



Transfer of the CMS Experiment Underground Part-2

A. Hervé / CERN



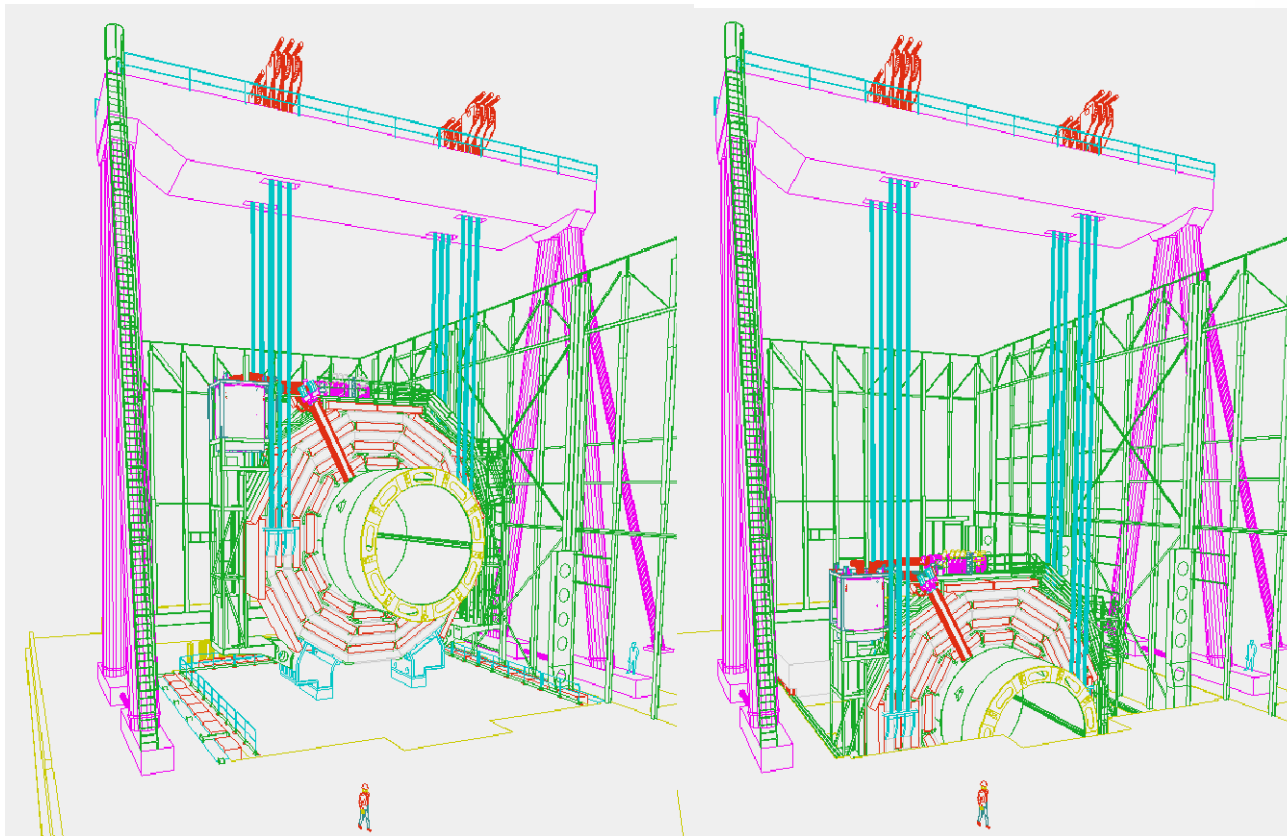
Lowering of the CMS detector into UXC55

Total of 15 loads from 300 to 2000 tons

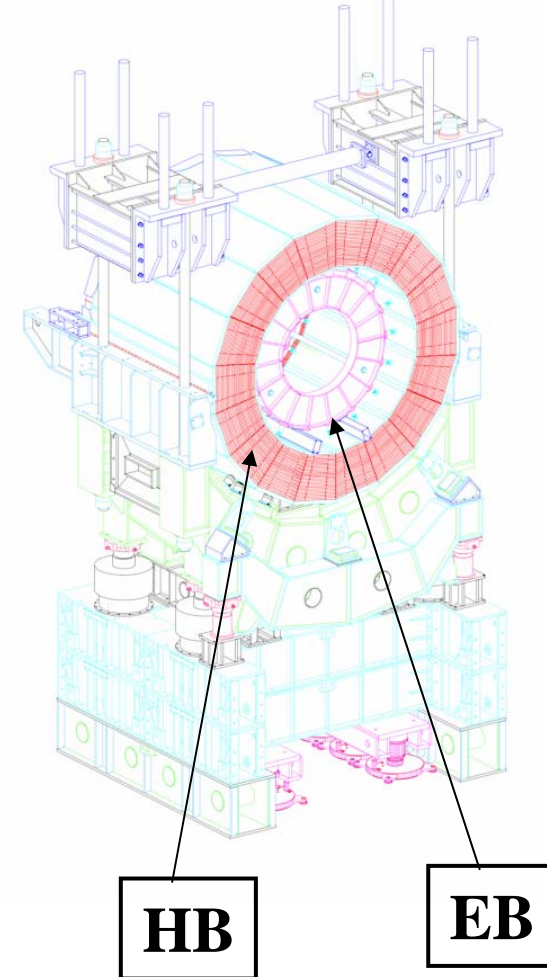


Detector lowering is part of the CMS basic concept.
Last certification tests of gantry in preparation
Lead Engineer for the operation is Hubert Gerwig.

2000-ton load



500-ton load



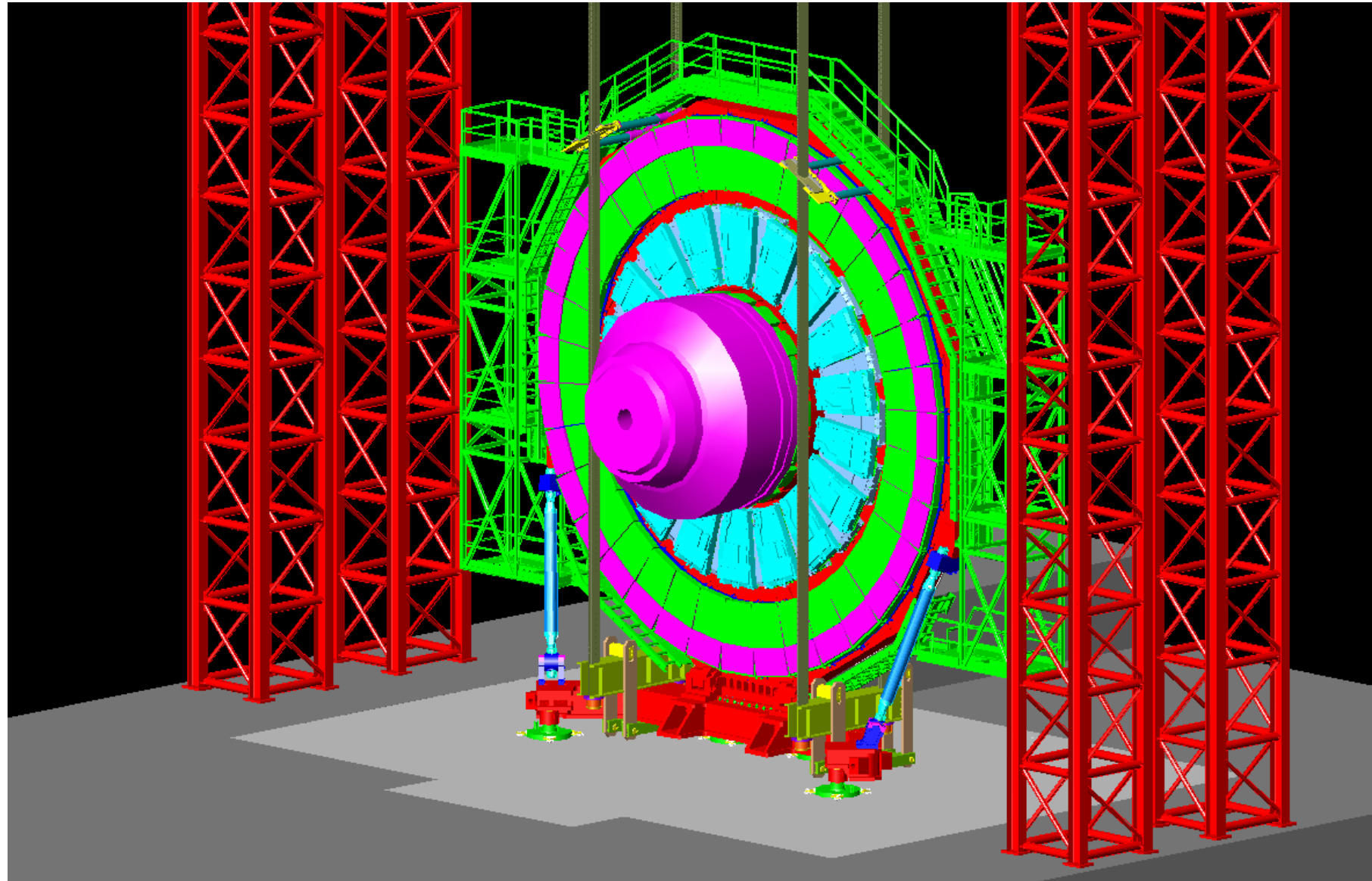
All detector elements move on the same air pad-system as used in the surface hall.



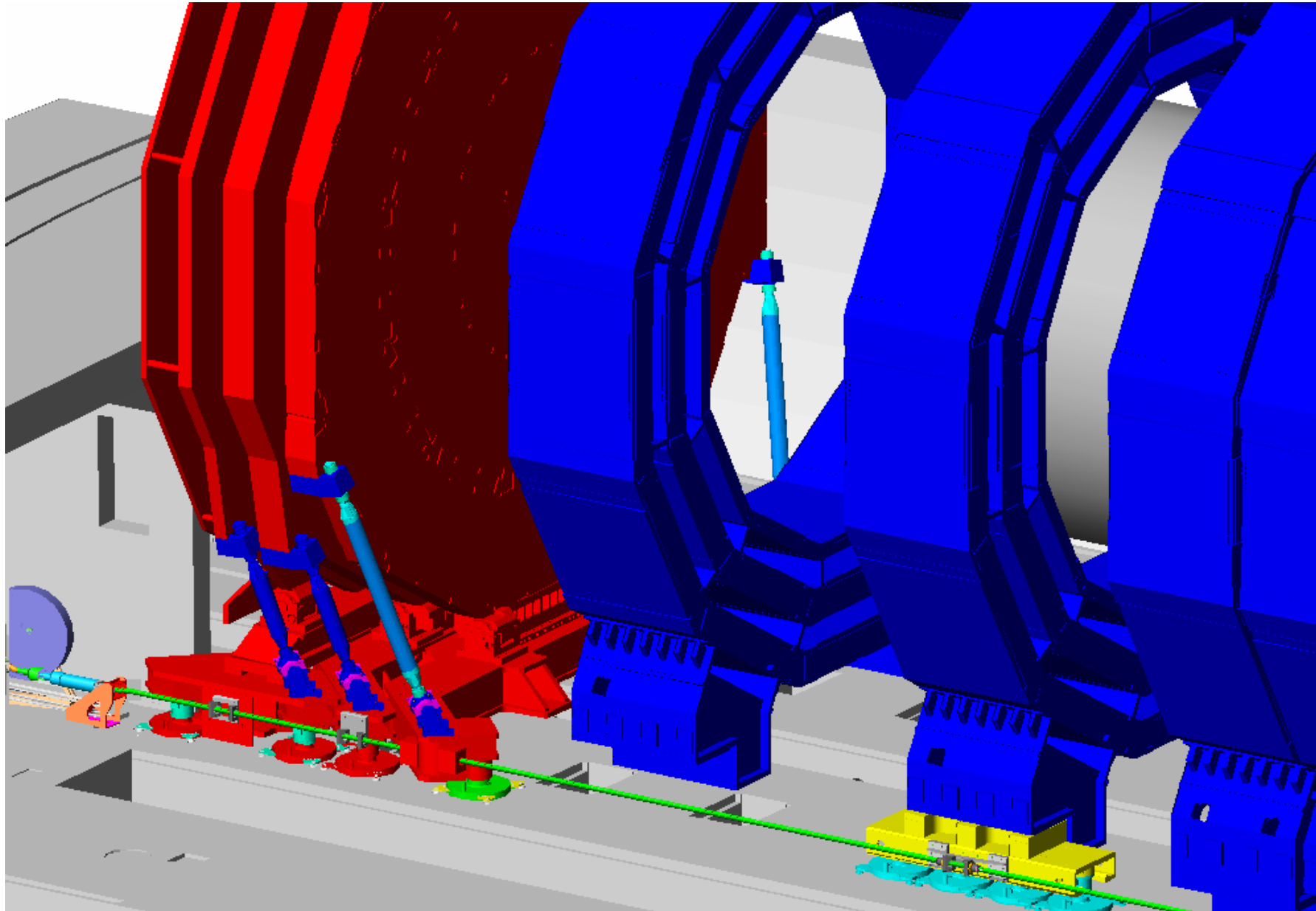
Hcal barrel moving in SX5 on the air pad system.



Transfer Underground of YE+1



Movement Underground



UX5 Ready to receive Elements

The cave below is used as dispatching center

RS in open position

Trenches for cable chains

Labyrinths from counting rooms

Design by CMS Integration group, April 2005.

Situation 2 weeks ago

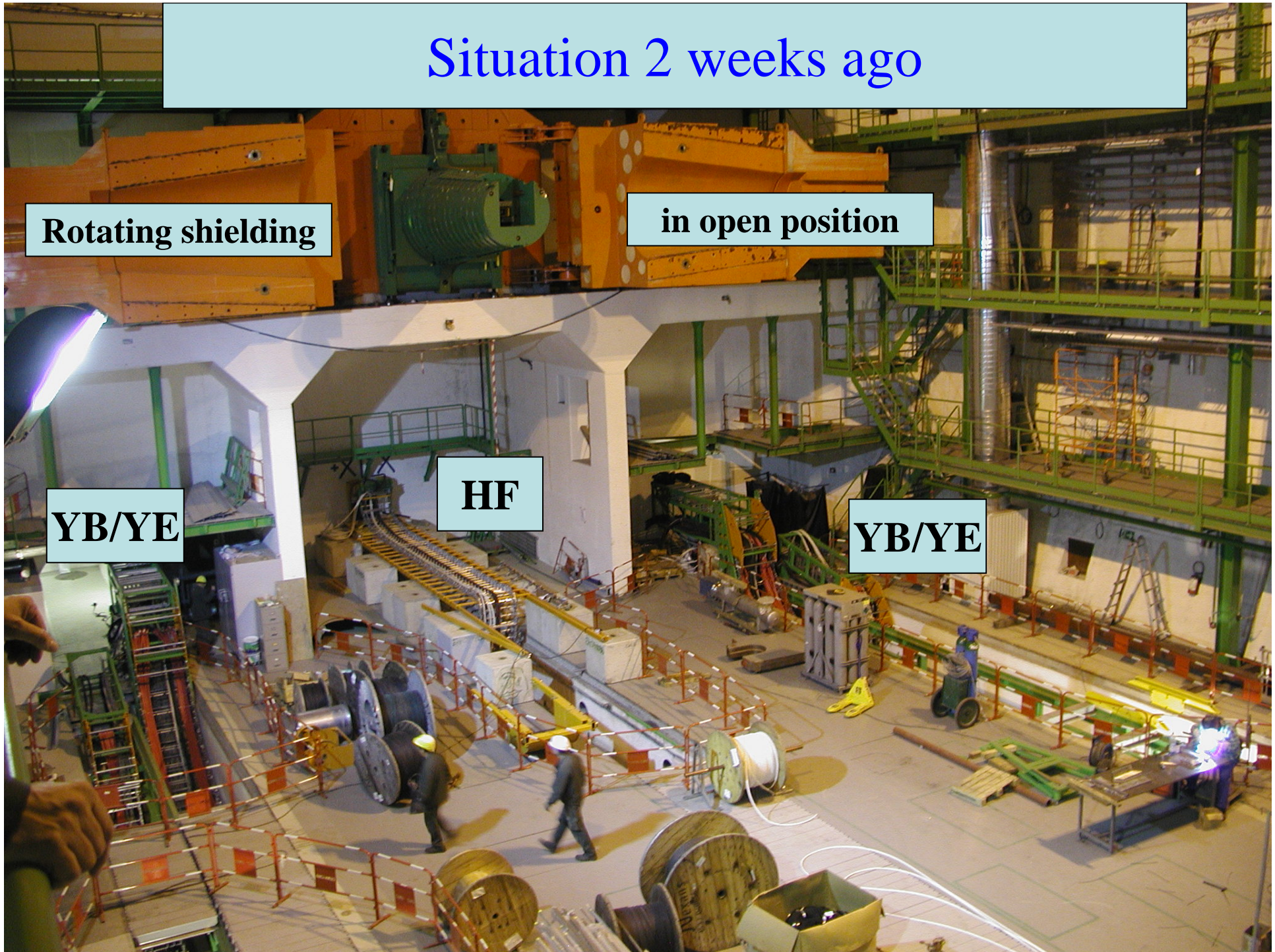
Rotating shielding

in open position

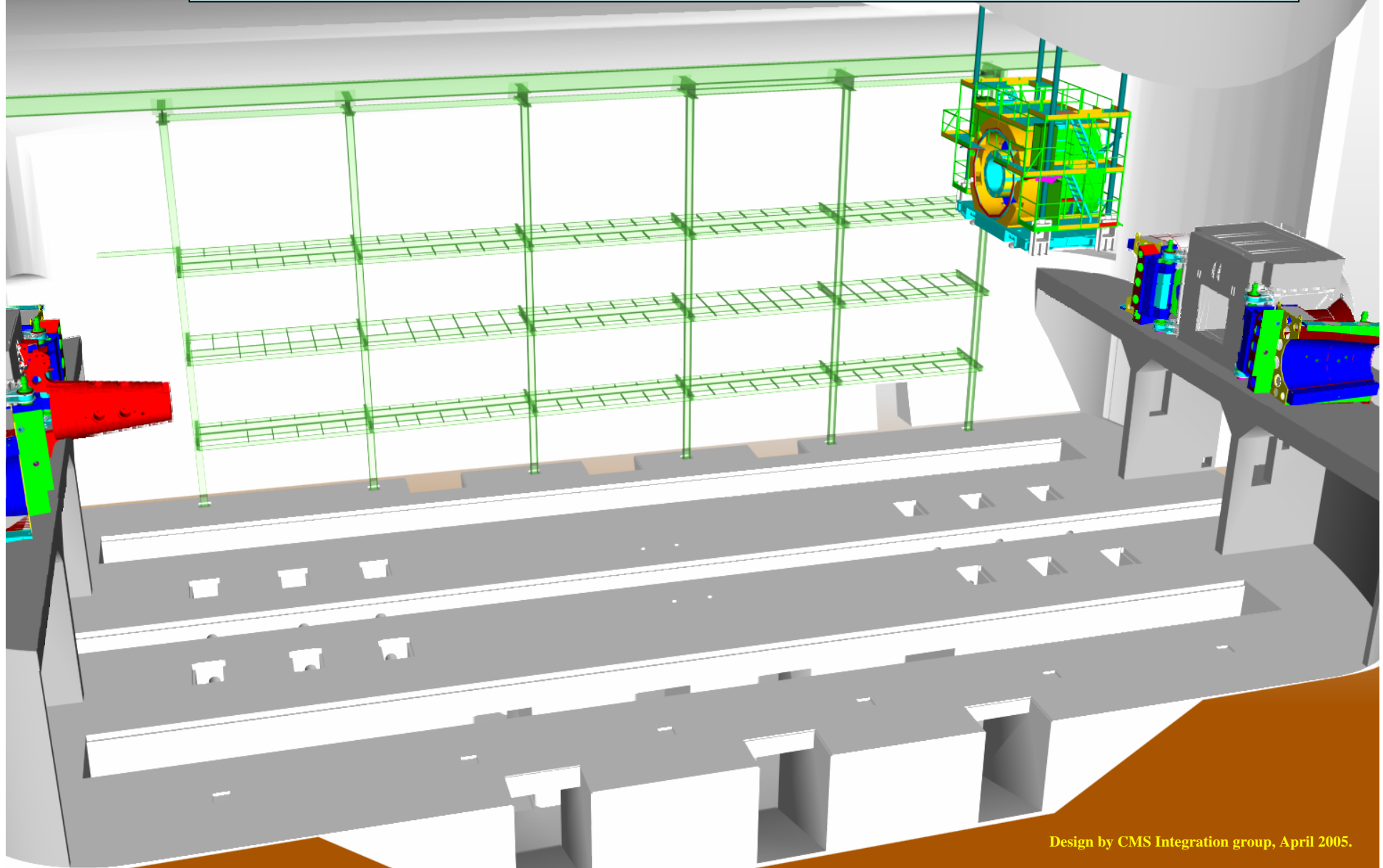
YB/YE

HF

YB/YE

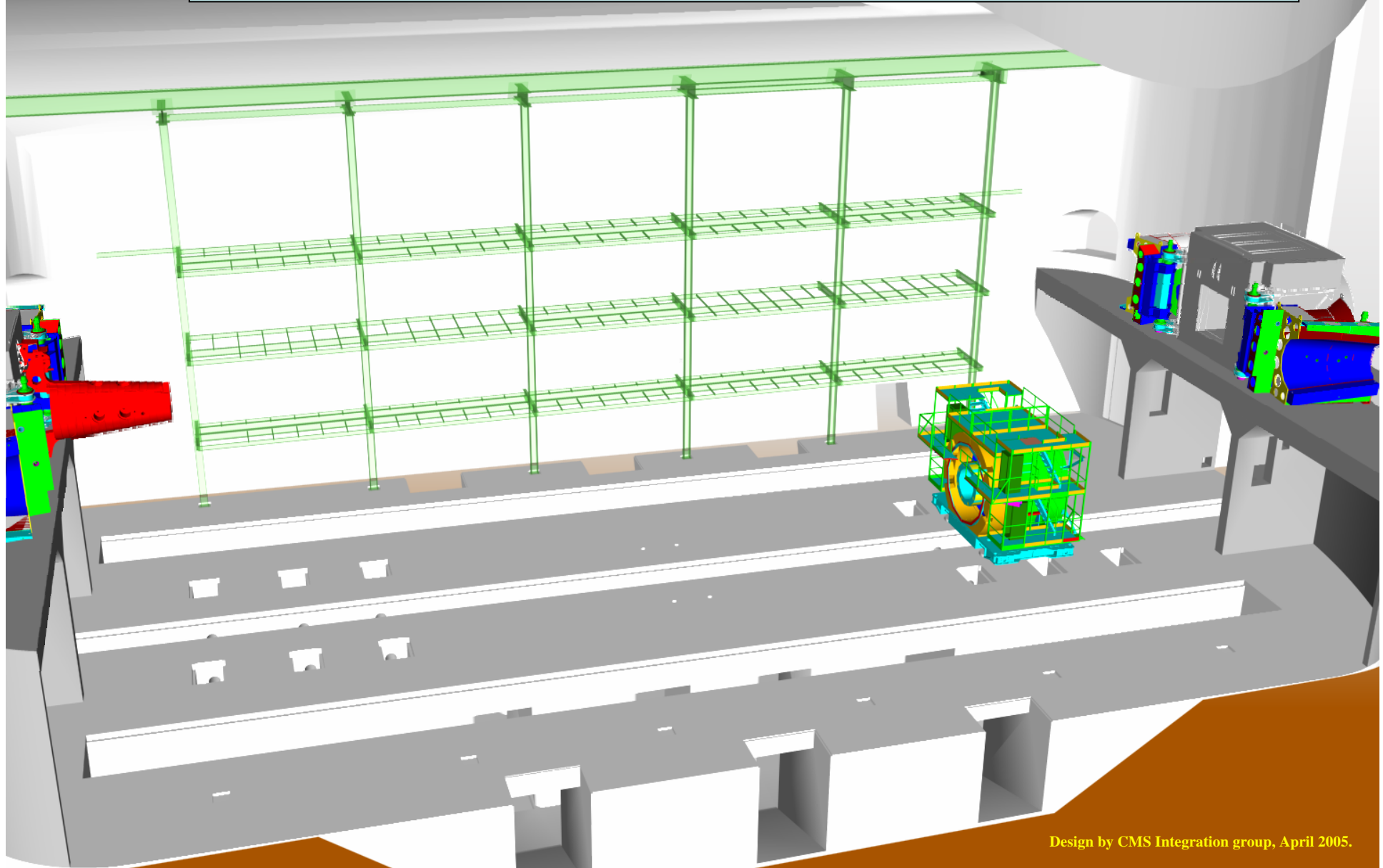


Lower HF Z+ move into garage



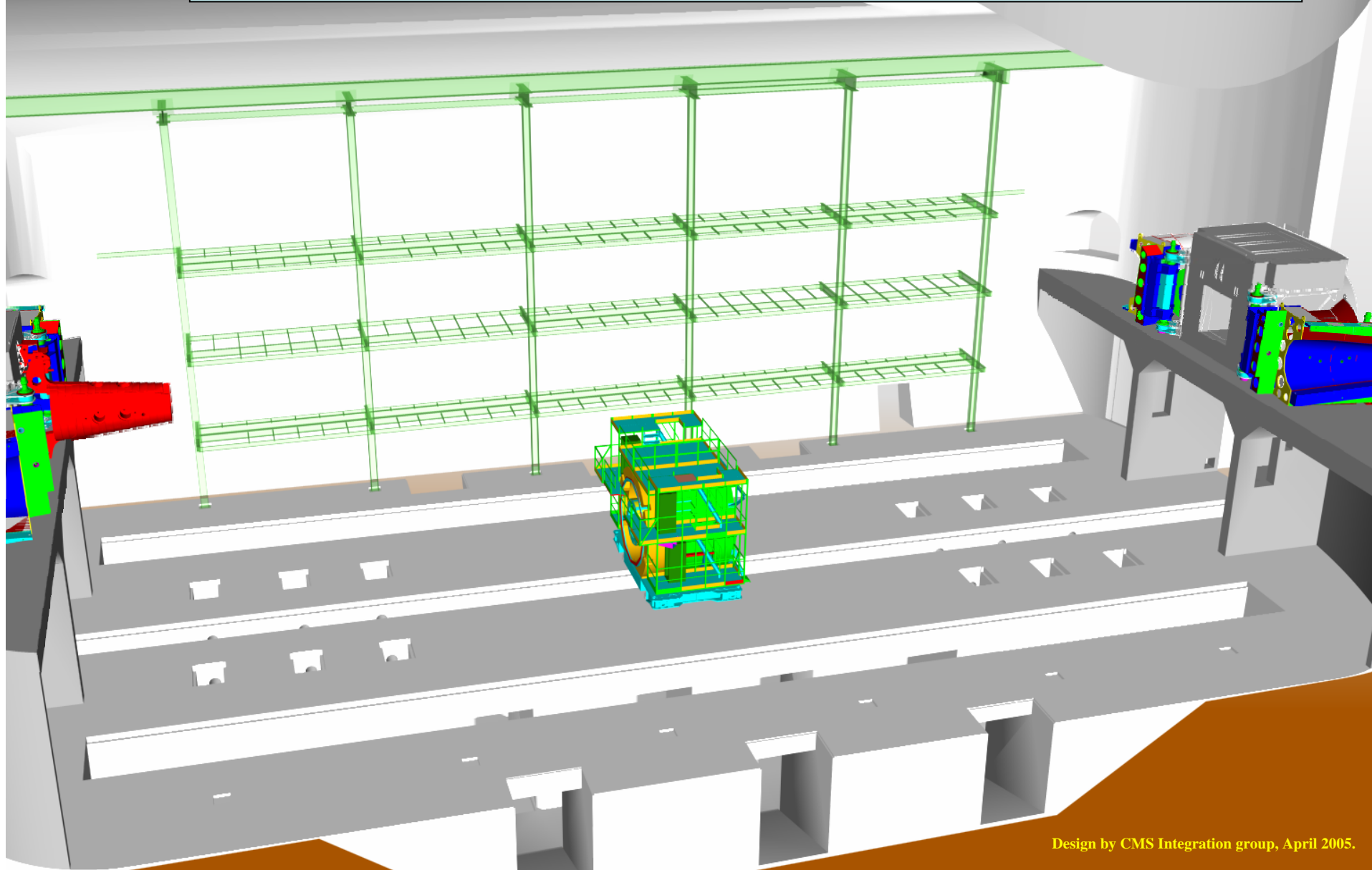
Design by CMS Integration group, April 2005.

Lower HF Z+ move into garage



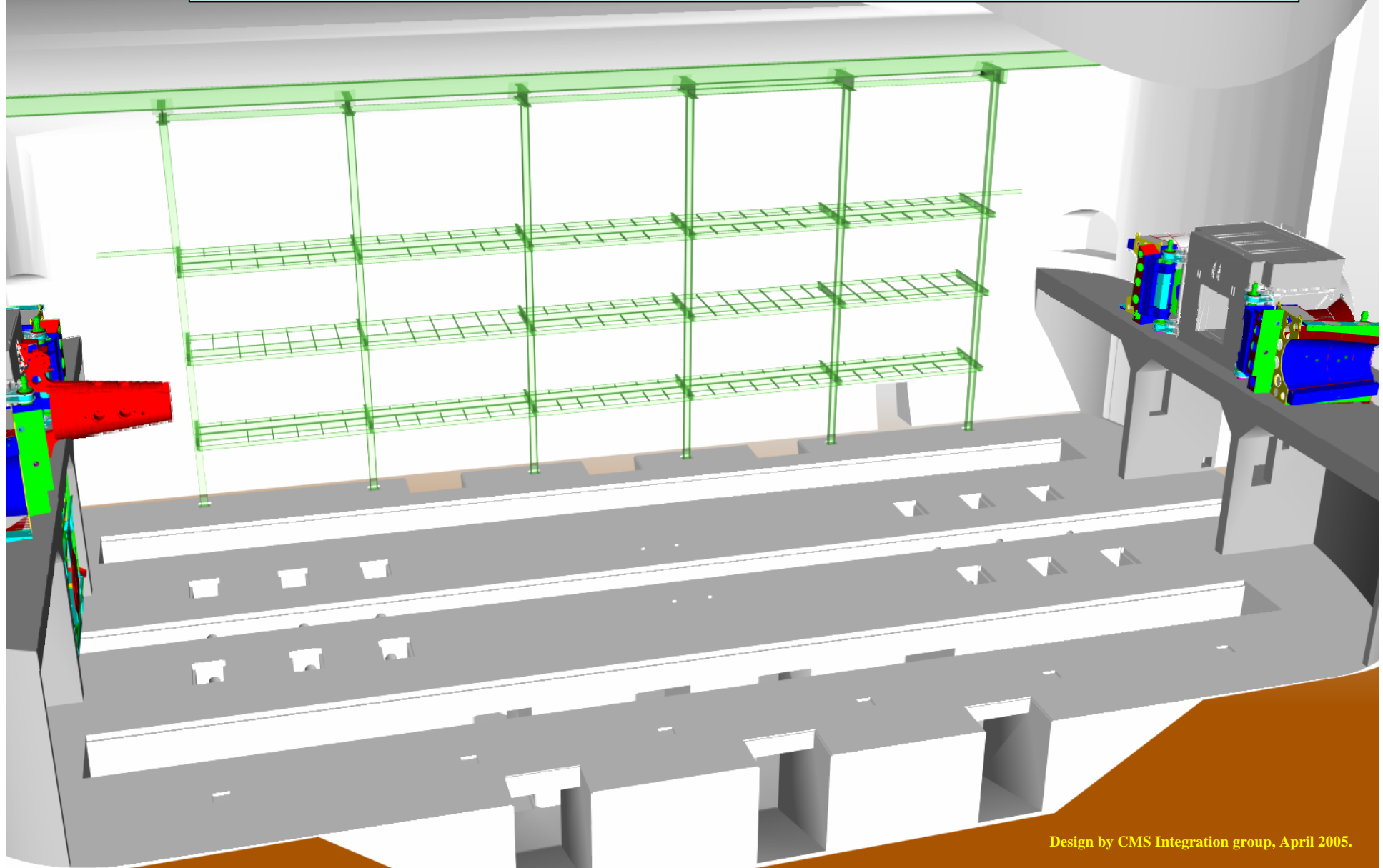
Design by CMS Integration group, April 2005.

Lower HF Z+ move into garage



Design by CMS Integration group, April 2005.

Lower HF Z+ move into garage

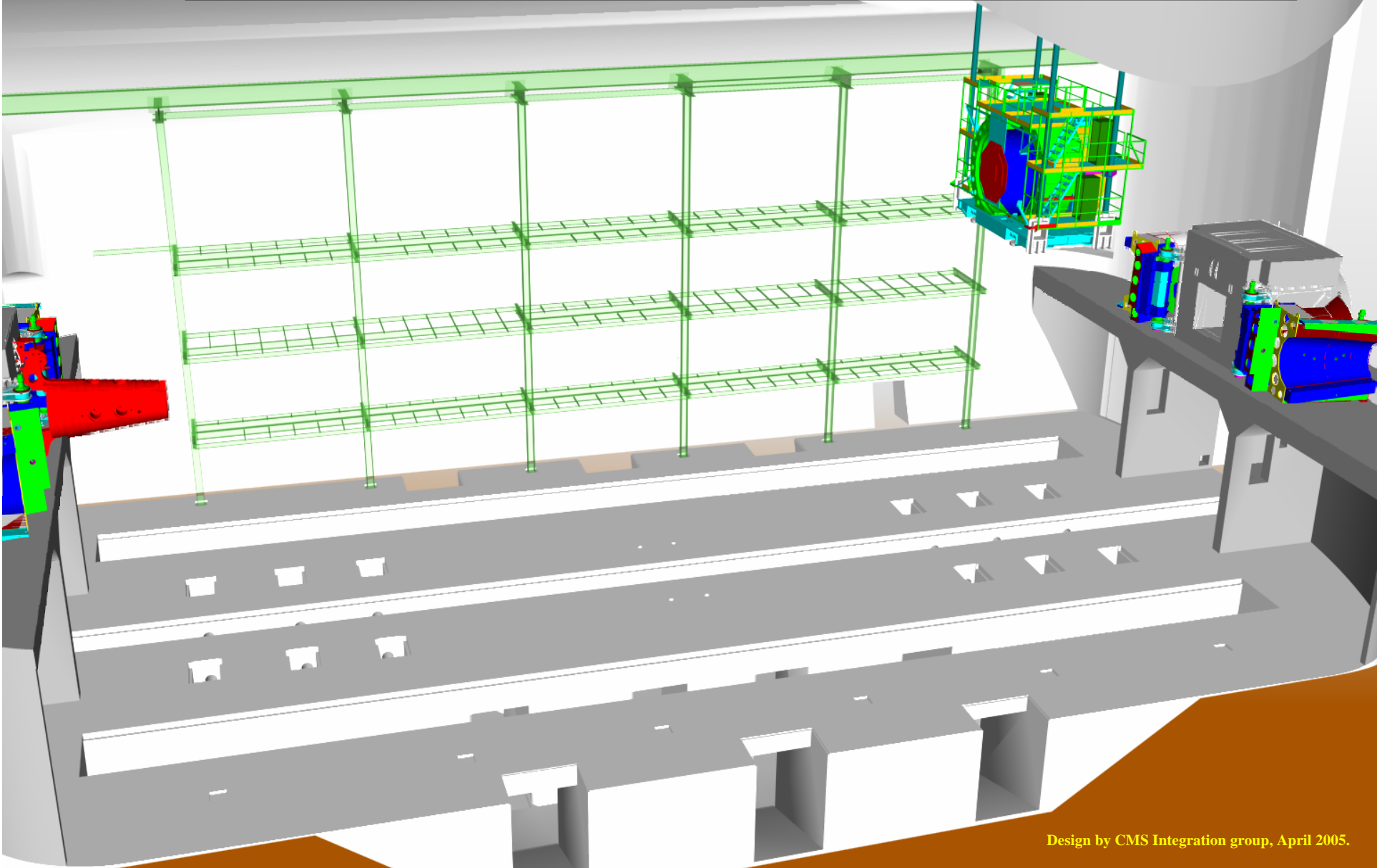


Design by CMS Integration group, April 2005.

Four 100-ton jacks are recessed in the ground to lift (and lower) one HF to beam height

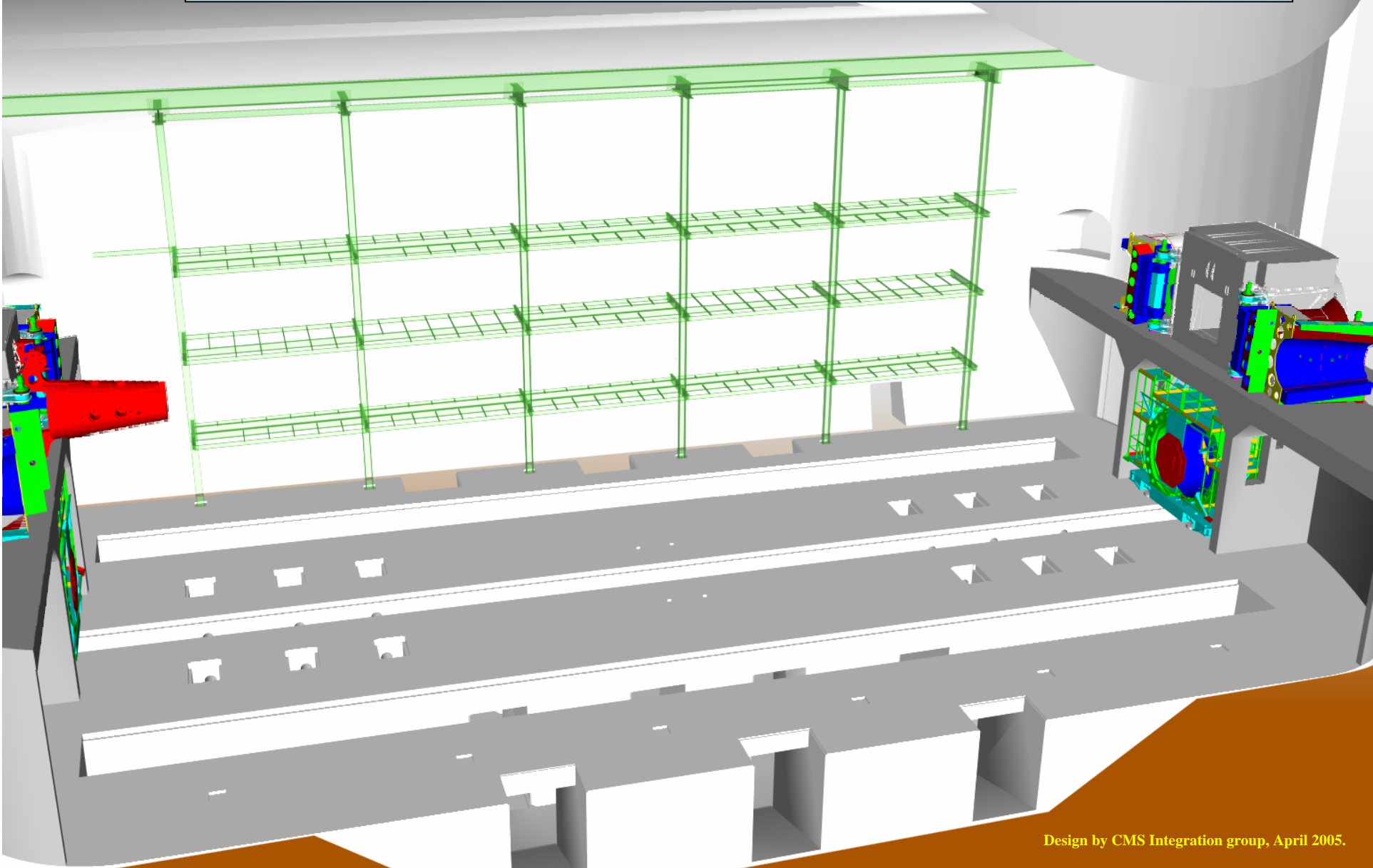


Lower HF Z- move into garage



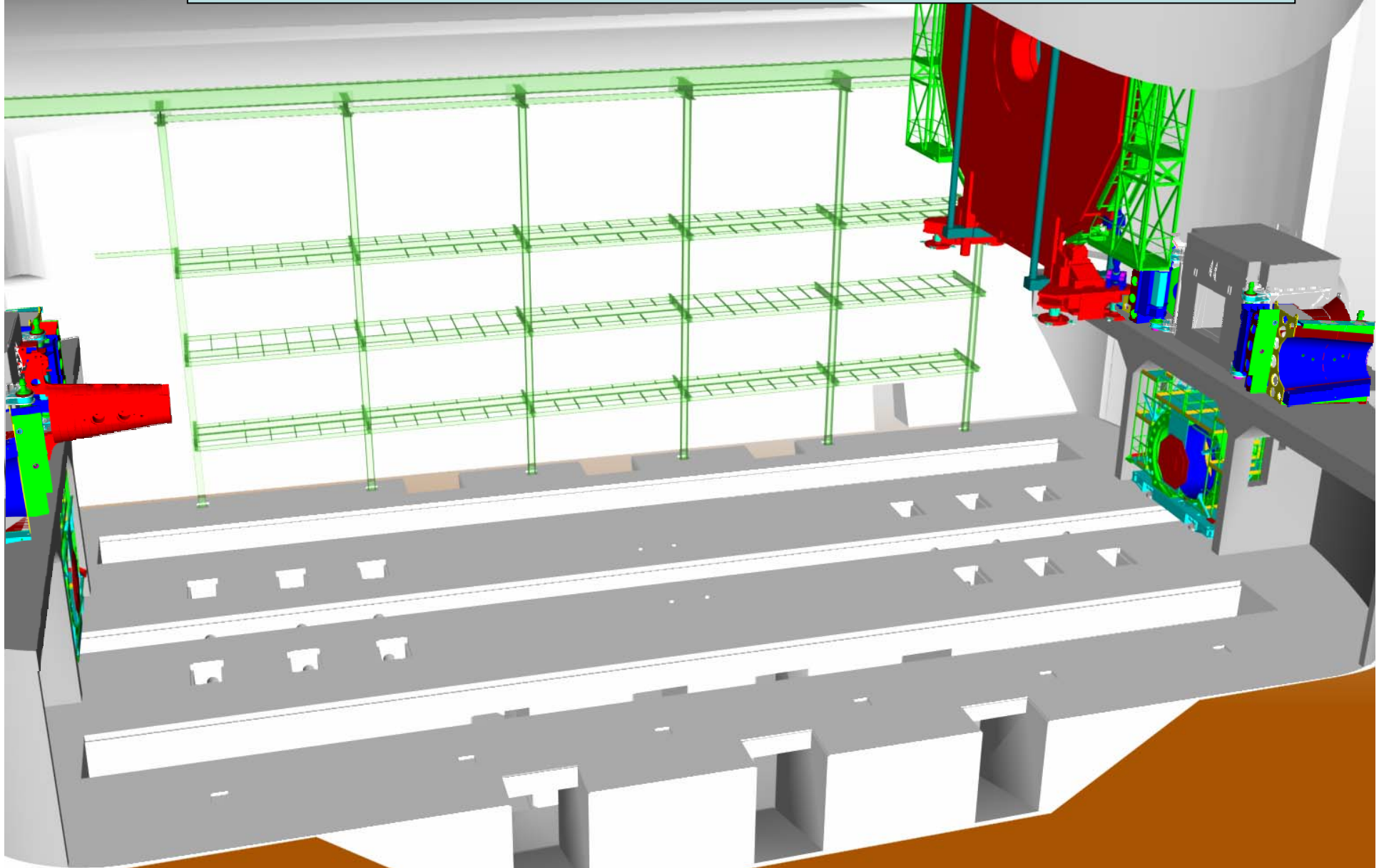
Design by CMS Integration group, April 2005.

Lower HF Z- move into garage

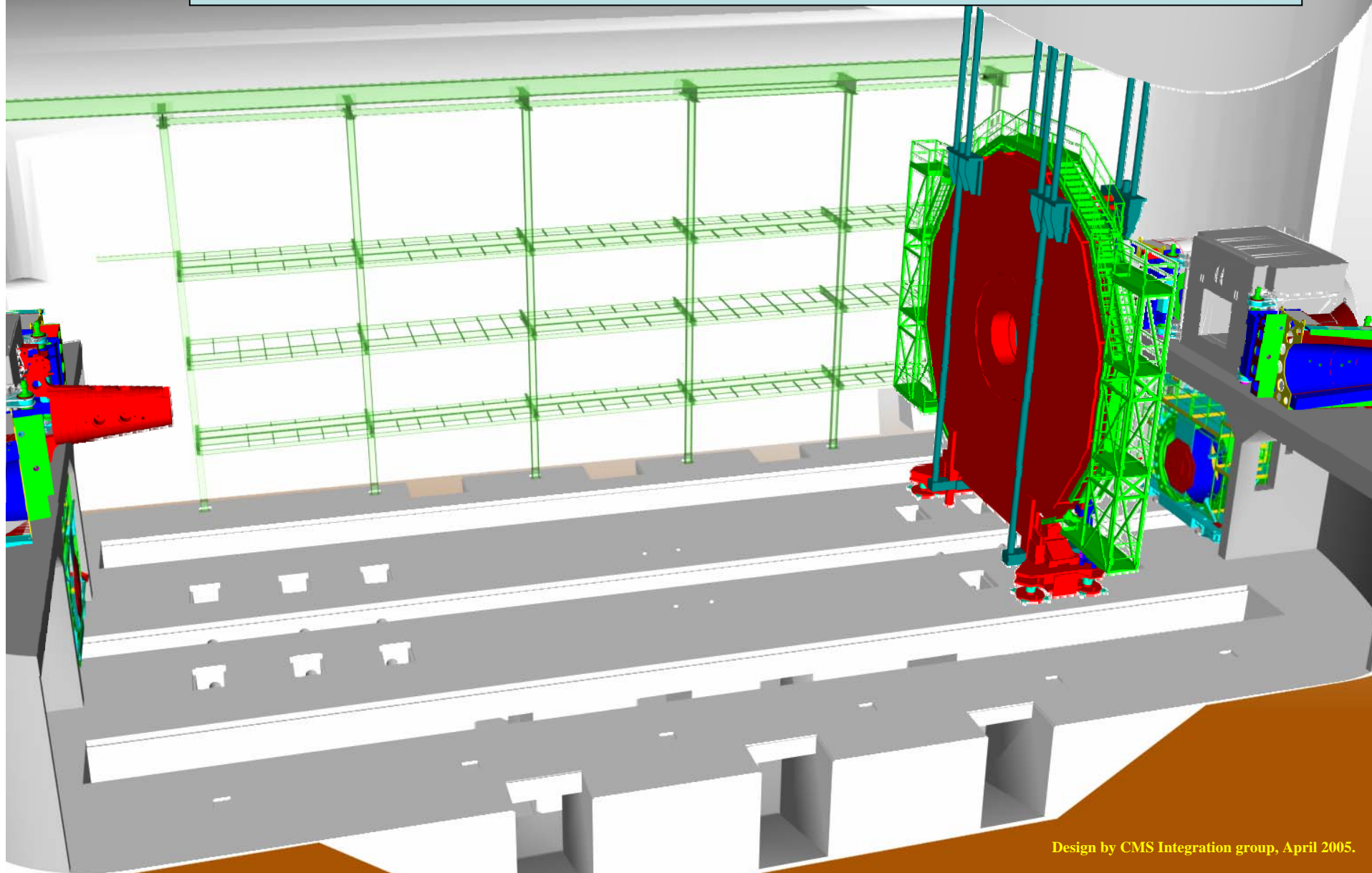


Design by CMS Integration group, April 2005.

Lower YE+3 move to far Z+

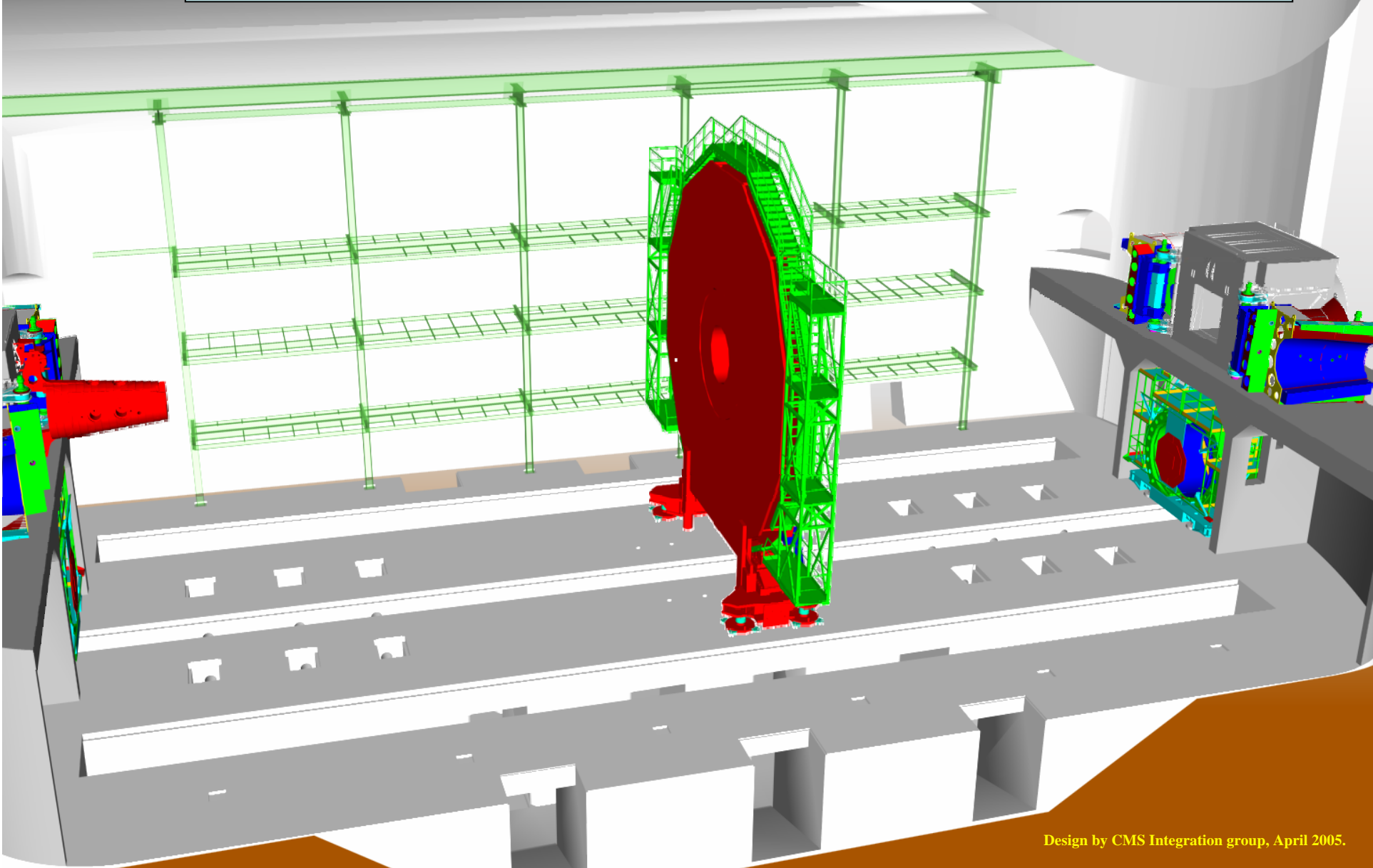


Lower YE+3 move to far Z+



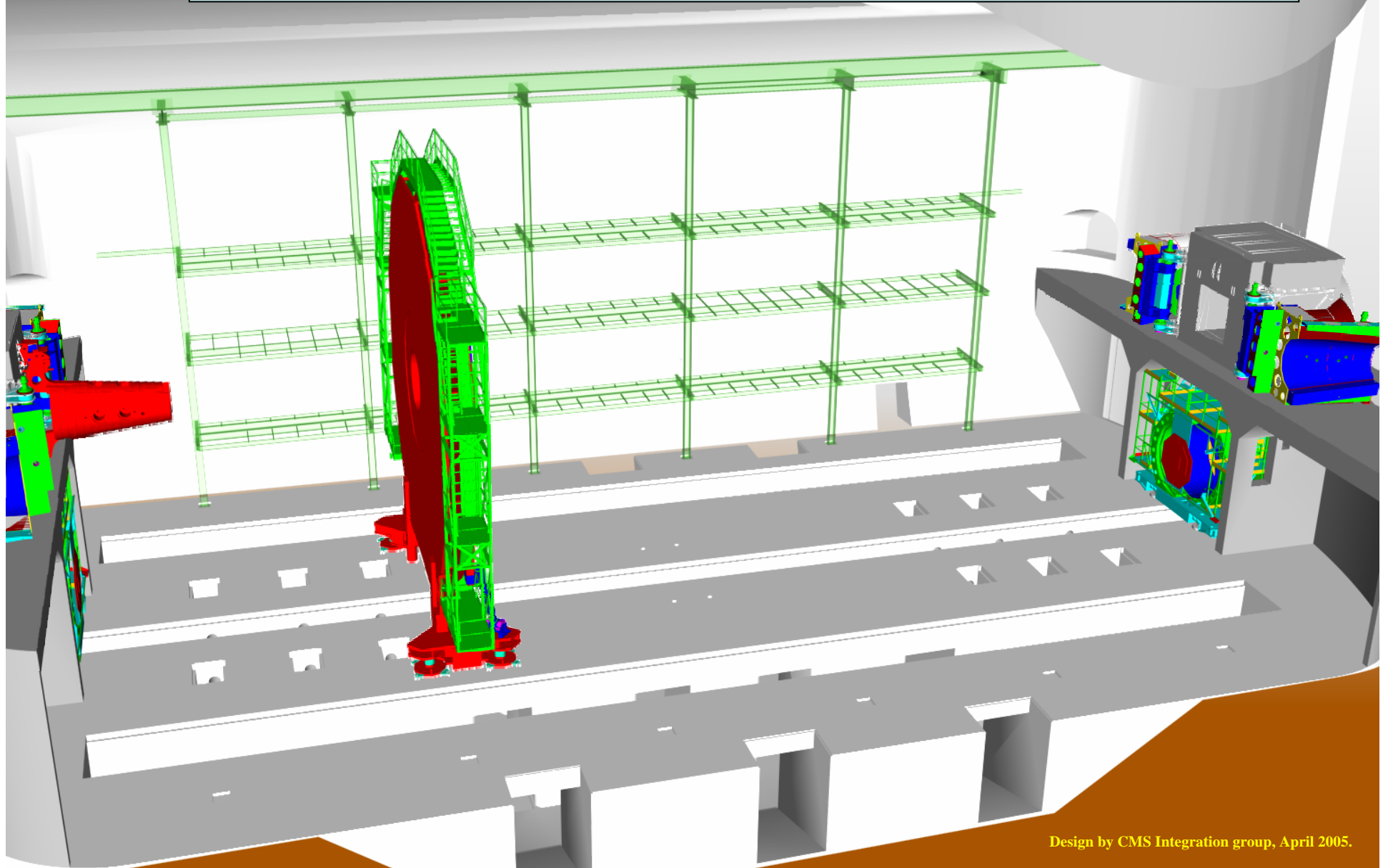
Design by CMS Integration group, April 2005.

Lower YE+3 move to far Z+



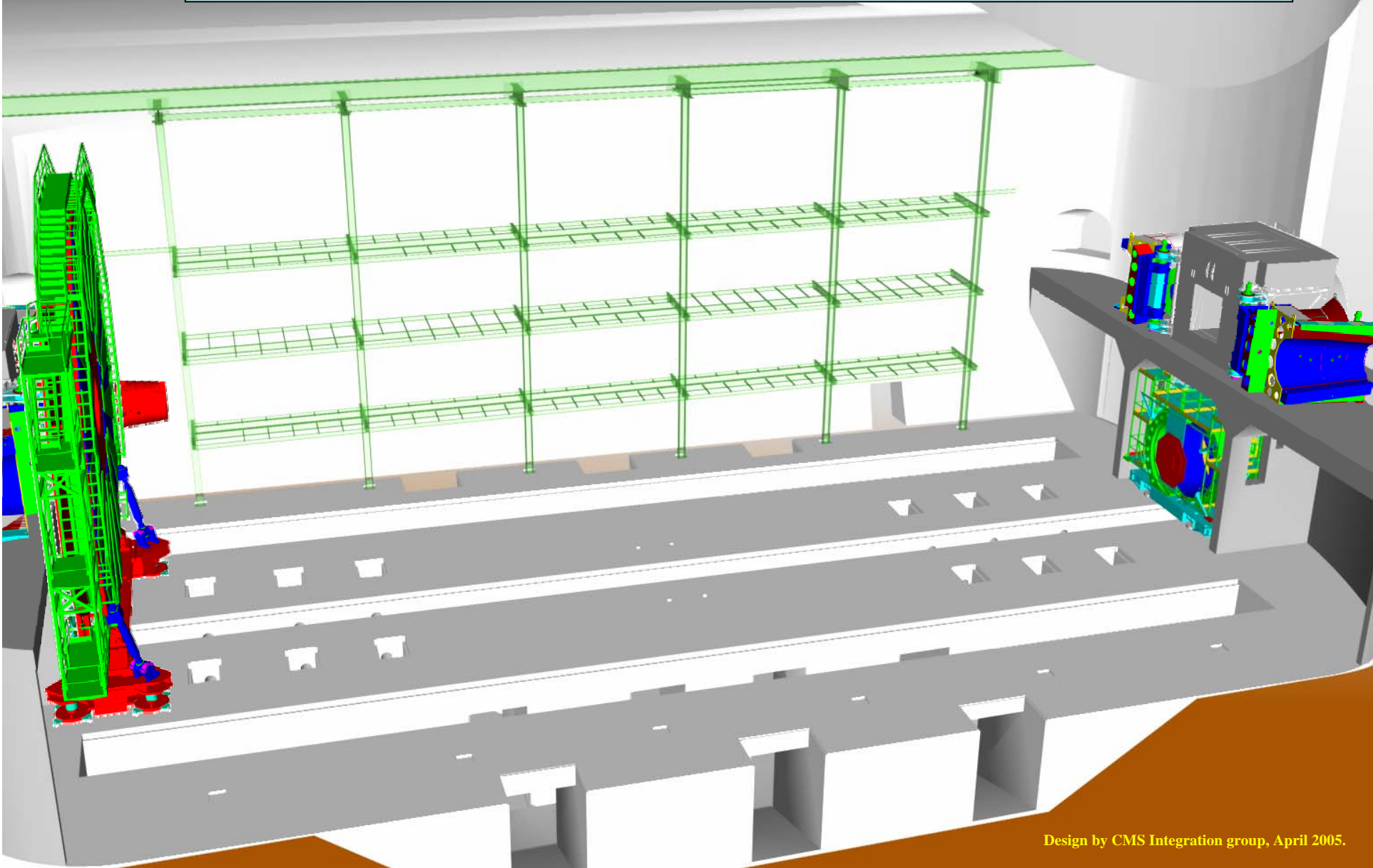
Design by CMS Integration group, April 2005.

Lower YE+3 move to far Z+



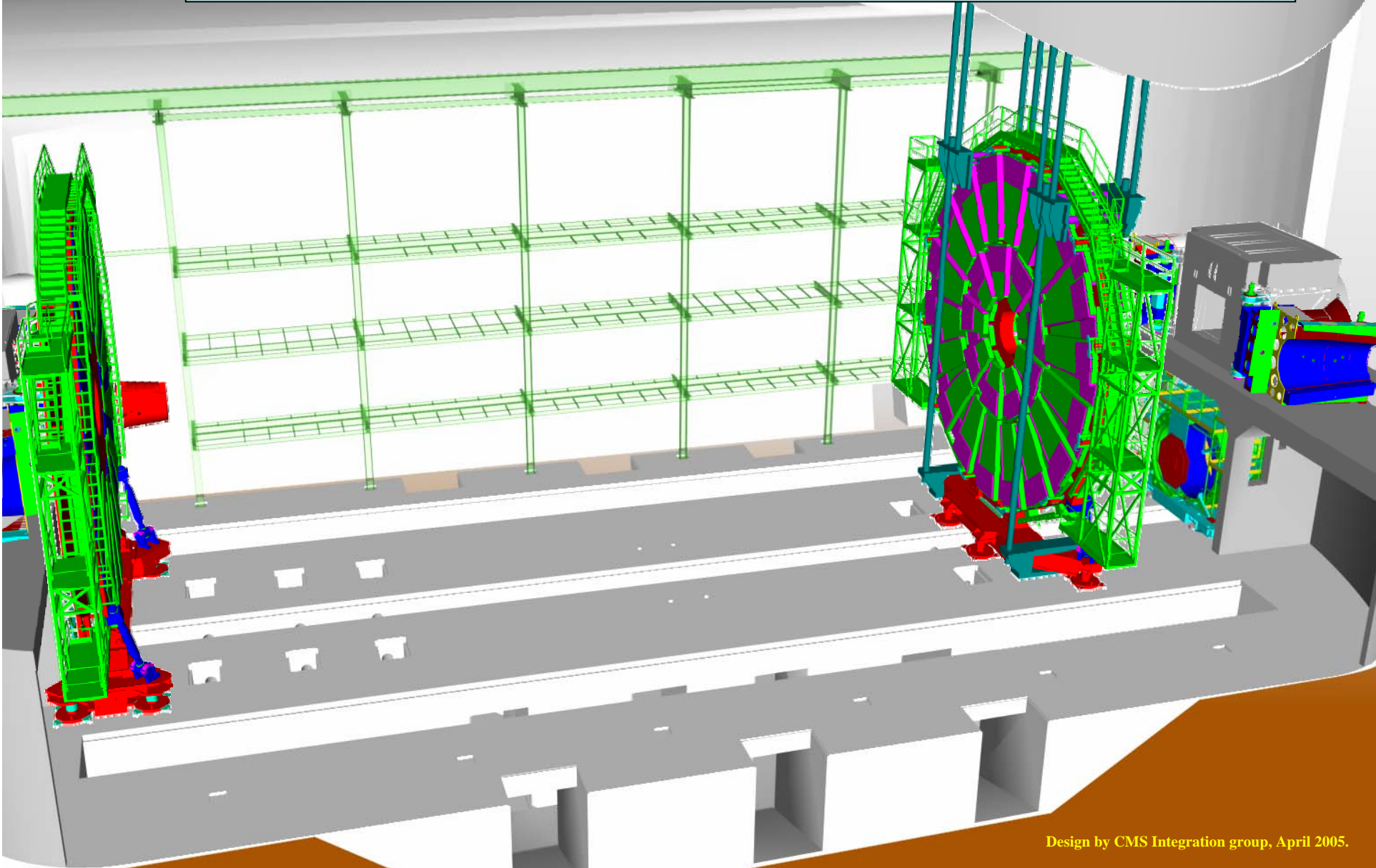
Design by CMS Integration group, April 2005.

Lower YE+3 move to far Z+



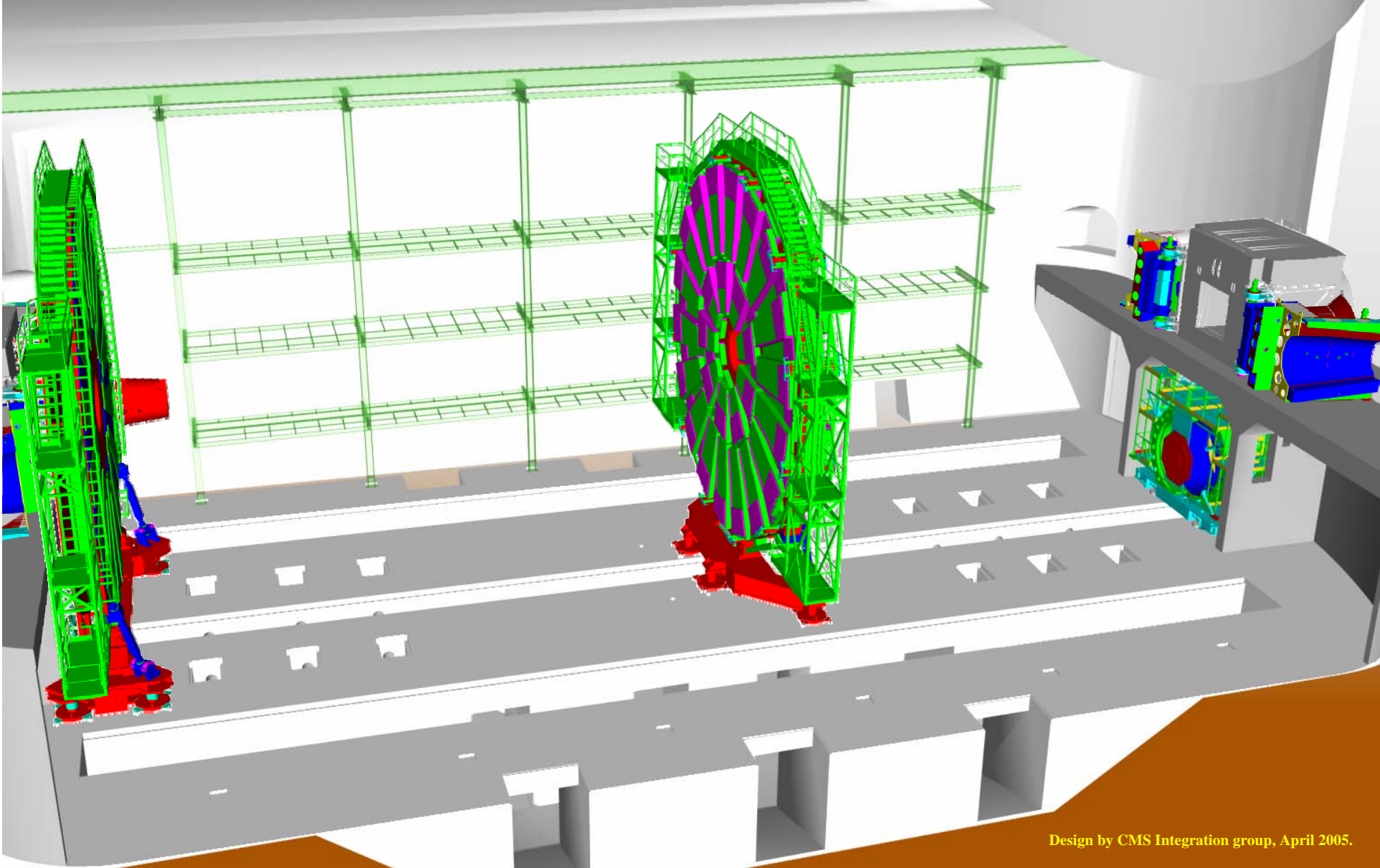
Design by CMS Integration group, April 2005.

Lower YE+2 move to far Z+



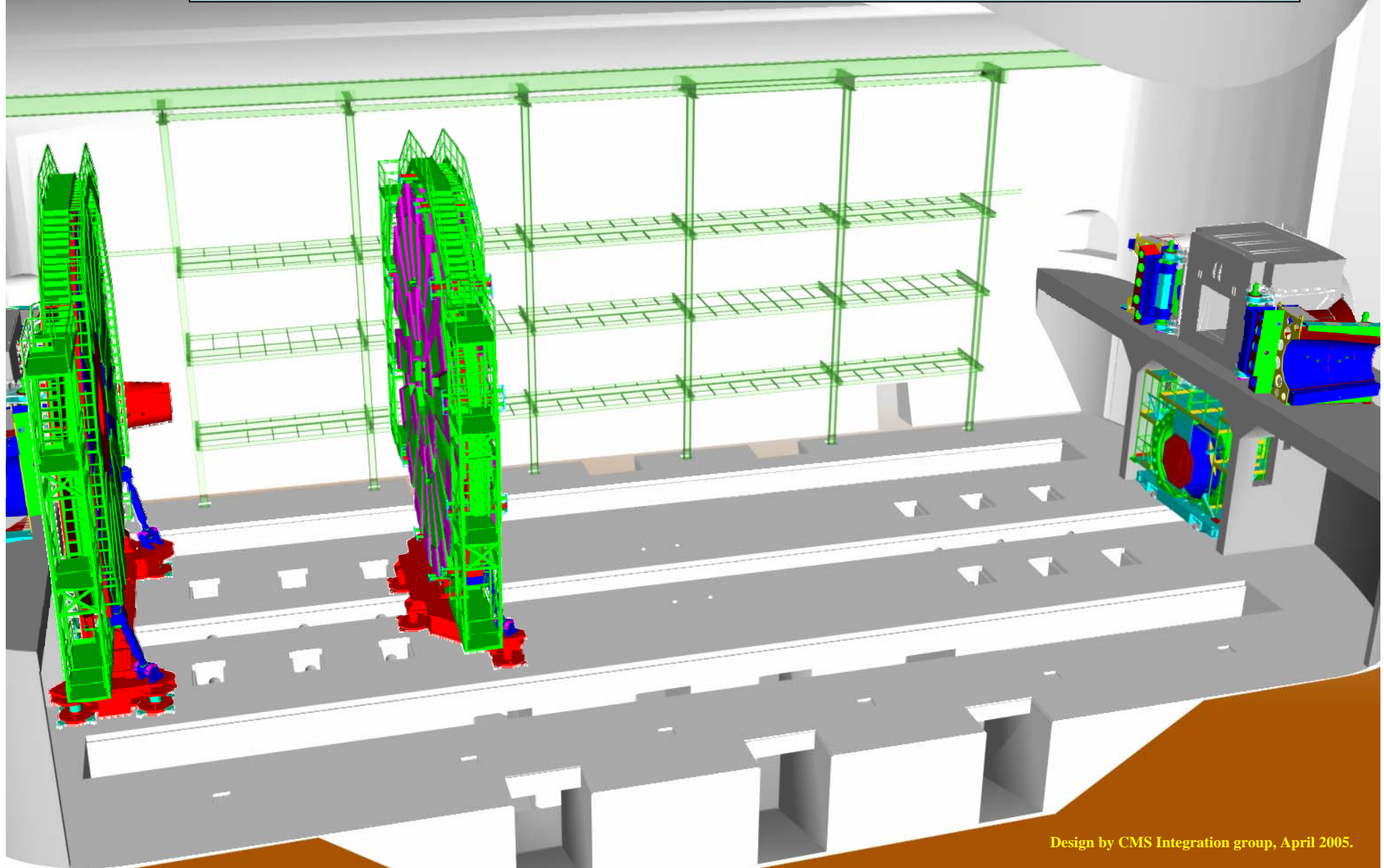
Design by CMS Integration group, April 2005.

Lower YE+2 move to far Z+



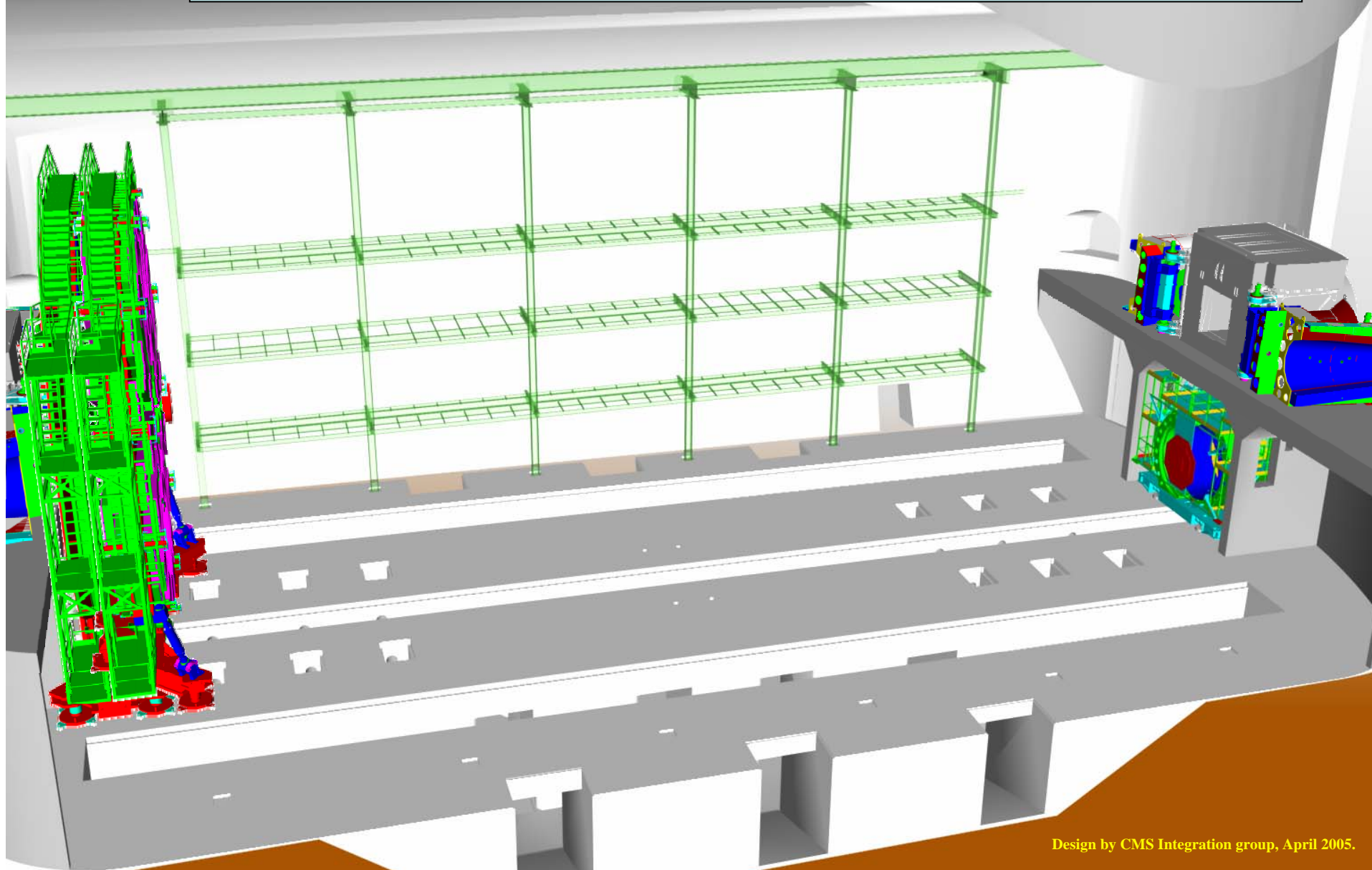
Design by CMS Integration group, April 2005.

Lower YE+2 move to far Z+



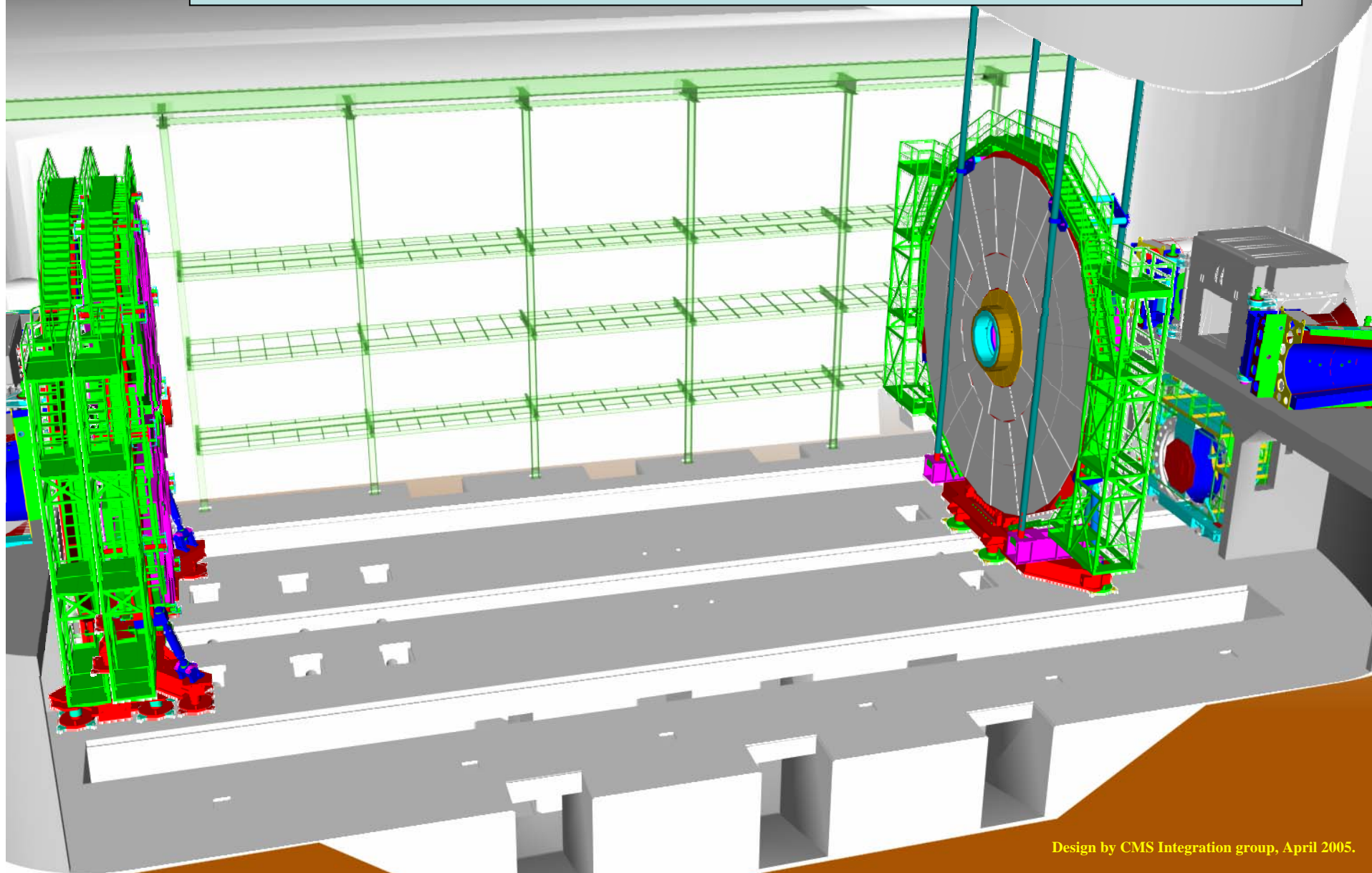
Design by CMS Integration group, April 2005.

Lower YE+2 move to far Z+



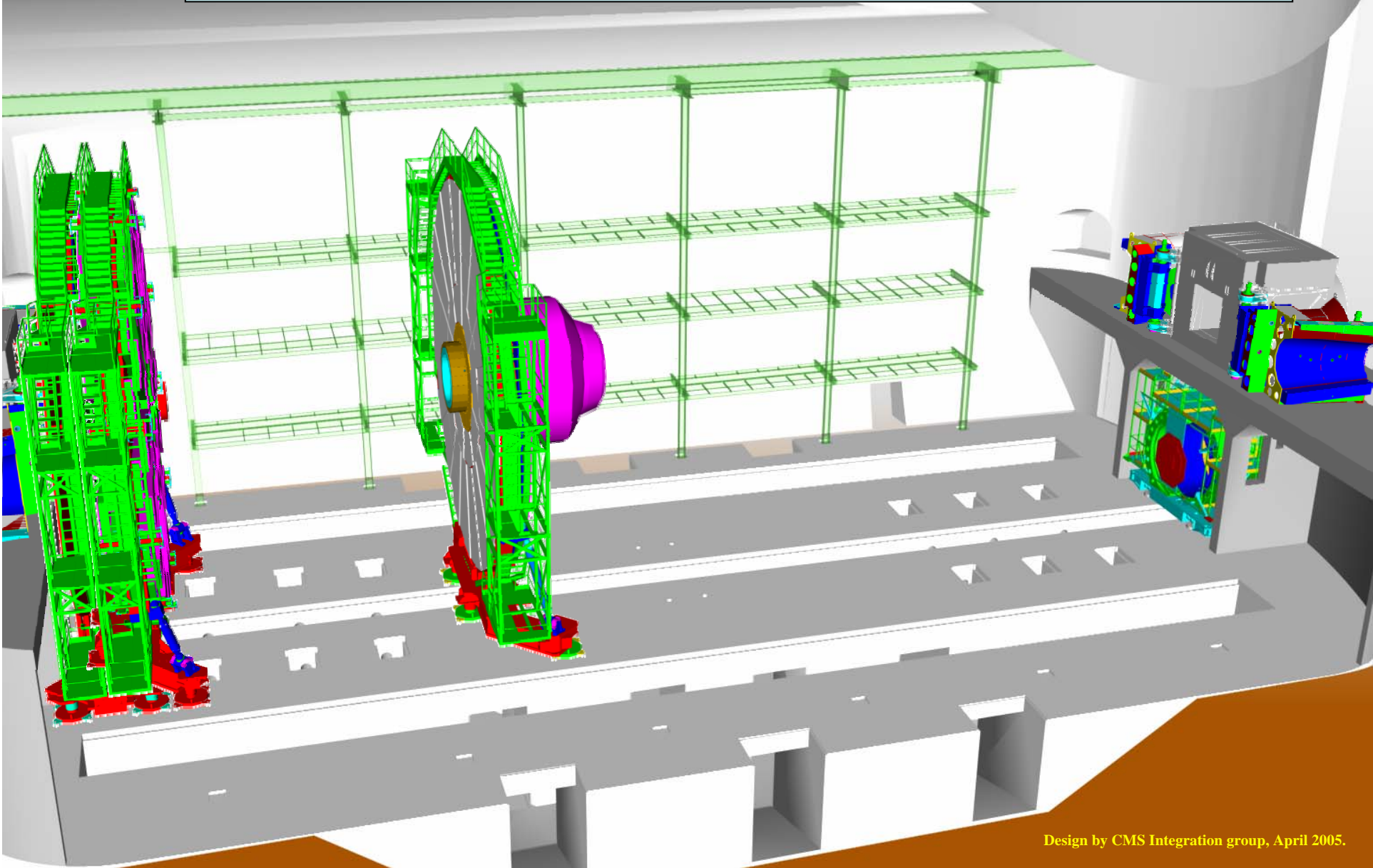
Design by CMS Integration group, April 2005.

Lower YE+1 move to far Z+



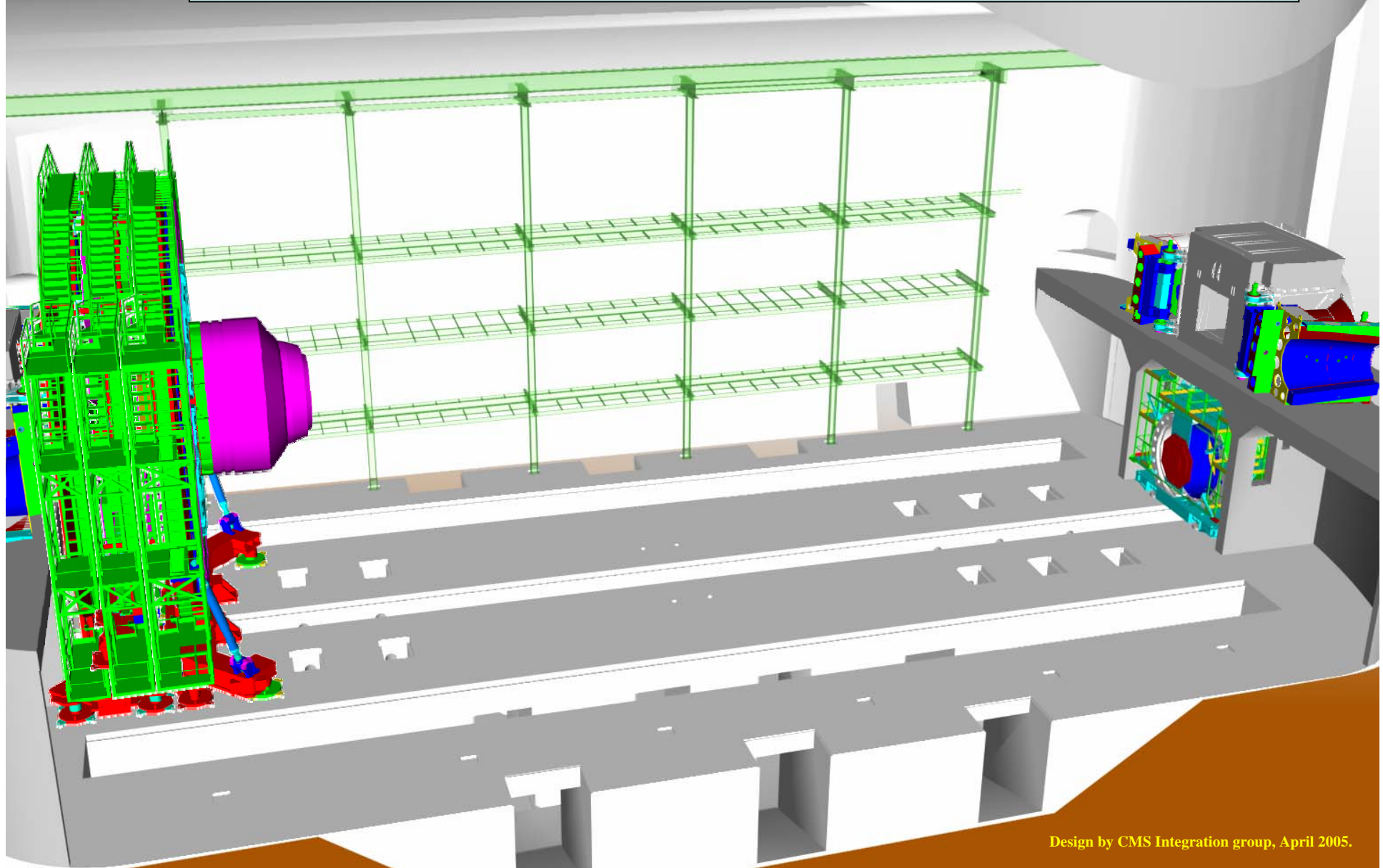
Design by CMS Integration group, April 2005.

Lower YE+1 move to far Z+



Design by CMS Integration group, April 2005.

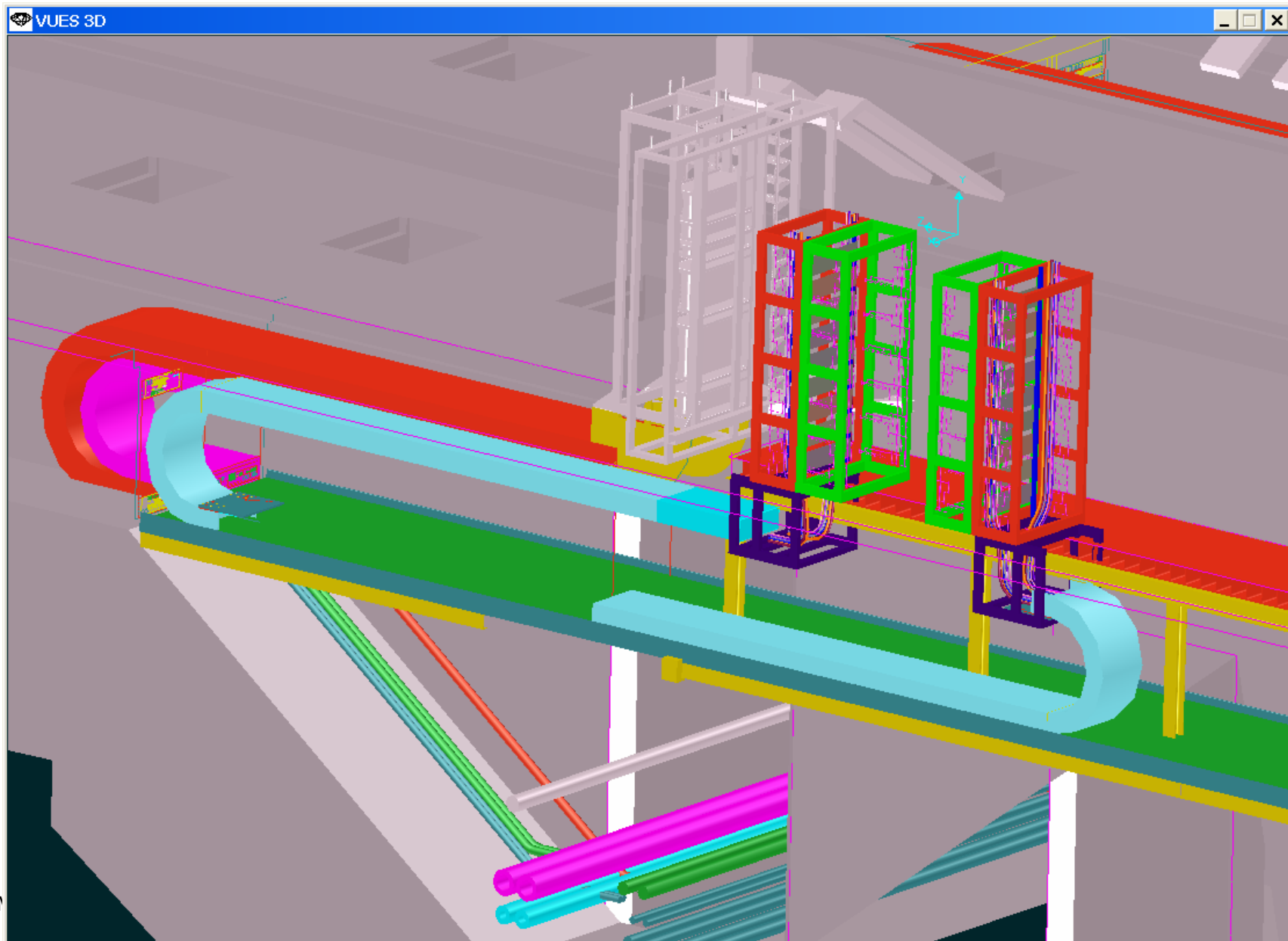
Lower YE+1 move to far Z+



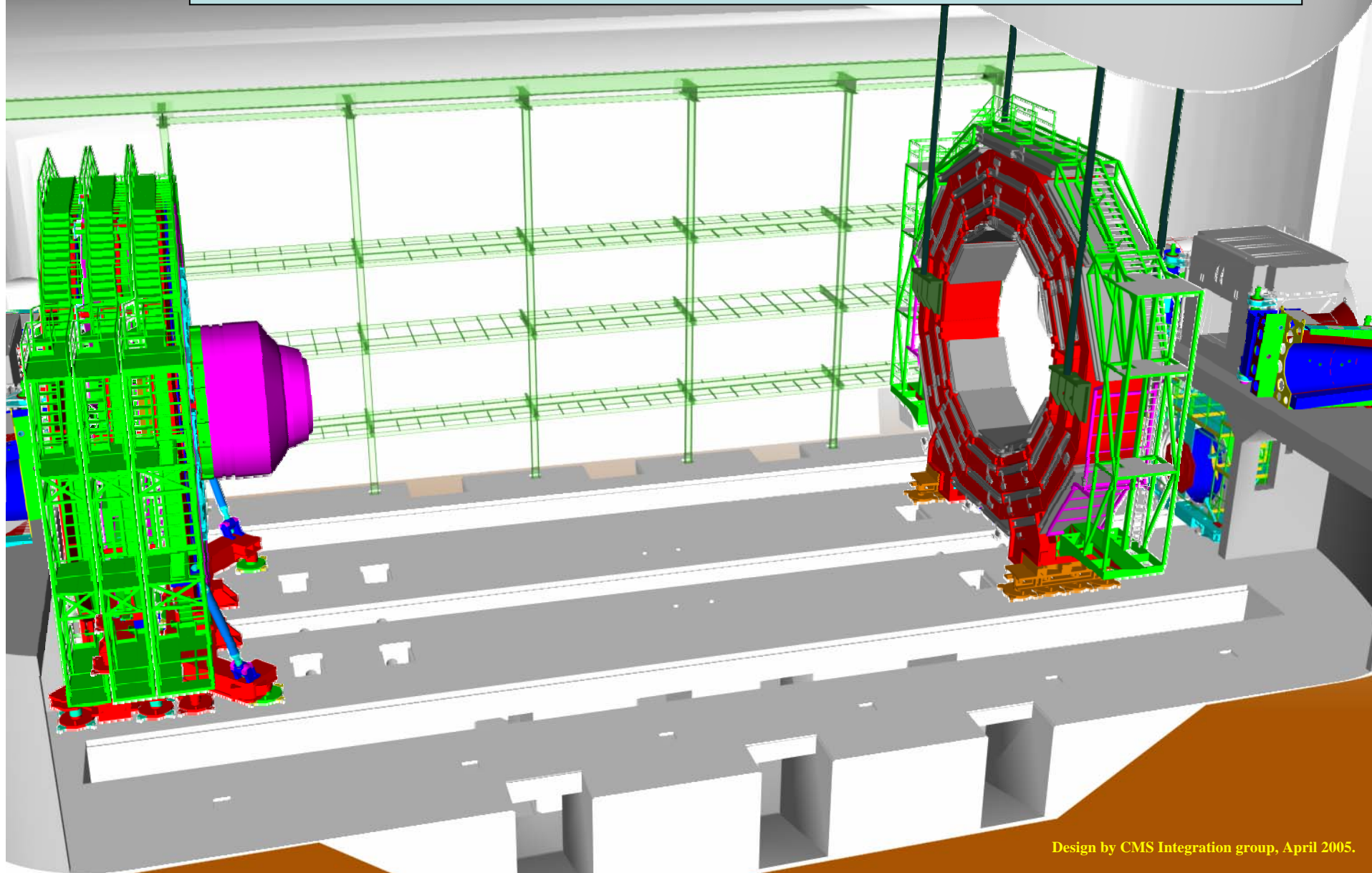
Design by CMS Integration group, April 2005.



Elements can be connected to cable chains

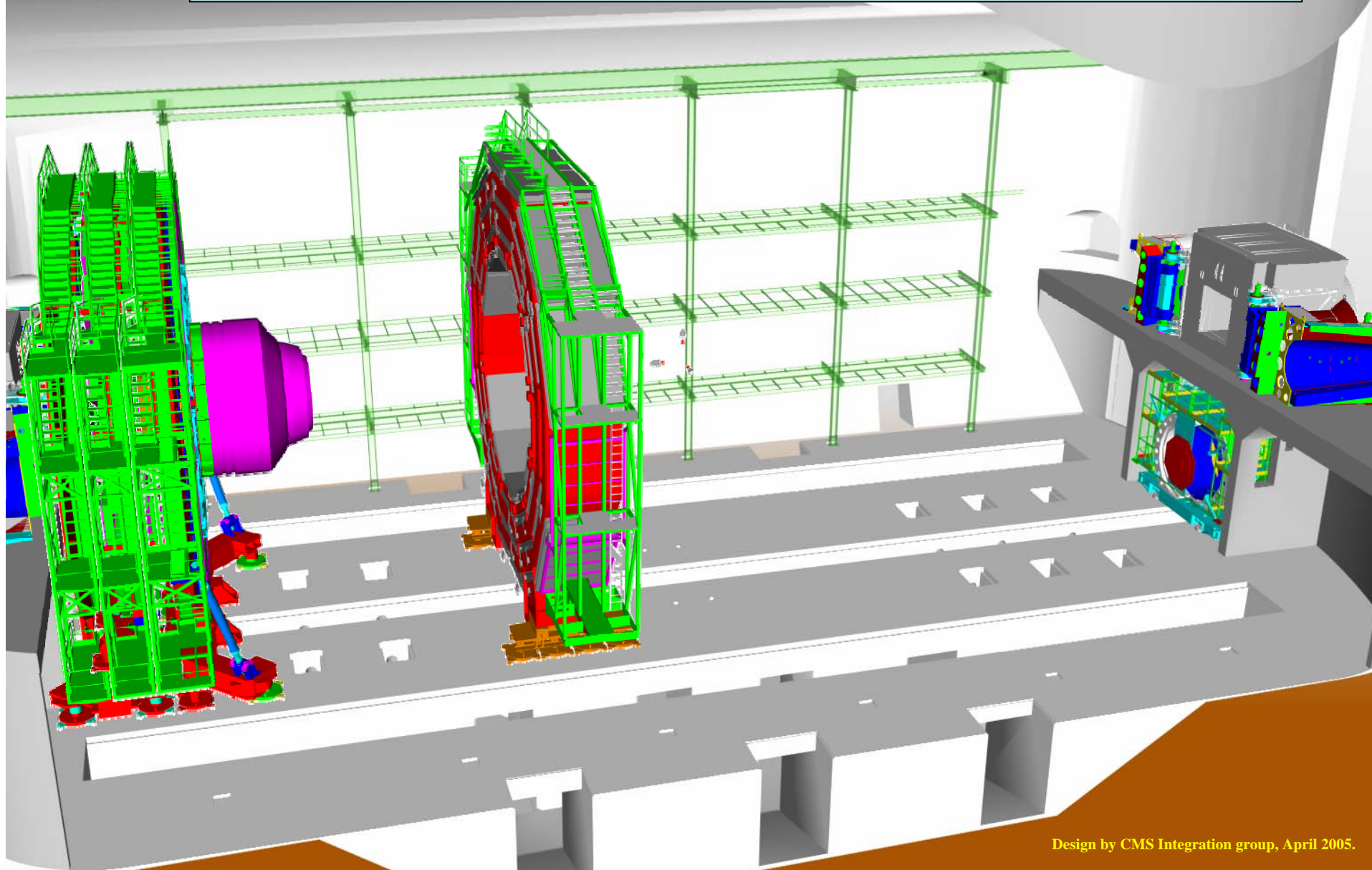


Lower YB+2 move to far Z+



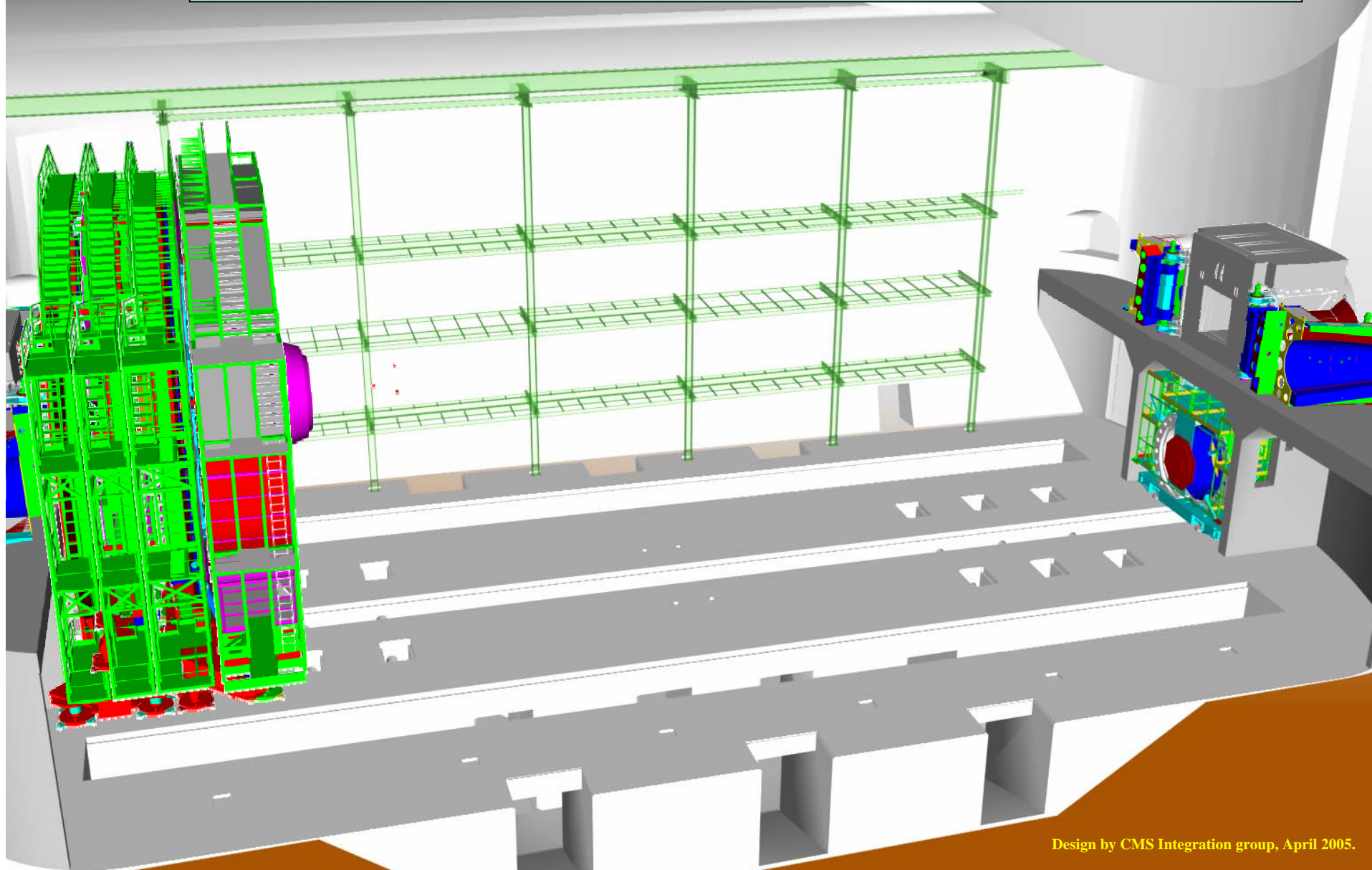
Design by CMS Integration group, April 2005.

Lower YB+2 move to far Z+



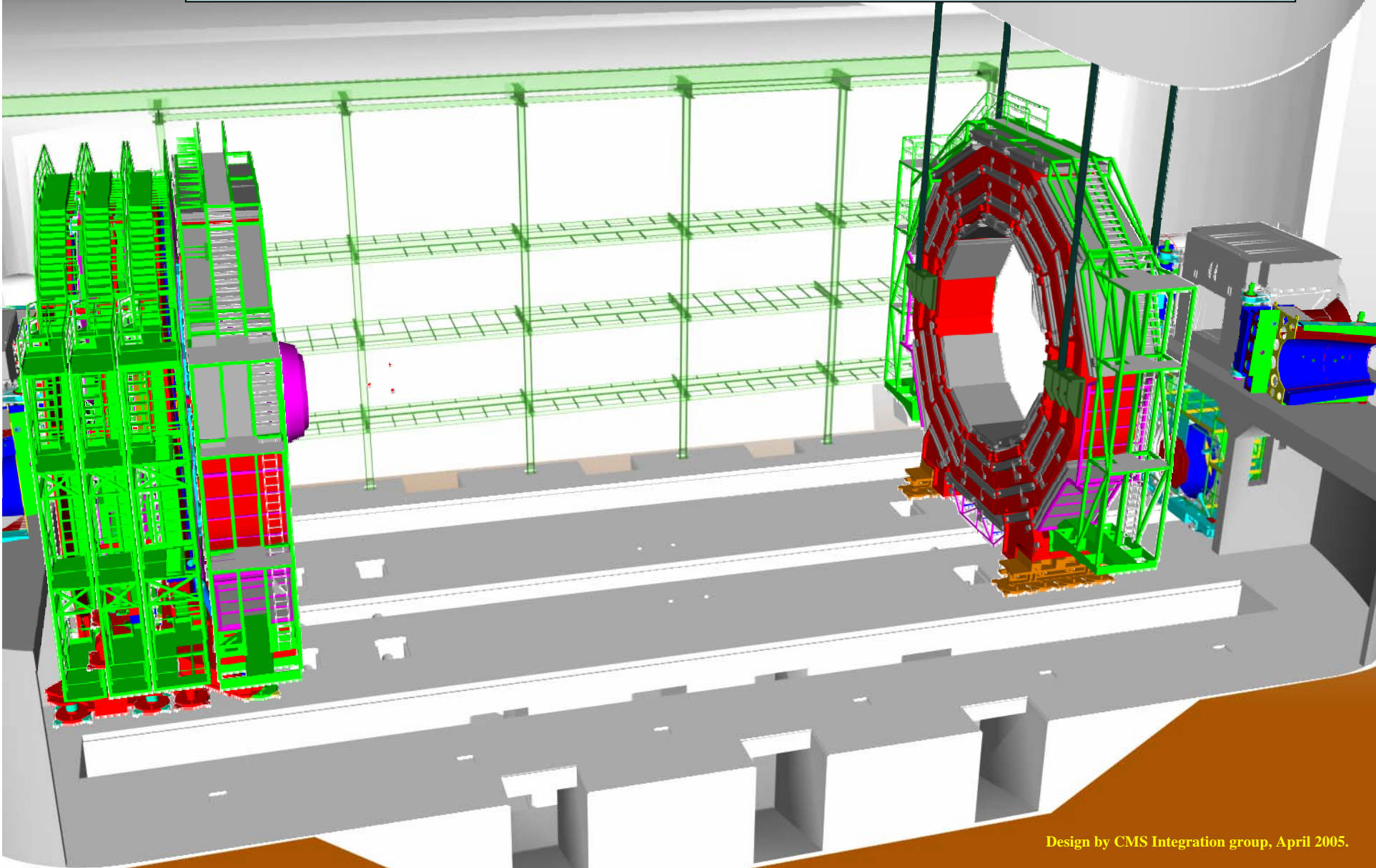
Design by CMS Integration group, April 2005.

Lower YB+2 move to far Z+



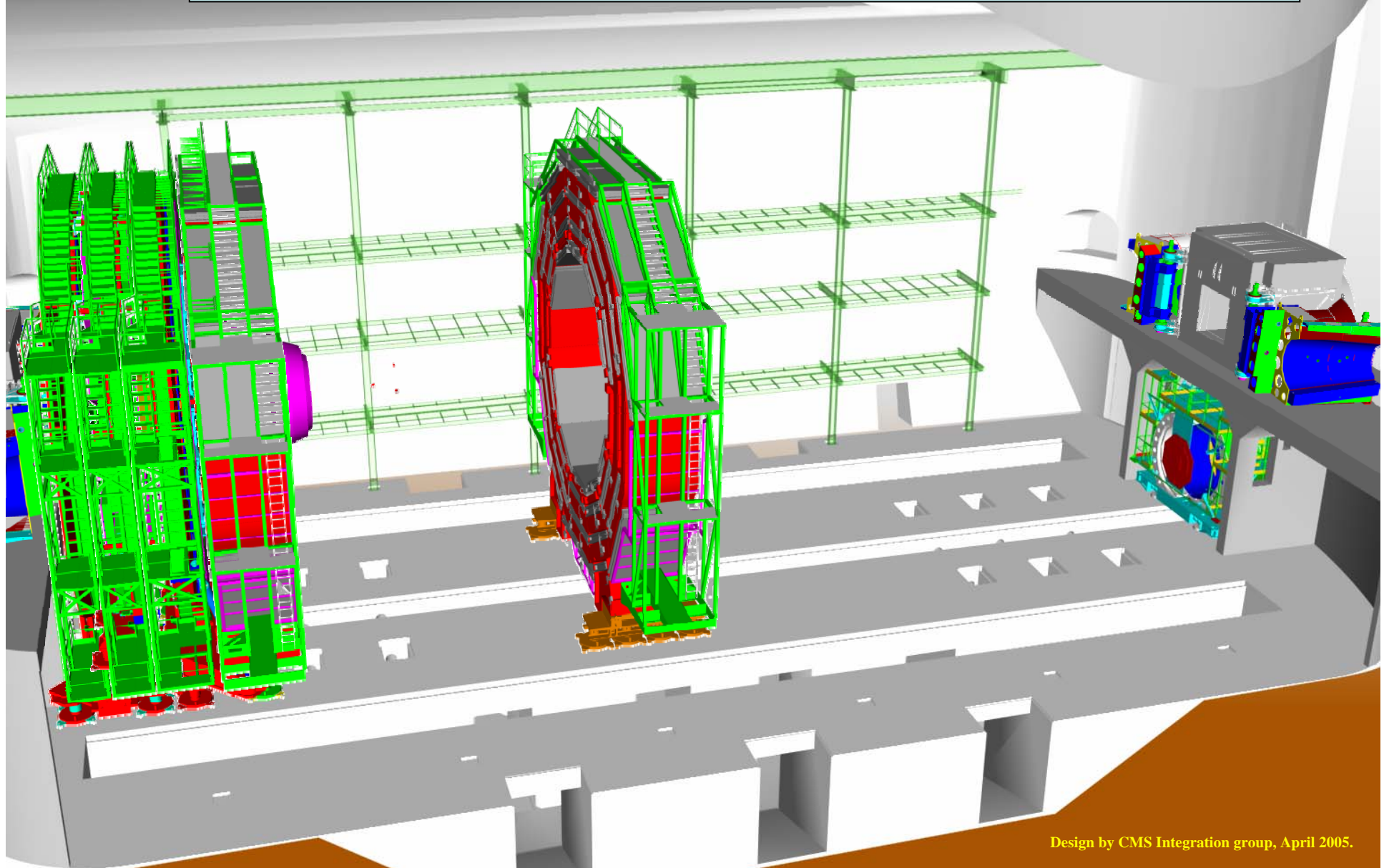
Design by CMS Integration group, April 2005.

Lower YB+1 move to far Z+



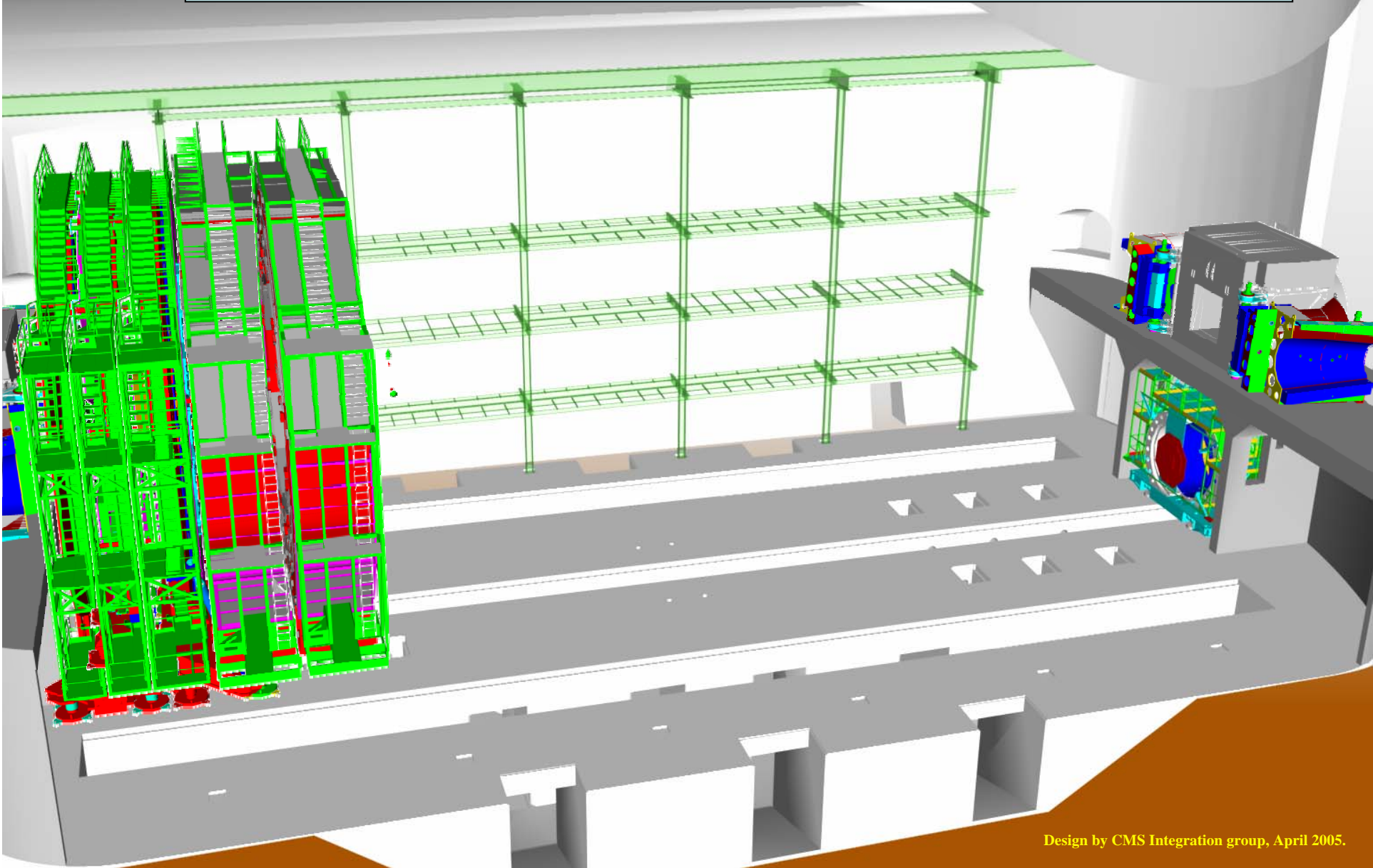
Design by CMS Integration group, April 2005.

Lower YB+1 move to far Z+



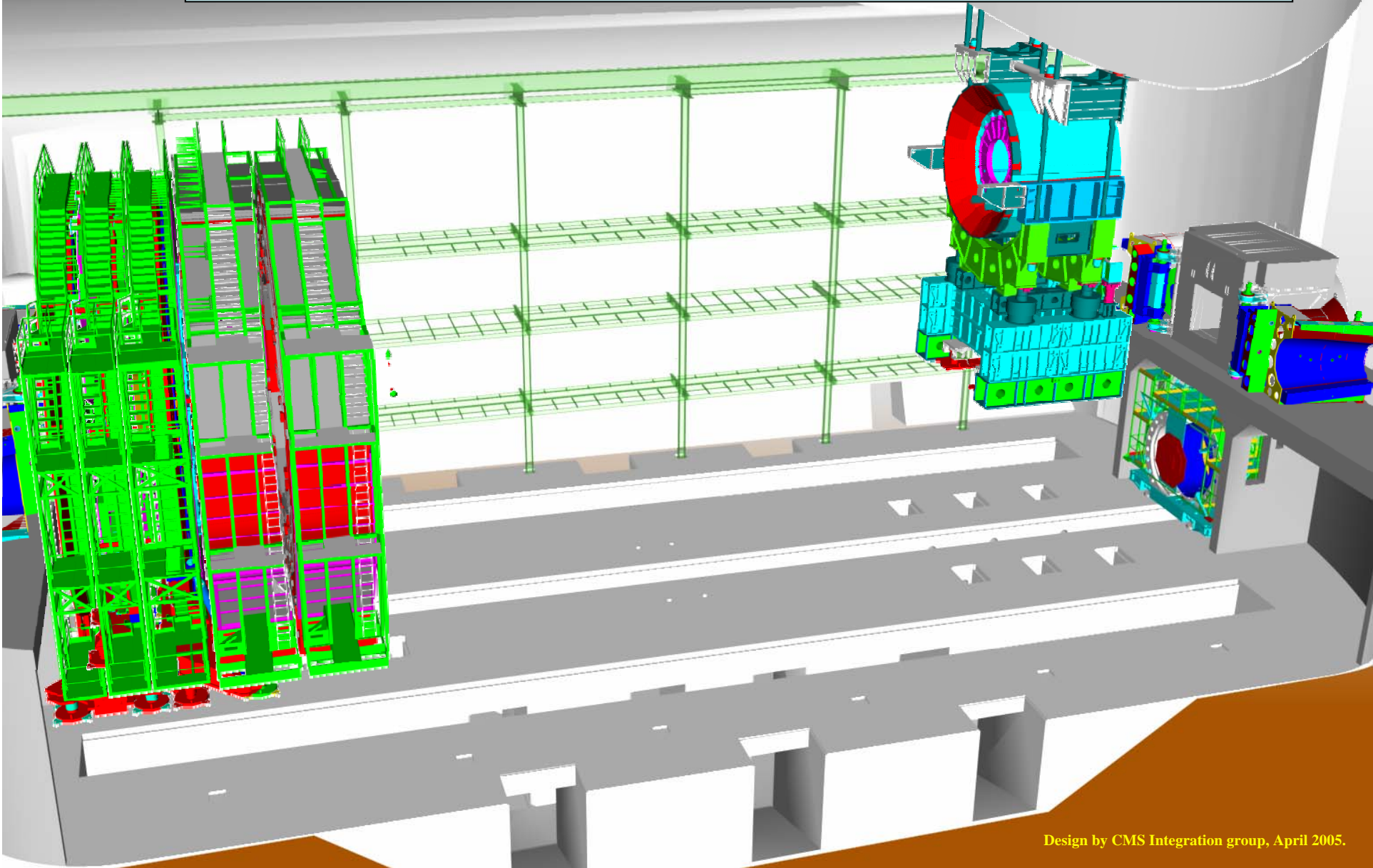
Design by CMS Integration group, April 2005.

Lower YB+1 move to far Z+



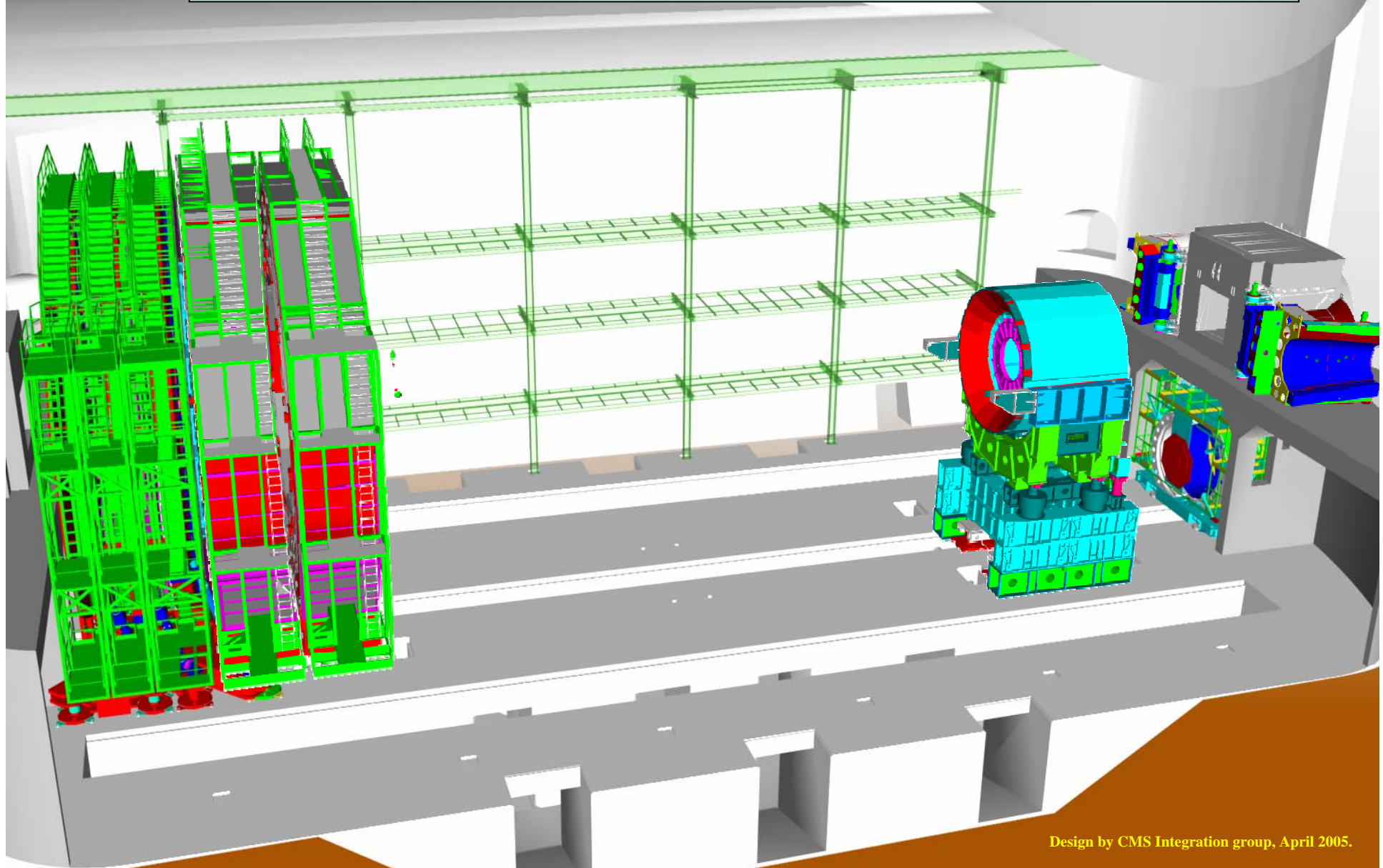
Design by CMS Integration group, April 2005.

Lower HB+ move to far Z+



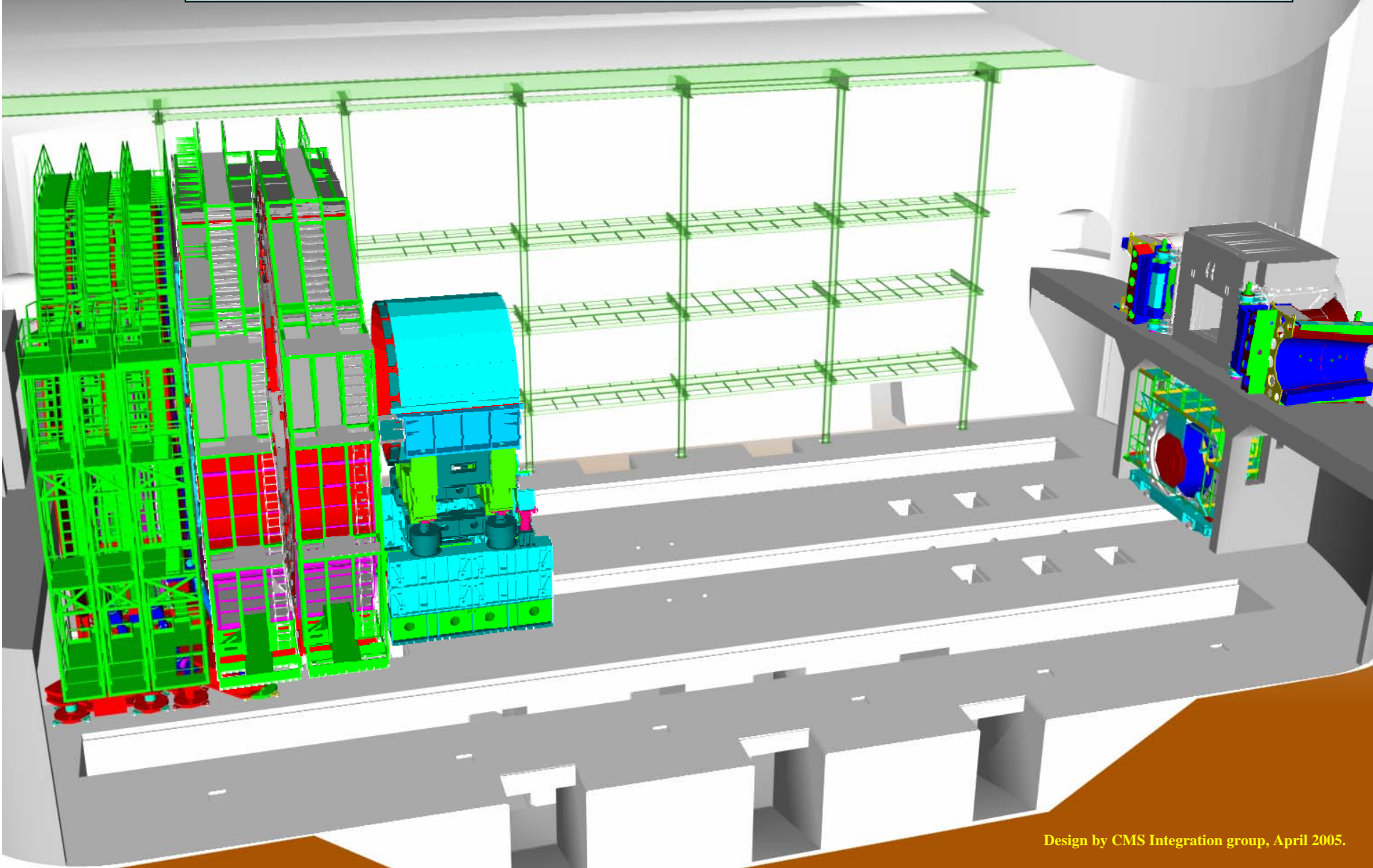
Design by CMS Integration group, April 2005.

Lower HB+ move to far Z+



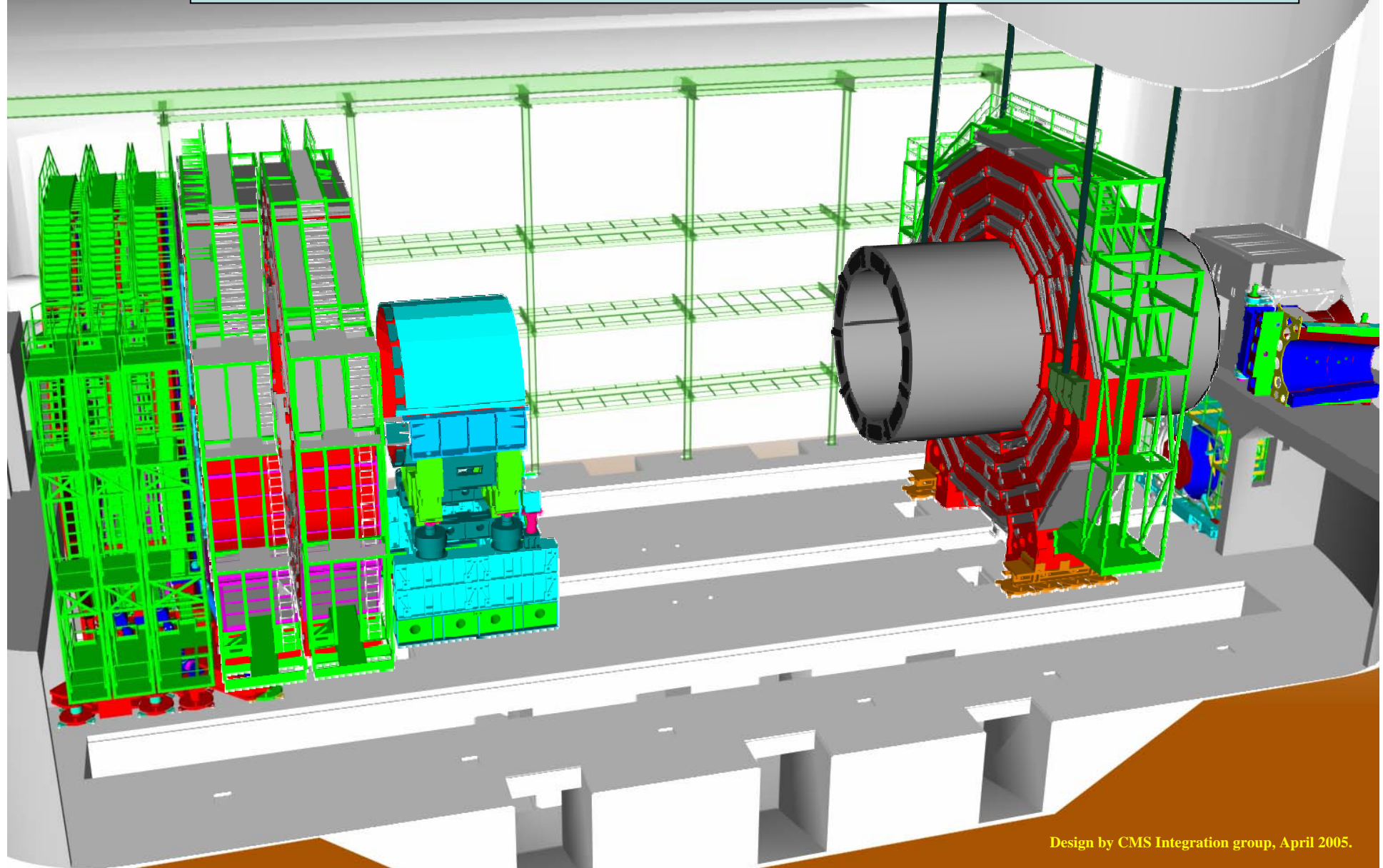
Design by CMS Integration group, April 2005.

Lower HB+ move to far Z+



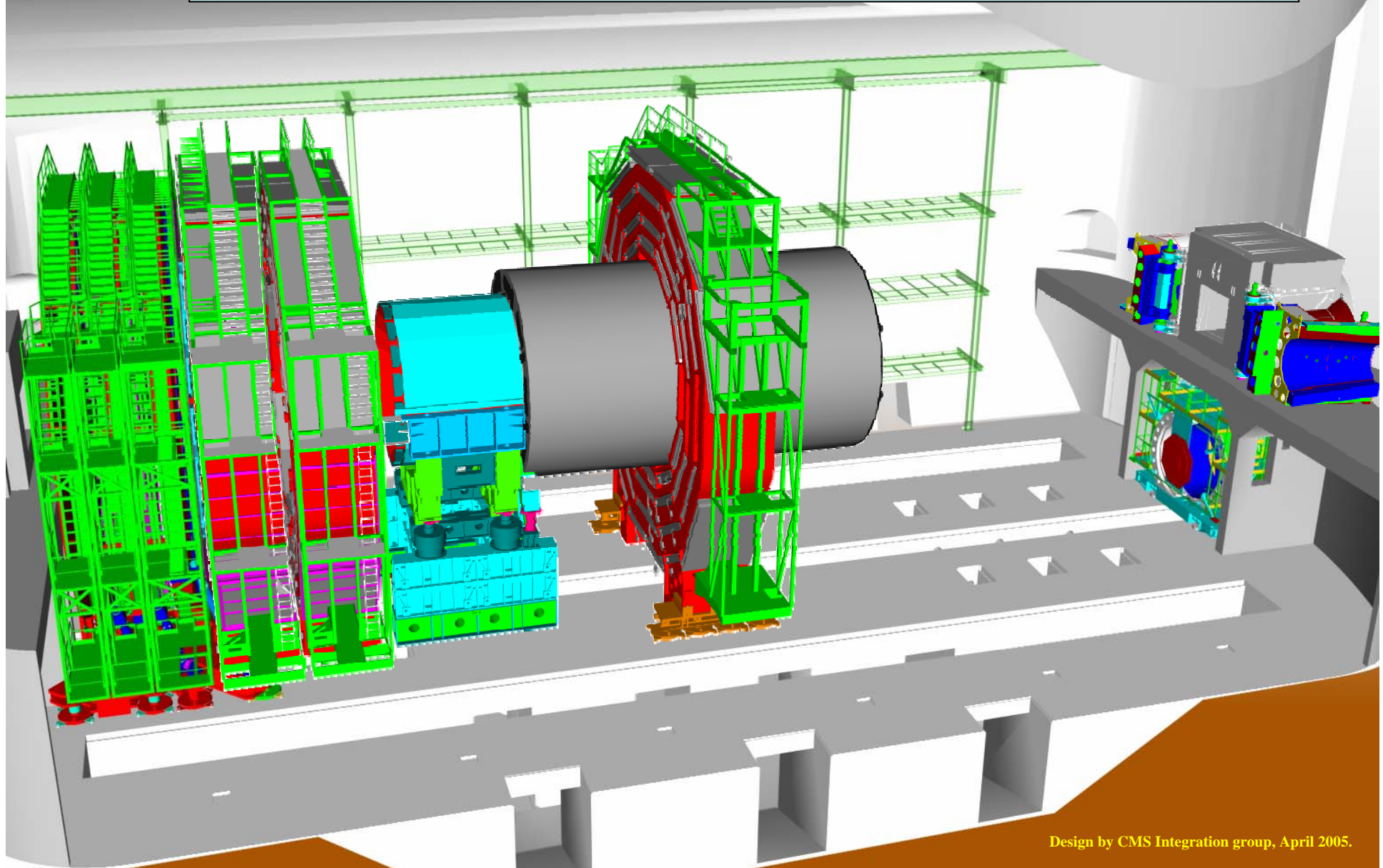
Design by CMS Integration group, April 2005.

Lower YB0 move to IP



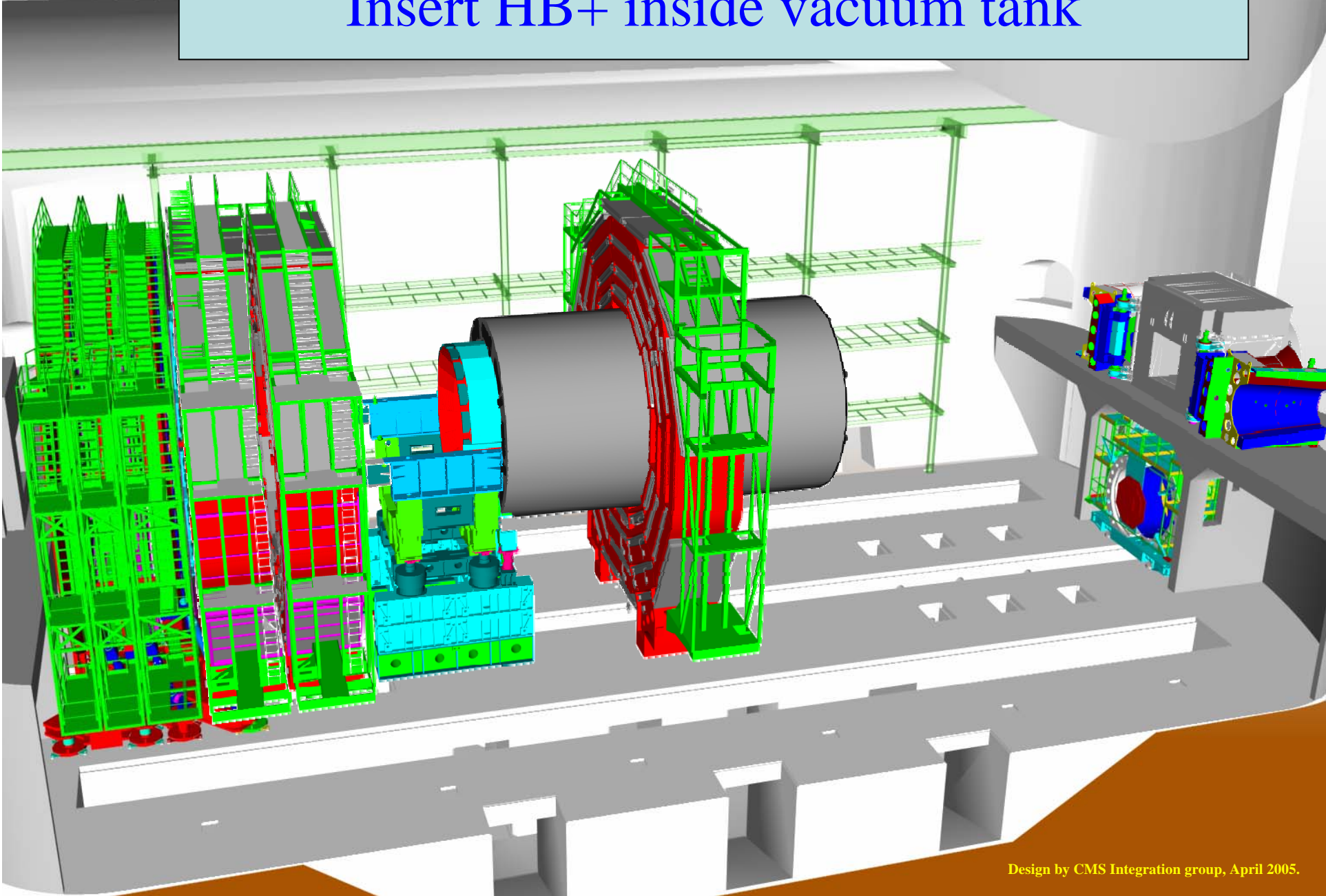
Design by CMS Integration group, April 2005.

Lower YB0 move to IP



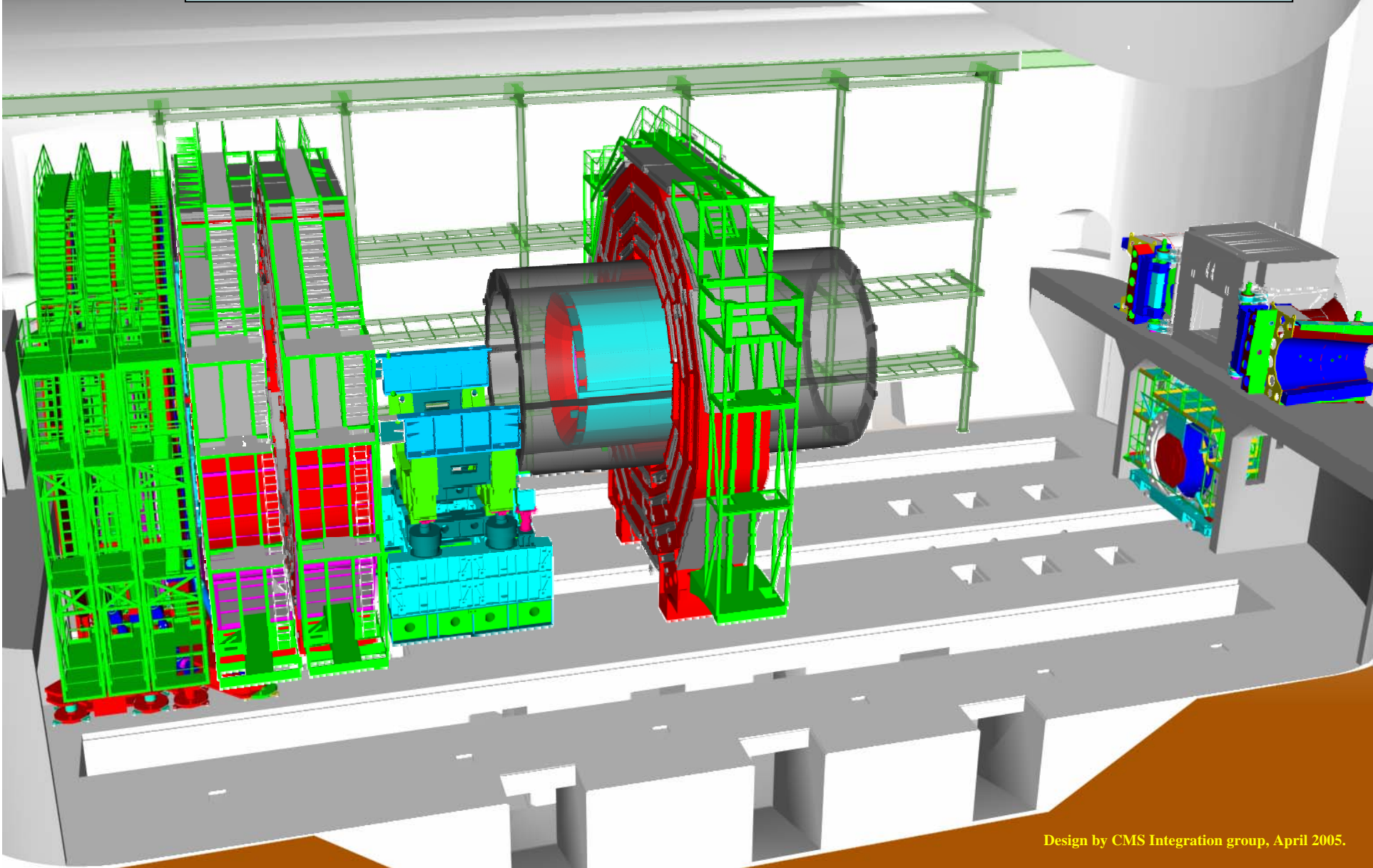
Design by CMS Integration group, April 2005.

Insert HB+ inside vacuum tank



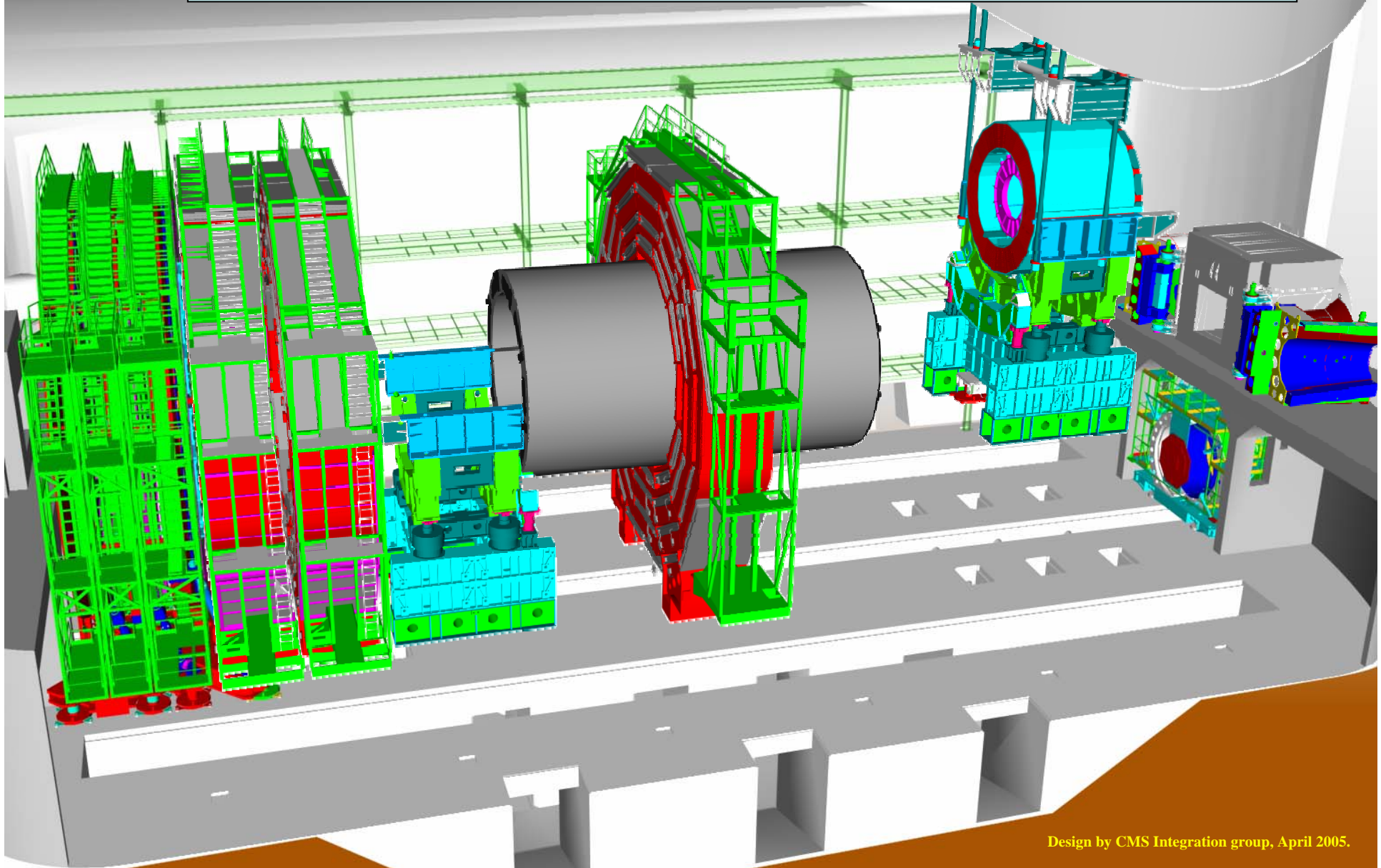
Design by CMS Integration group, April 2005.

Move HB+ inside vacuum tank



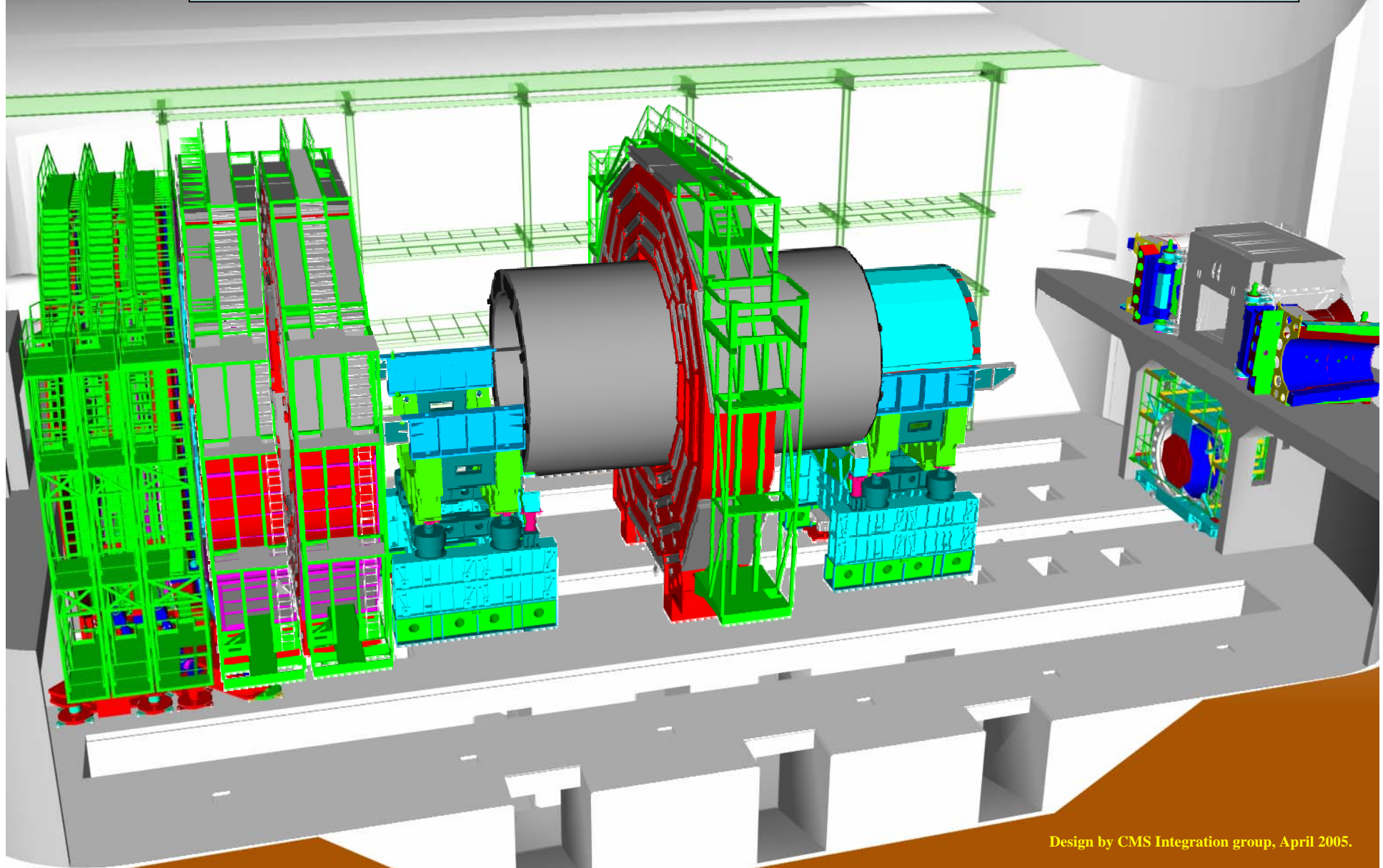
Design by CMS Integration group, April 2005.

Lower HB- move near YB0



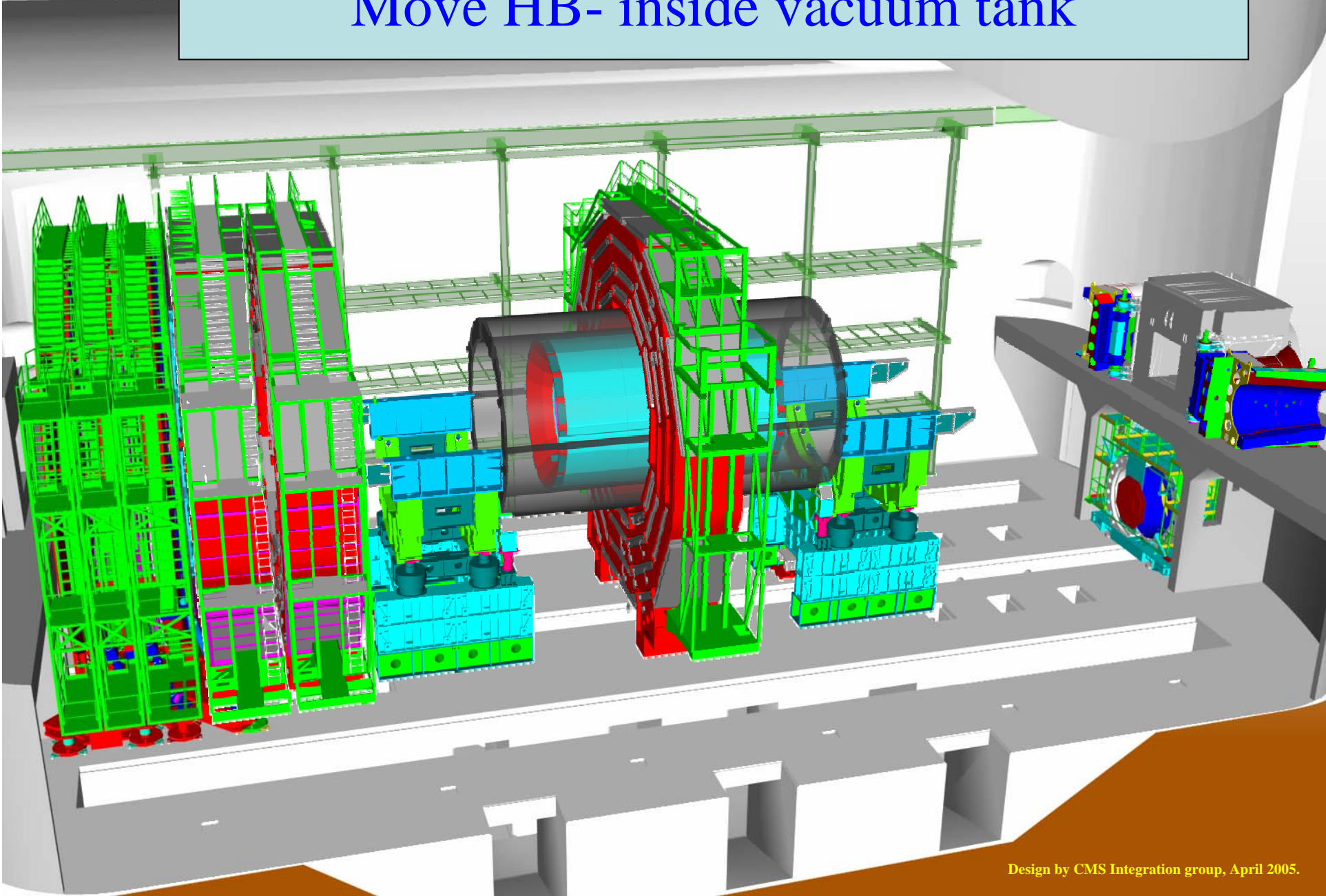
Design by CMS Integration group, April 2005.

Lower HB- insert in vacuum tank



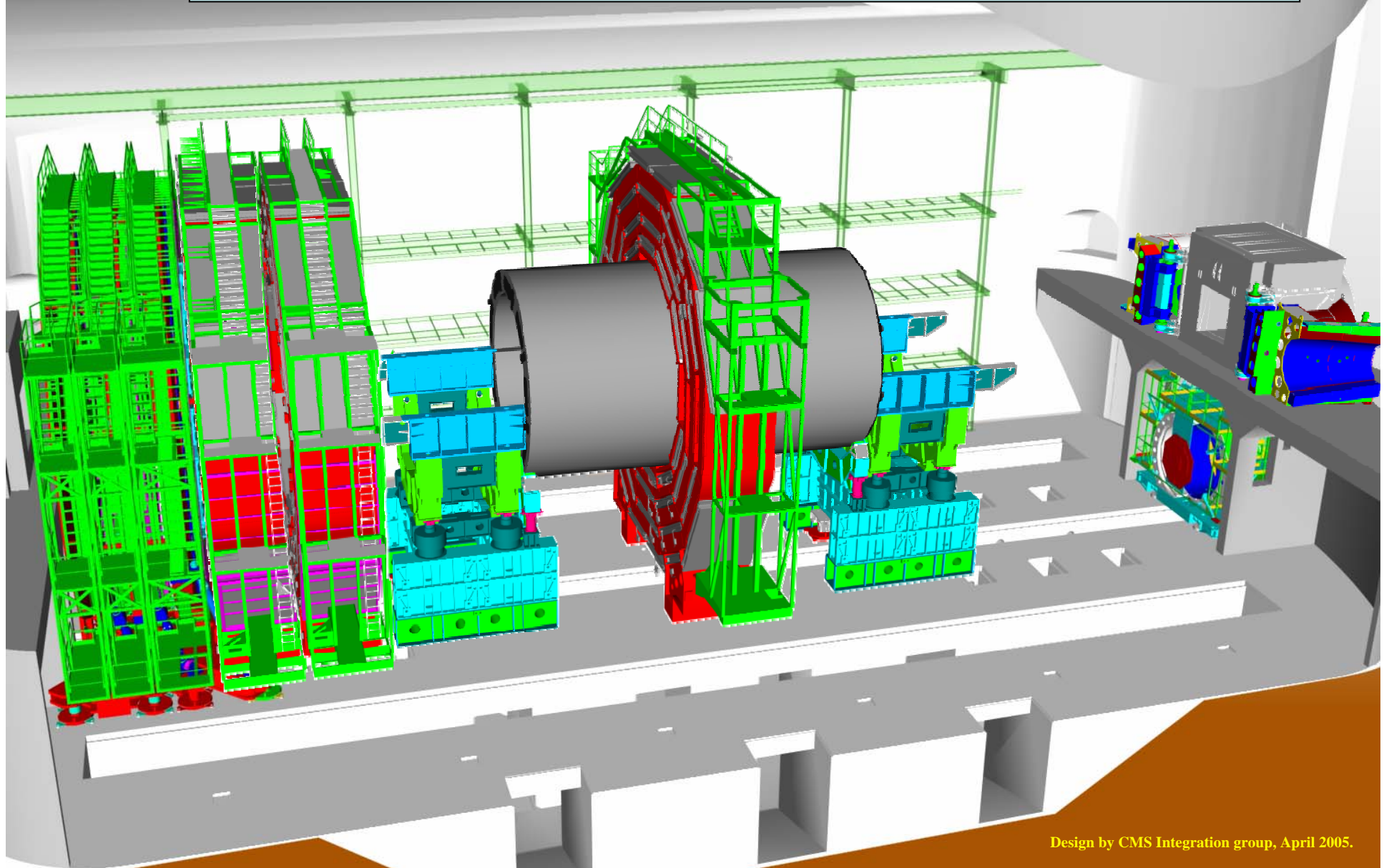
Design by CMS Integration group, April 2005.

Move HB- inside vacuum tank



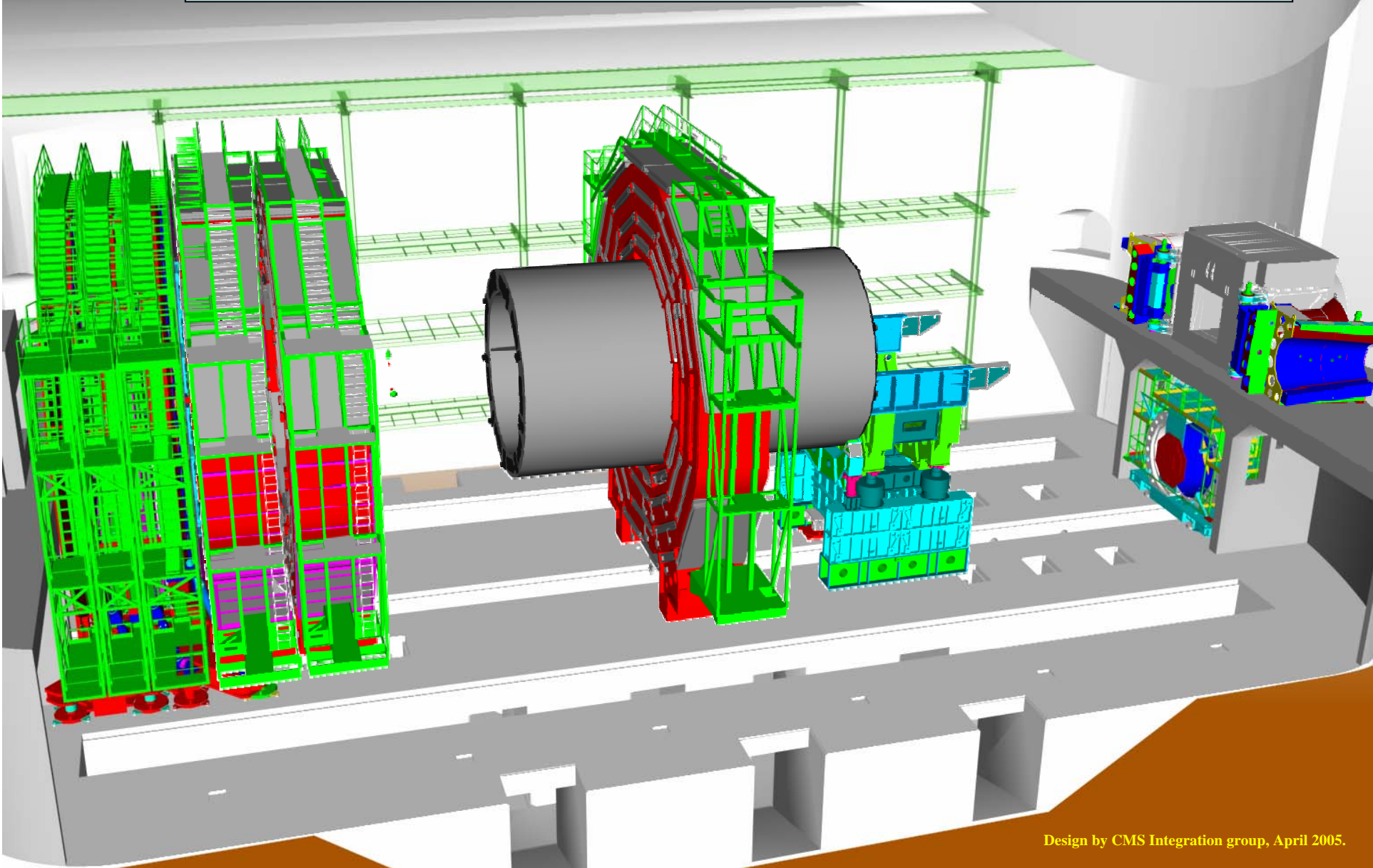
Design by CMS Integration group, April 2005.

Start HB cradle removal

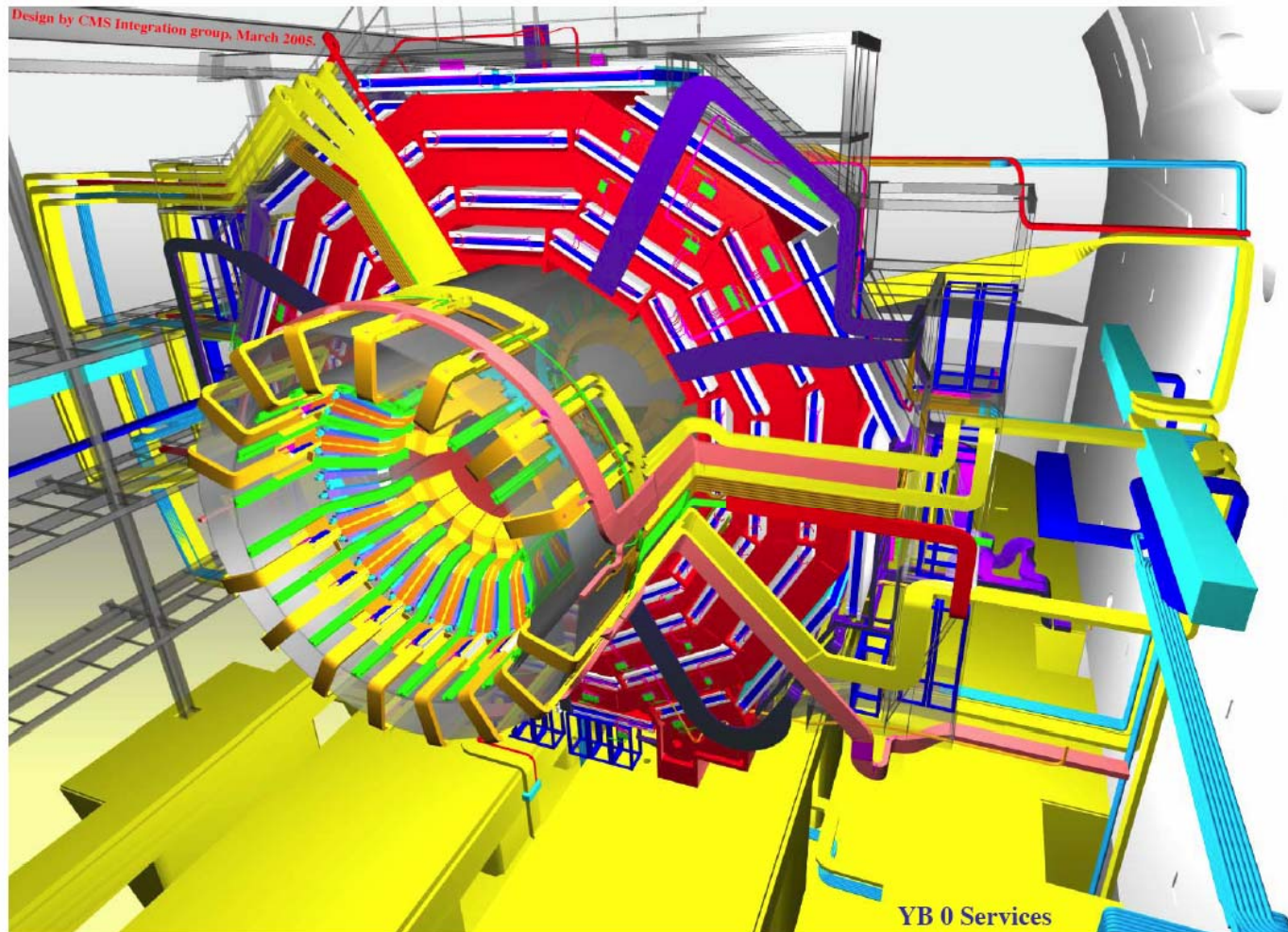


Design by CMS Integration group, April 2005.

Remove HB+ cradle

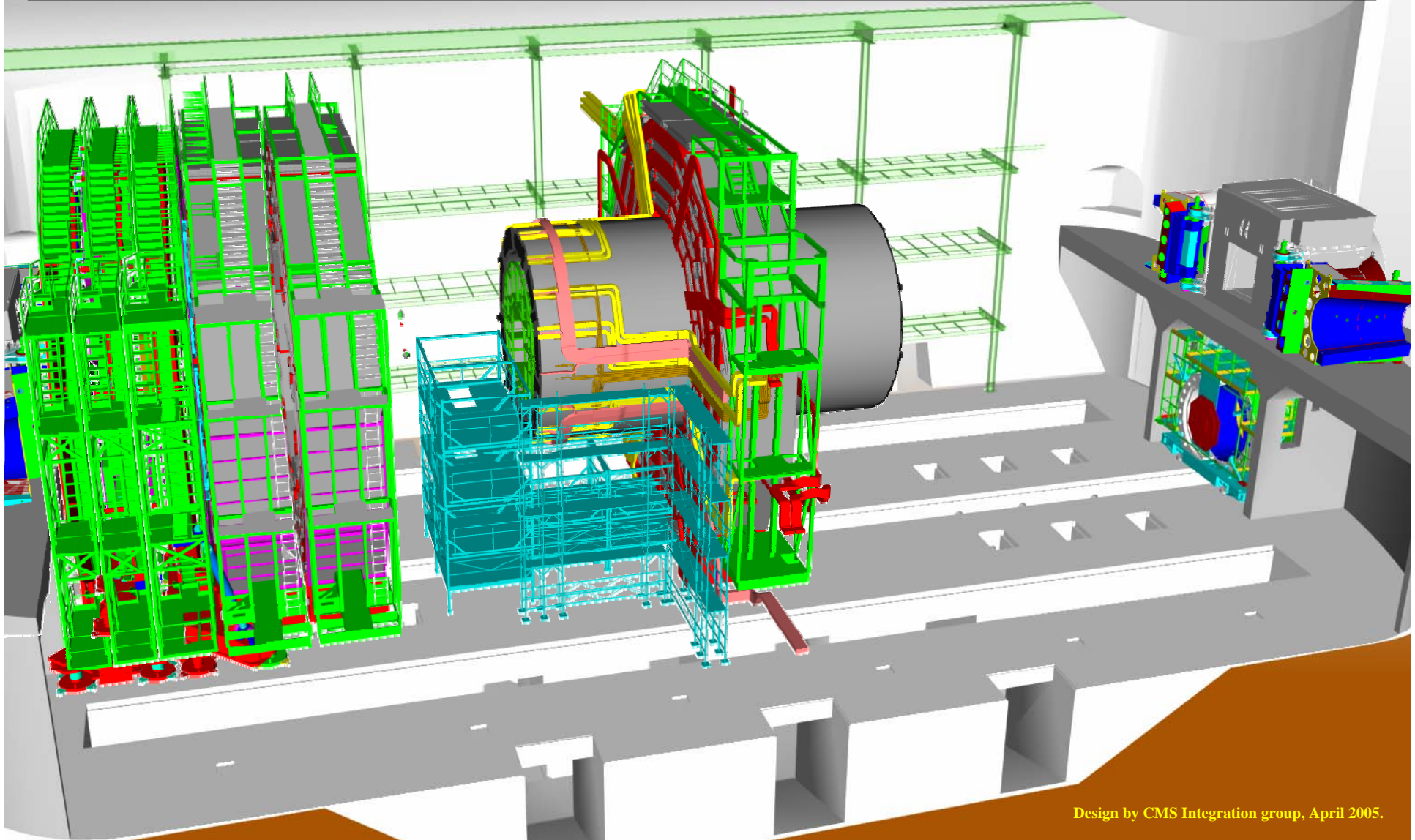


Design by CMS Integration group, April 2005.



3D model of the YB0 services to be installed

During installation of cables on YB0,
minus side wheels and disks can be completed on the surface



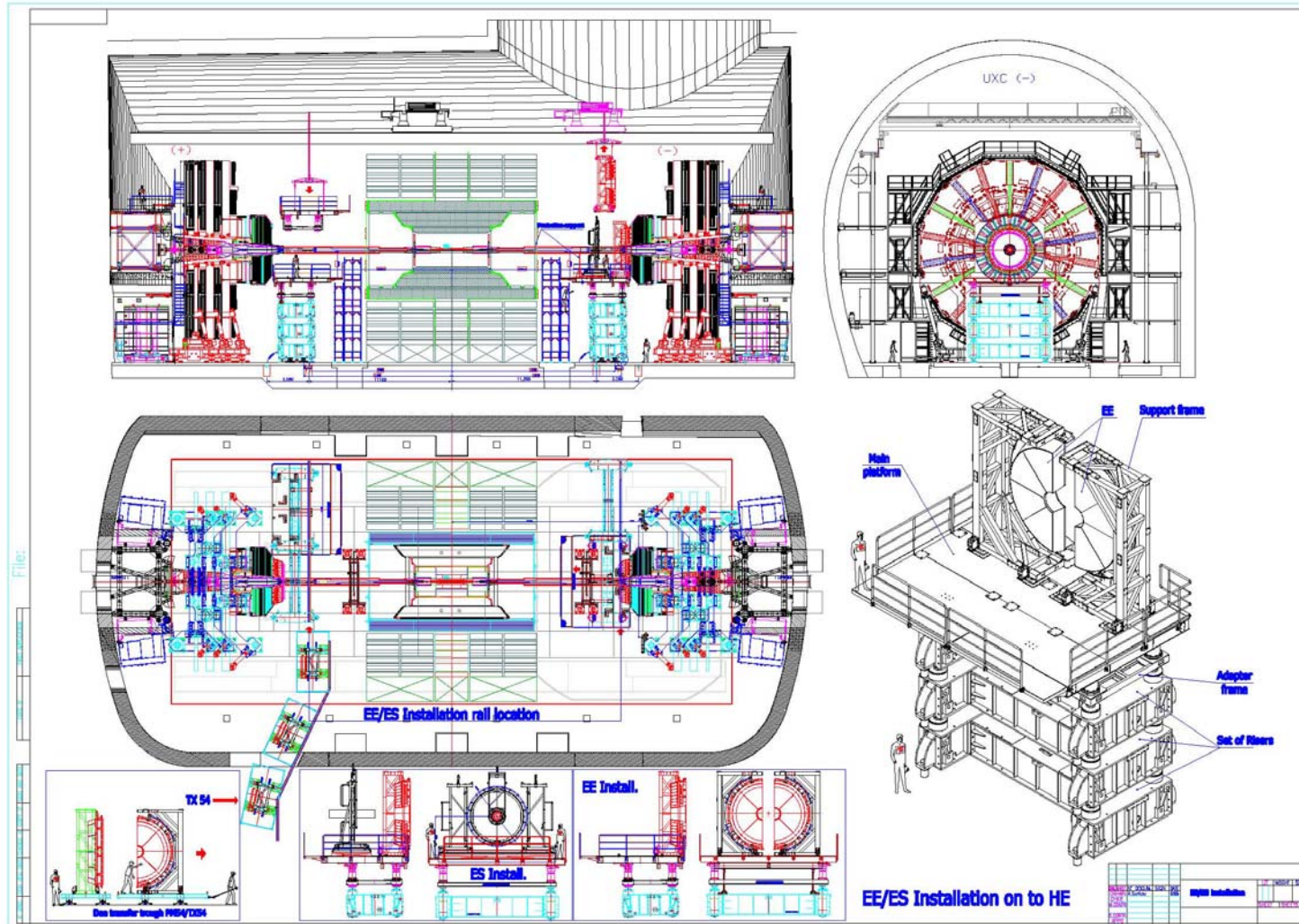
Design by CMS Integration group, April 2005.



Situation Underground during Shut-downs

Installation of EE during the first Shut-down

Typical 2D installation assembly drawing



Ecal End-cap installation inside UXC55.



Provisional Conclusions



Conclusions



- **We have been able to maintain the principles adopted in 1991/1992 without any compromising do date.**
- **The scenario of constructing on the surface followed by transfer underground looks still to us the best solution for a detector like CMS.**
- **However, principles and logistics definitions are not sufficient for a successful project, many other actors are needed in particular the implementation, very early in the game, of a powerful “Integration Project”.**



The "BIG CMS puzzle" to solve

CMS Engineering & Integration

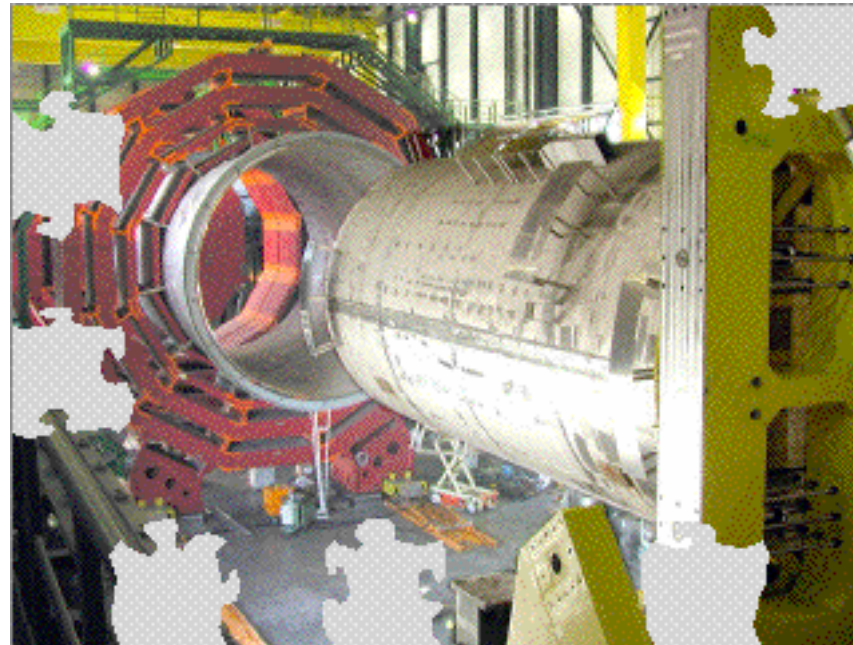


**Safety &
Quality Management**



**Sub-detectors
Parameters,
Envelopes
Installation**

**Configuration Management
Engineering data Management**



**Cables, Services
Gas & Cooling**



**Civil Engineering
Infrastructure**



**Beam pipe &
Vacuum systems**



to be continued...