AMS-02 Tracker Integration Status

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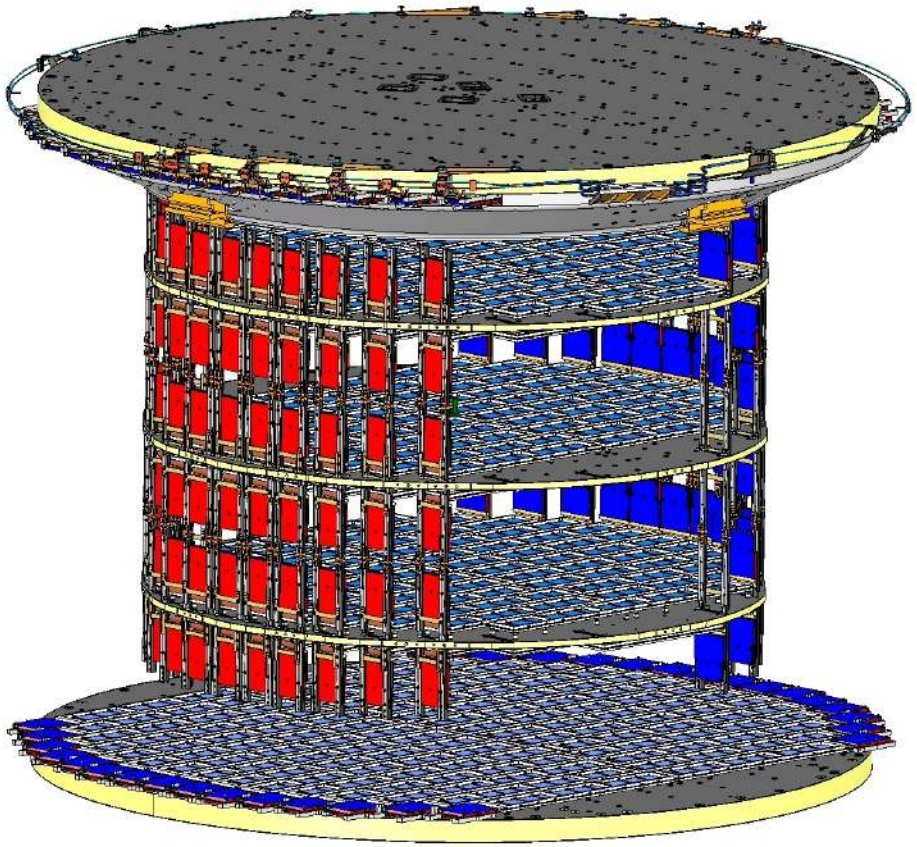
The AMS-02 Silicon Tracker:

2500 double-sided-silicon-microstrip sensors arranged in 192 ladders, installed in eight layers of about 1 m² each, on five planes of an ultra-light support structure.



PLANE 1, Layer L1

PLANE 2, Layers L2 L3

PLANE 3, Layers L4 L5

PLANE 4, Layers L6 L7

PLANE 5, Layer L8

Summary of silicon ladders production:

•2001-2004 :

UNIVERSITY and INFN PERUGIA: 13 ladders
UNIVERSITY of GENEVA: 18 ladders
G&A Engineering (Italy): 163 ladders

•2005:

G&A Engineering (Italy): 17 ladders

Ladders production flow:

Qualification tests on ladder components (Perugia/Geneva)

↓

Ladder assembly (G&A Engineering)

↓

Qualification tests on ladders (Perugia)

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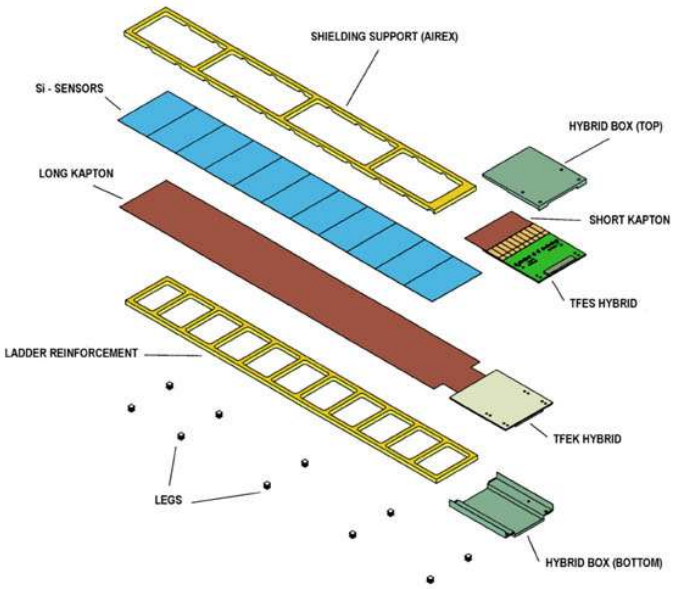
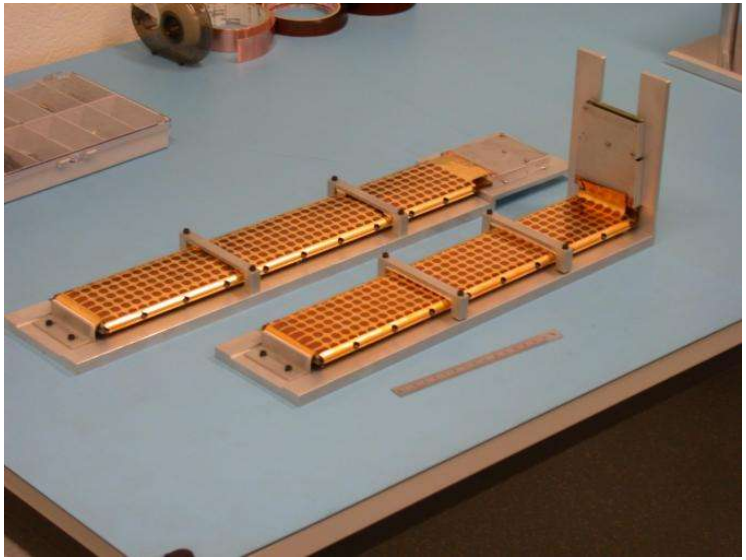
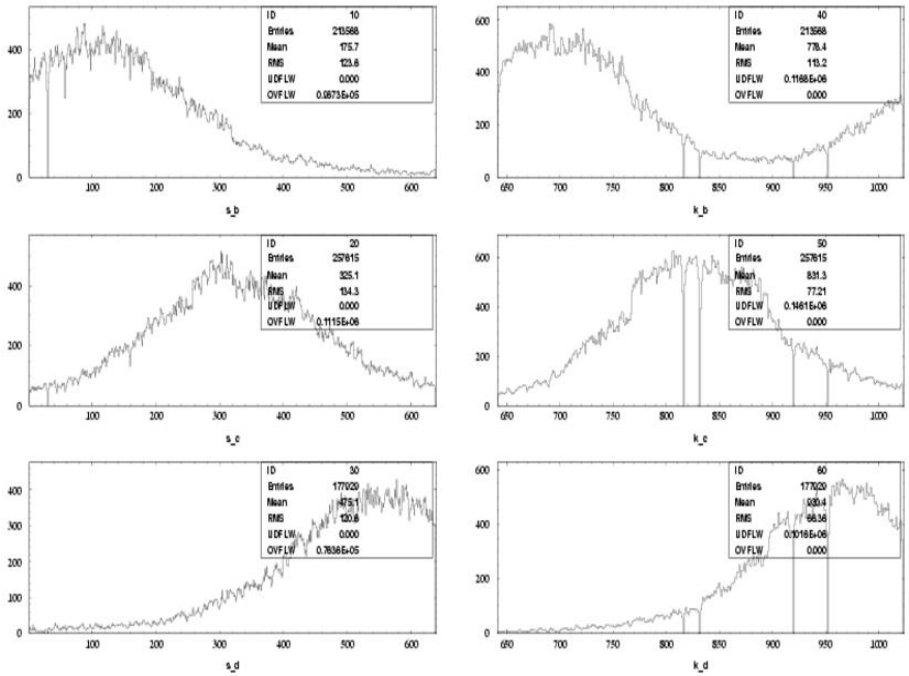
- Phase-2 (legs, hybrid box)
- Shielding
- Integration on planes
- Qualification tests after each step (Geneva)

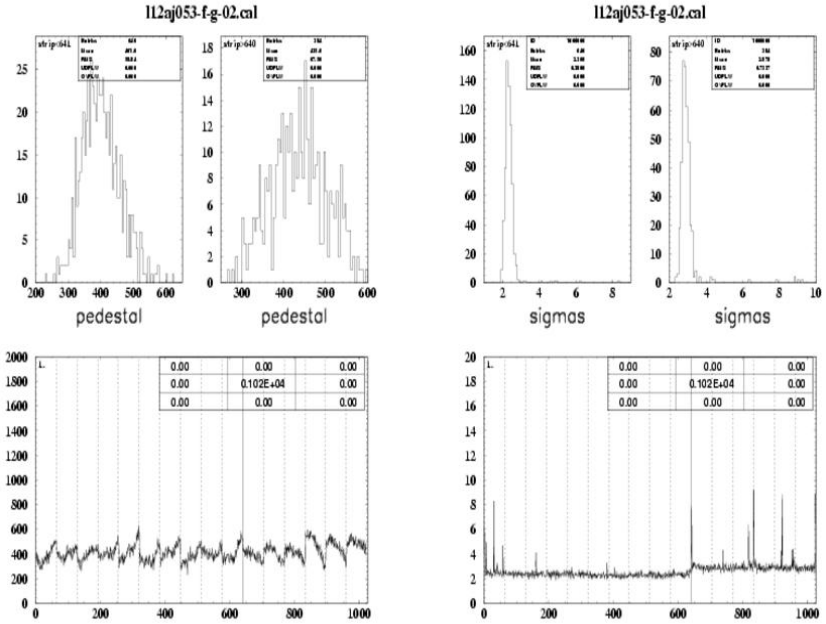




Qualification tests:

- Visual inspection
- Metrology
- Calibration
- Test with radioactive source





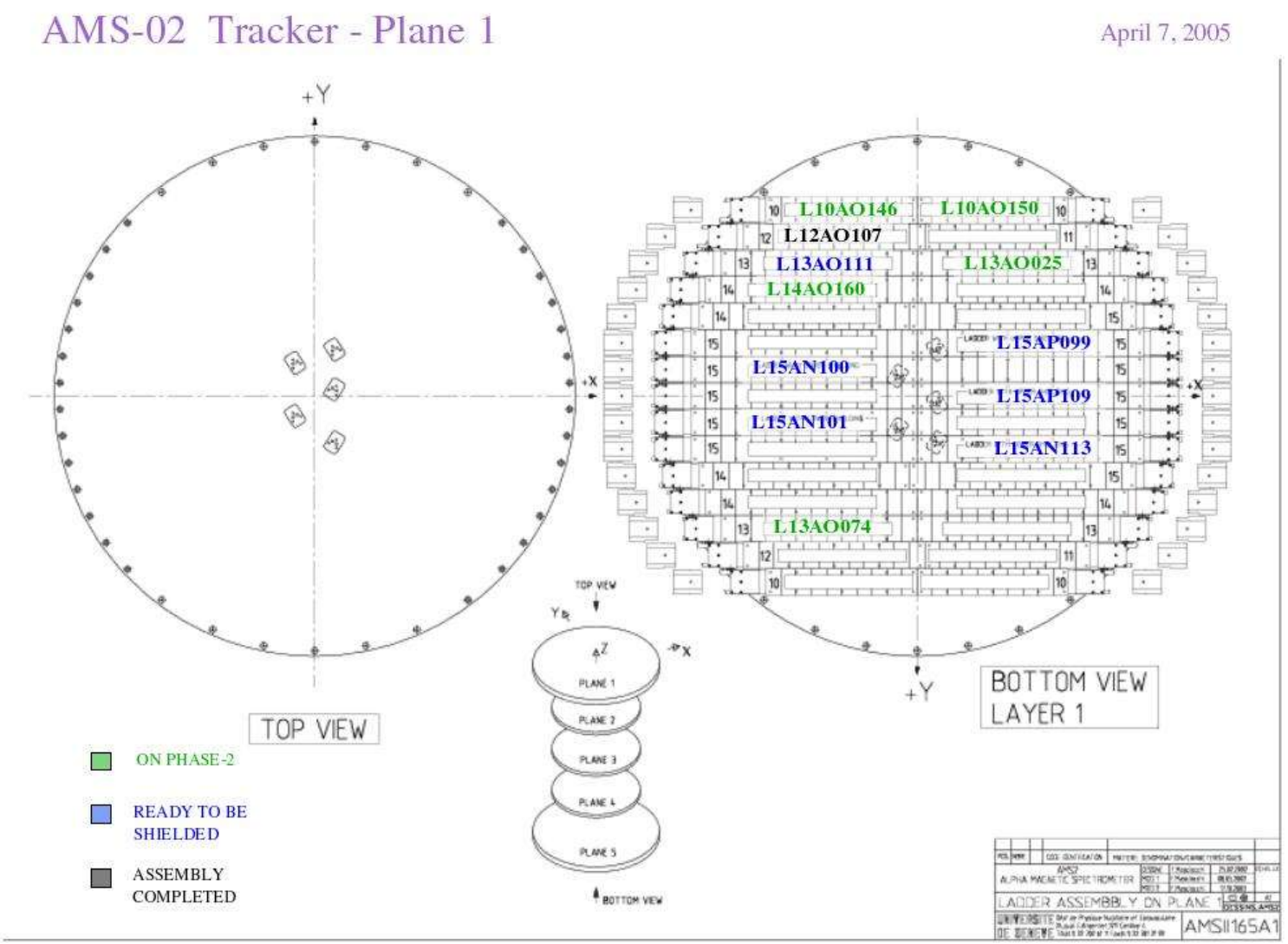
Acceptance criteria:

- mechanical precision 5 μm
- less than 5% bad channels
- good sensitivity to source

Summary of silicon ladders in Geneva:

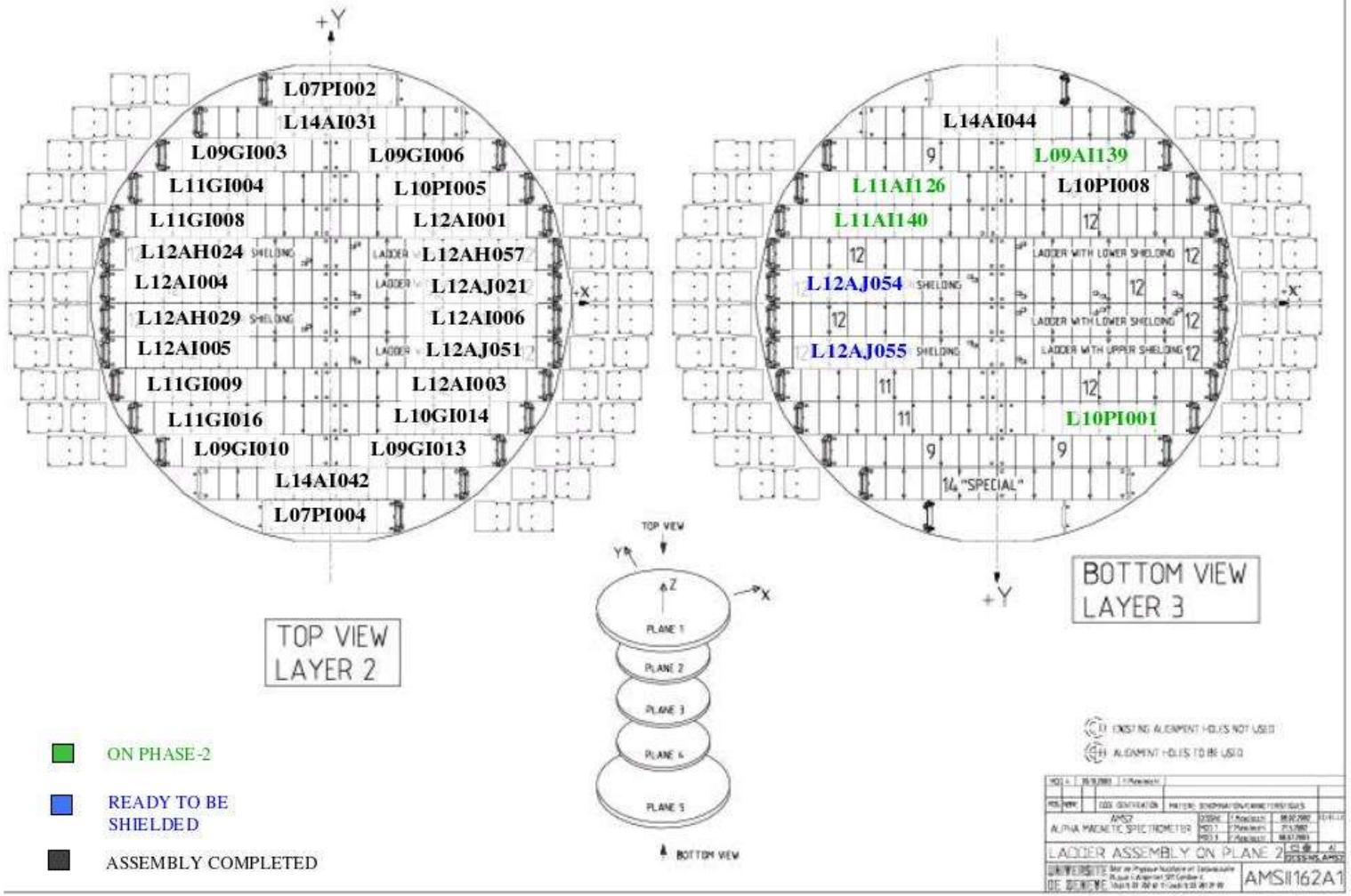
- Installed on planes: 88
- Assembly completed: 24
- Ready to be shielded: 21
- On phase-2: 20
- Under tests: 12

End of ladder assembly: End of July 2005


AMS-02 Tracker - Plane 1
April 7, 2005
+Y
+X
TOP VIEW
L10AO146
L10AO150
L12AO107
L13AO111
L13AO025
L14AO160
L15AP099
L15AN100
L15AP109
L15AN101
L15AN113
L13AO074
+Y
+X
BOTTOM VIEW
LAYER 1
TOP VIEW
PLANE 1
PLANE 2
PLANE 3
PLANE 4
PLANE 5
BOTTOM VIEW
ON PHASE-2
READY TO BE SHIELDED
ASSEMBLY COMPLETED
ALPHA MAGNETIC SPECTROMETER
LADDER ASSEMBLY ON PLANE 1
AMSII165A1

AMS-02 Tracker - Plane 2

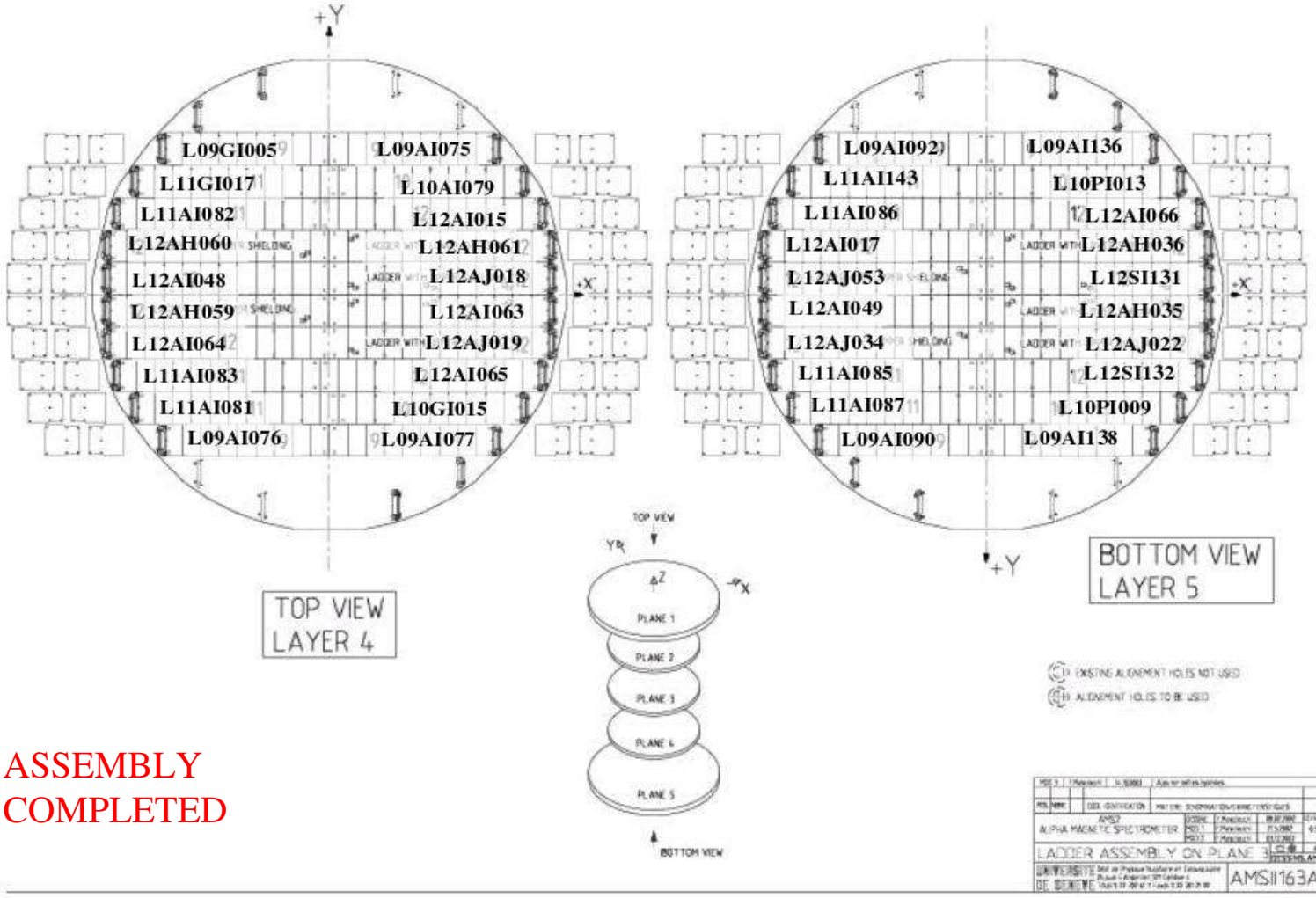
April 7, 2005



Plane 2 - Layer L2

AMS-02 Tracker - Plane 3

October 14, 2004

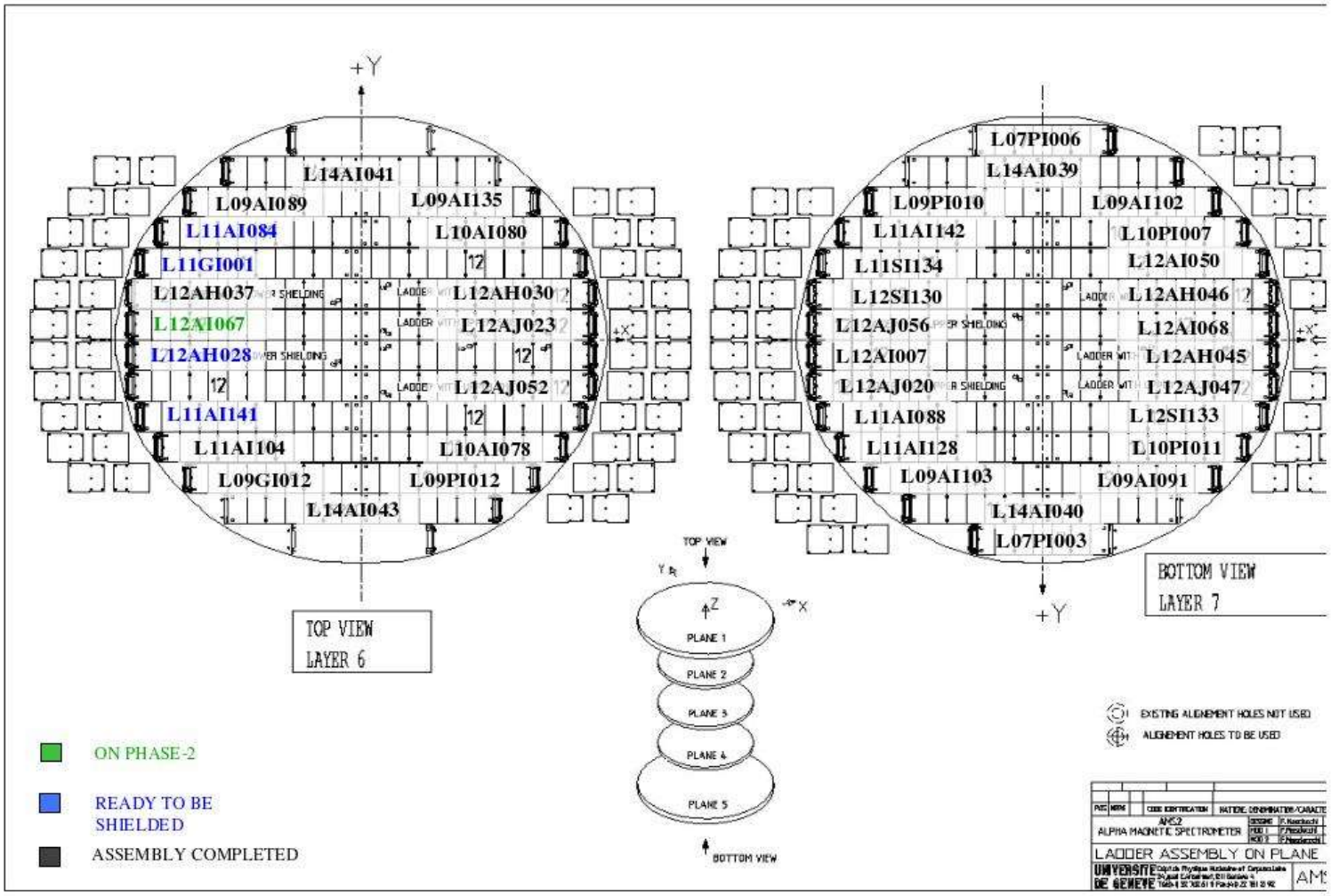


ASSEMBLY
COMPLETED

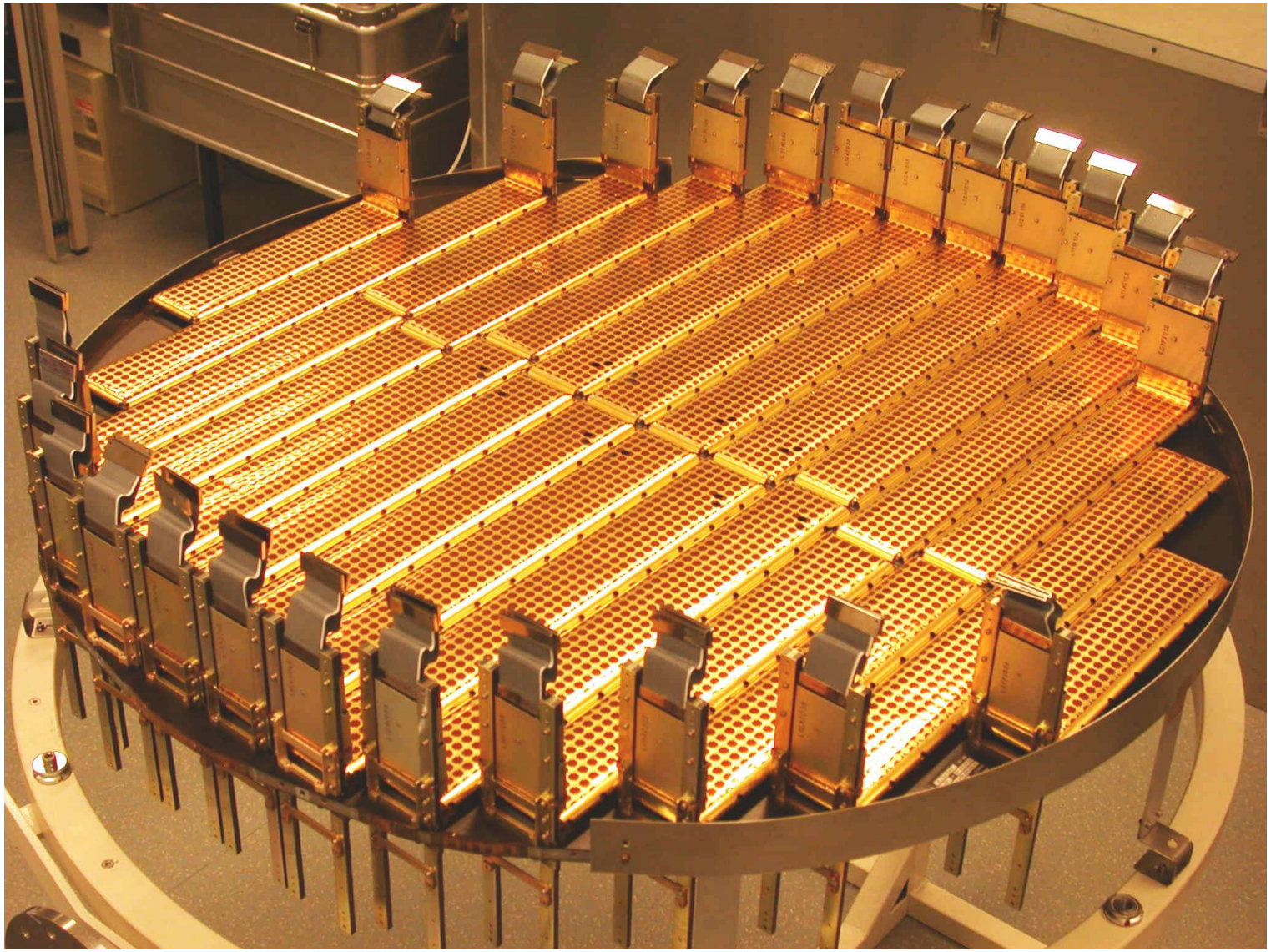
Plane 3 being stored

AMS-02 Tracker - Plane 4

April 7, 2004

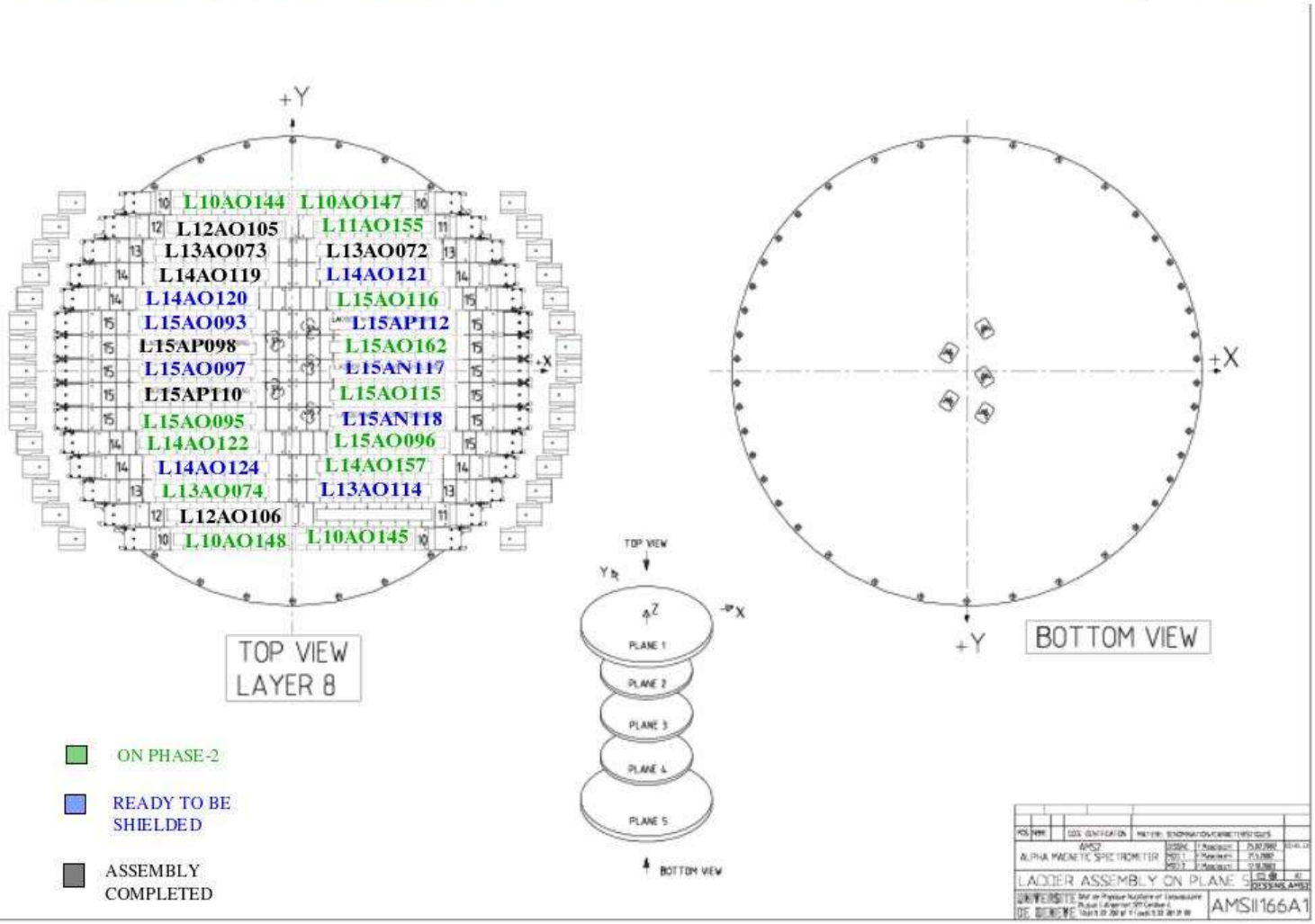


Plane 4 – Layer L7



AMS-02 Tracker - Plane 5

April 7, 2005



Inner planes:

All three planes being equipped with ladders

- Plane 2:
  - Layer L2: installation completed
  - Layer L3: 2/22 ladders ready to be installed
    2/22 on shielding
    4/22 on phase-2
    14/22 under tests or being produced
- Plane 3: installation completed
- Plane 4:
  - Layer L7: installation completed (under qualification test)
  - Layer L6: 13/22 ladders ready to be installed
    4/22 on shielding
    1/22 on phase-2
    4/22 under tests or being produced

Outer planes:

Ready to be equipped with thermal bars

Light tightness method still to be tested and applied between thermal bars and plane.

Al plates to be bonded between plane and thermal bars to improve thermal contact.

- Plane 1:

  Layer L1: 1/30 ladders ready to be installed
  6/30 on shielding
  5/30 on phase-2
  18/30 under tests or being produced

- Plane 5:

  Layer L8: 7/30 ladders ready to be installed
  9/30 on shielding
  13/30 on phase-2
  1/30 under tests

Tracker shell:

Ready

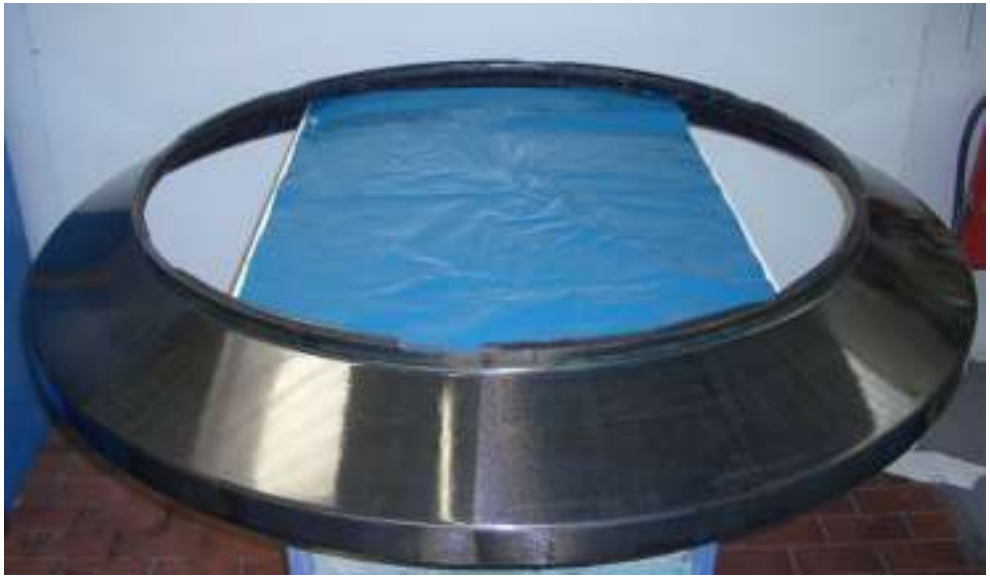
Conical flanges:

The two flanges have been laminated by FVT (Aachen)

All the 300 inserts have been produced (Geneva)

Machining under way:

delivery to Geneva end of April



Dry assembly of the Tracker:

To verify the interfaces

To gain experience for integration

Conical flanges to shell. Complete assembly of the 4 shell sectors + the two conical flanges + the spare inner plane empty.
+Z conical flange to Plane 1
-Z conical flange to Plane 5
-> Driven by conical flanges availability

Top conical flange to Star-Tracker support

Evaporator assembly and tooling to Tracker

Star-Tracker supports have to be bonded to the +Z conical flange

Assembly of the 3 inner planes with the shell:

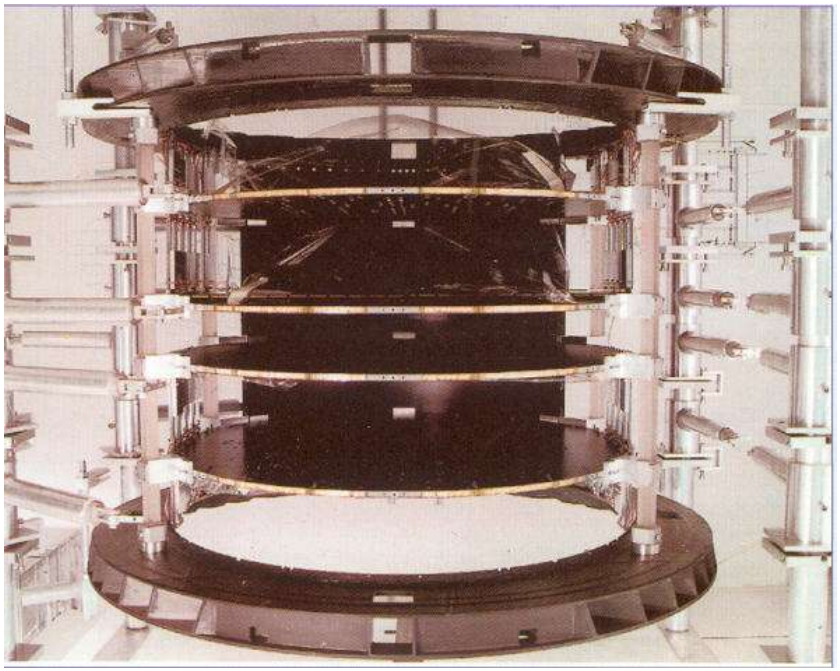
- Not a self supported assembly
- Use of the "Frankenstein machine" foreseen
- This procedure is currently reviewed in more details (be as simple as possible)
  - Handling of planes and their safe transfer into the "Frankenstein" machine
  - Cables installation will be done into the "Frankenstein" machine

Mount conical flanges:

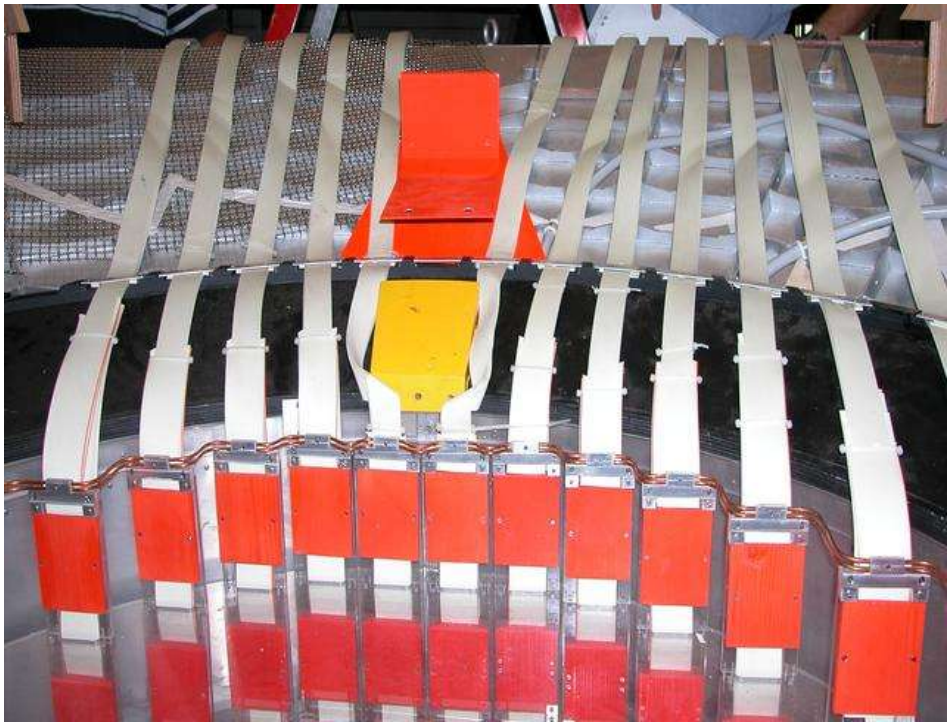
- To make Tracker transportable

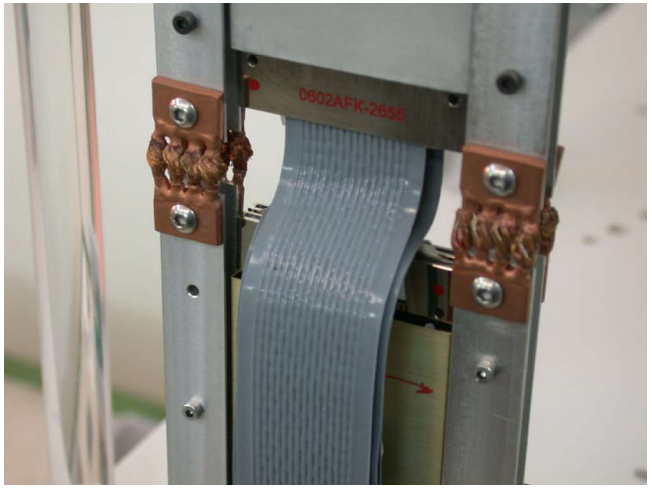
We need to apply a reflecting foil on the outside surface of the shell and of the conical flanges

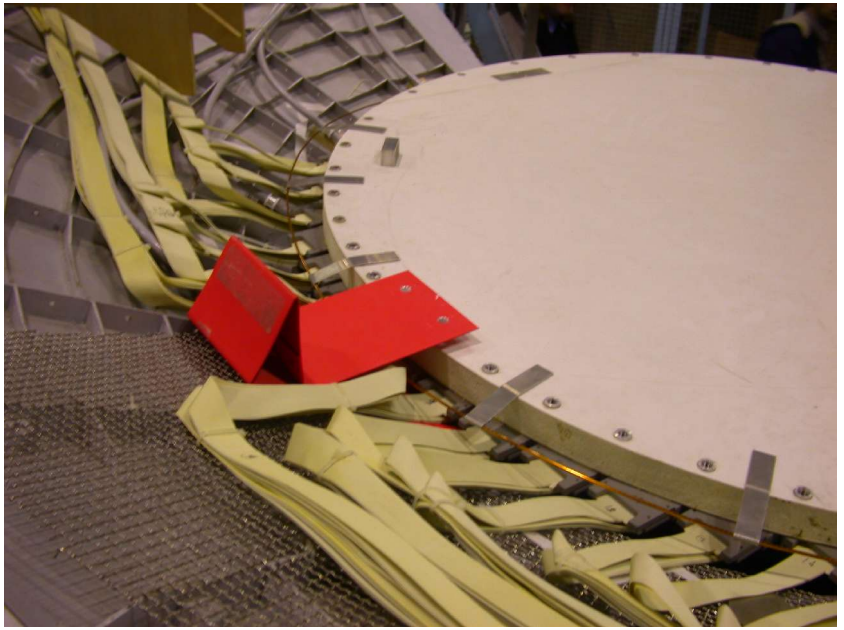
- Spec to be defined



Tracker Cabling

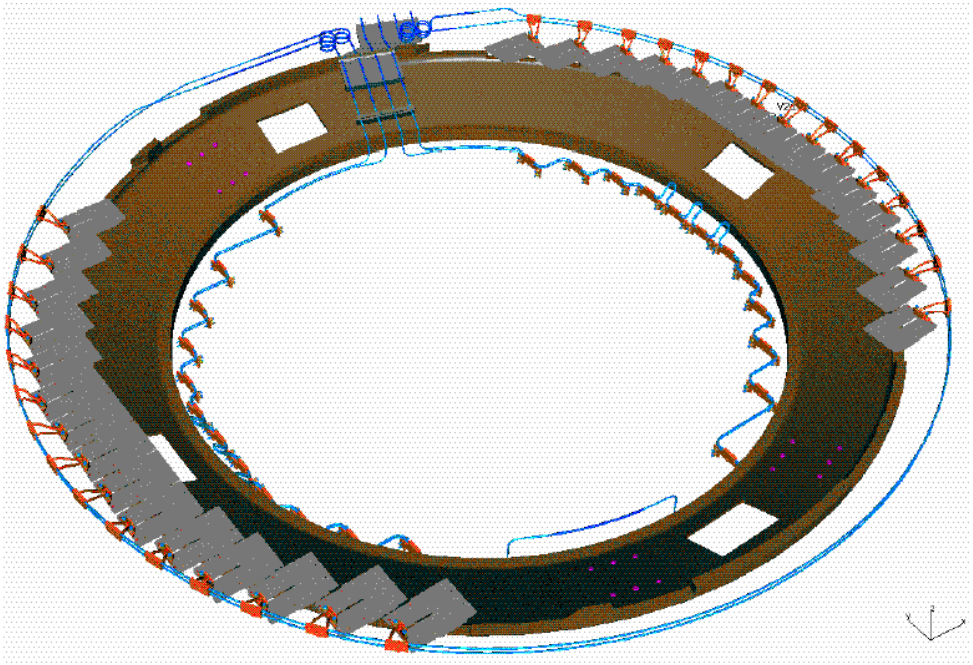






At this stage we will make dry assembly of the top evaporators + Plane 1 to verify the interfaces and prepare final integration:

- Arrange services
- Fasten inner loops to thermal bars/ remove ladder protection
- Mount and fasten Plane 1
- Fasten outer loops to Plane 1
- Dismantle in reverse order



Material needed to assemble/transport the Tracker:

Modification of the "Frankenstein machine"

- Lifting platform?

Transport container (spec to be issued)

- Inner Tracker + two conical flanges
- Supported by the bottom conical flange
- Supported by rubber blocks

Schedule :

Dry assembly of Tracker structure: May-June 2005

Bonding of Star-Tracker brackets: Summer 2005

All 5 planes complete: September 2005

Inner Tracker assembled: Autumn 2005

Evaporators dry assembly: End of 2005

At this stage the Tracker will be ready for transport to CERN
Inner Tracker + conical flanges in a special container to be made
Planes 1 and 5 in their existing containers