compton back scatter 351 nm Ar (UV) laser photons off electrons
- produces 1.5-2.4 GeV photon beam

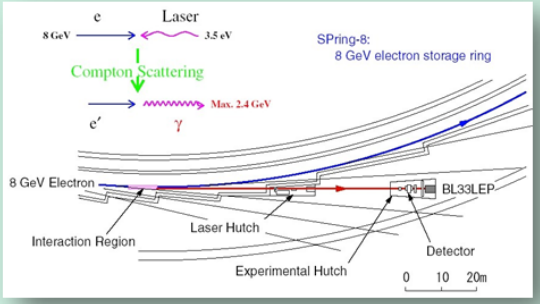
Add an informative title

Show some data!

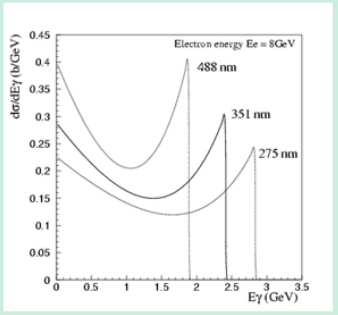
Position important info strategically

Maximize your slide real estate

Spring-8 "light" is ≈1 billion times more brilliant than conventional X-ray sources



Schematic view of the LEPS beamline and the Compton backscattering process



Differential cross sections for the BCS process between 8-GeV electrons and laser photons

Spring-8: Storage ring for 8-GeV synchrotron radiation

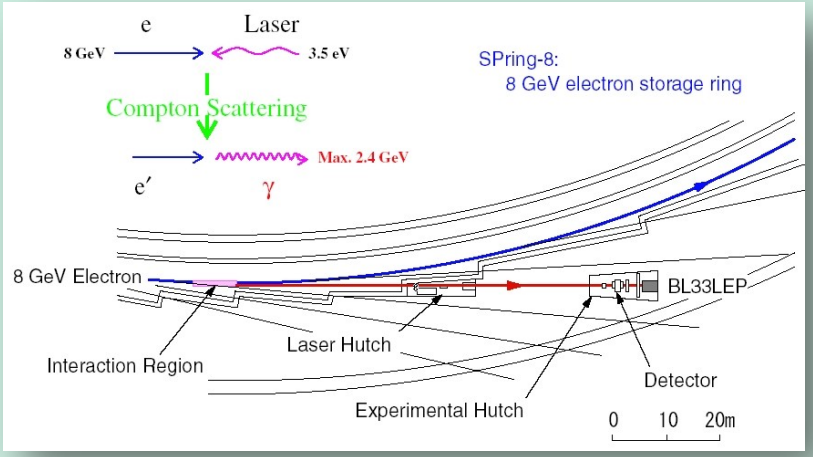
Compton back scatters 351-nm Ar (uv) laser off electrons

Produces 1.5-GeV–2.4-GeV photon beam

Use short captions to orient the viewer immediately

Use PPT animation to control the audience's attention while you're speaking

Spring-8 "light" is ≈1 billion times more brilliant than conventional X-ray sources



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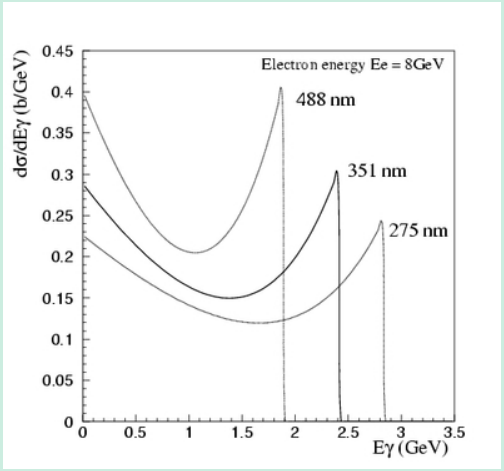

Differential cross sections for the BCS process between 8-GeV electrons and laser photons

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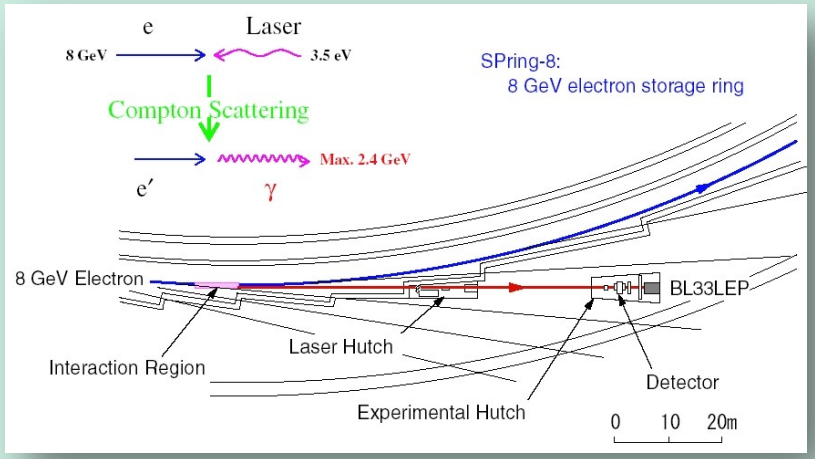
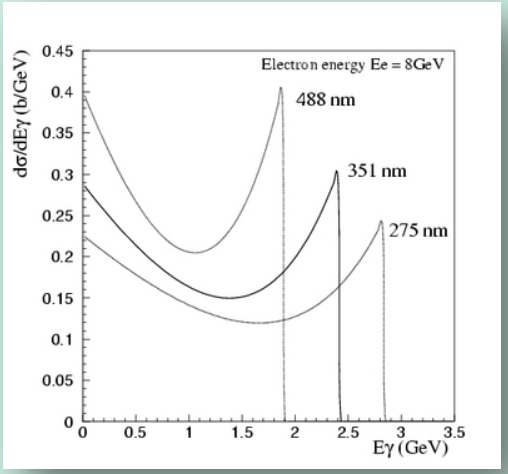


The Compton backscattering process and schematic view of the LEPS beamline



Differential cross sections for the BCS process between 8-GeV electrons and laser photons

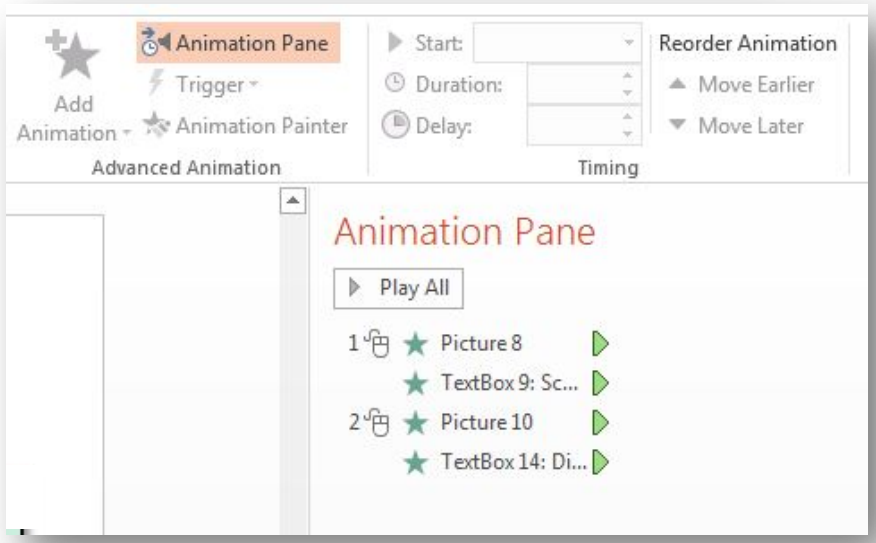
Spring-8: Storage ring for 8-GeV synchrotron radiation

Compton back scatters 351-nm Ar (uv) laser off electrons

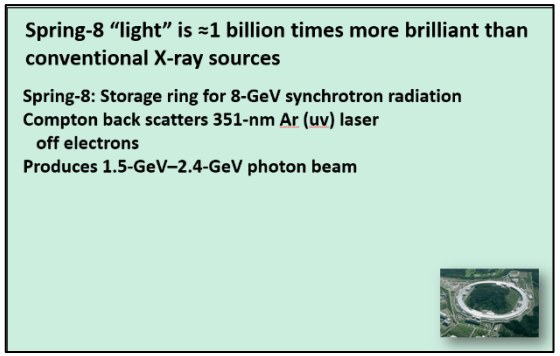
Produces 1.5-GeV–2.4-GeV photon beam

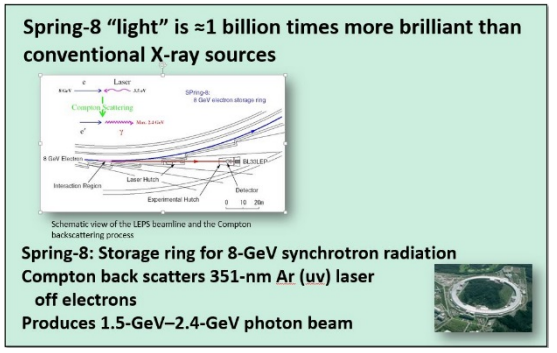
You can “build” slides in one of two ways

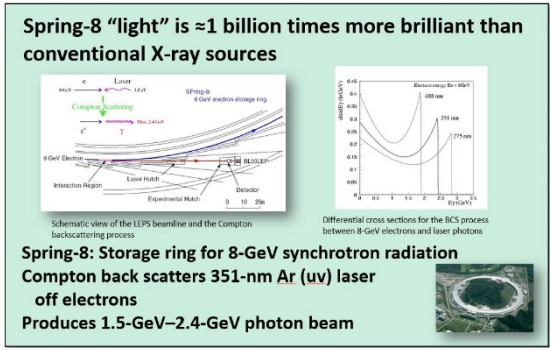
Use PPT animation (📈 learning curve)



Create multiple slides*







*Tip: Use the “Insert Duplicate Slide” tool for smooth builds

Never *ever* put *anything* on a slide that you do not thoroughly understand

That figure you got from somebody else and added at the last minute…

…will be all the audience asks questions about

Tip: Don’t put anything on a slide that you don’t explicitly talk about, either!

Technology presents its own challenges

Seminar and conference rooms are increasingly being outfitted with LCD monitors instead of fluorescent projector screens

Use the built-in PPT laser pointer (awkward)

Add animated arrows to your slide to point out important features

Step 3: PRACTICE out loud

Don't just flip through your slides; say them out loud

Ask for volunteers to listen and critique your practice sessions

Record yourself on your phone or Zoom so you can observe your talk

Train yourself to avoid verbal “fillers”

You know, sometimes, like, we really *really* use some words too much, *right*? So, *um*, maybe we can, *I don’t know*, concentrate on, *like*, eliminating filler words. Filler words *definitely* appear in, *um*, *literally all of our* sentences when we talk to our, *you know*, friends. But we *really* should, *like*, avoid them in formal, *you know*, talks.

Use minimal hand gestures

- Distracts the audience if you're flapping around
- Use a laser pointer, not your arm
- An innocuous gesture in your culture may mean something entirely different in another culture

Tip: Avoid laser-pointer acrobatics

If English is not your first language (and even if it is!)…use the simplest word

Tip: Watch for cues from the audience—if they look confused, **slow down, repeat, ask a rhetorical question, solicit a question, explain**

Step 4: CHECK your timing

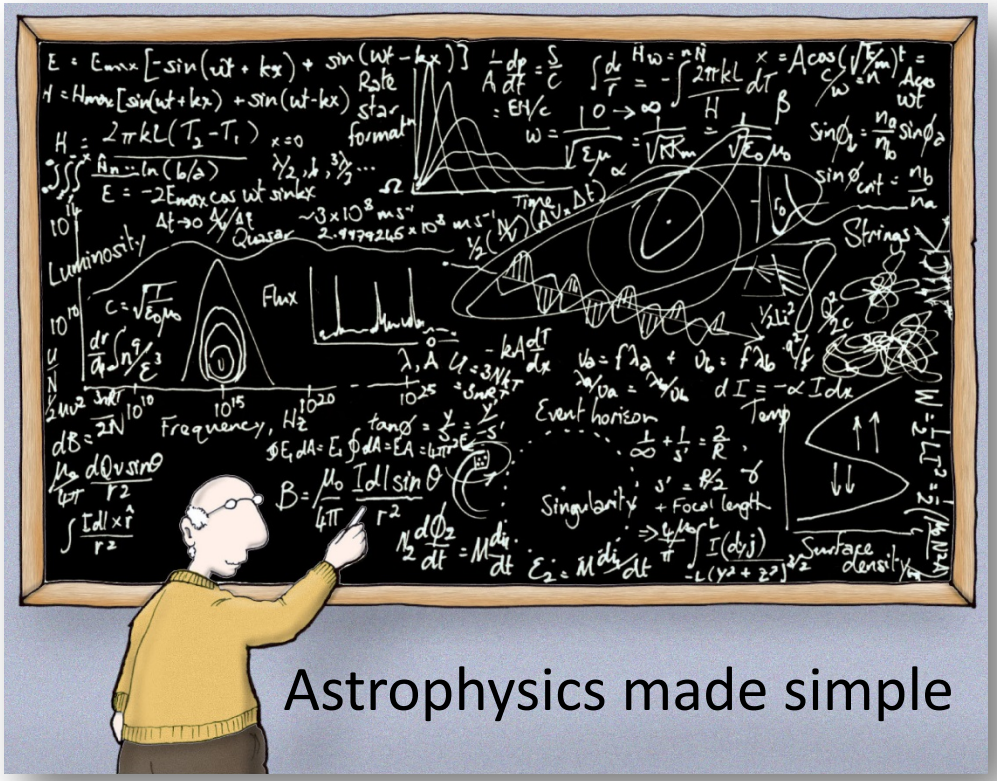
If you consistently go over your allotted time,

Narrow the scope of your talk

Cut down the number of main points

Eliminate slides

DON'T compensate by skipping slides or talking faster



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Before you leave for your talk, email an editable copy of your file to yourself, at an address you can get to from the road

Laptops fail

Thumb drives get lost

Files get corrupted

The person who was supposed to load your talk on the seminar room's computer gets sick or forgets

Tip: Print out a hard copy of the "notes" pages and take it along. Note animations on the hard copy.

Step 5: On the day of your talk

Check everything before your talk

If it can go wrong, it will

Trust me

A word about appropriate dress…

Tip: Wear comfortable clothes that present a neat, professional appearance (and to which you can attach a lapel microphone and power supply)

Handling questions is an essential part of giving a talk

Always repeat the question

What if you don't know the answer?

If the questioner disagrees, don't argue

Never insult
the questioner

If the question is off
topic, deflect

To recap:

- Determine your goal(s) for the talk and analyze your audience
- Decide on the major points you want to make
- Design your talk to make these points clearly, concisely, and memorably
- Select colors and images judiciously—pay attention to slide aesthetics
- Rehearse and revise (shorten!)

$$p = \frac{t}{8}$$

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