Report from the software and analysis WG

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Overview

- First meeting took place in October 17;
- There were 6 meetings, one per month with one or two talks/meeting;
- At least 8 people attended to the meeting;
- Discussion overview:
  - **Results of the density measurements of tungsten absorbers**
  - **Moliere radius of electron showers in MC simulated structures**
  - **ILD background simulations**
  - **Identification of back-scattering in the LumiCal detector**
- Summary and Plans

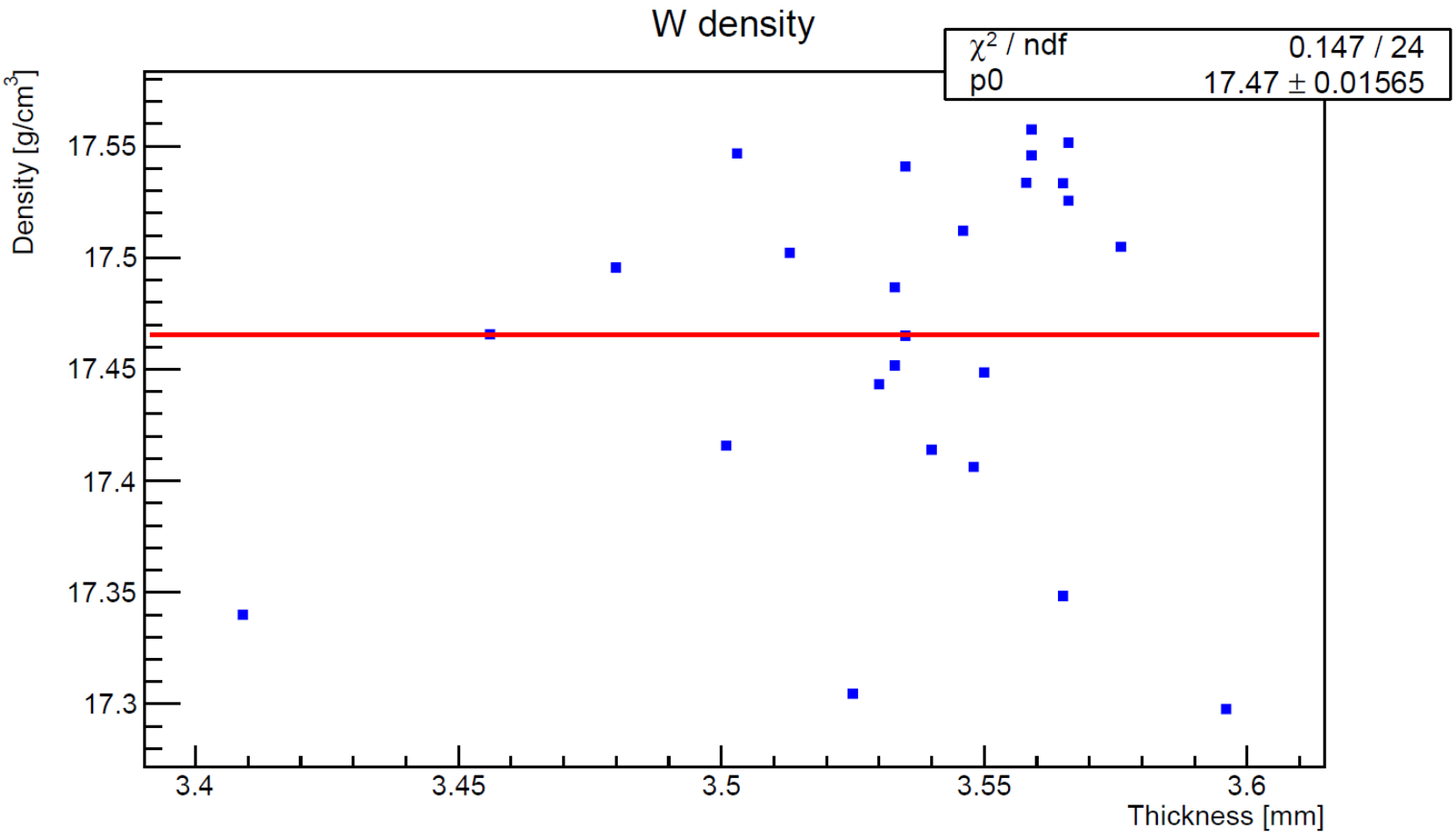
Density of tungsten absorbers

ID	Thickness (mean value), mm	Weight [g]	Volume [cm3]	Density [g/cm3]
1	3.576	1214.8	69.6356	17.45
2	3.535	1203.2	68.832	17.48
3	3.503	1192.6	68.2048	17.49
4	3.566	1214.6	69.4396	17.49
5	3.558	1210.6	69.2828	17.47
6	3.566	1212.8	69.4396	17.47
7	3.565	1213	69.42	17.47
8	3.559	1212.6	69.3024	17.50
9	3.559	1211.8	69.3024	17.49
10	3.596	1207.2	70.0276	17.24
11	3.525	1183.6	68.636	17.24
12	3.48	1181.2	67.754	17.44
13	3.54	1196.2	68.93	17.35
14	3.55	1202	69.126	17.39
15	3.513	1193	68.4008	17.44
16	3.548	1198.4	69.0868	17.35
17	3.456	1171	67.2836	17.40
18	3.535	1198	68.832	17.40
19	3.501	1183	68.1656	17.35
20	3.565	1200.2	69.42	17.29
21	3.53	1194.8	68.734	17.38
22	3.533	1196.4	68.7928	17.39
23	3.546	1205	69.0476	17.45
24	3.533	1198.8	68.7928	17.43
25	3.409	1146.6	66.3624	17.28

- The results of the density measurements of tungsten absorbers;
- Alloy mass composition VNM 5-3:
  W - 92%,
  Ni - 5%,
  Cu - 3%
  → $\rho = 17.0\ g/cm^3$
- Alloy mass composition VNM 3-2:
  W - 95%,
  Ni - 3%,
  Cu - 2%
  → $\rho = (17.9 \div 18.1)\ g/cm^3$

$$\rho = (17.47 \pm 0.02)\ g/cm^3$$

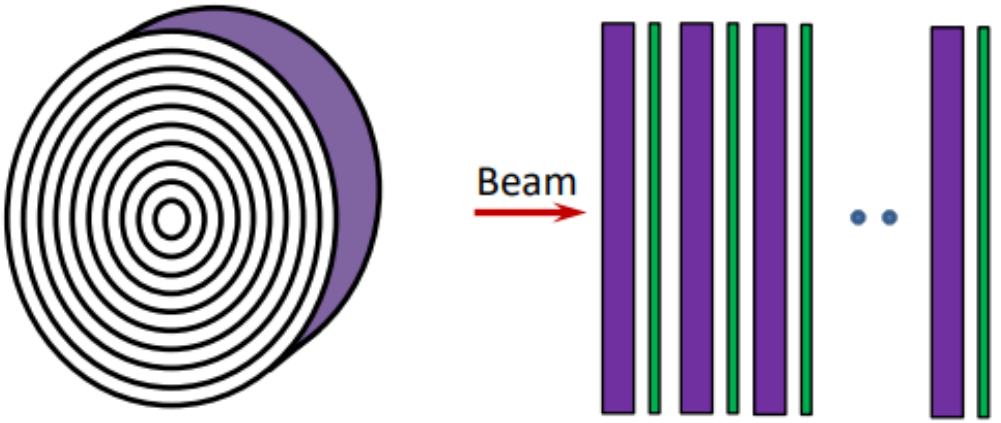
Density of tungsten absorbers



$$\rho = (17.47 \pm 0.02)\ \mathrm{g/cm^3}$$

Moliere radius of electron showers in MC simulated structures

Typical regular structure: absorber (passive) disks + radially segmented sensors in air gaps.
Electrons (5 – 100 GeV) sent along the structure axis.



Simulated structure

Segmentation: dR = 0.1 mm, dZ ~ 1 Xo

Tungsten absorber density:
ρ = 19.3 g/cm3 and R_M = 9.327 mm from PDG

Other materials used: Pb, Si, Air

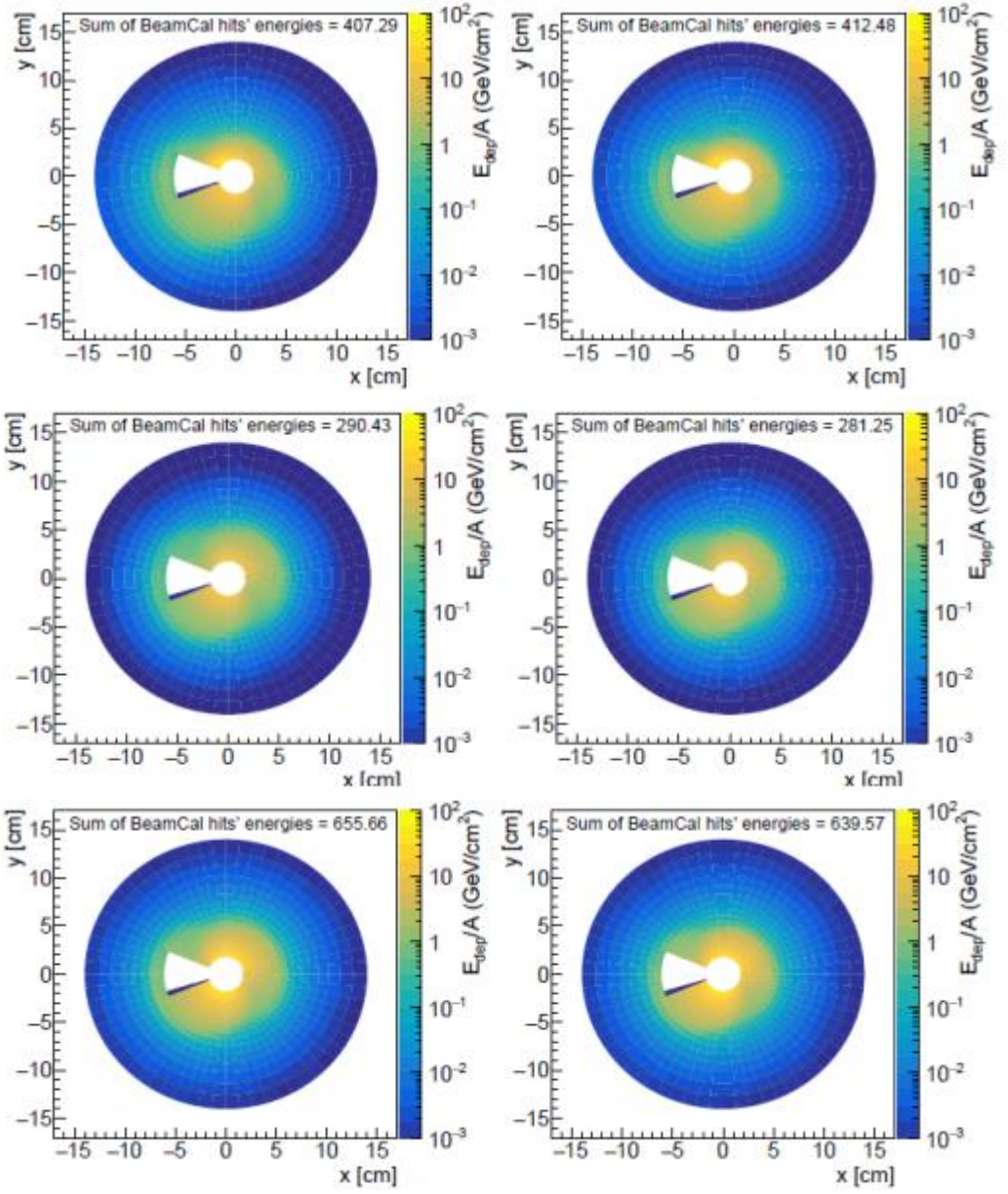
Moliere radius of electron showers in MC simulated structures

GEANT3 Simulation results

	← Electron energy →			
	5 GeV	10 GeV	50 GeV	100 GeV
W-W homogeneous		1.15 cm		
		<2%		
W-W sampling	1.13 cm	1.13 cm	1.13 cm	1.13 cm
	6.9%	5.04%	2.28%	1.64%
W-Si sampling	1.34 cm	1.34 cm		
	9.6%	7.2%		
Pb-Si sampling 0.62 Xo		1.82 cm		
		5.4%		
Pb-Si sampling 1 Xo		1.75 cm	- Eff. Moliere radius	
		7.1%	- Energy resolution	

GEANT4: $R_M(W) = 1.14$ cm

Background studies



BeamCal energy density for different ILD models:
Large (left) and Small (right)
Upper row: 250 GeV, w/o anti-DID;
middle row: 250 GeV, w/ anti-DID;
lower row: 500 GeV, w/ anti-DID.

Background studies

To be done by FCAL:

- Studies about background in LumiCal and BeamCal calorimeters,
- Muons rates for calibration and alignment.

Who should do this work:

for example, Zhanna Khuranova – master student at the Taras Shevchenko National University from Kiev

Identification of back-scattering in LumiCal detector

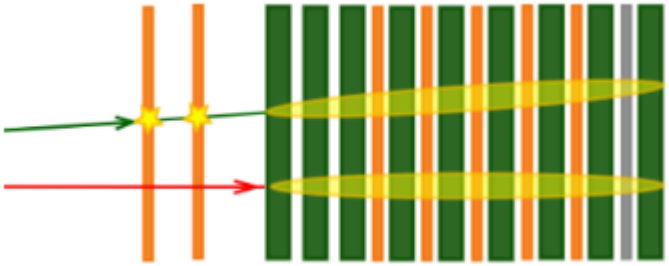
Goals:

- Study tracker's efficiency;
- Identify back-scattering events.

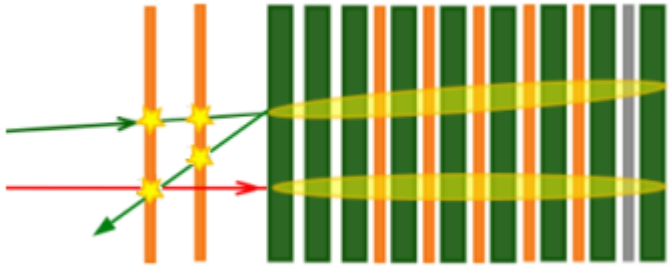
Data used for this analysis:

- 5 GeV electrons run 741 of the TB2016;
- MC simulation by Itamar.

Expected "good" event

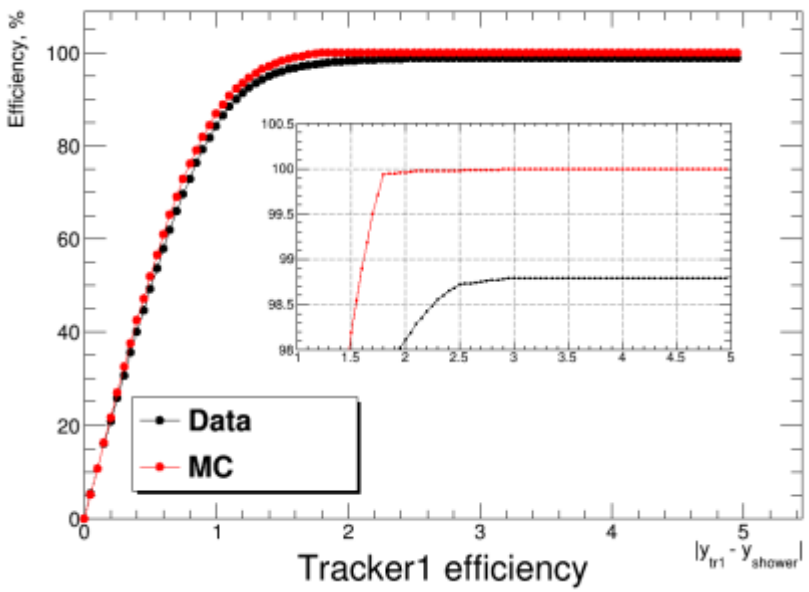


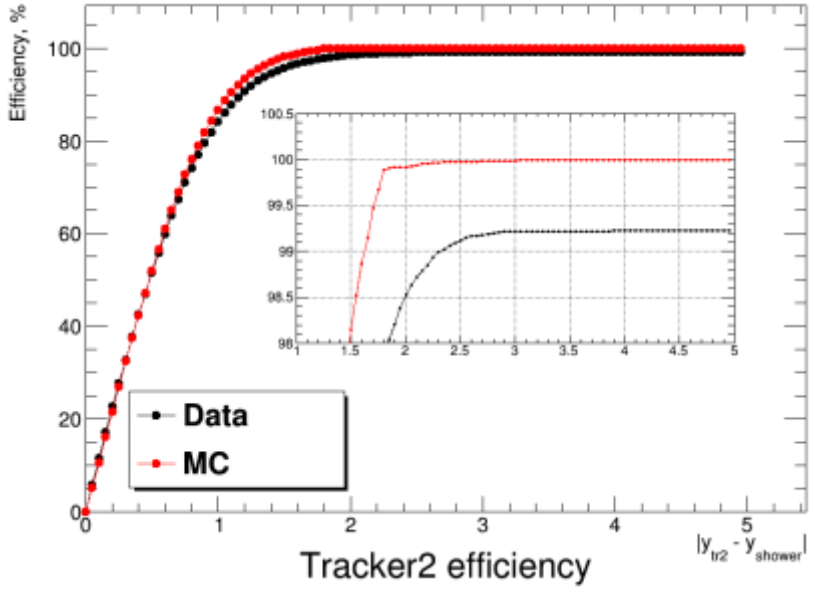
Back-scattered event



- Test the concept of tracker detector in front of the calorimeter
- Backscattered events may leave extra signals in trackers
- e −/γ identification and polar angle resolution should be affected

Identification of back-scattering in LumiCal detector





- MC and data mostly agree. But efficiency corrections are needed.
- Trackers efficiency is calculated and equal ~ 98% for 2 mm distance to the shower
- Tracker clusters further than 4 mm from the shower are back-scattered

Summary and plans

- Continue with ILD background studies;
- Continue analysis of back-scattering in LumiCal detector in case of runs with photons;

- Continue once a month?
- Schedule (day and time) for the next meetings?

THANK YOU FOR YOUR ATTENTION