

Physics 496

Introduction to Research

Lecture 4.0: Figures for Scientific Documents & Presentations

S.L. Cooper, David Hertzog, Alan Nathan, Tony Liss, Doug Beck

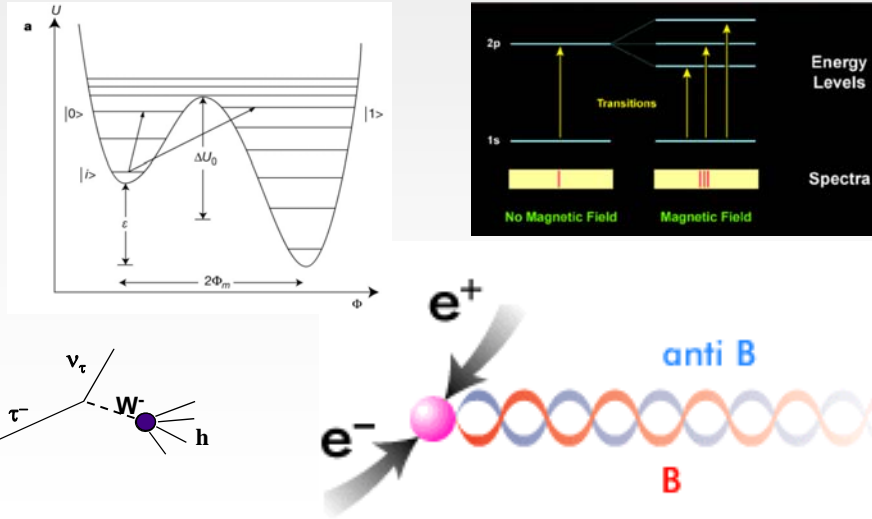
The Importance of Figures

“Graphic excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest place” - Edward R. Tufte -

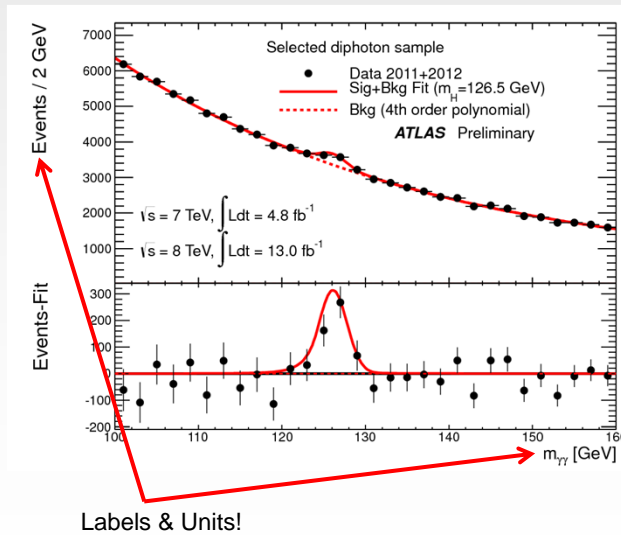
“Figures play a significant role in the expression of scientific ideas” - APS Style Guide -

[Imagine, presentations without figures...](#)

Figures that show physics processes

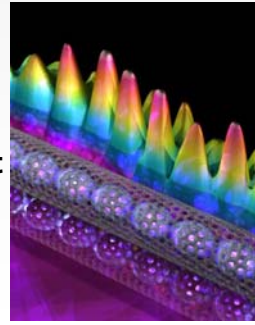


Figures that display data



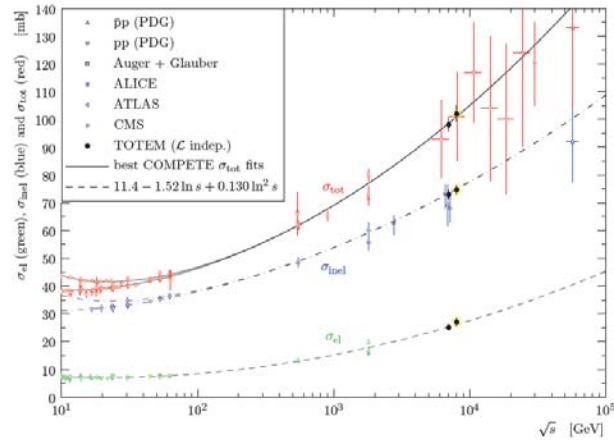
Some initial tips

- Use figures to add interest to your papers & talks.
- Make them clear, simple and memorable.
- Remove the words you don't need.
- Label all your plots !!
- Most photographs and drawings should have a scale.
- Caption carefully
- If a process is shown, make it clear where it starts and ends.
- Arrange figures so they “flow” the way people read (top left to bottom right).



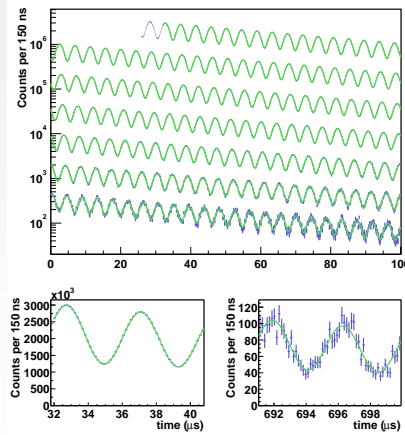
Examples, Dos and Don'ts

Figures that display data

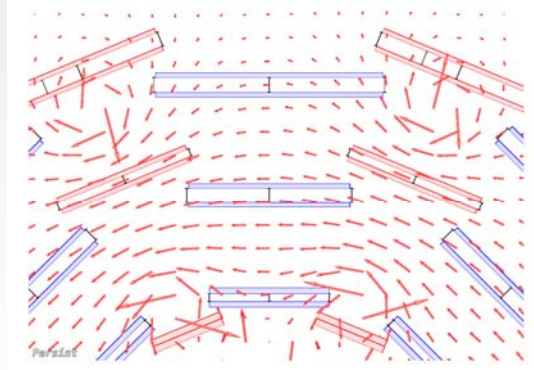


CERN-PH-EP-2012-354

Figures that display data



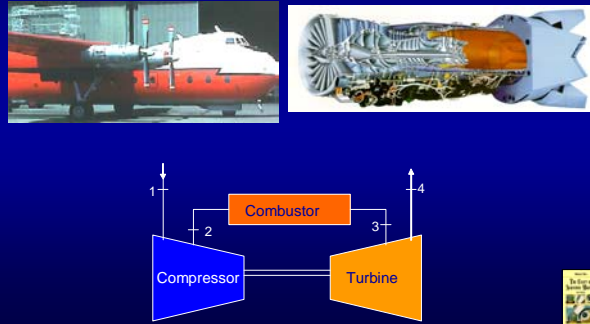
Figures that display data



Magnetic field vectors in the ATLAS muon spectrometer

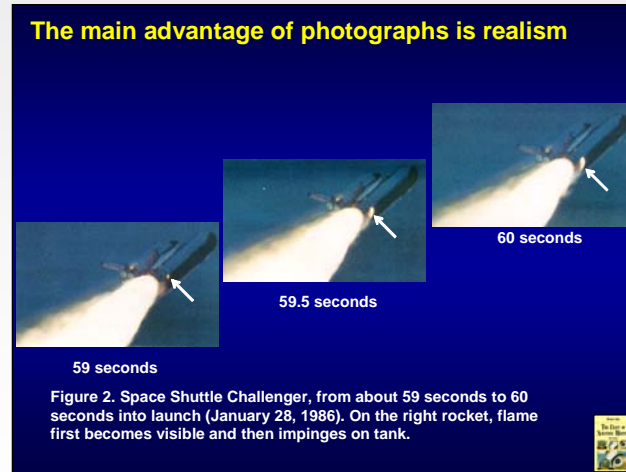
Illustrations

When presenting images, you choose between photographs, drawings, and diagrams



- Source: The Craft of Scientific Presentations, Michael Alley
- and <http://www.writing.eng.vt.edu/handbook/visuals.html>

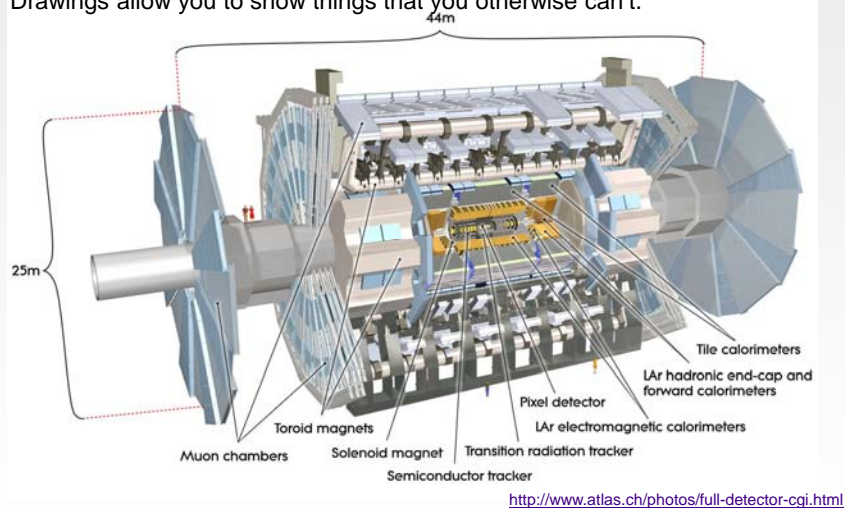
Illustrations



- Source: The Craft of Scientific Presentations, Michael Alley
- and <http://www.writing.eng.vt.edu/handbook/visuals.html>

Illustrations

Drawings allow you to show things that you otherwise can't.



Illustrations

The main advantage of a diagram is the ability to show flow of a variable through a system

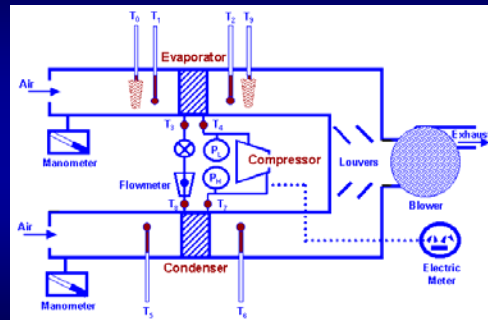


Figure 8. Schematic of test stand for evaluating components of an air conditioner design.

- Source: The Craft of Scientific Presentations, Michael Alley
- and <http://www.writing.eng.vt.edu/handbook/visuals.html>

Illustrations

Scientists and engineers often use illustrations that are too complex for the text

The thermal storage system stores heat in a huge, steel-walled tank. Steam from the solar receiver passes through heat exchangers to heat the thermal oil, which is pumped into the tank. The tank then provides energy to run a steam generator to produce electricity. A schematic of this system is shown in Figure 5.

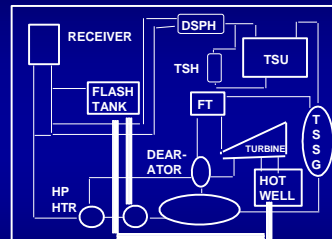


Figure 5. Schematic of thermal storage system.

- Source: The Craft of Scientific Presentations, Michael Alley
- and <http://www.writing.eng.vt.edu/handbook/visuals.html>

Illustrations

The precision of the illustrations should reflect the precision of the text

The thermal storage system, shown in Figure 6, stores heat in a huge, steel-walled tank. Steam from the solar receiver heats a thermal oil, which is pumped into the tank. The tank then provides energy to run a steam generator to produce electricity.

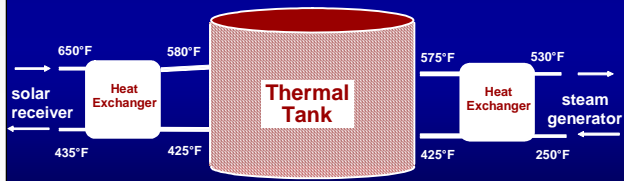


Figure 6. Schematic of thermal storage system for the solar power plant.

- Source: The Craft of Scientific Presentations, Michael Alley
- and <http://www.writing.eng.vt.edu/handbook/visuals.html>

Illustrations & Figures

For clarity, illustrations and figures must be referred to and explained in the text.

The momentum can be written as $p = k \int B d\ell / \Delta\theta$, where k is a constant. The resolution on k is measured as a function of momentum. As an example, Figure 2 shows the results for inner-middle 2-station muons. These results from the data are then compared to those from the simulation (which tends to have better resolution than the data). The difficulty is that the data extend only a little above 100 GeV/c, while typical muons from a heavy Z' have momenta close to or above a TeV. The extrapolation to high momentum introduces a systematic uncertainty that will become better controlled using the full 2012 dataset to provide the maximum reach in momentum in the data.

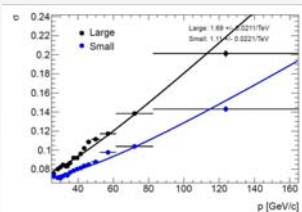


Figure 2 Resolution vs. p for inner-middle 2-station muons. Black points are for the large sectors and blue for the small.

Illustrations

Inconsistencies between text and images disrupt fluidity

The testing hardware of the rocket shown in Figure 8 has five main components: camera, digitizer, computer, I/O interface, and mechanical interface. Commands are generated by the computer, then passed through the I/O interface to the mechanized interface where the keyboard of the ICU is operated. The display of the ICU is read with a television camera and then digitized. This information is then manipulated by the computer to direct the next command.

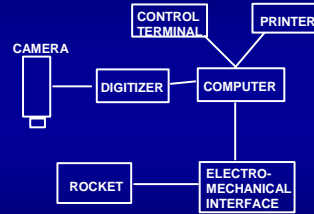
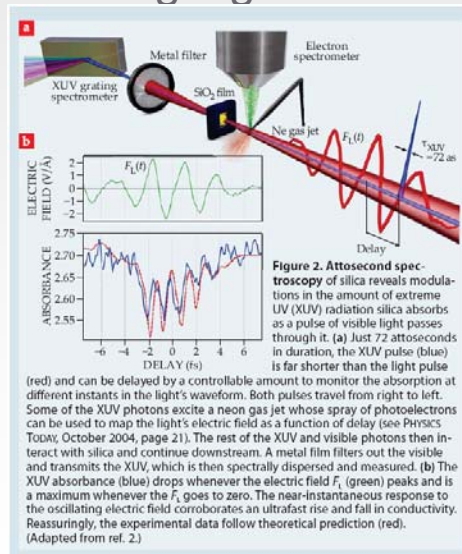


Figure 8. Testing hardware.

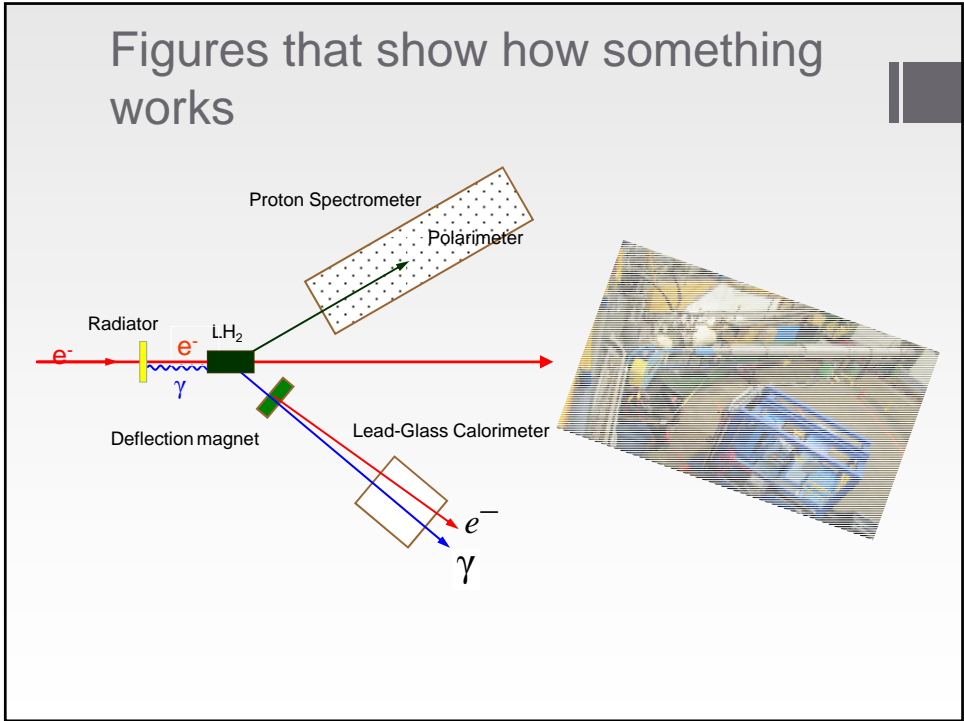
- Source: The Craft of Scientific Presentations, Michael Alley
- and <http://www.writing.eng.vt.edu/handbook/visuals.html>

Figures that show how something works: a “highlight”



Phys. Today 66(2), 13 (2013); doi: 10.1063/PT.3.1873

Figures that show how something works

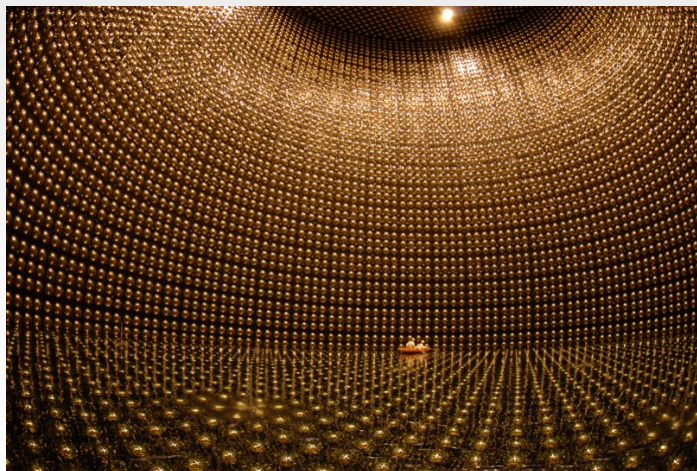


Figures that show scale



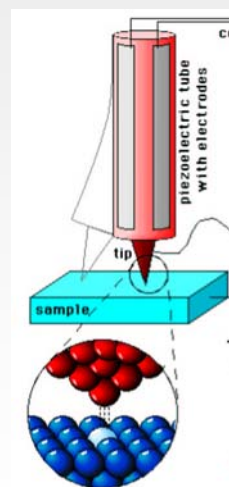
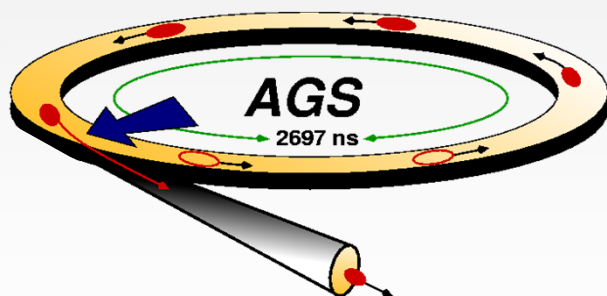
<http://www.atlas.ch/photos/detector-site-surface.html>

Figures that show equipment (and scale)

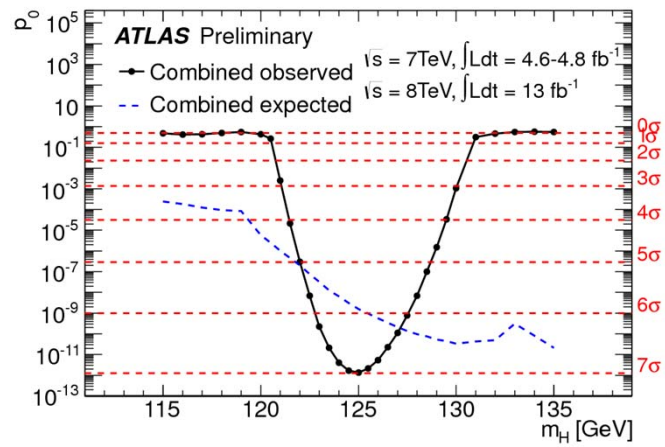


<http://t2k-experiment.org/>

Figures that peer inside

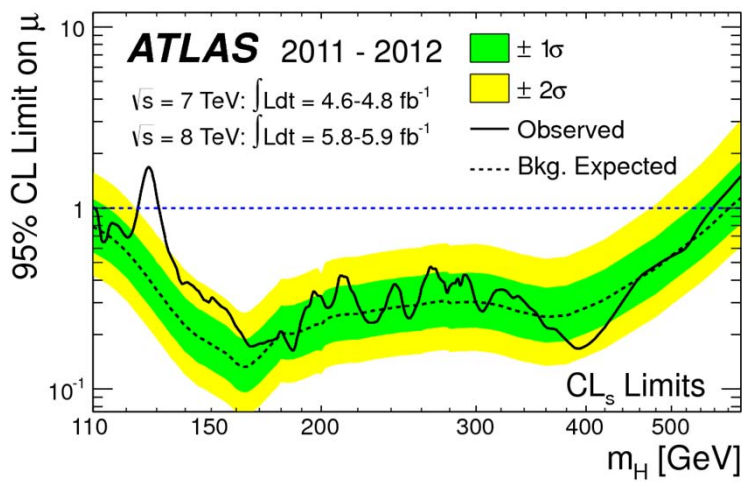


Figures that persuade



<https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/CONFNOTES/ATLAS-CONF-2012-170/>

Figures that confuse



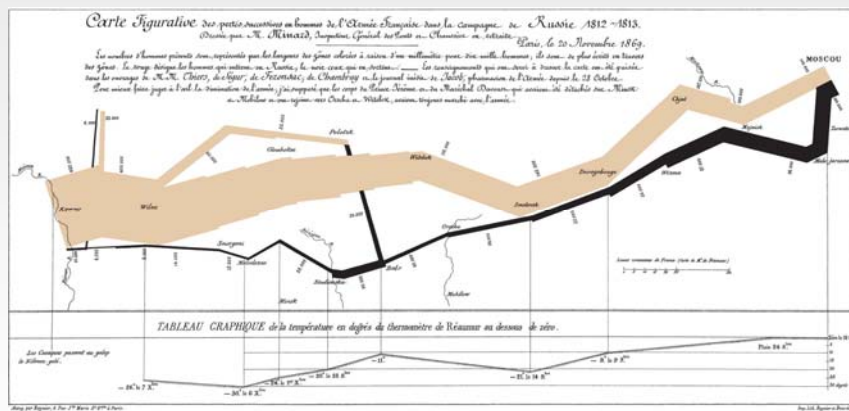
Figures that are doctored



<http://www.spacetelescope.org/images/opo0639a/>

But still totally amazing.

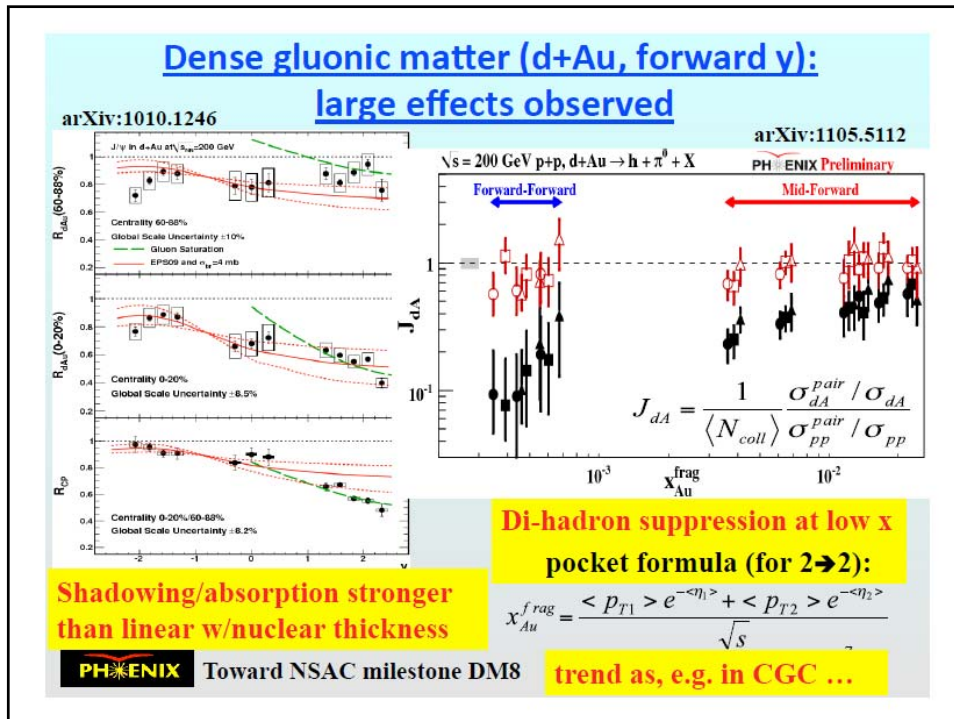
Figures that tell a story



Napoleon's invasion of Russia.
Drawn by French engineer
Charles Joseph Minard

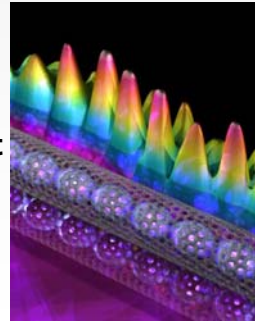
Figures with too much information

- Especially for slides in talks, simpler is usually better
- Prioritize!

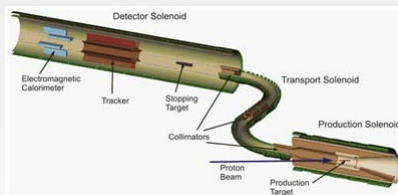


Some final tips

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This:



Or this?

