NETZWERK TEILCHENWELT

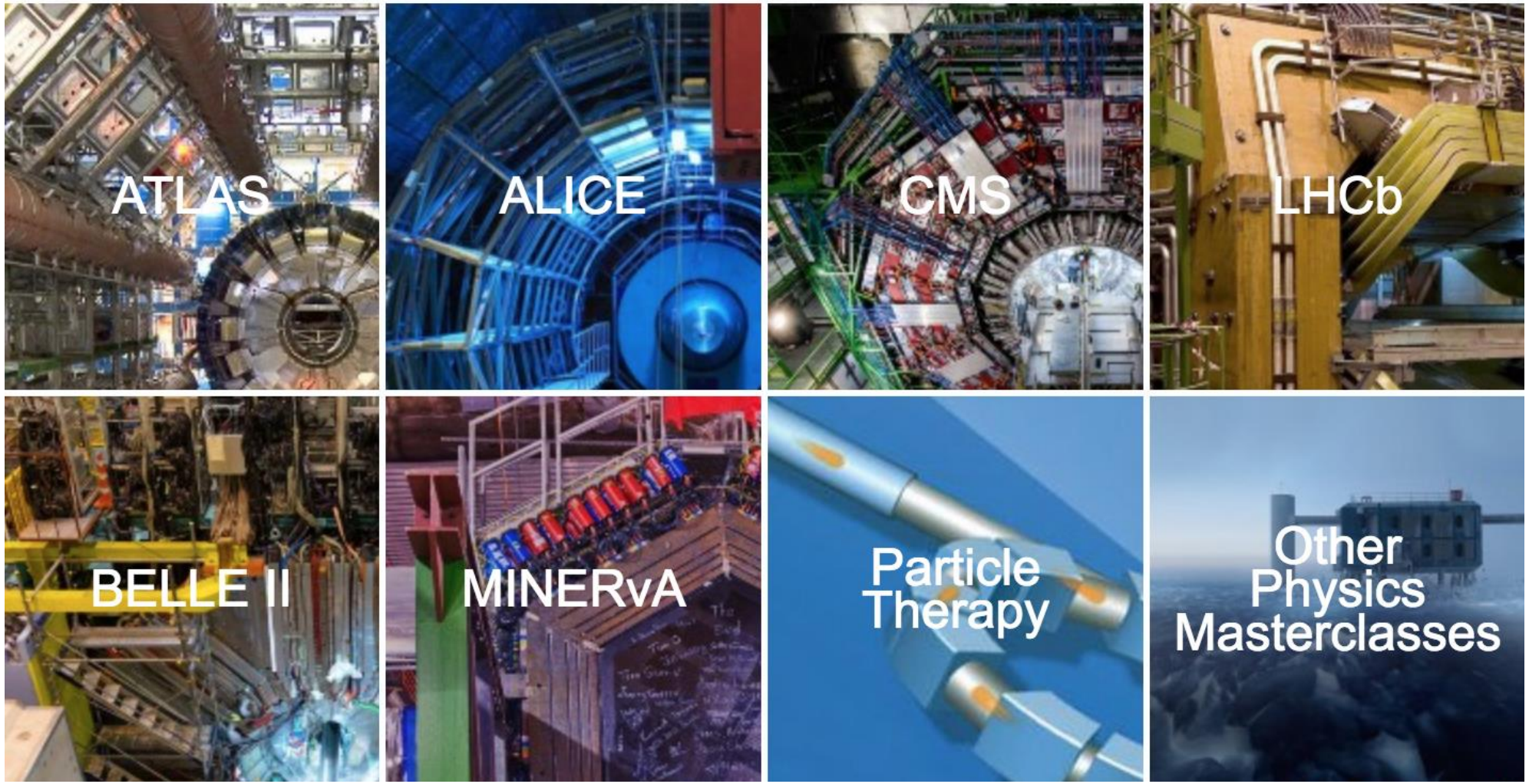
UNIVERSITÄT BONN

Masterclasses and Materials

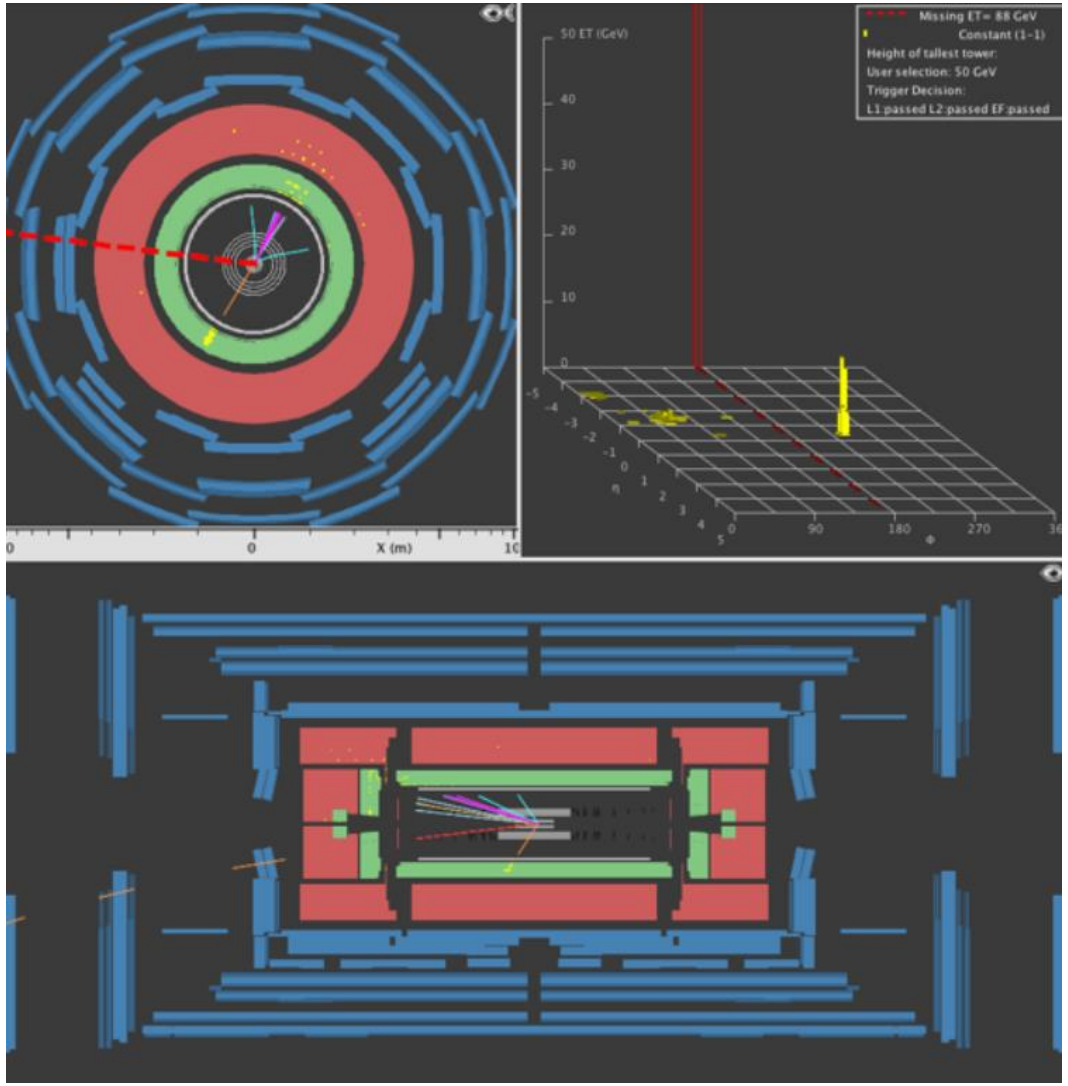
NETZWERK TEILCHENWELT

Masterclasses

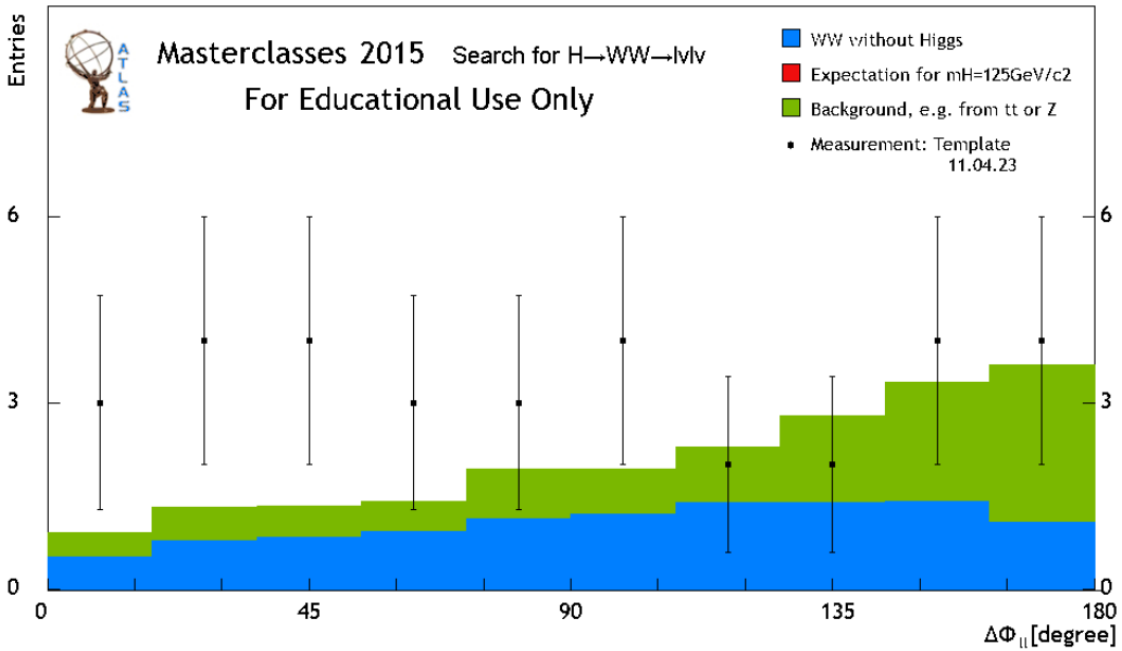
UNIVERSITÄT BONN



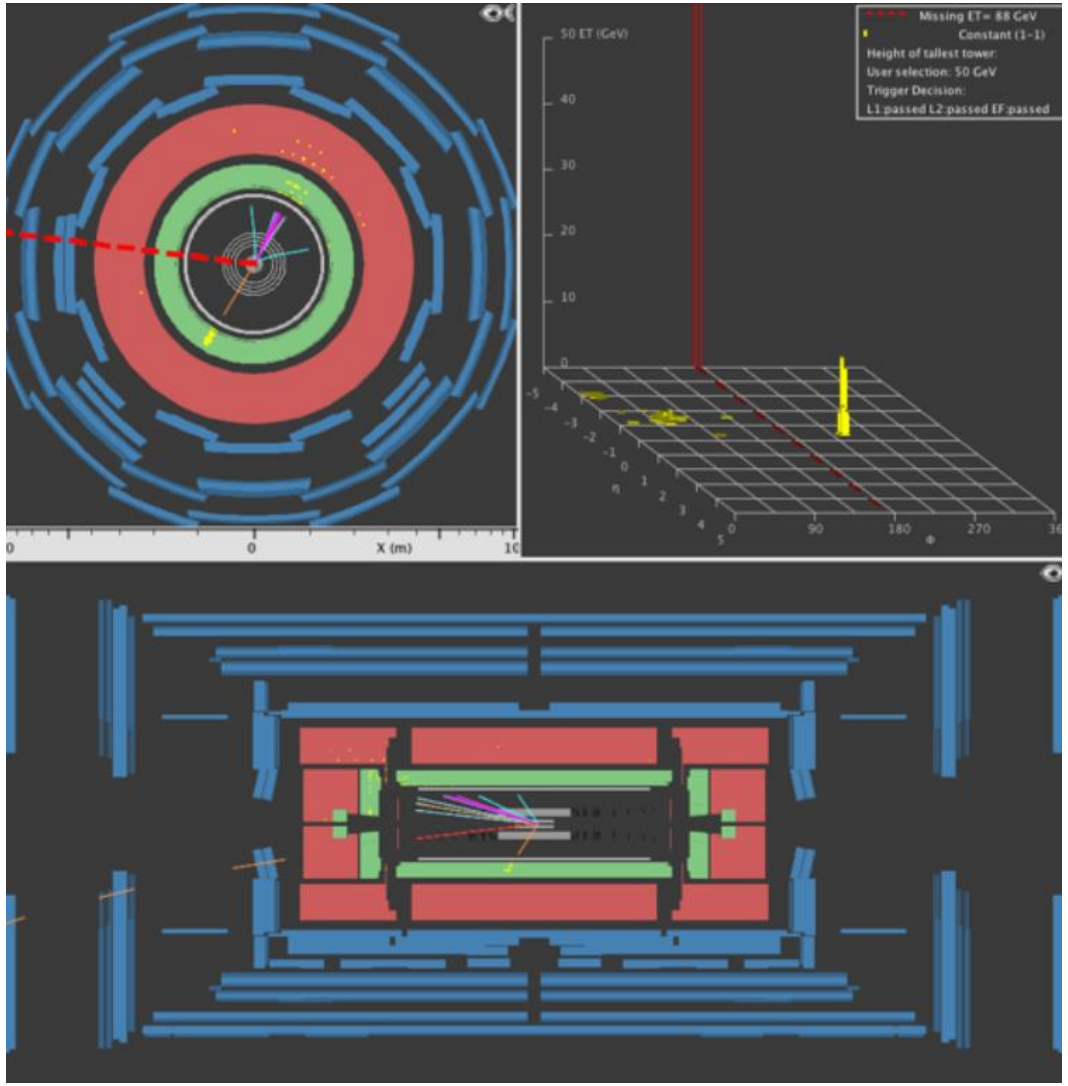
ATLAS

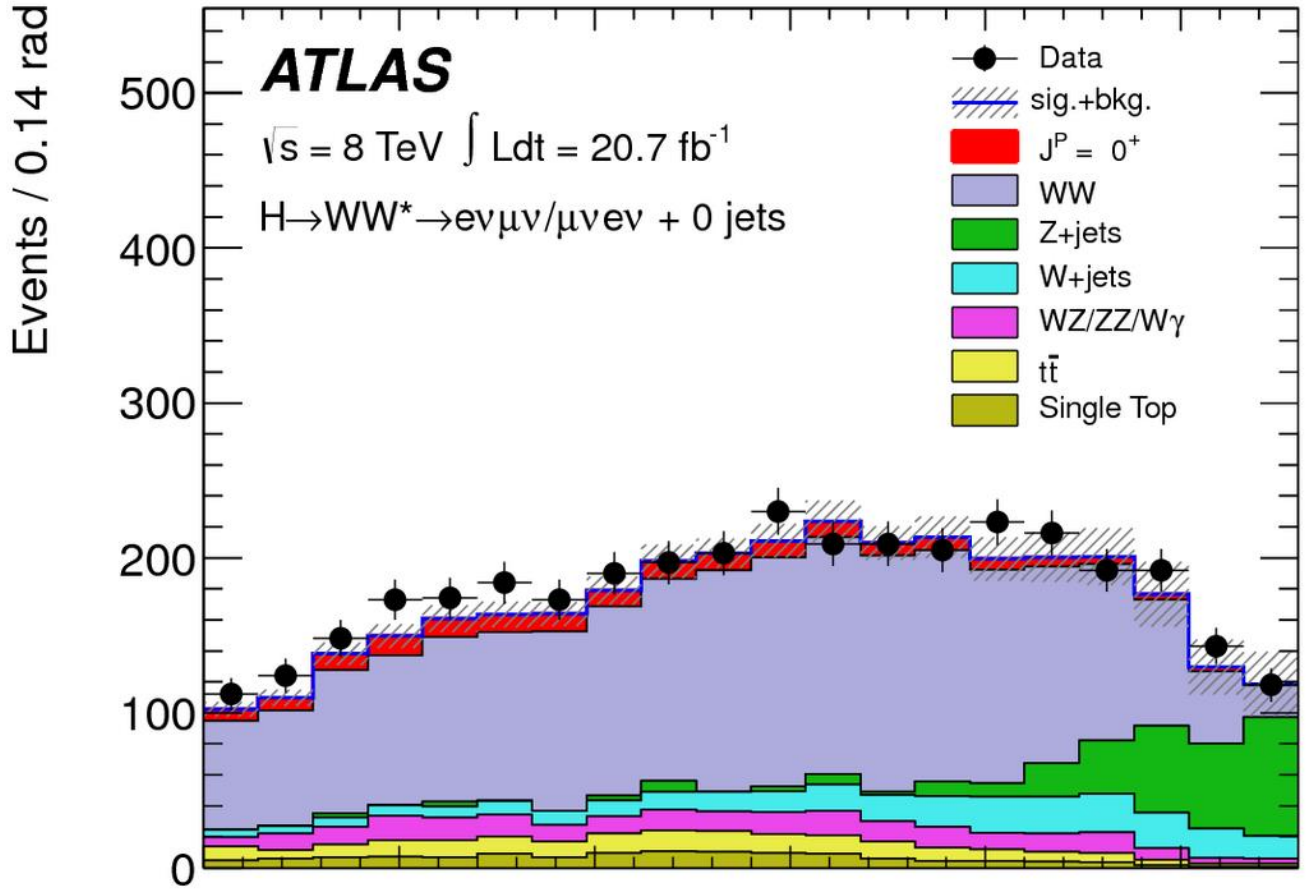


Total #	$W \rightarrow ... + \nu$				Background	WW
551	e^+	e^-	μ^+	μ^-		
group A	8	3	5	5	8	1
group B	3	3	8	8	23	5
group C	6	5	4	4	23	3
group D	12	2	7	2	29	1
group E	5	6	9	8	15	2

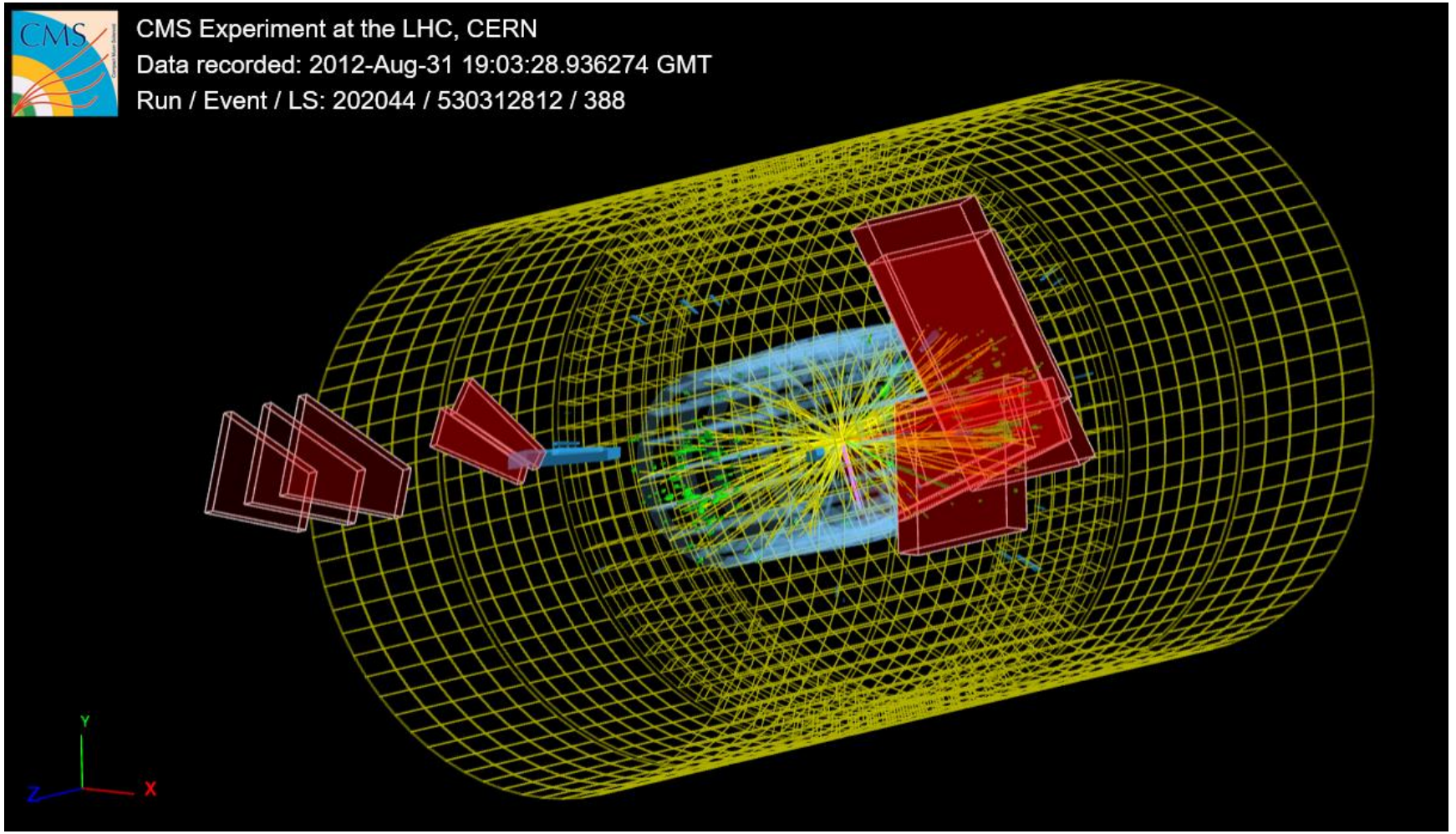


ATLAS

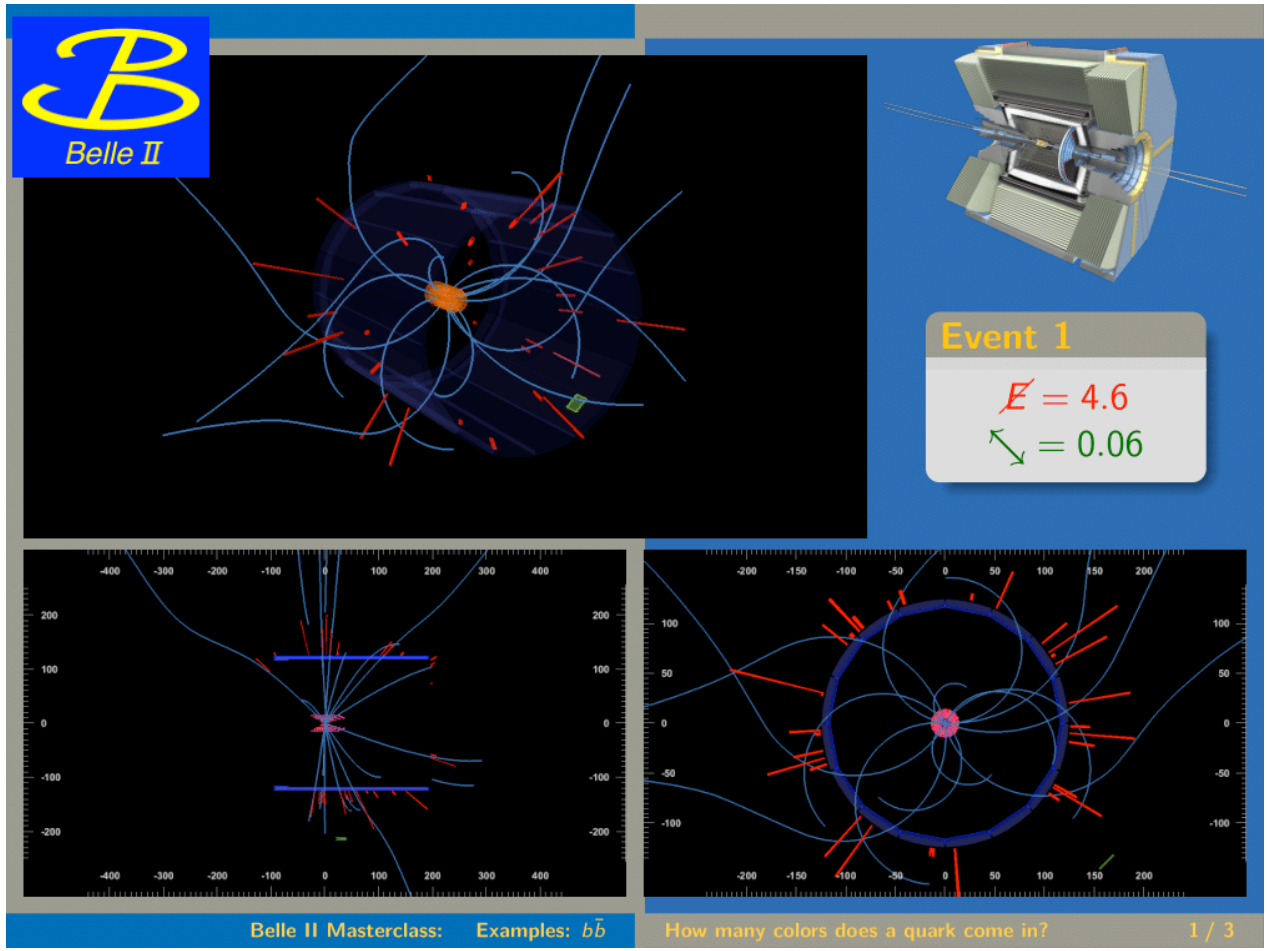

Missing ET = 88 GeV
Constant (1-1)
Height of tallest tower:
User selection: 50 GeV
Trigger Decision:
L1:passed L2:passed EF:passed
50 ET (GeV)
X (m)

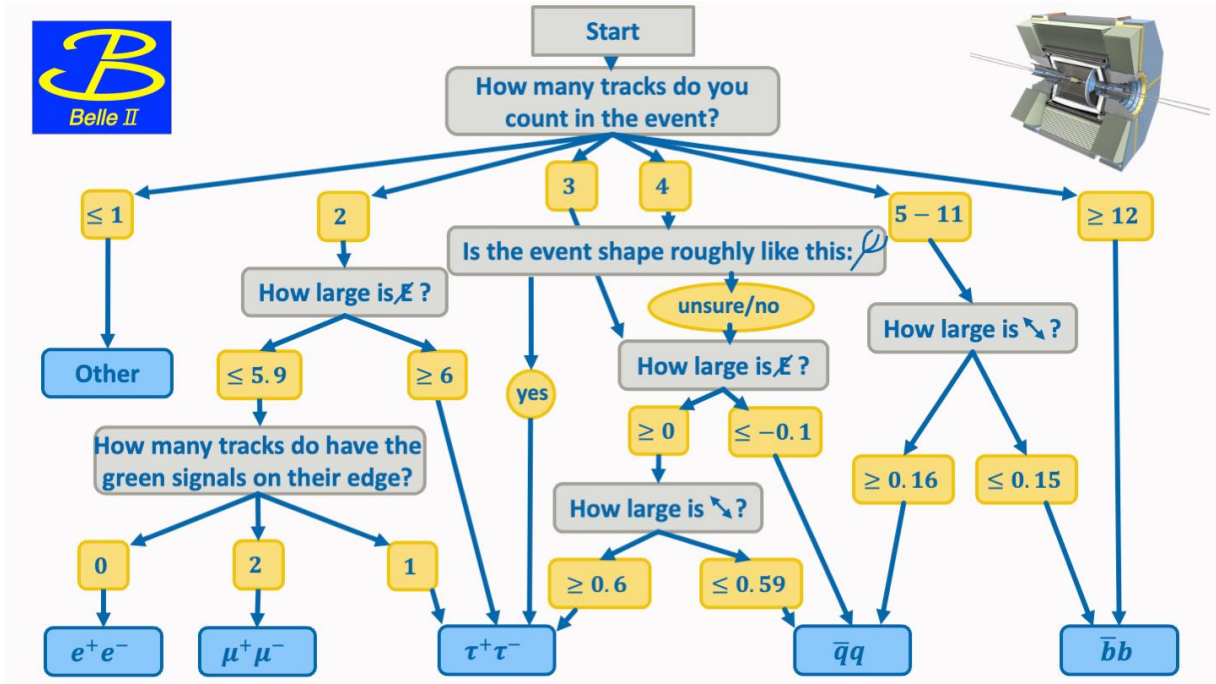

ATLAS
√s = 8 TeV ∫ Ldt = 20.7 fb-1
H→WW*→eνμν/μνeν + 0 jets
Data
sig.+bkg.
JP = 0+
WW
Z+jets
W+jets
WZ/ZZ/Wγ
tt̄
Single Top
Events / 0.14 rad
500
400
300
200
100
0

CMS

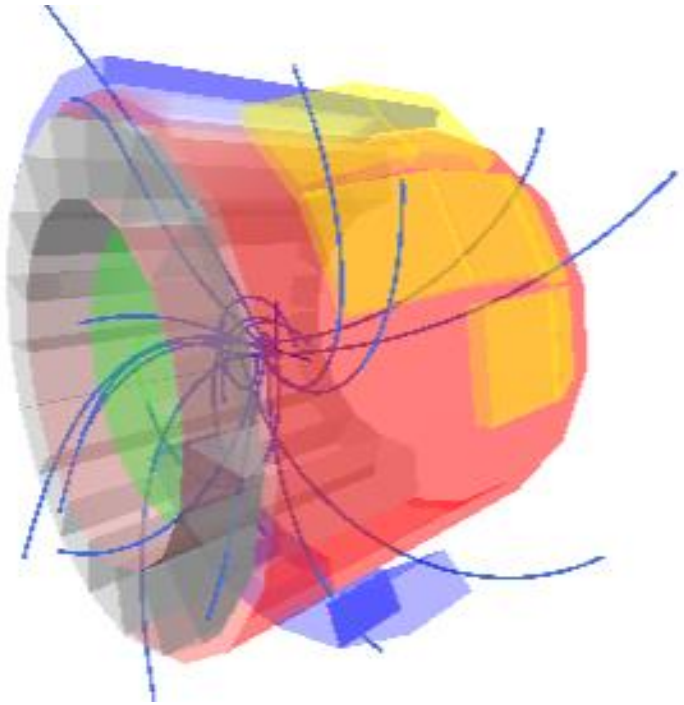

CMS Experiment at the LHC, CERN
Data recorded: 2012-Aug-31 19:03:28.936274 GMT
Run / Event / LS: 202044 / 530312812 / 388
Y
Z
X

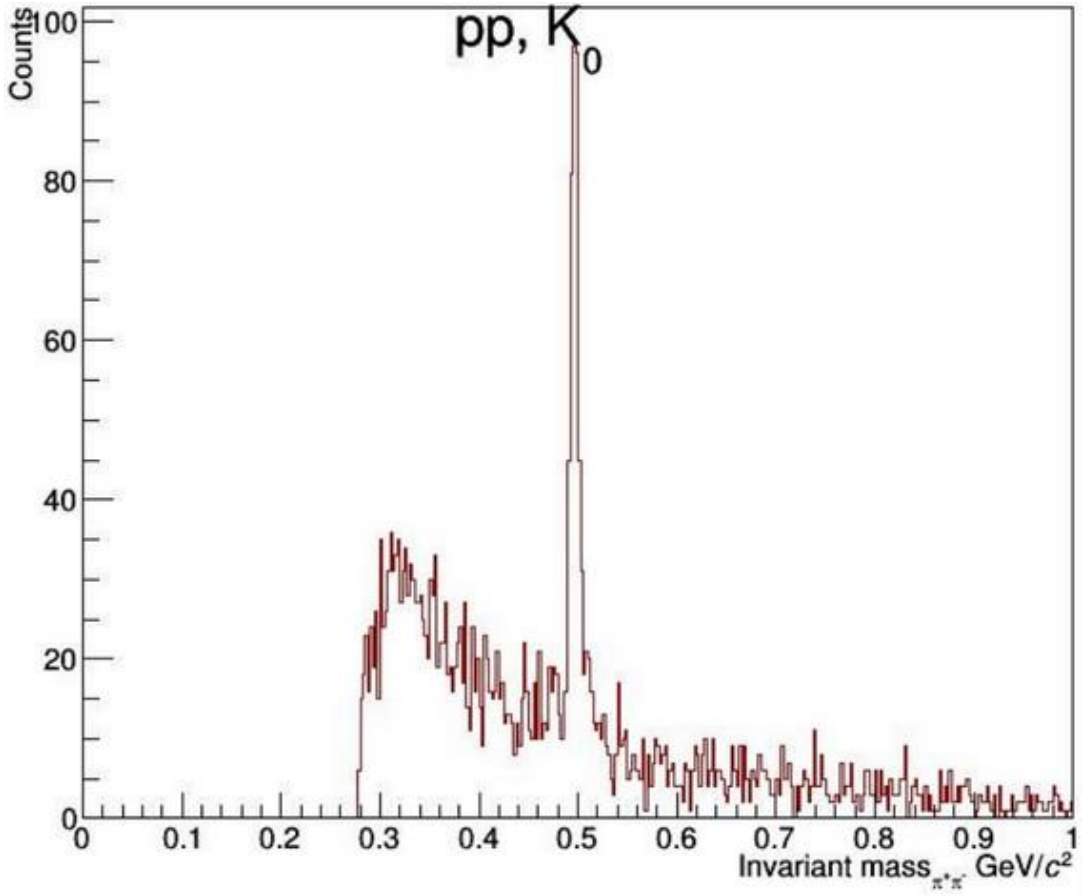
Belle II


Belle II
Event 1
$\not{E} = 4.6$
$\searrow = 0.06$
Belle II Masterclass: Examples: $b\bar{b}$
How many colors does a quark come in?
1 / 3

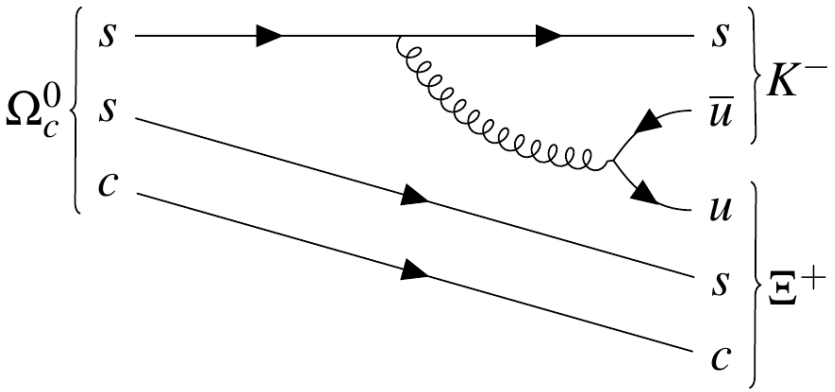

Belle II
Start
How many tracks do you count in the event?
≤ 1
2
3
4
5 – 11
≥ 12
Other
How large is $\not{E}$?
Is the event shape roughly like this:
How large is $\searrow$?
≤ 5.9
≥ 6
yes
unsure/no
How large is $\not{E}$?
≥ 0
≤ −0.1
How many tracks do have the green signals on their edge?
How large is $\searrow$?
≥ 0.16
≤ 0.15
0
2
1
≥ 0.6
≤ 0.59
e^+e^-
$\mu^+\mu^-$
$\tau^+\tau^-$
$\bar{q}q$
$\bar{b}b$

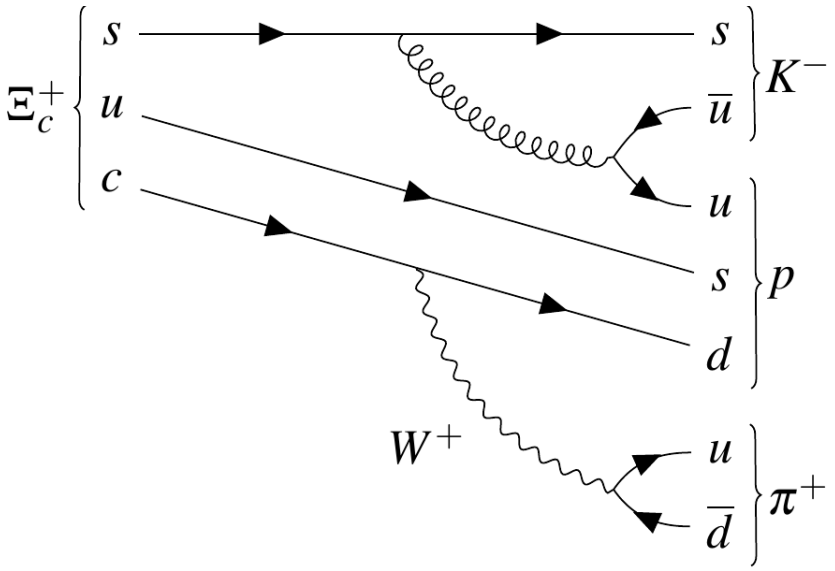
ALICE

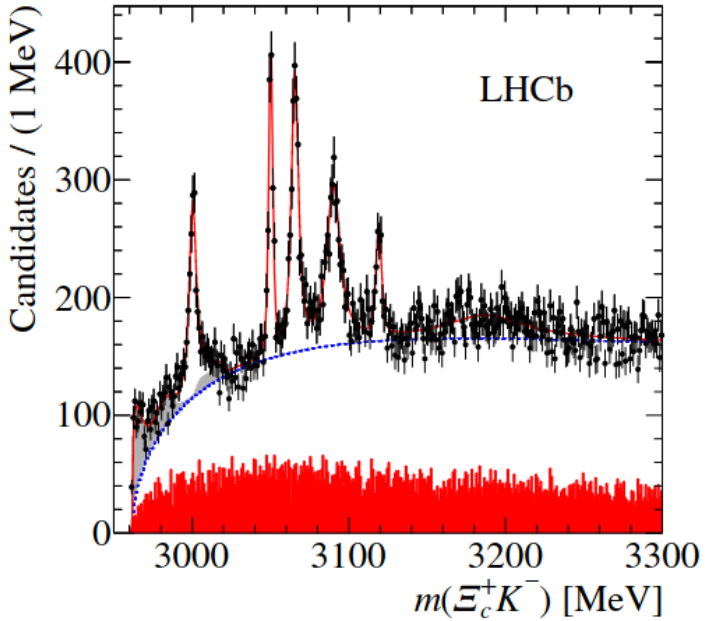



pp, K^0_S
Counts
100
80
60
40
20
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Invariant mass$_{\pi^+\pi^-}$ GeV/c^2

LHCb

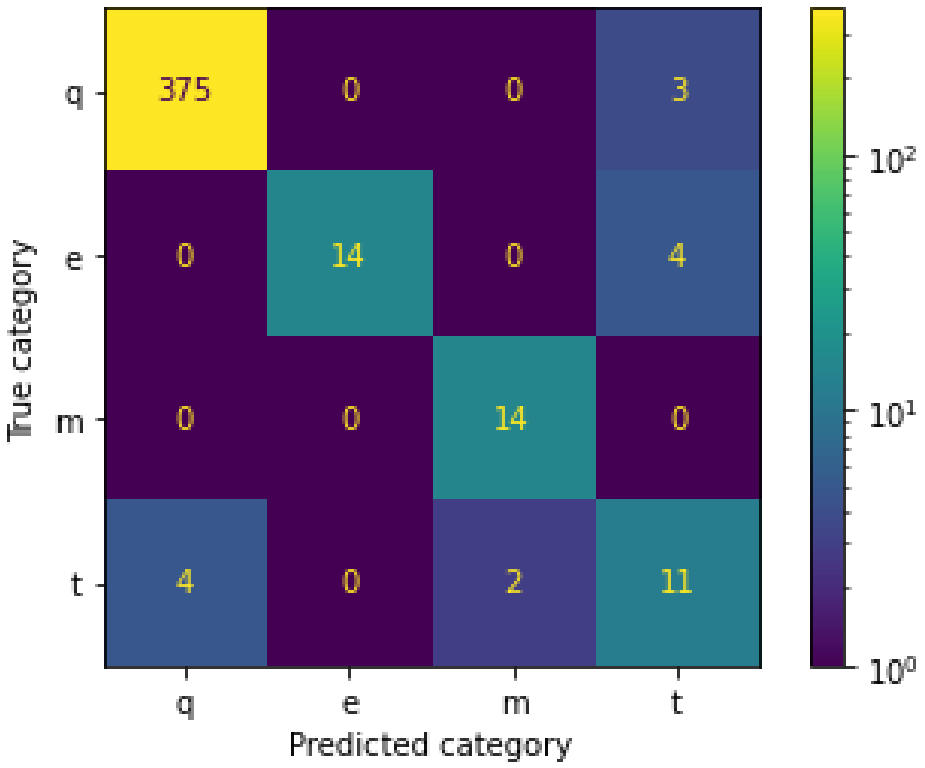






2017, https://arxiv.org/pdf/1703.04639.pdf

Machine Learning with OPAL data



Total prediction accuracy: 0.9696

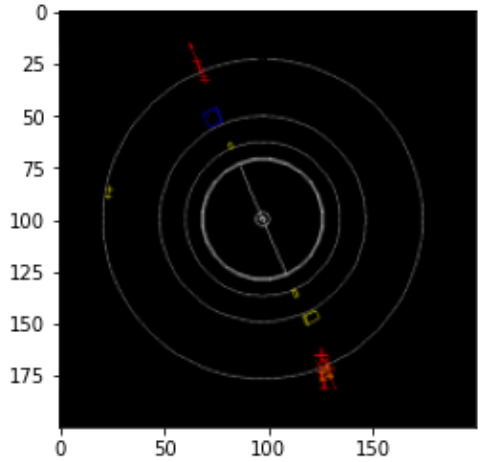
In [2]:
```
eventliste = load_events()
```

609 events loaded

Mit `eventliste[x]` kann auf das `x-1`-ste Ereignis zugegriffen werden.

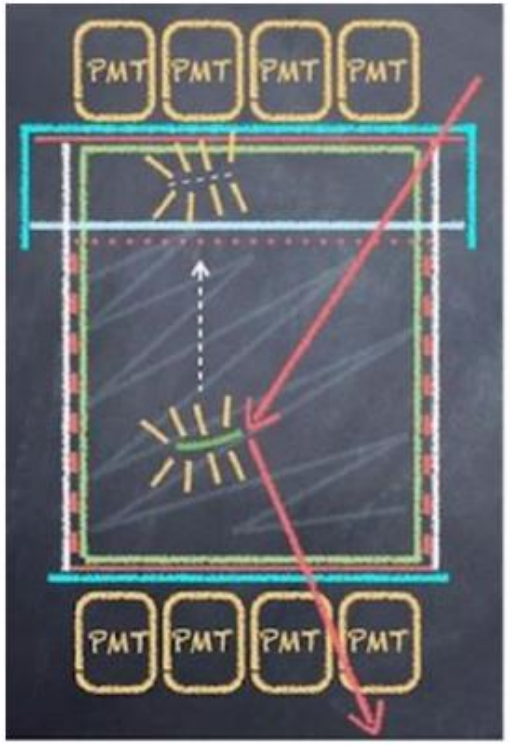
Die Methode `.show_image()` gibt das Ereignis grafisch aus.

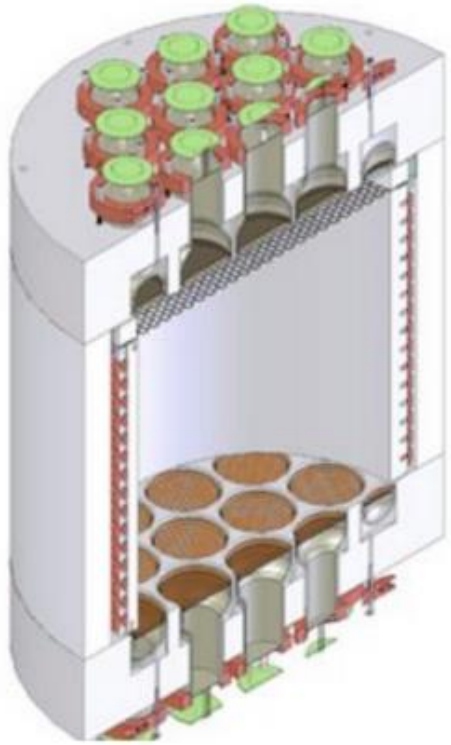
In [3]:
```
eventliste[53].show_image(show_category=True)
```

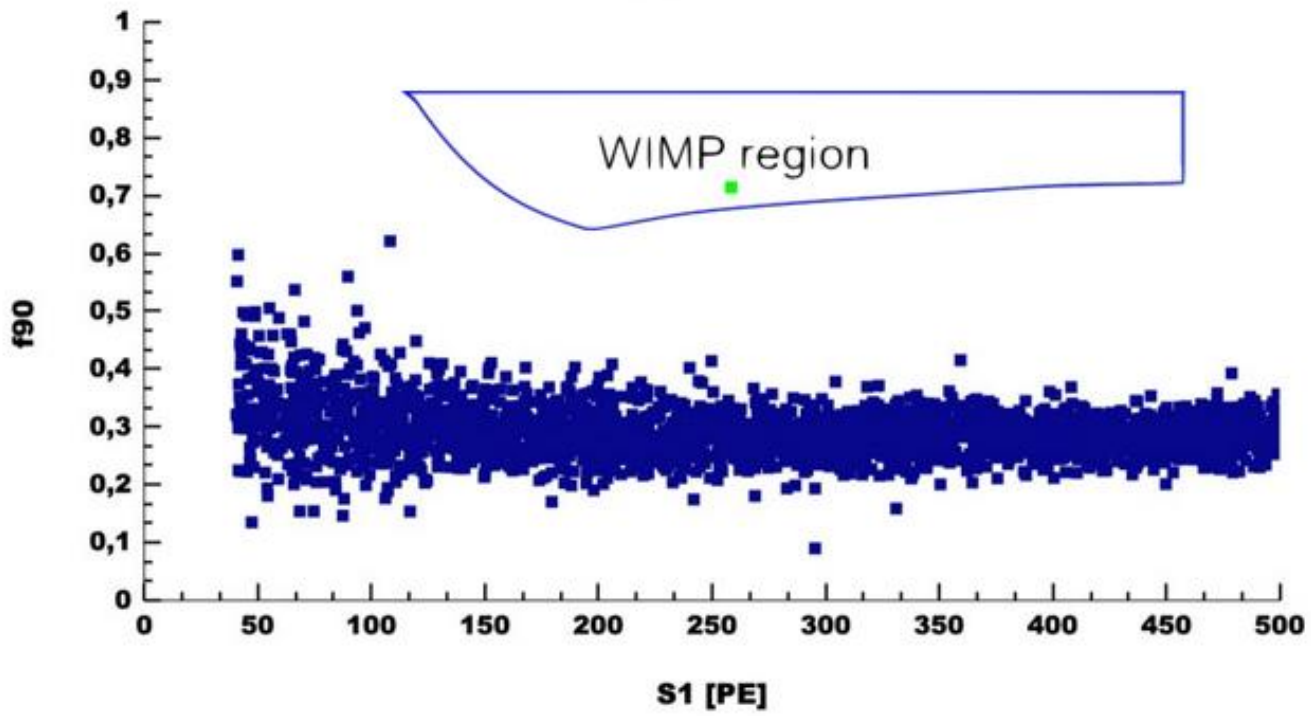


Name: z5293_15219.png Category: m

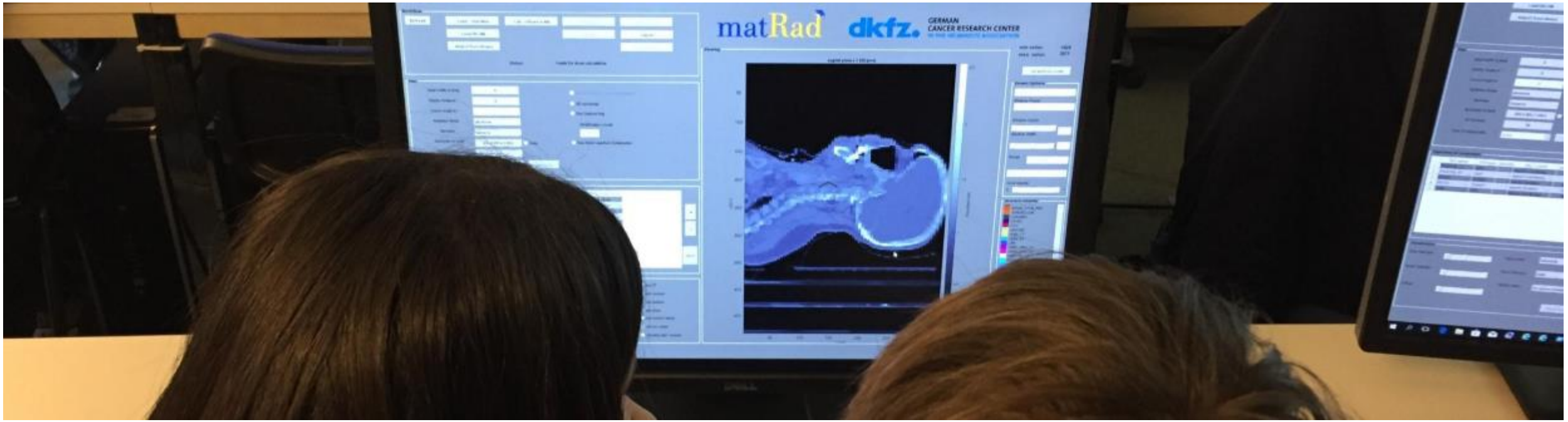
Darkside


PMT
PMT
PMT
PMT
PMT
PMT
PMT
PMT

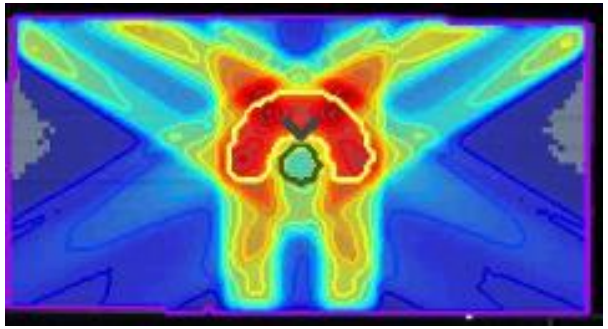



WIMP region
f90
S1 [PE]
0
0,1
0,2
0,3
0,4
0,5
0,6
0,7
0,8
0,9
1
0
50
100
150
200
250
300
350
400
450
500

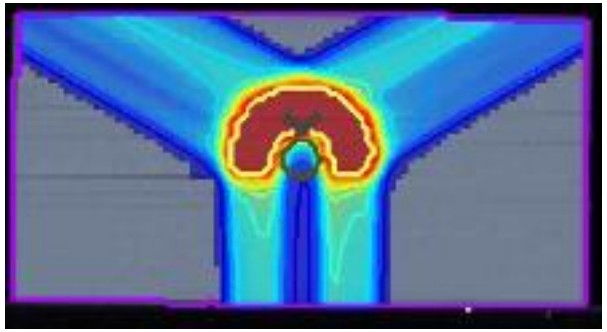
Particle Therapy Masterclass



Photons



Protons



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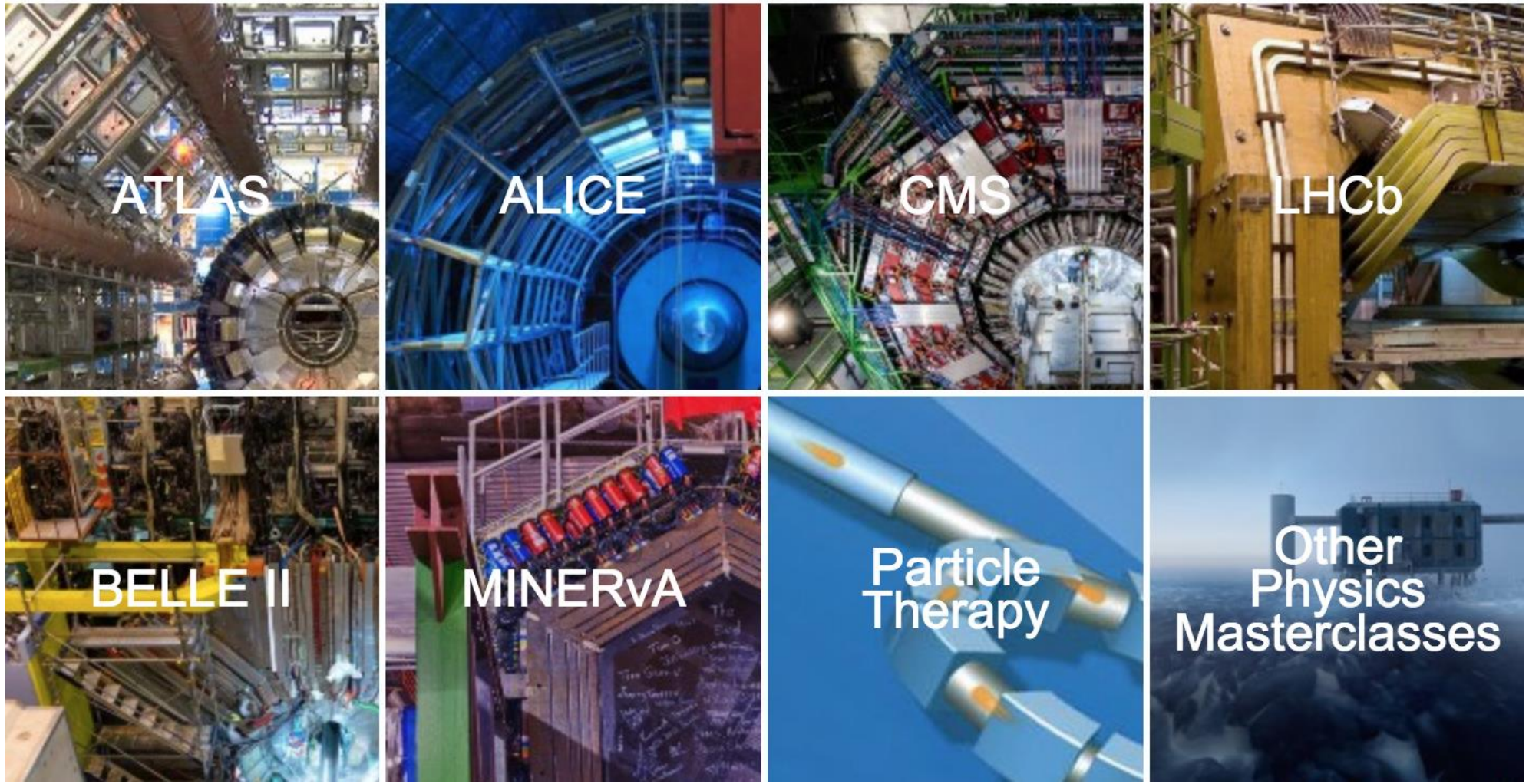
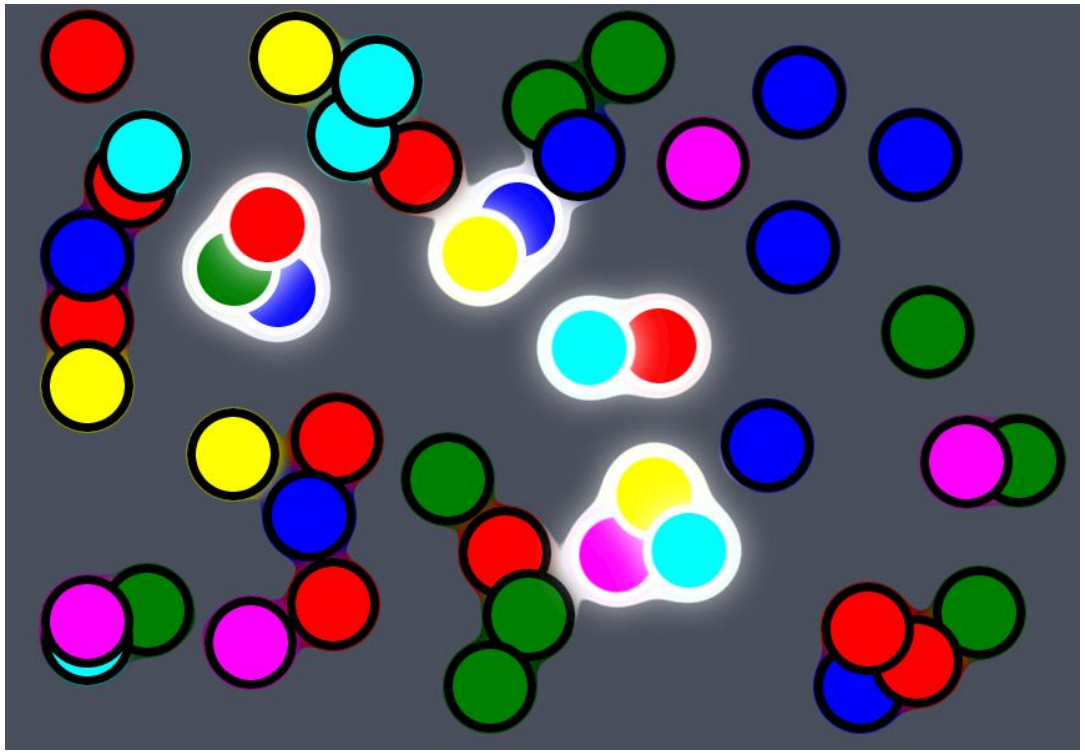


Materials



Wiki

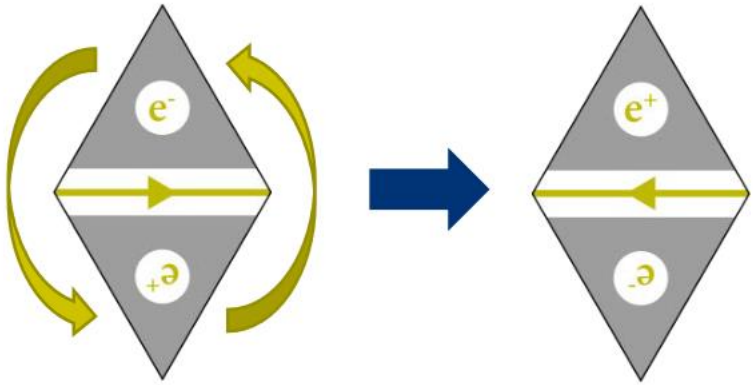
wiki.teilchenwelt.de

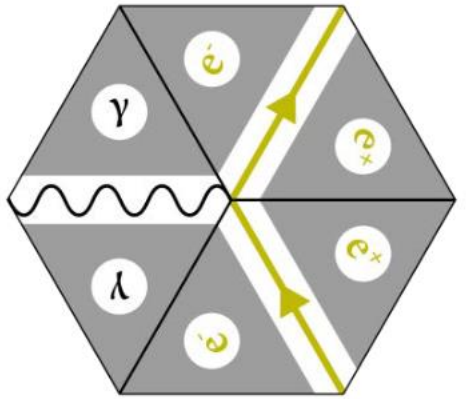
Particle Zoo

Particle Zoo

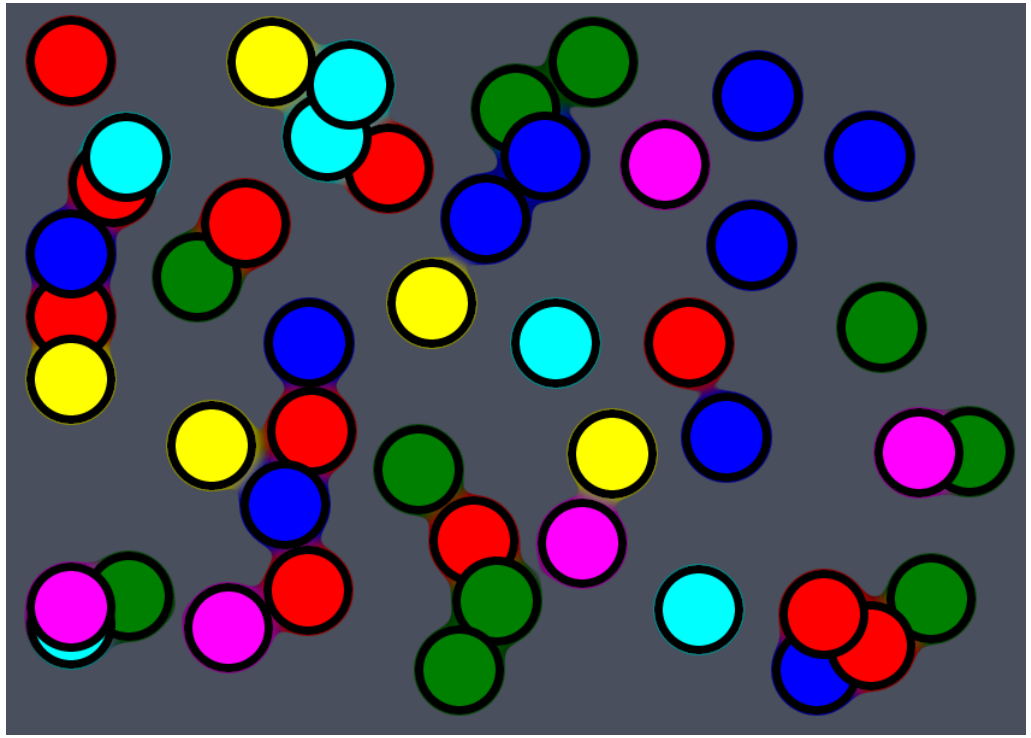
1. Take your particles and sort by mass!
2. Get together in 4 groups:
    1. Group: W boson, Higgs boson, top quark, Z boson, antitop quark, bottom quark
    2. Group: Gluon, photon, muon antineutrino, electron neutrino, tau antineutrino, tau neutrino
    3. Group: Proton, neutron, electron, electron antineutrino, up quark, down quark
    4. Group: Charm quark, strange quark, muon neutrino, muon

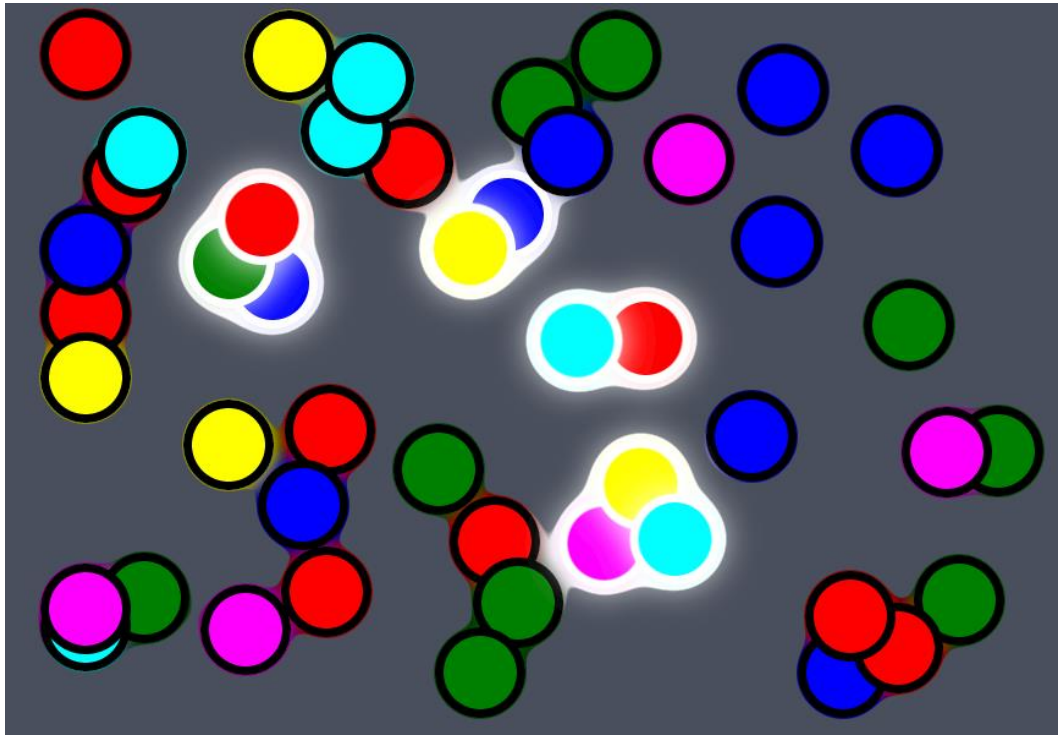
Feynman Rhombino



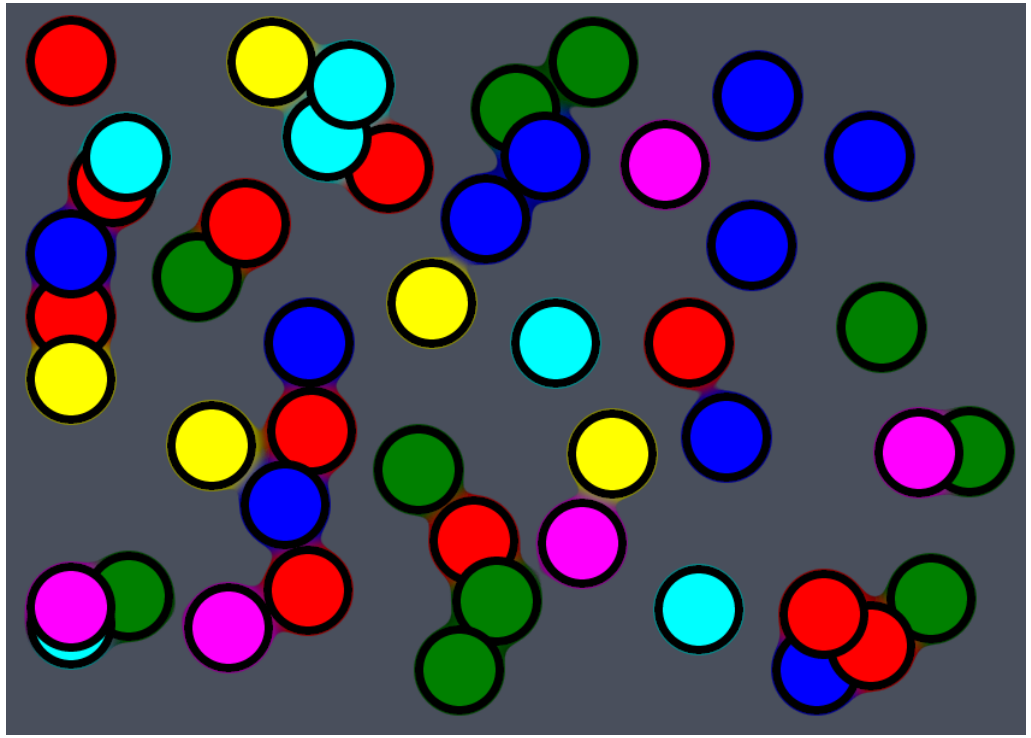


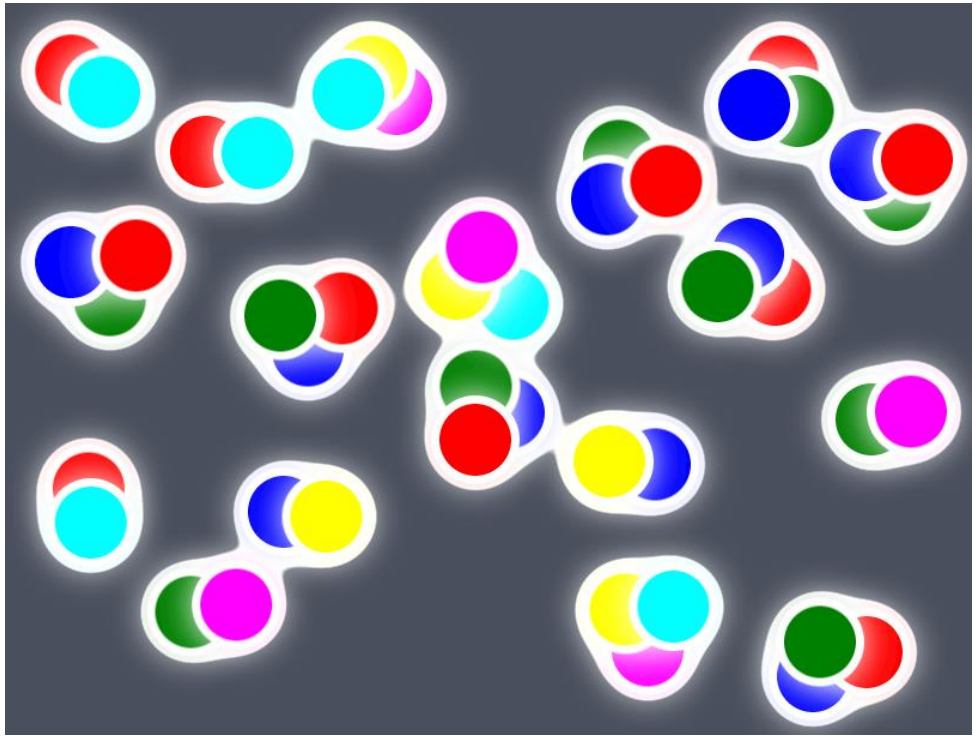
Color Game



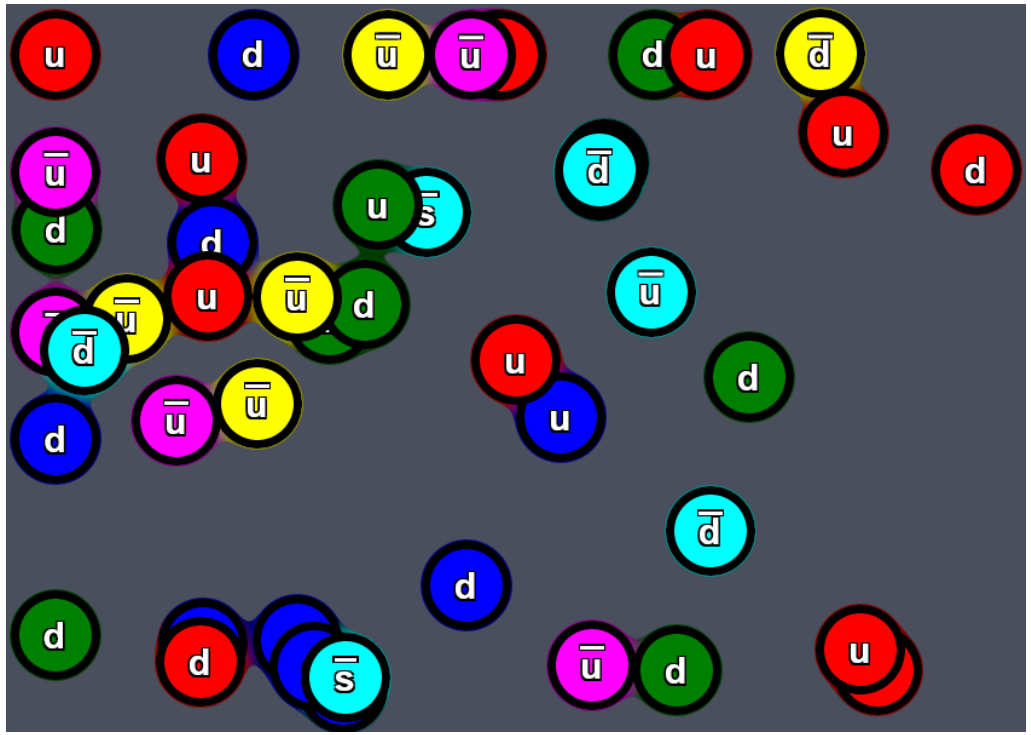


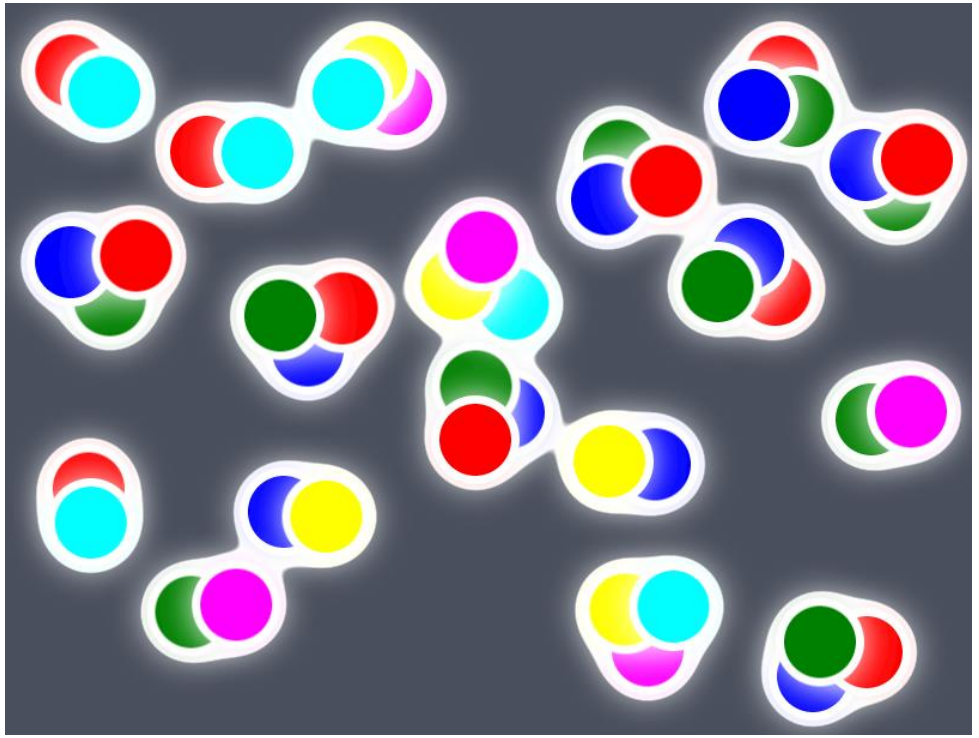
Color Game





Color Game

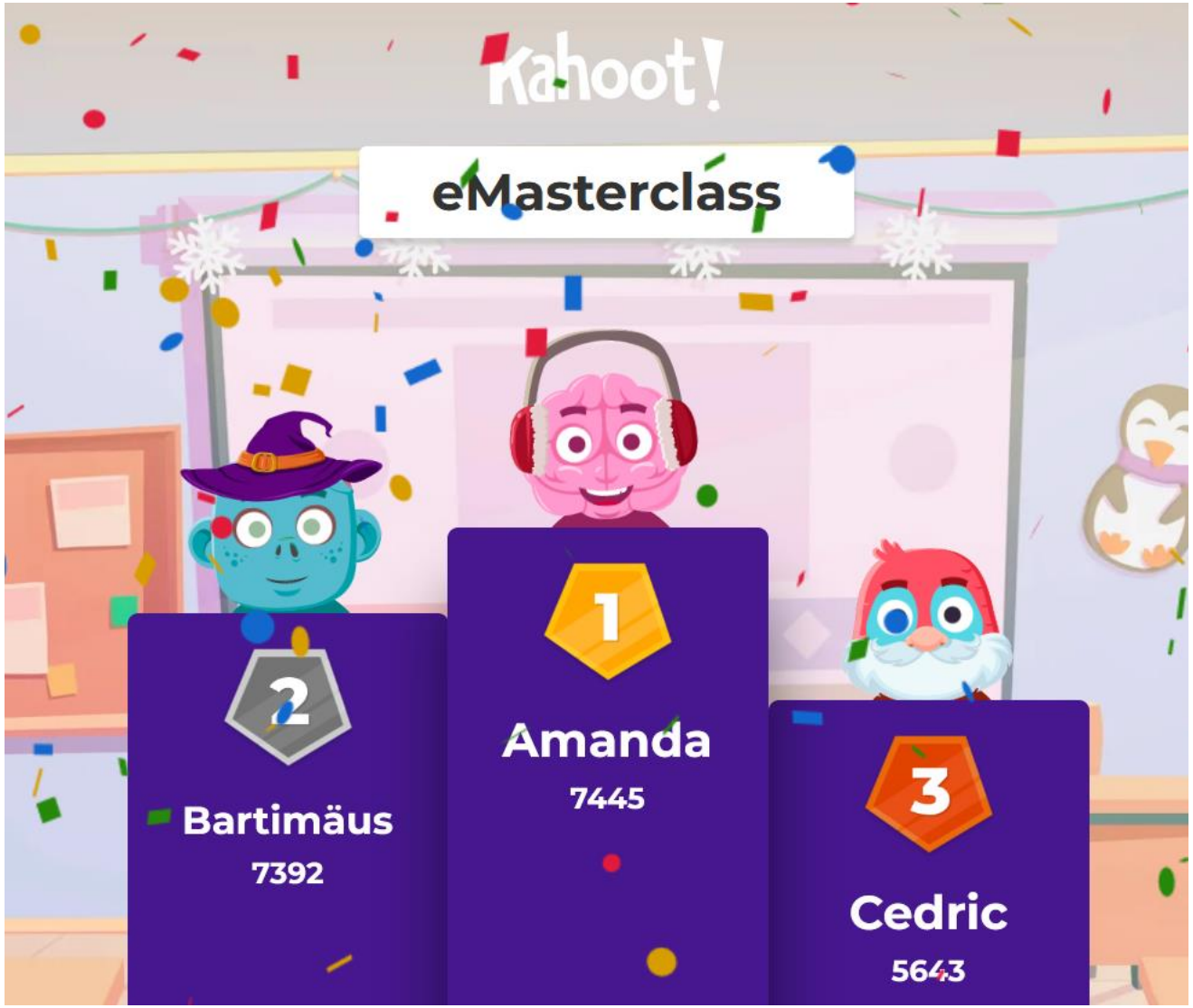




online.schule.physik.uni-mainz.de/teilchenspiele/farbspiel/

Interactive Quiz

Interactive Quiz



kahoot.com

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Backup

Links (besides teilchenwelt.de)

- ATLAS (W): https://atlas.physicsmasterclasses.org/en/wpath.htm
- ATLAS (Z): https://atlas.physicsmasterclasses.org/en/zpath.htm
- Belle II: https://belle2.ijs.si/public/home/quark-colors/
- Particle Therapy: https://indico.cern.ch/event/840212/
- CMS: https://web.quarknet.org/mc/cms/imc2021/cms.html
- LHCb: https://lhcb-public.web.cern.ch/en/LHCb-outreach/masterclasses/en/
- ALICE: https://alice-masterclass.web.cern.ch/ and http://www-alice.gsi.de/masterclass/
- Darkside: https://sites.google.com/unisa.it/darksidemasterclass/home-page
- Color Game: https://online.schule.physik.uni-mainz.de/teilchenspiele/farbspiel/

LHCb: Interactive Jupyter Notebook