

DB Formation layout

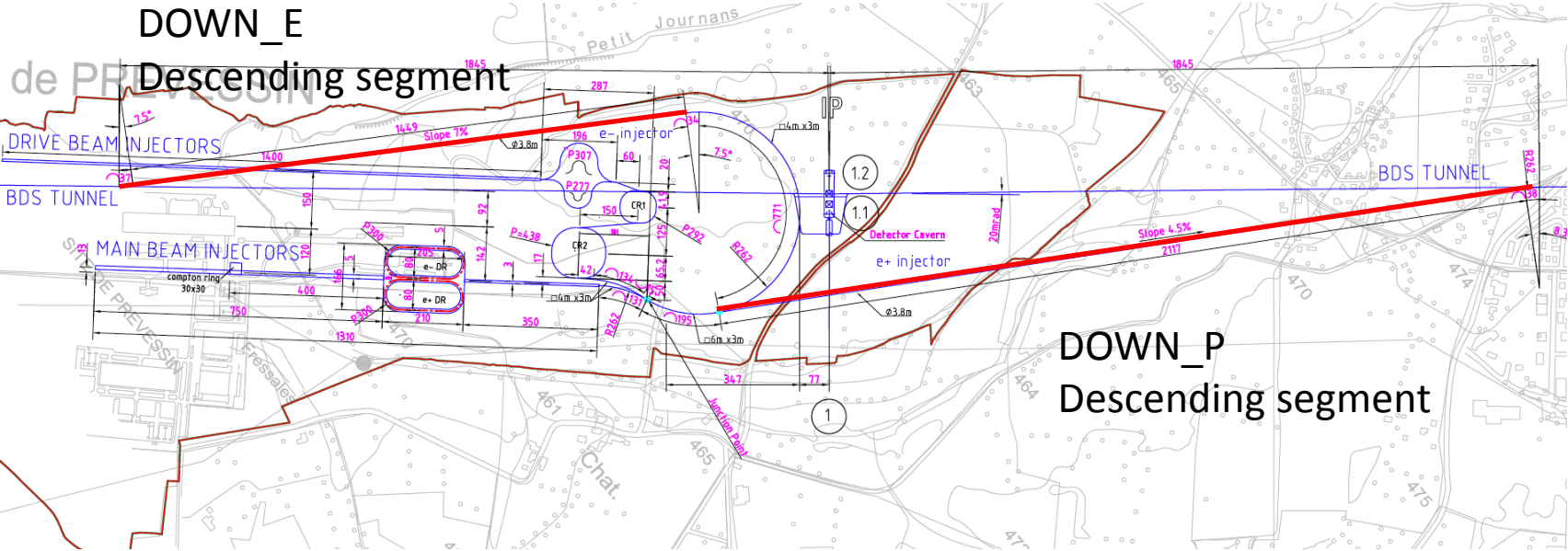
B. Jeanneret, 9th June 2010

Beam Dyn Committee

Changes to layout

- **Integrate new requests**
 - Energy scan :
 - 2nd Delay loop twice longer (may change further ...)
 - Twice longer 1st Combiner Ring
- **Realistic descent to the tunnel :**
 - Combine with main beam
 - Avoid coupling with tilted dipole (MB) [with Frank, Daniel]
- **Superimpose DB for e^+ and e^- (Cost)**
- **Add transfer lines between DL's, CR's, ...**
 - PBS already modified accordingly

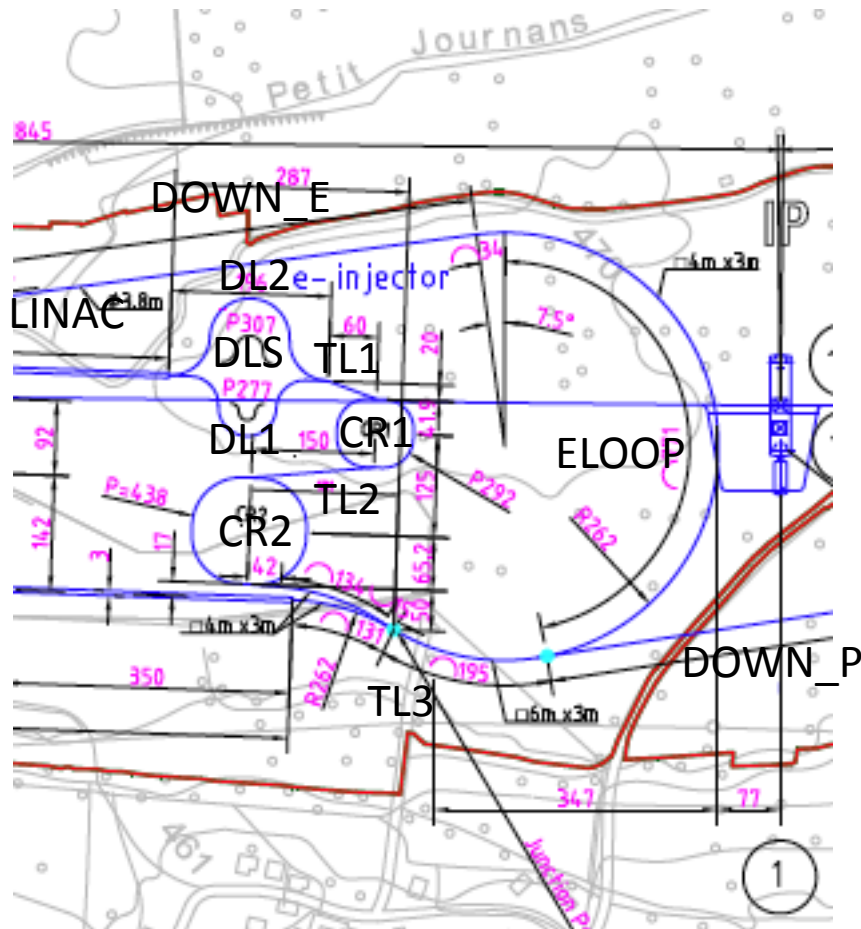
Underground



Same optics continues up to the end of the Main Linac :



Surface layout



| | L [m] | n |
|---------------|-------|----|
| DL1 | 215 | 2 |
| DL2 | 339 | 2 |
| DLS | 193 | 2 |
| TL1 | 60 | 2 |
| CR1 | 292 | 2 |
| TL2 | 150 | 2 |
| CR2 | 438 | 2 |
| TL3 | 330 | 2 |
| ELOOP | 770 | 1 |
| DOWN_E | 2354 | 1 |
| DOWN_P | 3022 | 1 |
| MT_SECTO R | 877 | 48 |
| TA | 146 | 48 |

| | length [m] | nb |
|-------------------|--------------|----|
| DELAY_LOOP_1_E | 215 | 1 |
| DELAY_LOOP_2_E | 339 | 1 |
| DLS_E | 193 | 1 |
| TL_1_E | 60 | 1 |
| COMBINER_RING_1_E | 292 | 1 |
| TL_2_E | 150 | 1 |
| COMBINER_RING_2_E | 438 | 1 |
| TL_3_E | 330 | 1 |
| ELOOP | 770 | 1 |
| DOWN_E | 2354 | 1 |
| MT_SECTOR | 877 | 24 |
| TA | 146 | 24 |
| DUMP | 30 | 24 |
| TOTAL | 30413 | |
| DELAY_LOOP_1_E | 215 | 1 |
| DELAY_LOOP_2_E | 339 | 1 |
| DLS_E | 193 | 1 |
| TL_1_E | 60 | 1 |
| COMBINER_RING_1_E | 292 | 1 |
| TL_2_E | 150 | 1 |
| COMBINER_RING_2_E | 438 | 1 |
| TL_3_E | 330 | 1 |
| DOWN_P | 3022 | 1 |
| MT_SECTOR | 877 | 24 |
| TA | 146 | 24 |
| DUMP | 30 | 24 |
| TOTAL | 30311 | |

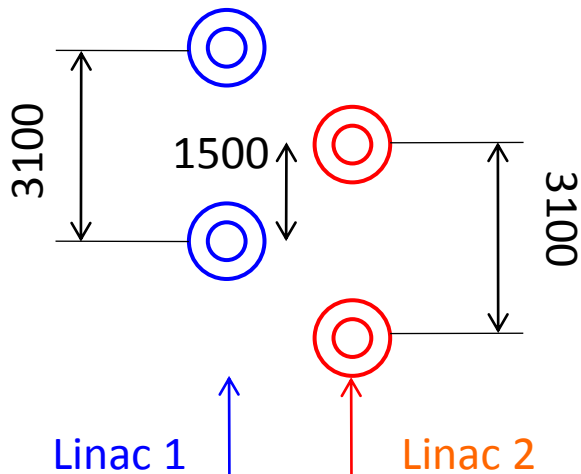
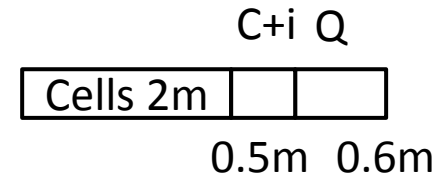
DB Linac

- RF structures & Klystrons worked-out by Rolf & Erk (ACE Feb 2010)
- Optics by Avni
- Combined tunnel & surface building by Gerry & BJ
 - Cost
 - Land occupation

Cell structure

R. Wegner, E. Jensen, A. Aksoy, D. Schulte

- RF active section : 20 cells \times 0.1m = 2m
- Coupler, interconnect : 0.5 m
- Quad, MBCO, BPM : 0.6 m
- **TOTAL** : **3.1 m**
- May need adjustment (Vacuum equip. for pressure $p \sim 5 \cdot 10^{-11}$ Torr, ...)



15 MW klystrons
 Acc. V/module 3.2 MV
 819 cells / linac
Total length 2540 m

Plug-power for RF (2 linacs):
 290 MW
 (\rightarrow 0.15 MW/m)

parameters

| | | | | | | | | | |
|--|------------------|-----|--------------------|--|---|--------------------------------|-------------------------------------|-------------|--|
| Beam energy | 2.370E+09 | eV | E | | DB Linac | Ref : | Erk ACE Feb10 | | |
| Rep rate | 5.000E+01 | | f | | BJ may 2010 | | Rolf B Dyn Aug09 | | |
| Total pulse length | 1.403E-04 | s | tau | | increased form 'April10' version | | Avni xls 14apr10 | | |
| pulse length | 2.450E+02 | ns | tau_train | | | | | | |
| Beam current | 4.210E+00 | A | I | | | | | | |
| Klystron power | 1.500E+07 | W | Pk | | OPTICS | | | | |
| module yield | 9.500E-01 | | Ym | | | | | | |
| loss between klys/cells | 9.500E-01 | | Yt | | Quad assembly (Q+BPM+other) | 6.000E-01 | m | | |
| Acc volt/module | 3.216E+06 | V | Ym*Yt*Pk/I | | Quadrupoles | | | | |
| accelerating phase phia | 1.900E+01 | deg | | | Integrated normalised nom gradient | 4.950E-01 | kL m ⁻¹ | (2.75x0.18) | |
| cos(phia) | 9.455E-01 | | cphia | | Integrated gradient + 10% margin | 4.302E+00 | GL Tm/m | from Avni | |
| | | | | | length | 2.500E-01 | L m | | |
| Installation margin | 1.050E+00 | | imargin | | Gradient | 1.721E+01 | G T/m | | |
| nb modules , 1 linac | 819 | | imargin*E/Vm/cphia | | Radius | 5.000E-02 | R = 49 mm + 1mm pipe | | |
| nb modules , 2 linac | 1638 | | | | Pole tip field | 8.603E-01 | T | | |
| RF length | 2.500E+00 | m | | | Total nb Q , 2 linac | 1638 | | | |
| (20cells 0.1m +0.5m couplers+interconnect) | | | | | | | L & G can be varied, GL is constant | | |
| 1 Module + 1 Q | 3.100E+00 | m | | | variant for quad | L=0.2m, G=21.5T/m, Bpole=1.08T | | | |
| | | | | | CO dipole corrector | L=0.2m, 0.03T | | | |
| RF length | 2.048E+03 | m | | | | | | | |
| Optics | 4.914E+02 | m | | | | | | | |
| Total Linac L | 2.539E+03 | m | | | | | | | |
| Klys+mod yield | 6.000E-01 | | | | | | | | |
| Total peak RF power/linac | 1.229E+10 | W | | | BEAM POWER | | | | |
| Average total RF power/linac | 8.618E+07 | W | | | | | | | |
| Total plug power/linac | 1.436E+08 | W | | | P1 = I*tau*fr*E | 6.999E+07 | 1 Linac | | |
| Total plug power , 2 Linac | 2.873E+08 | W | | | P = 2P1 | 1.400E+08 | W | | |
| FODO cell | Q + RF + Q + RF | | 6.200E+00 | | | | | | |
| Klystron spacing / linac | | | 3.100E+00 | | | | | | |

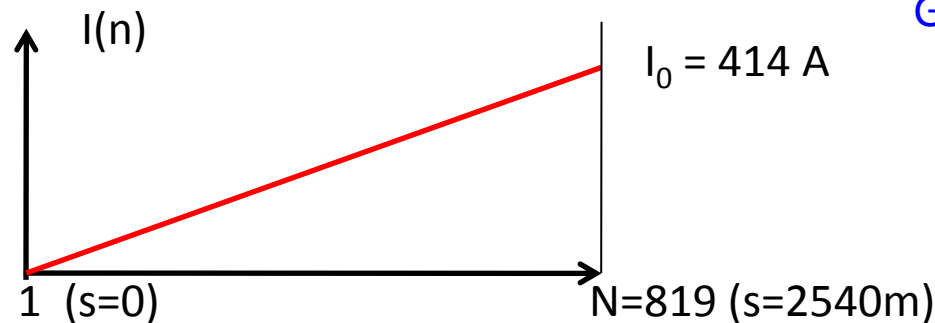
Magnets : quadrupoles

- $N=819$ Q, spaced by 3.1m for each Linac (total Linac length 2540m)
- $R = 3.7 \cdot 10^{-2} \Omega$, $I_{\max} = I_0 = 414$ A, $p_{\max} = 6.3$ kW
- Gradient must follow the beam energy increase
→ $I(n) = nI_0/N$

→ Power scheme similar to DECEL_Q advisable

→ Total power : $P = Np_{\max}/3 = 4$ MW

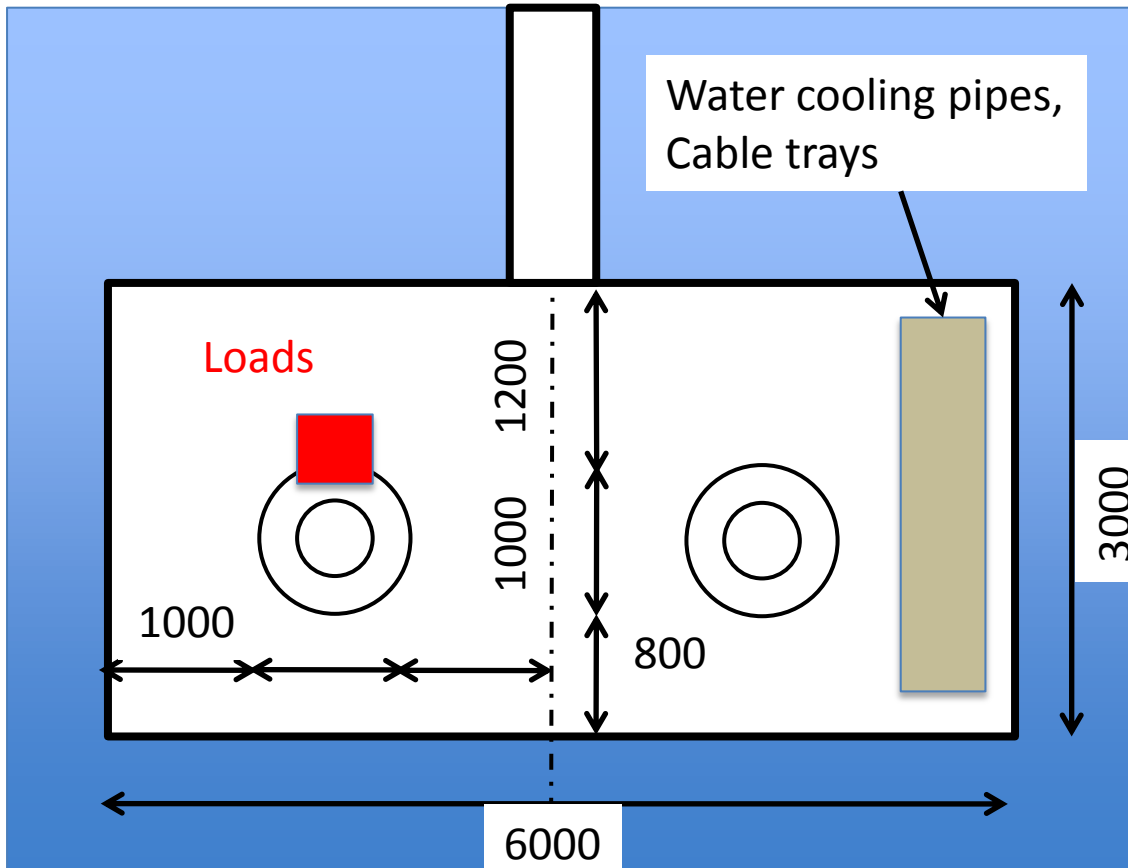
Inner diameter 100 mm
 $L=0.25$ m
 $G = 17$ T/m



Cooling

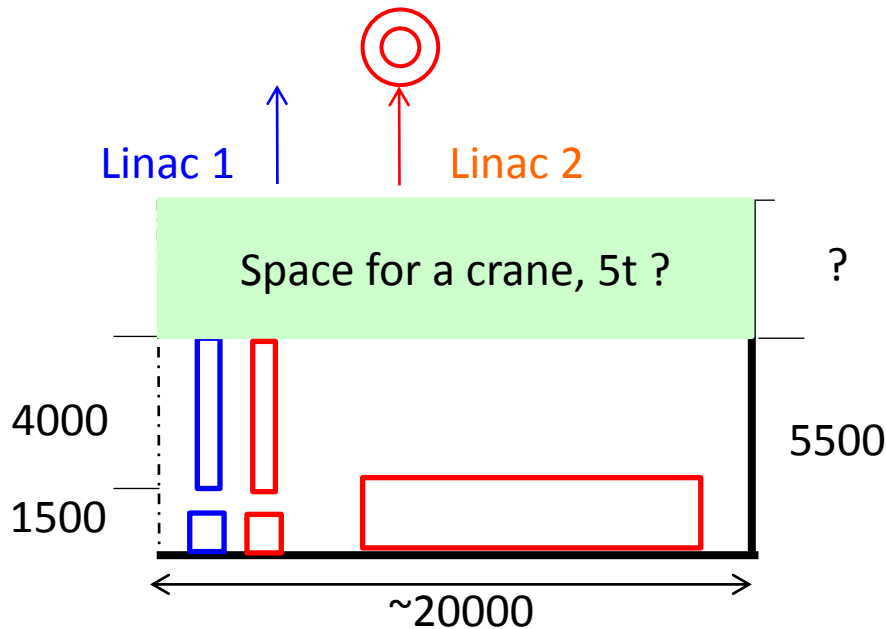
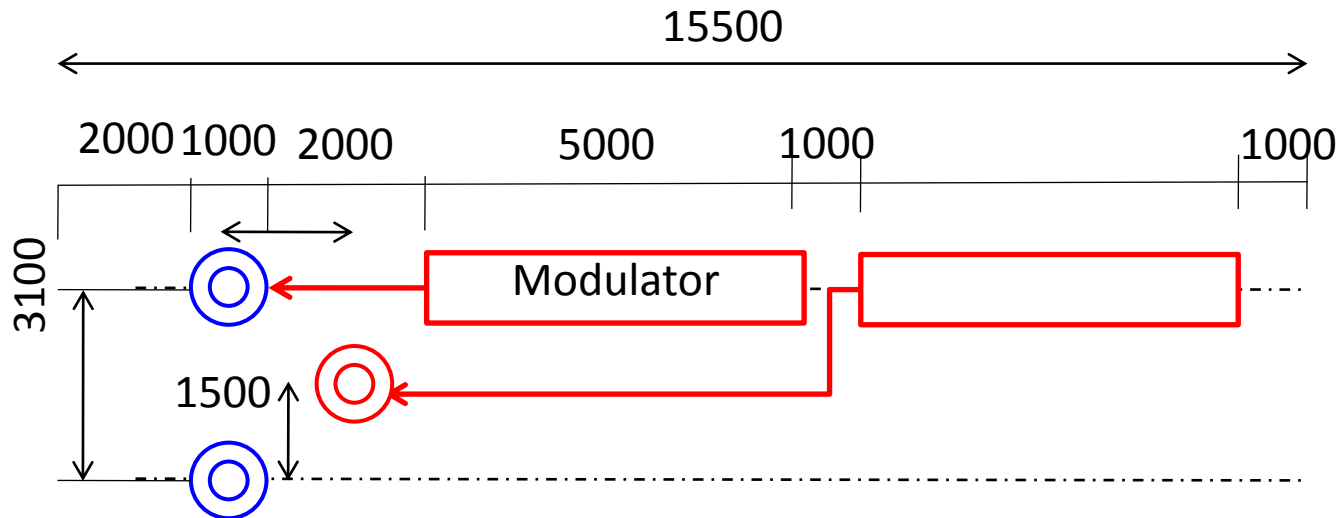
- Total plug power for RF : $P_{\text{tot}} = 290 \text{ MW}$
 - 140 MW to beam → 150 MW to heat
- Total power for magnets : 4 MW
 - Plug-power : ??

DB Linac, tunnel



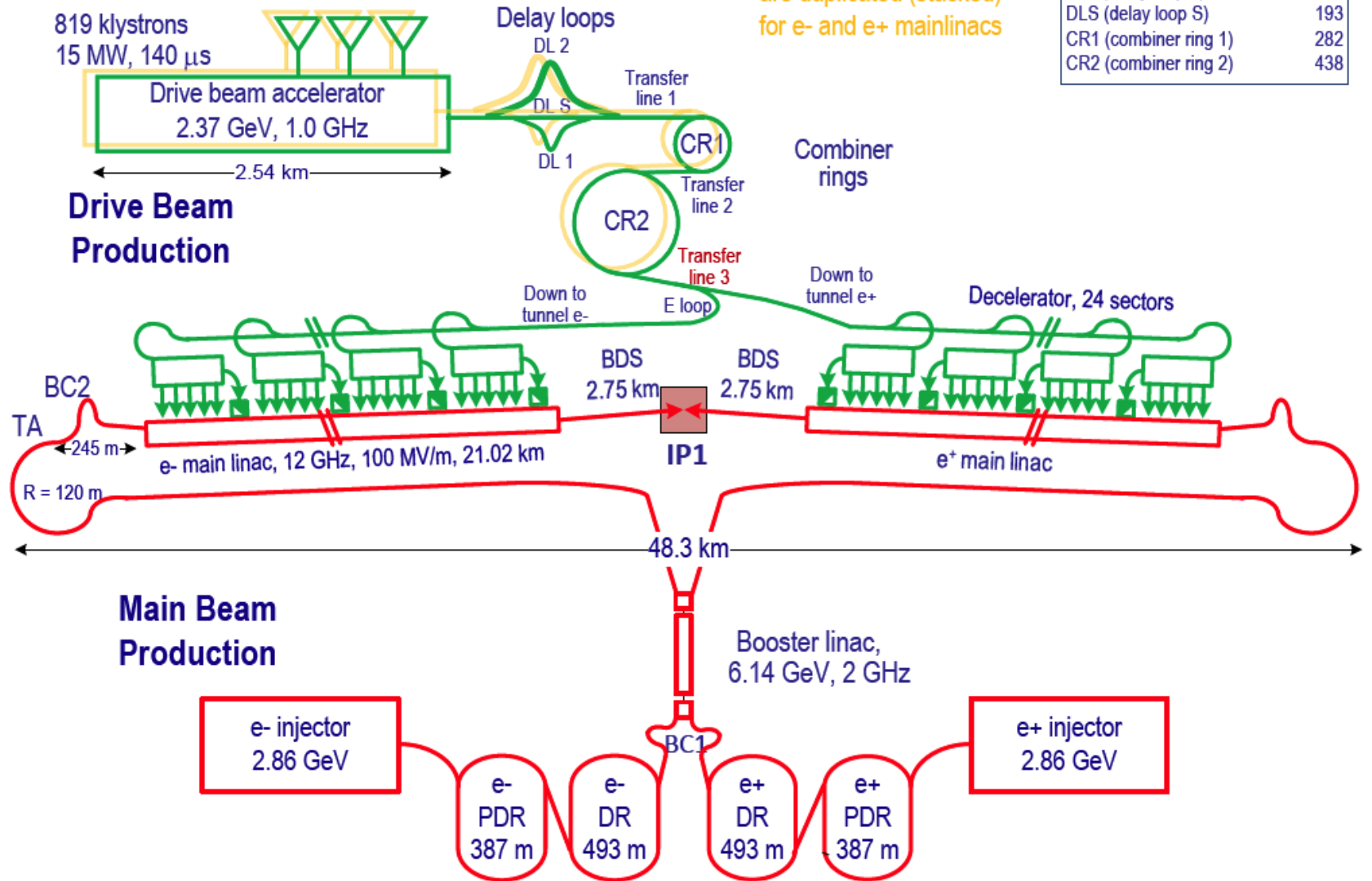
- Total length now : 1400m
- → conflict with EHN1
- → move towards top of the drawing, see below

DB Linac, Klystron&Modulator surface building

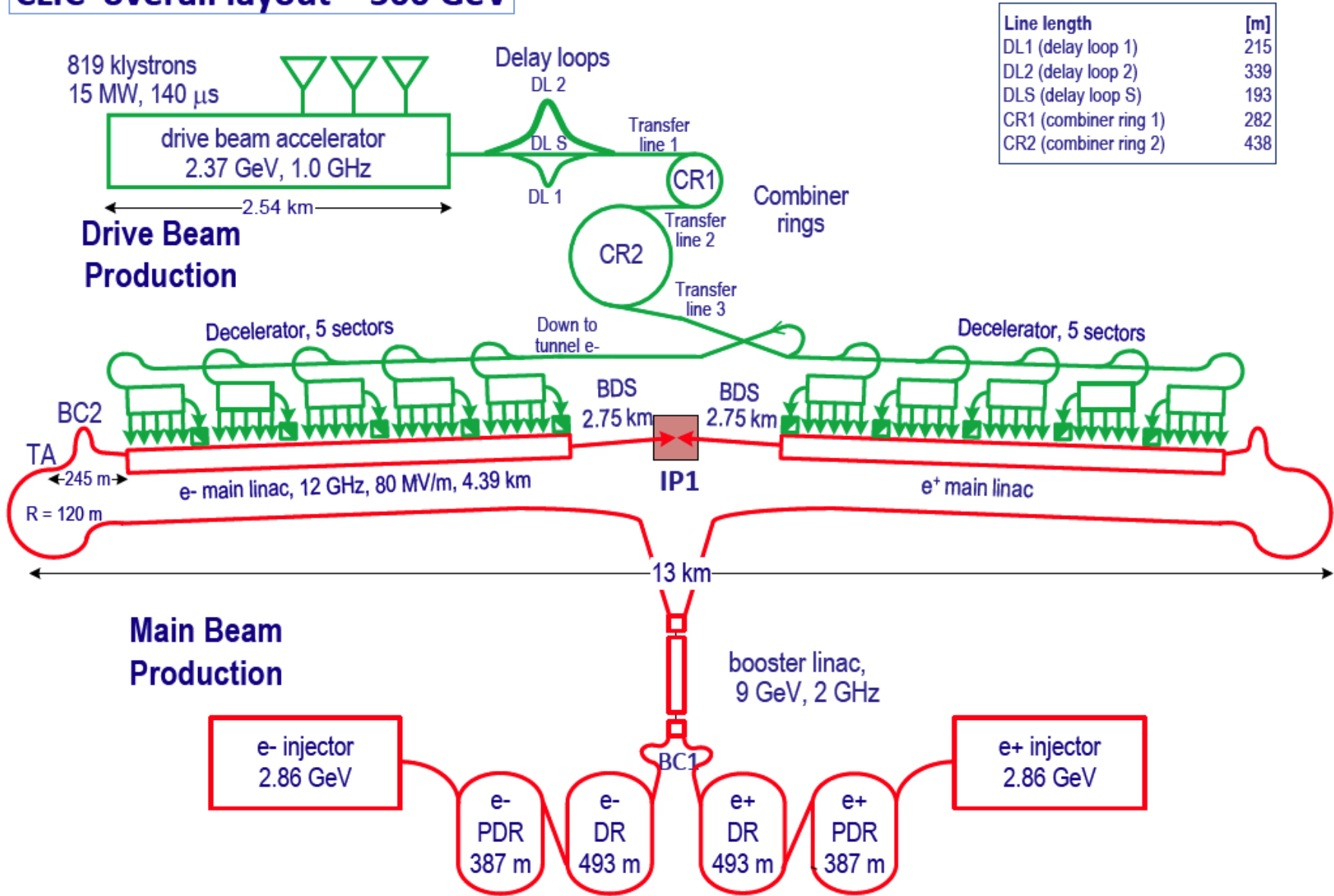


See next slide
For overall
top view

CLIC overall layout – 3 TeV



CLIC overall layout – 500 GeV



Still to do

- Pre-linac / chicane or arc / Linac (Avni/Daniel)
- Overall building definition (Gerry, Erk, BJ)
 - Dimensions
 - Modulator arrangement
- Network power (Gerry, Daniel Si, BJ)