

Useful numbers in ICARUS 600T

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Introduction.

This technical note is intended to define and to remember multiplicities of wires, connectors, flanges, printed circuit board cards, etc. for the design, the commissioning and the assembling of detector details.

1. Wire chambers and orientation.

Numbering of chambers and ordering of wires is better made once the orientation of the detector inside the LNGS hall is defined. (It can result practical to define the final orientation since the moment of loading the cold bodies on the trucks for their transport from Pavia to LNGS). As a working hypothesis and a proposal, in the following, let's consider the Icarus 600T detector aligned along the CERN-LNGS line and with the opening doors (*Front*) toward the CERN.

The Icarus 600T detector is split into two LAr filled volumes. In each volume there is a central vertical plane cathode and two wire chambers, one at each side. When looking from CERN we call the four chambers so resulting, from left to right, as WCH-1, WCH-2, WCH-3 and WCH-4.

Each chamber is built of three wire planes (see figure 1, 2). By ordering along the drift (from the cathode to the walls) the wire plane names and the wire orientations are defined as follows:

- **Induction-1**, with wires at 0° (horizontal),
- **Induction-2**, with wires inclined at 120° from *Top-Front* to *Bottom-Back*,
- **Collection**, with wires inclined at 240° from *Bottom-Front* to *Top-Back*.

2. Combs, printed circuit boards (PCB) and connectors.

In all wire planes, the wires are anchored, at the two ends, to stainless steel pins that are inserted in insulating combs in groups of 32. In the case of the **Induction-1**, the wires are split into two 9-meter long segments. The two segments are mechanically attached trough an insulating double hook. The resulting number of wires for each kind of plane is:

- **Induction-1.**

$$4(\text{chambers}) \times 2(\text{segments}) \times 33(\text{groups}) \times 32(\text{wires/group}) = \underline{\hspace{2cm}} \quad 264 \times 32$$

$$\text{Pin pitch: } \underline{\hspace{10cm}} \quad 3 \text{ mm}$$

$$\text{Groups: } \underline{\hspace{10cm}} \quad 264$$

$$\text{Wires: } \underline{\hspace{10cm}} \quad 8448$$

- **Induction-2** (with top ends anchored on horizontal sides).

$$4(\text{chambers}) \times 9(2 \text{ m modules}) \times 18(\text{groups/module}) \times 32(\text{wires/group}) = 648 \times 32$$

$$\text{Pin pitch: } \underline{\hspace{10cm}} \quad 3.46 \text{ mm}$$

$$\text{Groups: } \underline{\hspace{10cm}} \quad 648$$

$$\text{Wires: } \underline{\hspace{10cm}} \quad 20736$$

- **Induction-2** (with top ends anchored on vertical sides, *triangles*).

$$4(\text{chambers}) \times 17(\text{groups}) \times 32(\text{wires/group}) = \underline{\hspace{2cm}} \quad 68 \times 32$$

$$\text{Pin pitch: } \underline{\hspace{10cm}} \quad 6 \text{ mm}$$

$$\text{Groups: } \underline{\hspace{10cm}} \quad 68$$

$$\text{Wires: } \underline{\hspace{10cm}} \quad 2176$$

- **Collection** (with top ends anchored on horizontal sides).

$$4(\text{chambers}) \times 9(2 \text{ m modules}) \times 18(\text{groups/module}) \times 32(\text{wires/group}) = 648 \times 32$$

$$\text{Pin pitch: } \underline{\hspace{10cm}} \quad 3.46 \text{ mm}$$

$$\text{Groups: } \underline{\hspace{10cm}} \quad 648$$

$$\text{Wires: } \underline{\hspace{10cm}} \quad 20736$$

- **Collection** (with top ends anchored on vertical sides, *triangles*).

$$4(\text{chambers}) \times 15(\text{groups}) \times 32(\text{wires/group}) = \underline{\hspace{2cm}} \quad 68 \times 32$$

$$\text{Pin pitch: } \underline{\hspace{10cm}} \quad 6 \text{ mm}$$

$$\text{Groups: } \underline{\hspace{10cm}} \quad 68$$

$$\text{Wires: } \underline{\hspace{10cm}} \quad 2176$$

3. Global numbers.

Total number of wires	54272
Total number of groups of 32	1696
N° of combs with 3 mm pitch	264
N° of combs with 3.46 mm pitch	1296
N° of combs with 6 mm pitch	136
N° of PCB's, 3 mm pitch (signal cable connector, calibration 2)	264
N° of PCB's, 3.46 mm pitch (signal cable connector, calibration 2)	1296
N° of PCB's, 3.46 mm pitch (calibration 1)	1296
N° of PCB's, 6 mm pitch (signal cable connector, calibration 2)	136
N° of signal feedthrough flanges (18 connectors × 34 pairs, 8 coax.)	96
N° of standard feedthrough heads (1 flange/head)	72
N° of corner-left feedthrough heads (3 flanges/head)	4
N° of corner-right feedthrough heads (3 flanges/heads)	4
N° of 34 pair connectors Male/90°/PCB (detector + decoupling boards)	11968
N° of 34 pair connectors Female/Cable (detector + decoupling boards)	11968
N° of coaxial SMA connectors Fem./90°/PCB (out-flanges + calibration b.)	1056
N° of coaxial SMA connectors Fem./0°/PCB (detector + in-flanges)	3072
N° of coaxial SMA connectors Male/0°/Cable (out-flanges + calibration b.)	576
N° of coaxial SMA connectors Male/90°/Cable (detector)	2880
N° of 50 Ω SMA terminations	288
N° of 0 Ω SMA terminations	192
N° of 32 electronics channel cards	1696
N° of <i>analog</i> crates	96
N° of <i>digital</i> crates	96
N° of racks with 2 crates	72
N° of racks with 3 crates	8

4. Connector orientation.

The connectors are mounted on the PCB's soldered to the combs in such a way to respect the following ordering criteria:

- for the **Induction-1** planes, wire numbers are increasing from the *Bottom* to the *Top* of the plane, both for the front and the back wire segments;
- for the **Induction-2** planes, wire numbers increase, in the vertical front support (*triangles*), from the *Bottom* to the *Top* of the plane; in the top horizontal support, they increase from the *Front* to the *Back* of the plane;
- for the **Collection** planes, wire numbers increase, in the horizontal top support, from the *Front* to the *Back* of the plane; in the vertical back support (*triangles*), from the *Top* to the *Bottom* of the plane.

The above criteria are satisfied by mounting all connectors, except those concerning the back segments of the **Induction-1** horizontal wires, on the side of the PCB's that appear on the right by looking at Icarus 600T from CERN.

