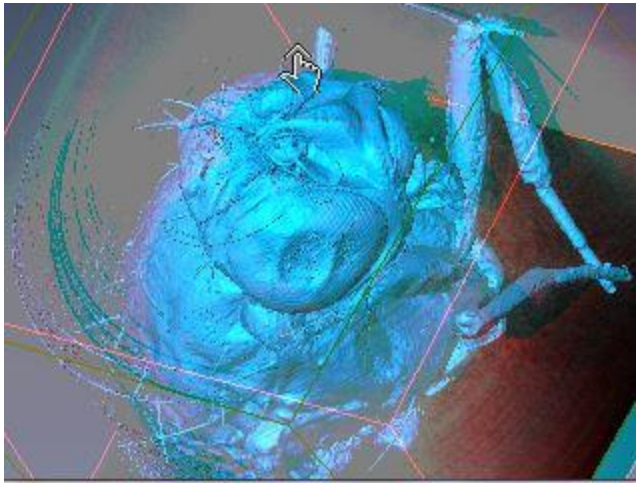
Совет ККПП
6 июня 2016



Тема №1. Тонкие пленки CsI(Tl)

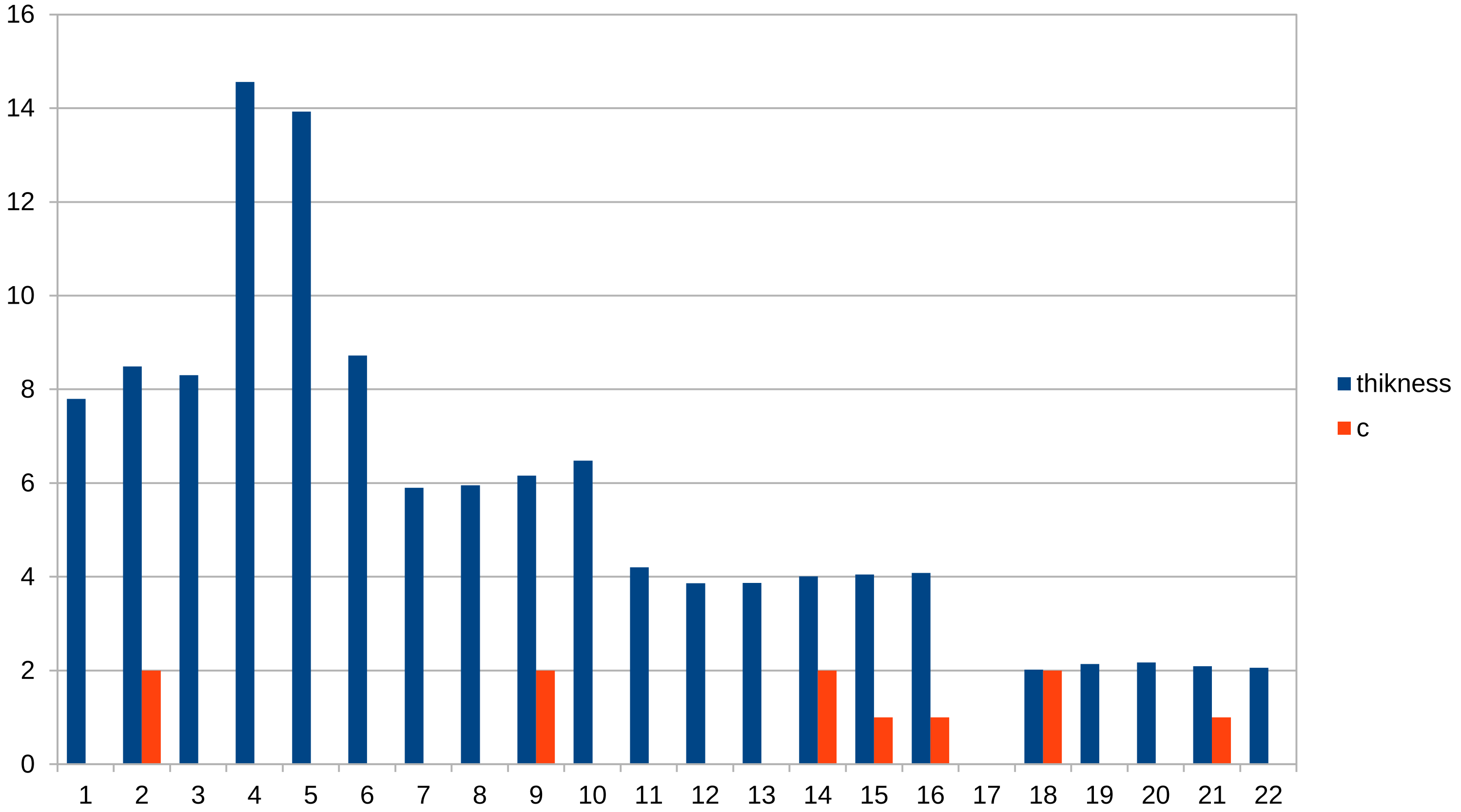
Вопросы на повестке

1.Какие результаты мы имеем.

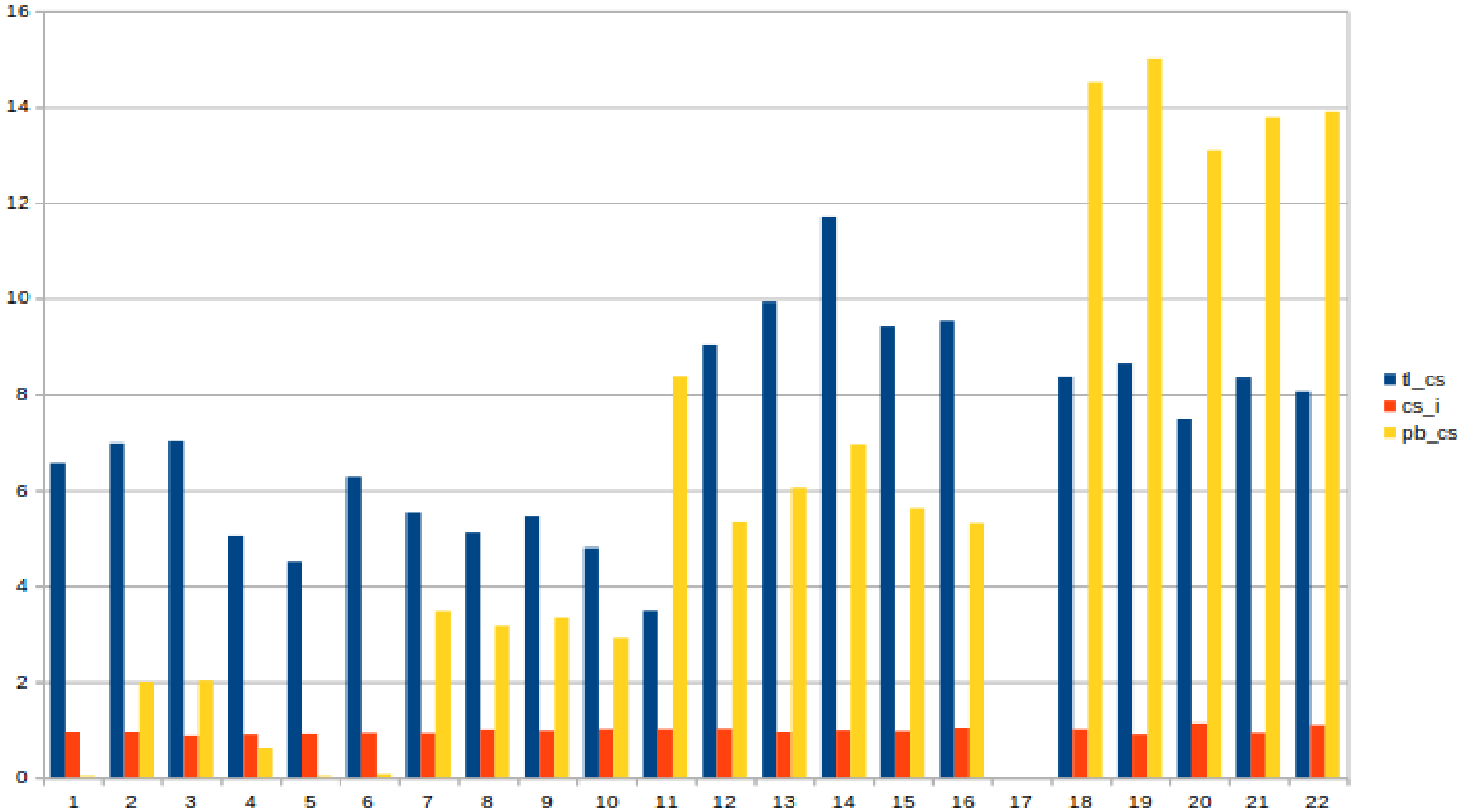
1.Как спланировать следующий эксперимент (что напылить, что измерить)

1.Как усовершенствовать установку по напылению пленок.

1.Статус статьи (очевидно, нулевой).
2.
2.



22 — также покрыт углеродом до напыления CsI, однако в таблице это не указано



16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
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17
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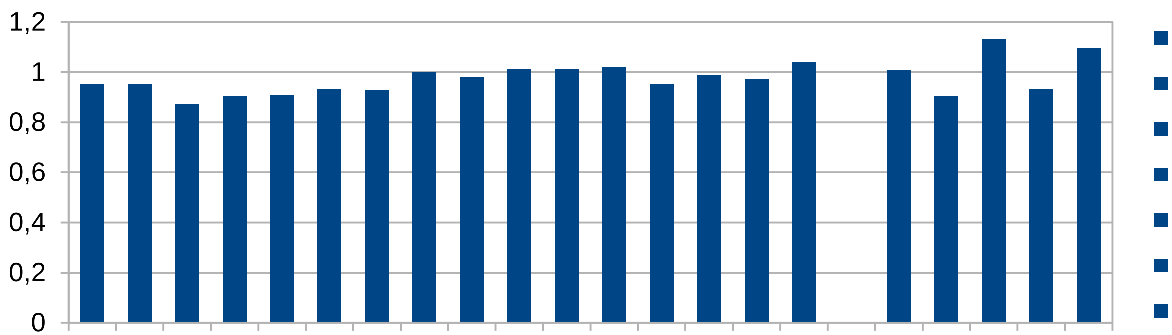
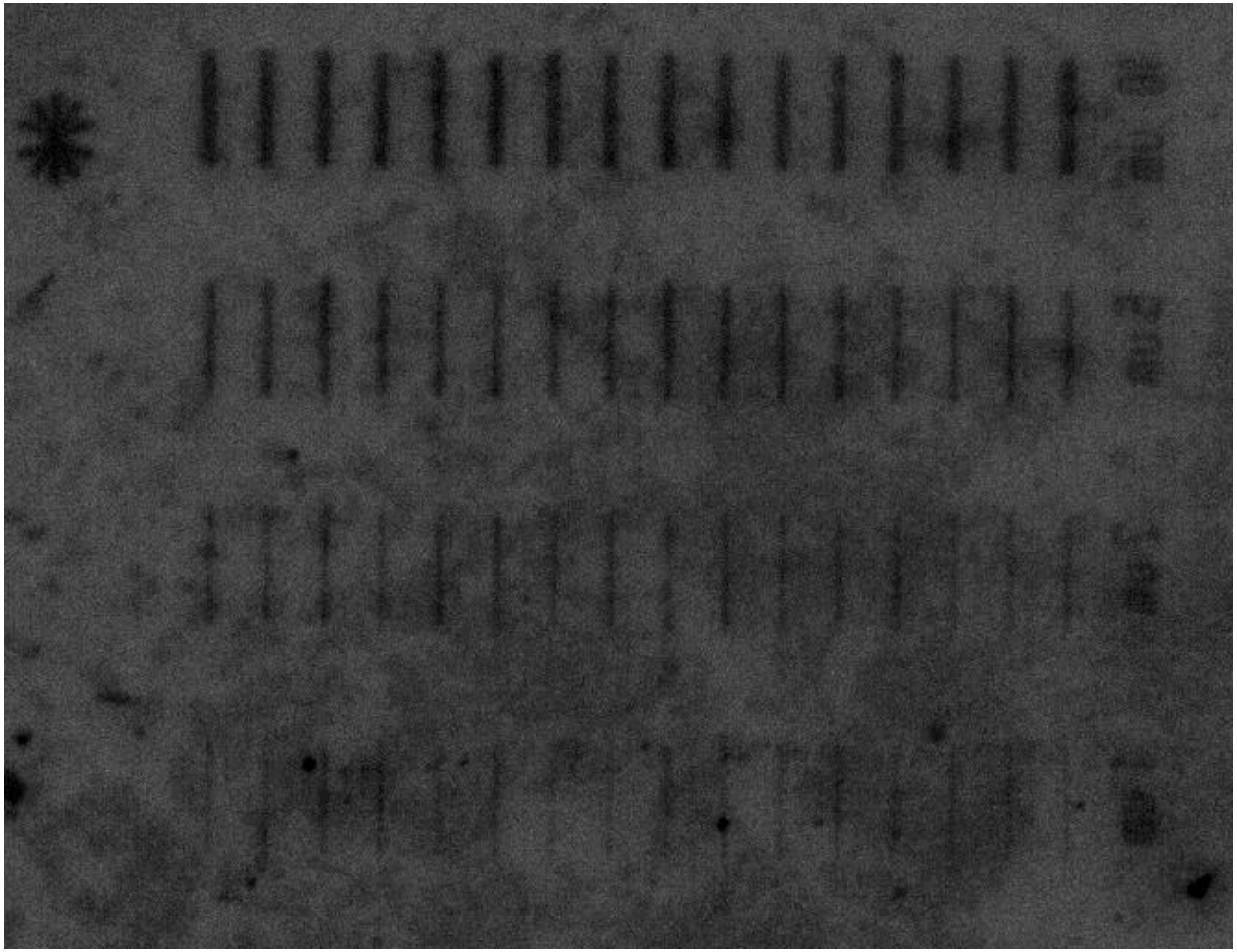
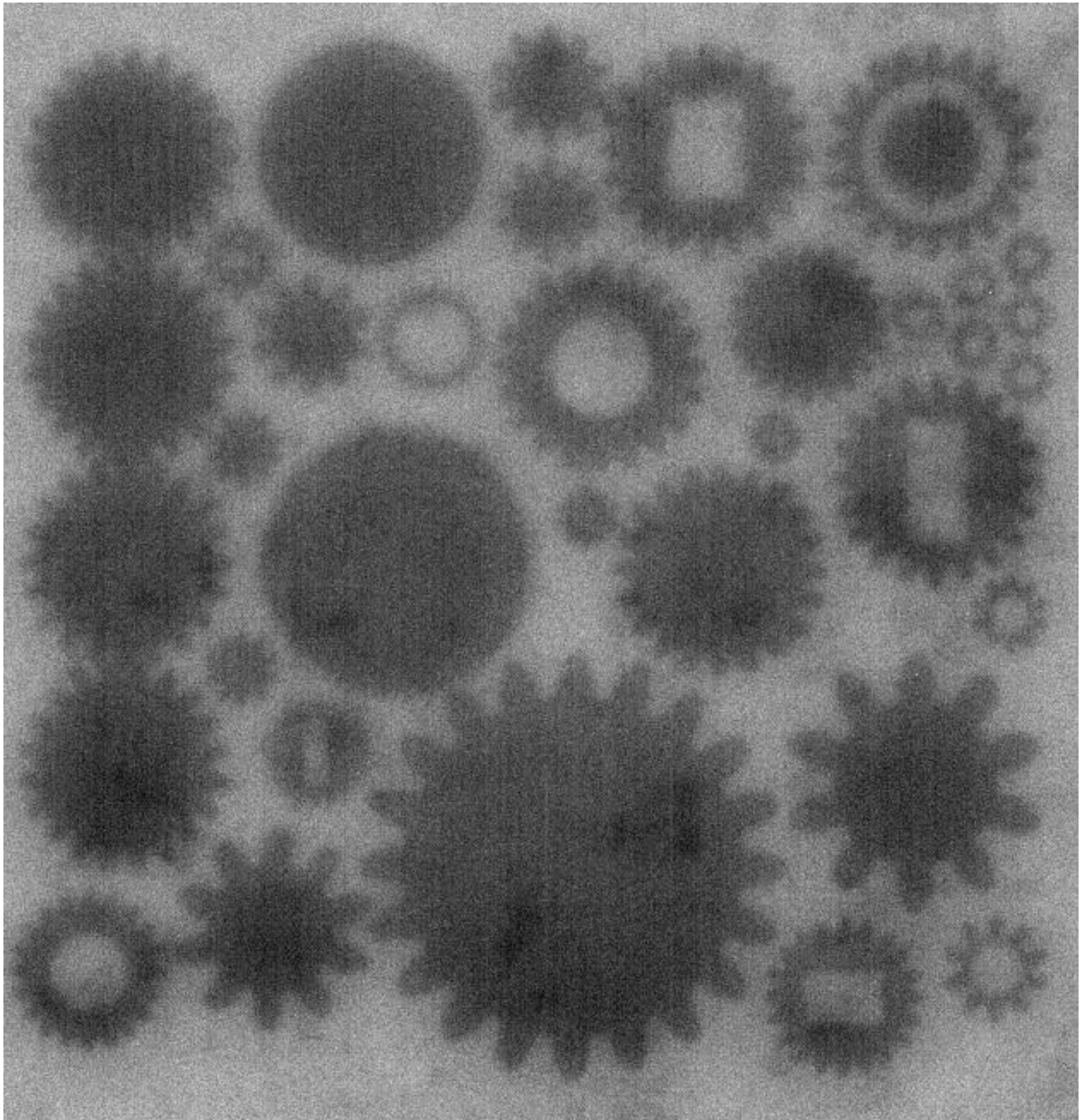
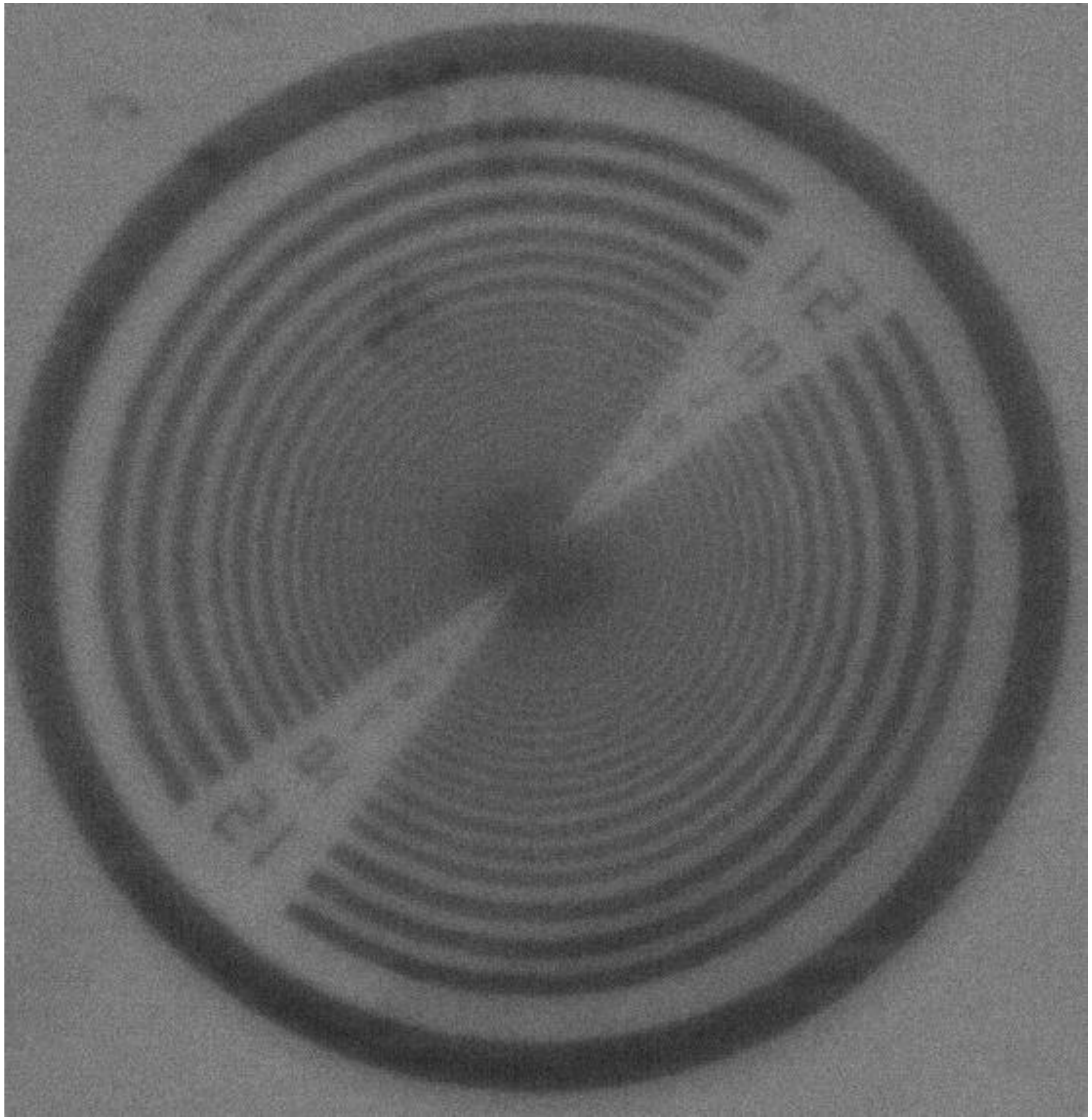
19
20
21
22
tl_cs
cs_i
pb_cs

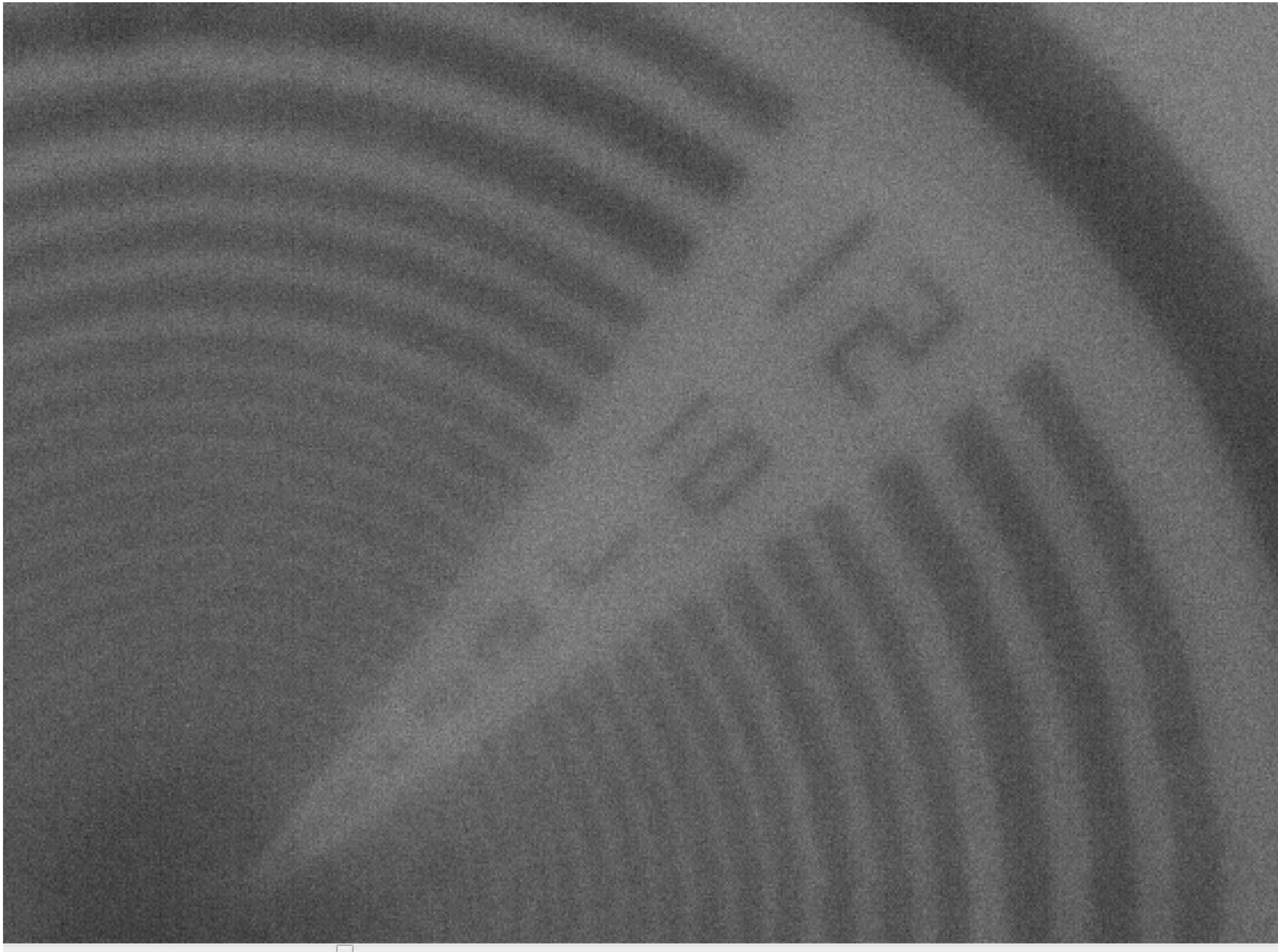


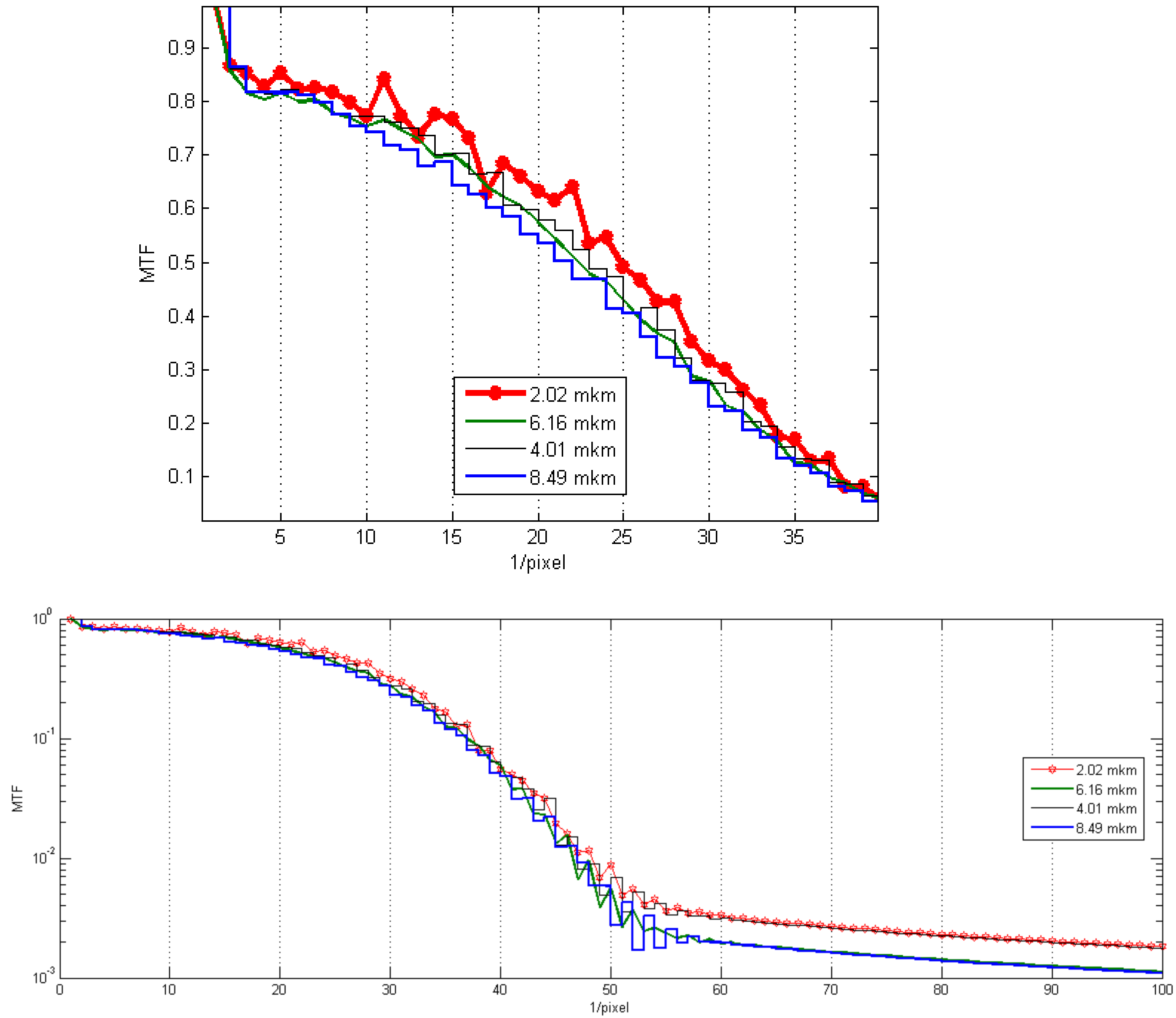
1,2
1
0,8
0,6
0,4
0,2
0

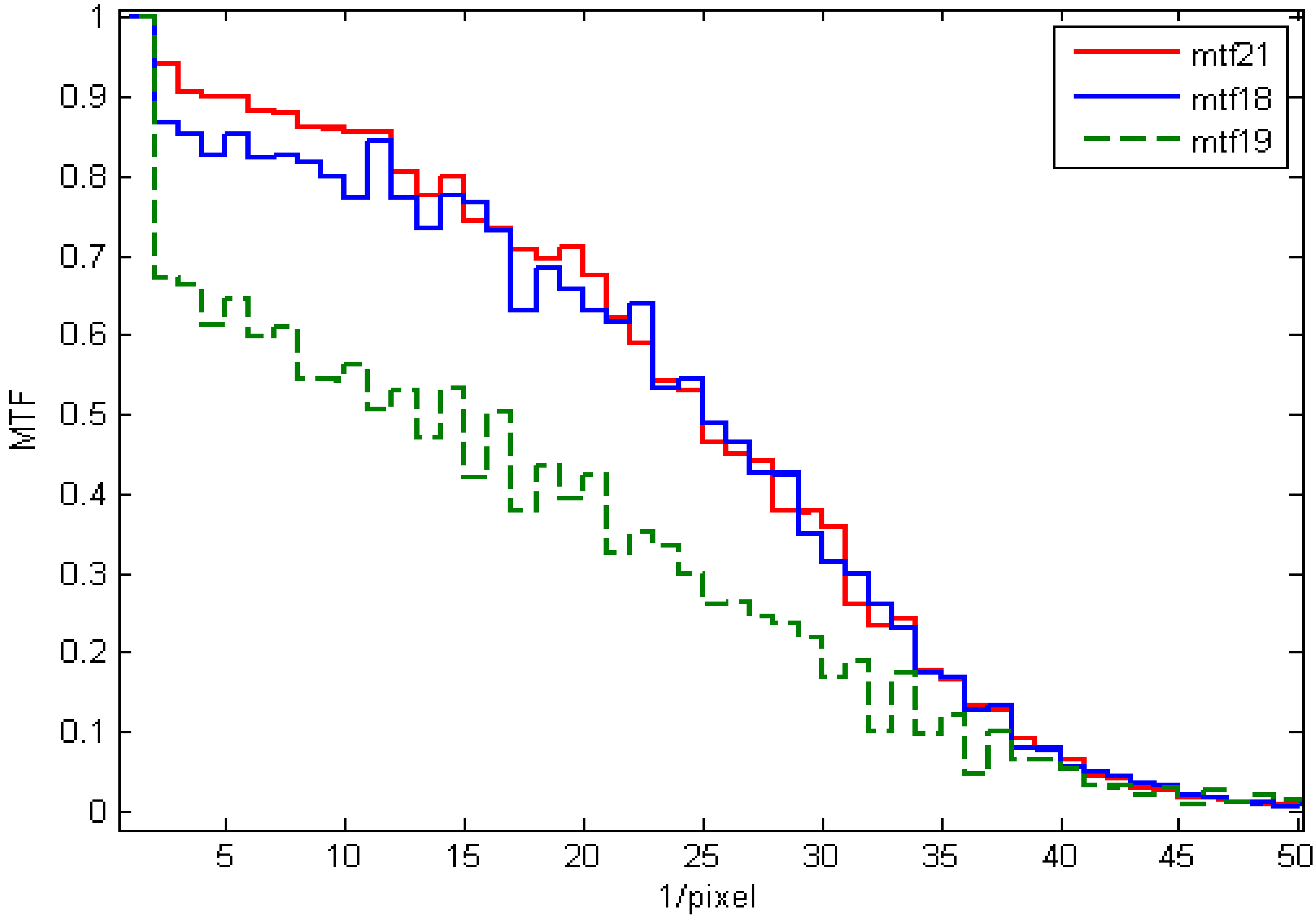




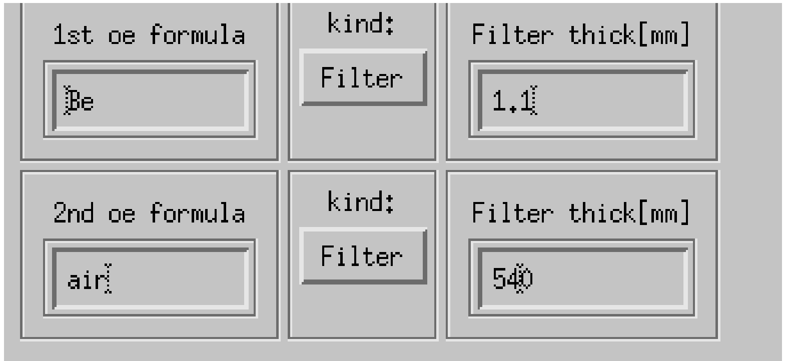


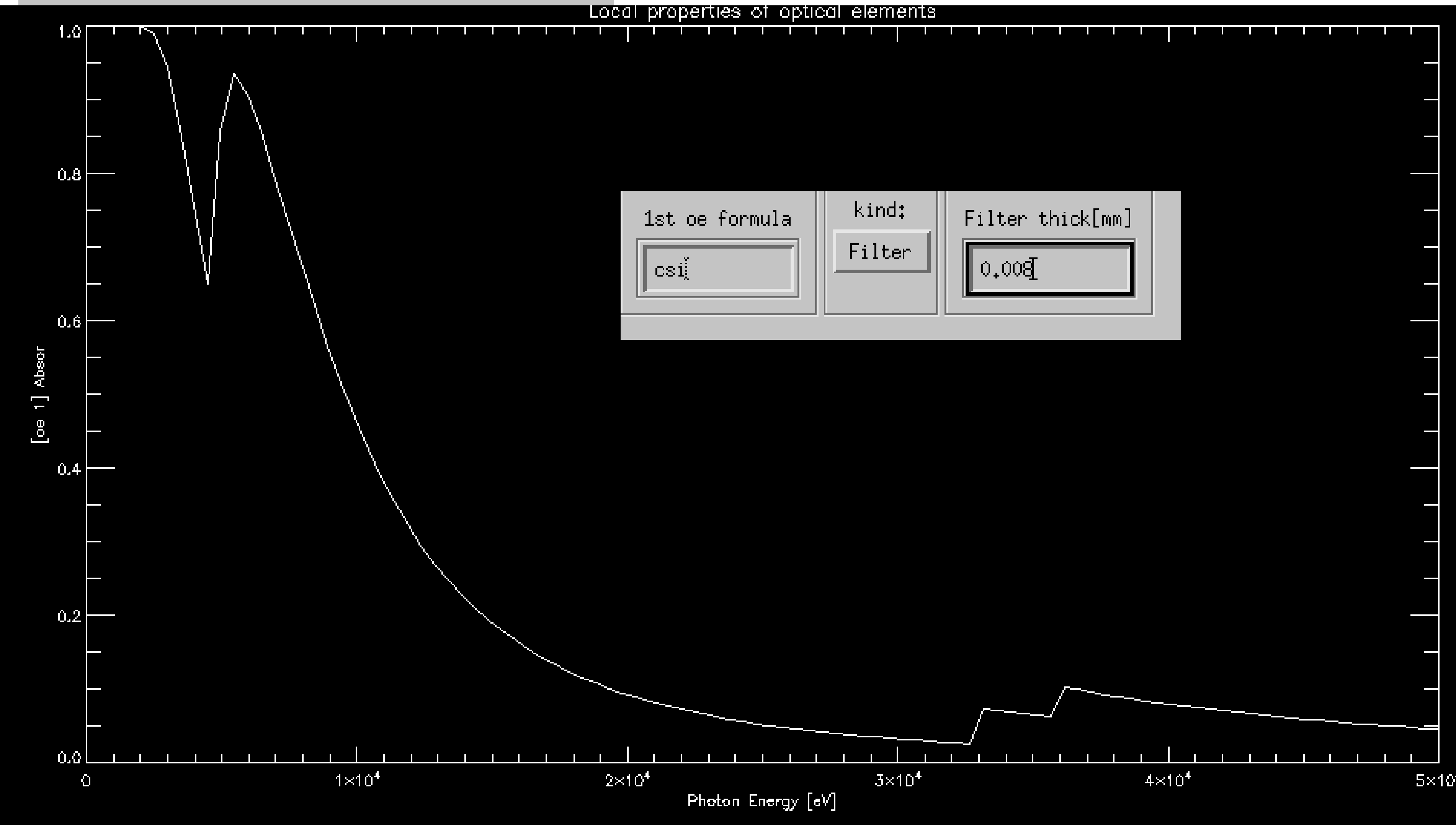



MTF
1/pixel
2.02 mkm
6.16 mkm
4.01 mkm
8.49 mkm
MTF
1/pixel
2.02 mkm
6.16 mkm
4.01 mkm
8.49 mkm



mtf21
mtf18
mtf19
MTF
1/pixel
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
5
10
15
20
25
30
35
40
45
50


1st oe formula
kind:
Filter thick[mm]
Be
Filter
1.1
2nd oe formula
kind:
Filter thick[mm]
air
Filter
540


Local properties of optical elements
[oe 1] Absor
Photon Energy [eV]
0.0
0.2
0.4
0.6
0.8
1.0
0
1×10⁴
2×10⁴
3×10⁴
4×10⁴
5×10⁴
1st oe formula
kind:
Filter thick[mm]
csi
Filter
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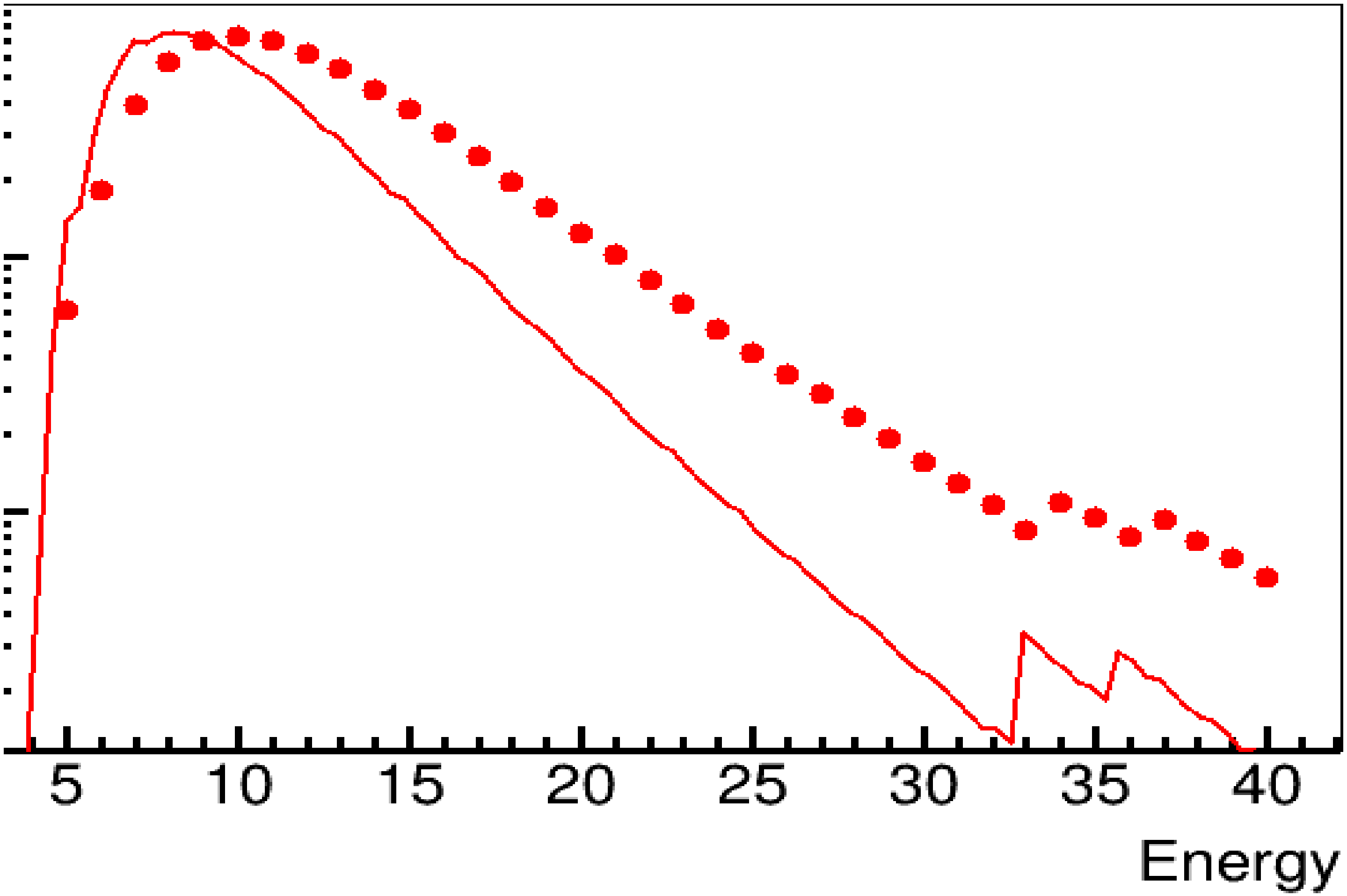
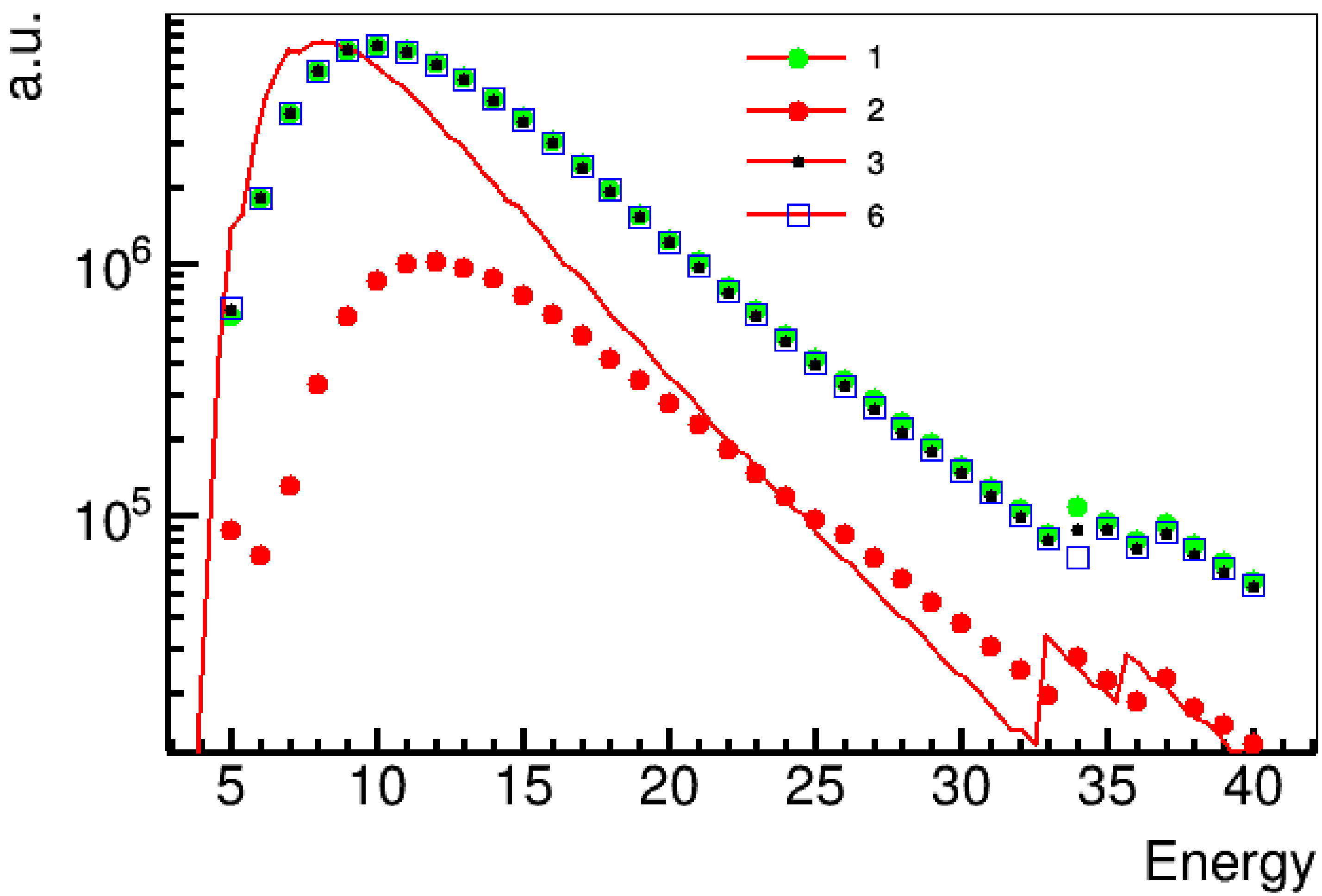
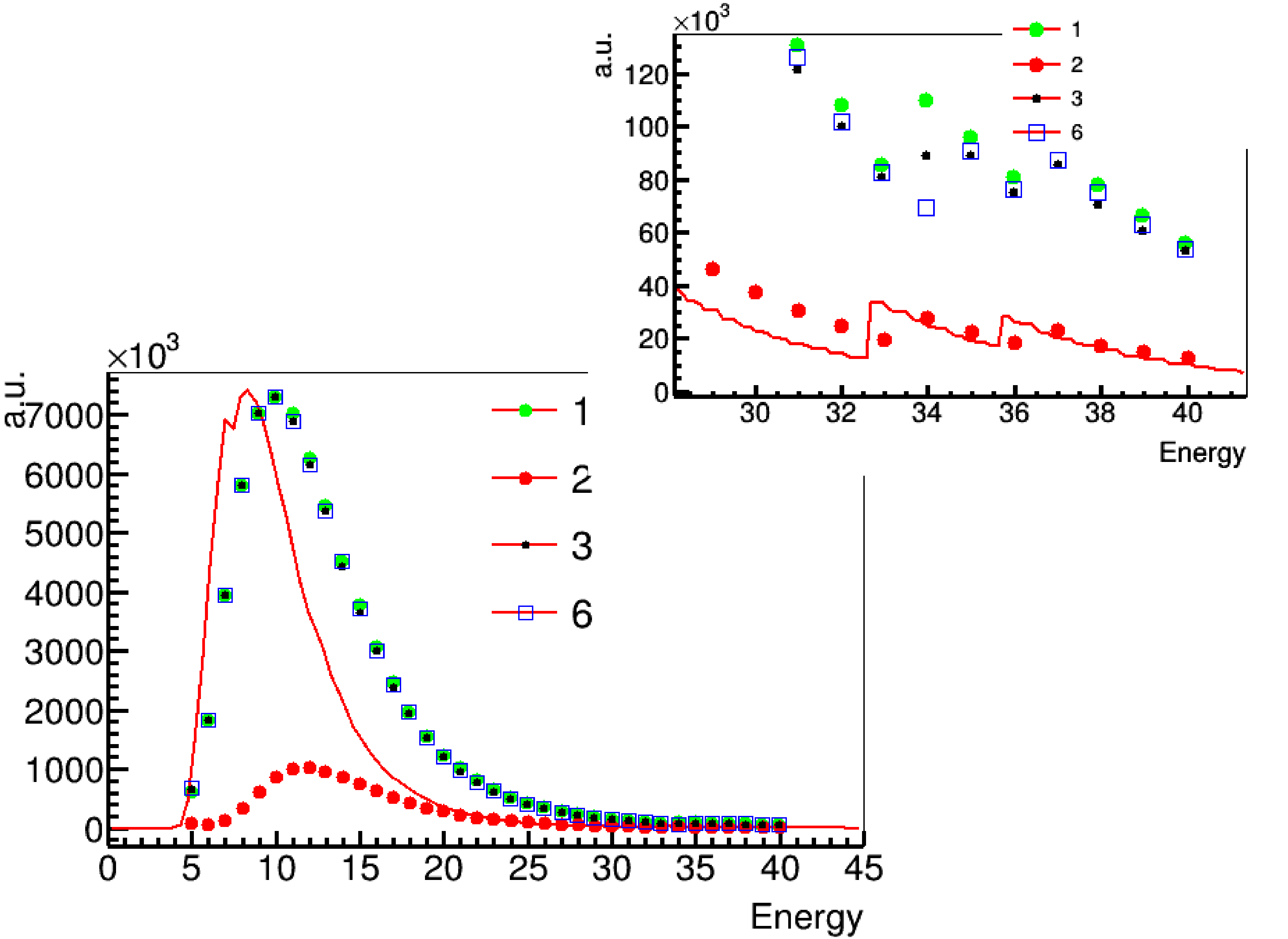
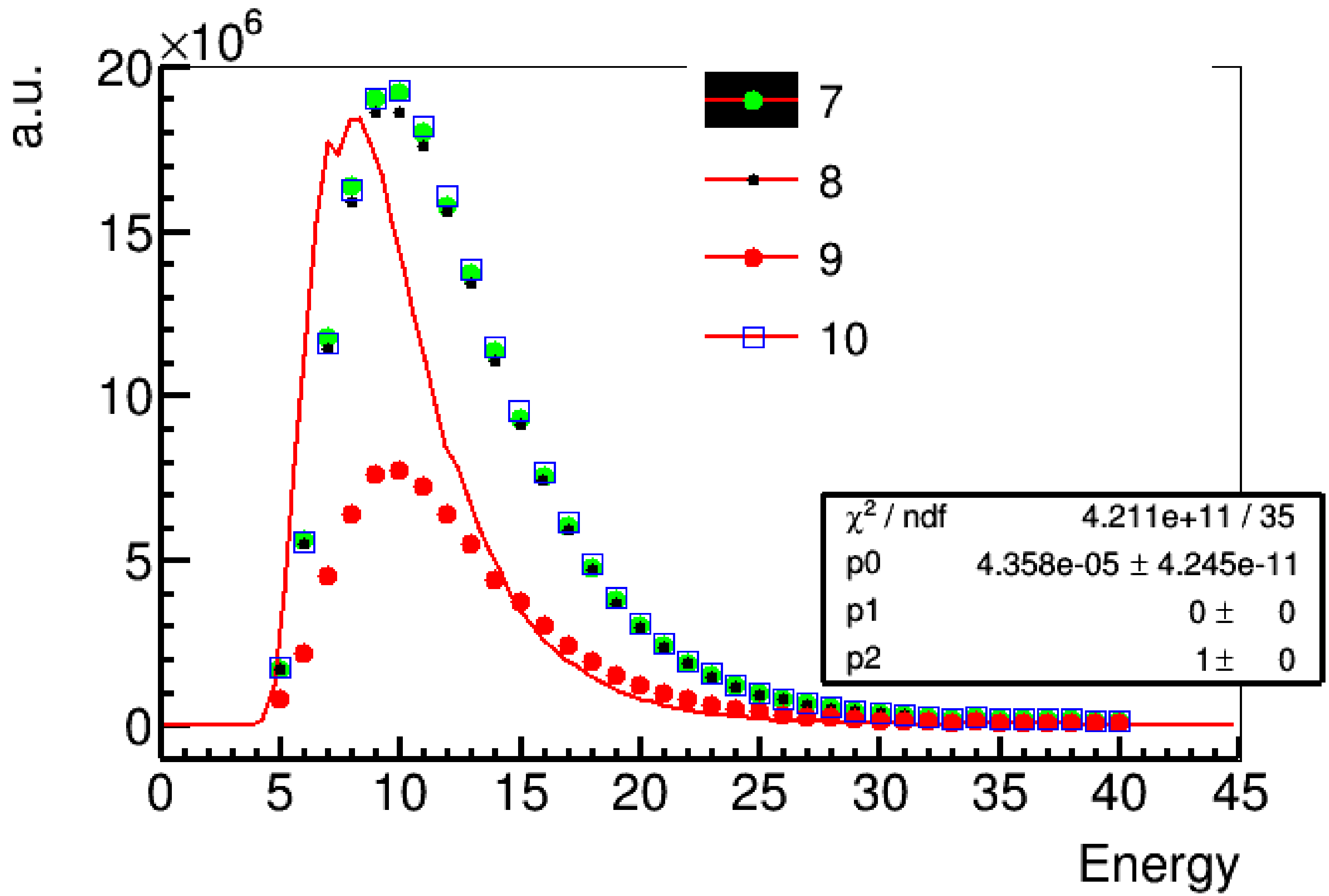




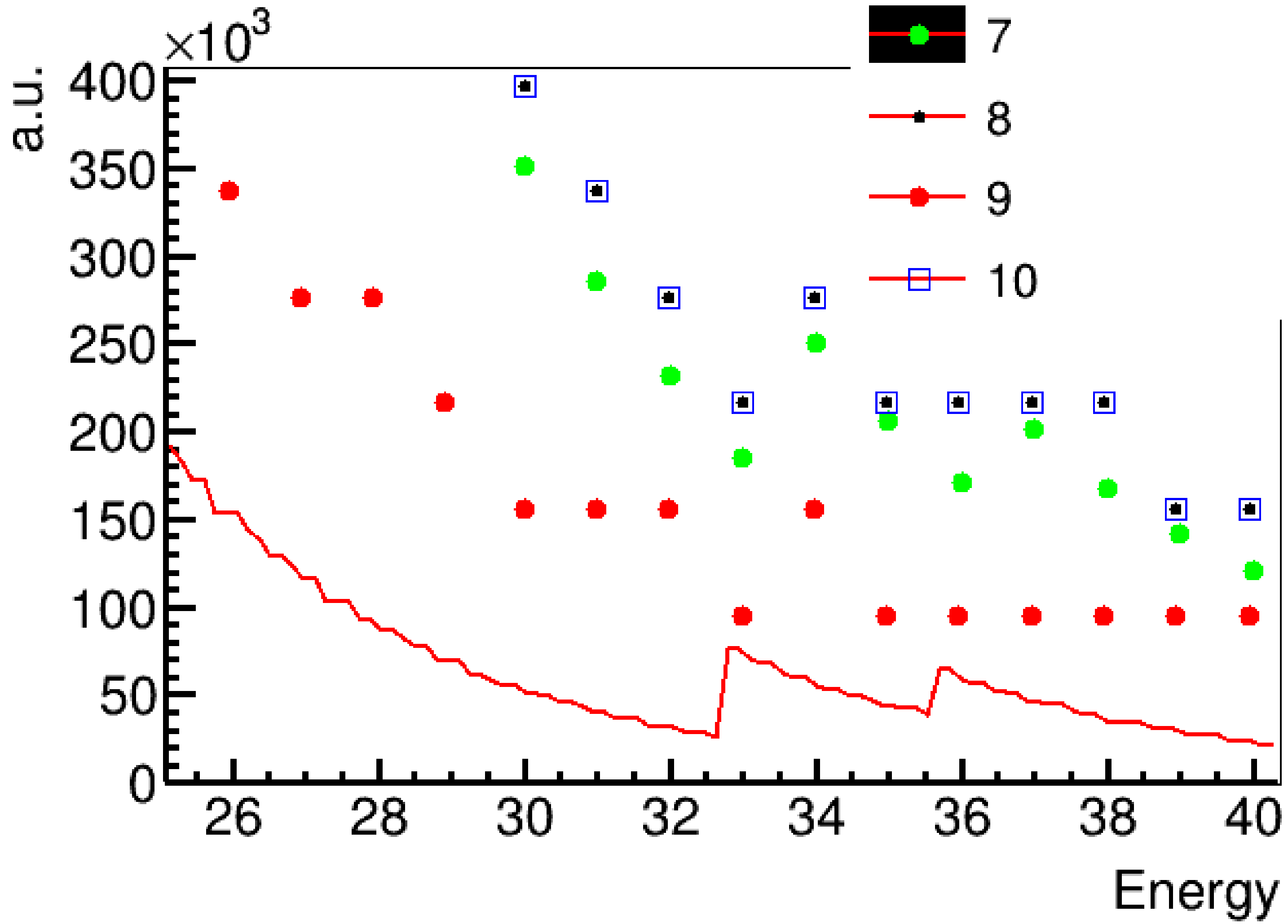
a.u.
10^6
10^5
1
2
3
6
5
10
15
20
25
30
35
40
Energy



×10³
a.u.
7000
6000
5000
4000
3000
2000
1000
0
0 5 10 15 20 25 30 35 40 45
Energy
1
2
3
6
×10³
a.u.
120
100
80
60
40
20
0
30 32 34 36 38 40
Energy



×10^6
a.u.
20
15
10
5
0
0
5
10
15
20
25
30
35
40
45
Energy
7
8
9
10
χ² / ndf 4.211e+11 / 35
p0 4.358e-05 ± 4.245e-11
p1 0 ± 0
p2 1 ± 0



×10^3
a.u.
400
350
300
250
200
150
100
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28
30
32
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36
38
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Energy
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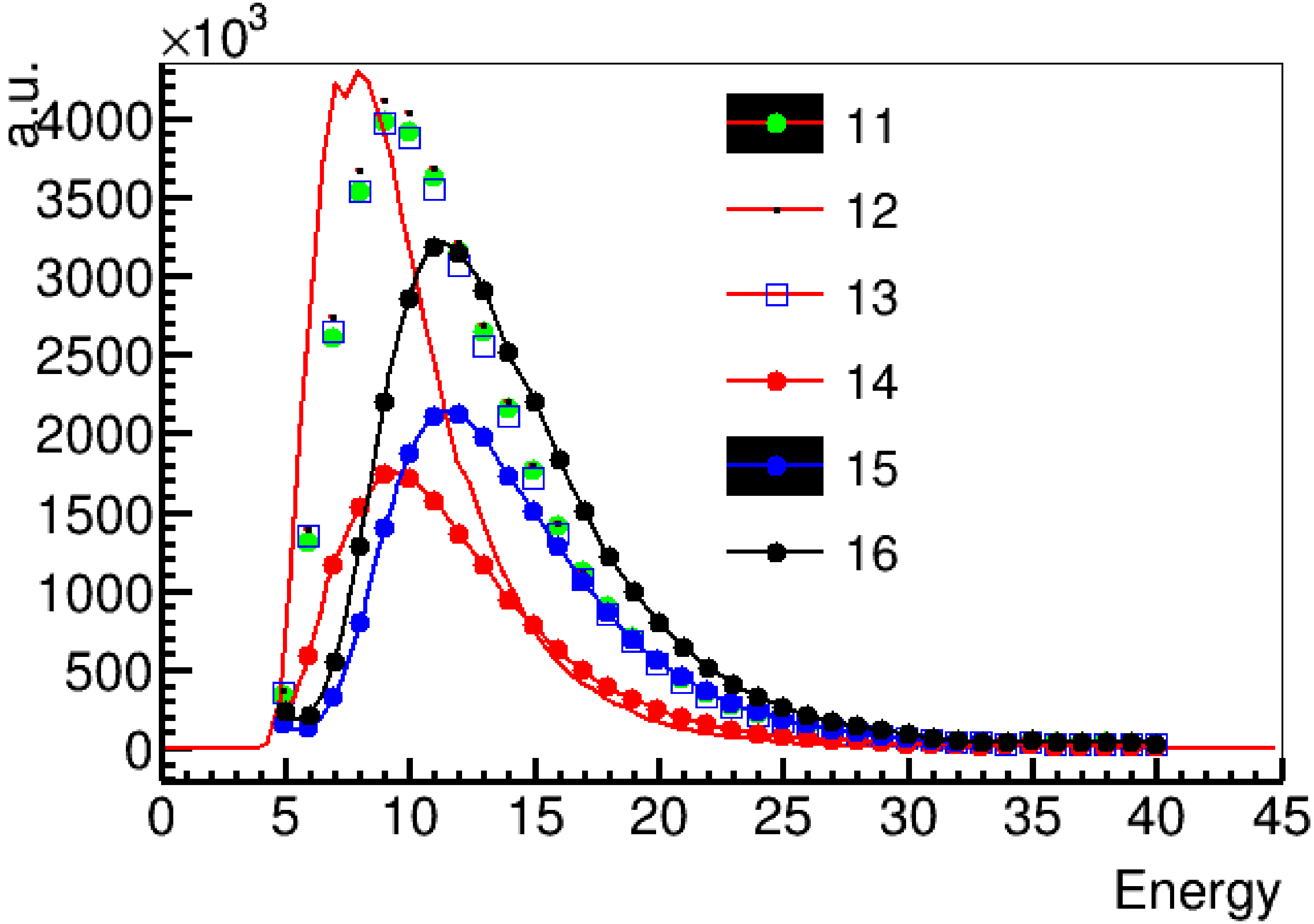
8
9
10



×10^3
a.u.
4000
3500
3000
2500
2000
1500
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35
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Energy
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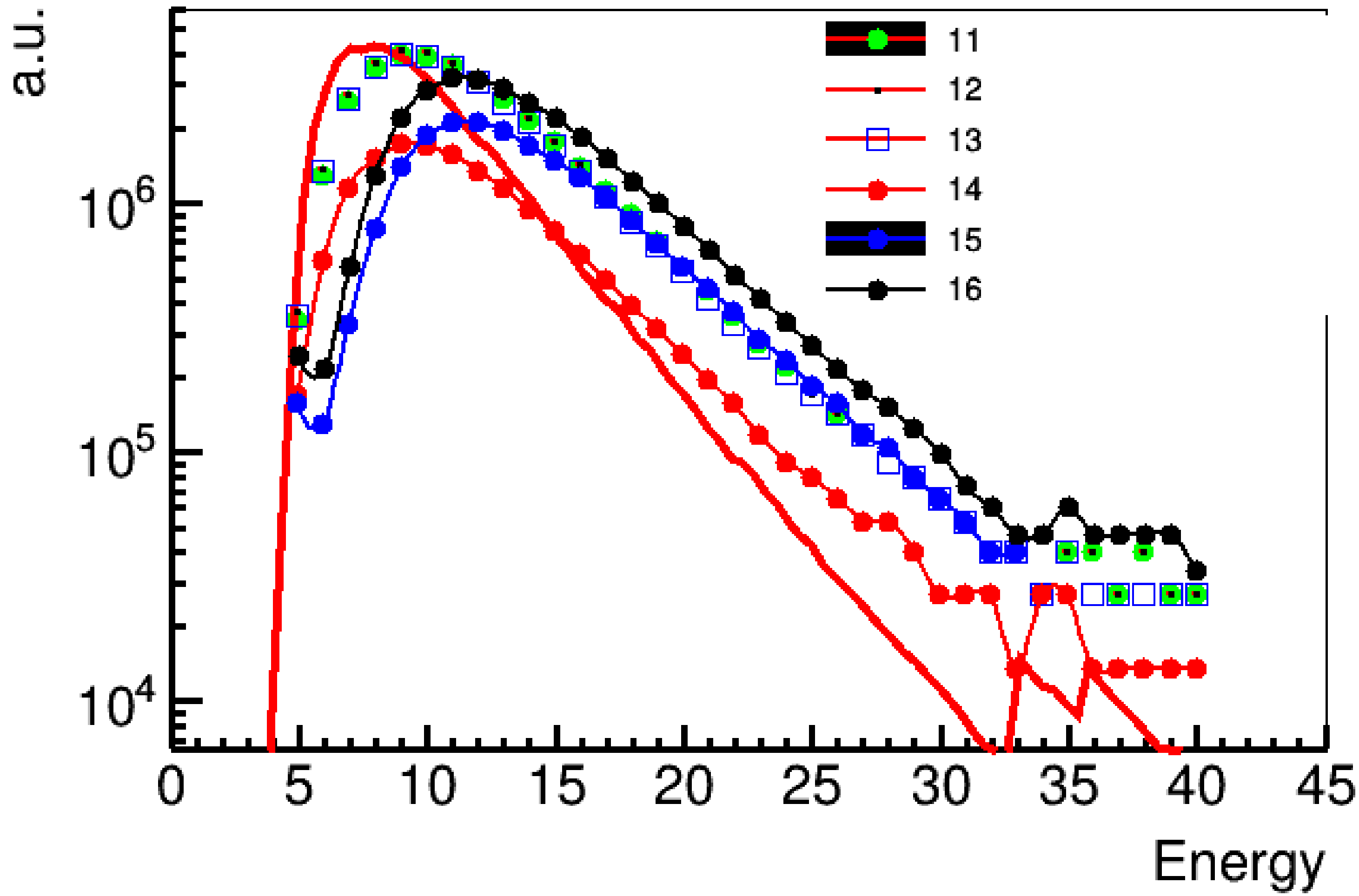
16



a.u.
10^6
10^5
10^4
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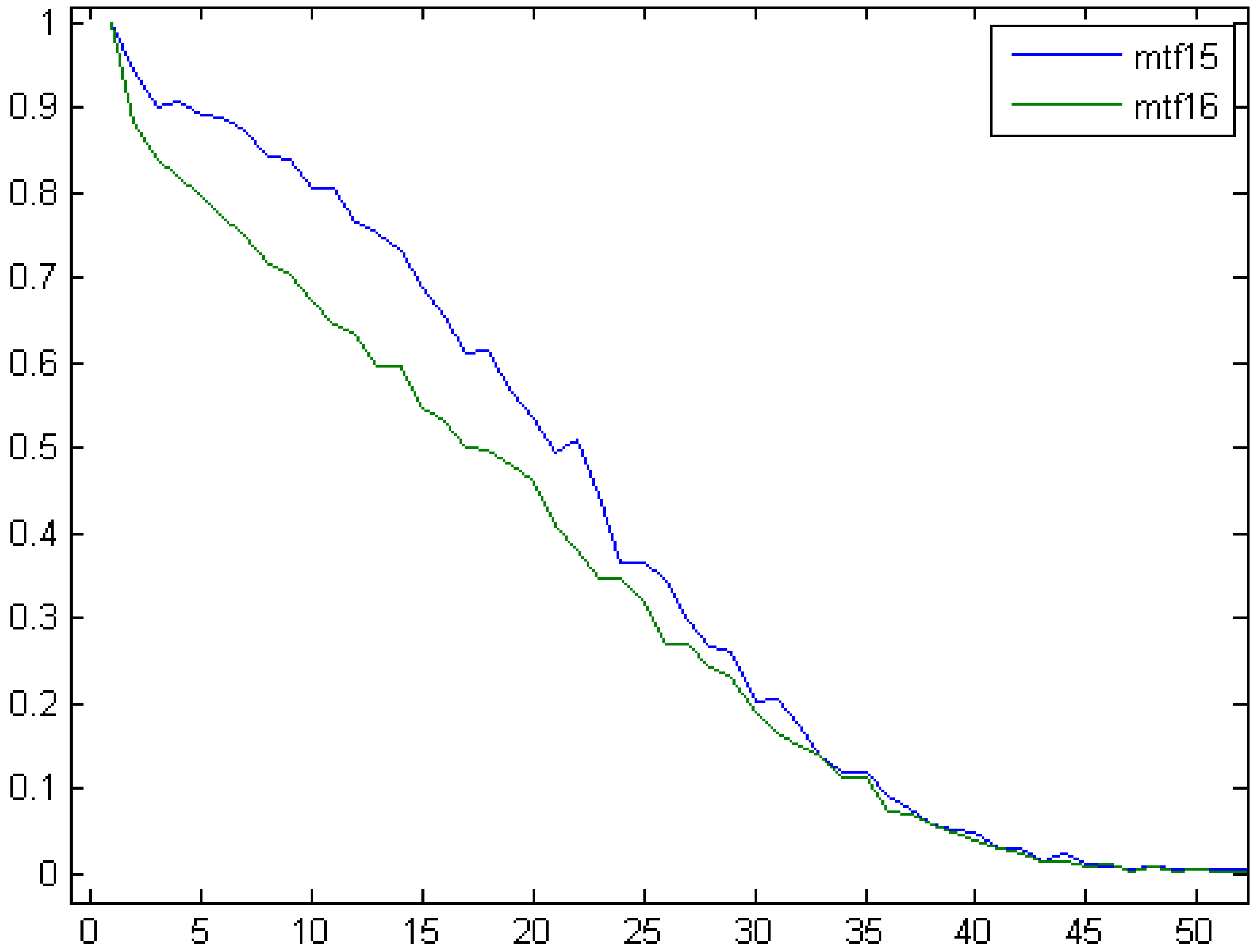
16



mtf15
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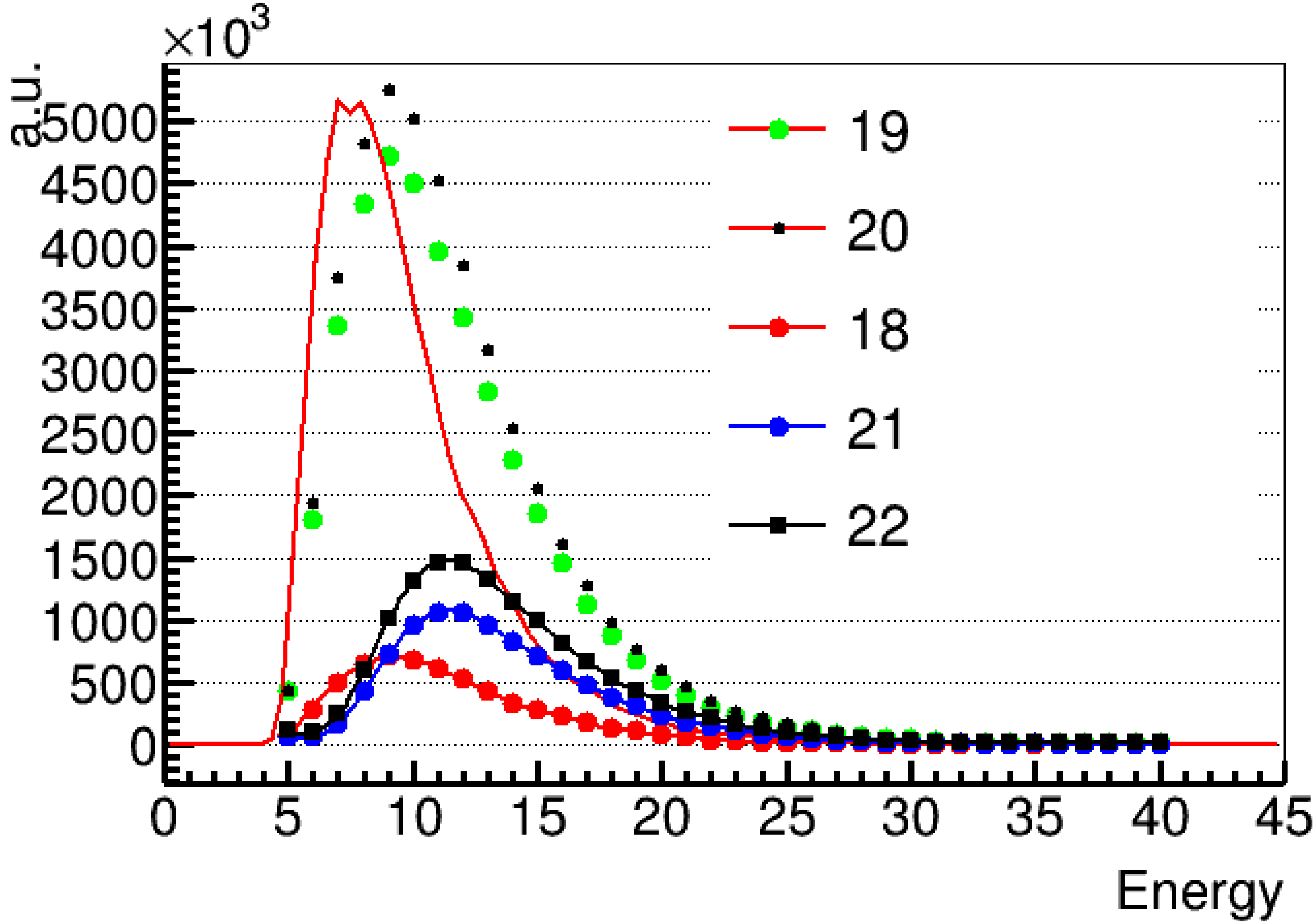

×10^3
a.u.
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3500
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Energy
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22

Возникшие вопросы

1. Гигантский световыход люминофором 6 мкм
2. Отличие световыходов люминофоров №15 и №16, №21 и №22
3. Как описать полученные спектры?

статья

1.Introduction.

2. Experimental.

a)Preparation of CsI(Tl) Scintillation Films.

Алексей П. – описание установки и метода напыление, сравнение с другими лабораториями. Схема установки.

b) Measurements of Microstructures, Crystalline Property, Light Output, Resolution.

Константин, Женя

3. Results and Discussion.

4. Conclusion.

план

1. Напылить углерод. «Обжечь» несколько пленок.
2. Померить световыход и разрешение в зависимости от толщины углерода
3. До 20 июня обменятся своими «литературными» изысканиями (на английском)

Тема №2. Толстые пленки CsI(Tl)

Задача:
Начать работу «руками» по изготовлению толстых сцинтилляторов.
Сделать что-нибудь до следующей смены на СИ.

«медицинские» толстые сцинтилляторы и тонкие пленки – Разные независимые задачи. Не смешиваем.

The need for fine detail visibility in various applications such as dental imaging, mammography, but also neurology and cardiology, is the driver for intensive efforts in the development of new x-ray detectors. The spatial resolution of current scintillator layers is limited by optical diffusion. This limitation can be overcome by a pixelation, which prevents optical photons from crossing the interface between two neighboring pixels. In this work, an array of pores was etched in a silicon wafer with a pixel pitch of $50\ \mu\mathrm{m}$. A very high aspect ratio was achieved with wall thicknesses of $4–7\ \mu\mathrm{m}$ and pore depths of about $400\ \mu\mathrm{m}$. Subsequently, the pores were filled with Tl-doped cesium iodide (CsI:Tl) as a scintillator in a special process, which includes powder melting and solidification of the CsI. From the sample geometry and x-rayabsorption measurement the pore fill grade was determined to be 75%. The scintillator-filled samples have a circular active area of 16 mm diameter. They are coupled with an optical sensor binned to the same pixel pitch in order to measure the x-ray imaging performance. The x-ray sensitivity, i.e., the light output per absorbed x-ray dose, is found to be only 2.5%–4.5% of a commercial CsI-layer of similar thickness, thus very low. The efficiency of the pores to transport the generated light to the photodiode is estimated to be in the best case 6.5%. The modulation transfer function is 40% at 4 lp/mm and 10%–20% at 8 lp/mm. It is limited most likely by the optical gap between scintillator and sensor and by K-escape quanta. The detective quantum efficiency (DQE) is determined at different beam qualities and dose settings. The maximum DQE(0) is 0.28, while the x-rayabsorption with the given thickness and fill factor is 0.57. High Swank noise is suspected to be the reason, mainly caused by optical scatter inside the CsI-filled pores. The results are compared to Monte Carlo simulations of the photon transport inside the pore array structure. In addition, some x-rayimages of technical and anatomical phantoms are shown. This work shows that scintillator-filled pore arrays can provide x-ray imaging with high spatial resolution, but are not suitable in their current state for most of the applications in medical imaging, where increasing the x-ray doses cannot be tolerated.