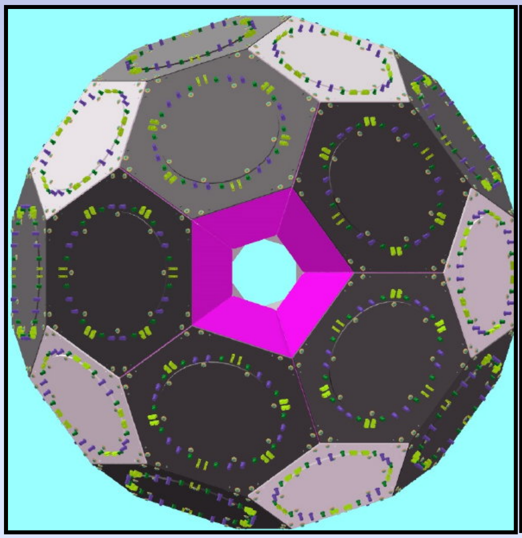
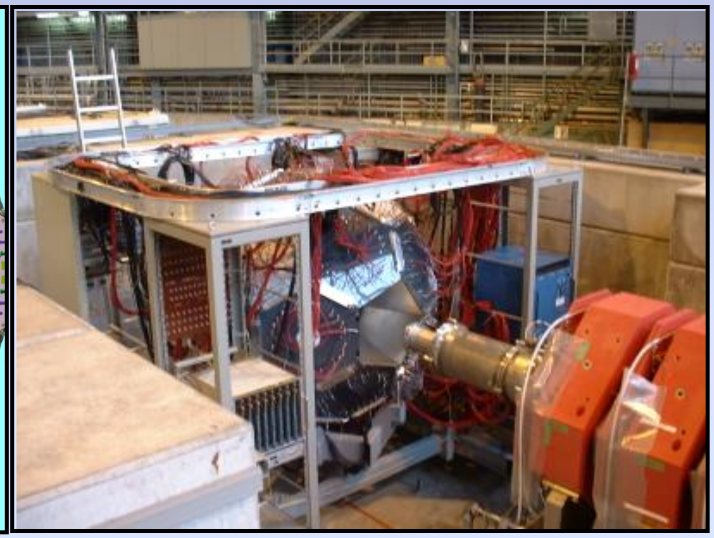
Designing Effective Physics Presentations

David Hertzog
University of Illinois at Urbana-Champaign





MuLan: Concept to Reality

(My remarks about real slides will be in these red boxes)

An eye-catching feature on slide 1

hertzog@uiuc.edu

Giving a "good" talk is a skill you can learn

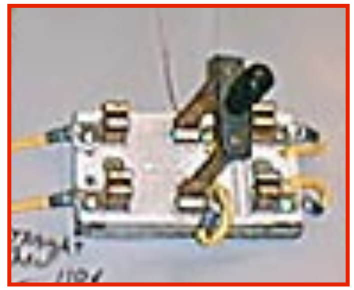
This bullet-ridden slide is AWFUL!

Let's look at context-based outlines

- Standard advice ☺
  - Don't prepare
  - Talk too fast
  - Never look at the audience
  - Use a lot of bullets
  - Animate all transitions
- The classic structure for a scientific talk
  - Ramble incoherently with emphasis on obscure details
  - Show your result in a manner that only experts can follow
  - If the audience doesn't know what this is about, who needs 'em
- Special issues important to physicists
  - Show every data point and curve
  - Many complex equations make you look smarter
  - Take graphs straight out of your formal papers … caption and all
  - Ditto for tables

Outline:

- Principle of the measurement
- New result with μ^-



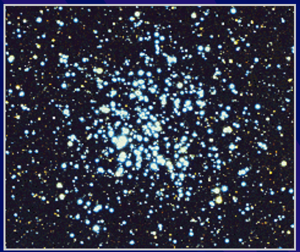
- SM theory
- BSM

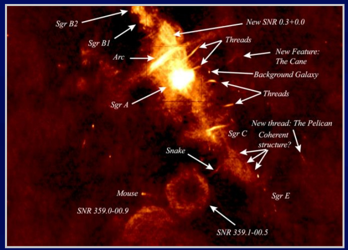
This outline has a purpose:

1. Relaxing and mood-setting
2. Annimated switch emphasizes somethng special about result
3. Data itself is used to frame slide

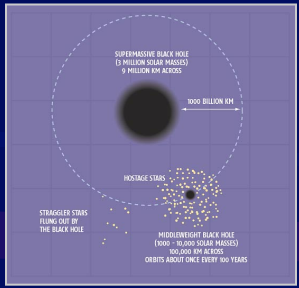
Overview

Black holes and star clusters

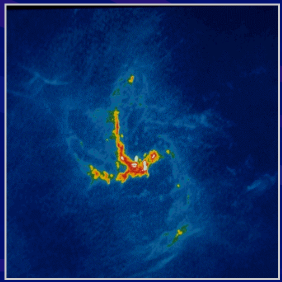




The galactic center



Intermediate-mass black hole kinematics



Here, we have a VISUAL and WRITTEN outline and it's not too long !

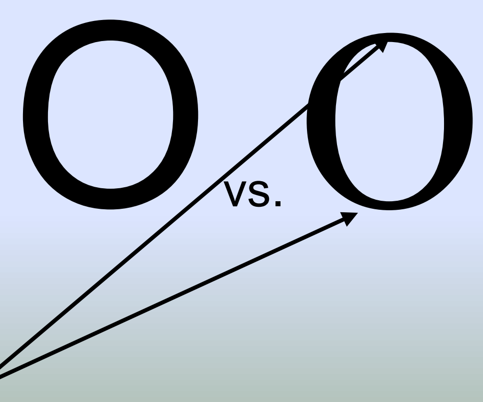
Experts offer consistent and standard advice

- **Title / Body / Conclusions**
  - What you will tell them
  - Tell them
  - What you told them
- **Voice**
  - Look at audience
  - Speak slowly
  - 1-2 minutes per slide

Aughh !

- **Slide composition**
  - Neat
  - Exercise witless Consistency
  - Only items you will discuss
  - Contrast of text / background
  - San sarif font (e.g., Ariel)
    - Not Times Roman (sarif)
  - Math (and gene names) serif
    - lacI *lacI*

- **Powerpoint Don’ts**
  - No flashy / fancy templates
    - They restrict space
    - They distract
    - They constrain content
  - Avoid excess builds
    - Always have purpose for using an animation
    - Good examples will follow
    - This example is meant to drive you crazy
    - Is it doing that yet?
  - Avoid long bullet lists like this
    - Especially when people animate them
  - Mix up your slide “look” occasionally
    - Drop the title
    - Fill the slide with a big photo or graph



Skinny parts disappear when projected

Structure of the classic physics talk – I

1. **Motivation and Introduction**
   - WHY is this interesting?
     - DO NOT assume it is obvious
   - WHAT is the context?
     - Often, your new contribution incrementally advances on a longer story. You will have to build up that previous story so people can appreciate the new finding(s)
   - What special terms might the audience need to know to follow the talk?
     - If you are going to say "pseudogap" for an hour, for sure remind everybody what it is – even if you think it is completely and utterly obvious
     - If you talk about data from WMAP, don't assume everybody's heard of it, so take a moment and remind them
       - *Then tell them the age of the universe*

Particle Physicists Ask

1. Why matter?

- CP Violation

2. Why mass?

- Higgs field

3. Why this standard model?

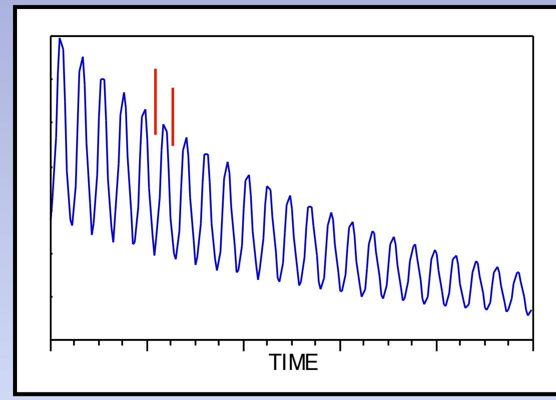
- SUSY or other extensions

Simple can be very effective, especially for a colloquim

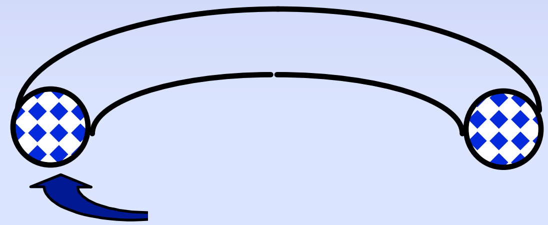
We measure

If you can simplify the steps required to obtain the result into icons of activity, your audience can follow the logical pieces

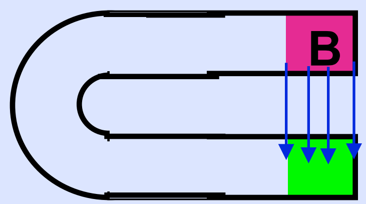
(1) Precession frequency



(2) Muon distribution



(3) Magnetic field map



$$(g-2) \propto \frac{(1)}{\left\langle \int (2)(3) \right\rangle}$$

Double Blind Analysis

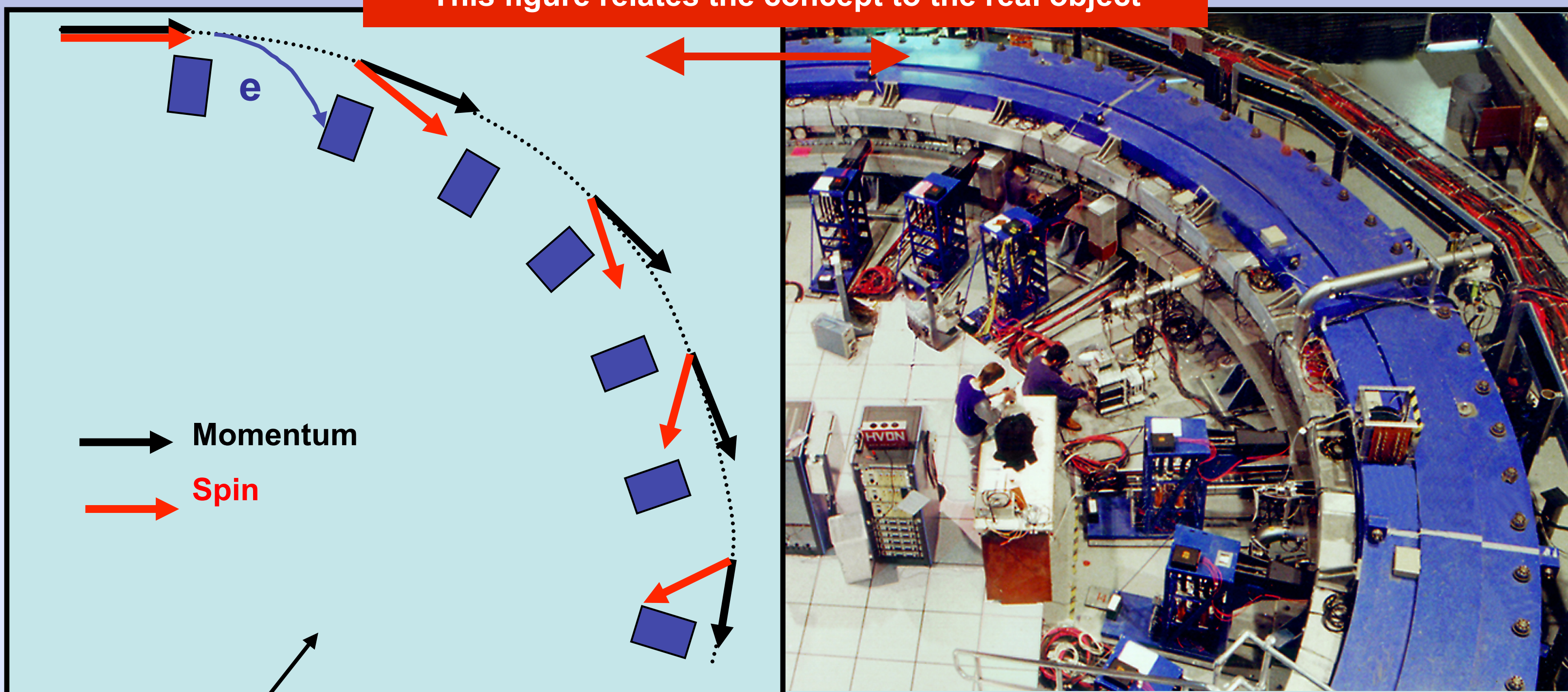
Structure of the classic physics talk– II

2. **Body**
   - Persuasion of a logical finding
   - This is a "proof"
     - *Demonstrate orderly delivery ... What follows from what?*
     - *Avoid unnecessary detail (save it for the written paper)*
     - *Highlight what really matters, bury what didn't matter*
       - *E.g., illustrate the BIGGEST sources of uncertainty, not the "most interesting" sources*
   - Use the Sentence Headline format (see M. Alley)
     - *Each slide has one specific point – put it in the slide title, then use the space to prove it*

This is the conclusion of this slide

a_μ is proportional to the difference between the spin precession and the rotation rate

This figure relates the concept to the real object



$$\Delta\omega = \omega_a = \left(\frac{g-2}{2}\right)\frac{eB}{mc}$$

This supports assertion in sentence headline

Structure of the classic physics talk– II

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     - ***Highlight what really matters, bury what didn't matter***
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   - **Use the Sentence Headline format** (see M. Alley)
     - ***Each slide has one specific point – put it in the slide title, then use the space to prove it***
   - **A physics proof often includes**
     - ***Equations***
     - ***Graphs of data***
     - ***Theoretical curves***
     - ***Tables***
     - ***Descriptions and depictions of equipment***
     - ***Animated simulations***

Keep equations selective and informative

- What can an audience grasp in ‘real time’?
  - If they already know it, then they know it
  - If they don’t know it, they usually have to study it term by term
- Take a sparse approach
  - Substitute proportionalities for equalities ?
    - Can eliminates uninteresting constants
    - Can emphasize relationship of variables
  - Substitute words for blocks of standard terms?

$$\frac{1}{\tau} = \frac{G_F^2 m_\mu^5}{192\pi^3}(1+\delta)$$

$$\frac{1}{\tau} \propto G_F^2(1+\delta)$$

Set them off attractively

$$\Gamma \propto (\text{phase space}) \times M_{ij}$$

  - Use builds and arrows to walk audience thru (see example)

Equations

Disaster ?

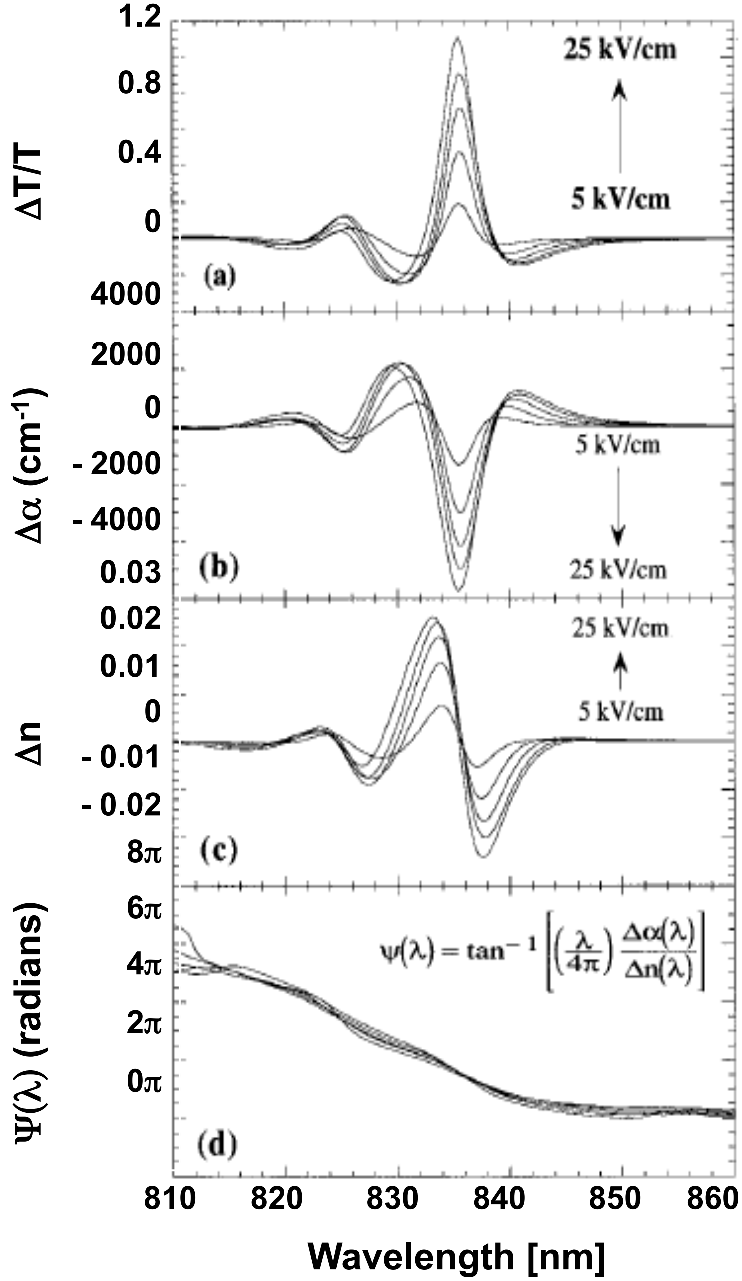
$$\frac{\Delta T}{T} = \frac{T(h\nu, F_o) - T(h\nu, 0)}{T(h\nu, 0)}$$

$$\Delta\alpha(h\nu, F_o) = -\frac{1}{L}\ln\left(1 + \frac{\Delta T}{T}\right)$$

$$\Delta n(\lambda) = \frac{\lambda^2}{2\pi^2} P\int_0^\infty \frac{\Delta\alpha(\lambda')d\lambda'}{\lambda^2 - \lambda'^2}$$

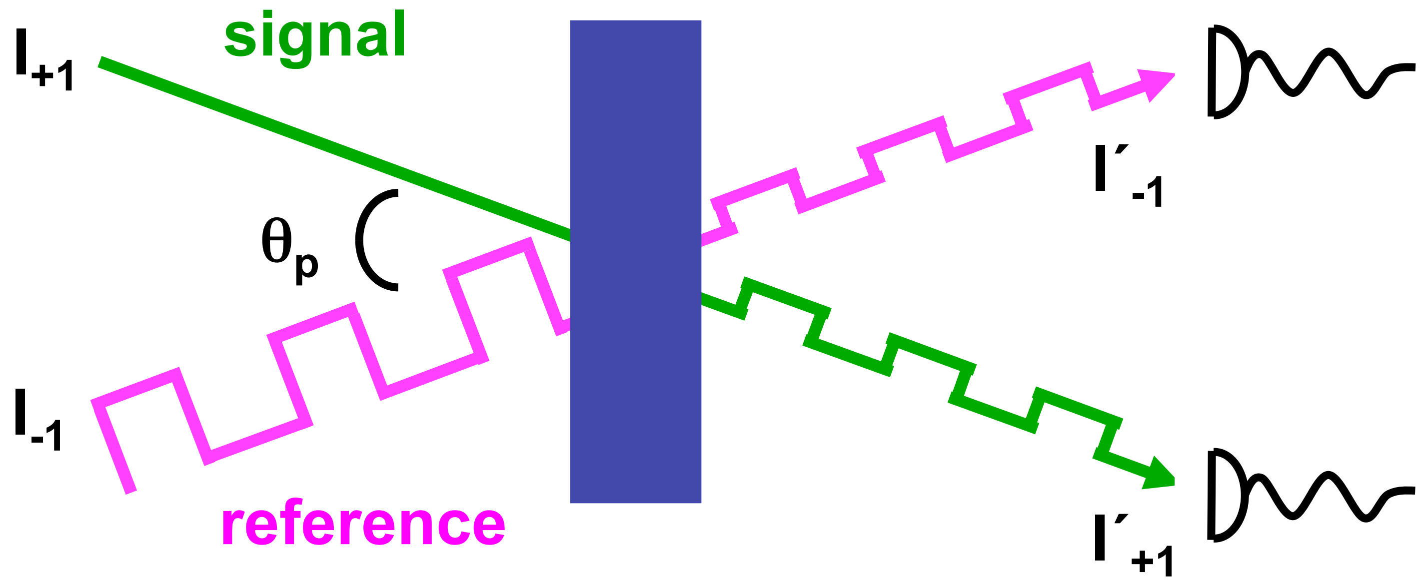
$$\psi(\lambda) = \tan^{-1}\left[\left(\frac{\lambda}{4\pi}\right)\frac{\Delta\alpha(\lambda)}{\Delta n(\lambda)}\right]$$

Rescue !



This is the result of several iterations from a truly, horribly complex set of expressions to simplifed equations and visual aids

Light beams transfer information



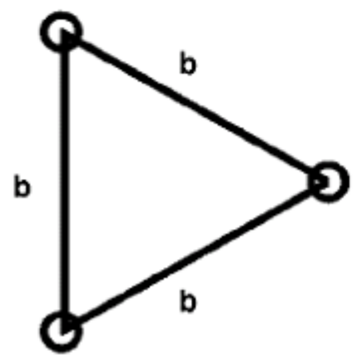
$$I'_{+1} \propto \frac{\alpha}{2}\cos\theta_p + \frac{2\pi n}{\lambda}\sin\theta_p$$

$$I'_{-1} \propto \frac{\alpha}{2}\cos\theta_p - \frac{2\pi n}{\lambda}\sin\theta_p$$

α = Electroabsorption
n = Index of refraction
θ_p = phase shift

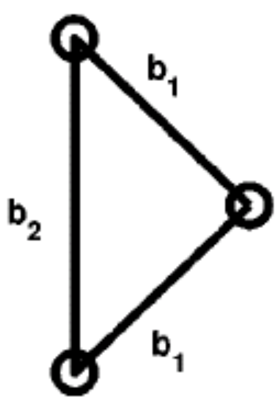
Monte Carlo trial functions

S = 3/2 (i.e. ↑↑↑)

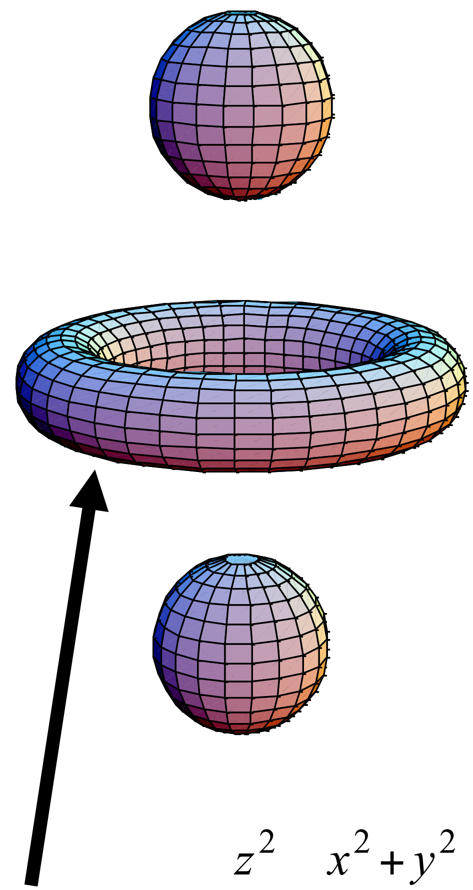


S = 1/2 (i.e. ↑↑↓)

Isosceles



Line



$$\left(1+\alpha(x^2+y^2)\right)e^{-\frac{z^2}{\sigma_z^2}-\frac{x^2+y^2}{\sigma_{xy}^2}}$$

I think this is a great and effective example from one of our students

The Radiative Transfer Equation

Number of Photons

Density of Dust Grains

$$\frac{dI}{ds} = -In(q_a + q_s) + \Im$$

Source Function

Distance Traveled

Absorption Coefficient

Scattering Coefficient

(from geometry and composition of dust grains)

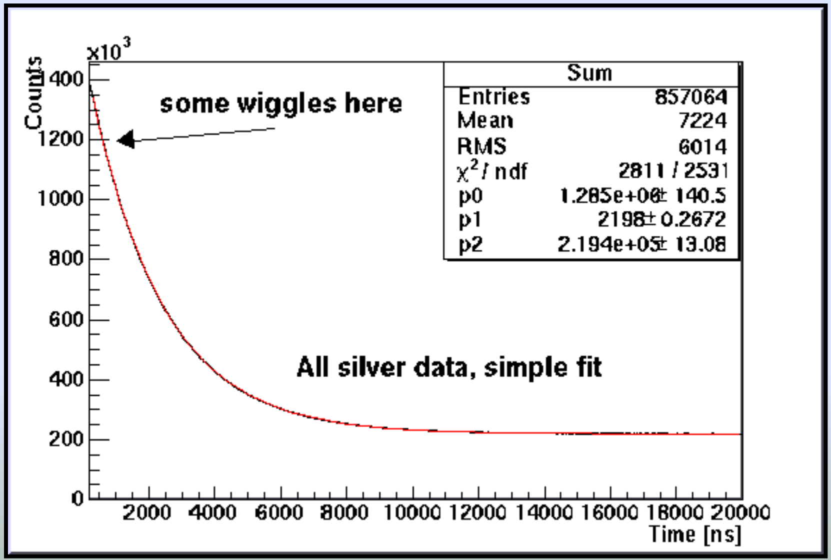
Requirements to solve analytically:

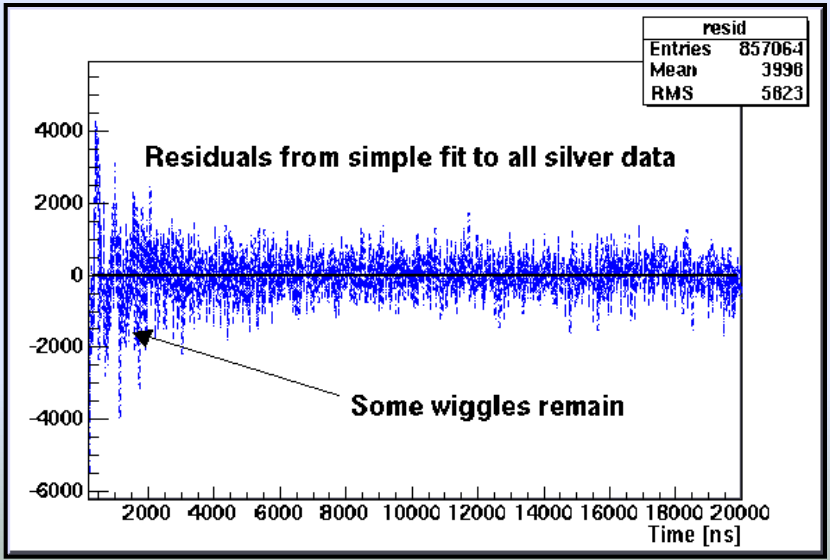
- *n* is a constant
- *qa = 0 or qs = 0*

We want turbulent clouds. *n* is not a constant

Presenting data is your most important and challenging task

- Avoid copying a graph for a formal article – they have a different style
- Use color and make lines thick
- Label axes and annotate important points with arrows and add words
- Use tables sparingly – if you do, highlight important parts





Fit to Simple 5-Par Function

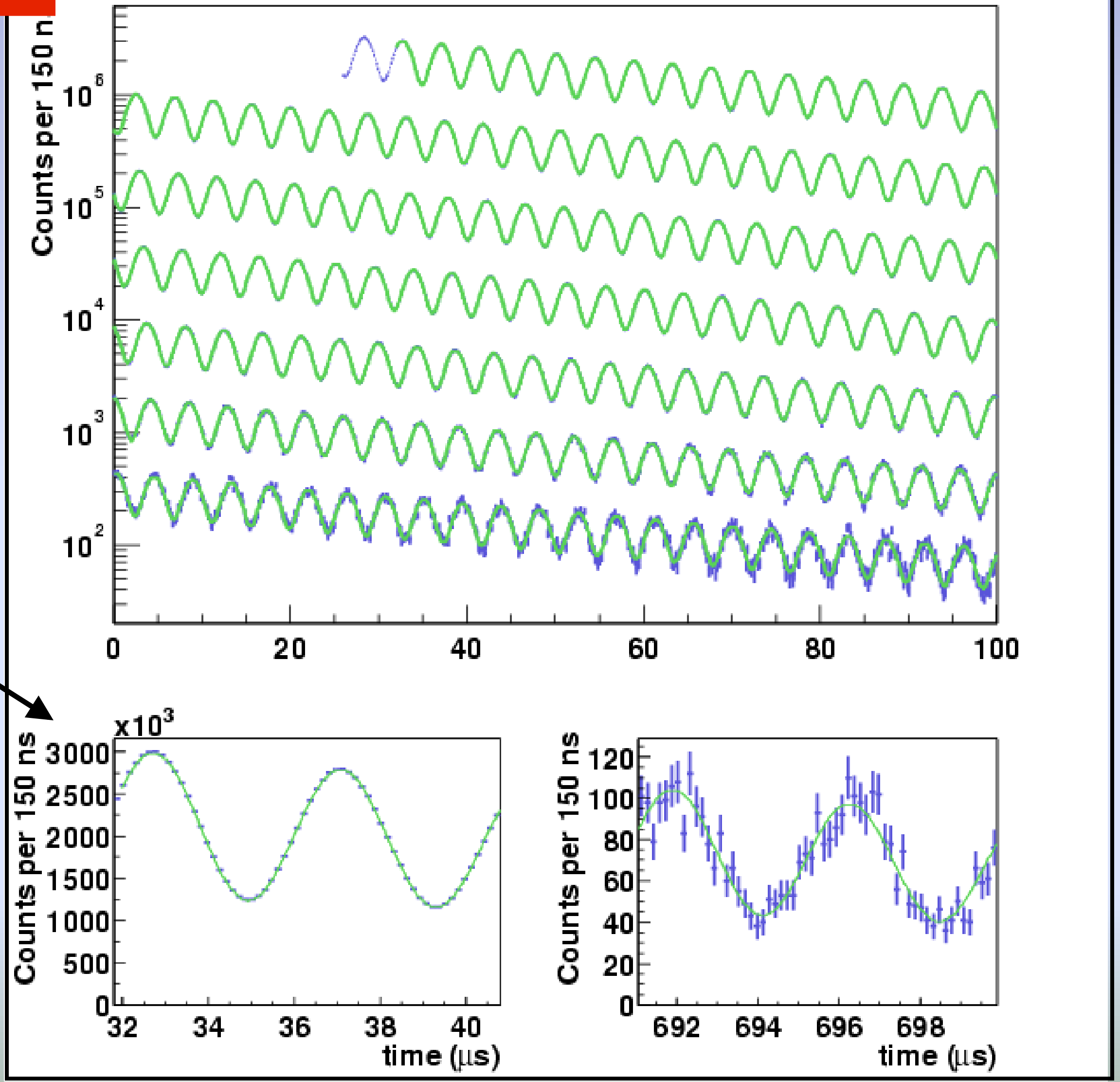
Equation uses COLOR to highlight the terms important to the talk

$$N(t) = N_0 e^{-t/\tau} [1 + A\cos(\omega_a t + \phi)]$$

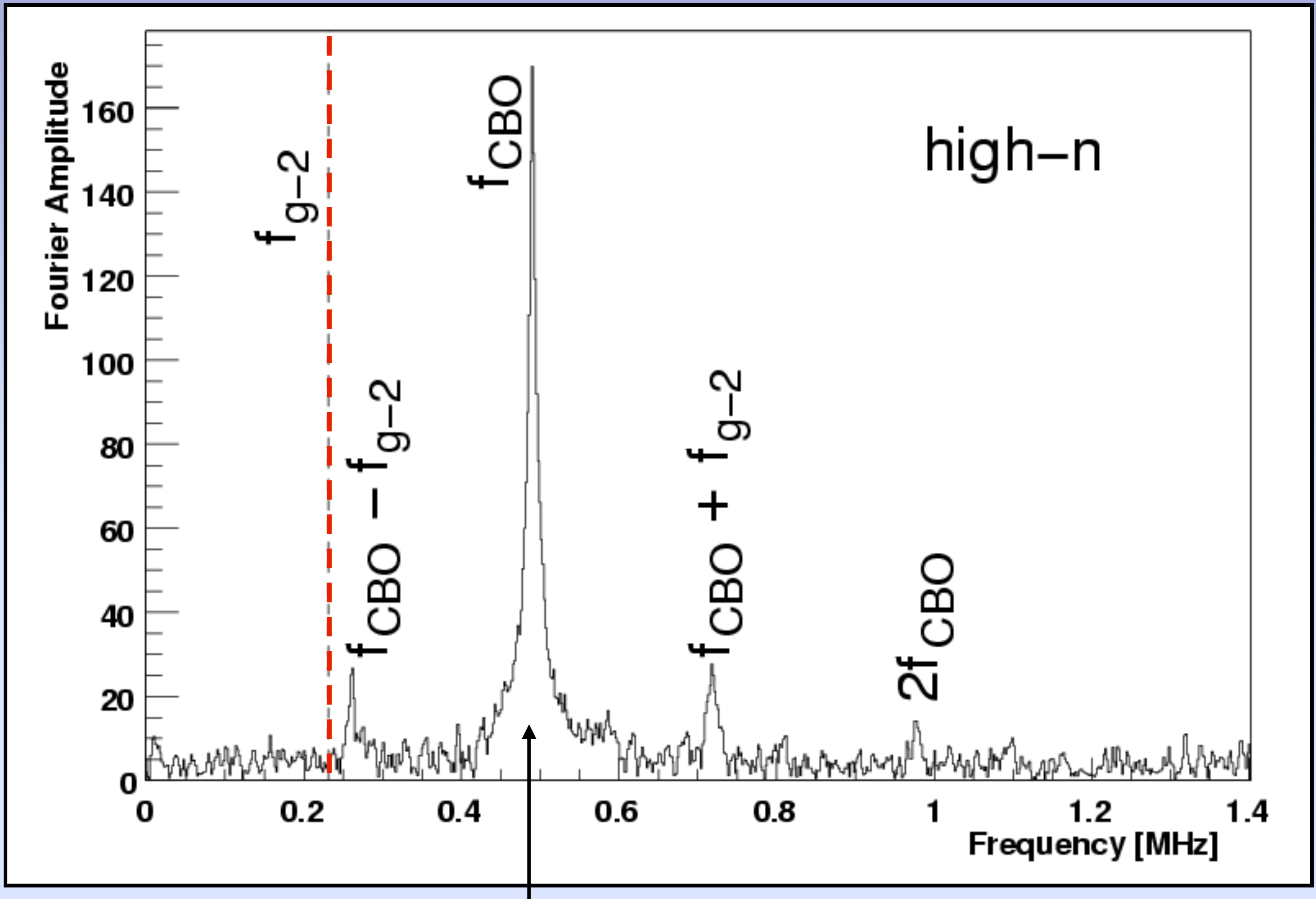
Few billion events

Getting a good χ^2 is a challenge

Blowups provide extra detail



Fourier spectrum of residuals shows CBO resonances, but they are not close to the g-2 frequency



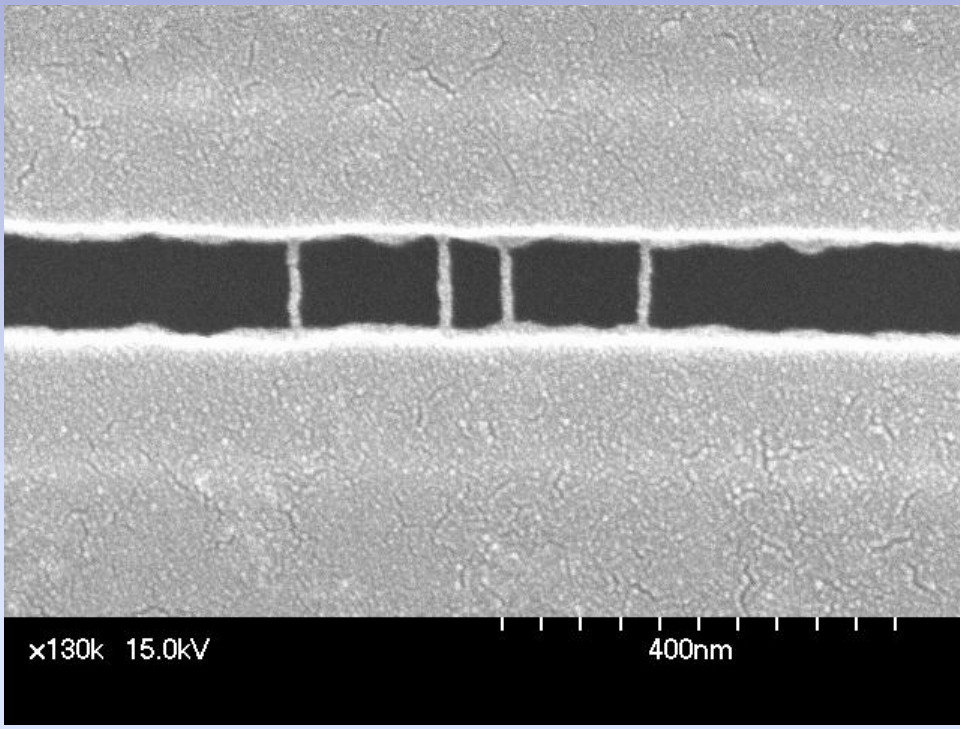
$$f_{CBO} \approx f_C\left(1-\sqrt{1-n}\right)$$

Annotate graphs that would appear in papers

Add color here

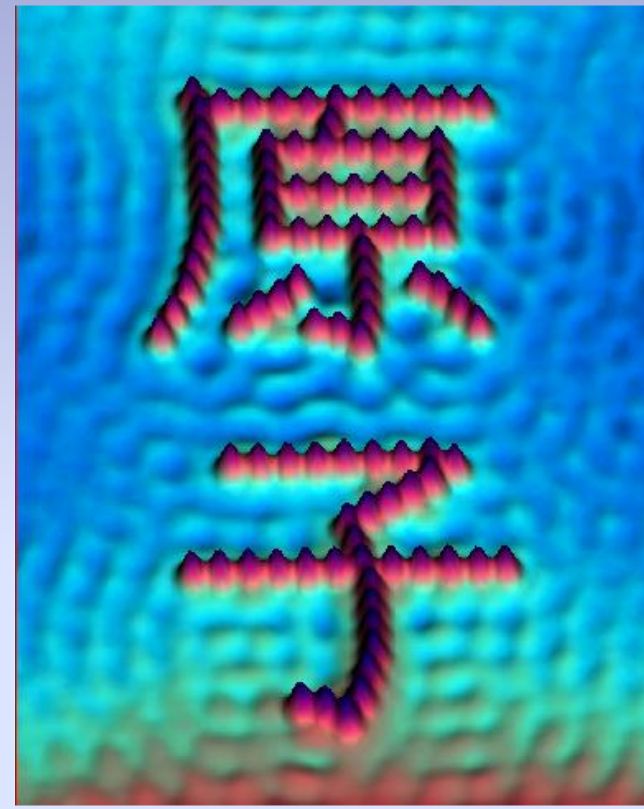
Some more examples of data

A photograph, which reveals the detail



10 nm wires: AuPd on DNA

A photograph, which reveals the detail



Occasionally, you will need to present a Table

Fall 2003 run summary with *dc* beam

Estimate of precision on lifetime for each target and rate in ppm.

	Silver	Sulfur	AK3	Totals
Very Low Rate 30 - 40 kHz	-	-	97	97
Low Rate 45 - 60 kHz	175	-	52	50
Mid Rate 100 - 130 kHz	112	66	55	40
High Rate 300 - 450 kHz	211	81	74	53
Ultra High Rate > 500 kHz	-	130	165	102
Totals	86	48	31	**25**

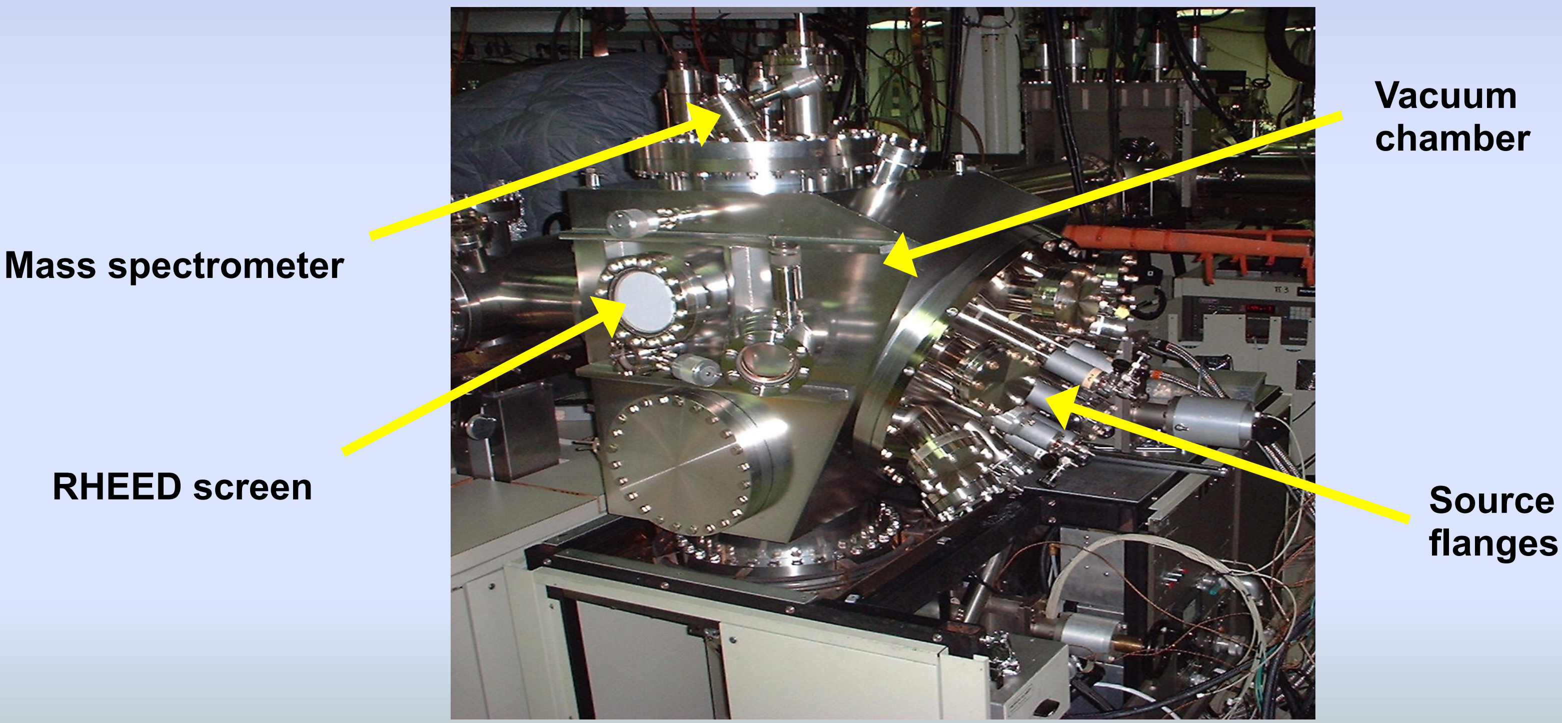
30 ppm

This can be useful to give people a feeling of the range of the data obtained

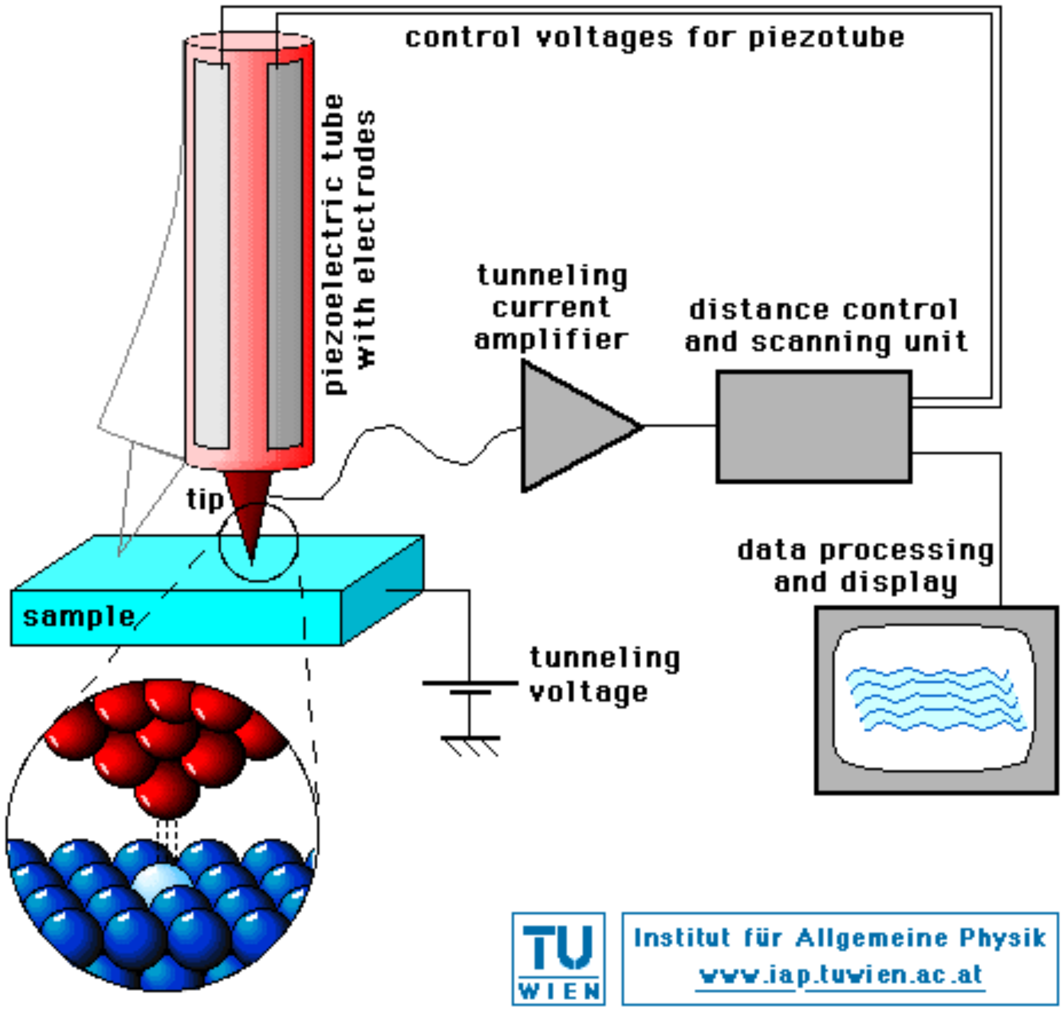
The shaded highlight then is used to focus audience in on a special conclusion

Show the equipment IF it helps as part of your proof – not because you love it

- **Photographs give scale and reality – but add labels**
- **Schematics provide concept**
- **Icons strip away unnecessary details**
- **ALL OF THESE are useful**

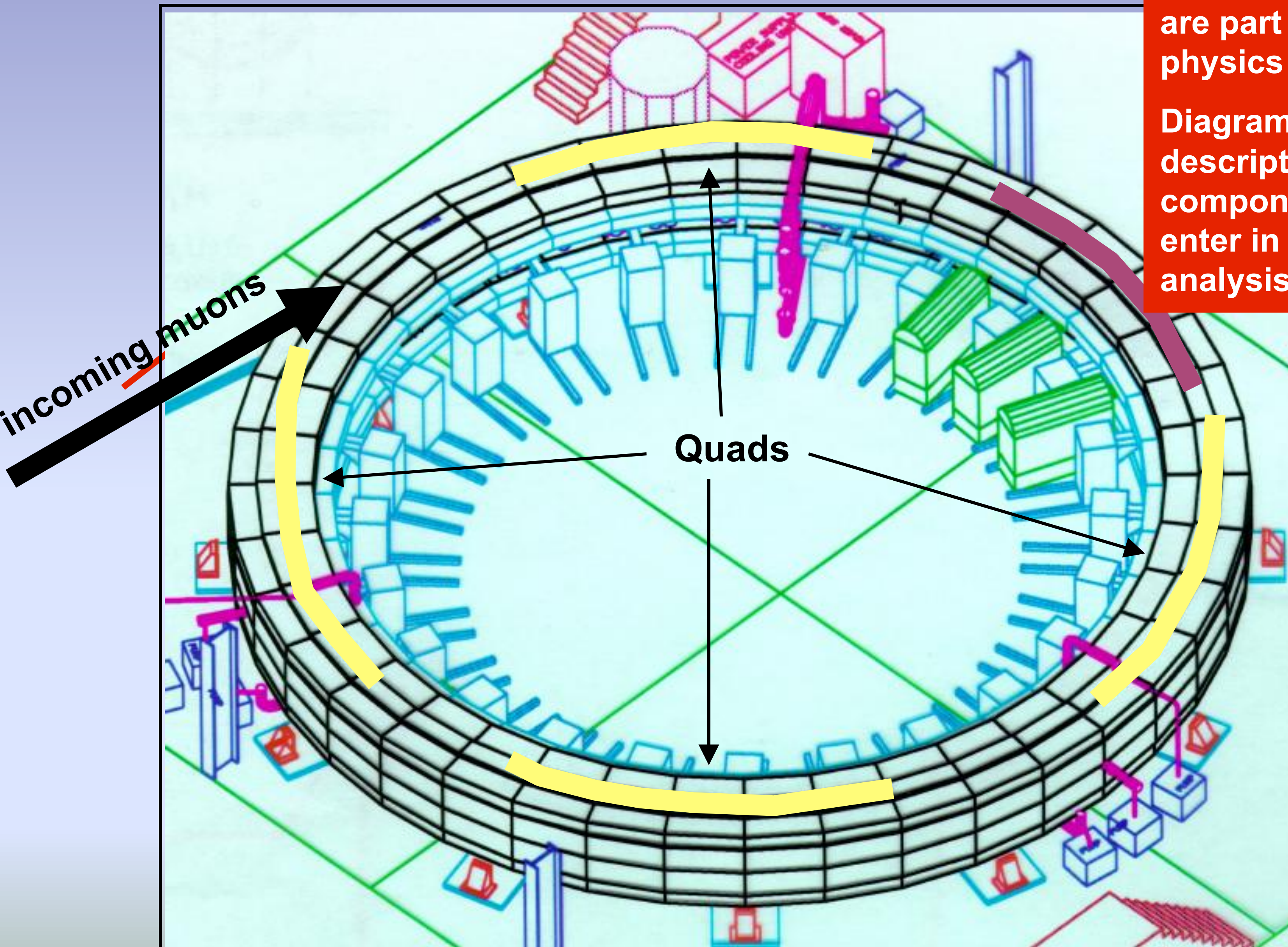


Basic Set-up



Courtesy IAP/TU Wien

BNL Storage Ring

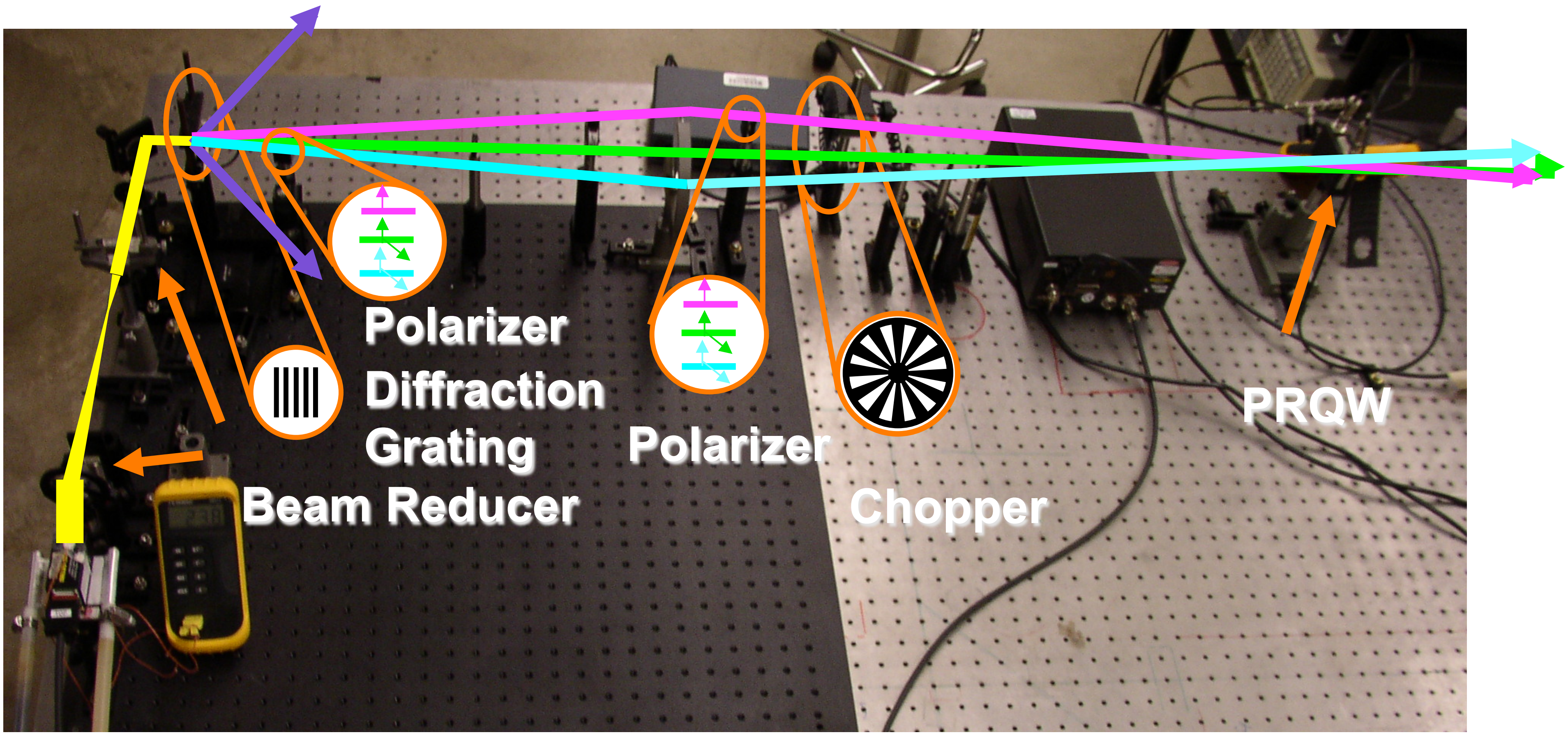


Features:

Blue/Red circles are part of the physics story

Diagram allows description of components that enter in the data analysis

Experimental Apparatus

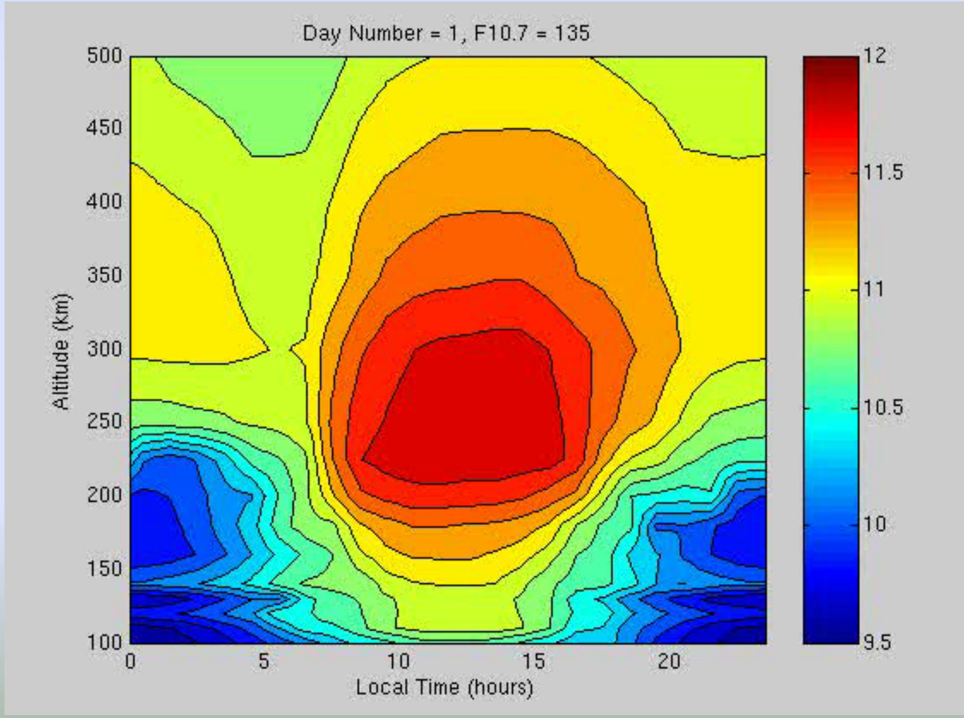


Here we add detail to the optical bench

Use your animations but make sure you set them up

- Describe to the audience what they will see
- Tell them what to look out for
- Add extra labels to define axes not on animation
- Be prepared to show the movie more than once

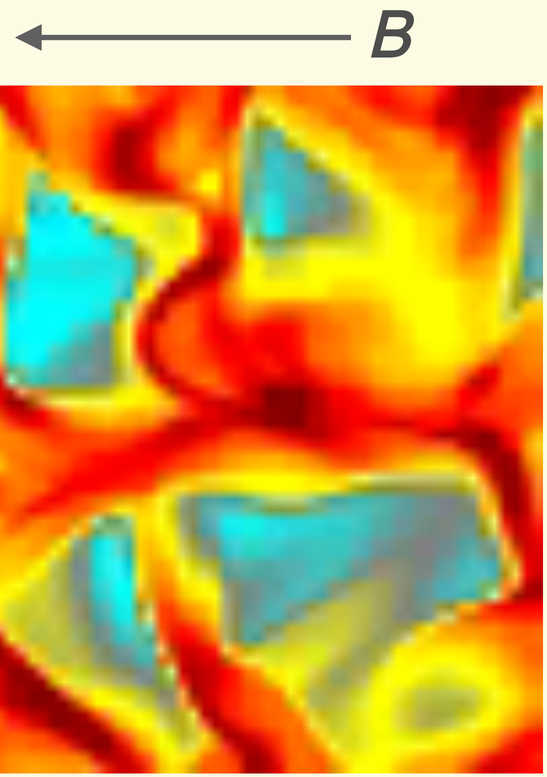
log(N_e): Alt. vs. LT, progressing over Day No., F10.7 = 135



Anistropies arise from magnetic fields

At the end of this animation, the speaker must reinforce the visual conclusion

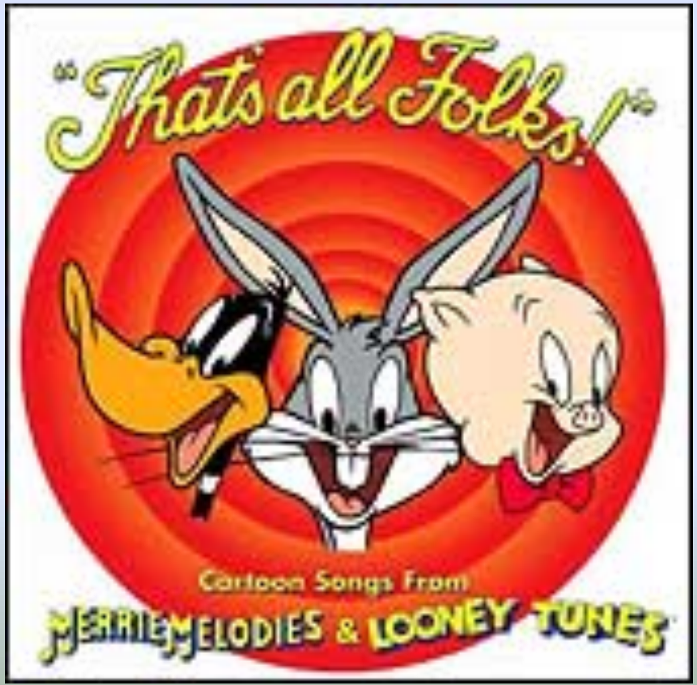
Low density tubes (holes) align with *B*



Density cross section of a cloud with magnetic field, red is high density and blue is low

Structure of the classic physics talk III

3. ***Conclusions***
   - **I'd advise no more than 3 points**
     - ***Say what you found and where it is going***
   - **Include a representative (simplified) graphic**
     - ***This slide will be up during question period so this graphic will get burned into people's memory***
   - **Include your contact information and link to talk on web**

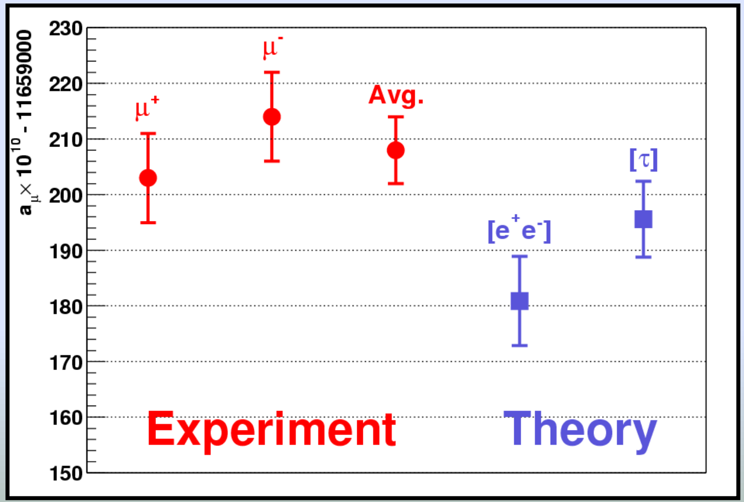


You can do better …

Not "exciting" but it has the pieces

Conclusions

- **All g-2 data published – final precision is 0.5 ppm**
  - **Systematics lowered again**
- **Consistent results, consistently above theory**
  - **The *ee* – *tau* controversy continues**
  - **Considerably more "*ee*" type data on the way**
- **The systematic limit is "far" away … we should continue**

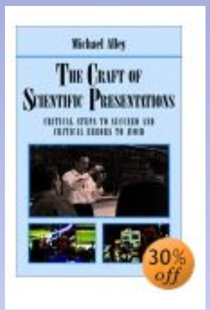


Main finding

hertzog@uiuc.edu

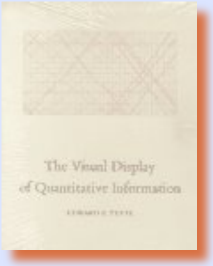
Copy of talk: www.npl.uiuc.edu/~hertzog/ASPENg2.pdf

Resources for advice



Michael Alley, ***The Craft of Scientific Presentations: Critical Steps to Succeed and Critical Errors to Avoid***

Vernon Booth, *Communicating in Science—Writing a scientific paper and speaking at scientific meetings*, 2nd ed., Cambridge University Press (1993).



Edward R. Tufte, *The Visual Display of Quantitative Information*, Graphics Press (2001).