



EUROPEAN
SPALLATION
SOURCE

The Evolution of the Cryogenic System of the European Spallation Source

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The ESS cryogenic system



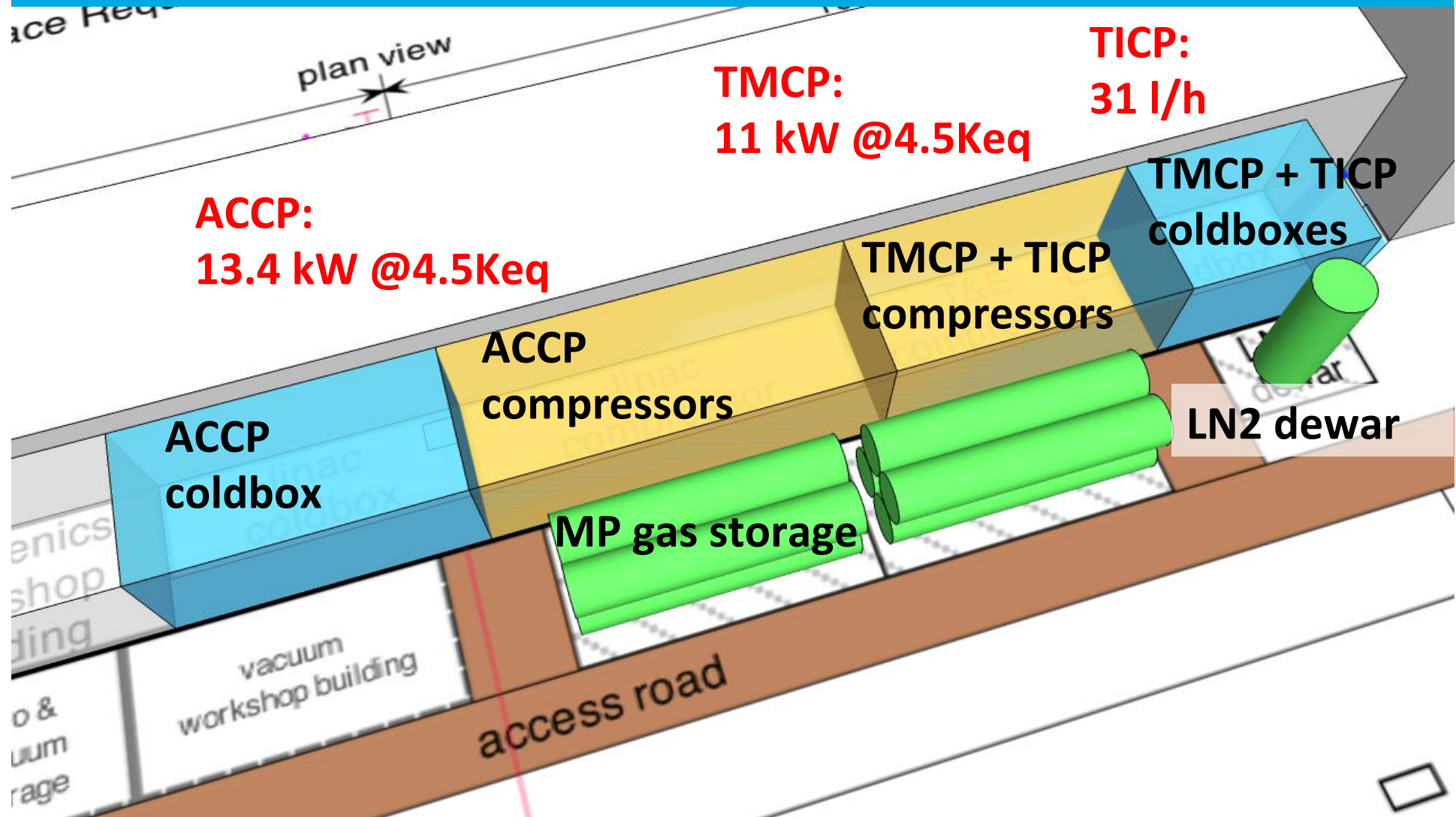
ESS: a spallation source, using a 5 MW proton beam to produce long pulse neutrons for research

Cryo clients:

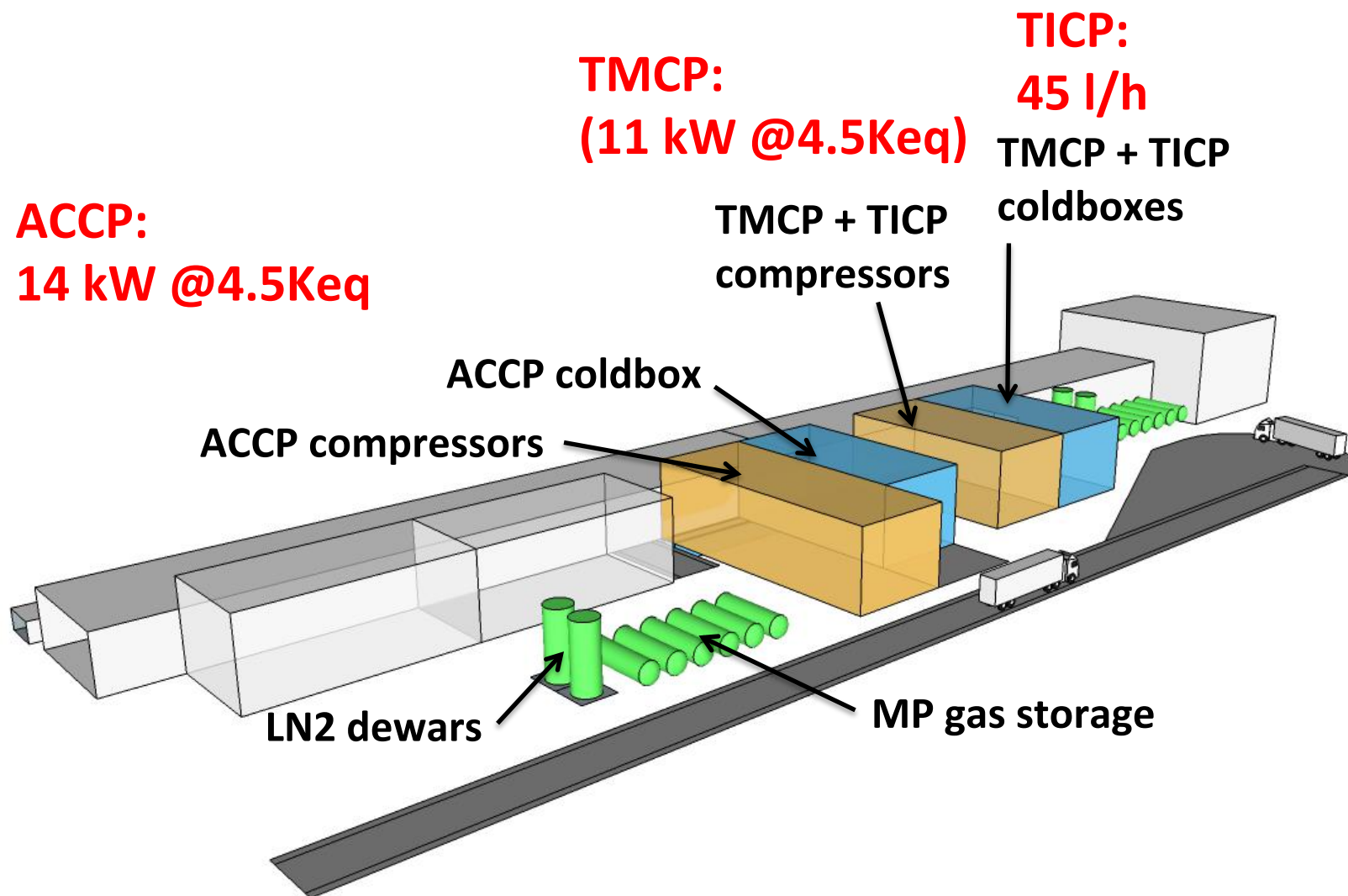
- accelerator: 146 SRF cavities at 2K
- target: two supercritical H₂ moderators
- instruments: consumers of LHe & LN₂
- test stand: testing 30 accelerator cryomodules



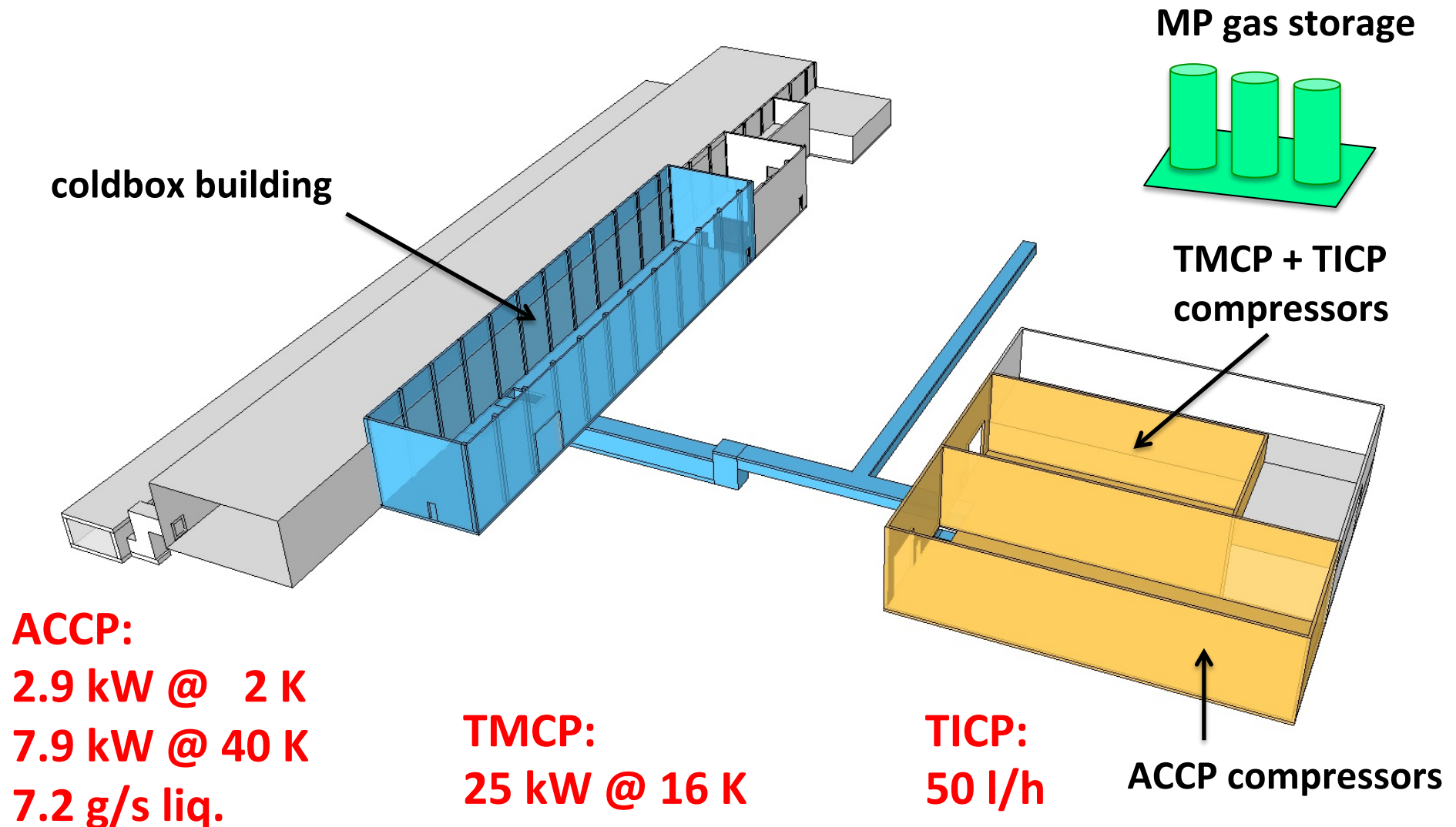
First Concept 2011: overview



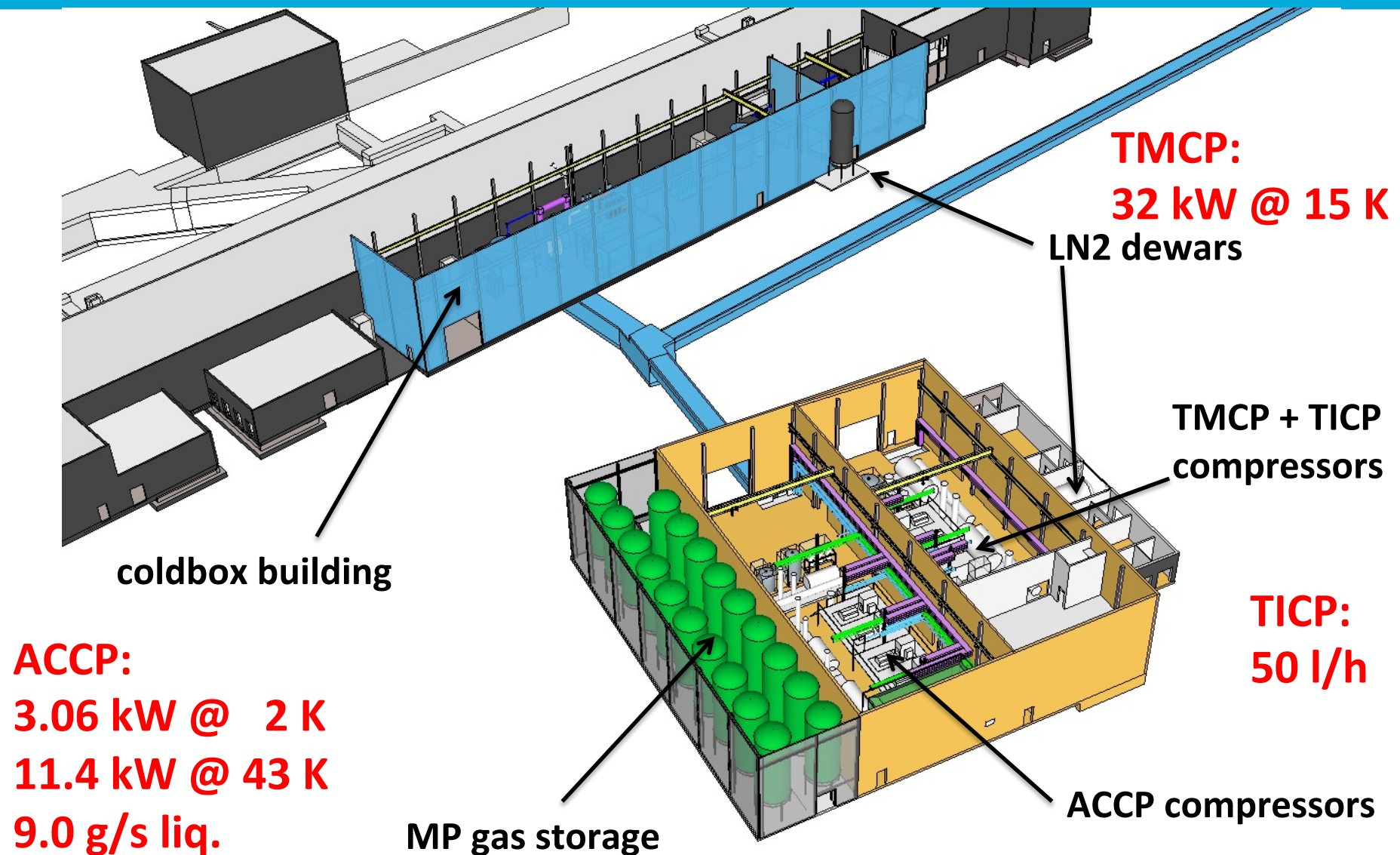
Second Concept 2012



Third Concept 2014



Current Layout 2015



Evolution of Heat Loads



source	date	accelerator cryoplant capacity	target cryoplant capacity	liquid helium yield
technical note	May 2011	13.4 kW @4.5Keq.	11 kW @4.5Keq.	31 l/h
CDR	Feb. 2012	14.0 kW @4.5Keq.	-	45 l/h
TDR	Apr. 2013	1.7 kW @ 2 K + 1.2 kW @ 5-8 K + 7.9 kW @ 40 K + 7.2 g/s liquefaction	25 kW @ 16 K (no contingency)	50 l/h
technical specifications	Jun. 2015	2.23 kW @ 2 K + 0.83 kW @ 2-4 K + 11.4 kW @ 33-53 K + 9.0 g/s liquefaction	32 kW @ 15 K	50 l/h

Compromises



- parallel design of cryo system and buildings/utilities
- necessary for schedule
- requires very close communication
- requires a healthy set of margins

Lessons learned



- location of TMCP was placed too far from target
- target H2 system not in cryo group's control
- procurement of ACCP should have been 'competitive dialog'
- requirements for buildings should have been defended better

Future



- ACCP: specified and ordered, design ongoing, plant ready in 2018
- TMCP: being specified, procurement in 2015, plant ready in 2018
- TICP: specified, procurement started, order in 2015, plant ready in 2017
- CDS: specified and ordered, design ongoing, ready in 2018

An aerial architectural rendering of a modern building complex, likely a university or research facility, situated in a lush green landscape. The main building is a long, low structure with a series of interconnected volumes and a prominent, curved, light-colored roof. To its right, there are several smaller, more traditional-looking buildings. The surrounding area is filled with green grass, scattered trees, and winding paths. A road runs along the top left, and a small body of water is visible on the left side. The overall scene is bright and sunny, with long shadows cast across the grass.

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