Recap:

- Common Mode Failure. Avoid!

- MR CTs - High-Z 87B
  - Always use full ratio! ✓
  - Matched CTs.
  - Central summing point.
Dr Mork was discussing differential CT connections in today's lecture. Here is a little mystery for you to think about during Winter Carnival.

Last week I was at a local Municipal Utility starting-up a couple of 2 MW diesel generators. The first time they tried to carry load the differential relay tripped the unit. When I looked at the analog data from the generator relay (SEL-300G) I found something wrong with almost every CT connection.

Here is a brief 1-line:

![Diagram of CT connections and generator, with labels 52G, Gen, CT, I87, 87G, 1.]

Here is how the three currents should look when everything is OK:
Here is what they looked like the first time they ran the unit:

Can you guess what is wrong with each CT?

The answers are on the next page:
IA87 is wired reverse polarity (it should be 180 degrees out of phase with IA).
IB87 is really reverse polarity IC87 (it should be 180 degrees out of phase with IB and
120 degrees behind IA87).
IC is shorted out.
IC87 is really reverse polarity IB87 (It should be 120 degrees ahead of IA87).

This is easier to see if I swap IB87 and IC87 on the graphs:

![Graph showing differential currents with phase differences]

I think that I have never seen a differential connection with so many problems all at once!