Best Practices for Scientific Presentation

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IceCube Bootcamp
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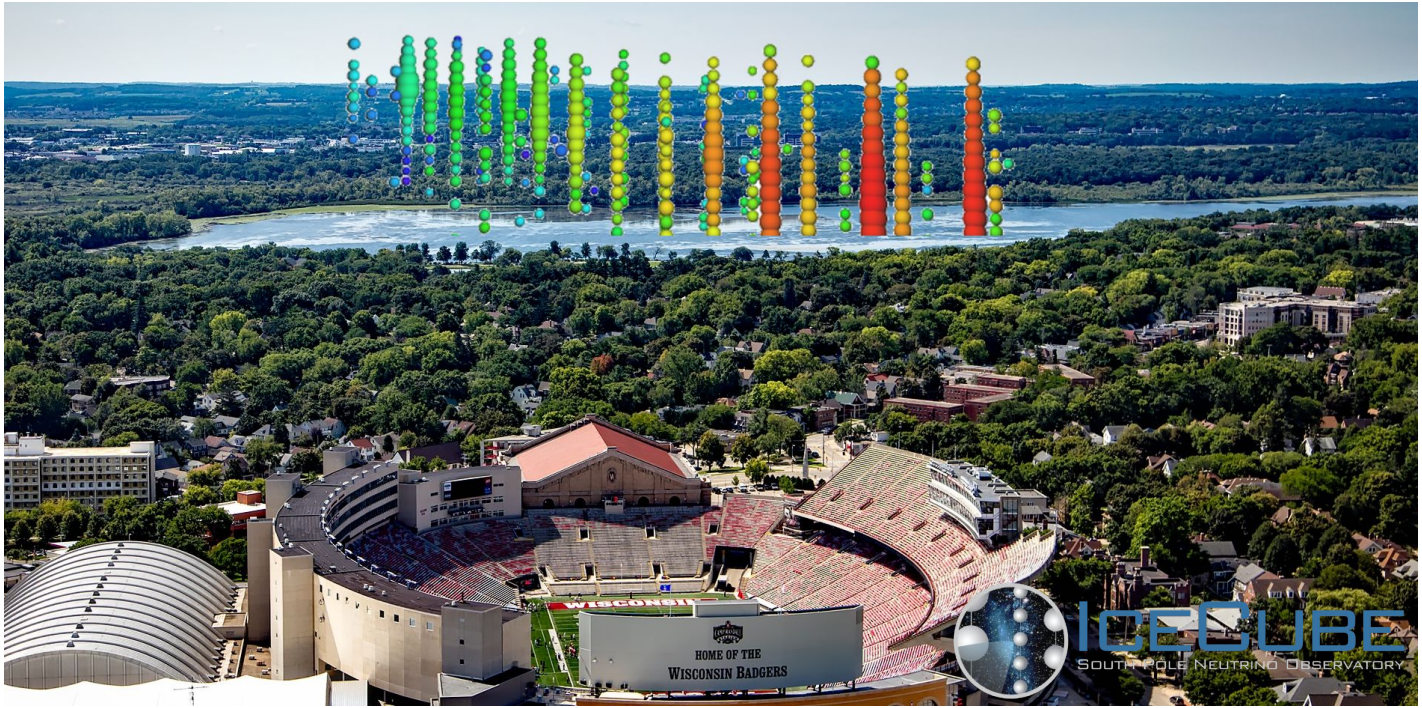

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Outline

Why is it important to think about scientific design?

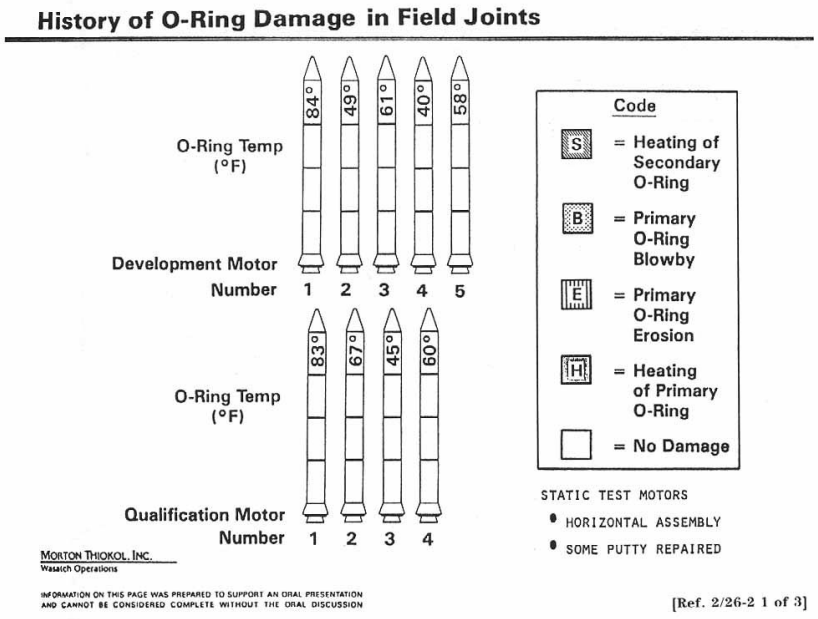
Basics of scientific presentation

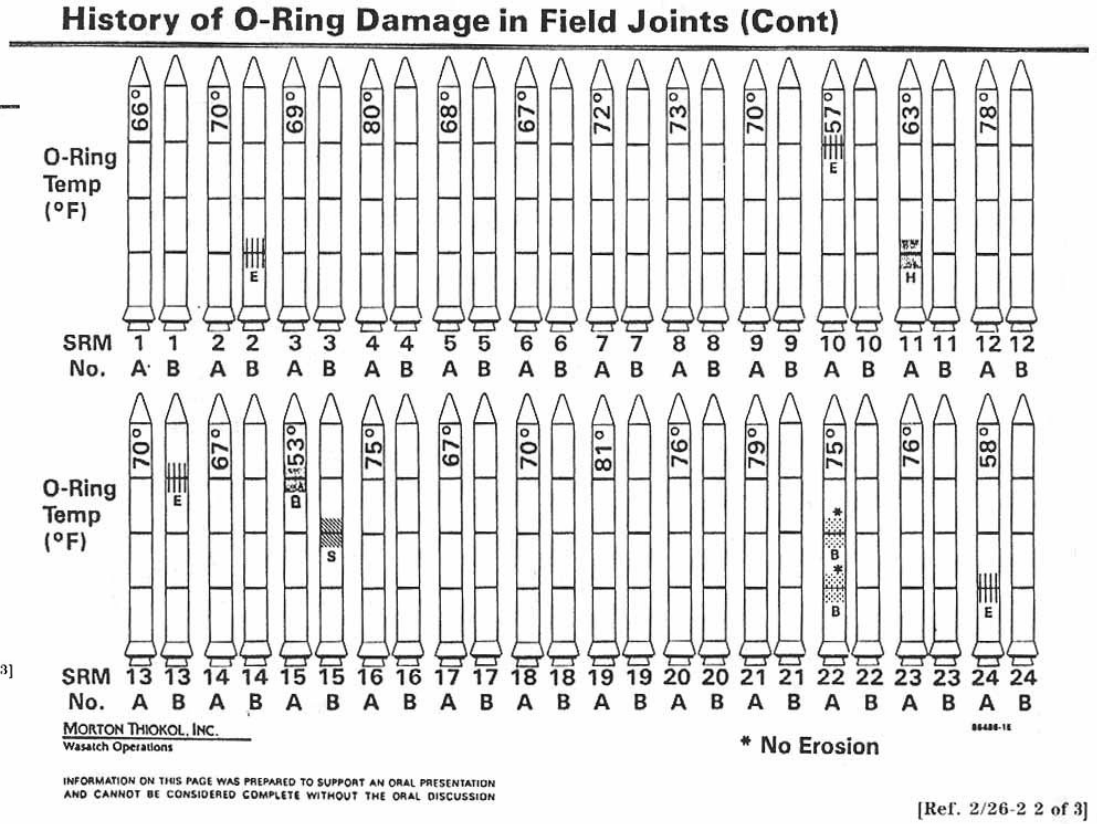
Slide presentations

Plot and diagram considerations

What information does this graphic give?

Case 1.





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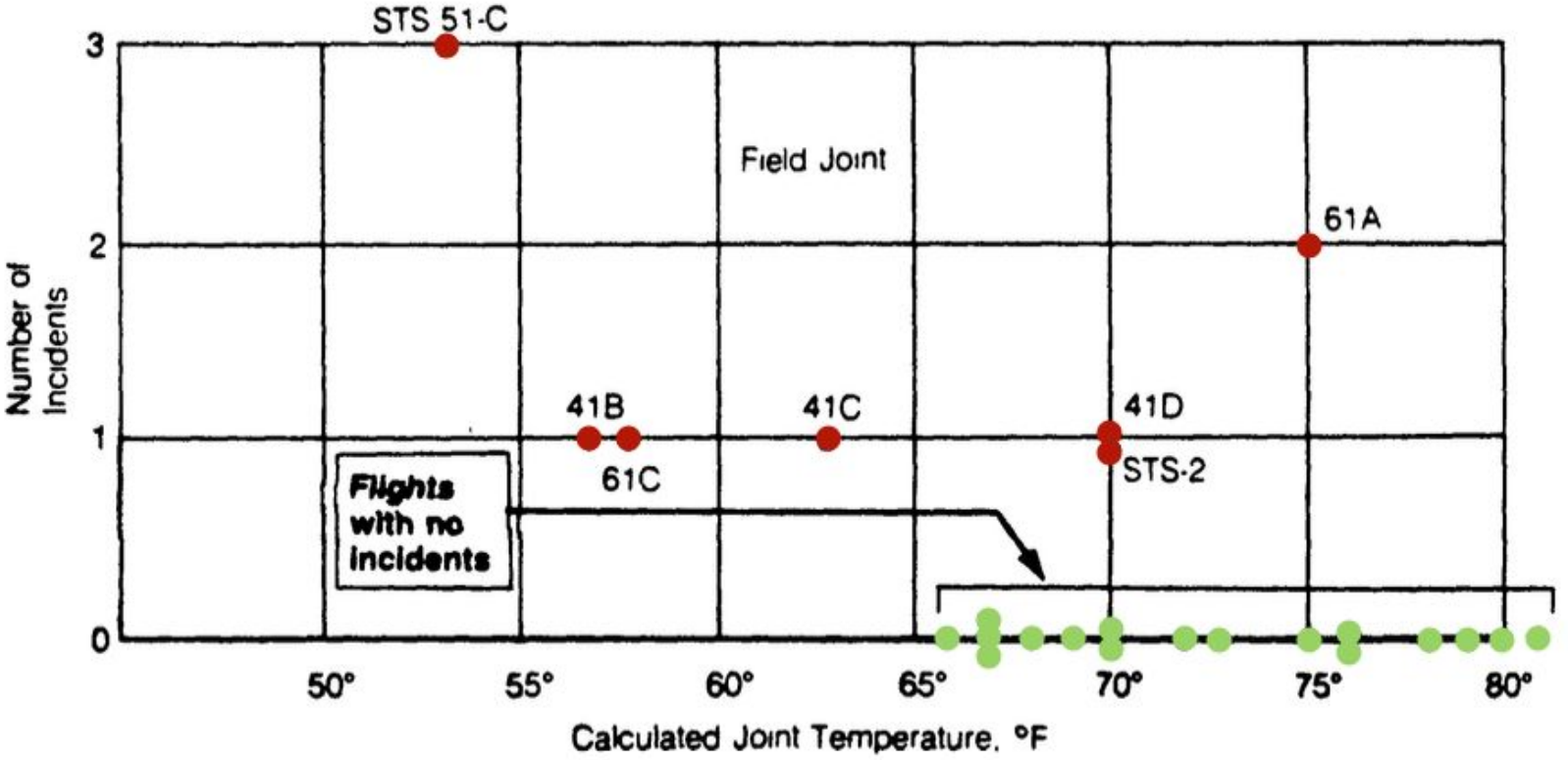

What information does this slide convey?

Case 2.

Review of Test Data Indicates Conservatism for Tile Penetration

- The existing SOFI on tile test data used to create Crater was reviewed along with STS-87 Southwest Research data
  - Crater overpredicted penetration of tile coating significantly
    - Initial penetration to described by normal velocity
      - Varies with volume/mass of projectile (e.g., 200ft/sec for 3cu. In)
    - Significant energy is required for the softer SOFI particle to penetrate the relatively hard tile coating
      - Test results do show that it is possible at sufficient mass and velocity
    - Conversely, once tile is penetrated SOFI can cause significant damage
      - Minor variations in total energy (above penetration level) can cause significant tile damage
  - Flight Condition is significantly outside of test database
    - Volume of ramp is 1920cu in vs 3 cu in for test

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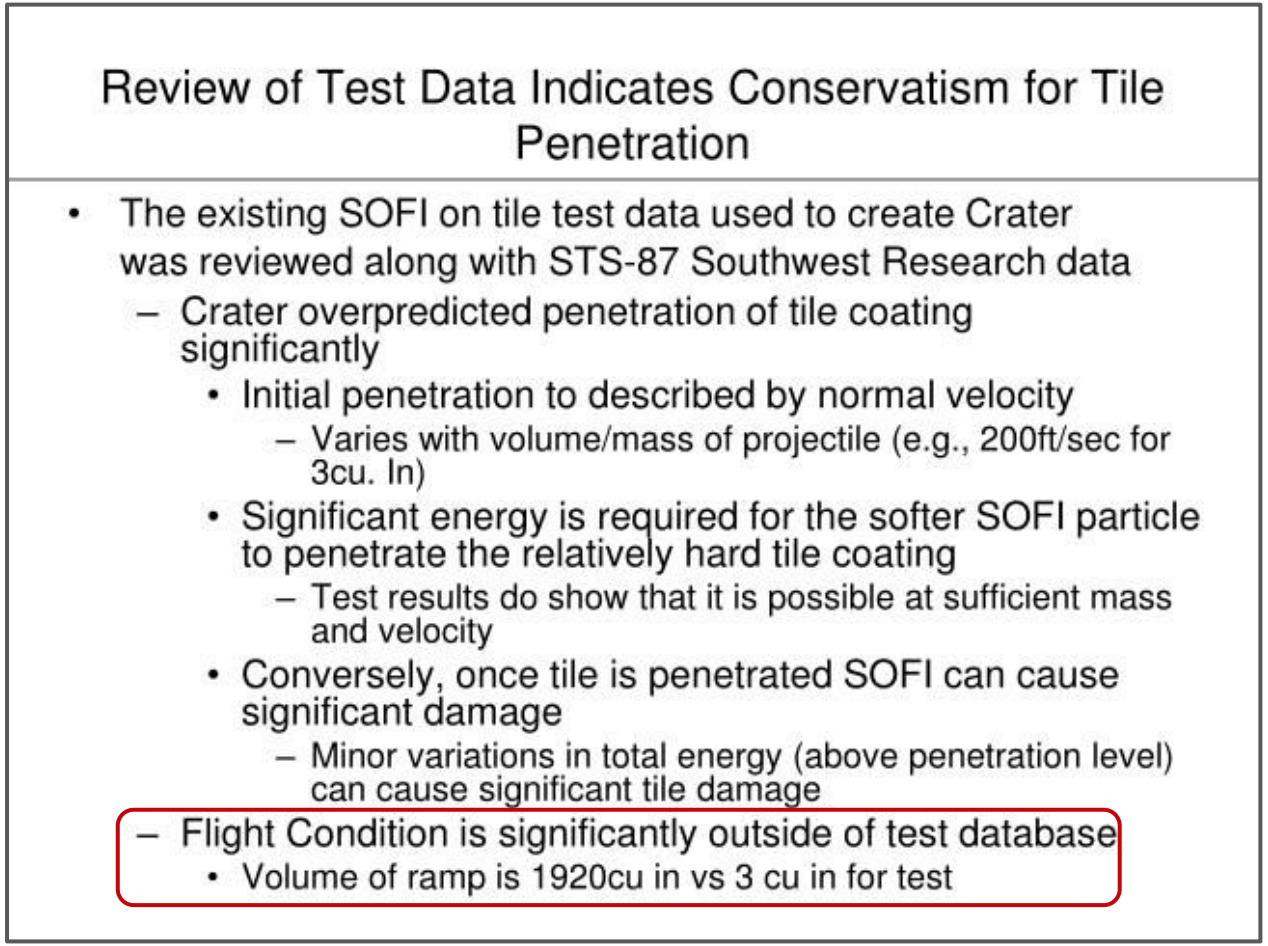

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Physicists tend to be unskilled communicators

What else do STEM employers say?

That physics graduates are also missing important training and experience:

- Ability to design a system, component or process to meet a specific need[5]
- Ability to function on multi-disciplinary teams[5,6]
- Ability to recognize value of diverse relationships (customers, supervisors, etc.)[5]
- Leadership Skills[5]
- Familiarity with basic business concepts (i.e. cost-benefit analysis, funding sources, IP, project management)[5,6]
- Communication skills (oral and written) – esp. how to tailor message to audience[5]
- Real-world experience in companies before graduation[6]
- Awareness of career paths outside of academia[6]

[5]ABET survey of applied and engineering physics graduates, Kettering University
[6]APS Workshop on Nat'l. Issues in Industrial Physics

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Most important questions to ask yourself

What is your message?

Who is your audience?

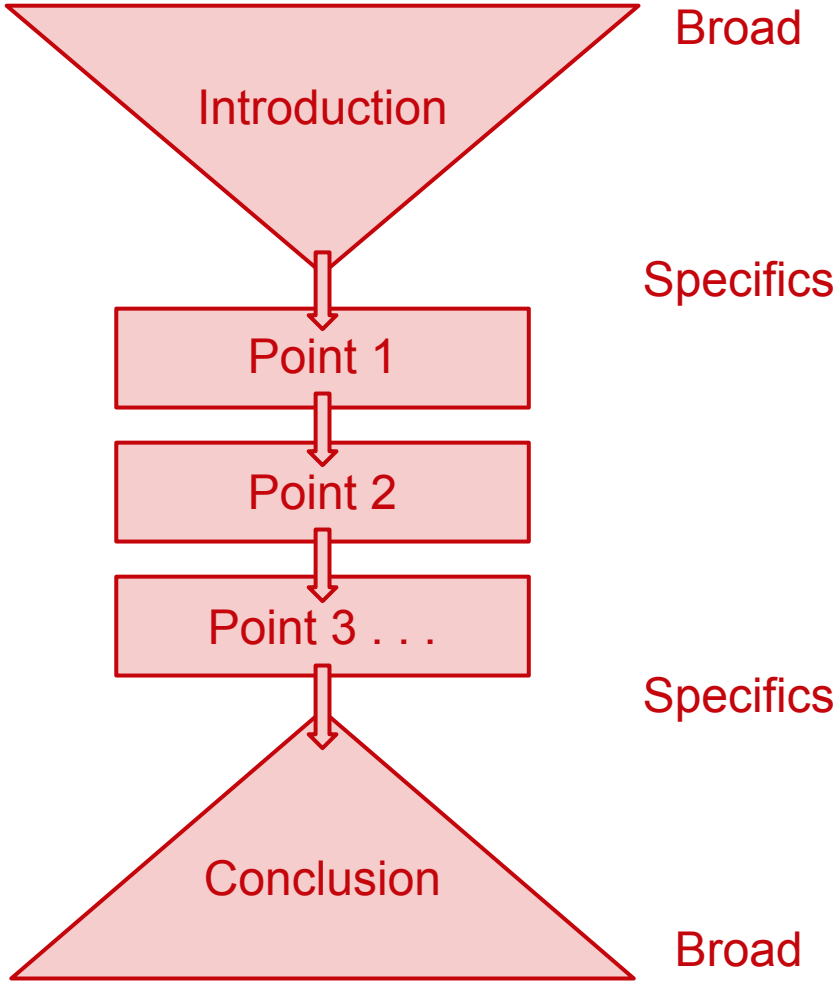
Finding your message

What to ask yourself:

- What takeaways do you want your audience to have?
- What broad questions motivate your science?

Advice:

- Shape your message
- Highlight 1-3 take home points
- Use your narrative to create figures, don't let figures drive your narrative
- Balance details with the big picture



Considering your audience

Why is your audience interested in your science?

What is the expertise level of your audience? (Age, Degrees)

How familiar with your work/experiment/field are they?

What time are you giving your talk?

“A good talk makes the audience feel smart” -Carlos (Paraphrased)

⇒ Don’t lose your audience by making the talk to complex

⇒ Don’t insult your audience by making the talk to basic

Examples

Working Group Call Talk

Goal: Communicate a technical update on your work

Audience: Mostly experts on your experiment

APS Conference Talk

Goal: Communicate your work to a general audience, advertise a technique you developed, or maybe just advertise yourself

Audience: Large variance in expertise, usually can assume a bachelor's in physics (or close to one), possibly in your field or close to your field

Exercise

Outreach talk to high schoolers

- Goal?
- Audience?

Colloquium Talk at a University

- Goal?
- Audience?

Paper for Science

- Goal?
- Audience?

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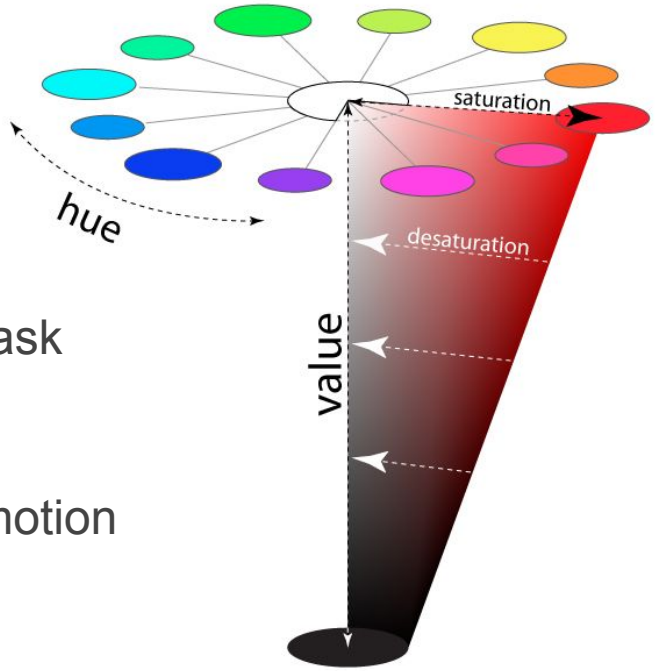
Visual Elements

Design not decoration

- All elements should communicate something
- Can communicate data, idea, emotion, etc.



Embrace **simplicity**

- Consider only one topic, plot, or table, per page
- Don’t overestimate your audience's ability to multi-task

Unify tone with **color palate**

- Use color as a tool to highlight, contrast, or send emotion
- Color considerations: hue, value, saturation
- Be aware of colorblindness!

Bullets and Words

Contrast

in typography can be used to

highlight

and

relate

ideas!

Use **bullets** to group ideas together

- Can be a waste of space, so only use if ideas are connected
- Never use a single bullet
- Keep bullets simple and consistent

Consider your choice of **typography**

- For presenting san-serif fonts are easiest to read
- Fonts convey a *personality*
- Make sure you use a legible font and font size!

Use precise and concise **vocabulary**

- Avoid wordiness on slides
- Avoid jargon!

Simplify Tables

Cut	Atmospheric μ	Atmospheric ν_μ	Astrophysical ν_μ*
	Number Per Year	Number Per Year	Number Per Year
All Filters	7.29×10^{10}	5.36×10^{5}	7.88×10^{3}
Filter and Charge Cut	5.15×10^{8}	9.67×10^{3}	8.31×10^{2}
Coarse Grid Cut	3.20×10^{6}	1.95×10^{3}	1.15×10^{2}
Fine Grid Cut	9.05×10^{3}	5.22×10^{2}	3.78×10^{1}
Final Level Up-going	0	127	9
Final Level Down-going	0.8	33	**9**

Final Level (per year)	Atmo μ	Atmo ν_μ	Asto ν_μ
Up-Going ($\delta > -20°$)	0	127	9
Down-going ($\delta < -20°$)	0.8	33	**9**

Photographs

Two reasons to show photographs:

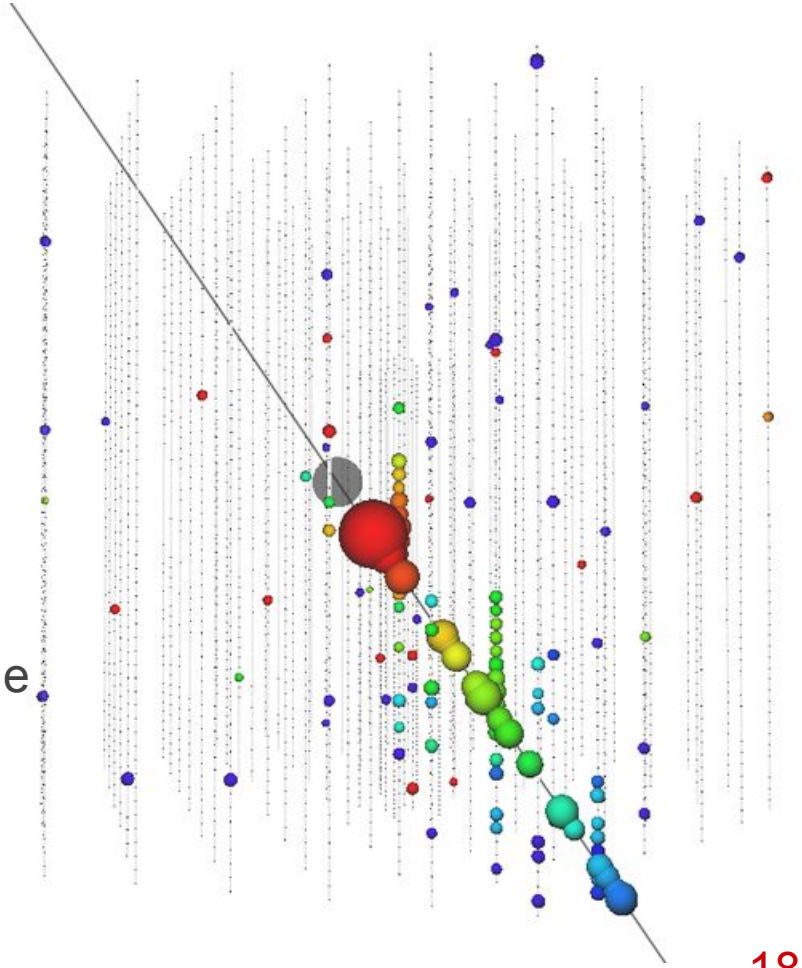
- Representing data
- Communicate idea/emotion

Consider cropping, the rule of thirds, brightness

Image file formats:

- JPEG - susceptible to generation degradation
- GIF - stores 8 bits per pixel, poor choice for detailed images
- PNG - lossless compression, does not degrade

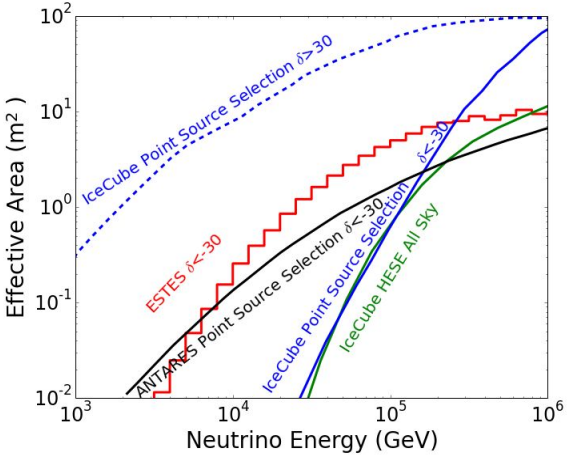
Projectors usually have 100dpi max

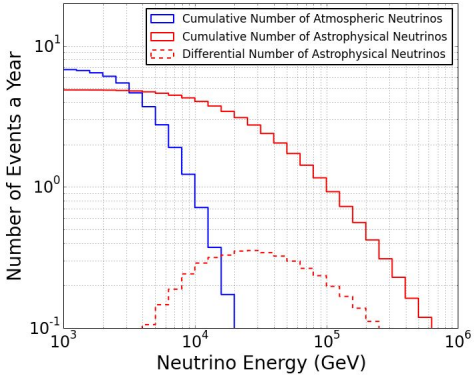


Why is there so much white space here

Slide design

- Oh wow gee this is annoying
  - Why are we sub-bulletting?
    - Oh no, where is this going?
    - Please someone help
      - It just got worse
  - Who will stop this madness?





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Slide design and layout

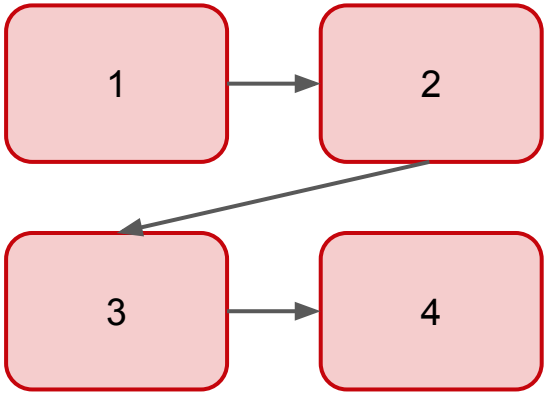
Do not use the default templates, create your own

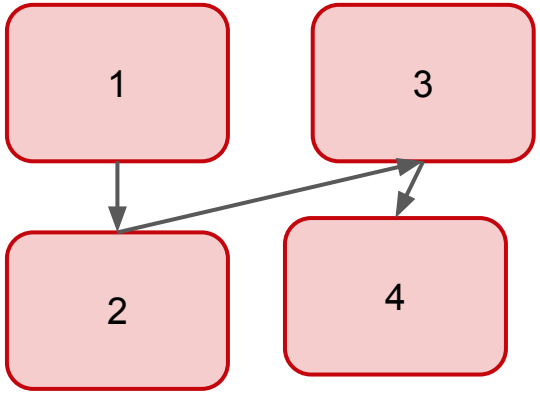
- Pick your color palette
- Consider breaking slides up into quadrants or thirds

Use **white space** appropriately

- Balance of white space and content
- Look for symmetry in white space

Control the flow of information using the **natural movement of the eyes**





Delivery and anxiety

Be present

- React to yourself: Are you talking too fast? too slow?
- React to your audience: Are they focusing on you?

Engage your audience

- Stand in front of the lectern
- Cater to them

Solutions for **anxiety**

- Rehearse! The more your present on a topic, the more comfortable you will be delivering it
- Memorize the first 2 minutes of your talk
- Use a water bottle, other anti-anxiety tools

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Plotting

Use to communicate:

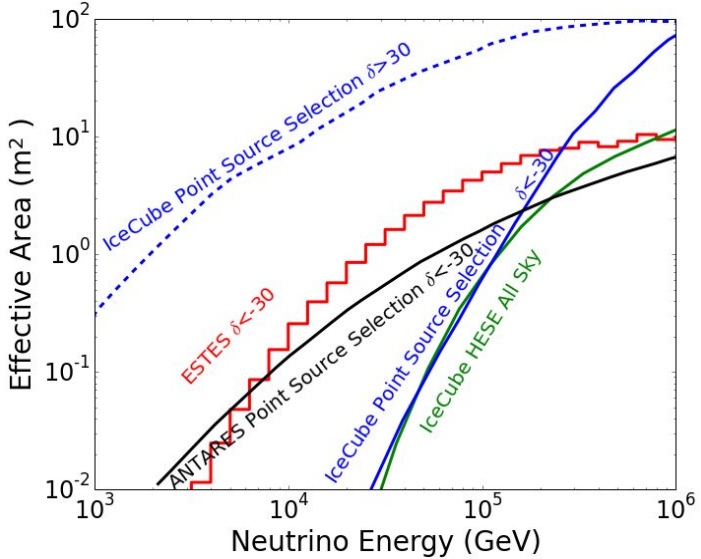
- Patterns
- Trends
- Differences
- Interactions

Plots >> words

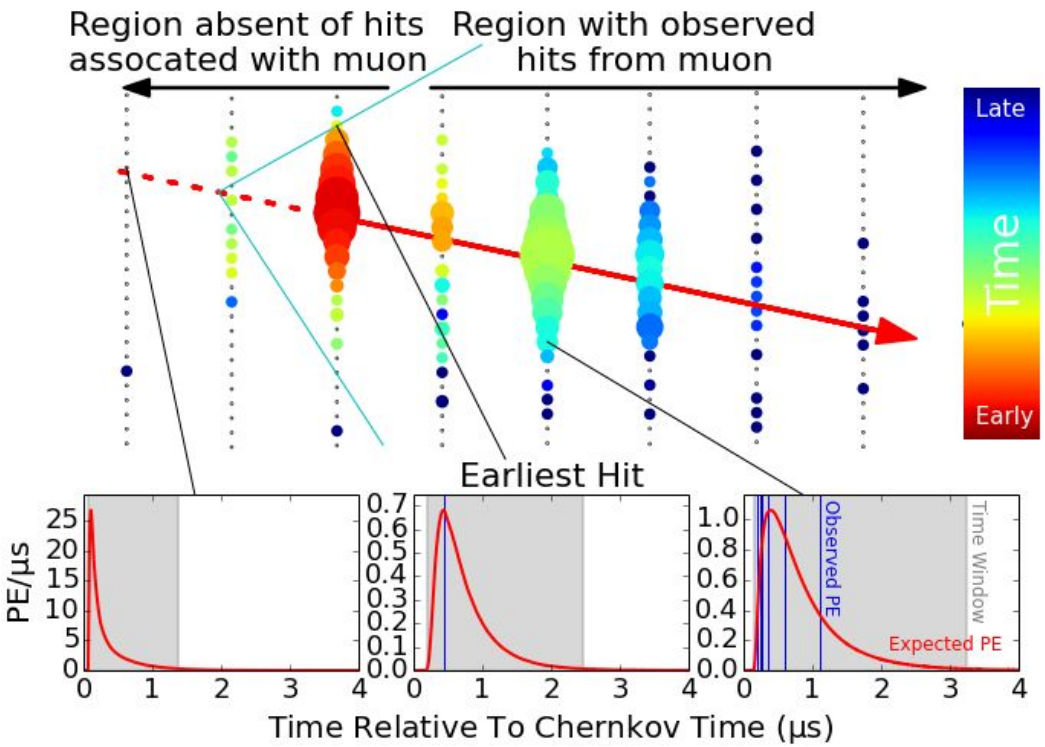
2D >> 3D (almost always)

Do not use matplotlib defaults

- Font size, tick size, etc. is probably too small
- Make sure colors are colorblind safe!



Diagrams



Use to illustrate:

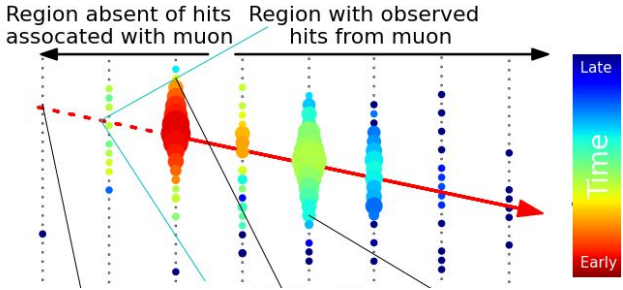
- Background information
- Experimental techniques
- Sorting Results into categories
- Proposing a Model
- Summarizing

Ask yourself:

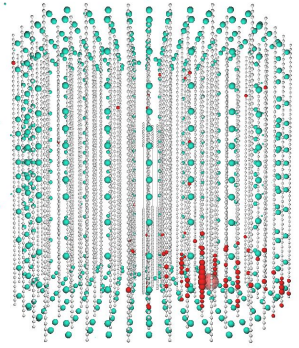
- What is necessary to show?
- What should be emphasized?
- What are the relationships of the elements?

ESTES steps

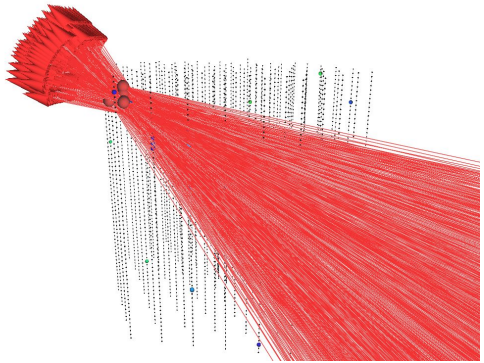
Event in Muon of FSS Filter → Total Charge > 200 PE → Starting track veto on SplineMPE



Fast Coarse Grid Search → Detailed Coarse Grid Search → Fine Grid Search → Run Millipede for energy losses



Coarse Grid Search



Fine Grid Search

Run Millipede for energy losses → Down-going (θ < 80°) → BDT Pre-Cuts → BDT Cuts

Run Millipede for energy losses → Up-going (θ > 80°) → Final Cuts

BDT Cuts → **Final Level**

Concluding Remarks

Always ask yourself:

- What is my goal, motivation, and/or main takeaway?
- Who is my audience?

Practice makes perfect:

- Reduces anxiety
- Lets others review your work and provide feedback

A good presentation requires thought and effort!

Assignment: “Gong session talk” - 3 Slides 5 minutes on research you’ve done before, a project you plan to do, or something interesting you learned this week