



AtomSmasher 1.0

USER MANUAL

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Atom Smasher - The Multimedia Accelerator Game



AtomSmasher™ Player's Manual for the Multimedia Accelerator Game
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Atom Smasher - The Multimedia Accelerator Game



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Atom Smasher - The Multimedia Accelerator Game



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1. Introduction

The Multimedia Accelerator Game, Atom Smasher, is designed to introduce the player to particle accelerators and particle detectors, the Standard Model of elementary particles, and the basic physics of charged particle motion in simple accelerator components. Atom Smasher is a combination of a fast-moving simulation game and a strategy role-playing game that immerses the player in the world of high-energy accelerators. This Player's Manual provides an overview of the various parts of the Atom Smasher game software.



Atom Smasher Overview

Atom Smasher is an educational game for learning about particle accelerators, elementary particles, and some of the fundamental physics included in these topics. By playing the role of a scientist conducting experiments in a particle accelerator facility, students can set up accelerator experiments, fly with a group of beam particles through the accelerator channels to a target, and discover the fundamental particles and forces of nature. From their position in the accelerator control room, students can access an educational film library, use interactive tutorials that illustrate particles moving through accelerator components, or play the Internet Physics Bowl in competition with three studio participants.

Atom Smasher is designed to immerse the students in the role of scientists performing experiments in an accelerator facility, teaching them how particles interact with electric and magnetic fields, teaching them basic accelerator physics, and motivating them to use their abilities to design and conduct experiments as they discover and identify the fundamental particles and forces of nature.

The Player Scientist

The game introduction places the player in the role of a scientist arriving at XIPAL, the eXotic International Particle Accelerator Laboratory. Driving in an electric car listening to the stereo radio, the player is interrupted by a digital cell phone call apprising him/her of a major scientific catastrophe: the loss of all existing information on elementary particles. The caller then requests the player's assistance in rebuilding the world's knowledge of elementary particles and forces. Upon arriving at the control tower of XIPAL, the player is lead to a seat in the main control room. Figure 1.1 shows the player's control room console with the Main Menu displayed on the monitor's screen. From inside the control room, the player can access the major assets of the XIPAL facility: the XIPAL film library, on-line tutorials, the internet, and of course, the accelerators of the XIPAL complex. By interacting with these assets, the players learn about accelerators, detectors and other subjects relating to particle physics. Throughout their journey, the players accumulate knowledge and record the results in the XIPAL particle database.

XIPAL (pronounced "zy-ple" similar to "title") is an advanced, futuristic, international accelerator laboratory, located in a park-like setting. The laboratory has a complex of accelerators that players use to conduct experiments in order to recover the "lost" knowledge of elementary particle physics.

Players score points by identifying particles and their properties, through correctly answering questions in the Internet Physics Bowl, and by correctly answering bonus questions that pop up during the game.

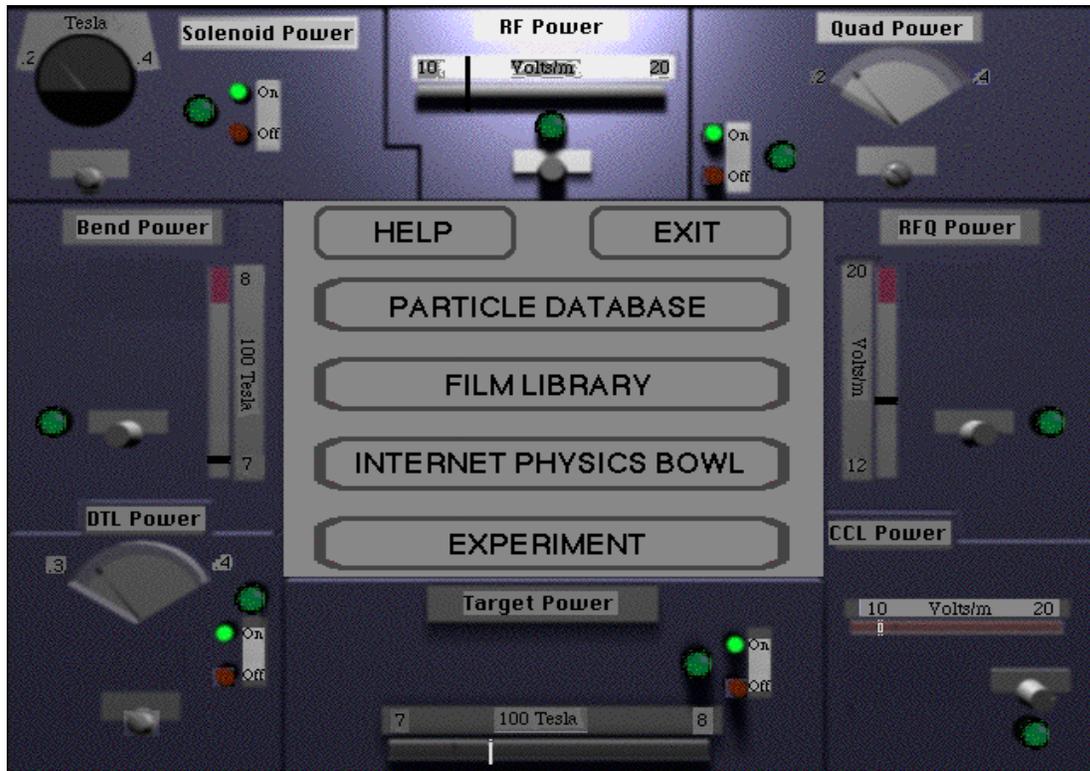


Figure 1.1 Player's Control Room Console with Main Menu Displayed.

The Atom Smasher Player's Manual is divided into six (6) Sections. Following this Introduction, Section 2 summarizes the procedures for the installation of Atom Smasher and the initial player log-in. Section 3 describes the assets of the XIPAL facility available in this version of Atom Smasher. The role-playing aspects of the game are also illustrated in Section 3. Section 4 outlines the use of the XIPAL accelerators to conduct experiments to search for new particles. Conducting accelerator experiments involves playing a fast-moving action game that includes flying through the interior of the accelerator components. Section 5 provides an overview of how players score points, become qualified to operate higher energy accelerators, and offer some hints on scoring. Section 6 acknowledges the large number of contributors who have made this version of Atom Smasher possible.

Players interact with Atom Smasher through a console in the control room of the virtual XIPAL facility. The outside border of the console contains controls for the accelerators. The center of the console is a computer monitor that displays a variety of interactive images.



2. Getting Started

Atom Smasher is distributed on CD-ROM and includes two primary directories (or folders): Atom Smasher and Videos. The contents of the Atom Smasher directory must be installed on your computer's hard drive and requires approximately 50 megabytes of disk space. The Videos directory may either be used with the Atom Smasher CD inserted into your computer's CD drive, or installed onto your computer's hard drive. When installed on your computer's hard drive, the Videos directory requires approximately 375 megabytes of disk space.

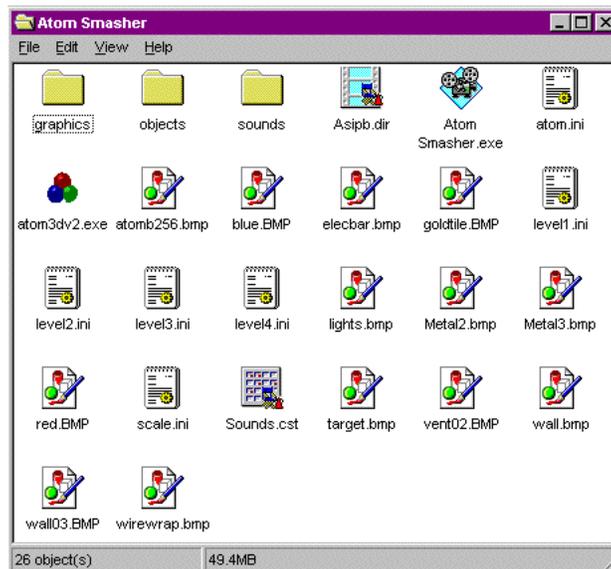


Installing on Windows

Insert the CD into your computer's CD-ROM drive and open the CD-ROM drive. (A window similar to that illustrated in Figure 2.2 should appear on your desktop.) The Atom Smasher application and all required files are contained in two directories (folders) on the CD: (1) the "Atom Smasher" folder and (2) the "VIDEOS" folder. To install Atom Smasher on your computer, select the folder entitled "Atom Smasher" and drag it to your hard drive. All of the files needed to run Atom Smasher, except those contained in the "VIDEOS" folder, will be copied to your hard drive. You may either (1) drag the "VIDEOS" folder to the Atom Smasher directory on your hard drive, or (2) leave the "VIDEOS" folder on the CD. If you leave the "VIDEOS" folder on the CD, the Atom Smasher CD will need to be in your computer's CD-ROM drive in order to begin play. After installation, the folder appearing on your hard drive should appear similar to that illustrated in Figure 2.1.

Atom Smasher for Windows includes the Atom Smasher application, the Internet Physics Bowl, the XIPAL film library, and the 3-D Accelerator Experiment Simulation.

Installation is simple. Drag the "Atom Smasher" folder from the CD to your hard drive.



Atom Smasher for Windows requires:

- *Pentium™ processor*
- *Windows™ 95 or 98*
- *QuickTime™ for Windows*
- *DirectX 5.0 or higher*
- *CD-ROM drive*
- *Mouse*

If your computer system does not meet the above requirements, Atom Smasher will not run properly on your machine.

Figure 2.1 Atom Smasher Installed on Windows.



Installing on Macintosh

The Atom Smasher application and all required files are contained in two folders on the CD: (1) the “Atom Smasher” folder and (2) the “VIDEOS” folder. Insert the CD into your Macintosh’s CD-ROM drive and double click the Atom Smasher CD icon. A window similar to that illustrated in Figure 2.2 should open on your desktop. To install Atom Smasher on your Macintosh, select the folder entitled “Atom Smasher” and drag it to your hard drive. Leave the “VIDEOS” folder on the CD. All of the files needed to run Atom Smasher, except those contained in the “VIDEOS” folder, will be copied to your hard drive.

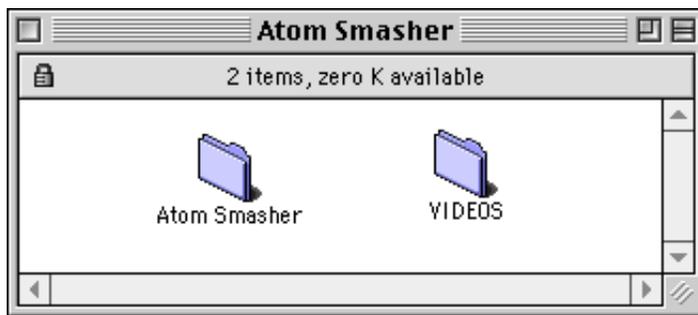


Figure 2.2 Atom Smasher Folders on Macintosh CD.

Atom Smasher for the Macintosh includes the Atom Smasher application, the Internet Physics Bowl, the XIPAL film library, and the 2-D Accelerator Experiment Simulation.

Installation is simple. Drag the “Atom Smasher” folder from the CD to your hard drive. Leave the CD in your computer’s CD-ROM drive so Atom Smasher can access the files in the “VIDEOS” folder.

Atom Smasher for Macintosh™ requires:

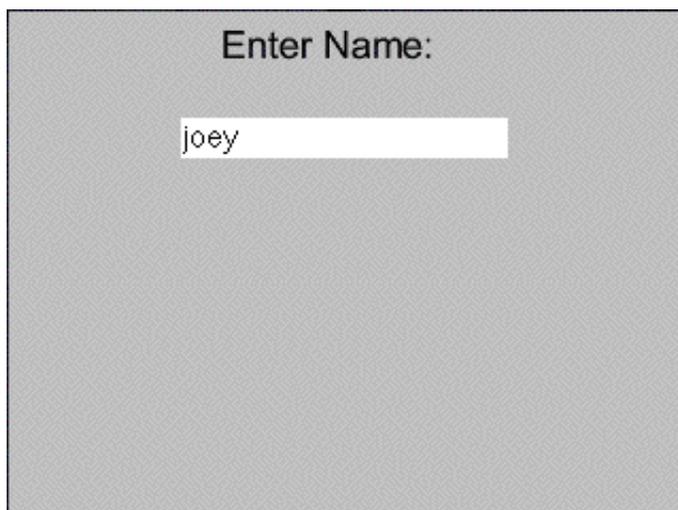
- *Power Macintosh*
- *MacOS 7.1 or higher*
- *QuickTime™*
- *CD-ROM drive*

If your computer system does not meet the above requirements, Atom Smasher will not run properly on your machine.



Player Log-in and Exit

Each time Atom Smasher is launched, and after the playing of the introductory video, the player is asked to either enter a name or select from a list of saved names. Entering a name will create a new player that will be added to the list when the next session is started. Along with the name, the player's progress in Atom Smasher is saved, including all particles and particle properties discovered, all bonus questions that have been answered correctly, and all Internet Physics Bowl questions that have been answered correctly. The current game progress is saved every time the player exits the Particle Database, and players can also save their work by clicking on the "Save" button in the Exit Menu. All of the players' names and information are stored in a file called "Score" in the Atom Smasher directory. This file can hold information for up to 255 players.



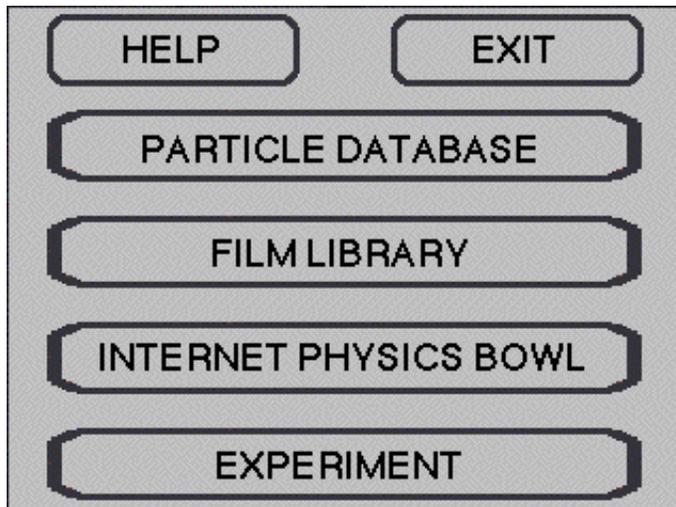
Player's scores, accelerator qualification level, and other data are stored with the player's initial log-in name. Simply select your log-in name each time you restart Atom Smasher.

Figure 2.3 Player Log-In Screen.

Once logged-in, the player's log-in name will appear in a list of all current players' names each time Atom Smasher is started. By selecting the appropriate name from the list of current players, each player is assured that his or her accelerator qualification level and cumulative score will be correct.



After logging-in, the Main Menu will appear in the center of the control panel. The Main Menu has six (6) buttons and is illustrated in Figure 2.4.



Use the “Exit” button of the Main Menu to quit the Multimedia Accelerator Game.

Figure 2.4 The Main Menu.

The use of the “Help,” “Particle Database,” “Film Library,” “Internet Physics Bowl,” and “Experiment” buttons are described in Section 2. To quit Atom Smasher, use the “Exit” button of the Main Menu. This button leads to the Exit Menu shown in Figure 2.5.



Use the “Save Game” button to record the current player’s score and accelerator qualification level.

Figure 2.5 The Exit Menu.



3. The eXotic International Particle Accelerator Laboratory (XIPAL)

The futuristic eXotic International Particle Accelerator Laboratory, or XIPAL (pronounced “zyple” similar to “title”), forms the backdrop for all player actions in the Multimedia Accelerator Game. XIPAL has several accelerators that can be used to conduct experiments. In addition to the accelerator complex, the XIPAL facility also has a number of other resources and assets that can be used to learn about accelerators, detectors, and particle physics. This Section describes the XIPAL facility, the accelerator complex, and the other assets of the facility.



The XIPAL Facility

Atom Smasher begins with a multimedia introduction to the futuristic eXotic International Particle Accelerator Laboratory, or XIPAL, which places the player in the role of a scientist. The player-scientist approaches the XIPAL facility driving along a scenic country road. After passing through the entrance gate, the high-rise central control tower of the XIPAL complex comes into view. Parking on a grass lot, the driver exits the electric vehicle and ascends an elevator to the top of the tower. The player-scientist then enters the control room, whose interior is illustrated in Figure 3.1, and is seated at a console. The control panel of the console, Figure 1.1, zooms into view and the game begins.

The virtual XIPAL facility is the world's foremost international high-energy physics laboratory of the 21st century.

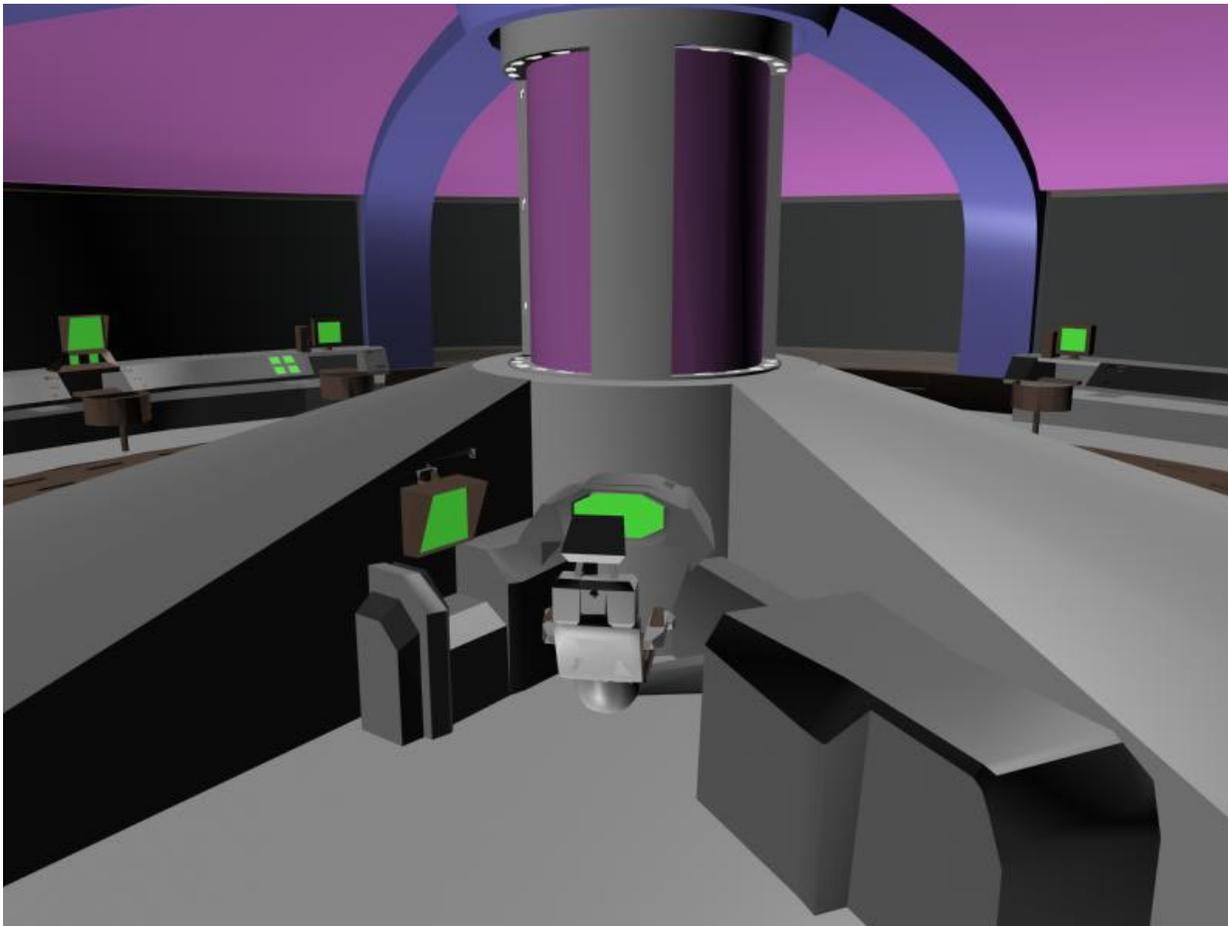


Figure 3.1 Control Room of the XIPAL Accelerator Complex.



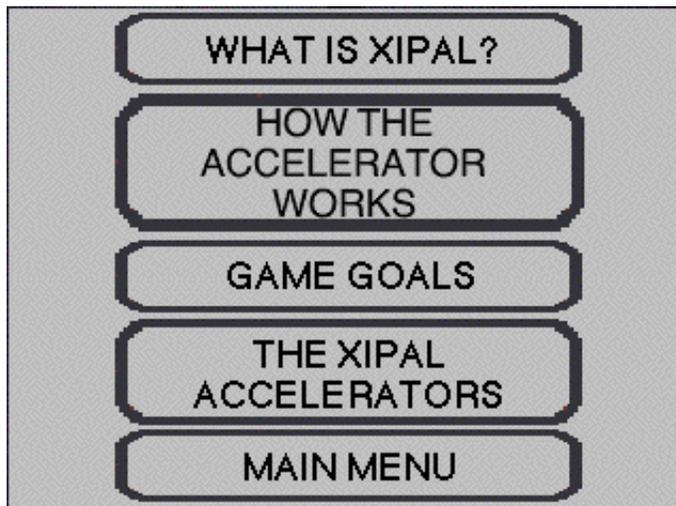
XIPAL Assets

While seated at a monitor in the control room, the player is presented with a Main Menu (Figures 1.1 and 2.4). The Main Menu offers choices for selecting among the XIPAL resources: overviews of the accelerators in the XIPAL complex; interactive and animated tutorials for learning how the components of the accelerators work; a film library with videos that cover particles, detectors, accelerators, and related subjects; and the ability to “log onto the internet” and compete with others through the Internet Physics Bowl (IPB) to learn about the Standard Model of elementary particles. The remainder of this Section provides an introduction to each of the primary assets available at XIPAL.

You gain access to all of the XIPAL facility assets through the Main Menu, illustrated previously in Figure 2.4.

XIPAL Assets - Help (Tutorials)

The “Help” button on the Main Menu (Figure 2.4) opens the Help Menu illustrated in Figure 3.1.



The Help Menu is used to open interactive slide show presentations on different topics about how to use Atom Smasher. Included are Tutorials on various components of the XIPAL accelerators.

Figure 3.2 The Help Menu.

Each button on the Help Menu launches a different interactive set of tutorial and/or help slides. The options available are summarized in Figure 3.3.



Atom Smasher - The Multimedia Accelerator Game

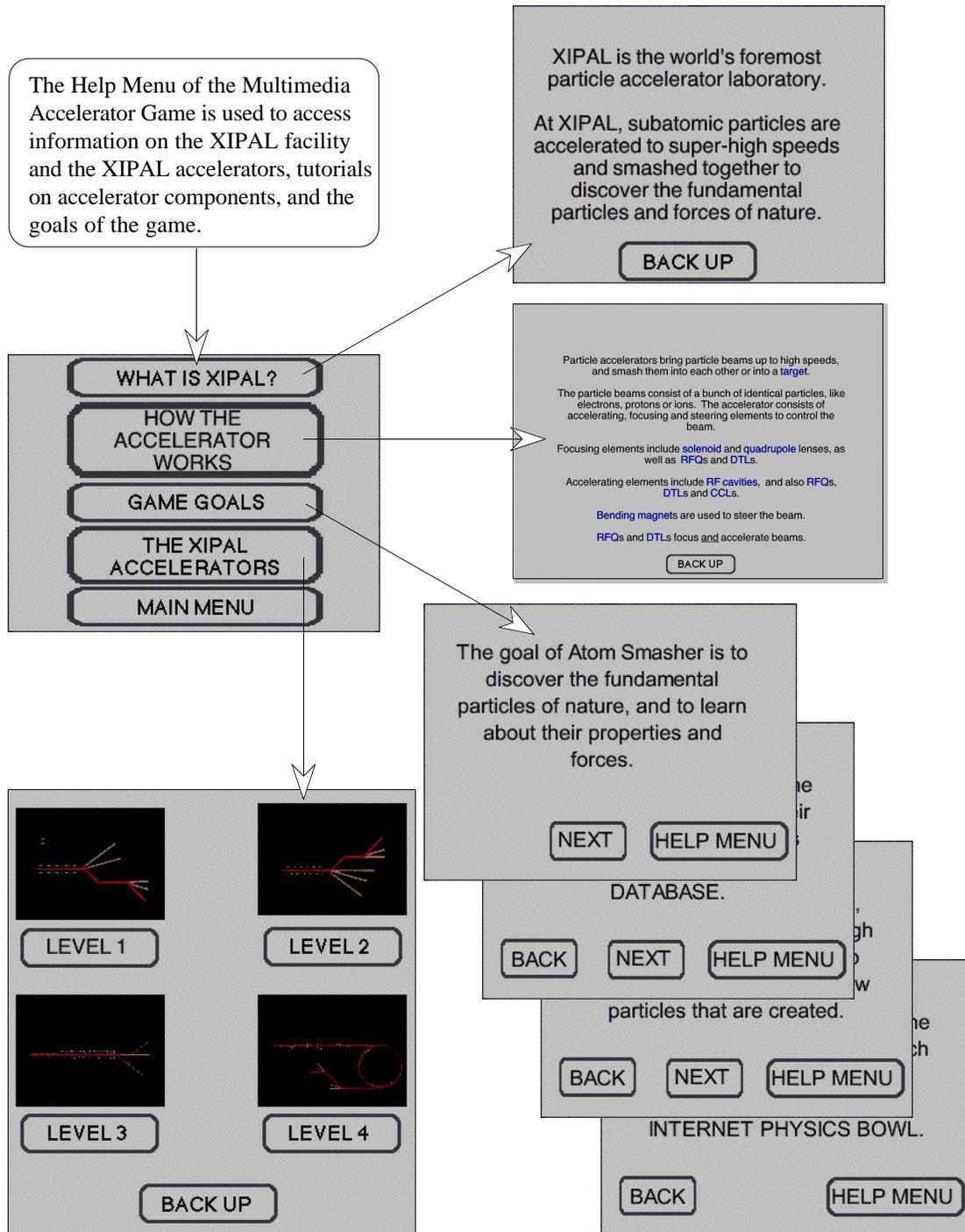


Figure 3.3 Options Available from the Help Menu.



Most the options available in the Help Menu provide a set of “slides” that the player-scientist can use to learn about the various parts of the Atom Smasher game. These are accessed by clicking on the buttons labeled: “What is XIPAL?”, “Game Goals,” and “The XIPAL Accelerators.” The slides are paged-through using the “Next” and “Back” buttons. Figure 3.3 illustrates a few examples of these slides.

Most buttons on the Help Menu lead to slide shows that are navigated with Next and Back buttons.

Interactive Tutorials, which describe how various components of the XIPAL accelerator operate, are accessed using the “How the Accelerator Works” button of the Help Menu. These tutorials have a number of interactive features. Figure 3.3 illustrates the initial slide of the “How the Accelerator Works” interactive slide show. This is a *hypertext* type of slide, where the player can select different tutorials by clicking on the **red** text for the accelerator components included. Figure 3.4 illustrates slides from one of the Interactive Tutorials.

All of the major components used by the XIPAL accelerators have Interactive Tutorials. Each Interactive Tutorial has several parts and typically consists of five (5) slides. Examples of these slides for the Quadrupole tutorial are illustrated in Figure 3.4. The first (1) slide summarizes the purpose of the component and how it impacts the motion of particles in an accelerator. Two buttons, “CONTROL” and “ANIMATION,” lead to slides at the next level, which provide (2) information on how to set controls for the component when that component is used in an Experiment (see Section 4), and (3) animations of a particle moving in the component. The control parameters for the component, and the particle’s initial displacement, can be changed by the player to better understand the motion. “END VIEW” and “Periodic Channel” buttons access new slides that (4) illustrate the particle motion as it will appear to the player while conducting an Experiment, as well as (5) the motion in a component array typical of those encountered in the XIPAL accelerators.

Tutorial interactive slide shows are used to illustrate how particles move in the various components used in the XIPAL accelerators. Player’s adjust component parameters and particle initial conditions to study the motion.



Atom Smasher - The Multimedia Accelerator Game

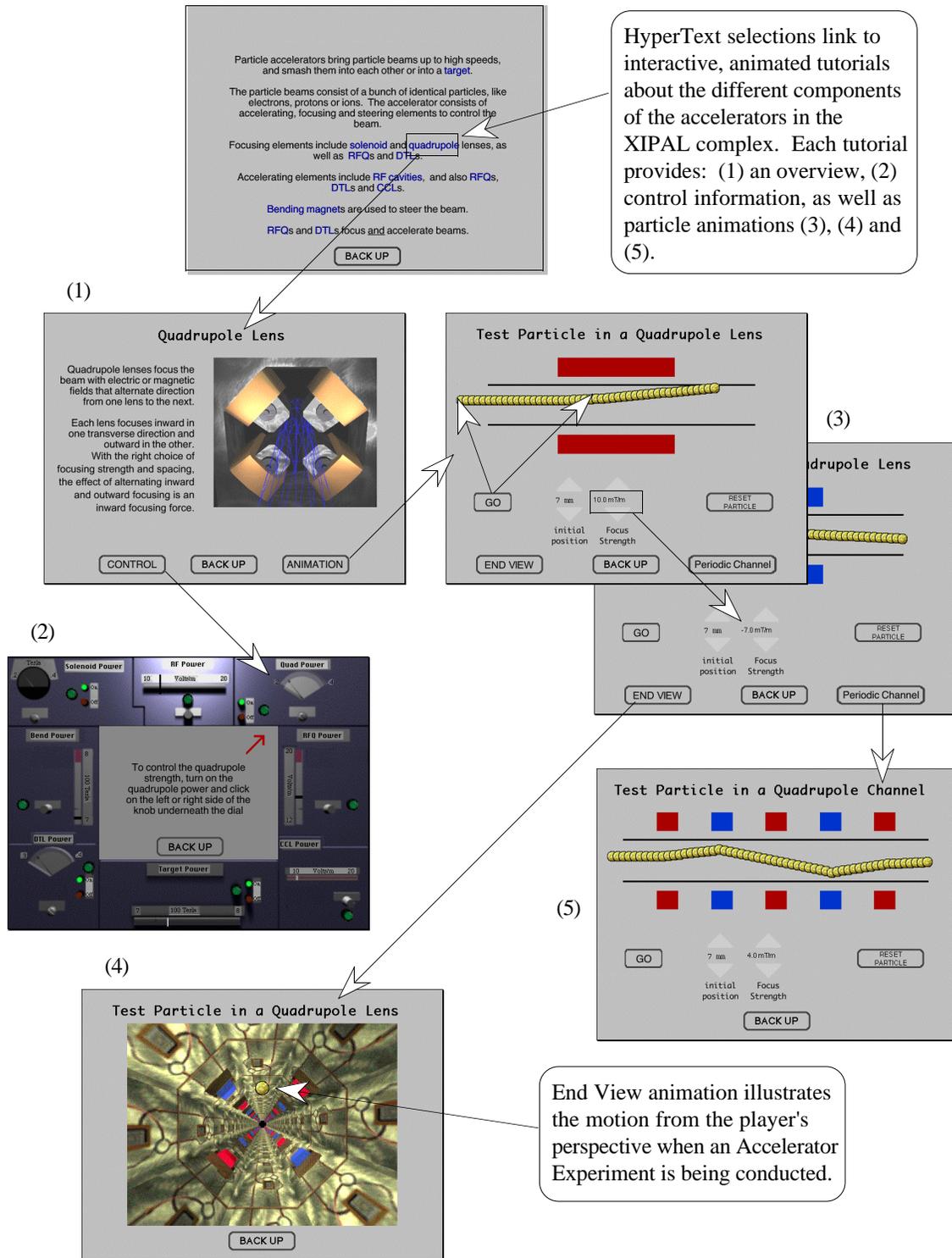


Figure 3.4 Interactive Tutorial for Quadrupole (Quad) Lenses.



XIPAL Assets - Particle Database

The XIPAL Particle Database is where all the knowledge of the elementary particles is stored. Unfortunately, all the data got erased and each player's mission is to reconstruct as much as possible. Conducting experiments using the XIPAL accelerators offers players the chance to select, identify, and characterize particles listed in the Database. If a player knows some of the information, the player can enter it directly into the Database.

Figure 3.5 illustrates the Particle Database input window, accessed from the corresponding button on the Main Menu (Figure 2.4). By selecting the Enter Numbers button in the Particle Database window, the player can type in any *one* of the locations in the chart. In Figure 3.5, the player has entered "1/1836" for the electron mass. If the entry is correct, the player is awarded points to his/her Score total. If the entry is incorrect, a buzzer sounds and the player is returned to the Main Menu.

	Mass	Charge
Photon	-	-
Electron	1/1836	-
Positron	-	-

Player: joe
LEVEL 1 Score: 300

ENTER NUMBERS
MAIN MENU

Mass and charge are in units of the proton mass and charge

In order to get to higher qualification levels, you have to complete the Particle Database for your current level. You can get information to enter into the Particle Database by conducting experiments with XIPAL accelerators, by viewing videos in the XIPAL, or by playing Internet Physics Bowl.

You can also get the information needed from many other sources, including books in your school's library. Books? Hey, what a thought!

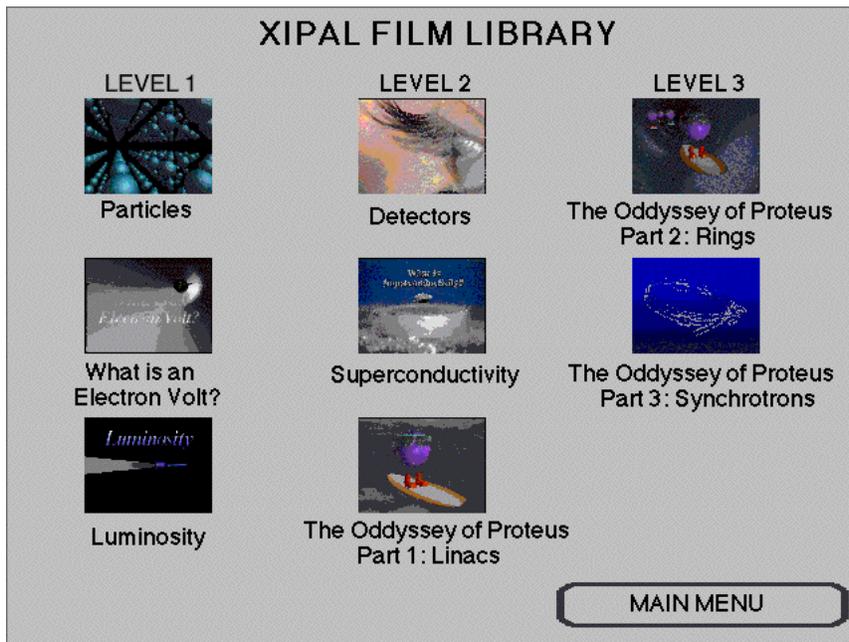
Figure 3.5 Entering Numbers in the Particle Database.



XIPAL Assets - Film Library

The XIPAL facility contains a Film Library with videos that cover a variety of subjects about particles, detectors and accelerators. The selection of videos available in the XIPAL Film Library is illustrated in Figure 2.6. Different films become accessible at different player qualification levels.

Learn more about particles, detectors and accelerators by viewing the videos in the XIPAL Film Library.



Simply click on the thumbnail video icon to see the movies in the XIPAL Film Library.

You will need to achieve accelerator qualification levels 2 and 3 to access some of the XIPAL films!

Figure 3.6 The XIPAL Film Library.

All players initially start at Level 1, so the three videos shown in the left column of Figure 3.6 can be viewed the first time any player launches the Atom Smasher. Players must progress to higher qualification levels in order to view the videos listed in the center and right columns.

The virtual XIPAL laboratory has many assets that are similar to those of the real Fermilab facility near Chicago, as well as many differences!

The three-part video series entitled the “Odyssey of Proteus” leads players through the complex of accelerators at a real high-energy physics accelerator facility: the Fermi National Accelerator Laboratory (“Fermilab”) located in Batavia, Illinois, just outside of Chicago.



XIPAL Assets - Internet Physics Bowl

Players can pit their knowledge against fellow students Courtney, Eric, and Steve by playing the Internet Physics Bowl (“IPB”). Figure 3.7 illustrates the moderator, Kat James, and the three students that compete with each player on the IPB. The moderator poses questions about the Standard Model of elementary particles. Any of the contestants, including the Atom Smasher player, can then “buzz-in” and attempt to answer the question. The first buzzer gets the chance.

You have to be fast to beat your IPB competitors to the “buzzer” - and some of them always know the correct answers.



Figure 3.7 Challenge Other Students in the Internet Physics Bowl (IPB).



XIPAL Assets - Experimental Facilities

The heart of XIPAL's assets are the machines of the accelerator complex used for conducting particle experiments. The XIPAL accelerators are grouped into four (4) levels. Figure 3.8 illustrates the first and fourth level accelerators of the XIPAL complex.

XIPAL's 4 accelerators can be used to conduct experiments of increasing energy. But you must become "qualified" to use machines at higher levels!

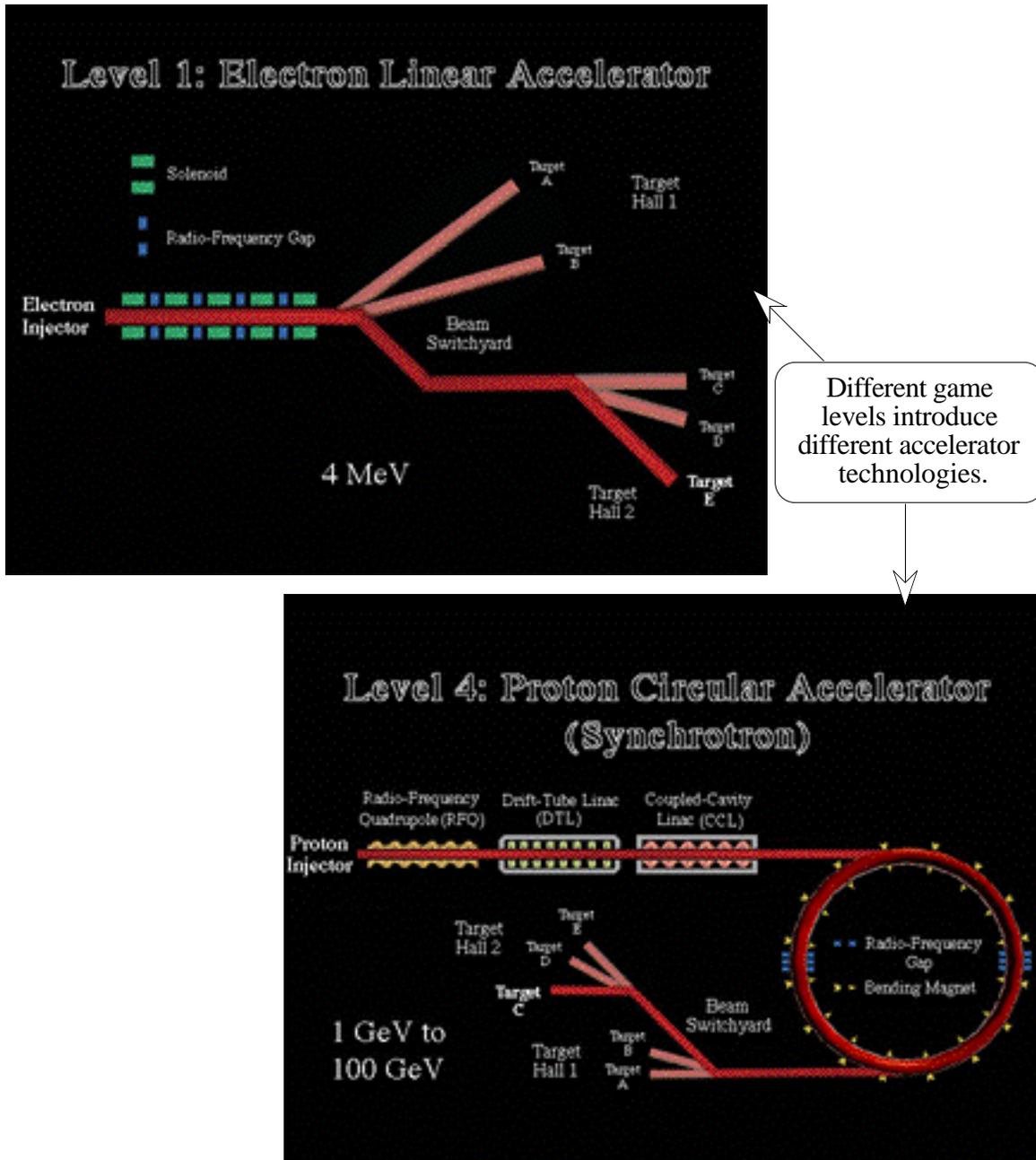


Figure 3.8 Two Machines of the XIPAL Accelerator Complex.



4. Conducting Accelerator Experiments

Most of the menu screens in Atom Smasher are surrounded by a control panel for eight different types of accelerator components. Each component type has a on/off switch and a dial or slider to adjust the strength. These controls can be used from most places in Atom Smasher, and brief instructions for each component are given when the “Control” button is clicked from the Slide Show Tutorials.

When the player clicks on the “Experiment” button in the Main Menu, and then guides a group of beam particles through the accelerator channel, the power in the accelerating and focusing elements will be the strengths that were set in the control panel, and the beam particles will react accordingly. As described in this Section, the accelerating and focusing strengths may be further adjusted interactively during an Experiment.



Setting Up & Initiating Experiments

Clicking on the “Experiment” button in the Main Menu (Figure 2.4) brings the player to a screen with selections for different accelerator experiment levels. Figure 4.1 shows the selection screen for a player who has achieved a Level 4 qualification. A demonstration level is always available, and each level up to the player’s current qualification level is also available. Each level corresponds to a different type of particle accelerator, with different components, different energies, and different particles that can be discovered.

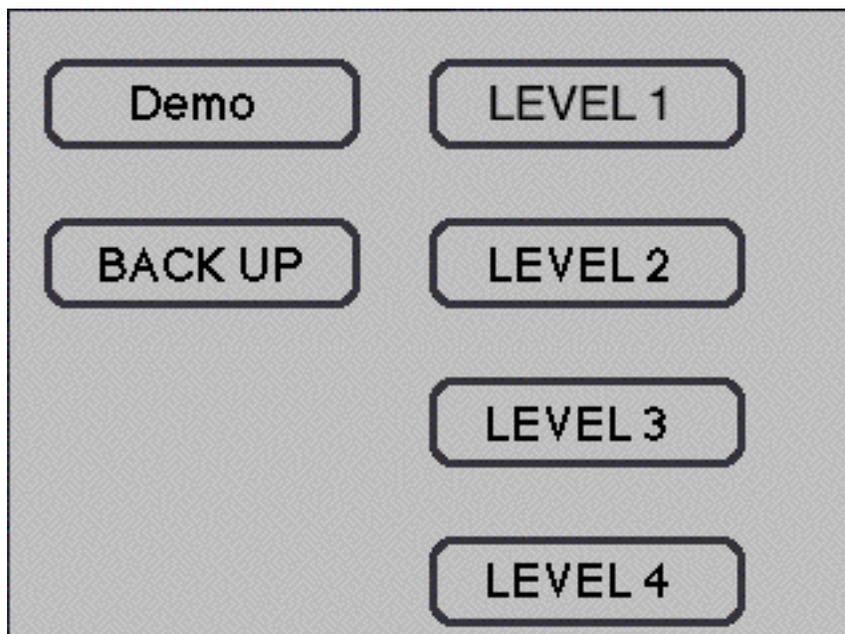


Figure 4.1 Experiment Level Selections.

Higher levels in Atom Smasher use machines of increasingly higher energy. Players must become “qualified” in order to conduct experiments with each level of accelerator. Higher level qualifications are achieved by successfully completing the Particle Database (Figure 3.5) for the current level.

The Demo button provides a “canned” experiment example, using a Level 1 type accelerator.

You can carry out virtual accelerator experiments using a different machine at each level. But you have to qualify for higher levels by completing the Particle Database at each of the lower levels.

Try the Demo to get a few hints on conducting experiments.



After clicking on one of the experiment level buttons, a map of the accelerator layout and target station is displayed. Figure 4.2 shows this map for Level 1. The power for various accelerator components needs to be turned-on by the player. Clicking on the “Inject Electron Beam” button then begins a Level 1 experiment.

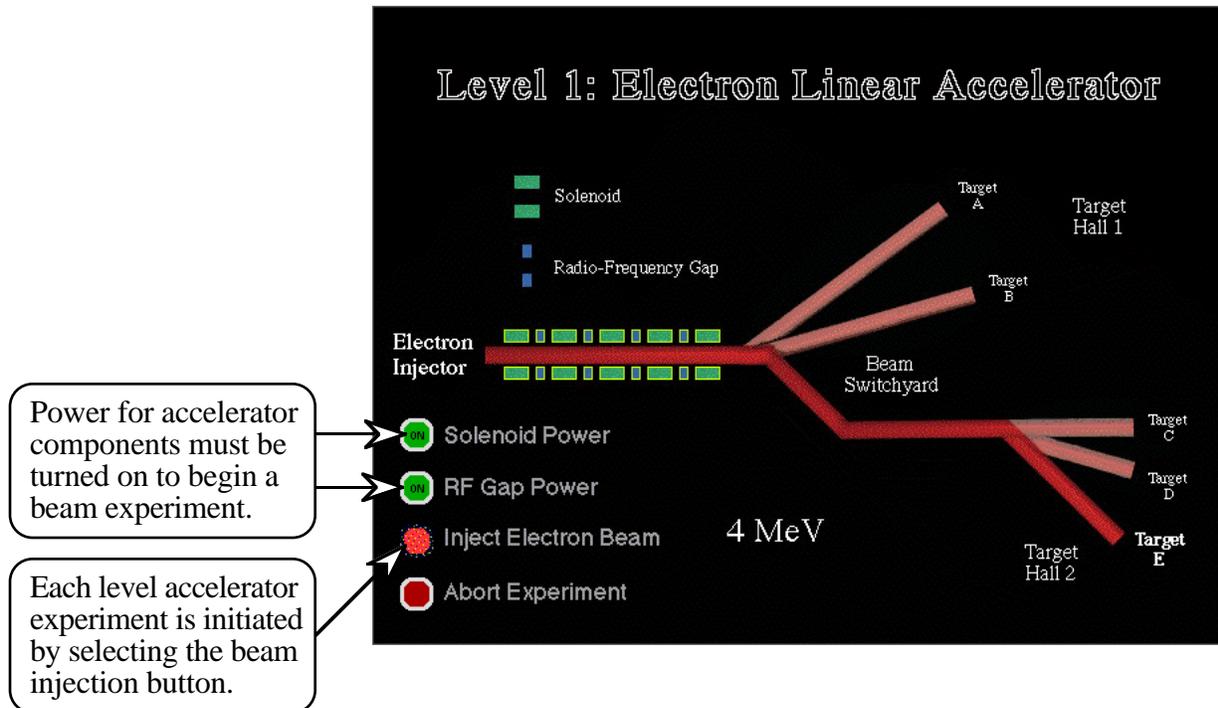


Figure 4.2 Powering Up an Accelerator and Starting an Experiment.

Once an experiment begins, the player must steer the beam through accelerating and focusing elements, trying to keep the particles from colliding with the walls. Whenever a particle strikes a wall, it explodes and is lost. Two primary types of controls available to assist players is the adjustment of the accelerating and focusing elements:

- Pre-experiment cavity and magnet set up, and
- Interactive adjustment during experiments.

To score points, you must get particles through the accelerator and into the target chamber. This will require adjustment of the accelerator's electric and magnetic fields.



Individual knobs, sliders and other adjustable elements around the perimeter of the player's control console (Figure 1.1) can be used to initially adjust accelerator component parameters. The Interactive Tutorials of the XIPAL Help (Figure 3.4) provide some assistance with the pre-experiment set up of the electric and magnetic fields for each accelerator component. When the "Control" button in any of Interactive Tutorials is selected, a description of how to adjust the control parameters for that component is displayed. Figure 4.3 illustrates an example for the Radiofrequency (rf) cavity.

While the Interactive Tutorials will help learn how to adjust initial control settings, it won't tell you what settings to use. You'll have to experiment!

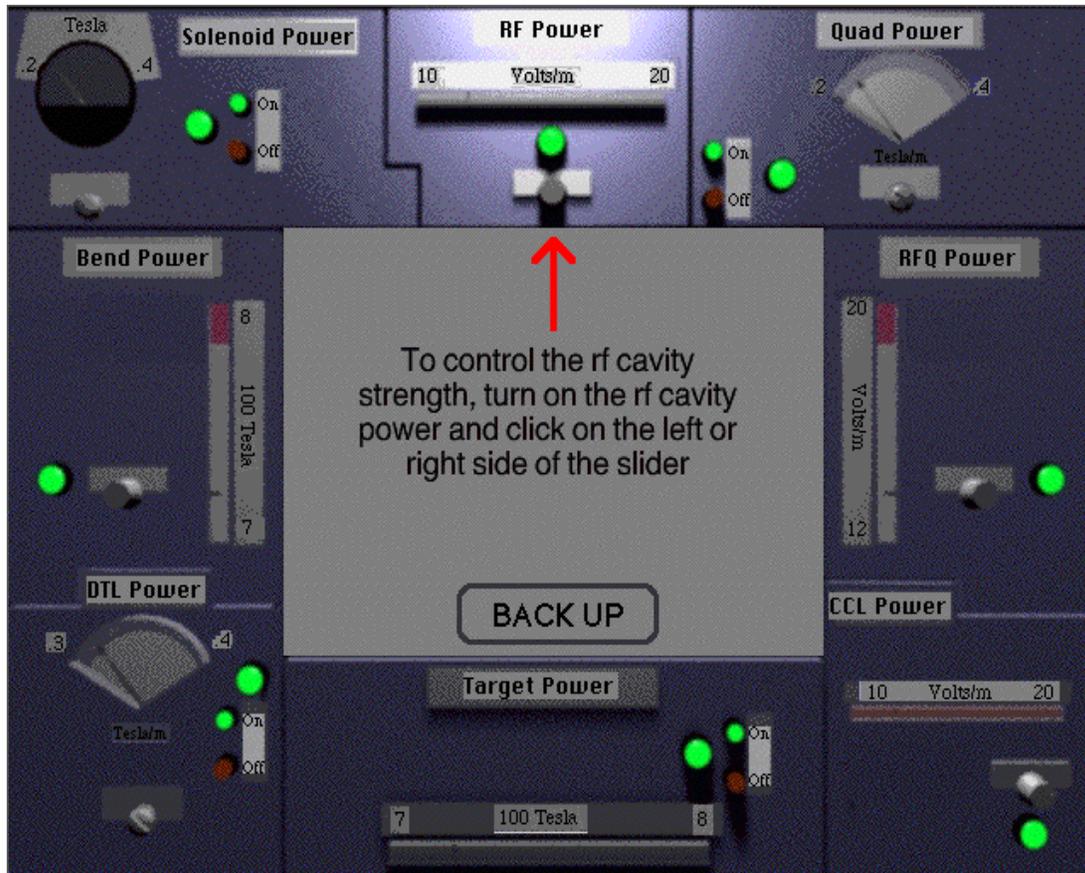


Figure 4.3 Interactive Tutorials Provide Guidance for Initial Parameter Setup.

Once an experiment has started, the accelerator beam may also be controlled interactively. For most experiments, the player will *have* to make additional adjustments in order to get particles to the target.



Controlling the Accelerator Beam

The player has several additional interactive controls to assist in controlling the beam particles as they fly through the accelerator during an experiment. Players must steer the beam through accelerating and focusing elements, trying to keep the particles from colliding with the walls. Whenever a particle strikes a wall, it explodes and is lost. The initial settings of the electric and magnetic fields of the accelerator components may be further adjusted using keyboard commands. Figure 4.4 shows the keys used for controlling the beam.

Interactive beam control will be required for many experiments. You'll be lucky if your particles can get to the target without adjusting any parameters!

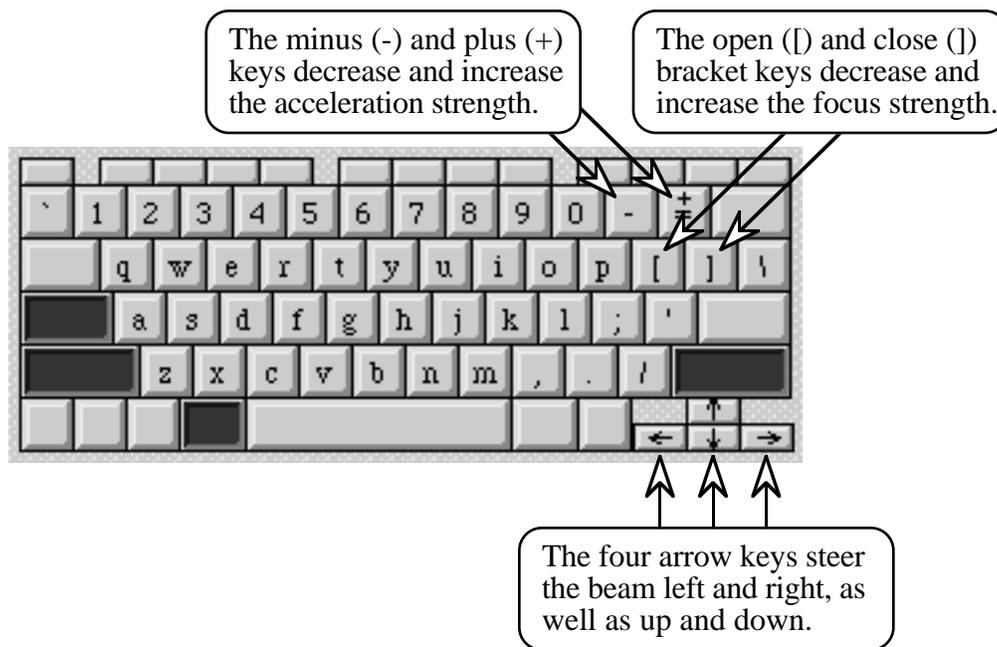


Figure 4.4 Interactive Keyboard Commands Are Used During an Experiment.

Once an experiment has started, the keyboard commands to increase/decrease the accelerating strength (+ and -) or the focusing strength ([and]) will take affect for the *next* accelerator component. Once adjusted, the changes will apply to an entire group of identical components (i.e. all quadrupoles) in a single accelerator section. New adjustments may be needed when the next type of component appears.

For the 3-D version of Atom Smasher, the current status of the accelerating and focusing strengths are displayed by red and blue bars in the upper right of the monitor.



Particles Produced by Collisions

New particles are created by colliding the beam into the target at the end of the each accelerator experiment. The number and type of particles created in the target depend upon (a) the energy of the beam and (b) the number of beam particles striking the target. The most new particles are created by getting as many beam particles as possible all the way through the accelerator. To create the largest variety of new particles, accelerators of higher energy are required, so the player must become qualified to conduct experiments with XIPAL machines of higher levels.

To achieve a higher level qualification, the player must be able to complete the Particle Database for his/her current level. To complete the Particle Database by conducting accelerator experiments, the player will have to identify and then characterize particles produced at the current level. Atom Smasher uses a color and texture coding scheme for displaying each type of particle. Real particles don't follow the color and texture coding scheme, but the player must figure out the scheme in order to identify each particle. To get each player started, Figure 4.5 shows some the Level 1 particles.



Electron



Positron

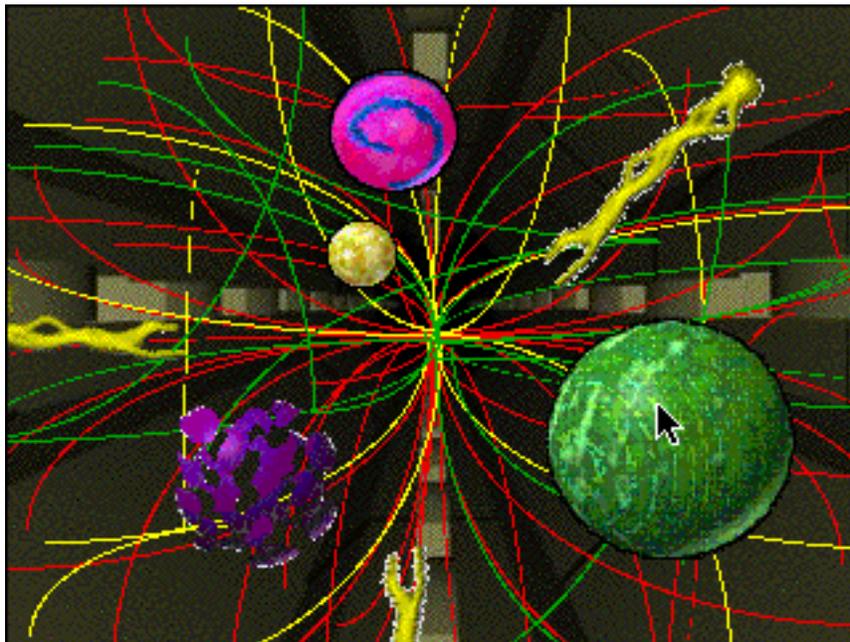


Photon

Figure 4.5 Particle Types Produced in Level 1 Collisions.

Capturing & Identifying Particles

When beam particles hit the target at the end of the accelerator channel, subatomic particles are created and move within the target chamber. These particles move in the target magnetic field according to their charge and mass. For each beam-target collision in which new particles are created, it is possible to catch *one* of the new particles by clicking on it with the mouse. The player must choose which particle to try to capture with the mouse. The debris of new particles created in a beam-target collision, together with the capture of one of the particles, is illustrated in Figure 4.6.



Each particle type has a unique color and texture coding. Figure 4.5 should help you identify some of the particle types shown in Figure 4.6.

Figure 4.6 Collision Debris and Capturing a Particle.

The *green* particle captured (with the mouse cursor) in the beam-target collision debris shown in Figure 4.6 can only be produced at Level 2 or higher. However, all three of the Level 1 particles also appear in the debris. In order to get to Level 2, the player has already identified all of the Level 1 particle properties, so capturing one of those Level 1 particles would not have helped him/her acquire any new knowledge for the Particle Database.

When a particle is captured, multiple choices will appear to identify the particle type. If the particle is correctly identified, then multiple choices appear to find the particle's mass in units of the *proton mass*. If the mass is correctly identified, then choices appear to find the particle's charge, also in units of the *proton charge*. Points are scored for any of these three responses that are correct, and the information is then automatically recorded in the player's Particle Database.

Points can also be accumulated in other ways.

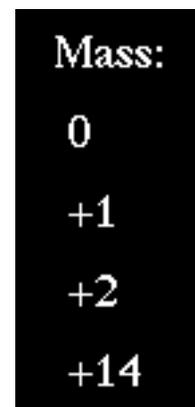


Figure 4.7 Select Particle Properties Using Multiple Choice.



5. Scoring Points

The Particle Database stores the information of all of the particles and particle properties that the player has discovered. When a certain number of particles is discovered (along with their properties), the player is advanced to the next level. 100 points are scored for each discovered particle, and another 100 points are scored for each correctly identified particle property. Points are also scored for correct answers in the Internet Physics Bowl (200 points for each question) and for correct responses to the bonus questions (100 points for each question).



Updating the Particle Database

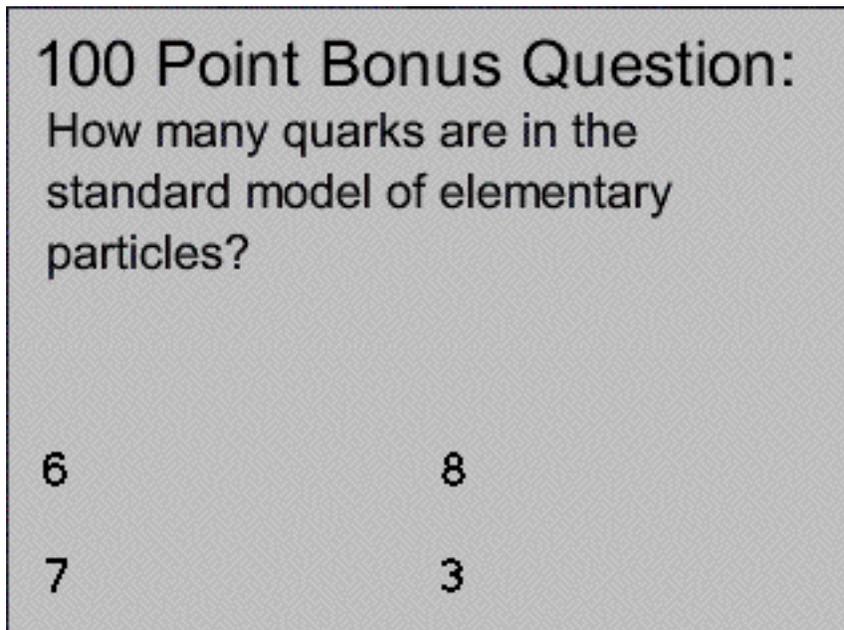
When players identify particles in the target chamber, the information is automatically entered into the Particle Database (Figure 3.5). There is also a button called “Enter Numbers” in the Particle Database. As described in Section 3, the player can use this button and then type in a number for any particle property, without conducting another accelerator experiment. Using this, it is possible to score points and advance to higher levels by learning about the particles and their properties from the videos in the XIPAL Film Library, by playing the Internet Physics Bowl, or from any other source.

You can get 100 points for each particle captured from the debris of a collision and correctly identified.

100 points are also awarded for each correctly identified particle mass and another 100 points for each correctly identified particle charge.

Scoring Bonus Points

Bonus point opportunities arise at various times after a player has entered information into the Particle Database. Figure 5.1 shows a typical Bonus Point Question screen. Players use the mouse to select an answer from the multiple choice options presented.

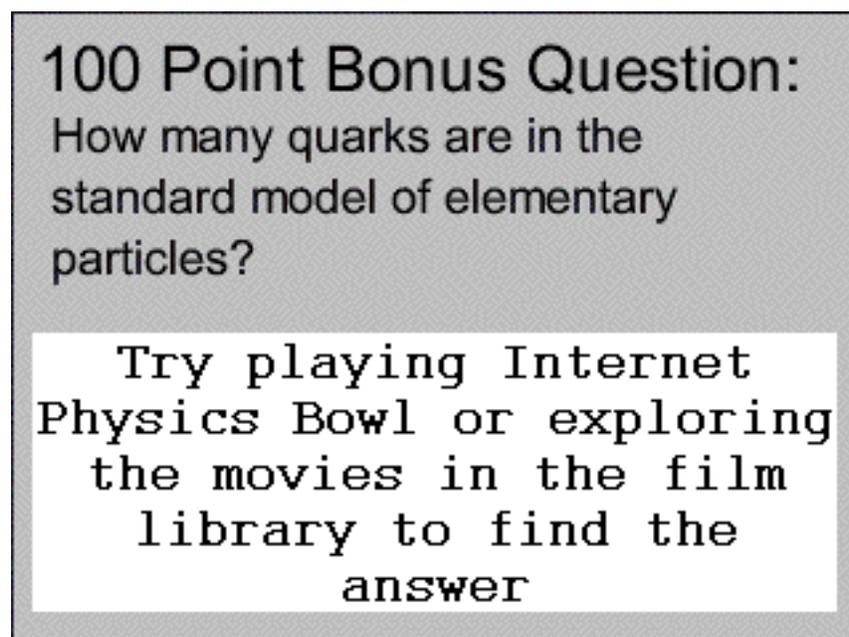


Many bonus questions offer the opportunity to increase scores. Each correct answer is worth 100 points.

Figure 5.1 Bonus Question Answers Increase Scores.



An incorrect answer to a Bonus Point Question produces the hint screen shown in Figure 5.2. The correct answers to the Bonus Point Questions may be found from other Assets of the XIPAL facility, but not simply by conducting accelerator experiments. In order to achieve the highest possible score, a player will need to explore the videos in the XIPAL Film Library and play the Internet Physics Bowl (IPB). Additional scoring opportunities arise while playing the IPB.



If you can't answer a Bonus Point Question, follow the hints and try to find the answer. You will probably get another chance to answer the question and receive a 100 point bonus!

Figure 5.2 Incorrect Answers Result in Hints.

Answering IPB Questions

The Internet Physics Bowl (IPB) also offers players the chance to earn points. The IPB questions relate to the so-called "Standard Model" of elementary particles. You can prepare for the IPB by learning a little about the Standard Model before you begin. The XIPAL Film Library provides one resource. Your school library is obviously another resource. You may also want to simply watch the IPB, letting the other competitors try to answer the questions, and then try again later.

Each correctly answered IPB question is worth 300 points! However, you have to be fast to beat your IPB competitors to the buzzer, so might want to do some homework first.



6. Acknowledgements

Contributions from a large number of individuals and organizations made the Multimedia Accelerator Game possible. Their assistance is gratefully acknowledged here.



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A number of individuals have also made significant contributions to the successful development of the Multimedia Accelerator Game. The assistance of Will Wilson of Torrey Pines High School, and Ed Hohman and Jeff Tieman of York Community High School, for using and evaluating the Phase II Multimedia Accelerator Game in their physics classes is gratefully acknowledged. The suggestions and feedback provided by both the teachers and students at these schools made a major contribution to the development of the concept.

A large number of people and organizations made significant contributions to the development of the Multimedia Accelerator Game. Atom Smasher owes a large measure of its success to those who are acknowledged here.



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