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The FINUDA metric

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1 Introduction

This note illustrates the choice of the reference system, nomenclature and numbering scheme, physical units for the FINUDA experiment.

2 The Reference Coordinate System

The FINUDA global reference system is a standard orthogonal, Cartesian, left-handed system with origin at the beam crossing point, which is also the nominal center of the apparatus. It follows the following conventions (fig.1), also adopted by $DA\Phi NE$ and KLOE [1]:

1. the x axis is orizontal, positive outwards with respect to the e^+axis;
2. the y axis is vertical, positive upwards;
3. the z axis is along the bisectrix of the e^+crossing angle, positive along the e^+motion.

The spherical (ρ, θ, ϕ) and the cilindrical (r, ϕ, z) coordinates are defined in the standard way:

$$x = \rho \cdot sin\theta \cdot cos\phi$$

$$y = \rho \cdot sin\theta \cdot sin\phi$$

$$z = \rho \cdot cos\theta$$

and

$$x = r \cdot cos\phi$$

$$y = r \cdot sin\phi$$

$$z = z$$

3 Detectors Numbering Convention

The front side of the detector is defined as "side E" as being the side entered by the electrons (along the positive z axis), the opposite view is "side P" entered by the positrons (along the negative z axis):

Figure 1: The FINUDA reference system in the $DA\Phi NE$ layout.

$$e^+ \Longrightarrow P[FINUDA]E \Longleftarrow e^-$$

Each detector is identified by a digam code DD: TI (Tofino), IS (Isim), TG (Target), OS (Osim), ID (internal drift chamber), OD (outer drift chamber), ST (straw tube), TO (Tofone).

The numbering of the various subcomponents of each detector is given facing side E. Submodule number 1 of each detector is the first one at $\phi \geq 0$, with increasing numbering in the counter-clockwise direction.

3.1 Interaction/target region numbering scheme

The detectors of the interaction/target region are identified by the following code numbers (fig. 2):

1. YY=01:12 for the scintillator slabs of Tofino,
2. Y=1:8 for the Isim modules,
3. Y=1:8 for the target slabs,
4. YY=01:10 for the Osim modules.

3.2 Drift Chambers numbering scheme

The eight planar drift chambers for each of the two layers are identified by a code number Y=1:8 as indicated in fig.3.

3.3 Straw Tubes numbering scheme

The Straw Tubes detector is composed of 2424 straws, arranged in three superlayers, each superlayer made of two layers of straws staggered by approximatly half diameter. The inner superlayer is axial, the two outer superlayer are stereo oriented, as indicated in tab.(1).

The straw tubes are numbered from 1 to 404 at each layer, with the code XYYY given by the layer number X and the tube number YYY with the following convention (fig. 4,5):

- $X = 1 : 6$ increasing with increasing radius R (see tab.(1))

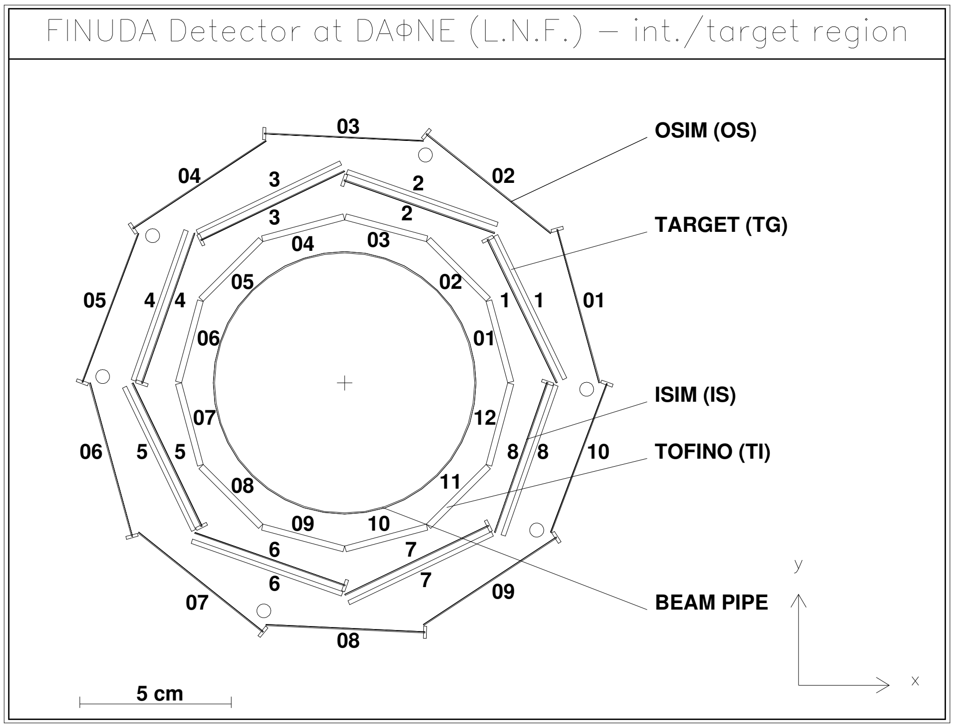

Figure 2: Numbering scheme for the modules of the interaction/target region.

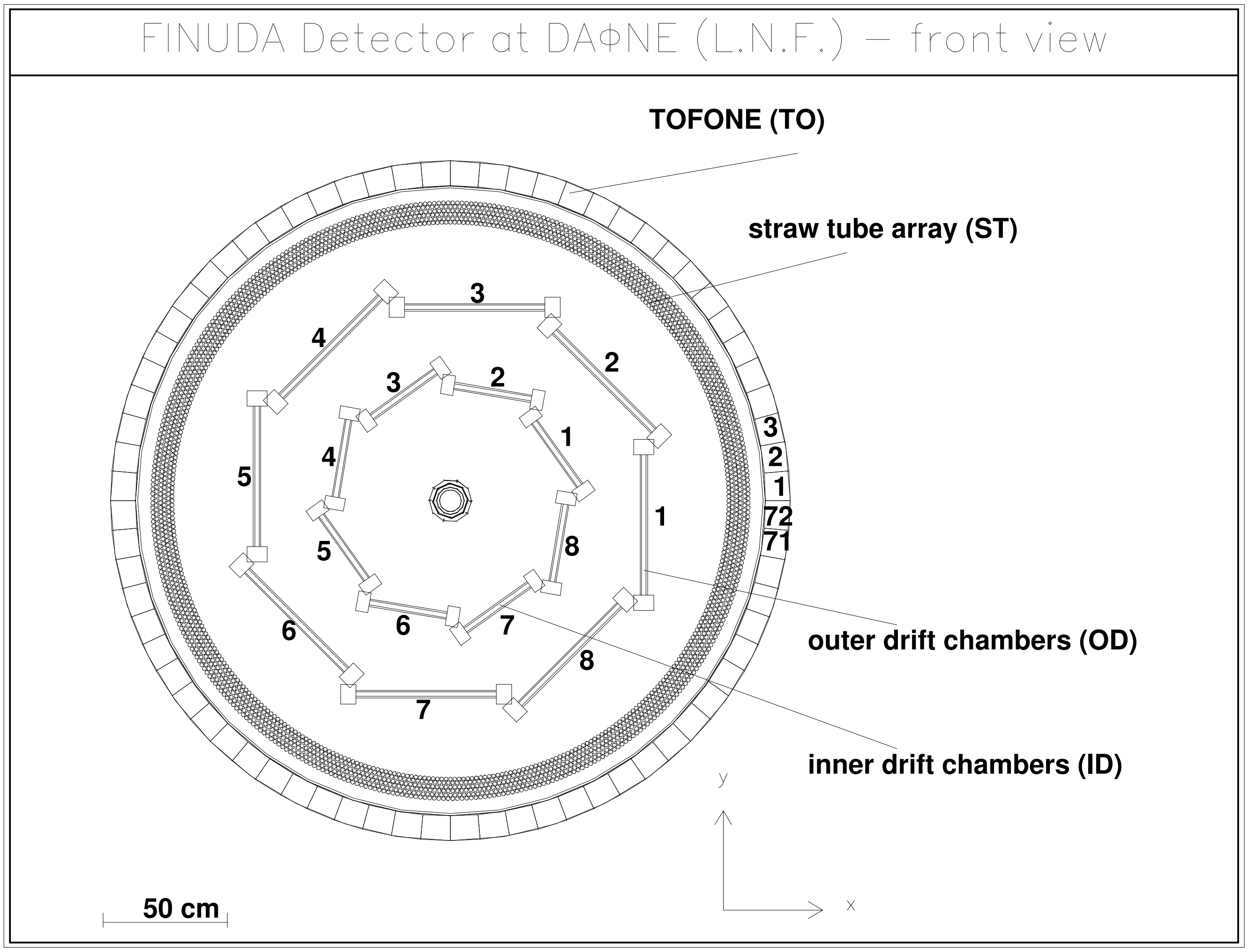

Figure 3: Sketch of the FINUDA detector front view, with drift chambers and Tofone numbering scheme.

- $YYY = 001 : 404$, defined in side E at cross section $z = 0$, where the first tube $YYY = 001$ is located at $\phi = 0$ for the layers X=1,3,5, at $\phi = 180/404 = 0.446^o$, for the staggered layers X=2,4,6. YYY increases in the anti-clockwise direction.

3.4 Tofone numbering scheme

The Tofone is composed of 72 scintillator slabs, numbered from 1 to 72 with the convention code YY where YY = 01 : 72, where slab 01 is defined at $\phi = 0$. This number increases with ϕ.

4 Readout Channels and cables numbering scheme

Each cable/channel is identiefied by a code DDTTWWWW, where:

- DD (A-Z) Detector code;
- TT (A-Z) Module type of detector DD;
- WWWW number of either type: XYYY with X=1:9 and YYY=1:999, or XXYY with XX=1:99 and YY=1:99 identifying respectivly the cable number and the channel number in the cable.

For example, the Straw tube detector DD=ST has the numbering scheme shown in table (tab.2). This is a general numbering scheme followed by all the detectors [2].

5 FINUDA Metric

The standard metric adopted is described in the following. The units are (h=c=1):

- Mass/Momentum/Energy = GeV
- Distance = cm

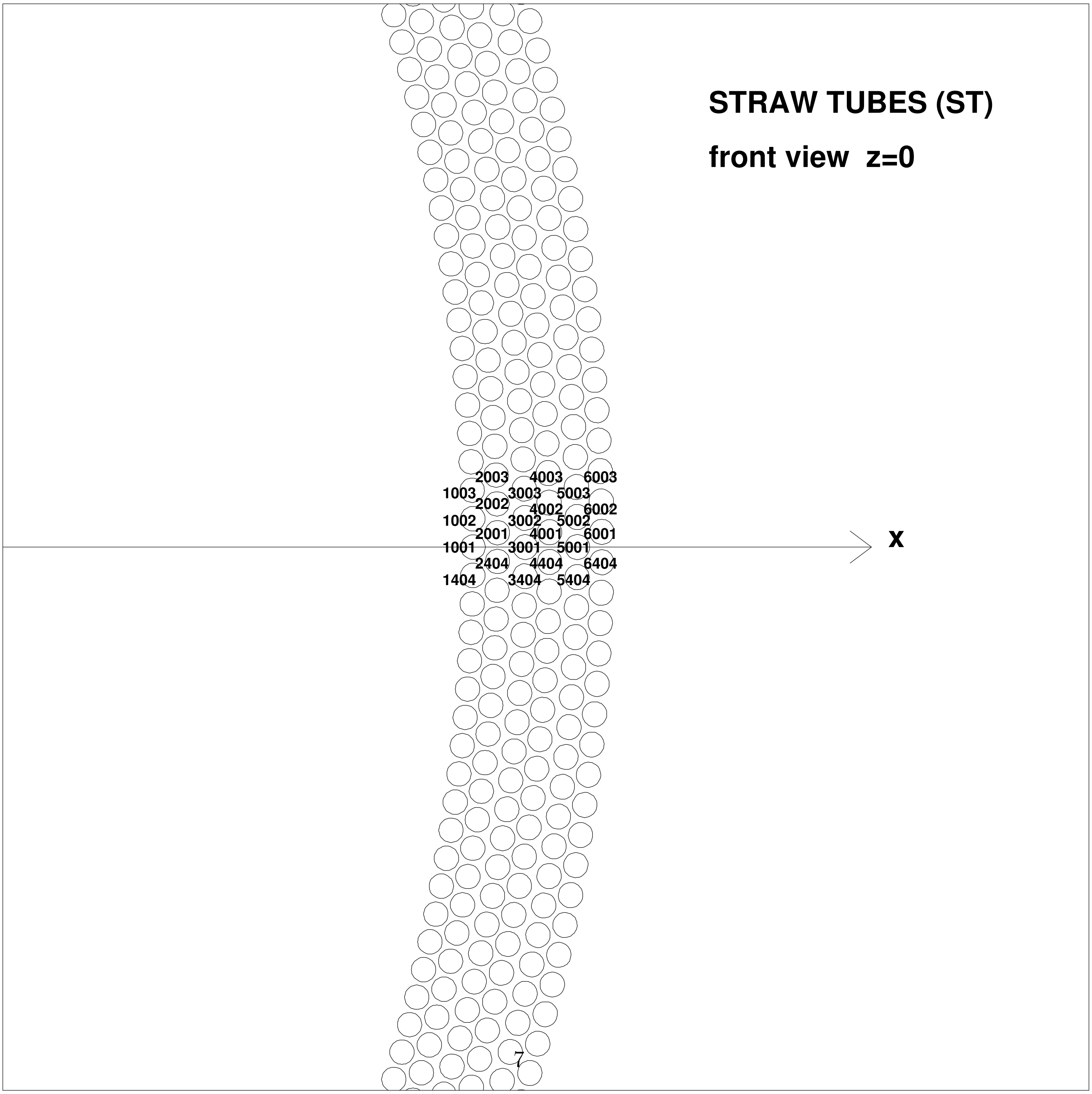

Figure 4: Indication of the Straw Tubes numbering scheme: zoomed view of the straw tube detector at z=0 around ϕ=0, seen from side E.

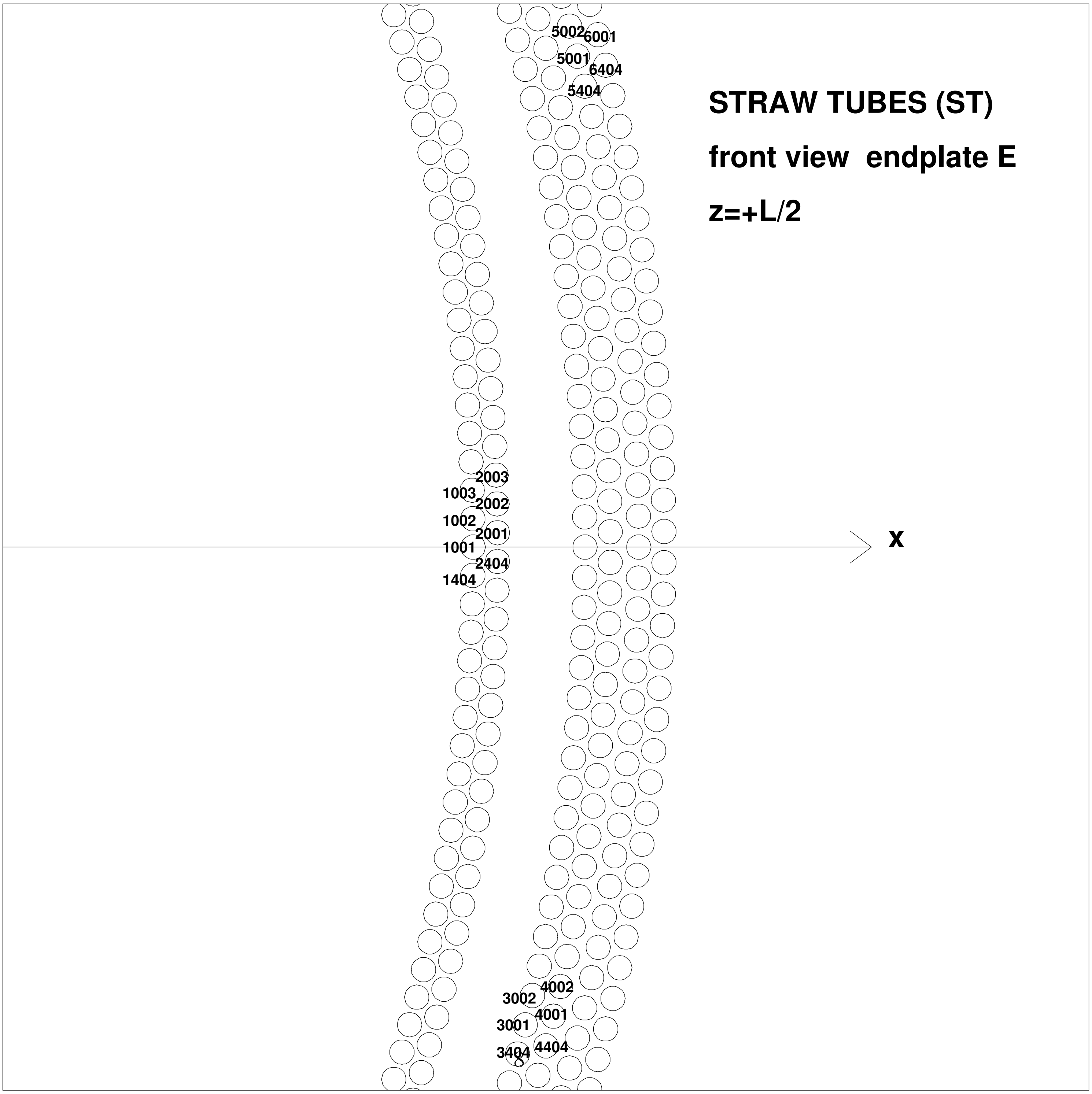

Figure 5: Indication of the Straw Tubes numbering scheme: zoomed view of the straw tube detector around ϕ=0 at endplate E, z=+L/2.

- Time = s
- B field = KG
- Temperature = ^{o}C
- Density = g/cm^3

References

[1] A.Andryakov et al., KLOE note 94-115 (1994)

[2] S.Bianco, A. Cecchetti, G. Delle Monache, Finuda Note 09/lnf/opr/95

Table 1: Radius (in cm) at sections $z = 0$ and $z = L/2$, with L total detector length, and stereo angle α at each layer.

N=404 straw tubes/layer			
L=2650 mm Distance between endplates external face			
Layer n.	Radius z=0	Radius z=L/2	α
1	112.20	112.20	0.000^o
2	113.70	113.70	0.000^o
3	115.40	119.07	12.479^o
4	116.90	120.62	12.636^o
5	118.60	122.37	-12.814^o
6	120.10	123.92	-12.971^o

Table 2: Numbering scheme for readout channels and cables for the Straw Tubes detector.

description	(DDTTWWWW)	comment
straw tube	STSTXYYY	layer X=1 $\div$ 6, tube YYY=001 $\div$ 404
from straw to Patch Panel	STSPXYYY	*same*
from Patch Panel to Disc	STPDX0YY	layer X=1 $\div$ 6, cable YY=01 $\div$ 14
from Disc to TDC	STDTX0YY	*same*
High Voltage to Patch Panel	STHPX0YY	*same*
Low Voltage to Patch Panel	STLPX0YY	*same*
Test Pulse cable	STTPX0YY	*same*
gas cable	STGAX0YZ	X=1(input), 2(output), Y=1 $\div$ 6 layer, Z=1 $\div$ 7 distributor
gas manyfold	STGMXYZZ	X=1(input), 2(output), Y=1 $\div$ 6 layer, Z=01 $\div$ 14 distributor