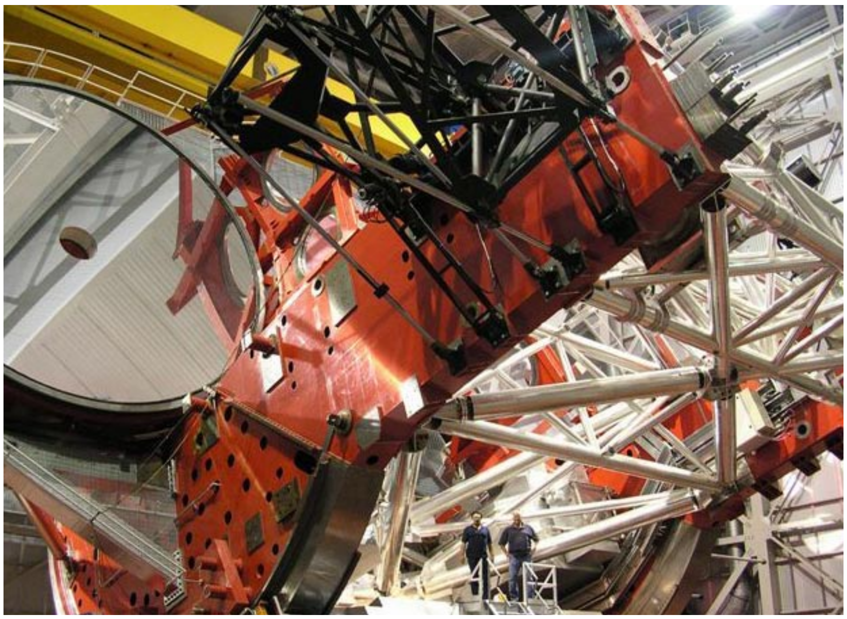
Rexroth
Bosch Group

Drive & Control profile

Rexroth aluminum structural framing helps world's largest binocular telescope reach for the stars



Towering about 11 stories high with ten times more power than the Hubble telescope, the Large Binocular Telescope uses Rexroth aluminum structural framing.

Challenge

Build modular and versatile framing to help cover azimuth hole and to protect energy chain cabling; use local support to save time and shipping costs

Bosch Rexroth Solution

Bosch Rexroth extruded aluminum structural framing system provided by local Rexroth distributor Pacific Integrated Handling

Results

- High-strength anodized profiles provide necessary support
- Modular framing easy to install and adapt
- Bolt-together connectors allow installation without special tools
- Re-builds occur in hours instead of days vs. using welded steel
- Extruded aluminum structures are recyclable

Local Rexroth distributor saved time and cost for shipping; provided custom milling capability to fulfill complex project

Modular aluminum structural framing provides strength, easy-to-install versatility

When you're building the largest and most advanced binocular astronomical telescope in the world, special attention is focused on the optics, reflective mirrors and other precision components that allow scientists to gaze into our vast universe. However, the structural elements of the telescope play a key role, too, ensuring protection for the delicate optical equipment.

For the Large Binocular Telescope (LBT) construction project on remote Mt. Graham in Arizona, Bosch Rexroth aluminum structural framing provided the strength, versatility and modularity that mechanical engineers needed to stabilize crucial fiber optic cables used to produce the imagery.

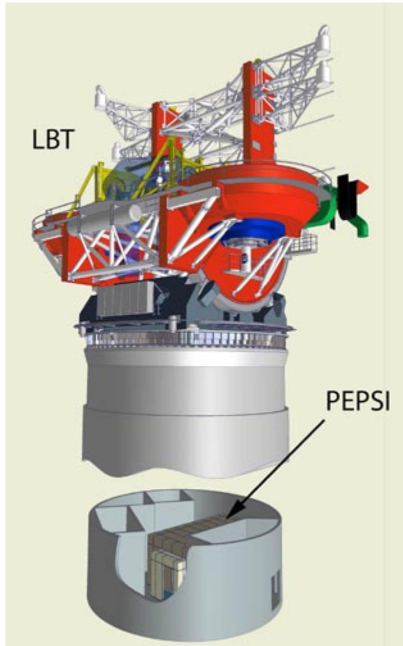
Vision for the future to help look into the past

The LBT project was conceived in the early 1980s as a vision and collaboration of engineers and astronomers in the United States, Germany and Italy. Momentum gathered in 2000 and today, LBT construction is underway with full operation expected soon. The concept is: The bigger the telescope, the farther it can look into space—with finer detail and better resolution. This allows scientists to see various substances on planets, including oxygen and hydrogen, as well as after-effects of cosmic activity that occurred long before our history.

Towering about 11 stories high with ten times more power than the Hubble telescope, the LBT is unique because it's the only telescope in the world with large dual mirrors on a common mount. The common mounting arrangement allows the 28-foot mirrors to be optically connected, delivering the same resolution power as a 74-foot telescope. This level of resolution was previously unattainable.

Solving the PEPSI challenge

About 80 feet beneath the mirrors is a critical component called PEPSI (**P**otsdam **E**chelle **P**olarimetric and **S**pectroscopic **I**nstrument), a high-resolution



The Large Binocular Telescope is the largest and most advanced binocular astronomical telescope in the world.

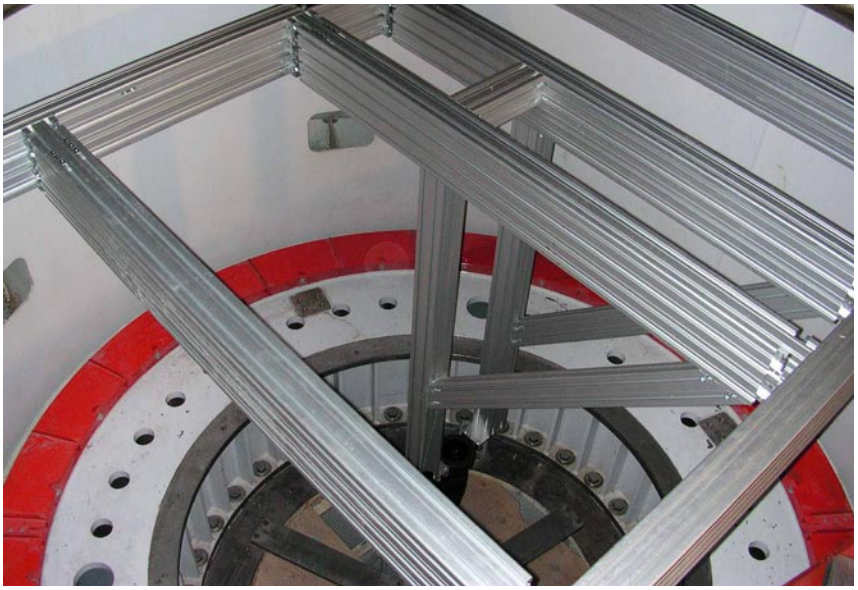
spectrograph built by the Astrophysikalisches Institut Potsdam (www.aip.de) in Germany (AIP). While the large mirrors are capturing light, PEPSI receives the light so that objects which are billions of millions of miles away can be seen clearly.

To obtain that kind of detail, the light must be delivered to PEPSI with little or no decomposition via a continuous light feed. This feed is carried over highly sensitive fiber optic cables bundled together and guided through encasements called energy chains. These energy chains run from the moveable mirrors high above to the stationary PEPSI below. A major challenge was determining how to stabilize the energy chains so they could move horizontally or vertically with the mirrors but deliver light to PEPSI without decomposition of any kind.

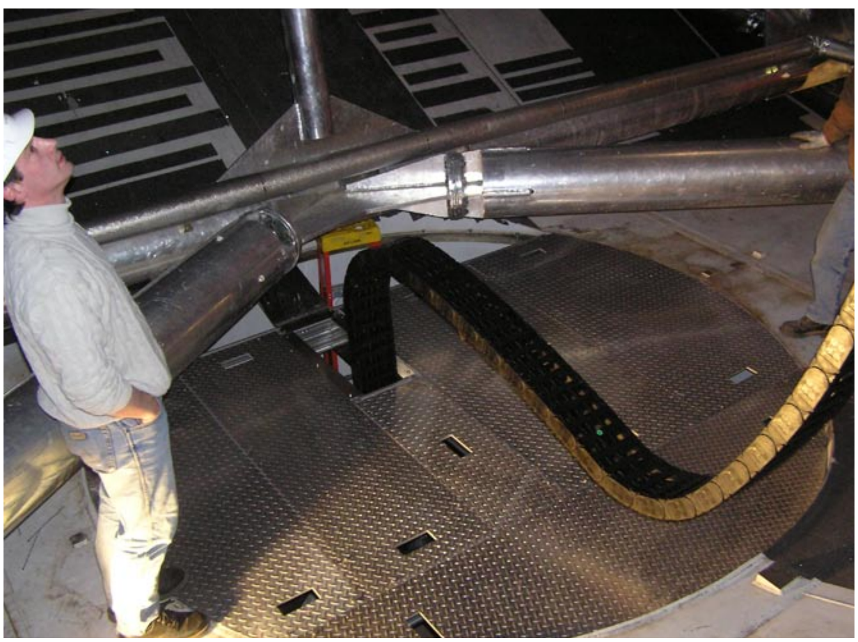
Another challenge for AIP was that PEPSI is housed in a temperature and air pressure stabilized room at the bottom of what is known as the *azimuth hole*, a large cement cylinder located on the floor above PEPSI which acts as the center of the vertical telescope axis. The fiber optics must go through a small opening down to the spectrograph, but the azimuth hole had to be covered to avoid accidents.

"We knew how we wanted to tackle the problem," explained Frank Dionies, mechanical engineer for AIP, "but we wanted to be sure we could get the necessary custom-milled components to cover the hole. Bosch Rexroth aluminum structural framing seemed to be the best solution," he said. "We've been using Rexroth extruded aluminum for many projects at our institute in Germany. The extruded aluminum framing is easy to complete or adapt if something changes, as often happens in our business. The structural components are also recyclable, so when a structure is no longer needed, it can be dismantled and the components stored for future use. That kind of flexibility is important to us."

Designed for versatility, the Rexroth aluminum framing system consists of dozens of high-strength, anodized extruded aluminum profile types and hundreds of accessories. Using versatile bolt-together



Project engineers used Rexroth aluminum structural framing to frame out the azimuth hole (above) before covering it with sectional steel plating and running the energy chain (below).



connectors available for virtually any load or application, almost any structure can be quickly assembled without special tools.

Down to earth solutions

The two primary challenges — the azimuth hole and the energy chain — required some out-of-the-box thinking from the engineering and manufacturing teams. The idea was to frame out the hole and cover it with sectional steel plating. The components needed to build the frame required detailed, custom machining to get the "T" structure made of straight aluminum framing within the hole to fit correctly to the steel ring circling the interior.

The second challenge required the engineers to protect the fiber optic cables along the energy chain — allowing the cables to connect from the moving mirrors to the PEPSI below without losing any of the light being transferred. To resolve this issue, the engineering team developed a modular framing system where cable track was laid on top of Rexroth extruded aluminum beams to guide the fiber optic cable.

"We solved the fiber optic cabling problem by using two different energy chains," explained Dionies. "The upper energy chain guides the fibers when the telescope is rotating along the horizontal axis and the lower energy chain guides the fibers when the telescope is moving along the vertical axis."

Dionies added that other Rexroth aluminum structural framing was used for ladders, railings and supports throughout the building.

To help implement the project, Dionies called Ken Grum at local Bosch Rexroth distributor Pacific Integrated Handling Tempe, AZ (www.pacificintegrated.com), asking if he could accommodate the project. Dionies wanted to be sure the distributor could mill the Rexroth aluminum structural framing components as needed.

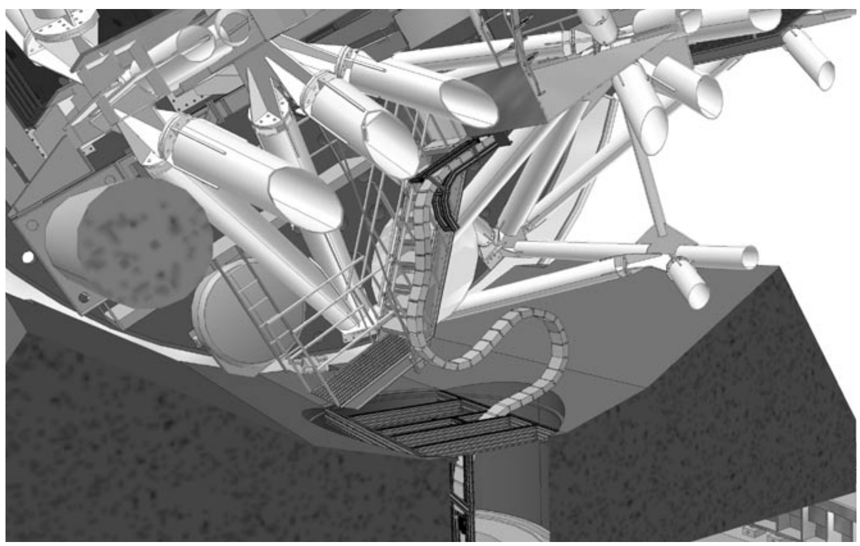
A Rexroth modular framing system will guide the energy chain, providing the strength, versatility and modularity needed to stabilize the fiber optic cables.

Dionies sent drawings of the telescope plans to Grum, including a drawing of the azimuth hole, and engineers at Pacific Integrated confirmed they could execute the custom milling and deliver the product as needed. This was a great relief for the engineering team in Germany, since the components could be milled and shipped within Arizona, rather than from Europe.

"We saved a lot of time and money working with Pacific Integrated," explained Dionies. "Building the components in Germany and shipping them would have required a hefty price tag with fees and tariffs, plus it would have taken more time. We were very pleased that Bosch Rexroth had a distributor so close to the observatory site," he said.

Using modular components saved a lot of time, added Dionies. "We opted for Rexroth extruded aluminum framing as the base frame structure because we knew it would remain modular — and we were right. For example, after we installed the framing the telescope crew decided to move one of the permanent ladders above the azimuth hole," he said. "That meant that we had to place our energy chain on the opposite side. It took us only about three hours to dismantle the framing, rebuild it and reinstall it. If this had been a welded steel component, we would have had difficulties because it would mean building a completely new structure with a time delay and additional costs."

This was an exciting project for everyone involved, but especially for Pacific Integrated because, says Grum, "The Large Binocular Telescope is one of the great astronomical achievements of all time. We look at this project as helping to build history."



Light carrying energy chains run from the moveable mirrors high above to the stationary PEPSI below.

Rexroth
Bosch Group

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Bosch Rexroth
Linear Motion and Assembly Technologies
816 E. Third Street
Buchanan, MI USA 49107
Telephone (269) 695-0151
www.boschrexroth-us.com