What’s next?

F. Martínez Vidal, IFIC-Valencia
Direct Probe Of short-Lived particle Electromagnetic dipole moments at LHCb
From last LHCb review

Bent crystals: FITPAN main recommendations

1. The panel considers that the MDM sensitivity makes this proposal a valuable physics programme with MDM measurements as likely main physics output.

2. The panel considers that the precision on EDMs can at best demonstrate the feasibility of this elegant and novel EDM measurement method which is a highly worthwhile goal that could lay the foundation of future experiments in this field.

3. The panel reiterates the recommendation to propose operational schemes that minimize the effect of the programme on LHCb and to work closely with the LHC machine to ensure the feasibility of these.

4. The panel reiterates the comment that the interaction with and possible involvement of the UA9 community should be better clarified.

5. The community is encouraged to continue its R&D on the project.

6. The panel would be happy to consider the proposal again after sufficient progress is made on
   i. feasibility of operation in the LHC
   ii. updated proposals for the model of data-taking
   iii. demonstration of the operation of large bending angle crystals in a test beam.
FITPAN recommendations

✓ feasibility of operation in the LHC
  D. Mirarchi’s talk

✓ demonstration of the operation of large bending angle crystals in a test beam
  A. Sytov’s & M. Romagnoni talks

? updated proposals for the model of data-taking
? updated proposals for the model of data-taking

- Proton flux $\approx 10^6 \text{ s}^{-1}$
- **Pilep** $\nu$ and $\Lambda c$ rate for W+Ge (15 mrad, 5 cm)

  - $0.5 \text{ cm W}$ $\quad \nu \approx 0.008 \quad \approx 250 \ \Lambda c/\text{year}$
  - $2.5 \text{ cm W}$ $\quad \nu \approx 0.015 \quad \approx 1300 \ \Lambda c/\text{year}$
  - Thicker W?

$\nu=7.6$ for pp collisions, upgrade conditions

1 year $= 4 \times 10^6 \text{ s}$
✓ Updated proposals for the model of data-taking

- Synergetic operation of the detector seems feasible

VELO occupancy $\nu = 0.81$

$pp + pW$ (1 PV)

- Reconstruction efficiency and resolutions stable up to $10^9$ p/s
- Need to assess final (optimal) target thickness
Sensitivities

0.5 cm W at $10^6$ p/s ($2 \times 10^{13}$ PoT/y), 5 y

F. Martínez Vidal, Workshop on electromagnetic dipole moments of unstable particles, 3-4 October 2019
Sensitivities

0.5 cm W at $10^6$ p/s (2×$10^{13}$ PoT/y), 5 y
What’s next

- Precise (and correct!) \( \Lambda_c \rightarrow pK\pi \) amplitude model, needed for \( \Lambda_c \) polarization measurement in FT

- \( \Lambda_c \) initial polarization in SMOG data (\( \sim 300 \) \( \Lambda_c \rightarrow pK\pi \))

- We have a unique physics case, but could be enhanced
  - Standard fixed target (QCD studies, different x regime)
  - Pentaquark studies
  - \( B_0 \)s (and perhaps \( D_0 \)s) mesons oscillations in baryonic matter
  - Prepare for longer term:
    - b-baryons
    - \( \tau \) (\( D_s \) production xsection & spectrum, \( D_s \rightarrow \tau\nu \) reconstruction, …)

E. Neil’s talk

A. Pilloni’s & D. Marangotto’s talks

A. Fomi’s & J. Ruiz Vidal’s talks
What’s next

- Next FITFAN: the week of the 18th or 25th Nov
  - LHCb Collab. Meeting (Dec), LHCC
  - Run 3 EYETS (additional valve in LS2)
  - Collaboration framework
    - Different communities, strength & define collaboration
    - Within LHCb Collaboration
  - LOI

- Engineering design

- Funding, sharing of responsibilities

- Next PBC General Meeting, 5-6 Nov
  - $\Rightarrow$ ES Physics Briefing Book
Additional valve

- To allow installation/maintenance of required instrumentation without breaking the VELO beam vacuum, a new vacuum valve will be installed during LS2
Thanks Nicola
Thanks Noemi
Backup
### Pileup vs proton flux & W thickness

- $\nu$ for $W$/
  - $W+\text{Si}$, $W+\text{Ge}$

$\nu=7.6$ for pp collisions, upgrade conditions

<table>
<thead>
<tr>
<th>Proton flux (s$^{-1}$)</th>
<th>$10^6$</th>
<th>$10^7$</th>
<th>$10^8$</th>
<th>$10^9$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>0.002 /</td>
<td>0.02 /</td>
<td>0.18 /</td>
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<tr>
<td></td>
<td></td>
<td>0.007, 0.008</td>
<td>0.07, 0.08</td>
<td>0.70, 0.81</td>
</tr>
<tr>
<td></td>
<td>1.0</td>
<td>0.004 /</td>
<td>0.04 /</td>
<td>0.35 /</td>
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<tr>
<td></td>
<td></td>
<td>0.009, 0.010</td>
<td>0.09, 0.10</td>
<td>0.87, 0.98</td>
</tr>
<tr>
<td></td>
<td>1.5</td>
<td>0.005 /</td>
<td>0.05 /</td>
<td>0.52 /</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.010, 0.011</td>
<td>0.10, 0.12</td>
<td>1.04, 1.15</td>
</tr>
<tr>
<td></td>
<td>2.0</td>
<td>0.007 /</td>
<td>0.07 /</td>
<td>0.68 /</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.012, 0.013</td>
<td>0.12, 0.13</td>
<td>1.19, 1.30</td>
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<tr>
<td></td>
<td>2.5</td>
<td>0.008 /</td>
<td>0.08 /</td>
<td>0.82 /</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.013, 0.015</td>
<td>0.13, 0.15</td>
<td>1.34, 1.45</td>
</tr>
</tbody>
</table>

- $10^7$ with $T \approx 2.0$ cm is the upper limit for parallel running ($<10\%$ occupancy)
## PoT vs operation scheme

- Two possible data taking options:
  - **Dedicated**: 2 weeks/year × 1/3 efficiency × 3 years = $1.21 \times 10^6$ s
  - **Parallel**: $4 \times 10^6$ s/year × 3 years = $1.20 \times 10^7$ s

- Shown are the number of reconstructed $\Lambda_c^+ \rightarrow pK^-\pi^+$ for dedicated scheme, for Si and Ge. For parallel running just $\times 10$ higher

[neglecting multiple interactions]

<table>
<thead>
<tr>
<th></th>
<th>10^6</th>
<th>10^7</th>
<th>10^8</th>
<th>10^9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dedicated</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>0.5</td>
<td>2.0×10^1, 7.5×10^1</td>
<td>2.0×10^2, 7.5×10^2</td>
<td>2.0×10^3, 7.5×10^3</td>
<td>2.0×10^4, 7.5×10^4</td>
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<tr>
<td>1.0</td>
<td>4.0×10^1, 1.5×10^2</td>
<td>4.0×10^2, 1.5×10^3</td>
<td>4.0×10^3, 1.5×10^4</td>
<td>4.0×10^4, 1.5×10^5</td>
</tr>
<tr>
<td>1.5</td>
<td>6.0×10^1, 2.3×10^2</td>
<td>6.0×10^2, 2.3×10^3</td>
<td>6.0×10^3, 2.3×10^4</td>
<td>6.0×10^4, 2.3×10^5</td>
</tr>
<tr>
<td>2.0</td>
<td>8.0×10^1, 3.0×10^2</td>
<td>8.0×10^2, 3.0×10^3</td>
<td>8.0×10^3, 3.0×10^4</td>
<td>8.0×10^4, 3.0×10^5</td>
</tr>
<tr>
<td>2.5</td>
<td>1.0×10^2, 3.8×10^2</td>
<td>1.0×10^3, 3.8×10^3</td>
<td>1.0×10^4, 3.8×10^4</td>
<td>1.0×10^5, 3.8×10^5</td>
</tr>
</tbody>
</table>

- $10^{15}$ PoT, 0.5 cm target $\equiv 1.7 \times 10^4, 6.2 \times 10^4$ reconstructed $\Lambda_c^+ \rightarrow pK^-\pi^+$