FP420m DETECTOR MECHANICS

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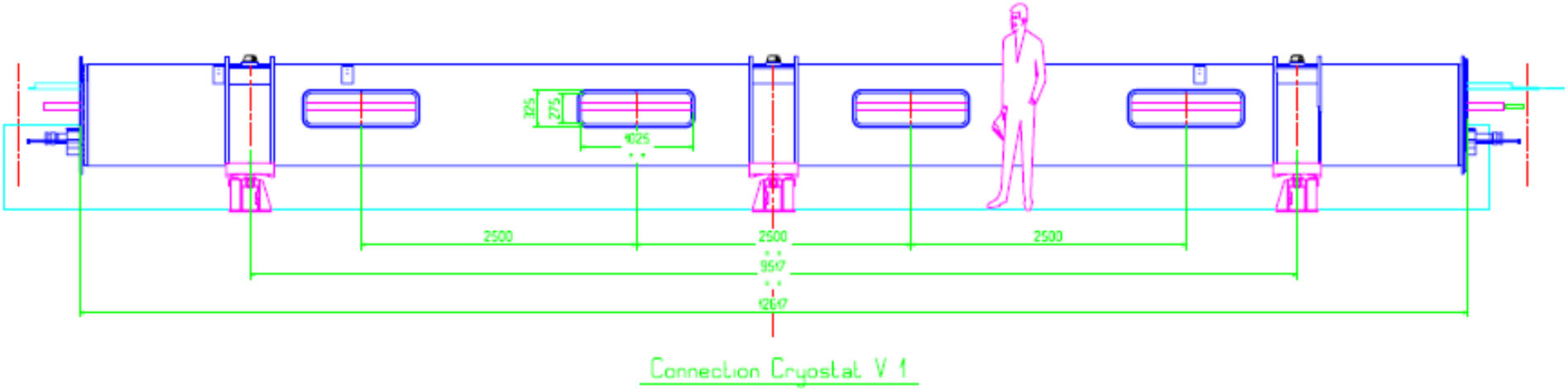
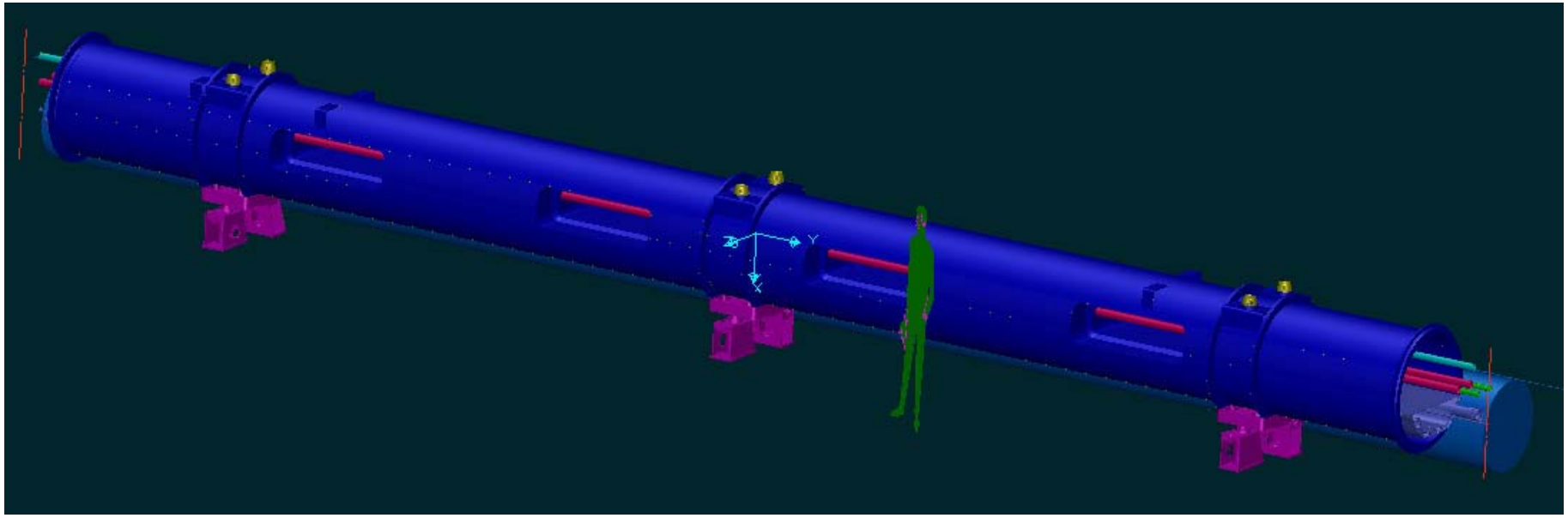
REQUIREMENTS

- Baking to 250°C
- Low outgassing
- Minimum number of degrees of freedom
- Detector positioning accuracy <10μm
- Modular design
- Maximum space for detectors
- Detectors in secondary vacuum

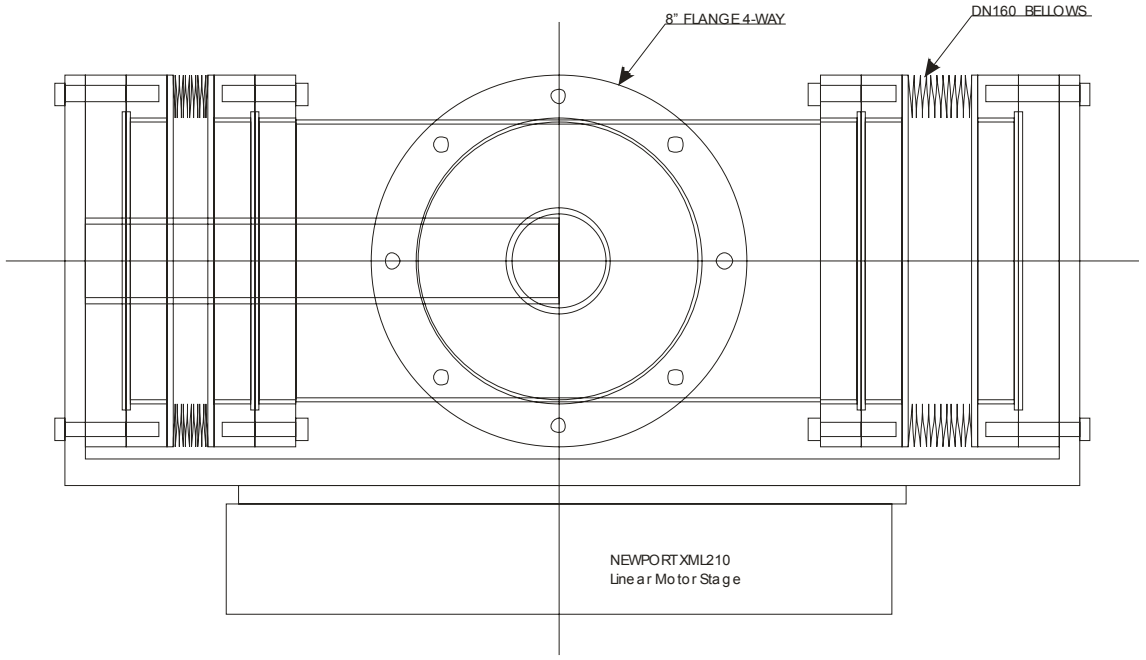
STATUS FROM THE LAST MEETING



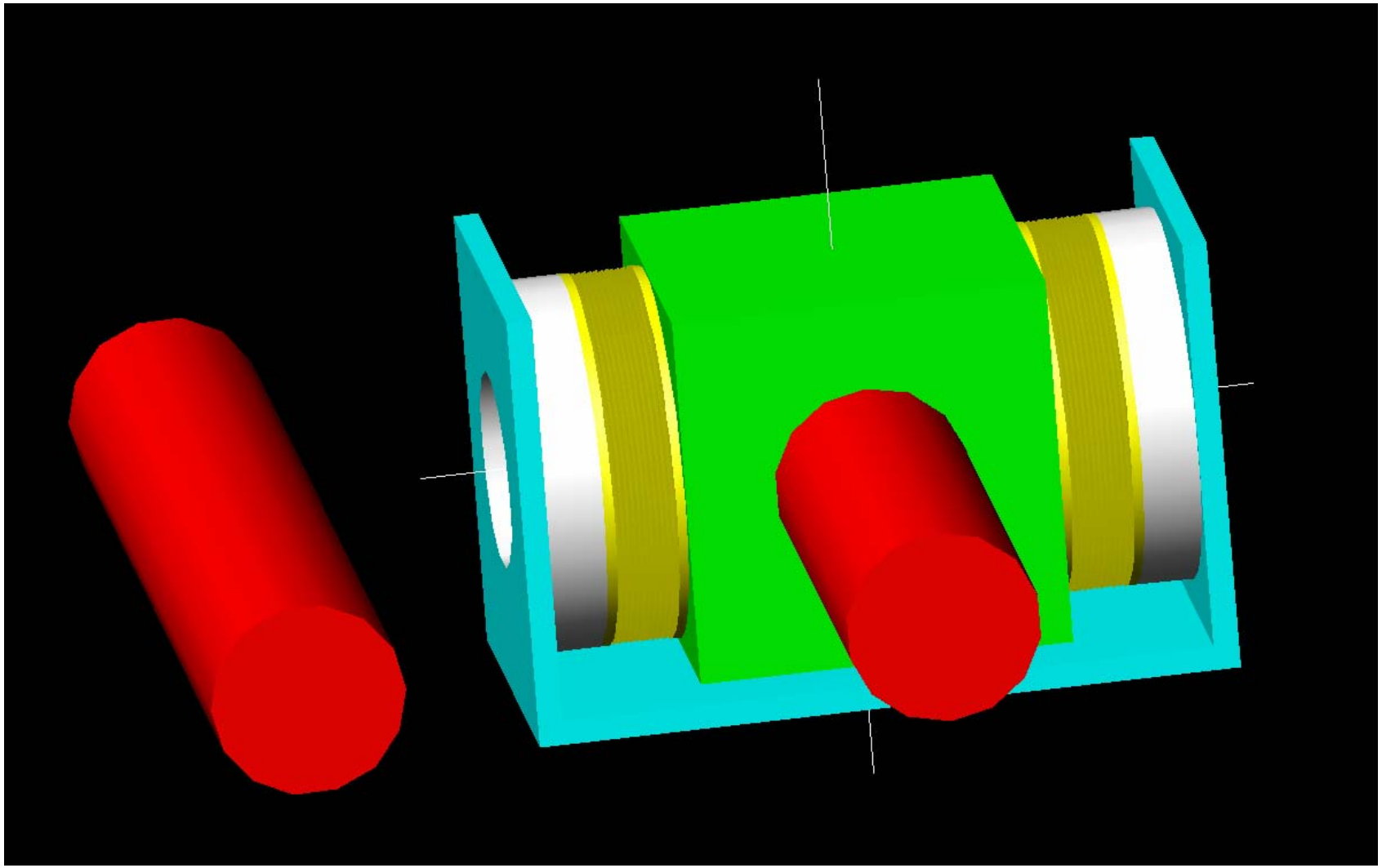


Status at last meeting

- Eliminate oblique detector movement
- Eliminate excessive pressure to detectors mount due to vacuum force
- And how we fit QUARTIC in it ???



But … it won’t fit !

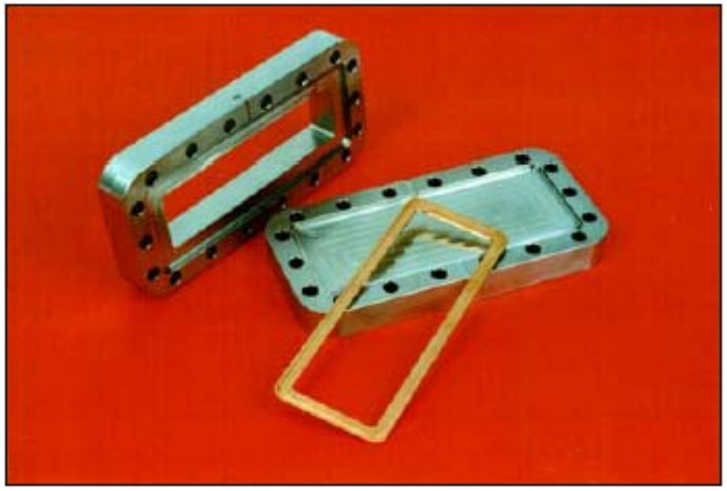


We designed a new chamber

- Review of the technologies and manufacturers of components that fit together
- How does the new chamber fit into the Transfer Cryostat
- Technical drawings

Detector enclosure components

thermionics
vacuum products



PyraFlat seals use the ConFlat sealing principle in a rectangular flange. Result: The ease, convenience, and reliability of circular seals are now available for rectangular vacuum seals.

In 1997, over 300 sets of PyraFlat flanges were installed at the Synchrotron Radiation Laboratory at the Stanford Linear Accelerator Center (SLAC) in California.

REQUIREMENTS

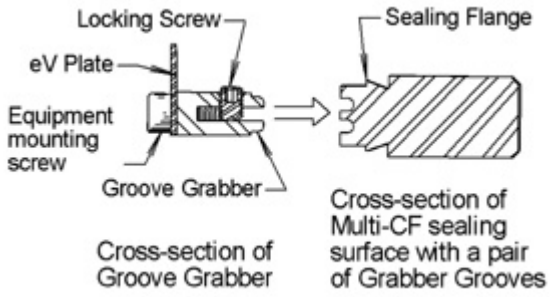
1. The flanges must meet ultra high vacuum specifications, including bakeability to 250°C.
2. The inside flange surfaces exposed to rf energy should be free of discontinuities so that RF wave patterns are not disrupted

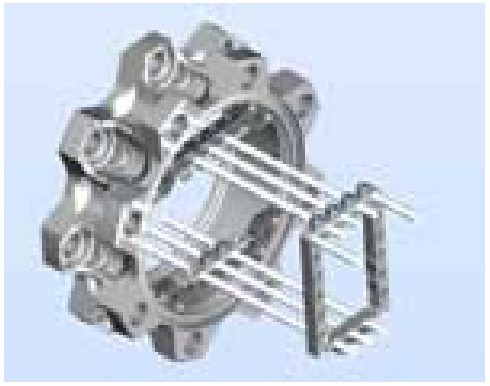
Detector enclosure components

KIMBALL PHYSICS INC. KPI

Perimeter Weld Flanges are a new type of weldable UHV CF flange. Most often they are welded into spherical chambers. However they may be welded into: tubes, cones, ellipsoids, plates, and other shapes. By placing the weld lip on the outer perimeter of the flange, it is possible to significantly improve access to the interior of a system, while simultaneously reducing overall size. Each 2¾ or larger CF flange has one or more pair of Grabber Grooves.

GROOVE GRABBERS





Detector enclosure components

INSULATOR SEAL
a division of MDC Vacuum Products Corp.

Specifications	
Voltage	300VDC max.
Current	5 Amperes max. at 20°C
Material	
Shell	Stainless steel
Pins	Ni-Fe alloy, gold plated
Insulation / Seal	Glass ceramic
Vacuum Range	UHV 1x10-10 Torr HV 1x10-8 Torr
Temperature Range	
Feedthrough	250°C
Del-Seal™ CF flange	450°C
Kapton® insulated UHV	ribbon cable
Air side connector	60°C
Vacuum side connector	250°C
Thermal Gradient	25°C / minute max.

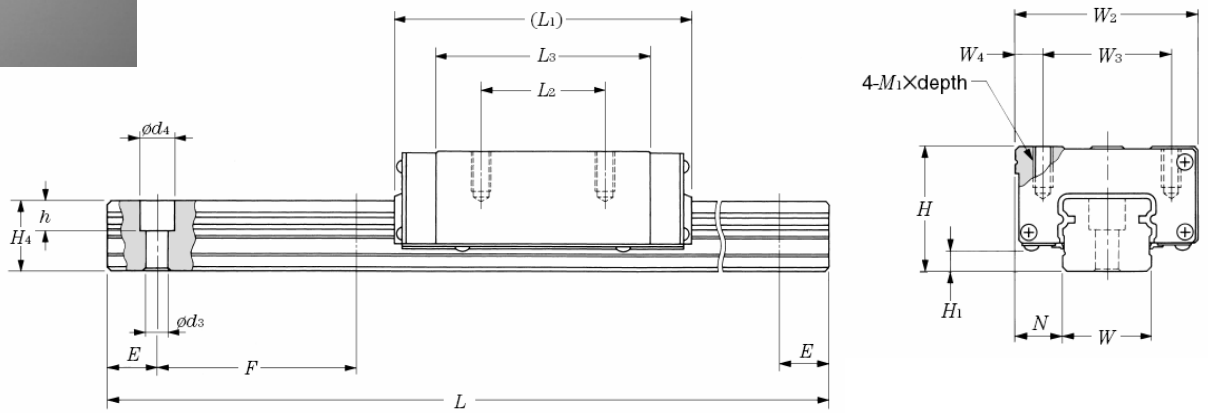
Detector enclosure components

Koyo®

BEARINGS FOR USE IN EXTREME SPECIAL ENVIRONMENTS

CERAMIC BEARINGS AND EXSEV BEARINGS

Linear motion bearings. Body made of stainless steel, balls made of ceramics (Si_3N_4) or stainless steel with Ag Ion-plating solid lubricant.

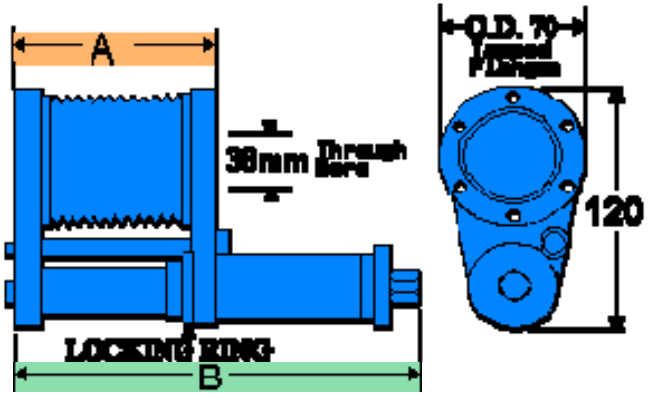


Detector enclosure components

VG SCIENTA
a gammadata company

Linear Transfer Mechanism (LTM Series)

- Range of travel 25 to 100mm.
- Easy adjustment.
- Graduated scale in 1mm increments.
- Fully bakeable to 250°C.
- Operating temperature range -20°C to +200°C.
- Fitted with tapped flanges at both ends.
- Positive stops at extremes of movement.
- Motorised resolution = 0.00025mm/half step.



Detector enclosure components

RENISHAW
apply innovation™

Differential interferometer

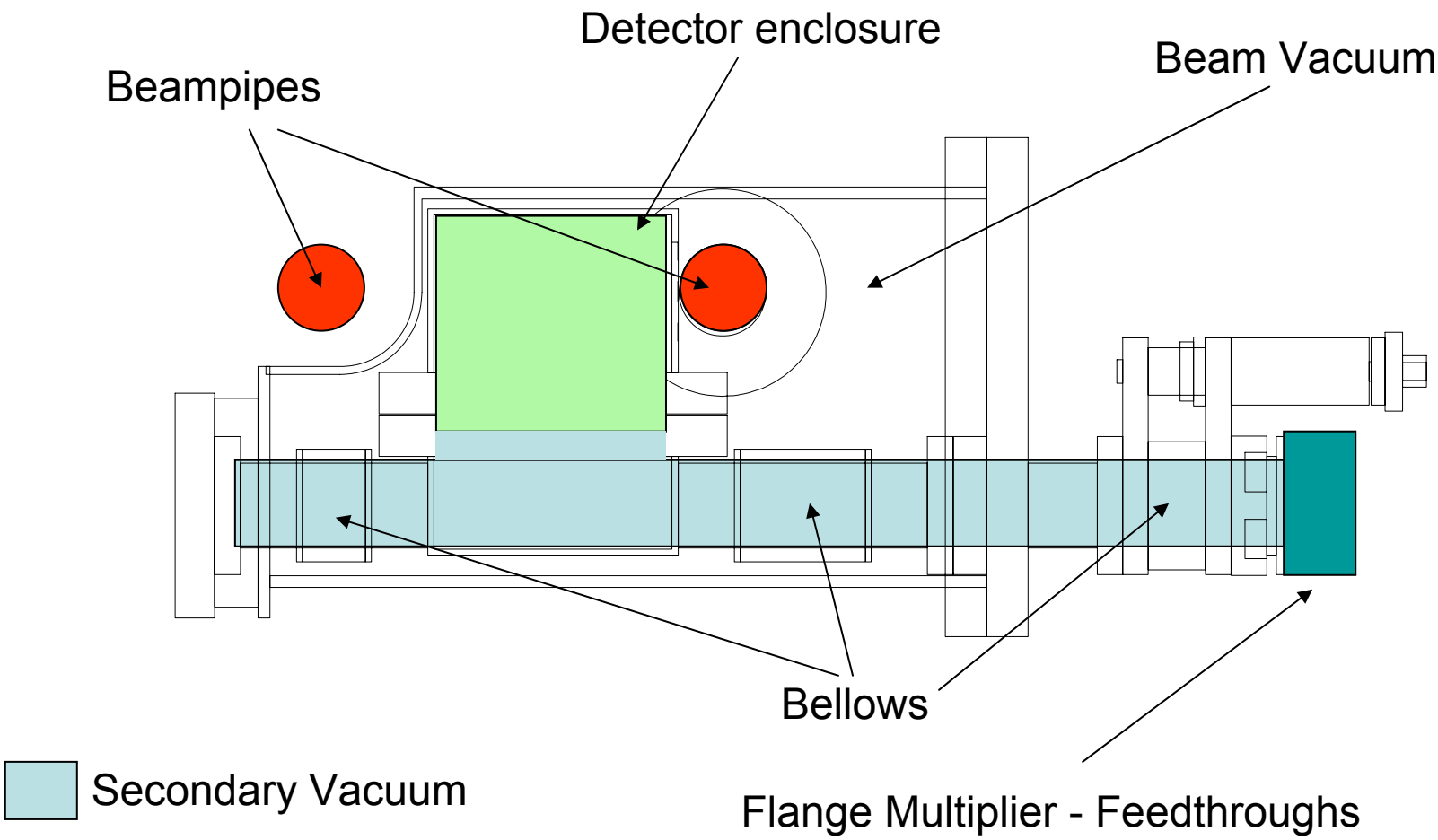
Exceptional metrology
ppb frequency stability and ultra low cyclic error
Differential configuration
Measures relative position of the stage to the tool and eliminates common mode errors such as chamber wall movement.
Rapid alignment
Simple alignment from outside the chamber using four integrated beam steerers (+/- 1° pitch and yaw movement to overcome vacuum chamber and mirror mounting tolerances)

Range 0 - 1 m
Cyclic error < 1 nm
Frequency stability* < +/- 1 ppb
Output signal format
Digital - RS422 quadrature
Analogue - 1 Vpp sin/cos
Max. velocity Up to 1 m/s
Laser type: HeNe, 632.8 nm (class 2)
Laser lifetime: > 50 000 hrs

New Design Features

- Square vacuum chamber design
- Detectors and motion mechanics can be easily changed
- Detector movement along one (X) axis
- Detector enclosure 120x120x115 mm
  - Can be modified to 120x120x165 mm
- Detector position measurement by Laser Differential Interferometer

Square Design



Risk Analysis

- MTBF values can be evaluated for standard industrial components which determine three probabilities:
  - Leak of ambient air to secondary vacuum due to bellows, flange gasket or feed-through failure
  - Leak from secondary vacuum to beam vacuum due to:
    - Bellows failure
    - Detector window rupture (due to sudden beam displacement)
  - Mechanical jam due to
    - Worn slider
    - Linear stage mechanical malfunction
    - Stepper motor malfunction
- Loss of electrical power from the control electronics causing detectors remain in the beam-pipe aperture
- Detector distance measurement failure

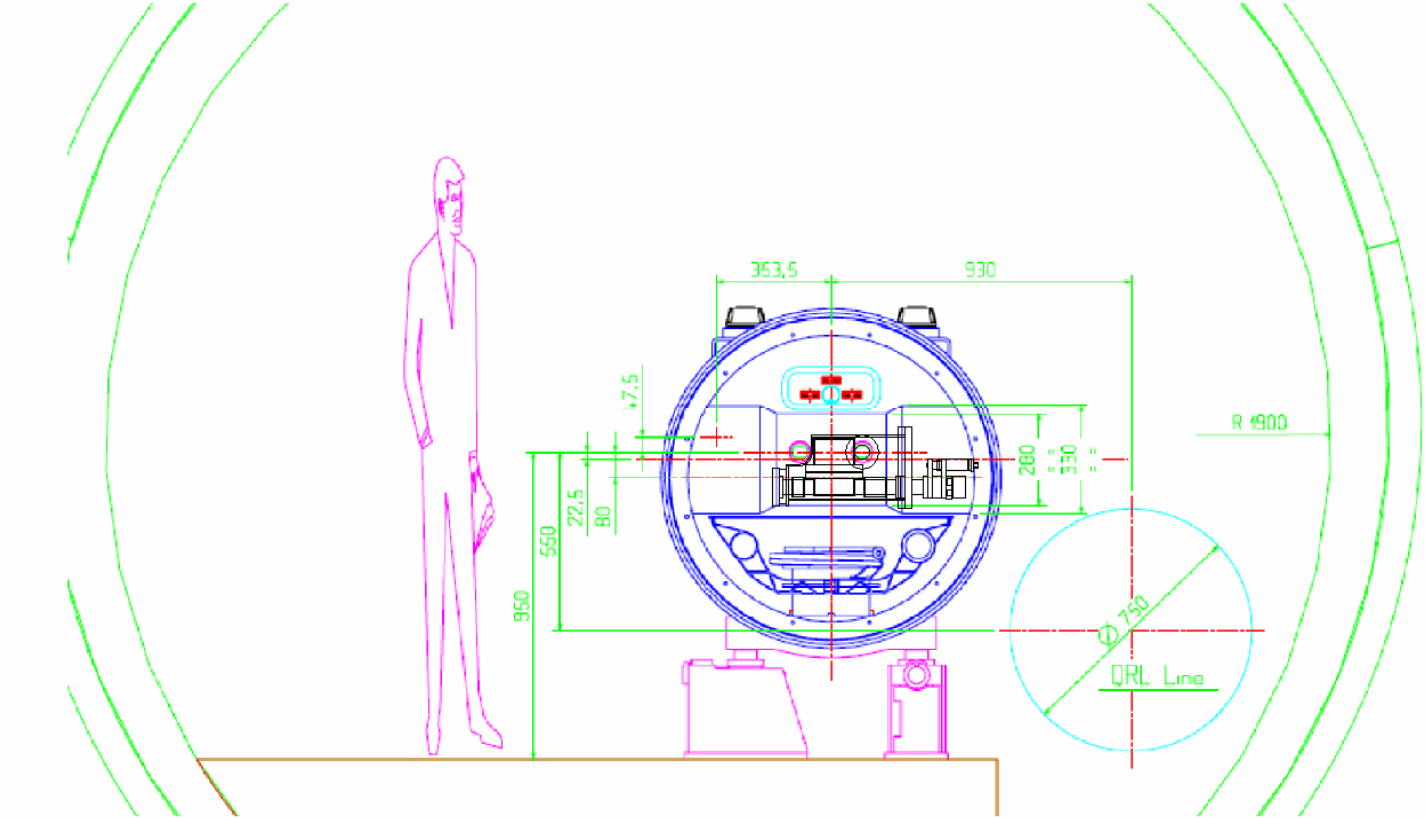
Bakeout Scenario

- Two processes to worry about
  - Thermal desorbtion
    - Specific desorbtion rates for polished stainless steel of 10^{-12} Torr / s^{-1} cm^{-2} achievable after bakeout at 250°C. Unbaked rates are about 5-10 times higher.
  - Photon Induced Desorbtion
    - Photodesorbtion rates for *Pre-baked* and *In-situ* baked chambers differ by less than 10 times for photon dose above 10^{22} photons/m

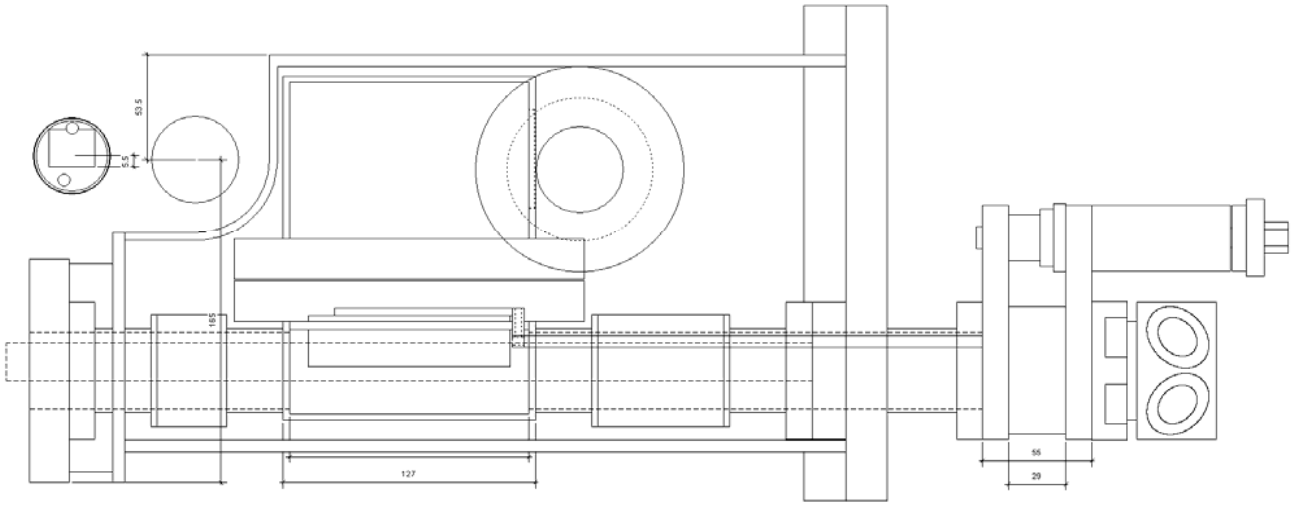
Bakeout Scenario

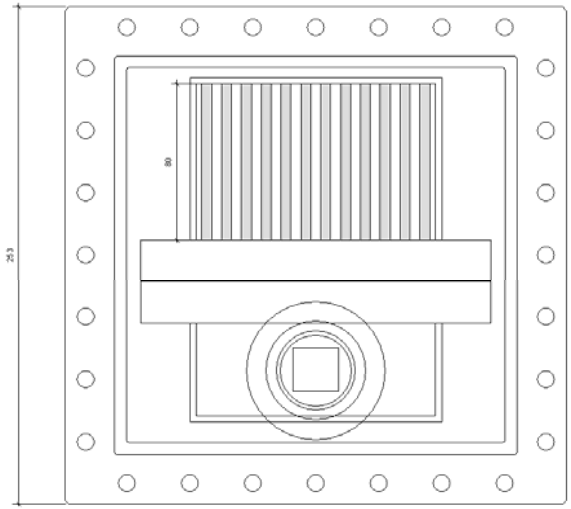
- Chamber is pre-baked and installed
- Detector assembly is installed
- NEG Strip (ST707) Pump is activated by current flow for approx 1h
- Last two steps are repeated during detector removal/reinstallation
- Main vacuum enclosure can be pre-baked with blank flange installed
- All component surfaces in contact with beam vacuum can be pre-baked

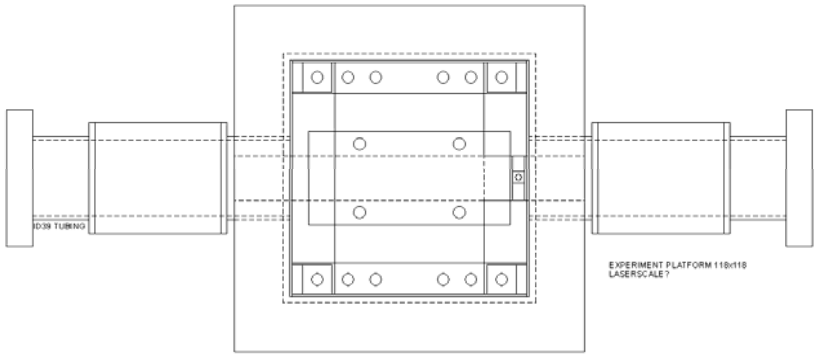
Design Features

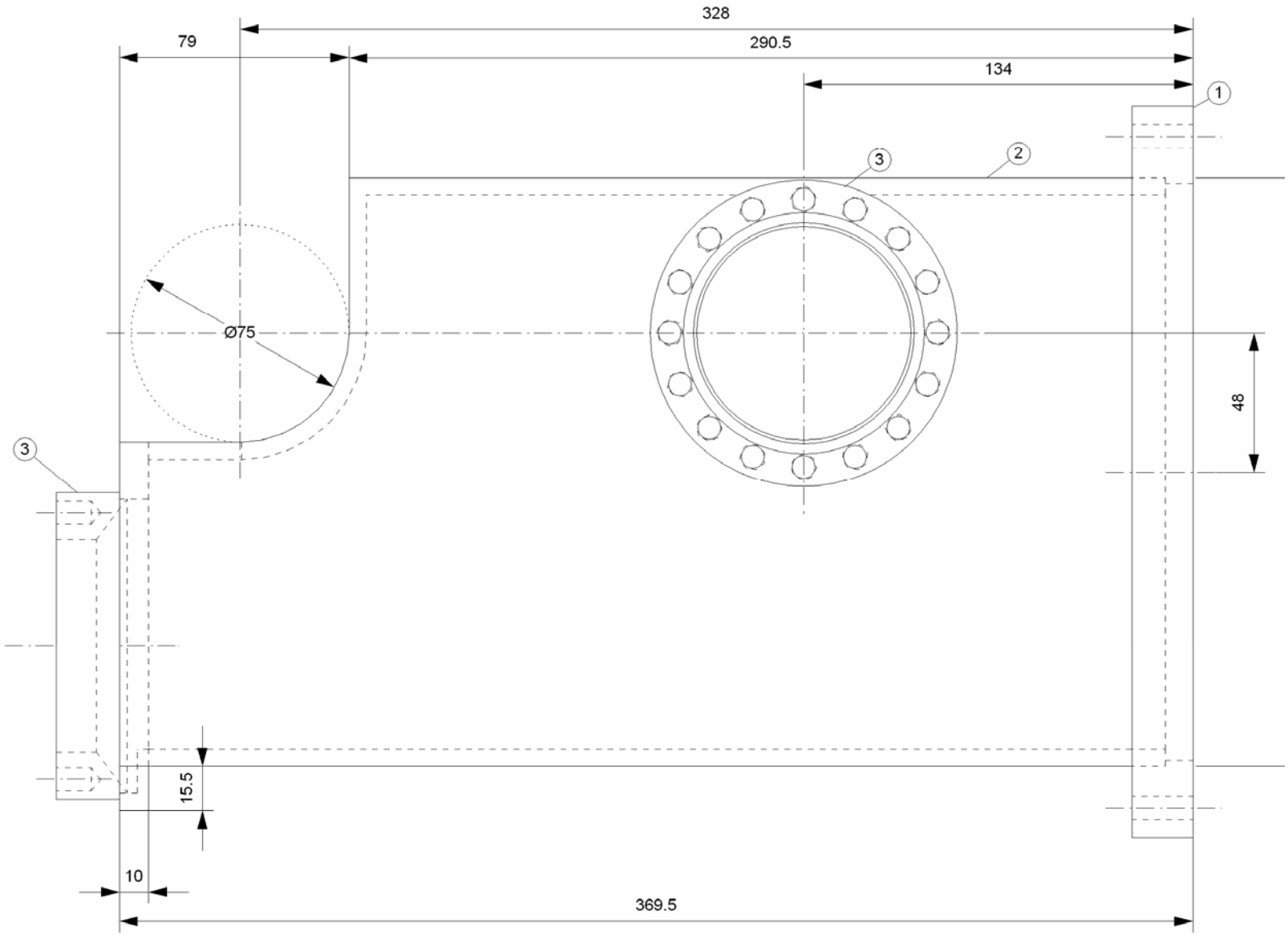


Design Features







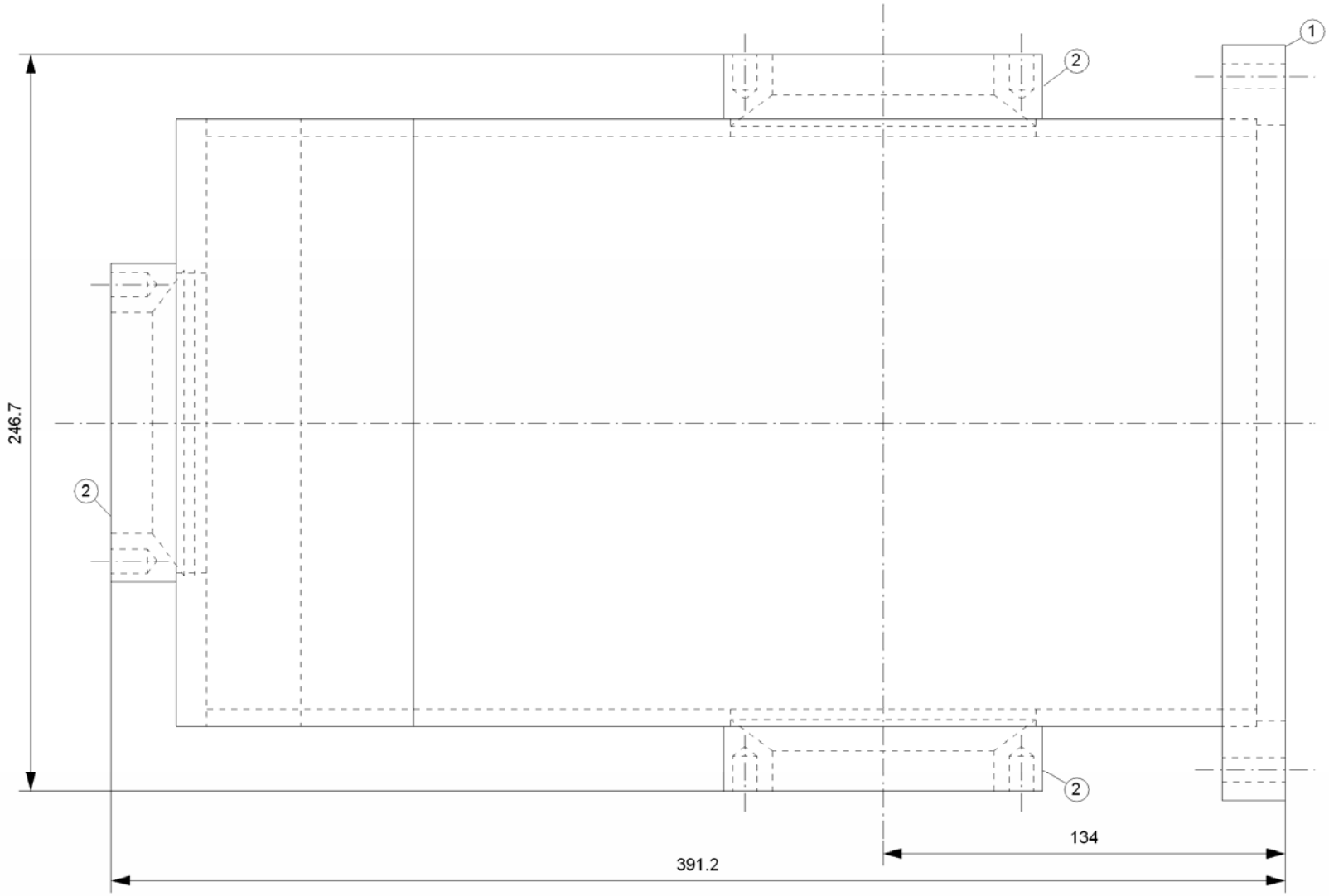


3	MCF450-PWF/GG-A 304
2	8" SQUARE TUBING, 1/4" WALL
1	PYRAFLAT FLANGE 099099T TAPPED 304-L

FP420 DETECTOR ASSEMBL

MAIN CHAMBER: SIDE

SCALE 1:2	SHEET 2 OF 12	REV 1	DATE 25.03.2006	SIG

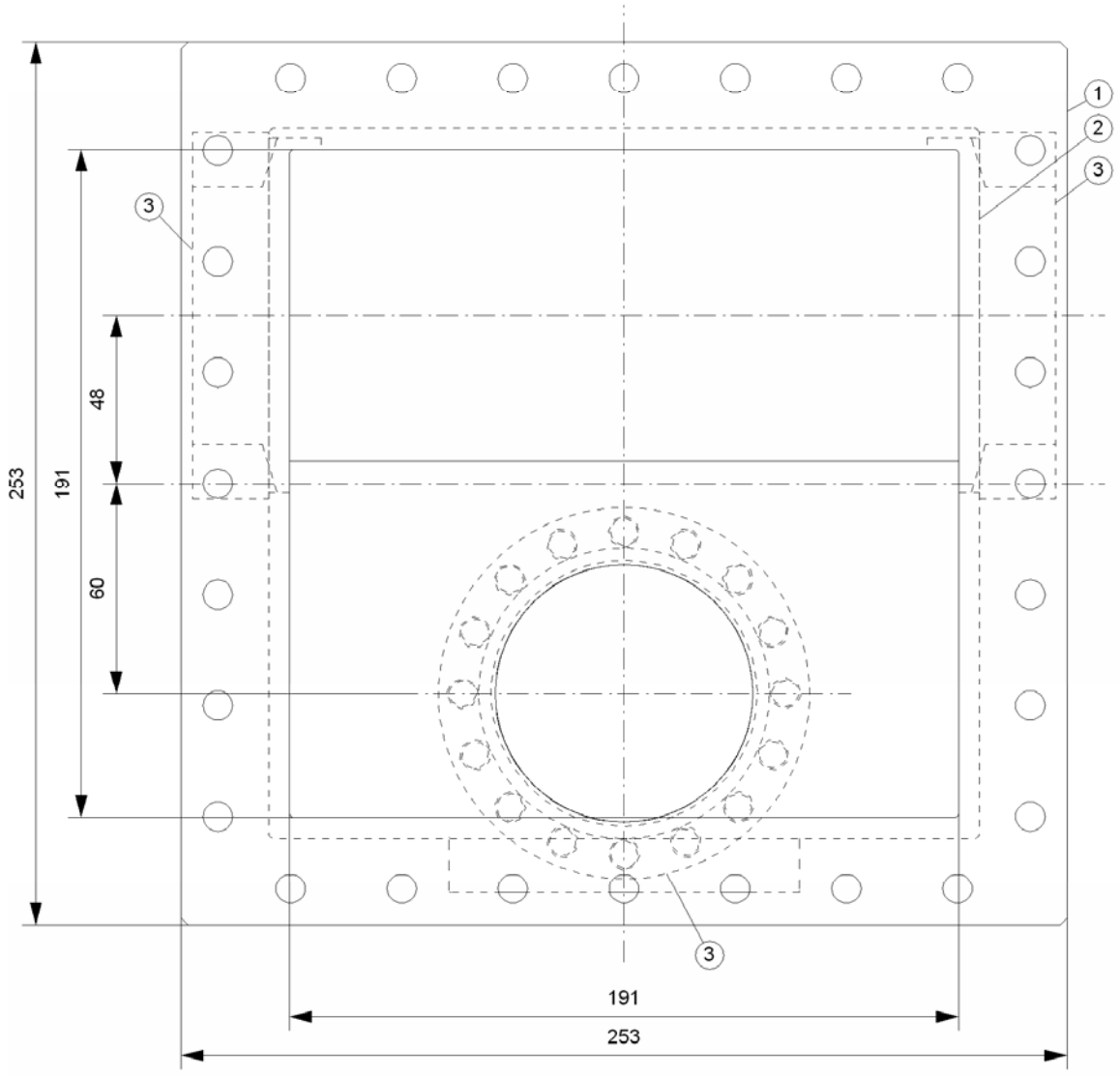


2	MCF450-PWF/GG-A 304	
1	PYRAFLAT FLANGE 099099T TAPPED 304-L	

FP420 DETECTOR ASSEMBL

MAIN CHAMBER: TOP

SCALE 1:2	SHEET 3 OF 12	REV 1	DATE 25.03.2006	SIG

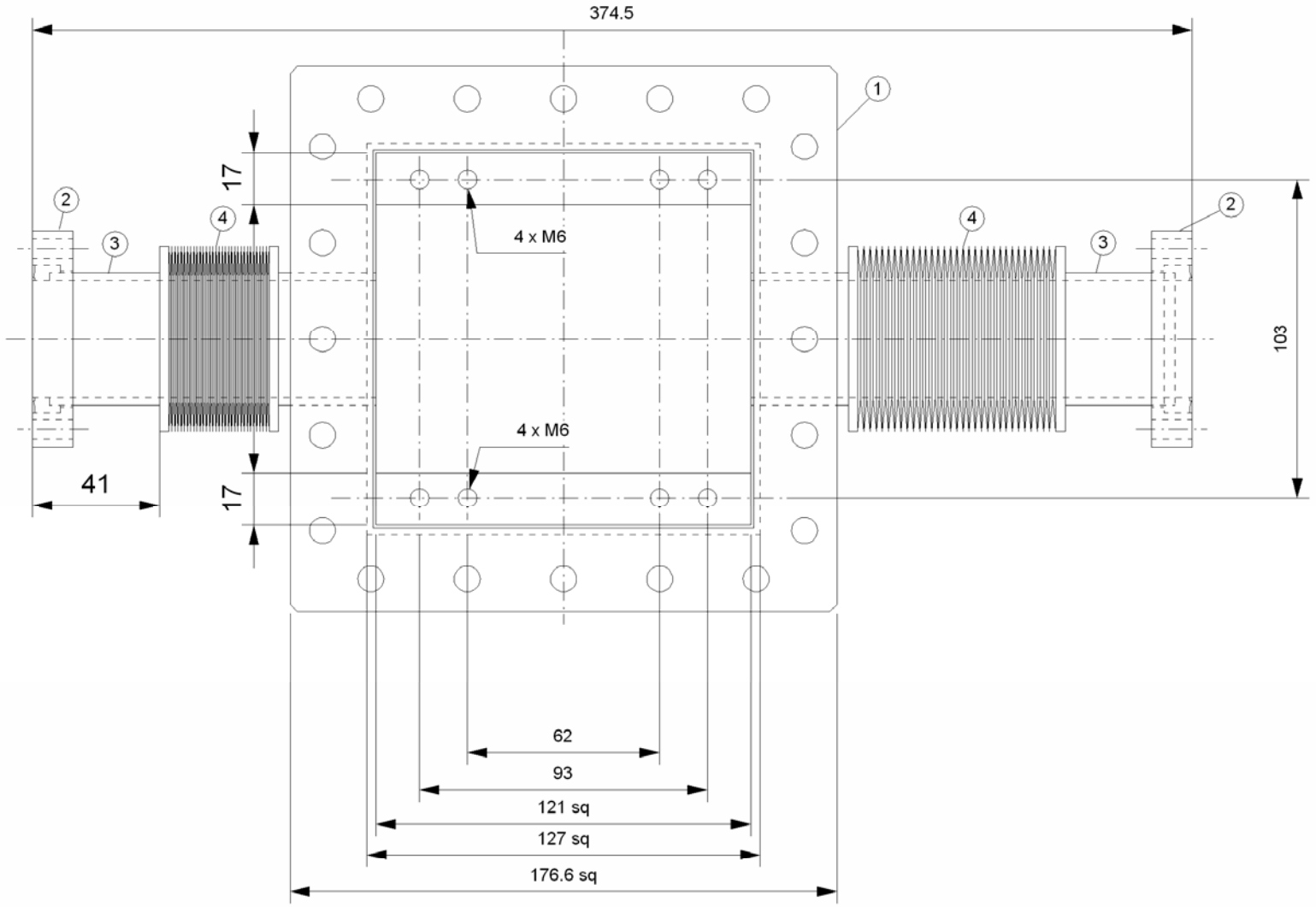


3	MCF450-PWF/GG-A 304	
2	8" SQUARE TUBING, 1/4" WALL	
1	PYRAFLAT FLANGE 099099T TAPPED 304	

FP420 DETECTOR ASSEMBI

MAIN CHAMBER: FRONT

SCALE 1:2	SHEET 1 OF 12	REV 1	DATE 25.03.2006	SIG

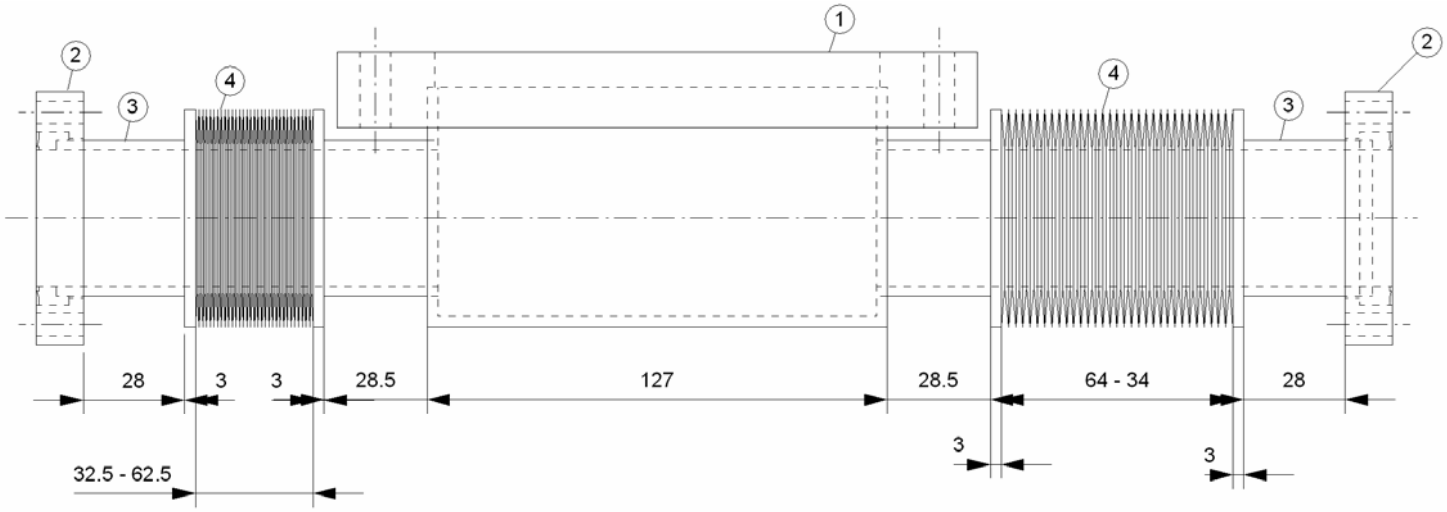


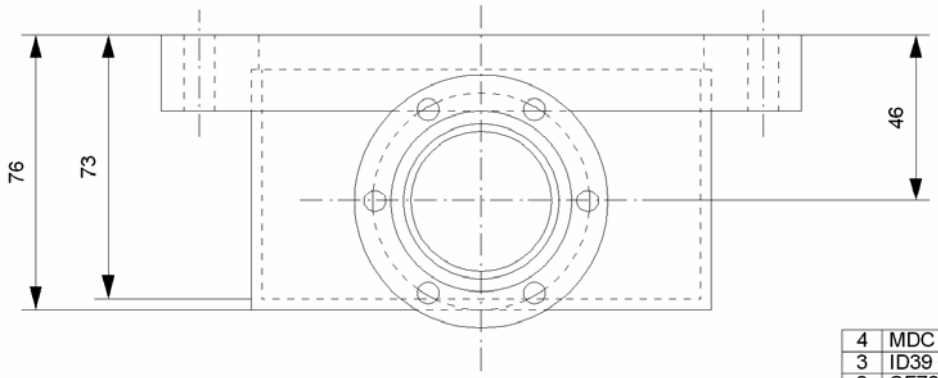
4	MDC WB-822 471022 2" STROKE C25 F64
3	ID39 OD43 TUBE
2	CF70 ROTATABLE FLANGE OD43 TUBE
1	PYRAFLAT FLANGE 069069 304-L/304

FP420 DETECTOR ASSEMBL

DETECTOR HOUSING

SCALE 1:2	SHEET 7 OF 12	REV 1	DATE 26.03.2006	SIG





4	MDC WB-822 471022 2" STROKE C25 F64
3	ID39 OD43 TUBE THROUGH BORE MIN 3
2	CF70 ROTATABLE FLANGE OD43 TUBE
1	PYRAFLAT FLANGE 069069T TAPPED 30

FP420 DETECTOR ASSEMBL

DETECTOR HOUSING: SIDE VIEWS

SCALE 1:2	SHEET 7 OF 12	REV 1	DATE 26.03.2006	SIG

Thank You !