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How to fit the Pellet-TRacking system, flanges, valves and pumps in the recesses (target pits) in the PANDA iron yoke.

This study is based on:

- Drawings/sketches distributed by H. Orth in February and May 2012
- Older PANDA CAD "PR" pictures (in lack of "better")
- PTR section conceptual design 2010 (now in Target TDR, Feb 2012)
- Components like flanges, pipe and valves with sizes taken from rough PANDA CAD sketches and from components used at UPTS.

A first version of a full scale model has been prepared and from the results presented here one can already get some feeling about the possibilities to accommodate piping and pumps in the pits.

Our main questions concern the space for installation of the PTR sections and the access to PTR components during pellet target operation. This together with the demand that the pellet generator (and PTR system) should be placed as close to the interaction region as possible.

Draft was distributed 21/8 to:

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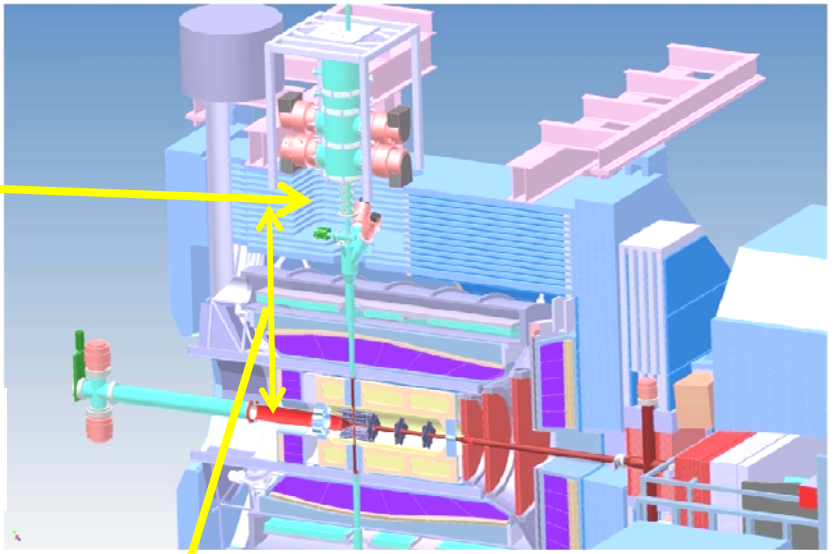
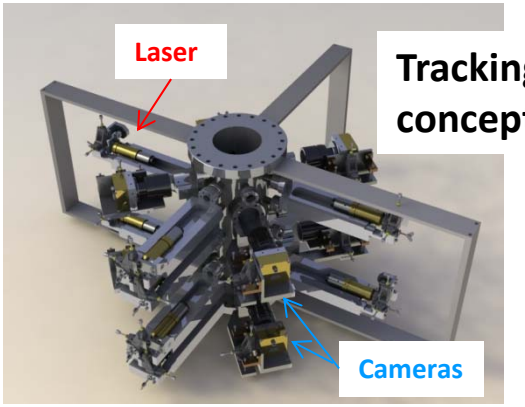
Pellet tracking system for panda

At PANDA two sections of the target pipe, one at the generator and one at the dump are planned for tracking equipment.
The sections are 40 cm long.



PTR section – Interaction region ≈ 2 meters



Tracking section conceptual design

Four levels for measurements, each with two lasers and two LS-cameras. Level spacing: 60 mm

Simulations are used to determine the optimal use of the tracking sections and they are also needed in the development of tracking algorithms.

Some main points of the design concern:

- Camera and laser configuration within each level
- Number of levels and the distance between the levels

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Target piping illustrated in Fig. 9.2 of Targets TDR (february 2012)

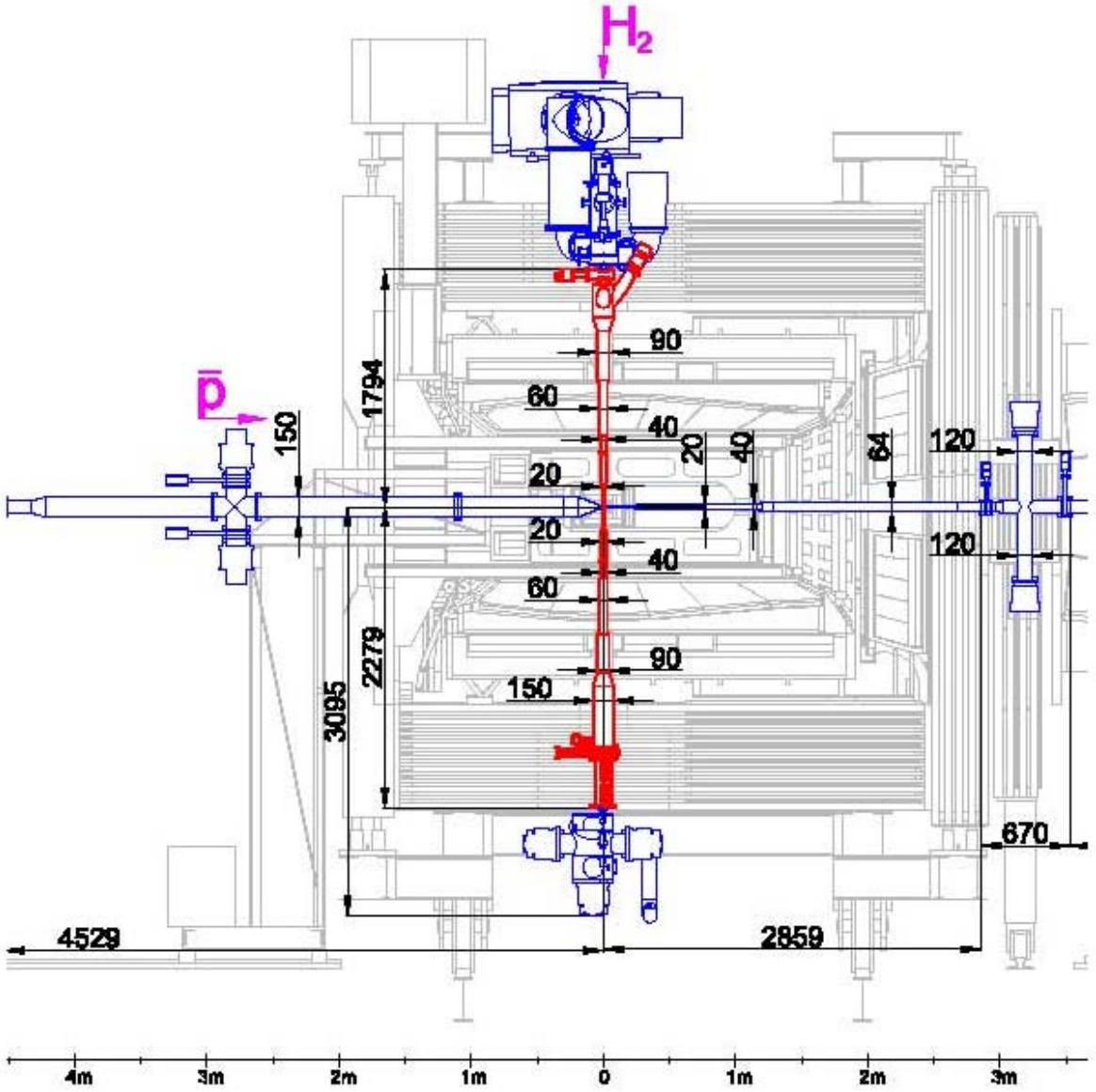
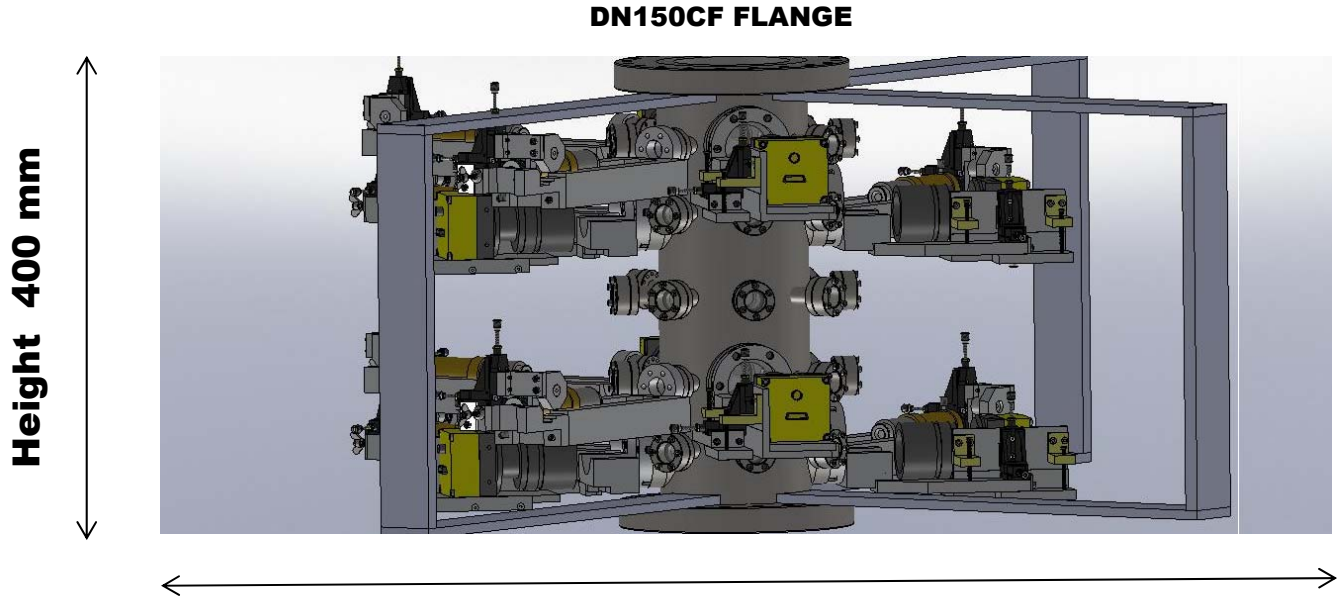


Figure 9.2: Cross section of the Target Spectrometer with detector components in light gray. The target and dump lines are marked in red. The antiproton beam line, as well as the cluster-jet target and the target beam dump, is marked in blue. The dimensions are given in mm. The diameters refer to inner diameters of the tubes.

PTR section conceptual design (2010)



Development of the procedure of installation and method of access to the PTR sections in the iron yoke recesses needs model tests.

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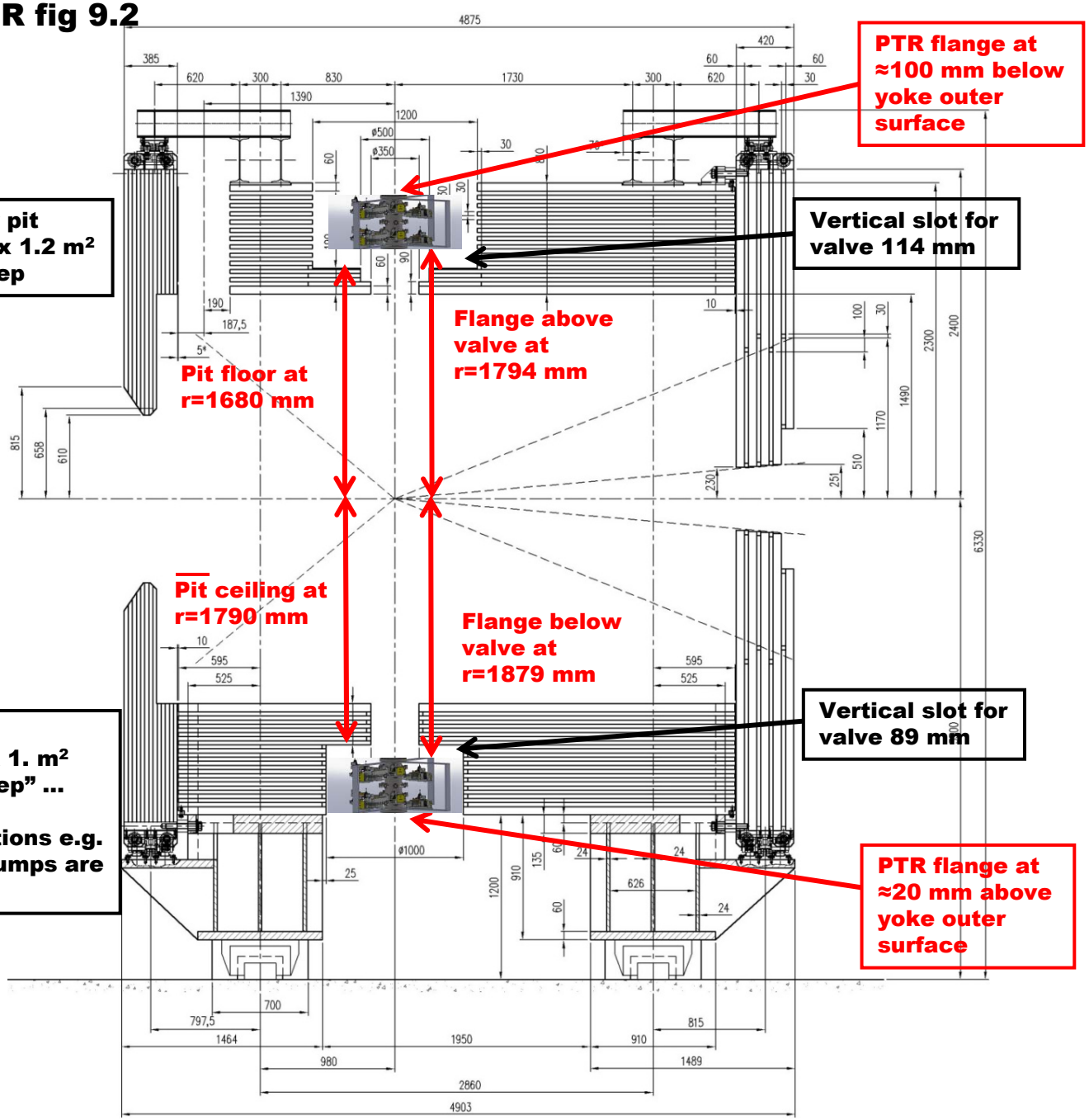
Drawing (H. Orth May 2, 2012). Positions for target pipe valve flanges from TDR fig 9.2



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Fitting of the PTR system in the recesses in the iron yoke.

Some general questions:

A. Component types: pipes, flanges, valves, pumps etc
(At UPTS the PTR section has copper seals but flanges to valves have O-rings…)
1) Which standard is foreseen at Panda target (at different places), ISO-K, CF?
2) Is any part of the target vacuum system expected to be possible to bake?
3) Which type of pumps should be placed in the pit? (Capacity, magnetic field…)

B. Mechanical support structures and other material in the pit.
1) Is any support foreseen for the target pipe? Any adjustment mechanics?
2) Is any other material foreseen e.g. cables and supply lines?

Some points where model studies may give some help.

C. Pumps in the pit.
1) Places for installation of pumps?
2) Possible number, types and sizes of pumps?

D. Installation of PTR section.
1) Procedure? Desirable to prepare as much as possible before installation.
2) Place for connecting PTR section to target pipe. Access to flange?

E. Access to PTR components during pellet operation.
1) Possibility for fine-adjustment of cameras and lasers. Human access when the pellet generator (and dump) is in place. Alignment system?
2) Possibility to replace malfunctioning cams, lasers, LEDs …

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PTR yoke-pit model studies

Model components (ID=inner diam., OD=outer diam., H=height, W=width, T=thickn., L=length, R=radius)

Pit floor **Pit walls**	**Rectangular 1x1.2 m^2 (with 1m extension marked). Hole OD=500mm indicated.** **H=620mm.**
Flanges (CF)	**For connection to target pipe and to pumps. Height above the floor are given. OD=155mm(CF90) and 205mm(CF150).**
Valves	**Transverse extension as VAT S12 DN100 (ID90 pipe), DN160 (ID150 pipe). T=70mm (only indicated with foam plastic blocks on the lower two valves).**
Pump pipes	**OD=105mm (ID=90mm).**
Detection level	**The lower part of a level containing 2 arms with cameras and 2 (or 3) arms with lasers with support structures is modeled by a corrugated cardboard sheet. On some levels the sizes of cameras and lasers with positioning mechanisms are illustrated with foam plastic blocks.** **Not included: At the cameras and lasers there are in addition a few adjustment screws and cables sticking out at the outer end. Opposite to each laser a structure for alignment of the laser beam will extend to R=250mm and have W=60mm. Fans for cooling of the cameras (and electronics).**
Camera	**Arm: W=160mm, max R=350mm. Block: H=60mm, W=95mm, L=155mm.**
Laser	**Arm: W=160mm, max R=400mm. Block: H=60mm, W=85mm, L=185mm.**

IMPORTANT NOTE: **The measures of flanges, pipe and valves are taken from rough CAD sketches or from components found (within arms length distance) at UPTS. These components are probably not "optimal"….**

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Photos of PTR yoke-pit model. p 0(8)

Page-figure	View	Comment (figure caption)
1-59	top fr upstr	Pit W=1m L=1.2 m H=0.62m, Downstream left quadrant is "free" for tilted straight pump pipe.
1-65	top fr right	Pit W=1m L=1.2 m H=0.62m. One quadrant "free" for straight pump pipe. "CF150" flange for connection to pellet generator and "CF90" flanges for connection to pumps (in two possible configurations). Heights of flanges above the floor are given.
2-31	side fr right	Detection levels and shafts of valves VAT S12 DN160 (down to the left) and DN100 are seen. The full height of a detection level is ≈ 60mm.
3-25	floor fr upstr	Poor space to connect PTR section above DN160 valve. Yellow spacers have H=20mm.
3-45	side fr upstr	The bottom of the detection levels are shown by the corrugated cardboard sheets. On the lower two levels, foam plastic blocks illustrate the sizes of cams and lasers. The full height of a detection level is ≈ 60mm.
4-47	side fr left	Valve "shaft" collide with camera/laser (at this height). To avoid this, the valve should move up further about 100 mm.
4-48	floor fr left	The bottom of the detection levels are shown by the corrugated cardboard sheets. On the lower two levels, foam plastic blocks illustrate the sizes of cams and lasers. The full height of a detection level is ≈ 60mm.
5-49	side fr downstr	Pipes and "CF90" flanges for pumps (in two possible configurations). Heights of flanges above the floor are given.
5-50	floor fr downstr	Pipes and "CF90" flanges for pumps (in two possible configurations).
6-53	fr downstr	S-shaped pipe for pump makes it possible to have a pump in this quadrant.
6-54	fr downstr	Pipe inclined 30 degrees is possible in this quadrant but a pump (valve) must be placed very high, sticking up above the pit.
7-75	top fr upstr	Space for valves and pumps with 1 x 1 m2 size of the pit (i.e. at the dump). The depth of the pit is 620mm. In the right quadrant the space for a pump inside the pit is about 200mm x 200mm x height 300mm. In the left quadrant the height left for a pump is less than 150 mm (see comments at figs.47 and 54.).
8-76,77,80		CAD drawing/sketch of yoke. Some measures are used for the model .
8-82		CAD sketch of PTR section. Some measures are used for the model .

Photos of PTR yoke-pit model. p 1(8)

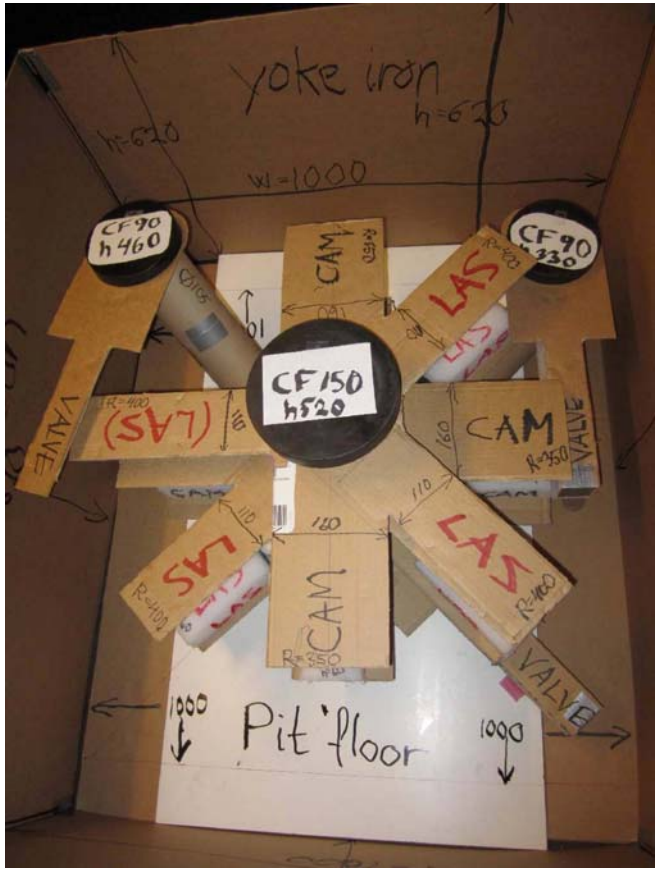

Fig.59. Top view from upstream.
Pit W=1m L=1.2 m H=0.62m.
Downstream left quadrant is "free" for tilted straight pump pipe.

Fig.65. Top view from right.
Pit W=1m L=1.2 m H=0.62m.
One quadrant "free" for straight pump pipe. "CF150" flange for connection to pellet generator and "CF90" flanges for connection to pumps (in two possible configurations). Heights of flanges above the floor are given.

Photos of PTR yoke-pit model.

Fig.31. Side view from right. Detection levels and shafts of valves VAT S12 DN160 (down to the left) and DN100 are seen. The full height of a detection level is ≈ 60mm.

Photos of PTR yoke-pit model. p 3(8)

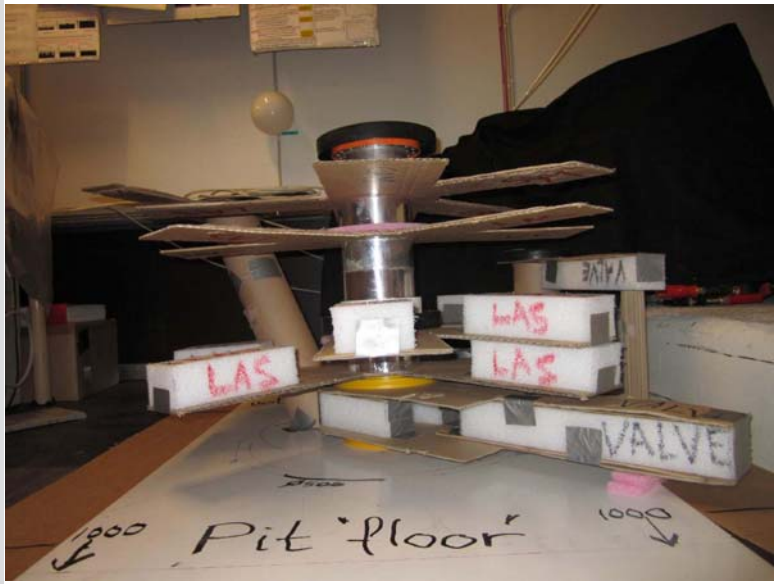

Fig.25. Floor view from upstream. Poor space to connect PTR section above DN160 valve. Yellow spacers have H=20mm.

Fig.45. Side view from upstream. The bottom of the detection levels are shown by the corrugated cardboard sheets. On the lower two levels, foam plastic blocks illustrate the sizes of cams and lasers. The full height of a detection level is ≈ 60mm.

Photos of PTR yoke-pit model. p 4(8)

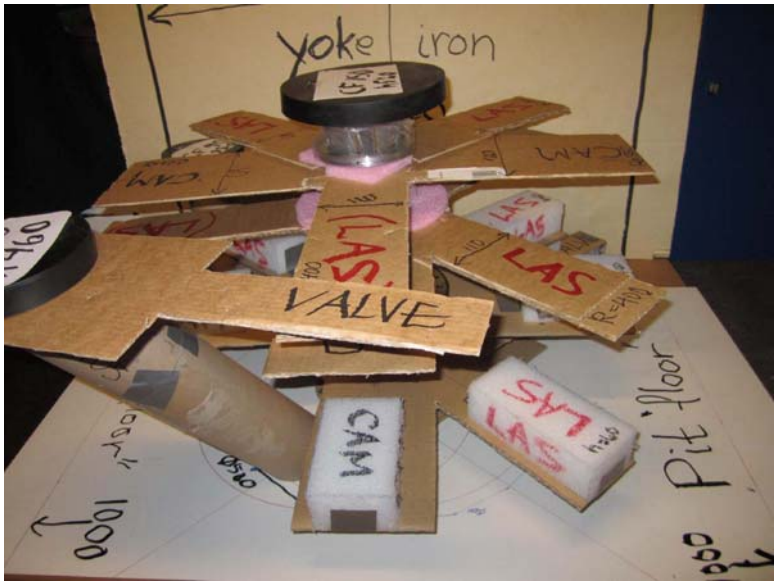

Fig.47. Side view from left.
Valve "shaft" collide with camera/laser (at this height). To avoid this, the valve should move up further about 100 mm.

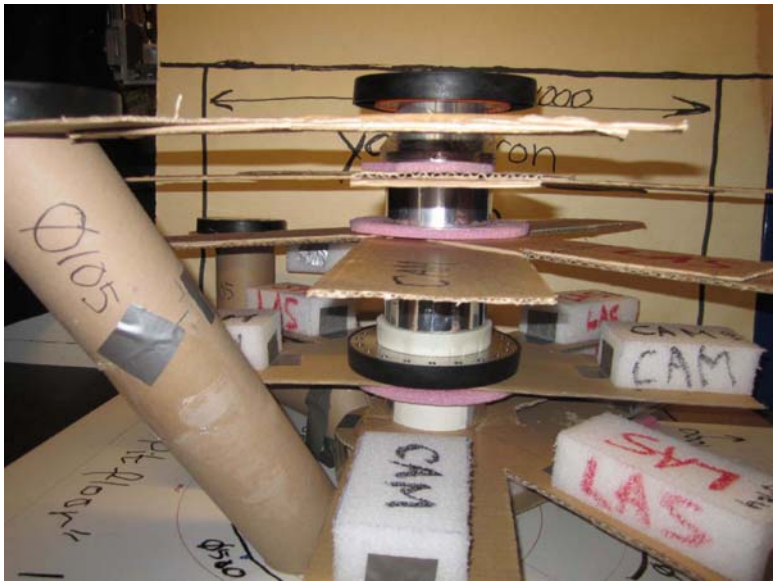

Fig.48. Side view from left.
The bottom of the detection levels are shown by the corrugated cardboard sheets. On the lower two levels, foam plastic blocks illustrate the sizes of cams and lasers. The full height of a detection level is ≈ 60mm.

Photos of PTR yoke-pit model. p 5(8)

Fig.49. Side view from downstream. Pipes and "CF90" flanges for pumps (in two possible configurations). Heights of flanges above the floor are given.

Fig.50. Floor view from downstream. Pipes for pumps (in two possible configurations).

Photos of PTR yoke-pit model. p 6(8)

Fig.53. View from downstream.
The S-shaped pipe for pump makes it possible to have a pump in this quadrant.

Fig.54. View from downstream.
A pipe inclined 30 degrees is possible in this quadrant but a pump (and valve) must be placed very high, sticking up above the pit.

Photos of PTR yoke-pit model. p 7(8)

Fig.75. Top view from upstream.
Space for valves and pumps with 1 x 1 m^2 size of the pit (i.e. at the dump). The depth of the pit is 620mm. In the right quadrant the space for a pump inside the pit is about 200mm x 200mm x height 300mm. In the left quadrant the height left for a pump is less than 150 mm (see comments at figs.47 and 54.).

Photos of PTR yoke-pit model. p 8(8)

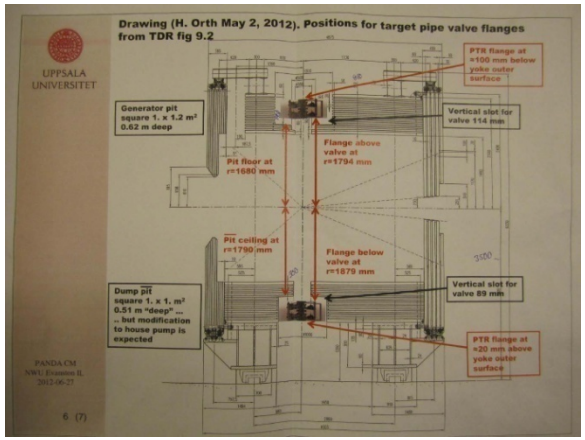

Fig.76. CAD drawing of yoke. Some measures are used for the model .

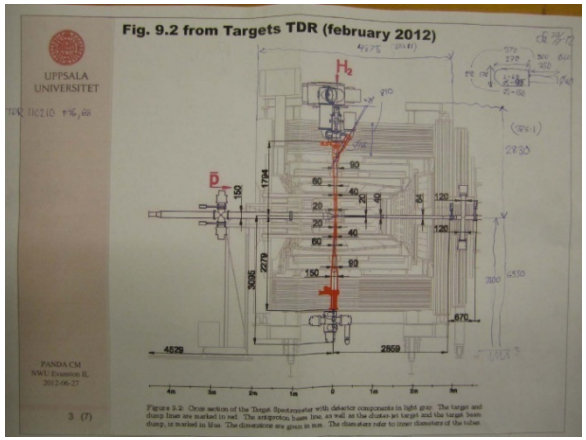

Fig.77. CAD sketch of yoke. Some measures are used for the model .

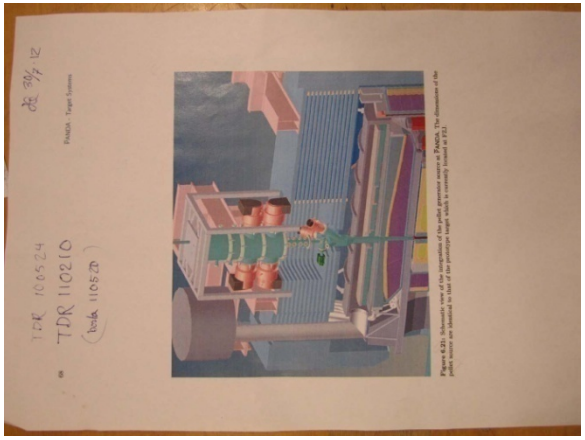

Fig.80. CAD sketch of yoke. Some measures are used for the model .

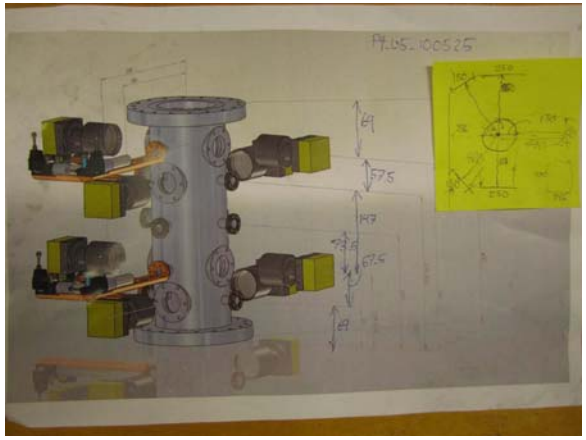

Fig.82. CAD sketch of PTR section. The measures are used for the model .

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Fitting of the PTR system in the recesses in the iron yoke.

General comment:

The space needed for the actual PTR equipment is given in the TDR, i.e. for each section 0.4 meter height and 0.5 meter radially. This equipment fits in both the upper (1x1.2 m^2) and lower (1x1 m^2) rectangular shaped "pits". The PTR section will extend to ≈100mm inside the yoke surface. (Then the pellet generator section can be placed at 2.2 m distance from the accelerator beam (≈ 0.85 m more distant than at WASA)).
In addition, space for installation, adjustment and access for fine-tuning/service during operation is required.

Some comments and conclusions from the model study.

Pumps in the pit.

A 30 degree tilted pump pipe (with valve) can be placed in one quadrant only. In such case the pump will extend outside the "pit".
S-shaped pump pipes can be put in 2 quadrants (3 if PTR section moved out ≈50 mm). The space for each pump can then be 200 x 200 x h300 mm^3 (in quadrant corners). A 250-300 l/s turbo would fit geometrically in this space.

Installation of PTR section.

Mechanics for cameras and lasers should be attached and aligned before installation in the pit. The PTR section should then be attached section to the target pipe. The access to the flange above the valve might be too difficult. In such case the space can be increased by moving out the PTR section a few cm.

Access to PTR components during pellet operation.

Fine-adjustment of cameras and lasers must be done with pellet beam. Then human access to the equipment is needed when the pellet generator and dump are in place (also for possibility to replace malfunctioning cams, lasers, LEDs …).
This mainly concerns design and configuration of equipment placed just outside the pits.

Camera electronics.

Might be disturbed by pumps and magnetic field. The closest distances of camera to yoke iron and of camera to pump are 200-250mm in this model study….
Cameras need air cooling …. Some fans may do the job.

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PTR items for FAIR Risk Management (February 2012)

PTR-001

Multi-Camera readout. Delay … Many other tasks relies on tests with multi-camera setup … (partly resource issue)

PTR-002

Operation in magnetic field. Must be tested … (design shielding)

PTR-003

Overheating of cameras. Heat tests … (design cooling system)

PTR-004

Too poor conditions for pellet detection at the dump. Tests at UPTS … (adapt design)

PTR-005

Instability of mechanical alignment. Design … (minimize risk, allow finetuning)

PTR-006

Too poor access for mechanical tuning and replacement of malfunctioning parts. Design … (allow finetuning, special tools)

PTR-007

Insufficient resources for development and preparation of a full prototype section. Mainly personnel. Unclear finance situation after 2012 …

PTR-008

Insufficient resources for preparation of full system to be installed at PANDA. Equipment and personnel …