Science & Technology Facilities Council

MICE – Moving Platform

- Engineering solution
  - A proposal

MICE – Moving Platform

This presentation covers:

- Design criteria/requirement
- Options available
- Design selection and decisions
- Detail design proposal presentation
  - Motion system
  - Lifting system
  - Alignment system
- Schedule
- Summary

MICE – Moving Platform

- **Problem/challenge**
  - Design a cost effective system to move the AFC (RFCC) out of the beam line sufficiently to permit maintenance access
  - The weight of the system (AFC) to be moved is estimated at 5000 kg (TBC)
  - It has to be moved approximately 3 meters
  - It must be stable and adhere to regulations and best practices
  - Returning the unit must be repeatable and accurate
  - Ideally there should be no items left when the unit is in operation to cause trip hazards
  - Crane usage to be avoided
  - Safe operation and ‘easy’ to use by as few people as possible
  - Interface with surroundings (Spectrometer, floor, etc) in a ‘non-obtrusive’ fashion

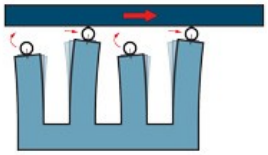
MICE – Options available

To move the modules out of the beam line, a linear motion is required.

The module must be secured to floor-beams during operation. This means the moving platform needs to be 'lifted off' the floor beams by a small amount. This 'breaks' the connection and permits the module to be 'pulled' out of the beam line.

Lifting methods:

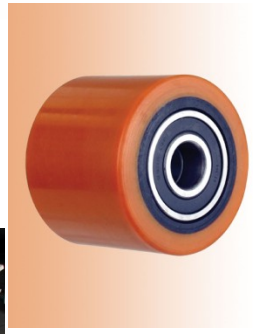
- Hydraulic or pneumatic jacks
- Jacking screws
- Belleville Spring washers
- Crane (and shims)
- Cam, sliding wedge (mechanical solutions)
- Hexapod struts
- Thin film hydro or walking piezo strips

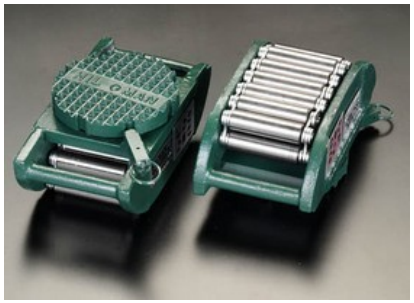


MICE – Options available

Moving methods:

- Rail system
  - Cross Roller
  - Linear Ball bearings
  - Profile Rail
- Wheels/Rollers
  - Omni directional
  - Railway
  - Palette
  - ‘Hillman’
- Conveyor
- Air





MICE – Design decision

Design decisions have been according to the requirement and design intend such as:

- Envelope
- Environment
- Cost
- Assembly
- Maintenance

Each has a different weighting and sub specifications influencing the design decisions.

Some options are discounted immediately and the remaining have had a ‘pro vs con’ analysis carried out.

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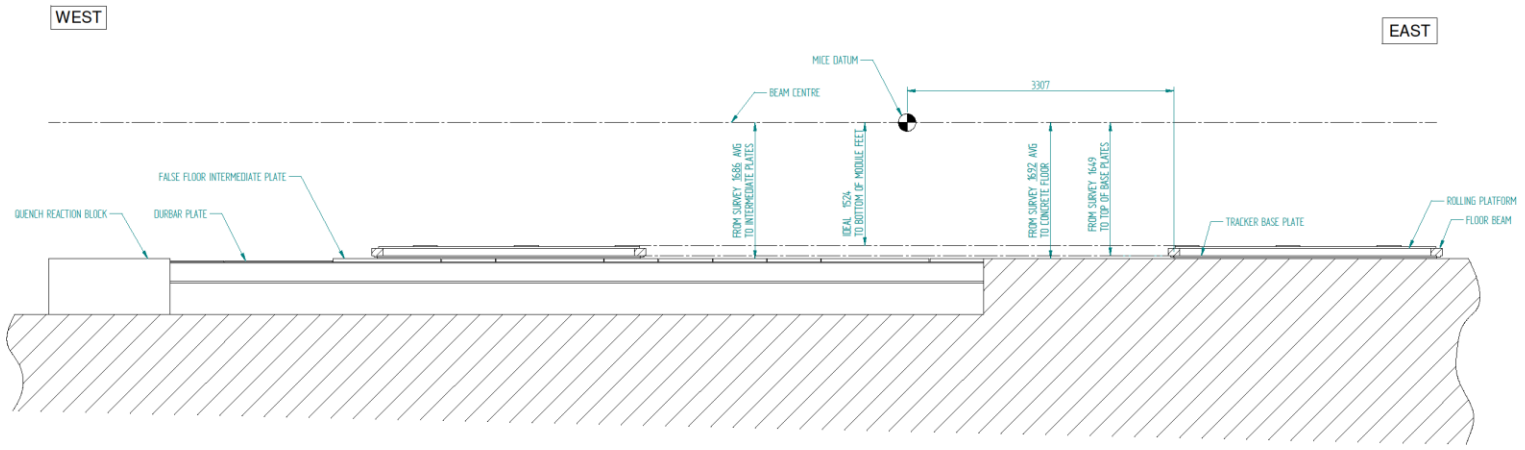
Drawing forms foundation of moving platform design



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HARWELL SCIENCE & INNOVATION CAMPUS, RUTHERFORD APPLETON LABORATORY, CHILTON, OXON, OX11 0QX							

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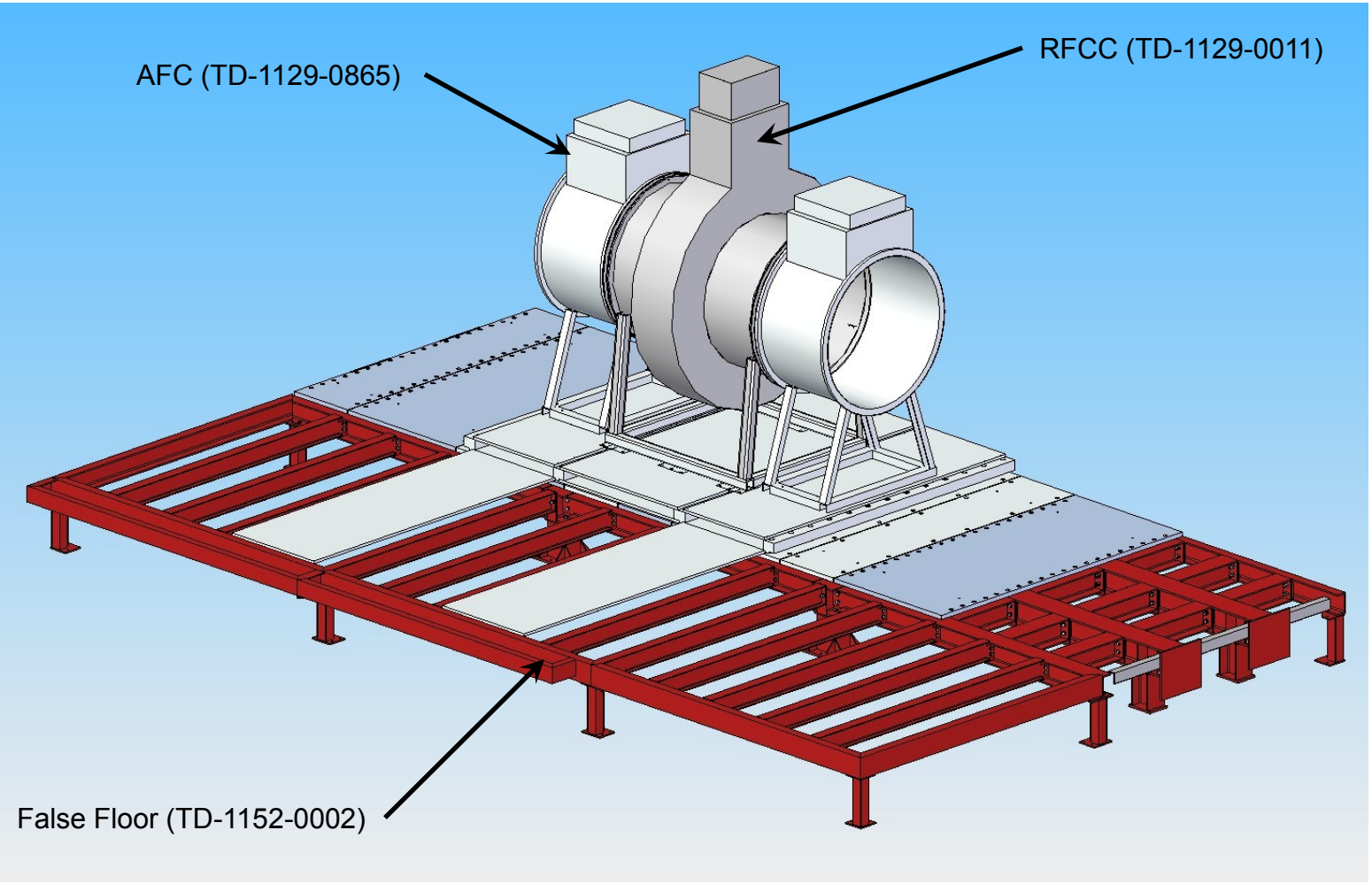
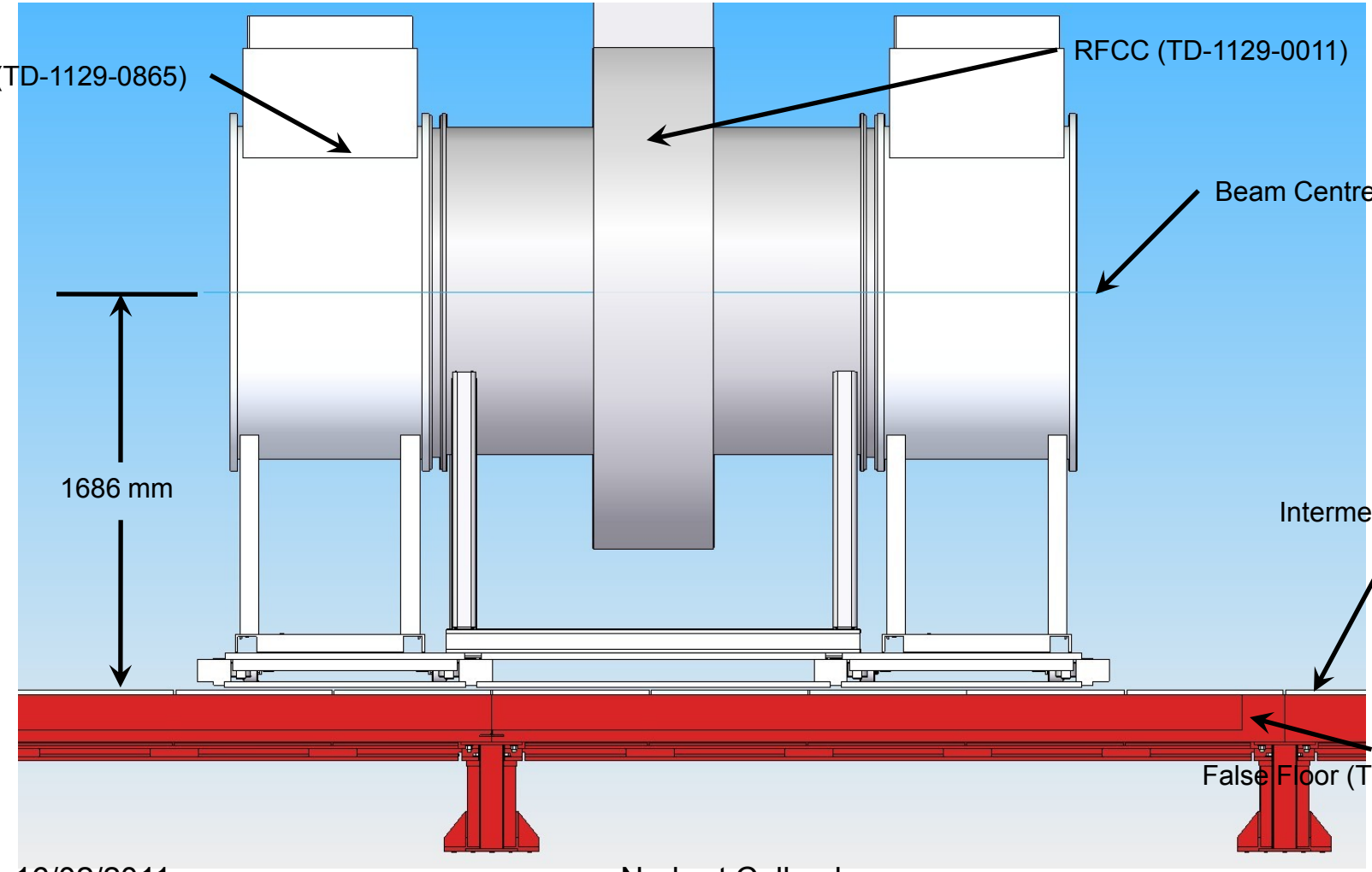
16/02/2011

Norbert Collomb

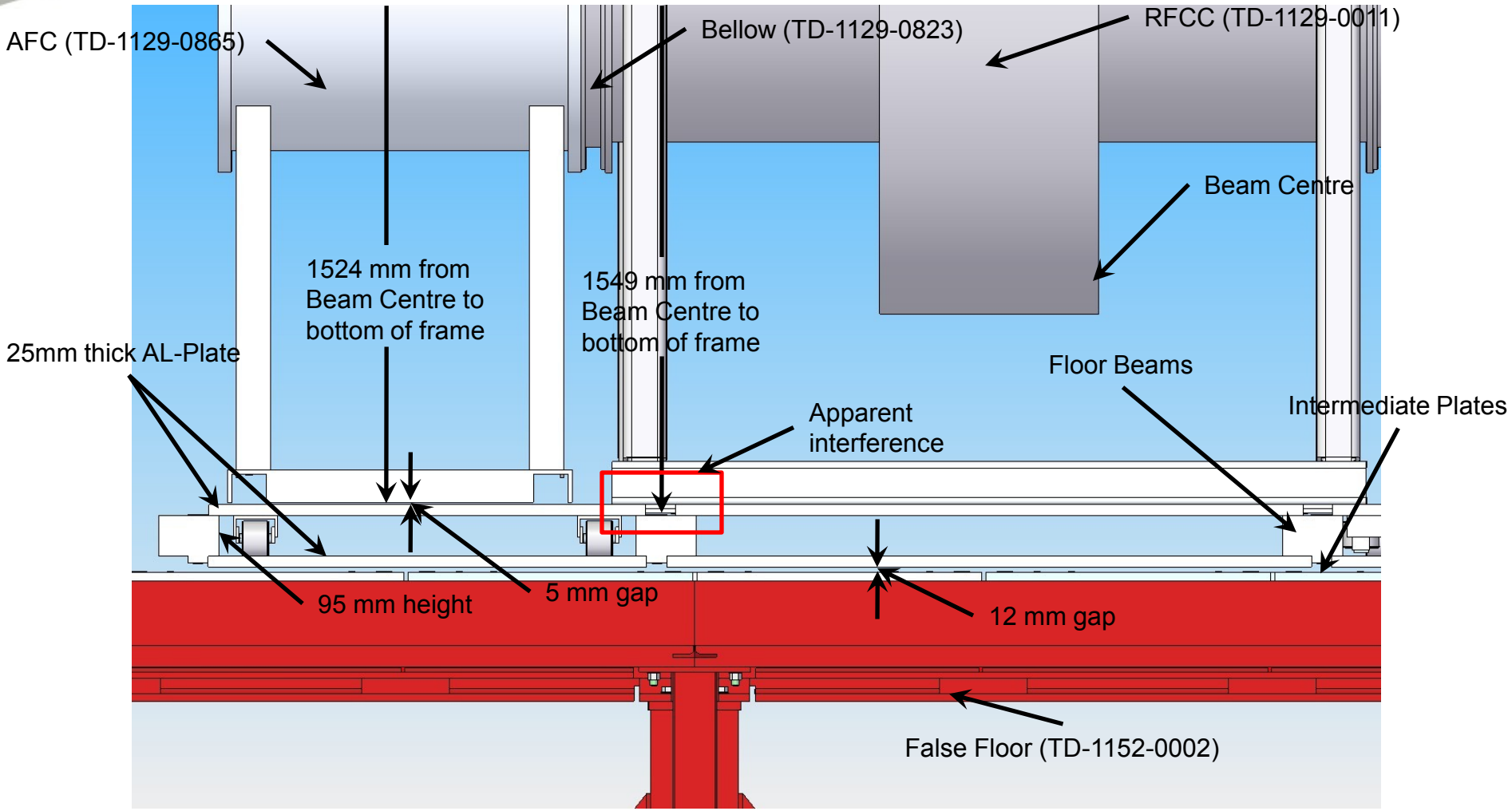
General Assembly serves as quick check to see how much space is available for the linear motion system.



Front view showing constraints in accordance with TD-1152-0831



Close up view showing dimension space for linear motion system



MICE – Design decision

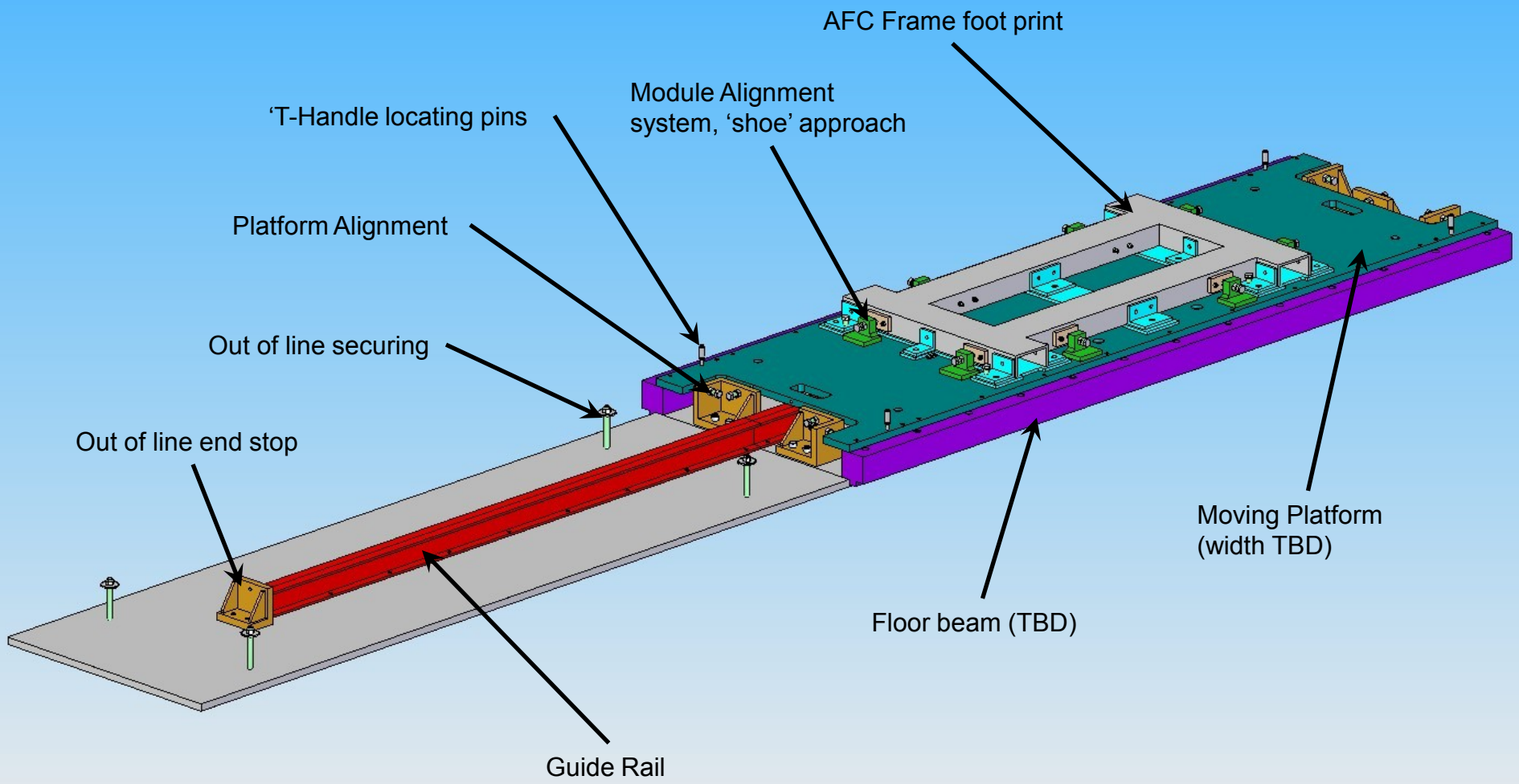
Two viable design sketches have been established and analysed (available upon request).

From the schematics a decision has been made to evaluate a combination of the two further.

Solution for schematic:

- Hydraulic low profile jacks
- Skates using Palette Rollers
- Central Guide Rail
- Platform alignment system
- Module alignment system
  - Includes AFC Base-frame ‘shoe’

MICE – Detail Design



MICE – Detail Design – Skate (x4)

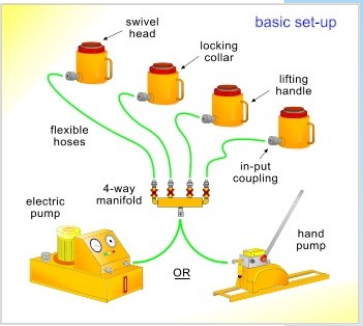
Linear Ball shaft fastened to moving platform plate

‘Off-the-shelf’ Aluminium channel

Hydraulic Jack, recessed and with Piston pad

Nylon Palette Rollers, low friction, 800kg carrying capacity each = 6400kg for 4 skates

Hydraulic arrangement

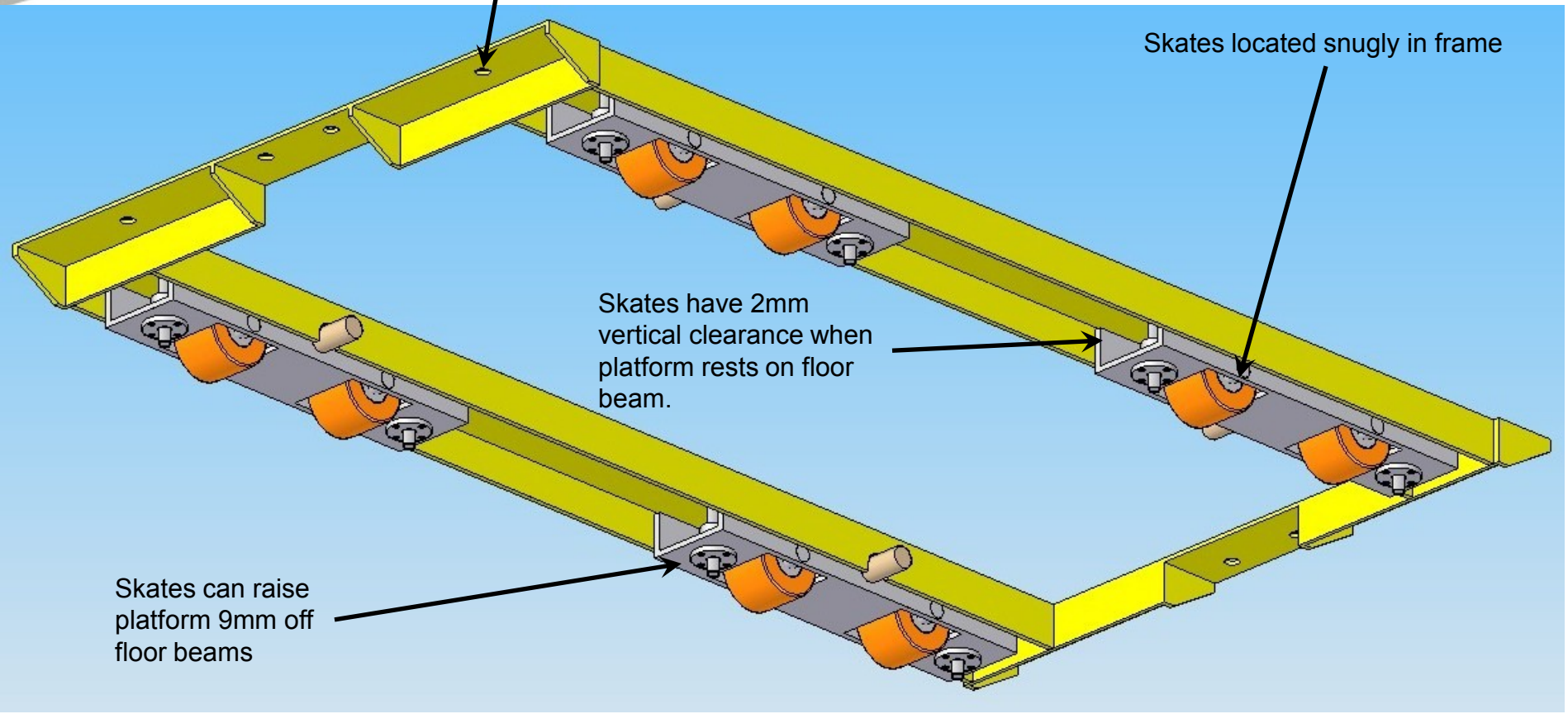


Hydraulic connector

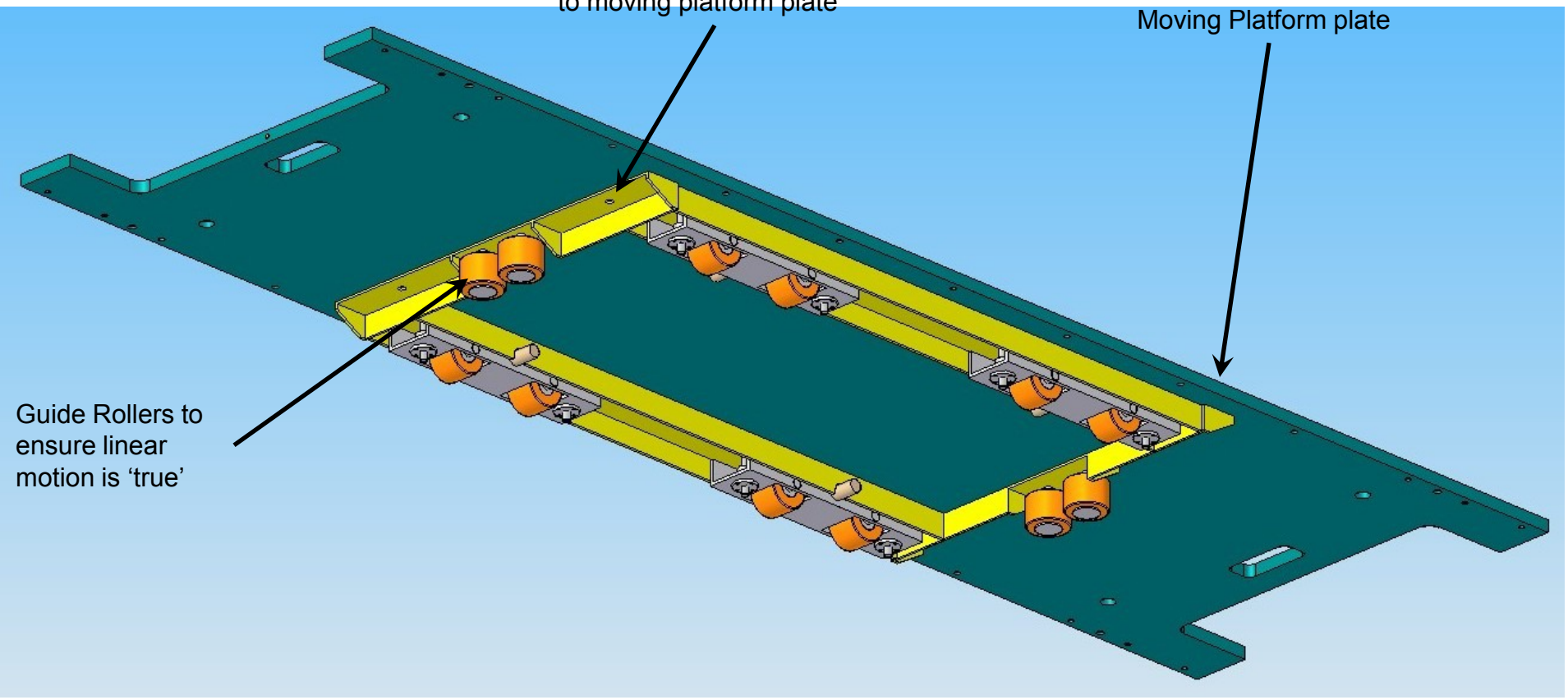
Out of line end stop

Linear Ball guides to prevent undesired steering

MICE – Detail Design - Frame

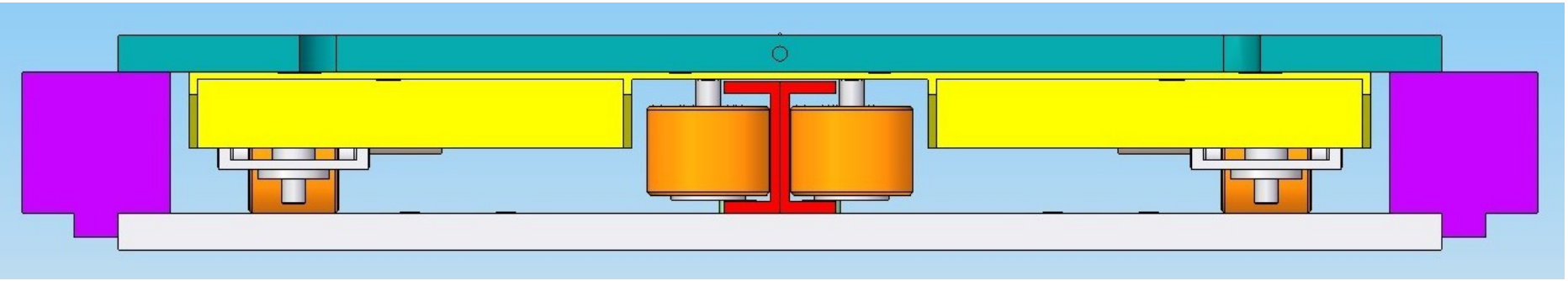


MICE – Detail Design

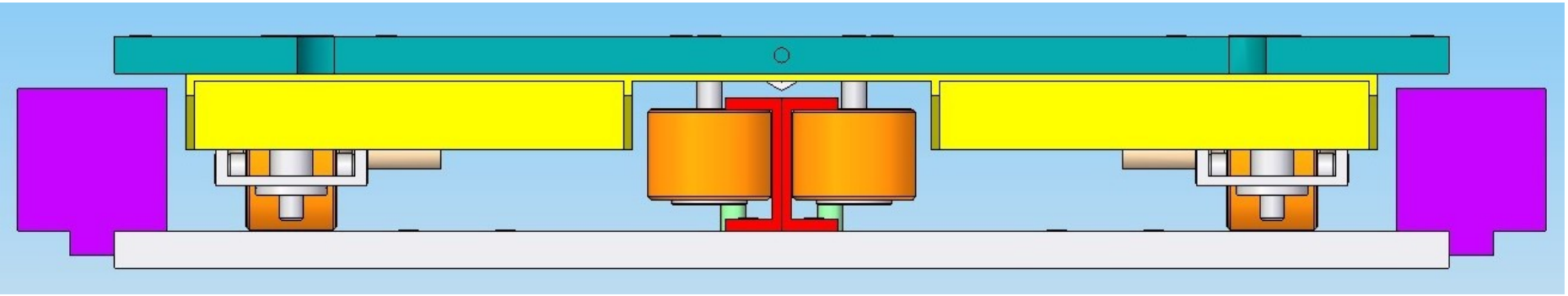


MICE – Detail Design – Guide Rails

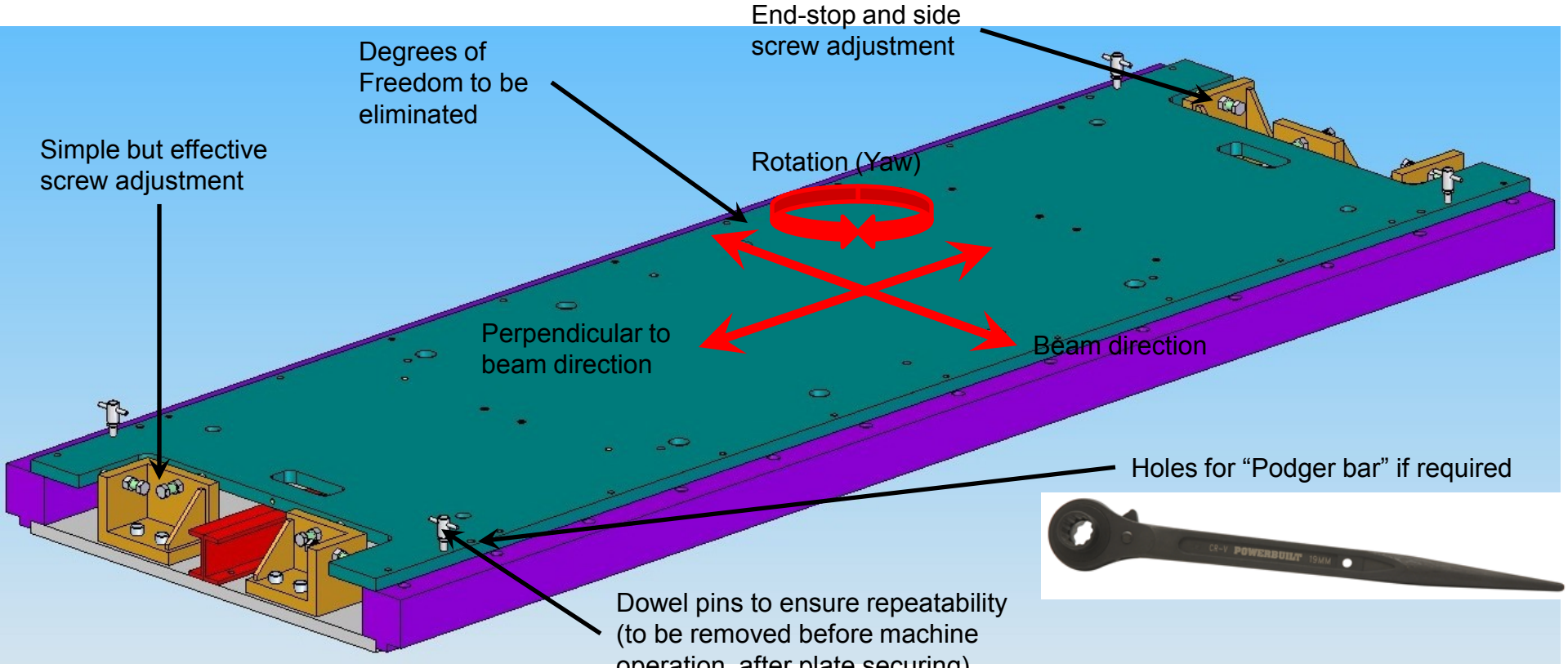
Platform in beam line just prior to vertical movement (lift). Skates can cater for 2mm ‘bumps’ before lifting platform.



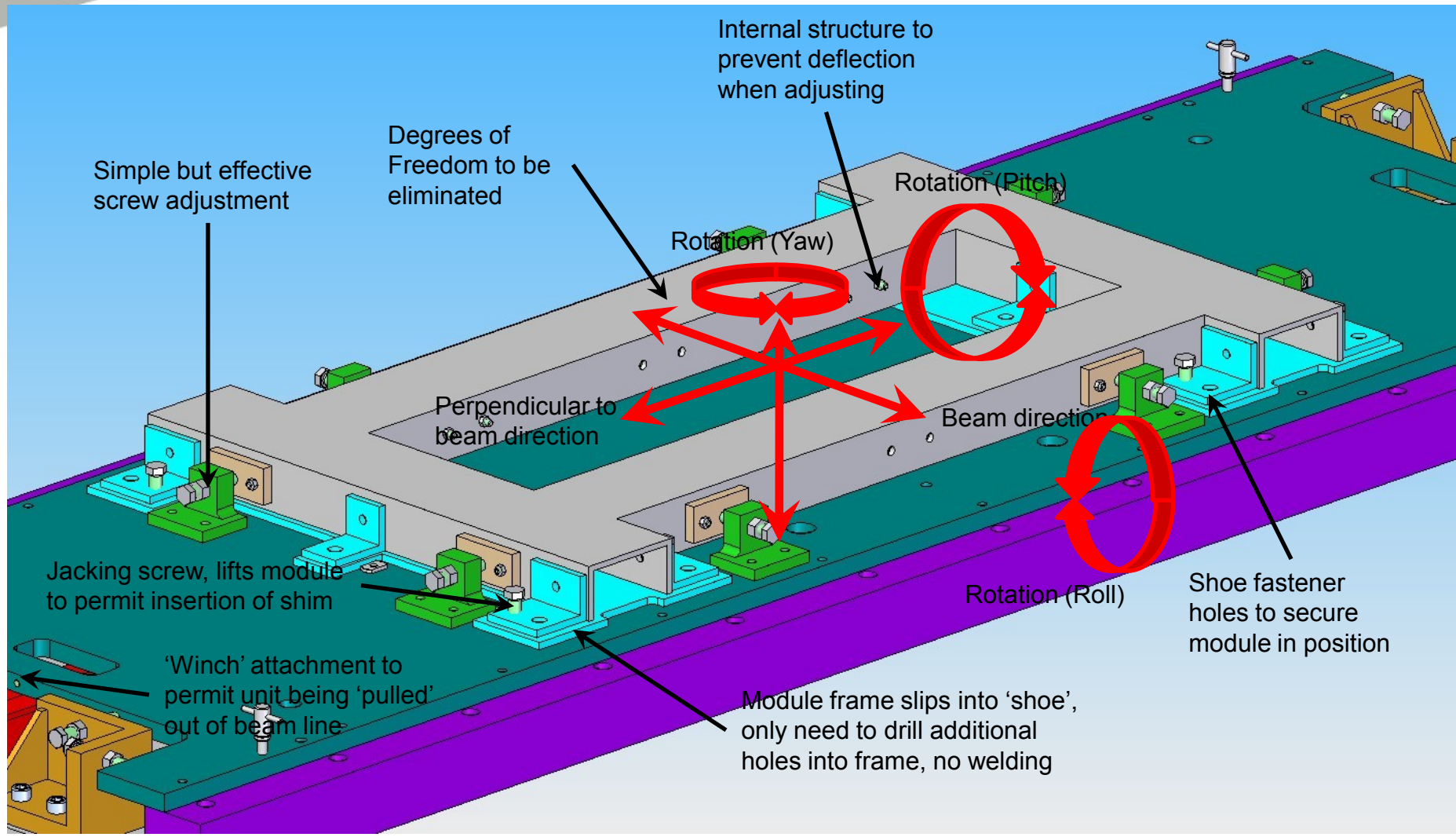
Platform raised by hydraulic jacks by 9mm. Guide Rail and Rollers prevent module from toppling (high centre of gravity).



MICE – Detail Design – Platform Alignment



MICE – Detail Design – Module Alignment



MICE – Sequence

- **Installation (simplistic)**
  - Assemble Skates, Frame and Moving Platform
  - Position Guide rail on intermediate plate(s)
  - Install Floor-beams
  - Roll platform into position
  - Position Platform alignment system
  - Secure Moving platform (in situ drilling)
  - Position Module alignment components (shoe)
  - Lower module into place (into shoe) and survey in
  - Secure module in position (fasten down)

MICE – Sequence

- **Operation (simplistic)**
- **Remove unit**
  - Position Guide rail on intermediate plate(s)
  - Remove Front alignment components
  - Remove Platform Fasteners
  - Raise platform
  - Attach strap/wire rope and winch module out of beam line (3m)
  - Secure Moving platform after lowering with corner fasteners
- **Return unit**
  - Remove corner fasteners
  - Winch unit back into position (alignment should be ‘slack’)
  - Use alignment system to position (approximate)
  - Use ‘Podger bar’ if required to align dowel (locating pin) holes
  - Secure unit with fasteners and remove locating pins

Science & Technology Facilities Council

MICE – Schedule

expand levels by clicking 1, 2, or 3

MICE Moving Platform schedule:

Level 1	Level 2	Level 3	Stat date:	expected end date:	Week No:	Duration:
Pre-requisites			24/01/2011		4 to TBC	TBC
	Moving Platform width to be confirmed		24/01/2011	17/02/2011	4 to 7	3
	Floor Beam position and outline to be confirmed		24/01/2011	17/02/2011	4 to 7	3
	Base-plate installation complete		TBC	TBC		
	Intermediate-plate installation complete		TBC	TBC		
Detail Design			24/01/2011	21/02/2011	4 to 8	3
	Model components		24/01/2011	04/02/2011	4 to 5	2
	Model assemblies		24/01/2011	04/02/2011	4 to 5	2
	Manufacturing drawings		24/01/2011	21/02/2011	4 to 8	3
		Component drawaings	31/01/2011	21/02/2011	4 to 8	3
		Assembly drawings	31/01/2011	21/02/2011	4 to 8	3
Costing			14/02/2011	07/03/2011	7 to 10	3
	Components		14/02/2011	07/03/2011	7 to 10	3
	Assemblies		21/02/2011	07/03/2011	8 to 10	2
	Bought out items		14/02/2011	28/02/2011	7 to 9	2
Procurement			07/03/2011	30/05/2011	10 to 22	12
	Manufactured Items		07/03/2011	30/05/2011	10 to 22	12
	Bought out items		07/03/2011	02/05/2011	10 to 18	8
Assembly			30/05/2011	20/06/2011	22 to 25	3
	Skates		30/05/2011	13/06/2011	22 to 24	2
	Frame		30/05/2011	20/06/2011	22 to 25	3
	Centre rail		30/05/2011	13/06/2011	22 to 24	2
	Stops and adjustment items		30/05/2011	13/06/2011	22 to 24	2
	Platform and Floor-beams including module alignment components		30/05/2011	13/06/2011	22 to 24	2
	End stops and alignment components		13/06/2011	20/06/2011	24 to 25	1
Documentation			07/03/2011	04/07/2011	10 to 27	17
	SHE		07/03/2011	25/03/2011	10 to 12	2
	Assembly		14/03/2011	28/03/2011	11 to 13	2
	Operation manual		20/06/2011	04/07/2011	25 to 27	2
	Maintenance manual		07/03/2011	01/04/2011	10 to 13	3
	Risk and other assessments		07/03/2011	01/04/2011	10 to 13	3
Installation and Trial			20/06/2011	11/07/2011	25 to 28	3
	Orientation (survey)		20/06/2011	27/06/2011	25 to 26	1
	Load trial		20/06/2011	27/06/2011	25 to 26	1
	Align		27/06/2011	04/07/2011	26 to 27	1
	In-situ "drilling/tapping/reaming/etc.		04/07/2011	11/07/2011	27 to 28	1

MICE – Summary

The design presented is feasible with minor validation work to be completed (platform width to be confirmed, stress calculations to be carried out, some features added, floor beams designed).

It is a cost effective solution compared to alternatives we initially investigated.

It may not be the most operator friendly system, however, the frequency at which the unit may be moved out of and returned into the beam line does not warrant a Rolls Royce design.

Process and procedural documentation will need to be written taking into consideration SHE and other regulations.

A trial must be carried out with the AFC to ensure the system can be adopted for the RFCC (a backup “design” is in place).

Thank you for your attention. Questions?