Fulldome projection

Fulldome systems project images and videos onto a dome with an 360° x 180° image angle. These systems are increasingly becoming standard in modern star theaters. In large planetariums, the projection area is many times that of standard silver screens; for this reason, fulldome projection consists of several image channels to avoid disappointingly inadequate definition and brightness. In fact, the task does not only involve projecting images and videos; the data must be processed in a format suitable for a hemispherical dome, and this is taken care of by special computers and software.

Carl Zeiss Fulldome projection systems are known under the trade name powerdome®.
When developing powerdome, Carl Zeiss was consistently guided by the vision of providing users with all possible options to create their own shows in combination with planetarium projectors including digital audiovisual contents for dome projection and to perform them both live and automatically.

System control
Powerdome generates the relevant image data for projection and outputs them to the projectors for reproduction onto the dome via standardized video interfaces. At the same time, powerdome controls the projectors, any other external devices (e.g. the dome lighting), and offers a user platform for the creation, editing, and reproduction of both simple and complex projection contents including sound reproduction. Another component is an interactive Digital planetarium to represent the night sky complete with stars, planets and other astronomical objects. Optionally, powerdome also provides an interface to Uniview, the world’s unequalled viewing software for three-dimensional display of the Universe.

At the same time, powerdome was also designed for integrated coupling with an opto-mechanical planetarium projector by Carl Zeiss (from the current SKYMASTER ZKP 4, STARMASTER, and UNIVERSARIUM Model IX series). The coupling feature means that astronomical processes such as the movements and object positioning of both the optomechanical and the digital planetarium automatically match and coincide, so that they are congruent within the scope of positioning accuracy.

Shows in powerdome
A powerdome show comprises the linear or interactive reproduction of images, videos, astronomical representations, texts, and sound for the fulldome presentation. In the simplest of cases, the system performs a fulldome video. In powerdome you can arrange show components on a timeline with different planes and tracks, structure them into chapters, and combine them into your own customized show. You can position the show components on the dome, define where and how they are to be faded in or out, and also your preferred text color. You can control 3D objects, animate motions, vary sizes, and much, much more. The timeline control makes it possible easily to create even complex shows with several hundred components.

With powerdome, you play off your shows “at the push of a button”. The system works along the same lines as DVD games, with the control functions “Play”, “Stop”, “Pause”, “Fast Forward” and “Rewind”. These control functions are available both on the operator’s console and via external devices (Web interface to the wireless remote control).

The timeline, together with all chapters and show elements, is shown during playback. You can jump to Chapters, Triggers, and Bookmarks, and change to any given position on the timeline using the mouse cursor. Both individual chapters and planes can be excluded from playback. This makes for added flexibility. In this way, shows can be adapted to a given public or to the preferences of the presenter with just a few mouse clicks. All this without scripts or the need to master a programming language!

But – by the way – powerdome writes every show into a script. And, of course, you can open and edit the scripts at any time.
The Digital planetarium

The Digital planetarium is a fixed component of Powerdome. Its representation possibilities are similar to the basic functions of a traditional planetarium.

In combination with an ergonomically designed operator console, SKYCONTROL is a full-fledged digital planetarium, especially developed for planetarium control.

Ease of operation

The planetarium control system fully matches the operating program of a modern opto-mechanical planetarium by Carl Zeiss. With the control software you can arrange planetarium programs to run entirely live. Of course, it also includes an editor for recording and scheduling automatic playback.

So that you will not need to operate all functions at the same time, you can couple selected brightness functions to astronomical motion processes.

Operator panel for dynamic presentations

The Digital planetarium is managed live from the control panel, enabling both automatic and semi-automatic processes to be steered from the panel.

The Digital planetarium is generously equipped. Naturally, you will find all coordinate systems, all 88 constellations – as images and as line and boundary figures. Enlarge the Sun, the Moon and the planets as if through a telescope – show the phases of the Moon, Venus, and its companions ... The planetarium will even draw the loops of Mars, the analemma of the Sun and other similar phenomena for you.

Coupling the Digital planetarium to the star projector

In combination with a ZEISS planetarium projector, the manifold possibilities offered by the Digital planetarium are real trump cards for a planetarium operator. With it, you can, for example, have the “analog” Mars describe its apparent trajectory by means of digital projection. Coupling digital to opto-mechanical projection is a matter of pride for Carl Zeiss. The coupling is not contrived, it is not an interface between two different systems and manufacturers, but, rather, originates from a “systems lab”. Analog and digital are thus, if you like, directly intermeshed in the planetarium’s gears.
With Uniview into the depths of the Universe

Expand powerdome with Uniview, a viewing platform for the three-dimensional representation of the Universe. Uniview is a development of SCISS, a Stockholm company, and is built on the “Digital Universe” database of the American Museum of Natural History in New York. Uniview contains almost all known objects of the Universe and turns your celestial navigation into a walk in the park.

With powerdome® II you can also place UNIVIEW system commands onto the timeline, or simply trigger them with a mouse click. This generates intuitive options for the inclusion of Uniview in your show design. The transition from the analog planetarium projection to a 3D sky and the combination of the star projection with 3D effects practically is not perceptible for the visitor.

Uniview also enables access to the most up-to-date information on the Internet, in order to view many different kinds of information, such as the population density on Earth, weather events, volcanic activity, and much more.
Remote control and interaction

Every powerdome system comprises a Web interface for wireless remote control including numerous planetarium functions. For this purpose, all devices can be used with a browser application. In this way you can start shows from a Smartphone, an iPad, iPod touch, or from a PC with WLAN, remotely operate the Digital planetarium, and interactively involve visitors. The integrated WLAN in powerdome also provides access to the Web interface for the visitors to the planetarium. They can participate in the events taking place in the dome via their Smartphones or other devices with browser applications. There are multiple options for simultaneous interaction. A popular application is a visitor vote to determine what show or sequence is to be projected. Spectators can access the pertinent descriptions with their Smartphones and then record their vote. They can also answer questions or make evaluations. The results can be stored in a database and shown on the dome.

Control of external devices

The display system (projector, diaphragms, lamp power etc.) is also controlled from powerdome, where it is possible also to place the pertinent steering commands on the timeline. External devices, too, can be controlled from powerdome: thus the system enables e.g. the dome lighting to be operated remotely.

powerdome®Webinterface with planetarium functions (Firefox).
Show selection website (Safari).
Show elements, data administration, and many powerdome extras

With powerdome, the distribution of the image data over the individual image channels takes place in real time. This removes the need to split up ("slice") Fulldome videos and other image content before projection and to distribute it among the client computers.

For data storage purposes, powerdome uses a server called Network Attached Storage, or NAS for short. Powerdome loads the data used for the presentation into the client computers via the internal network; the clients process their image contingent in accordance with the display system configuration and output it to the projectors over the video interface. The master computer not only directs the data management, but also ensures frame synchronous playback of all image channels.

Show data can be moved onto the system over a network, by external data carriers, or over the Internet.

Show elements in powerdome
In powerdome, you can add practically all audiovisual components of a show:
- Images/graphics
- 3D objects
- Panoramas
- All-Skys
- Standard videos
- Fulldome videos
- Didactic components (lines, scales)
- Text functions, labels
- Control commands, bookmarks

Image and text components can be “tacked on” to astronomical coordinates, which enables them to be permanently assigned to the firmament and its objects.

Use of 3D models
Powerdome II enables 3D objects to be realistically represented and projected as well as animated in real time as well as providing control over the properties assigned to the models. 3D models can be found in the powerdome®Library. Of course you can also load and animate your own models.

Plug-ins for expanded functions
A plug-in interface is essential to enable new system components to be included in powerdome. It renders powerdome expandable and open for special requirements. An example of an interesting plug-in is the controllable, three-dimensional Earth with its day and night aspects, atmosphere, clouds, and insertable rotation axis. There are many ways in which you can include plug-ins in the show program and in live presentations.

Better image sharpness with rapid motion
In powerdome, contents represented in real time are in principle always played back at a 60 Hz image repeat frequency. With powerdome, you can also encode and project Fulldome videos with 60 images per second, which causes the projected video to appear sharper as compared to traditional frame rates while preventing ghost images.
Encoder for Fulldome videos
Together with its powerdome system, Carl Zeiss also supplies an encoder with which you can generate the video to be used by powerdome for the dome projection from your own dome masters. The graphical user interface allows for selection of the frames to be encoded, with numbering completeness being automatically verified. The encoding process can be started for several files or output versions; all available computer cores in the cluster can be used for encoding simultaneously.

Fulldome video from powerdome
A supplementary module also enables the operator to generate a full dome video from a timeline scheduled fulldome show. The powerdome®ShowRenderer generates dome masters both from the show components and from the Digital planetarium functions. The exported dome masters can be used to generate Fulldome videos for other Fulldome systems.

Auto-calibration
If necessary, the camera based auto-calibration facilitates the geometric correction of all image channels. It time-efficiently ensures constant and accurate adjustment that does not need to rely on the skill of a service engineer.

Remote maintenance for powerdome and planetarium projectors
For powerdome systems and planetarium projectors, Carl Zeiss offers a remote maintenance service that enables access to selected computers. This service provides timely help with questions or problems. Carl Zeiss offers different service levels, from online support for operation and maintenance all the way to regular updates. With remote maintenance, service visits frequently become redundant.

powerdome UserGroup
Powerdome system users are given access to our Extranet User Group, enabling data exchange, downloads of current software versions, etc.

Fulldome shows for all ages and all seasons
Carl Zeiss has entered into distribution agreements with numerous Fulldome show producers and can therefore offer you a wide choice of shows. Select from a wealth of astronomy shows, special children’s programs, entertainment shows, and numerous other topics. The shows are delivered in the powerdome format. Just copy the data onto your system and you’re ready to present the shows – no slicing, no encoding, no additional costs, no nothing – just powerdome!

powerdome Workshop
Carl Zeiss regularly holds powerdome workshops for both new and experienced users, which also act as an expertise exchange. The workshop provides basic knowledge, tips and tricks, and introduces the latest software and hardware developments from Carl Zeiss.