

MRO Delay Line ICD

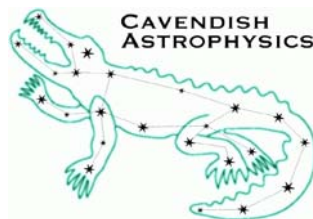
Metrology System to Beam Combining Facility

ICD INT-406-VEN-0012

The Cambridge Delay Line Team

rev 0.1

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1 ICD Description

ICD Number	Sub-systems		Org	Owner	Brief description and preliminary contents
INT-406- VEN-0012	Metrology System	BCF	UoC	MF	Relates metrology bench, services and electronics racks etc to BCF (BCA) area. • Location and requirements of metrology bench • Location and requirements of electronics racks • Service connections, heat removal etc.

2 Change Record

Revision	Date	Authors	Changes
0.1	2007-08-10	MF	First draft version

3 Notification List

The following people should be notified by email that a new version of this document has been issued:

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4 Scope

This document describes the interface requirements for the metrology system within the BCF. This includes the size and positioning of the metrology table(s), the accommodation of electronics associated with the metrology system, cabling requirements and services. The layout of the metrology system on the table is not part of this interface.

5 Acronyms and Abbreviations

BCA	Beam Combining Area	MROI	Magdalena Ridge Observatory
BCF	Beam Combining Facility		Interferometer
BRS	Beam Relay System	UoC	University of Cambridge
DL	Delay Line	NMT	New Mexico Tech
DLA	Delay Line Area	OPD	Optical Path Delay
ICD	Interface Control Document	TBC	To be confirmed
ICS	Interferometer Control System	TBD	To be determined
SCS	Supervisory Control System		

6 Applicable Documents

DOCUMENTS

AD1 Derived requirements document (thermal loading etc).

DRAWINGS

AD2 Specific interface drawings(s) – provisional diagrams are included in the appendix to this document.

7 Reference Documents

- RD1 Delay line to Beam Relay system (INT-406-VEN-0008)
- RD2 Delay line to metrology system (INT-406-VEN-0010)
- RD3 Metrology System to BCF (INT-406-VEN-0012)
- RD4 Metrology System to Beam Relay System (INT-406-VEN-0013)
- RD5 Metrology table layout (drawing)
- RD6 ZMI 7712 Laser Head Operating manual (P/N 8070-0159-XX)
- RD7 M3 Architectural Dimension Floor Plan AR101

8 Introduction

This ICD describes the facilities and services which the metrology system requires to be provided in the BCF. There are four areas of interface: the metrology table in the inner BCA; the placement of electronics chassis in the outer BCA; the cabling between the electronics chassis and subassemblies on the metrology table; and the services required at the metrology table and the electronics chassis.

The size and positioning of the metrology table is closely associated with the delay lines which the metrology system feeds (information on the interface between the delay lines and the metrology system is contained in RD2 and the layout of the components on the metrology table is presented in RD5). Access to the delay line end-plates close to the table and also to components on the table is very important and since space in the inner BCA is limited some further compromise may be necessary e.g. incorporating some of the other optical components required in the BCA on the metrology table.

To meet heat loading limitations in the inner BCA most of the electronics associated with the metrology system is located in the outer BCA while the laser head, located on the metrology table, is specified to be a water cooled model.

9 Requirements

9.1 *Metrology Table*

9.1.1 Metrology table area and location

A metrology table area of 6.7m [TBC] minimum by 0.6m [TBC] minimum is required to support the optical layout for 10 delay lines fed by one laser head. It may comprise several tables but must behave as one monolithic table.

Access is required to the front (closest to the delay lines) and rear of the table for adjustment of various optical components and the shear camera. This places a maximum practical width on the optical table of 1.8m [TBC].

The distance between the end-plate of each delay line and the nearest edge of the metrology table should not be less than 0.75m. This allows sufficient space for the protection mechanism of the DL science beam exit window to project a further 250mm in front of the end-plate (the surface of which is 100mm from the inside wall of the BCA) thus allowing at least 500mm clear for personnel access to the delay lines or the metrology table.

The laser head is to be mounted at the south end of the table. At least 850mm between the end of the table and the centreline of the nearest delay line is required to accommodate the laser head and branch mirrors.

The metrology table should be positioned at least 600mm from the south wall of the BCA to allow personnel access.

9.1.2 Metrology table height

The height of the table is determined by the height of the metrology beam expander assembly and the incoming science beam height above the BCA floor. The nominal height of the centre of the incoming science beam above the BCA floor is 1.6m. The base of the metrology system is 322mm below this and therefore the *nominal* height of the top surface of the metrology table is 1278mm above the floor with an allowance of +/-0.25mm for height setting and +/-0.1mm in the table surface error. Adjustment of the height of the metrology table (with a sensitivity of approximately 0.1mm) must be provided as there is no height adjustment in the individual metrology beam expander assemblies.

9.2 *Electronics*

Rack space in the outer BCA for a single 12U height [TBC] VME crate plus space for a pull-out shelf for keyboard and mouse and for a suitable flat-panel monitor is required for the metrology system.

Rack space in the outer BCA for a 3U power supply rack for the laser head.

Rack space of 15U for up to 10 1U height shear camera computer modules with a 0.5U minimum spacing between each is required. They need not occupy the same rack as the VME system nor all be contained in one rack.

The positioning of the rack(s) in the outer BCA used for housing the electronics should take into account the available cable tray routes and the maximum cable lengths detailed in the following section. The preferred location of all the electronics is in a single rack located in the outer BCA close to the south end of the metrology table as shown in Figure 1 in the appendix.

9.3 Cabling

Cabling between components on the metrology table and the electronics rack(s) is identified here:

Source (Metrology Table)	Destination (Outer BCA)	Function	No.	Cable Type	Maximum allowed cable length
Interferometer block	VME System	Signal	10	Optical Fibre	20m
Laser	VME System	Reference	1	Optical Fibre	20m
Laser		Power supply and control	1	Multi-core	20m
Shear Camera	Shear Cam Computer	Shear image	10	Fire-wire	20 m super cable OR 10m standard cable or 14.5m with one repeater

9.4 Services

The following services are required for the metrology system:

- Utility power for the VME rack 250W
- Utility power for up to ten shear camera computers each fitted with 180W power supply.
- Utility power for the Laser head Power supplies 65W
- Water cooling for the laser head: water at 0.5 litres per minute at ambient temperature ($21.5^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$) and stable to $\pm 0.1^{\circ}\text{C}$ (see RD6)
- One network socket at the metrology table. (Gigabit Ethernet recommended for displaying shear camera images)
- Ten Ethernet ports for the shear camera computers. (Gigabit Ethernet recommended for displaying shear camera images)
- One Ethernet port for the VME system
- Ducting/cable trays for connections between metrology table and equipment rack(s)

10 Design

10.1 Metrology Table

The optical layout of the metrology system provides for ten channels of metrology from a single laser which is placed at one end of the metrology system. This requires a table area which is long and narrow though the width could be increased to a standard size or more, if needed to accommodate other BCA optics, but in any case no more than 1.8m. The layout of the laser metrology system for the ten delay lines is described in RD5.

The distance between the inside of the south wall of the BCA and the centre of the first delay line pipe is 5 feet 11 $\frac{3}{4}$ inches i.e. 1.82m (according to the architectural drawing given in RD7). The preferred placement of the optical table along the N-S direction is such that there will be a 0.9m space between the inner BCA wall and south end of the metrology table. This provides a distance of 920mm between the edge of the table and the centre of the first delay line pipe (accommodating the 850mm

minimum requirement) and allows for cables from components on the table to be routed into the cable tray directly above that end of the table. The diagram in Figure 1 in the appendix shows the laser mounted at the S end of the table and the dimensions for positioning the table.

If the cooling water available in the inner BCA cannot meet the requirements of the laser then a separate water circulation system or second stage cooler may be required.

10.2 Electronics

No allocations are made but it should be noted that the shear camera fire-wire cable length is limited to 20m for superior cable. If standard cable is used the limitation becomes 10m. A repeater allows an additional 4.5m of cable to the standard 10m length. The repeater draws power from the fire-wire cable and therefore it would be undesirable to use more than one repeater per cable. Cable trays are approximately 2.5m above floor level and therefore cable length from the table surface to a tray directly above (if one is available) is approximately 1.25m. The distance of the furthest shear camera from the south wall is nominally 7.6m. Allowing the cable to rise and travel through the wall by the shortest route and then fall to the same level implies a further 3m length making the total minimum length for this run 10.6m.

There is no cabled arrangement envisaged for controlling the motorised mirror mounts which are incorporated into the metrology beam expander blocks. A handset may be plugged into the mirror mount to be adjusted. If remote operation from outside the BCA is desired then further cabling and interfacing would be necessary.

11 Appendix

Two diagrams are appended:

Figure 1: showing the minimum size and preferred position of metrology table.

Figure 2: showing the relationship of the metrology table surface to the incoming science beam height.

Figure 3 showing the nominal metrology table height above the inner BCA floor.

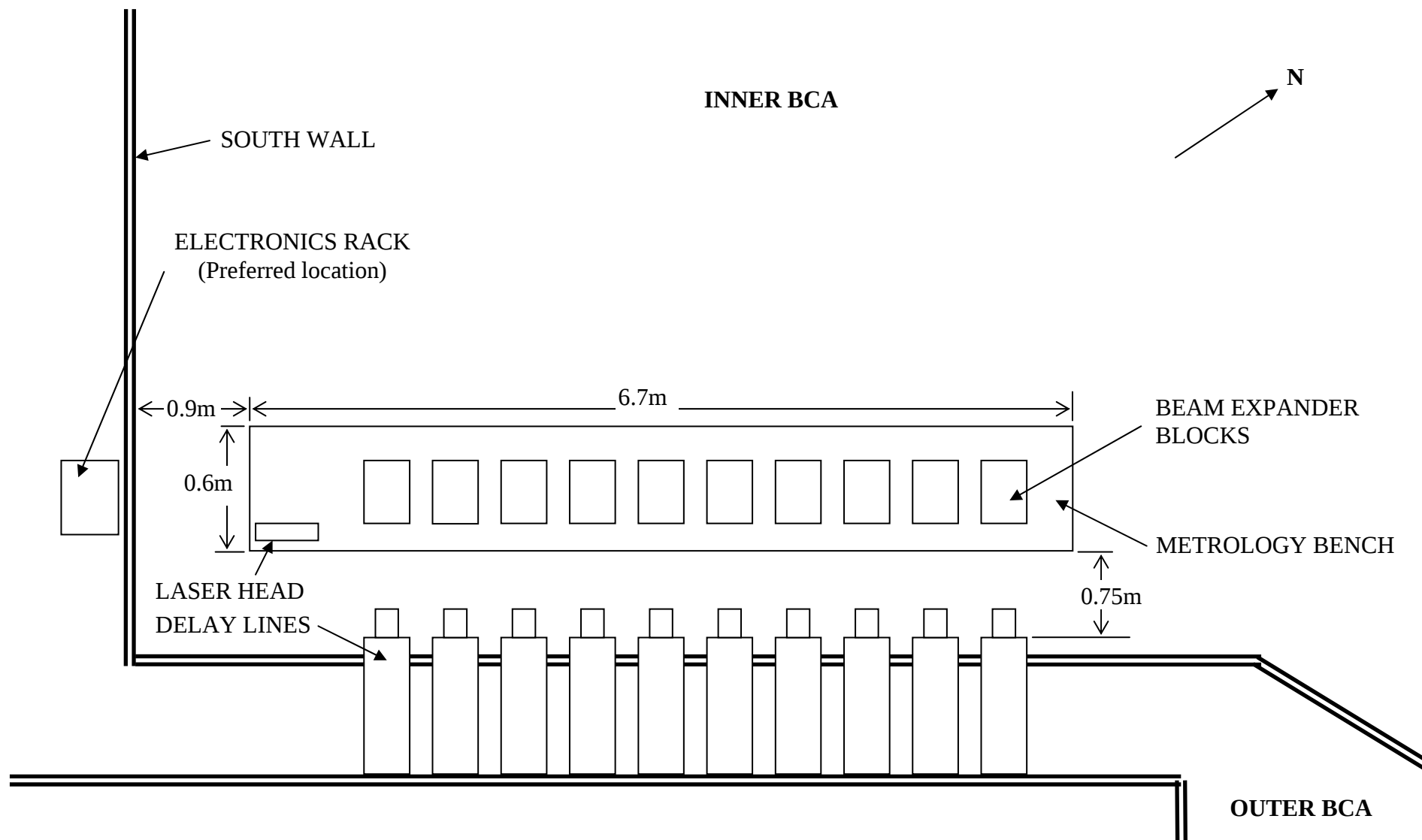


Figure 1 Placement of metrology table in the inner BCA

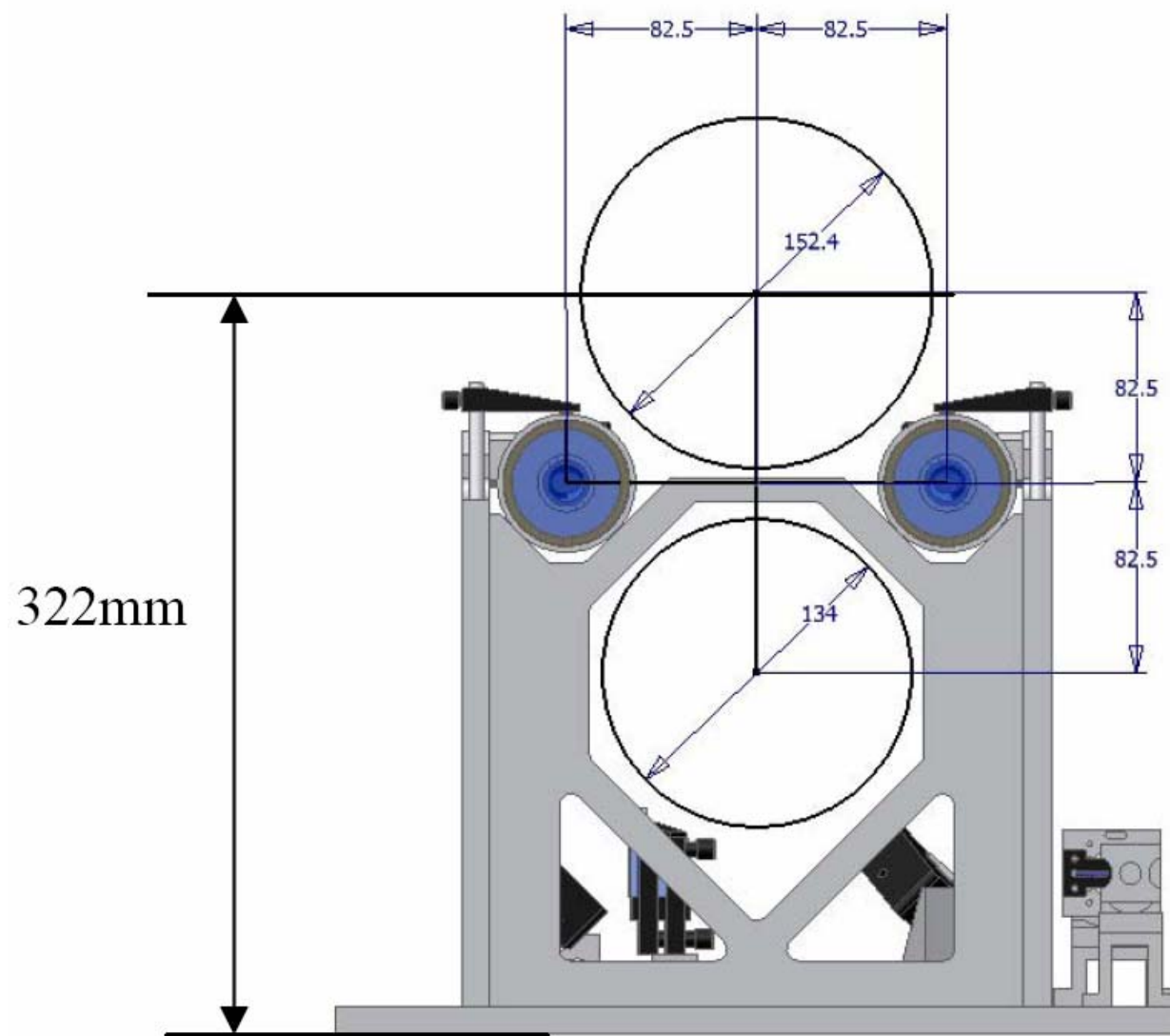


Figure 2 Position of the top surface of the metrology table with respect to the incoming science beam height (322mm).

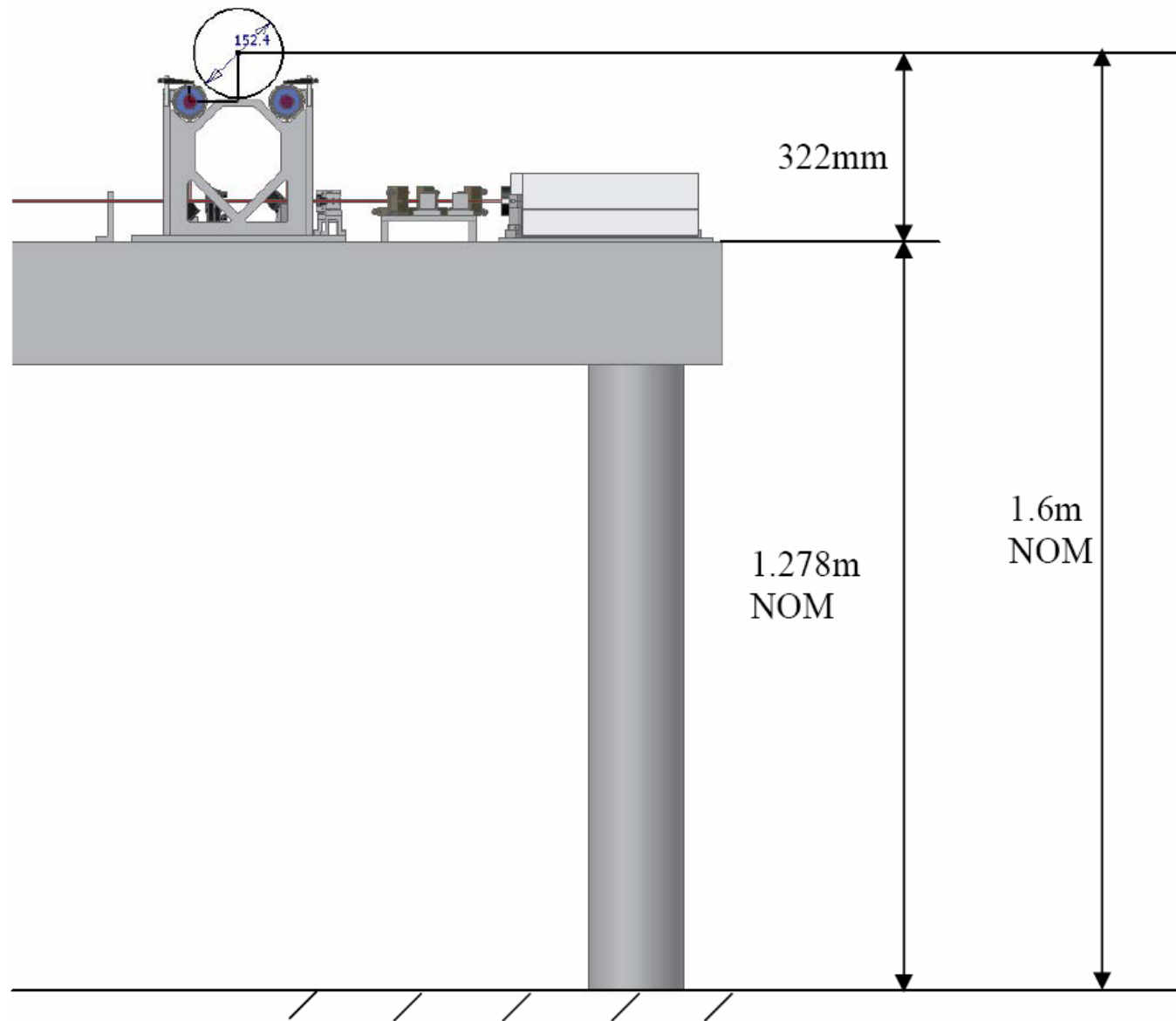


Figure 3 The nominal dimension for the metrology table height above the inner BCA floor.