

MINERvA electronics disassembly procedure v1

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Team setup

Depending on workforce availability:

1) Two teams

- One team in elevated lift removing electronics from detector
- One team on ground labeling and storing components, working from catwalk, pulling back cables to DAQ rack

or

2) One team

- In elevated lift and on catwalk, removing electronics from detector, then labeling and storing components on ground, pulling back cables to DAQ rack
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Electronics risk assessment

- All electronics are powered down from the main power supplies
- No work will be done on internal or external power supplies
- In the very unlikely case of power accidentally being on, the highest voltage is delivered to the FESBs from the fuse box is 48V DC at 1.16A
- The PMT HV is delivered from the FEB to the PMT via the FEB connectors, whose connections are not exposed to workers. They are delivered through the PMT/FEB interface
- A configuration file needs to be loaded externally to place the PMTs in high voltage mode. This configuration is not uploaded: if power is accidentally on, the PMTs are not receiving high voltage from the FEB
- If power to the boards is mistakenly turned on, all the electronics risks are removed when the FESB to FEB power supply cable is disconnected. No power is delivered to a PMT once this cable is disconnected

Work at height risk assessment

- Portions of disassembly occur in elevated lift loft and on an elevated permanent catwalk
- Risk of dropping tools, cables, electronics
 - Minor hazard due to low weight of objects
- Heaviest object is the PMT enclosure, which is lifted up from detector and weighs ~10kg
 - Poses intermediate hazard to workers directly below the elevated lift loft
 - **Mitigate by cordoning off area around the upstream plane being worked on**
 - **No access allowed to area below lift when lift is active**

Miscellaneous risk assessment

- Trip hazards of cables

- Fingers and toes caught between objects
 - **Mitigate by wearing proper shoes**
 - Gloves not favourable during main work due to worse grip and tactility
 - **Gloves necessary when disconnecting fibre optic cables from detector next to sharp steel mesh**
 - ~10kg lifting of PMT box at height for short duration (~5s)
 - Mitigate by taking turns every few PMTs
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Tools required:

Scissors, tape, cable ties, cable tie cutter, labels, pens, philips screwdriver, storage boxes for hardware
Proper shoes, light gloves for part of work

FNAL NuMI underground training is required

All work in red is work at height on scissor or boom lift, which requires FNAL training

Some of the work accessing the electronics can be done from the catwalk on either side of the detector without using the lift loft.

- **Same risks apply for work on catwalk as elevated lift loft**
 - **Clear the area below the work from sensitive materials, and cordon it off for access**
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Procedure

- 1) Check DAQ rack to make sure **power is off**
- 2) Locate the FEB/PMT master list¹
- 3) Clear area below the most upstream MINERvA plane and close off to access
 - **Dropping objects (e.g. PMT, FEB, tools) from height is largest risk involved**
- 4) Position the lift upstream of plane, with the loft within reach of electronics that are on top of the MINERvA planes (or access electronics from catwalk if possible)
- 5) Unplug the yellow and blue CAT5 (ethernet) cables connecting the FEBs in a chain, and store
 1. The yellow cables should be stored
 2. The blue cables have to be pulled back to the DAQ rack later, then stored
- 6) Unplug the gray FESB → FEB power cables on the FEB
 - If power is accidentally left on, this delivers 48V DC
- 7) Lift up the FEB from the PMT, check the FEB number against the master list, and store
- 8) Unscrew the 2 black LI fibers from each PMT, cables will need pulling back to DAQ rack
- 9) Unplug the 8 optical cables from each PMT, and from each MINERvA plane, and store
 1. Inspect the cables for damage
 2. Tape up to prevent light leaking in during storage
 3. Label cables: module set (MS-1-27, E or W), FEB number in chain (1-10)
- 10) Remove the PMT, check the PMT number against the master list, and store
 - Involves lifting weight at height

¹ If not printed out please find at <https://minerva-docdb.fnal.gov/cgi-bin/private/ShowDocument?docid=4086> or ask Howard/Clarence. There should be one printed underground

- Risk of injuring fingers and toes
 - Mitigate by wearing gloves and proper shoes
 - Risk of dropping PMT from significant height
 - Mitigate by clearing area below lift when work is being done
1. Tape up the fiber connectors on the PMT to optical fibers and LI fibers
 - 11) Pull back the power cables to the FESB on east or west sides
 - 12) Remove power cables from FESB and label
 - 13) Remove the FESB from the mount and store it
 - This can be done from the catwalk
 - 14) Pull back cables (ethernet, LI, FESB power) to be accessible from catwalk
 - 15) Lower lift and disembark
 - 16) Pull back cables from catwalk to DAQ and LI racks
 - 17) If you haven't already, tape up PMT fibre optic and LI connectors
 - 18) If you haven't already, tape up fibre optic cables and LI cables
 - 19) Store in cabinet