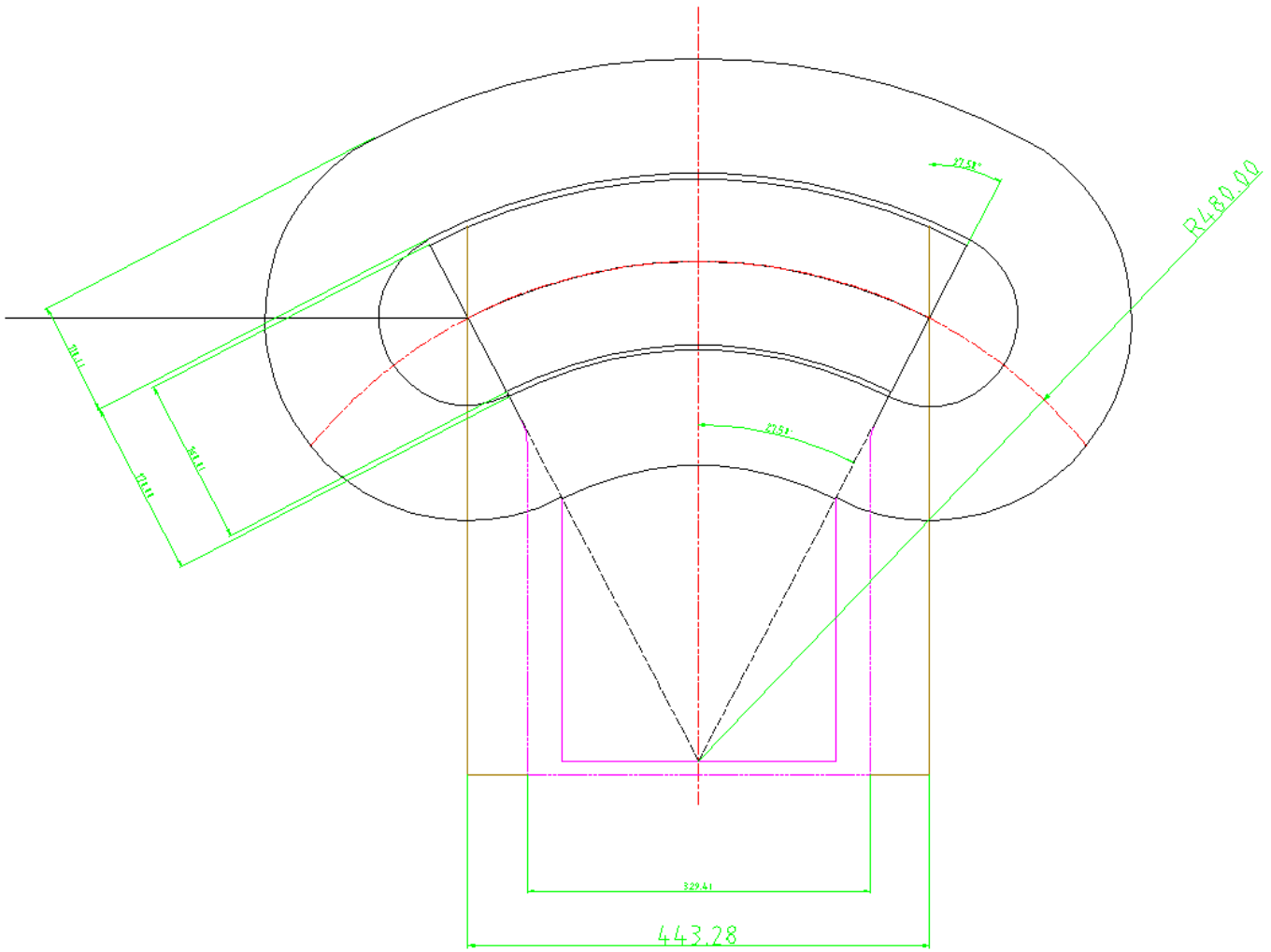
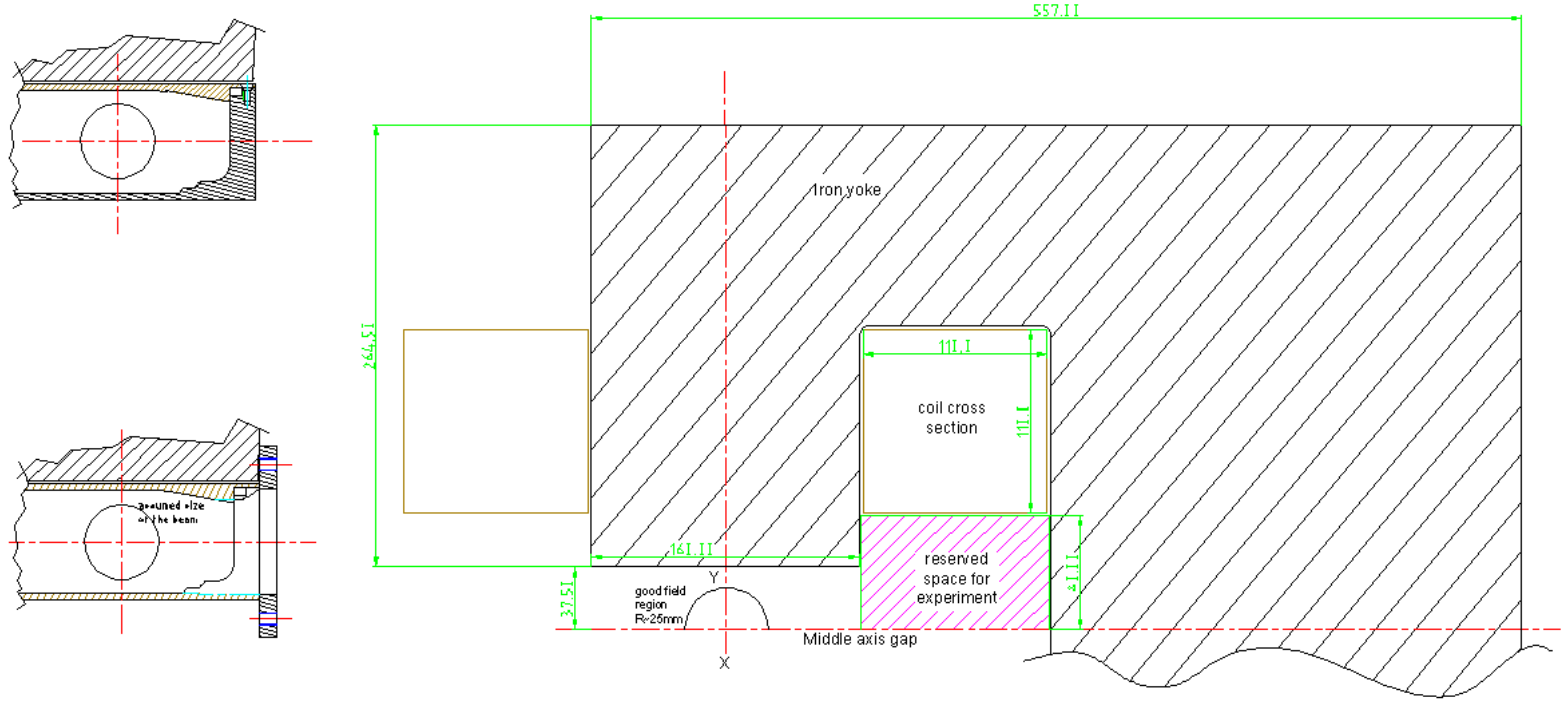
July 2012

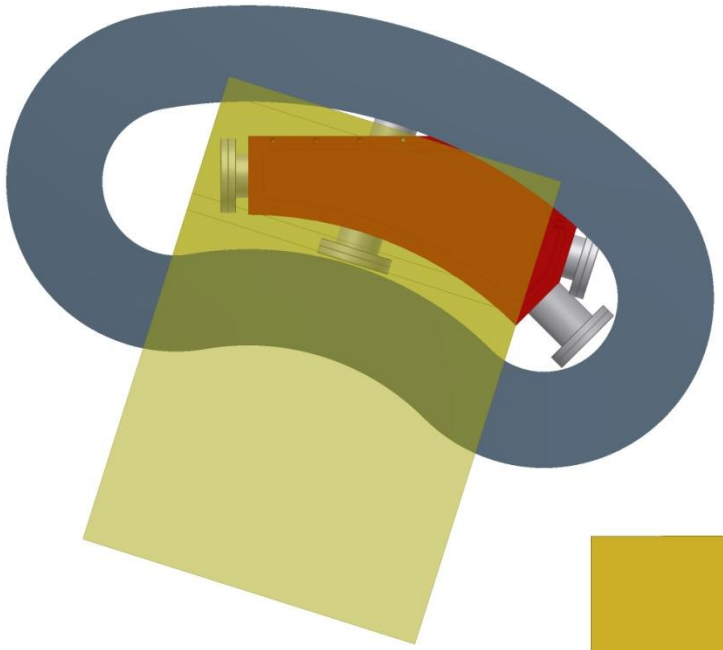


CS-PDemi005.dwg from Christoph

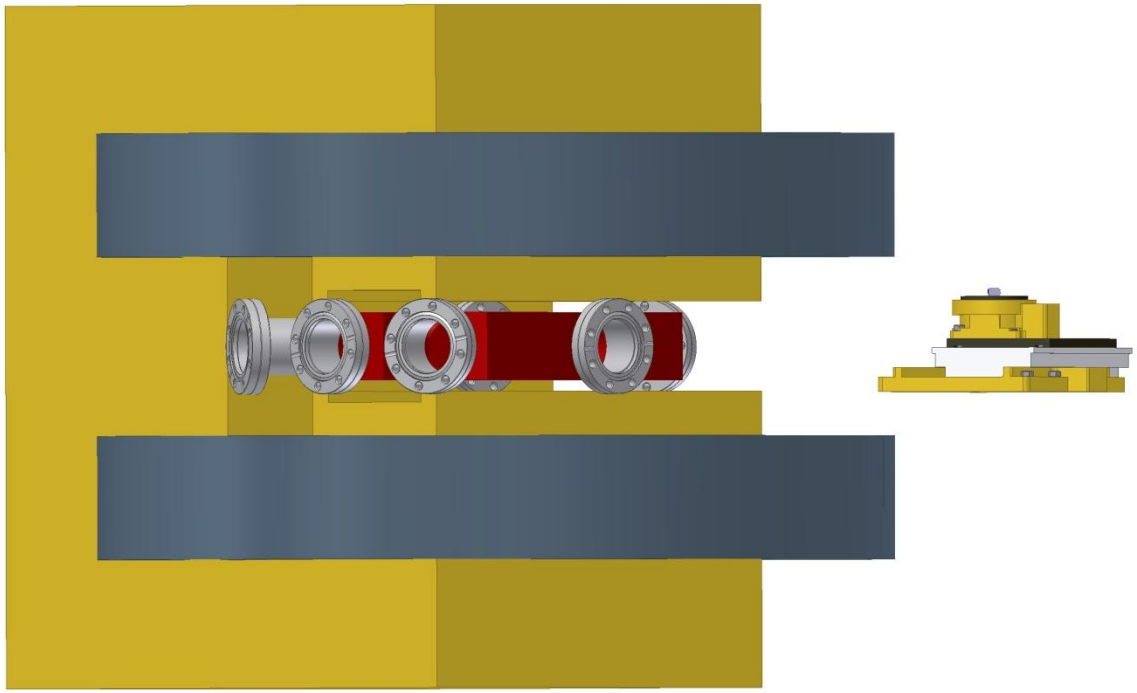


CS-PDemi005.dwg from Christoph

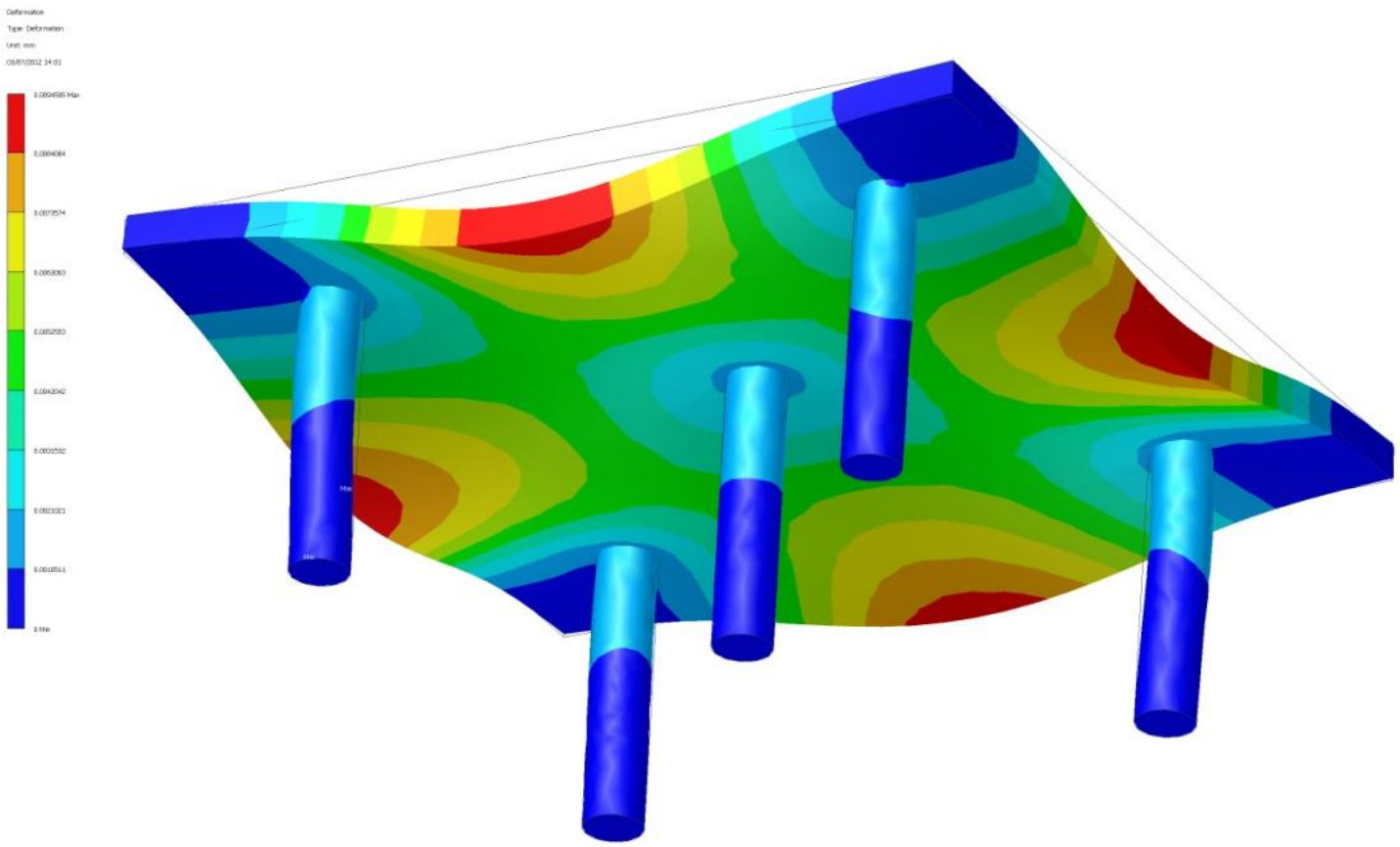
July 2012



Redrawn coils to match the 2D version shown in CS-PDemi005.dwg and altered the vessel to match the 480mm radius of the central path. Now both vessel and coils share a common axis.



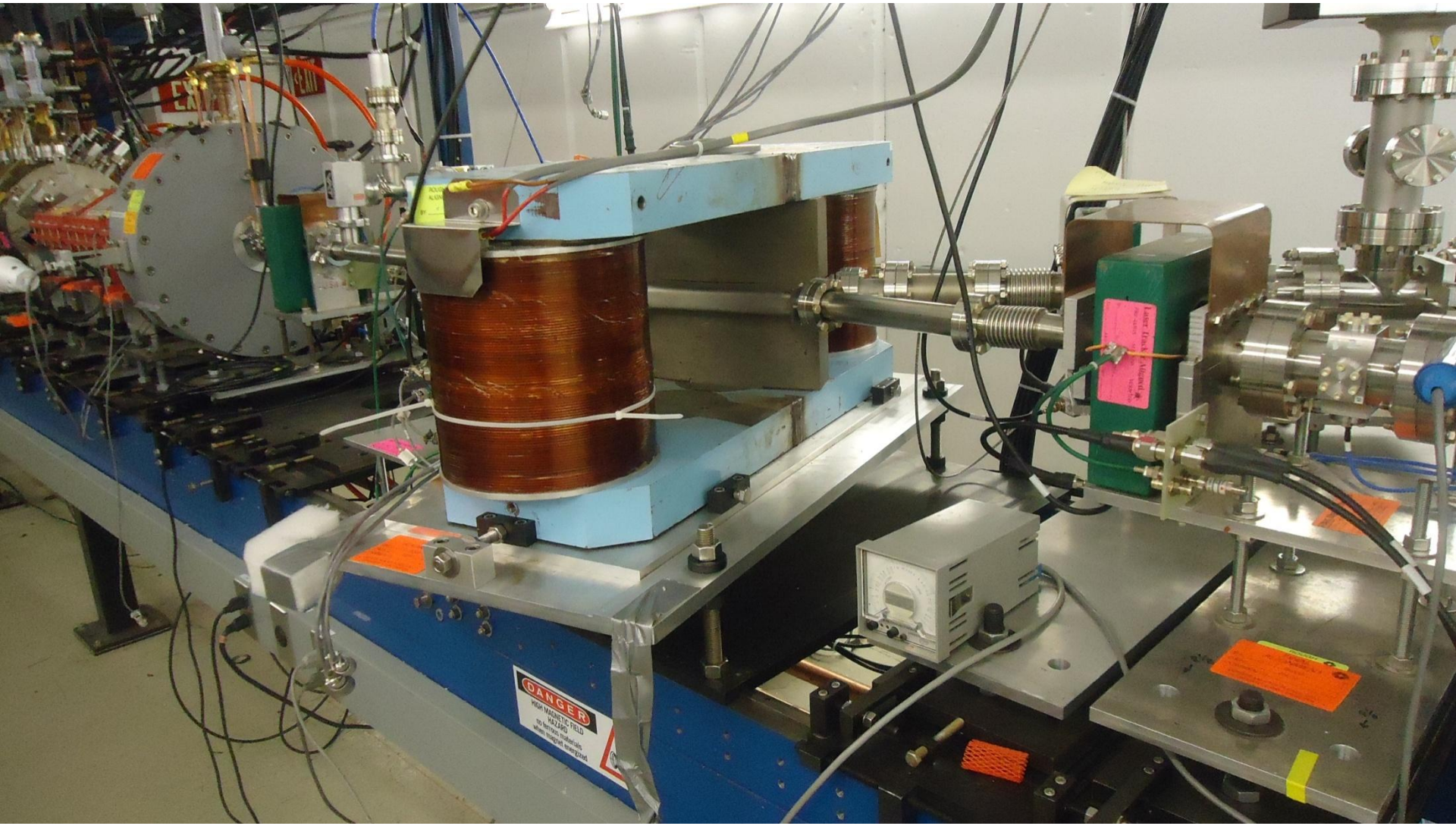
July 2012



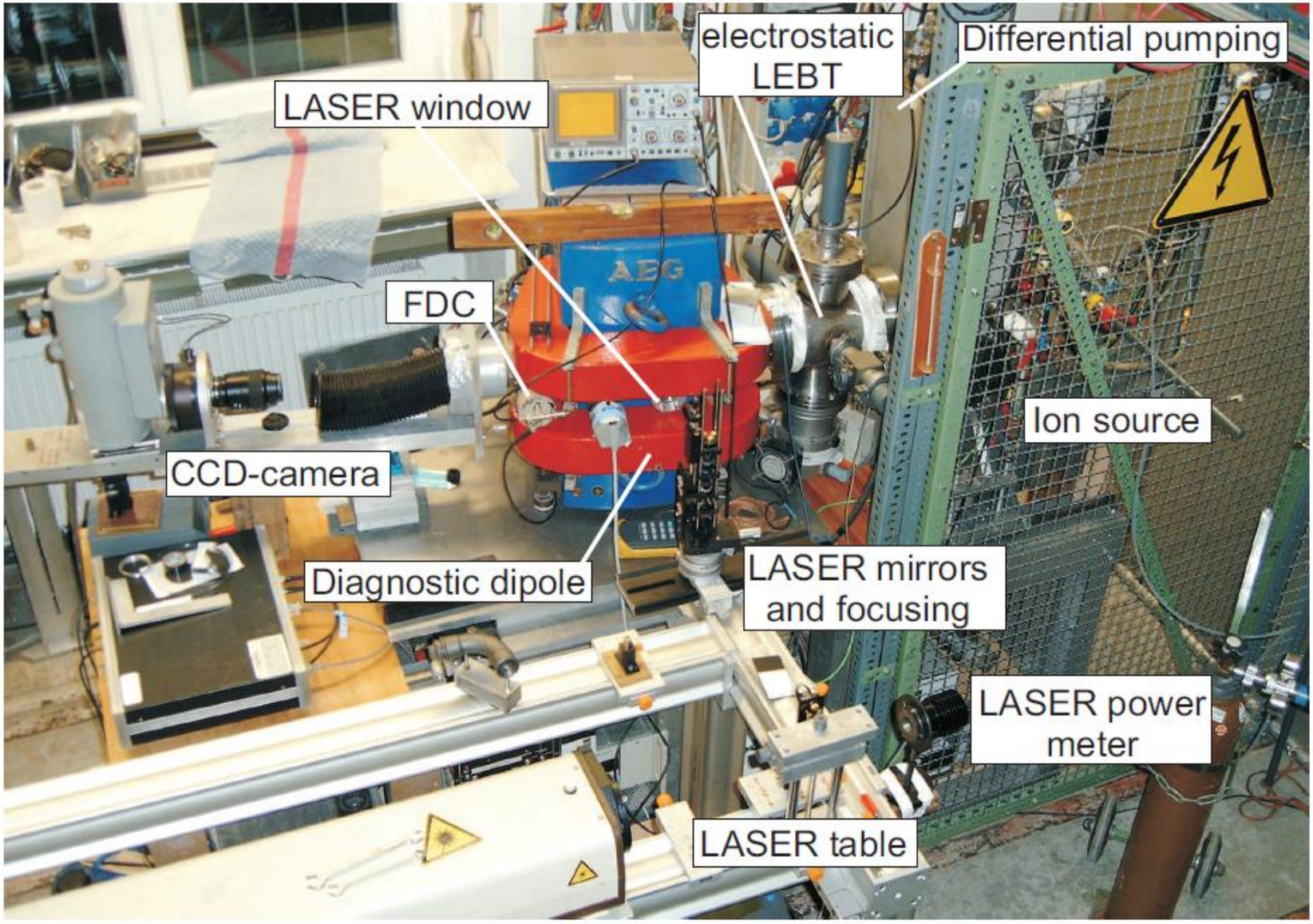
Can use Inventor to help us analyse minimum plate thickness required to give reasonable deformation and stress.

July 2012

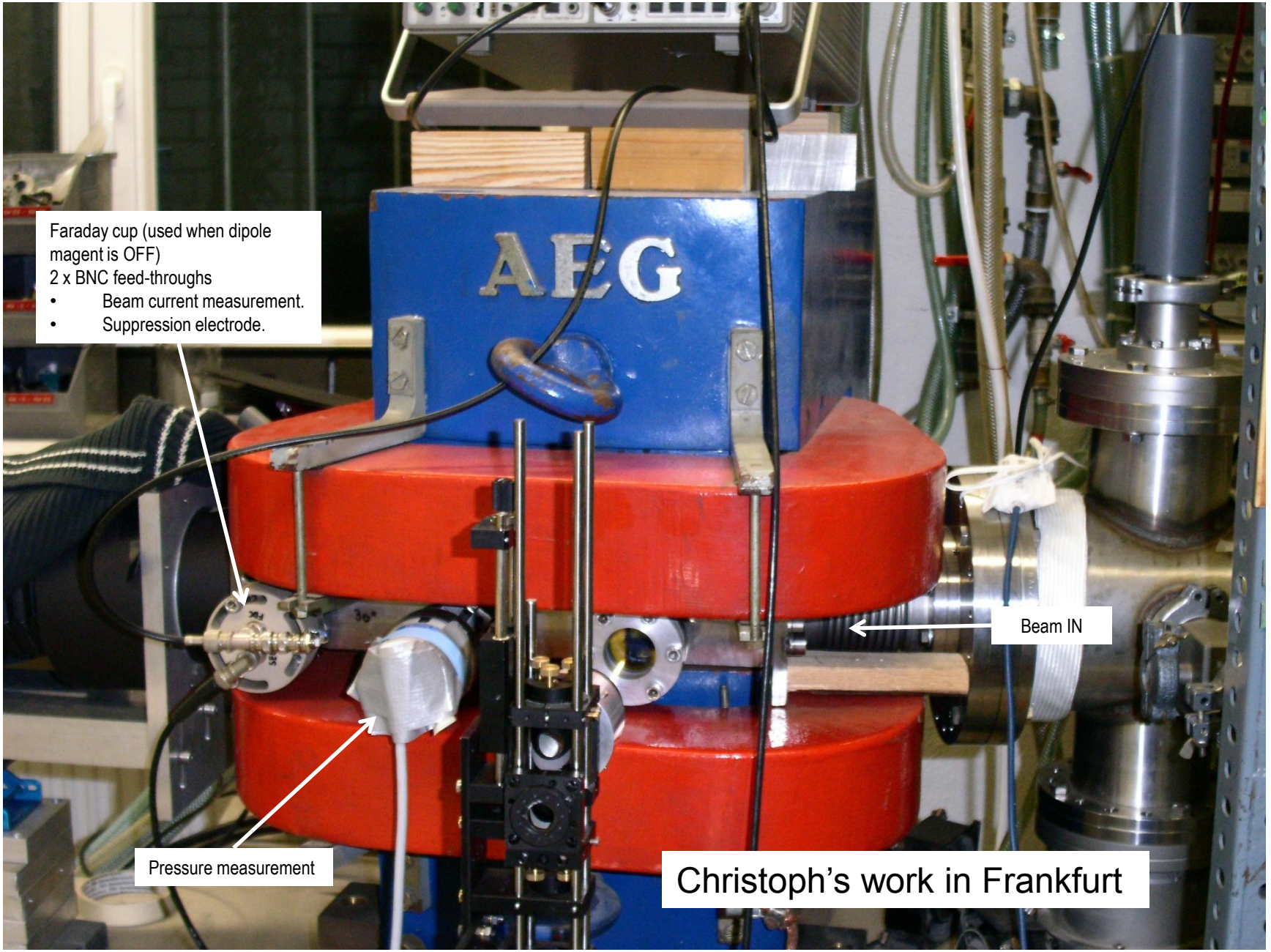
Can we learn anything from the SNS HINS dipole?

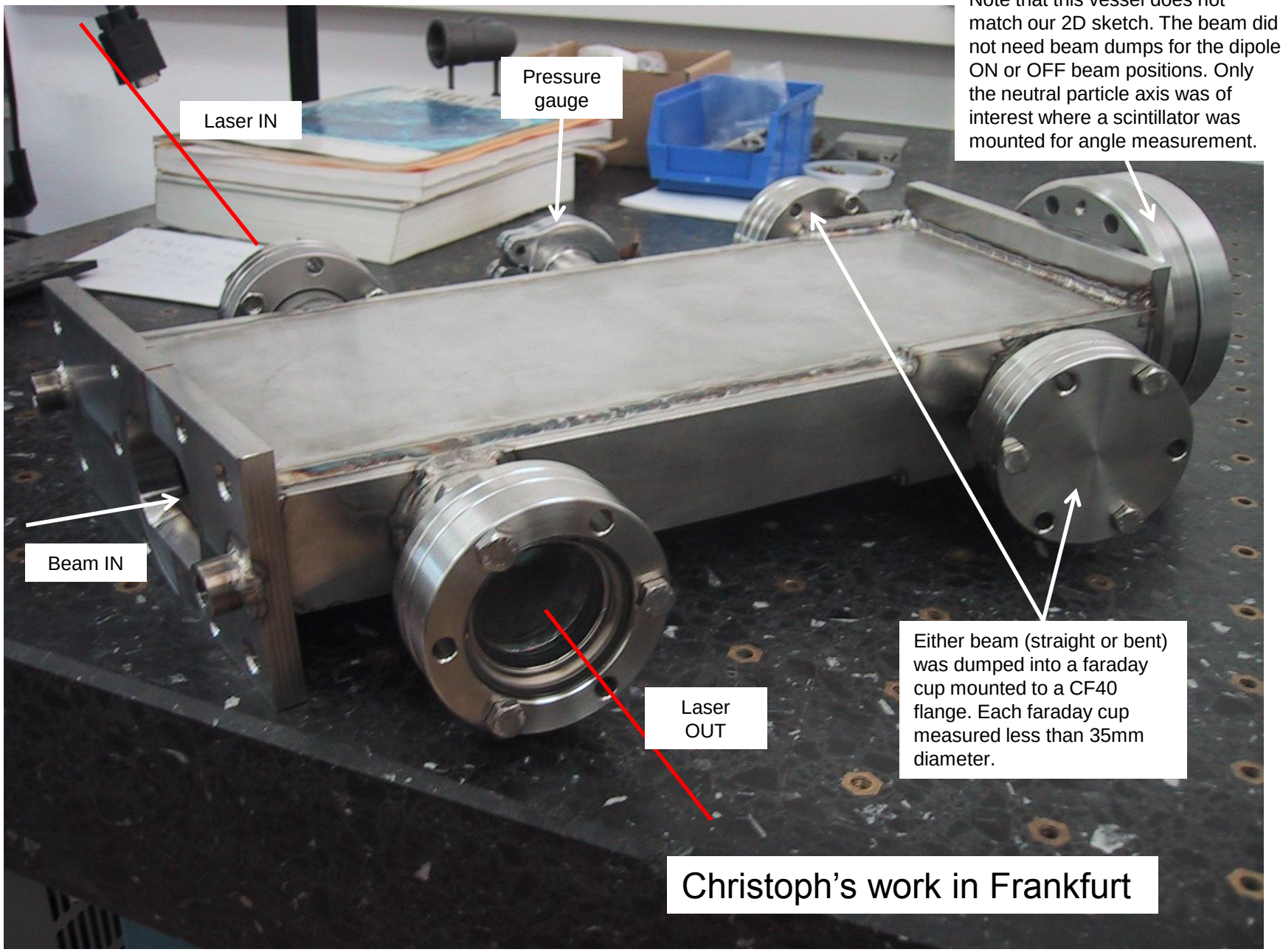


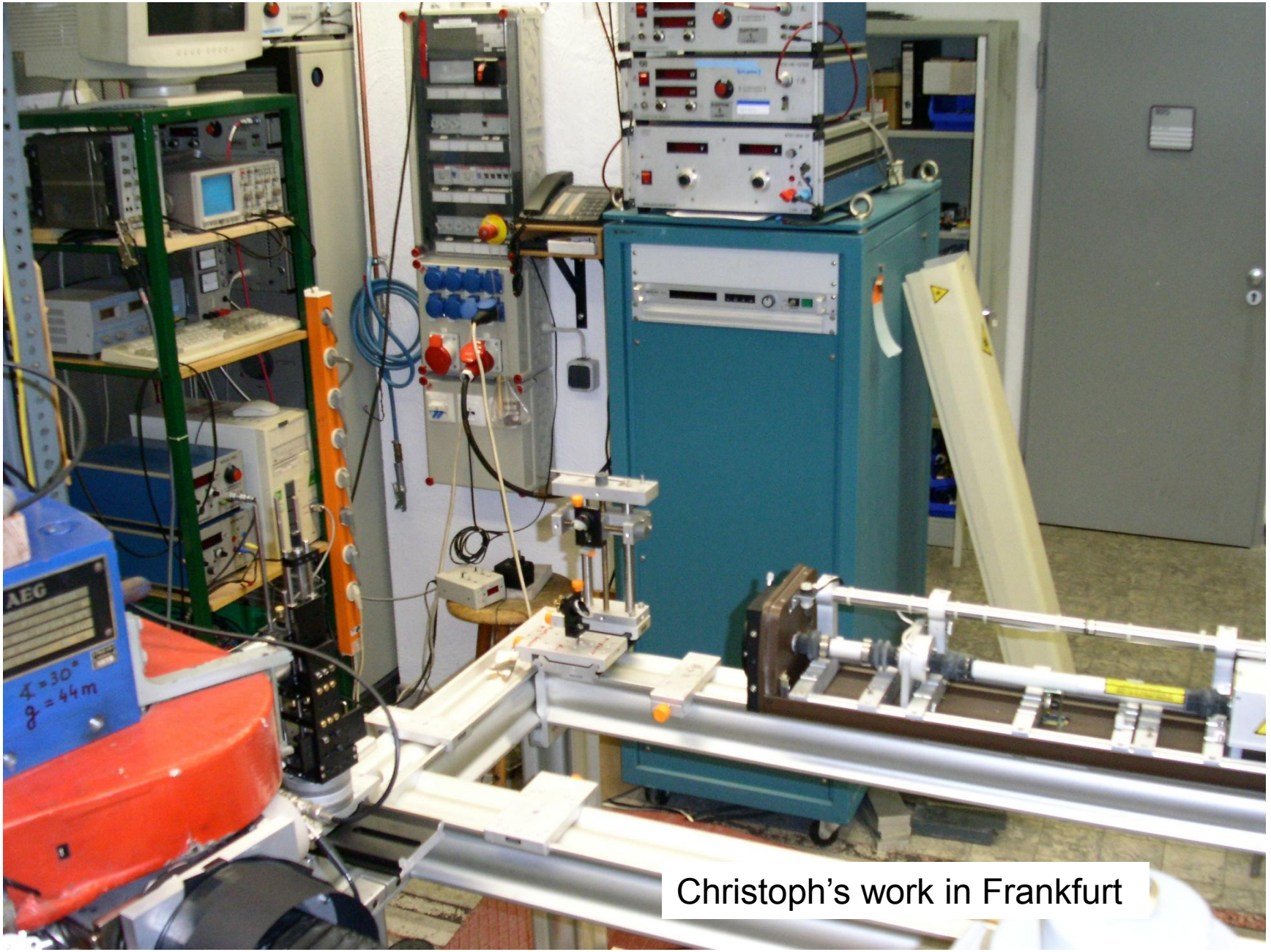
Jan 2012.....



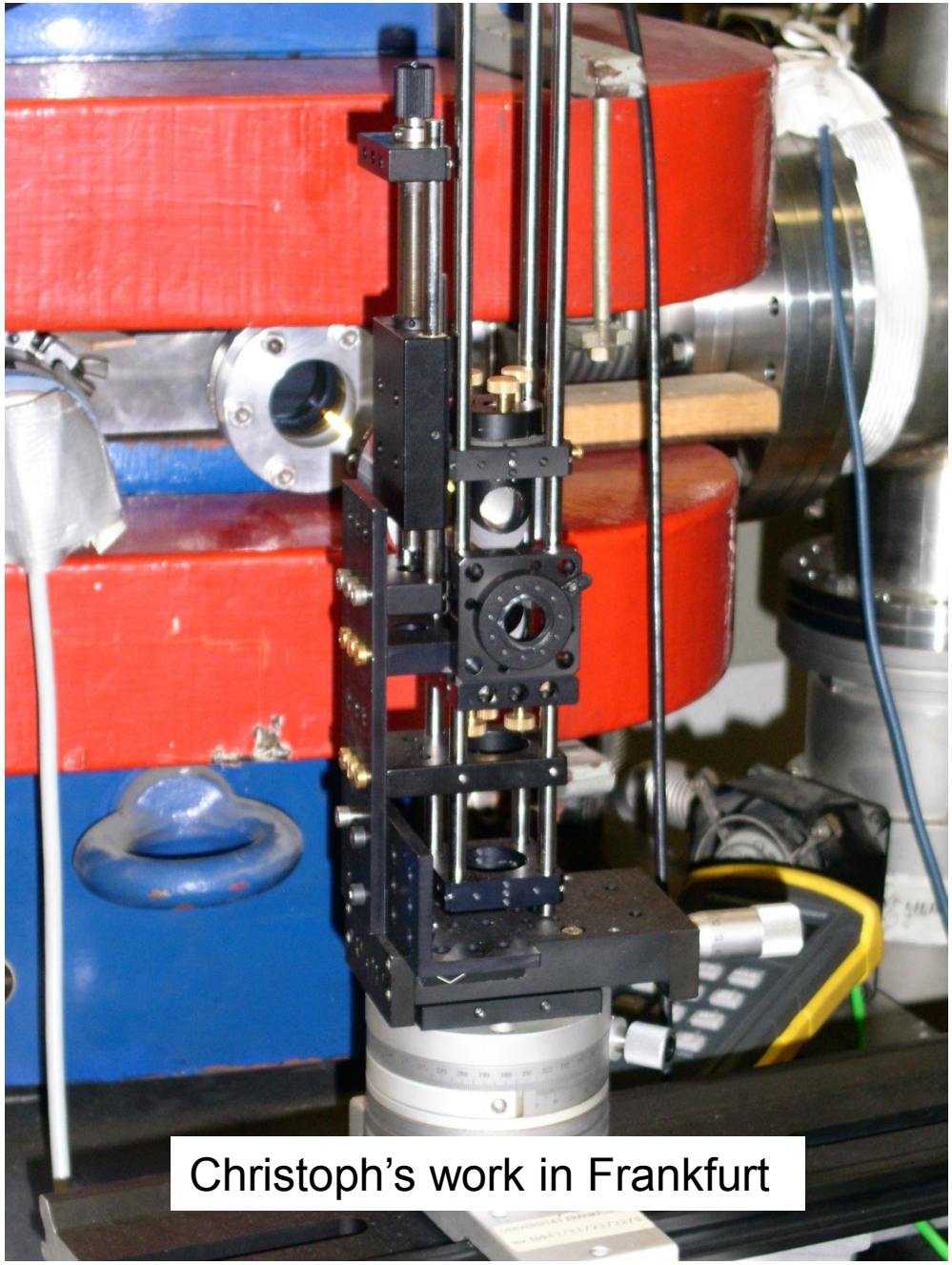
Source: Christoph's PhD Thesis. Page 61

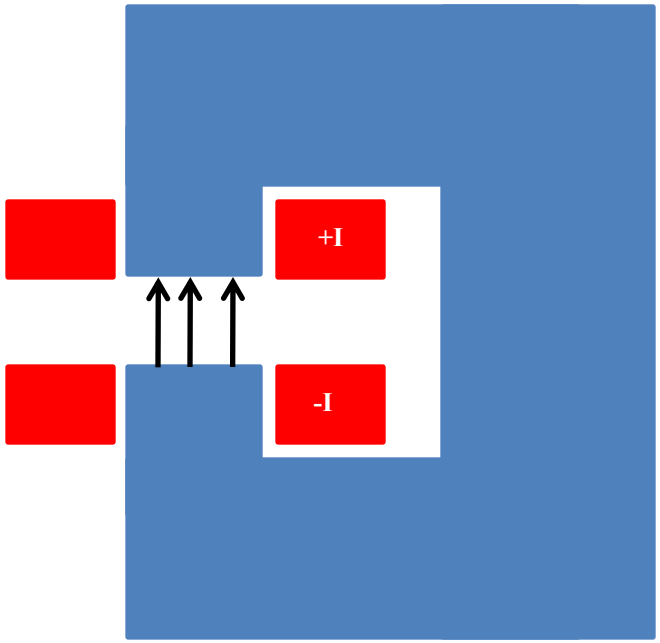

Faraday cup (used when dipole magent is OFF)
2 x BNC feed-throughs
• Beam current measurement.
• Suppression electrode.
AEG
Beam IN
Pressure measurement
Christoph's work in Frankfurt

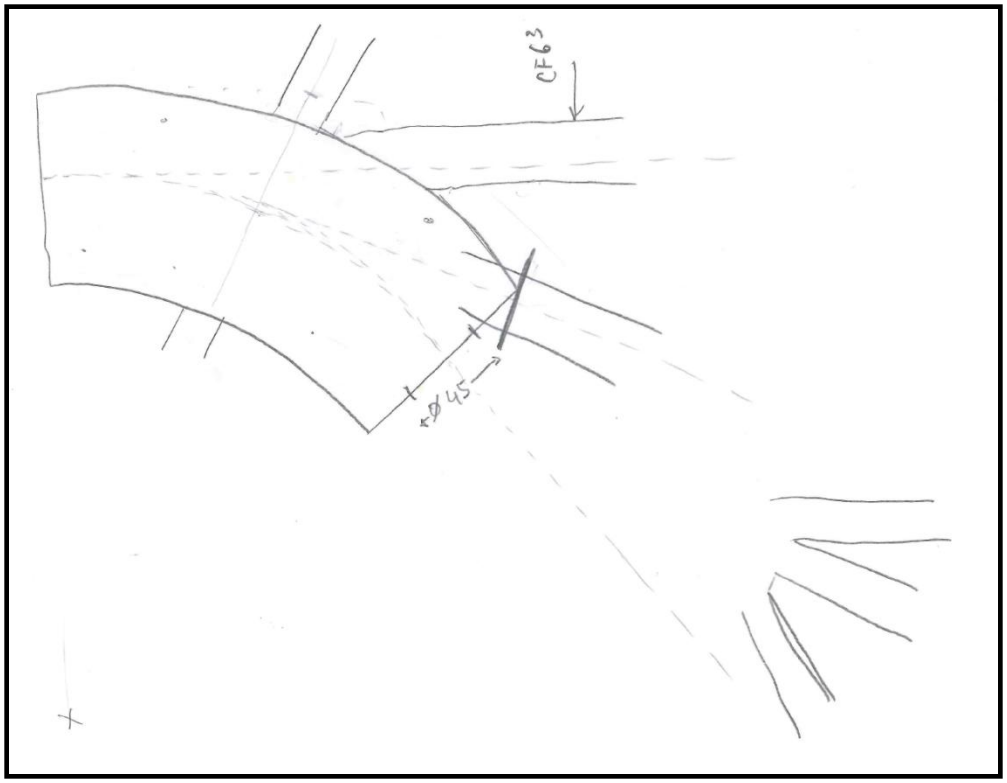

Laser IN
Pressure gauge
Note that this vessel does not match our 2D sketch. The beam did not need beam dumps for the dipole ON or OFF beam positions. Only the neutral particle axis was of interest where a scintillator was mounted for angle measurement.
Beam IN
Either beam (straight or bent) was dumped into a faraday cup mounted to a CF40 flange. Each faraday cup measured less than 35mm diameter.
Laser OUT
Christoph's work in Frankfurt

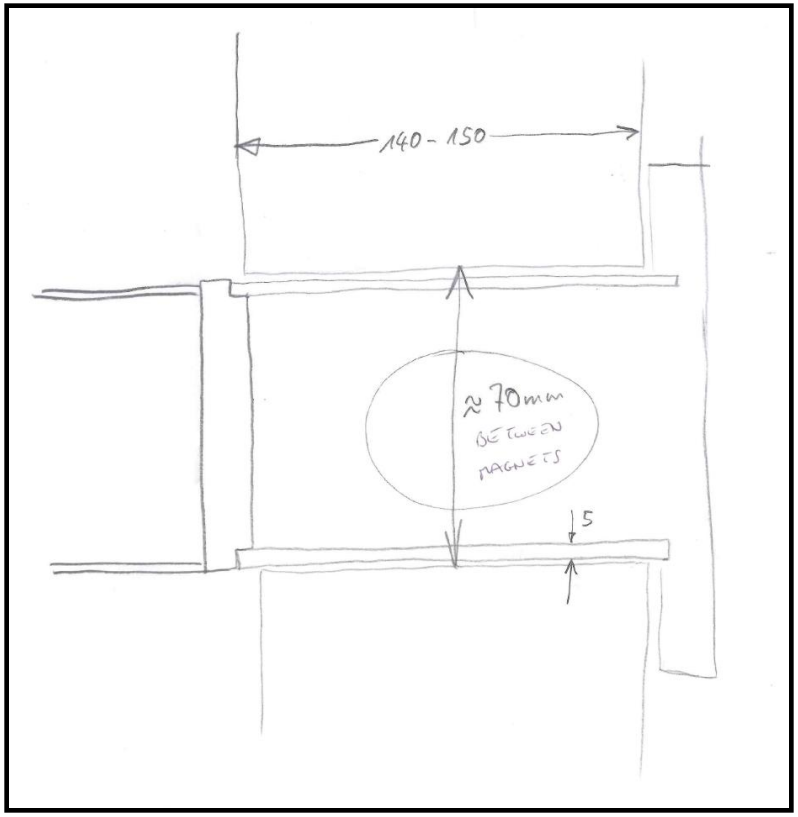


Christoph's work in Frankfurt


Christoph’s work in Frankfurt


+I
-I


CF6³
Ø45


140 - 150
≈ 70mm
BETWEEN
MAGNETS
5

Notes from meeting Monday 16th Jan 2012

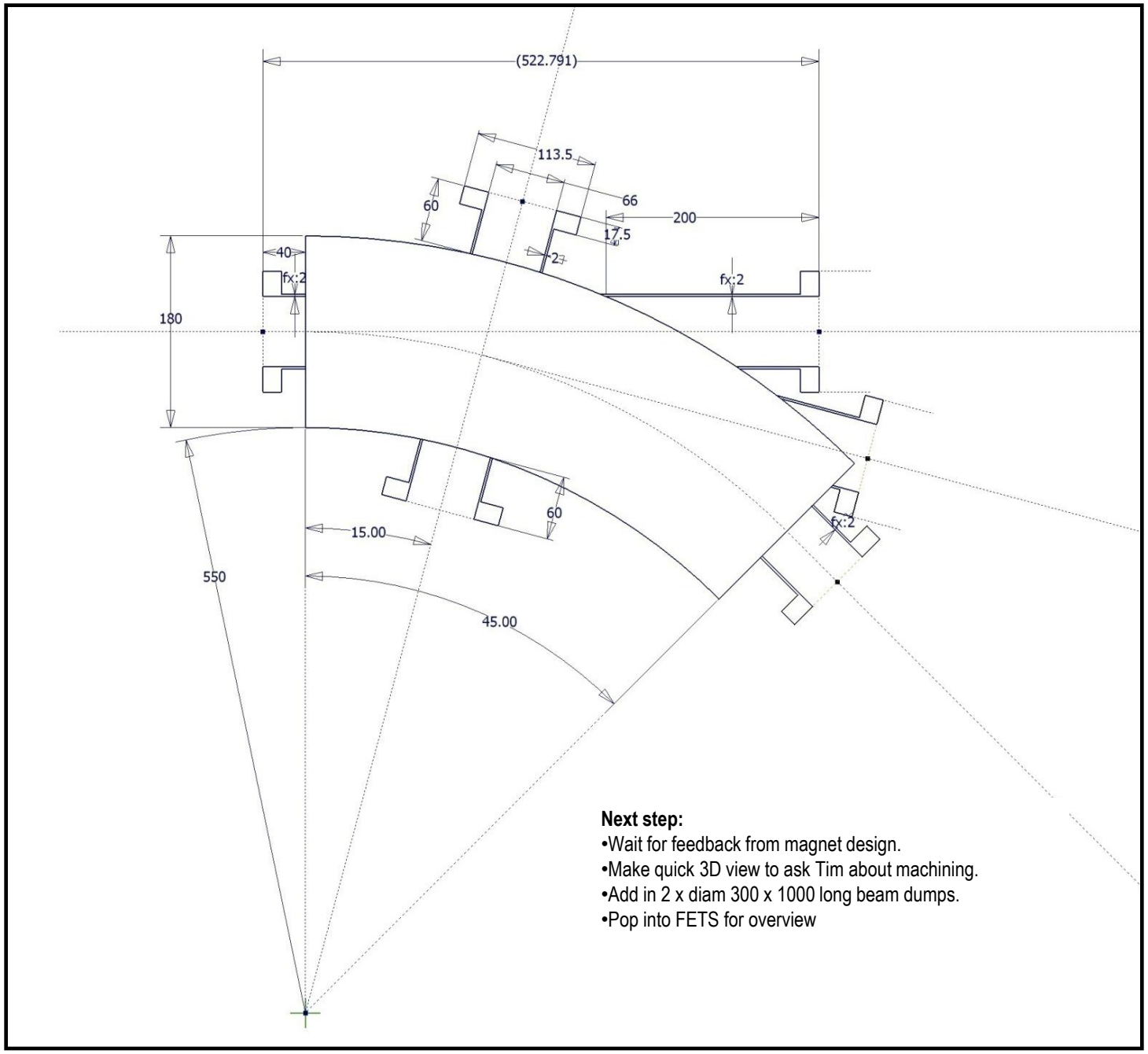
Sweep bend as far as is practical - ideally we would have a 90 degree bend. Christoph had problems with previous tank. Bend wasn't enough and light from the plasma was shining on the scintillator dwarfing the light from the neutrals. However, the further the bend sweeps the smaller the return yoke becomes and there's a limit to this due to saturation of the magnet material. Christoph is talking to Dan Physik to look at the magnet design. Bend will probably be something like 40 to 60 degrees.

Need to keep drift length as short as possible because with no focusing elements the space charge will blow up the beam.

Take a look at Christoph's thesis regarding a good separation of neutrals from further upstream and neutrals caused by the laser beam. This is a function of the laser position i.e. If the laser path is positioned too far upstream there will be little separation.

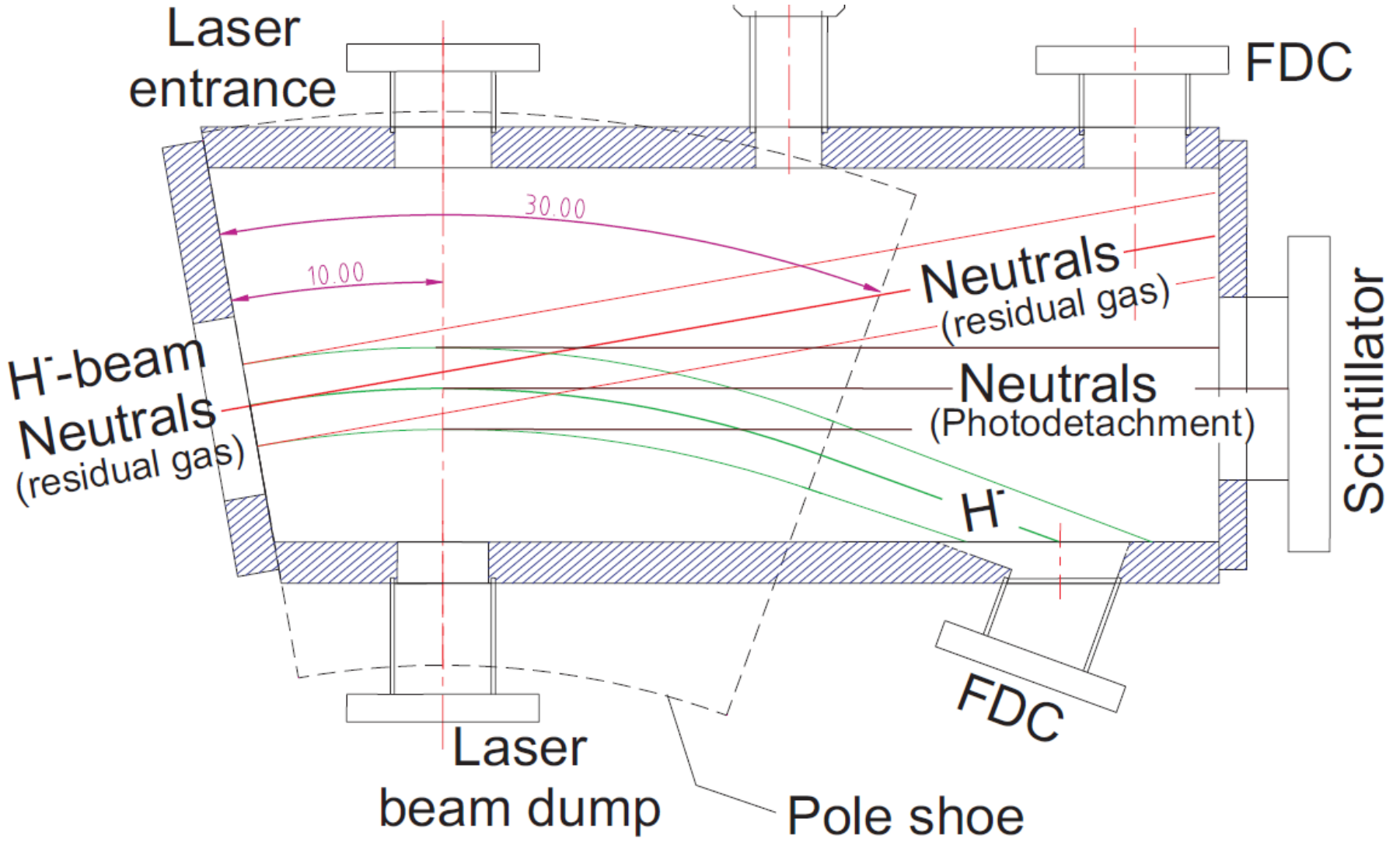
Also the thesis highlights how light hitting scintillator from the laser diagnostics (or a slit slit scanner) can be integrated to give a plot of intensity. All the data from the individual intensity plots can be combined to create the isoline type emittance plots we are used to.

The resolution of the diagnostic is a function of the distance of the scintillator from the point where the laser strips the beam.



Next step:

- Wait for feedback from magnet design.
- Make quick 3D view to ask Tim about machining.
- Add in 2 x diam 300 x 1000 long beam dumps.
- Pop into FETS for overview


Laser
entrance
FDC
30.00
10.00
Neutrals
(residual gas)
H⁻-beam
Neutrals
(residual gas)
Neutrals
(Photodetachment)
H⁻
Scintillator
FDC
Laser
beam dump
Pole shoe

Post MEBT diagnostics vessel

First thoughts ahead of meeting on 16th Jan 2012

Goal:

- What should the vessel achieve?
  - A brief outline of the Physics goal to help with the Engineering Specification.
- What goes inside?
  - Mirrors with mounts?
  - All bought components?
  - Off the shelf?
  - Are CAD models or drawings available for download?
  - Moveable stages?
  - How many movement axes?
- Lessons from existing designs?
  - Photos, drawings, papers?
  - Can we visit any and discuss?

Fabrication:

- Assumed stainless steel?
- Welding access will be difficult.
- Can it have a removable top plate?
  - Using O ring seal and bolts for vacuum seal.
  - Bolt heads could be external to magnet footprint?
  - Allows access for changes of use.
  - Avoids welding access problems.
  - Negative is increased potential for leaks.
- Internal supports required against vacuum load – fixed or repositionable?

Vessel location:

- How many times will vessel be installed and uninstalled?
- Vessel installation and removal procedure to be defined.
- Does vessel rest on bottom magnet?

Ports

- How many?
- Port sizes and types?
- How critical is port alignment?
- Extra ports for flexibility.
- Which devices sit external to the ports?

Magnets:

- Are the dimensions known?
- What is the magnet separation distance? (70mm?)
- Does the magnet manufacturer do the magnet design?
- What is the magnetic field strength?
- Lead time and cost estimates?
- Which companies will quote for magnet build?
- What is their weight?
- Prevention of stray magnetic fields affecting rest of beam line.
- Magnet support framework required?
- How is upper magnet supported?
- Which services do they require?
  - Power
  - Cooling
  - Monitoring
- Do the magnets need to be electrically isolated from the vessel?

Datums / Tolerances:

- What is vessel aligned to?
- Where are the datums?
- Are vessel internals to be positioned relative to a datum?
- To what accuracy are the magnets manufactured?
- Do standard engineering tolerances apply for the vacuum vessel?
- How repeatable would you require vessel installation?
- Magnetic centre plane more relevant than vessel centre plane?

Beam:

- What is the beam size (diameter) coming out from the MEBT?
- How far off axis could the beam be?
- Is its energy of concern? – need to avoid beam collisions with vessel?
- Do beam dumps attach directly to vessel?
- What services do the beam dumps require?
  - Cooling water?
  - Flow control?
  - Flow monitoring?
  - Temperature monitoring?
- Beam dump support structure required?
- Beam dump manufacturing issues – Tekniker.
- What do neutrals dump into?

Safety:

- What are the safety issues?

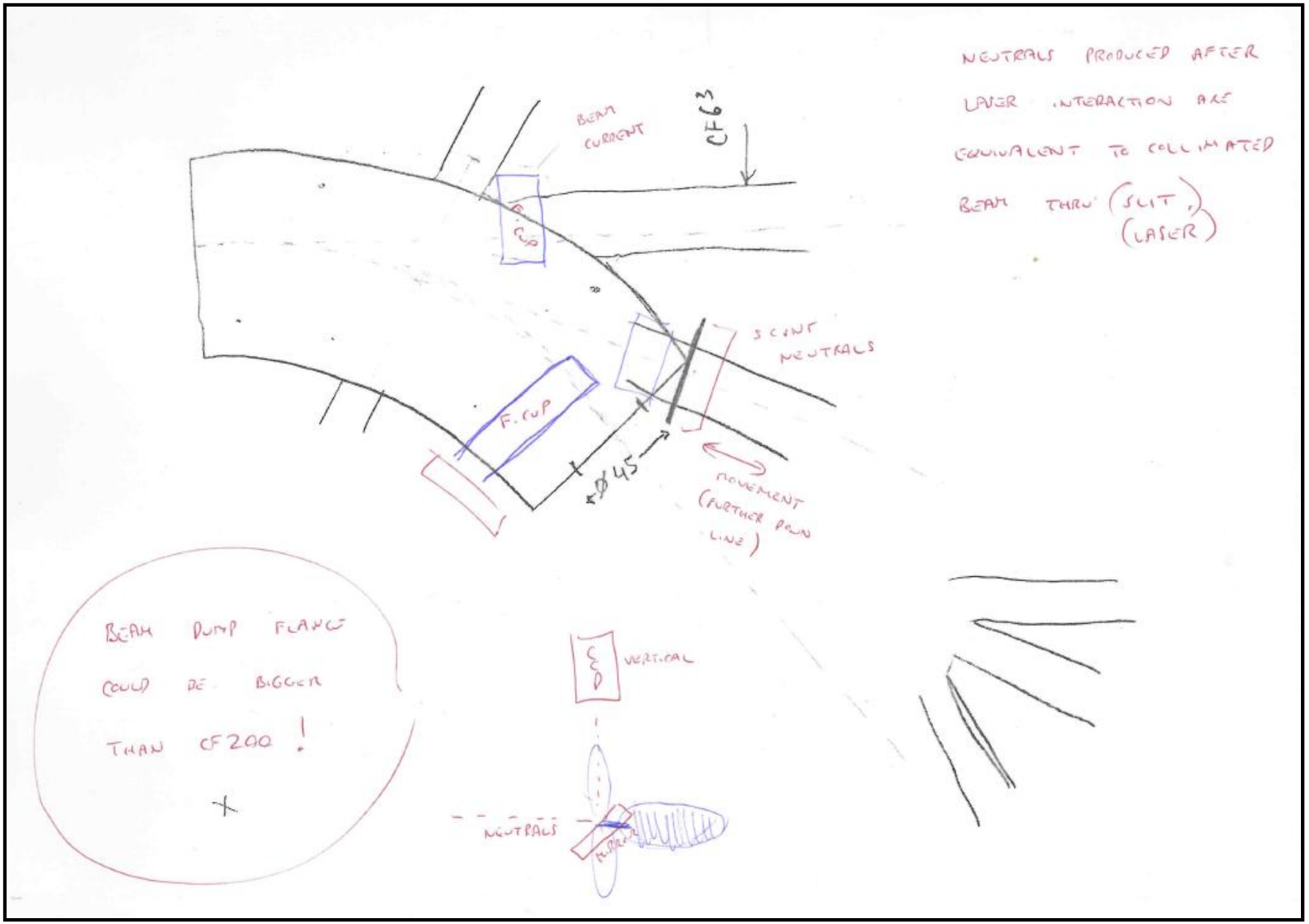
Time:

- When should it be in place?
- Is there any diagnostic work to be done prior to MEBT completion?
  - Or, will it ever come after the RFQ?
  - What will we need for the IPAC 2012 paper?

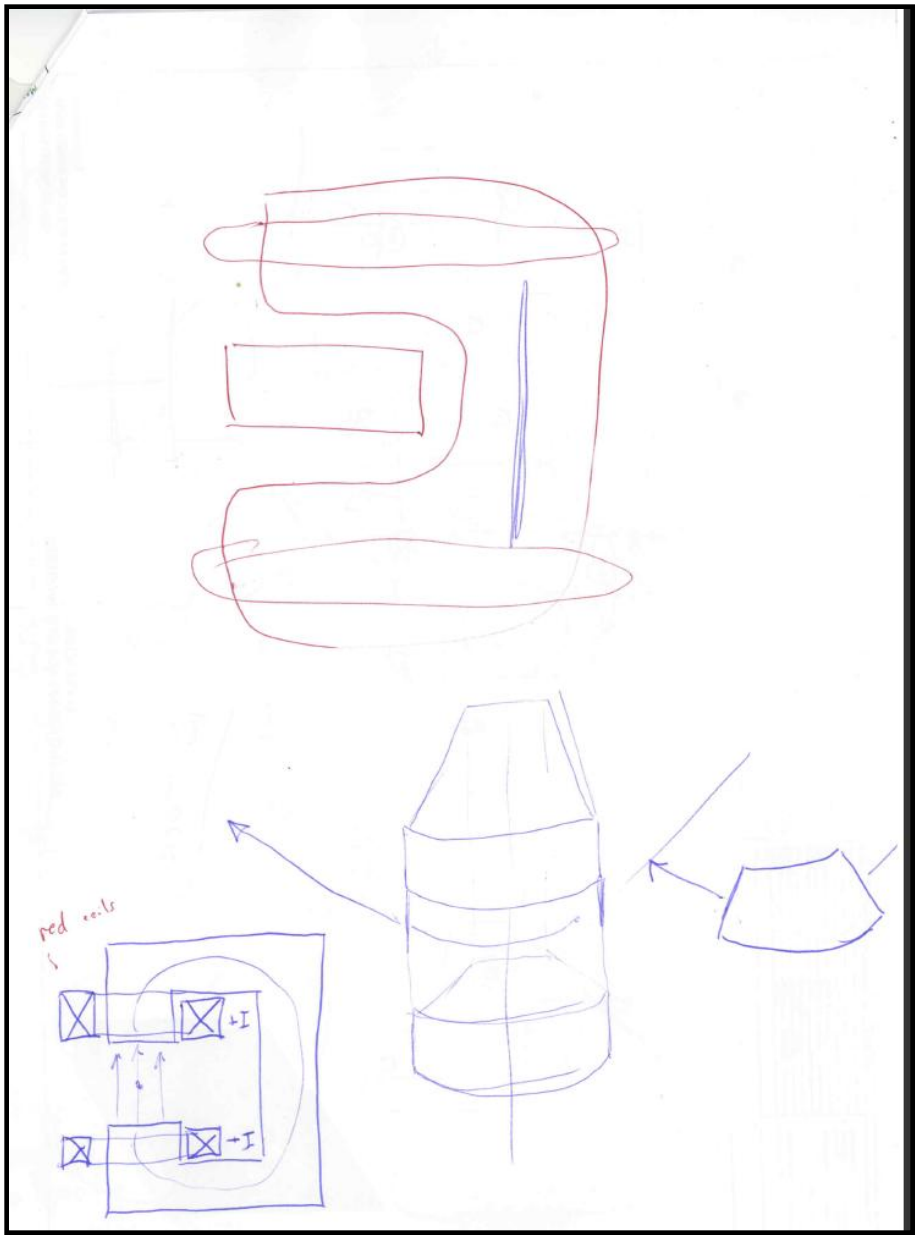
Payment:

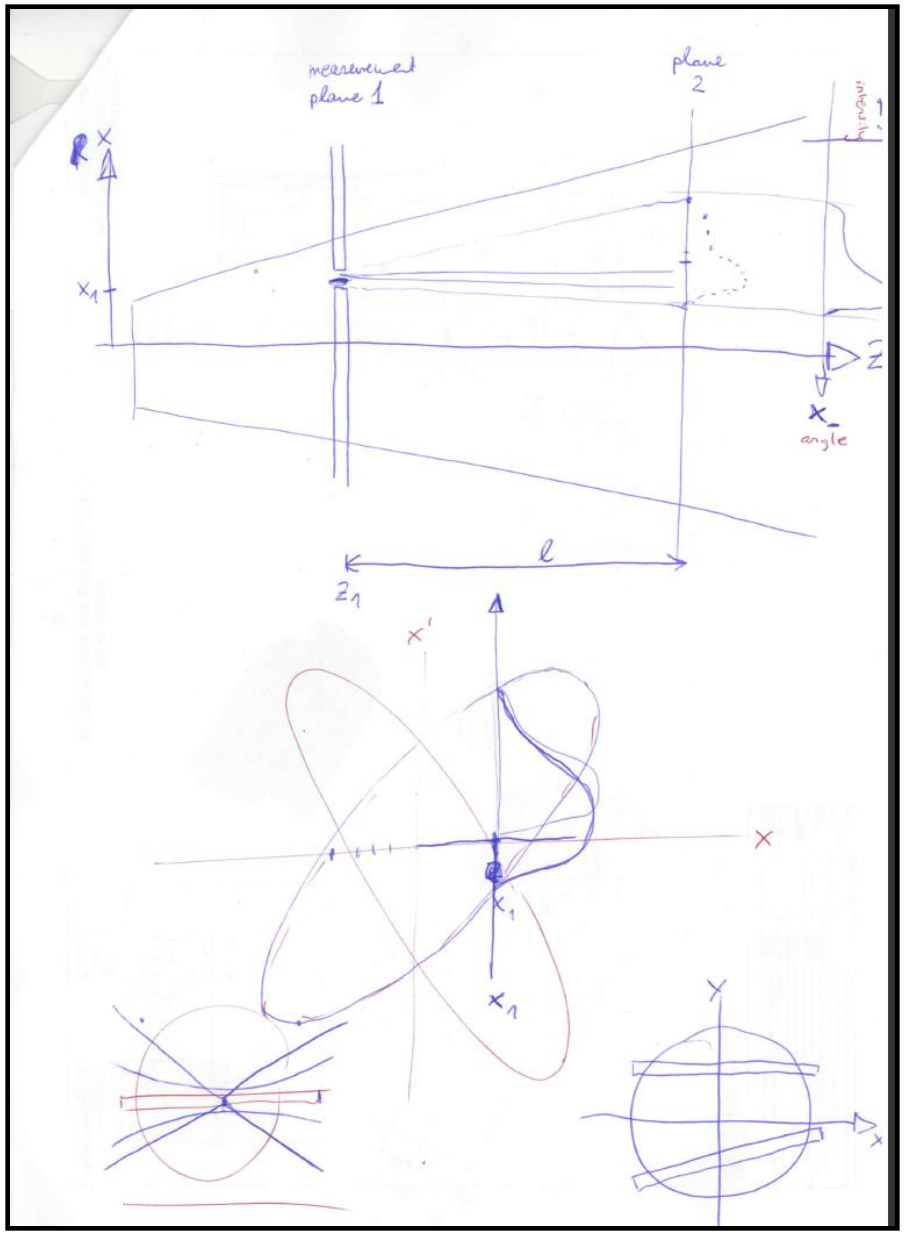
- Are the funds in place?

Sketches from meeting

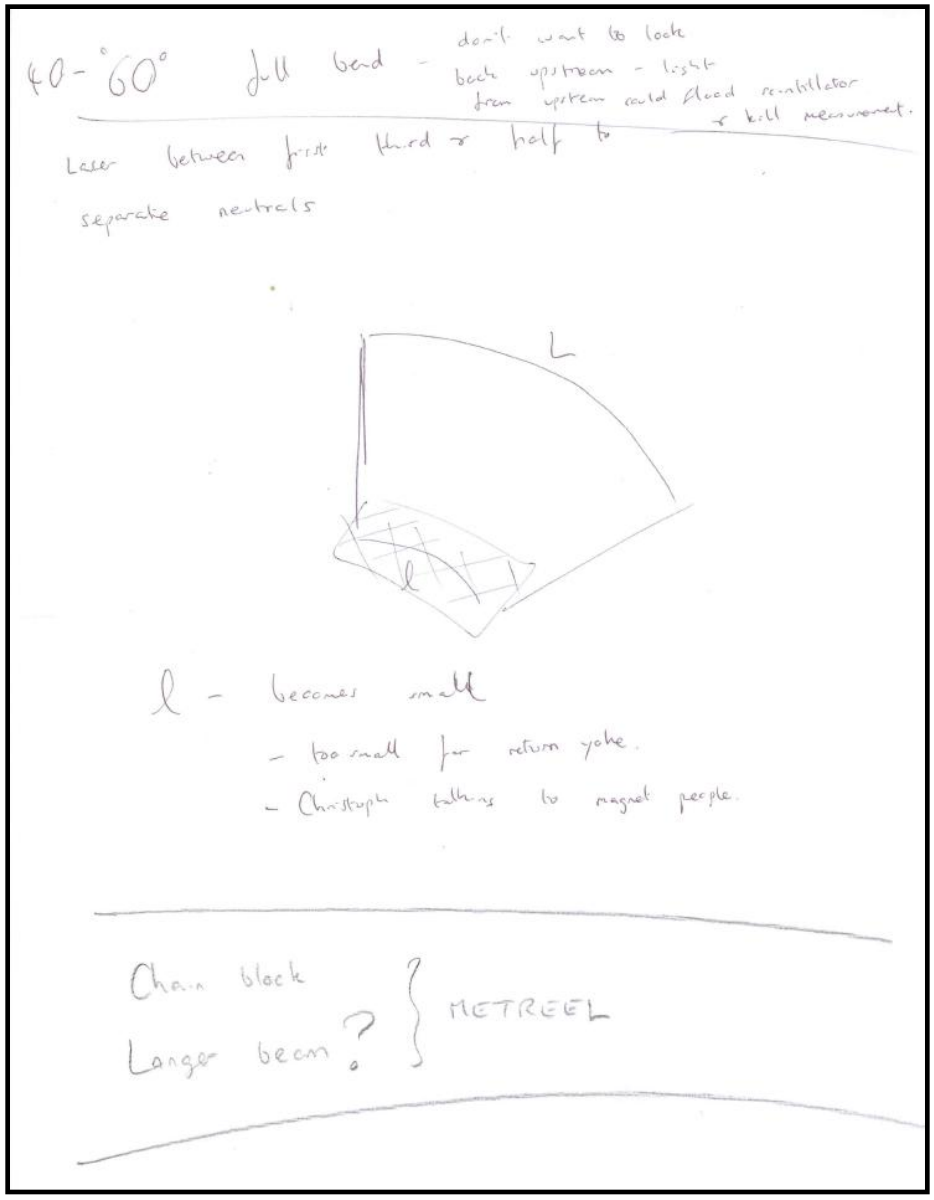


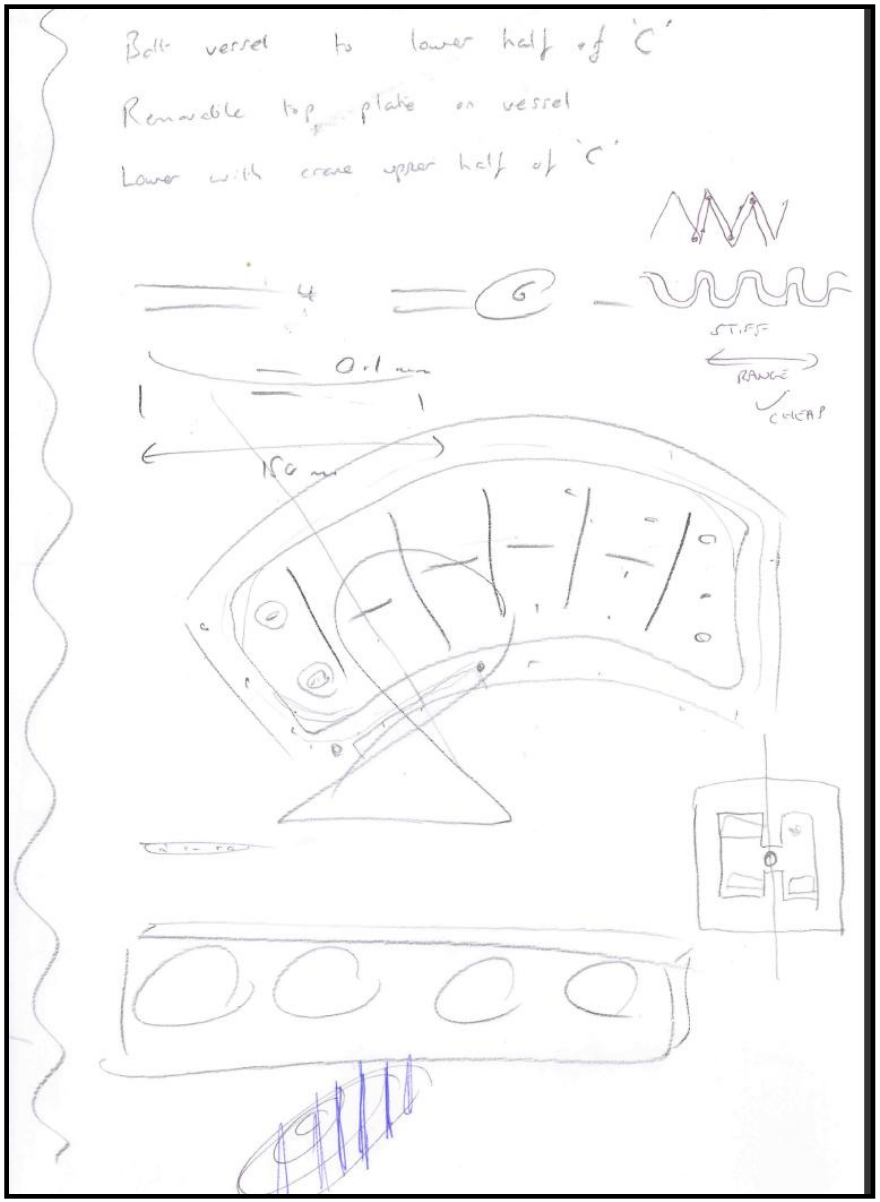
Sketches from meeting



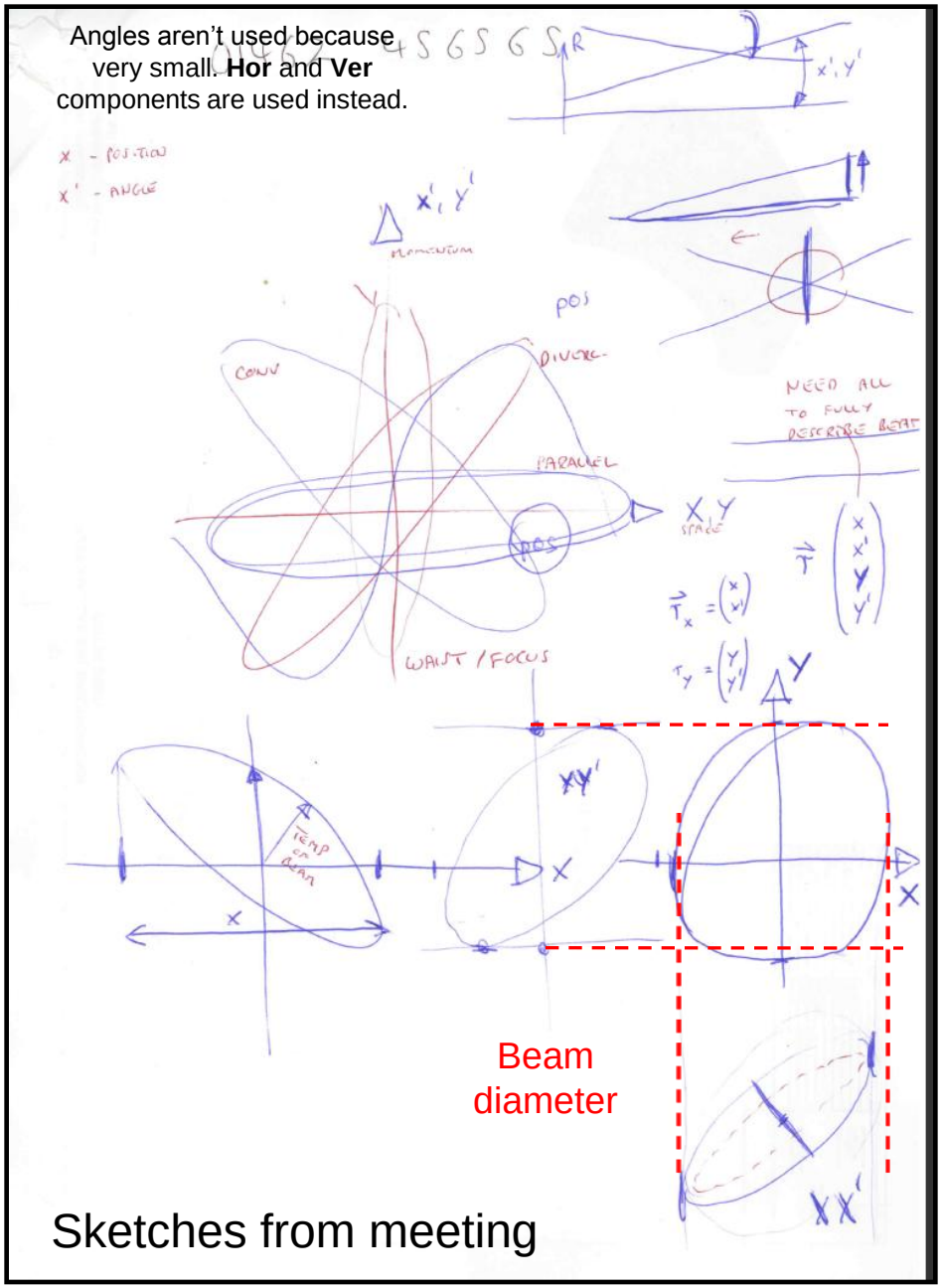


Sketches from meeting

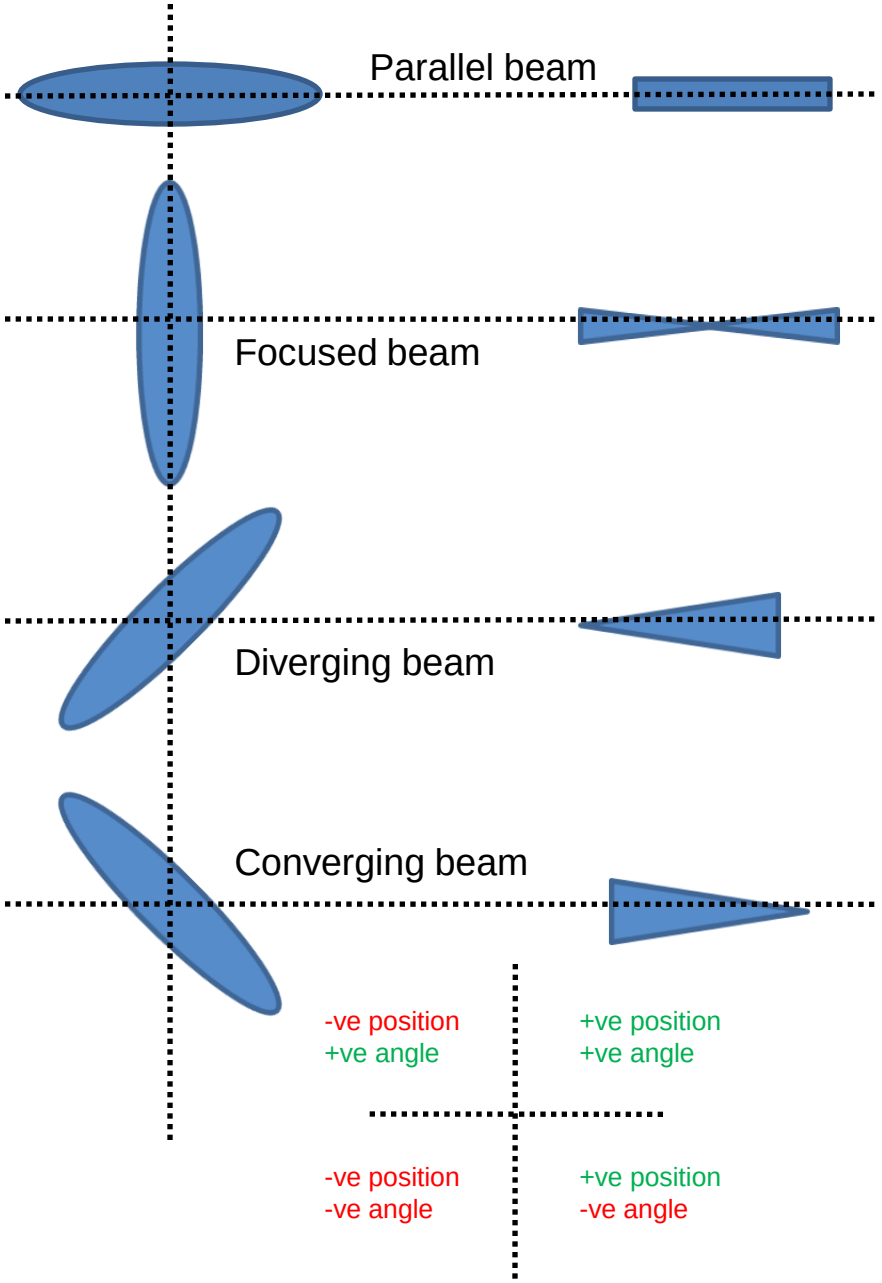




Angles aren't used because very small. **Hor** and **Ver** components are used instead.

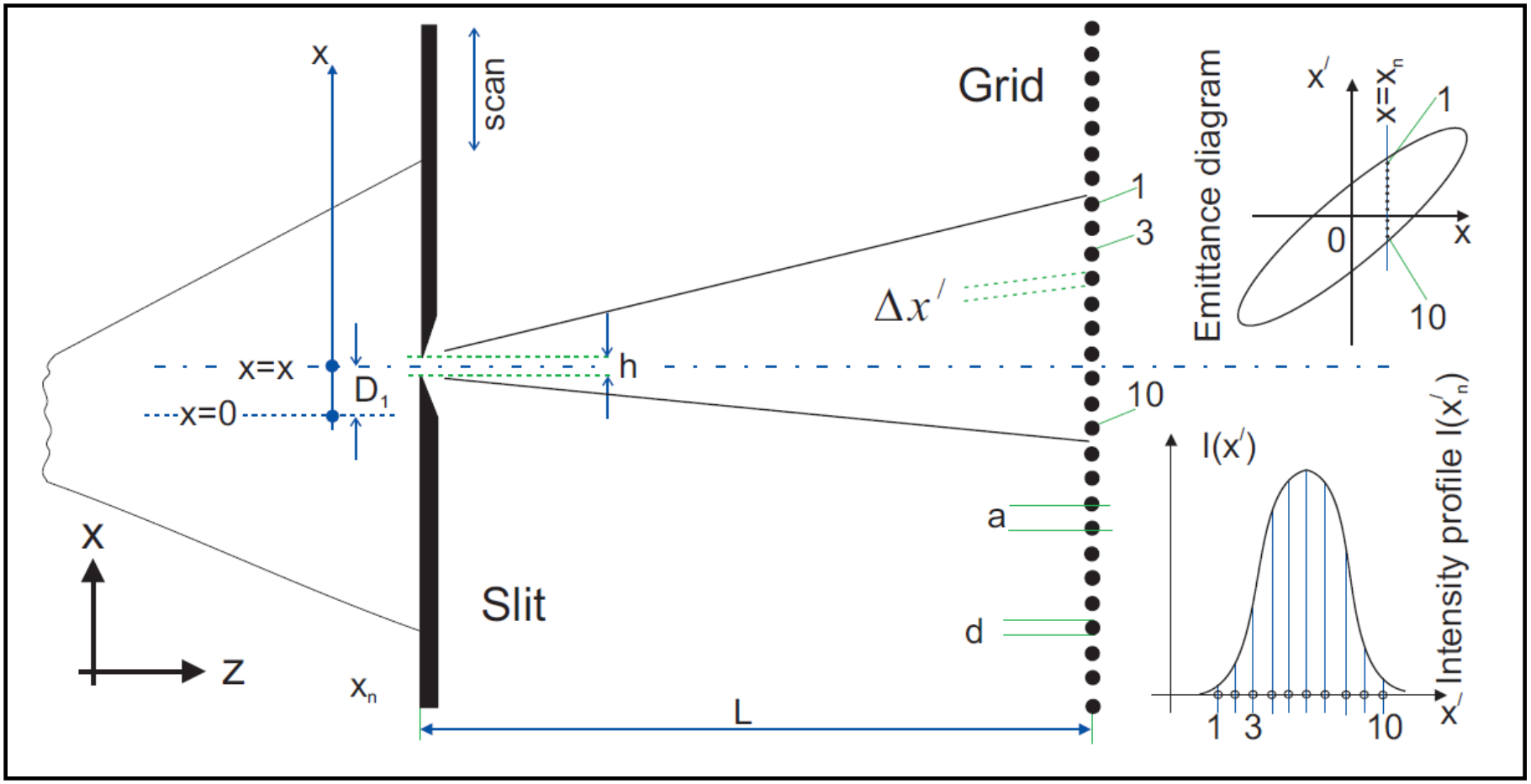


Sketches from meeting



Slit or laser creates a line of light on scintillator

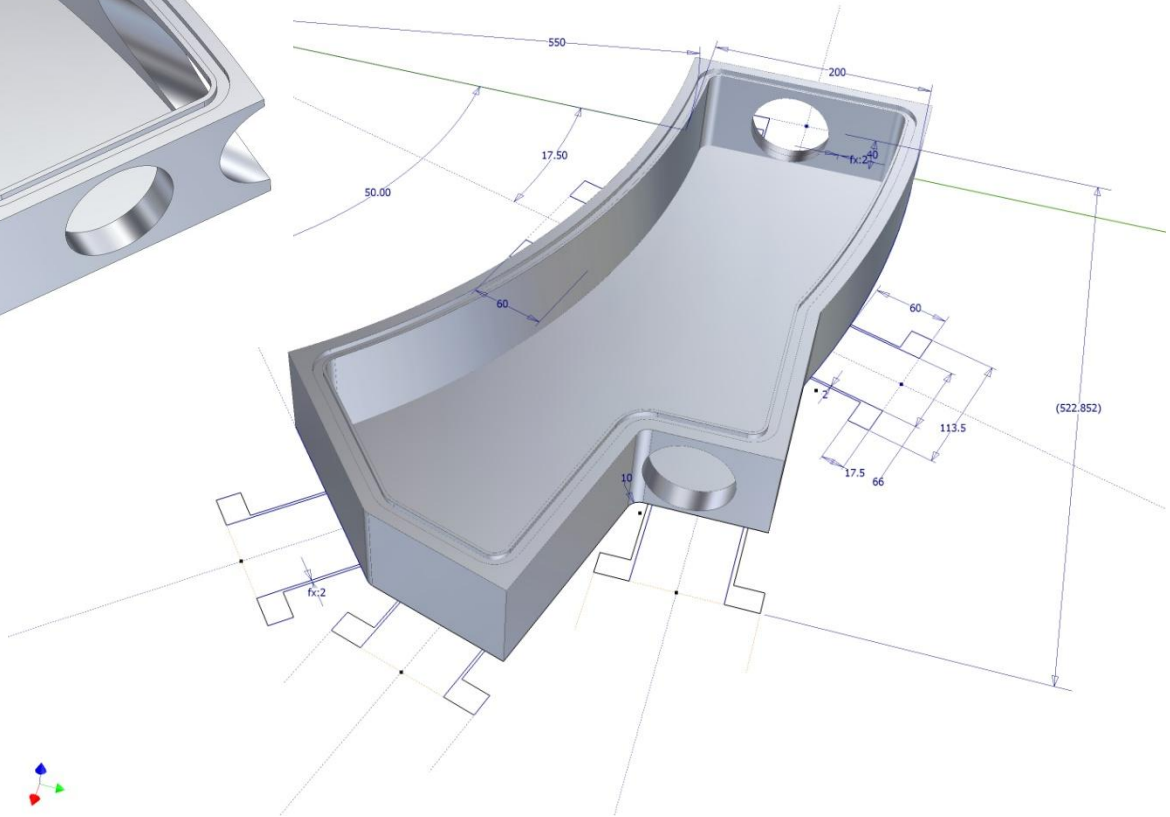
The slit or laser results in a line of light on the scintillator screen. This line is captured by the camera and each pixel recorded. The data is then integrated to give an intensity profile for the slice of beam at that position. As the slit or laser move transversally across the beam the profiles are recorded. They can then be combined to produce an emittance plot that is usually shown with isolines of equal intensity.

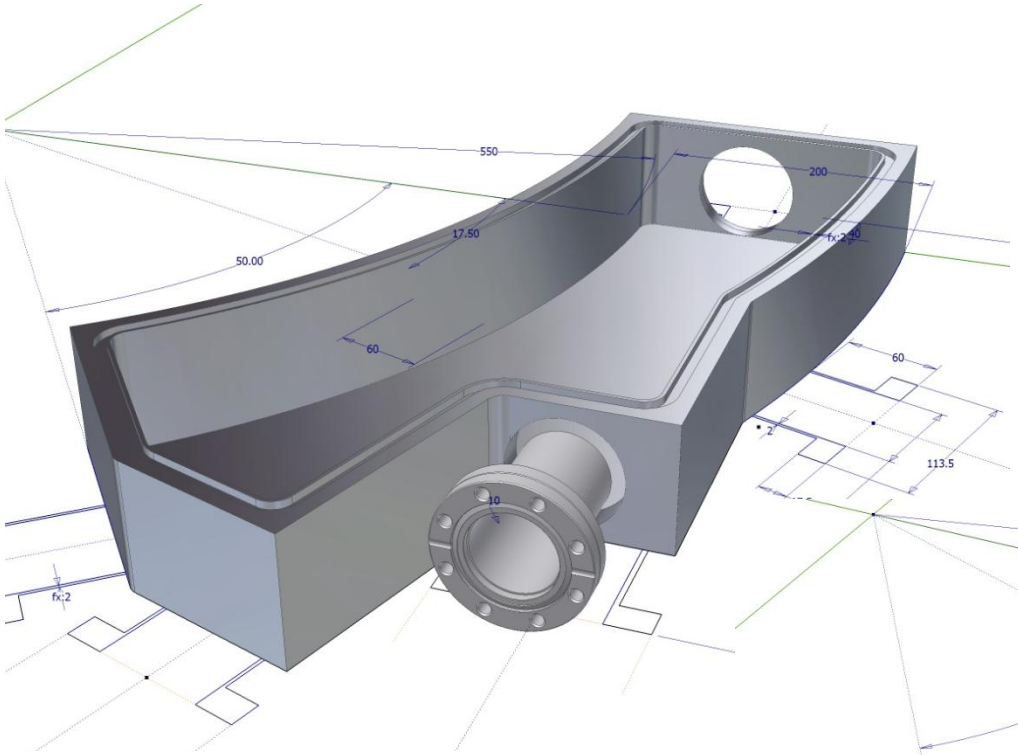


Source: Christoph's PhD Thesis. Page 39

Simple extrusion of 2D sketch with holes for DN63CF

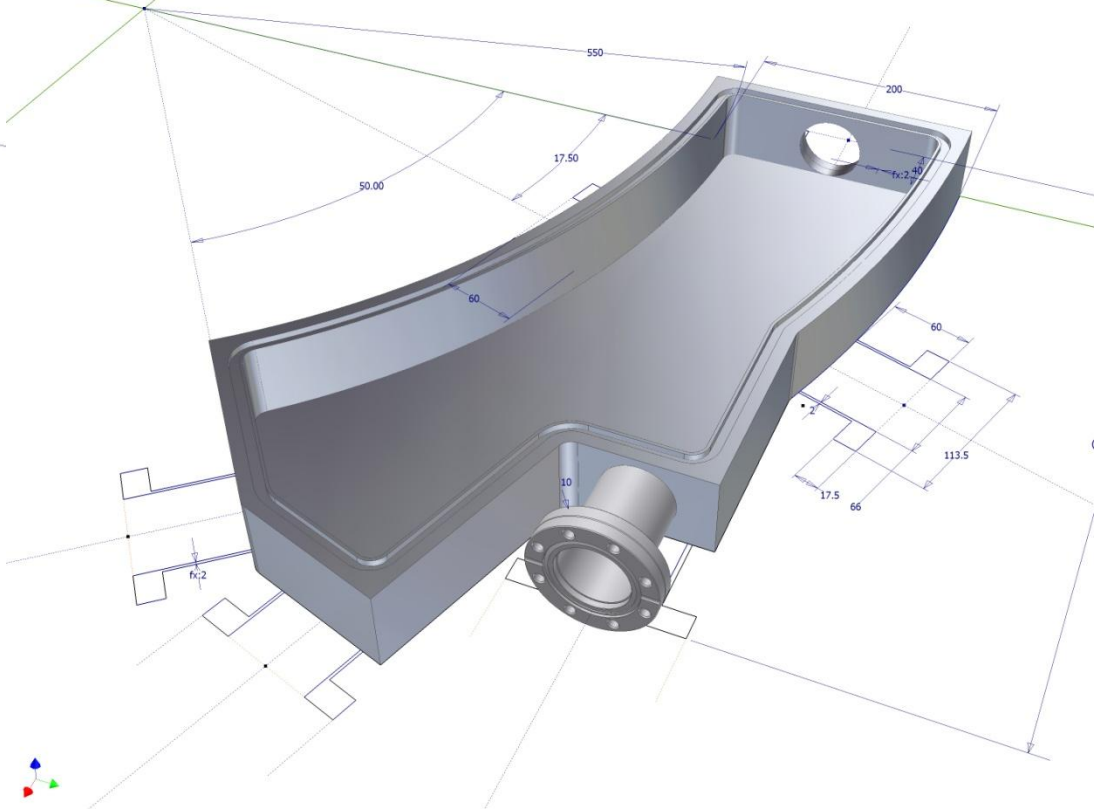
Adapting the vessel shape to be perpendicular to holes where possible.



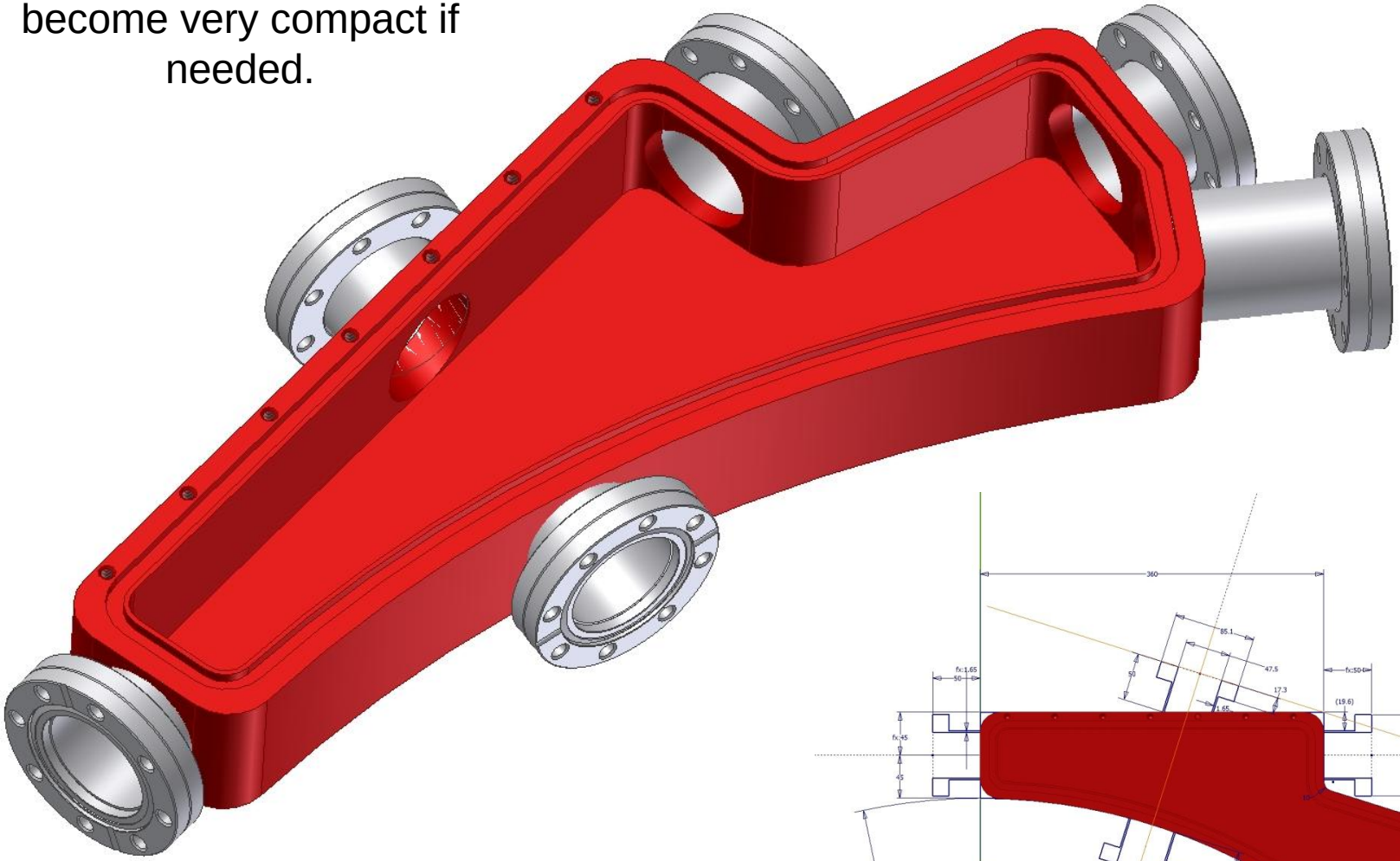


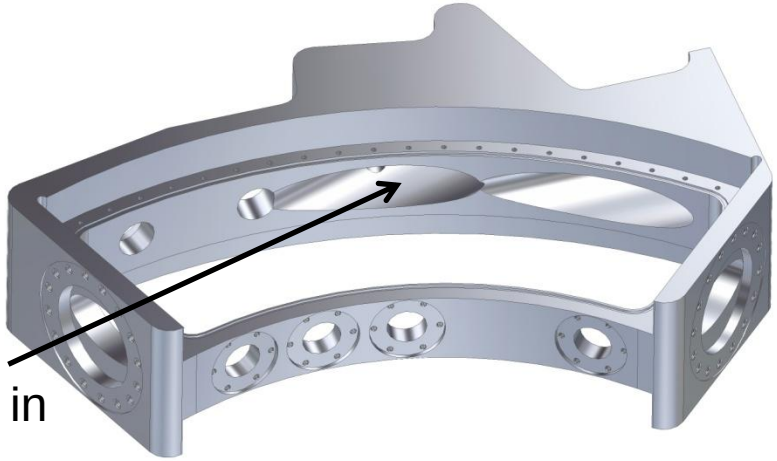
Using DN62CF results in a vessel that measures 82mm tall without the lid.

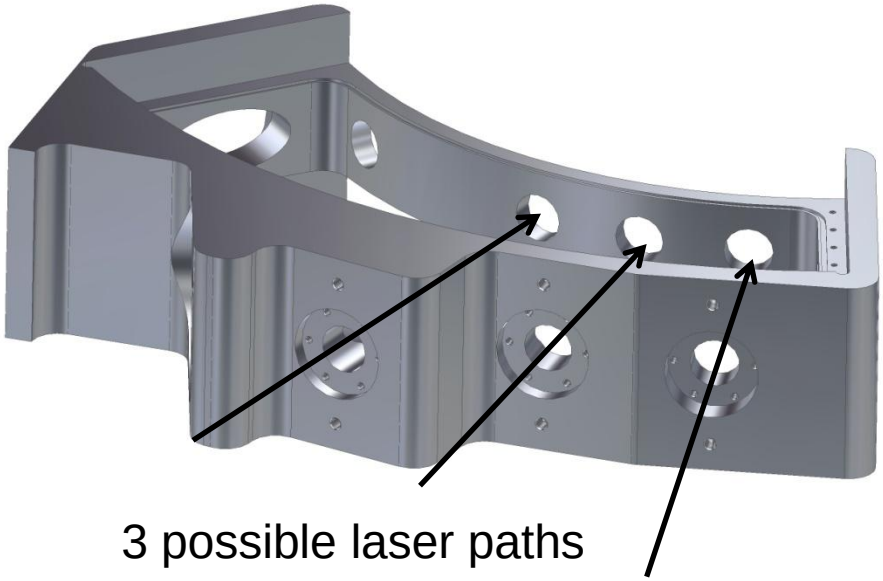
Using DN50CF (less common but available) results in a vessel that measures 60mm tall without the lid.



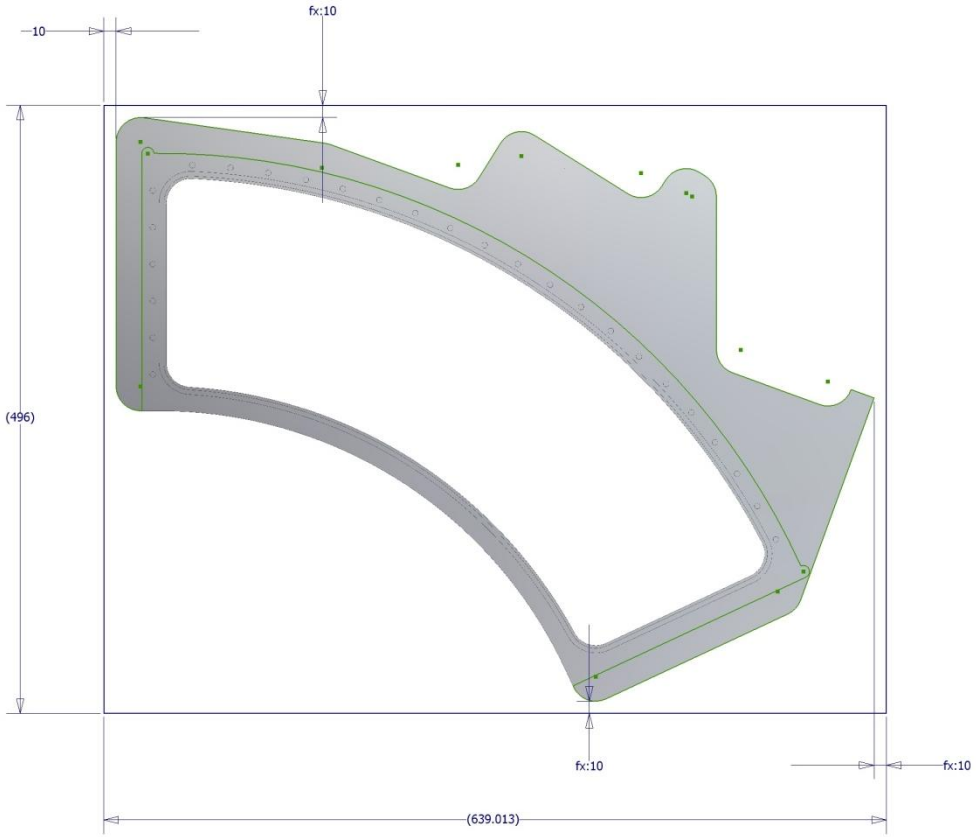
The vessel could become very compact if needed.







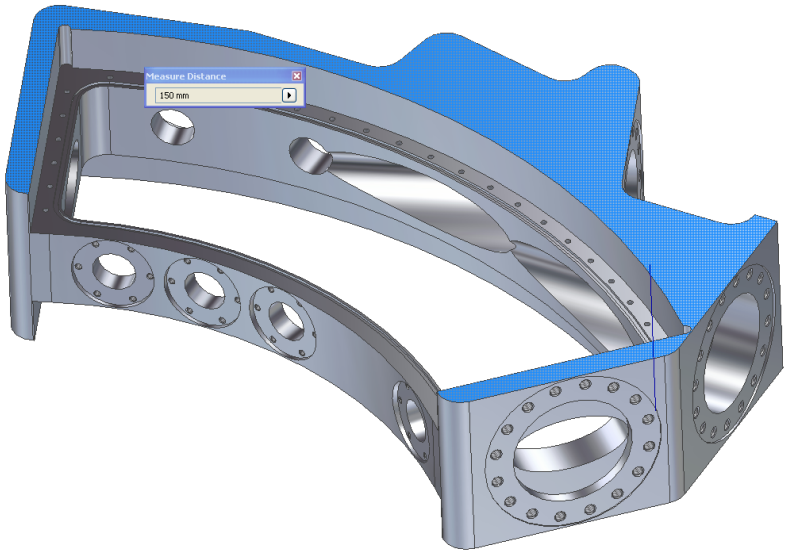
This design is version 7. All previous designs were based on welded fabrications. This design is based on machining from a solid billet which offers several advantages.



Previous quote (based on a guess):
1 Off - 675mm x 675mm x 165.1mm
6082T6 @ £1,251.00 Each

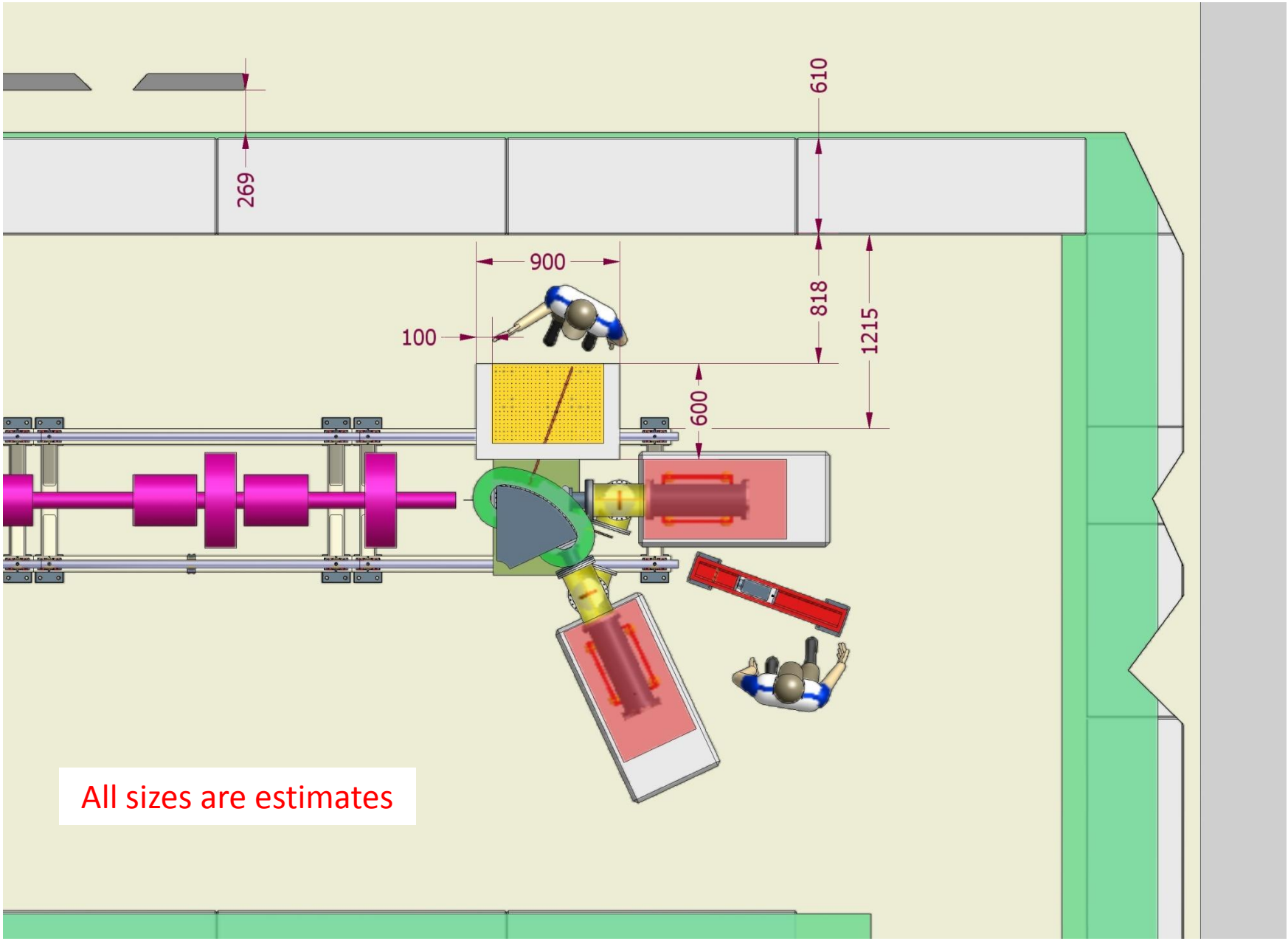
We actually need:
500mm x 650mm x 160mm thick

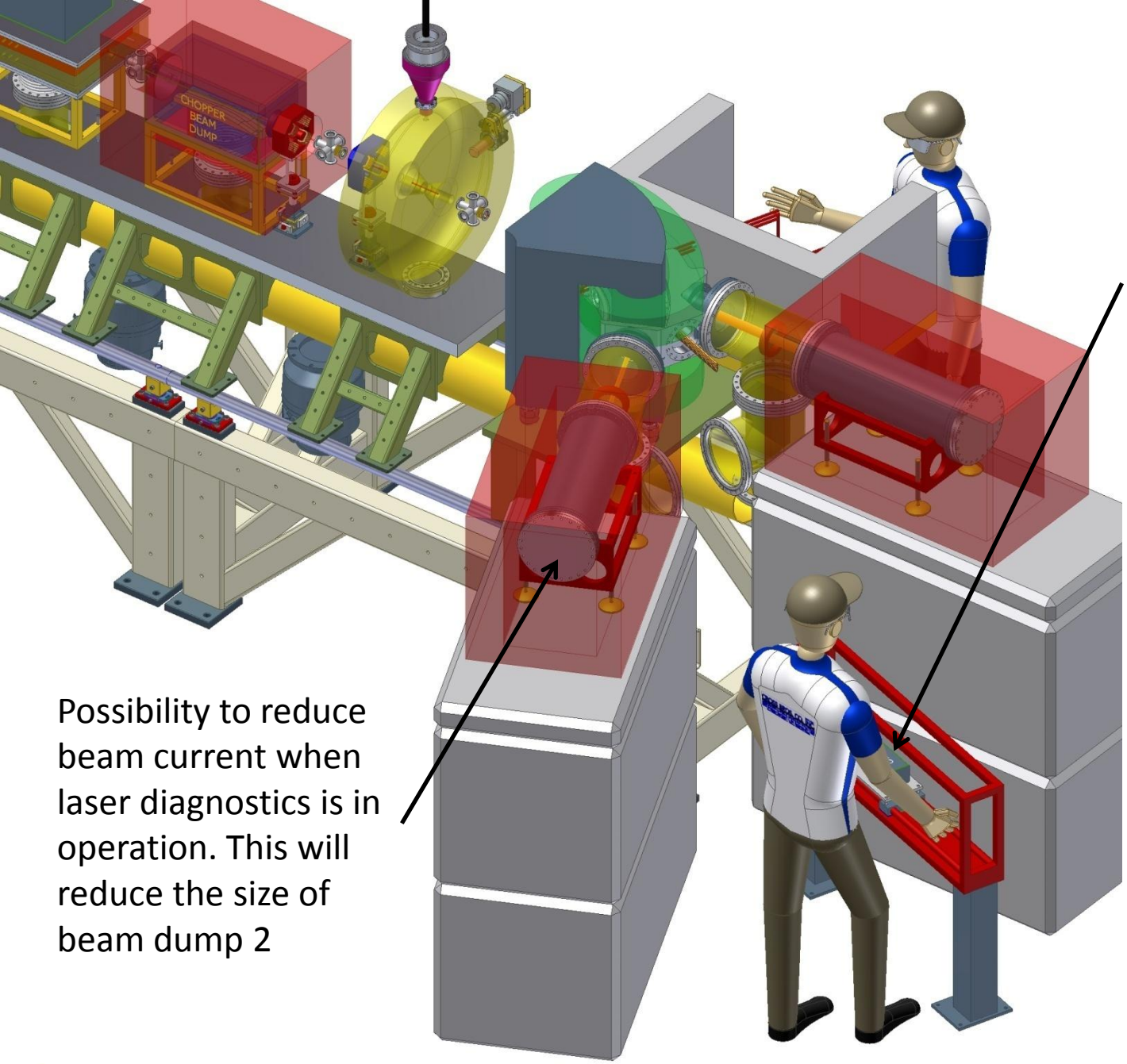
Weight = 140 kg



Stock required...

Space between laser diagnostics breadboard (900mm x 600mm)
and inside of North wall concrete shielding

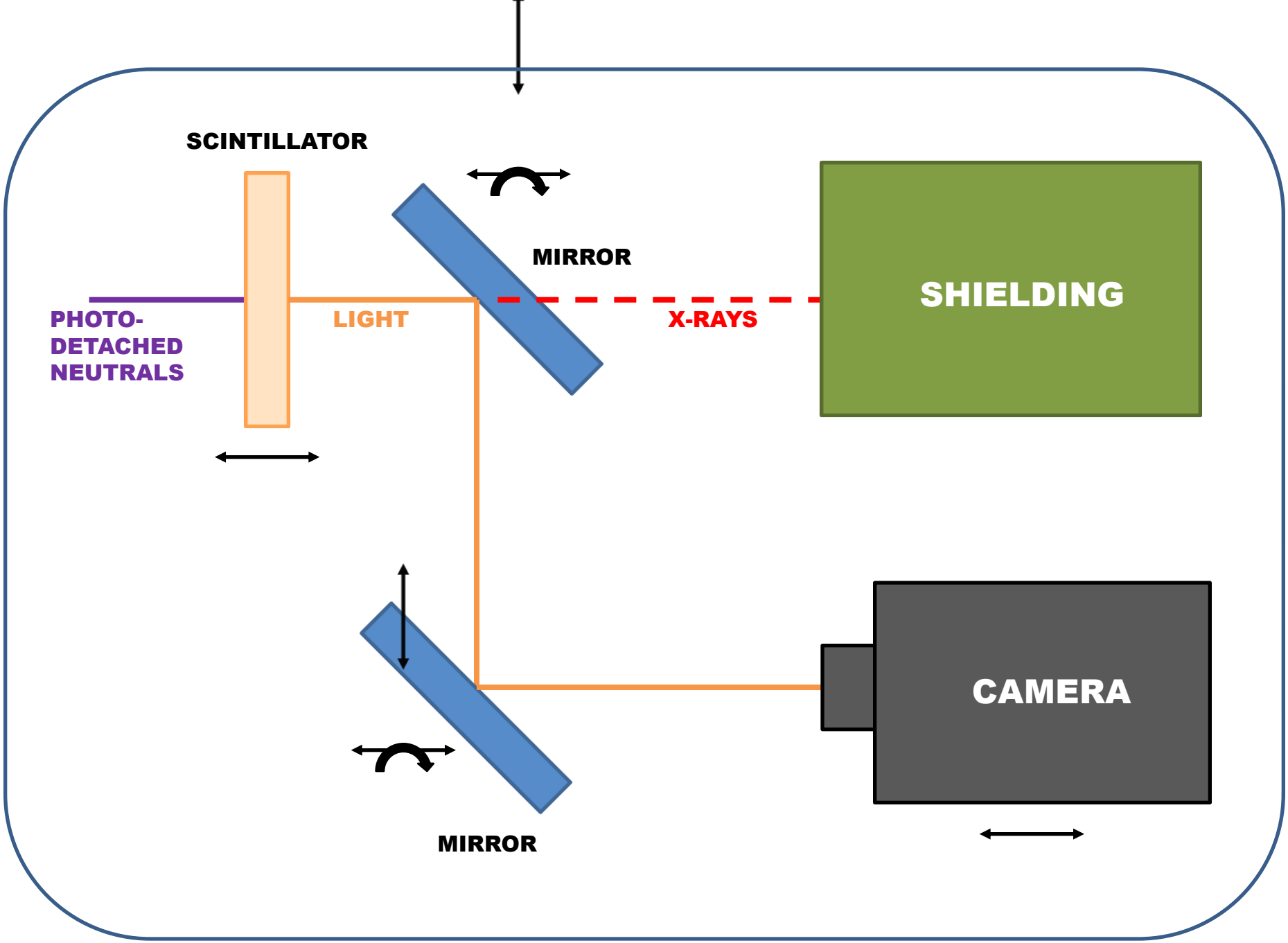


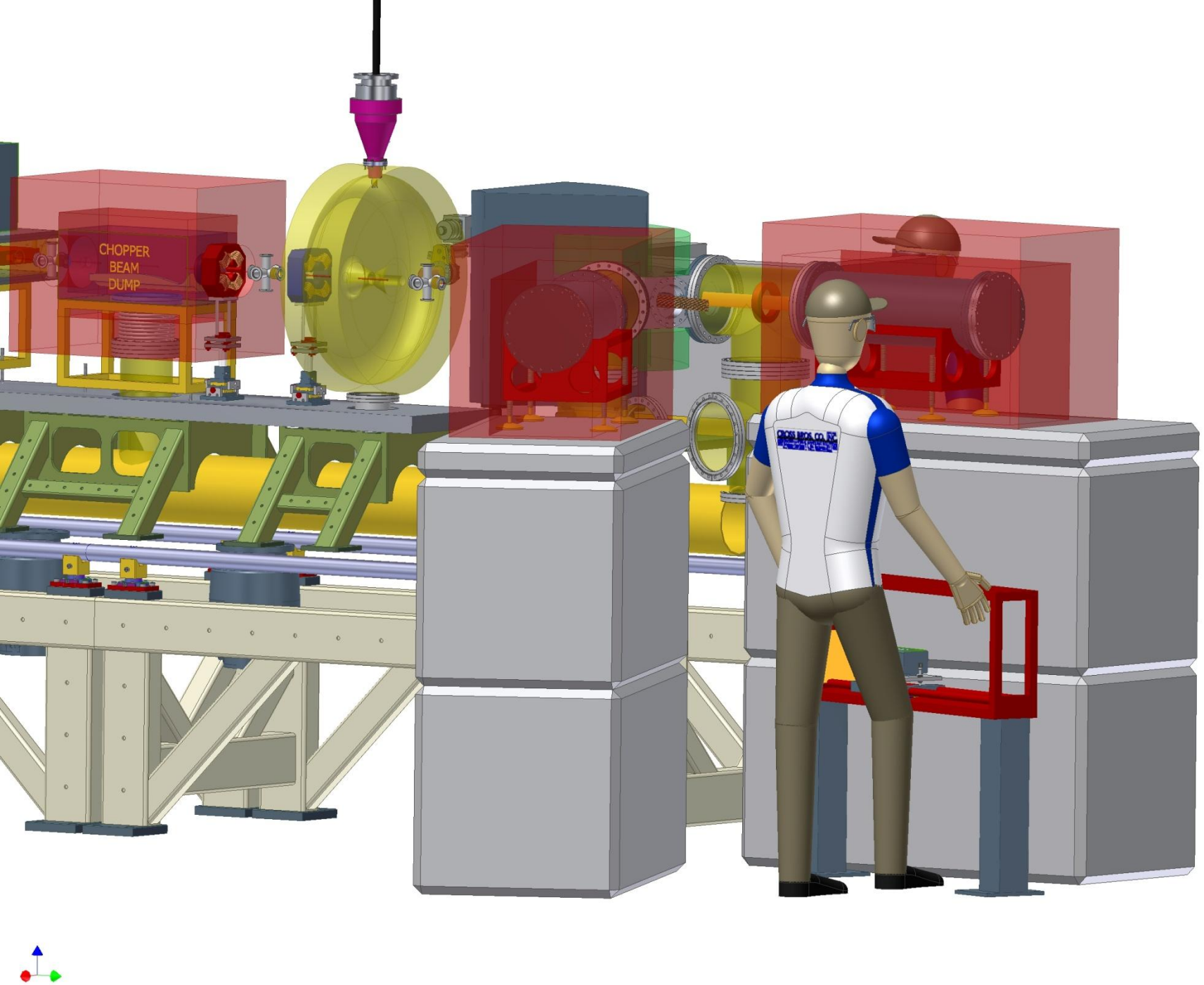


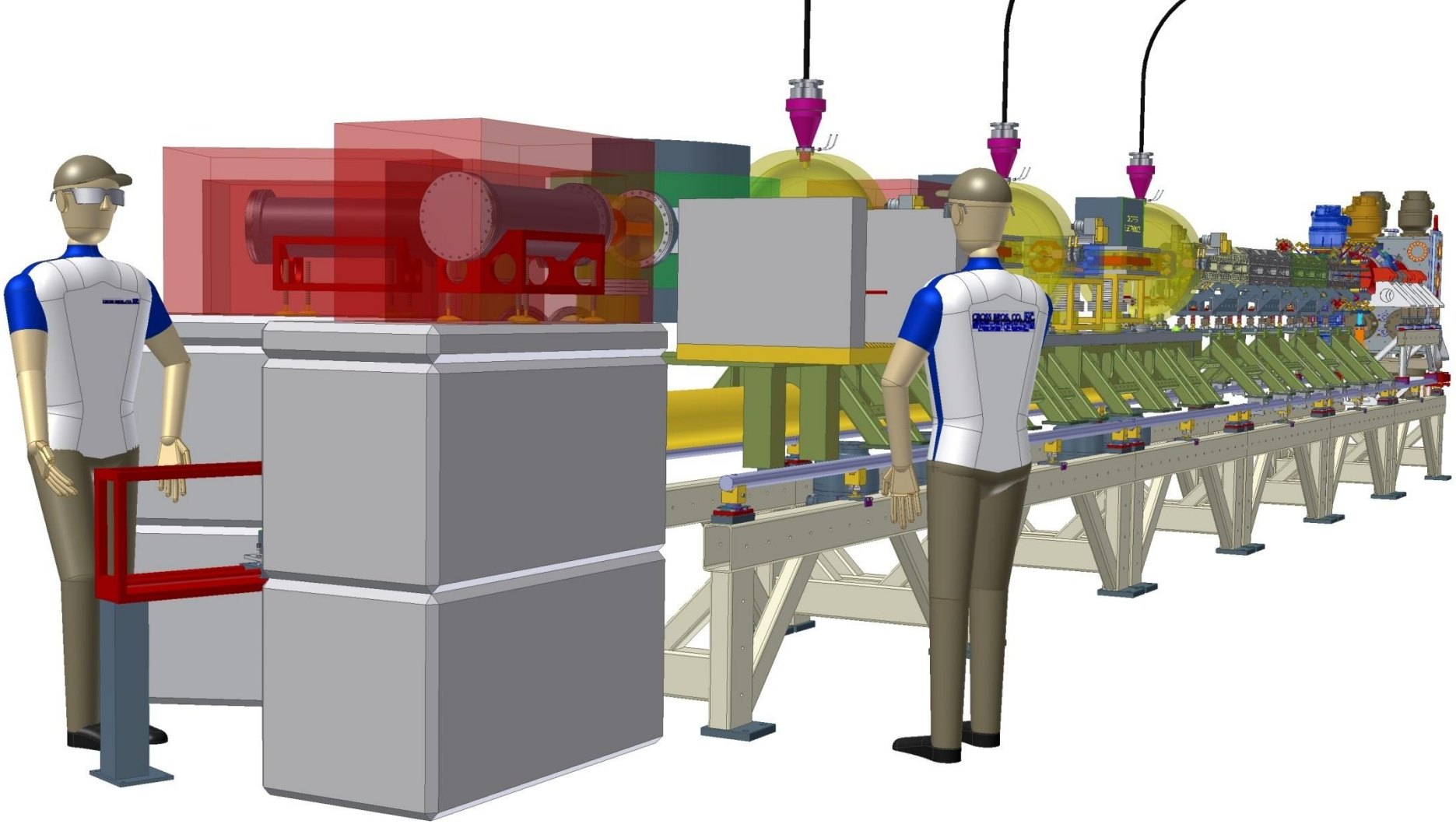
If optics allow could site camera low down in the lee of the two concrete pillars supporting the beam dumps with lead shielding. This will help to protect the camera from the radiation caused by the beam dumps.

Possibility to reduce beam current when laser diagnostics is in operation. This will reduce the size of beam dump 2

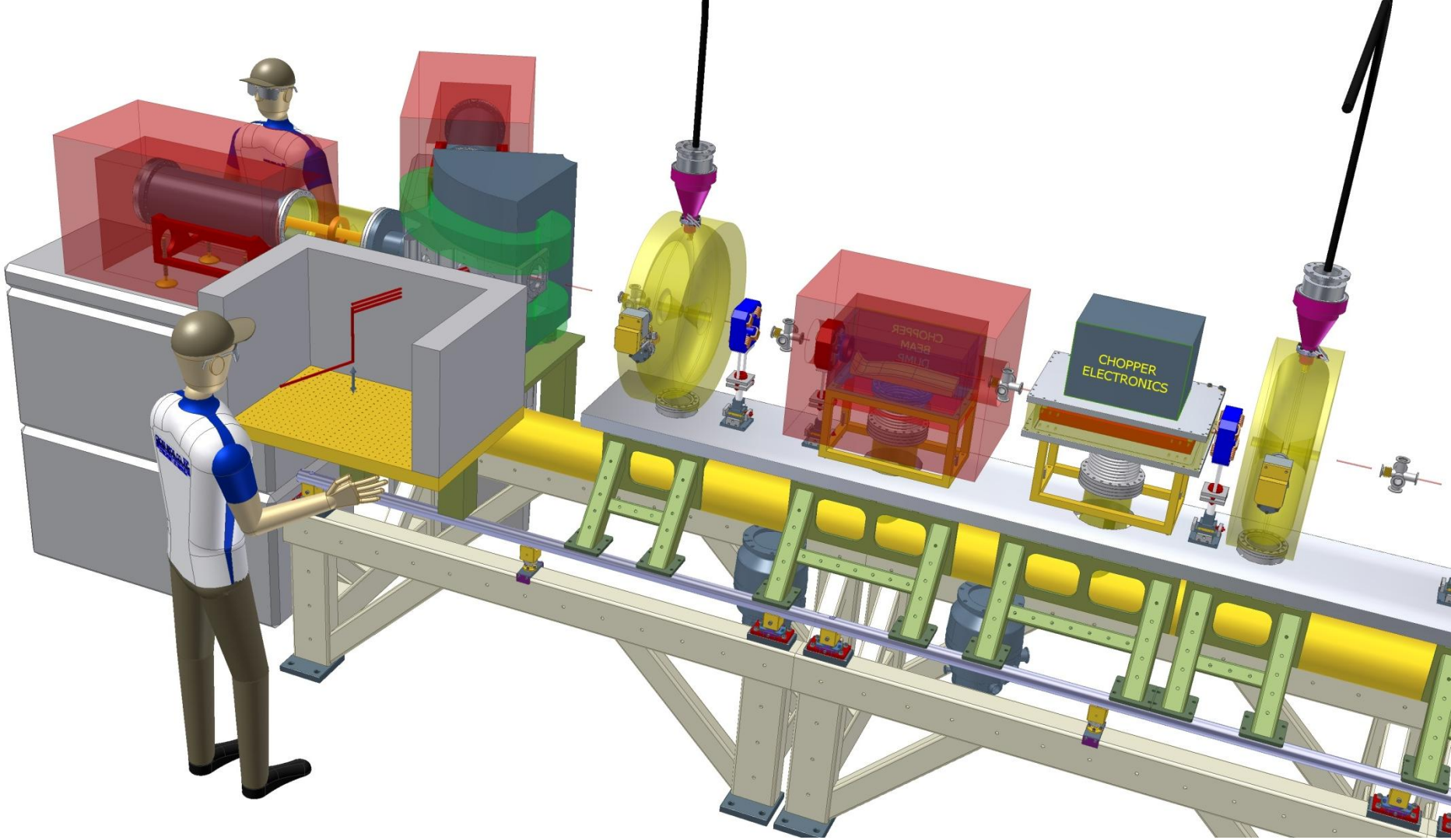
Shielding may be required behind the beam-line level optics to stop X-rays.


SCINTILLATOR
MIRROR
SHIELDING
PHOTO-
DETACHED
NEUTRALS
LIGHT
X-RAYS
CAMERA
MIRROR


CHOPPER
BEAM
DUMP

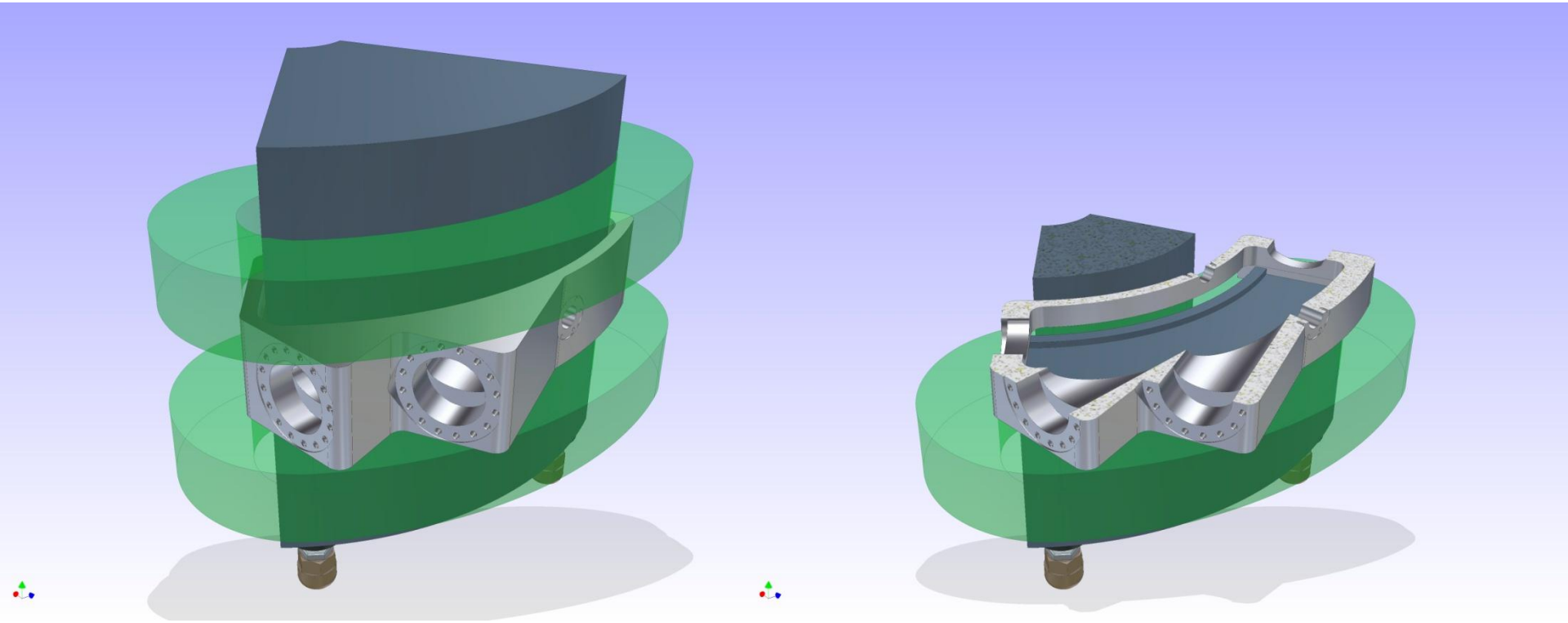


Breadboard shown is 900mm x 600mm. Shielding is 100mm thick lead, both protecting laser from the emitted gamma rays and protecting people from the laser light. Roof and front cover not shown for clarity but may not need such thick shielding.



The next logical step is to focus on the space available between FETS and the inner face of the shielding South wall. This will tell us whether the LEBT solenoid power supplies need to be moved and will guide the shielding design / cost.

Vessel iteration #8 shown with dipole



Note that vessel base and lid are not shown

3D_8 With Dipole