



# FUTURE CIRCULAR COLLIDER

FCC-ee Infrastructure

K Hanke, CERN

# FCC-EE INFRASTRUCTURE

K Hanke, CERN



# Technical Infrastructure Working Group

integration • geodesy • electricity & energy management • cooling & ventilation • cryogenic systems • computing infrastructure • safety • operation & maintenance • transport, installation & logistics



Safety		
 Wear Safety Glasses	 Flammable	 Hazardous
 Toxic	 Corrosive	 Oxidising
 Explosive	 Gloves	 Safety Glasses



# 8-site baseline "PA31"

Number of surface sites	8
LSS@IP (PA, PD, PG, PJ)	1400 m
LSS@TECH (PB, PF, PH, PL)	2143 m
Arc length	9.6 km
Sum of arc lengths	76.9 m
Total length	91.1 km

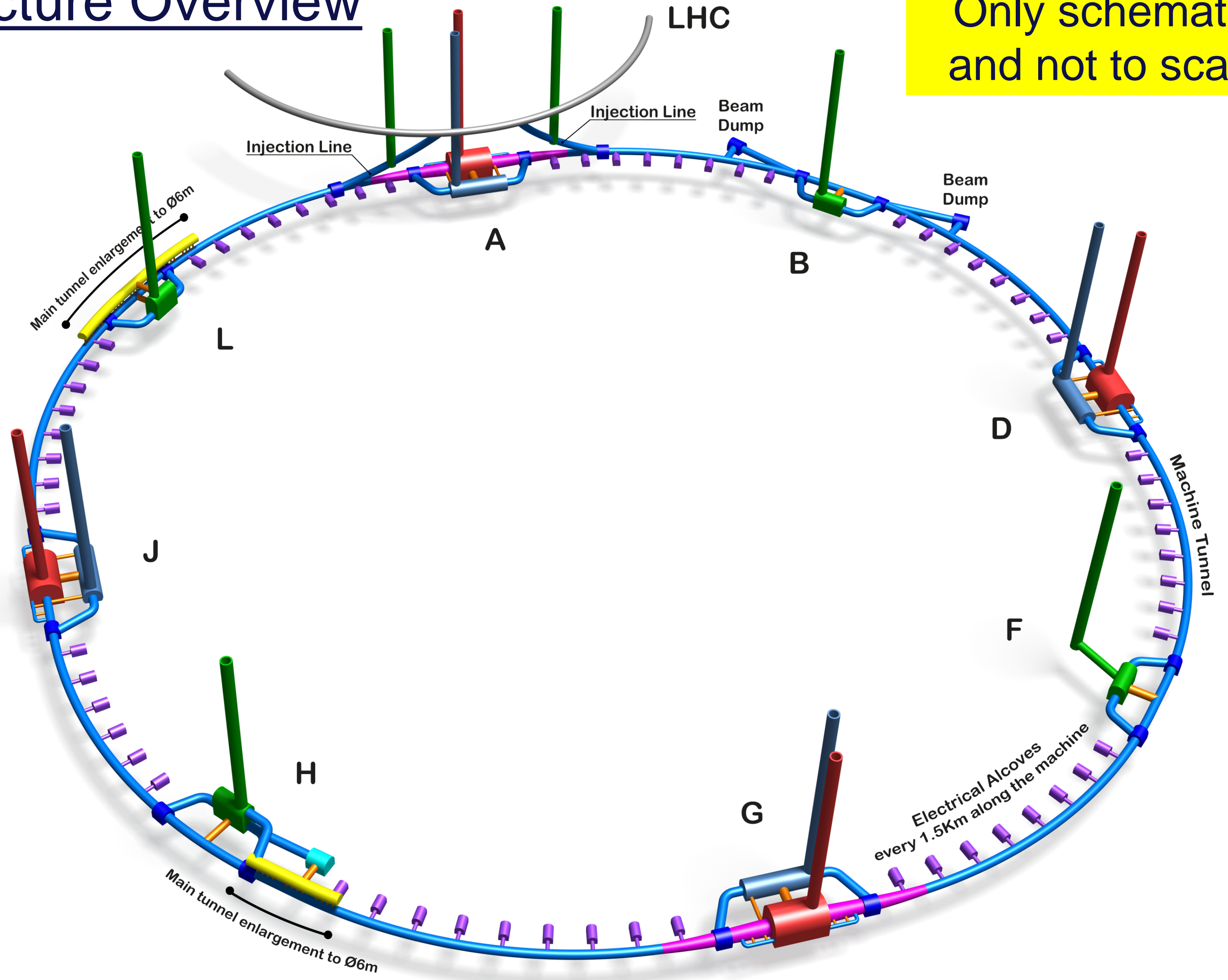
- 8 sites – less use of land, <40 ha instead 62 ha
- Possibility for 4 experiment sites in FCC-ee
- All sites close to road infrastructures (< 5 km of new road constructions for all sites)
- Vicinity of several sites to 400 kV grid lines
- Good road connection of PD, PF, PG, PH suggest operation pole around Annecy/LAPP



# FCC-ee Underground Structure Overview

Only schematic, and not to scale.

- █ FCC Tunnels
- █ Experimental points
- █ Access points
- █ Service caverns
- █ Connection tunnels
- █ Electrical alcoves
- █ Klystron galleries
- █ Tunnel widening
- █ Cryo cavern
- █ LHC

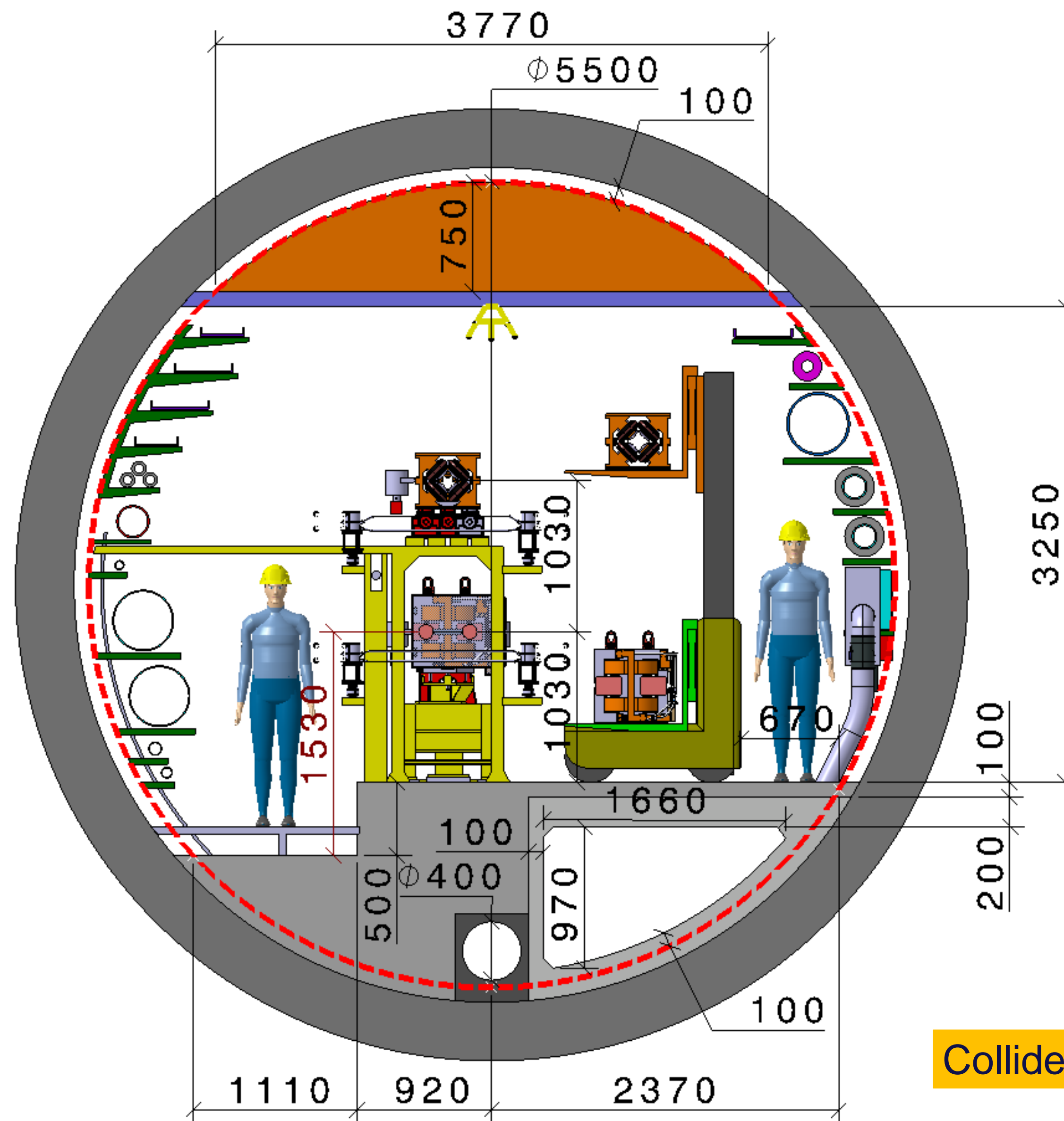


Courtesy A. Navascues Cornago

# Integration of FCC-ee Arc Cell

# Integration of FCC-ee machine elements (regular arc)

Machine tunnel 5.5m in diameter



Main cross section as for FCC-hh  
 Main ring below of booster ring  
 Main ring and booster ring 1.03 m distant  
 Water distribution changed to DN550

Courtesy F. Valckkova-Georgieva

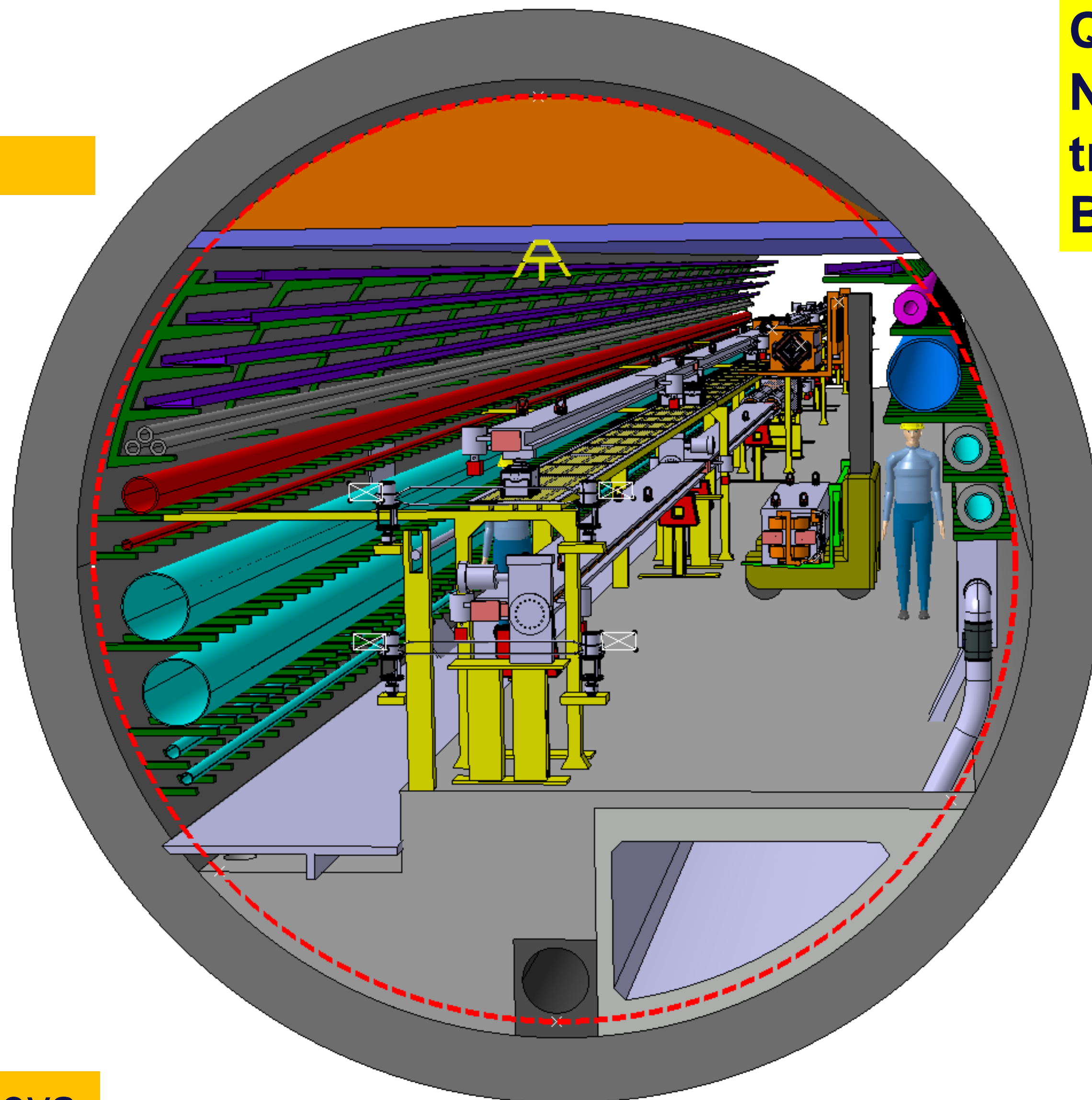
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# Integration of FCC-ee machine elements (regular arc)

## Perspective view

Machine tunnel 5.5m in diameter



**Question for BI:  
Needs for cables, cable  
trays, other infrastructure  
Best guess is sufficient**

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Courtesy F. Valckkova-Georgieva



# Alternative Integration of FCC-ee Arc Cell



# Alternative Integration of FCC-ee machine elements (regular arc)

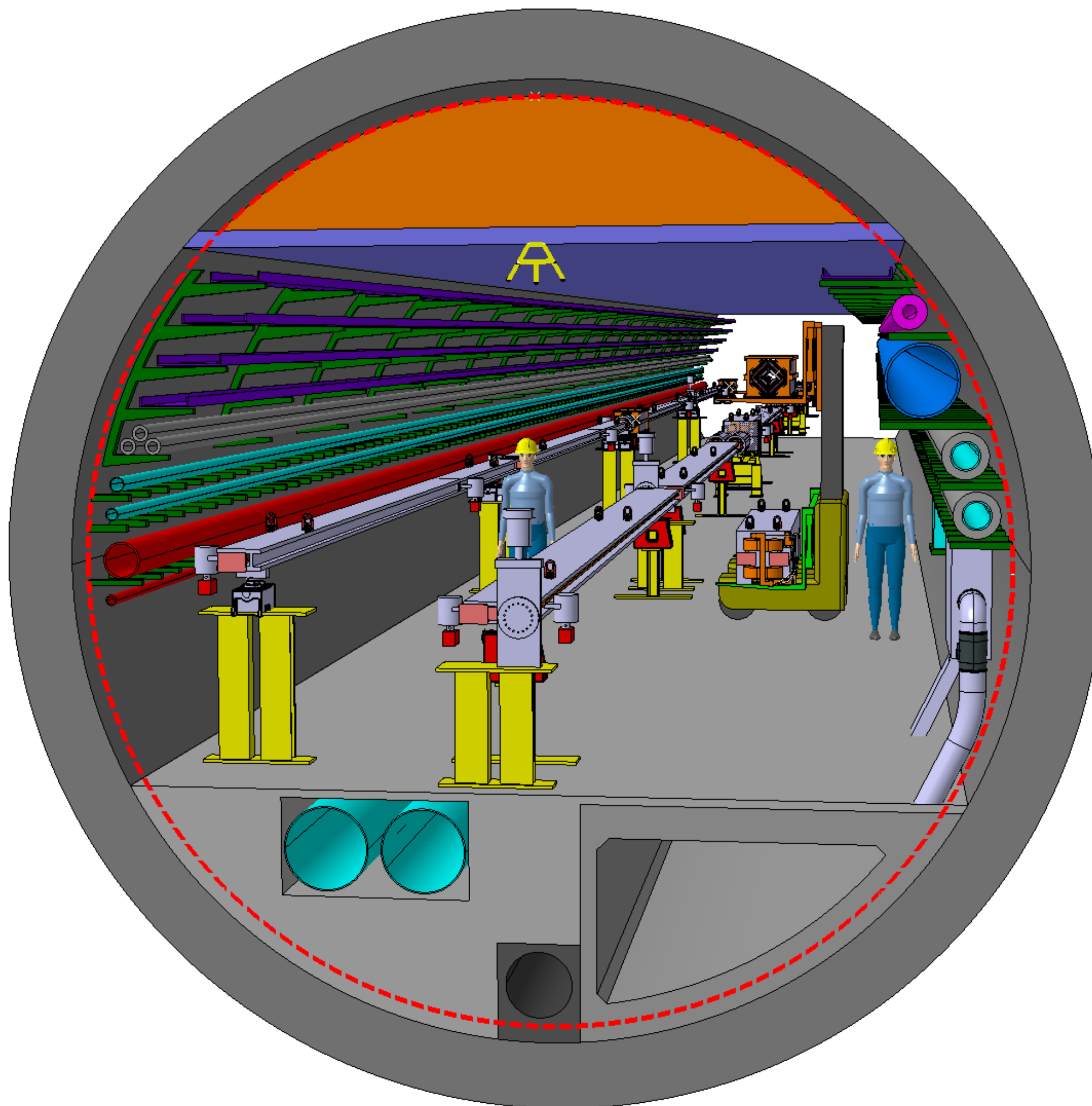
## Perspective view

Machine tunnel 5.5m in diameter

**Question for BI:**  
Needs for cables, cable trays, other infrastructure  
Best guess is sufficient

**Is there a preference for either vertical stacking or parallel configuration of Collider / Booster?**

**Beam instrumentation for Booster?**



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# Alcoves

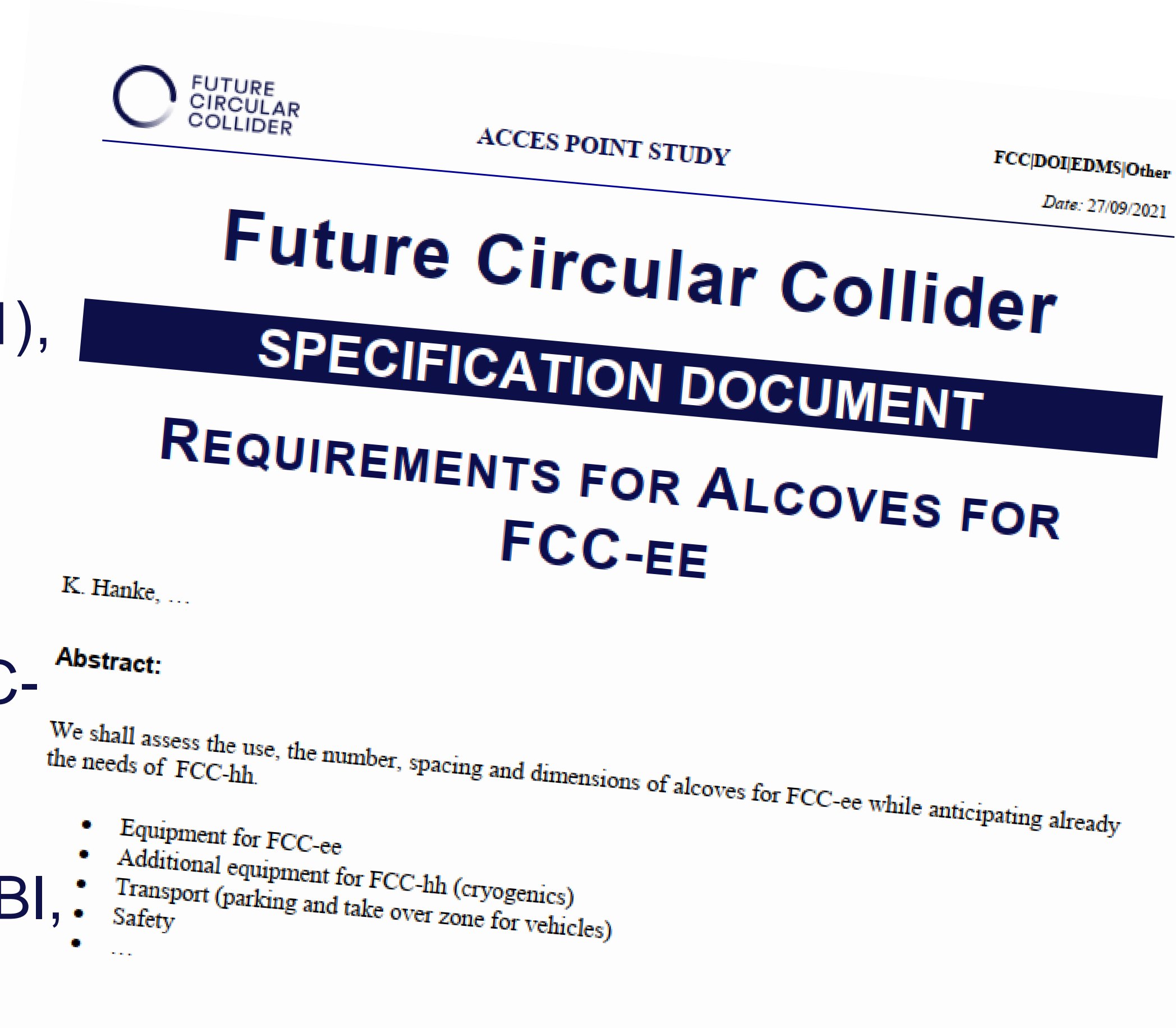
Under study

Present base line is alcoves every 1.5 km (from study 1), i.e. 66 alcoves

Users:

- Transport (parking, overtaking vehicles)
- Safety
- Cryogenics (minor user for FCC-ee, but a lot for FCC-hh!)
- Cooling & Ventilation
- Equipment groups (power supplies, racks, vacuum, BI, ...)

We are in the process of editing a specification document  
 Your input is appreciated!  
 (best guess / scaling from LEP/LHC)



**Question for BI:  
 Needs for space (racks etc.)  
 Best guess, scaling from  
 LEP/LHC is sufficient**

# Alcoves

The need for smaller trenches close the magnets / equipment around the ring was also discussed (in order to reduce cable length).

**Question for BI:  
Would BI be a potential user  
for this? What are the  
maximum cable lengths to  
the equipment?**

# Surface Sites

For all technical and experimental points the surface installations have been compiled in large tables

<https://twiki.cern.ch/twiki/bin/viewauth/FCC/ProjectElements>

These tables summarise to our best present knowledge the requirements in terms of surface, location, capacity etc. for all infrastructure services

Tables are continuously being updated and are the basis for a more detailed CE integration study

**Question for BI:  
Special requirements?  
Office / storage space, lab  
space, etc.?**

# Summary of Infrastructure Work Packages

- Integration: As soon as you have any 3D drawings please get back to us!
- Survey: foresee alignment targets, should be standard
- Electricity; probably minor user
- C&V; probably minor user
- Cryo: not concerned unless there is any diagnostics in the cold environment (for FCC-ee this is only the RF)
- Computing
- Safety
- Operation
- Transport: should not be a big issue; we are designing a transport system running at approximately 30 km/h in order to facilitate interventions

If anything comes to your mind, please get back to us. Bi-weekly TIWG meetings are open to everyone. Where is BI interfacing with the FCC study?

# Summary

- Probably more questions than answers
- All is work in progress... trying to freeze a base line by the end of 2022, and based on this make a costing exercise in 2023
- Next major milestones are FCC week May 2023 and mid-term review autumn 2023





Thank you for your attention