Reorganization of East Area Beam Lines

Status Report at ATOP meeting

L.Gatignon, 06/03/2009

OUTLINE:

- Motivation
- Guiding principles and strategy
  - *Constraints from physics programme*
  - *Contain radiation*
  - *Magnets available*
- Primary beams
  - *Optimize choice of magnets*
  - *DIRAC, Irradiation facilities*
- Test beams
  - *Optics, layout*
  - *Performance*
- Practical implementation
  - *Magnets*
  - *Shielding*
- Time line
- Conclusions

WHY A NEW LAYOUT FOR THE EAST AREA

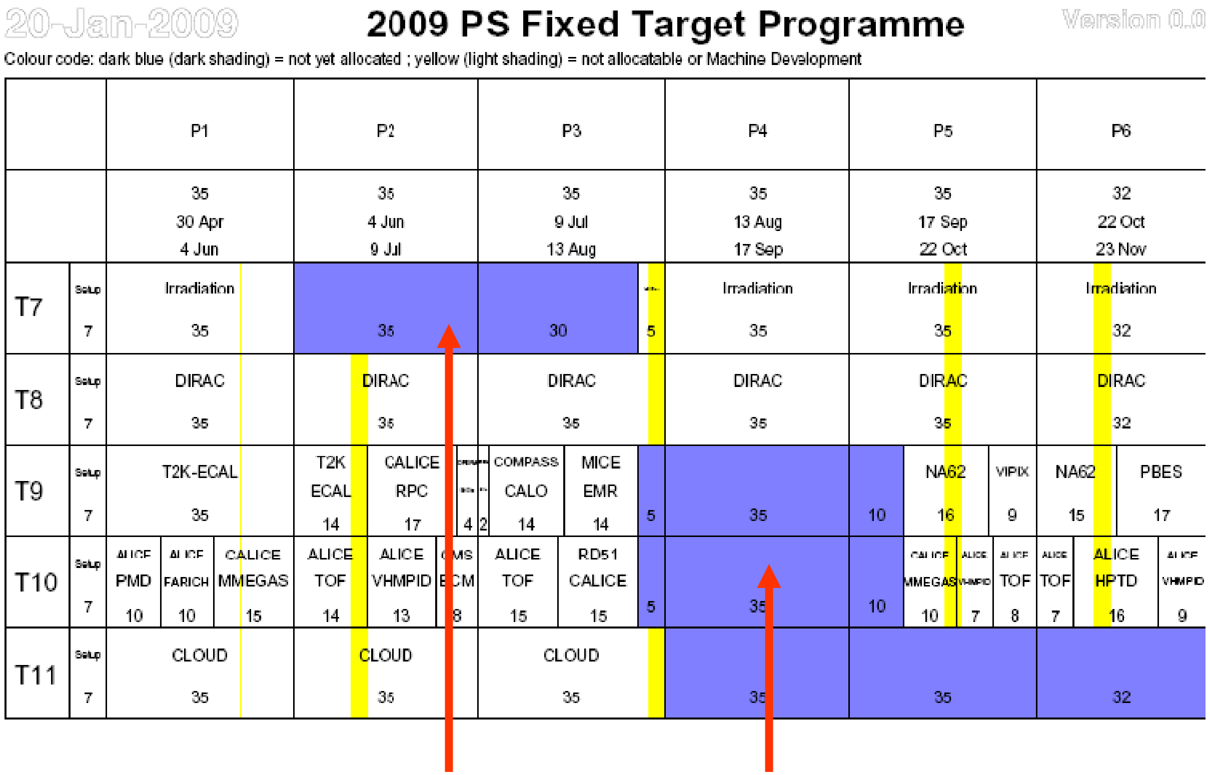
Triggered by ABOC/ATC days in 2007

- Splitters lead to high beam losses in critical regions
  - high radiation levels
  - no beam loss monitors!
- Catastrophic situation of magnets
  - 63 magnets of **22 different types**, many critically weak and/or **no spares**
  - need **2 weeks to open & close concrete roof shield** + cooldown + repair
  - space very tight, access extremely difficult
  - high radiation levels
  - EA has only 8% of #magnets in NA, but needs same #FTE to maintain
- No remote control for most systems (motors in particular)
  - No high level control system, no beam files
  - Grossly insufficient beam instrumentation – *somewhat improved since then*

Recommendation: global review of East Area

Note: *Operational difficulties with F61N.BVT01 in 2008,*
T10 only 6 GeV due to two Q800 (smoke traces!), three Q120's being replaced now…

THE EAST AREA CONTINUES TO BE POPULAR:



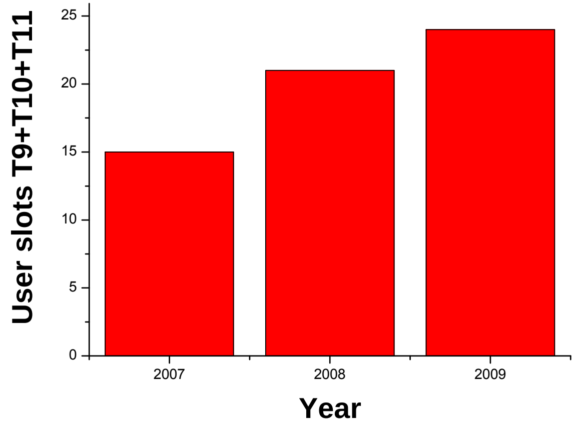
20-Jan-2009 — **2009 PS Fixed Target Programme** — Version 0.0

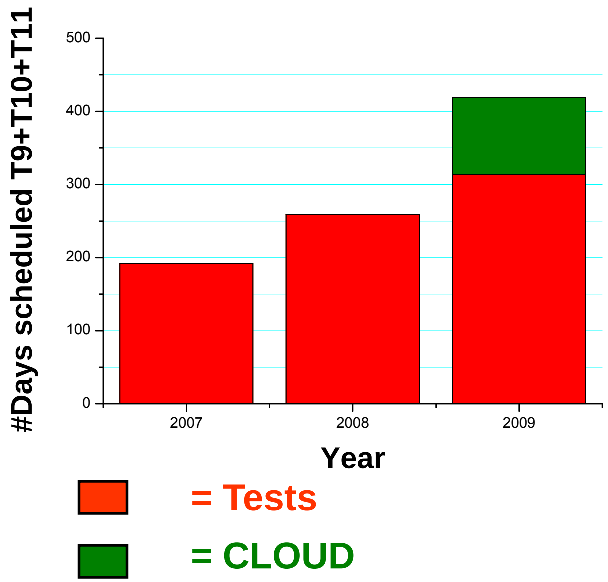
Colour code: dark blue (dark shading) = not yet allocated ; yellow (light shading) = not allocatable or Machine Development

		P1	P2	P3	P4	P5	P6
		35 30 Apr 4 Jun	35 4 Jun 9 Jul	35 9 Jul 13 Aug	35 13 Aug 17 Sep	35 17 Sep 22 Oct	32 22 Oct 23 Nov
T7	Setup 7	Irradiation 35	35	30; 5	Irradiation 35	Irradiation 35	Irradiation 32
T8	Setup 7	DIRAC 35	DIRAC 35	DIRAC 35	DIRAC 35	DIRAC 35	DIRAC 32
T9	Setup 7	T2K-ECAL 35	T2K ECAL 14; CALICE RPC 17; 4	2; COMPASS CALO 14; MICE EMR 14; 5	35	10; NA62 16; VIPIX 9	NA62 15; PBES 17
T10	Setup 7	ALICE PMD 10; ALICE FARICH 10; CALICE MMEGAS 15	ALICE TOF 14; ALICE VHMPID 13; CMS ECM 8	ALICE TOF 15; RD51 CALICE 15; 5	35	10; CALICE MMEGAS 10; ALICE VHMPID 7; ALICE TOF 8	ALICE TOF 7; ALICE HPTD 16; ALICE VHMPID 9
T11	Setup 7	CLOUD 35	CLOUD 35	CLOUD 35	35	35	32

To liberate PS cycles for DIRAC

and still requests being added,
due to pressure on beam time!

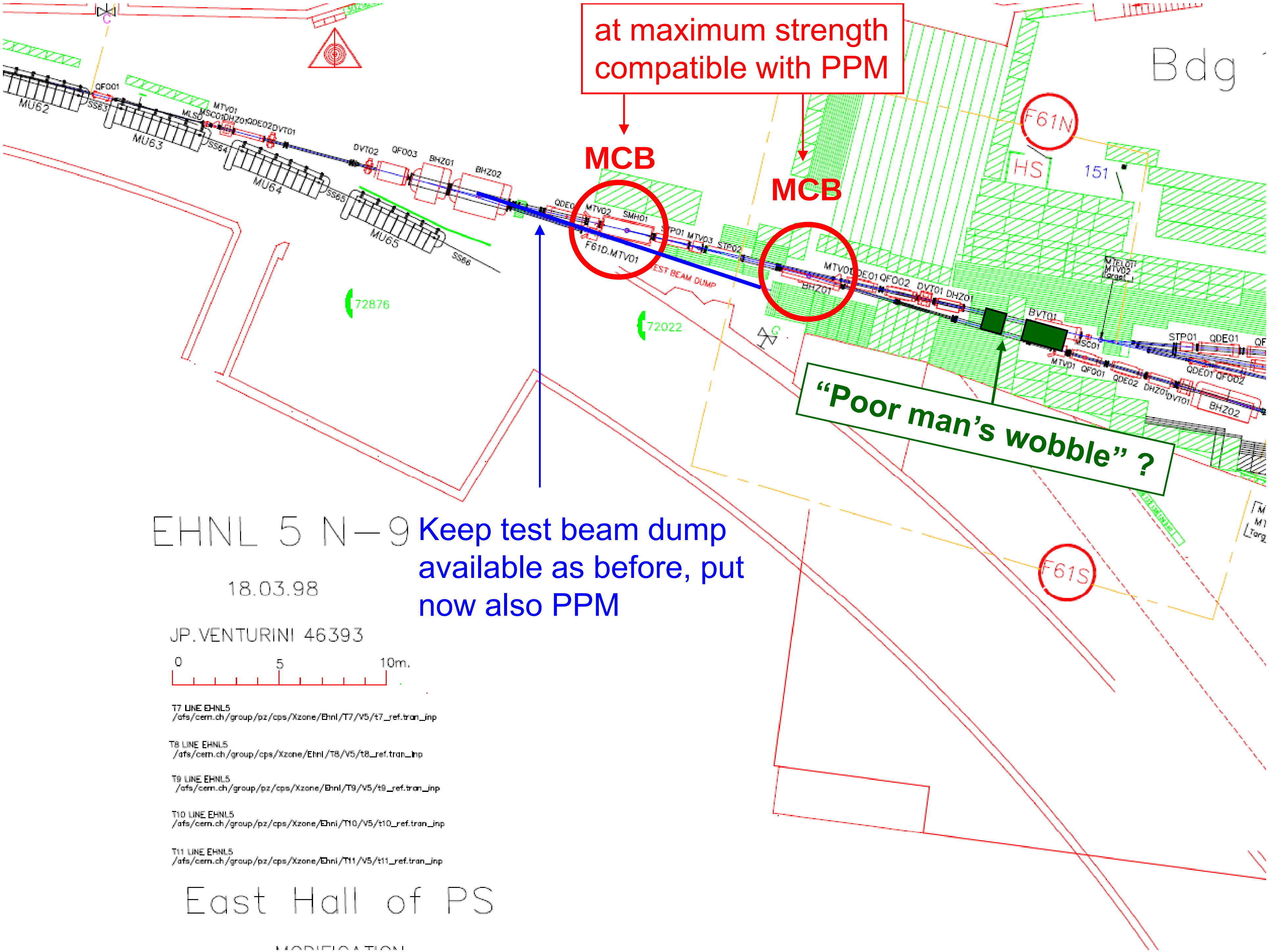




BASIC PRINCIPLES FOR NEW EAST AREA

- Use fewer types of **reliable magnets** with spares
- Reduce roof shielded areas and **ease access to equipment**
- **Keep radiation restricted** to upstream areas as much as possible
- Keep T8 beam and DIRAC installed as it is until the end of DIRAC, or for IRRAD in case they take over the DIRAC location
- Replace SMH1 and F61S.BHZ1 by two MCB magnets in PPM mode, i.e. no more splitter *(F61S.BHZ01 replacement already done).*
- Could also serve IRRAD as now, through air, however not from ZT7.BHZ01 but from F61S.BHZ02
- **Design new beam(s)** to 1 (or 2) “North target” marguerite(s)
  - *two decoupled beams, but at the cost of cycle efficiency*
  - *two beams coupled by “wobbling station”, coupled but higher cycle efficiency*
- Test beams can provide **pure** hadron and muon secondary beams up to 15 GeV/c and pure (> 95%) electron beams from γ conversion (up to about 10 GeV/c)

Inspired by and similar in spirit to West Area rebuild in the end of the 1990’s!

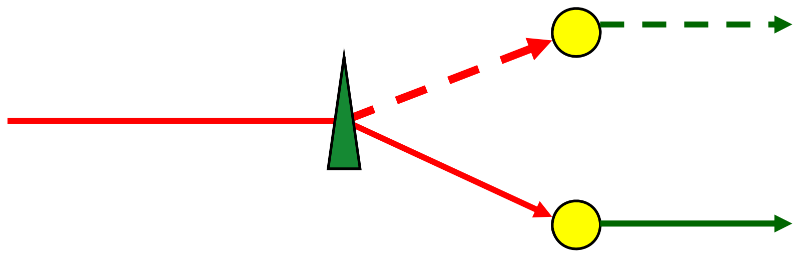


at maximum strength compatible with PPM
MCB
MCB
Bdg
F61N
HS
151
72876
72022
F61S
TEST BEAM DUMP
“Poor man’s wobble” ?
Keep test beam dump available as before, put now also PPM
EHNL 5 N–9
18.03.98
JP.VENTURINI 46393
0 5 10m.
T7 LINE EHNL5
/afs/cern.ch/group/pz/cps/Xzone/Ehnl/T7/V5/t7_ref.tran_inp
T8 LINE EHNL5
/afs/cern.ch/group/cps/Xzone/Ehnl/T8/V5/t8_ref.tran_inp
T9 LINE EHNL5
/afs/cern.ch/group/pz/cps/Xzone/Ehnl/T9/V5/t9_ref.tran_inp
T10 LINE EHNL5
/afs/cern.ch/group/pz/cps/Xzone/Ehnl/T10/V5/t10_ref.tran_inp
T11 LINE EHNL5
/afs/cern.ch/group/pz/cps/Xzone/Ehnl/T11/V5/t11_ref.tran_inp
East Hall of PS

End of primary beam:

1. Switch *Concentrate on this option for the moment*

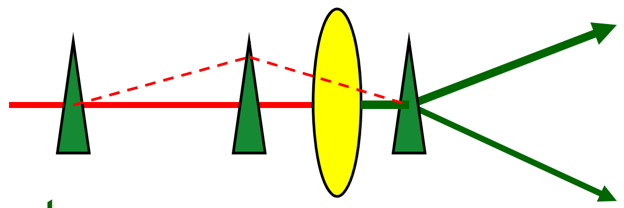
Loss of cycle efficiency,
but two performing,
decoupled test beams

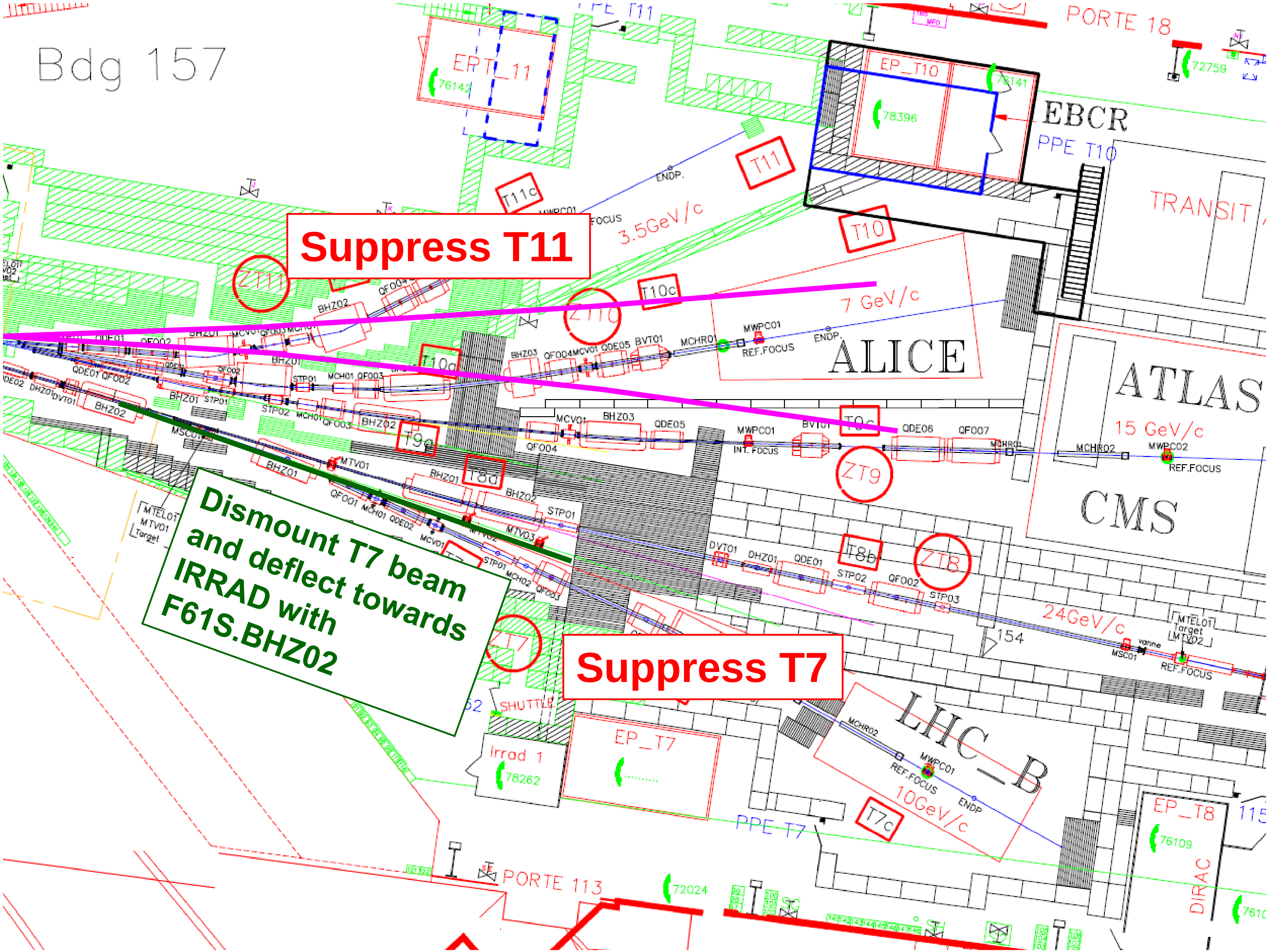


or

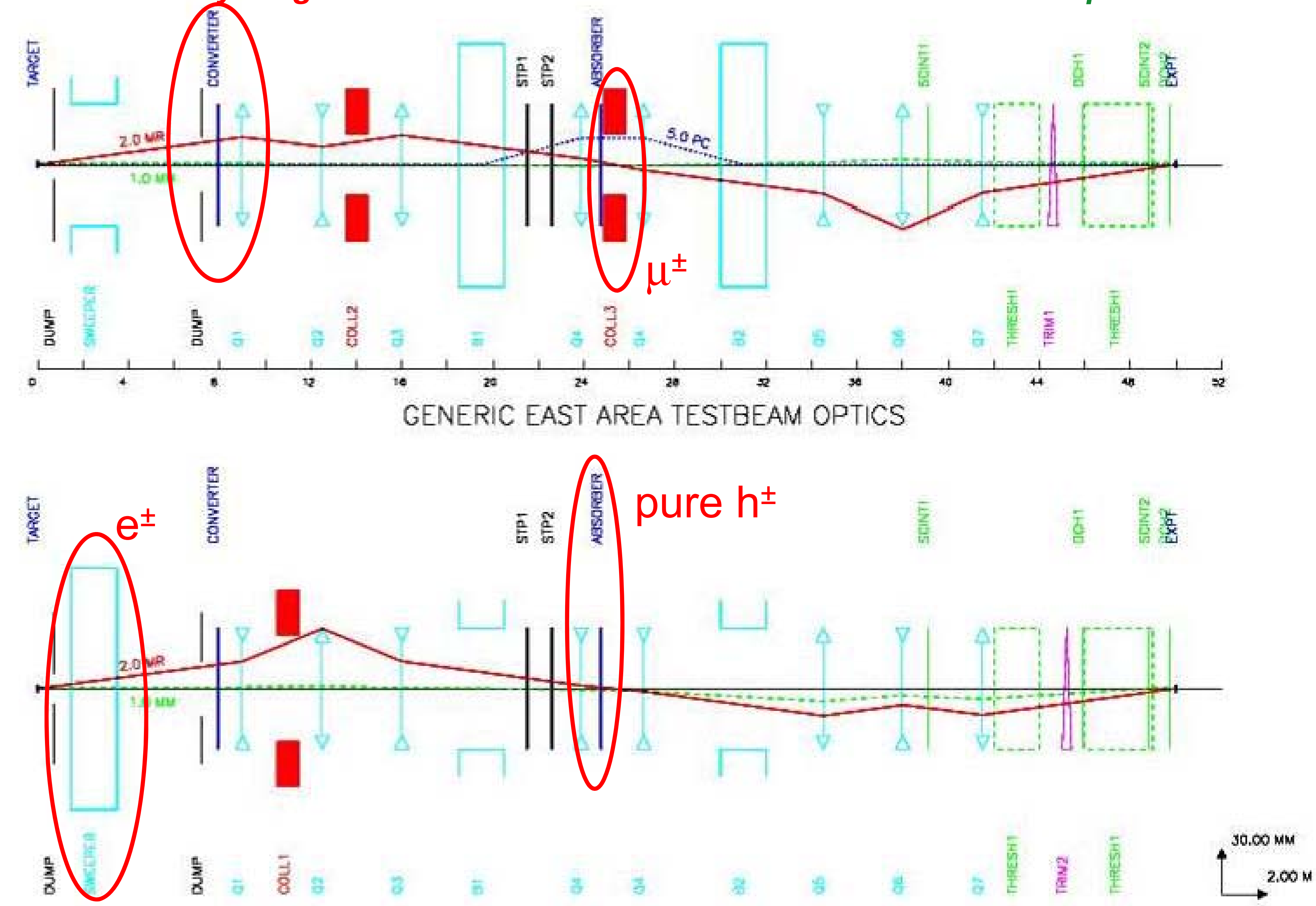
2. Wobbling

2x better cycle efficiency
but some coupling.
Can run as in the past
(i.e. on fixed axis), but with
same restrictions as in the past




Bdg 157
Suppress T11
Dismount T7 beam and deflect towards IRRAD with F61S.BHZ02
Suppress T7
EBCR
PPE T10
TRANSIT
ALICE
ATLAS
CMS
LHC_B
EP_T10
EPT_11
EP_T7
EP_T8
PORTE 18
PORTE 113
3.5GeV/c
7 GeV/c
15 GeV/c
24GeV/c
10GeV/c
Irrad 1
SHUTTLE
PPE T7
DIRAC

Uses "dummy magnets" ***~5x better transmission than present lines!***



MAGNETS

List of magnets available for the new area (only the green ones).

Also documentation!

Could eventually be complemented with magnets from NA stock (?)

Received on 30/09/2008

code check	Total magnets available	Specifications	Magnetic measurements
		edms #	edms #
HB2; MCB	10	864252	864160 / 865818
M100SP	4	864253	864162
M105	3	-	864169
M200SP	10	864255	864165 / 864162
MC200	7	864257	864168
MEA19	8	864171	864172
MNPA25	6	-	-
MNPA30	7	-	-
Q100	17	864260	864174
Q120	7	864262	864176
Q200	5	864260	864174
Q600	9	864263	-
QFL	5	864259	-
QFS	10	864259	-
QDS	12	864259	-
MDX	10	-	966185
ME15	3	966180	-
MNP19	1		
MNP23	6		
HB1, MCA	2		
HB4l	1		
HB4r	1		
B190 (ATP)	2		
F056	1		
M45	1		
MEA43	3		
MNPA38	1		
Q12	4		
Q74	2		
Q800	2		
M100TP	2		
M45	1		
Q50	2		

Please note that this list is based on huge efforts (over about one year!) by the TE/MCS team (D.Bodart, D.Tommasini et al), including a test campaign of $\approx$100 spare magnets in T7 zone

Start with the primary beams

- As short as possible
- Compatibility as much as possible with DIRAC
- Respect list of magnets wherever possible

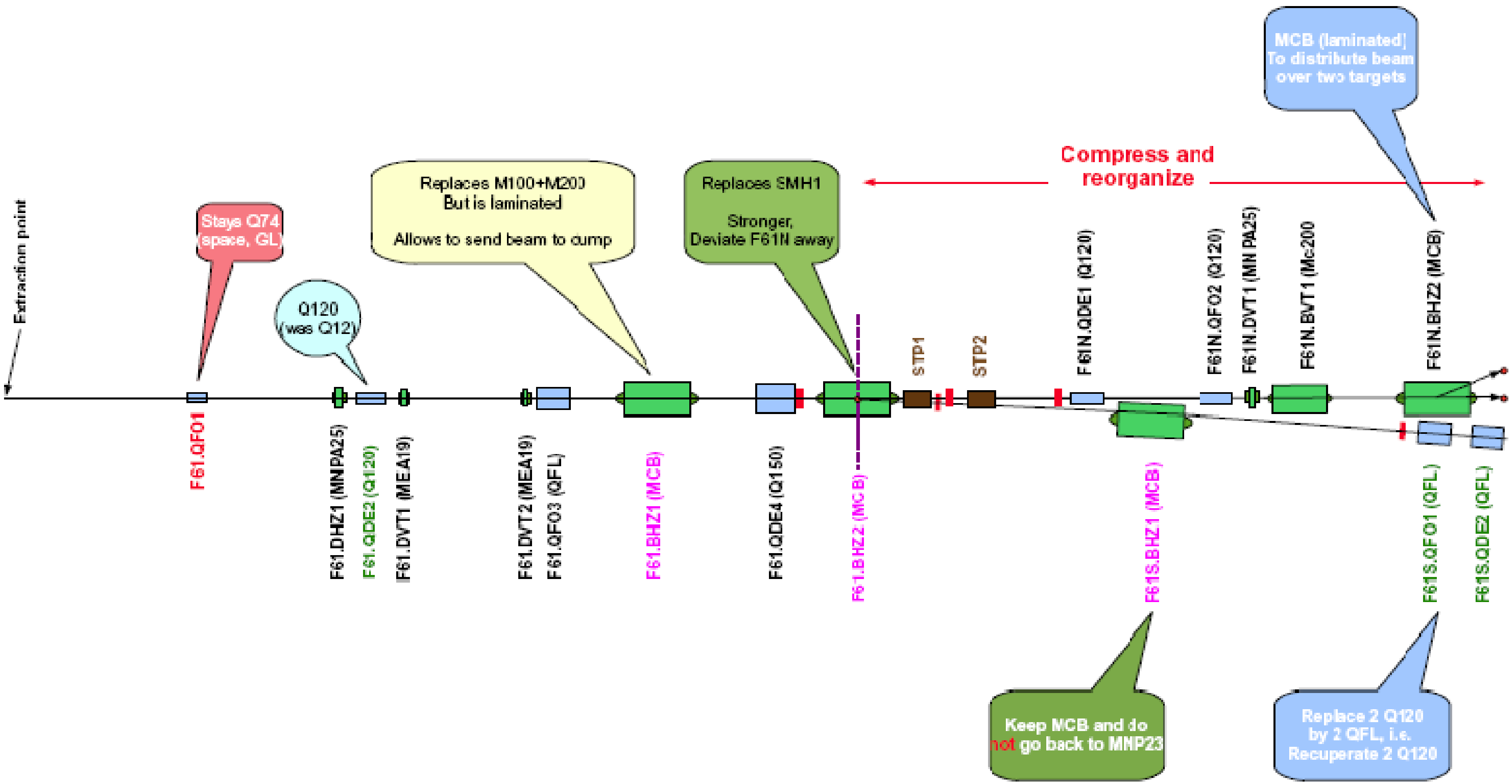
  i.e. no MNP23, few M105, few narrow magnets!
- Maximize lateral separation between beam lines
- Try to have primary target(s) in isolated zone (RP-wise)

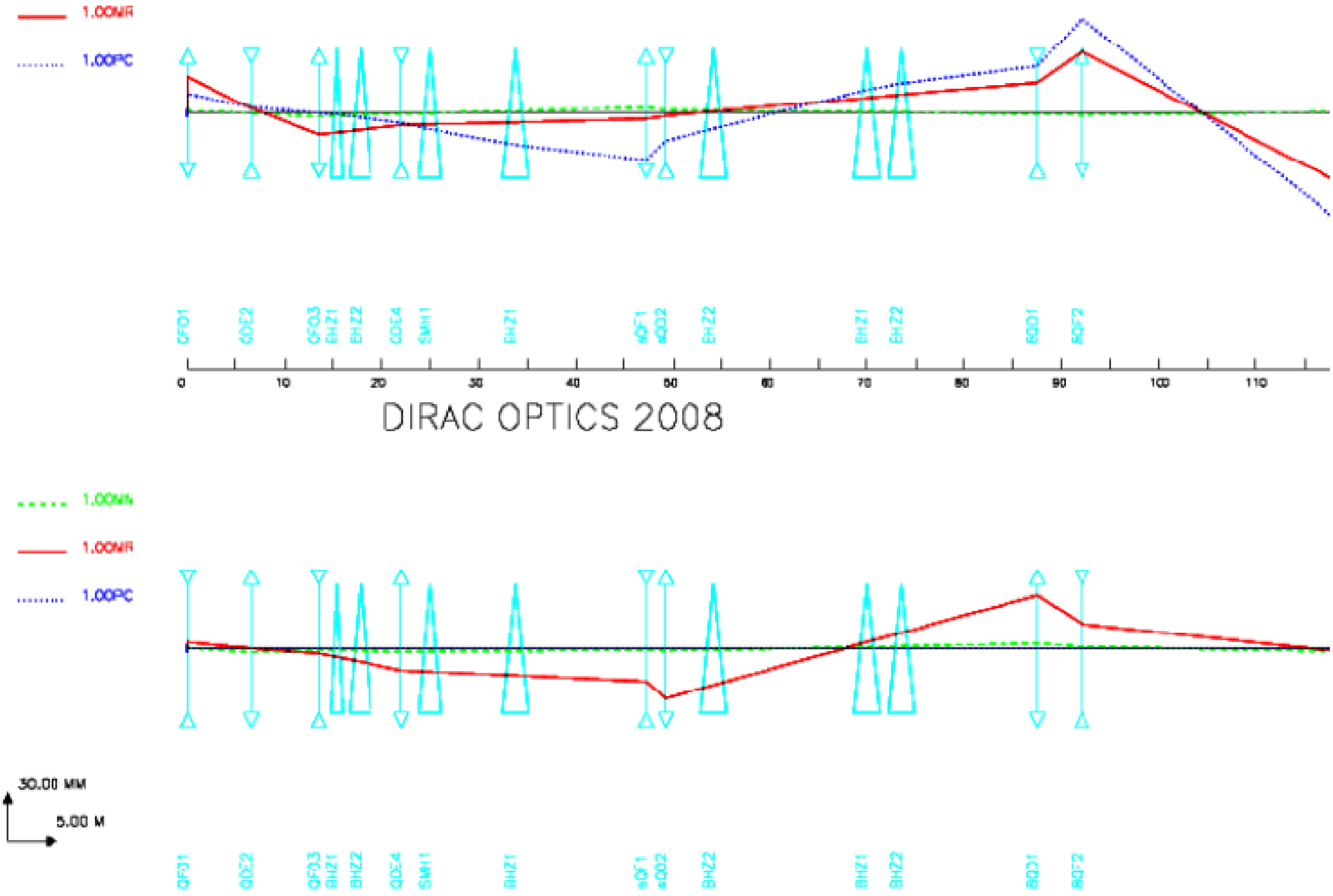
Make coherent 'Beatch' files from extraction to targets (Dirac, North) and consistent optics files, describing correctly phase space from extraction:

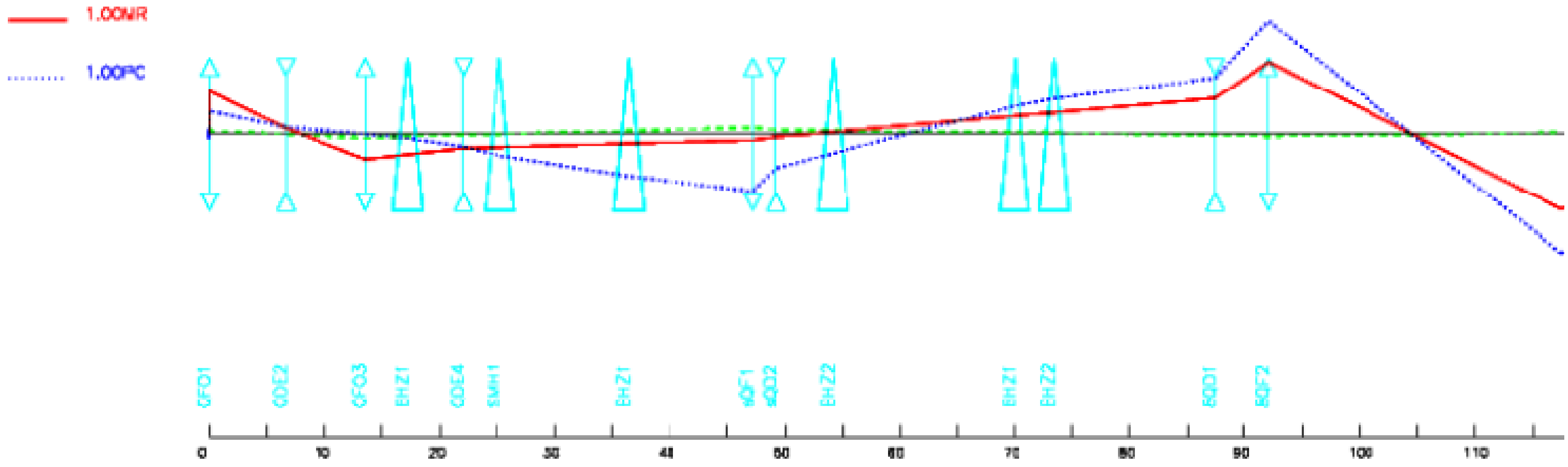
dirac2011, north2011 *old files: dirac2008, north2008*

t9y2011, t10y2011

SCHEMATIC LAYOUT OF NEW EAST AREA PRIMARY BEAM FRONTENDS

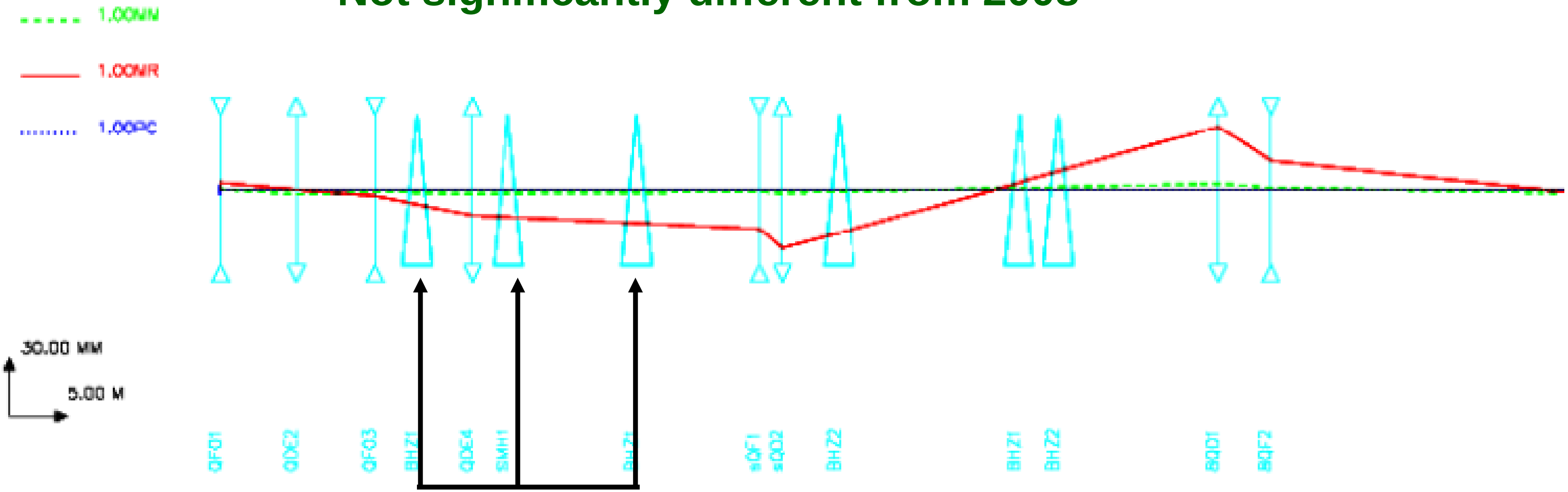



1.00MR
1.00PC
QFO1
QDE2
QFO3
BHZ1
BHZ2
QDE4
SMH1
BHZ1
sQF1
sQD2
BHZ2
BHZ1
BHZ2
BQD1
BQF2
0
10
20
30
40
50
70
90
100
110
DIRAC OPTICS 2008
1.00MN
1.00MR
1.00PC
30.00 MM
5.00 M



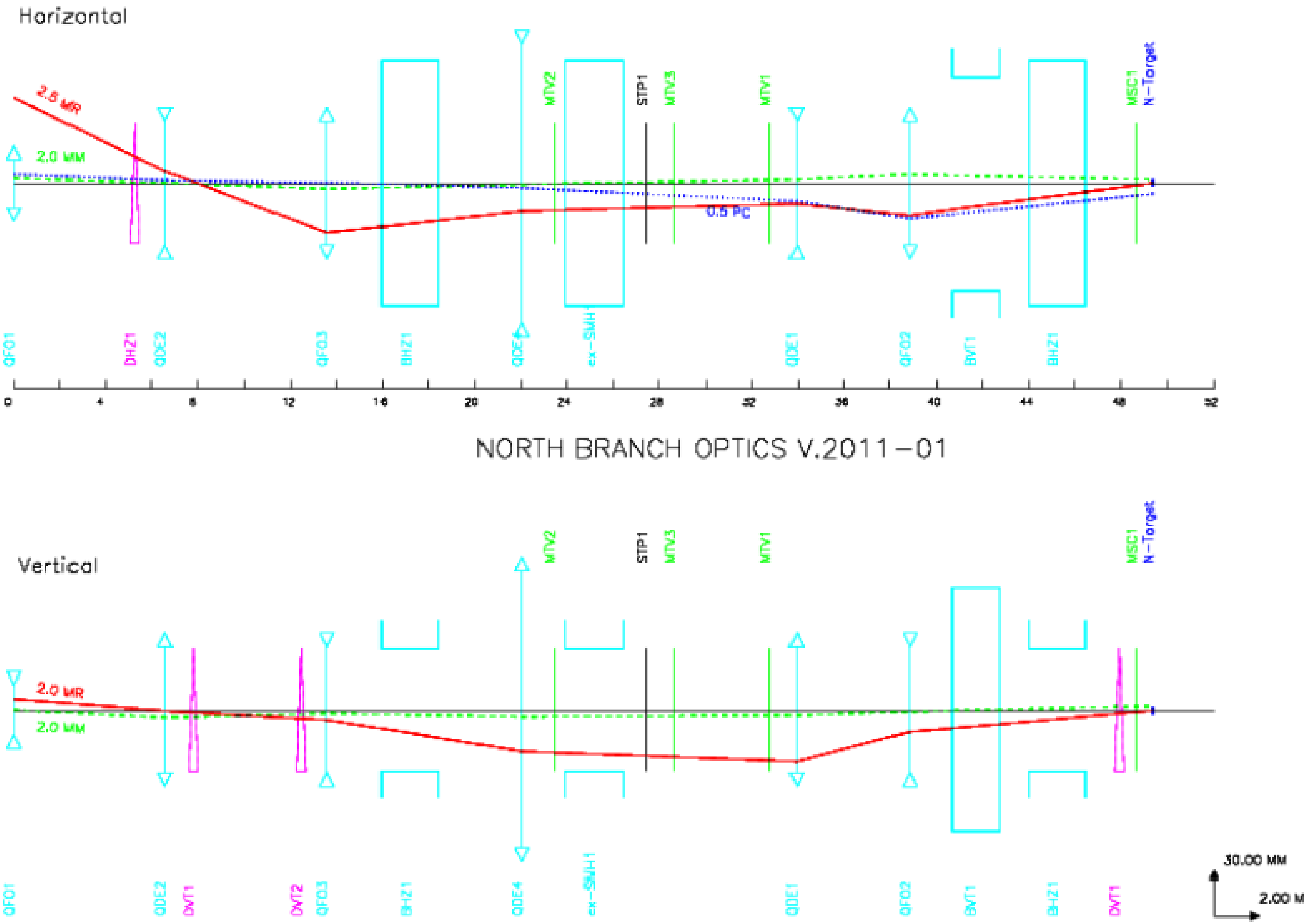
DIRAC OPTICS V2011–01

Not significantly different from 2008



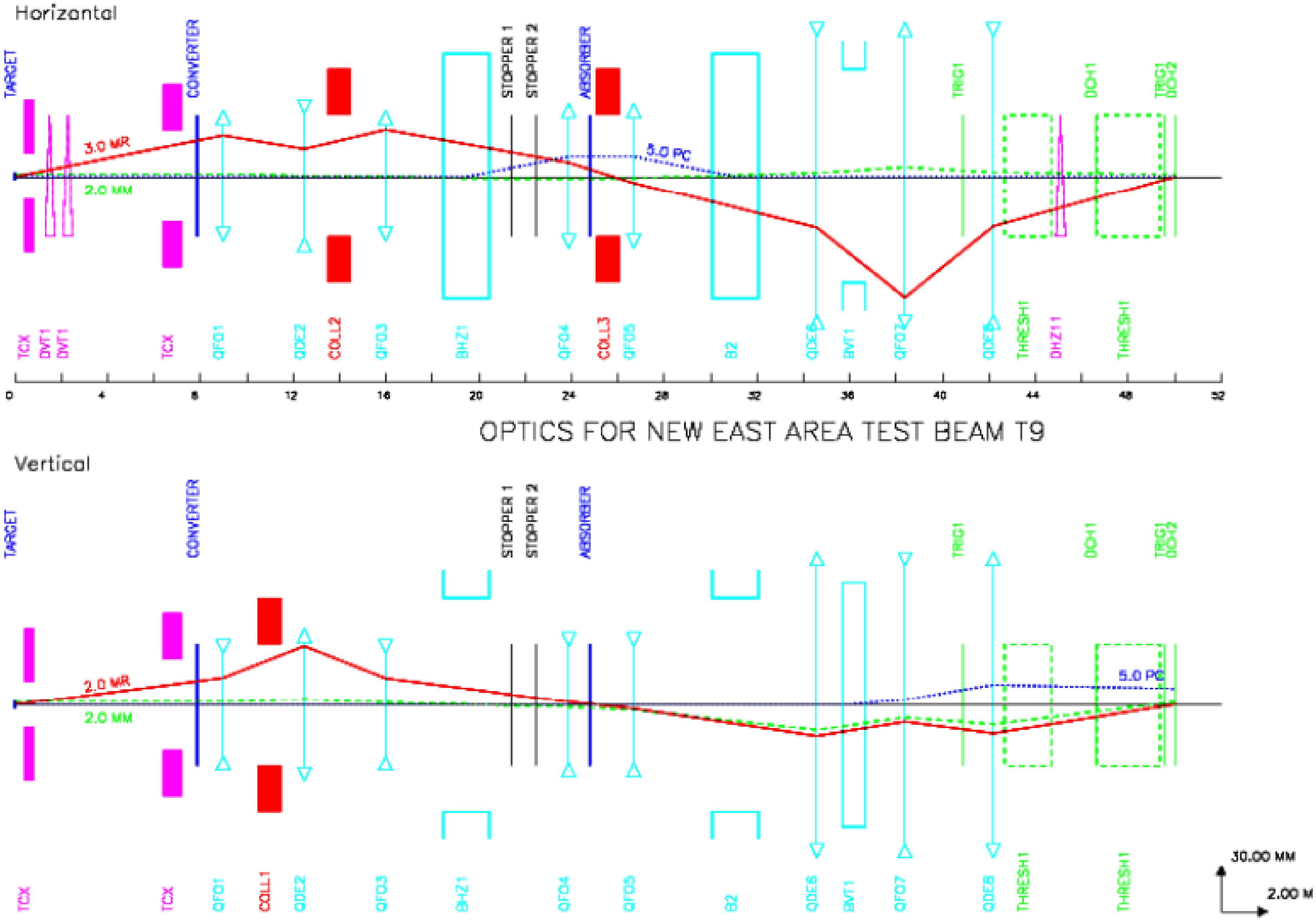
Different central trajectory

+ changes of magnet types



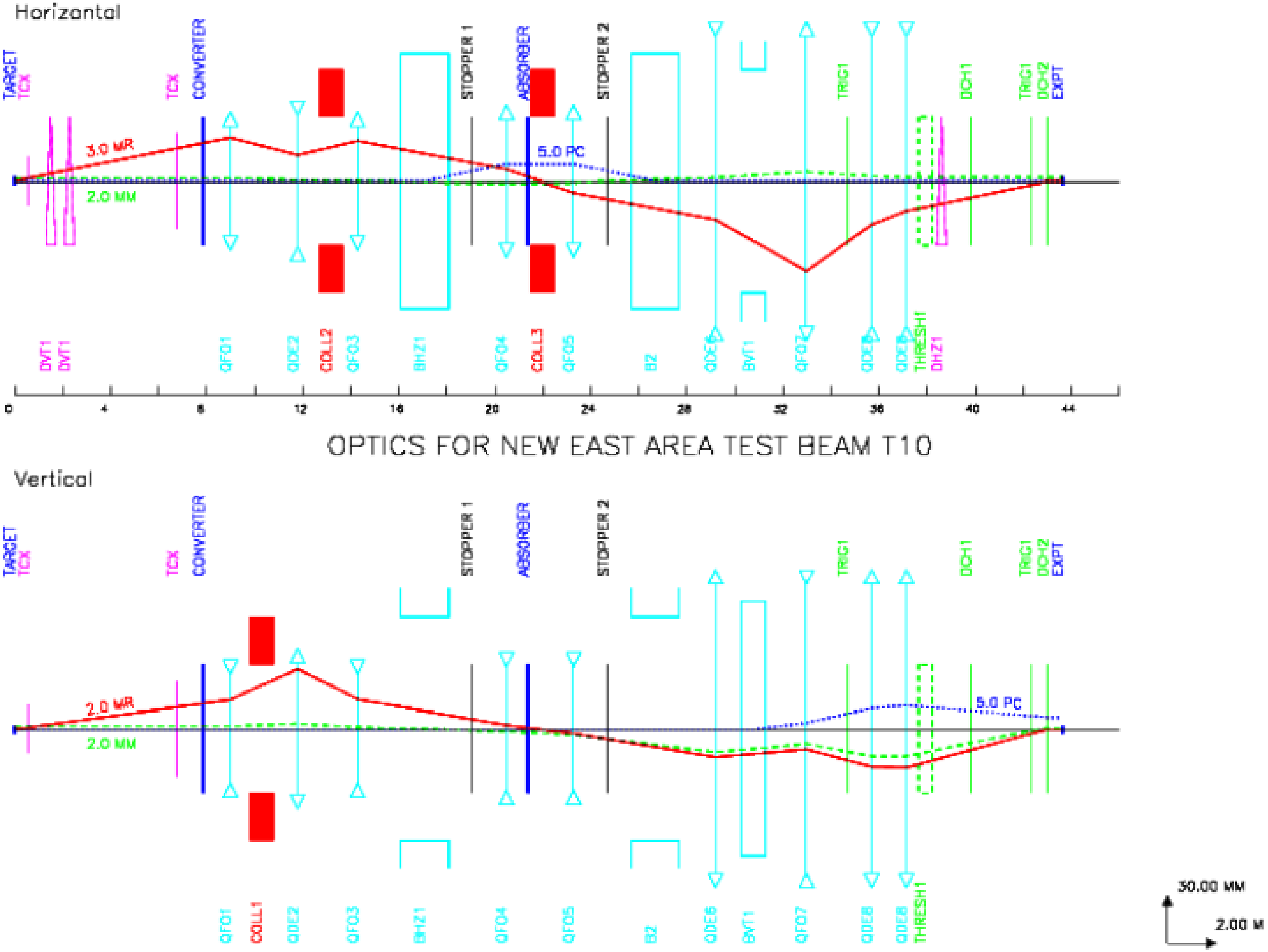
Horizontal
2.5 MR
2.0 MM
0.5 PC
MTV2
STP1
MTV3
MTV1
MSC1
N-Target
QFO1
DHZ1
QDE2
QFO3
BHZ1
QDE4
ex-SWH1
QDE1
QFO2
BVT1
0
4
8
12
16
20
24
28
32
36
40
44
48
52
NORTH BRANCH OPTICS V.2011-01
Vertical
2.0 MR
2.0 MM
DVT1
DVT2
30.00 MM
2.00 M

SECONDARY BEAM → OPTICS FOR "T9++ BEAM"

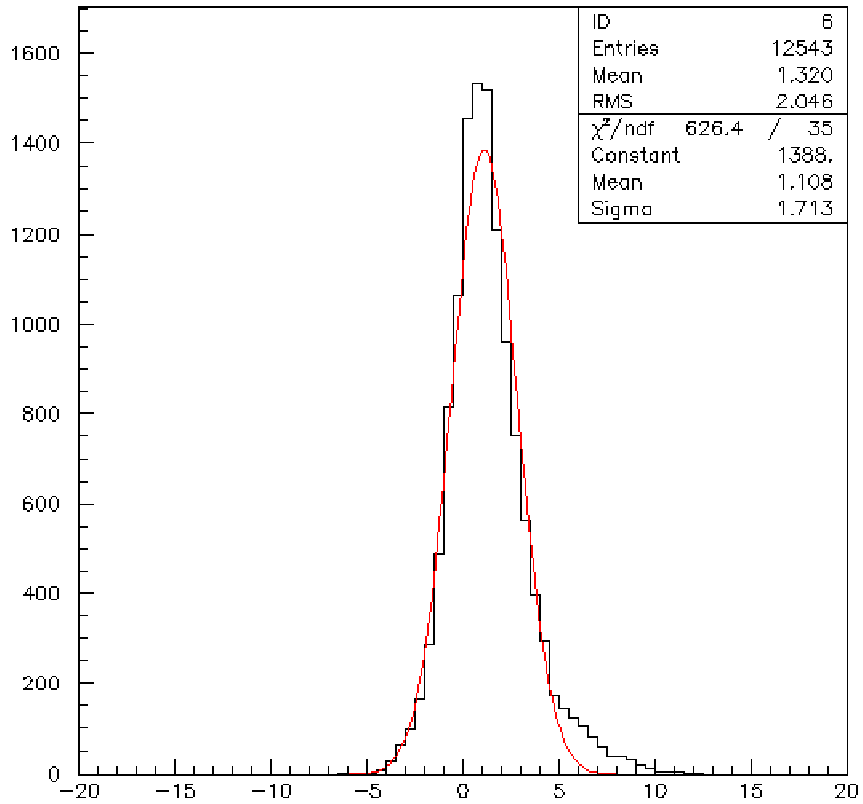


Even better transmission than generic optics!

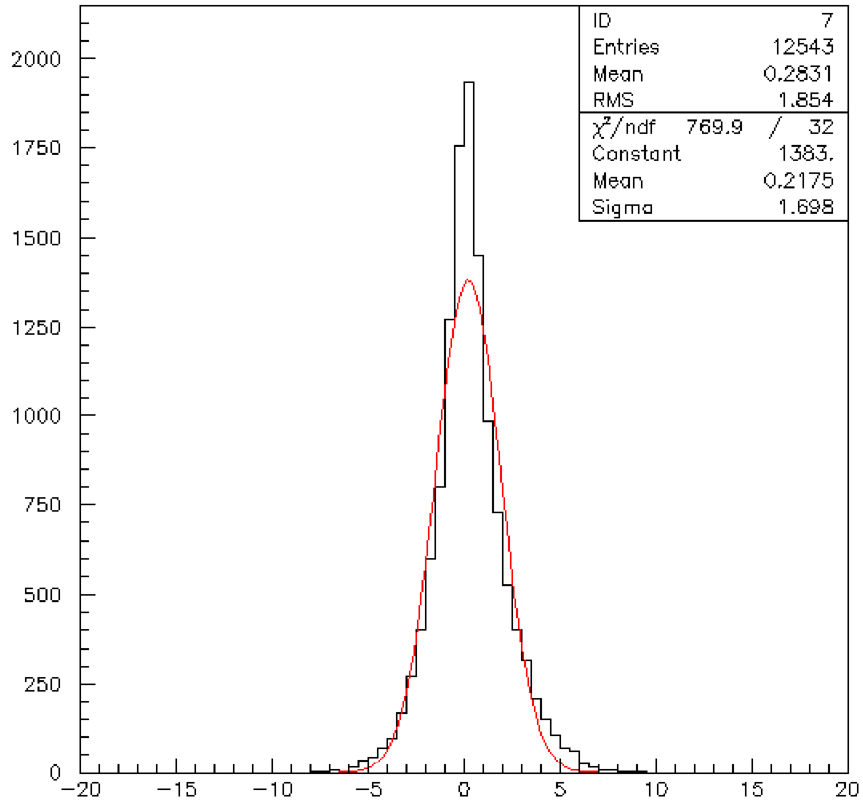
SECONDARY BEAM OPTICS FOR "T10++ BEAM"



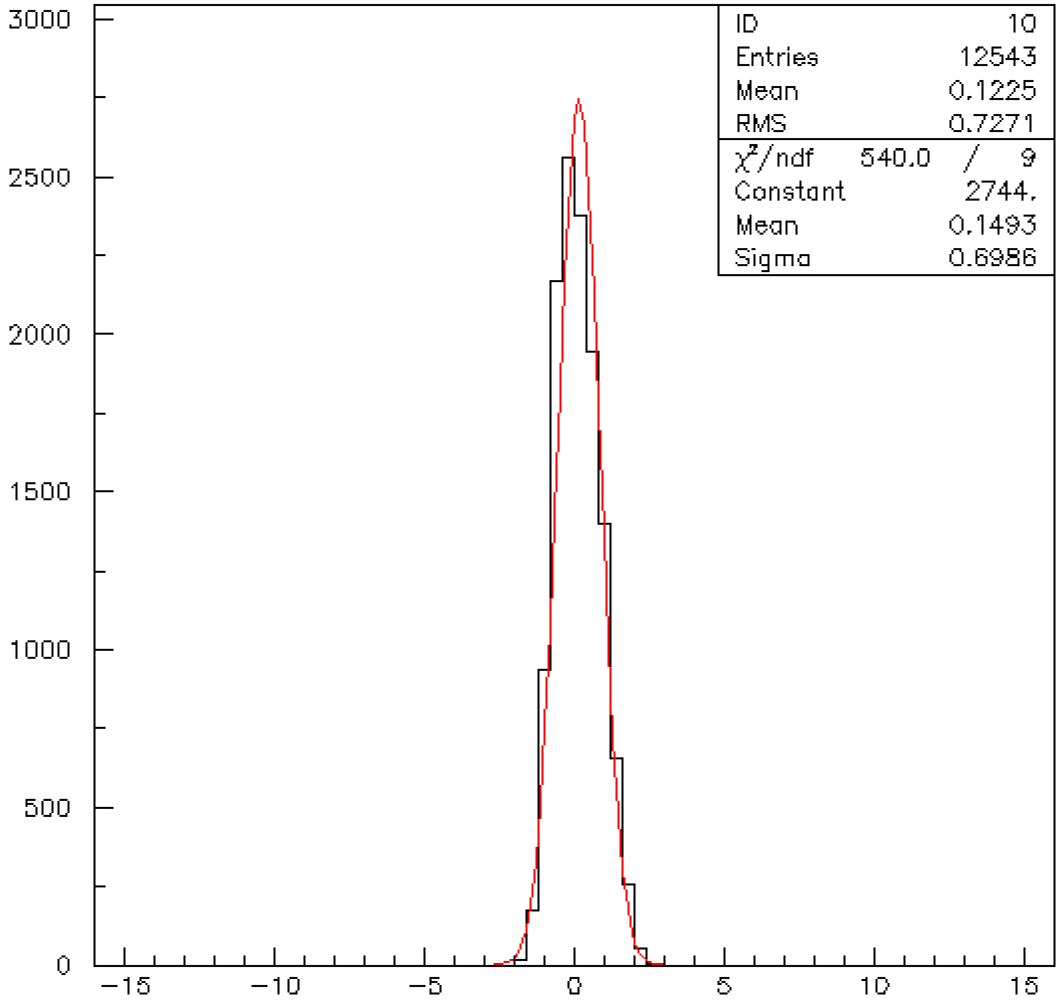
TURTLE SIMULATION (for $C1_{ACCV}$=$C2_{ACCH}$ = ±40 mm, $C3_{\Delta P}$ = ±1 mm)



X in mm



Y in mm

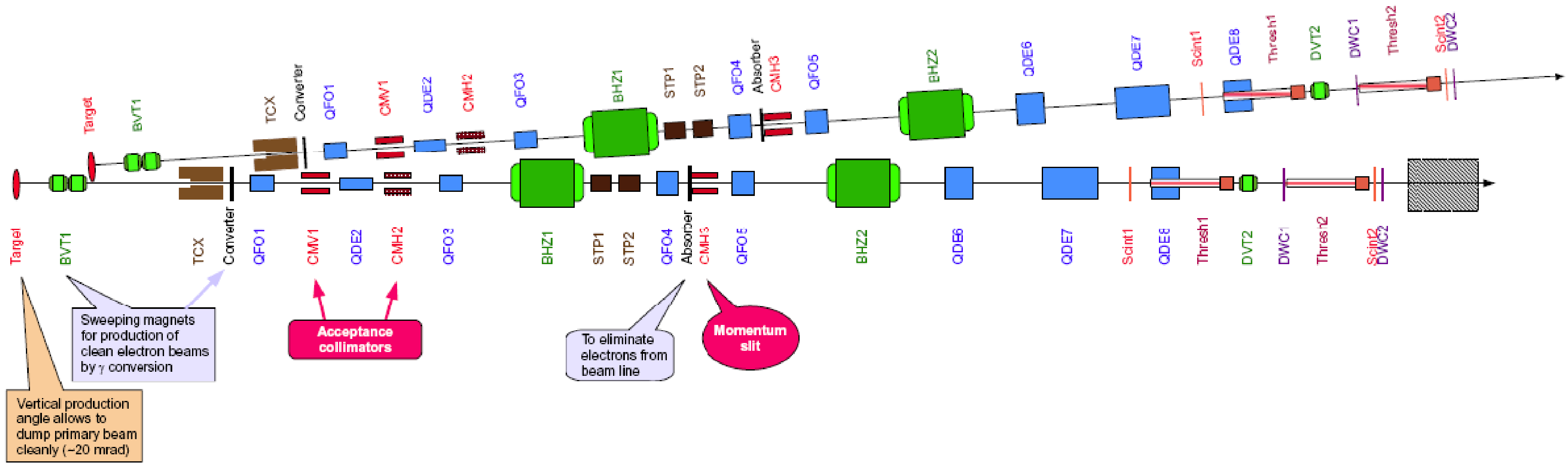


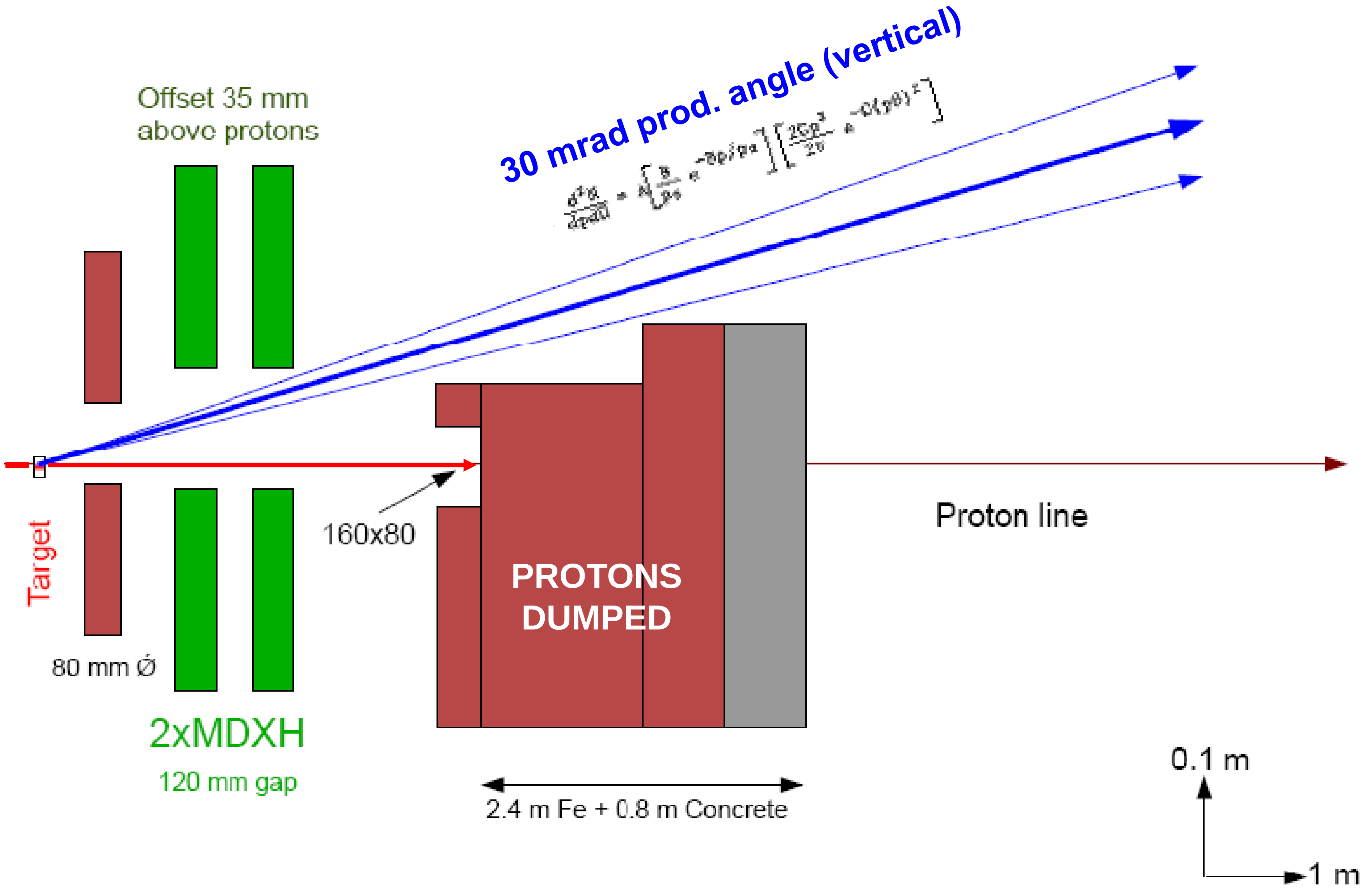
ID 10
Entries 12543
Mean 0.1225
RMS 0.7271
χ^2/ndf 540.0 / 9
Constant 2744.
Mean 0.1493
Sigma 0.6986
3000
2500
2000
1500
1000
500
0
−15
−10
−5
0
5
10
15

Δp/p in %

SCHEMATIC LAYOUT OF THE TWO SECONDARY BEAMS

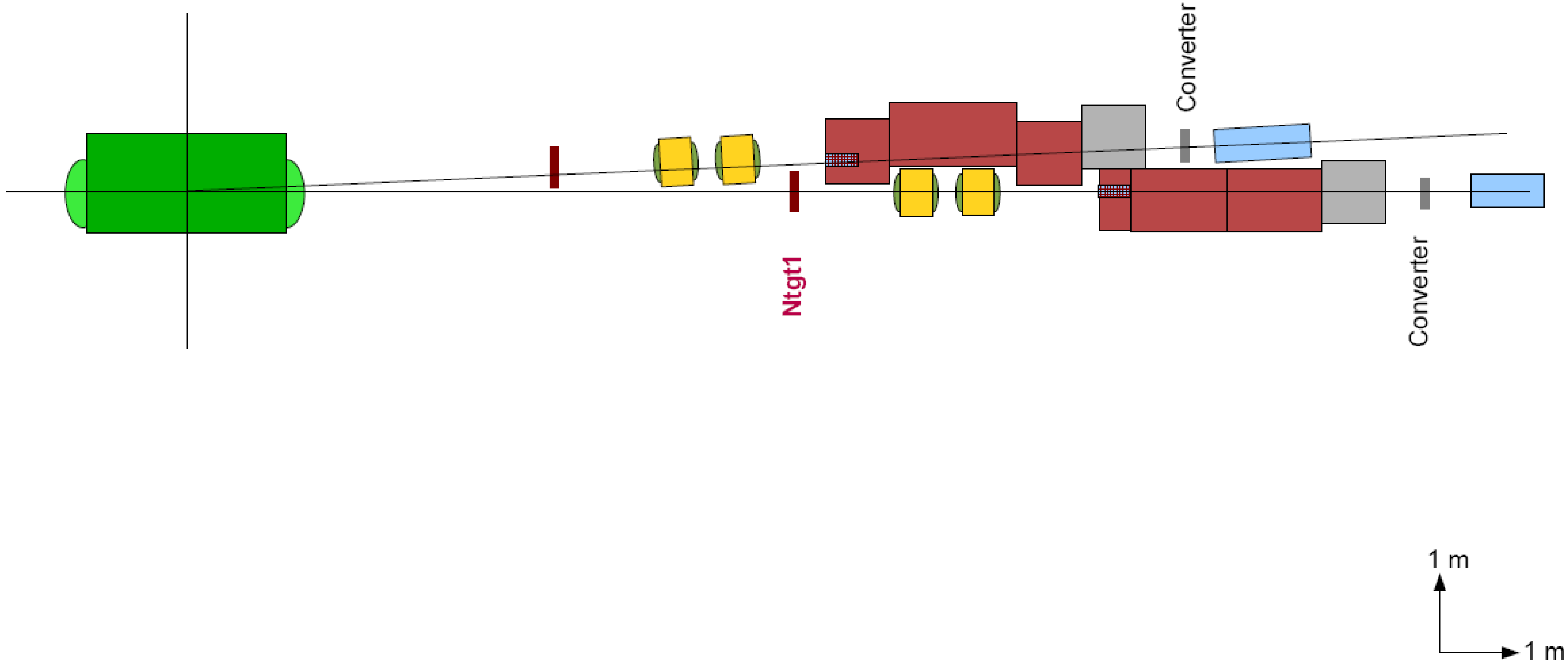
(inspired by "West Area 2000" approach)





30 mrad prod. angle (vertical)
Offset 35 mm
above protons
Target
80 mm Ø
2xMDXH
120 mm gap
160x80
PROTONS
DUMPED
2.4 m Fe + 0.8 m Concrete
Proton line
0.1 m
1 m

Top view of shielding after North targets in East Area



Magnets for new East Area

Type	# Avail	Locations where used										Used	#Spares
MCB	10	BP.BHZ1	BP.SMH1	BS.BHZ1	BS.BHZ2	BD.BHZ1	BD.BHZ2	BP.BHZ1	BN.BHZ2	+Spares at SPS		8	2
M100SP	4	B1.BVT1	B2.BVT1									2	2
M105	3	BS.DHZ1	BN.DHZ1									2	1
M200SP	10	B1.BHZ1	B1.BHZ2	B2.BHZ1	B2.BHZ2							4	6
MC200	7	BN.BVT1										1	6
MEA19	8	BP.DVT1	BP.DVT2									2	6
MNPA25	6	BP.DHZ1	BN.DVT1									2	4
MNPA30	7	BS.DVT1	BD.DVT1									2	5
Q100	17	B1.QDE6	B1.QDE8	B2.QDE6	B2.QDE8	B2.QDE8b						5	12
									Spares at SPS				
Q120	7	BP.QDE02	BN.QDE1	BN.QFO2	B1.QDE2	B2.QDE2						5	2
Q200	5	BD.QDE1	BD.QFO2	B1.QFO7	B2.QFO7		Spares at SPS					4	1
Q600	9	BP.QDE4										1	8
QFL	5	BP.QFO03	BS.QFO1	BS.QDE2								3	2
QFS	10	B1.QFO4	B1.QFO5	B2.QFO4	B2.QFO5							4	6
QDS	12	B1.QFO1	B1.QFO3	B2.QFO1	B2.QFO3							4	8
Q74	2 (?)	BP.QFO01										1	1
MDX	10	B1.DVT1a	B1.DVT1b	B2.DVT1a	B2.DVT1b	B1.DHZ1	B2.DHZ2					6	4
MEJ15	3											0	3

BP = Primary line
BD = DIRAC beam line

BN=North branch
BS=South branch

B1 = Secondary beam #1
B2 = Secondary beam #2

Green shading = spares
Red shading = unavailable

POWER SUPPLY REQUIREMENTS PRIMARY BEAMS

Preliminary

Magnet	I_{max}[A]	V_{max} [V]	Rectifier
PRIMARY LINE			
BP.QFO1	650		R2g.07
BP.DHZ1	600	60	R2.08
BP.QDE2	400	80	R1.15
BP.DVT1	250	70	R1.17
BP.DVT2	250	70	R1.16
BP.QFO3	400	40	R2.14
BP.BHZ1	600	120	R2.03
BP.QDE4	350	140	R2b.06
SOUTH BRANCH			
BS."SMH1"	500	100	R3.07
BS.BHZ1	300	50	R3.02
BS.QFO1	400	40	R2b.05
BS.QDE2	400	40	R2a.25
BS.DHZ1	180*		T1b.01pp
BS.DVT1	600	80	R2g.02
BS.BHZ2	800	150	R2a.20

Magnet	I_{max}[A]	V_{max} [V]	Rectifier
DIRAC LINE			
BD.BHZ1	400	80	R2.10
BD.BHZ2	400	80	R2g.04
BD.DVT1	200	40	R2b.07
BD.DHZ1	480*	30	T1b.03
BD.QDE1	500	100	R2a.28
BD.QFO2	500	100	R2a.22
SPECTRO	2500		R6.01
NORTH BRANCH			
BN.QDE1	250	50	R10.02
BN.QFO2	300	60	R2b.08
BN.DVT1	400*	60	R1.14
BN.BHZ2	800	100	R2g.05
BN.BHZ3	880	200	R3.08

*) Same limit as before

green = as before
red = swapped with other elements

POWER SUPPLY REQUIREMENTS SECONDARY BEAMS

Preliminary

Magnet	I_{max}[A]	V_{max} [V]	Rectifier
"T9 BEAM"			
T9.DHZ1	240	150	R2g.03
T9.QFO1	350	25	R2.17
T9.QDE2	350	80	R2a.23
T9.QDE3	350	25	R2g.01
T9.BHZ1	600	150	R2b.01
T9.QFO4*	350	30	R2g.08
T9.QFO5*	350	30	R2g.10
T9.BHZ2	600	150	R2.09
T9.QDE6	700	150	R2.06
T9.BVT1	450	120	R2.12
T9.QFO7	600	120	R2.15
T9.QDE8	700	150	R2.16
T9.DHZ1	240	80	R2.07
T9.DVT2	240	80	R2.04

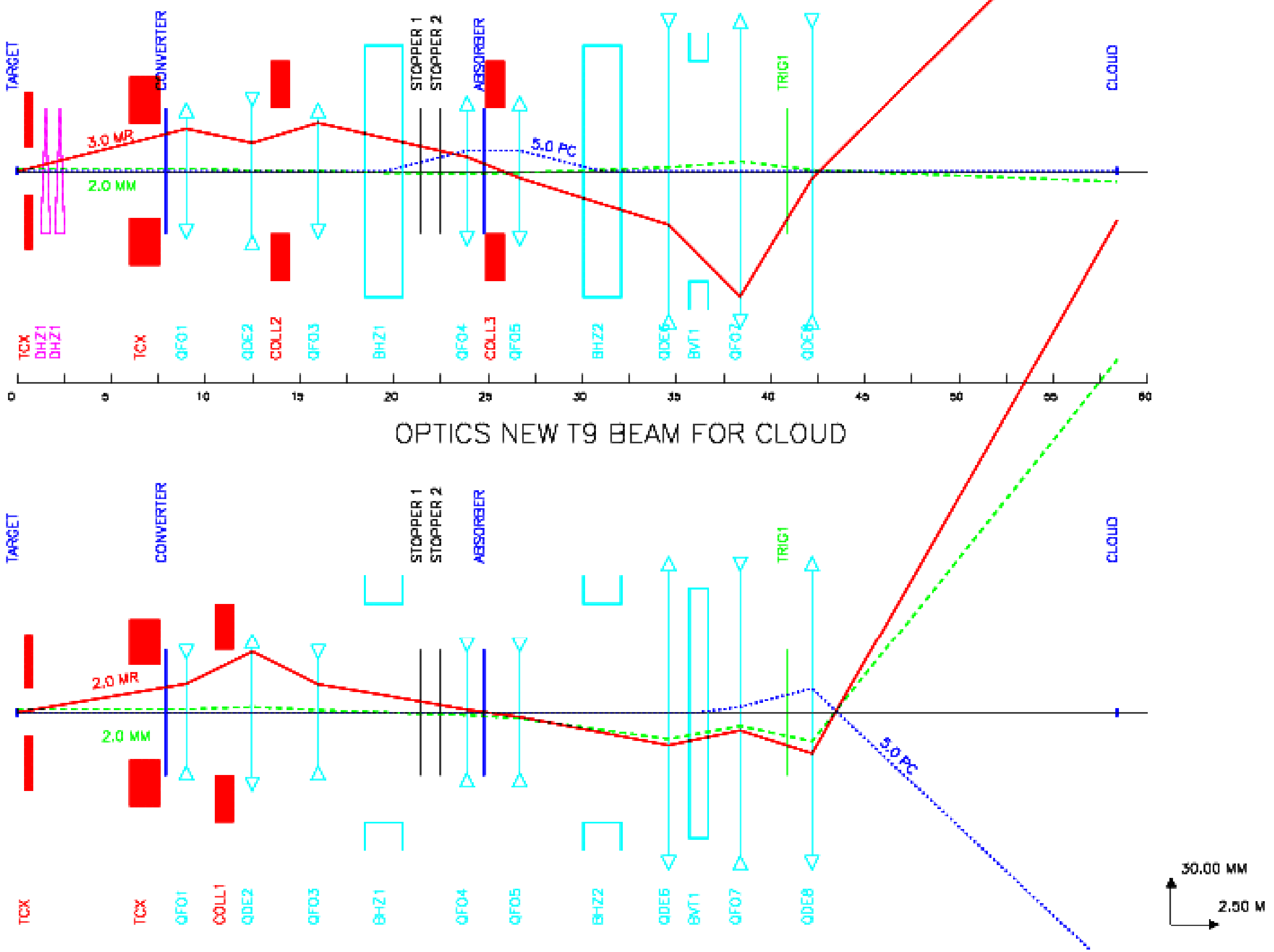
Magnet	I_{max}[A]	V_{max} [V]	Rectifier
"T10 BEAM"			
T10.DHZ1	240	150	R2a.27
T10.QFO1	400	30	R2.01
T10.QDE2	450	80	R2.11
T10.QDE3	400	30	R3.05
T10.BHZ1	750	200	R3.04
T10.QFO4*	500	50	R1.18
T10.QFO5*	500	50	R2g.09
T10.BHZ2	750	200	R3.03
T10.QDE6	600	150	R2.13
T10.BVT1	600	150	R2b.04
T10.QFO7	600	150	R2.05
T10.QDE8	400	160	R2.18
T10.DHZ1	240	80	R2a.21
T10.DVT2	240	80	R2g.06

All existing in present T9, T10, T11. Spectrometers (existing!) to be added

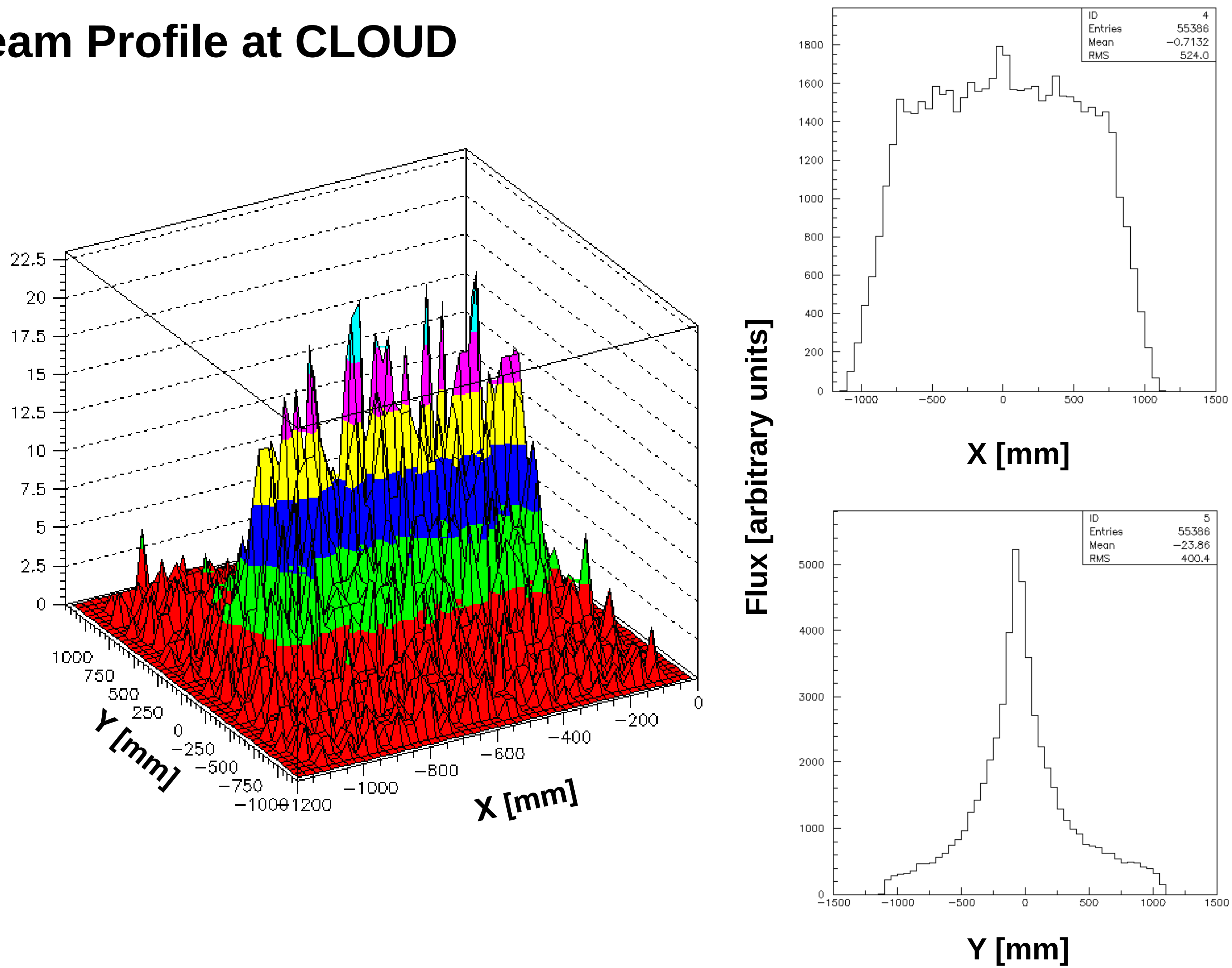
**) Could be connected in series*

Detailed attribution remains to be optimised!

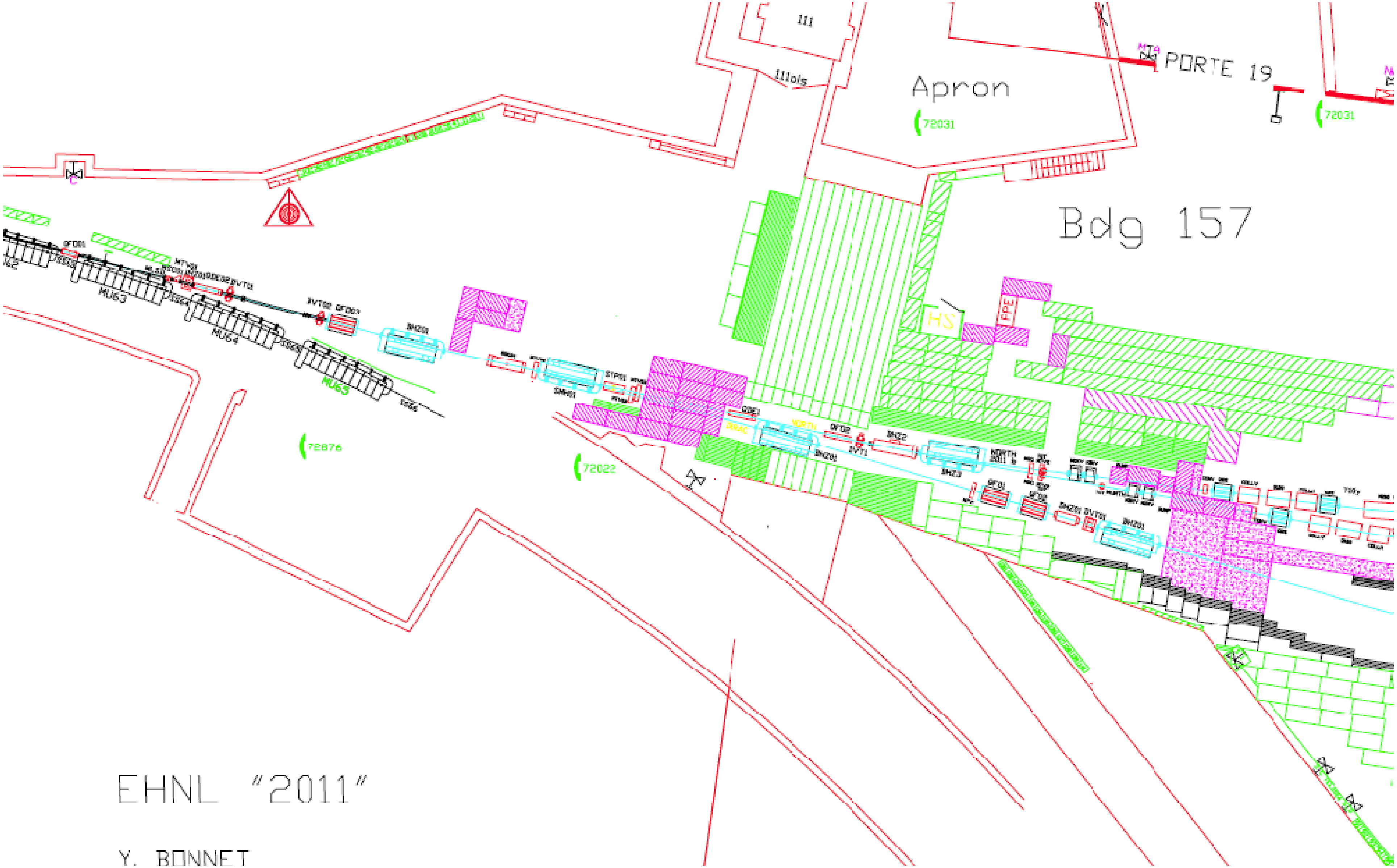
SPECIAL BEAM OPTICS FOR CLOUD (Beam spot ~2x2 m!!!)



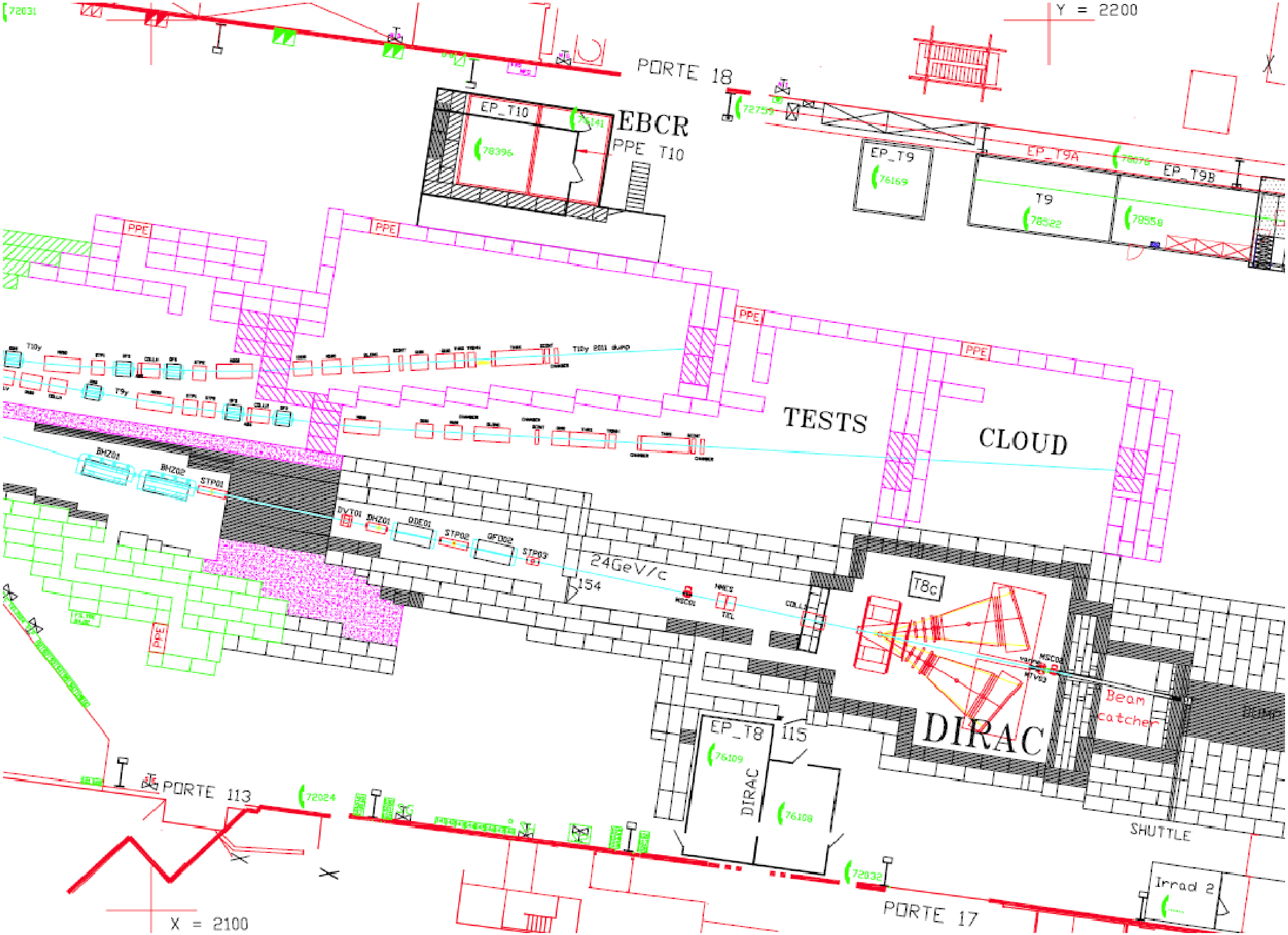
Beam Profile at CLOUD



And this is how it looks 'on the floor':



Apron
PORTE 19
Bdg 157
72031
72031
72876
72022
MU63
MU64
MU65
HS
EHNL "2011"
Y. BONNET

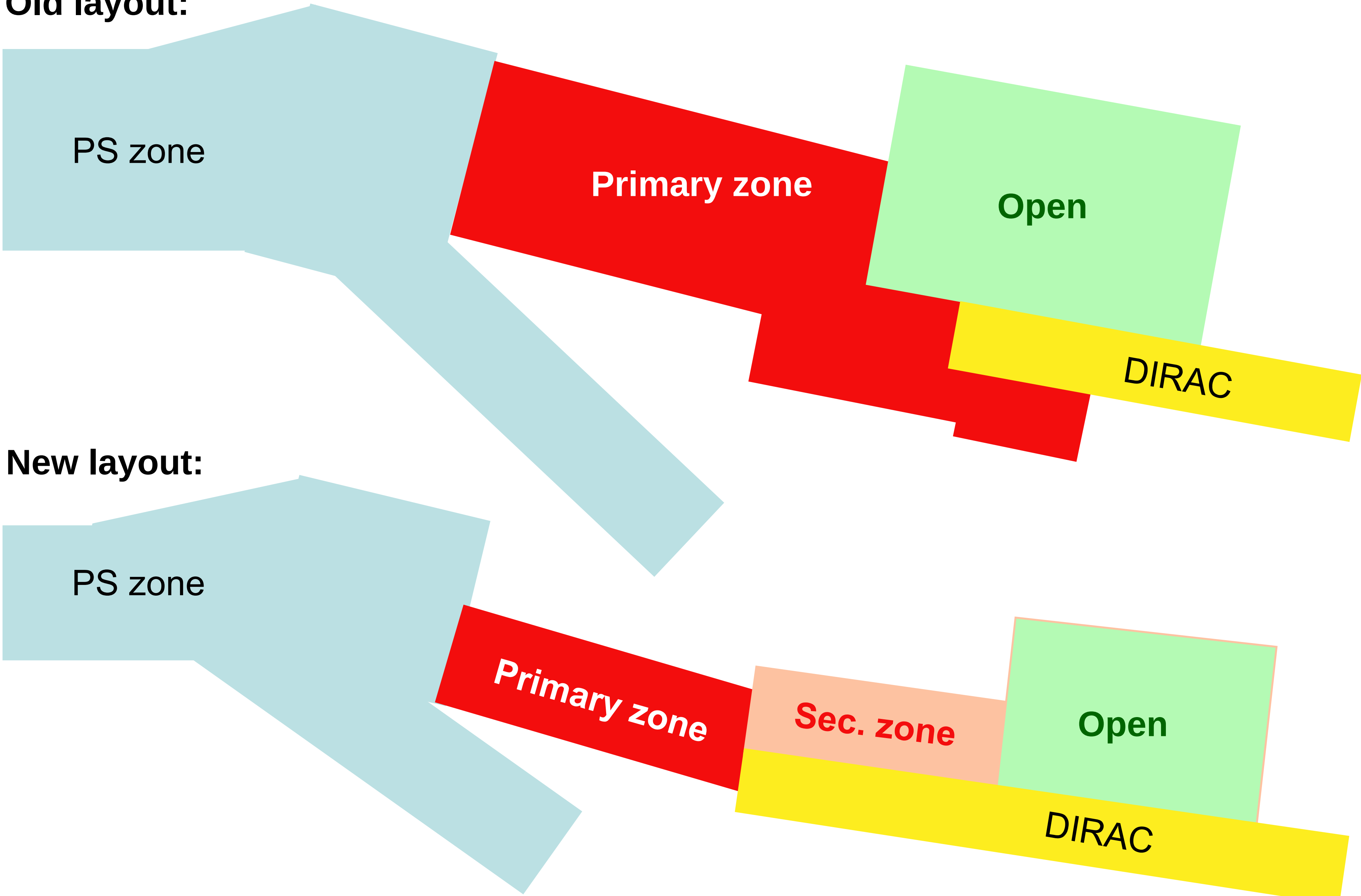


Y = 2200
PORTE 18
EP_T10
EBCR
PPE T10
EP_T9
EP_T9A
EP_T9B
T9
PPE
TESTS
CLOUD
BHZ01
BHZ02
STP01
DVT01
QDE01
STP02
QFO02
STP03
24GeV/c
154
T8c
DIRAC
Beam
catcher
EP_T8
115
DIRAC
SHUTTLE
PORTE 113
PORTE 17
Irrad 2
X = 2100

The shapes are made as overlays on the old, respectively new layout drawing, on the same scales

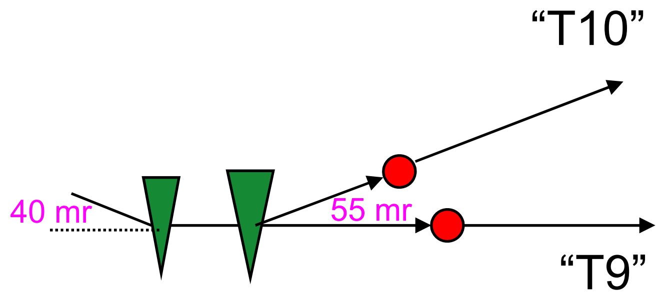
Old layout:

New layout:



How to run two test beams simultaneously

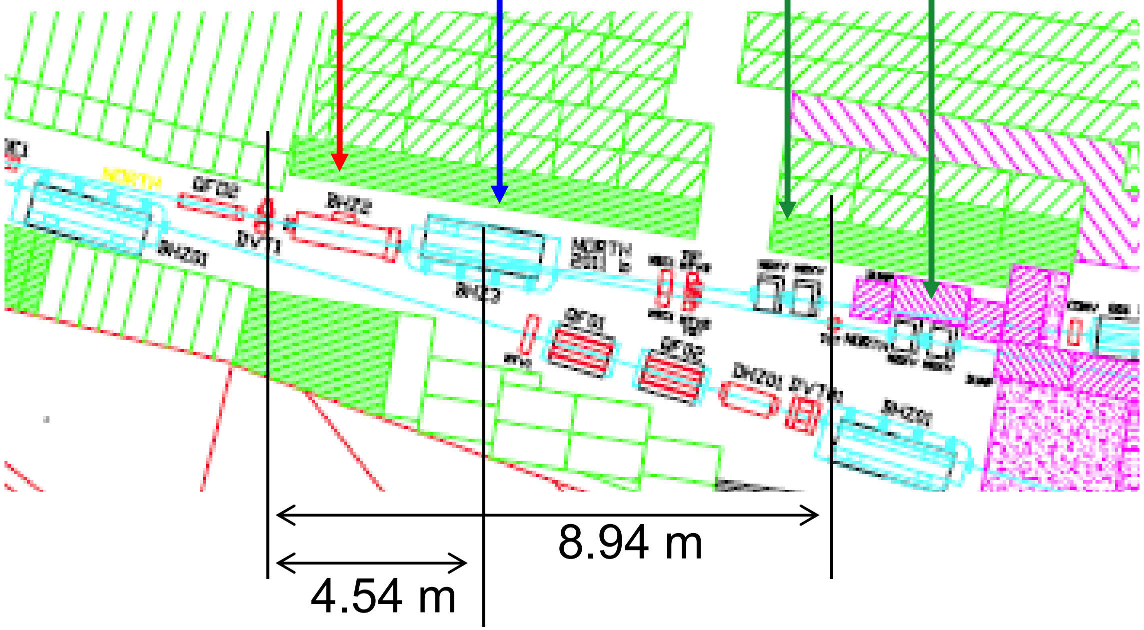
So far: Layout for switch, i.e. run two test beams on different cycles



M200
40 mrad Bend
to separate
North branches
from DIRAC

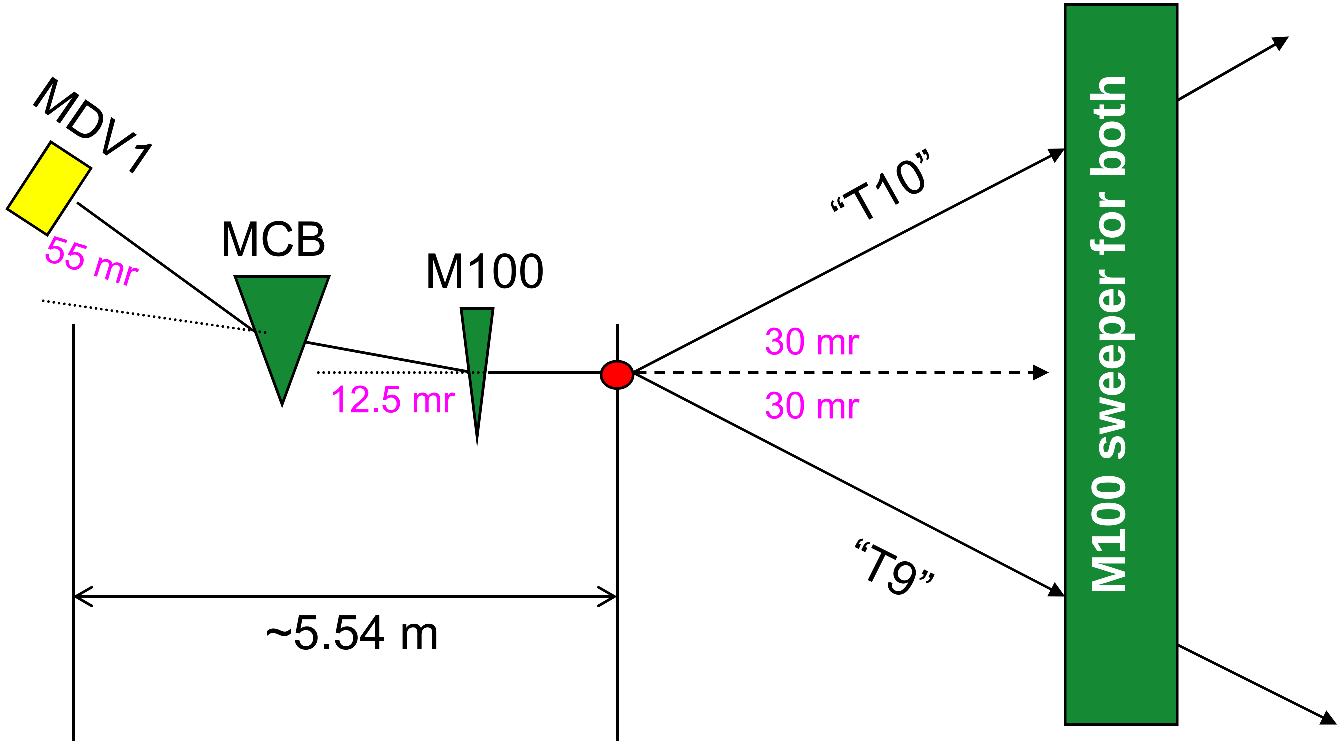
MCB
to switch from
"T9" to "T10"
in PPM mode
(55 mrad)

2x2 MDX
to sweep



Alternative solution:

$\theta_{prod} = 30\ mrad_H \oplus 35\ mrad_V \approx 46\ mrad$

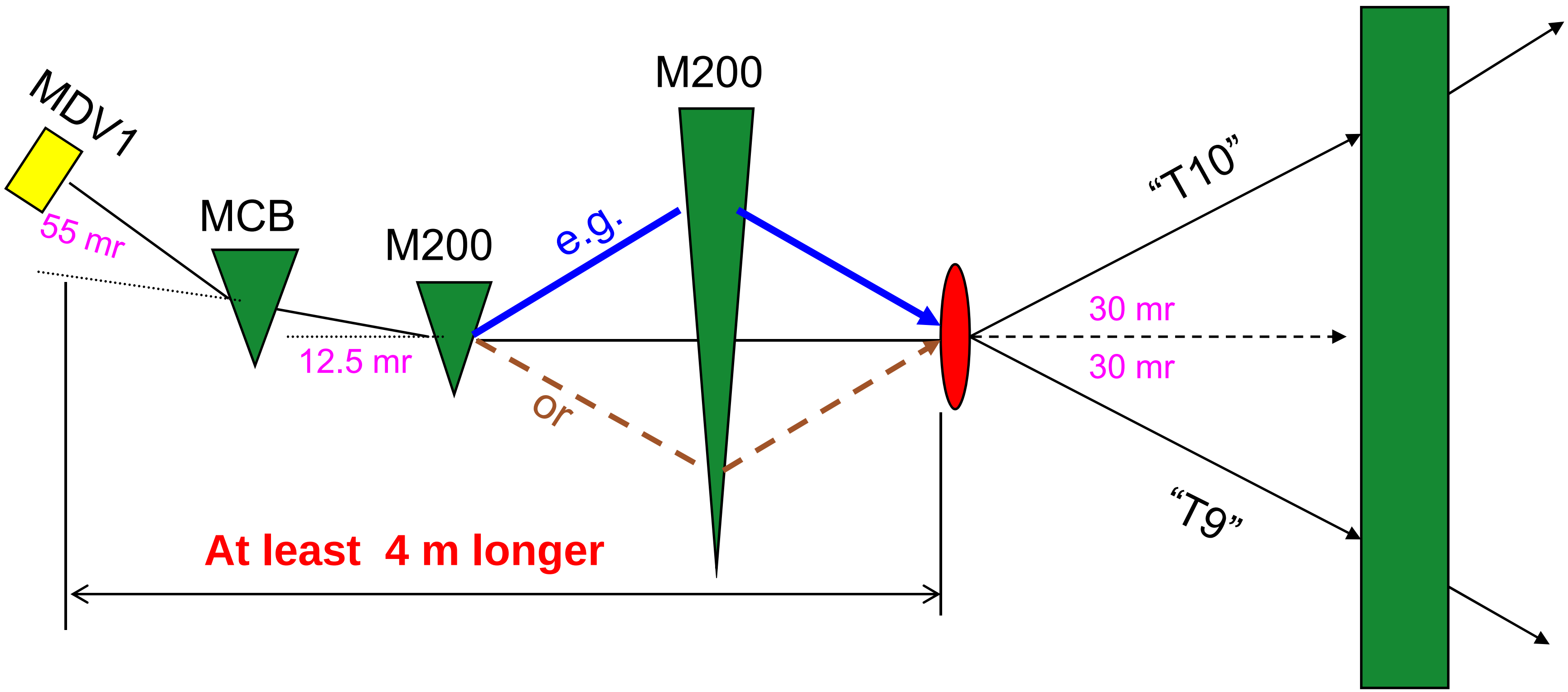


$\theta_{prod} = 30\ mrad_H \oplus 30\ mrad_V \approx 42\ mrad$

Advantage: operate both beams on the same cycle

Disadvantages: Larger production angles (degrade with θ^2 !)
Electron sweeping on/off for both beams
Shorten T9,T10 front-ends by 1 m, hence 5.5 cm closer together

Or a complete “Wobbling” as in North Area



Advantage: Get simultaneous operation with larger decoupling (as in North Area T2)

But have to move T9 and T10 beams downstream by at least 4 metres, i.e. into transit areas

What does this mean?

- Compatibility with requirements from DIRAC/IRRAD and CLOUD
- More flexible and better test beams, but (effectively <) 1 less

  Higher top momenta, small production angles, choice of particle type
- Only use agreed ‘healthy’ magnets with sufficient spares

  All magnets and rectifiers exist – reduced cost
- Primary beam is dumped almost immediately after target

  High (also induced) radiation levels restricted to minimal areas
- Very restricted number of magnets is under heavy roof shielding
  The ones in a limited zone following the primary area have only a thin roof shield.
  Many have no roof shielding.

  RP simulations are required to see whether the latter shield can be avoided
- Restricted material cost but lots of reshuffling of lines and shielding

Side remark:

In 2005 a proposal was made to upgrade the controls of the East Area.
For the moment in the East Area there is:

- no remote control / readout of collimators
- control of magnet currents only by working sets and knobs
- no easy and convenient beam files
- no remote reading of access system and vacuum state
- no user applications for reading of beam instrumentation

However, one delay wire chamber + a scintillator were added per beam since then

It seems that this could be an occasion to **migrate the East Area controls to Cesar** (i.e. the recently upgraded North Area controls).

At the time the resource estimate (excluding DWC + scints) were about 80 kCHF for VME crates + Cerenkov upgrades plus a number of man months on the software side. Now part of this upgrade has been done already (timing, VME).

Proposed time line

- CLOUD changes from Mk2 to Mk3 module in 2011 (tbc)
  This requires a larger beam and a larger zone (T11 → T9B zone)
  It seems reasonable to synchronize the EA modifications with this change
- DIRAC / IRRAD future not well understood at this moment
  but new design is essentially decoupled from this question

➡ Rebuild of parts inside PS and of primary zone in **shutdown 2010/11**, provided CLOUD has completed its Mk2 program

Continue construction of test beams during the 2011 run
Could probably continue operation of DIRAC during 2011 with some additional local shielding at exit of the primary zone

Total duration of project: **first estimates 8-12 months**

SUMMARY

- A conceptual design has been presented for a new East Area
  - *Compatible with approved experiments*
  - *Better, more flexible test beams. Users would benefit!*
- Uses reliable hardware with spares
- Restrict radiation hot spots to restricted regions
- Easier access to most of equipment in case of failure
- Modest material cost, but work to reshuffle lines and shielding
- Could start in shutdown 2010/2011 if funding available
- Engineering studies needed to finalize RP aspects and resource estimates

Thanks for your attention

Thanks also for very valuable input and help from many people.
In particular I want to mention:

F.Bordry, J.Lettry, W.Kalbreier, D.Tommasini, D.Bodart,

C.Rembser, E.Perez, H.Breuker, R.Steerenberg, J-L.Blanc, Th.Otto, M.Widorski, M.Lazzaroni, Y.Bonnet, …

Spare Slides

VERY PRELIMINARY ESTIMATES *(tbc by engineering studies)*

Team	Item	Weeks
Transport	Remove roof shielding	6
Transport	Remove equipment	2
Transport	Remove side shielding walls	2
Survey	Trace walls and beam lines on floor	2
Transport	Rebuild new shielding walls	4
Transport	Install concrete floors in beam areas	4
Transport	Install beam elements	4
Survey	Align beam elements	4
Transport	Rebuild roof shields	4
Magnets	Connect magnets (power, cooling, interlks)	4
Vacuum	Install and connect vacuum	4
Various	Instrumentation, RP monitors, etc	8
Various	Tests	4
		52 / **30**

green: can be done mostly in the shadow of other activities

Total duration could be 7-8 months (?). Primary + PS zone work in 4 months?

Remember: West Area rebuild in late 1990's

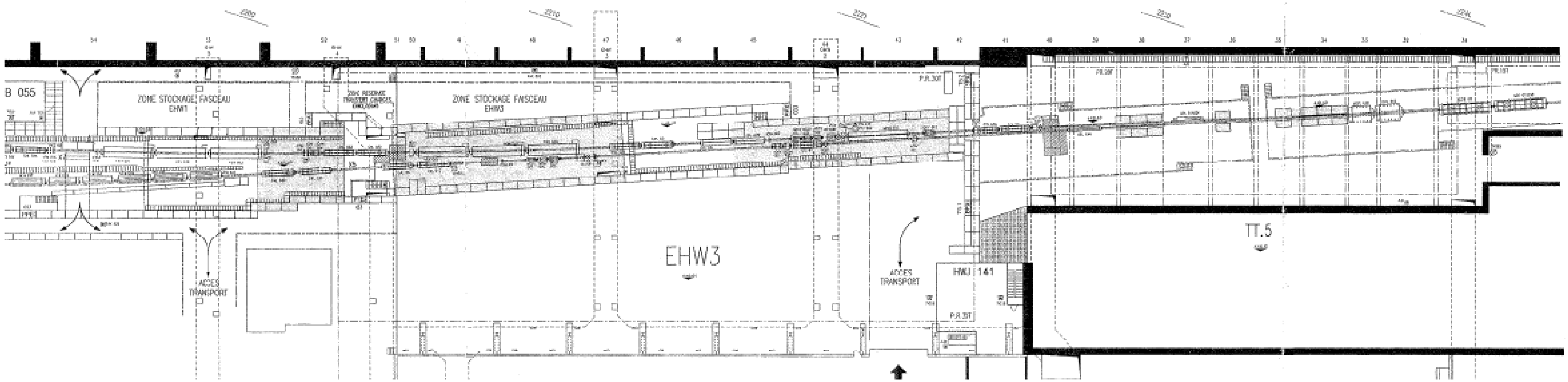
Beam	Length (m)	Budget	Duration	Comments
X5	≈ 280	< 250kCHF	14 weeks	From H3 splitter
X7	≈ 220	< 250kCHF	14 weeks	From H3 splitter
H3	≈ 600	~1.1 MCHF	18 weeks	From T1 target to H3 splitter. Cost dominated by new T1 target and primary beam dump blocks

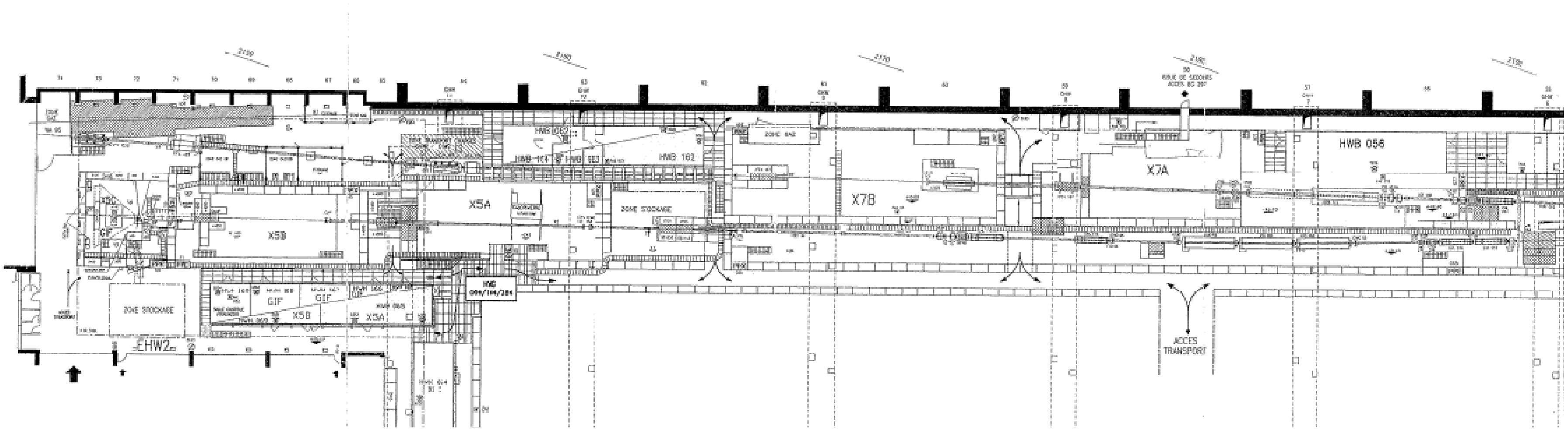
Compare to East Area

Beam	Length (m)
Primary beam+South branch	65
Dirac line (hardly touched)	75
North branch	30
T9 beam	70
T10 beam	50
Total	290 (215)

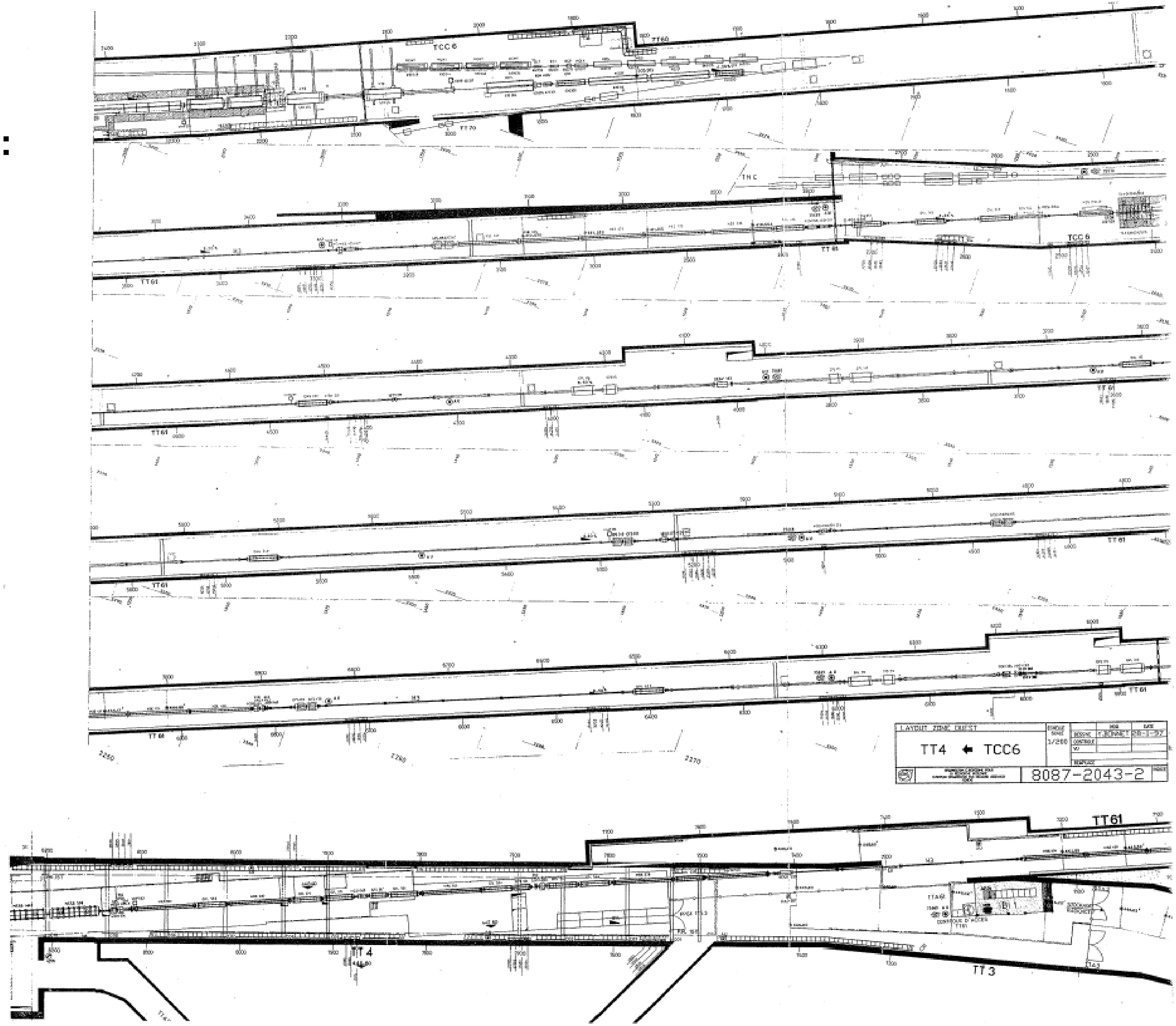
The proposed East Area reorganization seems of a similar scale as the rebuild of X5 and X7 (i.e. excluding the H3 part), which took at the time a total of ≈ 7 months and ≈ 500 kCHF

X5&X7 beams after upgrade in late 1990' s:





T1+H3 modification:



Characteristics of magnets available for new East area

Type	Curve	B_{max}(T)	BL_{max}	I_{max}(A)	Gap(mm)	w_{gap}(mm)	L_{yoke}	L_{upstr}	L_{down}	L_{tot}	Width	Height
MCB	MCB	1.73	4.5	880	80	160	2.5	0.325	0.295	3.12	1.246	1.25
M100SP	D100B	1.88	1.88	675/800	140	520	1.0	0.358	0.312	1.67	1.74	1.16
M105	D105	0.2476	0.2598	600	100	100	1.05	0.11	0.11	1.27	0.44/.413	1.515
M200SP	D200B	1.83	3.66	830	140	520	2.0	0.358	0.312	2.67	1.74	1.16
MC200	D200C	1.74	3.48	850	140	340	2.0	0.195	0.240	2.435	1.40	1.10
MEA19	D19B1	.79, .61	.15,.117	180	130, 196	220	0.19	0.067	0.067	0.324	0.62	0.86
MNPA25	D25	0.784	0.196	600	202	260	0.25	0.147	0.147	0.544	0.79(.68)	0.685
MNPA30	D30F	0.813	0.244	600	205	400	0.30	0.1465	0.1465	0.593	0.918	0.838
MDX	MDX100	1.35	0.54	240	100 (max)	80	0.40	0.135	0.108	0.643	0.60	0.60
MEJ15	D150	2.34	3.52	880	50	100	1.5	0.18	0.07	1.75	0.78	0.75

Type	Curve	B_{tip}(T)	G(T/m)	GL_{max}	I_{max}(A)	R_{gap}(mm)	L_{yoke}	L_{upstr}	L_{down}	L_{tot}	Width	Height
Q100	Q100	1.17	11.7	11.7	625	100	1.0	0.23	0.23	1.46	1.13	1.13
Q120	Q120A	1.322	26.44	31.73	900	50	1.2	0.17	0.09	1.46	0.415	1.46
Q200	Q200	1.115	11.15	22.3	750	100	2.0	0.23	0.254	2.484	1.13	1.13
Q600	Q150	1.01	10.05	15.08	875	100	1.5	0.135	0.26	1.895	1.09	0.58
QFL	Q120B	0.97	19.33	23.2	500	50	1.2	0.146	0.135	1.481	0.844	0.8775
QFS	Q80	0.945	18.9	15.7	500	50	0.8	0.146	0.135	1.081	0.844	0.8775
QDS	Q82	0.871	19.2	16.3	500	45.5	0.82	0.135	0.125	1.08	0.6	0.801

Units in metres, except if indicated otherwise. Indications in blue: depends critically on overall orientation
Curves in black: PS parameterization, curves in red: NA parameterization

Characteristics of magnets available for new East area (2)

Type	Weight(t)	Flow(m^3hr^{-1})	T rise (°)	P drop (bar)	R (mΩ)	Induct (mH)	Number	Reference	Manufact
MCB	20.5	3.6	30	15	172	639	10	PXMBHHCCWP	Alsthom
M100SP	17.7	2.7	30	3.5	195		4	PXMBHGGHWC	Oerlikon
M105	0.75	15	35	15	80	1.7	3	PXMBHBCHWP	Jungers
M200SP	35.5	4.0	30	5	208	975	10	PXMBHHEHWC	Alsthom
MC200	29.3	7.5	30	18	360		7	PXMBHHDCWC	Lintott
MEA19	0.52	0.6	30	5	250		8	PXMCXCCHWC	Elin
MNPA25	0.73	1	30	5.3	100		6	PXMCXCBWWC	Rade Koncar
MNPA30	1.04	1.1	30	5.3	100		7	PXMCXCDHWC	Rade Koncar
MDX	1.0	0.54	30	10	305	221	10		
MEJ15	8.5	4.5	30	16.7	200		3		Slikkerveer
Q100	6.85	2.7	30	5	200	80	17	PXMQNEETWC	Oerlikon
Q120	4.5	4.1	30	4	175		7	PXMQNEI8WC	Tesla
Q200	12, 17.1	3.3	30	4.5	200	115	5	PXMQNFBTWC	Rade Koncar
Q600	4.1	0.9	30	15	360		9	PXMQNEH_WC	BREDA
QFL	3.72	0.72	30	6	102	120	5	PXMQNEFTWP	BBC
QFS	2.6	0.6	30	8	64	82	10	PXMQNEGTWP	BBC
QDS	1.45	0.5	30	6	62	45	12		

Nominal Currents

BP ("F61") beam	
QFO1	642.5
DHZ1	0 (< 600)
QDE2	367.2
DVT1	0 (< 250)
DVT2	0 (< 250)
QFO3	388.0
BHZ1	490.7
QDE4	329.6

South branch	
"SMH1"	518.1
BHZ1	247.8
QFO1	375.5
QDE2	376.6
DHZ1	0 (< 180)
DVT1	0 (< 600)
BHZ2	0 (< 800)

"DIRAC" beam	
BHZ1	369.9
BHZ2	369.9
DVT1	0 (< 200)
DHZ1	0 (< 480)
QDE1	426.9
QFO2	486.7
Spectro	< 2500

North branch (A/B)	
QDE1	196.9 / 213.8
QFO2	226.1 / 269.5
DVT1	0 (< 400)
BHZ2	763.8
BHZ3	0 / 850.0

"T9" beam (15 GeV/c)	
DHZ1	0 (< 240)
QFO1	301.4
QDE2	320.4
QFO3	301.4
BHZ1	560.1
QFO4	338.2
QFO5	338.2
BHZ2	560.1
QDE6	630.1
BVT1	430.7
QFO7	505.2
QDE8	630.1
DHZ2	0 (< 240)
DVT1	0 (< 240)
Spectro	< 1000

"T10" beam (12 GeV/c)	
DHZ1	0 (< 240)
QFO1	299.1
QDE2	330.8
QFO3	299.1
BHZ1	712.9
QFO4	354.8
QFO5	354.8
BHZ2	712.9
QDE6	417.5
BVT1	386.2
QFO7	446.9
QDE8	277.3
DHZ2	0 (< 240)
DVT1	0 (< 240)