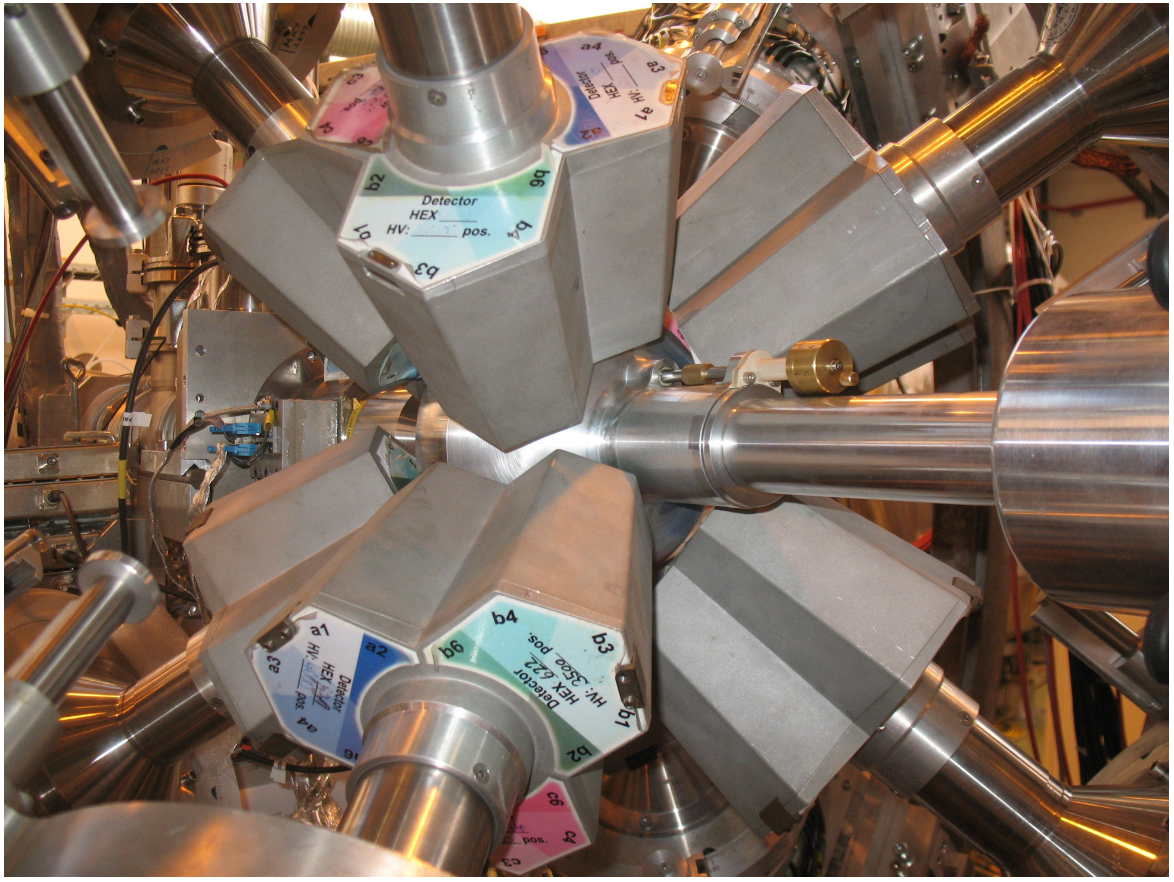
The Miniball Array

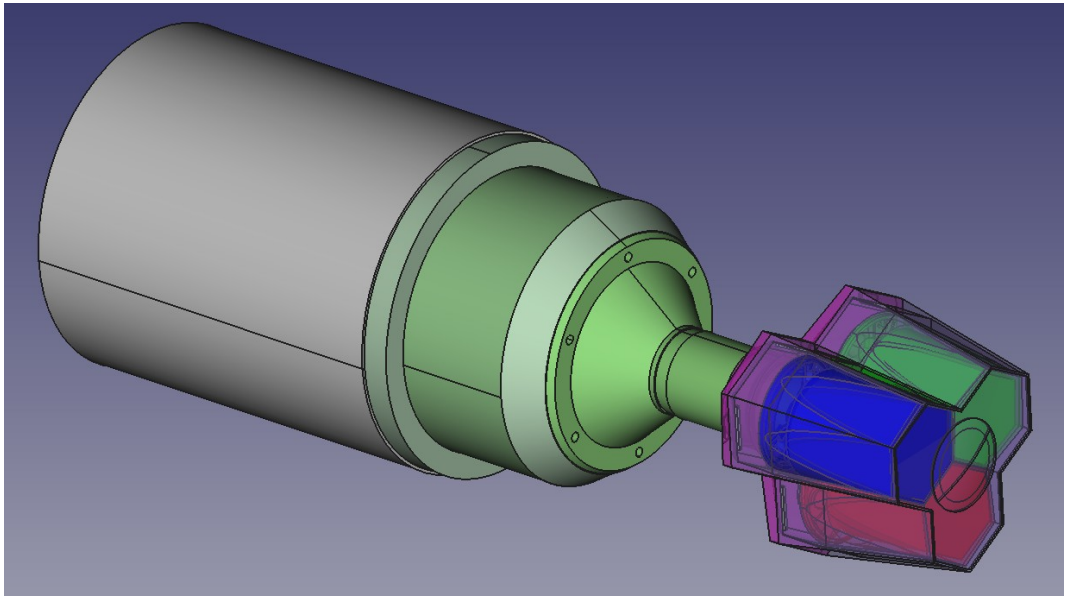


The Miniball Array

- Consists of 24 six-fold segmented encapsulated HPGe crystals housed in eight cryostats.
- Each crystal has an active volume of about 260 cm^3 housed in a thin-walled aluminium can.
- The segmentation is essential for experiments at ISOLDE, but not relevant for PSI.
- The encapsulation is crucial for ease of maintenance, but is not relevant for experiments.

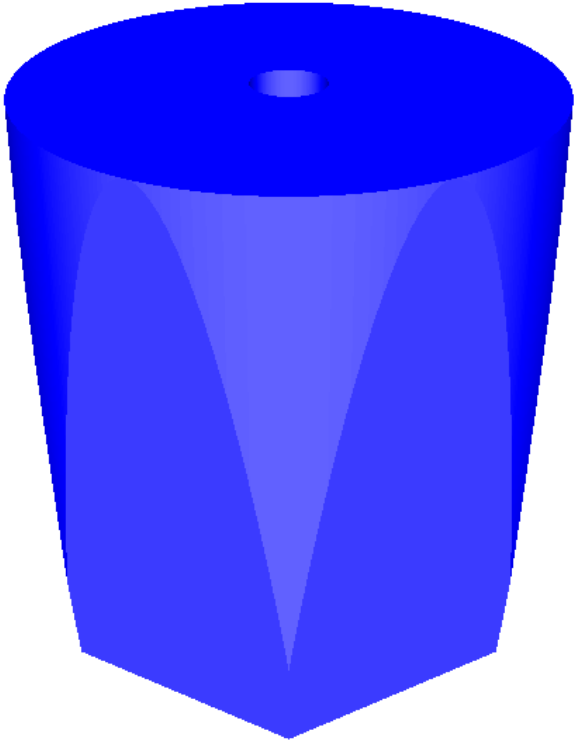
Miniball clusters

- Each cluster consists of a single cryostat housing 3 HPGe crystals.
- Needs one +/-12 V preamplifier supply per cluster (D-sub).
- Needs three bias supplies (SHV) per cluster (max 4500 V).
- Provides two identical BNC outputs from the core electrode of crystal and one from each of the segments. i.e. 24 signals.
- However, PSI will only need the three core signals per cluster.



Miniball crystals

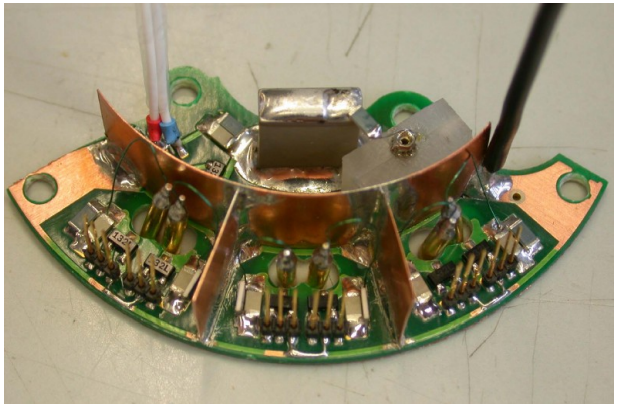
- The HPGe crystals are cut hexagonally from a cylinder of length 78 mm and diameter 70 mm.
- Each crystal has about 1.4 kg of HPGe.
- The active volume (after cutting) is about 260 cm^3.

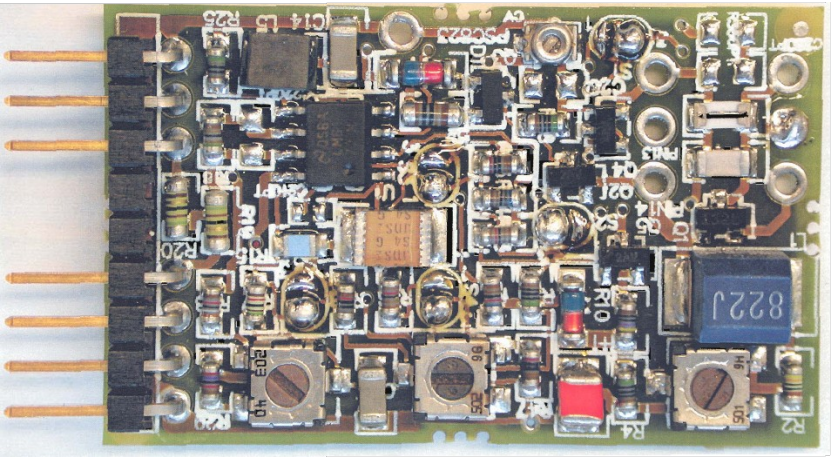


Miniball pre-amplifiers

- Miniball uses 21 of the HeKö PSC823 pre-amplifiers, which have a larger bandwidth than older types.
- This gives less problems with overshoots and ringing, which cause problems with digital systems.

Cold part for core + 6 segments

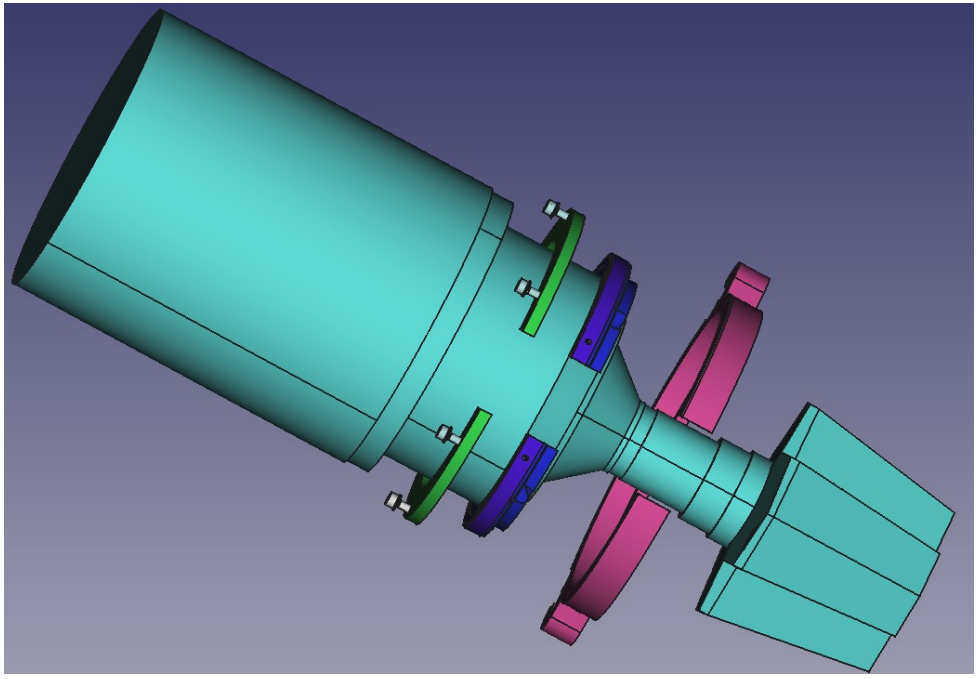




Warm part for one core

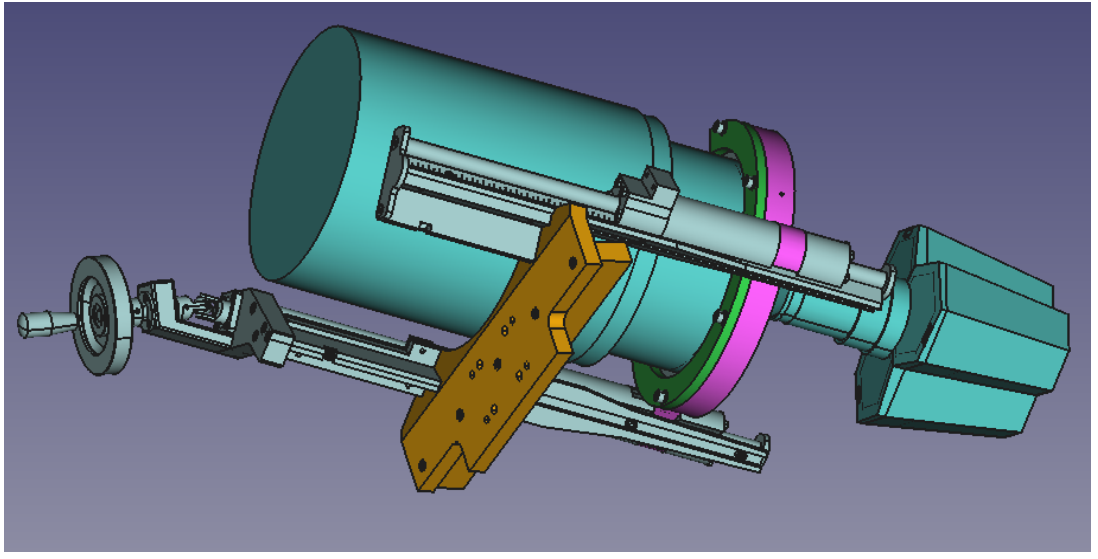
Detector mounting

- To mount the cluster, a **ring** is bolted onto it. This ring is sandwiched between two rings, **one** of which is fixed to the frame.
- Teflon pieces between the rings ensure the detector can still rotate about its axis.



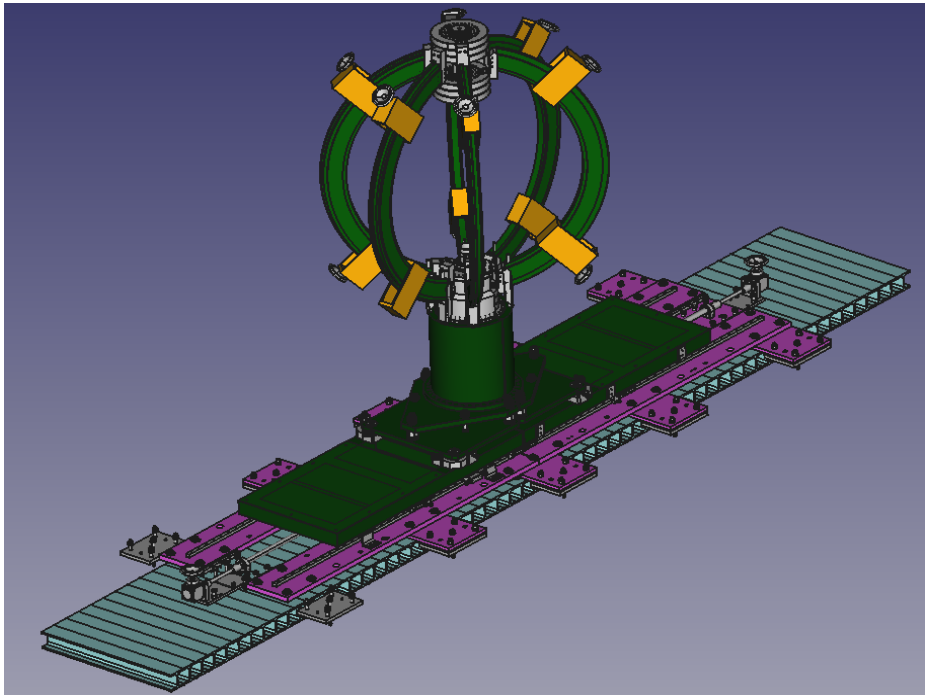
Fixing detectors to frame

- The detector support allows the cluster to be moved in and out in a controlled manner.
- It is fixed to the frame with a **bracket** by four bolts.



Support frame

- The Miniball frame consists of six arcs, which can be rotated about the vertical axis.
- On each arc, there are two riders, which can move along the arc, on which detectors can be mounted.
- Is this needed at PSI? Or do we mount the support bracket on some other frame?



What does PSI need?

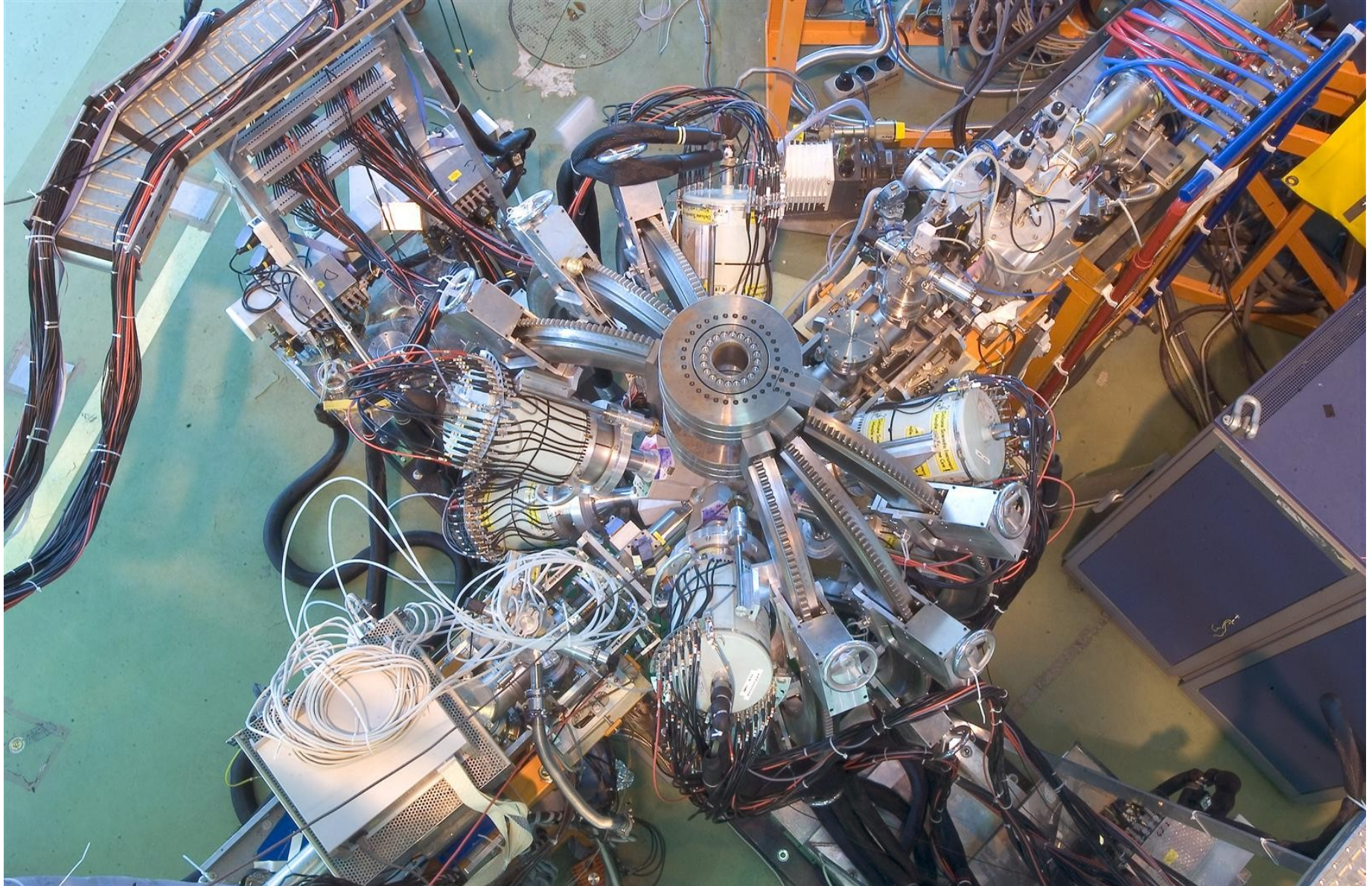
- How many of the 8 clusters?
- What about the frame?
  - Miniball frame? Would need CAD integration of target chamber.
  - PSI frame? How do we mount the clusters? At the ring or the bracket?
- HV supply? Or just the HV cards?
- Pre-amp power supply?
- Cables? One D-Sub with +/-12V, three HV and three BNC per cluster.

Status of Miniball

- All clusters operational in 2018 campaign at ISOLDE. Since then, they have been warmed up and pumped.
- One cluster is noisy (poor resolution). This can probably be fixed at ISOLDE.
- One cluster has two swapped segments internally. This can only be fixed in Cologne, but is not urgent.
- One cluster has crosstalk problems leading to double-peaking in the core. This can only be fixed in Cologne.

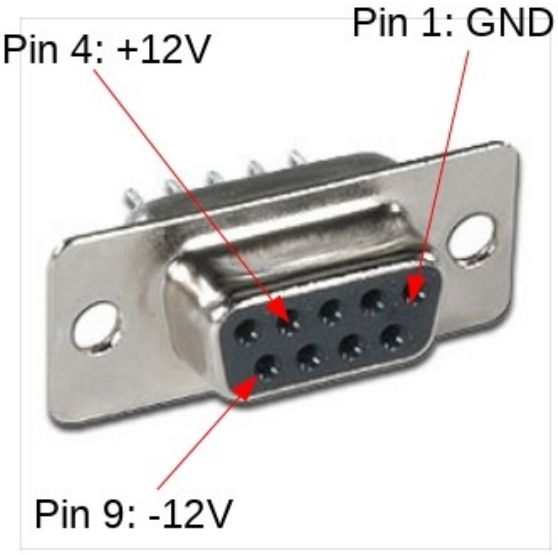
Plans for the shutdown

- During the CERN long shutdown, the Miniball clusters will be completely overhauled.
- The first step is to build new cryostats; during this time, the clusters can still be used for physics.
- The second stage involves installing the capsules in the new cryostats; during this phase, at least three clusters at a time will be out of action.
- RIKEN has requested Miniball for 2020.



Pre-amp power pin-out

Detector end



Supply end