ATLAS FCAL

ATLAS Forward Calorimeter Hadronic Test Beam Results

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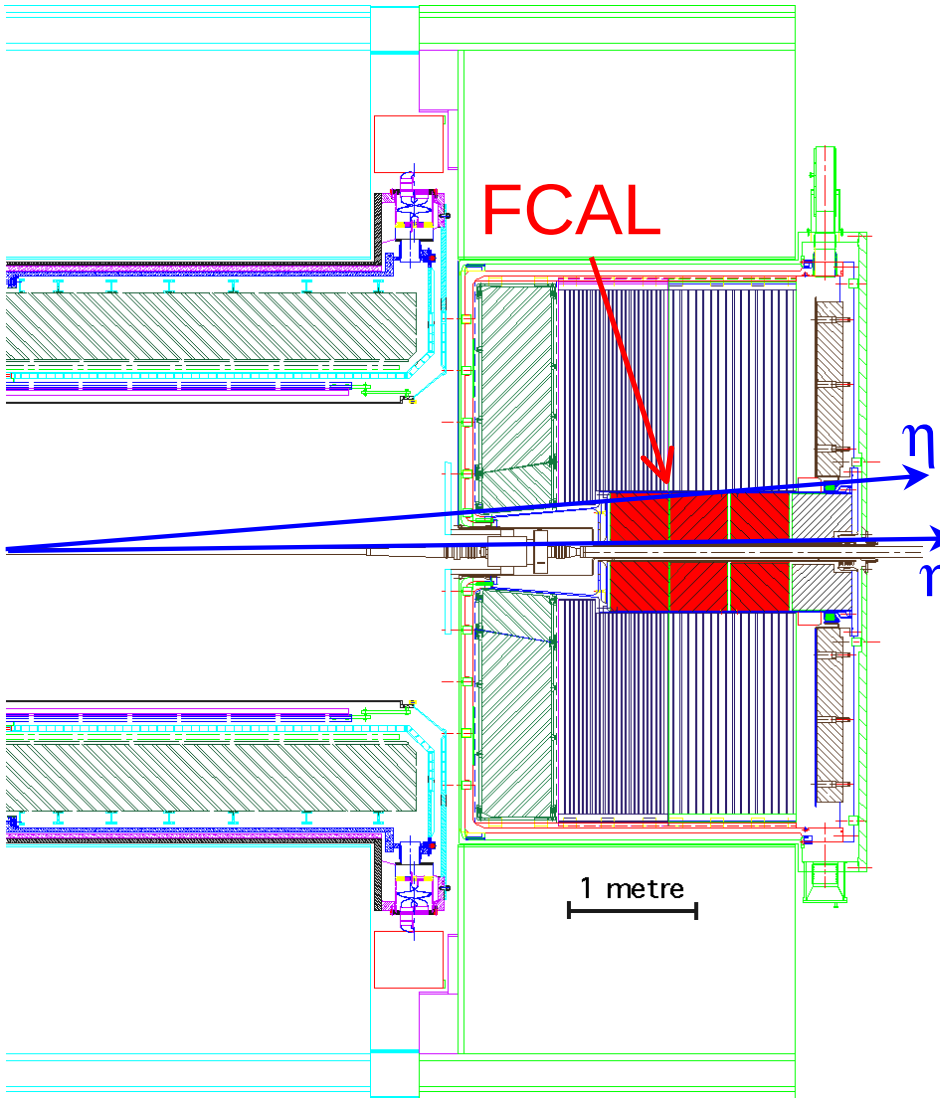
Arizona - CRPP Carleton - ITEP - Montreal - Toronto

See also talks by

- R.Mazini & P.Loch: Comparison of electron data with GEANT3 and GEANT4
- A.Savine: Hadronic energy resolution improvement using transverse information

ATLAS Forward Calorimeter



- Tag forward jets
- Measure missing E_T

$$\frac{\sigma(E_T)}{E_T} \leq 10\%$$

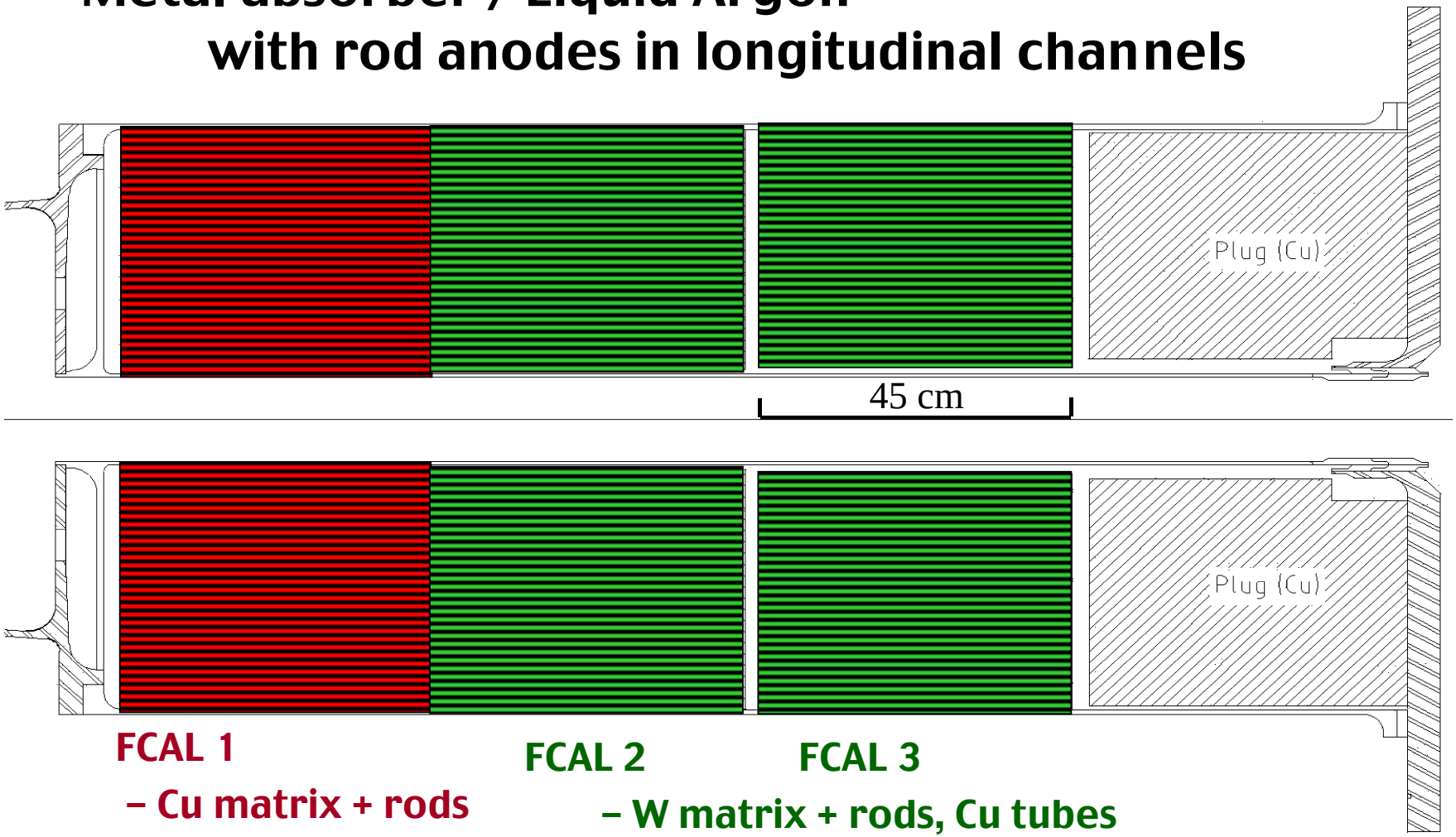
~ 40Mh z

~ 10^8 GeV/cm^2/s at η=4.5

~ 10^6 Gy/year

~ 100 Watts absorbed

Metal absorber / Liquid Argon with rod anodes in longitudinal channels



FCAL 1

– Cu matrix + rods

– 2.6 λ, 28X_0, 2.1 t

FCAL 2 **FCAL 3**

– W matrix + rods, Cu tubes

– each ~ 3.7 λ, 90 X_0, 4 t

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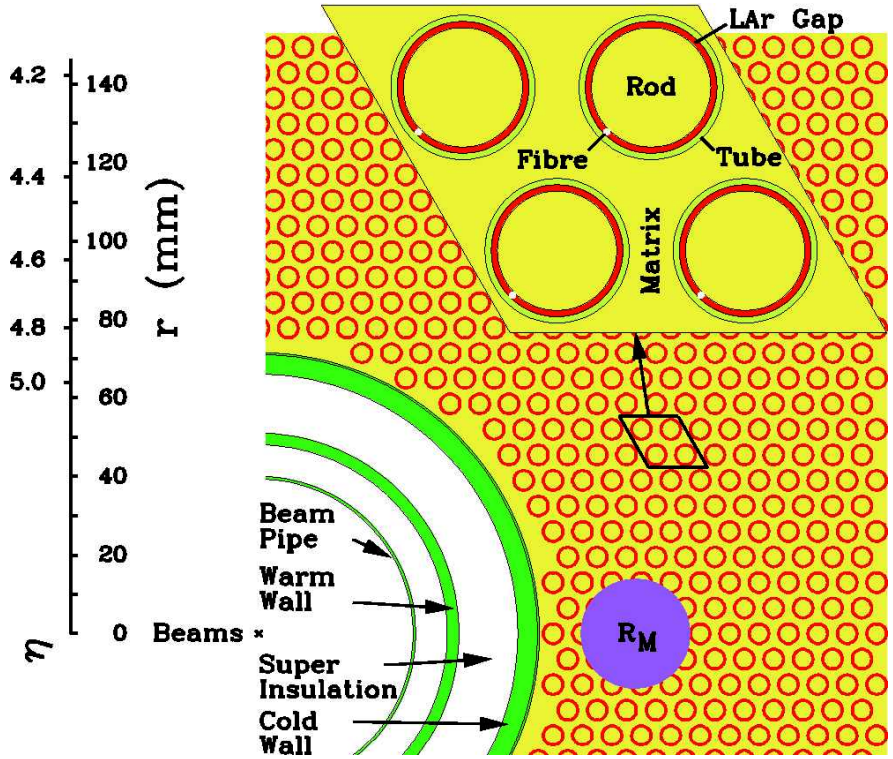
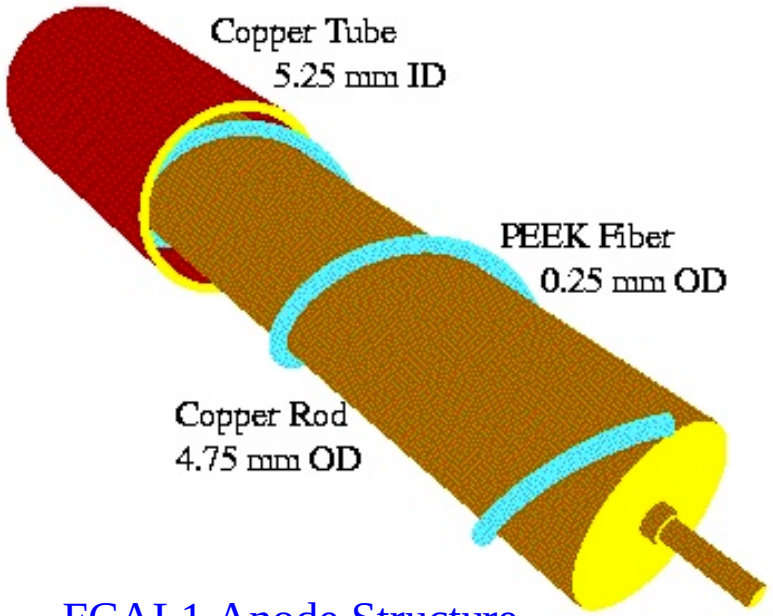


FCAL End View

Anode Spacing (FCAL1/2/3)

- 7.5 / 8.18 / 9.00 mm



FCAL1 Anode Structure

Liquid Argon gap

- 250 / 375 / 500 μm

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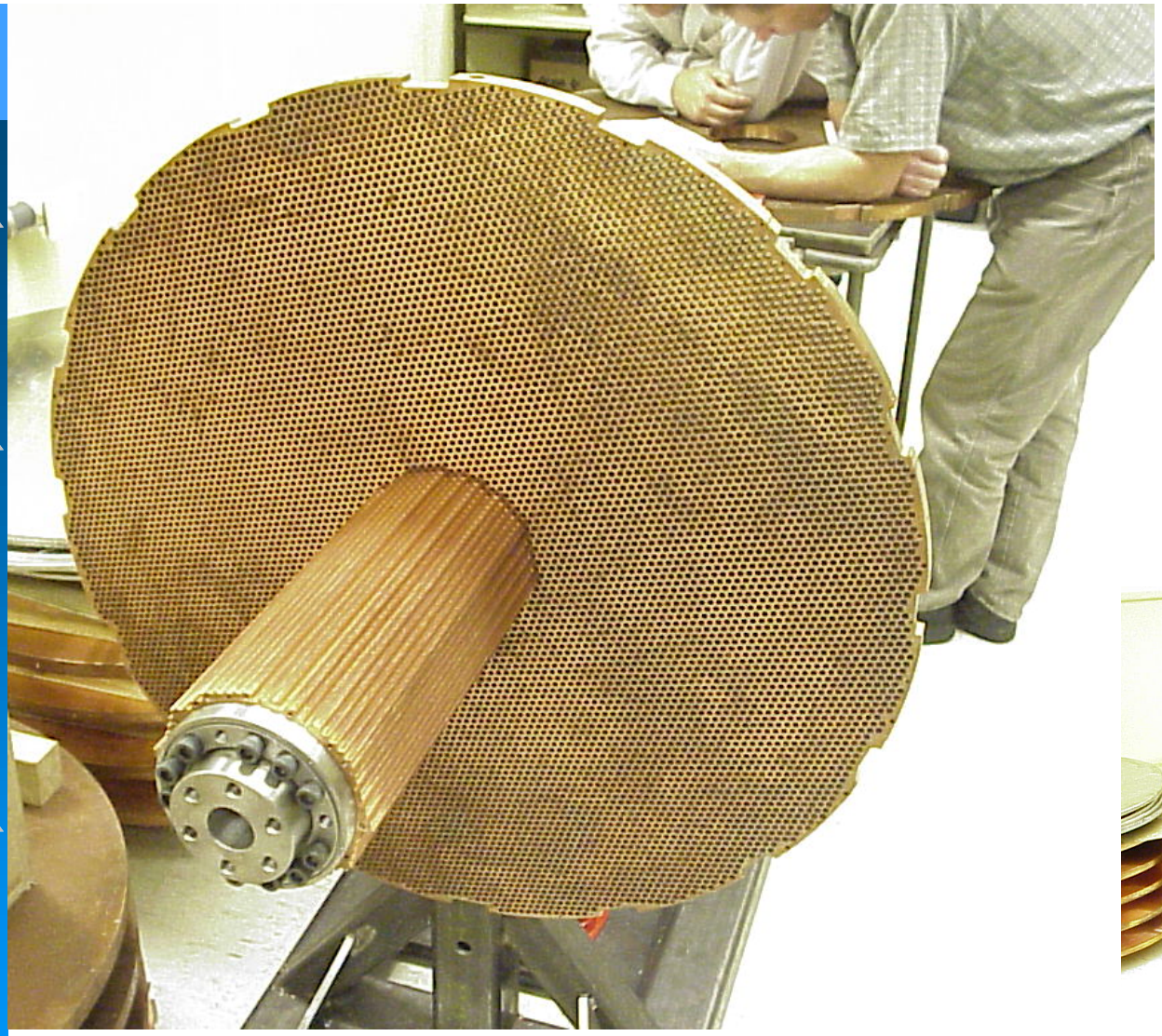
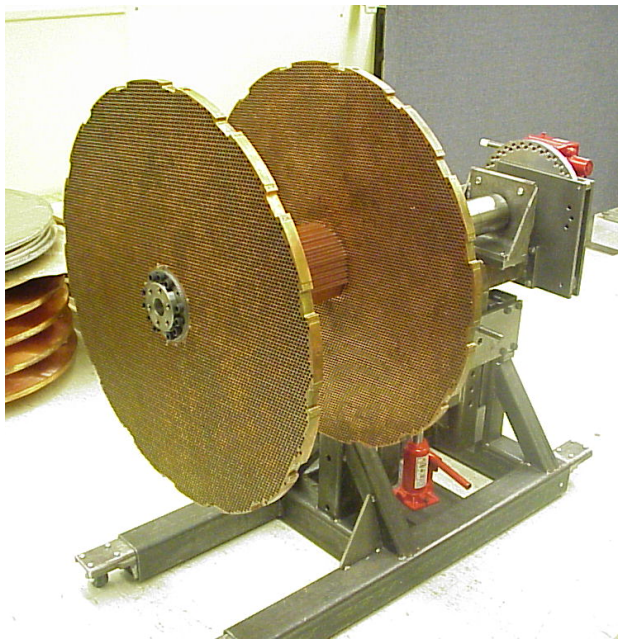
FCAL2 Endplates and inner absorber





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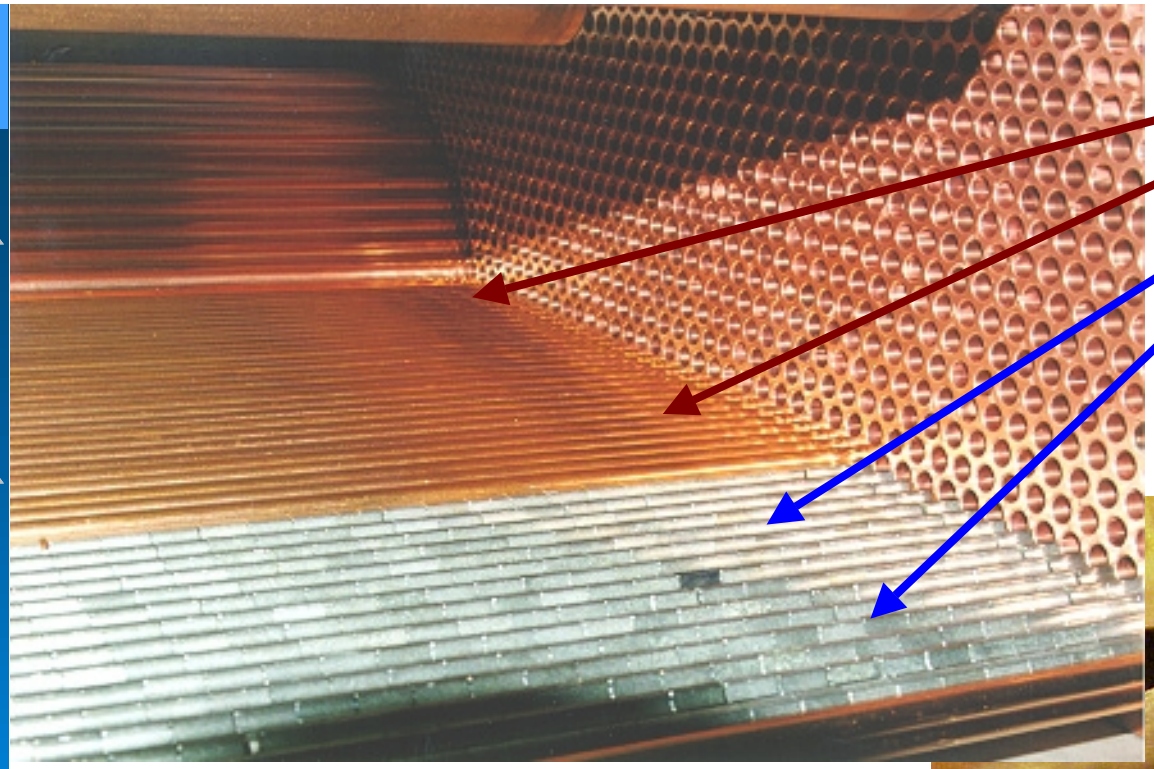
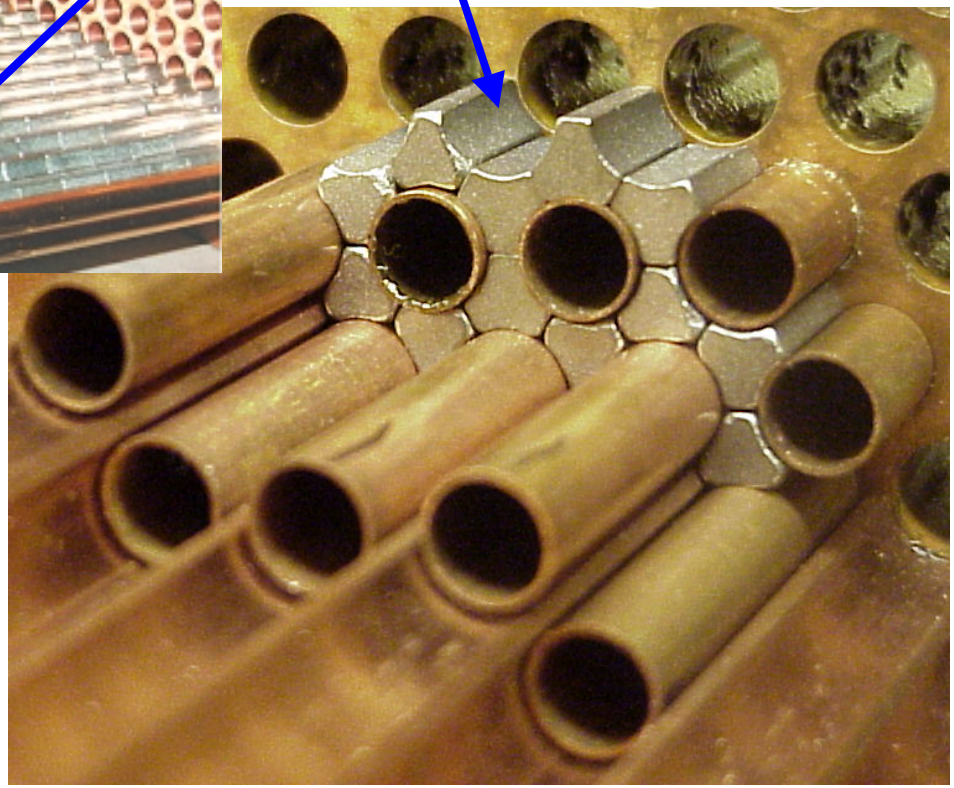


Tube and slug matrix



Cutaway demonstration of matrix

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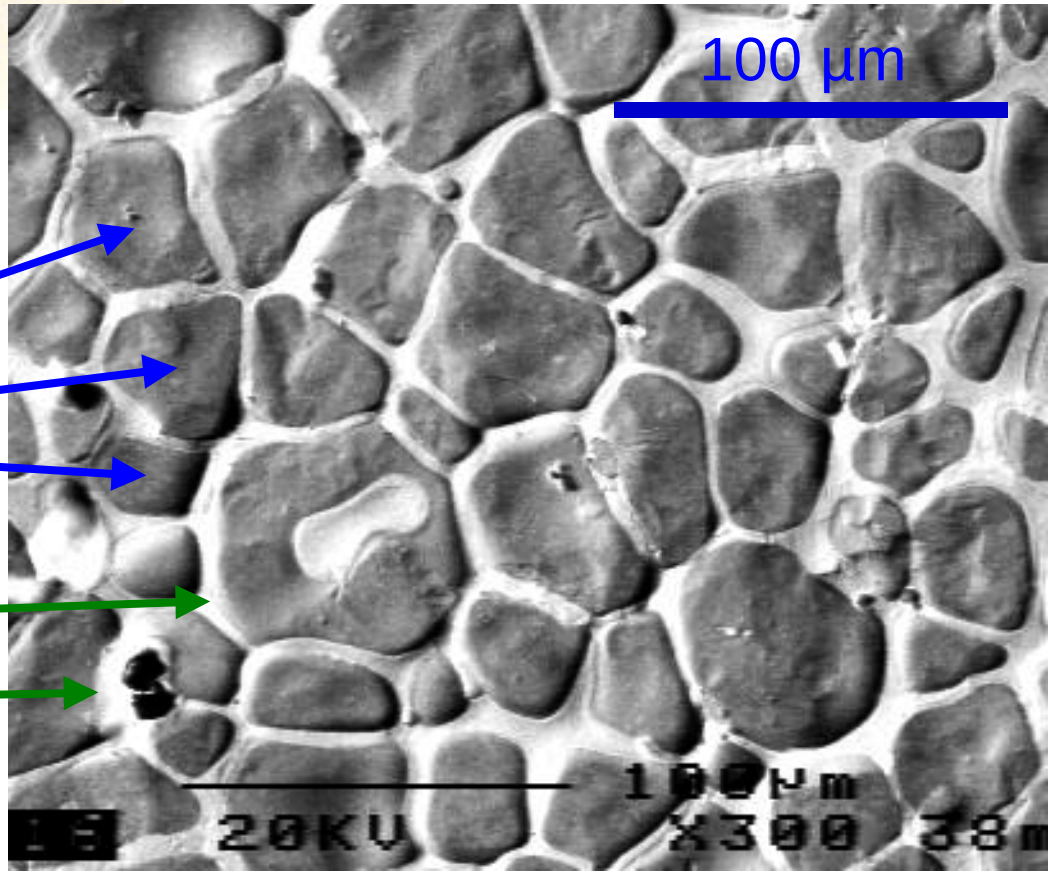
Tungsten slugs

Powder

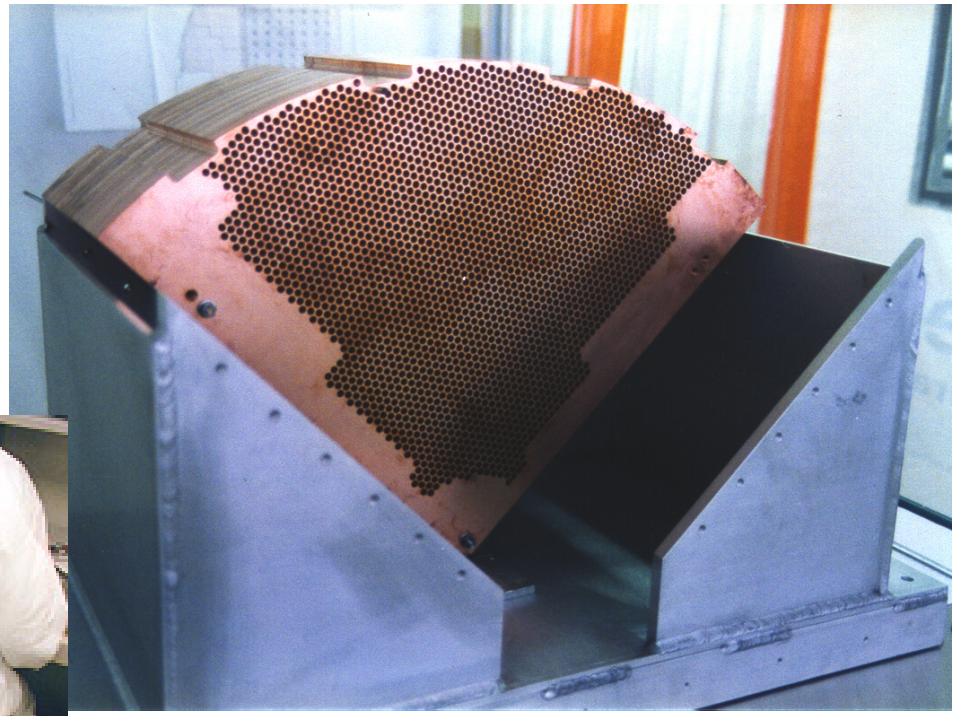
- **97% W**

Binder

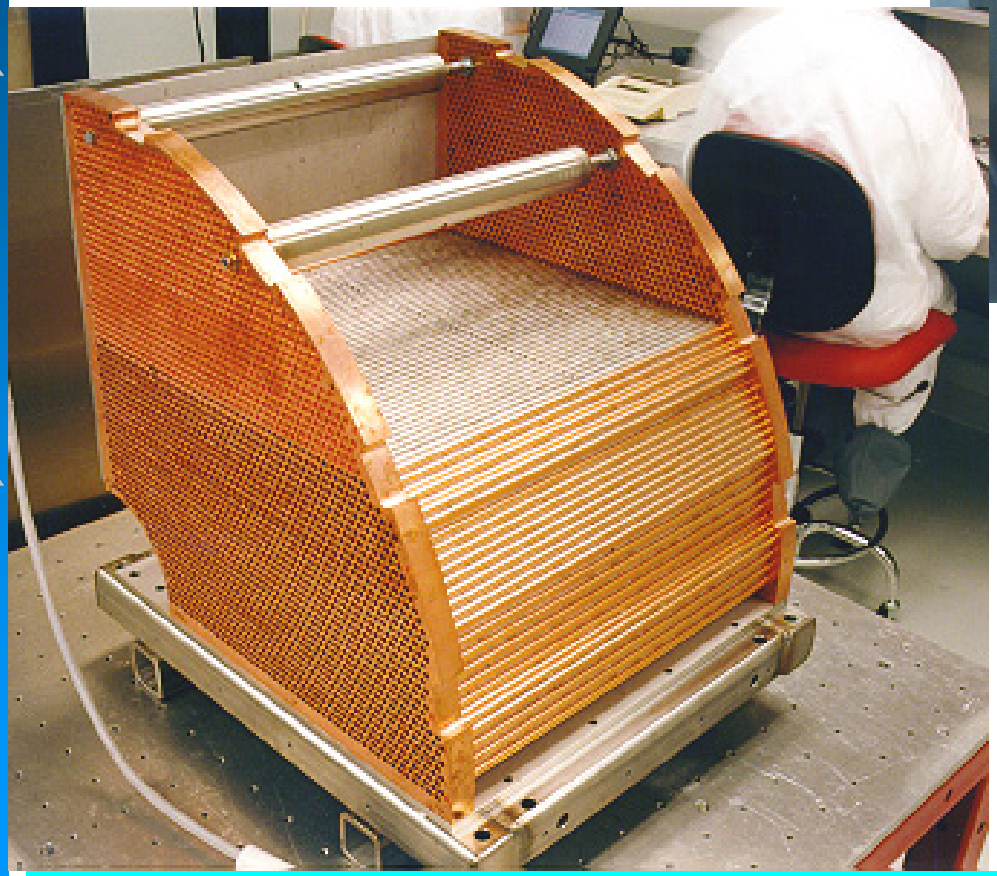
- **2% Ni**
- **1% Fe**



FCAL Module-0's under construction

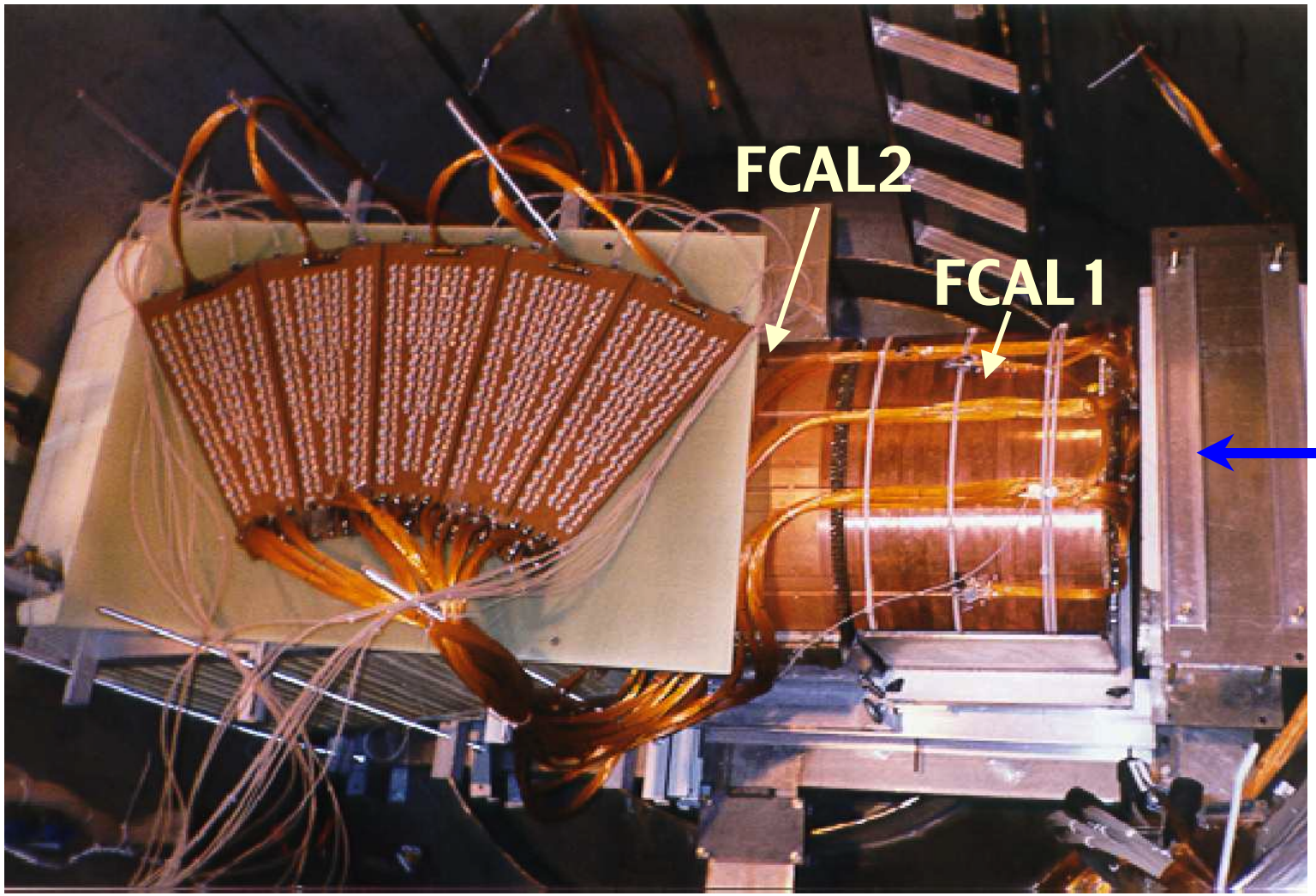


FCAL1



FCAL2

Module-0 beam setup at CERN



MWPCs in front of cryostat, tailcatcher and muon tagger behind

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Beam test results

- **FCAL modules work very well**
  - **Good resolution, linearity**

- Metals conduct electricity very well

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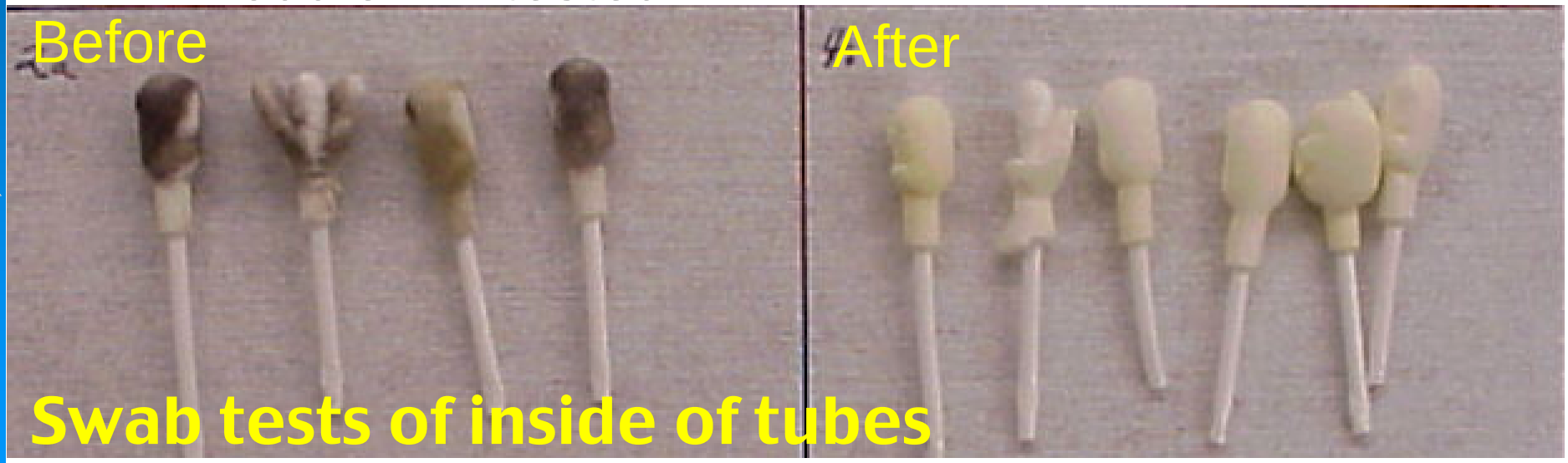
Parts cleaned by

- degreasing solvent
- ultrasound in hot alkaline detergent
- ultrasound in hot acidic cleaning solution
- high pressure rinses
- assembled in Clean room
- module HV tested

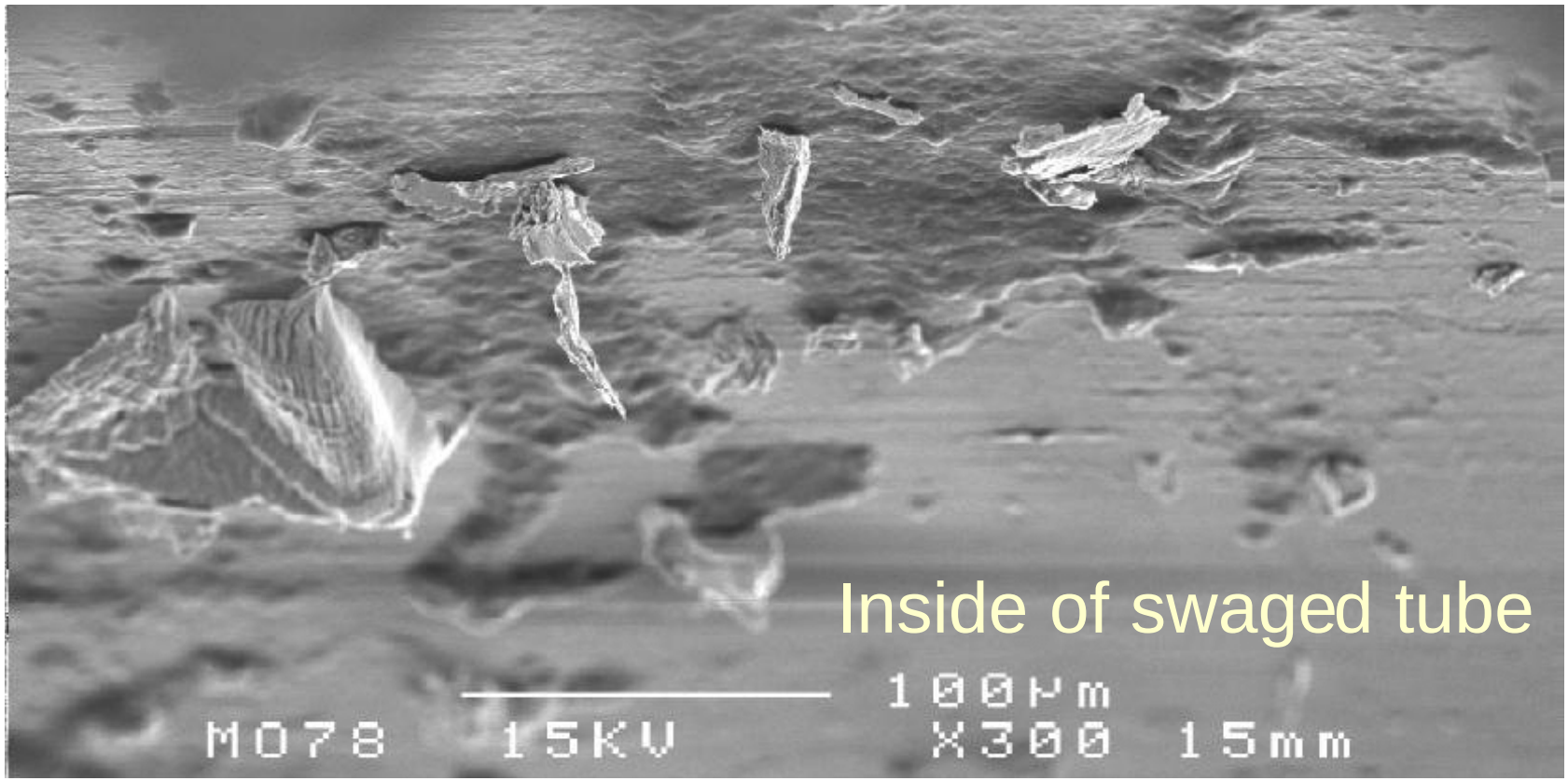


BUT ...

On arrival at CERN from Canada, there were about 1% shorted (but repairable) anodes

Metal shards shaken loose during transport.

e.g. from swaging (attaching) tubes to endplates.



Shipping Test of 1000 tube test module

Module driven for 3 hours:

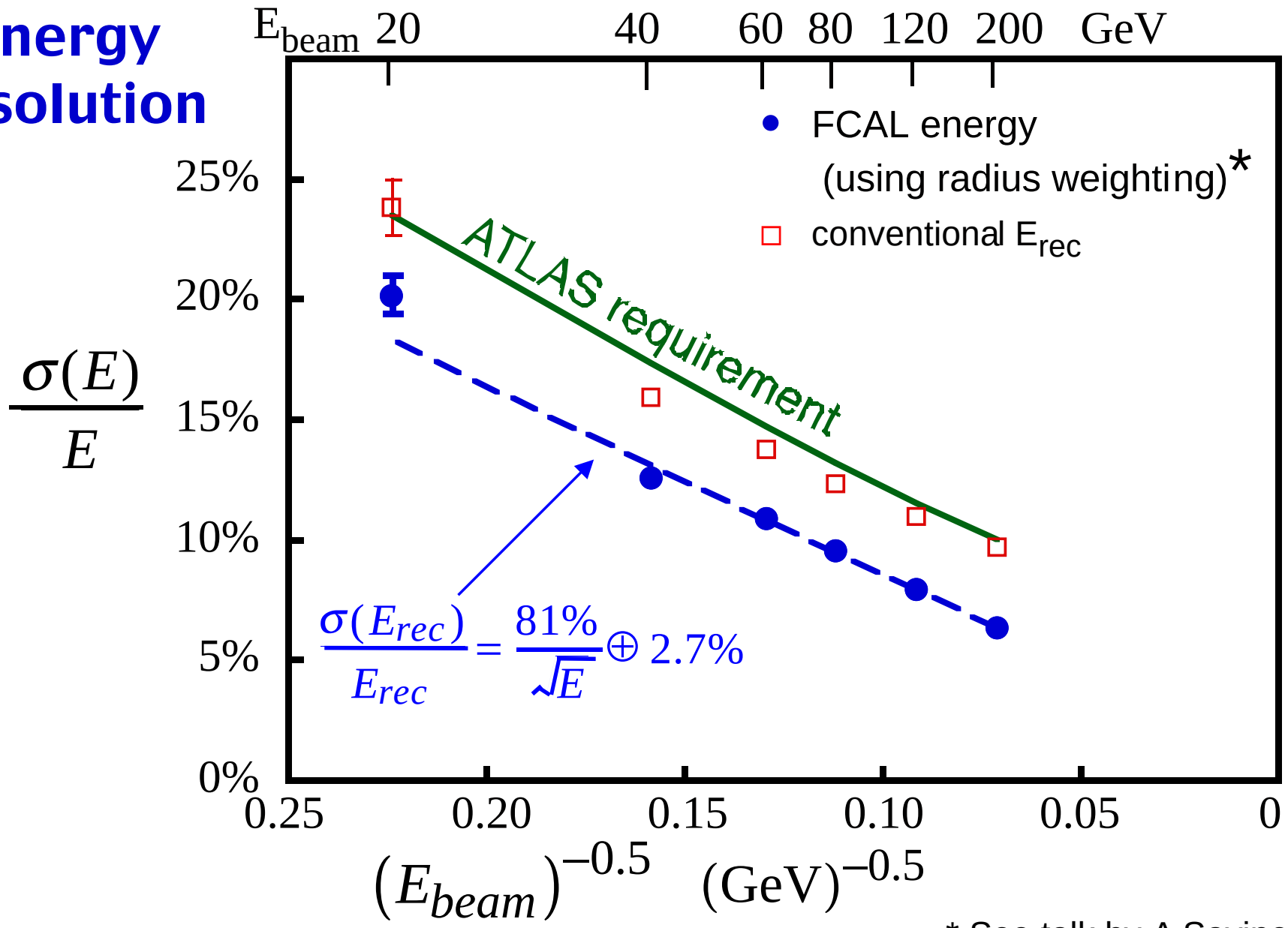
1.5 hours on highway

1.5 hours on very rough unpaved Canadian back roads

Crate not fixed to truck, so it could bounce and move.

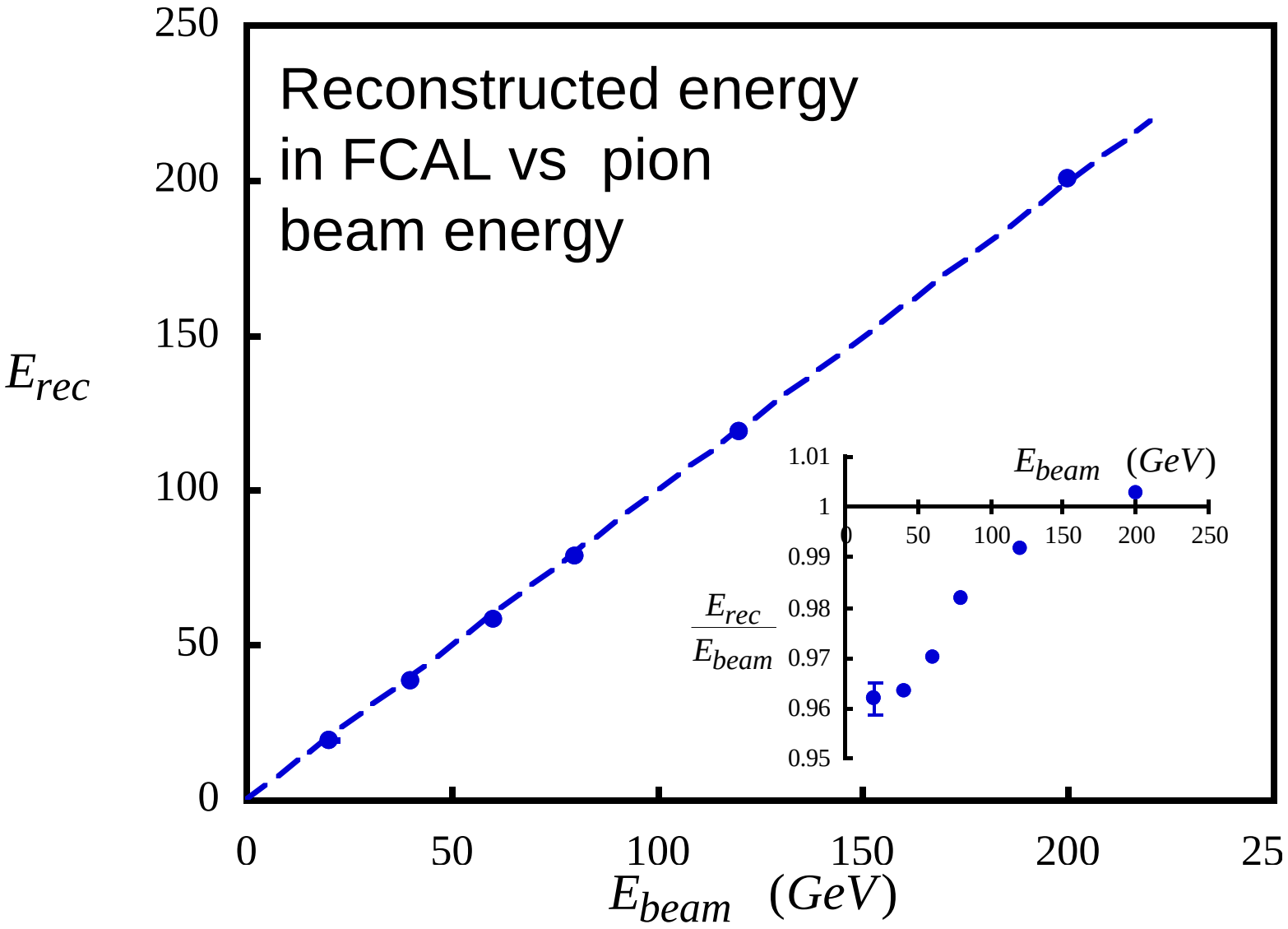
Module tested at 800 V after trip: no breakdowns

Energy Resolution



* See talk by A.Savine

FCAL Hadronic Linearity



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Conclusions

- ATLAS FCAL module-0 beam test very successful
- ATLAS FCAL technology meets design requirements
- Test has lead to improved construction and reconstruction methods