

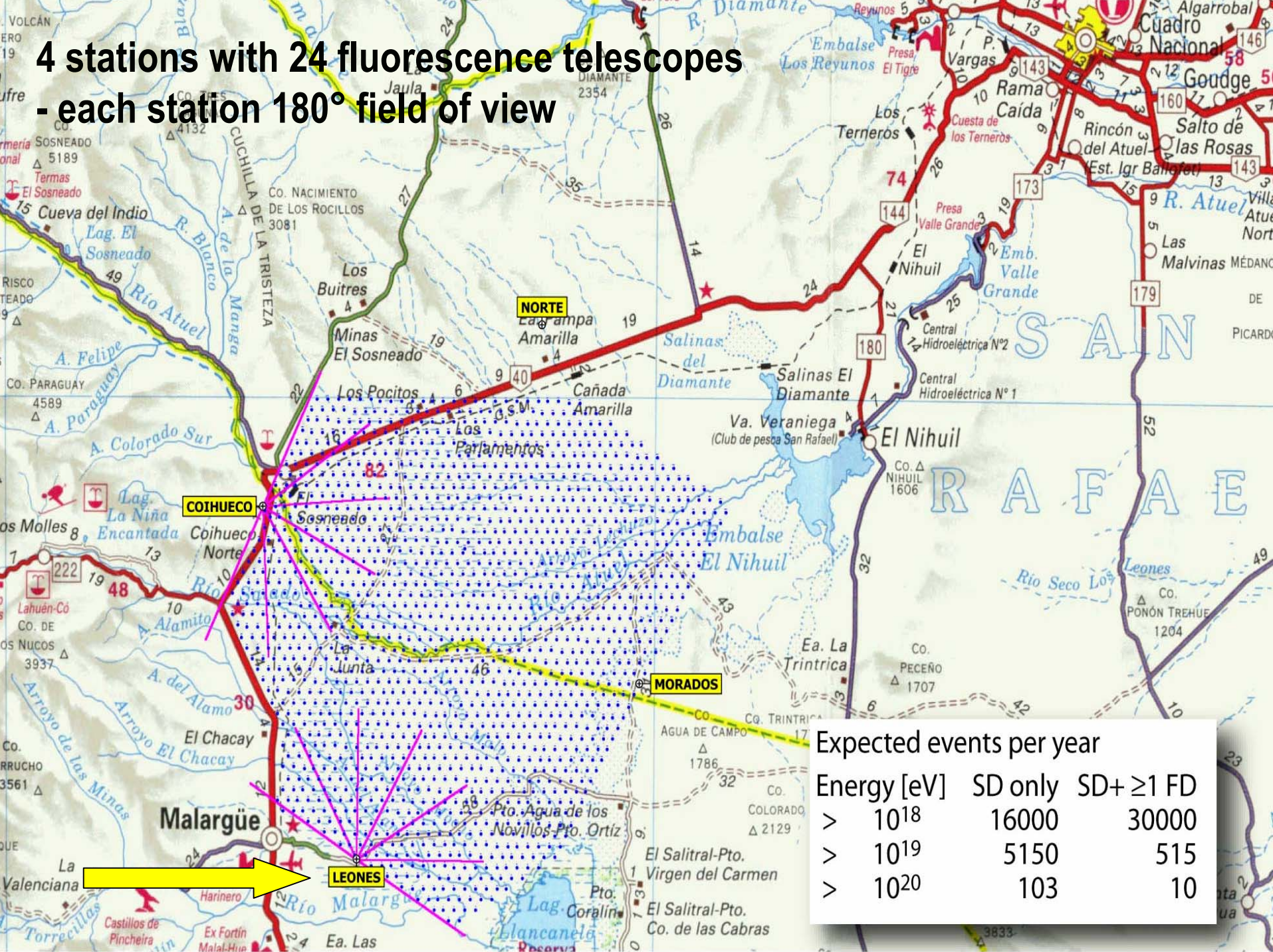
**Astročásticová fyzika v
Centru částicové fyziky
v roce 2003**

- vlastní fyzikální výzkum
 - částicová fyzika (Delphi, QGP)
 - astronomie (šíření UHECR)
- účast na projektu Auger
 - výstavba FD
 - zpracování dat, AIRFLY

Observatoř Pierra Augera v roce 2003



4 stations with 24 fluorescence telescopes
 - each station 180° field of view



Expected events per year

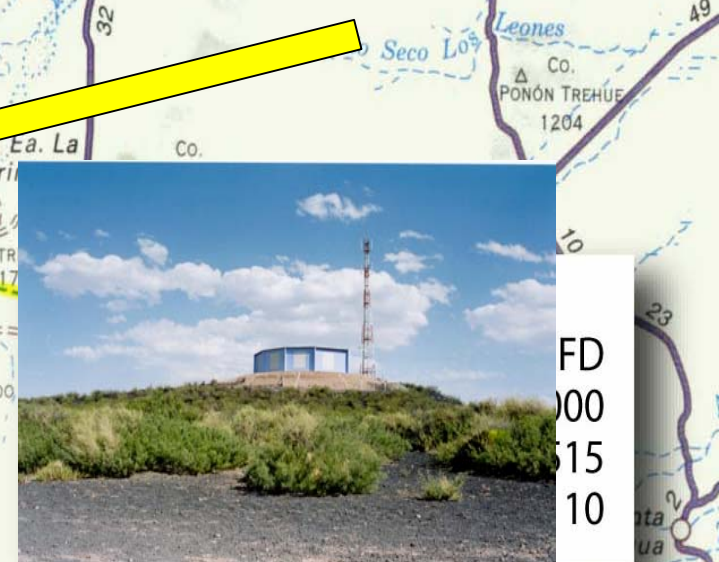
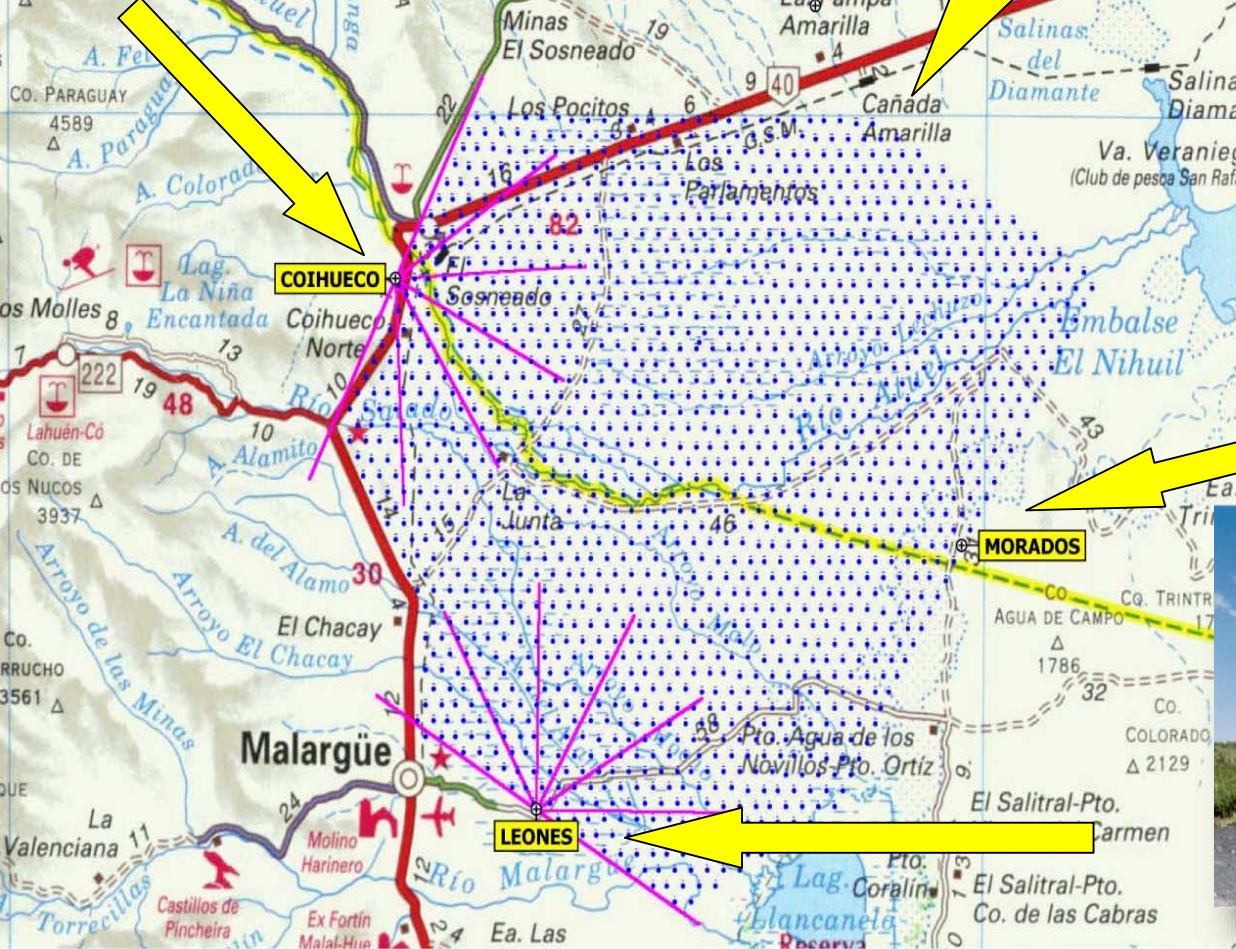
Energy [eV]	SD only	SD+ ≥1 FD
> 10 ¹⁸	16000	30000
> 10 ¹⁹	5150	515
> 10 ²⁰	103	10





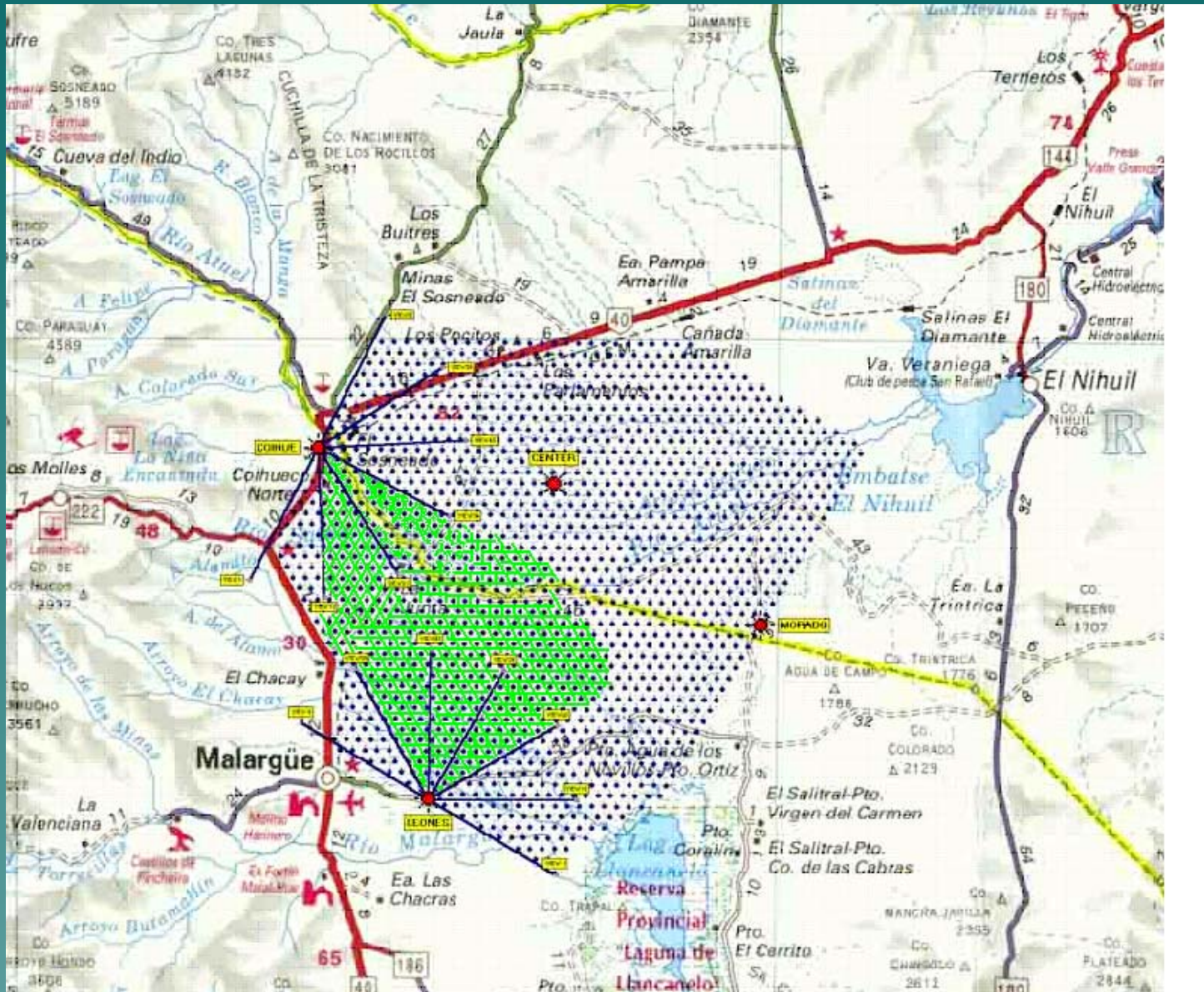


Science telescopes of view

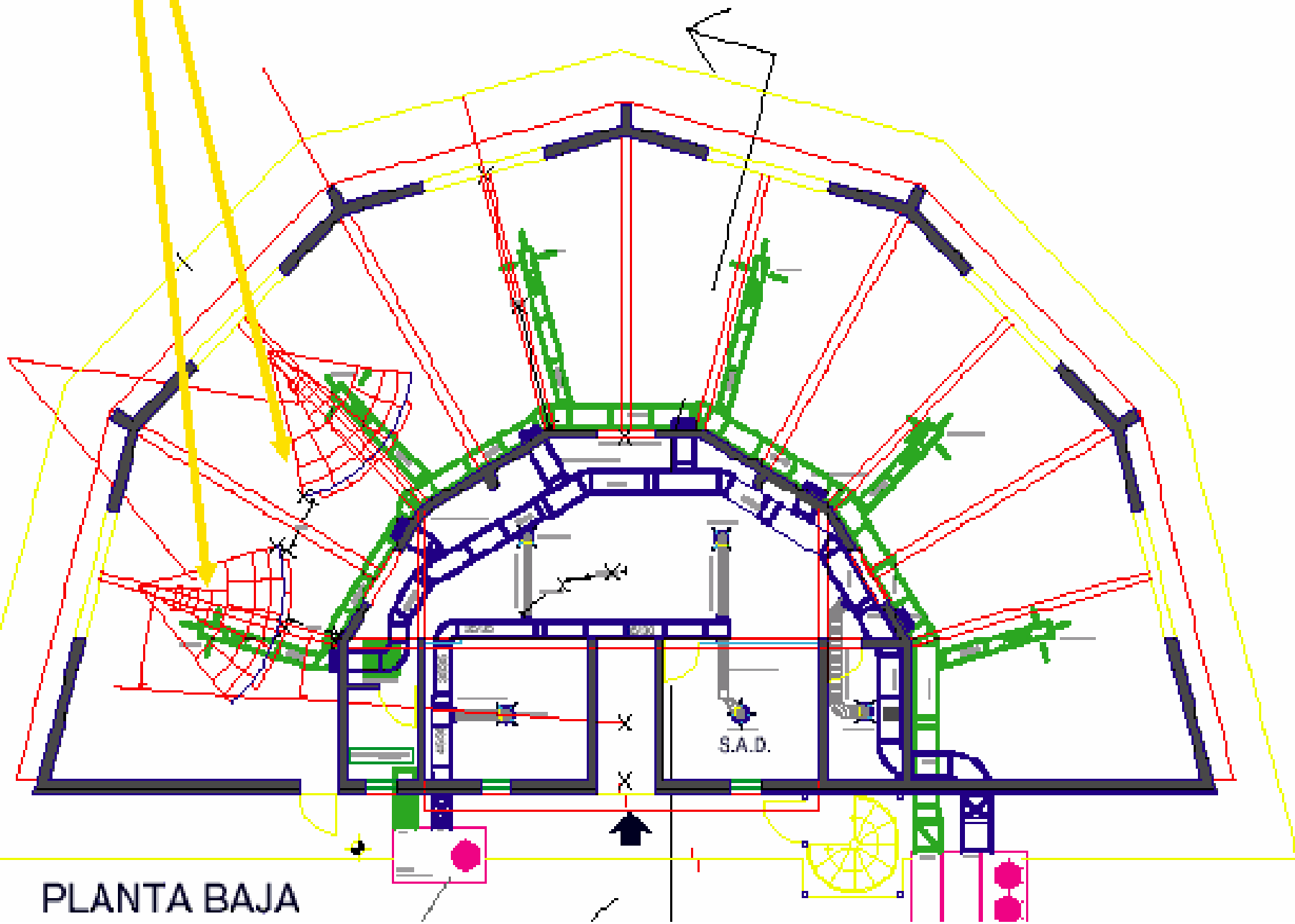


FD
000
15
10

Auger FD 2003/2004

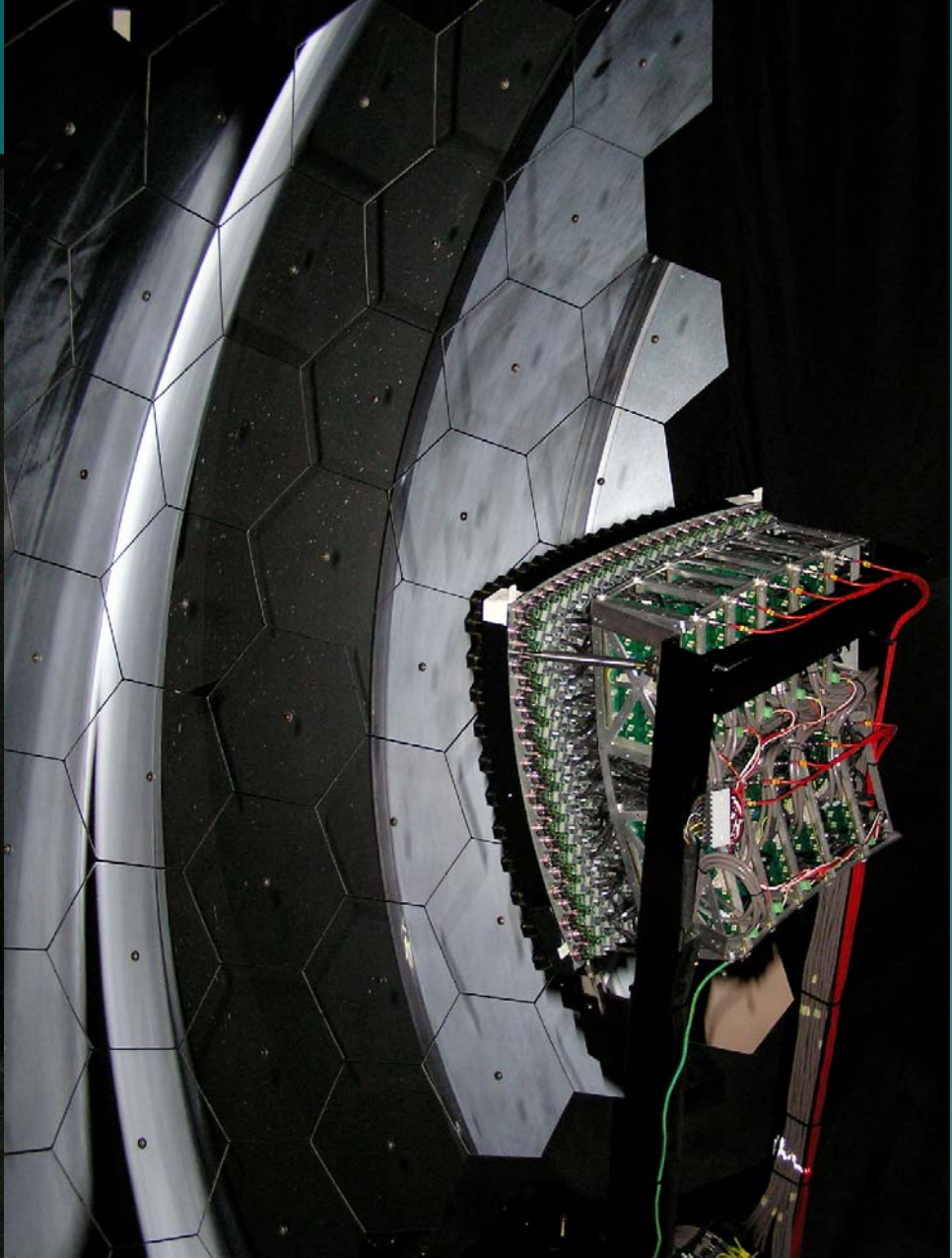


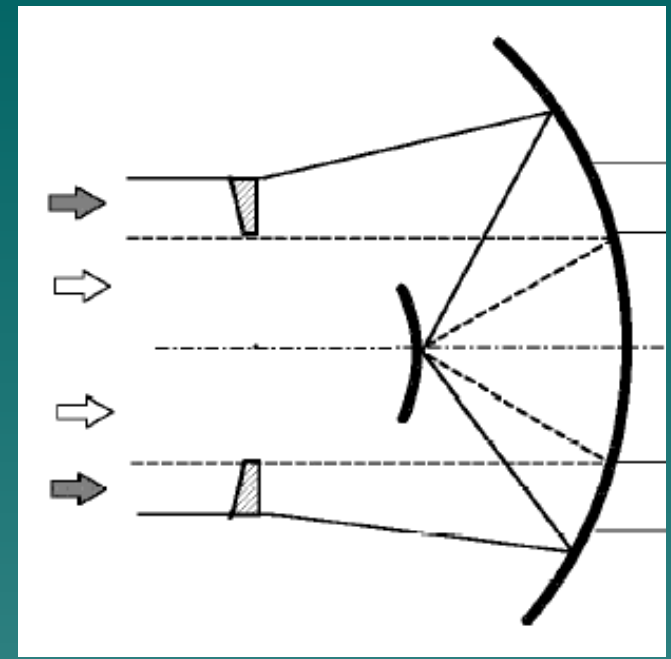
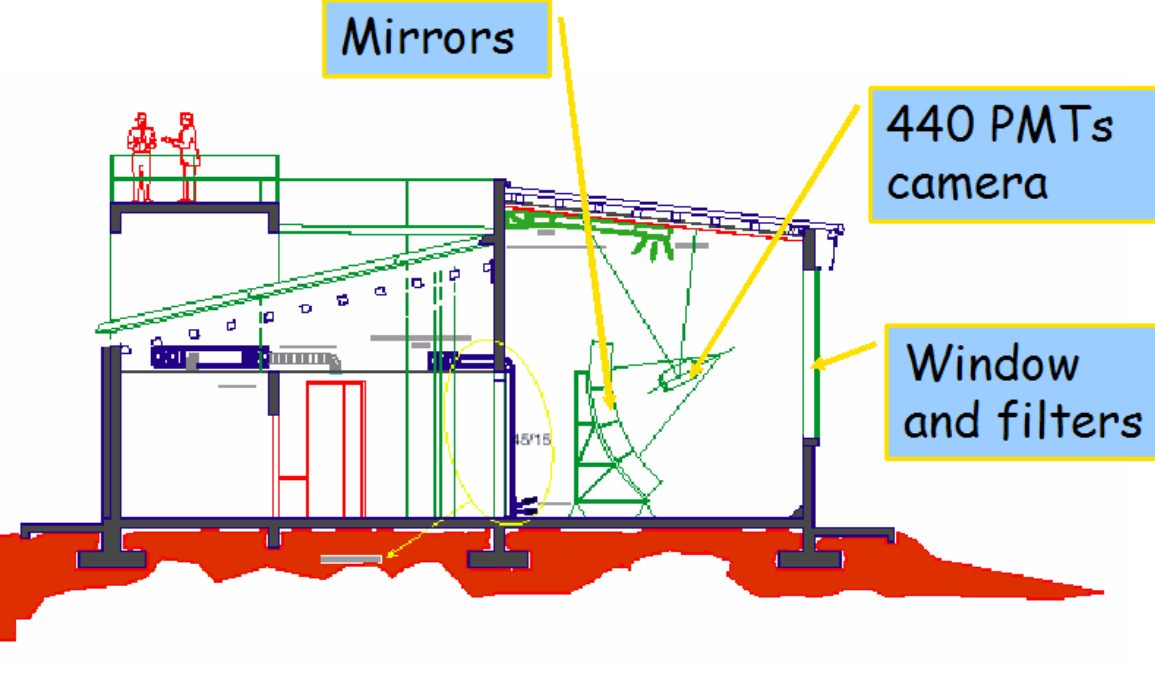




PLANTA BAJA

Coihueco





Schmidtova kamera

apertura: $D = 2200 \text{ mm}$

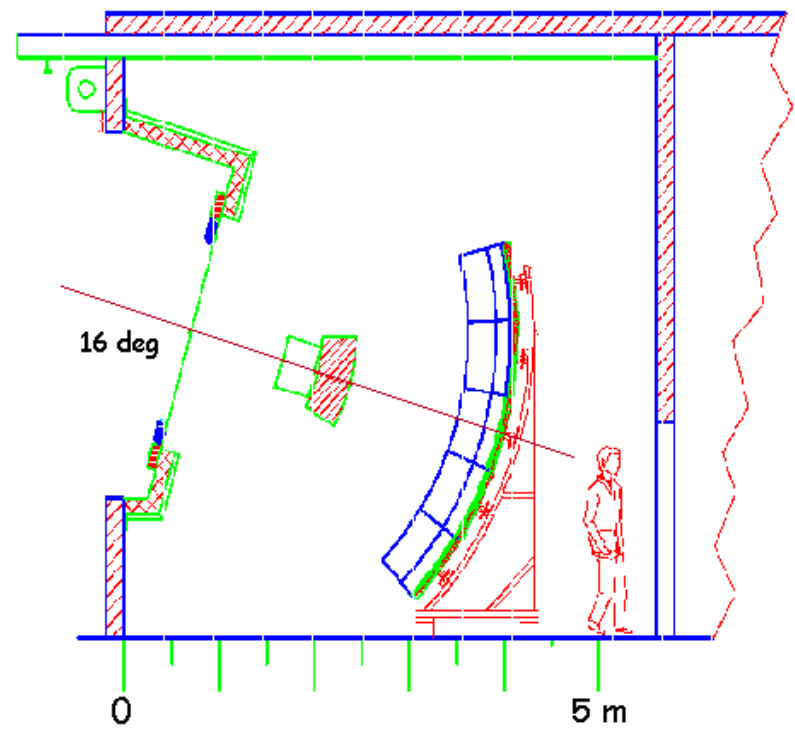
zrcadlo: $R = 3440 \text{ mm}$

plocha: $3,6 \times 3,6 \text{ m}^2$

Sběr dat

20 x 22 PMT ve fokální rov.

- vzorkování po 100 ns

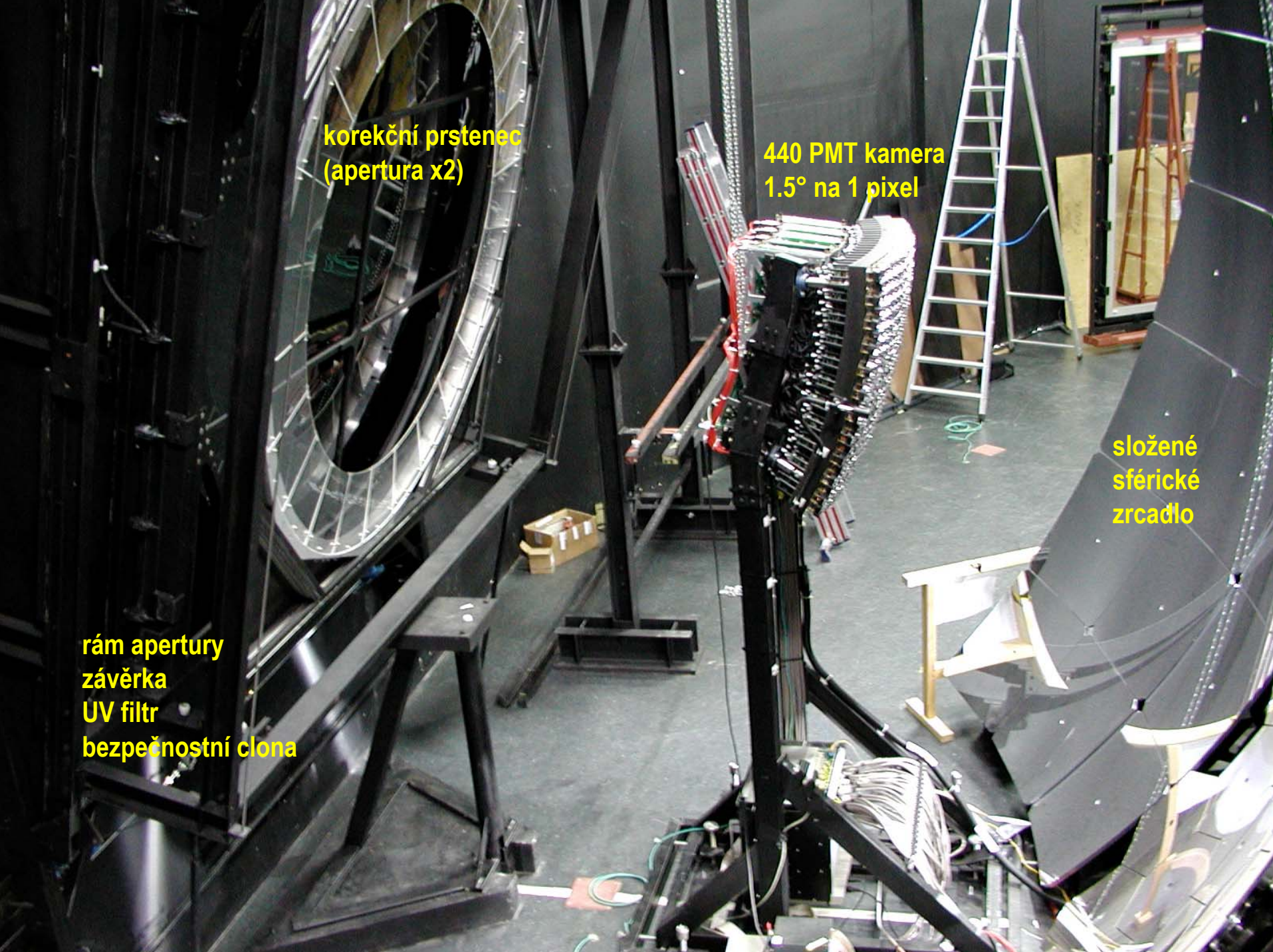


korekční prstenec
(apertura x2)

440 PMT kamera
1.5° na 1 pixel

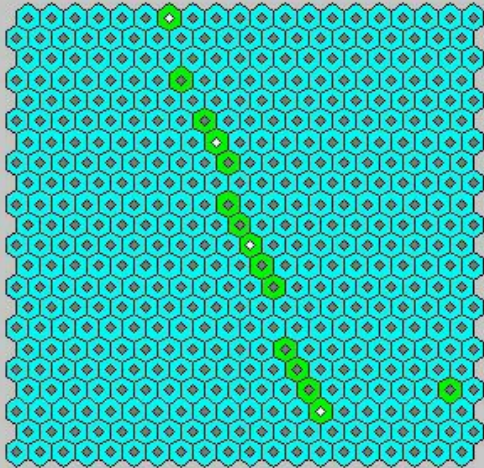
složené
sférické
zrcadlo

rám apertury
závěrka
UV filtr
bezpečnostní clona

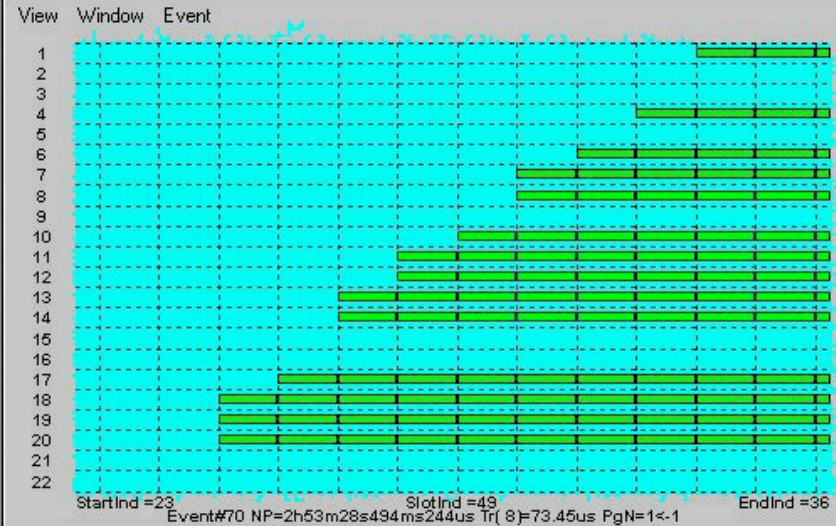


sprška viděná ve FD

SLT. Mirror view.

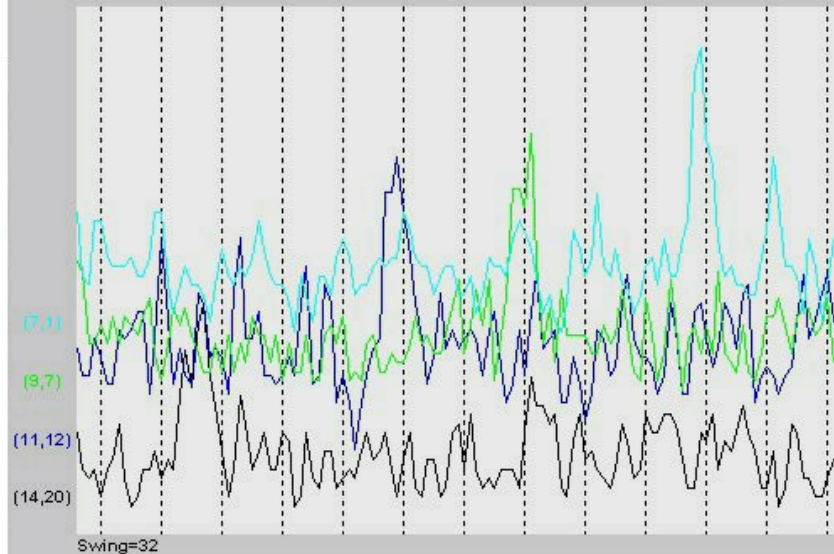


SLT. Time-Altitude View



**first large
shower in
Auger FD
23.05.2001**

ADC data

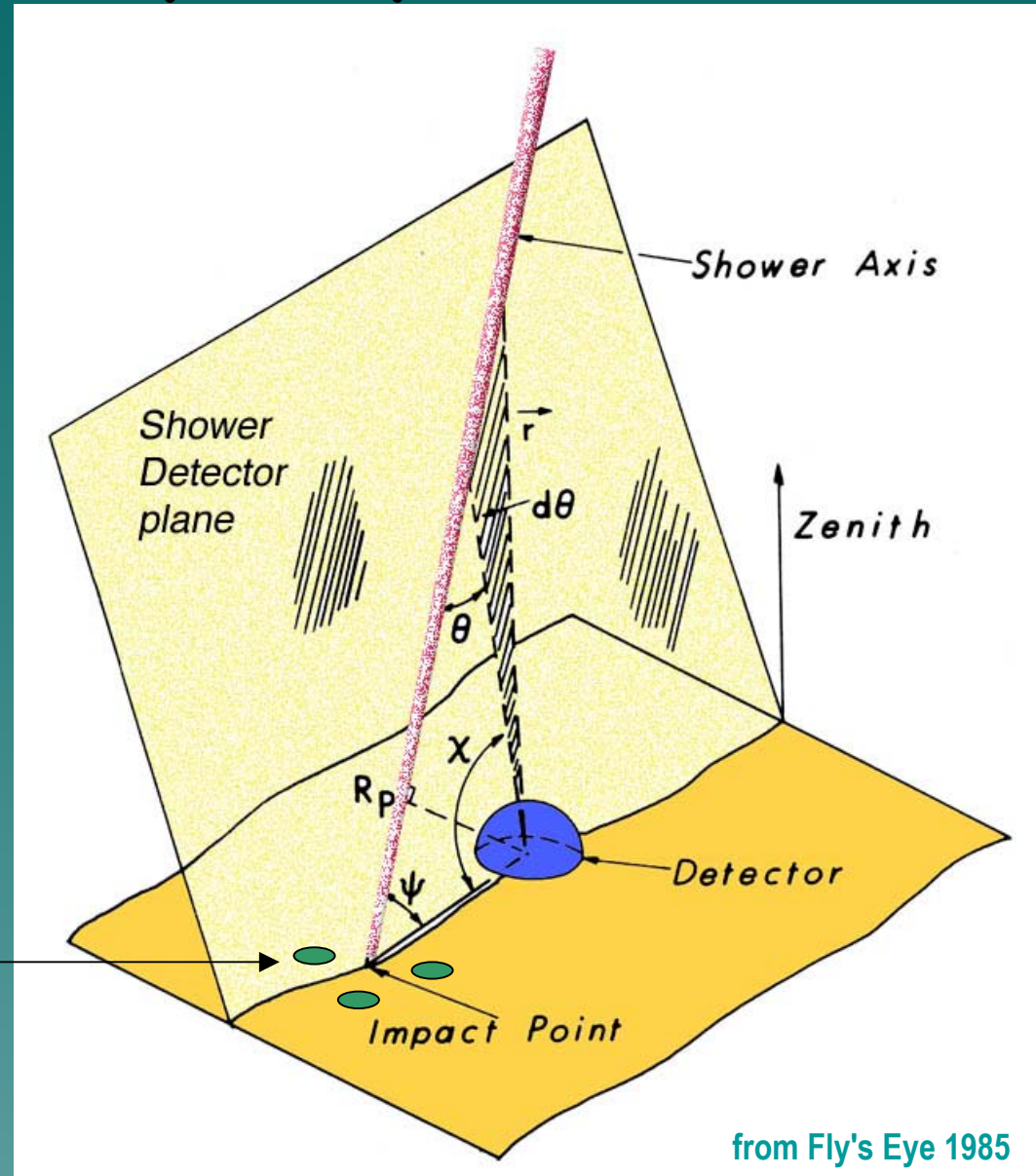


rekonstrukce spršky z dat FD

Sprška - Detektor (SD) rovina se určí docela přesně (chyba $\sim 1^\circ$)

určení místo dopadu a úhlu Θ se zlepší díky informaci z SD

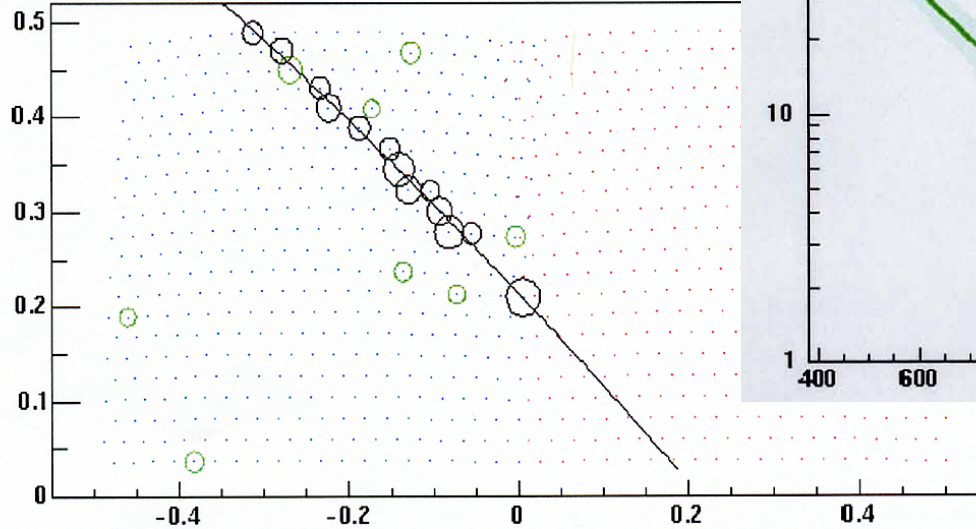
povrchový detektor



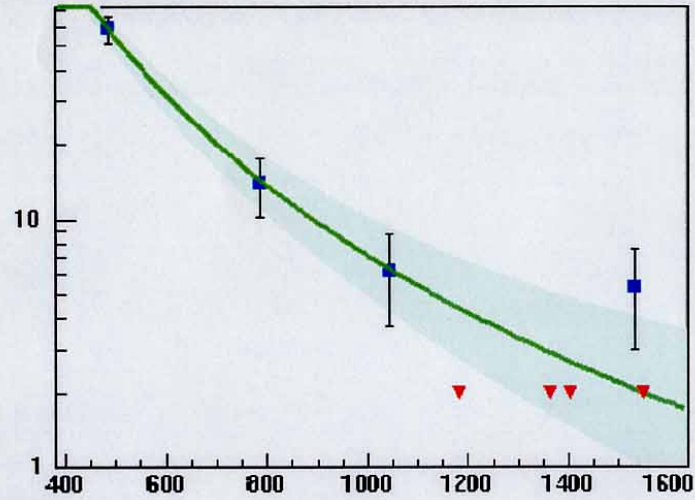
from Fly's Eye 1985

nz:nx

camera

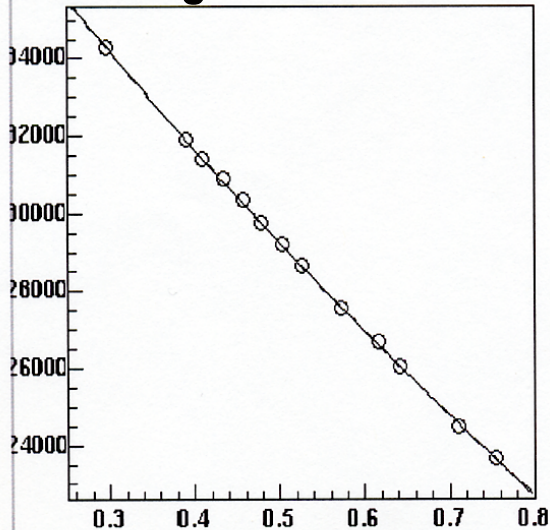


Lateral distribution function fit



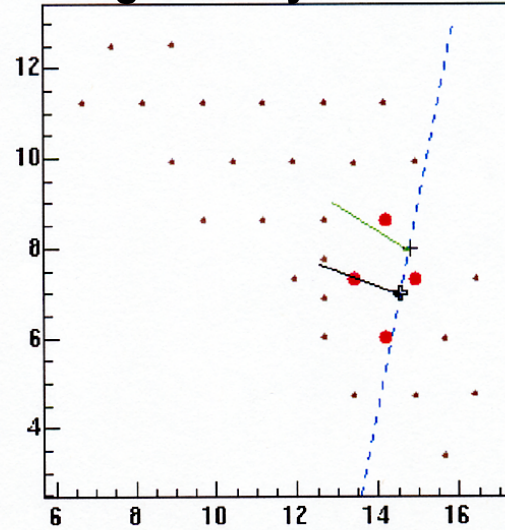
Graph

angle vs time



Graph

geometry



Easting = $461438 \pm 97m$
Northing = $6082453 \pm 104m$
dt = $0.5ns$

$\Delta Y = 3m$

Theta = $44.5 \pm 0.9 \text{ deg}$
Phi = $161.9 \pm 0.8 \text{ deg}$

Theta = 44.1
Phi = 161.9

R = $11.1 \pm 2.0 \text{ km}$

SD energy = 1.60 ± 0.34
 FD energy = 1.29 ± 0.08

100%

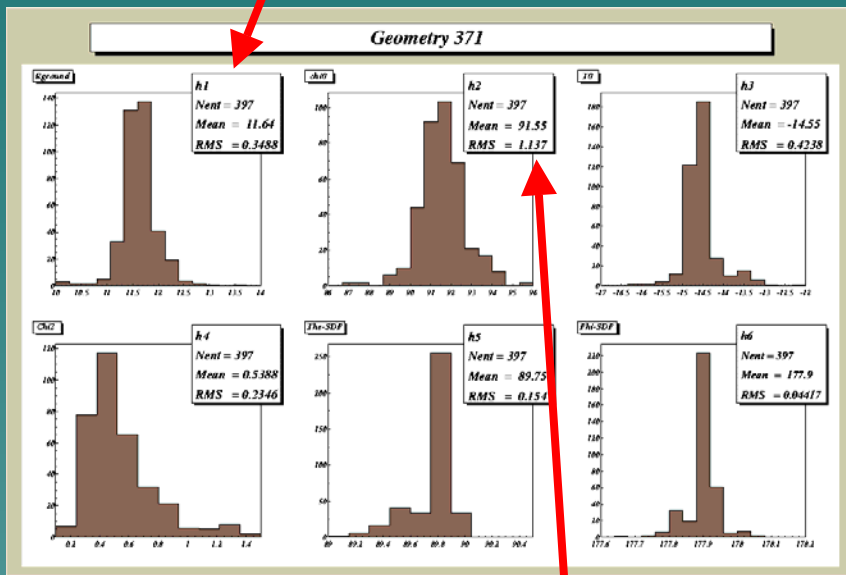
Kalibrace - hardware & atmosféra

- laserové záblesky

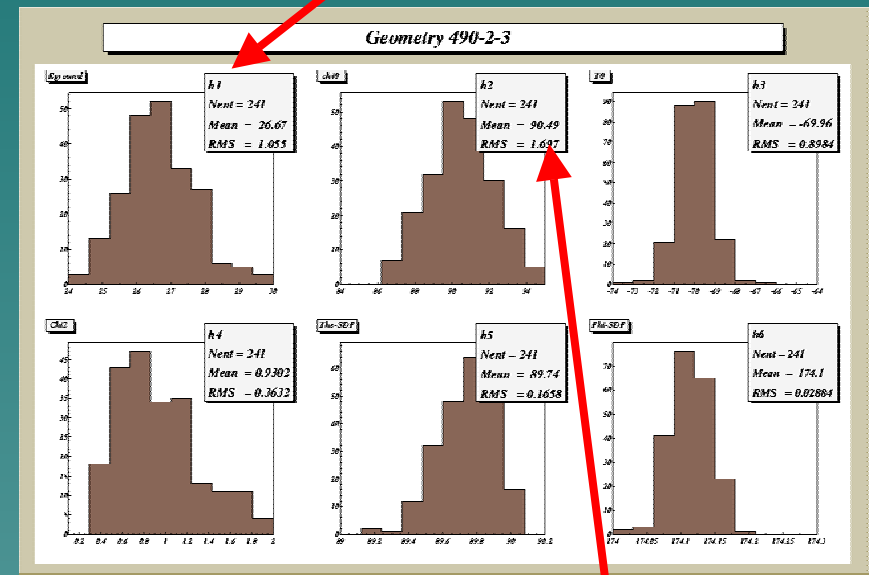
vzdálenost: 11.6 km
RMS = 0.35 km

rekonstrukce
bez SD!

vzdálenost: 26.7 km
RMS = 1.1 km



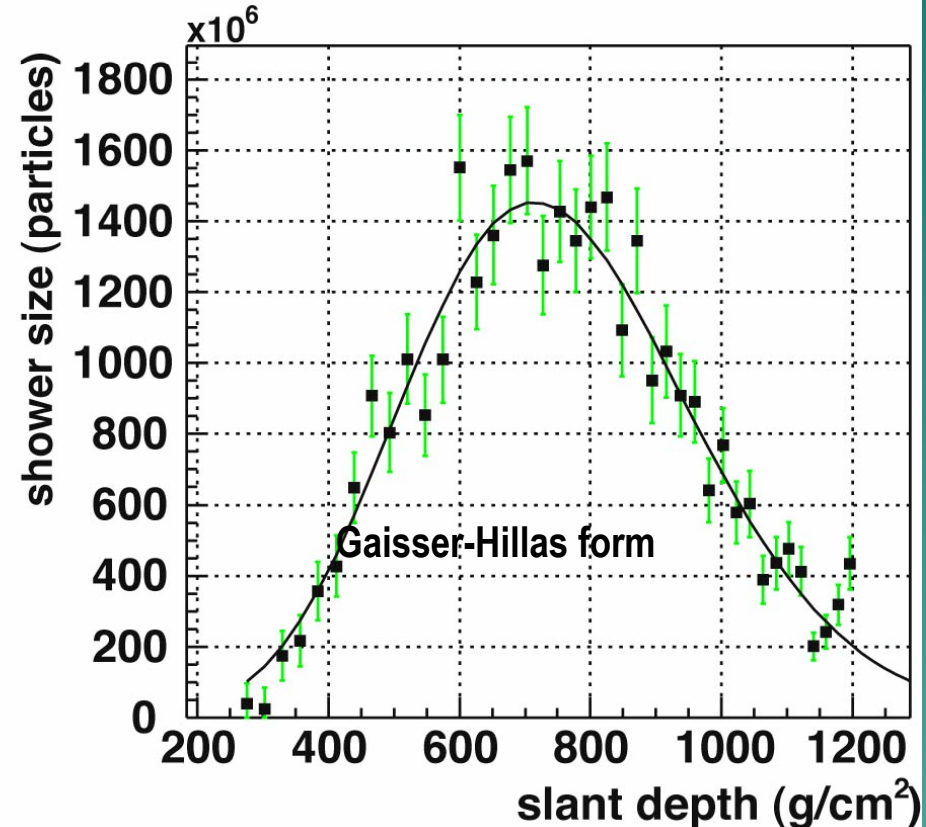
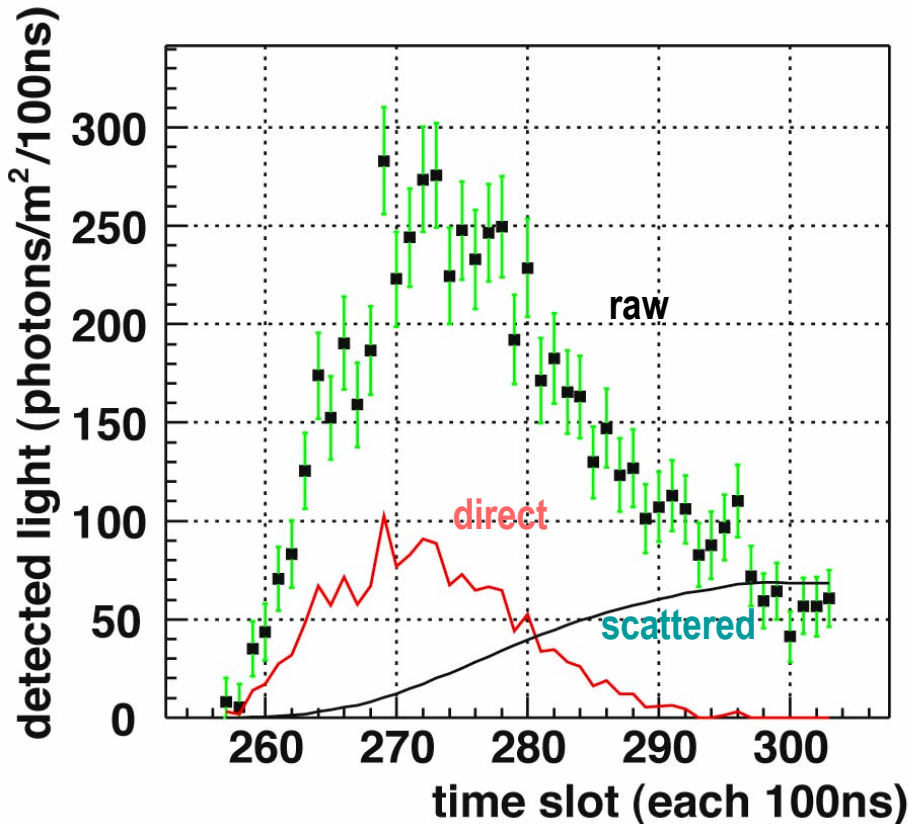
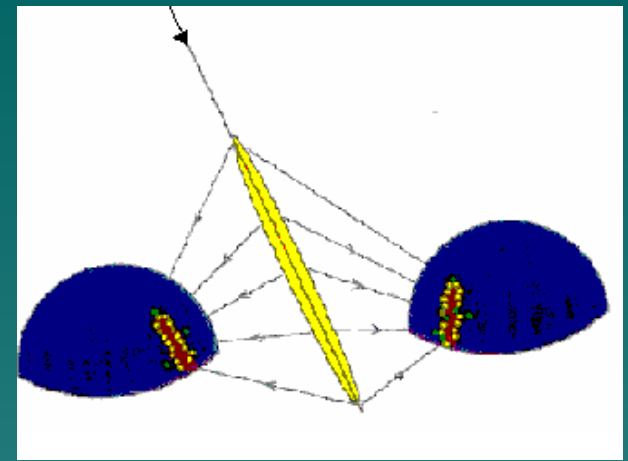
zenit: 91.6°
RMS = 1.1°



zenit: 90.5°
RMS = 1.7°

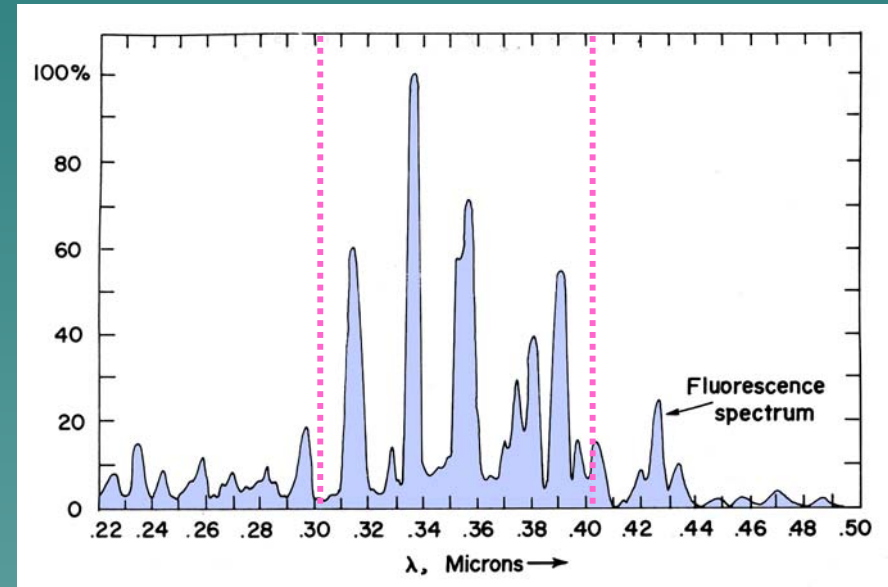
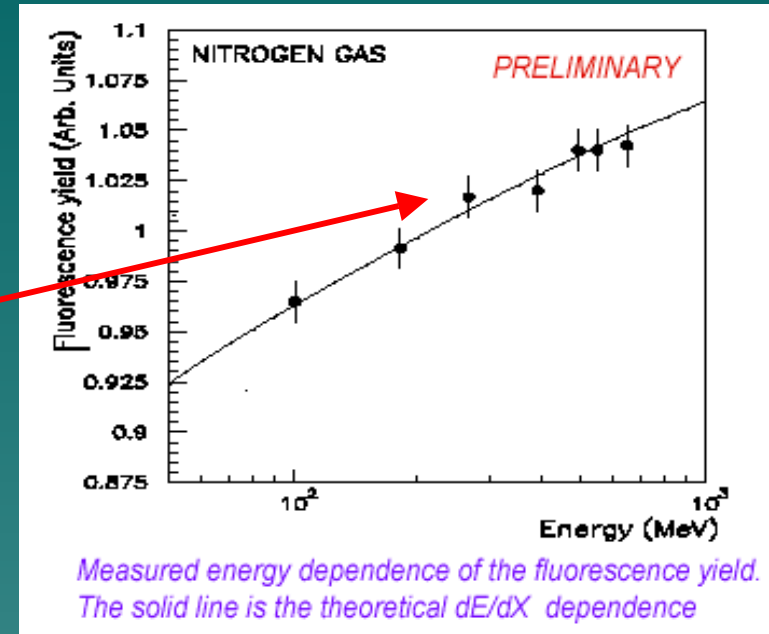
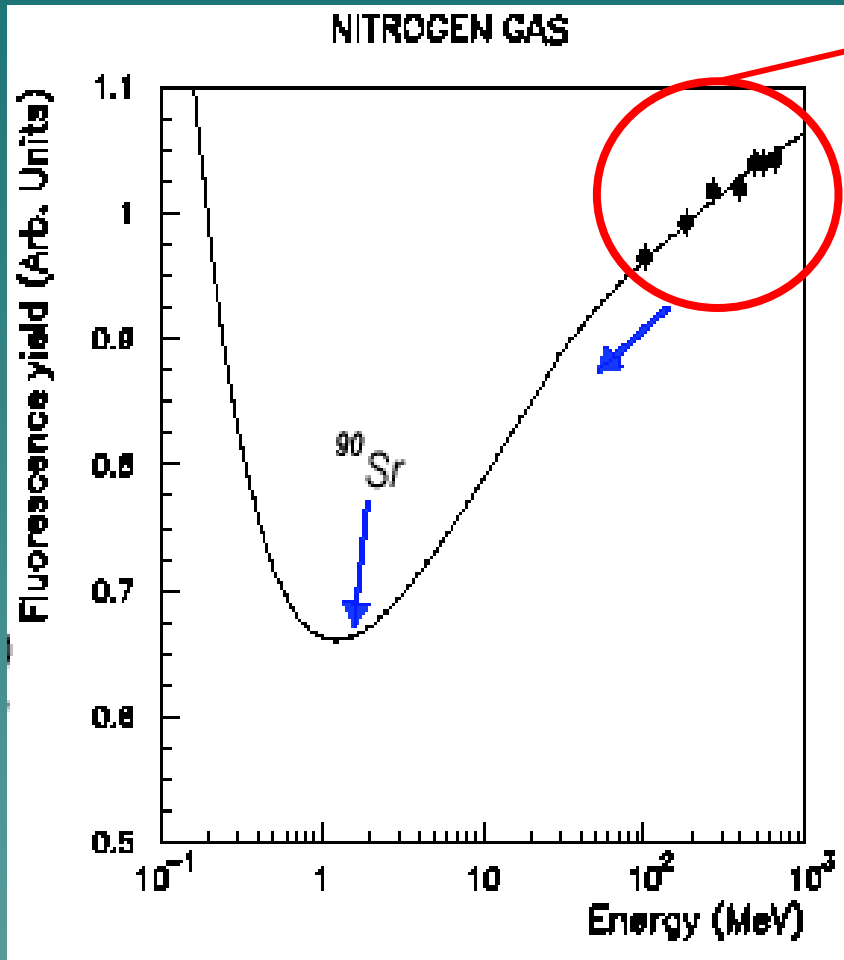
Čerenkovovo záření

tento případ: původní zorný úhel 15° ,
→ velká příměs Čerenkovova záření
iterativní procedura, konverguje v < 4
krocích, zde dává energii $\sim 2e18$ eV



Fluorescenční výtěžnost

experiment AIRFLY
výtěžek v závislosti na
 p, T a vlhkosti



... měřené stereo-případy !!!

Event Display, version v3r1

Event Display Help

Control

File Configure Experts only...

Reconstruct Previous Next Get # 584032 Update 0

#00584047, 2 stations, DIA_NOCHE	0157 (0 ns, 2.7 VEM)
#00584048, 2 stations, MOULIN_ROUGE	0155 (2130 ns, 2.9 VEM)
#00584030, 5 stations, 3C2&4C4	0154 (6014 ns, 13.8 VEM)
#00584031, 1 stations, FD	0169 (8063 ns, 11.0 VEM)
#00584032, 8 stations, FD	0168 (10156 ns, 89.2 VEM)
#00584033, 0 stations, 3C2&4C4	0167 (12389 ns, 31.0 VEM)
#00584034, 3 stations, FD	0220, station deleted
#00584035, 1 stations, FD	0186, station deleted
#00584036, 2 stations, FD	
#00584037, 1 stations, FD	
#00584038, 4 stations, 3C2&4C4	
#00584039, 1 stations, FD	
#00584040, 1 stations, FD	
#00584041, 3 stations, FD	
#00584042, 2 stations, FD	

Array

Status

```
file selected: sd_2003_10_25_23h06.root
Minimum number of triggered stations: 0
Trigger selected: all of them, 454 event(s).
Date of this event: Sun Oct 26 02:17:40 2003 (GPS 751169873)
```

Display

Quechubii (157)
Signal: 2.7 VEM
Area/Peak: 2.32
Time Over Threshold

Mawen Lufke (155)
Signal: 2.9 VEM
Area/Peak: 2.26
Time Over Threshold

La Paz (154)
Signal: 13.8 VEM
Area/Peak: 4.33
Threshold

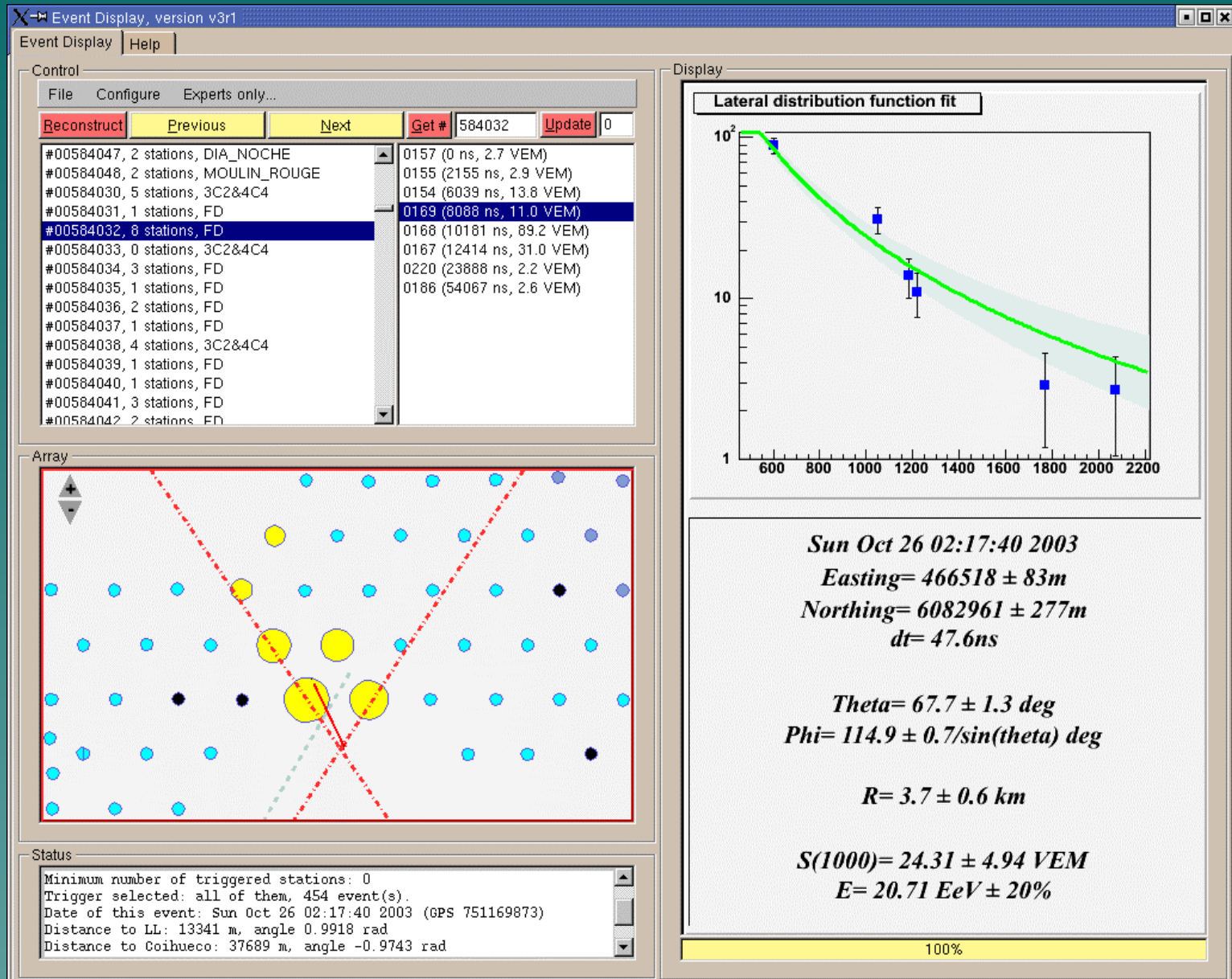
Irini (169)
Signal: 11.0 VEM
Area/Peak: 2.81
Threshold

Paix (168)
Signal: 89.2 VEM
Area/Peak: 2.63
Threshold

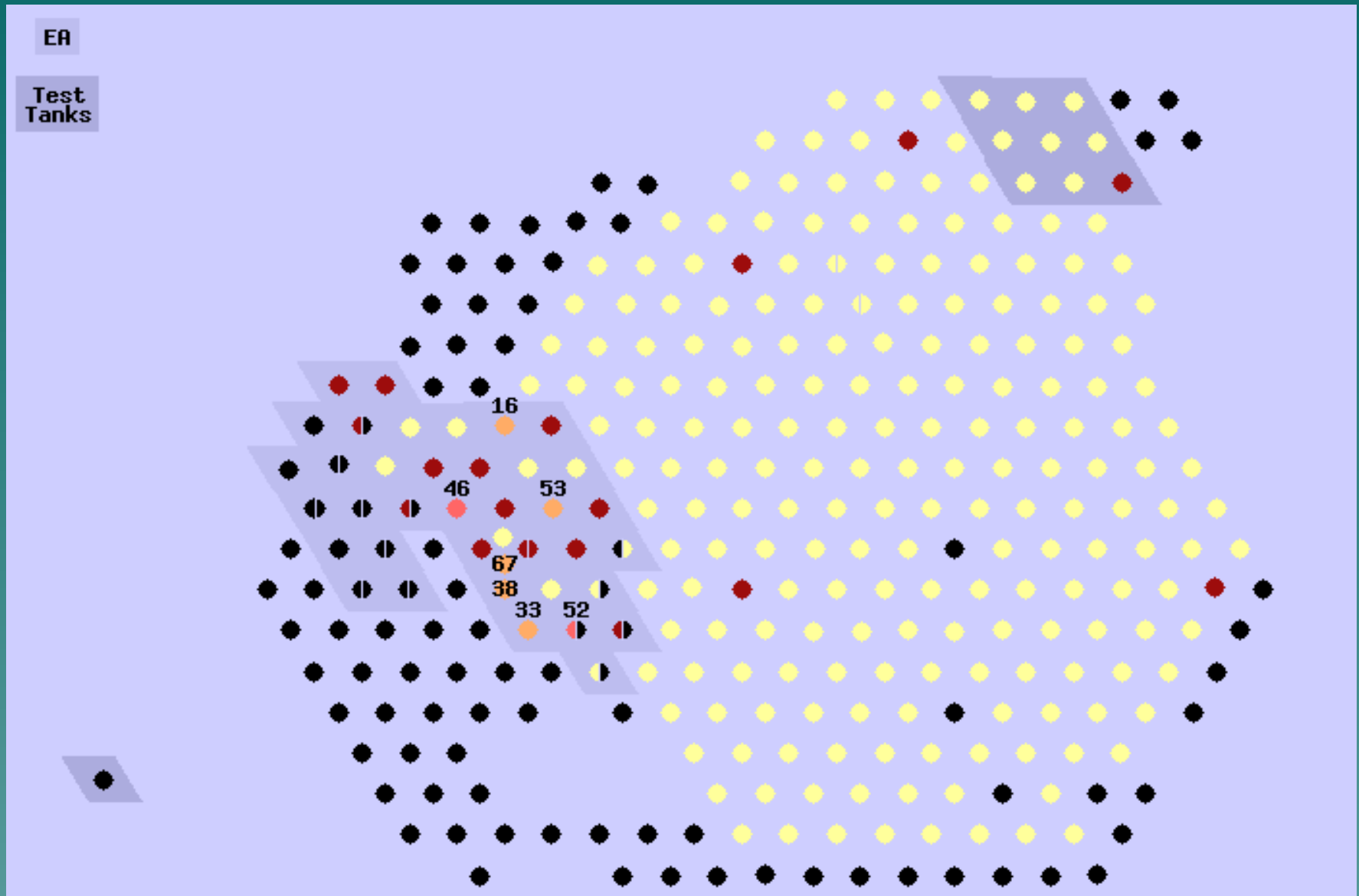
Gasikay (167)
Signal: 31.0 VEM
Area/Peak: 3.75
Threshold

100%

1. hybridní stereo-případ !!!



SD ke 7.3.2004 – 241/345 sudů



Control

File Configure Experts only...

Multiple selection

Reconstruct

Previous

Next

Get #

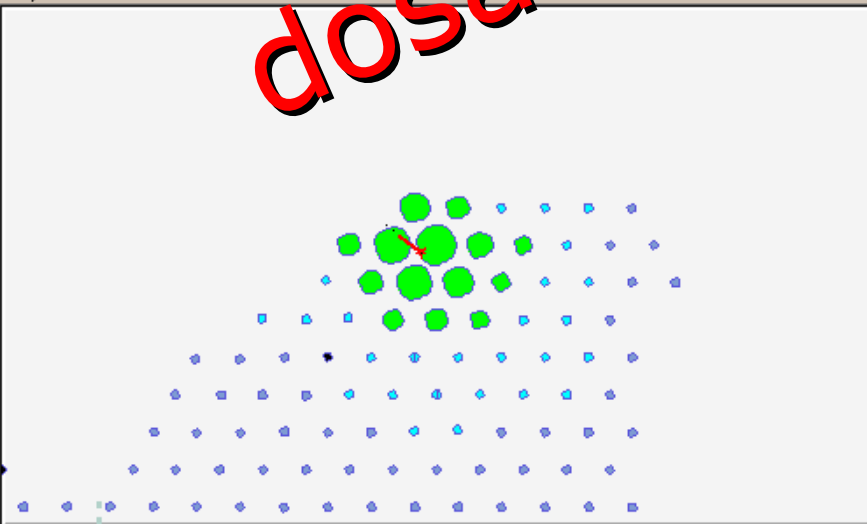
Update

8

#00617049, 8 stations, 3C2&4C4
 #00617100, 9 stations, 3C2&4C4
 #00617161, 8 stations, 3C2&4C4
 #00617446, 9 stations, FD
 #00617476, 10 stations, FD
 #00617563, 10 stations, FD
 #00617638, 9 stations, FD
 #00617662, 11 stations, FD
 #00617728, 8 stations, FD
 #00617730, 8 stations, FD
 #00617736, 17 stations, 3C2&4C4
 #00617799, 11 stations, 3C2&4C4
 #00617830, 16 stations, 3C2&4C4
 #00617943, 8 stations, 3C2&4C4

0205 (0 ns, 12.3 VEM)
 0206 (1548 ns, 71.0 VEM)
 0203 (1799 ns, 624.8 VEM)
 0118 (2564 ns, 16.5 VEM)
 0213 (3837 ns, 14.3 VEM)
 0204 (3916 ns, 2495.3 VEM)
 0116 (4432 ns, 386.6 VEM)
 0110 (5939 ns, 6.7 VEM)
 0215 (6661 ns, 24.1 VEM)
 0114 (6679 ns, 106.5 VEM)
 0117 (7579 ns, 13.1 VEM)
 0212 (9436 ns, 5.3 VEM)
 0217 (9603 ns, 5.3 VEM)
 0107 (10397 ns, 5.4 VEM)
 0112 (sum deleted)

Array

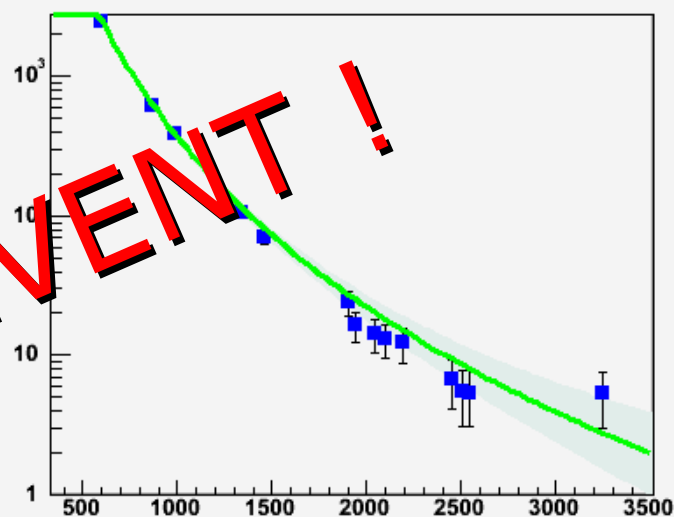


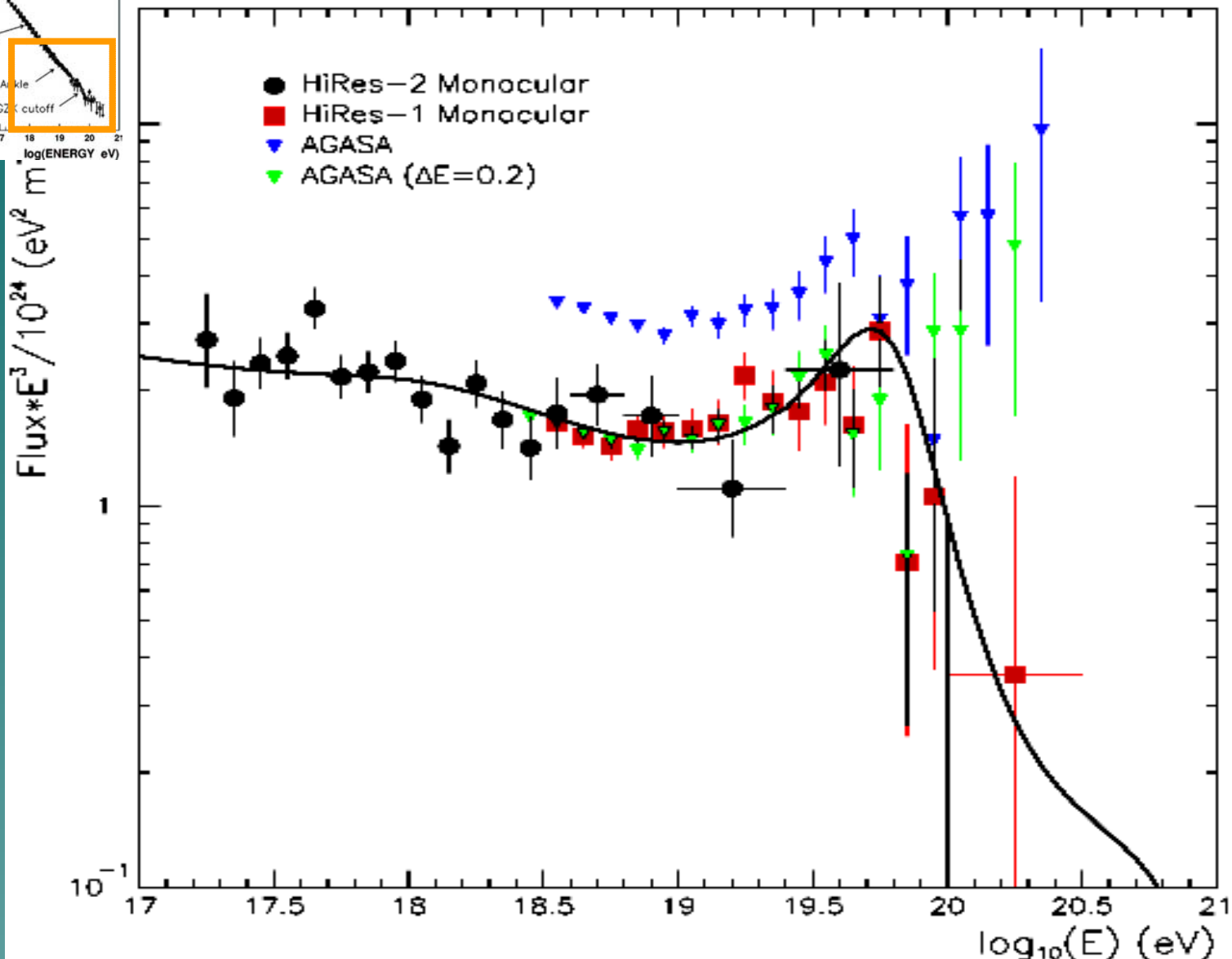
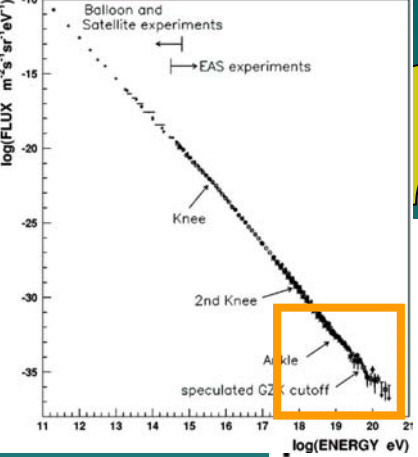
Status

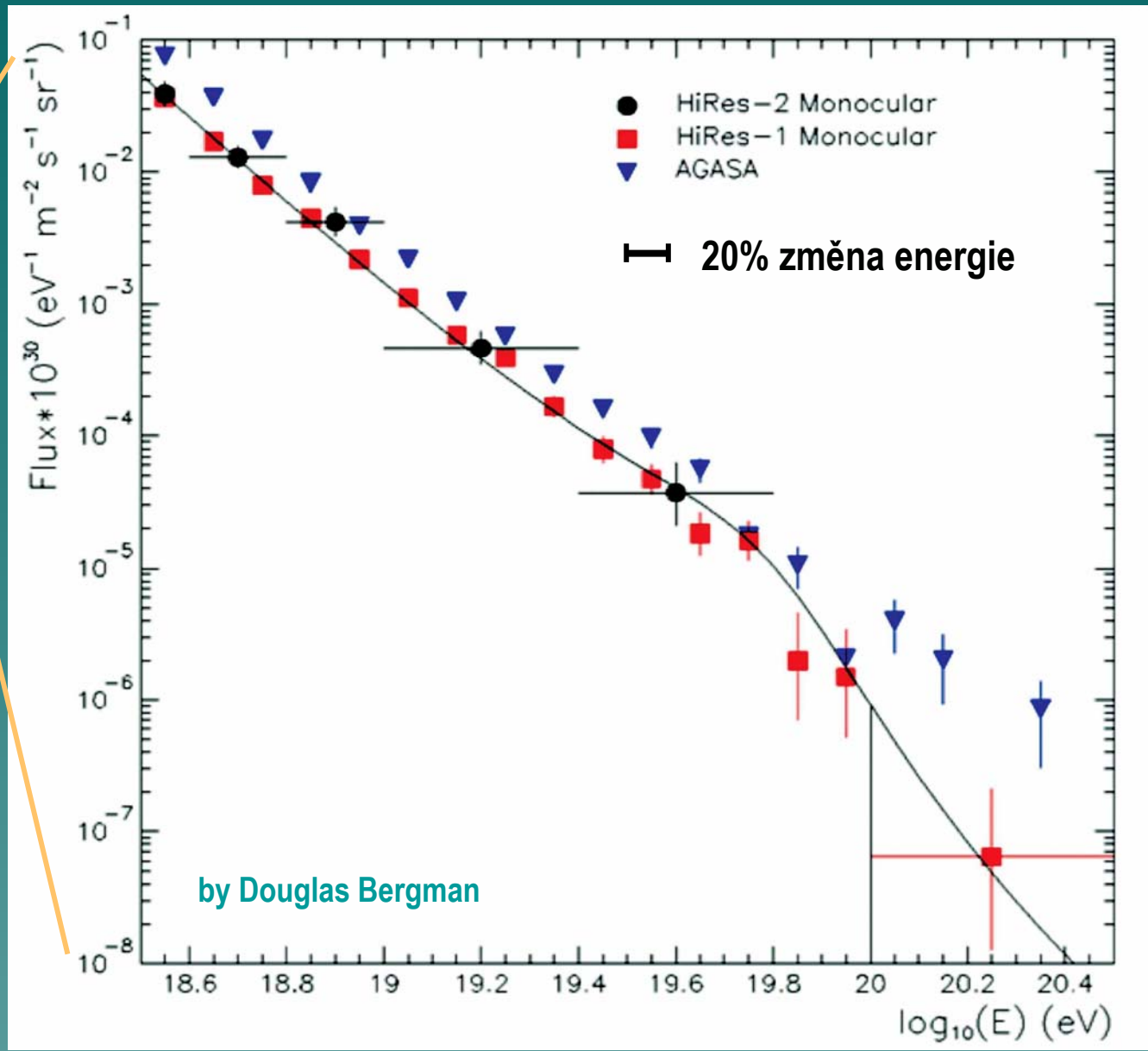
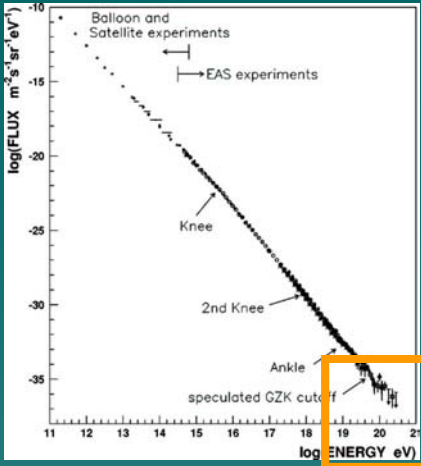
Date of this event: Mon Dec 29 09:23:45 2003 (GPS 756725038)

Display

Lateral distribution function fit

*Mon Dec 29 09:23:45 2003**Easting= 470347 ± 7m**Northing= 6095443 ± 11m**dt= 114.0ns**Theta= 34.4 ± 0.3 deg**Phi= 140.2 ± 0.3/sin(theta) deg**R= 12.5 ± 0.8 km**Preliminary Xmax= 1040 ± 66 g/cm²**S(1000)= 365.51 ± 20.78 VEM**E= 74.81 EeV ± 6%*





by Douglas Bergman

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12