PHYS 1443 – Section 001
Lecture #1

Tuesday, May 30, 2006

Dr. Jaehoon Yu

- Who am I?
- How is this class organized?
- What is Physics?
- What do we want from this class?
- Brief history of physics
- Standards and units
- Dimensional Analysis
- Fundamentals
- One Dimensional Motion

Today's homework is homework #1, due 7pm, this Friday!!

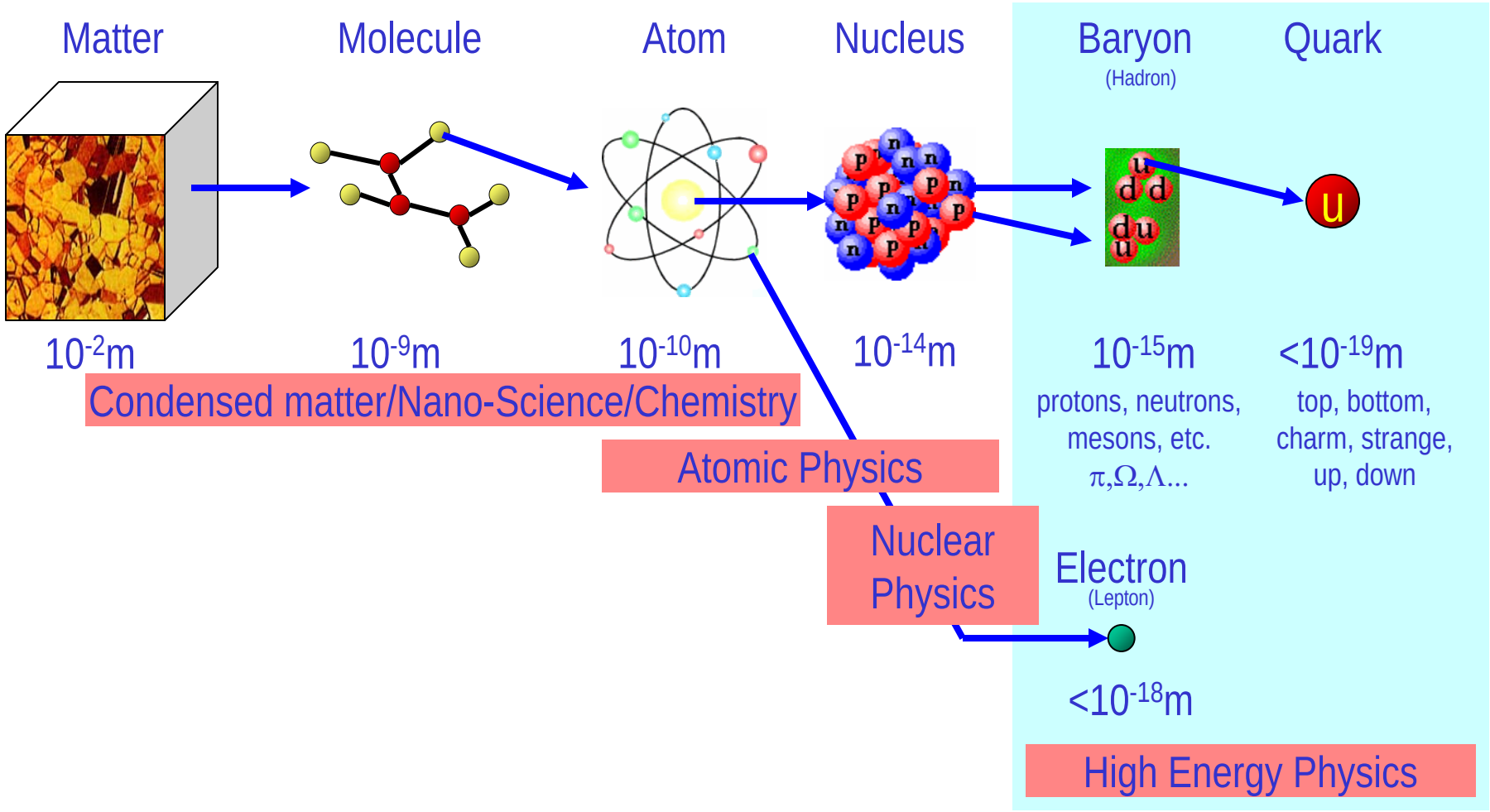
Announcements

- Reading assignment #1: Read and follow through all sections in appendices A and B by Thursday, June 1
- There will be a quiz on Thursday, June 1, on this reading assignment.

Who am I?

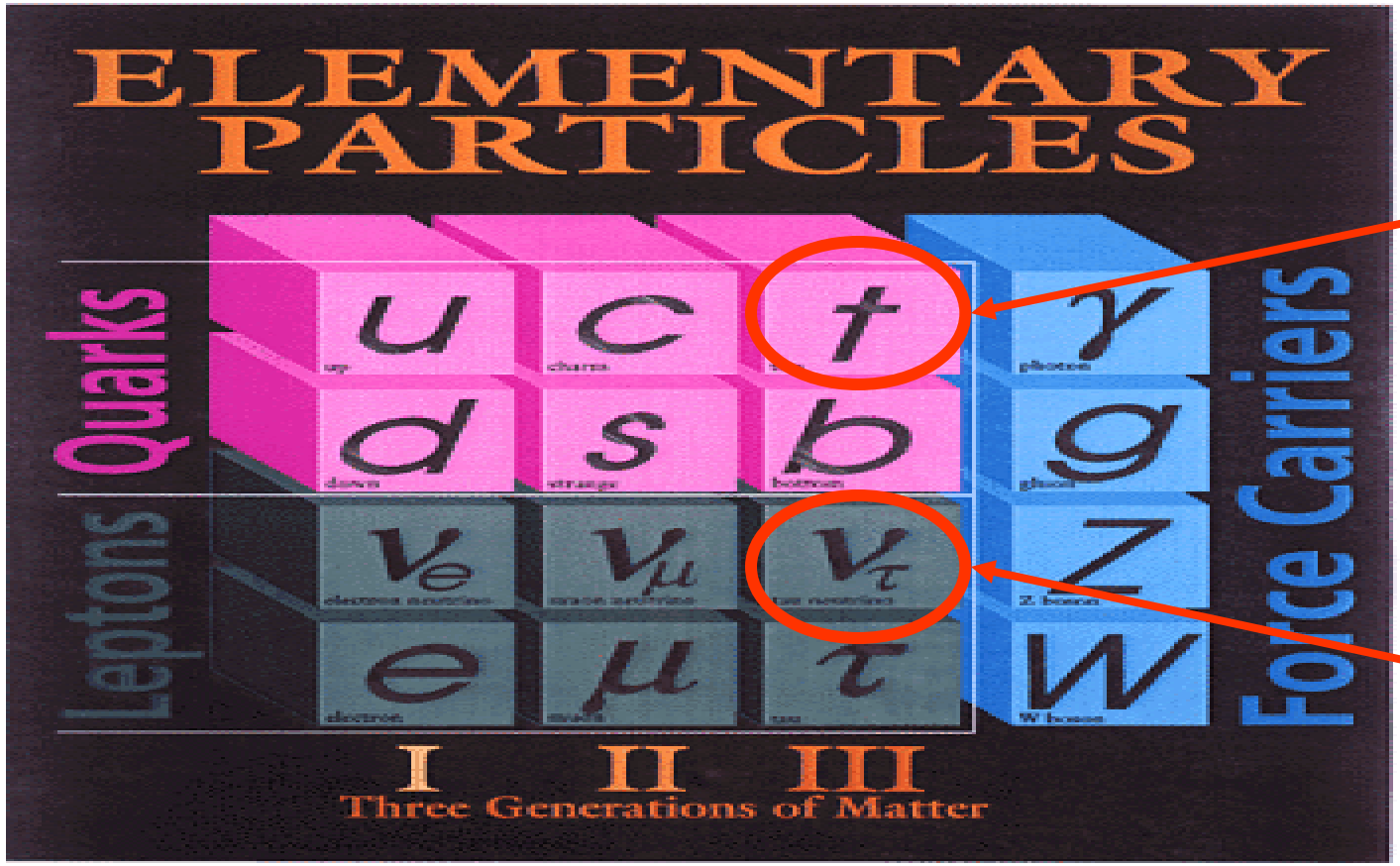
- Name: Dr. Jaehoon Yu (You can call me Dr. Yu)
- Office: Rm 342, Chemistry and Physics Building
- Extension: x22814, E-mail: *jaehoonyu@uta.edu*
- My profession:High Energy Physics (HEP)
  - Collide particles (protons on anti-protons or electrons on anti-electrons, positrons) at the energies equivalent to 10,000 Trillion degrees
  - To understand
    - Fundamental constituents of matter
    - Interactions or forces between the constituents
    - Origin of Mass
    - Creation of Universe (**Big Bang** Theory)
  - A pure scientific research activity
    - Direct use of the fundamental laws we find may take longer than we want but
    - Indirect product of research contribute to every day lives; eg. WWW

Structure of Matter



The Standard Model

- Assumes the following fundamental structure:



Discovered in 1995

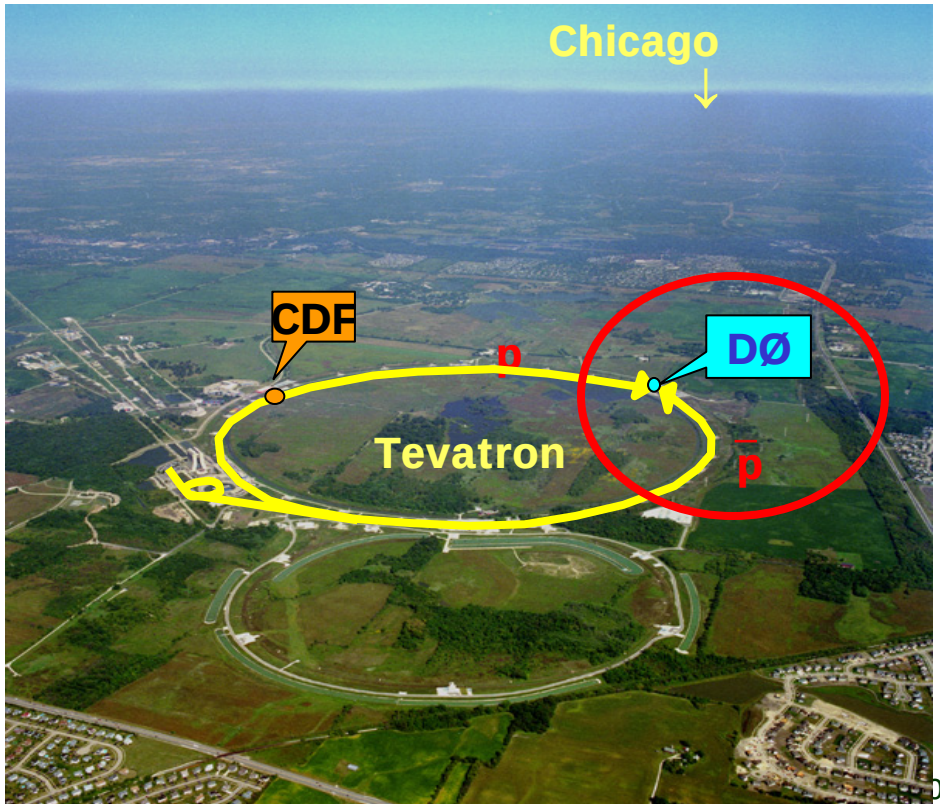
Directly observed in 2000

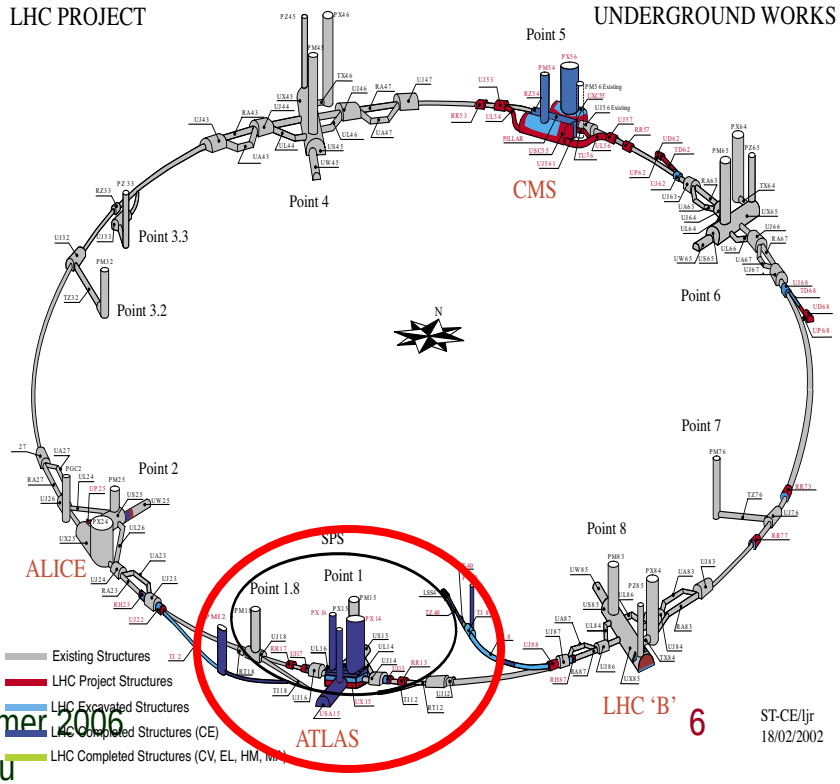
Fermilab Tevatron and LHC at CERN

- Present world's Highest Energy proton-anti-proton collider
  - E_{cm}=1.96 TeV (=6.3x10^{-7}J/p➔ 13M Joules on 10^{-4}m^2)

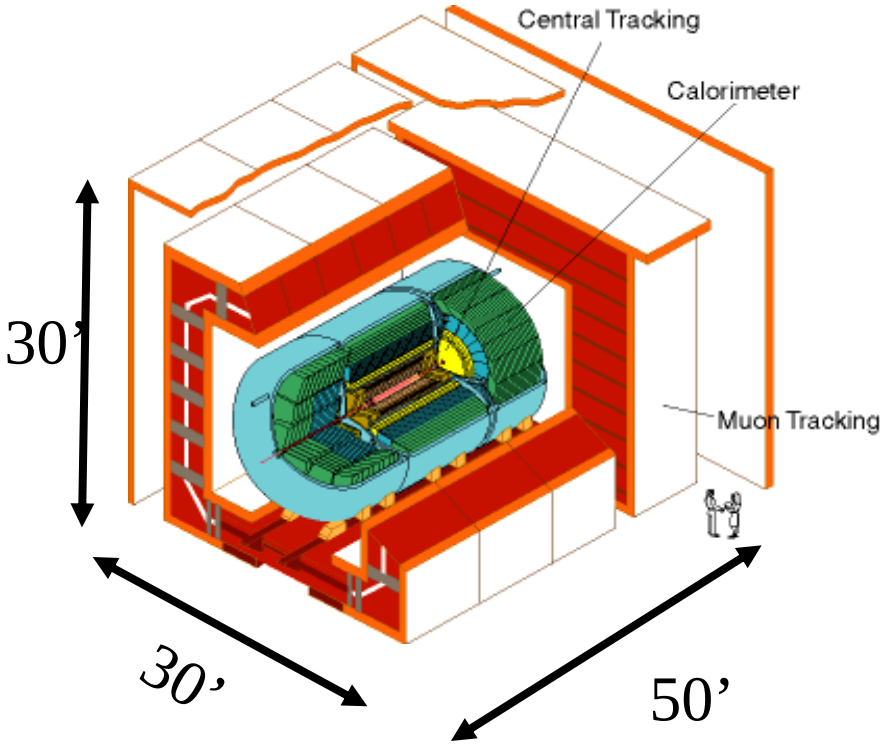
  ⇒Equivalent to the kinetic energy of a 20t truck at a speed 80 mi/hr
- World's Highest Energy proton-proton collider in 2 years
  - E_{cm}=14 TeV (=44x10^{-7}J/p➔ 1000M Joules on 10^{-4}m^2)

  ⇒Equivalent to the kinetic energy of a 20t truck at a speed 212 mi/hr



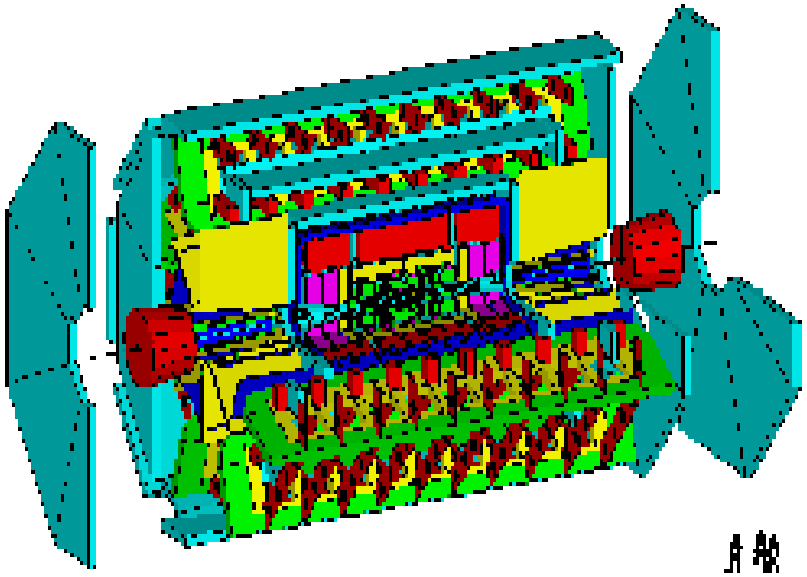


DØ Detector



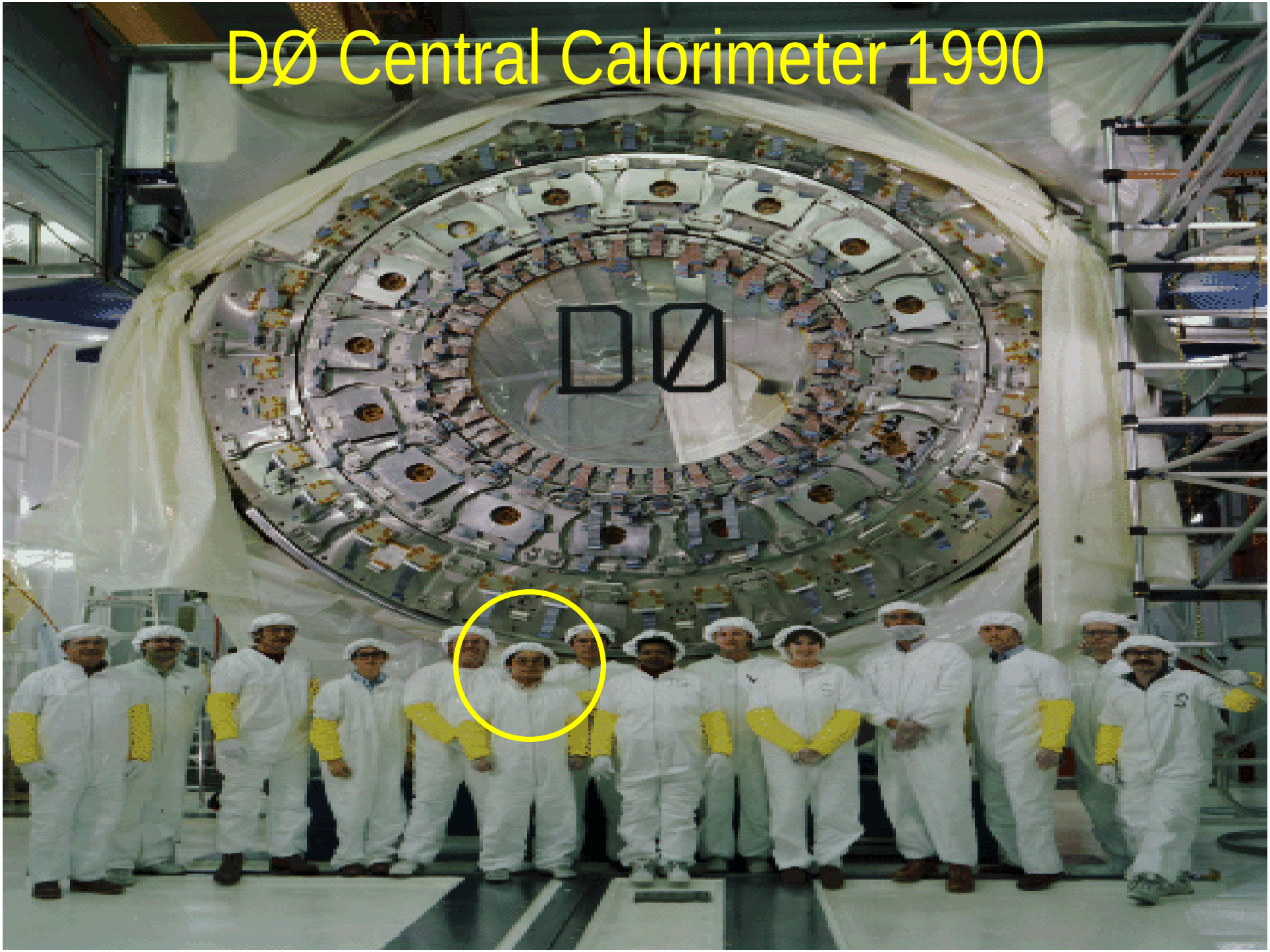
- Weighs 5000 tons
- Can inspect 3,000,000 collisions/second
- Will record 50 collisions/second
- Records approximately 10,000,000 bytes/second
- Recording 0.5×10^{15} (500,000,000,000,000) bytes per year (0.5 PetaBytes).

ATLAS Detector

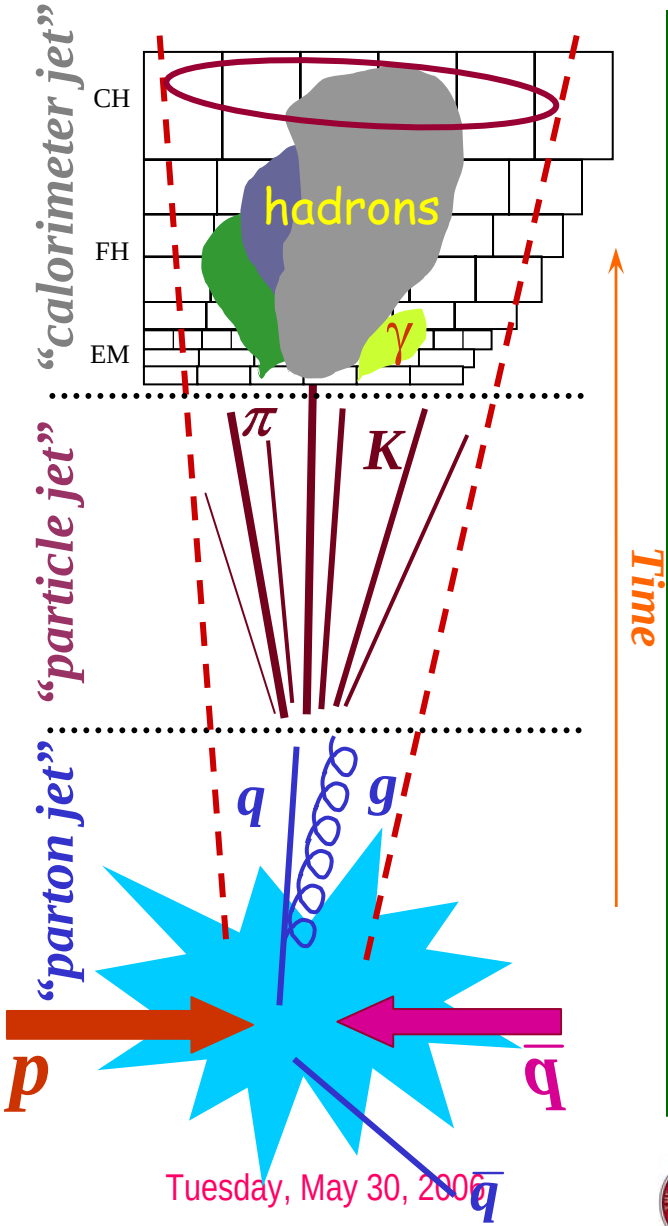


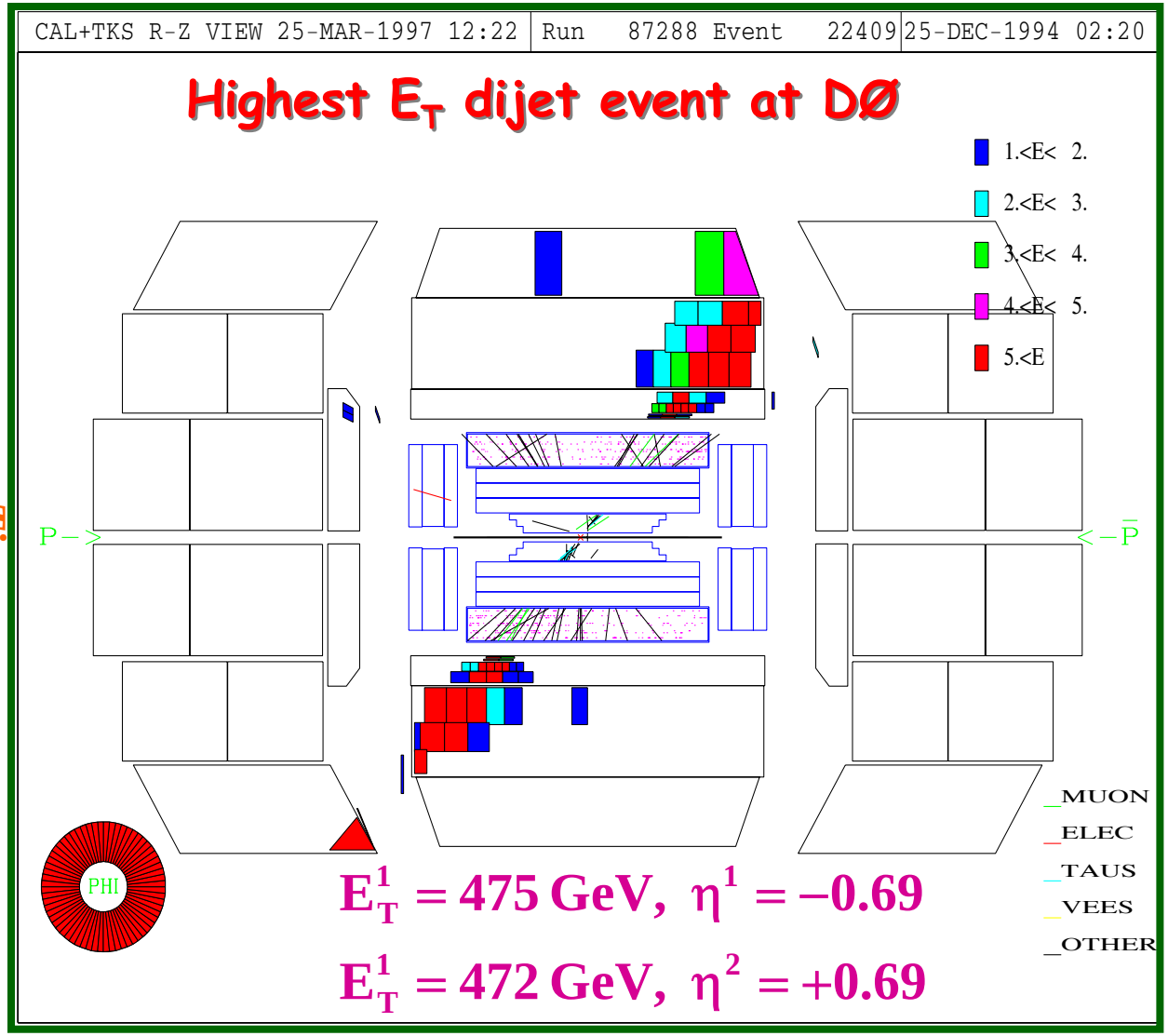
- Weighs 10,000 tons
- Can inspect 1,000,000,000 collisions/second
- Will record 100 collisions/second
- Records approximately 300,000,000 bytes/second
- Will record 1.5×10^{15} (1,500,000,000,000,000) bytes each year (1.5 PetaByte).

DØ Central Calorimeter 1990



How does an Event Look in a Collider Detector?





Information & Communication Source

- My web page: http://www-hep.uta.edu/~yu/
  - Contact information & Class Schedule
  - Syllabus
  - Homework
  - Holidays and Exam days
  - Evaluation Policy
  - Class Style & Communication
  - Other information
- Primary communication tool is e-mail: Register for PHYS1443-001-SUMMER06 e-mail distribution list as soon possible ➔ Instruction available in Class style & Communication
  - 5 points extra credit if done by next Monday, June 5
  - 3 points extra credit if done by next Wednesday, June 7
- Office Hours: 10:00 – 11:00am, Mondays, Wednesdays and Thursdays or by appointments

Evaluation Policy

- Term Exams: 45%
  - Total of two exams (6/15 and 6/30)
  - Both exams will be used for the final grade
  - Each will constitute 22.5% of the total
  - Missing an exam is not permissible unless pre-approved
    - No makeup test
    - You will get an F if you miss any of the exams without a prior approval
- Lab score: 20%
- Homework: 25%
- Pop-quizzes: 10%

100%

- Extra credits: 10% of the total
  - Random attendances
  - Strong participation in the class discussions
  - Other many opportunities
- Will be on sliding scale unless everyone does very well

Homeworks

- Solving homework problems is the only way to comprehend class material
- An electronic homework system has been setup for you
  - Details are in the material distributed today and on the web
  - https://hw.utexas.edu/studentInstructions.html
  - Download homework #1 (1 problem), attempt to solve it, and submit it ➔ You will receive a 100% credit for HW#1
  - Roster will close Friday, June 2
- Each homework carries the same weight
- ALL homework grades will be used for the final grade
- Home work will constitute 25% of the total ➔ A good way of keeping your grades high
- Strongly encouraged to collaborate ➔ Does not mean you can copy

Attendances and Class Style

- Attendances:
  - Will be taken randomly
  - Will be used for extra credits
- Class style:
  - Lectures will be on electronic media
    - The lecture notes will be posted on the web AFTER each class
  - Will be mixed with traditional methods
  - Active participation through questions and discussions are STRONGLY encouraged ➔ Extra credit….

Why do Physics?

Exp.
- To understand nature through experimental observations and measurements (Research)

Theory
- Establish limited number of fundamental laws, usually with mathematical expressions
- Predict the nature's course

⇒Theory and Experiment work hand-in-hand

⇒Theory works generally under restricted conditions

⇒Discrepancies between experimental measurements and theory are good for improvements

⇒Improves our everyday lives, though some laws can take a while till we see amongst us

Models, Theories and Laws

- Models: A kind of analogy or mental image of a phenomena in terms of something we are familiar with
  - Often provides insights for new experiments and ideas
- Theories: More systematically improved version of models
  - Can provide quantitative predictions that are testable and more precise
- Laws: Certain concise but general statements about how nature behaves ➔ The statement must be found experimentally valid
- Principles: Less general statements of how nature behaves
  - Has some level of arbitrariness

What do we want from this class?

- Physics is everywhere around you.
- Understand the fundamental principles that surrounds you in everyday lives…
- Identify what law of physics applies to what phenomena and use them appropriately
- Understand the impact of such physical laws
- Learn how to research and analyze what you observe.
- Learn how to express observations and measurements in mathematical languages.
- Learn how to express your research in systematic manner in writing
- I don't want you to be scared of PHYSICS!!!

Most of importantly, let us to have a lot of FUN!!