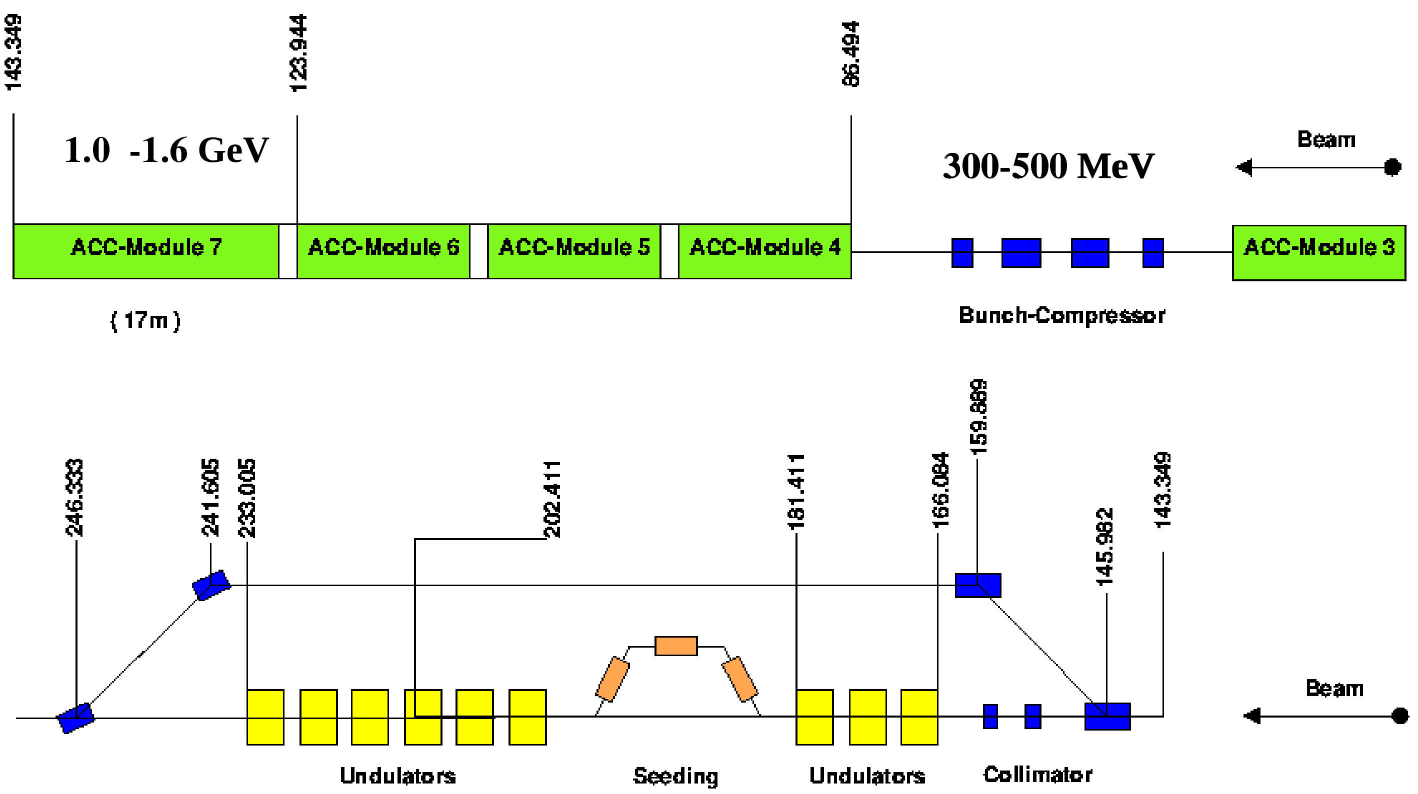
- **TTF2 overview**
- **Cross-section**
- **BC3**
- **Collimator**
- **temp. Beamlines**

- **Bypass - general layout**
  Bypass - quadrupole
  BPM
  Steerer

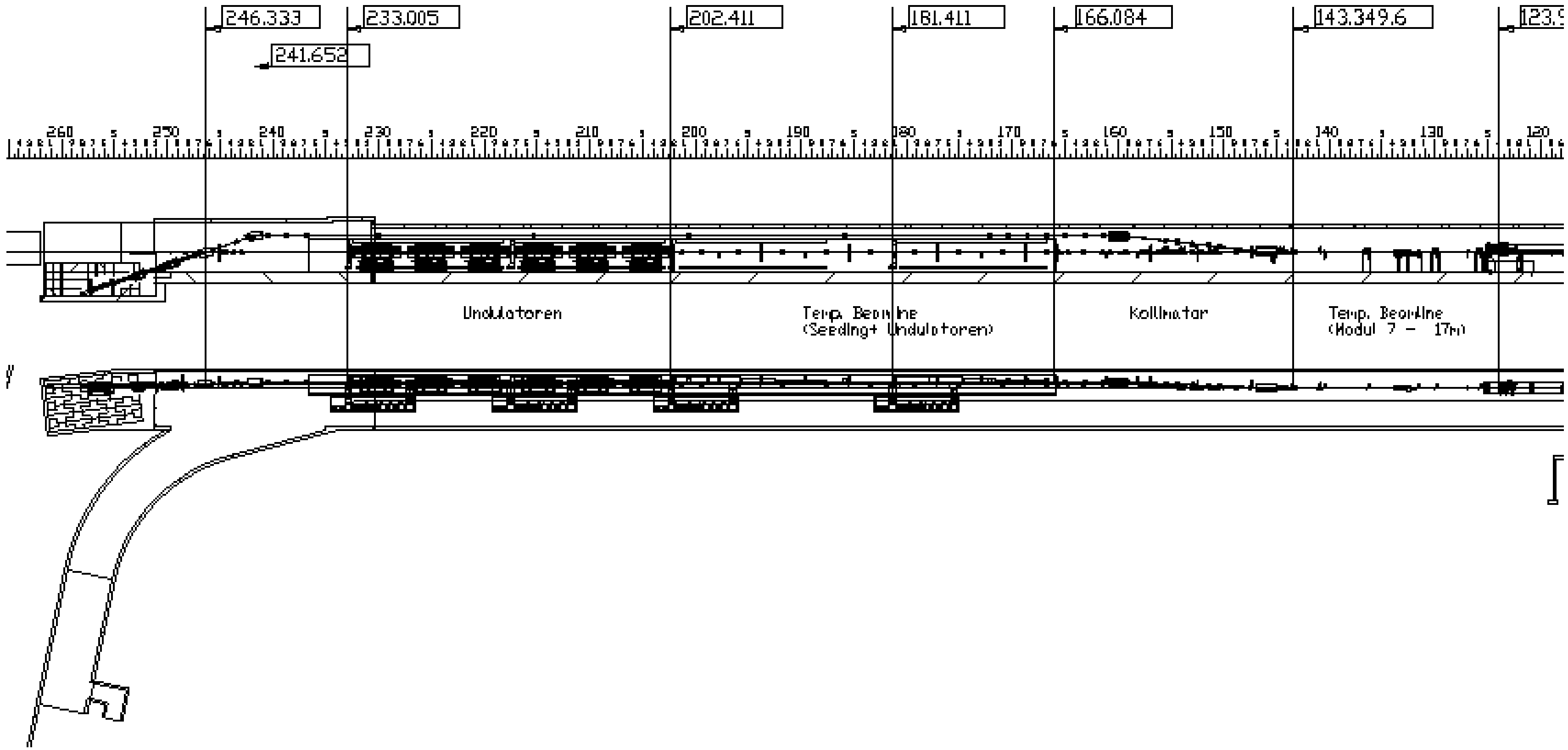
- **Impedance - long. wakefields**

TTF2 Scheme

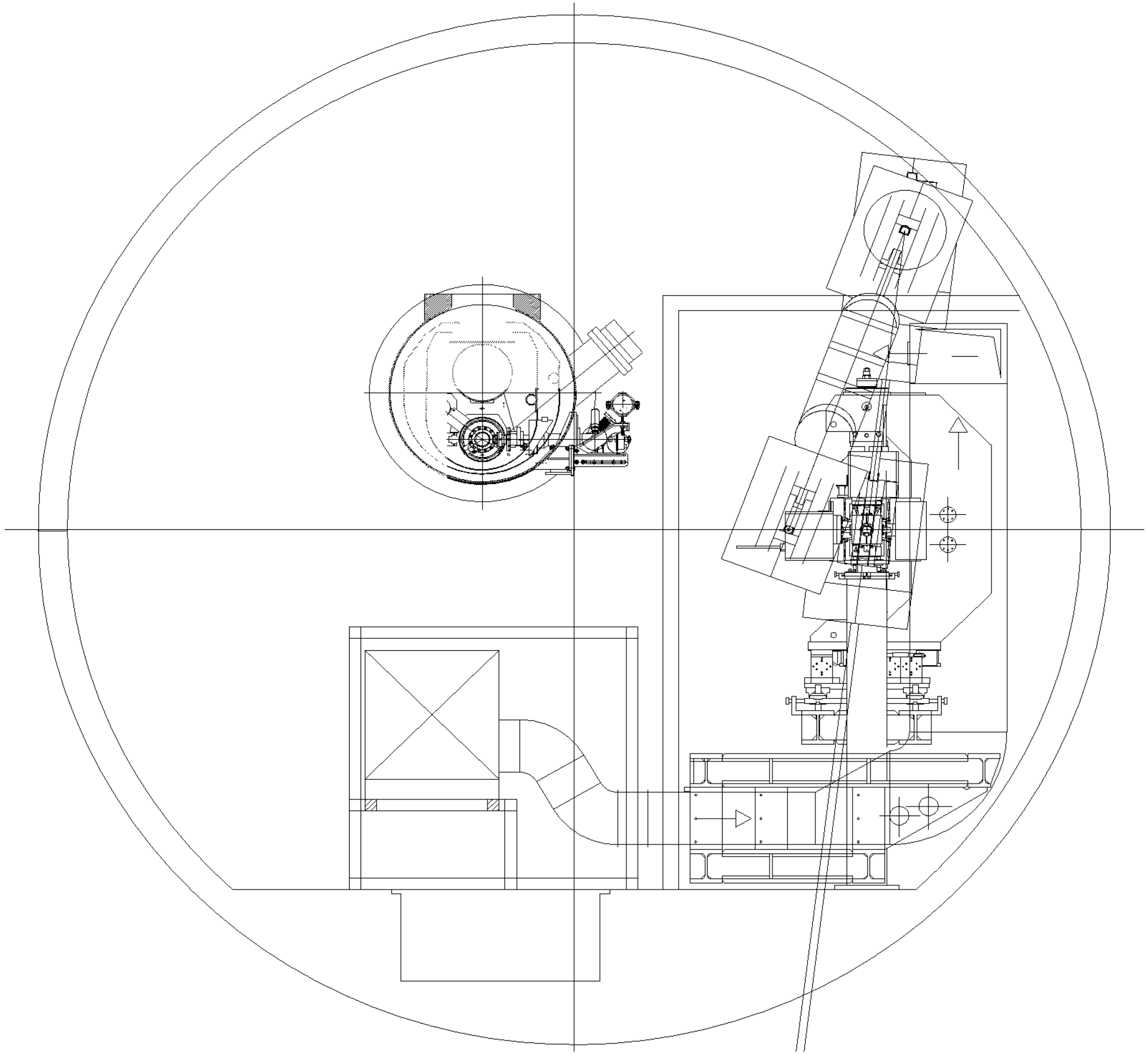

143.349
123.944
86.494
1.0 -1.6 GeV
300-500 MeV
Beam
ACC-Module 7
ACC-Module 6
ACC-Module 5
ACC-Module 4
ACC-Module 3
(17m)
Bunch-Compressor
246.333
241.605
233.005
202.411
181.411
166.084
159.889
145.982
143.349
Beam
Undulators
Seeding
Undulators
Collimator

Overview


246.333
241.652
233.005
202.411
181.411
166.084
143.349,6
123.944,6
125.299,6
86.494,6
49.894,6
Undulatoren
Temp. Beamline
(Seeding+ Undulatoren)
Kollimator
Temp. Beamline
(Modul 7 - 17m)
Module 4,5,6
Bunchkompressor III
Modul 3



M.Körfer / TTF2



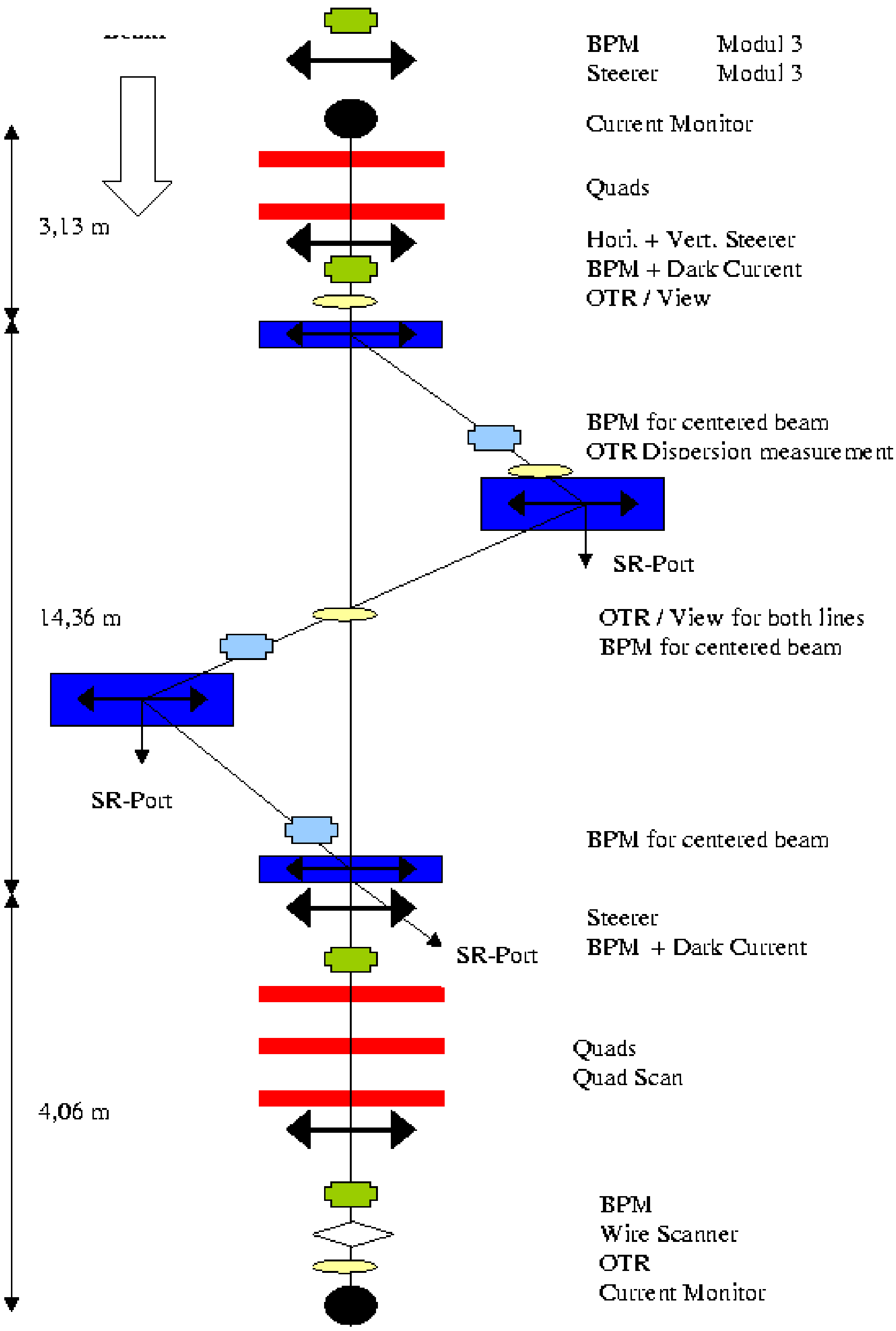
BC3

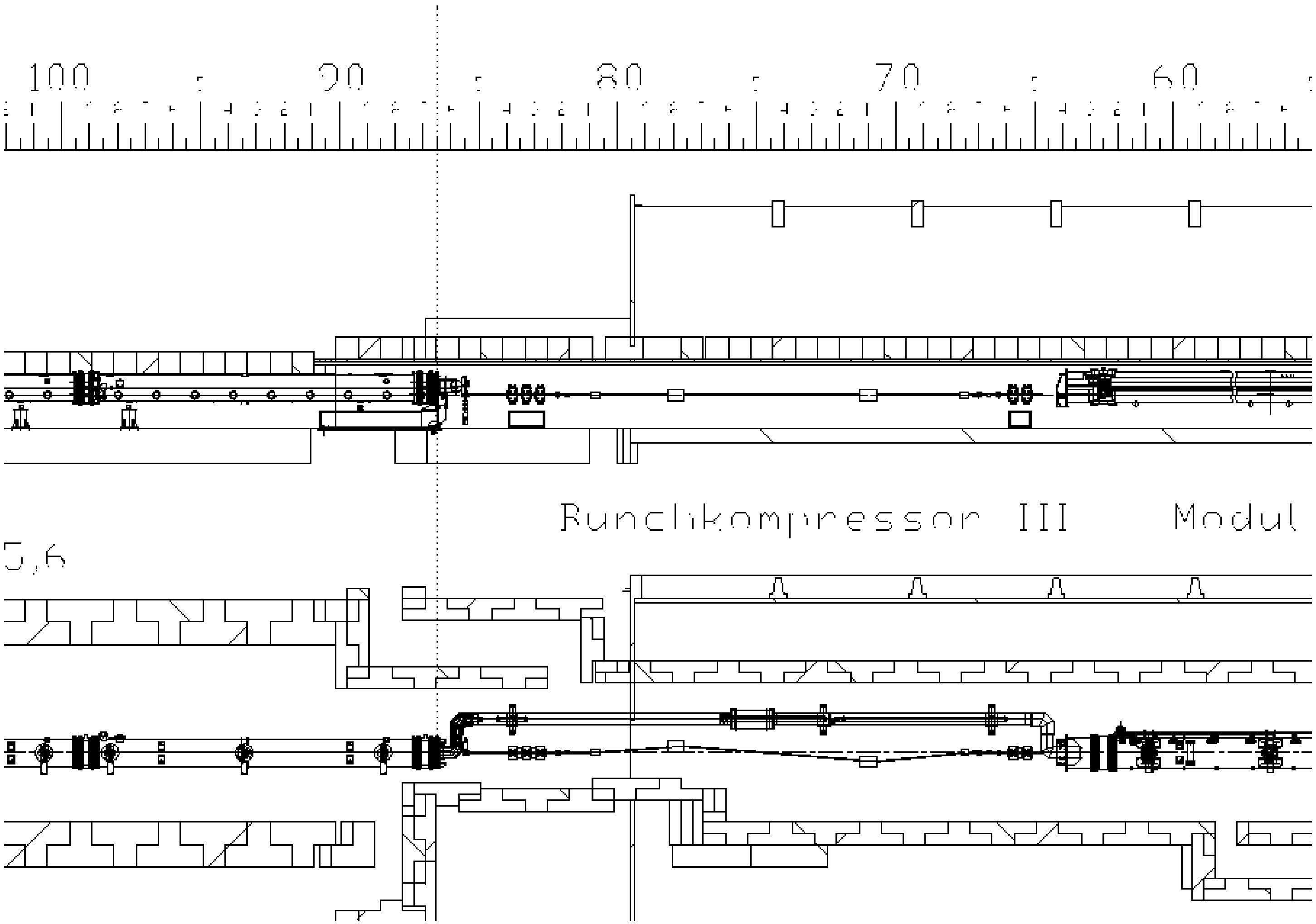
Main criteria:

- Energy range 300 - 500 MeV
- Bunch compression 250µm $\Rightarrow$ 50µm
- R_{56} = 0.05 m, ΔR_{56} = 0.025 m $\Rightarrow$ 0.1 m
- Peak current 2.5 kA
- Projeted Emittance growth $\approx$ 40 %

Status

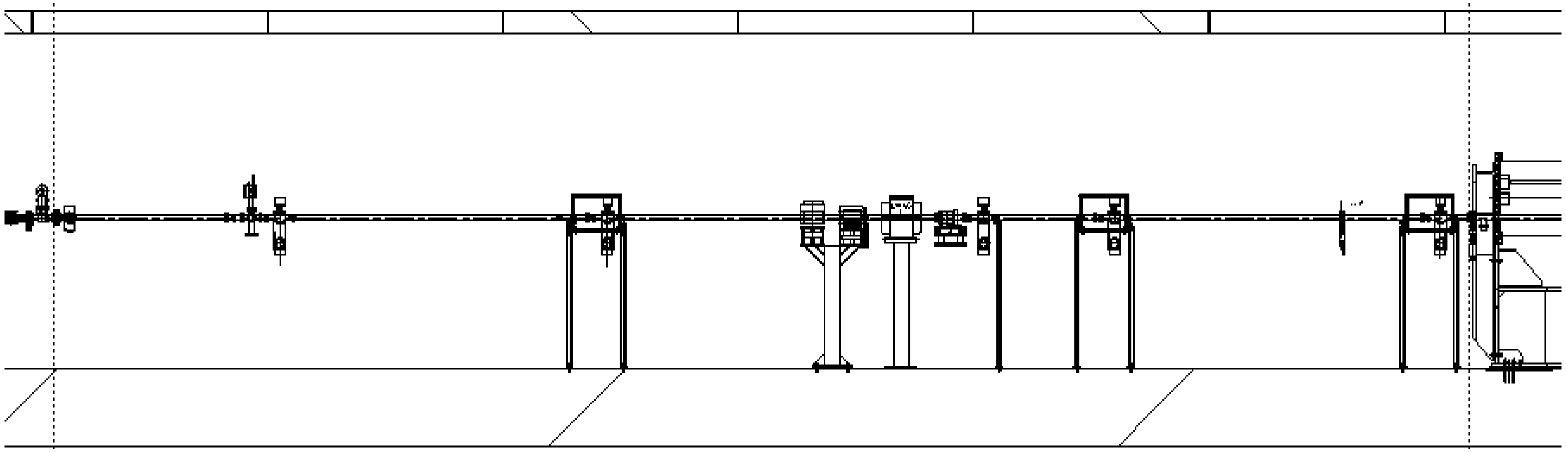
- recycling of TTF1 components
  BC2 dipole layout
  Collimator quadrupoles
  Stripline BPM Zeuthen
  Saclay Toroid (?)
  HERA-Steerer


BPM Modul 3
Steerer Modul 3
Current Monitor
Quads
Hori. + Vert. Steerer
BPM + Dark Current
OTR / View
BPM for centered beam
OTR Dispersion measurement
SR-Port
OTR / View for both lines
BPM for centered beam
SR-Port
BPM for centered beam
Steerer
BPM + Dark Current
SR-Port
Quads
Quad Scan
BPM
Wire Scanner
OTR
Current Monitor
3,13 m
14,36 m
4,06 m


100
90
80
70
60
Bunchkompressor III
Modul
5,6

6 Modules + 17 Meter temp. Beamline

- 6 Modules -- 20.8 T/m -- 1.0 GeV
-- 25.0 T/m -- 1.2 GeV
- 17 Meter TESLA module -- temp. Beamline space for temp. tests -- quad scan TTF2/1
- End-energy 1.6 GeV -- for Collimator / Bypass given by power supplies



Temp. Beamline (Modul 7 – 17m)

Collimator

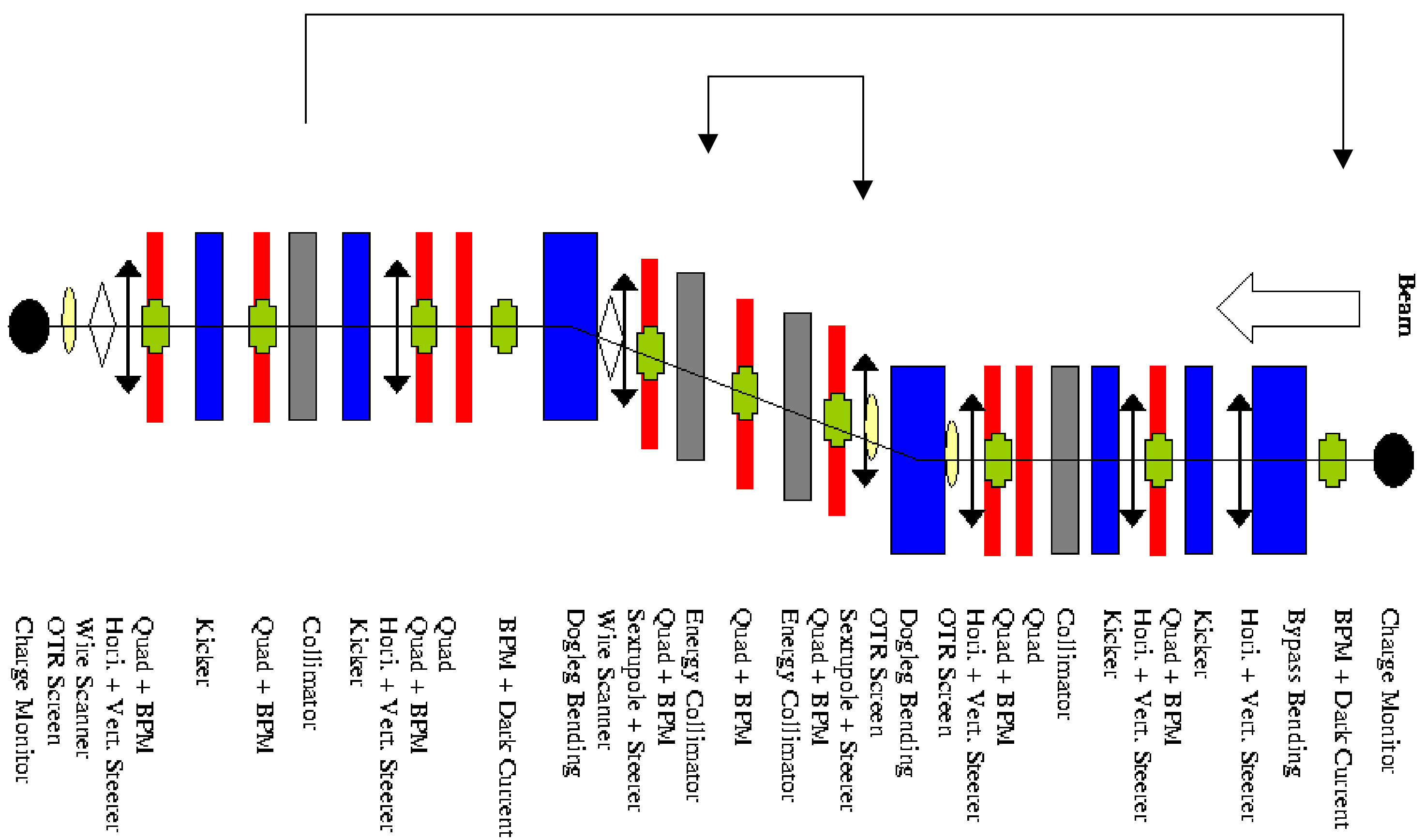
- Main purpose : Undulator protection against accident
  : Dark Current / Energy Collimator
  : Fast Feedback
  : collimator section length as short as possible

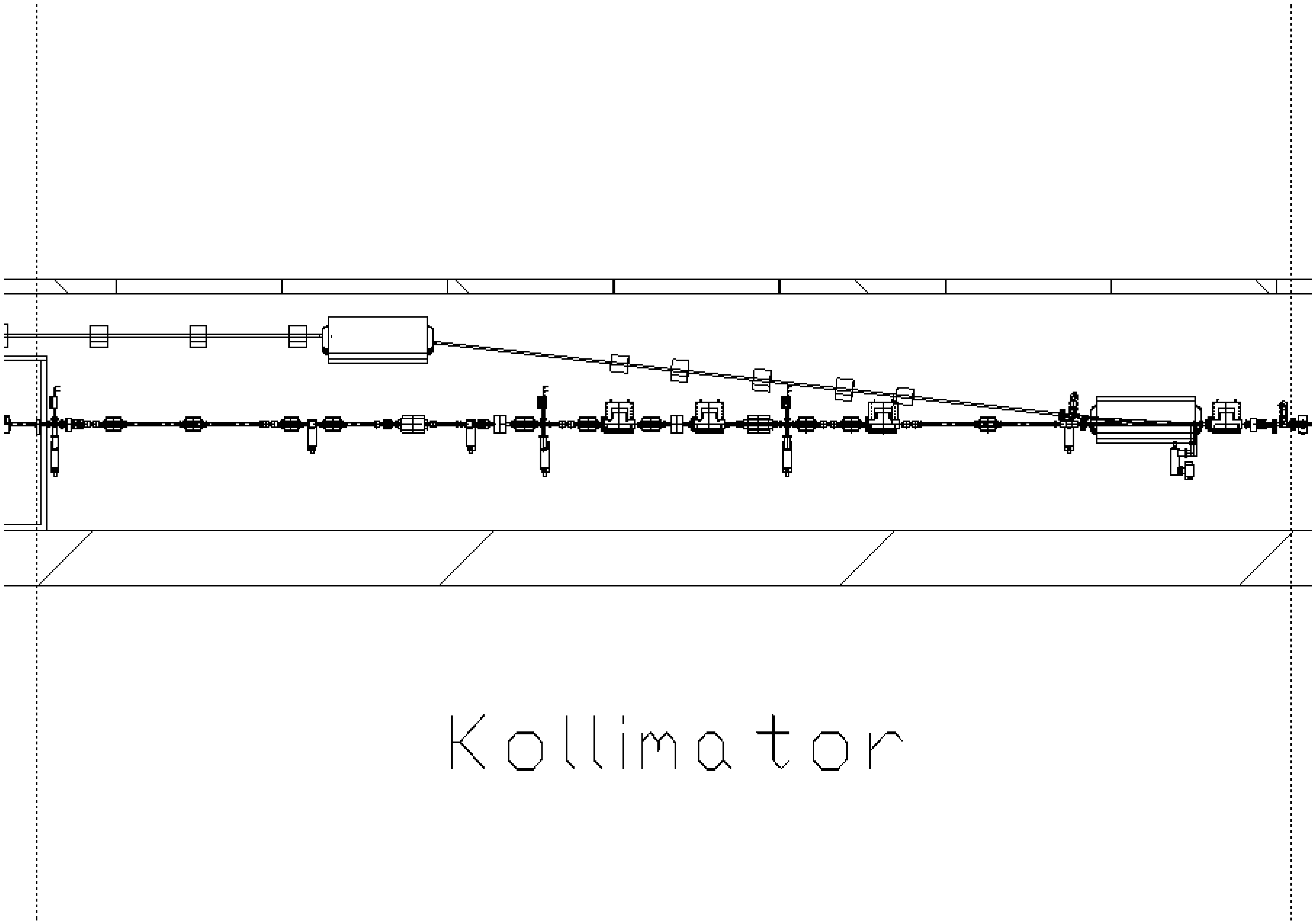
- Criteria : None of particle should hit an undulator

- Calculations : black body collimator without special geometry
  : maximize the minimum aperture radius

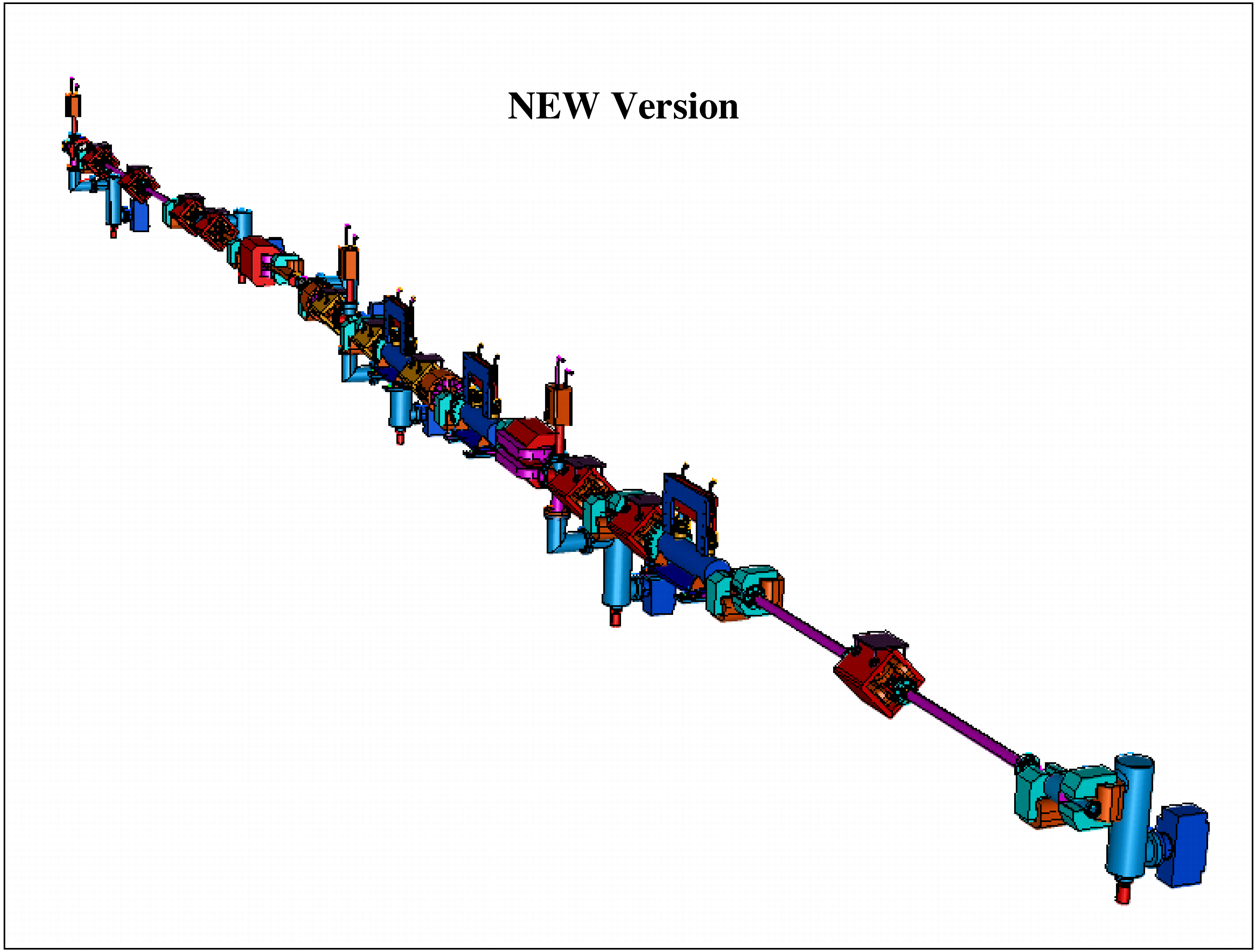
  1) losses in-between collimator
  2) no losses in-between collimator
  3) lock up all particles at the undulator entrance
  4) Aperture depending on the safty factor and collimator length
  5) Energy deposition in Ti

Results : Absorber system is sufficient

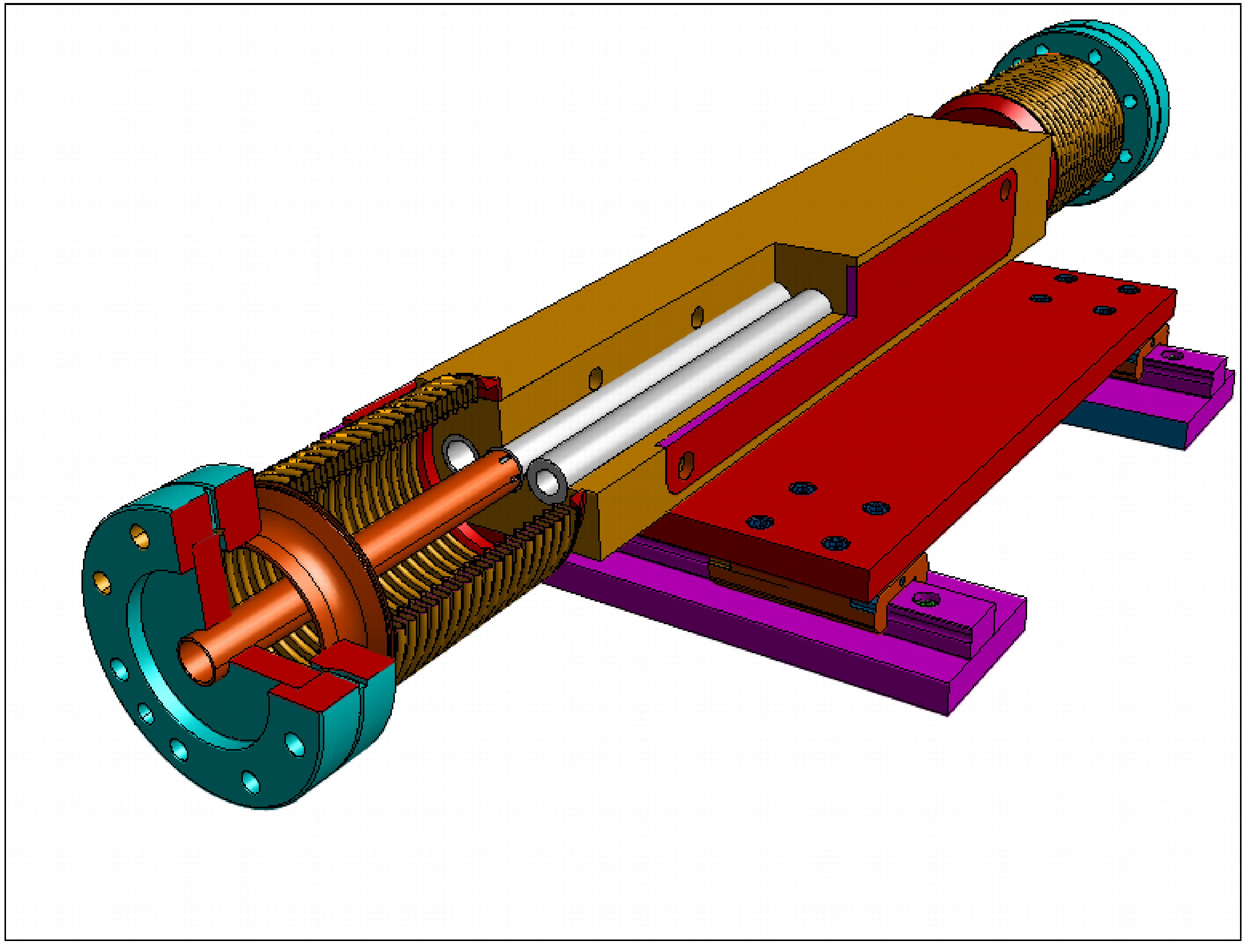

Beam
Charge Monitor
BPM + Dark Current
Bypass Bending
Hori. + Vert. Steerer
Kicker
Quad + BPM
Hori. + Vert. Steerer
Kicker
Collimator
Quad
Quad + BPM
Hori. + Vert. Steerer
OTR Screen
Dogleg Bending
OTR Screen
Sextupole + Steerer
Quad + BPM
Energy Collimator
Quad + BPM
Energy Collimator
Quad + BPM
Sextupole + Steerer
Wire Scanner
Dogleg Bending
BPM + Dark Current
Quad
Quad + BPM
Hori. + Vert. Steerer
Kicker
Collimator
Quad + BPM
Kicker
Quad + BPM
Hori. + Vert. Steerer
Wire Scanner
OTR Screen
Charge Monitor



Kollimator


NEW Version

Collimator scheme

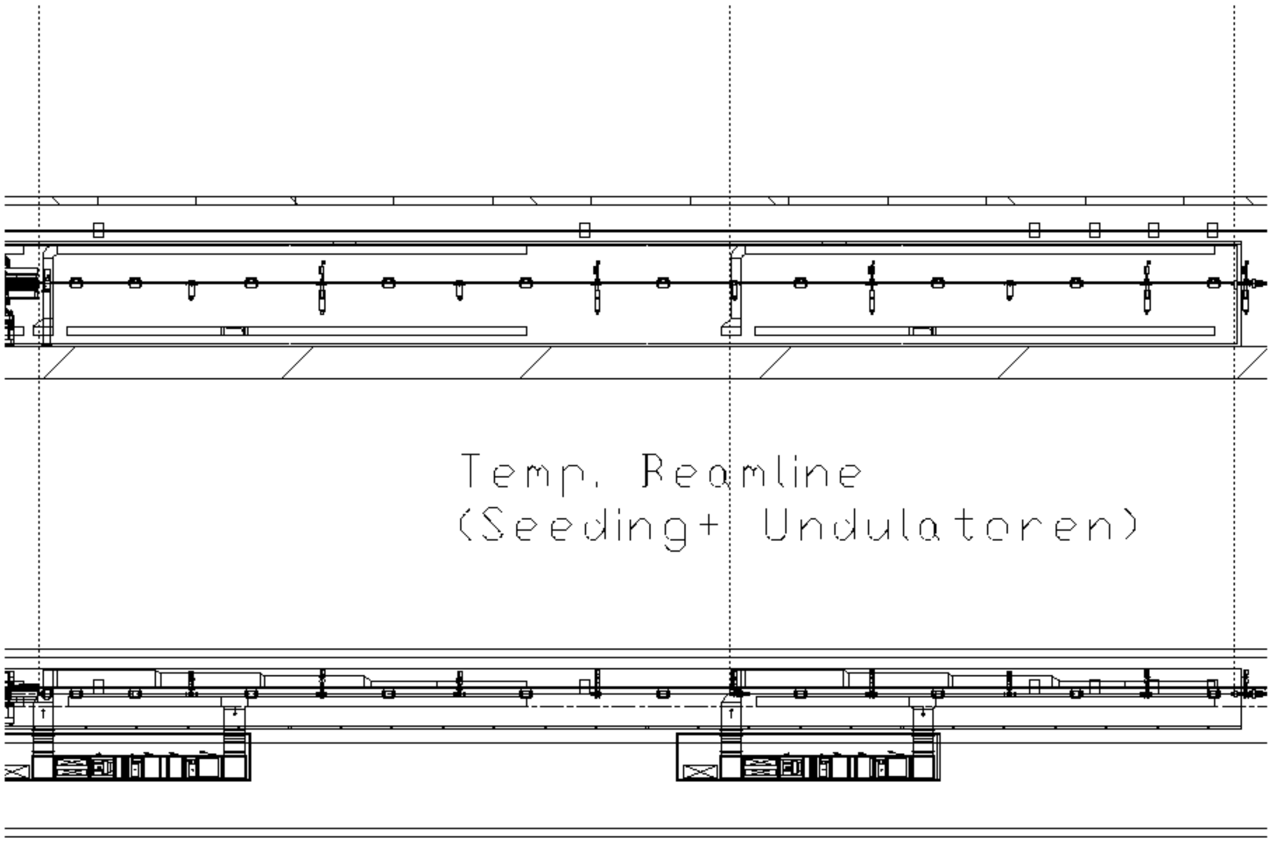


Temporary beamline TTF2 /1

4 FODO cells for diagnostic

45° phase advance -- rotation of beam spot

- measuring beam spot size step by step with OTR-stations
- calculate R-Matrix elements
- determine emittance in a (arbitrary) position in front of the undulator



Main advantages:

- no optic variation
- spotsize 100 μm at OTR
- faster commissioning

Main disadvantage:

- limited in time

Bypass

- Motivation

  -- linac commissioning and undulator protection
  -- Module tests with beam
  -- temp. tests in-between user-operation

  -- experiments in the bypass
  ⇒ collimator material test stand (M. Seidel)

- Comments

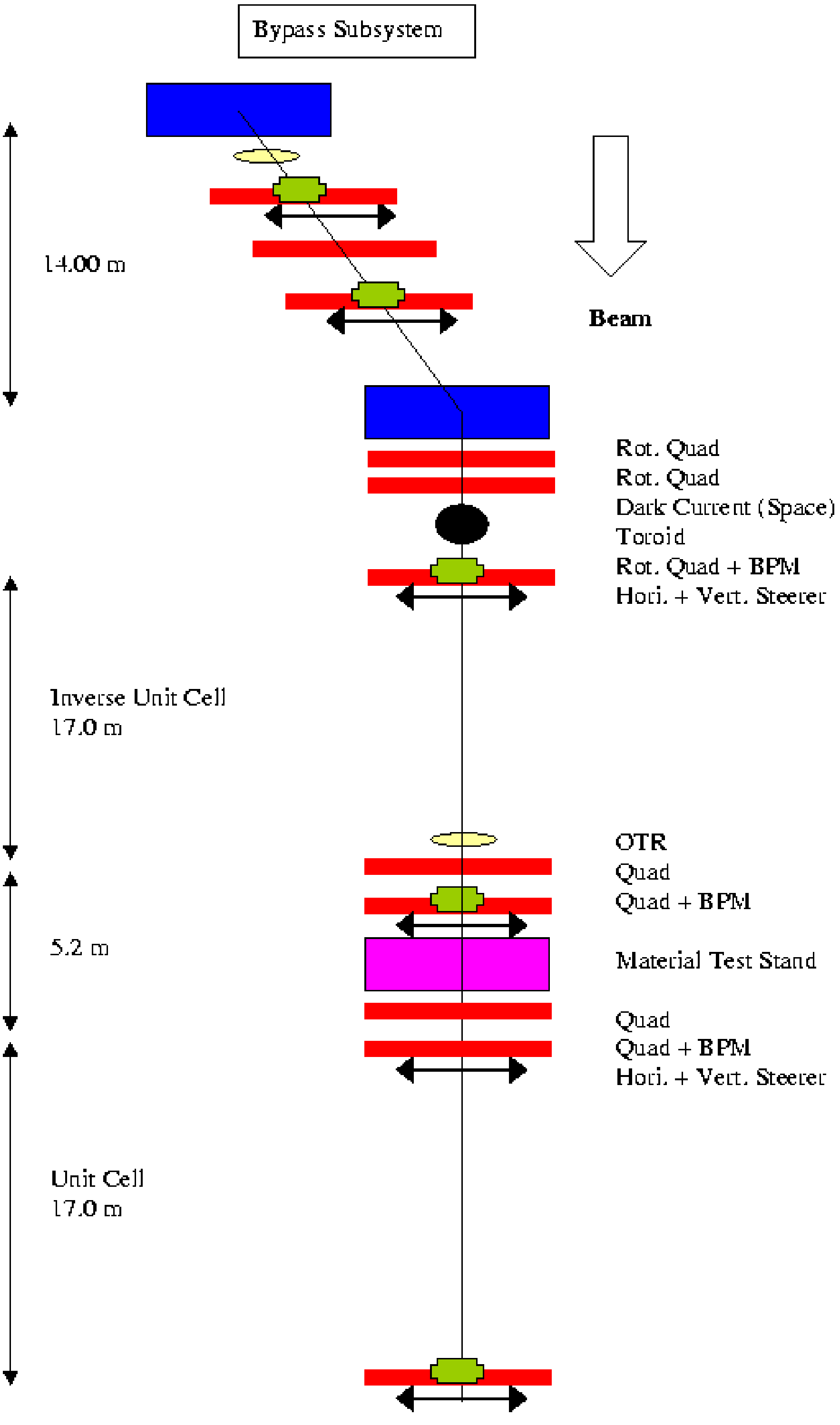
  -- coupled optic in the doglegs
  -- de-coupling in the straight line
  -- simple FODO structure
  -- option for emittance measurement
  -- reducing CSR effects with 7 ° Bending angle

List of Bypass-Components

Dipole	TDA	4
	TDC	2
Quadrupole	TQB	13
Sextupole	TSB	2
Steerer	TCA	8 pairs h+v
BPM	TypeB	7
BPM	Zeuthen	DUMMY

Vacuum-pipe along the Quad + BPM +Steerer	∅ 48 mm outside
Dogleg- up	∅ 48 mm outside
Straight line	∅ 48 mm + DN63
Dogleg dump	∅ 48 mm + DN100

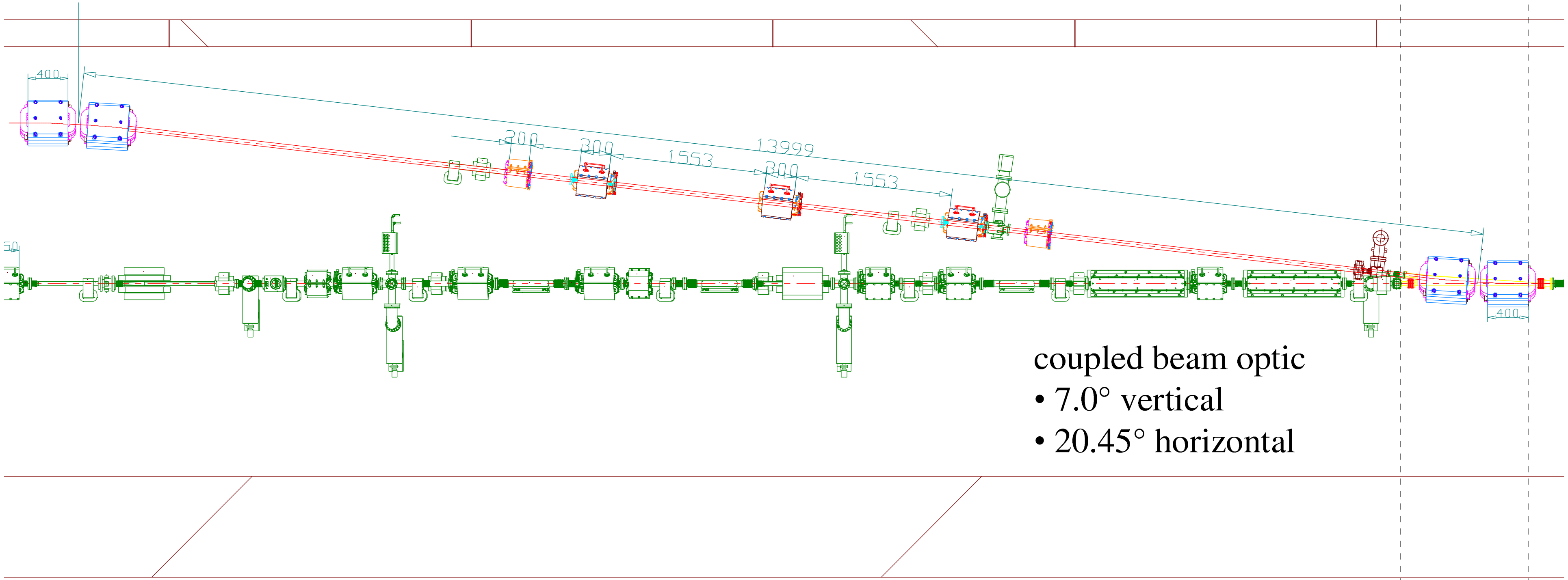
Koordinators	U. Harder / M. Körfer
Vacuum aspects incl. pumps	H.P. Wedekind / MVP
Technical drawings	J. Gonschior / ZM1
Girder	G. Weichert / MPL
OTR-stations	D. Nölle / K. Honkavaara / MPY
Collimator material test	H. Wollenberg / MVA



M.Körfer / TTF2

Bypass Dogleg Up

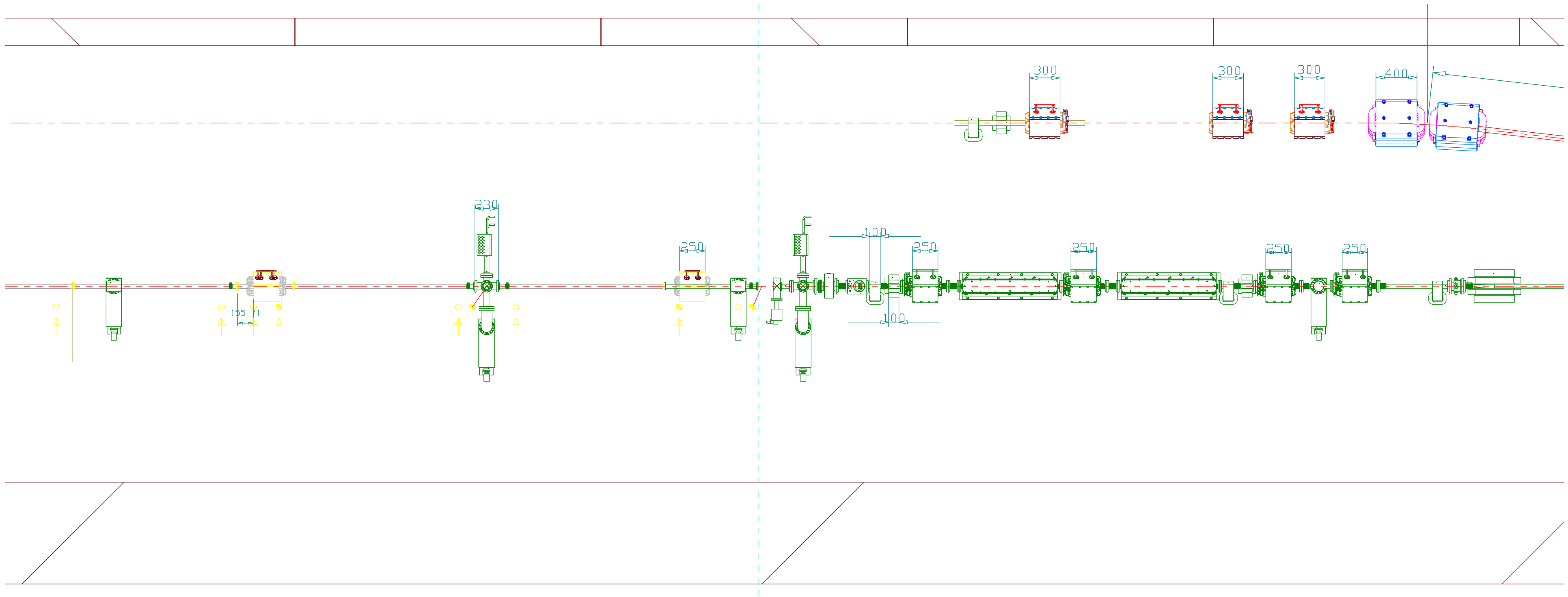
Dipole Type	TDA
Quadrupole Type	TQB
Sextupole Type	TSB
Steerer Type	TCA



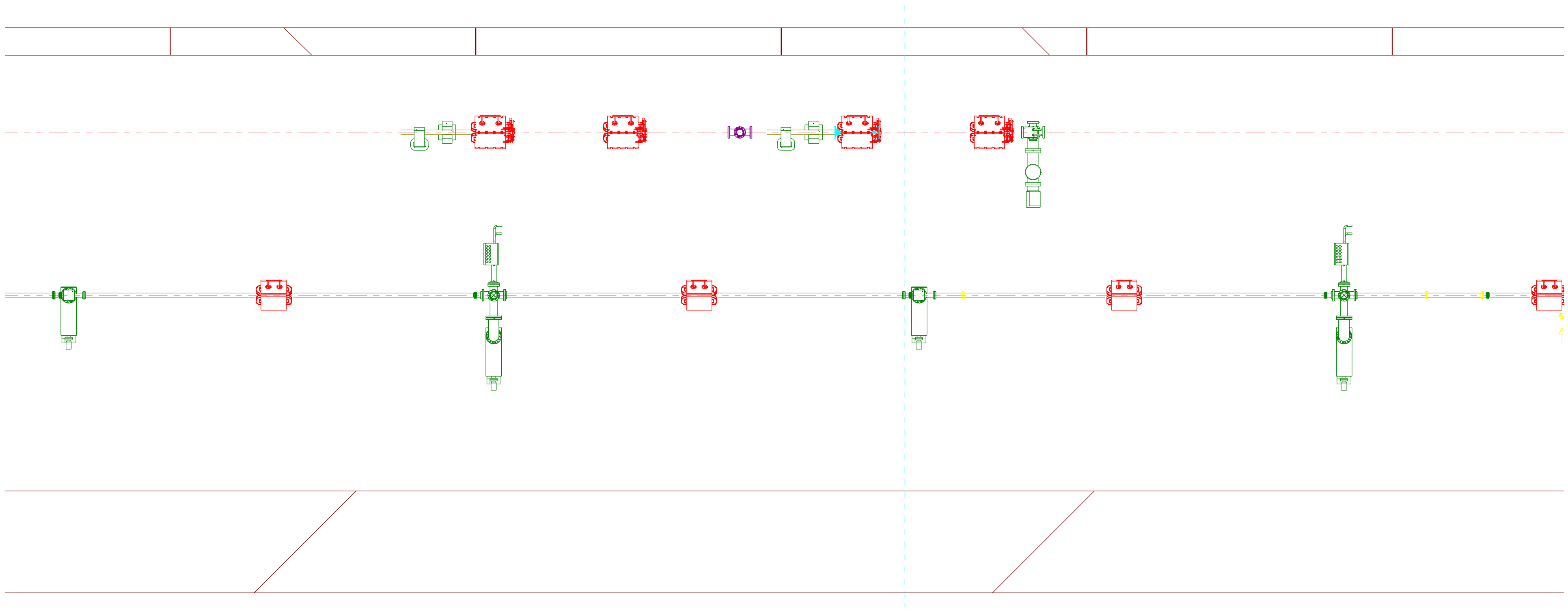
coupled beam optic
- 7.0° vertical
- 20.45° horizontal

Bypass Straight Line

Optic de-coupling
3 skew Quads
• 20.45° horizontal
(to the right)

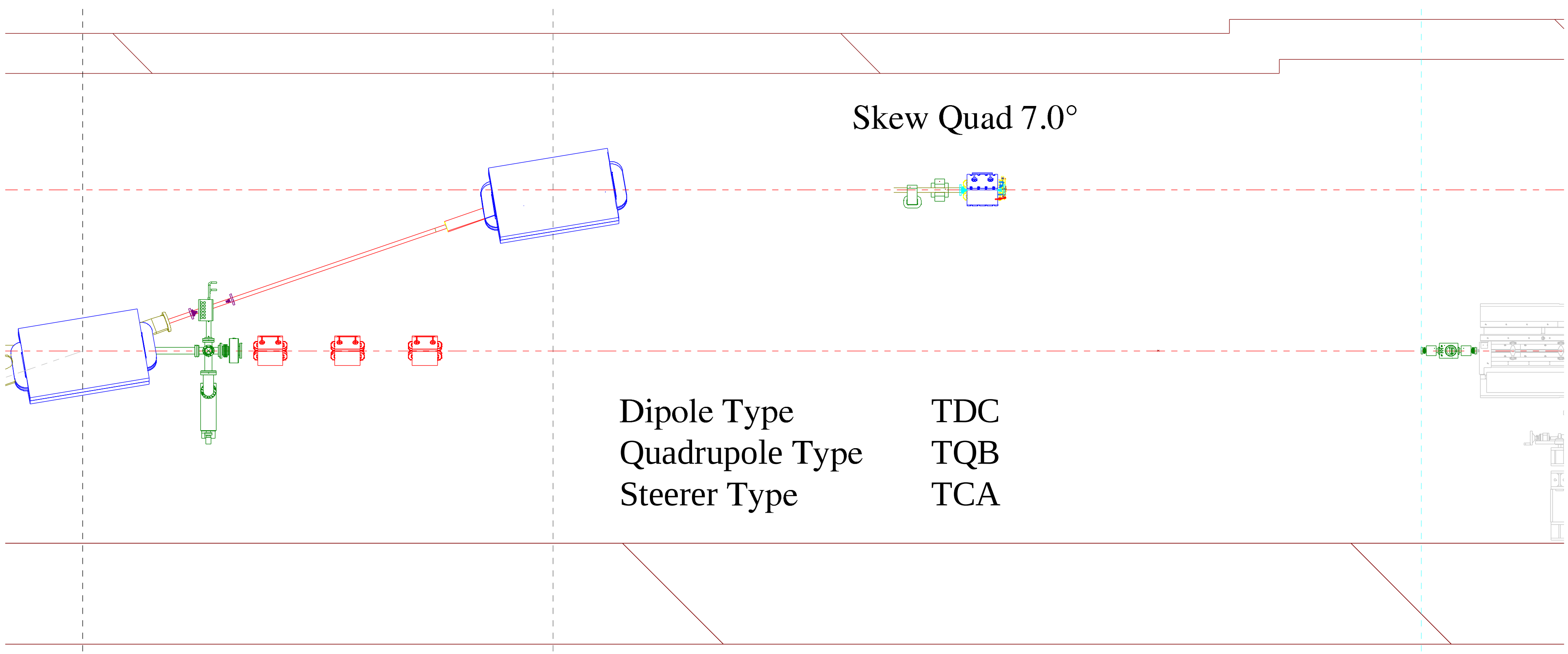


Collimator material experiment



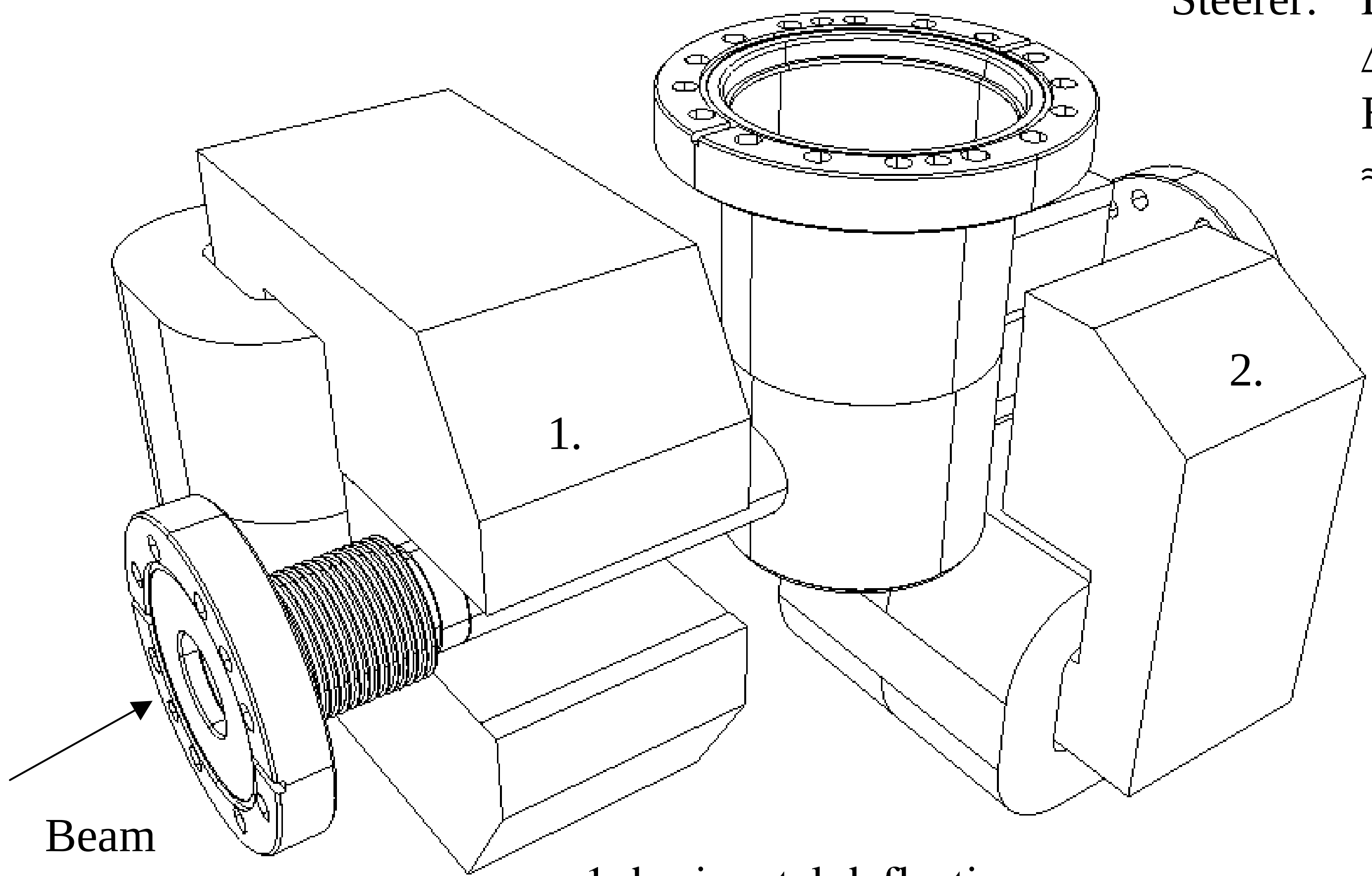
coupled beam optic

- 19.0° vertical
- 7.0° horizontal



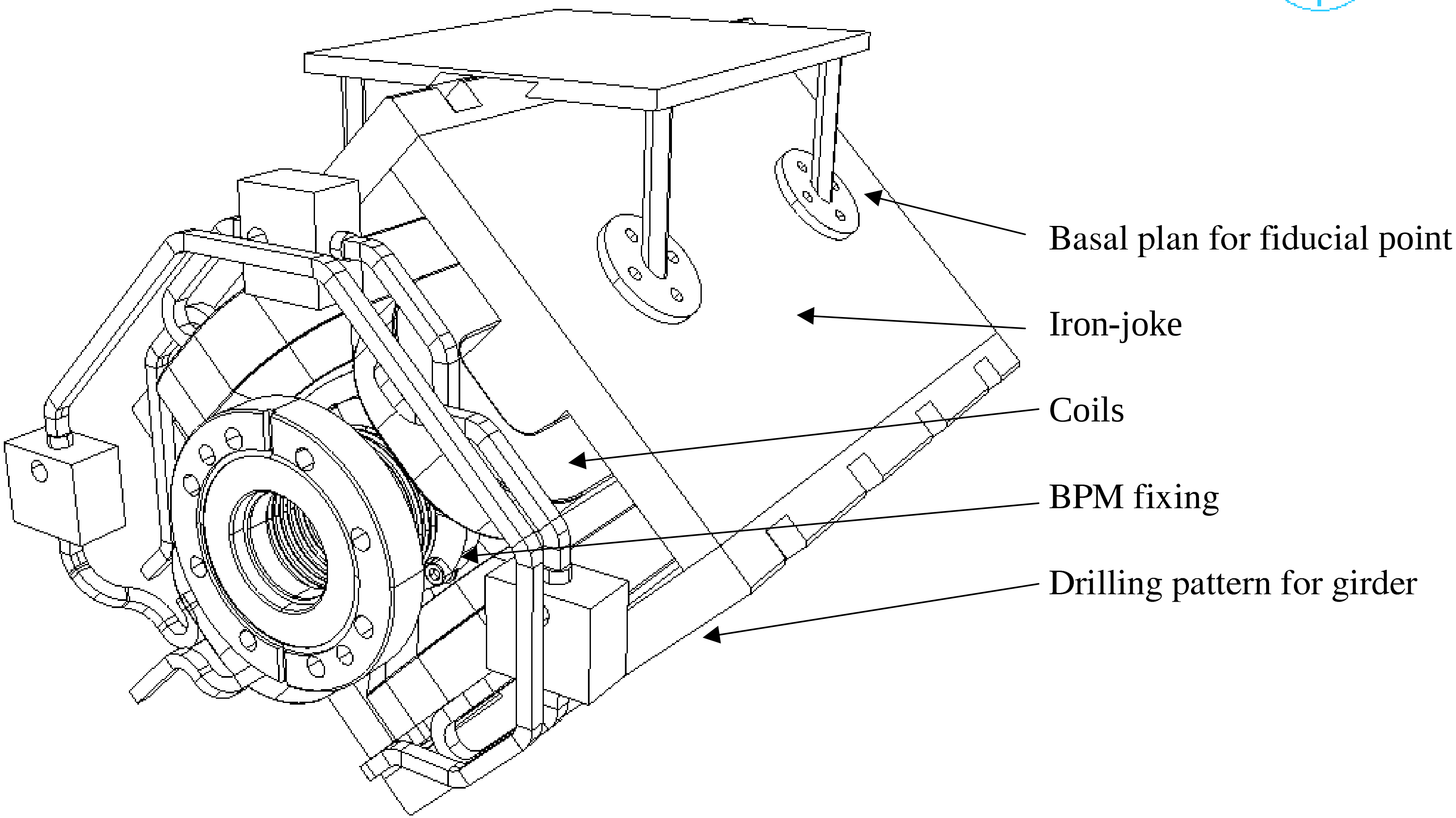
Combination of **steerer** and pump tube -- Collimator

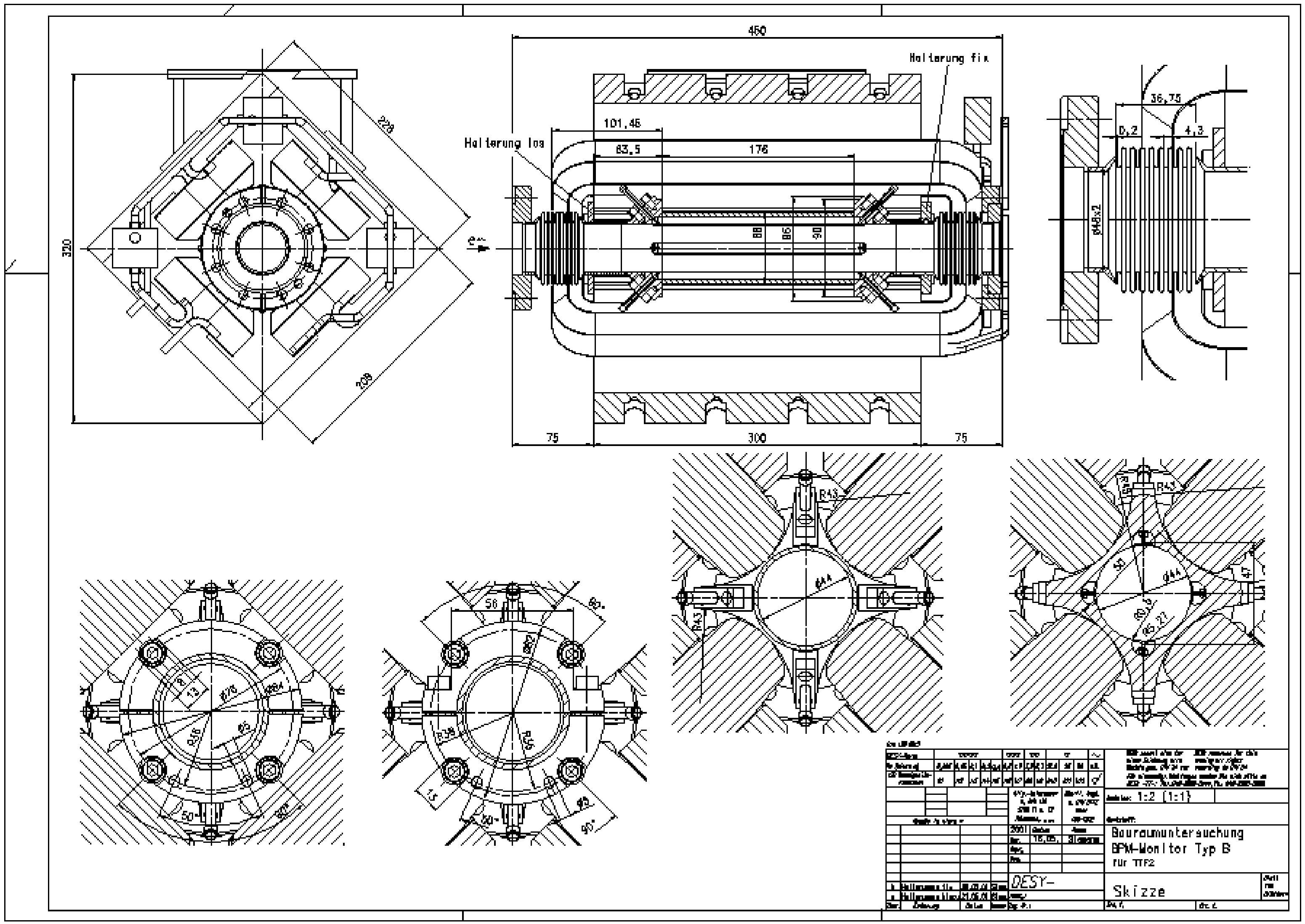
Steerer: L = 100 mm
ΔL = 100 mm
B_{max} = 0.15T
≈ 3 mrad @ 1.0 GeV



1. horizontal deflection
2. vertical deflection

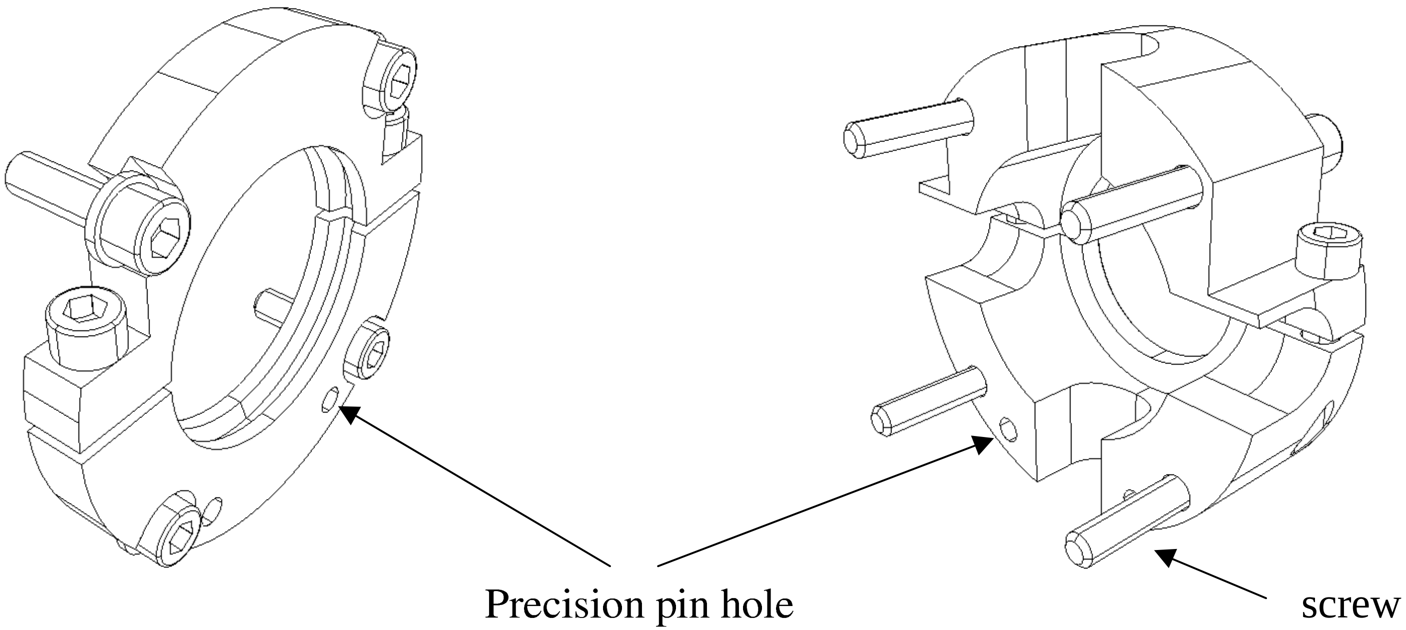
Bypass Quad and BPM located in the same position




450
Halterung fix
Halterung los
101,46
83,5
176
88
86
90
320
228
208
75
300
75
36,75
0,2
4,3
ø48x2
R43
ø44
50
80,3
65,27
58
R38
R36
ø78
ø84
ø5
Maßstab: 1:2 (1:1)
Bauraumuntersuchung
BPM-Monitor Typ B
für TTF2
DESY-
Skizze

Fixed-point for BPM inside the quad
-- upstream

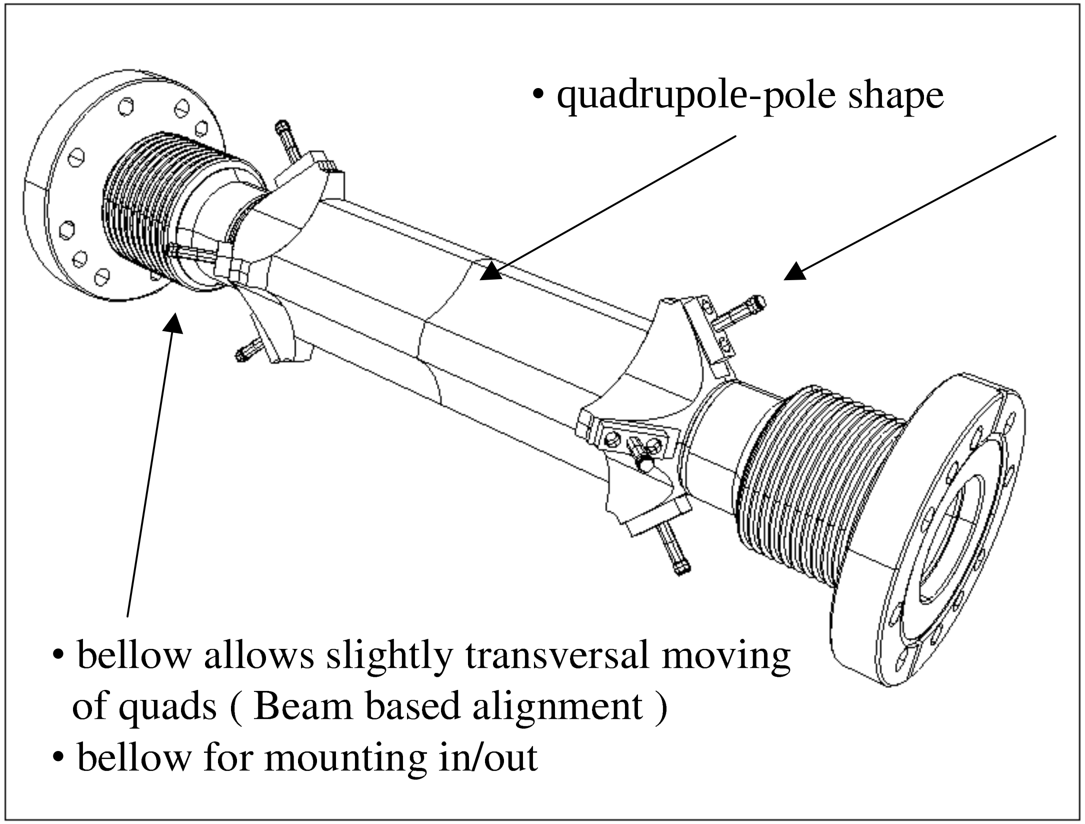
Un-fixed-point for BPM
-- downstream



TTF2 - BPM

BPM inside the Quad (TQB)

- electrical and magnetic axis close together ±20 µm
- save space in the tunnel



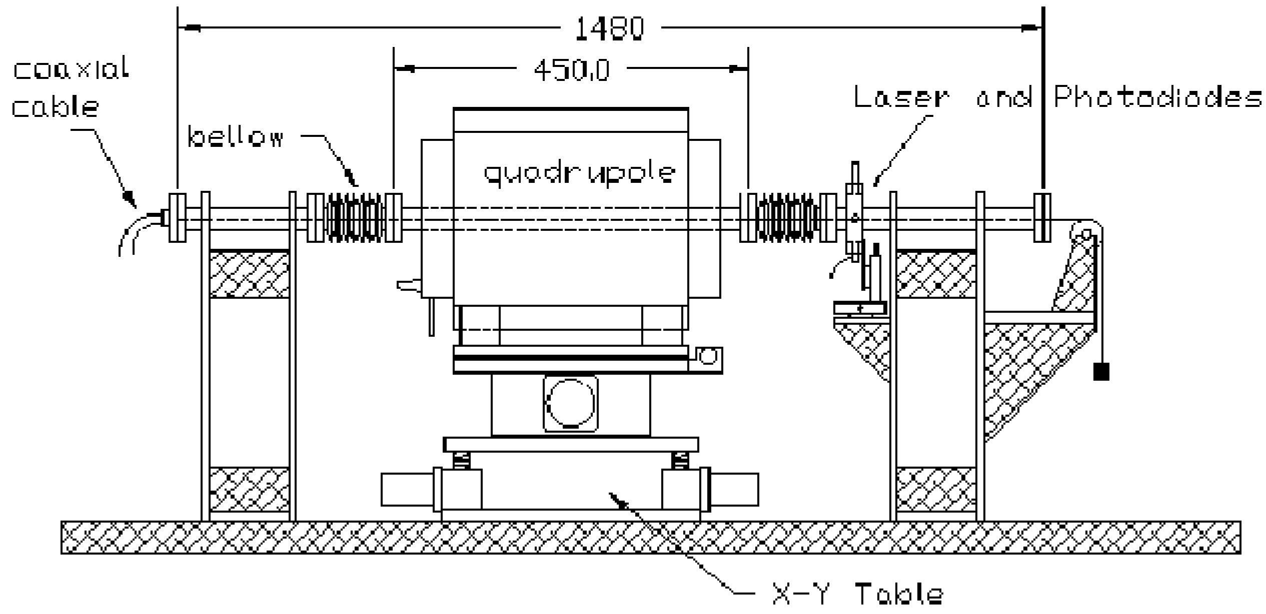
- electrical BPM feedthrough
- construction allows particle free UH-Vacuum conditions

Construction Details

Advantages of the stripline BPM are:

- Broadband pickup with well defined position and transfer characterisics.
- Low beam impedance (no HOM's).
- Resistive (50 Ω) source impedance simplifies the matching to the read-out electronics.
- High signal levels at moderate frequencies improves the S/N-ratio $\Longrightarrow$ high sensitivity!

Alignment and Calibration



Moving-wire teststand for BPM-to-quadrupole alignment.

	d / mm	$\sigma = 250\ \mu m$		$\sigma = 50\ \mu m$	
		$k_{loss}/10^{12}\cdot V/C$	$\sigma_{rms}/10^{12}\cdot V/C$	$k_{loss}/10^{12}\cdot V/C$	$\sigma_{rms}/10^{12}\cdot V/C$
TESLA cavity	78	14.6	7.8	17.2	9.6
Step collimator	34-5	77.8	30.6	**389**	**153**
TTF Bellows	35	4.7	1.9	10.8	4.4
TTF toroid	72	3.9	1.6	**20.4**	**8.1**
BPM type x	78	0.71	0.30	1.74	0.70
Cavity BPM	78	2.2	0.9	4.8	2.0
Gap, L=1mm	78	0.22	0.09	0.57	0.24
Gap, L=1mm	40	0.44	0.18	1.12	0.47
Vac. Pump	35	0.38/3.46		3.7/6.6	

	$\frac{d}{mm}$	$\sigma = 250\ \mu m$		$\sigma = 50\ \mu m$	
		$k_{loss}/10^{12} \cdot V/C$	$\sigma_{rms}/10^{12} \cdot V/C$	$k_{loss}/10^{12} \cdot V/C$	$\sigma_{rms}/10^{12} \cdot V/C$
Step in	78→40	0.40	0.83	-1.35	4.5
Step out	40→78	26.7	10.6	**135**	**53**

	$\frac{d}{mm}$	$\sigma = 250\ \mu m$		$\sigma = 50\ \mu m$	
		$k'_{loss}/10^{12} \cdot V/Cm$	$\sigma'_{rms}/10^{12} \cdot V/Cm$	$k'_{loss}/10^{12} \cdot V/Cm$	$\sigma'_{rms}/10^{12} \cdot V/Cm$
Steel pipe	78	1.01	0.93	8.1	3.9
Steel pipe	40	1.76	1.78	**22.3**	**10.4**