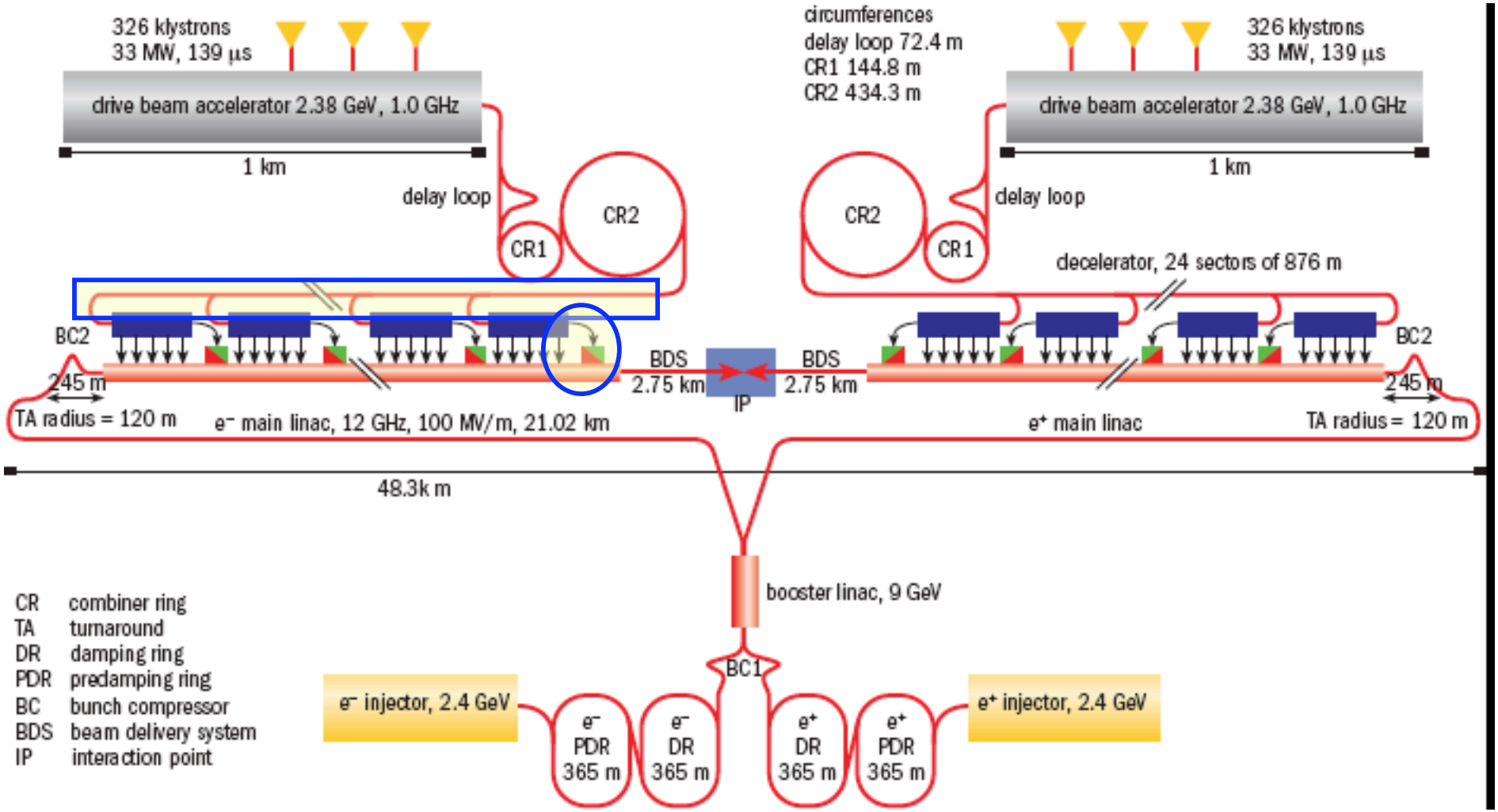
Long Transfer Lines in the main tunnel

B.Jeanneret CERN / AB

CLIC Workshop, Oct 2008

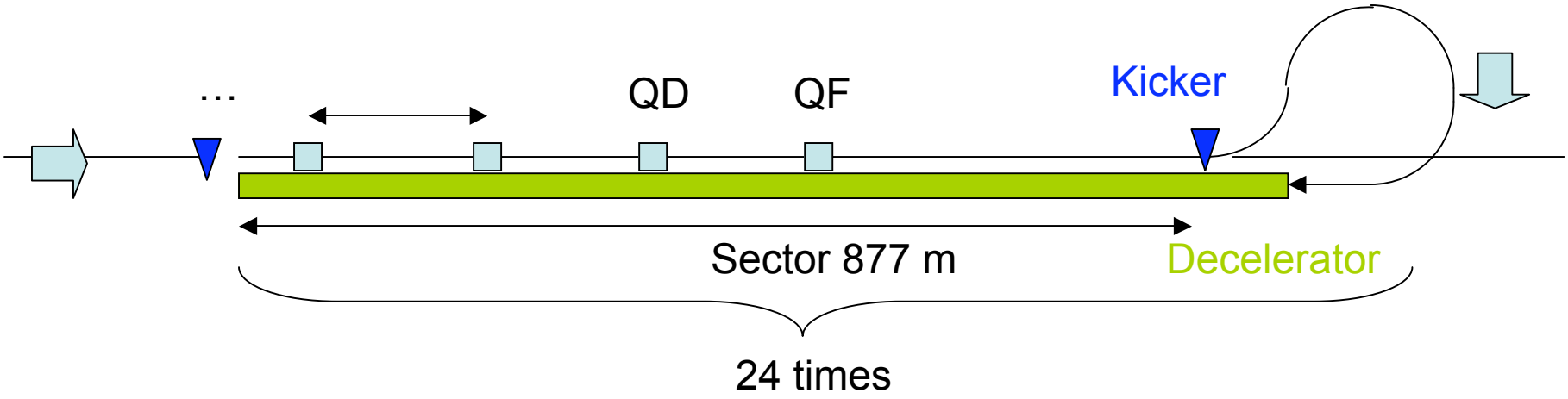
Outline

- Long transfer line, Main + Drive Beam
  - Optics + longitudinal layout
  - Transverse layout
  - Integration in the tunnel (space reservation …)
- Issues related to turnaround
- Issues around the dump sections

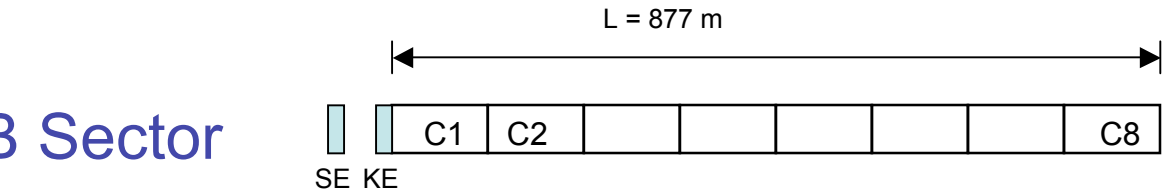

326 klystrons
33 MW, 139 μs
drive beam accelerator 2.38 GeV, 1.0 GHz
1 km
delay loop
CR1
CR2
circumferences
delay loop 72.4 m
CR1 144.8 m
CR2 434.3 m
326 klystrons
33 MW, 139 μs
drive beam accelerator 2.38 GeV, 1.0 GHz
1 km
delay loop
CR2
CR1
decelerator, 24 sectors of 876 m
BC2
245 m
TA radius = 120 m
BDS
2.75 km
IP
BDS
2.75 km
e⁻ main linac, 12 GHz, 100 MV/m, 21.02 km
e⁺ main linac
BC2
245 m
TA radius = 120 m
48.3k m
booster linac, 9 GeV
BC1
e⁻ injector, 2.4 GeV
e⁻ PDR 365 m
e⁻ DR 365 m
e⁺ DR 365 m
e⁺ PDR 365 m
e⁺ injector, 2.4 GeV
CR combiner ring
TA turnaround
DR damping ring
PDR predamping ring
BC bunch compressor
BDS beam delivery system
IP interaction point

Long DB transfer line

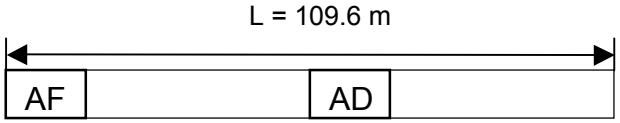
- Aim : transport the Drive Beam trains from the central area of the site towards the head of the Main Linac
- Deflect a train in each turnaround, one after the other



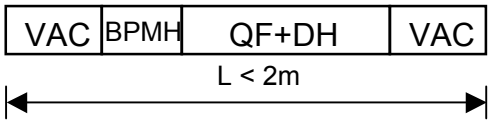
DB Sector



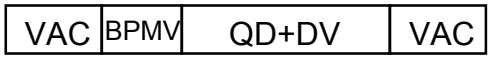
Cell C1..C8



Assembly AF

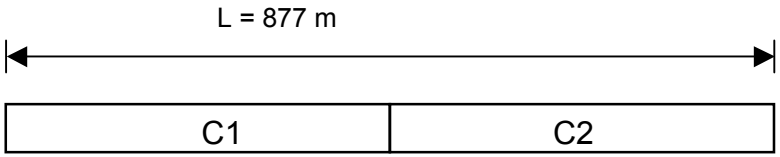


AD

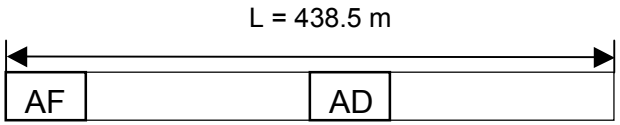


Layout by Sector
For Drive Beam
& Main Beam

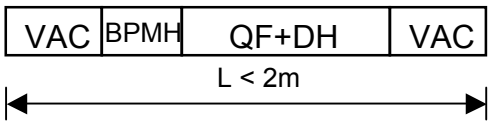
MB Sector



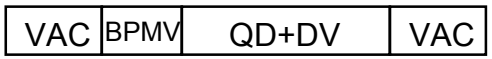
Cell C1,C2



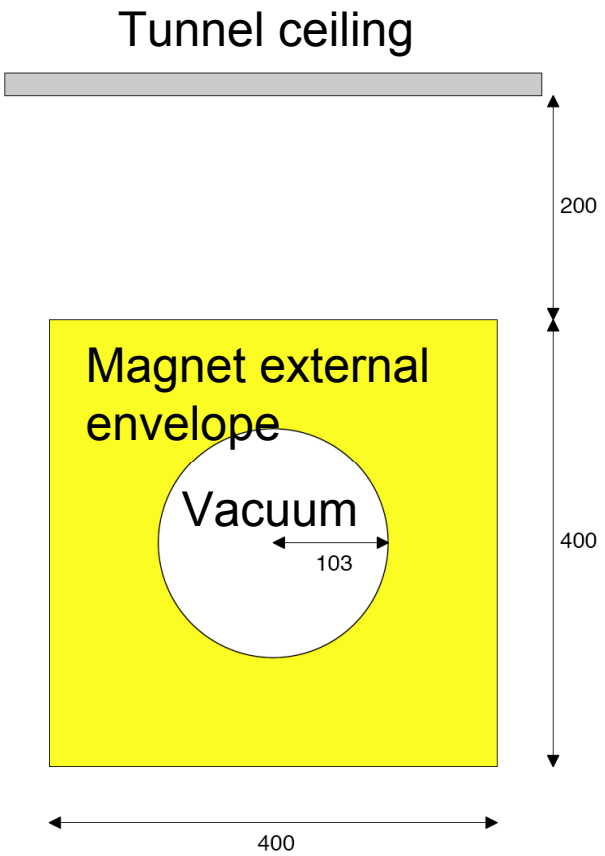
Assembly AF



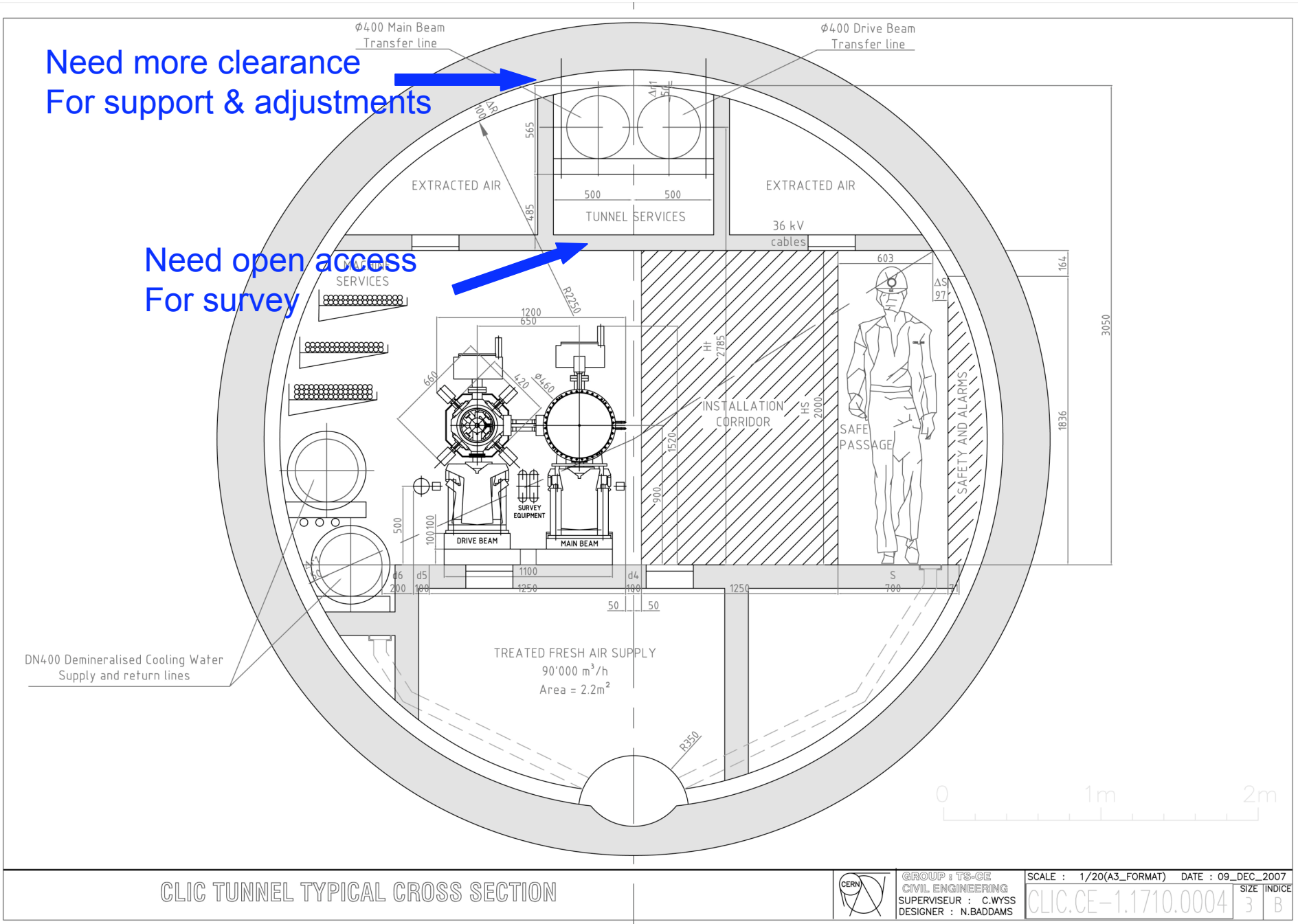
AD



Magnets, DB & MB



- Quadrupole and dipole embedded
- Forces
  - Quad : Gl = 0.14 Tm/m
  - Dipole : Bl = 0.03 Tm
  - Same for DB & MB
  - > not demanding for electrical supply & cooling
- Length : as yet free
  - say l < 2 m
- MB : need solid static positionning (yet to make it a specification)
- Need free space for survey



CLIC TUNNEL TYPICAL CROSS SECTION

CERN

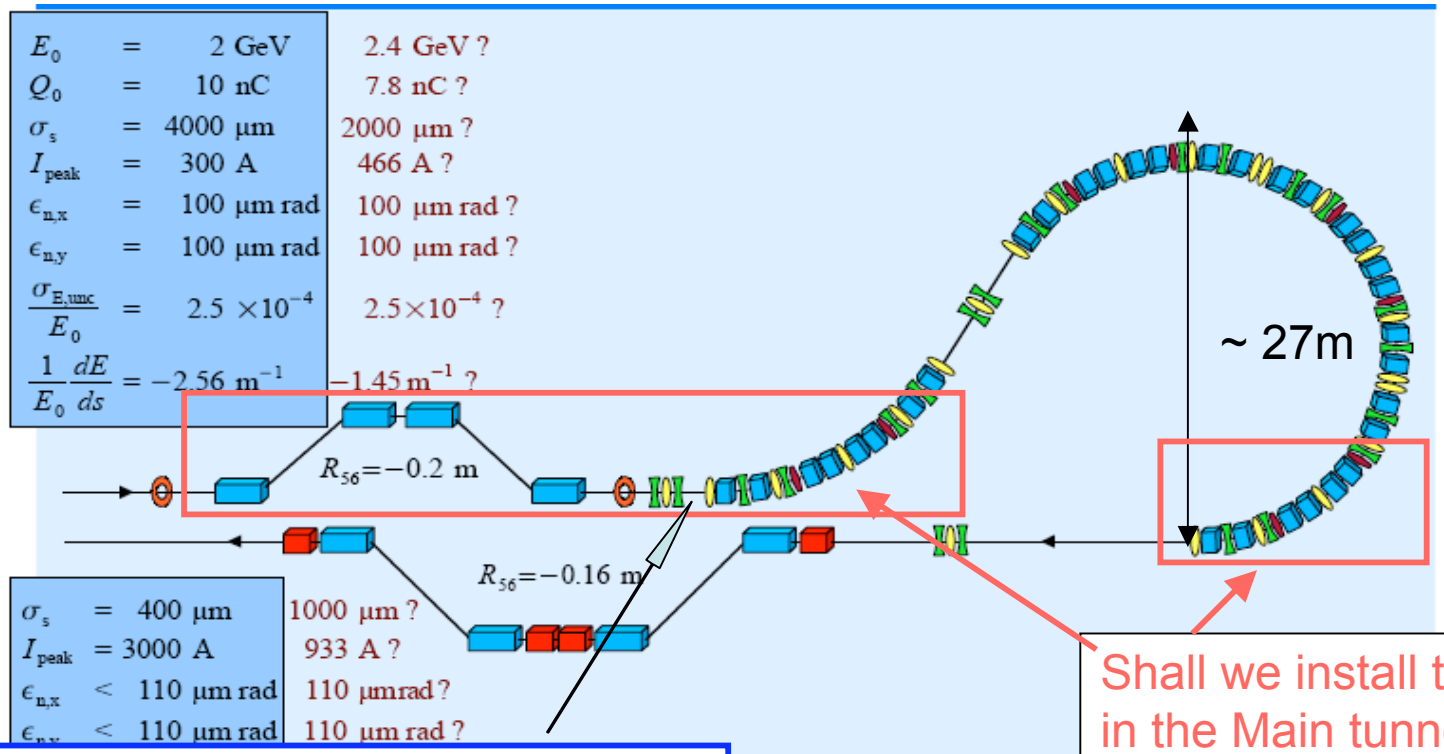
GROUP : TS-CE
CIVIL ENGINEERING
SUPERVISEUR : C.WYSS
DESIGNER : N.BADDAMS

SCALE : 1/20(A3_FORMAT) DATE : 09_DEC_2007

CLIC.CE-1.1710.0004 | SIZE 3 | INDICE B

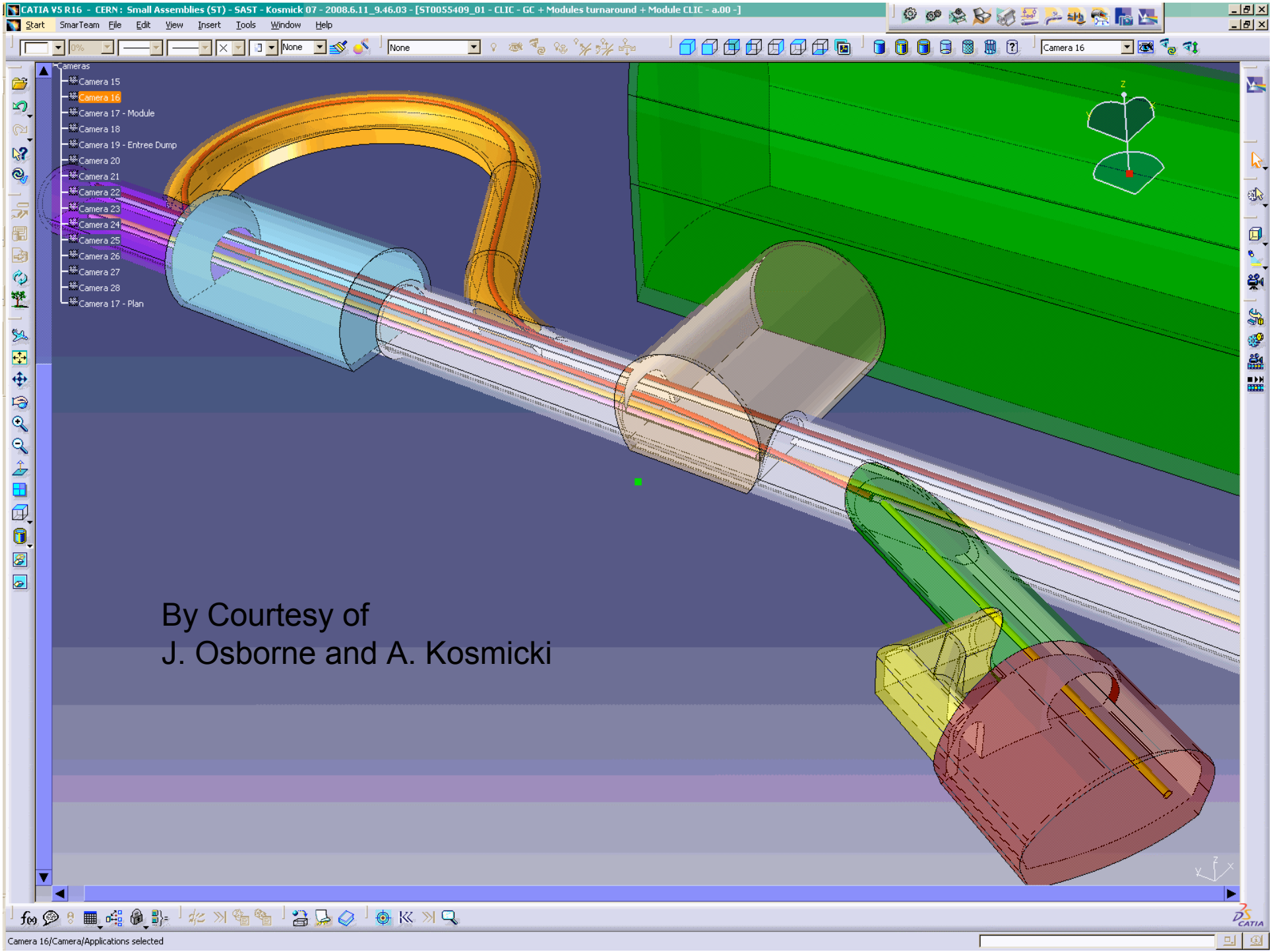
Turnaround :
A first look at integration issues

Turnaround as of today , F. Stulle/PSI (this w'shop)

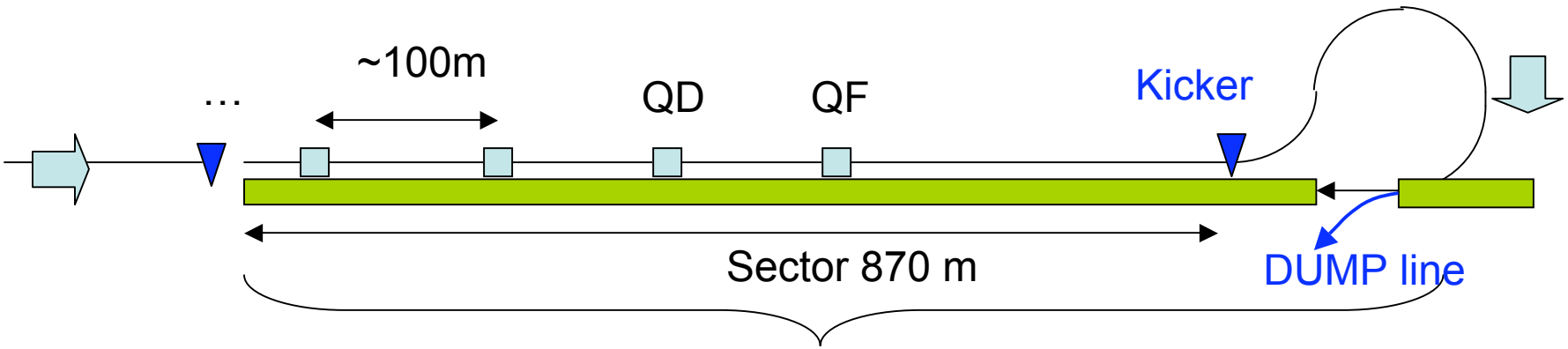


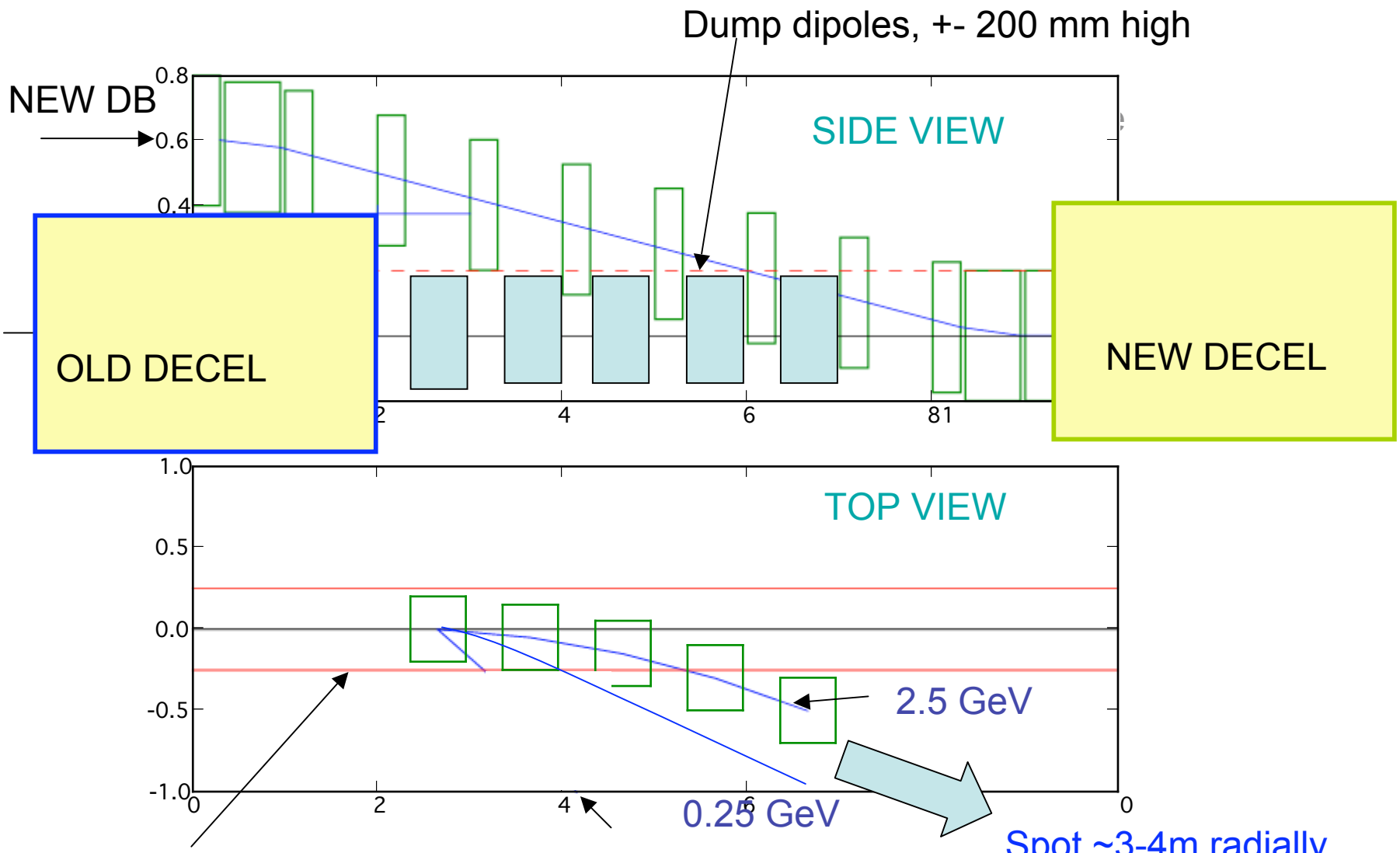
Recent input :
Decelerator length and DB sector no more equal
Implies : '5th' beam line of length [0..200]m depending on sector position

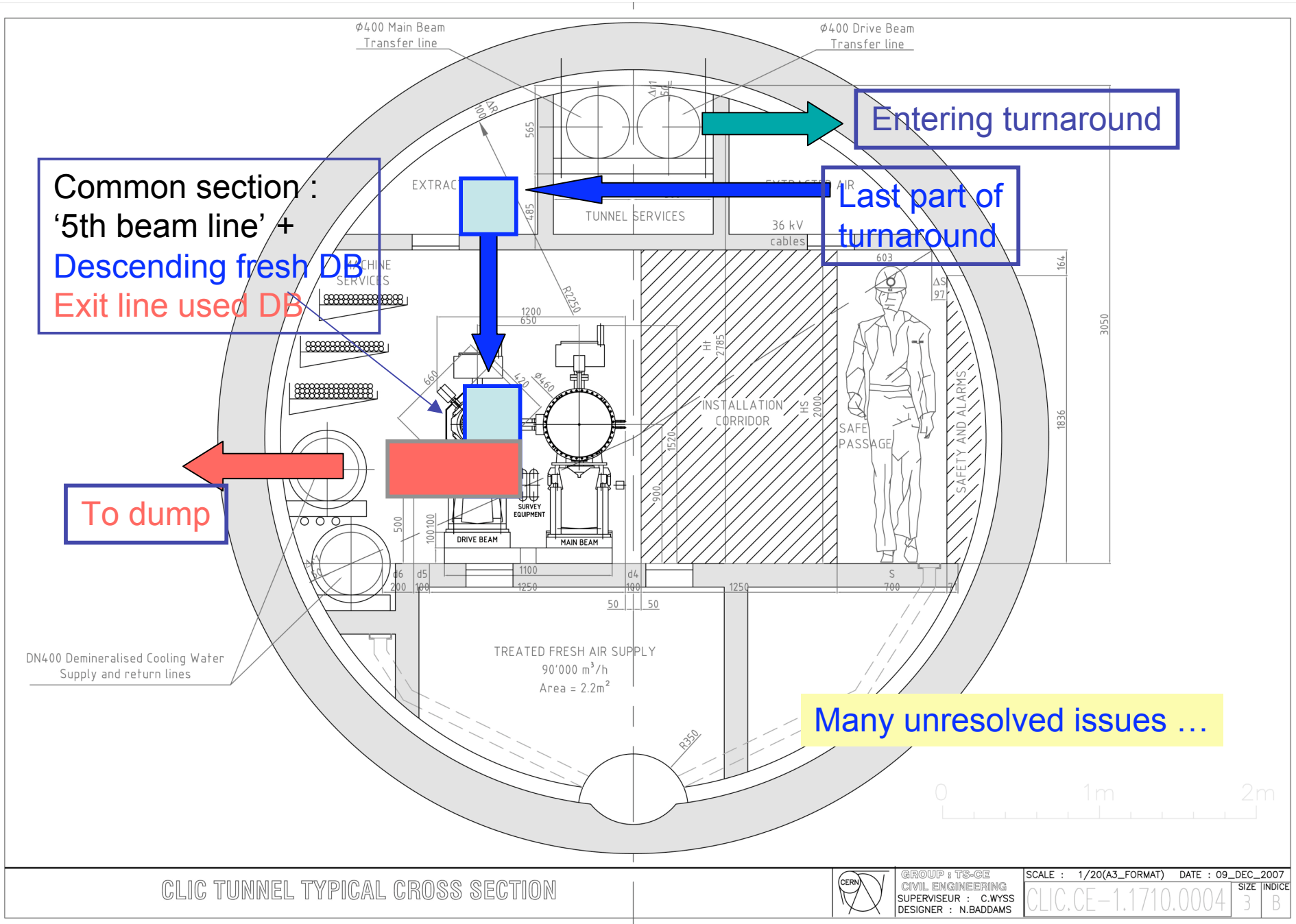
Shall we install this in the Main tunnel ?
Dipoles :
L=1m, section .4x.4 m^2
Weight ~ 1 ton
-> need more work


CATIA V5 R16 - CERN : Small Assemblies (ST) - SAST - Kosmick 07 - 2008.6.11_9.46.03 - [ST0055409_01 - CLIC - GC + Modules turnaround + Module CLIC - a.00 -]
Start SmarTeam File Edit View Insert Tools Window Help
Cameras
Camera 15
Camera 16
Camera 17 - Module
Camera 18
Camera 19 - Entree Dump
Camera 20
Camera 21
Camera 22
Camera 23
Camera 24
Camera 25
Camera 26
Camera 27
Camera 28
Camera 17 - Plan
By Courtesy of
J. Osborne and A. Kosmicki
Camera 16/Camera/Applications selected

Drive Beam dumps :
A first look at integration issues




Dump dipoles, +- 200 mm high
NEW DB
SIDE VIEW
OLD DECEL
NEW DECEL
TOP VIEW
2.5 GeV
0.25 GeV
Width of DB quads
Spot ~3-4m radially
at ~20m on dump


Common section :
'5th beam line' +
Descending fresh DB
Exit line used DB
Entering turnaround
Last part of turnaround
To dump
Many unresolved issues …
Φ400 Main Beam Transfer line
Φ400 Drive Beam Transfer line
TUNNEL SERVICES
36 kV cables
INSTALLATION CORRIDOR
SAFE PASSAGE
SAFETY AND ALARMS
SURVEY EQUIPMENT
DRIVE BEAM
MAIN BEAM
DN400 Demineralised Cooling Water Supply and return lines
TREATED FRESH AIR SUPPLY
90'000 m³/h
Area = 2.2m²
0
1m
2m
CLIC TUNNEL TYPICAL CROSS SECTION
GROUP : TS-CE
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CLIC.CE-1.1710.0004
SIZE 3
INDICE B

Summary

- Long transfer line
  - Compact and light combined magnet are considered
  - Conflict services / beam line / survey must be resolved
- DB Turnarounds
  - Optics exists, but need to adapt to C.E. constraints
- ‘5th Beam line’ between TA and input decelerator
  - Now non-negligible fraction of the linac length
- DB Dump line
  - Short 10m section with two lines must be studied
  - Dump exit through main tunnel to be solved (water pipe on the way)
  - Dump proper still to be designed