Boresino is a real-time detector for low energy Solar neutrino spectroscopy installed in the underground laboratories (3800 mwe depth) at Gran Sasso, Italy (LNGS). Boresino is specifically designed to measure the mono-energetic (662 keV) 7Be flux via neutrino-electron elastic scattering in ultra-pure organic scintillation liquid. The separation of signal and background relies on the identification of the Compton-like edge in the recoil electron energy spectrum at 665 keV. The physics potential of Boresino strongly depends on the unprecedented requirements of low level background. The exceptional radio-purity reached by the Boresino, in order to guarantee the success of the experiment, must be complemented with the identification and discrimination of the residual intrinsic contaminants, as well as of the external and cosmogenic backgrounds. Crucial in this respect are the energy and spatial reconstruction capabilities of the detector, which thus require a careful and precise calibration. Identified background sources can represent optimal samples for auto-calibrating the detector. We report on the Boresino performances after 1 year of data taking in reconstructing event energy and position, in discriminating on the nature of the contaminant with the pulse shape analysis and in the identification of fast coincidences looking at time and space correlations.

**Energy Scale**

The calibration of energy scale requires well defined sample of a known source. The best candidates are: $^{14}$C decays, whose activity is dominant below 0.2 MeV, 2.2 MeV gammas from capture of cosmogenic neutrons, tagged in coincidence with the muon parent, and cosmogenic $^{13}$C $\beta^+$ events, identified with the three fold coincidence with the muon parent and the associated neutron emission.

The energy distortion due to the quenching effect is formalized with the Birks model. The expected quenching factors for $\beta$ and $\alpha$ are energy dependent and belong to the [1.02-1.05] and [10-13] ranges, respectively. Even if the effect in the $\beta$ case is smaller, it is amplified in the Compton electron gamma induced showers: $\gamma$ energy can be reduced by a factor up to 1.3, introducing a bias in the analysis. 2.2 MeV $\gamma$ induced by neutrons and the 0.511 MeV $^{12}$C reaction share some properties: 0.511 MeV $^{12}$C $\beta$ and $^{14}$C $\alpha$ are tagged in coincidence with the muon parent, and cosmogenic $^{214}$Pb (214Bi-Po, 212Bi-Po) or secondary decaying channels with known branching ratio (FK-Rb). Moreover, they can represent calibration samples to tune the bulk distribution, which is formalized with a fiducial volume, guarantees about 4% accuracy. The fiducial volume, guarantees about 4% accuracy. The fiducial volume, guarantees about 4% accuracy.

**Pulse Shape**

$\alpha/\beta$ analysis with the optimum Gatti method based on the different time response of the scintillator to $\alpha$ and $\beta$ particles

- Neutron $\gamma$
- $^1$H $\beta$ energy range
- $^7$Be $\beta$ energy range
- Without radial cut: $R < 3.8$ m
- With radial cut: $R < 3.5$ m (FV)

**Muon Identification** with the pulse shape analysis.

Muons are track-like events and their pulse shape differ from neutron candidates (point-like events) because is "slower": its mean time and the time of the first peak are shifted to longer times. The inner detector is hence able, to recognize efficiently muons. The cuts have been calibrated on events tagged by the muon veto (OD).

**Position Reconstruction and Vessel Shape**

The event spatial reconstruction is based on the time information of each photon. The arrival time $t_i$ of the first photon of the $i$-electronic channel is equal to: $t_i = t_fi + t_{fi} + t_j + t_{ji}$, where $t_fi$ is the absolute time of the event, $t_{fi}$ the scintillator decay time, $t_j$ the time of flight, and $t_{ji}$ is the jitter time of the PMT. Spatial position results from the maximum likelihood fit of the time distribution.

**Fast Coincidences**

Fast coincidence identification have been performed in the Borexino analyses: beyond the event by event identification of single neutrons, they allow statistical subtraction of segments of radioactive chain in equilibrium ($^{218}$Po, $^{214}$Po) or secondary decaying channels with known branching ratio ($^{220}$Rb). Moreover, they can represent calibration samples to study the detector response in energy and time.

**Bibliography**