

The **MINERvA** Detector Construction Database

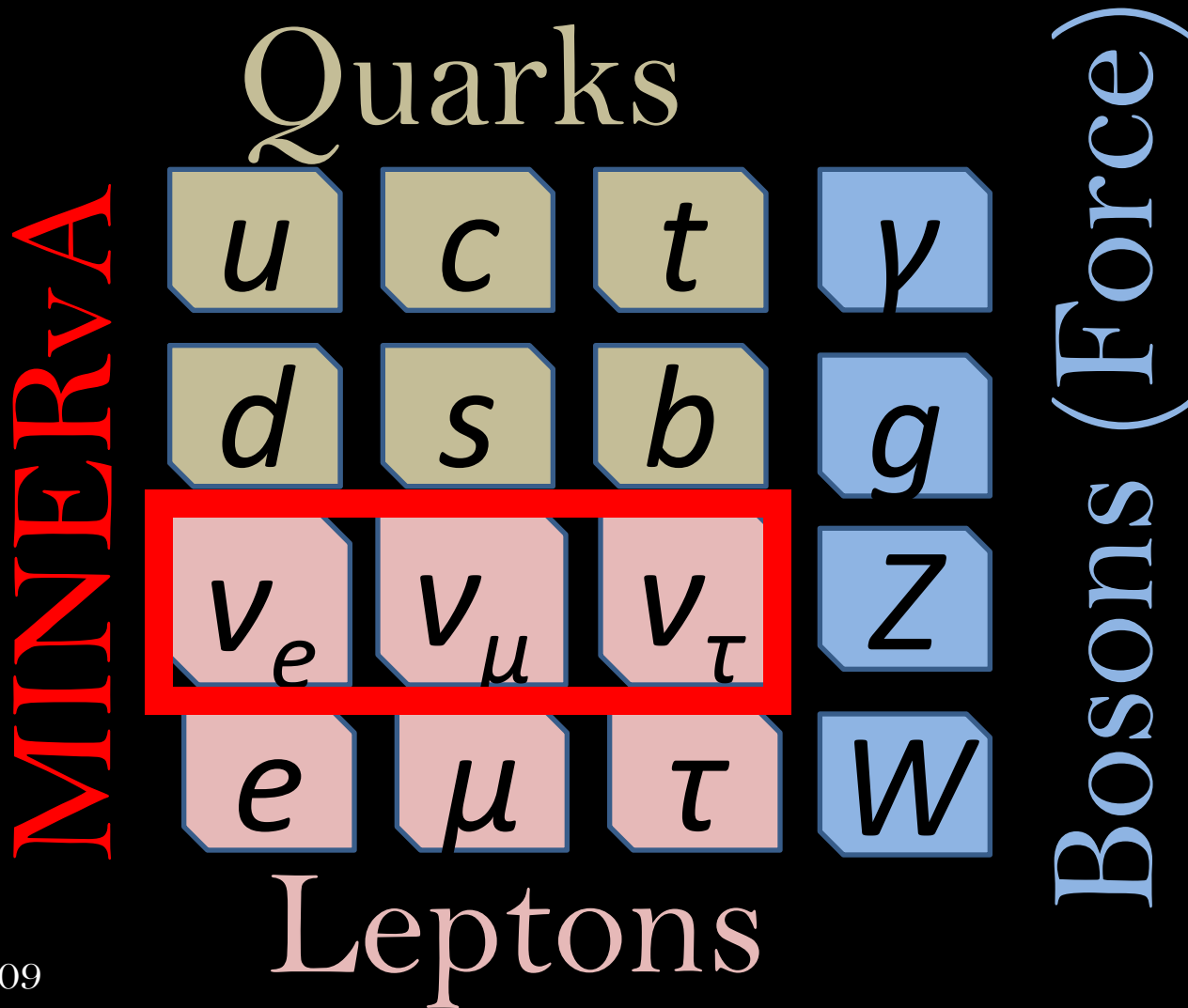


Moureen Kemei
Fermilab
Minerva Experiment
Dave Boehnlein

Outline:

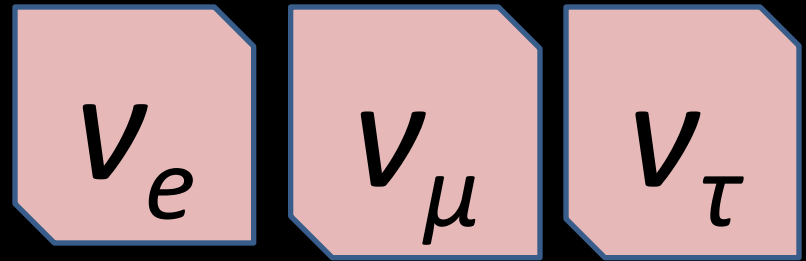
- Overview of **MINERvA** (Main Injector Experiment for ν -A)
- Motivation: Physics Goals for **MINERvA**
- Detector
- Construction Database
- Conclusion & Acknowledgements

MINERvA studies rare neutrino interactions



Neutrinos Interactions(vs), why so rare?

- Extremely low mass
- No charge
- Weakly interacting

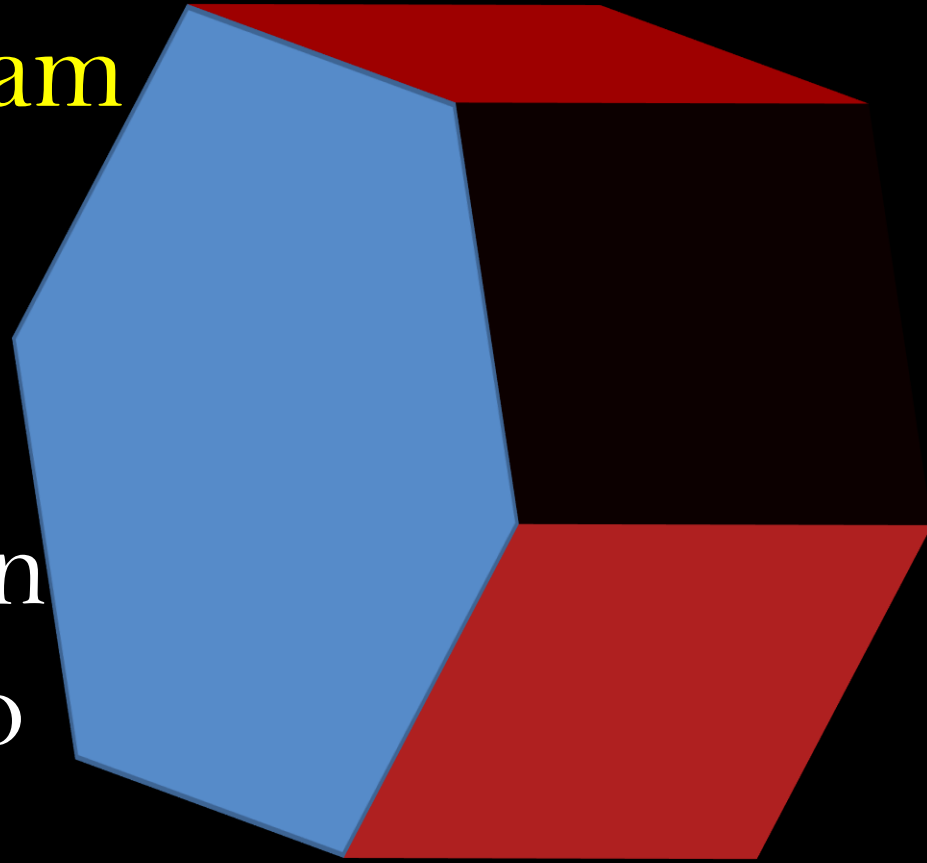
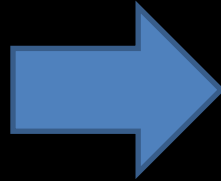
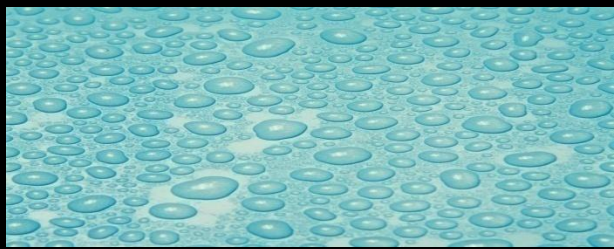


Leptons

Just how cool are neutrinos? A
hundred trillion vs pass through
our bodies every second!

How do we study neutrino interactions?

Intense neutrino beam



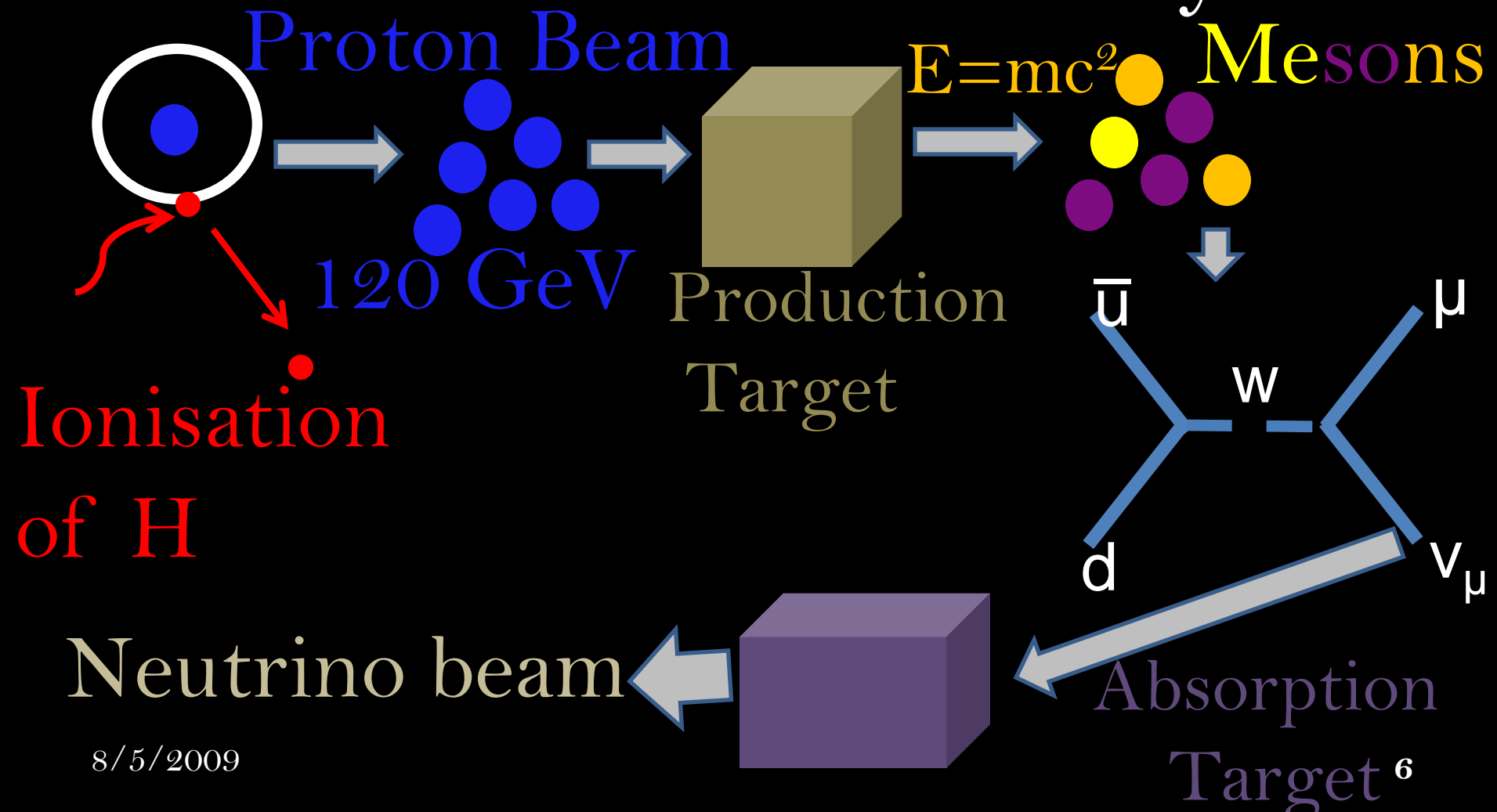
In Pb the interaction length of a neutrino is ~ 10 light years

Massive Detectors

MINERvA: NUMI Beam

Most **intense** ν beam in the world.

receives 4×10^{20} POT annually

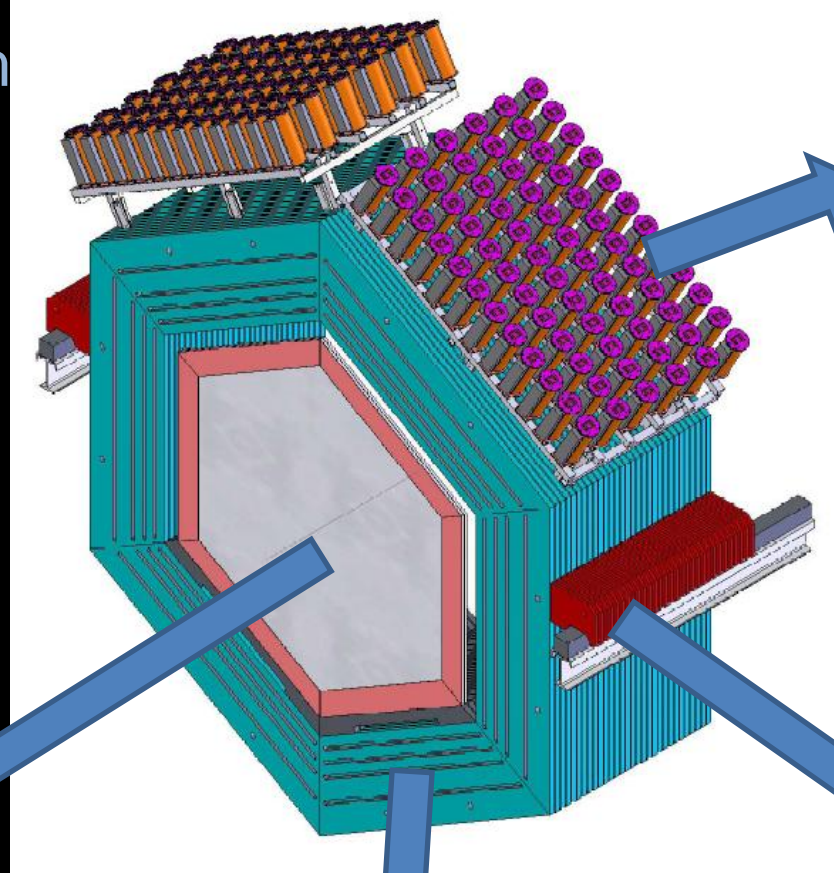
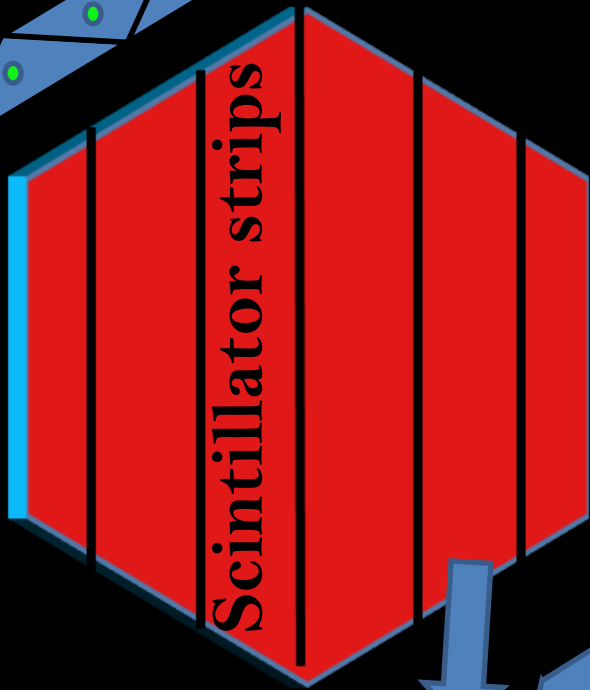


**Ionisation
of H**

MINERvA: Low mass fine grained fully active detector

WSF

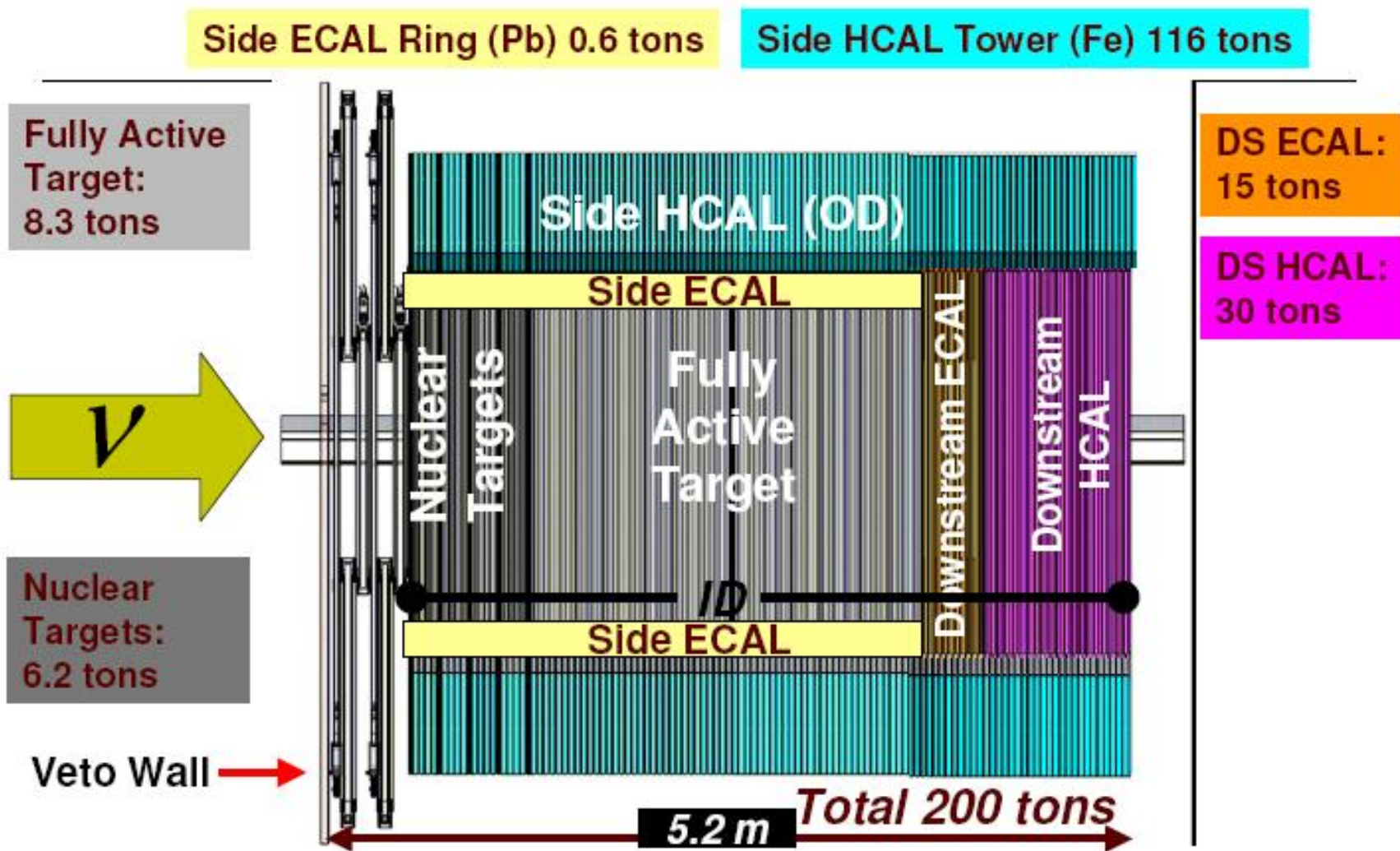
Base-3.3 cm
Height-1.7 cm



Tubes (PMTs)
Photomultiplier
Rail

Outer Detector

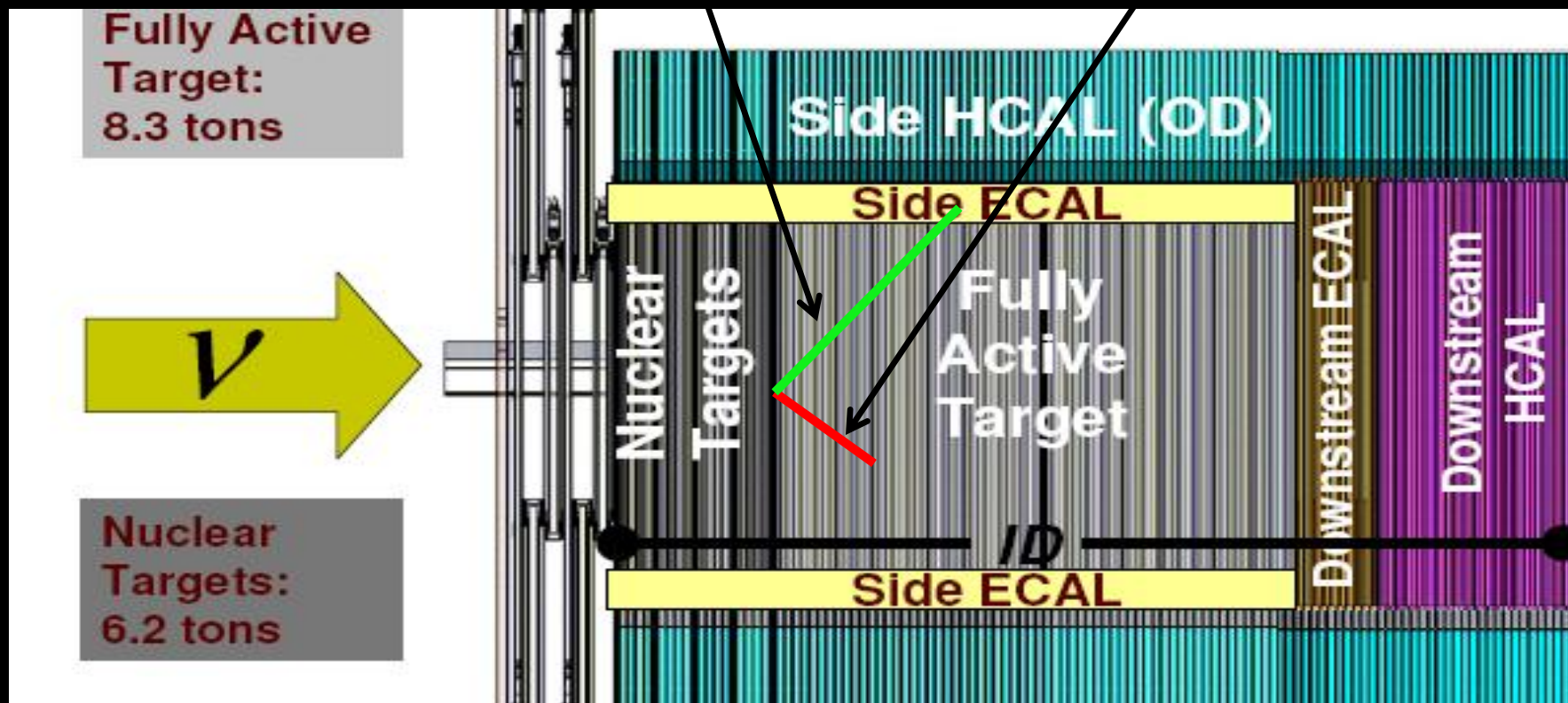
MINERvA: Detector Cross-section



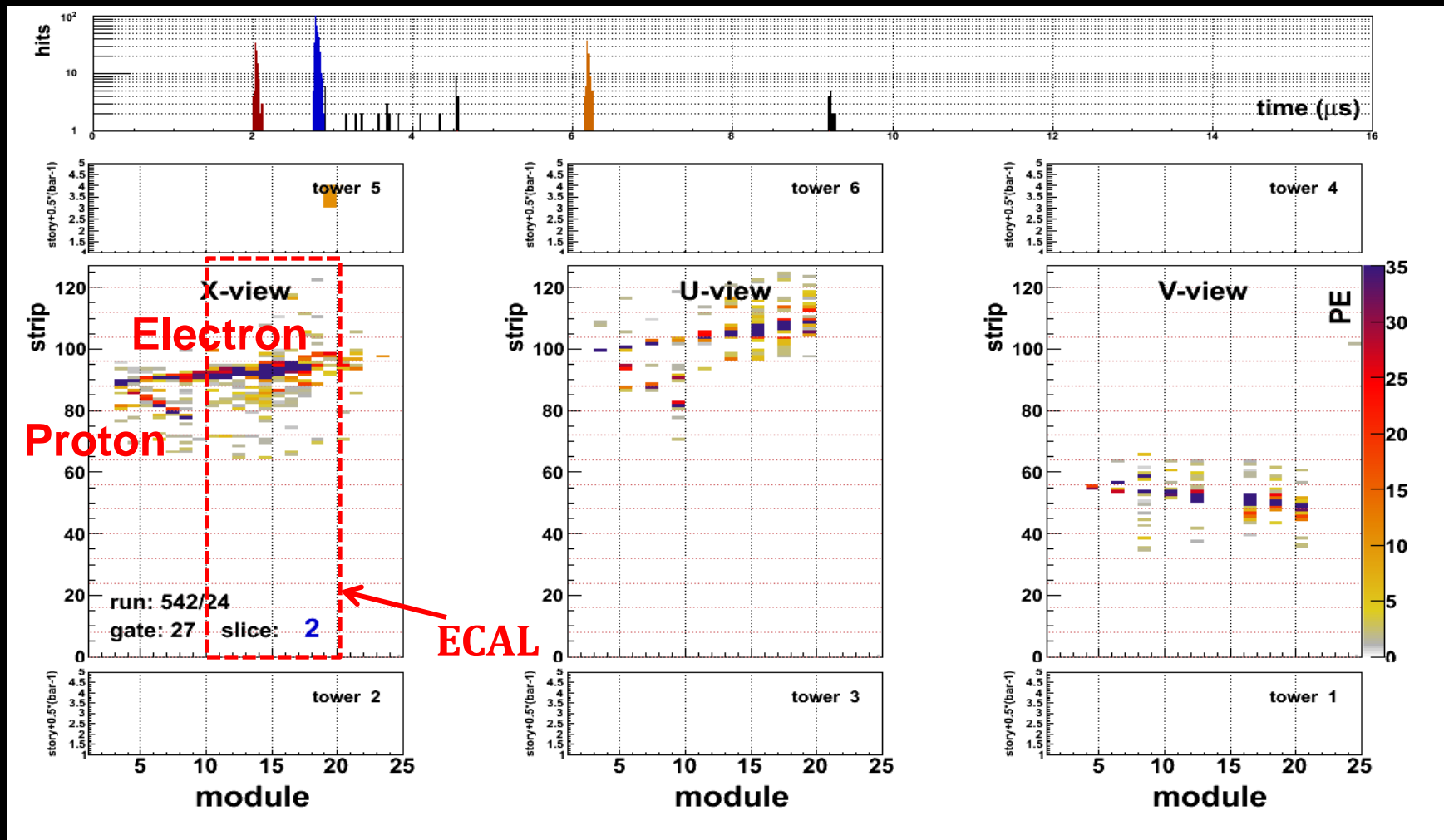
MINERvA: Neutrino Events

Electron

Proton



MINERvA: Event Reconstruction



$$\nu_e + n = e^- + P \text{ (Charged Current Interaction)}$$

MINERvA: Physics Goals

- Improved cross-section measurements of ν -nucleus interactions through a fine-grained fully active detector and high statistics
- Nuclear dependence of ν interactions by interspersing different nuclear targets with scintillator strip planes



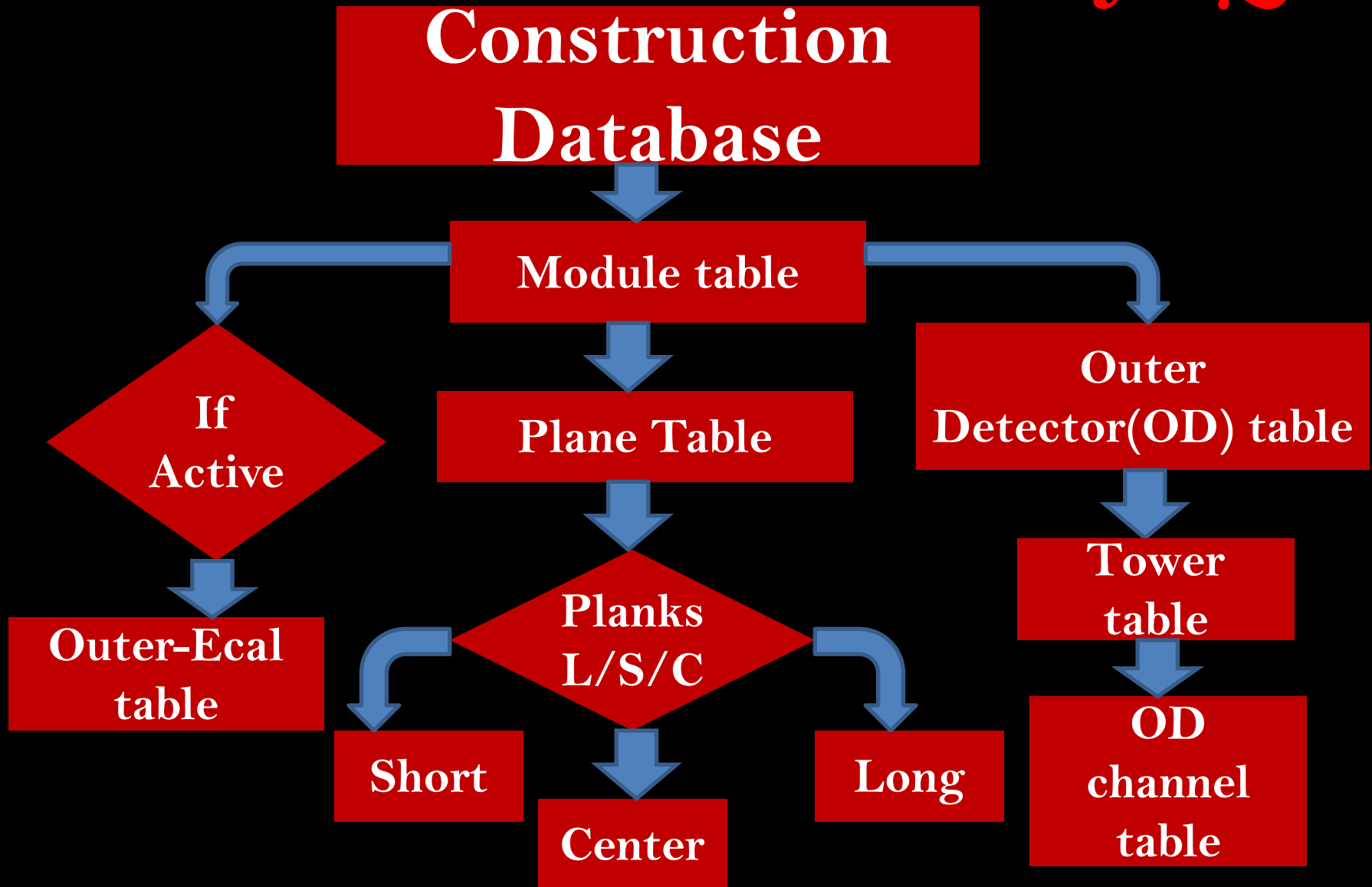
The **MINERvA**
tracking Prototype

Databases: Importance

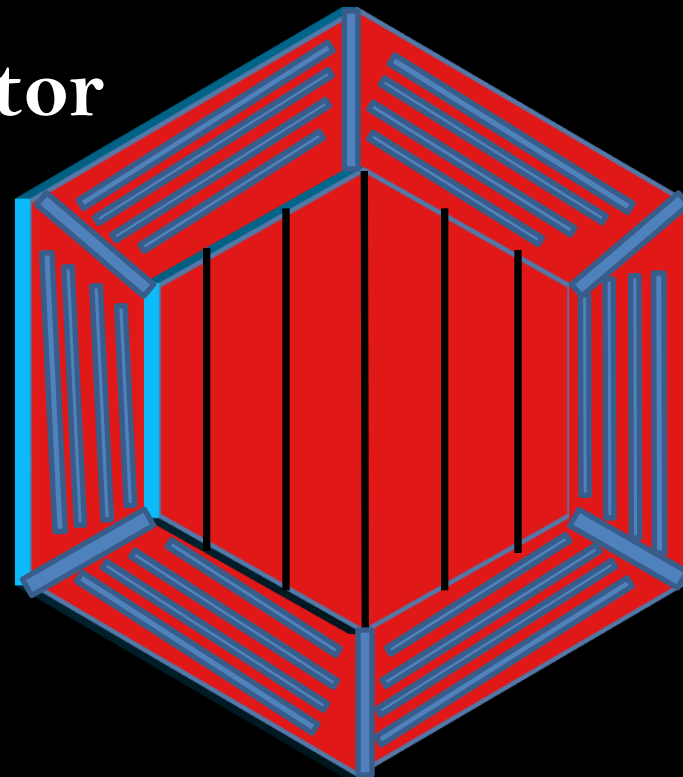
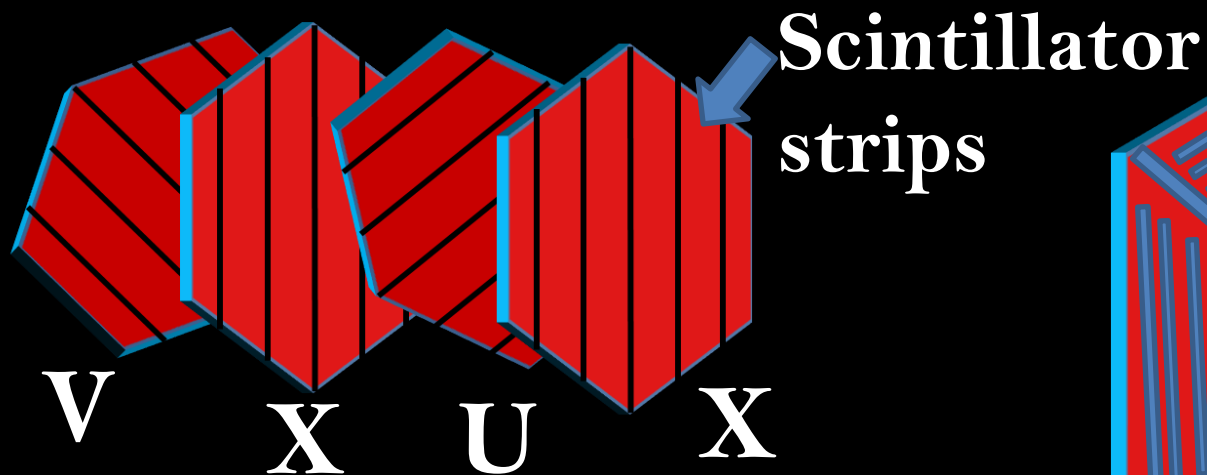
- Organization of large amounts of data into **relational tables**.
- Several clients can **interface** with the database.
- **MINERvA**: Where components are located

```
H006S, RD01653B, RD01230B, RD01221B, RD01722B, RD012
H007S, RD01637B, RD01465B, RD01413B, RD01615B, RD016
H008S, RD01409B, RD01517B, RD01624B, RD01577B, RD015
H009S, RD01295B, RD01277B, RD01299B, , RD01300B, RD01
H010S, RD01681B, RD01641B, RD01583B, RD01663B, RD016
H011S, RD01085B, RD01024B, RD01054B, RD01061B, RD010
H012S, , RD01384B, RD01215B, RD01394B, RD01214B, RD01
H013S, RD01173B, RD01197B, RD01172B, RD01196B, RD011
H014S, RD01184B, RD01179B, RD01187B, RD01170B, RD011
H015, RD01104B, RD01111B, RD01117B, RD01133B, RD011
H016, RD01073B, RD01069B, RD01138B, RD01140B, RD010
H017, , , , , , , , , , , , , , , , , , , , , , , , , , ,
H018S, RD04854B, RD04874B, RD04841B, RD04887B, RD048
H019S, RD04897B, RD04901B, RD04898B, RD04894B, RD048
H020S, RD04933B, RD04925B, RD04914B, RD04913B, RD049
H021S, RD01358B, RD01361B, RD04360B, RD01329B, RD014
H022S, RD04818B, RD04837B, RD04820B, RD04836B, RD048
H023S, RD04593B, RD04609B, RD04589B, RD04611B, RD045
H024S, RD04582B, RD04577B, RD04566B, RD04574B, RD045
H025S, RD04532B, RD04546B, RD04527B, RD04544B, RD045
H026S, RD04634B, RD04648B, RD04638B, RD04627B, RD046
H027S, RD04641B, RD04016A, RD04652B, RD04078A, RD046
H028S, RD04725B, RD04727B, RD04710B, RD04728B, RD047
```

Database Flowchart: MySQL



Module Table: basic structure

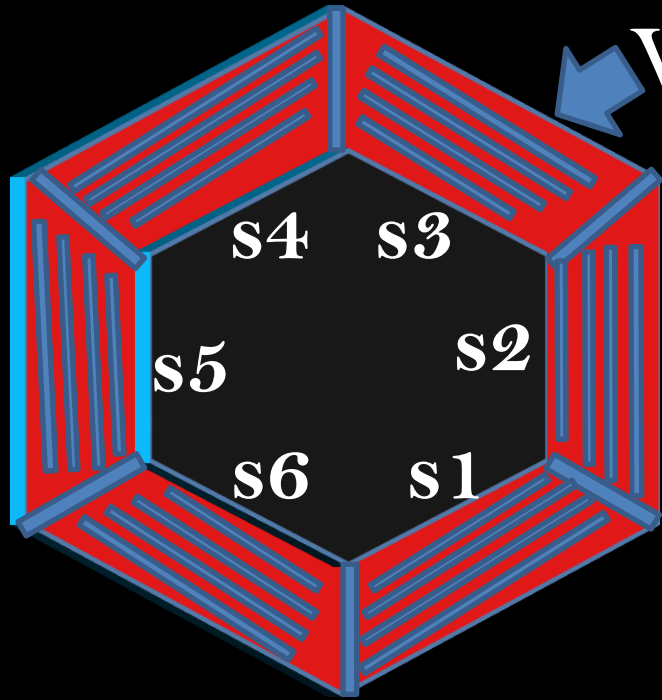


Inner Detector (ID) Plane orientations.

1 module: 2 ID planes

modulenumber	configuration	tpid	plane1	plane2	cal	date
95	HCAL	X-HCAL-1	X-W036H	U-STEEL	HCAL	05/05/200

Outer Detector (OD) Table:

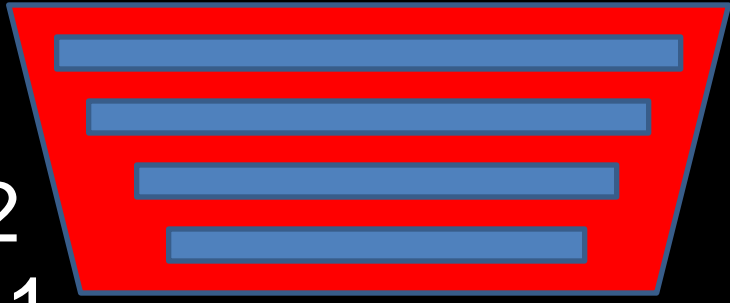
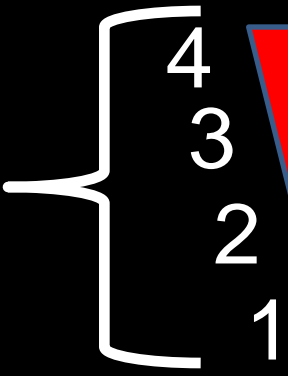


- The OD supports the inner detector planes, absorbs particles and measure the energy of large angle scattering particles

moduleno	wedge	weight	scintillator
95	S1	540	H97L
95	S2	521	H92R
95	S3	513	6L
95	S4	522	H90R
95	S5	514	H98L
95	S6	530	H91R

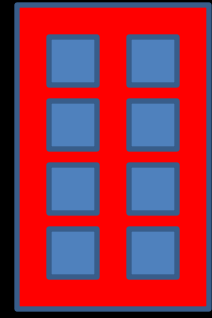
Tower table:

4
Doublets



Wedge

UL

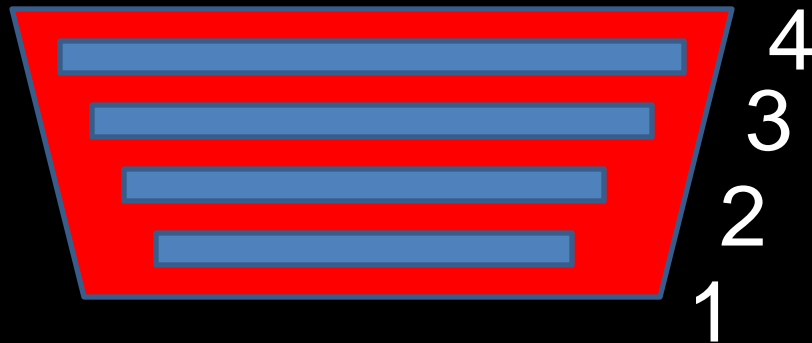


Wedge cross section

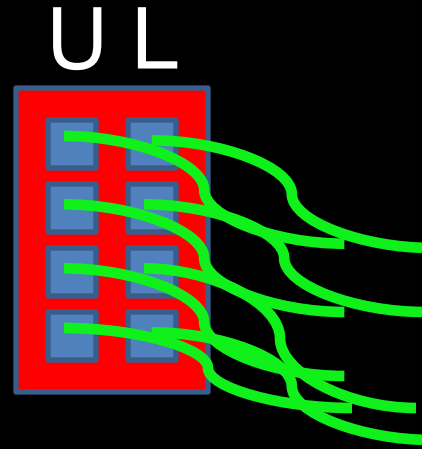
Fields in the tower table:

Field	Type	Null	Key
TOWERID	char(5)	NO	PRI
POSITION	text	NO	
STRIP1A	text	YES	
STRIP1B	text	YES	
STRIP2A	text	YES	
STRIP2B	text	YES	
STRIP3A	text	YES	
STRIP3B	text	YES	
STRIP4A	text	YES	
STRIP4B	text	YES	

The OD channel table:



Wedge

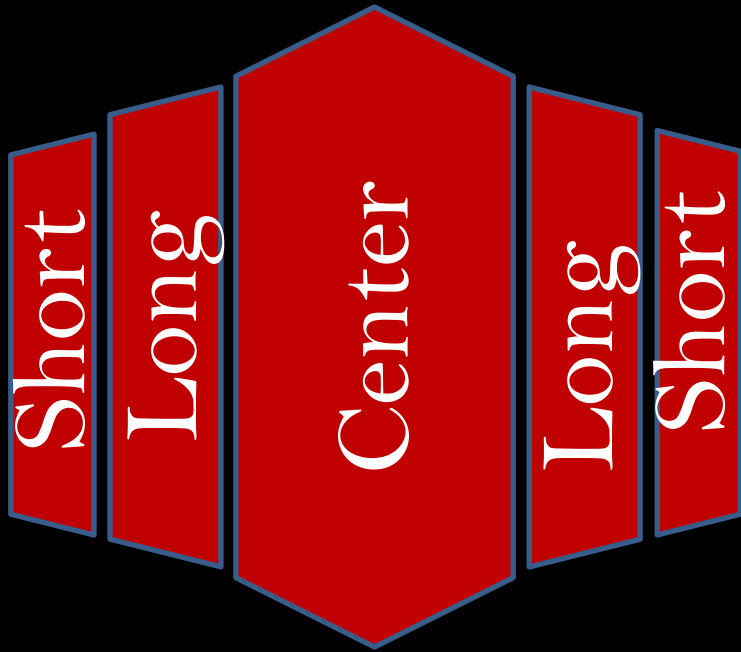


**Wavelength shifting
Fibers (WSFs)**

Fields in the OD channel table:

Field	Type	Null	Key
WEDGEID	char(5)	NO	PRI
DOUBLET	int(1)	NO	PRI
POSITION	char(1)	NO	PRI
CHANNEL	tinyint(4)	NO	

Plank table:

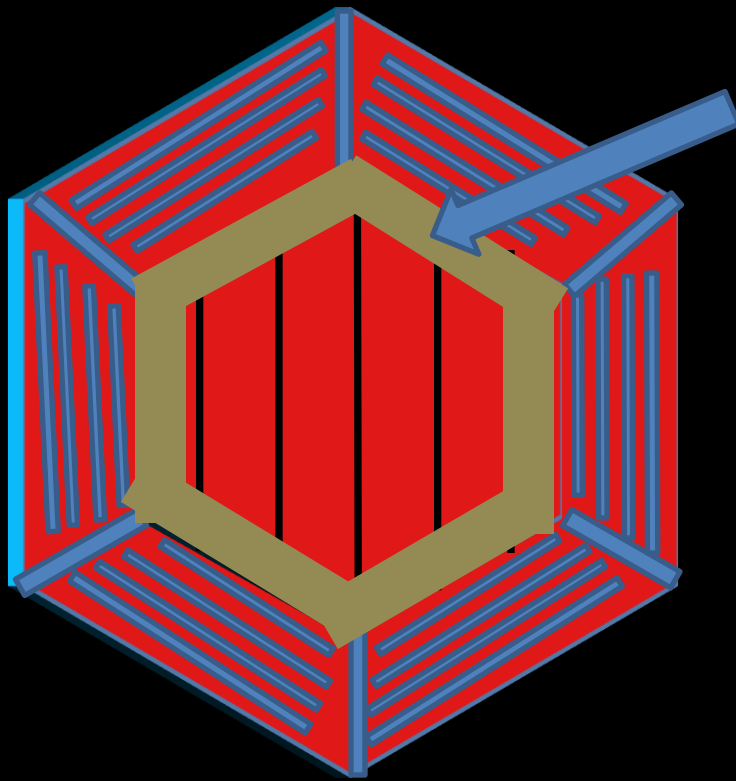


5 planks in each active plane.

Three plank tables:

- Short – 24 scintillator strips
- Long – 24 scintillator strips
- Center – 31 scintillator strips

The Outer-Ecal Table:



- **6 Pb lead plates** between the ID and OD of active planes.
- The Pb plates form the outer electromagnetic calorimeters (ECAL)

wedgeid	plane	pbwedge
66S1	U	908
66S1	X	883

In Progress: **Graphical user interface** for the database

HOST	<input type="text"/>
USER NAME	<input type="text"/>
PASSWORD	<input type="text"/>
DATABASE	<input type="text"/>
<input type="button" value="LOGIN"/>	<input type="button" value="CLEAR"/>

Instead of: `>mysql --host = minerva
--user=kemei --password=psword
--database= minerva`

Simplifying data entry:

Python Graphical user interface

MODULENUMBER

CONFIGURATION

TPID:

PLANE1:

PLANE2:

CALORIMETER

DATE:

MODULENO to DELETE:

Instead of: `>mysql Insert into module (modulenumber, Configuration, tpid, plane1, plane2, calorimeter, date) VALUES (95, HCAL, ghyy, X, HCAL, 07/28/2009)`

Conclusion and Summary:

- A construction database has been created for the **MINERvA** detector and runs on **MINERvA05**
- Data from completed modules has been loaded into the database
- A GUI is being developed to ease the process of data entry
- Along the way: new skills !



Acknowledgements:

- Dave Boehnlein, my supervisor.
- Dianne Engram
- Jamieson Olsen
- Dr. James Davenport
- Linda Diepholz
- Dianne Alexander
- Chris Marshall
- The MINERvA Collaboration
- **Fermilab and the SIST program**
- Friends and Family

References:

- The Minerva Collaboration
- MINERvA, a Neutrino-Nucleus Interaction Experiment, C.J. Solano Salinas, A. Chamorro, C. Romero and the MINERvA Collaboration, 2007
- Brandon Eberly