It's easy to understand why Alison Gingeras, the curator of French billionaire François Pinault's art collection, suggests we meet at the bar of the Monaco Hotel in Venice. The view from the hotel terrace over to Dogana del Mare, the 17th-century customs house across the Grand Canal, is spectacular. La Dogana, as the building will now be known, is also where Gingeras has worked night and day for the last six weeks. Timed to coincide with the opening of the Venice Biennale, it will throw open its doors later this week.

Rewind to spring 2001, when Pinault, who built a business empire on everything from timber to fashion (he owns brands including Gucci and Yves St-Laurent), left his eldest son François-Henri running the group in order to focus on his art collection – 2,500 pieces by celebrity artists such as Jeff Koons, Cindy Sherman, Cy Twombly, Takashi Murakami and the Chapman brothers, alongside rising stars including Matthew Day Jackson, Adel Abdessemed, Nate Lowman and Kai Althoff. But there was a problem: the art had no home.

Pinault needed somewhere to base his foundation and exhibit the collection. Initially, he chose a location just outside Paris, near where Renault used to have its factories. But negotiations with the French state were tough, and not eased by Pinault's friendship with the president at the time, Jacques Chirac. After three years going nowhere, Pinault threw in the towel.

Then, in 2005, he heard that the impressive 18th-century Palazzo Grassi in Venice was looking for an owner. Pinault didn't think twice, and even poached the French culture minister and former Pompidou Centre director, Jean-Jacques Aillagon, to become his man in Italy. The space opened in spring 2006 with a shock for regulars – the art had no home.

Ando and his team also made the building waterproof – an obvious necessity in the most canal-bound city in the world, where "acqua alta" is a regular hazard – and added concrete flooring. The building's famous tower, which is crowned by two statues of Atlas holding a bronze globe, surmounted by a statue of Fortune, was restored to its copper-and-gold glory. The whole lot cost something in the region of €20m, and, together with the Palazzo Grassi, it has made Pinault the owner of the biggest permanent space dedicated to contemporary art in Venice.

Pinault is no Charles Saatchi, Gingeras says. "He favours artists he likes and has followed for a long time; he doesn't try to be encyclopedic. We do go to new galleries and shows, but 70% of the art he buys is from artists he knows."

Mapping the Studio follows no chronology, Gingeras explains. "It has been conceived as one exhibition split between our two spaces. The atmosphere of Grassi and Dogana may be very different, but visitors will intuitively feel the continuity."

In honour of the occasion, Pinault has commissioned six new works, mainly monumental sculptures. British artist Mark Handforth has created Man on the Moon, a suspended crescent featuring a human figure who seems to have crashed there moments before, which will remain in the Dogana permanently. "This piece is both hopeful and optimistic. It should add playfulness to the place's own magic," says Gingeras.

There is also a sculpture by American artist Charles Ray, yet to be unveiled, which will sit on the very tip of the site. "It has the potential to become a new symbol for Venice, like the lions in St Mark's square," Gingeras says. "I expect to see it on every new postcard."
Art aside, one thing that really will define the Dogana, says Gingeras, is its light, much of which is reflected from the water that surrounds it on three sides. "I have worked at the Pompidou Centre, at Moma in New York and at Tate Modern, but I have never encountered such incredible light. It is absolutely perfect for monumental paintings with a warm palette."

Wonderful as all this is – and there’s no denying that the space is beautiful – the project has more than a hint of self-promotion about it, as if Pinault were asking his curators to devise an exhibition showing the world what a great art collector he is. But can collecting ever be considered an art? Gingeras is quite clear: "Of course not: you can’t compare the act of acquiring with the art of creating. Exhibiting art may be a craft or a skill, but it’s certainly not comparable to art itself. Having said that, I don’t see why private collectors should disappear behind their collection. They are not an institution; they don’t have to be self-effacing." Perhaps, then, they can be allowed to do a bit of showing off.

But this isn’t a vanity project, Gingeras insists. "I know many art collectors who started collecting during the hedge-fund years, and who sold everything when the world markets turned sour. They have no consideration for the art. Pinault is not one of them, he is a true patron of the arts.

"The good thing about the recession is that we will now be able to concentrate on art, on what matters. The bullshit we had to deal with before is over."