PITZ beam line remodeling for the plasma cell insertion - a proposal

Adding, shifting and eliminating beam line elements

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PITZ beam line remodeling
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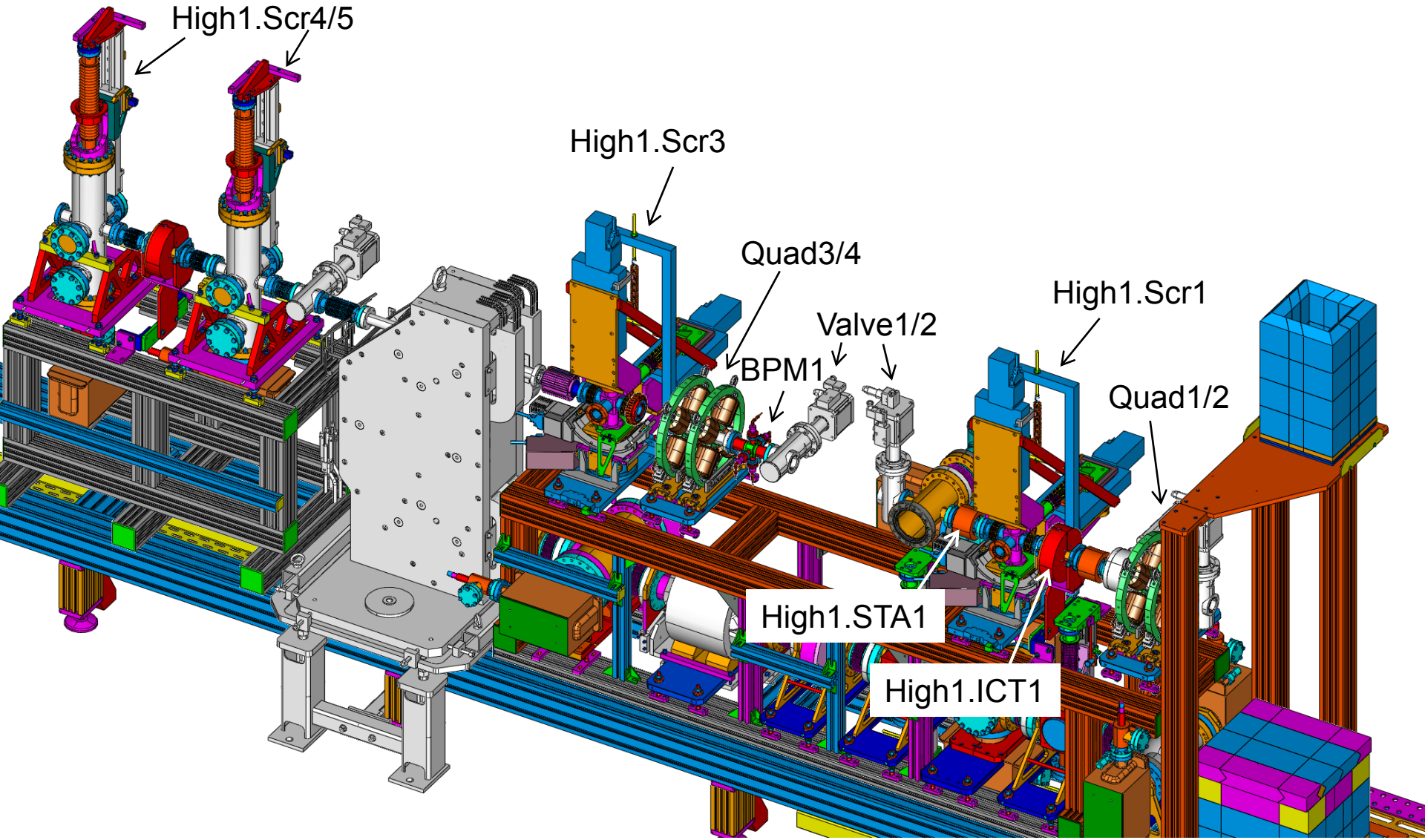
HELMHOLTZ ASSOCIATION

DESY

Introduction

- Task: adding plasma wakefield acceleration experiment to PITZ
  - Insertion of plasma cell into PITZ beam line between High1.Scr1 (EMSY) and High1.Scr3 (EMSY2). Total length: 1185mm
  - Rearranging (4) and adding (4) quadrupole magnets for beam transport into and out of plasma cell
- Main difficulty: not enough space
  - Rearrange PITZ beam line (booster shift etc.)
  - Eliminate beam line elements (High1.Scr2 etc.)
- 2 work phases:
  - May/June 2014: insertion of plasma cell with periphery
  - End of 2014: final configuration

Current State minus High1.Scr2



First Stage: Insertion of plasma cell

Current state

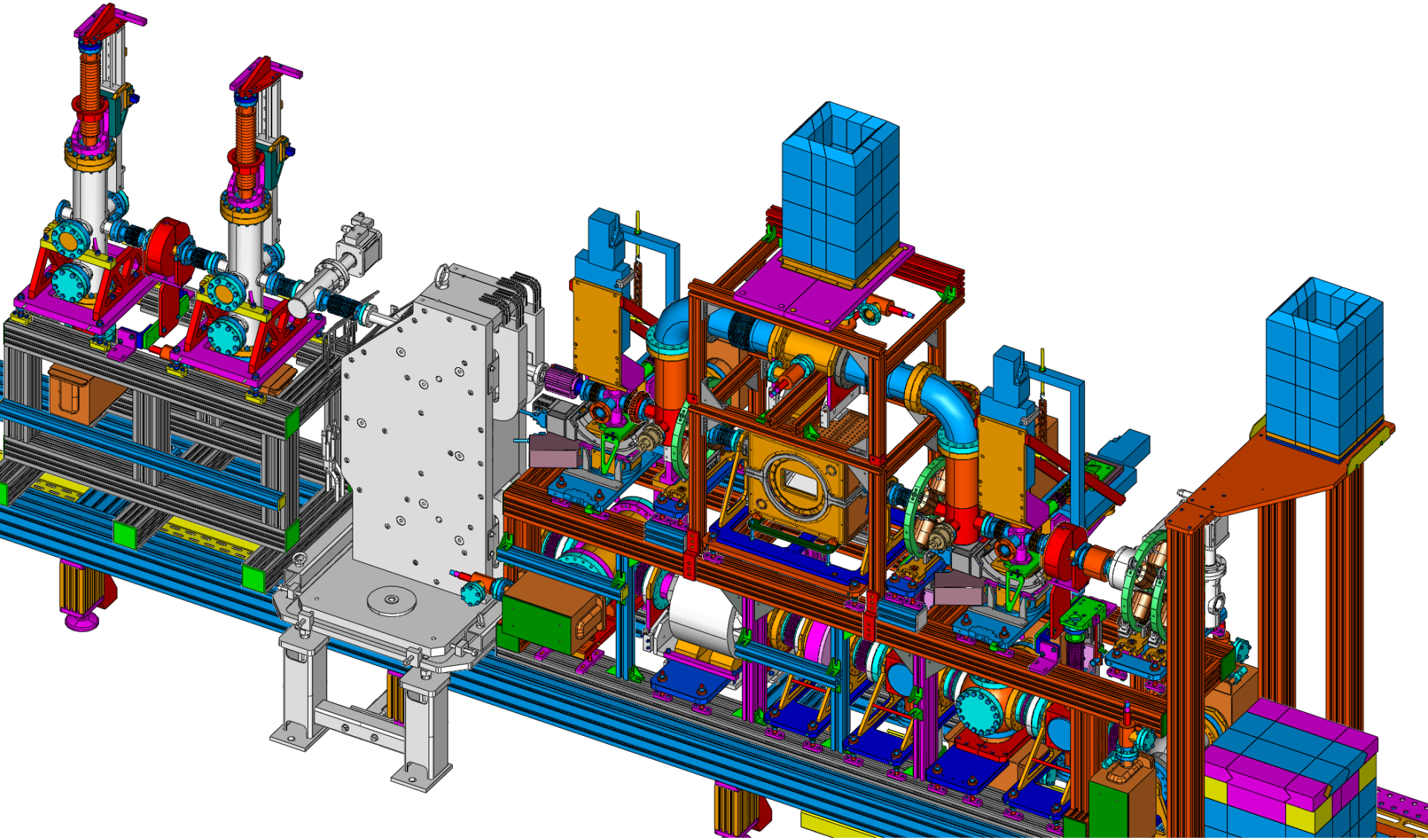
Name	Element	Start-position	End-position	Mittel-position
BOOST.V2	Schieber (ND40)	5058	5130	5094
HIGH1.Q1	Quadrupol Q1			5190
HIGH1.Q2	Quadrupol Q2			5290
HIGH1.V1	Schieber (ND40) Schnellschließer	5350	5410	5380
HIGH1.St1	Steerer (non-rotating)	5435	5495	5465
HIGH1.ICT1	ICT	5520	5640	5580
HIGH1.Scr1 [EMSY1]	EMSY	5640	5840	5740
~~HIGH1.STA1~~	~~Steerer auf Wellbalg~~	~~5865~~	~~5925~~	~~5895~~
HIGH1.IGP1, ~~HIGH1.TSP1~~	Pumpkreuz (ND 100/40)	5950	6120	6035
~~HIGH1.V2~~	~~Schieber (ND40)~~	~~6120~~	~~6192~~	~~6156~~
~~HIGH1.Scr2~~	~~Schirmstation mit 2 Faltenbälgen~~	~~6192~~	~~6498~~	~~6345~~
HIGH1.IGP2	inkl. Pumptopf			
~~HIGH1.V3~~	~~Schieber~~	~~6498~~	~~6570~~	~~6534~~
~~HIGH1.BPM1~~	~~BPM~~	~~6570~~	~~6710~~	~~6640~~
HIGH1.Q3	Quadrupol Q3			6780
HIGH1.Q4	Quadrupol Q4			6880
HIGH1.St2	Steerer auf Wellbalg	7025	7055	7040
HIGH1.Scr3 [EMSY2]	EMSY	7025	7225	7125
HIGH1.STA2	Steerer	7248	7348	7298
HIGH1.Dipol	Dipol	7370	7970	
HIGH1.V4	Schieber	8128	8200	8164

Plasma cell inserted

Name	Element	Start-position	End-position	Mittel-position
BOOST.V2	Schieber (ND40)	5058	5130	5094
HIGH1.Q1	Quadrupol Q1			5190
HIGH1.Q2	Quadrupol Q2			5290
HIGH1.V1	Schieber (ND40) Schnellschließer	5350	5410	5380
HIGH1.St1	Steerer (non-rotating)	5435	5495	5465
HIGH1.ICT1	ICT	5520	5640	5580
HIGH1.Scr1 [EMSY1]	EMSY	5640	5840	5740
HIGH1.Q3	Quadrupol Q3			6035
	Plasma cell including 2 pump crosses	5840	7025	6432.5
HIGH1.Q4	Quadrupol Q4			6830
HIGH1.St2	Steerer auf Wellbalg	7025	7055	7040
HIGH1.Scr3 [EMSY2]	EMSY	7025	7225	7125
HIGH1.STA2	Steerer	7248	7348	7298
HIGH1.Dipol	Dipol	7370	7970	
HIGH1.V4	Schieber	8128	8200	8164

- High1.V2 and V3 are removed: big vacuum volume. Remedy: insert High1.V3 instead of High1.STA2 – move High1.STA2 behind dipole
- High1.STA1 and High1.BPM1 will be removed. Option: move booster and use that space
- Quadrupole pair Q3/4 is broken up

First Stage: Insertion of plasma cell



Second Stage: Move of High1.Scr1

Current state

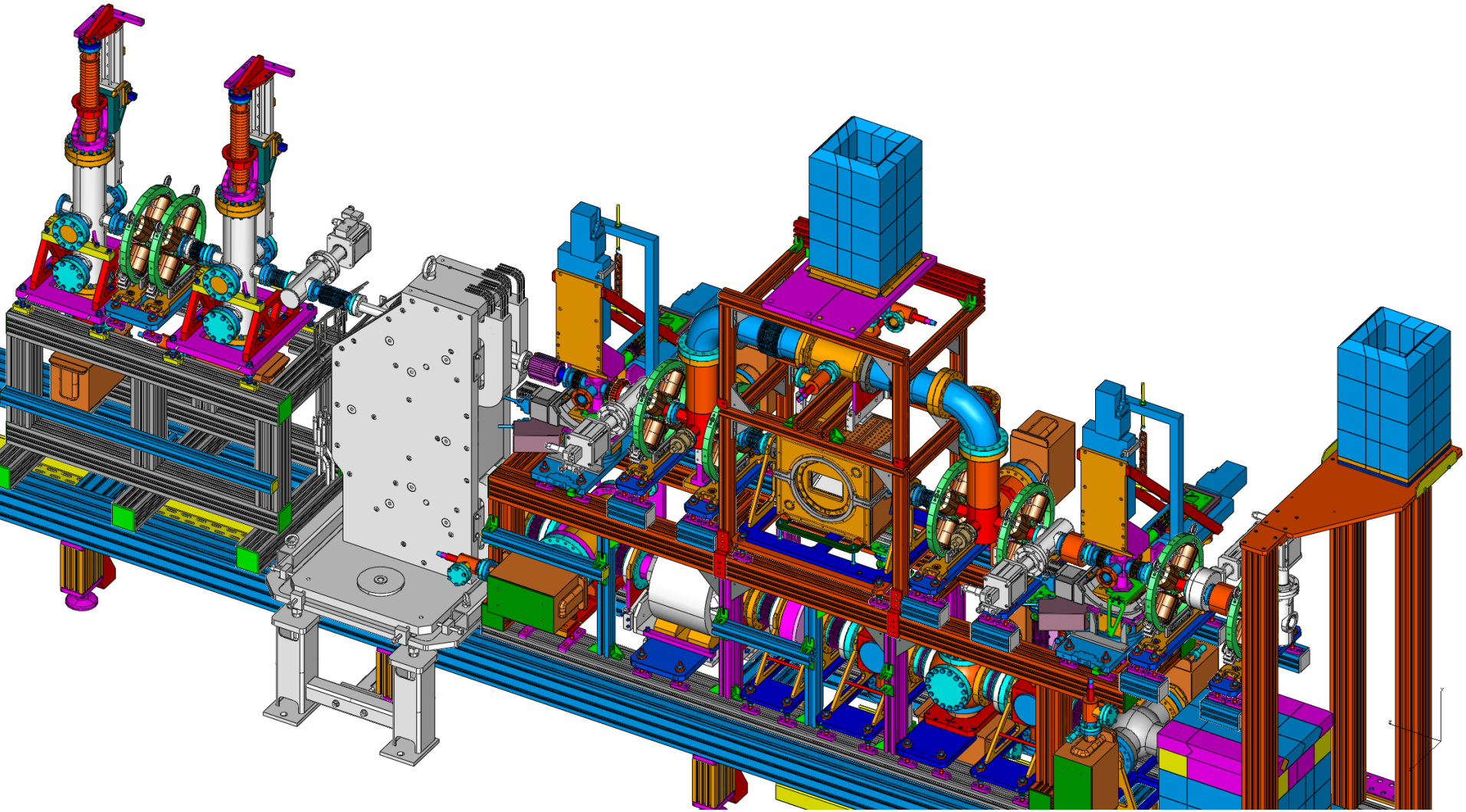
Name	Element	Start-position	End-position	Mittel-position
BOOST.V2	Schieber (ND40)	5058	5130	5094
HIGH1.Q1	Quadrupol Q1			5190
HIGH1.Q2	Quadrupol Q2			5290
HIGH1.V1	Schieber (ND40) Schnellschließer	5350	5410	5380
HIGH1.St1	Steerer (non-rotating)	5435	5495	5465
~~HIGH1.ICT1~~	~~ICT~~	~~5520~~	~~5640~~	~~5580~~
HIGH1.Scr1 [EMSY1]	EMSY	5640	5840	5740
HIGH1.STA1	Steerer (non-rotating)	5865	5925	5895
HIGH1.IGP1, ~~HIGH1.TSP1~~	Pumpkreuz (ND 100/40)	5950	6120	6035
HIGH1.V2	Schieber (ND40)	6120	6192	6156
~~HIGH1.Scr2~~	~~Schirmstation mit 2 Faltenbälgen~~	~~6192~~	~~6498~~	~~6345~~
HIGH1.IGP2	inkl. Pumptopf			
HIGH1.V3	Schieber	6498	6570	6534
~~HIGH1.BPM1~~	~~BPM~~	~~6570~~	~~6710~~	~~6640~~
HIGH1.Q3	Quadrupol Q3			6780
HIGH1.Q4	Quadrupol Q4			6880
HIGH1.St2	Steerer (non-rotating)	7025	7055	7040
HIGH1.Scr3 [EMSY2]	EMSY	7025	7225	7125
HIGH1.STA2	Steerer (non-rotating)	7248	7348	7298
HIGH1.Dipol	Dipol	7370	7970	
HIGH1.V4	Schieber	8128	8200	8164
HIGH1.St3	Steerer (non-rotating)	8272	8302	8287
HIGH1.Scr4	Schirmstation	8287	8487	8387
HIGH1.IGP3	inkl. Pumptopf			
~~High1.ICT2~~	~~ICT~~	~~8590~~	~~8710~~	~~8650~~
HIGH1.Scr5	Schirmstation	8820	9020	8920

Plasma cell inserted

Name	Element	Start-position	End-position	Mittel-position
BOOST.V2	Schieber (ND40)	4658	4730	4694
HIGH1.Q1	Quadrupol Q1			4790
HIGH1.St1	Steerer (non-rotating)	4865	4925	4895
HIGH1.V1	Schieber (ND40) Schnellschließer	4950	5010	4980
HIGH1.Q2	Quadrupol Q2			5075
HIGH1.Scr1 [EMSY1]	EMSY	5165	5365	5265
HIGH1.STA1	Steerer (non-rotating)	5390	5450	5420
HIGH1.V2	Schieber (ND40)	5475	5547	5511
HIGH1.Q3	Quadrupol Q3			5602.5
HIGH1.Q4	Quadrupol Q4			5852.5
	Plasma cell	5657.5	6842.5	6250
HIGH1.Q#	Quadrupol Q#			6647.5
HIGH1.Q#	Quadrupol Q#			6892.5
HIGH1.V3	Schieber	6953	7025	6989
HIGH1.St2	Steerer (non-rotating)	7025	7055	7040
HIGH1.Scr3 [EMSY2]	EMSY	7025	7225	7125
HIGH1.STA2	Steerer (non-rotating)	7248	7348	7298
HIGH1.Dipol	Dipol	7370	7970	
HIGH1.V4	Schieber	8128	8200	8164
HIGH1.St3	Steerer (non-rotating)	8272	8302	8287
HIGH1.Scr4	Schirmstation	8287	8487	8387
HIGH1.IGP3	inkl. Pumptopf			
HIGH1.Q#	Quadrupol Q#			8600
HIGH1.Q#	Quadrupol Q#			8700
HIGH1.Scr5	Schirmstation	8820	9020	8920

- No High.ICT. Alternative: remove High1.Scr4 (or something else, e.g. valves, steerer?) – note: ICT needs bellows on both sides
- “dead vacuum arm” between Boost.V2 and High1.V2. remedy: Move High1.V1 (fast valve) to position if High1.V2
- EMSY moves 75mm towards booster (move High1.STA1?)

Second Stage: Move of High1.Scr1



3-D Model