

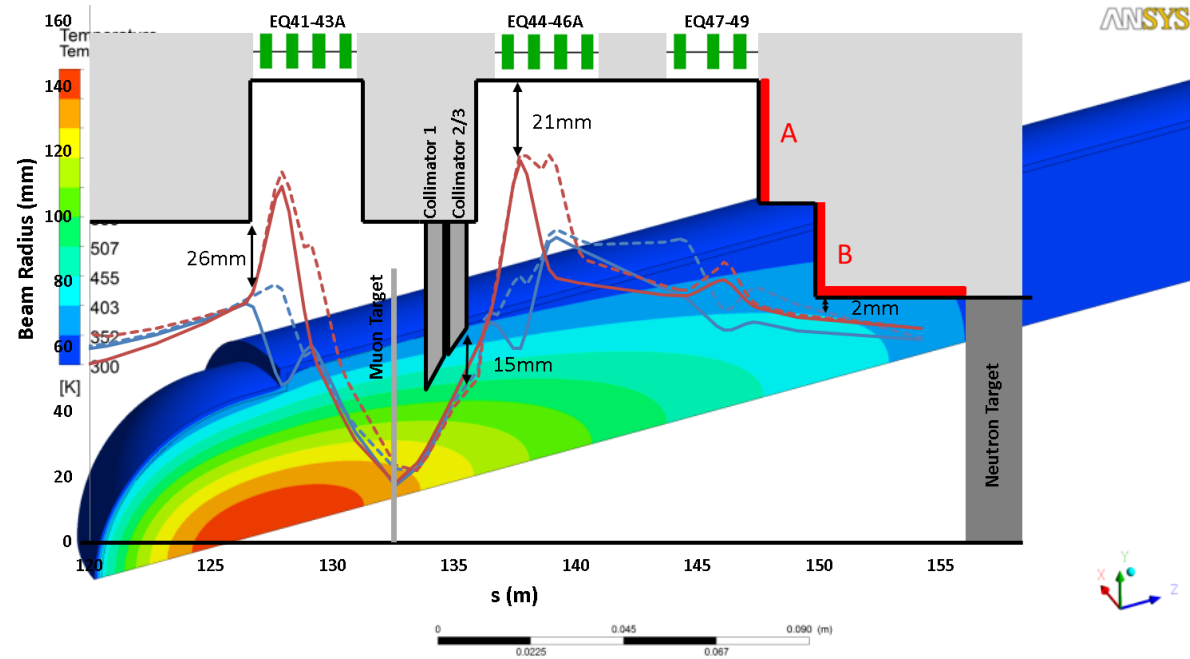
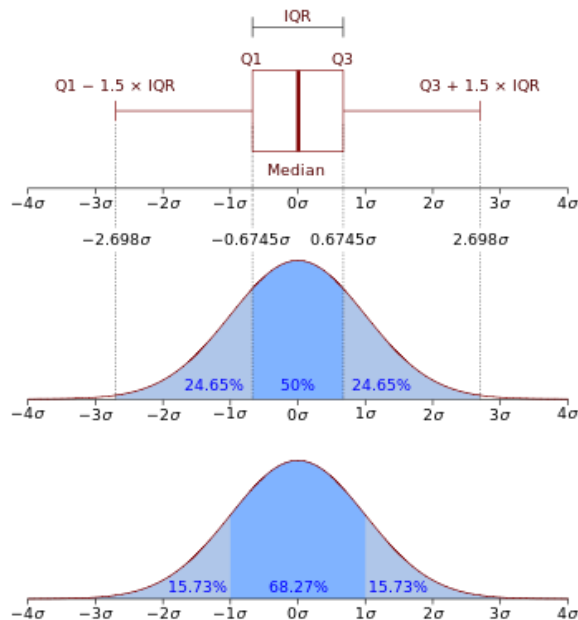
Delivering Beam to ISIS TS1

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ISIS Synchrotron Group

Background

- New better-optimised TS1 design
 - Can we shrink/move the beam?
- Does design allow for sufficient operational flexibility?



Content

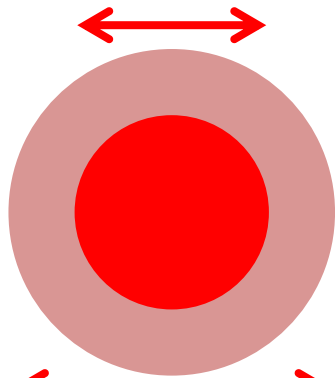
- Definitions
- Design Beam
- Diagnostic systems
- Beam Trips/Warnings
- Scope for Error
- Operational Experience



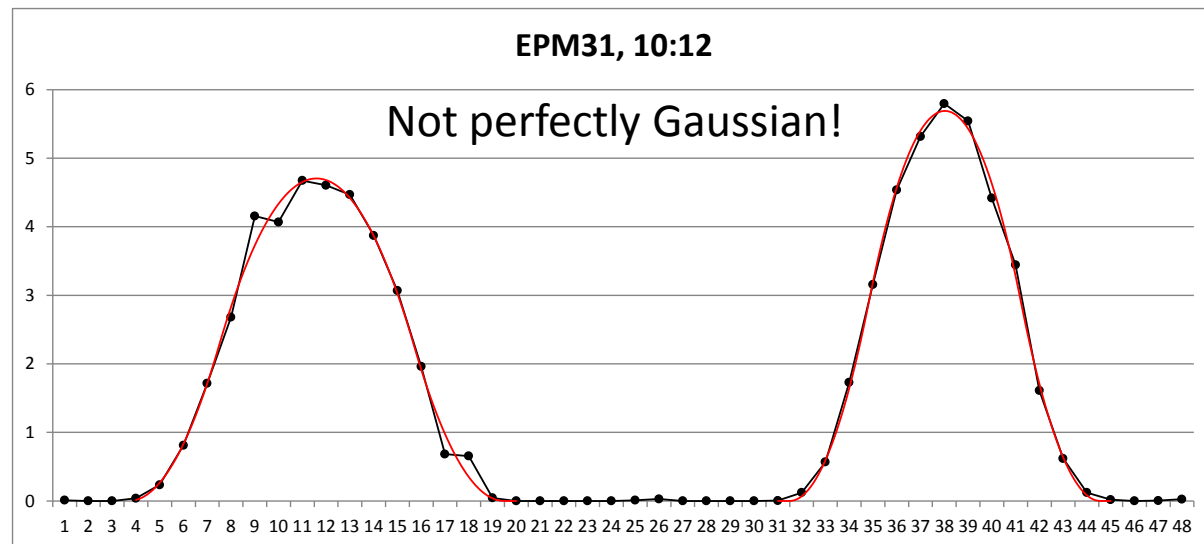
Definitions

- 95% beam widths
 - Calculated from EPB Profile Monitor data
- '100%' beam widths
 - Confirmed by deliberately mis-steering into beam pipe

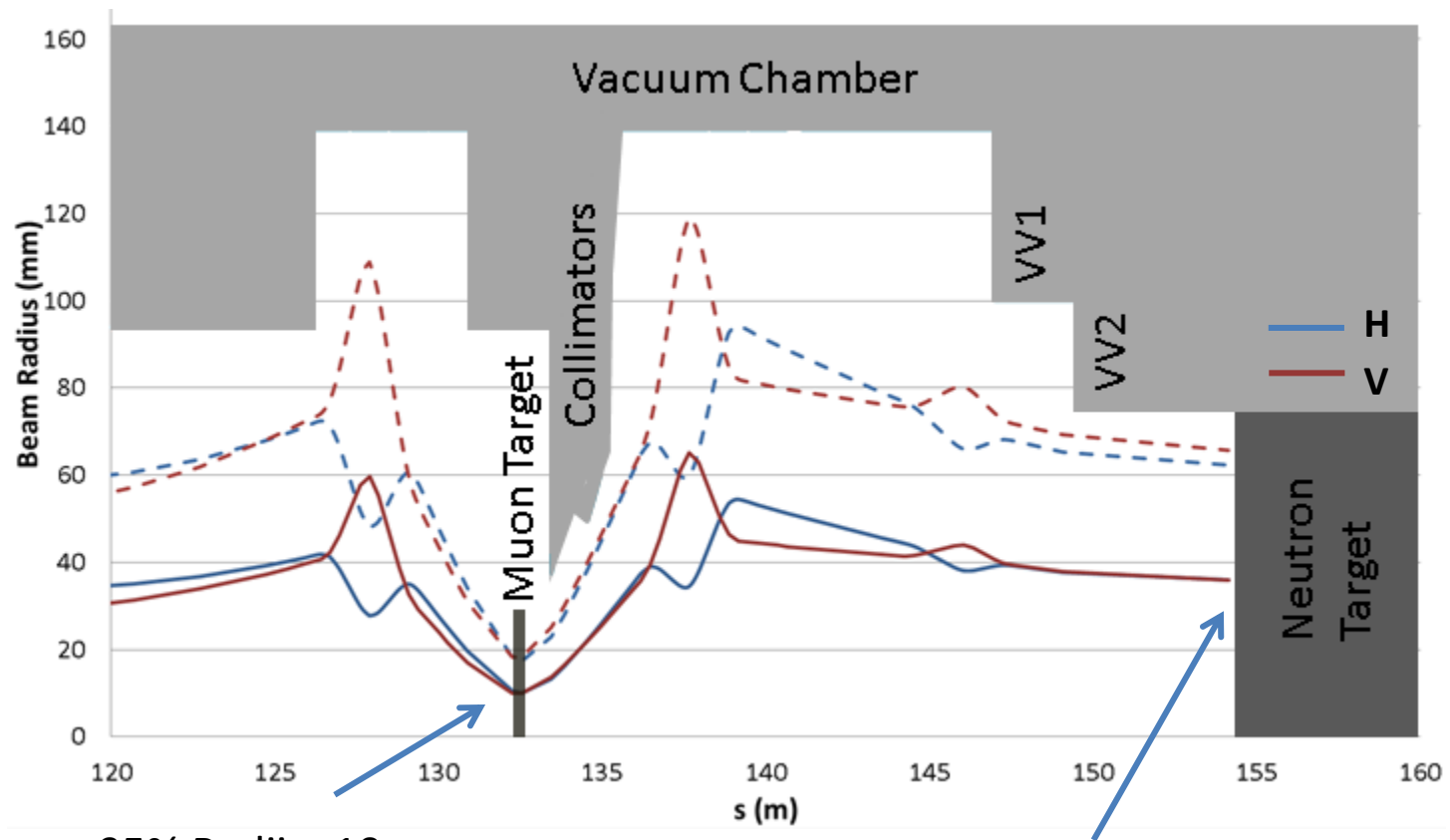
10mm 95% width



17mm 100% width

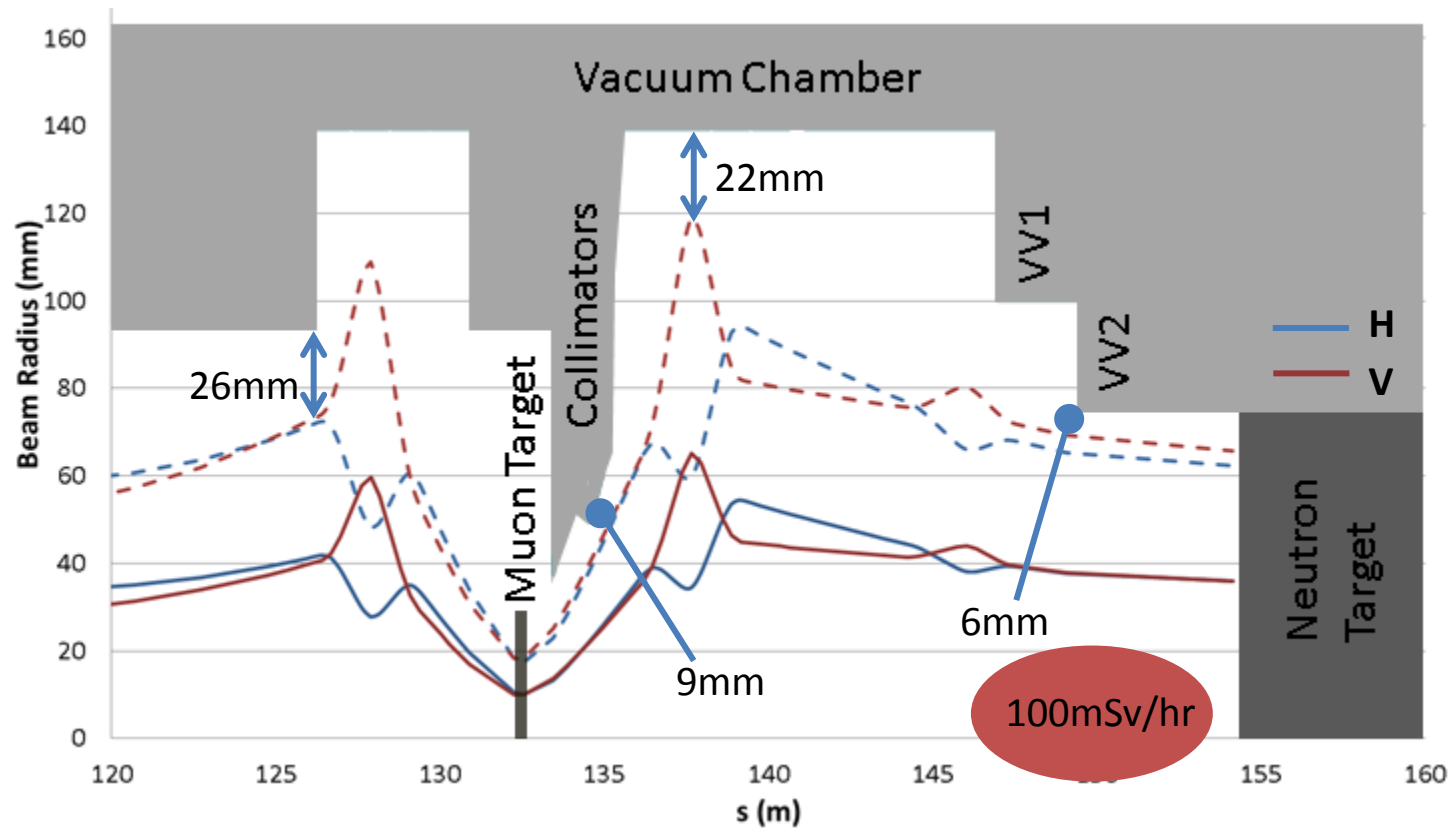


Design Beam Optic



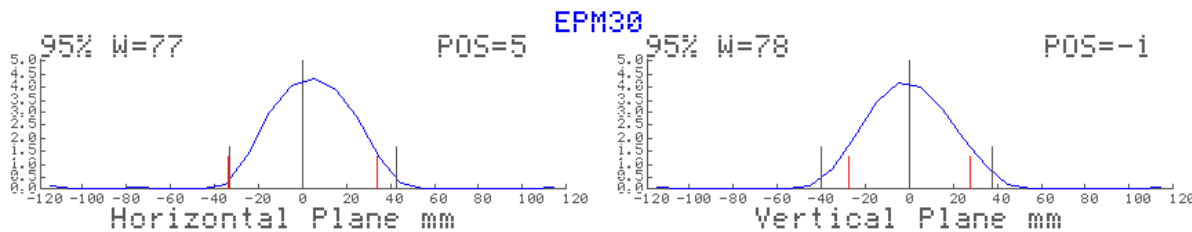
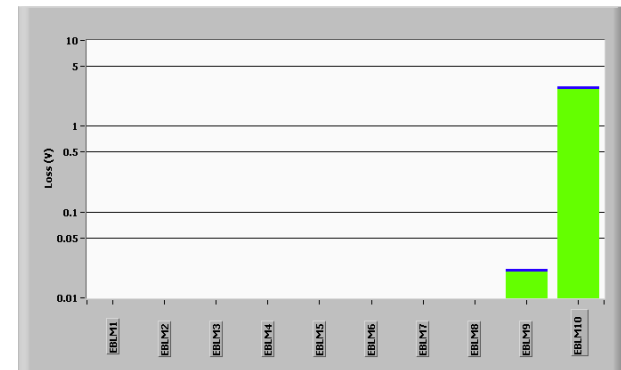
Design Beam Clearance

Design goal is 20mm clearance everywhere

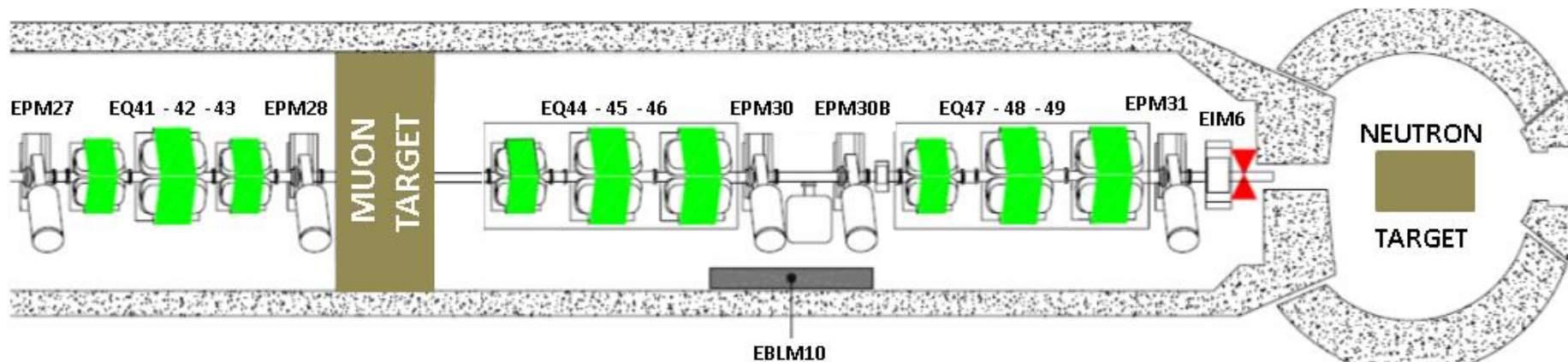


Diagnostics

- 5 Profile Monitors (Harp type)
- 1 Beam Loss Monitor
- 1 Intensity Monitor

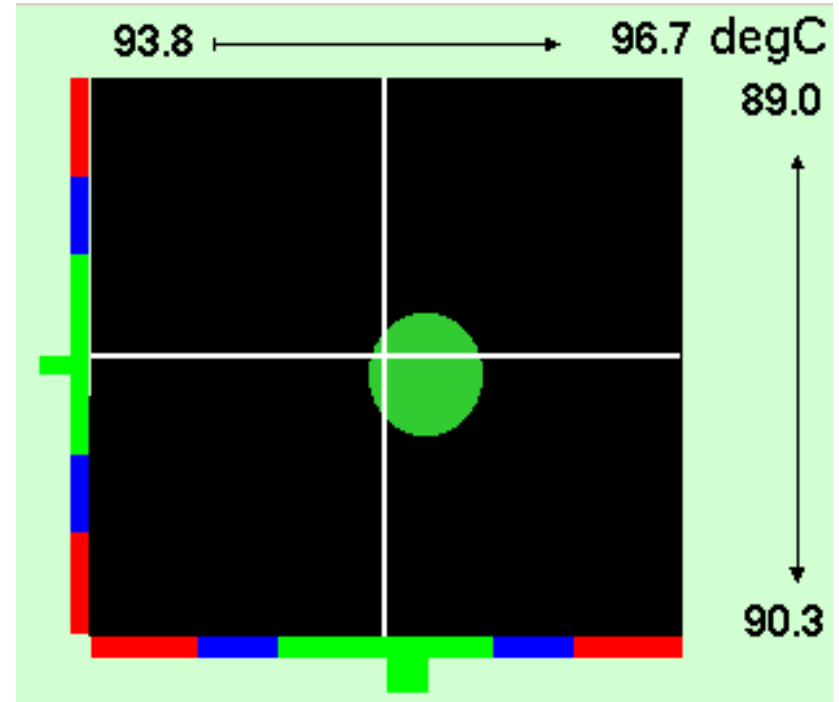


EIM5: 2.49E+13 ppp	100.0% Trans
EIM6: 2.42E+13 ppp	97.1% Muon
Overall Efficiency T1	91.8%



Diagnostics

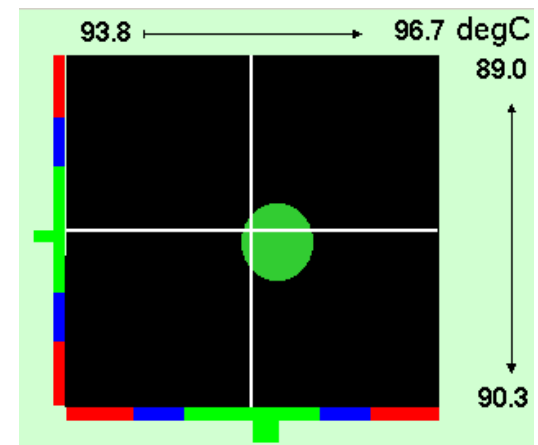
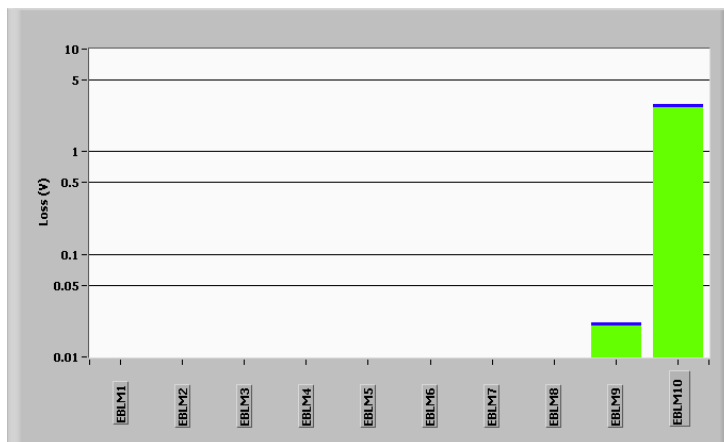
- Halo monitor
 - Eight thermocouples
 - Relative measurement
 - Does calibration hold?



TS1 CRITICAL PARAMETERS				3-DEC-2013 14:07:01			
Pressures	Value	Low	High	Flows	Value	Low	High
PD101	5.9	3.5	6.5	FM101	255.1	245.0	285.0
PD102	3.4	1.4	4.0	FM102	130.3	120.0	152.0
PD103	2.6	1.1	3.5	FM103	102.0	90.0	120.0
PD104	10.2	6.0	42.0	FM104	157.5	150.0	200.0
PD110	30.0	22.3	45.0	FM105	158.4	150.0	200.0
PD501	13.7	10.0	21.0	FM106	159.5	150.0	200.0
P105	54.5	45.0	60.0	FM107	61.5	60.0	85.0
P106	56.0	45.0	60.0	FM108	74.9	58.0	85.0
P107	59.2	45.0	62.0	FM110	503.4	500.0	580.0
P108	87.9	65.0	94.0	FM111	13.0	-1.0	20.0
P115	42.6	27.0	45.0	FM113	946.1	850.0	1000.0
P118	77.6	65.0	90.0	FM115	368.7	270.0	460.0
P502	23.2	17.0	25.0	FM122	8.1	7.0	13.0
				FM201	37.8	25.0	42.0
				FM202	37.9	25.0	42.0
				FM203	0.0	-1.0	6.0
				FM301	6.9	4.0	8.5
				FM303	0.0	-1.0	6.0
				FM401	0.0	-1.0	15.0
				FM505	26.1	22.5	34.0
Levels	Value	Low	High				
LS101	41.8	35.0	60.0				
LS107	0.2	0.1	10.0				
LS108	0.2	0.1	10.0				
LS109	39.0	35.0	65.0				
LS110	0.1	-1.0	20.0				
LS111	23.8	10.0	30.0				
LS112	65.5	10.0	70.0				
LS201	46.6	35.0	60.0				
LS501	74.7	55.0	85.0				

Setup Procedure

- EPMs used to check beam alignment and widths
 $\pm 5\text{mm}$ is acceptable
- Minor adjustments to optimise
 - EBLM9,10 loss levels
 - Halo monitor temperatures



Beam Protection System

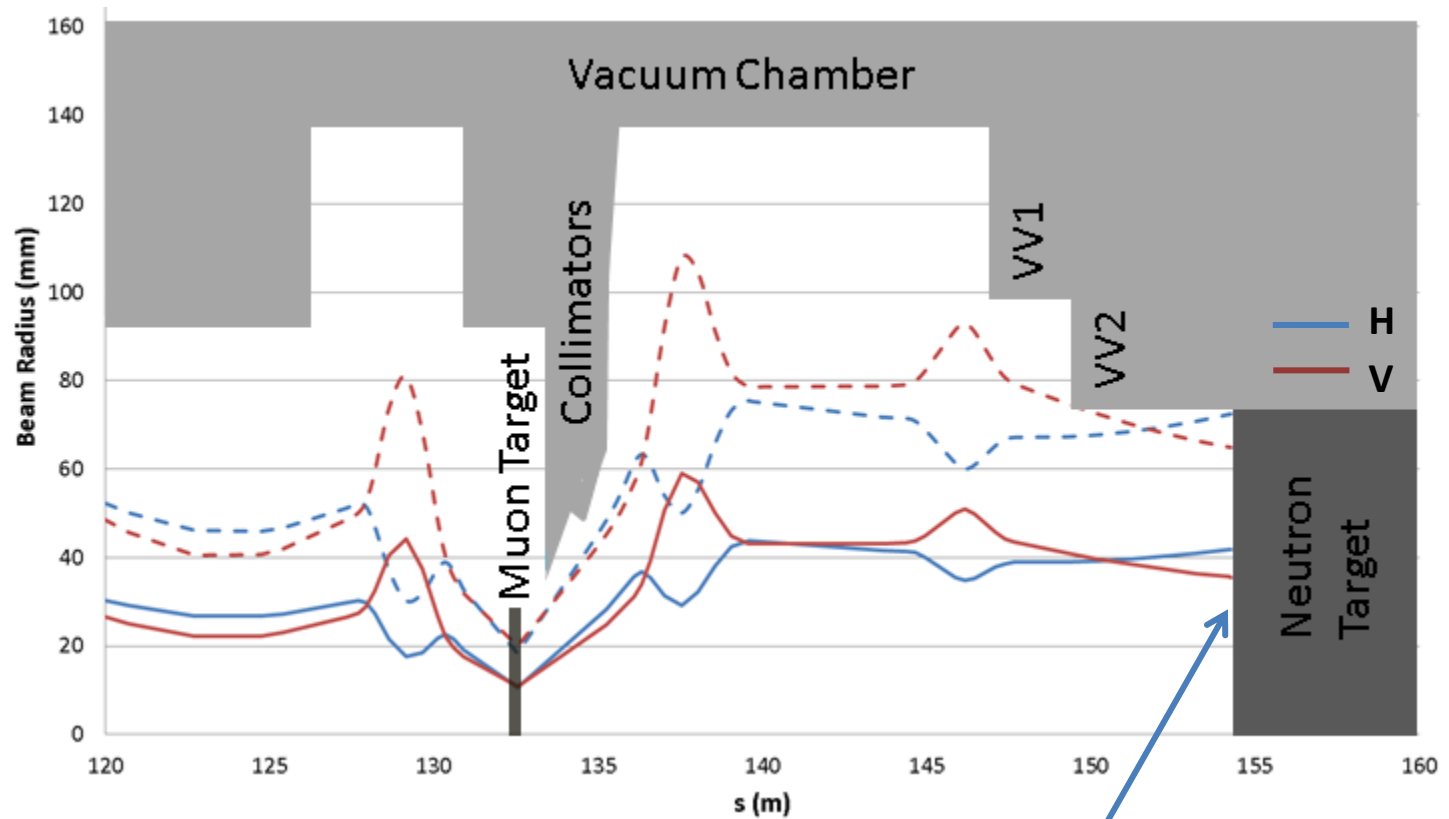
- Beam Loss
 - >6 V on EBLM10, normal operation = 3.0 ± 0.5 V
- Beam Intensity
 - > 1.5×10^{12} particles lost between start/end EPB
- Halo Monitor
 - Any one >140°C **or** left-right/top-bottom difference >14°C

1 event = beam inhibited for 2 seconds
2 events in 10s = beam off and first beam stop inserted



Scope for Error

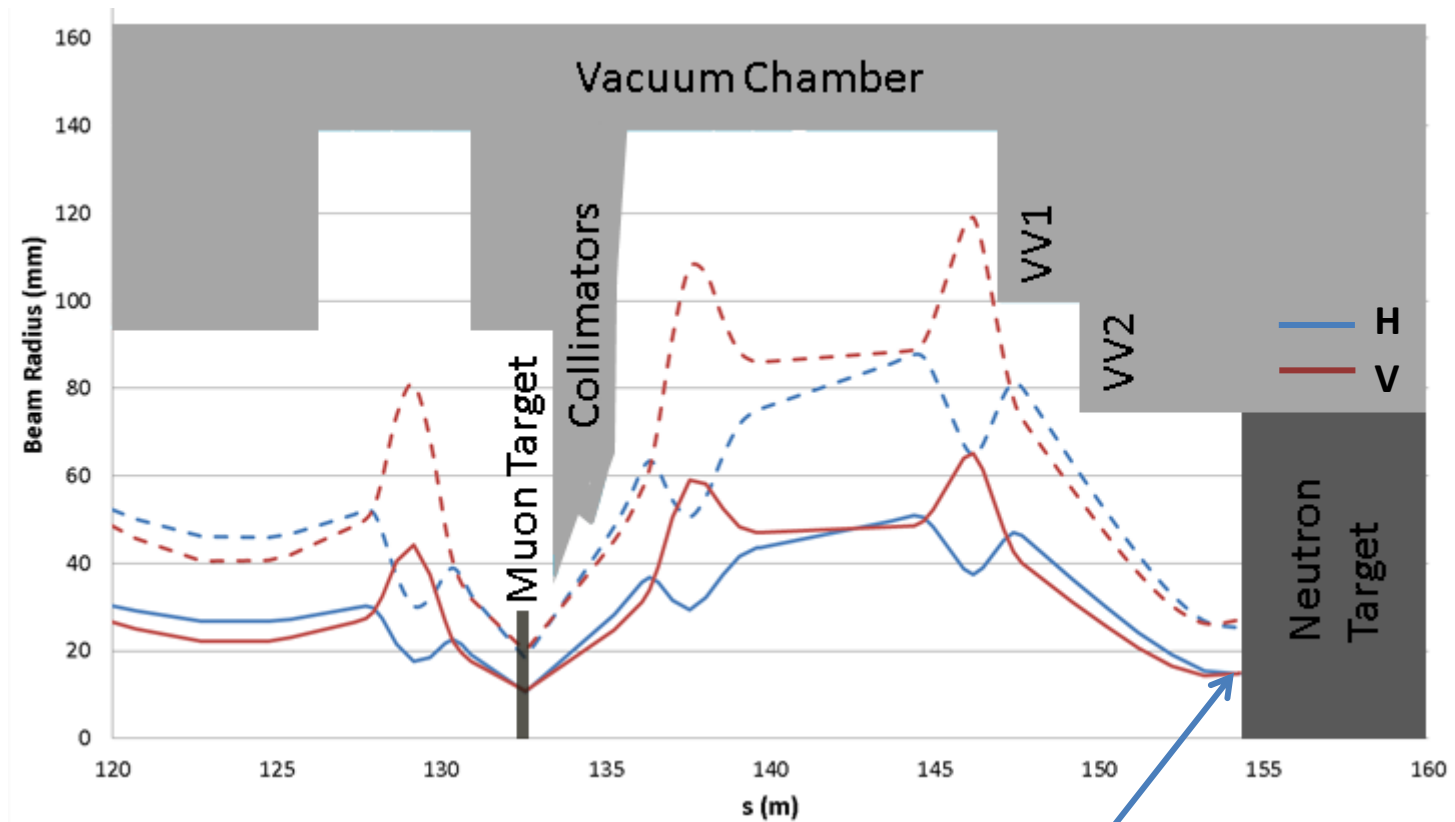
Under Focussed Beam



95% Radii = 42 x 38mm

Scope for Error

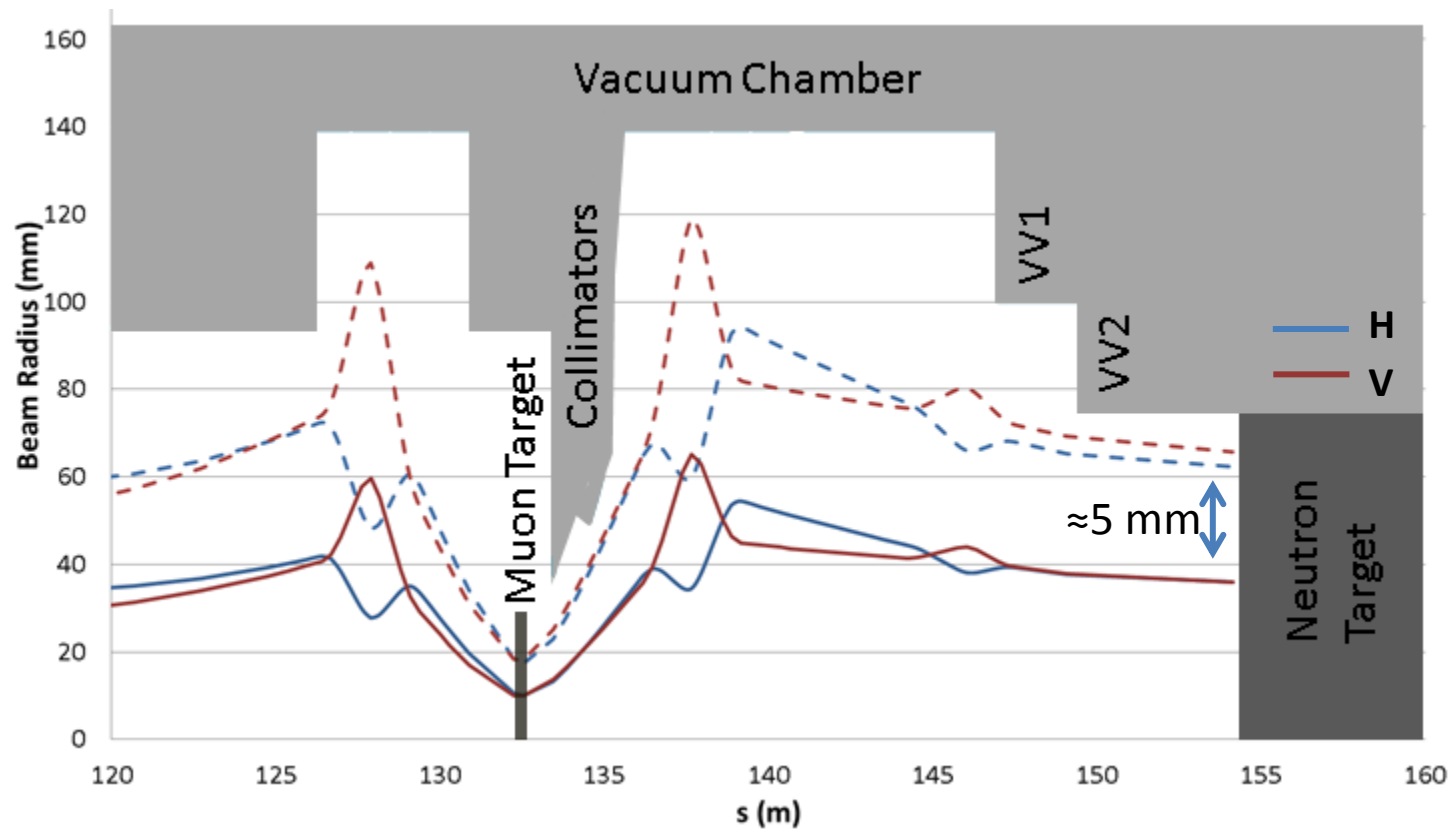
Over Focussed Beam



95% Radii = 15mm

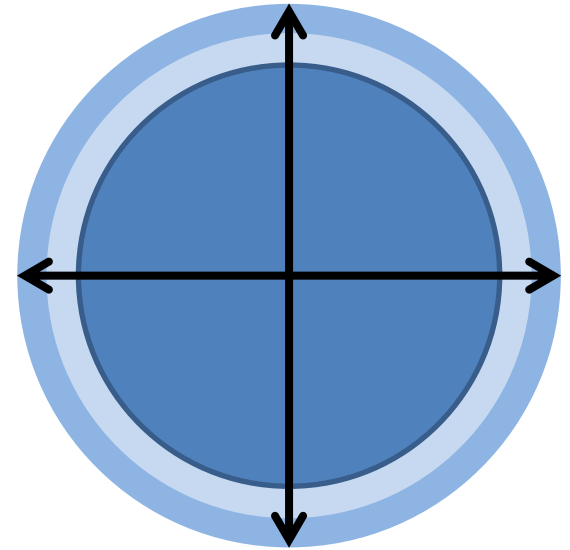
Scope for Error

Mis-steered Beam



Operational Experience

- Summary
 - Estimate setup with beam at target face
 - ± 5 mm error on 95% width
 - ± 5 mm error on centroid position
 - Possibility of greater error within BPS limits (15 - 42 mm radius)
 - Stable to ± 2 mm during operation



Conclusion

- Beam is not perfect...
- Finite number and accuracy of diagnostics
- Finite stability of components
 - Must allow margin of error for continuous operation

